May 2025

# WEST CULBURRA CONCEPT PROPOSAL

AQUATIC ECOLOGY & OYSTER AQUACULTURE BASELINE MONITORING REPORT



Frontis. Sampling the intertidal saltmarsh zone at site SWB2-I

**FINAL REPORT PREPARED FOR SEALARK PTY LTD**

MARINE POLLUTION RESEARCH PTY LTD

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# EXECUTIVE SUMMARY

State Significant Development Application SSD3846 for a staged, residential and commercial development located on the northern side of Culburra Road between the Crookhaven River Estuary and Lake Wollumboola was approved with agreed conditions in October 2021 that included a requirement for an 18-month water quality and aquatic ecology baseline monitoring program to be undertaken in Crookhaven River estuary and Lake Wollumboola catchment freshwater streams. Following initial pilot studies an aquatic ecology study program was approved and commenced on 1st December 2022 with formal completion in May 2024. As per the Conditions of Consent two six monthly data reports were prepared and approved and this final report provides a synthesis and consideration of the combined 18-month data with conclusions about the utility of the study results for future staged development aquatic ecology construction and operational monitoring.

**Study Rationale**

As per the approved Concept Proposal it was agreed that the most pressing Crookhaven River estuarine ecological protection aim for the Proposed Staged Development is the protection of inshore Crookhaven River and Curleys Bay estuarine habitats and their use for oyster aquaculture from possible construction and operational impact from the project footprint. As the majority of this footprint slopes north and north-east to Curleys Bay, the base-line program estuarine study site selection has been governed by fitting the mandated requirements of the Agreed Conditions to this overall geographical situation, with “near” potential impact near-shore intertidal sites placed along the development Curleys Bay shoreline. As the other shoreline habitats of Curleys Bay and of the Crookhaven River exhibit a wide variation in topographic settings (particularly slope and width of intertidal zones) and as there is a variety of adjacent land use (grazing, forested and urban), other Curleys Bay study sites further from the development shoreline have been situated to include a variety of differing topographical and land-use aspects.

As Curleys Bay is clearly defined in these Conditions as 'the area of potential influence from the project' and this area coincides with the Curleys Bay Shellfish Harvest Area, the so called Control Sites have been positioned in the non-Curleys Bay harvest areas, i.e., Crookhaven River Up (Cup) sites located in the Crookhaven River Shellfish Harvest Area upstream of Curleys Bay Harvest Area and Crookhaven River Down (Cdn) sites located in the Goodnight Island Shellfish Harvest Area downstream from Curleys Bay Harvest Area.

**Typicality of Study Climatic variation**

As the 18-month aquatic ecology study results are intended to provide a suitable baseline for future construction monitoring, the study needs to consider the 'typicality' of the overall climatic conditions for the study in relation to potential climatic conditions that may arise during and post construction. Whilst there was overall higher than long-term average monthly rainfall leading up to the start of the monitoring programme (3 of 6 months) plus through the monitoring program (6 of 18 months) resulting in record breaking annual rainfalls for 2022 and 2023 (and thus far for 2024), the outstanding feature of the rainfall patterns for these years was that high rainfalls volumes were generally associated with 'higher than normal' individual daily rainfall volumes rather than more prolonged rainfall. That is, the pattern of rainfall leading into and through the 18-month survey period conformed to the long-term climatic change prediction of overall higher daily rainfall volumes. In this respect the rainfall for the study period is considered more likely for typical future rainfall patterns, meaning the results of the study in terms of rainfall are relevant to future monitoring studies.

**Riparian Edge & Intertidal Habitat Monitoring**

As for the most part, sub-catchment stormwater discharges from the proposal site are not confined to incised or eroded defined creek lines but rather flow down through the forest buffer via vegetated swales. Accordingly, monitoring for possible project associated impact on adjacent riparian edge and inshore estuarine intertidal habitats is predicated on the possibility of increased surface and groundwater runoff volume/frequency plus altered water quality, principally increased sediment and nutrient loads, that could be directed through the 100m buffer zone to the intertidal zone habitats via existing site woodland/forested sub-catchment discharge swales that could result in physical swale erosion, riparian edge sediment deposition and smothering of inshore saltmarsh habitat, increased riparian zone terrestrial weed diversity. Over the long-term and in line with predicted sea level rise, riparian and saltmarsh habitats could also be subjected to increased erosion and deposition from offshore and saltmarsh will also be susceptible to 'squeeze impact" as intertidal mangrove habitat encroaches upslope with increased mean sea-level impacts on tides.

The 18-month intertidal estuarine habitat study, with the nine essentially bi-monthly repeat surveys has demonstrated that under the influence of projected higher energy storm activity (as experienced during the study) there have not been any indications of swale erosion or intertidal sediment deposition and changes in intertidal transect profiles over the study period have been associated with natural temporary deposition and dispersal of inshore riparian edge leaf litter or mid shore seagrass wrack, both seasonally and dependent on neap to spring monthly tidal cycles. Whilst the study

using fixed ladder transects has also demonstrated the individuality of site responses to weather that highlight the difficulty of site selection for traditional "impact" verses "control" site selection for impact assessment, the study has also highlighted several saltmarsh species that could be considered as 'indicator' species for construction and operational monitoring particularly in relation to potential increased freshwater run-off from developed areas.

**Seagrass Monitoring**

Increased stormwater runoff can cause potential changes in sediment loads and nutrient concentrations within estuarine environments which can impact seagrass habitats via increased epiphytic sediment deposition, algae growth and encrusting faunal growth. Accordingly, the Condition C17(c) requirement for seagrass monitoring has been met by monitoring changes in seagrass blade epiphytic sediment, and biota (mainly algae) densities utilising replicated Seagrass Artificial Sampling Units (ASUs) over nine essentially bi-monthly repeat surveys. For this baseline study it is evident that rainfall effects both sediment and algae accumulation rates on seagrass blades, and over the 18-month study period, results varied in response to wet weather events, with a combined number of factors including poor water clarity causing low light penetration, water temperature and site hydrology. These influences also appear to require a time delay as while there have been numerous large wet weather events over the nine seagrass ASU deployment periods, many spikes in both sediment and algae were delayed and often recorded in the following survey. The complexity of results for this study underlines the original base contention of the overall baseline study that choosing and selecting appropriate locations/sites for possible Construction and Post Construction Impact assessment will need to take these site-specific confounding factors into account. Notwithstanding this 18-month baseline study provides appropriate insight into how these site-specific confounding factors contribute to both algae and sediment recruitment spatially and how different locations respond to wet weather and increased surface water runoff. These results may be able to be used to generate preconstruction baseline triggers to monitor the response to any potential development impacted surface water runoff.

**Oyster Bioaccumulation Study**

For both Oyster Condition Index (CI) and Metal Bioaccumulation results, the individual site results after the six-to-seven-week deployments (to meet bimonthly sampling requirement) were influenced by the depuration rate of oysters. Results had the potential to reflect the original baseline values in that if the Baseline deployment concentrations were high, site post-deployment values may be correspondently high. However, with the suite of factors controlling depuration rates for differing analytes, the results were considered to successfully represent both within and between-site

variations with the consideration of the baseline value variations.
Whilst the utility of oysters for bioaccumulation studies is a well-accepted impact monitoring tool, its usefulness will always be dependent on the appropriateness of the actual bioaccumulation chemicals selected for study, particularly in relation to the expected detection limits that can or need to be met by the analysis laboratory. In the case of this study the overall mandated suite of metals (and metalloid) was generally appropriate in that laboratory analysis was able to meet most required detection limits and the study has indicated that baseline Chromium, Lead and Mercury levels in oysters were generally lower than detection whilst Selenium, Arsenic, Copper and Zinc concentrations were consistently above detection limits. Given the problem for the commercial laboratory to be able to meet the necessary low µg/gm detection limits for organics (PAHs and Organochlorides) in oyster flesh, it is considered more appropriate to limit testing for organics to water quality testing with testing of oysters only initiated as a TARP response to high organics in water samples. Overall, Sydney Rock Oysters are a sufficiently sensitive indicator of contaminant bioaccumulation and testing of both Sydney Rock Oysters and Pacific Oysters is considered redundant in terms of monitoring for construction and post-construction related water quality impacts.

**Lake Wollumboola Freshwater Macroinvertebrates and Fish Study**
As noted above, the pattern of rainfall leading into and through the 18-month survey period conformed to the long-term climatic change prediction of overall higher daily rainfall volumes. Inspection of the Lake Water Level gauges data from 2022 through the study period indicates an overall more volatile opening and closing regime for the lake with rapid filling events from the high-volume storms and associated fast lake discharge plus fast re-filling once closed again. In these respects, the rainfall and lake opening and closing regimes for this Lake Wollumboola freshwater aquatic study period are considered more likely for typical future rainfall and lake opening patterns, meaning the results of the study in terms of rainfall and lake water levels are relevant to future monitoring studies.

This study included metered water quality which was deemed necessary owing to previous surveys that indicated salinity and low dissolved oxygen stratification in creek waters from both groundwater sources for up-stream sites and from elevated lake water levels for down-stream creek sites. The study confirmed these impacts to the extent that the nominated macroinvertebrate ASU sampling method had to be duplicated with ASUs deployed in upper and lower creek water levels to account for stratification.

The nominated ASU macroinvertebrate study component was also hampered by the

ephemeral nature of the creek sites that meant that over a full season the ASUs may have only been underwater for a small proportion of the deployment time and as a consequence final assemblage results were more related to (a) whether there was water around the ASU at the time of collection and (b) if so how long had that last wetting lasted. This restraint was in the end so severe that the method is not recommended for future monitoring purposes and instead it is recommended that future macroinvertebrate sampling be undertaken using sweep net sampling with the proviso that the methodology will need to be fully replicated to overcome the acknowledged limitations of the AusRivAS protocol methods that were disallowed for the present study. Such a pilot study was undertaken in June 2024 that confirmed the conclusion and recommendation. For such a study to be successful in associating results with climatic and water quality variation it will need strict sampling protocols that include a sampling time period related to a fixed number of days after a designated rain event that would result in continuous flow through the creek and sampling must then be related to metered water quality parameters. Additional constraints will need to be applied to downstream sites that are susceptible to lake flooding, and it may be sufficient to factor in lake back flooding duration plus metered water quality.

The Electrofishing portion of the nominated study was more successful in providing a comprehensive assessment of fish assemblages in the three creeks; However, future monitoring programs will also need to include the same timing protocols recommended for the macroinvertebrate sampling study so that results can be compared for fixed post re-charge times for ephemeral study pools.

**Number of Study Sites for Construction and Operational Monitoring**

This 18-month background study had as its aim the provision of sufficient baseline information/data from sites nominated as near impact sites and from a sufficiently broad range of potential not-near sites so that informed decisions can be made about the utility of these latter sites as 'control' sites. From this study it is clear that the dynamics of overall estuarine and creek aquatic assemblage change is both complex and generally variable for both 'within site' and for 'between' site' assessments but that change in many of the measured parameters remained fairly well constrained between recognisable limits (albeit with spikes that for the most part could be linked back to rain/storm events).

Accordingly, future construction and operational programs could be managed by the use of pre-construction limits for a range of the measured parameters at the designated near impact sites and a few selected control sites, using conditional Trigger Action Response Plans (TARPs) where if the measured Trigger parameters are out of range in a negative way from Impact sites but not for Control sites, the Action will be a

requirement to confirm whether the result arises from construction/operation so that can be remedied. If not, construction related to the out-of-range results can be added to the long-term baseline data to provide new TARP ranges for the next assessment.

# 1. INTRODUCTION

State Significant Development Application SSD3846 is a concept proposal for a staged, residential and commercial development located on the northern side of Culburra Road between the Crookhaven River Estuary and Lake Wollumboola. The concept proposal that was approved with agreed conditions in October 2021, included the undertaking of an 18-month water quality and aquatic ecology baseline monitoring program to be undertaken as specified in Agreed Conditions C16 (Water Quality), C17 (Crookhaven River estuarine ecological monitoring and Lake Wollumboola catchment freshwater ecology monitoring) plus C18 (Oyster Aquaculture). Each of these conditions required the proponent to prepare detailed monitoring methodology to meet the specified requirements of these Conditions, to be submitted to the Department of Planning and Environment for approval.

Marine Pollution Research Pty Ltd (MPR) was commissioned by the proponent Sealark Pty Ltd in late 2022 to prepare the baseline aquatic ecology monitoring methodology report for the Agreed Conditions C17 and C18, noting that the Aquatic Ecology monitoring program would not include the Condition C18d oyster lease water quality sampling, as Martens & Associates Pty Ltd were commissioned to undertake all Agreed Condition water quality monitoring, to include the estuarine and freshwater water quality monitoring for Condition 16 and for Condition 18d.

The Aquatic Ecology Methodology Report (MPR 2022) and Water Quality Methodology Report (Martens & Associates 2022) were reviewed and endorsed by the Environmental Representative (ER) on 16 November 2022 and the 18-month monitoring program formally commenced on 1st December 2022.

As per Conditions C17(f) and C18(f) an Aquatic Ecology Monitoring Addendum Report (MPR 2023b) was prepared in August 2023 arising from implementation and practical adjustments of the original approved methodology over the first six-monthly sampling program. This addendum included amendments to the oyster monitoring program following consultation with the oyster industry as per Condition C18e. Following ER approval, the methodology as amended by that report was implemented for the remaining monitoring program.

As per Agreed Conditions C17(f) and C18(f) there have been two Aquatic Ecology progress reports prepared; for the first and second six monthly sampling periods (MPR 2023a, 2024) and this present report incorporates the final six months sampling data. The report provides an assessment of the completed data sets and provides recommendations on how or whether the present monitoring programs could or should be utilised for future

Staged Construction, as per Conditions C17(g,h) and C18(f).

### 1.1. Report Structure

**Section 1.2** provides a summary of the site selection rationale for the overall aquatic ecology study and provides a summary timetable of the completed program. **Section 1.3** summarises the relevant weather and climatic information for the entire study period and **Sections 2** to **5** then provide the methods, summary results, analysis and conclusions for each of the four monitoring segments: Estuarine Intertidal Habitats, Subtidal Seagrass, Crookhaven Aquaculture Oysters and Lake Wollumboola Freshwater Biota.

### 1.2. Overall Study Design Rationale and Timetable

As per the approved Concept Proposal it was agreed that the most pressing Crookhaven River estuarine ecological protection aim for the Proposed Staged Development is the protection of inshore Crookhaven River and Curleys Bay estuarine habitats and their use for oyster aquaculture from possible construction and operational impact from the project footprint, and as the majority of this footprint slopes north and north-east to Curleys Bay, the base-line program estuarine study site selection has been governed by fitting the mandated requirements of the Agreed Conditions to this overall geographical situation, with "near" potential impact near-shore intertidal sites placed along the development Curleys Bay shoreline. As the other shoreline habitats of Curleys Bay and of the Crookhaven River exhibit a wide variation in topographic settings (particularly slope and width of intertidal zones) and as there is a variety of adjacent land use (grazing, forested and urban), other Curleys Bay study sites further from the development shoreline have been situated to include a variety of differing topographical and land-use aspects.

The Agreed Conditions mandate the overall monitoring program design in terms of requiring a designated number of sampling *sites* or *leases* or *locations* for both the estuarine Crookhaven River study area and for freshwater aquatic biota Lake Wollumboola study. For the purposes of the approved Crookhaven River Estuary nested sampling scheme, the study has drawn a distinction between the use of the terms *sites, leases* and *locations* as follows:

- There are six geographically described estuarine sampling ***locations***, with these location names applied across all the estuarine sampling programs:
- Four Curleys Bay *Locations* (named Billys Bay BB, South West Bay SWB, South East Bay SEB and North Bay NB), and two River Estuary *Locations* (Crookhaven up CUP and Crookhaven down CDN).

- Individual sampling *sites* within each location are designated by number e.g., BB1 and BB2.
- For the inshore Intertidal Monitoring, sub-sites are designated as ***In-line sites*** **(I)** for sub-sites most likely to drain sub-catchments and **Ridge sites (R)** for sub-sites located on the elongation of the ridging boundary between sub-catchments that are least likely to drain sub-catchments (e.g., CUP1-I and CUP1-IR respectively.

Conditions C16c, C17c and C18c also require sampling from estuarine sites in 'Control Locations', defined as 'locations selected outside of any potential influence from the project'. As Curleys Bay is clearly defined in these Conditions as 'the area of potential influence from the project' and this area coincides with the Curleys Bay Shellfish Harvest Area, (see **Figure 1**), the so called *Control Sites* have been positioned in the non-Curleys Bay harvest areas, i.e., Crookhaven River Up (Cup) sites located in the *Crookhaven River Shellfish Harvest Area* upstream of Curleys Bay Harvest Area and Crookhaven River Down (Cdn) sites located in the *Goodnight Island Shellfish Harvest Area* downstream from Curleys Bay Harvest Area.

Condition C18c requires sampling at Crookhaven River *high use and opportunistic leases* and at two leases in northern Curleys Bay plus two leases each at two control sites. In keeping with both the integrated sampling concept and the intertidal estuarine monitoring siting rational described above, and following fine tuning and approval of sites by oyster farmers, nominated leases were selected to be as close to, or *tidally downstream* of selected intertidal aquatic ecology sampling sites.

For Lake Wollumboola freshwater aquatic ecology sampling, Condition C17e requires sampling in three *locations*: Wattle Creek and two other creeks draining to Lake Wollumboola. Aside from Wattle Creek which is nominated, the two other creeks selected for both water quality and aquatic ecology sampling were Downs Creek and an un-named Southern Creek draining to Downs Creek.

In terms of mandated monitoring schedules, the program included pre-monitoring pilot studies plus a mix of bi-monthly and seasonal mandated monitoring requirements. These are detailed in the Approved Monitoring program (MPR 2022) and the Approved Monitoring Program Update Report (MPR 2023) and outlined in the introductions for each of the individual study elements.

**Table 1** below summarises the completed monitoring through to the end of the 18-month sampling period.

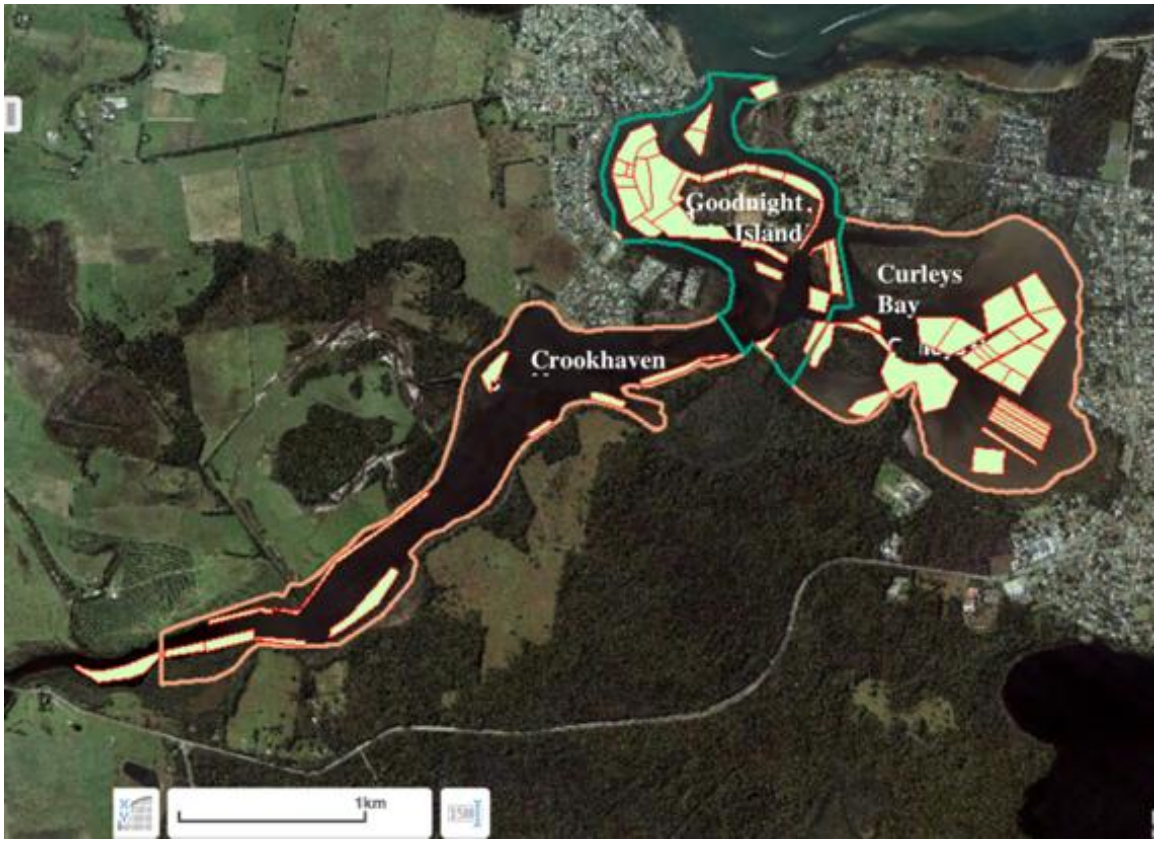



**Figure 1** Designated Shellfish Harvest Areas in the Crookhaven River (Fisheries NSW Spatial Data Portal). The staged proposal drains to the Curleys Bay Harvest Area and estuarine plus oyster lease monitoring sites have been placed into all three Shellfish Harvest Areas.

| Year | 2022 | | | 2023 | | | | | | | | | | | | | | | | | | | | | | | 2024 | | | | | | | | | | | | | | | | | | |

### 1.3. Climate & Hydrology

Daily rainfall data for the Culburra and Lake Wollumboola study areas is sourced from the Bureau of Meteorology (BOM) Culburra Treatment Plant gauge (CTP) (68083), operational since 1962, and tidal plus river and lake water level data are available from automatic level gauges operated by the Water Division of the NSW Department of Planning and Environment (DPE); a lower estuary water level gauge at Greenwell Point (Gauge 215417), a tide level gauge at Crookhaven Heads (Gauge 215408) and a lake water level gauge at the north end of Lake Wollumboola (Gauge 215454).

#### 1.3.1. Rainfall

**Appendix A** provides CTP daily rainfall data from 2022 to June 2024 and **Table 2** below shows daily rainfall in mm rain for each 24-hour period up to 9am on the reporting day) from June 2022 to June 2024 to incorporate the pre, pilot and 18-month formal monitoring program (December 2022 to May 2024). There were no missing data for the period. The Table includes the following features:

- Rainstorms where there was 20mm or more over any consecutive 48-hour period have been highlighted in red and days of no rain have been left blank to emphasise the extent of dry weather between events.
- Days of rainfall at or above 48mm are indicted by pink shading as rainfall at or above this level is generally regarded as having erosion potential.

The Table also provides Total Monthly Rainfall, long-term Average Monthly Rainfall, (from the BoM records), and these combined data are used to indicate the following monthly comparisons:

- The number of rain days for each month (with low rainfall months shown as blue shading).
- The number of as-defined rainstorms each month (with pink shading indicating days with greater than 48mm rainfall on one day).
- A comparison of actual monthly rainfall against average monthly rainfall - indicated as a proportion of average (with dry months indicated as pink numbers). About average months are indicated as black numbers and well above average indicated as pink shading.

The transition of rainfall patterns of the 2022 pre-study data through the study programme period as indicated in **Table 2** is summarised as follows:

- For the six months leading into the study program commencement in December 2022, June was dry with no storms. August and November had no storms but had gentle rain partitioned relatively evenly through the month.
- Whilst July, September and October 2022 were very wet in terms of overall

monthly rainfall, for the most part the rainfall was concentrated in heavy non-consecutive rain-storm events (3 events over 19 days total in July, 18 days for 4 events in September and 17 days over three events in October).

- For the first month of the study program December 2022 matched November 2022 with low rainfall, no storms and 33mm rain spread evenly through the month over six non-consecutive days.
- Rainfall for January 2023 was closer to monthly average but with most rain confined to four two- to three-day rain events.
- This pattern continued through to April 2023 with high overall monthly rainfall, but with rainfall generally concentrated in non-consecutive heavy rain-storm events (four events in January, one large event in February (277mm over two days), one event in March and three in April).
- For the most part the months May to October 2023 all had low rainfall below monthly average), generally no rainstorms and low sporadic rainfall. There was one two-day rainstorm (31mm) in the last week of October 2023.
- November and December 2023 had far more rain days than the preceding six months and like February, 275mm of the November 334mm monthly total was dumped over three days. December 2023 was relatively dry for about three weeks then wet for the remainder including two rainstorms.
- January to April 2024 fitted the earlier pattern of overall below monthly average rainfall and most concentrated in short rainstorm.
- May 2024 had very high and continuous rainfall for the first two weeks that included four days of >45mm rainfall and a total rainfall 4.3 time the long-term average. It was then dry for the rest of the month.
- June 2024 had a similar but attenuated pattern with high rainfall in the first week and two spaced out rainstorms for the rest of the month.

Whilst there was overall higher than long-term average monthly rainfall leading up to the start of the monitoring programme (3 of 6 months) plus through the monitoring program (6 of 18 months) resulting in record breaking annual rainfalls for 2022 and 2023 (and thus far for 2024), the outstanding feature of the rainfall patterns for these years was that high rainfalls volumes were generally associated with 'higher than normal' individual daily rainfall volumes rather than more prolonged rainfall. That is, the pattern of rainfall leading into and through the 18-month survey period conformed to the long-term climatic change prediction of overall higher daily rainfall volumes. In this respect the rainfall for the study period is considered more likely for typical future rainfall patterns. meaning the results of the study in terms of rainfall are relevant to future monitoring studies.

**Table 2 June 2022 to June 2024 Culburra Treatment Plant Daily Rainfall (mm to 9am on day & blank = 0mm)**

| Year | 2022 | | | | | | | 2023 | | | | | | | | | | | | 2024 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
| 1st | | 1 | | | 22 | 15 | | | | | 5 | | | | | | | | | 1 | 2 | 3 | | | 4 |
| 2nd | | 127 | | | 7 | | 9 | | | 3 | 2 | | | 2 | 2 | | | | 2 | | 1 | 11 | | 5 | 11 |
| 3rd | | 48 | | 2 | | | | | | 5 | | | 1 | | | | | 1 | 8 | | | | 2 | 49 | |
| 4th | | 64 | 1 | 21 | | 1 | | 2 | | 9 | 1 | | 5 | 4 | | | | 1 | 1 | 1 | | | | 25 | |
| 5th | | 33 | 2 | 3 | 3 | | | 15 | | | | | 2 | 4 | | | 18 | 17 | | 1 | 8 | | 2 | 48 | 6 |
| 6th | | 5 | | 1 | 28 | | 2 | 17 | | 2 | | | 1 | | 1 | | | | | | 30 | | 86 | 27 | 187 |
| 7th | | 7 | | 1 | 5 | | | 3 | | | | | | | 2 | | | | | | | | 1 | 5 | 76 |
| 8th | | 1 | 1 | | 2 | | | | 24 | | 6 | 16 | | | 2 | 3 | | | | 4 | 1 | | 3 | 20 | 16 |
| 9th | | | 2 | 1 | 75 | | | | 253 | | | | | | | | | 11 | | 7 | | | | 28 | |
| 10th | | 22 | 4 | 1 | 3 | | | | 7 | | | | | | | | | 8 | 3 | | 1 | | 9 | 17 | |
| 11th | | 33 | | 29 | | | | | 3 | | | | | | | | 1 | | 1 | | 2 | | | 34 | |
| 12th | | | | | | | | | | | | | | | | | | | | | | | | 80 | |
| 13th | | | 1 | 21 | | | 2 | | 2 | 22 | 3 | | | | | | 2 | | | | | | | 135 | 3 |
| 14th | | 2 | | | 3 | 14 | | 2 | 2 | 5 | 35 | | | | 10 | | | | | | 1 | | | | |
| 15th | | | | | | | | | 17 | 12 | 6 | | | | 5 | | | | | 51 | 2 | 10 | | | 25 |
| 16th | | | | 1 | | | | | | | 1 | | | | | | | | | 14 | 3 | | | | 17 |
| 17th | | | | | 2 | 3 | | 1 | | | 1 | 3 | | | | | 3 | 2 | | | | 31 | | | |
| 18th | | | | | | | 3 | | | | | 2 | | | 1 | | 8 | | | 4 | | 52 | | 3 | 1 |
| 19th | | 4 | | | | | | 23 | 11 | | | 1 | | | | | | | | | 1 | 5 | | 4 | |
| 20th | 9 | 21 | 3 | | | 2 | | 1 | | | 11 | | | | | | | | 48 | | 5 | 8 | 9 | | |
| 21st | 1 | 23 | 2 | | 21 | | | | | 6 | | | | | | | | | 48 | | 15 | | | | |
| 22nd | | 2 | | 38 | 5 | | | 1 | 17 | | | 1 | | 1 | | 2 | | 2 | | | | | | | 1 |
| 23rd | | 10 | | 8 | 15 | | 3 | 21 | | 1 | | | 5 | | 5 | | | 7 | 6 | 4 | | | | | 28 |
| 24th | | 6 | 8 | 2 | 8 | | | | | 7 | 30 | | | | 2 | | | 7 | 4 | | 22 | | | | 1 |
| 25th | | | | 5 | 37 | | | 13 | | 1 | | | | | | | | 1 | 4 | | | | | | |
| 26th | | 2 | | | 1 | | | | | | | | | | | | | 2 | 32 | 2 | | | | | |
| 27th | | | 4 | 5 | | 1 | | | | 5 | | 2 | | | | 7 | 12 | 1 | 2 | | 6 | | | | |
| 28th | | | 1 | 11 | 1 | | | 1 | | | | | | | | 4 | 19 | 87 | 7 | | | | | | |
| 29th | | 1 | | 20 | | | | | | | 1 | 1 | 1 | | 5 | | | 168 | 0 | | | | | | |
| 30th | | | 2 | 29 | | | 6 | 7 | | 4 | 61 | | | 1 | | | | 20 | 0 | 1 | 3.93 | | 6 | | |
| 31st | | | | | | | 7 | 14 | | 2 | | | | | 2 | | | | 1 | | | | | | |
| Total | 9.7 | 411 | 30 | 198 | 239 | 37.4 | 32.7 | 119 | 337 | 83.6 | 162 | 25.3 | 15.4 | 12 | 36.2 | 16.2 | 61.7 | 334 | 167 | 90 | 97.8 | 123 | 119 | 481 | 377 |
| Average | 139 | 84 | 79.3 | 73.4 | 86.7 | 84.9 | 73.3 | 98.1 | 130 | 140 | 112 | 105 | 139 | 84 | 79.3 | 73.4 | 86.7 | 84.9 | 74.9 | 98 | 130 | 140 | 112 | 111 | 141 |

**Monthly Comparisons**

| Year | 2022 | | | | | | | 2023 | | | | | | | | | | | | 2024 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
| Rain days | 2 | 19 | 12 | 18 | 17 | 6 | 7 | 14 | 9 | 14 | 13 | 7 | 6 | 5 | 11 | 4 | 7 | 15 | 16 | 11 | 16 | 7 | 8 | 14 | 13 |
| Storms | 0 | 3 | 0 | 4.5 | 2.5 | 0 | 0 | 4 | 1±2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1±1 | 1±2 | 2 | 1 | 3 | 1 | 1 | 1 | 3 |
| Total/Avg | 0.1 | 4.9 | 0.4 | 2.7 | 2.8 | 0.4 | 0.4 | 1.2 | 2.6 | 0.6 | 1.4 | 0.2 | 0.1 | 0.1 | 0.5 | 0.2 | 0.7 | 3.9 | 2.2 | 0.9 | 0.8 | 0.9 | 1.1 | 4.3 | 2.7 |
| Season | Winter | | | Spring | | | Summer | | | Autumn | | | Winter | | | Spring | | | Summer | | | Autumn | | | Wi |

### 1.3.2. Crookhaven Tide Level Gauging

**Appendix B** provides the published MHL July 22 to June 23 Crookhaven Heads Tidal data and additional data for that gauge and the Greenwell Point River Level Data for July 2023 onwards are provided as downloaded monthly water level and tidal data graphs for the three water level gauges from March 2023 to June 2024:

- The **Appendix B** graphing has included daily rainfall into the presentation and yellow shading for rainfall periods that included 20mm or more daily rainfall events.
- The water level gauge data include several gaps that relate to either gauge missing data due to gauge malfunction or missed data accumulation.
- Note also that the direct downloaded Crookhaven Heads Tidal data provides both measured tide levels plus residual levels (i.e., the height difference of the actual tide from predicted lunar tide) whereas the published graphed data from July 22 to June 23 does not include residual data.

Whilst the aquatic ecology study program did not include a requirement for collection and analysis of these data we nevertheless attempted to provide as much of the available data to evaluate at least whether future data collection would be relevant to interpretation of overall aquatic ecological variation in relation to large storm events.

When the previous ocean discharge for Shoalhaven River at Shoalhaven Heads is blocked, Greenwell Point and Crookhaven Heads water level/tide gauges are measuring the combined water level variation arising from tidal exchange, atmospheric impact on tidal change including storm surge, catchment runoff from both the larger Shoalhaven River catchment and the smaller Crookhaven Catchment (with their variable responses to overall evenness of rainfall over each catchment plus the variable timing of flood transport downstream in each catchment) and the additional compounding impacts on Crookhaven River tidal exchange by Shoalhaven flood waters restricting or backing up Crookhaven River discharges. Accordingly, interpretation of possible flood induced changes noted on the graphed data in relation to possible Crookhaven River storm water level behaviour is just not possible (see Kumbier et al 2018 for a modelled study of compound flooding in the Shoalhaven/Crookhaven River).

Notwithstanding, inspection of the available data provide some insight in respect to at least the large impact storms noted though the study period:

- The Crookhaven Head Residual tide level data generally exhibit a slow rhythm of change associated with the slow change in local atmospheric pressure and anomalies in this pattern then often coincide with measured high rainfall events as noted in mid and late April 23, possibly early May 23, early April 24 and mid-June 24. However, unpacking residual water

level change for the remaining high spike rainfall events such as those in November and December 2023 is not visually possible.

- The published 2022 to 2023 ocean tide data shown in **Appendix B** indicate four periods of storm surge, 31 Oct to 3 November 2022, 15 December 2022, 9 to 13 April 2023 and 6 to 10 May 2023. Of these only the April 2023 event is associated with a large rain event (38mm from 13 to 14 April) which occurred immediately after the storm surge.
- Visually correlating the known storm events where residual change was noted with actual elevated tides is even more problematic with only the early April 24 graph showing sustained higher flood tides over two tide cycles.
- Visual interpretation of the Greenwell Point water level gauge data is also difficult to interpret in relation of flood impacts although there are a few elevated low tide points following high rainfall events (e.g., end November 23 event and the 6 April 24 event with flood water impact obvious over two tidal cycles.
- Interestingly, the May 2024 prolonged rainfall event that commenced on 2nd May did not appear to impact overall tidal water levels until about 12 May with elevated low tides for three tidal cycles. This may result from the lag time of Shoalhaven River peak flood waters reaching Greenwell Point.

Over the 18-months sampling period there were 23 rainfall events with greater than 20mm falling over 48 hours. Inspection of the available graphed tide gauge data indicated that rainfall events delivering less than 60mm did not appear to influence the tidal heights at either Greenwell Point or Crookhaven Heads.

For events with greater than 60mm of rainfall, more rain generally equated to a larger influence on tidal water levels with the observable effects of a high rainfall event in the estuary lasting for 24-48 hours. Water level changes were most noticeable during low tides, often with up to a 50cm increase in the tide height from expected values.

However, although the general trend was an increase in tidal heights there was some inconsistency, with large rain events not always influencing water levels. This may reflect the influence of preceding rainfall and resultant saturation levels of soils in catchment areas. Thus, for example, 89mm fell in early April 2024 over three days, with a spike of water levels up to 0.5m greater than the forecast heights. In the 6 months prior to this, there had been nine evenly distributed rainfall events. Conversely 276mm fell over 4 days at the end of November 2023. Prior to this storm there had been a long dry period with only one small rainfall event in the six months prior. The heavy rainfall in November only resulted in a 0.25m alteration from the predicted water heights.

In relation to this 18-month baseline survey, it is apparent from the visual interpretation that Crookhaven River estuary has the capacity to handle most large storm events to the extent that for the estuarine portion at least, flood waters may have backed up for one to two tidal cycles but not for any

prolonged extent of time. That is for the interpretation of rainfall and tidal influence over the 18-month sampling period there do not appear to have been any elongated periods of submergence of intertidal and immediate riparian shorelines, with at the most one or two tidal cycle submergence (i.e. no more than a day).

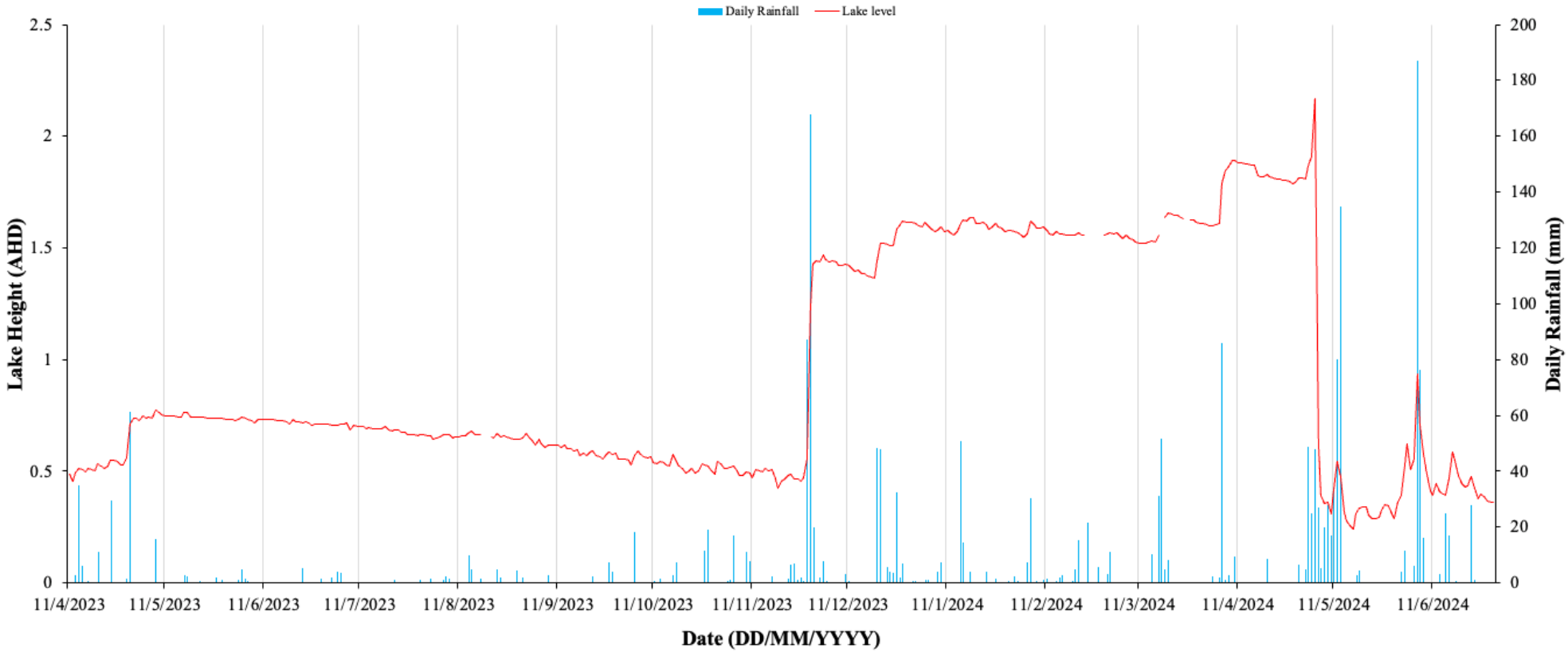
### 1.3.3. Lake Wollumboola Gauging

Lake Wollumboola Water Level Data from 2022 to 2024 are provided in **Appendix B,** and **Figure 2** provides combined water level gauge and Culburra rainfall data from April 2023 to June 2024:

- The combined data indicate that the Lake open for about 9 months in 2022; closed to 8 March 2022, open to tidal waters to about beginning of September, closed to 10 October 2022, and then remained open to about 1st April 2023 and closed through to 5 May 2024.
- The data also indicate two significant rainfall events for filling the lake in 2022 and two in 2023, the 61mm rain event on 30th April 2023 and the 275mm three-day event 28 to 30 November 2023.
- The lake level between April and November 23 showed a steady decline that is probably associated with both slow through sand-barrier discharge to the ocean with overall lake water evaporation.
- The lake levels between the November 2023 and the eventual breakout in May 2024 show a more gradual net increase owing the regularity of the six high volume storms leading up to the high volume and prolonged storm in May 2024.

As noted for the rainfall analysis in **Section 1.3.1** above, the pattern of rainfall leading into and through the 18-month survey period conformed to the long-term climatic change prediction of overall higher daily rainfall volumes. In this respect the rainfall for the Lake Wollumboola freshwater aquatic study period is considered more likely for typical future rainfall patterns, meaning the results of the study in terms of rainfall are relevant to future monitoring studies.

**Figure 2**
**Combined Daily Rainfall and Lake Level (Lake Wollumboola) from April 2023 to June 2024**



## 2. ESTUARINE INTERTIDAL HABITAT MONITORING

In relation to C17d, the Revised Culburra Beach Concept Plan Aquatic Ecology Assessment Report (MPR 2020) and the subsequent Aquatic Ecology Assessment Report Addendum (MPR 2021), noted that for the most part, sub-catchment stormwater discharges from the proposal site are not confined to incised or eroded defined creek lines but rather flow down through the forest buffer via vegetated swales. Accordingly, the two reports recommended that monitoring for possible project associated impact on adjacent riparian edge and inshore estuarine intertidal habitats should be predicated on the possibility of increased surface and groundwater runoff volume/frequency plus altered water quality, principally increased sediment and nutrient loads, that could be directed through the 100m buffer zone to the intertidal zone habitats via *existing site woodland/forested sub-catchment discharge swales*. Accordingly for the baseline survey sub-sites were designated as In-line sites (I) for sites most likely to drain sub-catchments and Ridge sites (R) for the sub-sites located on the boundary between sub-catchments (**Table 3**).

**Table 3 Estuarine Sampling Site Characteristics**

| Location | Site | Sub-site | Below | Sub-site Catchment Characteristics | |
|---|---|---|---|---|---|
| | | | Project | Land Use | Discharge |
| | | | Footprint | | |
| Crookhaven River Upstream | CUP1 | CUP1-R | No | Forest | Ridge |
| | | CUP1-I | No | Grazing | In-line |
| | CUP2 | CUP2-R | No | Grazing | Ridge |
| | | CUP2-I | No | Grazing | In-line |
| Billys Bay | BB1 | BB1-R | No | Forest | Ridge |
| | | BB1-I | No | Forest | In-line |
| | BB2 | BB2-R | Yes | Forest | Ridge |
| | | BB2-I | Yes | Forest | In-line |
| South West Bay | SWB1 | SWB1-R | Yes | Forest | Ridge |
| | | SWB1-I | Yes | Forest | In-line |
| | SWB2 | SWB2-R | Yes | Forest | Ridge |
| | | SWB2-I | Yes | Forest | In-line |
| South East Bay | SEB1 | SEB1-R | Yes | Forest | Ridge |
| | | SEB1-I | Yes | Forest | In-line |
| | SEB2 | SEB2-R | No | Urban | Ridge |
| | | SEB2-I | No | Urban | In-line |
| Crookhaven River Downstream | CDN1 | CDN1-R | No | Rural/Residential | Ridge |
| | | CDN1-I | No | Rural/Residential | In-line |
| | CDN2 | CDN2-R | No | Other | Ridge |
| | | CDN2-I | No | Urban | In-line |

As most of the upper intertidal estuarine sites are obscured by overhanging riparian vegetation (generally Casuarinas) at the riparian end and by mature mangroves at the mid to lower intertidal limits there is little scope for planar drone photography for

landscape analysis of the relatively narrow but crucial saltmarsh zone between the two. In consequence, the monitoring reports recommended the use of fixed replicate shore normal "ladder" transects for baseline intertidal habitat zonation and profile variation monitoring, with transects located at the bottom of individual terrestrial buffer zone sub-catchment “swale” locations below the proposal footprint and at other individual sub-catchment swale locations not under the project footprint (see also for example Chapman & Roberts 2004).

### 2.1. Adopted Sampling Methodology

Section 2.1 of the Aquatic Ecology Methodology Addendum Report (MPR 2023) provides a full description of the approved and adopted intertidal habitat monitoring program**.** The study utilised two fixed ladder transects (plots) established at each sub-site. The Intertidal Vegetation Monitoring plots were established in the transitional zone between the riparian (terrestrial) plant communities and saltmarsh and continued through the saltmarsh proper terminating in the mangrove zone. **Figure 3** below shows the location of the adopted inshore intertidal sampling sub-sites.

The two 2m ladder transects per site are separated by a 2m space configuration providing four fixed line intercept transects set 2m apart and an overall fixed 6m wide plot for placement of random quadrats. As each sub-site contained site specific features which influence the distribution of intertidal vegetation communities (e.g., slope, aspect, exposure to tides), the Intertidal Vegetation Monitoring plots were of variable length, with some sites containing mixed assemblages of saltmarsh and mangrove plants in their outermost limits.

#### 2.1.1. Six Monthly Transect Gradients, Driplines and Landscape Mosaics

Once established the profile/gradient (AHD height) of each of the transect lines was measured, followed by plot Shade/Drip Line measurements and Landscape Mosaic assessments. These measurements were repeated at the middle and towards the end of the of the 18-month sampling period (see **Table 4** for sub-site sampling dates). Methodology for *landscape mosaic descriptions* was as follows:

- For each of the 6m wide landscape plots initial definition of the main plant assemblages within the plot are determined by dominant zone species and/or dominant abiotic factors such as bare sediment.
- Cross-over points for each of the assemblages at and between each of the four fixed transects are determined on-site and the data are plotted directly onto squared graph paper in-situ then subsequently digitised to produce the landscape mosaics

for each sub-site plot. Each landscape plot is accompanied by site photographs up and down slope.

### 2.1.2. Bi-Monthly Ladder Transect Measurements

Sampling for the intertidal ladder transects at nominally two monthly intervals means nine surveys over the 18-month period. Nine surveys were completed but not strictly at two monthly intervals as surveys were timed around significant rain events. Bimonthly transect methods are summarised as follows:

*Line point intercept measurements*:
The transect point-intercept analysis monitors progression or receding vegetation or assemblages over time. For each line transect start to stop points of vegetation assemblages are recorded based on main species present.
*Intertidal plot quadrat density*:

- Density change within the riparian, saltmarsh and inshore mangrove assemblages and zones was assessed via three haphazardly placed quadrats within each zoned area within the plot mosaic (i.e, riparian edge, saltmarsh, saltmarsh-to upper mangrove and upper mangrove zoned habitats):
- The quadrat is 1m x 1m square with a 5x5 grid (i.e., 25 squares). Density is recorded via the following density scale:
    - In quadrats with only one individual, a density value of 0.1 is recorded.
    - Quadrats with species < 30% coverage (< 8 squares) is density value One.
    - Cover between 30 and 60% (9 to 16 squares) is density value Two.
    - Density value 3 for coverage greater than 60% (17 or more squares).
    - Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat.
    - Mangrove pneumatophore cover is determined by a count of occupied grid squares with values recorded as 0 to 25.

*Wet weather triggers*

- The post wet weather trigger for formal sampling of intertidal habitats following wet weather (where there was more than 20mm rainfall recorded), required inspection of a representative number of intertidal site riparian edges for any signs of physical erosion and or possible inshore sediment deposits. Assessment for possible erosion/deposition was facilitated by comparisons against previous up and down slope transect photography undertaken for each bimonthly intertidal sampling event:
    - In the event whilst there were no formal triggers (i.e., no obvious erosion or deposition at any sites) noted for post wet weather inspections, the starts for

three of the bimonthly sampling programs were synchronised to follow a high rainfall event (the May 2023 sampling event after 61mm on 30 April, the post-Christmas-January 2024 bimonthly sampling following 96mm on 20 and 21 December 2023, and the April 2024 sampling brought forward following 86mm on 6 April. These post wet weather sampling events are indicated by an asterisk in **Table 5** below.

**Table 4 Sampling Dates for Intertidal Transect Height Profiles, Mosaic and Shade/Drip Line Surveys**

| Intertidal Sub-Site | Transect Height Profiles | | | Mosaic/Landscape and Shade/Drip Line Surveys | | |
|---|---|---|---|---|---|---|
| | **Start** Dec-May | **Middle** Jun-Nov | **Finish** Dec-May | **Start** Dec-May | **Middle** Jun-Nov | **Finish** Dec-May |
| **CUP1-I** | 18/1/2023 | 24/8/2023 | 10/1/2024 | 15/2/2023 | 24/8/2023 | 18/4/2024 |
| **CUP1-R** | 18/1/2023 | 22/8/2023 | 11/1/2024 | 16/2/2023 | 22/8/2023 | 17/4/2024 |
| **CUP2-I** | 18/1/2023 | 23/8/2023 | 10/1/2024 | 15/2/2023 | 23/8/2023 | 18/4/2024 |
| **CUP2-R** | 18/1/2023 | 23/8/2023 | 10/1/2024 | 7/2/2023 | 23/8/2023 | 18/4/2-24 |
| **BB1-I** | 11/4/2023 | 22/8/2023 | 11/1/2024 | 15/2/2023 | 22/8/2023 | 17/4/2024 |
| **BB1-R** | 11/4/2023 | 22/8/2023 | 11/1/2024 | 15/2/2023 | 22/8/2023 | 17/4/2024 |
| **BB2-I** | 11/4/2023 | 21/8/2023 | 11/1/2024 | 15/2/2023 | 21/8/2023 | 17/4/2024 |
| **BB2-R** | 29/3/2023 | 21/8/2023 | 11/1/2024 | 15/2/2023 | 21/8/2023 | 17/4/2024 |
| **SWB1-I** | 21/3/2023 | 26/9/2023 | 10/1/2024 | 14/2/2023 | 3/8/2023 | 16/4/2024 |
| **SWB1-R** | 21/3/2023 | 26/9/2023 | 10/1/2024 | 14/2/2023 | 3/8/2023 | 16/4/2024 |
| **SWB2-I** | 6/3/2023 | 26/9/2023 | 10/1/2024 | 8/2/2023 | 2/8/2023 | 15/4/2024 |
| **SWB2-R** | 20/3/2023 | 25/9/2023 | 10/1/2024 | 8/2/2023 | 2/8/2023 | 16/4/2024 |
| **SEB1-I** | 1/3/2023 | 10/8/2023 | 8/1/2024 | 2/2/2023 | 1/8/2023 | 10/4/2024 |
| **SEB1-R** | 2/3/2023 | 10/8/2023 | 9/1/2024 | 6/2/2023 | 31/7/2023 | 11/4/2024 |
| **SEB2-I** | 2/3/2023 | 10/8/2023 | 9/1/2024 | 7/2/2023 | 1/8/2023 | 15/4/2024 |
| **SEB2-R** | 2/3/2023 | 10/8/2023 | 9/1/2024 | 6/2/2023 | 1/8/2023 | 11/4/2024 |
| **CDN1-I** | 28/2/2023 | 25/8/2023 | 5/1/2024 | 28/2/2023 | 25/8/2023 | 22/4/2024 |
| **CDN1-R** | 28/2/2023 | 25/8/2023 | 5/1/2024 | 28/2/2023 | 25/8/2023 | 22/4/2024 |
| **CDN2-I** | 28/2/2023 | 24/8/2023 | 9/1/2024 | 27/2/2023 | 24/8/2023 | 22/4/2024 |
| **CDN2-R** | 27/2/2023 | 25/9/2023 | 9/1/2024 | 27/2/2023 | 25/9/2023 | 23/4/2024 |




**Figure 3** Final Adopted Intertidal Habitat Site Location

## Table 5 Culburra Treatment Plant Daily Rainfall 2023 & 2024 - Estuarine Intertidal Sampling Schedule

| Date | 2023 | | | | | | | | | | | | 2024 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May |
| **1st** | 0 | 0 | 0 | 5 | 0 * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 |
| **2nd** | 0 | 0 | 3 | 2 | 0 * | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 11 | 0 | 5 |
| **3rd** | 0 | 0 | 5 | 0 | 0 * | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 2 | 49 |
| **4th** | 2 | 0 | 9 | 1 | 0 * | 5 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 25 |
| **5th** | 15 | 0 | 0 | 0 | 0 * | 2 | 4 | 0 | 0 | 18 | 17 | 0 | 1 | 8 | 0 | 2 | 48 |
| **6th** | 17 | 0 | 2 | 0 | 0 * | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 86 | 27 |
| **7th** | 3 | 0 | 0 | 0 | 0 * | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| **8th** | 0 | 24 | 0 | 6 | 16 * | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 20 |
| **9th** | 0 | 253 | 0 | 0 | 0 * | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 28 |
| **10th** | 0 | 7 | 0 | 0 | 0 * | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 9 * | 17 |
| **11th** | 0 | 3 | 0 | 0 | 0 * | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 * | 34 |
| **12th** | 0 | 0 | 0 | 0 | 0 * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 * | 80 |
| **13th** | 0 | 2 | 22 | 3 | 0 * | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 * | 135 |
| **14th** | 2 | 2 | 5 | 35 | 0 * | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 * | 0 |
| **15th** | 0 | 17 | 12 | 6 | 0 * | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 51 | 2 | 10 | 0 * | 0 |
| **16th** | 0 | 0 | 0 | 1 | 0 * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 3 | 0 | 0 * | 0 |
| **17th** | 1 | 0 | 0 | 1 | 3 * | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 * | 0 |
| **18th** | 0 | 0 | 0 | 0 | 2 * | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 52 | 0 * | 3 |
| **19th** | 23 | 11 | 0 | 0 | 1 * | 0 | 0 | 0 | 0 | 0 | 0 | 0 * | 0 | 1 | 5 | 0 * | 4 |
| **20th** | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 * | 0 | 5 | 8 | 9 * | 0 |
| **21st** | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 * | 0 | 15 | 0 | 0 * | 0 |
| **22nd** | 1 | 17 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 * | 0 | 0 | 0 | 0 * | 0 |
| **23rd** | 21 | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 7 | 6 * | 4 | 0 | 0 | 0 * | 0 |
| **24th** | 0 | 0 | 7 | 30 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 * | 0 | 22 | 0 | 0 | 0 |
| **25th** | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 * | 0 | 0 | 0 | 0 | 0 |
| **26th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 32 * | 2 | 0 | 0 | 0 | 0 |
| **27th** | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 7 | 12 | 1 | 2 * | 0 | 6 | 0 | 0 | 0 |
| **28th** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 87 | 7 * | 0 | 0 | 0 | 0 | 0 |
| **29th** | 0 | | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 | 168 | 0 * | 0 | 0 | 0 | 0 | 0 |
| **30th** | 7 | | 4 | 61 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 0 * | 1 | | 0 | 6 | 0 |
| **31st** | 14 | | 2 | | 0 | | 0 | 2 | | 0 | | 1 * | 0 | | 0 | | 0 |
| **Monthly Total** | 119 | 337 | 83.6 | 162 | 25.3 | 15.4 | 12 | 36.2 | 16.2 | 61.7 | 334 | 167 | 90 | 97.8 | 125 | 119 | 481 |
| **Monthly Average** | 98.1 | 130 | 140 | 112 | 105 | 139 | 84 | 79.3 | 73.4 | 86.7 | 84.9 | 74.9 | 98 | 130 | 140 | 112 | 105 |

| **Legend** | | | | |
|---|---|---|---|---|
| | | Consecutive Sampling Periods | 20 | High Rainfall Event (>20mm over 48 hours) |
| | * | Post Wet Weather Intertidal Site Checks | | |

| Table 6 Sub-site Bi-Monthly Intertidal Point Intercept Transect & Quadrat Sampling Dates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bimonthly Sample | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **CUP1-I** | 15/2/2023 | 5/4/2023 | 16/5/2023 | 14/7/2023 | 24/8/2023 | 3/10/2023 | 4/1/2024 | 11/3/2024 | 18/4/2024 |
| **CUP1-R** | 16/2/2023 | 5/4/2023 | 4/5/2023 | 13/7/2023 | 22/8/2023 | 3/10/2023 | 4/1/2024 | 11/3/2024 | 17/4/2024 |
| **CUP2-I** | 15/2/2023 | 5/4/2023 | 4/5/2023 | 18/7/2023 | 23/8/2023 | 4/10/2023 | 4/1/2024 | 12/3/2024 | 18/4/2024 |
| **CUP2-R** | 7/2/2023 | 3/4/2023 | 4/5/2023 | 18/7/2023 | 23/8/2023 | 4/10/2023 | 4/1/2024 | 12/3/2024 | 18/4/2024 |
| **BB1-I** | 15/2/2023 | 3/4/2023 | 5/5/2023 | 12/7/2023 | 22/8/2023 | 28/9/2023 | 3/1/2024 | 15/2/2024 | 17/4/2024 |
| **BB1-R** | 15/2/2023 | 3/4/2023 | 5/5/2023 | 12/7/2023 | 22/8/2023 | 28/9/2023 | 3/1/2024 | 15/2/2024 | 17/4/2024 |
| **BB2-I** | 15/2/2023 | 3/4/2023 | 3/5/2023 | 12/7/2023 | 21/8/2023 | 28/9/2023 | 3/1/2024 | 15/2/2024 | 17/4/2024 |
| **BB2-R** | 15/2/2023 | 29/3/2023 | 3/5/2023 | 12/7/2023 | 21/8/2023 | 28/9/2023 | 3/1/2024 | 14/2/2024 | 17/4/2024 |
| **SWB1-I** | 14/2/2023 | 21/3/2023 | 3/5/2023 | 12/7/2023 | 3/8/2023 | 26/9/2023 | 2/1/2024 | 13/2/2024 | 16/4/2024 |
| **SWB1-R** | 14/2/2023 | 21/3/2023 | 2/5/2023 | 11/7/2023 | 3/8/2023 | 26/9/2023 | 2/1/2024 | 14/2/2024 | 16/4/2024 |
| **SWB2-I** | 8/2/2023 | 6/3/2023 | 2/5/2023 | 11/7/2023 | 2/8/2023 | 26/9/2023 | 19/12/2023 | 7/2/2024 | 15/4/2024 |
| **SWB2-R** | 8/2/2023 | 20/3/2023 | 2/5/2023 | 11/7/2023 | 2/8/2023 | 25/9/2023 | 19/12/2023 | 8/2/2024 | 16/4/2024 |
| **SEB1-I** | 2/2/2023 | 1/3/2023 | 12/4/2023 | 10/7/2023 | 1/8/2023 | 27/9/2023 | 19/12/2023 | 5/2/2024 | 10/4/2024 |
| **SEB1-R** | 6/2/2023 | 2/3/2023 | 12/4/2023 | 10/7/2023 | 31/7/2023 | 27/9/2023 | 19/12/2023 | 5/2/2024 | 11/4/2024 |
| **SEB2-I** | 7/2/2023 | 2/3/2023 | 1/5/2023 | 11/7/2023 | 1/8/2023 | 27/9/2023 | 2/1/2024 | 6/2/2024 | 15/4/2024 |
| **SEB2-R** | 6/2/2023 | 2/3/2023 | 1/5/2023 | 10/7/2023 | 1/8/2023 | 27/9/2023 | 2/1/2024 | 6/2/2024 | 11/4/2024 |
| **CDN1-I** | 28/2/2023 | 14/4/2023 | 24/5/2023 | 19/7/2023 | 25/8/2023 | 5/10/2023 | 5/1/2024 | 13/2/2024 | 22/4/2024 |
| **CDN1-R** | 28/2/2023 | 14/2/2023 | 24/5/2023 | 19/7/2023 | 25/8/2023 | 5/10/2023 | 5/1/2024 | 13/2/2024 | 22/4/2024 |
| **CDN2-I** | 27/2/2023 | 11/4/2023 | 17/5/2023 | 20/7/2023 | 24/8/2023 | 4/10/2023 | 9/1/2024 | 12/2/2024 | 22/4/2024 |
| **CDN2-R** | 27/2/2023 | 11/4/2023 | 17/5/2023 | 20/7/2023 | 25/8/2023 | 4/10/2023 | 9/1/2024 | 12/2/2024 | 23/4/2024 |

### 2.2. Estuary Intertidal Sub-Site Height Profiles

The intertidal height profile transect diagrams for each of the Intertidal estuarine sub-sites are provided in **Appendix C-2**. Each diagram shows three riparian height estimates obtained at the start, middle and finish of the sampling program. Relative heights were initially calculated in relation to reference start peg heights (Data Reports 1 and 2) and once the reference peg heights were surveyed in, the relative heights could be converted to AHD heights for this final report:

The transect data confirm that whilst there is considerable variation for overall transect shape between sites and sub-sites (and sometimes even within sub-sites - see for example BB1-I) there is little variation between individual sub-site repeat gradient sampling indicating overall good within site stability.

Inspection of survey data for the two sites with obvious gradient discrepancies (SWB1-R Transect 1, SEB2-I - Transect 1) indicated that the discrepancies both related to build up of wrack at the time of the profile sampling. Inshore casuarina wrack and offshore seagrass wrack build-up were also correlated with some of the smaller but evident variations in gradient measurements.

It is concluded that the evident overall stability of site upper intertidal gradients over the 18-month monitoring period that featured a continuous series of high rainfall events indicates a conservative resilience for the combined upper and lower river plus Curley Bay sites so that these data provide an appropriate baseline for future during and post construction potential estuarine edge erosion monitoring purposes.

### 2.3. Inshore Riparian Drip Line Measurements

Drip line measurements show the linear length of canopy shading provided by riparian trees (mostly swamp oak *Casuarina glauca*), from the inner edges of the transect lengths, and the mean results are shown below in **Figure 4** below.

The extent of riparian canopy coverage was highest at the Southwest Bay sub-sites SWB1-I and SWB1-R which spanned on average of 27.1 ± 0.4m and 19.6 ± 1.4m respectively. The coverage of riparian canopy among Billys Bay sites was variable.

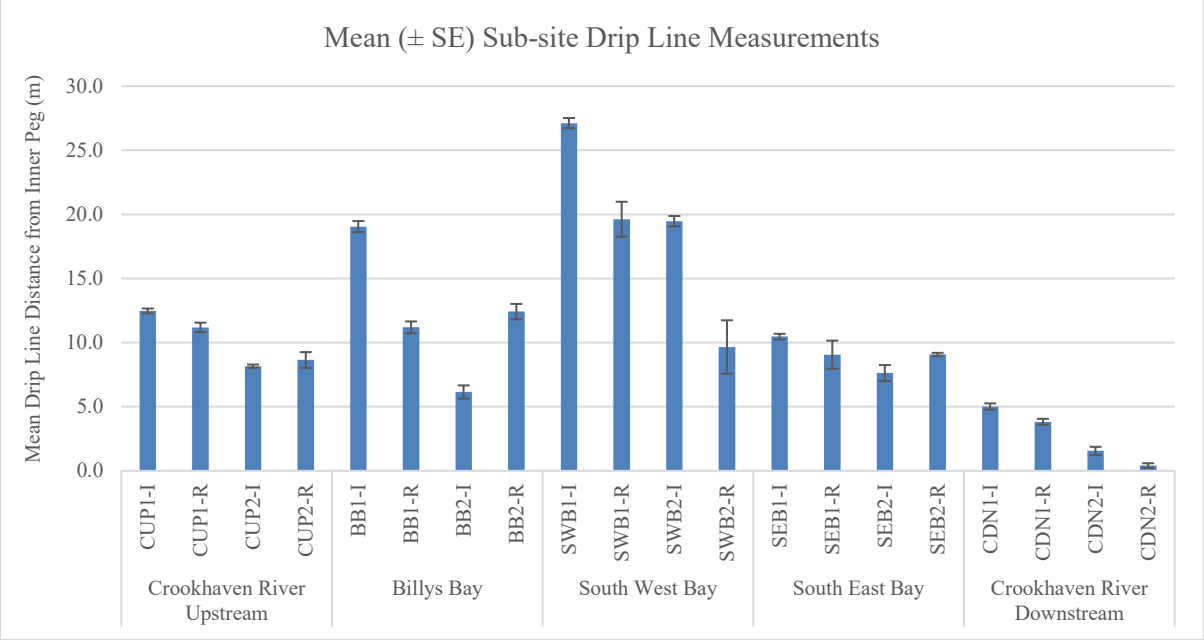



**Figure 4** Mean drip line results recorded along each sub-site transect, surveys 1, 5 and 9.

### 2.4. Estuary Intertidal Landscape (Mosaic) Diagrams & Site Photographs

The mosaic (landscape) diagrams from the first (Dec 22 to May 23), second (June 23 to Nov 23) and third (Dec 23 to May 24) sampling events are provided in **Appendix C-5**. **Appendix C-8** also provides up and down slope seasonal transect photographs. The tables below and each mosaic plot in **Appendix C-5** provide the plant/abiotic descriptions utilised for distinguishing between mosaic-plot assemblages. Each of these colour zones or assemblages is defined by the dominant (generally one to three) species. **Appendix C1** provides the consolidated estuarine intertidal monitoring program species lists plus abiotic character lists and codes utilised in the various study elements.

The first round of mosaic plots was utilised as a scoping study of the zones with the consecutive second and third rounds outlining all species present in each zone. Note that whilst there is some *zonation consistency* from upslope to down slope for the mosaic plots, there is *no assemblage consistency* for colour schemes between plots as for each of the mosaic plots colours have been allocated to provide definitive contrasts.

Inspection of each set of sub-site mosaics indicates an overall within-site stability in major zone limits over the 18-month monitoring period. In terms of within site differences there was less apparent difference for *within* R Ridge and I In-Line sub-site assemblages compared to *between* site comparisons:

- The four BB sub-sites were generally similar and characterised by a few (2 to 4) broad zones with little sub-zone variation.
- The four SWB sub-sites had 5 to 7 zones with some more complex sub-zone presence.
- Three of the four SEB sub-sites had more zones (6 to 7) but less complexity in regard sub-zones compared to SWB. Site SEB2-I was more complex.
- Three of the four CUP sub-sites had up to 5 zones but with less complexity in regard sub-zones compared to SWB. Site CUP1-R was more complex.
- Three of the four CDN sub-sites had five broad zones and less complexity regarding sub-zones and Site CDN2-I was more complex.

Whilst the results of the mosaic study support the conclusion of overall intertidal habitat stability over time, the difficulty of defining microhabitats and smaller sub-assemblages plus the overall time that this type of survey requires is not considered sustainable for future construction and post construction monitoring.

**Appendix C7** provides before and after transect riparian edge photographs for the SEB Ridge and In-line sites that were utilised as a check of potential riparian edge erosion following the combined high rainfall events in February/March 2023. These photographs combined with the wider check visits to other sites confirmed that there were no observable erosion or sedimentation events to trigger additional transect height surveys - as per the approved methodology.

### 2.5. Bimonthly Intertidal Habitat Vegetation & Abiotic Variation

On the basis that there were no observed weather-related variations for each of the intertidal sub-sites over the three six bi-monthly monitoring periods, it is postulated that there should either be little or minor variation in overall intertidal transect species cover or density over this period, there could be some consistent season-related variation for particular species over time or there may be consistent variation associated with wrack accumulation.

To test this preliminary assumption, initial assessment of the intertidal transect bimonthly point intercept data has included summing of transect lengths occupied by keystone saltmarsh plant and abiotic factors along each of the replicate transect lines and summing plus averaging replicate quadrat density results. These data were then averaged across the replicates, with the results shown in the bar graph plots.

**Table 7** below shows the overall distribution of saltmarsh plants across sample site locations. Two other listed species known from the Crookhaven River estuary and reported in MPR

(2020) were not recorded among the current suite of monitoring sites; streaked arrowgrass *Triglochin striata* and knobby club-rush *Ficinia nodosa*. The table includes tidal range measurements in Australian Height Datum (m AHD), extrapolated from the transect length GPS survey undertaken in July 2024.

**Table 7 Culburra Estuarine Intertidal Sub-site Saltmarsh Species Occurrences**

| | Common Name | Creeping Brookweed | Swamp Weed | Bare Twig Rush | Seablite | Samphire* | Sea Rush | Sea Couch |
|---|---|---|---|---|---|---|---|---|
| Location | | *Samolus repens* | *Selliera radicans* | *Machaerina juncea* | *Suaeda australis* | *Sarcocornia quinqueflora* | *Juncus kraussii* | *Sporobolus virginicus* |
| | Spp code | SE | BS | BJ | SA | GW | JK | SQ |
| Crookhaven River Upstream | CUP1-I | √ | √ | √ | | | √ | √ |
| | CUP1-R | √ | | | | | √ | √ |
| | CUP2-I | √ | | | √ | | √ | √ |
| | CUP2-R | | | | √ | | | √ |
| Billys Bay | BB2-I | √ | | √ | | | √ | √ |
| | BB2-R | √ | √ | √ | | | √ | √ |
| | BB1-I | | √ | √ | | | √ | √ |
| | BB1-R | | √ | √ | | | √ | √ |
| South West Bay | SWB1-I | √ | √ | √ | √ | | √ | √ |
| | SWB1-R | √ | √ | | | √ | √ | √ |
| | SWB2-I | | √ | √ | | | √ | √ |
| | SWB2-R | | √ | √ | | | √ | √ |
| South East Bay | SEB1-I | | | | | | √ | √ |
| | SEB1-R | | | √ | √ | | √ | √ |
| | SEB2-I | | | | | | √ | √ |
| | SEB2-R | | | | | | √ | √ |
| Crookhaven River Down stream | CDN1-I | | | | | | √ | √ |
| | CDN1-R | | | | | | √ | √ |
| | CD2N-I | | √ | | | | √ | √ |
| | CDN2-R | | | | √ | | | √ |
| Tidal Range AHD (m) | Upper | 1.13 | 1.17 | 1.16 | 0.97 | 0.97 | 1.17 | 1.18 |
| | Lower | 0.73 | 0.68 | 0.50 | 0.56 | 0.54 | 0.34 | 0.32 |
| Note: | *Samphire tidal range data taken from MPR (2020) as the only data point for the current survey period (0.95 to 0.97m AHD) came from a single plant occurrence at SWB1-R. | | | | | | | |

There were seven saltmarsh species recorded across all locations for the 18-month monitoring period. South West Bay was the only location to contain all species within the sub-site boundaries, with most of the other locations supporting small quantities of the less common saltmarsh species. Sea rush (*Juncus kraussii*) and sea couch (*Sporobolus virginicus*) were the most widespread species over all locations, and both species occupied the widest range of tidal heights.

As each of the estuarine intertidal monitoring sub-sites contain location specific intertidal habitat features, the remaining monitoring results are presented for the grouped Billys Bay, South West Bay, South East Bay, Crookhaven River Up and Crookhaven River Down Sites and Sub-sites to better characterise the existing baseline conditions for these main locations.

### 2.6. Intertidal Habitats at Billys Bay Sites

The Billys Bay sites are situated along the shoreline of Billys Bay to the north of the project footprint. Whereas the catchment area upslope from BB1 and BB2 contain native woodland communities, BB2 is located below the project footprint, however the riparian corridor is continuous and generally dense across all BB sites.

Saltmarsh is continuous along the Billys Bay foreshore fronting the riparian corridor. The Billys Bay saltmarsh comprises a continuous thin band of *Sporobolus virginicus* and *Juncus kraussii* species complexes with scattered patches of dense swamp weed (*Selliera radicans*) and bare twig rush (*Machaerina juncea*) stands of varying density along the upper saltmarsh zones. The saltmarsh band widths (as measured from the innermost species occurrence to the outermost) were generally narrow at BB1-R (8m) and BB2-I (11m) compared to BB1-I (up to 20m) and BB2-R (28m). The lower intertidal habitats offshore from the saltmarsh comprise dense grey mangrove *Avicennia marina* stands, which are for the most part continuous across the intertidal channel to Billys Island (> 100m in width).

#### 2.6.1. Intertidal Vegetation Transect Results

The mean combined length of saltmarsh plants along each of the four sub-site transects are provided below for BB1 (**Figures 5** and **6**) and BB2 (**Figures 7** and **8**). The figures allow for a visual comparison of the individual species occurring in the saltmarsh at each location and the variation between transects within surveys (shown by the standard error bars) and between bi-monthly surveys (bars). Note that there are no error bars for instances where species presence was limited to one transect per survey.

The riparian habitat zone at BB1-R was generally sparsely occupied by riparian grasses, herbs (*Lobelia anceps*) and infrequent observations of lantana (*Lantana camera*) in the uppermost limits of all transects, and consistent record of swamp oak needle layer throughout the monitoring period. Sites BB1-I and BB2-R contained a higher diversity of riparian plants which included several riparian grasses (blady grass, buffalo grass) and herb species which were recorded throughout the upper saltmarsh zone. The riparian zone at site BB2-I supported very few species which included wetland plants (*Phragmites australis*) and swamp paperbark (*Melaleuca ericifolia*) along the upper limits of the transects.

Lantana was recorded from the uppermost limits of the transect lengths at BB1-R on three occasions and BB2-R for the final survey. Lantana is known to occur in dense thickets in the riparian zone around Billys Bay foreshore, and the records of lantana within the transect boundaries likely represent encroachment from existing stands.

The swamp oak riparian corridor provided shading of the upper limits of the BB saltmarsh zones, with a change in species composition beyond the drip line:

- The wetland plant common reed *Phragmites australis* occurred at BB2-I only. The species were recorded in the upper half of the transect plots in sparse aggregations with variable occupation between transects and monitoring surveys. Overall, the presence of common reed at BB2-I followed similar patterns to the rainfall, with higher representation during wet period in early 2023 (Surveys 1 to 3) and absence (die back) during the middle of the year (Surveys 4 to 6) and renewed growth between summer and autumn (Surveys 7 to 9).
- *Selliera radicans* occurrences were generally limited to the upper saltmarsh zone (within the upper 3m of the transects) at BB1 and BB2. The ridge sites BB1-R and BB2-R maintained the most consistent results which remained relatively stable over the monitoring period, with dense patches observed at BB1-R and sparse, sometimes single plants observed at BB2-R.
- Occurrences of *Selliera radicans* at BB1-I were limited to sporadic observations of isolated small patches underneath moderately dense *Machaerina juncea* stands.
- *Machaerina juncea* was the dominant species in the upper saltmarsh zone at the inline site BB1-I (recorded between 0m and 16m across all transects) and the occurrences at BB1-R were mostly adjacent to (seaward of) *Selliera radicans* patches (between the 0m and 6m mark).
- While *Machaerina juncea* was only haphazardly recorded at ridge site BB2-R for the first three surveys as very sparse growths (generally single leaves), growths at the inline site BB2-I were characterised by generally dense and continuous stands occurring from the 0m to 8m mark across all transects.
- Occurrences of *Samolus repens* was limited to very sparse growths at BB2-R in Transect 1 and a single plant observed on one occasion at BB2-I.
- *Machaerina juncea* and *Sporobolus virginicus* were the most well represented species at BB1-R sub-site, however the inter-survey variation in species occupation fluctuated for both species due to differences in representation among transects and differences in the measured lengths between surveys. *Sporobolus virginicus* stands were absent

from transect 4 at BB1-R which also contributed to the variation observed between surveys.

- *Sporobolus virginicus* and *Juncus kraussii* were the dominant species of the mid to lower saltmarsh at BB1 and BB2 sites. The overall longer mean length values by both species at BB1-I and BB2-R reflects the broader saltmarsh zone at these locations.

With regards to intertidal vegetation zone boundaries, there was overlap in the outer limits of the saltmarsh zone and inner limits of mangroves, as indicated by occurrences of pneumatophores and seedlings, for all transects at each Billys Bay sub-site. The was less overlap observed with sapling occurrences among the lower saltmarsh limits.

### 2.6.2. Billys Bay Intertidal Quadrat Results

At each sub-site, density measurements and count data were collected using three haphazardly placed quadrats within each of the main assemblages identified in the Transect Mosaics. Billys Bay sub-site mean (± SE) quadrat density results are provided below in **Figures 9** to **15** and were calculated for the main saltmarsh species among riparian, saltmarsh and mangrove zones, with each zone determined by the dominant species according to the Transect Mosaic assemblages (according to species classifications in **Appendix Table C-1)**. Quadrat density results for other vegetation (e.g., terrestrial species) are provided in **Appendix C**. Note that there are no error bars where species presence was limited to one quadrat per zone.

As there were minor differences in the Billys Bay sub-site assemblage composition of species or other measured variables (e.g., debris or wrack accumulation) between surveys, **Table 8** below presents the characteristic assemblage compositions which contributed to the respective zone classifications and corresponding number of quadrats per zone for each survey (S) with dominant species in **bold**.

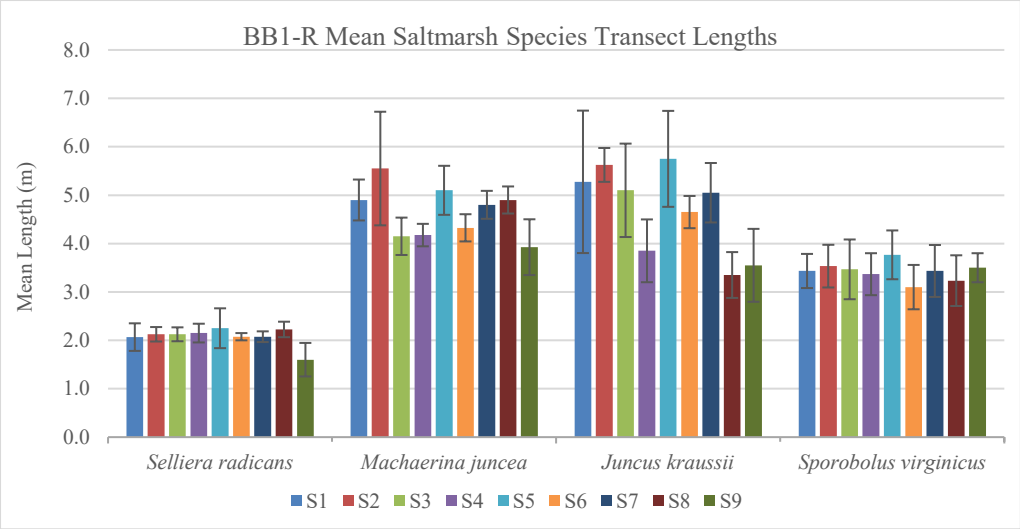



**Figure 5** BB1-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

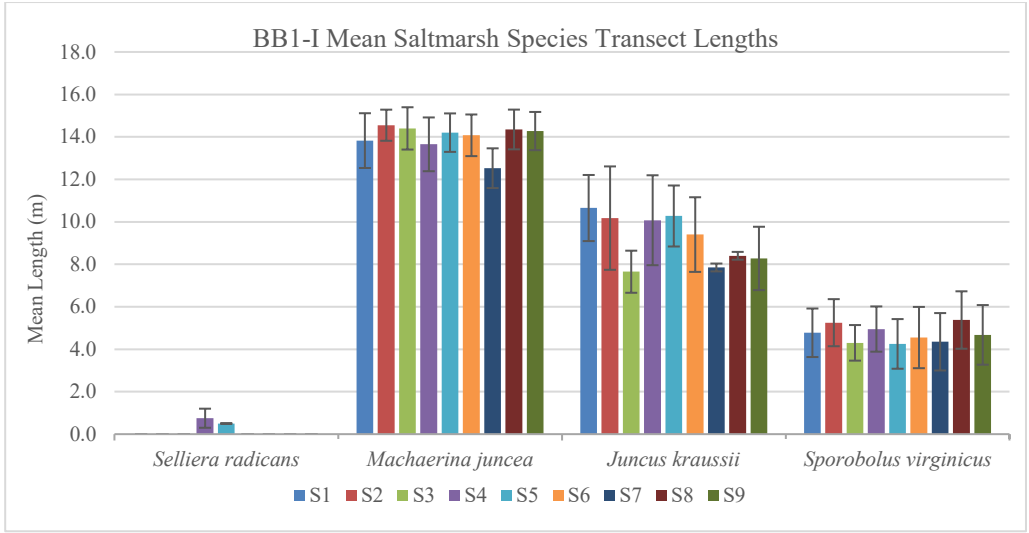



**Figure 6** BB1-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

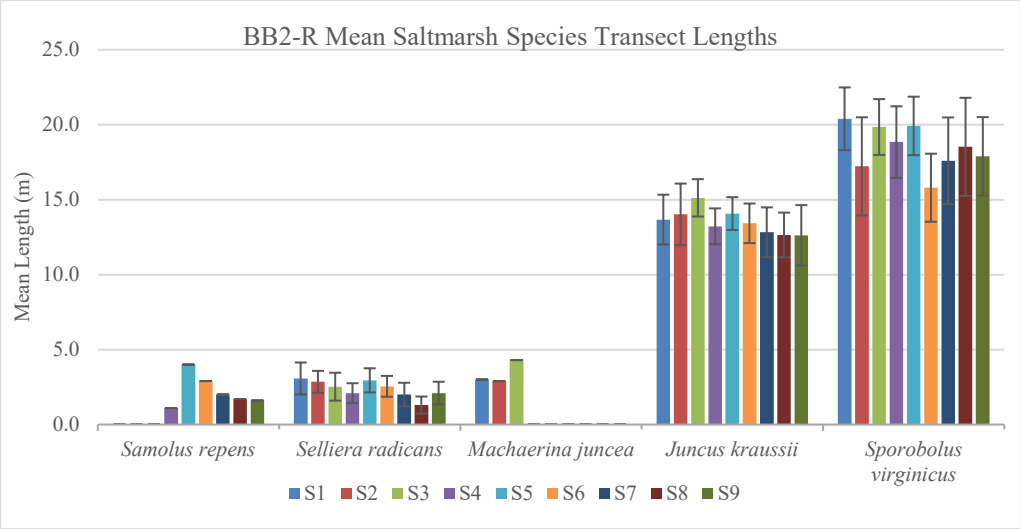



**Figure 7** BB2-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

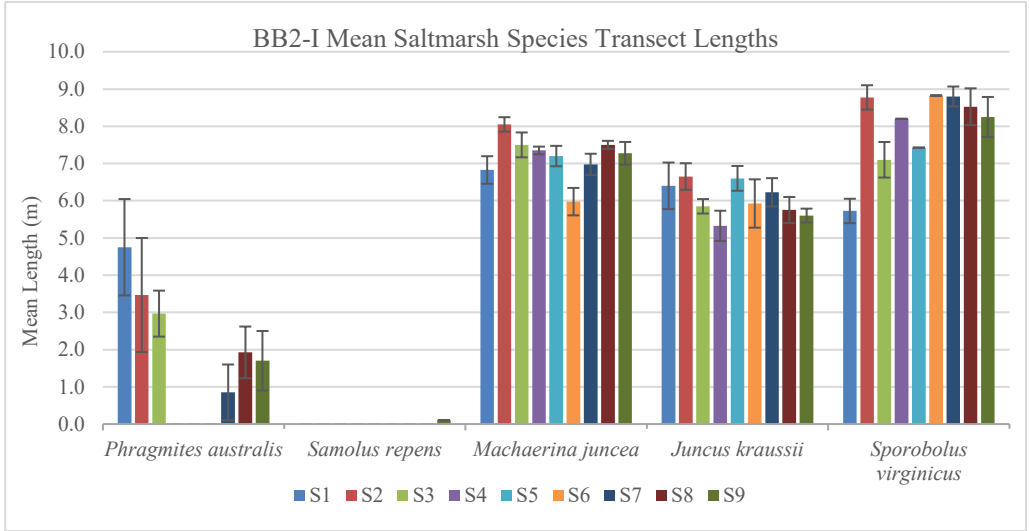



**Figure 8** BB2-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

| Table 8 Billys Bay Sub-Site Intertidal Quadrat Data Zone Classifications | | | | |
|---|---|---|---|---|
| **Site** | **Survey*** | **Transect Mosaic Assemblage** | **Zone Classification** | **# Quadrats / zone** |
| BB1-R | 3 | **BS** + LC + BJ + AL + CW + RG + D | Upper Saltmarsh | 3 |
| | | **JK + BJ** + AL + CW + SQ + CS | Lower Saltmarsh | 6 |
| | | **SQ** + JK + PN + CW + D + BM | | |
| | | **BM + CW + SD** + PN + SD + AD + CH | Mangroves | 3 |
| BB1-I | 3 | **JK + BJ + CW** + SQ + HD + AL + BG + CG + RG + EW + HY + PS | Saltmarsh | 3 |
| | | **BM + CW + AD** + PN + SD + SP | Mangroves | 3 |
| BB2-R | 2 | **BG** + RG + CW + BS + RN + JK + C + IP | Riparian-Upper Saltmarsh | 3 |
| | | **JK + CW** + C + D + SQ | Saltmarsh | 6 |
| | | **JK + SQ** + CW + R + PN + D | | |
| | | **BM + PN + SD + SP** + AD + SQ + CH | Mangroves | 3 |
| BB2-I | 1 | **BJ + ML** + C + JK + SQ + PA | Upper Saltmarsh | 3 |
| | | **JK + SQ** + PA | Lower Saltmarsh | 3 |
| | | **BM + PN + SD + AD** | Mangroves | 3 |
| Note: *Indicates the relevant survey from which the mosaic assemblage classifications were extracted. | | | | |

Density measurements were categorised according to species presence across the 5 x 5 grid (i.e., 25 squares) within the 1m x 1m quadrat, with categorical values of 1 (<30% of coverage), 2 (30 to 60% coverage) or 3 (>60% coverage). In quadrats with only one individual, a density value of 0.1 was recorded. Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat and pneumatophore cover was determined by a count of occupied grid squares with values recorded as 0 to 25.

The complexity of intertidal vegetation varied between sites with generally site-specific assemblages of plants occurring between the riparian edge through to the mangrove habitats:

- Occurrences of *Selliera radicans* was limited to the ridge sites and BB1-R and BB2-R. *Selliera radicans* dominated the upper riparian-saltmarsh habitats at BB1-R and was present in generally sparse coverage in the lower saltmarsh. *Juncus kraussii* co-occurred with *Selliera radicans* density in the upper zone at BB2-R and its density was generally lower than BB1-R and was not recorded among sample quadrats for the final survey nine.
- *Machaerina juncea* was the main species among the saltmarsh at both inline sub-sites, with high coverage recorded for the upper saltmarsh zone at BB2-I
- At BB1-R *Juncus kraussii* and *Sporobolus virginicus* were absent from the upper saltmarsh, and along with *Machaerina juncea* were more dominant in the lower saltmarsh with infrequent records of *Sporobolus virginicus* being recorded form the mangrove zone.

- *Juncus kraussii* and *Sporobolus virginicus* were secondary species among *Machaerina juncea* stands at BB1-I, however both species were dominant in the main saltmarsh zones at BB2 sub-sites.
- Common reed *Phragmites australis* followed similar temporal patterns to the transect length measurements, being better represented during the early and latter surveys in the upper and lower saltmarsh zones at BB2-I.

**Figures 13** provides the pneumatophore counts for all Billys Bay sub-sites:

- Pneumatophore presence in the mangrove zone was high across all Billys Bay sub-sites with mean (± SE) values ranging between 20.7 ± 0.7 (of a total 25 quadrat grids) to 25.0 ± 0.0 grids containing pneumatophores.
- There were no mangrove pneumatophores observed in saltmarsh zone at BB1-I.
- Mangrove pneumatophore occurrences were generally better represented among the BB1-R and BB2-I sites with more consistent readings across the nine surveys, however there were considerable differences between replicate quadrat pneumatophore counts in the lower saltmarsh zones (indicated by the error bars in **Figure 13)**. This was due to pneumatophores being present only from the *Sporobolus virginicus* assemblage and absent from the *Juncus kraussii* - *Machaerina juncea* assemblage at BB1-R (see **Table 7** above for assemblages present per zone), and the variability in quadrat counts at BB2-I. The overall largest mean pneumatophore count value (6.3 ± 0.0 quadrat grids) was at BB2-I which came from a single replicate reading of 19 grids recorded for survey 5.

**Figures 14** to **17** below present the Billys Bay sub-site mean count data for seedlings, saplings and adult mangroves:

- Occurrences of mangrove seedlings, saplings and adults in sample quadrats were restricted to the mangrove zone at BB1-R, BB1-I and BB2-R. Sub-site BB2-I was the only site to record mangrove seedlings in the saltmarsh zone, and for both instances a single plant was observed for surveys 3 and 7.
- At each of the Billys Bay sub-sites, mangrove seedling recruitment to the mangrove zone was much higher for surveys 7 to 9 with variable trends in values. The western Billys Bay sites at BB1 sites had generally much lower seedling establishment than the eastern sites at BB2, which reached a maximum of 183.7 ± 53.3 seedlings per $m^2$ at BB2-R for survey 8.

- Mangrove saplings were relatively uncommon in BB1 sites and were limited to three plants recorded at BB1-R over surveys 3 and 8 and a single specimen recorded at BB1-I for survey 8.
- Mangrove adults were generally not well represented among the Billys Bay quadrat sampling with no adult mangroves recorded in sample quadrats at BB2-R and only one or two specimens recorded on single survey occasions at BB1-R and Sub-site BB2-I recorded the highest number of mangrove adults which reached maximum densities of 2.7 ± 0.8 plants per $m^2$ for survey 7 - which comprised localised dense areas of dwarf mangrove trees.

**Figure 18 to 21** below represents the Billys Bay sub-site mean count data for crab holes:

- Crab hole occurrences were mostly confined to the mangrove zone, with some low counts no greater than 2 per $m^2$ observed in the saltmarsh zone at BB2 sites.
- Crab hole densities were significantly higher at BB2 sub-sites compared to BB1. No crab holes were recorded at BB1-I across all nine surveys, and occurrences at BB1-R were very low, with a maximum count of 2.7 ± 0.8 in survey 2.
- BB2 sub-sites experienced an initial increase in crab hole numbers after survey 1, followed by a notable drop during surveys 4 and 5. However, there was a sharp rise in survey 6, and these higher densities were maintained for the remainder of the surveys.
- BB2-R had the highest crab hole abundance in Billys Bay, with densities in the mangroves ranging from 2.3 ± 0.4 to 27.7 ± 7.4. In contrast, crab hole counts at BB2-I ranged from 0.7 ± 1.6 to 13.7 ± 2.8.

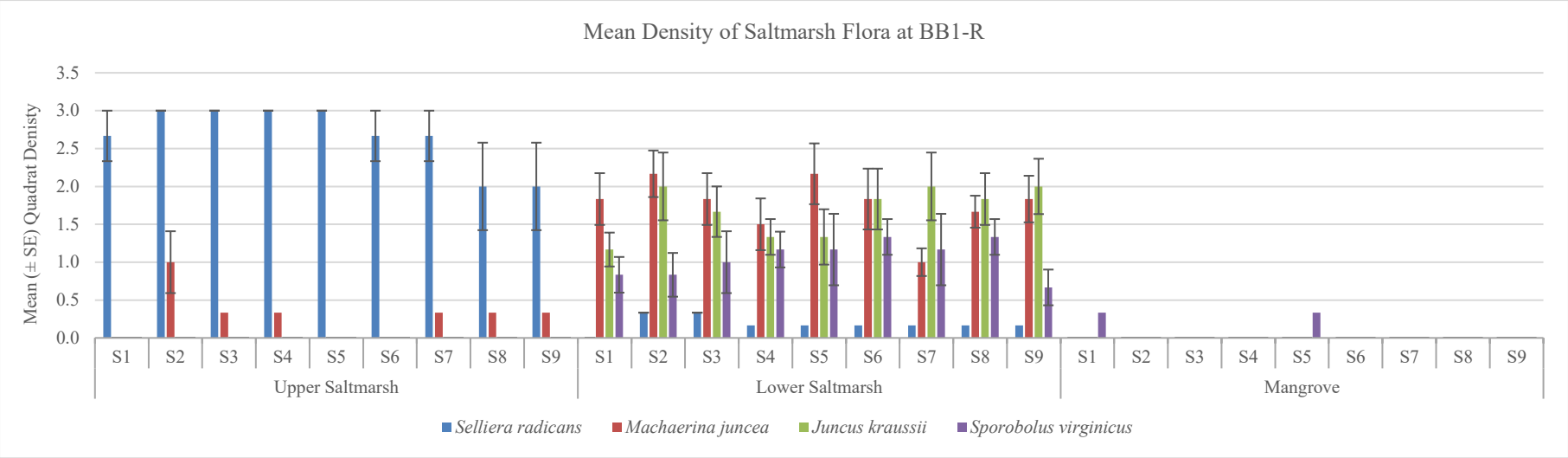



**Figure 9** BB1-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

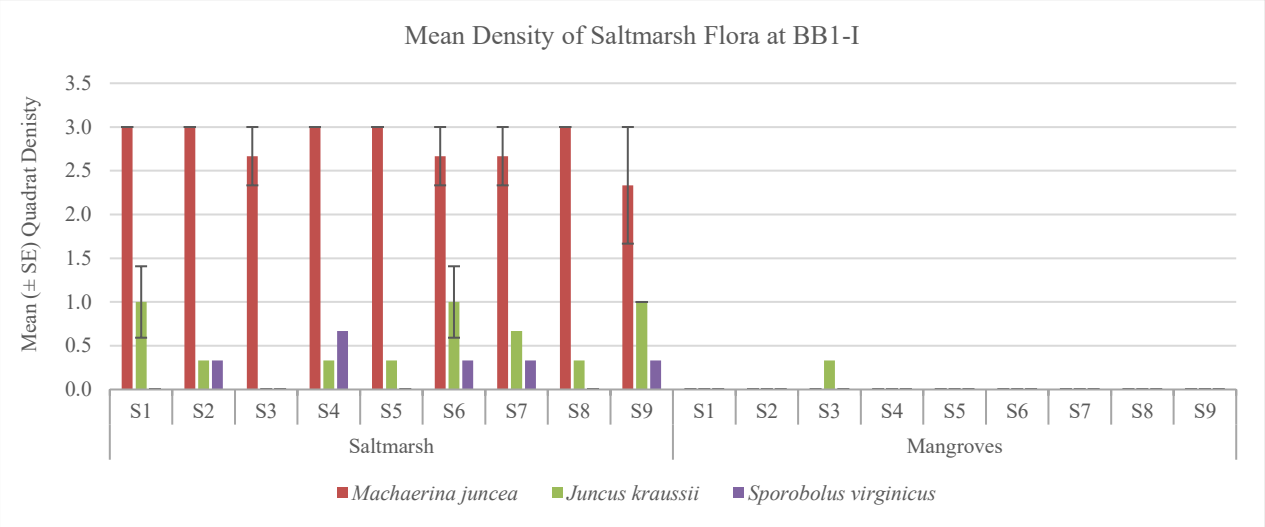



**Figure 10** BB1-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

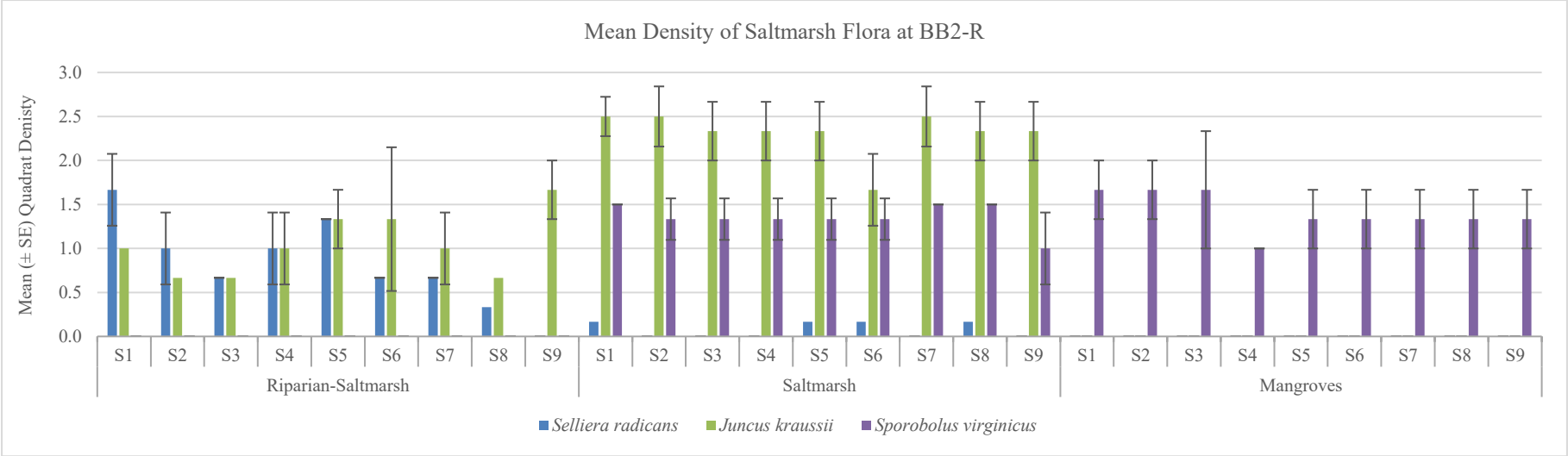



**Figure 11** BB2-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

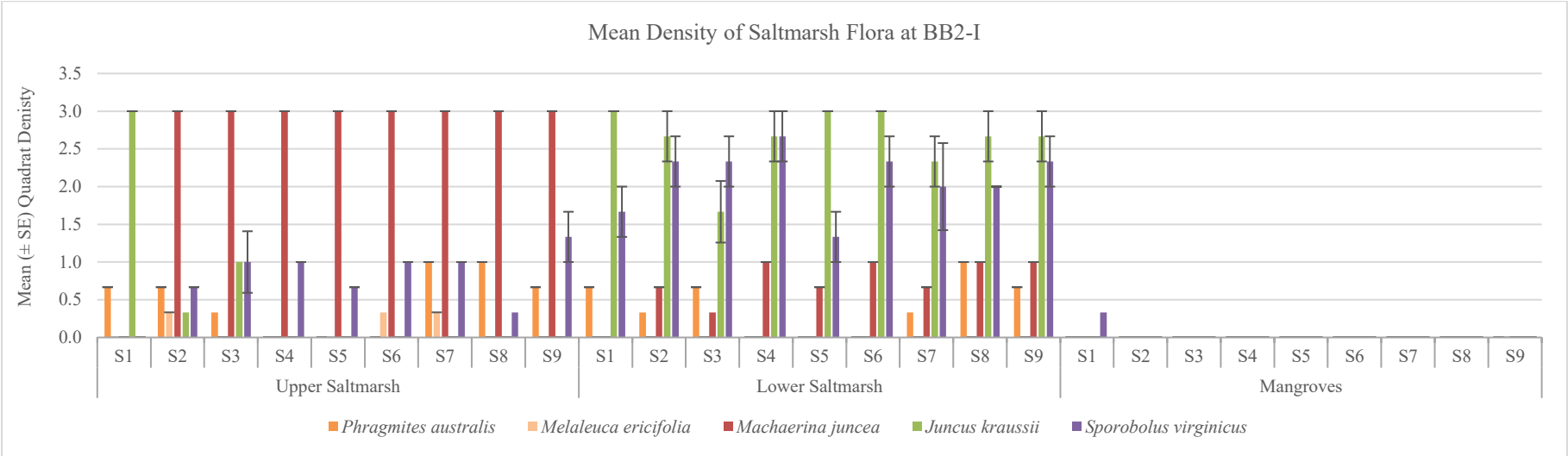



**Figure 12** BB2-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

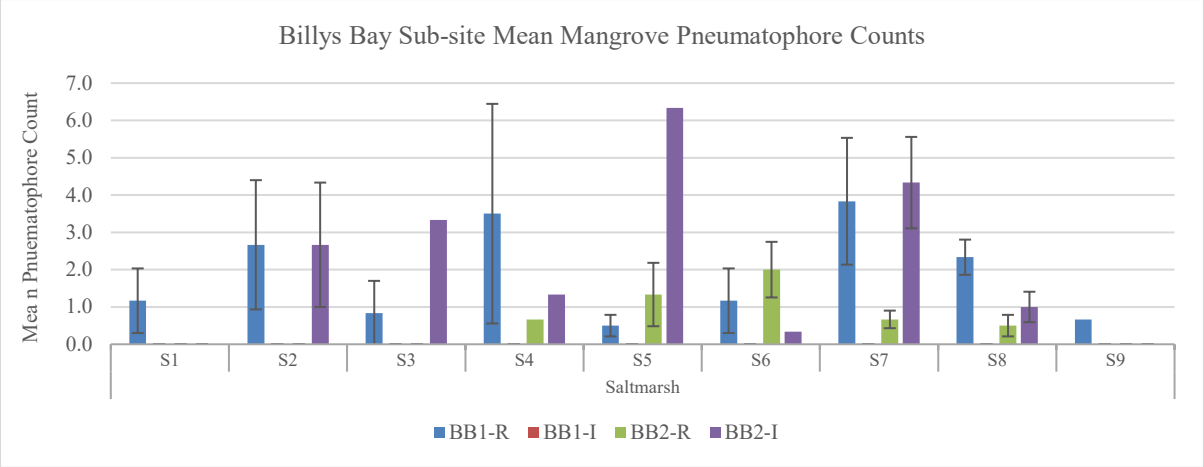



**Figure 13** Billys Bay site mean mangrove pneumatophore count results in the lower saltmarsh zone.

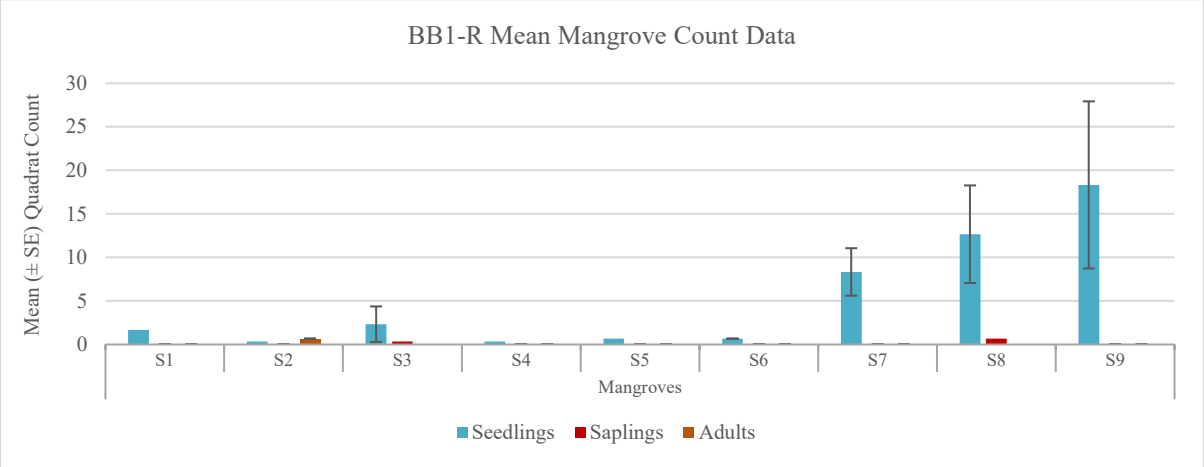



**Figure 14** BB1-R survey mean quadrat count results for mangroves in the mangrove zone.

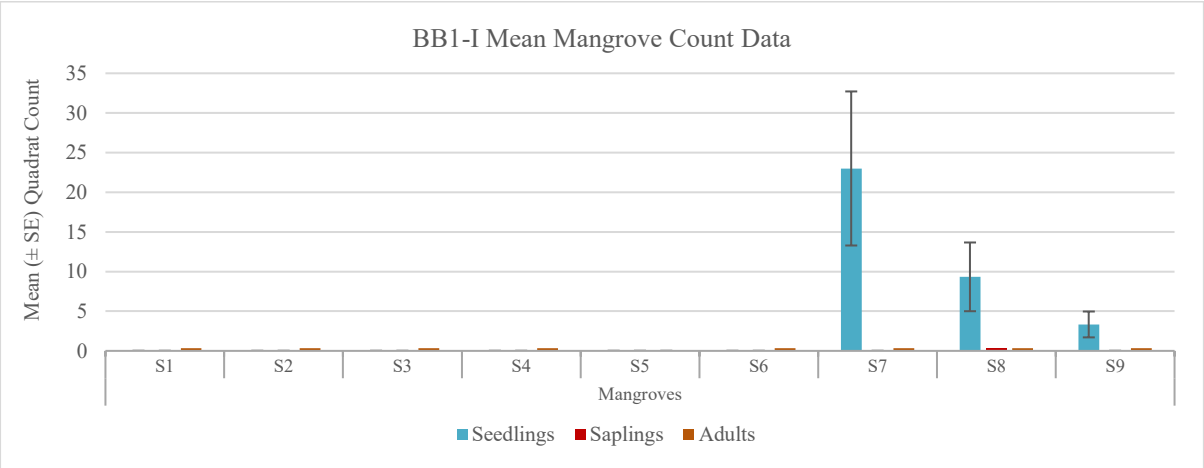



**Figure 15** BB1-I survey mean quadrat count results for mangroves in the mangrove zone.

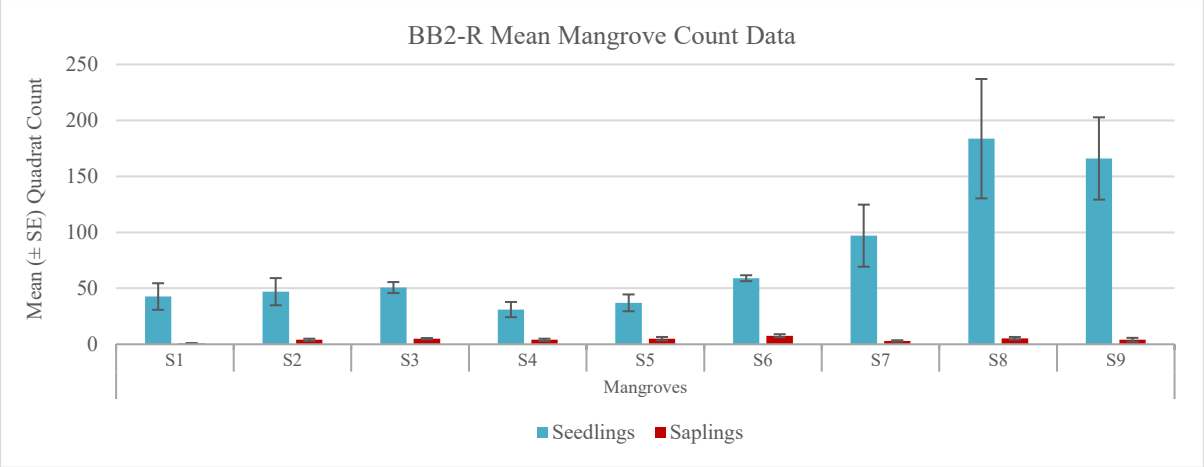



**Figure 16** BB2-R survey mean quadrat count results for mangroves in the mangrove zone.

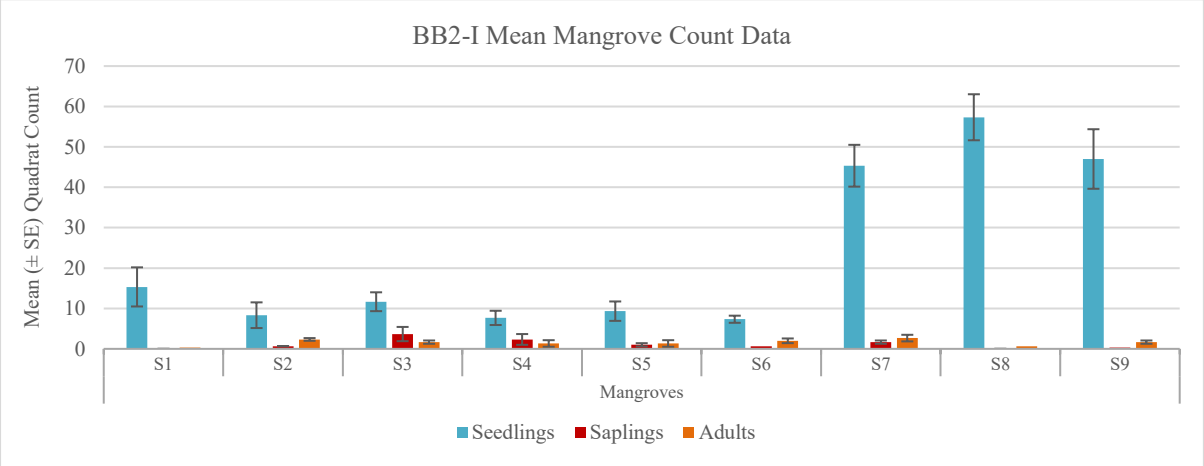



**Figure 17** BB2-I survey mean quadrat count results for mangroves in the mangrove zone.

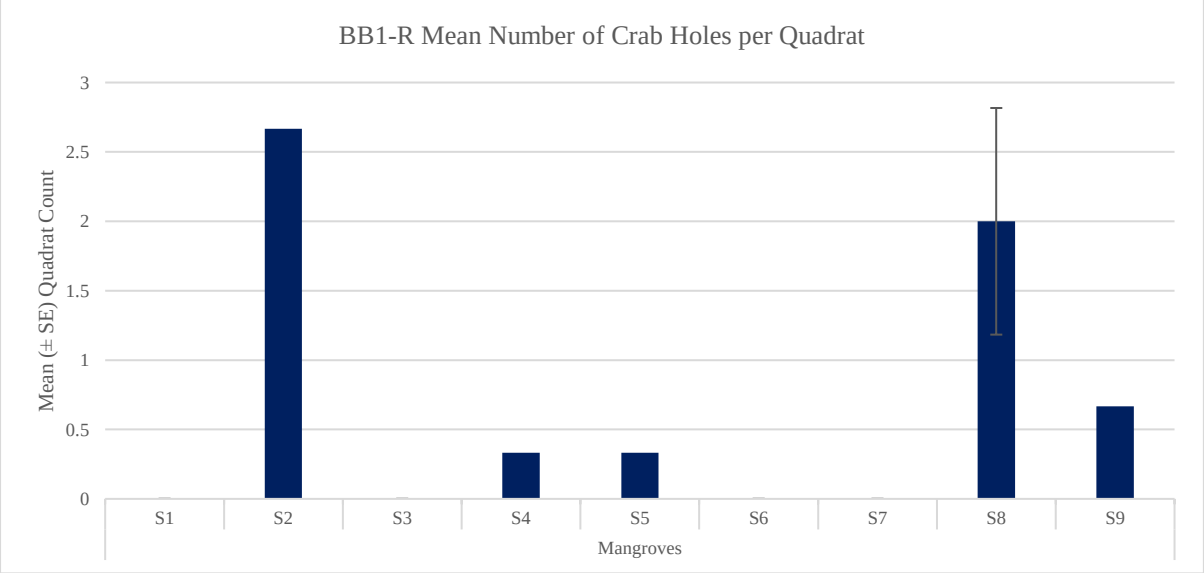



**Figure 18** BB1-R survey mean quadrat count results for crab holes.

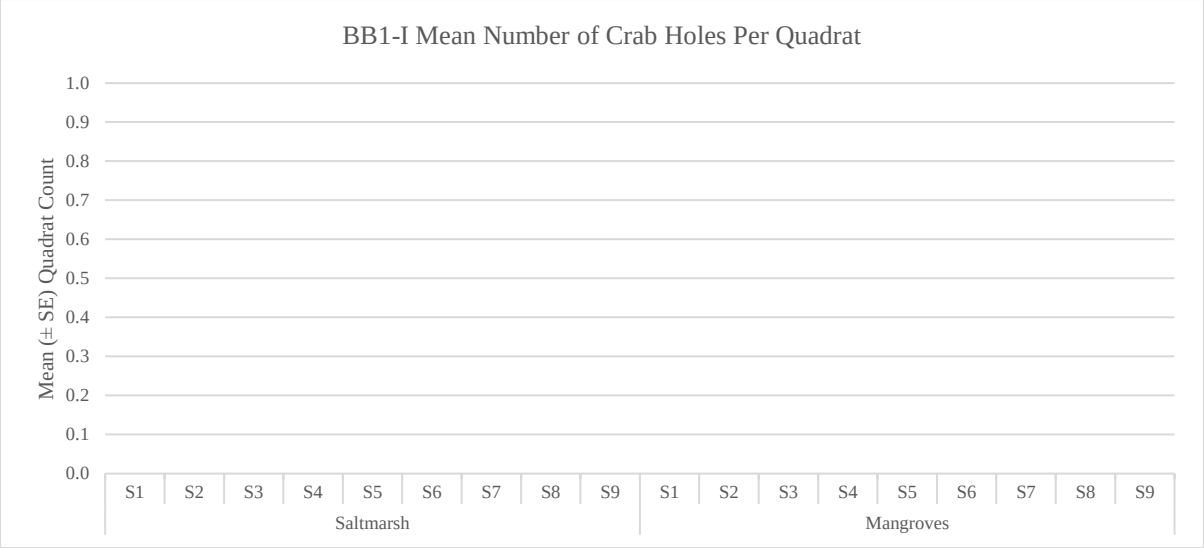



**Figure 19** BB1-I survey mean quadrat count results for crab holes.

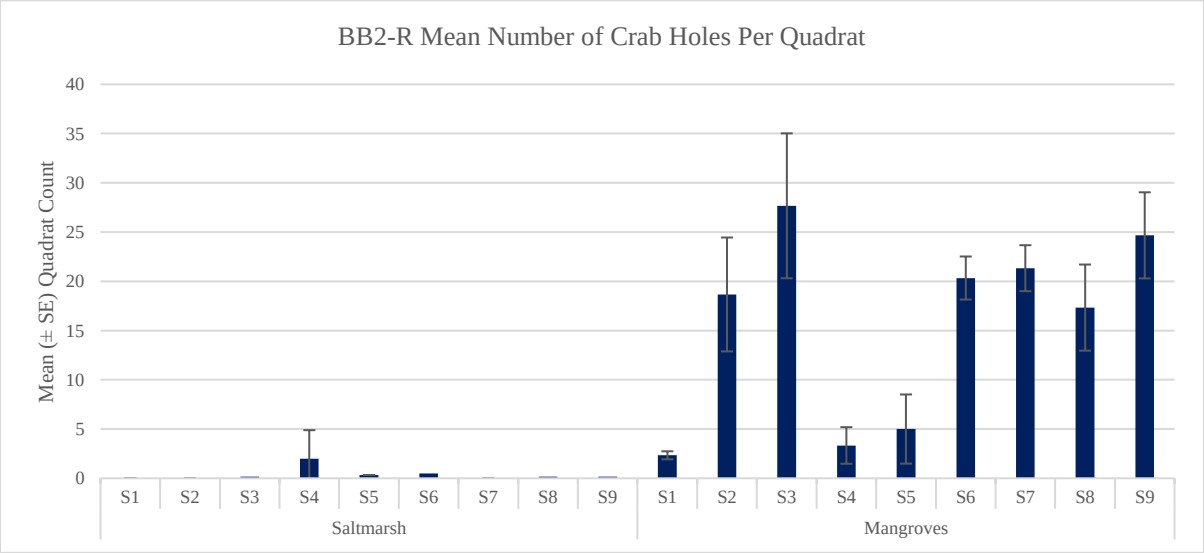



**Figure 20** BB2-R survey mean quadrat count results for crab holes.

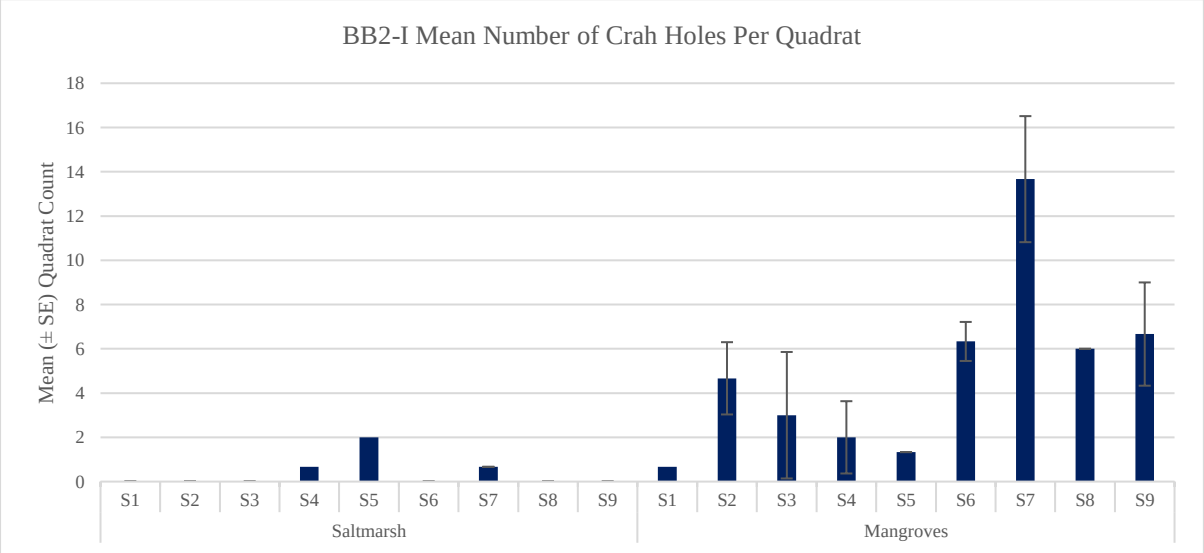



**Figure 21** BB2-I survey mean quadrat count results for crab holes.

### 2.7. South West Bay Sites

The South West Bay sites (SWB) are situated along the foreshore in the south-western portion of Curleys Bay, to the south of Crow Island. Both SWB1 and SWB2 are located below the project footprint and for the most part the catchment areas draining to the site foreshore are forested with continuous and intact native woodland. The riparian corridor fronting the intertidal foreshore habitats is continuous and dominated by a swamp oak woodland community.

Saltmarsh is generally continuous along the South West Bay shoreline with scattered swamp oak trees occurring throughout the broader saltmarsh area (including to its outer limits), which contributes to relatively high drip line measurements (**Figure 4** above). An outer raised berm is present at SWB1-I which also contains saltmarsh inshore. Overall, the saltmarsh band widths were relatively broad among the South West Bay sites ranging from 21m total width (at SWB2-I) to 43m (SWB1-I), comprising saltmarsh characterised as *Sporobolus virginicus-Juncus kraussii* and *Machaerina juncea-Juncus kraussii* species complexes. A continuous 40 to 50m wide strip of adult grey mangroves borders the foreshore to the north-east of the berm throughout the length of the South West Bay study area.

#### 2.7.1. SWB Intertidal Vegetation Transect Results

The mean combined length of saltmarsh plants along each of the four sub-site transects are provided below for SWB1 (**Figures 22** and **23**) and SWB2 (**Figures 24** and **25**). The figures allow for a visual comparison of the individual species occurring in the saltmarsh at each location and the variation between transects within surveys (shown by the standard error bars) and between bi-monthly surveys (bars). Note that there are no error bars for instances where species presence was limited to one transect per survey.

The riparian zone within the transect lengths at SWB site generally supported higher diversities of understorey plants among the incised sites SWB1-I and SWB2-I compared to ridge sites. Riparian grasses were the dominant taxa with sporadic occurrences of other terrestrial herbs (*Viola hederacea*, *Lobelia anceps*), swamp oak saplings, and swamp oak detrital accumulations were a prominent feature among areas shaded by the riparian corridor canopy at all SWB sites (to the drip line boundary). Lantana occurred in small quantities (within transect lengths) at all sites, occurring within the upper 5m of the transect lengths.

The SWB saltmarsh contained the highest number of species with representation of multiple species from the upper to lower saltmarsh zone:

- *Machaerina juncea* was the dominant upper intertidal species for the inline sites (SWB1-I and SWB2-I), however it was infrequently recorded in low quantities at ridge site SWB2-R and was absent from SWB1-R.
- As for the Billys Bay sites where *Samolus repens* was present (BB2 sub-sites), the SWB1 ridge sub-site (SWB1-R) contained regular occurrences of *Samolus repens* and the inline site (SWB1-I) contained a single observation from transect 4 in Term 8.
- For both BB2 and SWB1 locations, the tidal ranges where *Samolus repens* occurred was much lower for the ridge sites at BB2-R (0.83 to 0.90m AHD) and SWB1-R (0.76 to 0.89m AHD) compared to the inline sites at BB2-I (1.01m AHD) and SWB1-I (0.96 to 1.04m AHD).
- *Selliera radicans* occurrences were limited to the inner limits of transects and were contained within the drip line boundary at all SWB sub-sites. Temporal trends of the measured lengths of *Selliera radicans* were the most stable of the SWB saltmarsh species (as indicated by the consistency in overall bar and SE lengths), however there was a slight decline in values over the monitoring period at SWB1-R and SWB1-I.
- There was also a declining trend in *Juncus kraussii* representation across all four transects at SWB1-R and SWB1-I sub-sites over the monitoring period with more stable results recorded for the SWB2 sub-sites. The error bars for *Juncus kraussii* at SWB2-R were relatively long owing to the much broader occupation of the species at transect 4 (24.3 to 29.5m) compared to the shorter values for transects 1 and 2 (7.2 to 14.7m).
- *Sporobolus virginicus* was the dominant species occurring throughout the lower saltmarsh zone of the ridge sites SWB1-R and SWB2-R and inline site SWB1-I. The relatively long SE bars at SWB1-R were due to the differences in widths measured for transects 1 to 3 (mostly between 13 and 16m) and transect 4 (mostly between 6 and 9m).

There was overlap between the lower saltmarsh limits (the outermost occurrences of saltmarsh plants- usually *Sporobolus virginicus*) and the upper limits of the mangrove zone (as indicated by occurrences of pneumatophores and seedlings), which reached up to 13m for some sites (SWB2-R). For all SWB sites the occurrences of seedlings were further out than the pneumatophores.

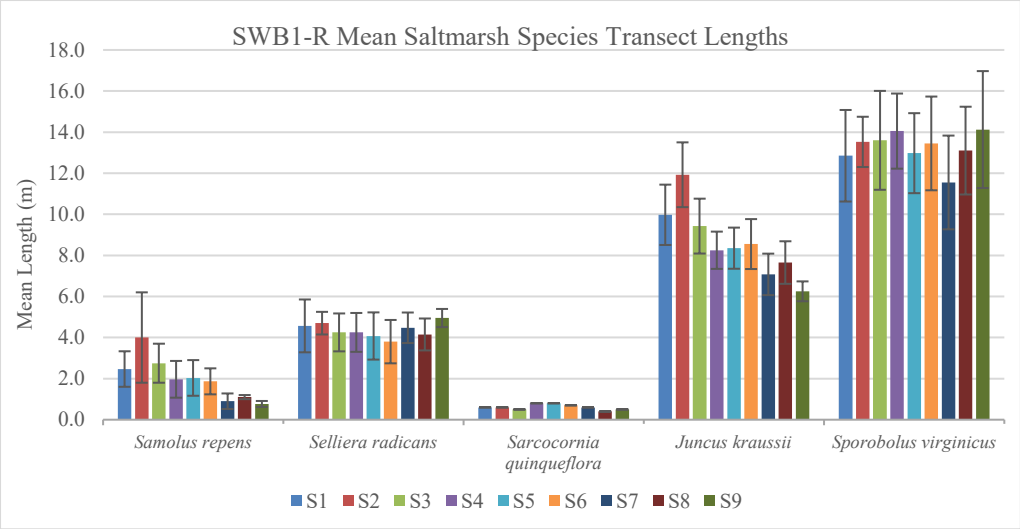



**Figure 22** SWB1-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

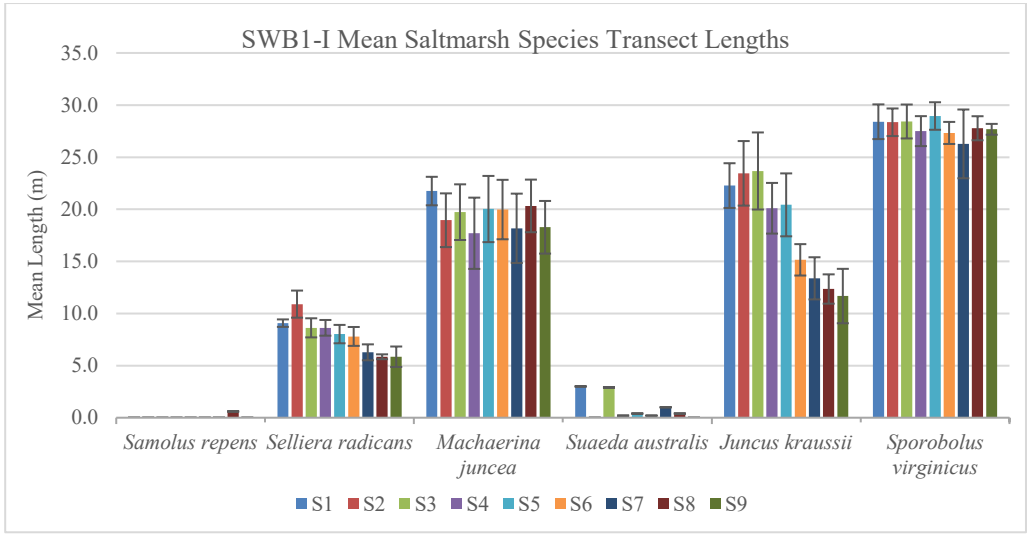



**Figure 23** SWB1-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

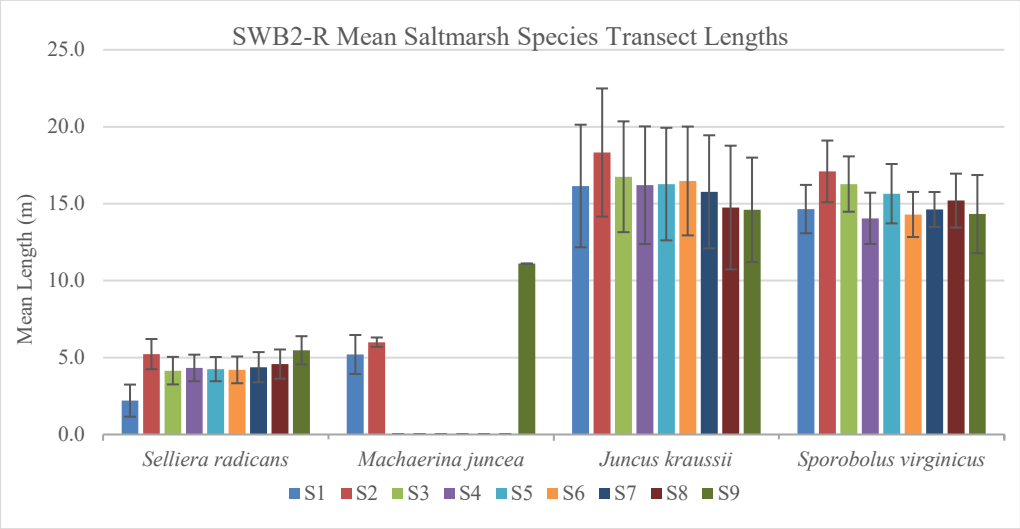



**Figure 24** SWB2-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

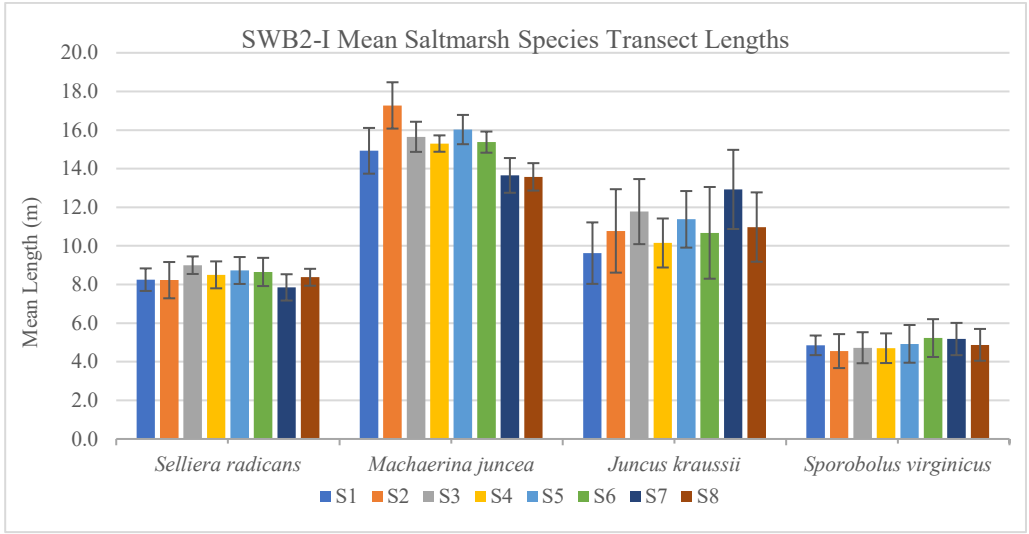



**Figure 25** SWB2-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

### 2.7.2. SWB Intertidal Quadrat Results

The South West Bay sub-site mean (± SE) quadrat density results are provided in **Figures 26** to **29** and were calculated for the main saltmarsh species among riparian, saltmarsh and mangrove zones, with each zone determined by the dominant species according to the Transect Mosaic assemblages (see species classifications in **Appendix Table C-1)**. Quadrat density results for other vegetation (e.g., terrestrial species) are provided in **Appendix C**. Note that there are no error bars for instances where species presence was limited to one quadrat per zone. **Table 9** below presents the characteristic assemblage compositions which contributed to the respective zone classifications and corresponding number of quadrats per zone for each survey (S) with dominant species in **bold**.

**Table 9 South West Bay Sub-Site Intertidal Quadrat Data Zone Classifications**

| Site | Survey* | Transect Mosaic Assemblage | Zone Classification | # Quadrats / zone |
|---|---|---|---|---|
| SWB1-R | 1 | **CW** + BS + SQ + C + JK + AL | Upper Saltmarsh | 3 |
| | | **JK + CW** + SQ | Lower Saltmarsh | 9 |
| | | **SQ + CW** + JK | | |
| | | **SQ** + JK | | |
| | | **BM +** PN + SD | Mangroves | 3 |
| SWB1-I | 1 | **RG** + CW + AL + BS + LC + PT + C | Riparian-Upper Saltmarsh | 3 |
| | | **RG** + BJ + JK + C + PT | Saltmarsh | 12 |
| | | **SQ + JK** + BJ + C + BM + CW | | |
| | | **BM** | | |
| | | **SQ** + **JK** + BM | | |
| | | **SQ + JK** + C | Mangroves | 3 |
| SWB2-R | 1 | **BS** + JK + C + CW + CS | Upper Saltmarsh | 3 |
| | | **JK** + SQ + C | Saltmarsh | 9 |
| | | **BM** + PN + SD | | |
| | | **SQ** | | |
| | | **SQ + PN** | | |
| | | **JK + SQ** | | |
| | | **BM + PN + SD + SP + AD** | Mangroves | 3 |
| SWB2-I | 2 | **BS + AV** + **CW** + ALT + LC + BJ + RG + CS + GH + SG + MA + BR | Riparian-Upper Saltmarsh | 9 (S1-S2), 3 (S3-S9) |
| | | **BS + JK** + BJ + CW | Upper Saltmarsh | 3 |
| | | **JK** + **CW** + BJ + D + C | Lower Saltmarsh | 15 |
| | | **BJ + CW** | | |
| | | **CW** + JK + SQ | | |
| | | **JK + SQ** + BM + CW + SD | | |
| | | **CW** + PN + SD + SP + D | | |
| | | **BM + PN + SD** + SP + CH + ZW + D | | |
| | | **BM + PN + SD + AD** + SP + ZW | Mangroves | 6 (S1), 3 (S2-S9) |

Note: *Indicates the relevant survey from which the mosaic assemblage classifications were extracted.

Density measurements were categorised according to species presence across the 5 x 5 grid (i.e., 25 squares) within the 1m x 1m quadrat, with categorical values of 1 (<30% of coverage), 2 (30 to 60% coverage) or 3 (>60% coverage). In quadrats with only one individual, a density value of 0.1 was recorded (see methodology in **Section 2.1.2** for more detail). Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat and pneumatophore cover was determined by a count of occupied grid squares with values recorded as 0 to 25.

The South West Bay site saltmarshes contained variable saltmarsh densities throughout the intertidal zones with some differences in species occupation between the inline and ridge sites:

- *Selliera radicans* was the dominant upper saltmarsh species across all South West Bay sib-sites, forming generally dense mats and was co-occurring with rushes *Machaerina juncea* and *Juncus kraussii.*
- *Machaerina juncea* was generally limited to the inline sites SWB1-I and SWB2-R, where mean densities were consistent throughout the riparian-upper saltmarsh and lower saltmarsh zones with no outstanding temporal trends in density estimates.
- *Samolus repens* was recorded from the lower saltmarsh at SWB1-R only with values showing consistent occupation between surveys 1 to 7 and generally sparse density for the latter 2 surveys.
- *Juncus kraussii* was present in variable density in the lower saltmarsh at all sites and was absent from the upper saltmarsh at SWB1-R only.
- *Sporobolus virginicus* was the dominant species in the lower saltmarsh at SWB1 sites and was also present as patchy isolated clumps in the mangrove zone at SWB1-I and SWB2-I. Occurrences in the riparian to upper saltmarsh zone at the ridge sites were limited to sporadic records of generally low-density growths over the monitoring period. *Sporobolus virginicus* was also present in the lower saltmarsh zone at SWB2 however both *Juncus kraussii* and *Machaerina juncea* were present in equal or higher proportions.

As noted for the Billys Bay sites, mangrove pneumatophore counts were high among the mangrove zone quadrats for all South West Bay sub-sites (**Figure 30** range of 19.3 ± 5.7 grids to 25.0 ± 0.0 grids). Occurrences of pneumatophores in the lower saltmarsh was variable between sites and between survey events, with higher densities recorded for the SWB2 sub-sites and infrequent observations in the SWB1 sub-sites. For the most part, mangrove pneumatophores were present in less than a quarter of the quadrat grids.

There was high variation in pneumatophore counts between replicate quadrats for each survey occasion for the SWB2 sites which are shown graphically by the wide standard error bars in **Figure 30**, and there were no error bars for many of the SWB1 sites as pneumatophores were recorded from single replicate quadrats only.

Except for pneumatophores, there were no mangrove plant structures recorded from the saltmarsh zone for the SWB1 sites, however there were small quantities of mangrove seedlings recorded from the lower saltmarsh at both SWB2 sites (**Figures 31** to **34**):

- Seedlings occurred among the lower limits of saltmarsh stands (*Sporobolus virginicus* and *Juncus kraussii*) at SWB2-R and SWB2-I, being consistently recorded at low densities at SWB1-I and only from survey 1 and surveys 7 to 9 at SWB2-R (all less than 3.3 seedlings per $m^2$).
- All South West Bay sub-sites recorded marked increases in seedling occurrences in the mangrove zone for the latter three surveys (S7 to S9). Seedling density in the mangrove zone was relatively low at SWB2-R with mean densities reaching a maximum of 26.3 ± 1.9 seedlings per $m^2$ for survey 9, higher for SWB1-R (152.7 ± 39.9 seedlings per $m^2$ for survey 8) and SWB2-I (151.7 ± 58.5 seedlings per $m^2$ for survey 8), with SWB1-I recording the overall highest seedling density measurements which peaked in survey 8 (313.0 ± 60.2 seedlings per $m^2$).
- Adult grey mangroves were recorded within quadrat samples at SWB2-R only, with consistent records throughout the monitoring period of values ranging between 1 and 3 adult trees per sample. Most of the adult occurrences were of stunted dwarf mangroves.

**Figures 35 to 38** below present the South West Bay sub-site mean count data for crab holes:

- Crab hole occurrences were primarily observed in the mangrove zones at all SWB sub-sites, with minimal counts in the saltmarsh zones. The highest crab hole count in the saltmarsh zone was at SWB2-R, with significant increases in survey 7 up to 9.2 ± 6.0. Saltmarsh crab hole counts at all other sub sites were low and stable across all surveys.
- Crab hole densities were highest at SWB2-R, where survey 2 recorded a peak count of 36.3 ± 7.0 crab holes per quadrat. In comparison, SWB1-R and SWB2-I exhibited similar trends, with densities peaking in survey 6 at 20.0 ± 8.0 and 24.3 ± 4.3 crab holes per quadrat, respectively.
- SWB1-I showed the lowest overall crab hole densities, with notable increases from survey 1 through to 6, peaking at 13 ± 1 crab holes per quadrat. Following this peak there was a distinct decrease in surveys 7, 8 and 9, this trend was unique to this site.

- Across all other SWB sub-sites, crab hole densities showed a general increase as surveys progressed from 1-9, with occasional sporadic counts. SWB2 sites recorded more consistent increases, while SWB1 sites exhibited more variable trends.
- Variable, sporadic increased or decreased counts were not consistent across sites and did not appear to influence other sub sites in the South West Bay.

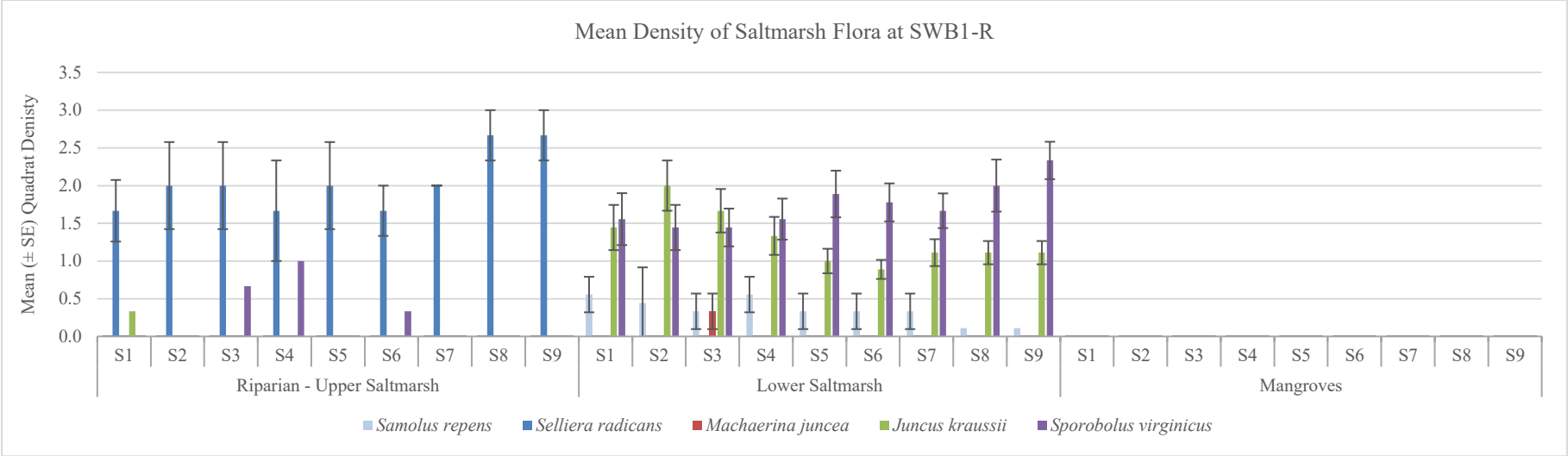



**Figure 26** SWB1-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

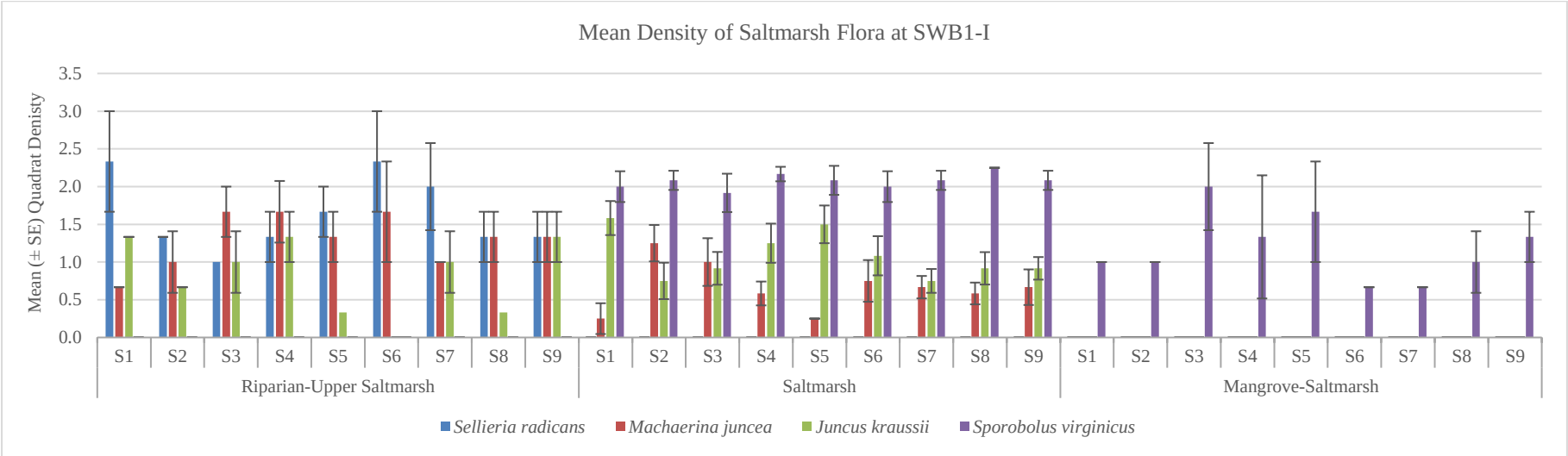



**Figure 27** SWB1-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

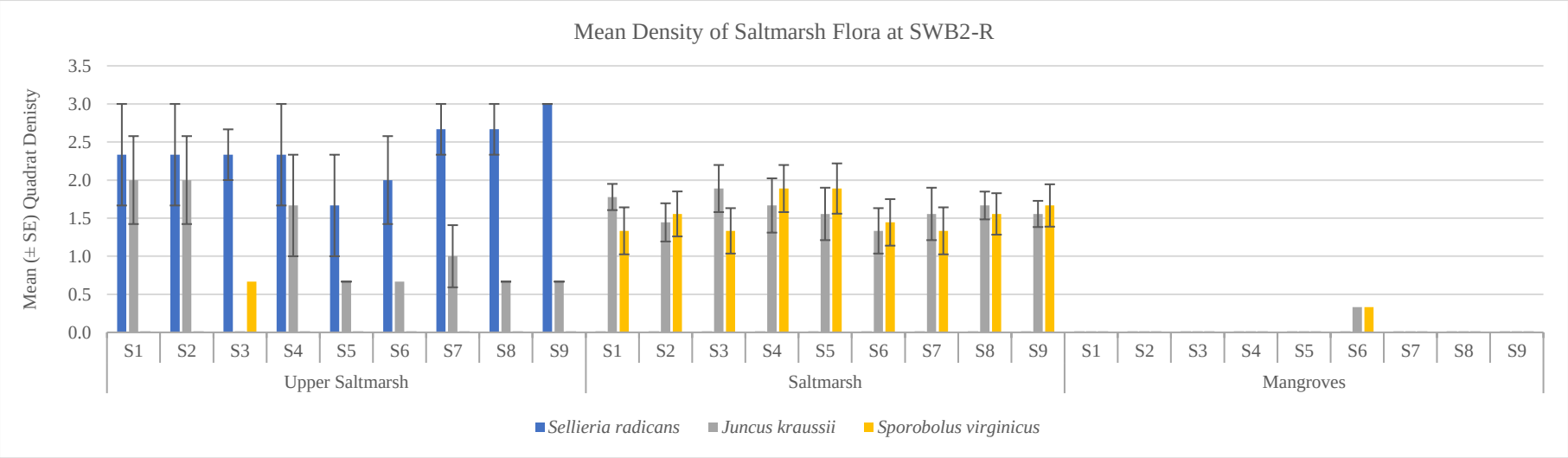



**Figure 28** SWB2-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

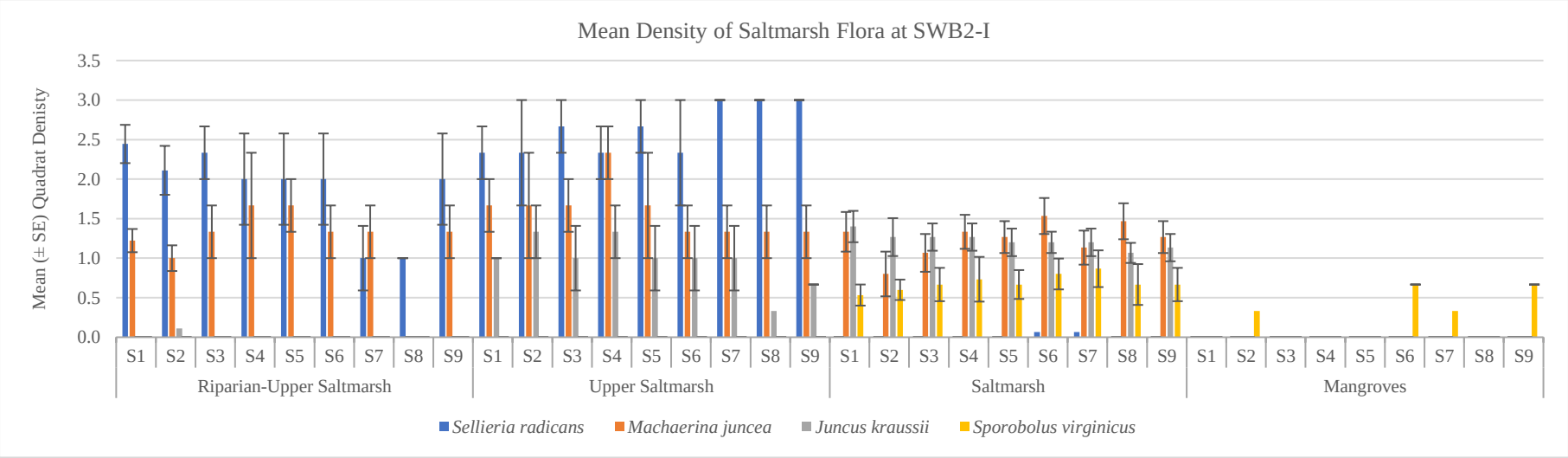



**Figure 29** SWB2-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

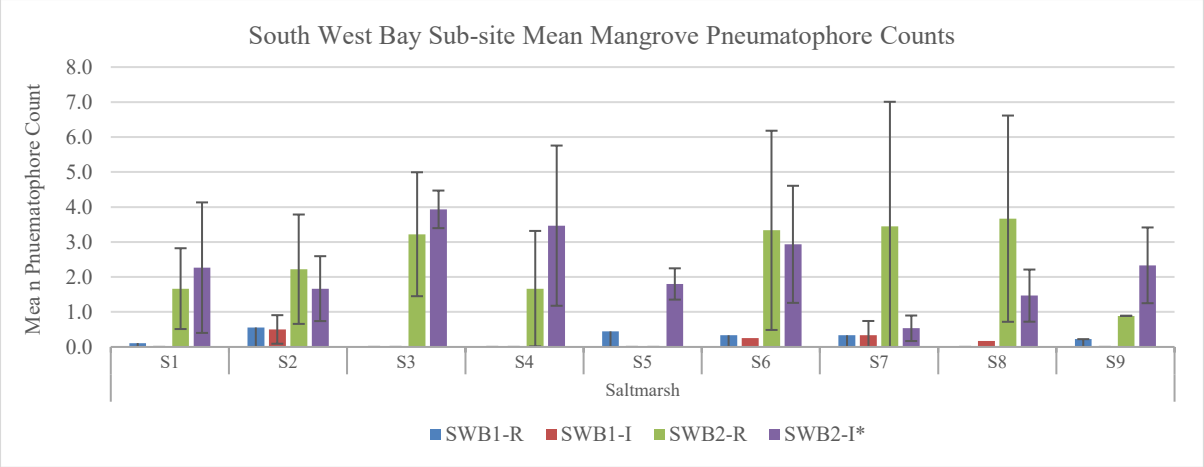



**Figure 30** South West Bay site mean mangrove pneumatophore count results in the lower saltmarsh zone.

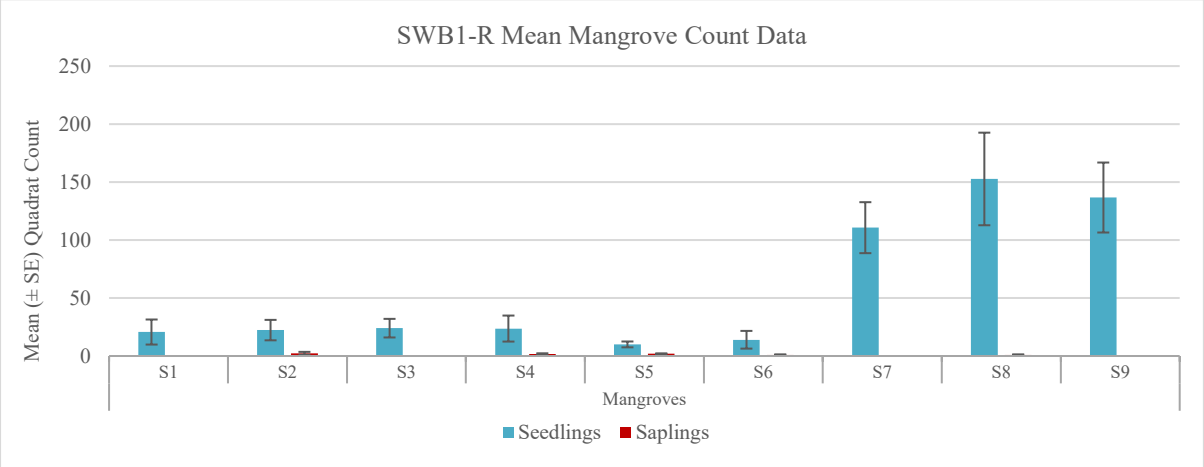



**Figure 31** SWB1-R survey mean quadrat count results for mangroves in the mangrove zone.

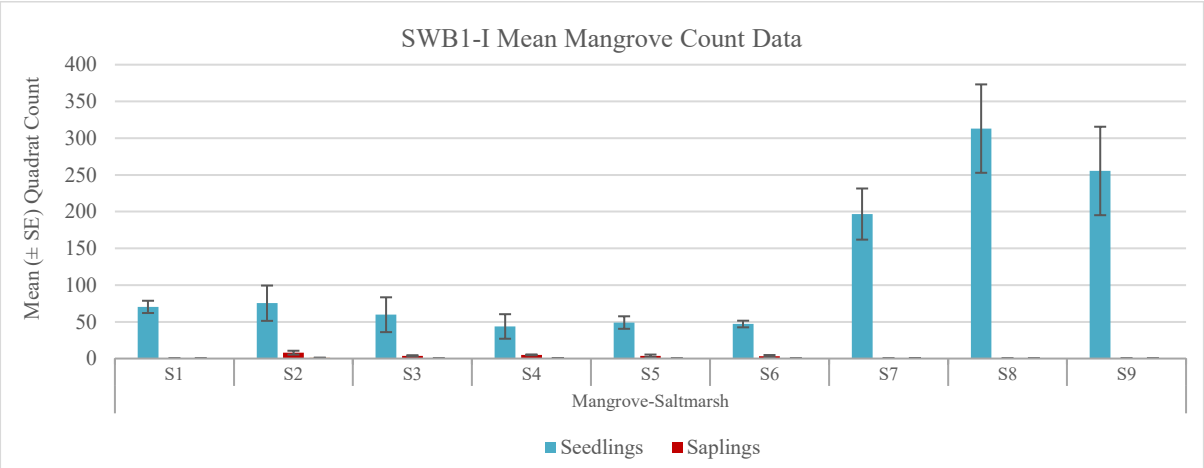



**Figure 32** SWB1-I survey mean quadrat count results for mangroves in the mangrove zone.

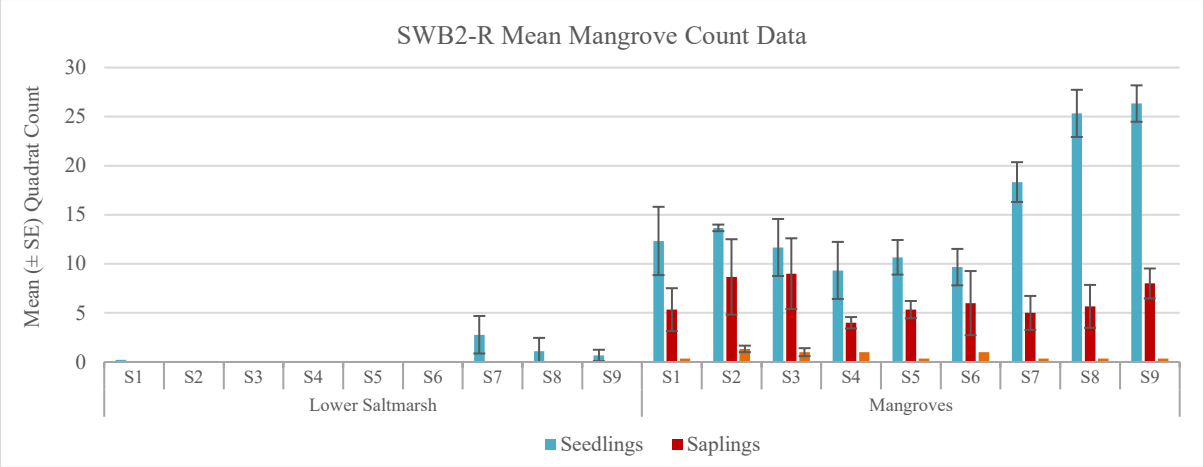



**Figure 33** SWB2-R survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

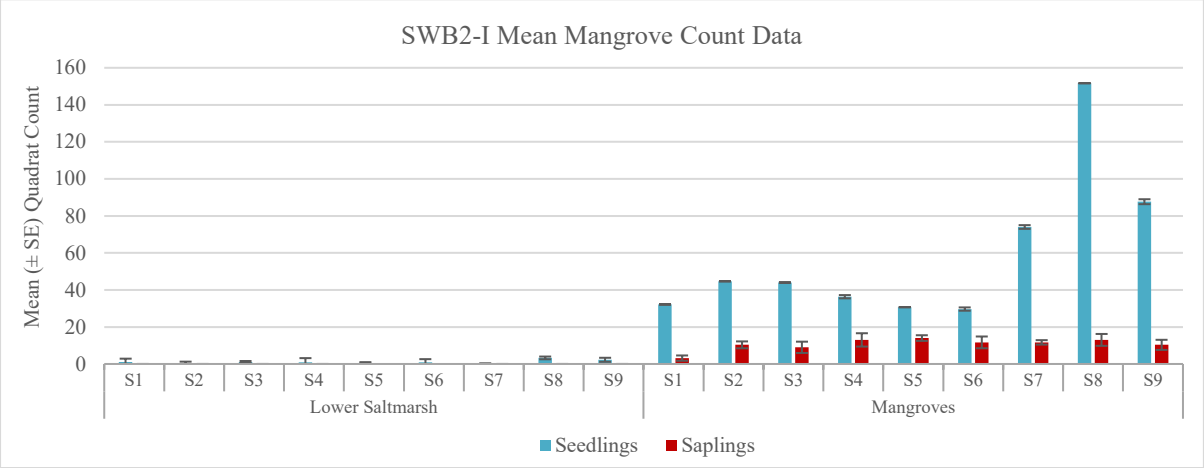



**Figure 34** SWB2-I survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

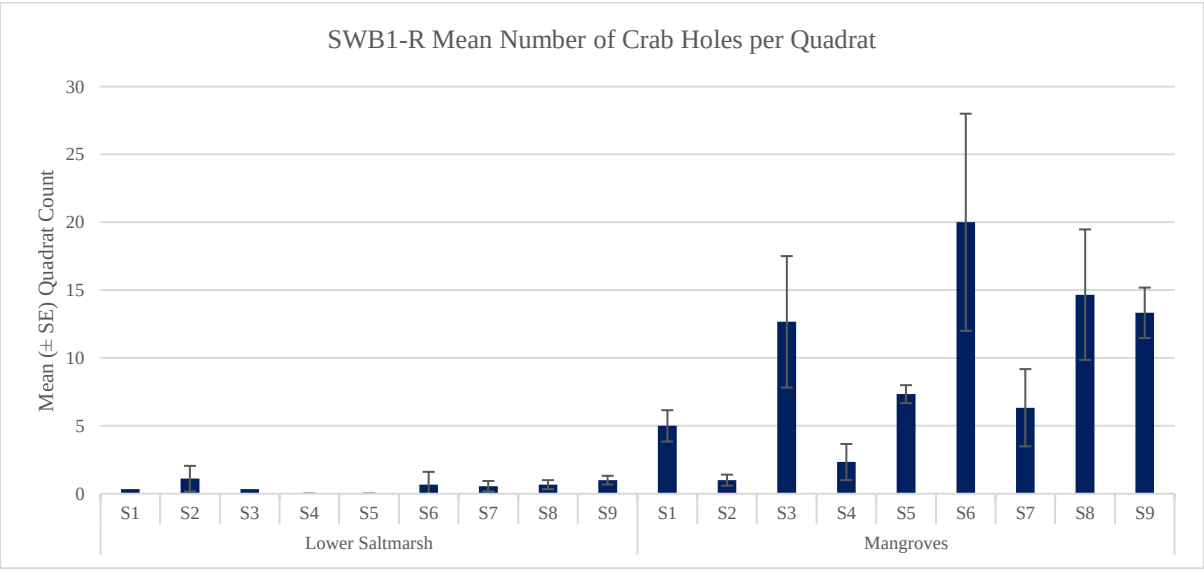



**Figure 35** SWB1-R survey mean quadrat count results for crab holes.

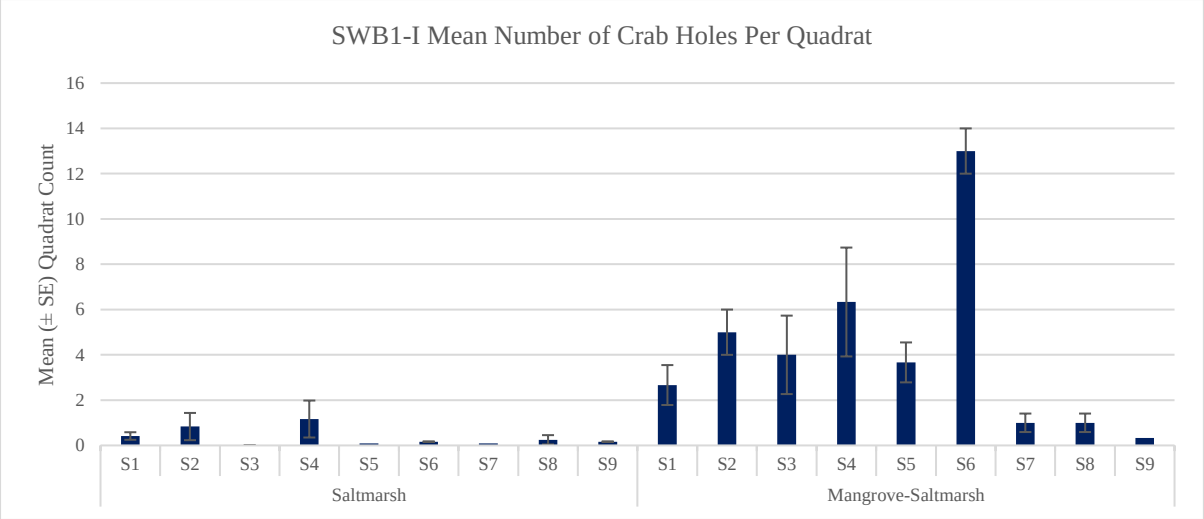



**Figure 36** SWB1-I survey mean quadrat count results for crab holes.

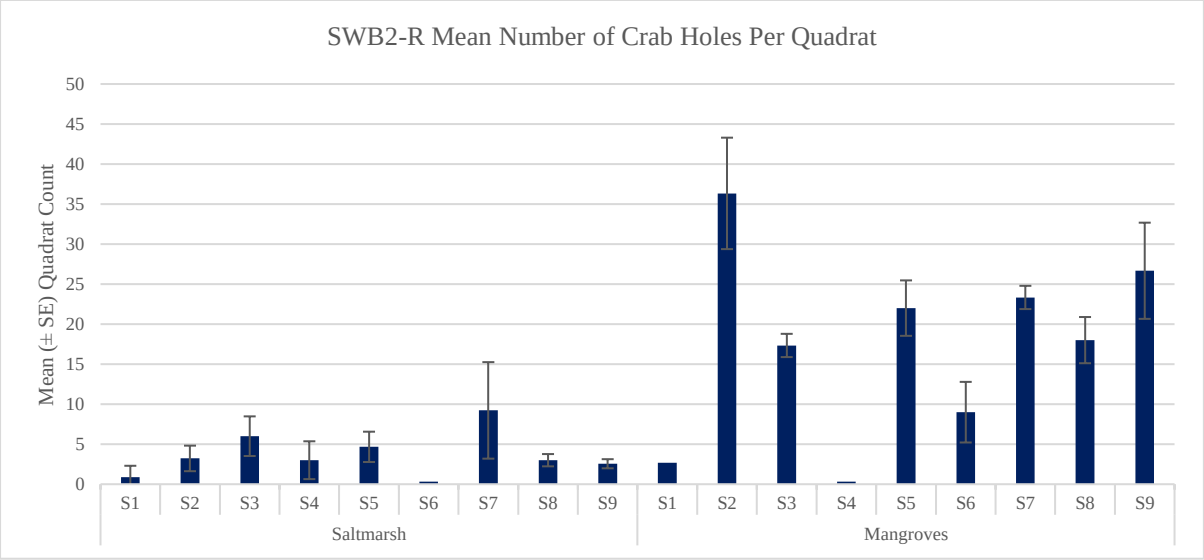



**Figure 37** SWB2-R survey mean quadrat count results for crab holes.

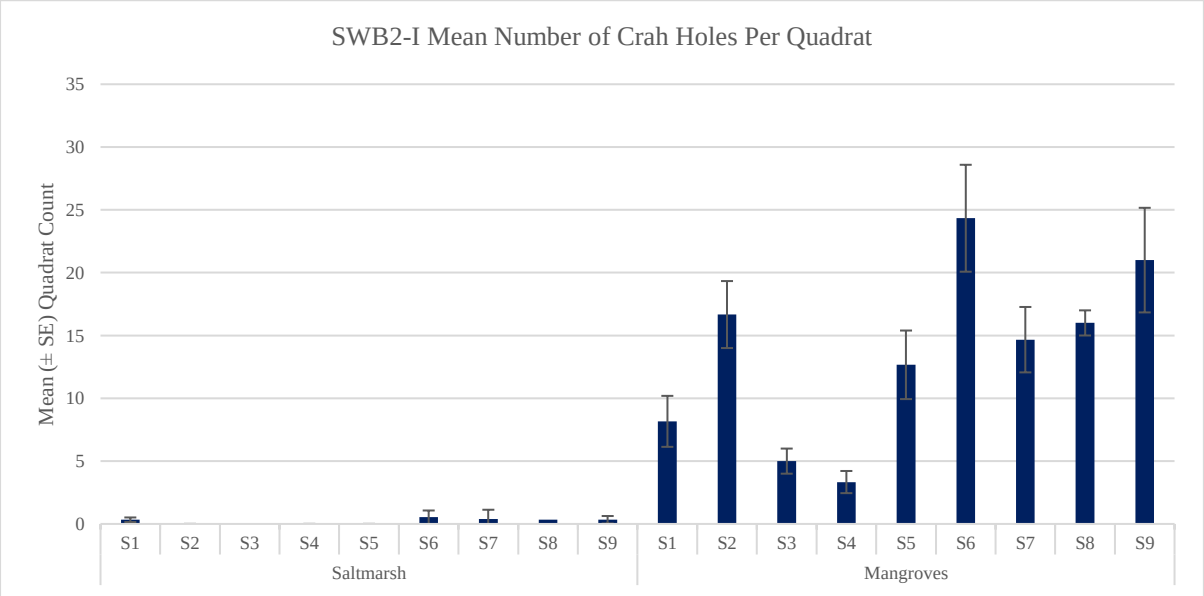



**Figure 38** SWB2-I survey mean quadrat count results for crab holes.

## 2.8. South East Bay Sites

The South East Bay (SEB) sites are situated along the southern foreshore of Curleys Bay. Whereas the SEB1 sites are located below the project footprint and for the most part drain catchment areas comprising continuous native woodland, the catchment area upslope from SEB2 is urban-residential. A thin (90m) forested riparian buffer spans the length of shoreline adjacent to SEB2 intertidal foreshore habitats, and for both SEB1 and SEB2 the riparian corridor is dominated by a swamp oak woodland community which provides canopy coverage for the inner saltmarsh limits for a short distance (8 to 10m) from the inner transect pegs.

A *Sporobolus virginicus-Juncus kraussii* saltmarsh complex occurs along the South East Bay foreshore with scattered patches of seablite (*Suaeda australis*) and very sparse *Machaerina juncea.* The width of saltmarsh intertidal habitats is variable along the foreshore and generally greatest at SEB2-I (to 42m) compared to SEB1 sites (19 to 24m) and SEB2-R (10m). Large adult grey mangroves form a continuous 40 to 50m wide strip to the north of the SEB1 saltmarsh habitats, and the width of mangroves are much wider (120 to 140m wide) adjacent to SEB2, comprising an inner band (50 to 70m) of smaller grey mangroves inshore (1 to 5m height) and outer band (60 to 70m) of large adults.

### 2.8.1. SEB Intertidal Vegetation Transect Results

The mean combined length of saltmarsh plants along each of the four sub-site transects are provided below for SEB1 (**Figures 39** and **40**) and SEB2 (**Figures 41**and **42**). The figures allow for a visual comparison of the individual species occurring in the saltmarsh at each location and the variation between transects within surveys (shown by the standard error bars) and between bi-monthly surveys (bars). Note that there are no error bars for instances where species presence was limited to one transect per survey.

The SEB riparian understorey habitats were comprised mostly of couch (*Cynodon dactylon*) at all sub-sites or buffalo grass (SEB1-R only), occupying the upper limits of the transect plots underneath the swamp oak riparian canopy. With regards to weed species, the following observations were made:

- Lantana at the SEB sites was limited to a single plant observed for the final survey event only at SEBR-1 transect 2.
- Another invasive weed species, asparagus fern (*Asparagus sp*), were present in the upper limits of the riparian zone at all SEB sites. The transect measurement results

indicates that the species presence was mostly stable with consistent records in generally low quantities.

- A single nightshade (*Solanum sp*) plant was recorded from the inner limits of SEB1-R transect 1 for the first four surveys, and cape ivory (*Delairea odorata*).

Saltmarshes at SEB1 and SEB2 were for the most part dominated by *Sporobolus virginicus* and *Juncus kraussii* with only small quantities of *Suaeda australis* at SEB1-R:

- Representation of *Suaeda australis* at SEB1-R was variable across transects (being absent from transect 1) and declined within two transects between surveys which contributed to the large error bars and gradual reduction in bar lengths over time. Sections of the shoreline at SEB1-R were subjected to periodic large accumulations of tide sourced debris and wrack (swamp oak and *Zostera* seagrass wrack), and the *Suaeda australis* shrubs that occurred parallel to the shoreline at transects 2 and 3 were subjected to smothering which resulted in temporal fluctuations in length measurements.
- In contrast, SEB1-R transect 4 contained the largest *Suaeda australis* occurrences which were relatively stable across the 18-month monitoring period.
- Observations of *Machaerina juncea* were limited to a single plant in the upper saltmarsh zone at SEB1-R for the second survey.
- *Juncus kraussii* and *Sporobolus virginicus* occupied generally similar zones throughout the transects and similar heights in the tidal column (upper limits of 1.09m AHD to lower limits of 0.46m AHD).
- While most of the SEB1-R *Juncus kraussii* length measurements in transects 1 to 3 maintained some consistency over the 18-month survey period, there was a steady regression of *Juncus kraussii* stands from two locations in transect 4 over time which contributed to both the decline in mean values and the increased length of the error bars. Both stands were initially present as very sparse, thin growths which eventually died back (innermost stands) or were outcompeted by dense *Suaeda australis*.
- The decline in *Juncus kraussii* at SEB1-I over the 18-month monitoring period was due mainly to gradual declines in the extent of sparse growths in transect 4 over consecutive surveys occurrences of *Juncus kraussii* for each of the other transects remained relatively stable.

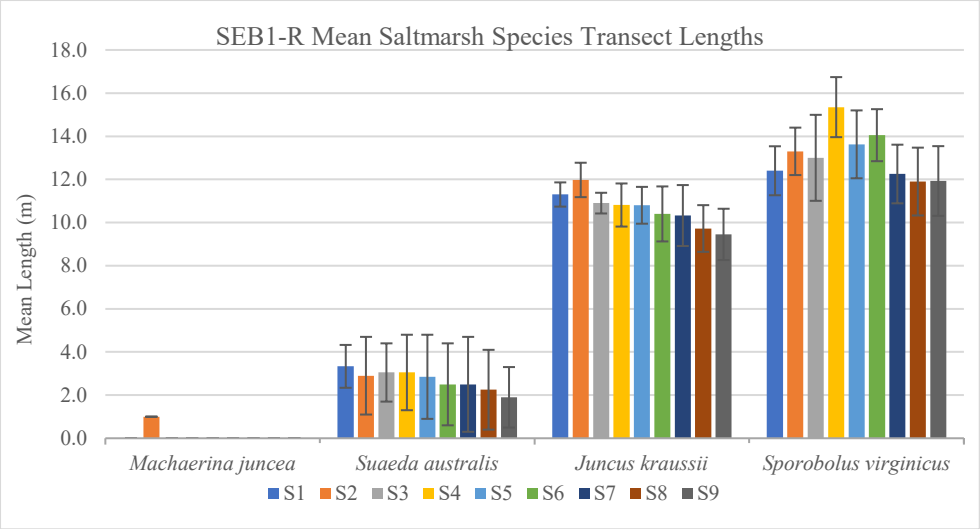



**Figure 39** SEB1-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

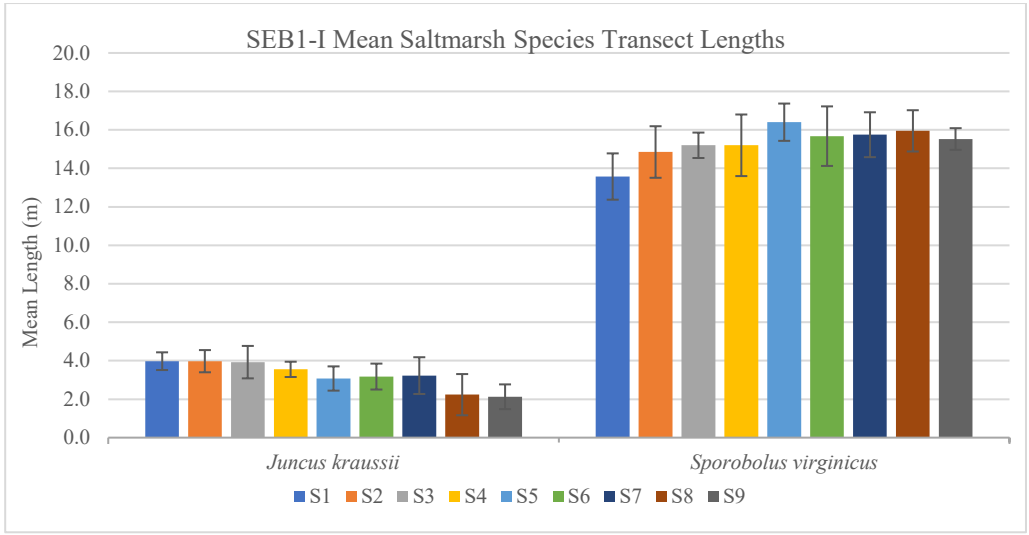



**Figure 40** SEB1-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

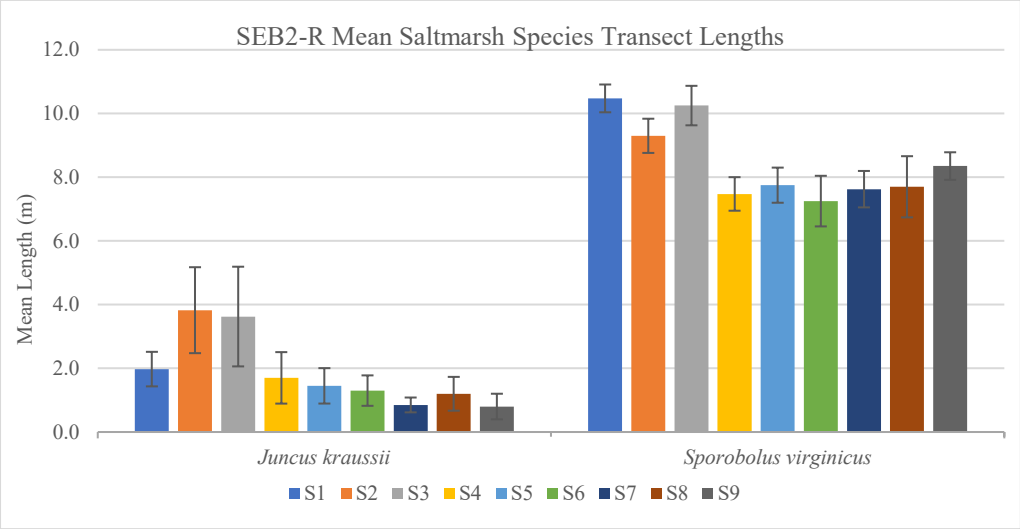



**Figure 41** SEB2-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

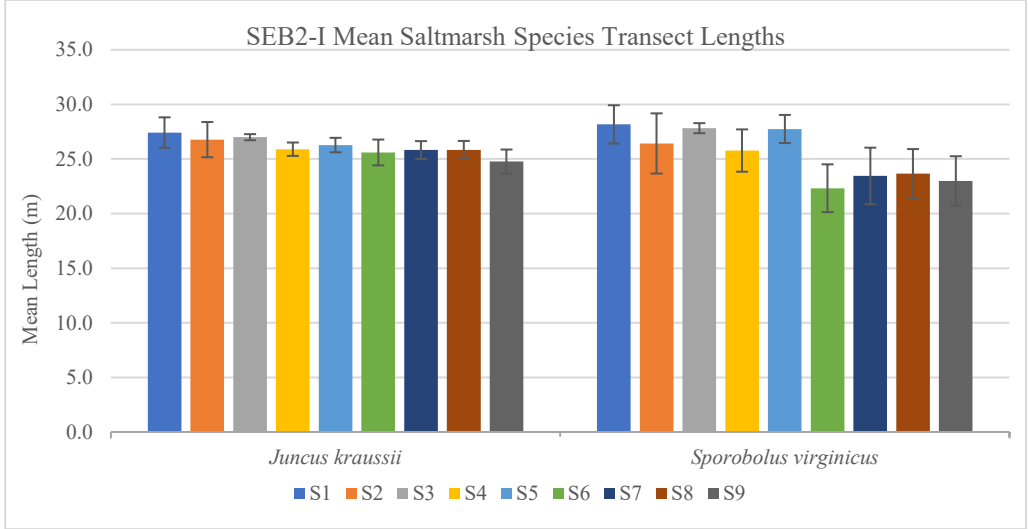



**Figure 42** SEB2-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

- Temporal fluctuation in the *Juncus kraussii* results for SEB2-R **(Figure 45**) were owing to both actual spatial differences in occurrences between transects and difficulties in repeated measurements for the very sparse occurrences over the first three surveys. The measurement method was later reconciled for surveys four to nine to better represent the overall condition of the *Juncus kraussii* stands, however the initial survey data was likely overestimated.
- Variations in the occurrences of *Sporobolus virginicus* at SEB2-I were due mostly to temporal changes for the sparser plant occurrences amongst dense *Juncus kraussii* stands, which generally decreased over the course of the extended monitoring period.

For the SEB1 sub-sites, mangrove measurement variables (pneumatophores, seedings, saplings or adults) were recorded below the outer limits of the lower saltmarsh zone or with slight overlap (<5m), however these instances were mainly noted for pneumatophores and occasionally grey mangrove seedlings. There was considerable overlap between the outer saltmarsh plant limits and inner mangroves at SEB2-I (at least to 34m) and at SEB2-R, where mangrove pneumatophores were regularly recorded further inshore from the innermost saltmarsh plant occurrences (within the drip line) owing to the inner limits of the transects generally containing lower height profiles which were within the upper range of pneumatophore occurrences (<0.98m AHD).

### 2.8.2. SEB Intertidal Quadrat Results

The South East Bay downstream sub-site mean (± SE) quadrat density results are provided below in **Figures 43** to **46** and were calculated for the main saltmarsh species among riparian, saltmarsh and mangrove zones, with each zone determined by the dominant species according to the Transect Mosaic assemblages (see species classifications in **Appendix Table C-1)**. Quadrat density results for other vegetation (e.g., terrestrial species) are provided in **Appendix C.**

Note that there are no error bars for instances where species presence was limited to one quadrat per zone. **Table 10** below presents the characteristic assemblage compositions which contributed to the respective zone classifications and corresponding number of quadrats per zone for each survey (S) with dominant species in **bold**.

| Table 10 South East Bay Sub-Site Intertidal Quadrat Data Zone Classifications | | | | |
|---|---|---|---|---|
| **Site** | **Survey*** | **Transect Mosaic Assemblage** | **Zone Classification** | **# Quadrats / zone** |
| SEB1-R | 2 | **BG + CW** + TT + AF + PS + Sparse CD | Riparian | 3 |
| | | **JK** | Riparian-Saltmarsh | 3 |
| | | **JK + CW +** CD + SQ | | |
| | | **JK + SQ** | Saltmarsh | 6 |
| | | **SA** + JK + PN + CW + SQ | | |
| | | **SA** + PN + SQ + D + CW + ZW | | |
| | | **ZW + D** + SA + SD + SQ + BM + PN + SP | | |
| | | **BM + SQ +** PN + SD + SP + SQ | Mangroves | 3 |
| | | **BM + PN + SD + SP + AD** | | |
| SEB1-I | 1 | **CW** + CD | Riparian | 3 |
| | | **JK** + **CD** + SQ | Riparian-Upper Saltmarsh | 3 |
| | | **CD + SQ** | | |
| | | **SQ** | Saltmarsh | 9 |
| | | **BM** | | |
| | | **JK + SQ** | | |
| | | **BM + PN** + SD + SQ | Mangroves | 3 (S1), 6 (S2-9) |
| | | **BM** + **AD** + PN, SP, SD | | |
| SEB2-R | 1 | **CW** + CD + AF + IP + PN + C + D | Riparian | 3 |
| | | **CD + SQ +** JK + CW + PN | Riparian-Saltmarsh | 3 |
| | | **SQ** + JK + CH +PN | Saltmarsh | 3 |
| | | **BM** + **SQ** + PN + CH | Saltmarsh-Mangroves | 3 |
| | | **BM** + PN + SD + SP | Mangroves | 6 |
| | | **BM + AD** + PN + SD + SP + CH | | |
| SEB2-I | 2 | **CD** + CW + CS + AF + SQ + JK | Riparian | 3 |
| | | **JK + SQ** + CW | Saltmarsh | 6 |
| | | **JK + SQ** + CH + PN | | |
| | | **SQ** + D + PN | Saltmarsh-mangroves | 21 |
| | | **BM** + Some PN | | |
| | | **SQ + PN** + SD + AD + BM | | |
| | | **BM** + PN | | |
| | | **JK** + PN + BM | | |
| | | **JK + C** + CW + SQ + PN | | |
| | | **JK** + RM + PN + BM + SP | | |
| | | **JK** + PN + SD + SP + BM + D + R + SQ | | |
| | | **SQ + SP + AD** + BM + PN + SD + D + RM | | |
| | | **BM + AD** + PN + SD + SP | Mangroves | 3 |
| Note: | *Indicates the relevant survey from which the mosaic assemblage classifications were extracted. | | | |

Density measurements were categorised according to species presence across the 5 x 5 grid (i.e., 25 squares) within the 1m x 1m quadrat, with categorical values of 1 (<30% of coverage), 2 (30 to 60% coverage) or 3 (>60% coverage). In quadrats with only one individual, a density value of 0.1 was recorded. Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat and pneumatophore cover was determined by a count of occupied grid squares with values recorded as 0 to 25.

The South East Bay sites exhibited notable variability in saltmarsh flora density across the intertidal zones, with distinct differences in species composition and density between the ridge (R) and inline (I) sites. Overall, the South East Bay sub-site saltmarsh complexes were restricted to two dominant saltmarsh species:

- *Sporobolus virginicus* was the dominant species in the saltmarsh and saltmarsh-mangrove zones across all SEB sub-sites, especially at the ridge sites, where its densities were higher and more stable compared to the inline sites. It was typically found in dense strips adjacent to less dense stands of *Juncus kraussii*. With exception in the mangroves at SEB2-R where consistently dense *Sporobolus virginicus* did not coexist with *Juncus kraussii.*
- *Juncus kraussii* was present at all sub-sites but generally in low densities, except at SEB2-I where it was more abundant. Inline sites tended to show higher Juncus densities in the upper intertidal zones, while ridge sites had more consistent densities across the entire saltmarsh. Sub-site SEB2-I had particularly consistent and dense *Juncus kraussii* throughout all 9 surveys and similar densities to *Sporobolus virginicus,* with no significant temporal variation.
- *Selliera radicans* was rare across the sub-sites, found only at SEB1-R in very low densities and limited to the riparian-saltmarsh transitional zone. Its only recorded occurrence was in survey 9, observed at less than 30% density within a single quadrat.
- *Suaeda australis* was restricted to SEB1-R, where it appeared in low densities exclusively in the saltmarsh zone. There was little variation throughout the sampling period, with no significant changes in its distribution or density.

Similar to the Billy Bay and South West Bay sites, pneumatophores were highly abundant in the mangroves across all South East Bay sub-sites, (**Figure 47**) with densities ranging from 11.6 ± 5.8 to 25.0 ± 0.0 quadrat grids occupied by pneumatophores. In SEB2-R mangroves, pneumatophore density showed notable variability, with density measurements increasing from surveys 3 to 9. In the saltmarsh to upper mangrove zones, pneumatophore densities were consistently lower.

However, SEB1 sites had significantly lower pneumatophore densities in the saltmarsh compared to SEB2 sites, with no pneumatophores extending into the upper saltmarsh or riparian zones. In contrast, SEB2 sites showed pneumatophore occurrences extending higher into the intertidal zones, particularly at SEB2-R, where they spread into the riparian zone. The distribution of pneumatophores in the upper intertidal zones at SEB2 ridge and inline sites was patchy and inconsistent, with large standard errors.

In addition to pneumatophores, seedlings and saplings were observed at all South East Bay sub-sites within the saltmarsh and saltmarsh-mangrove zones (**Figures 48 to 51**). While adult mangroves were also present in the saltmarsh-mangrove zone at SEB2-I, they were generally limited to low density within sample quadrats:

- Seedling density was generally low across all South East Bay sub-sites in the saltmarsh and saltmarsh-mangrove zones for Surveys 1 to 6, with SEB2-R showing slightly higher densities, reaching up to 10.3 ± 4.5 seedlings per m².
- SEB2-R was the only sub-site to exhibit a steady increase in seedling density in both the mangrove and saltmarsh zones during Surveys 1, 2, and 3.
- As noted for the Billys Bay and South West Bay sub-sites, there was a distinct increase in seedling density values at South East Bay sub-sites for the final three surveys (S7 - S9). This pattern was consistent across all South East Bay sub-sites, with increases noted in both the lower saltmarsh and mangroves zones. Both SEB1 sites consistently had higher seedling densities across all zones, peaking at 193.7 ± 48.0 seedlings per m² in survey 9 at SEB1-R. In contrast, the highest seedling count at SEB2 sites was 78.0 ± 2.1 seedlings per m² in survey 7 at SEB2-I.
- SEB2-R had the lowest overall seedling density, reaching a maximum of 37.7 ± 15.2 seedlings per m² in survey 8, following a notable spike in survey 7. In contrast, SEB1 recorded the highest density with 193.7 ± 48.0 seedlings per m² in Survey 9 at SEB1-R.
- Saplings were primarily found in the mangrove zones but occasionally appeared in very low densities in the outer saltmarsh areas. Compared to seedlings, sapling densities were low across all sub-sites, though they were slightly more common at SEB1-I and SEB2-R.
- Adult mangroves were observed in quadrats at consistently low densities, rarely exceeding 1.5 per m² in any survey. The highest density of adult grey mangroves was recorded in Survey 6 at SEB2-I, with 2.6 ± 0.6 per m². Adult mangroves ranged in size from small dwarf individuals to large overhanging trees.

**Figures 52 to 55** below present the South East Bay sub-site mean count data for crab holes:

- Crab hole occurrences were generally very low across all zones at SEB sub-sites, not including SEB1-I.
- There was a distinct lack of crab holes in the mangroves with most occurrences at SEB1-R, SEB2-R, and SEB2-I in the saltmarsh and saltmarsh-mangrove zones.
- Crab hole densities at SEB1-I were significantly higher compared to other sub-sites, with a peak of 20.8 ± 3.7 crab holes per quadrat in S2. The mangrove zone at SEB1-I exhibited consistently higher densities than the saltmarsh. Both the saltmarsh and mangrove zones saw an initial spike in counts in S2 and S3 followed by a sharp decline of more than 50%. Surveys 4 – 9 then exhibited a steady increase in crab holes counts, to similar numbers as the spike in S3 and S4. This steady increase in counts over the surveys is similar to large scale trends observed in Billys Bay.
- SEB1-R recorded very low crab hole counts, with the highest density observed in survey 4 at 0.7 ± 0.0 per quadrat.
- SEB2-R exhibited a sharp increase in crab hole density in survey 9 in the saltmarsh-mangroves, reaching 11.0 ± 0.0 per quadrat. Prior to that, crab hole counts remained relatively low across the other zones (<4 crab holes per $m^2$), with minor spikes in the saltmarsh zone during earlier surveys.
- SEB2-I had similarly variable trends in crab hole densities, with the highest counts recorded in S4 (3.0 ± 2.2 crab holes per $m^2$) in the saltmarsh zone. Densities remained low in the mangroves.
- Sporadic and unpredictable crab hole counts at SEB1-R, SEB2-R and SEB2-I were too low in abundance and did not portray any conceivable trends across the 9 surveys.

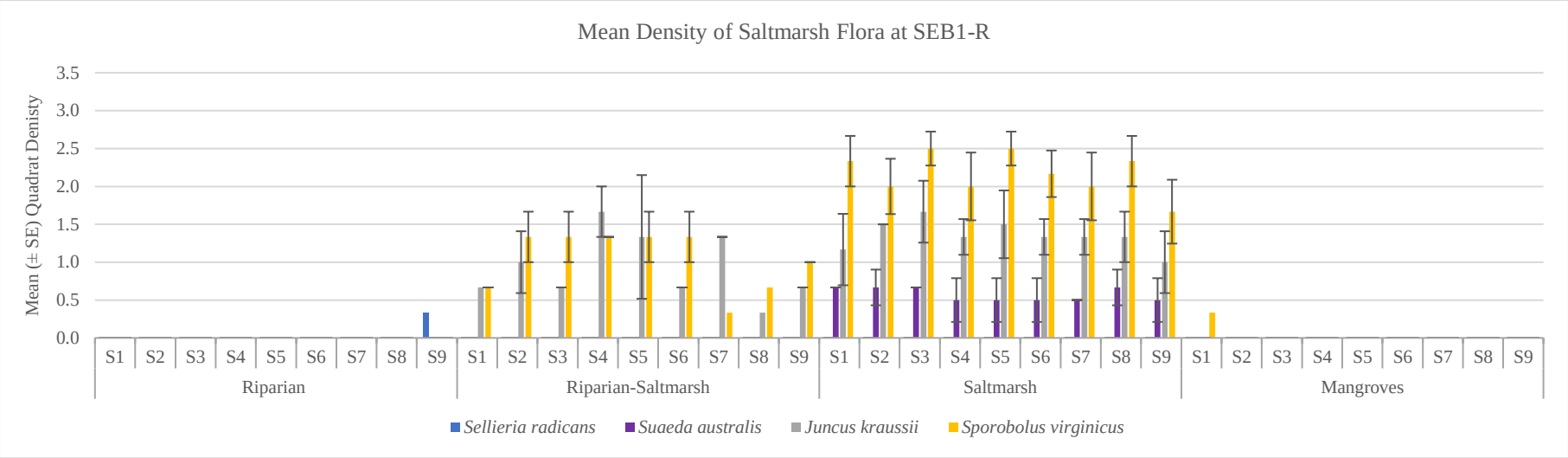



**Figure 43** SEB1-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

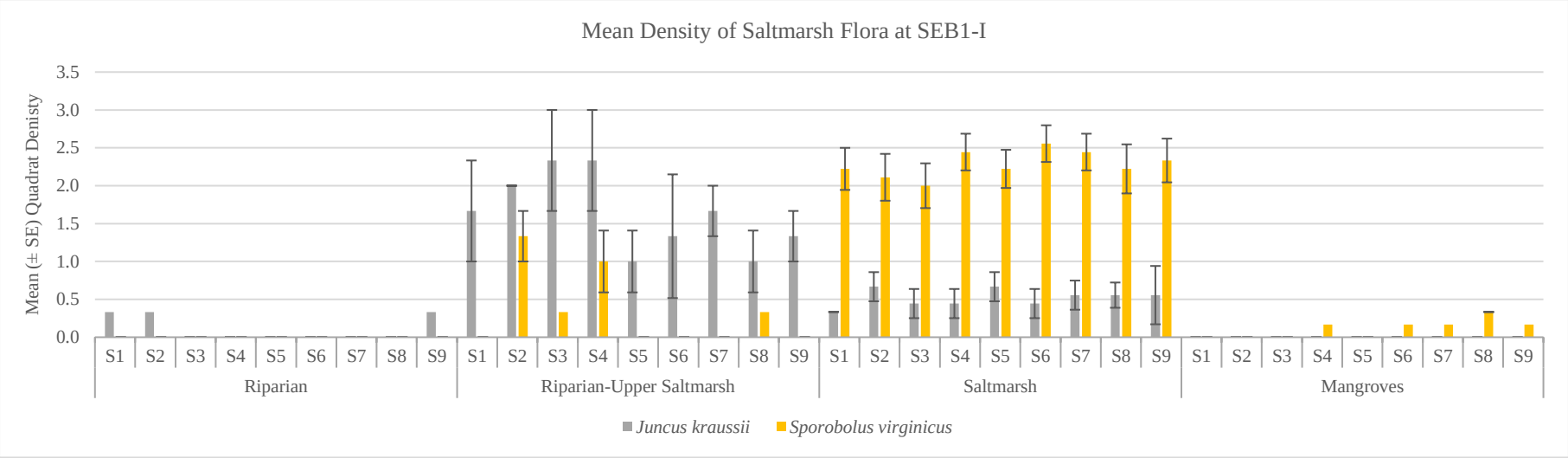



**Figure 44** SEB1-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

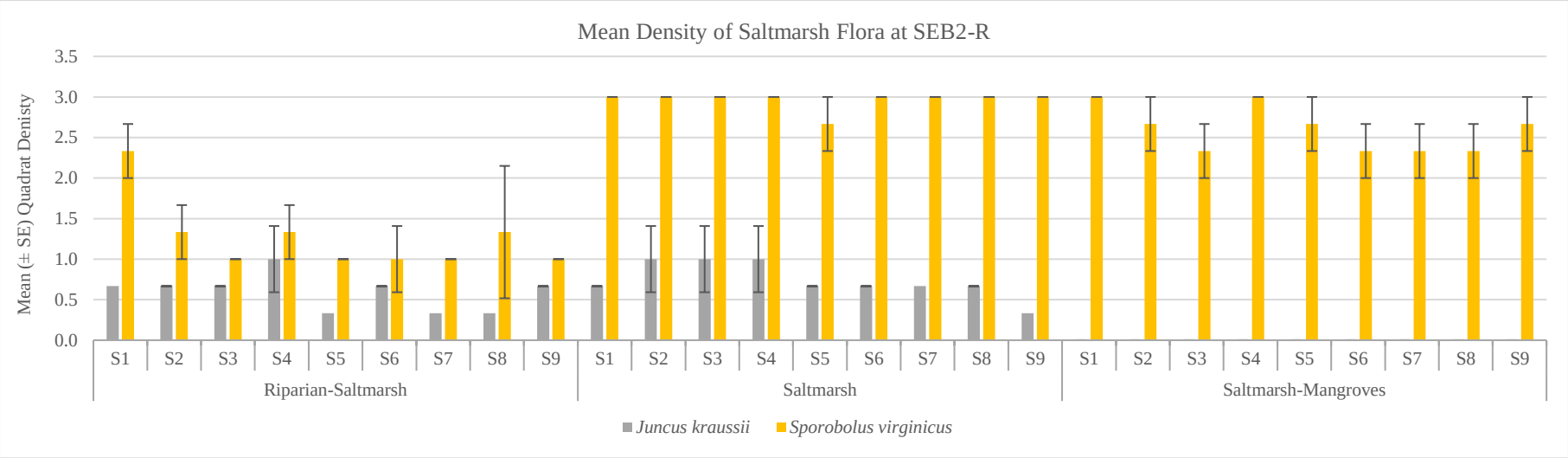



**Figure 45** SEB2-R survey mean quadrat density results for saltmarsh plants among the intertidal zones.

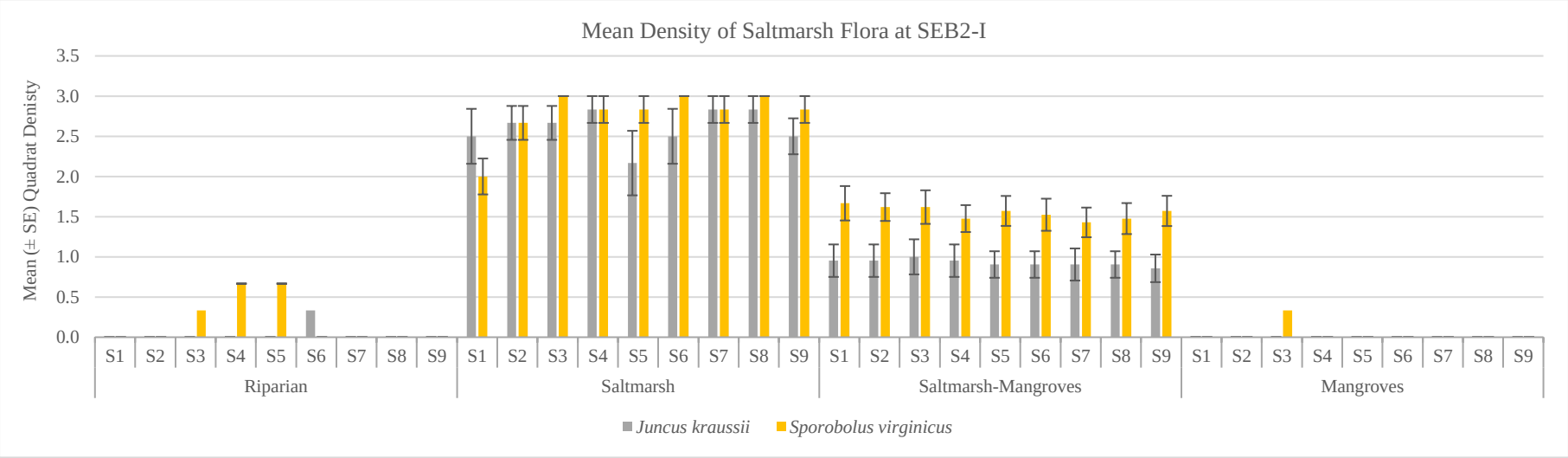



**Figure 46** SEB2-I survey mean quadrat density results for saltmarsh plants among the intertidal zones.

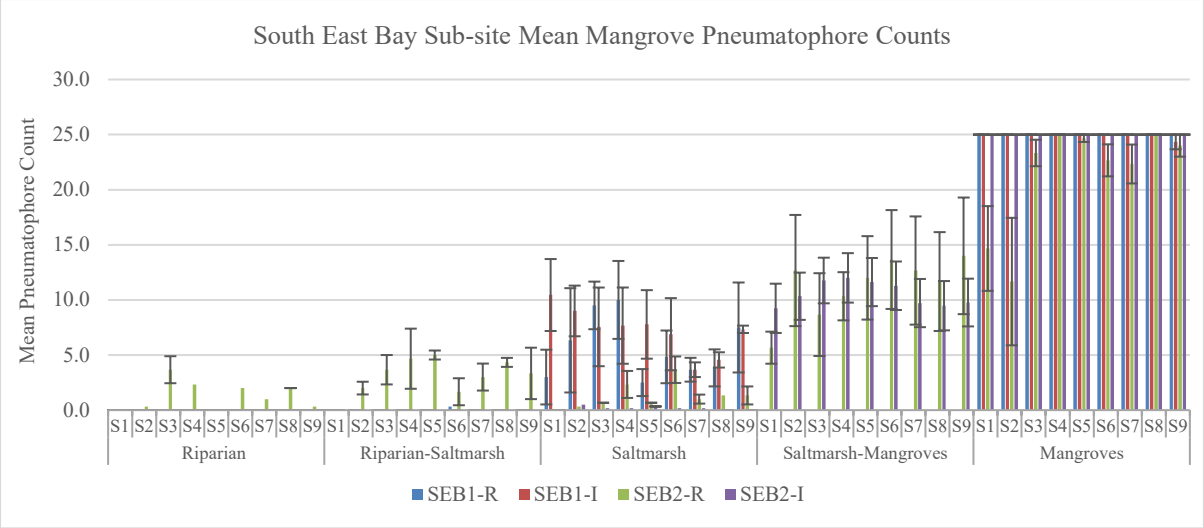



**Figure 47** South East Bay site mean mangrove pneumatophore count results. Note there were no saltmarsh-mangrove zones for SEB1 sub-sites nor was there a riparian-saltmarsh classified zone for SEB2-I.

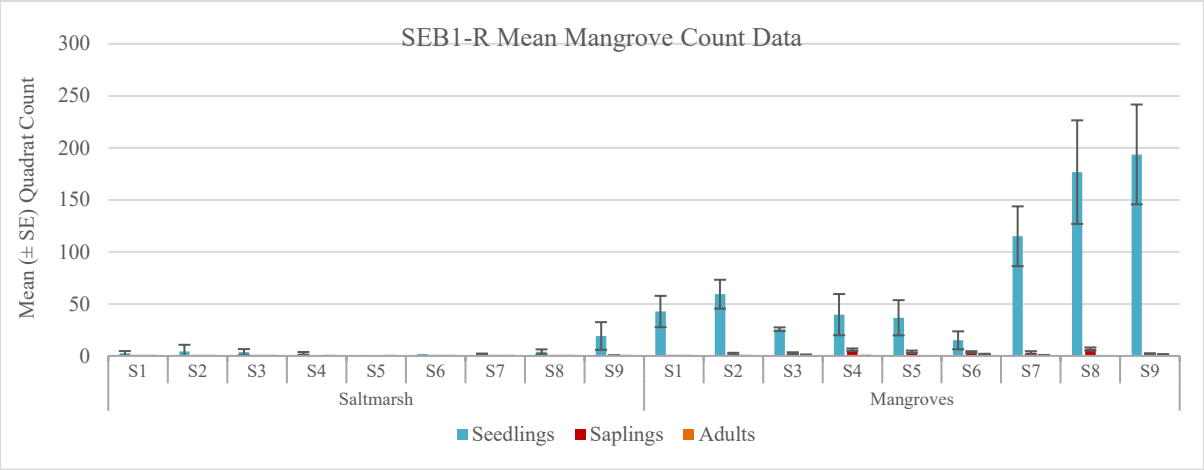



**Figure 48** SEB1-R survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

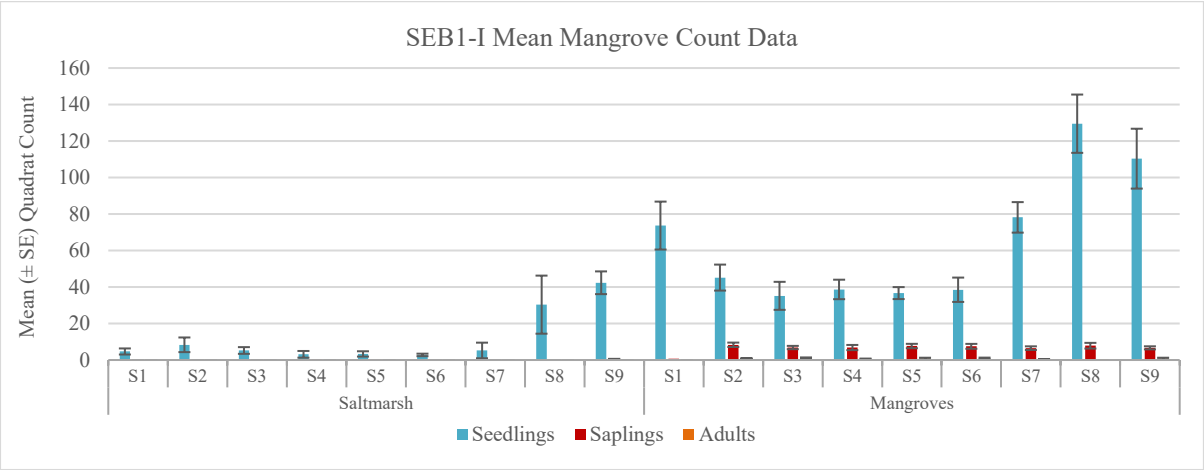



**Figure 49** SEB1-I survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

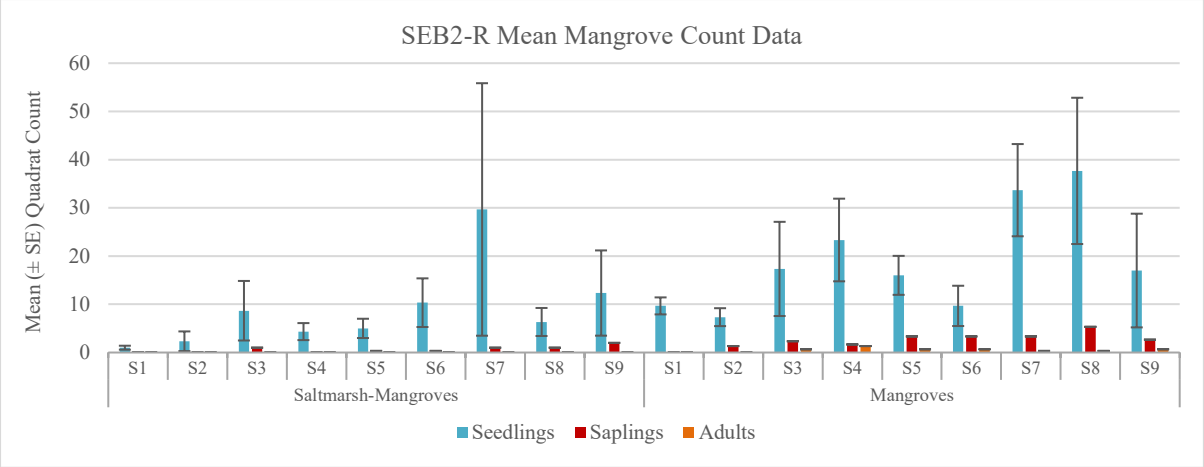



**Figure 50** SEB2-R survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

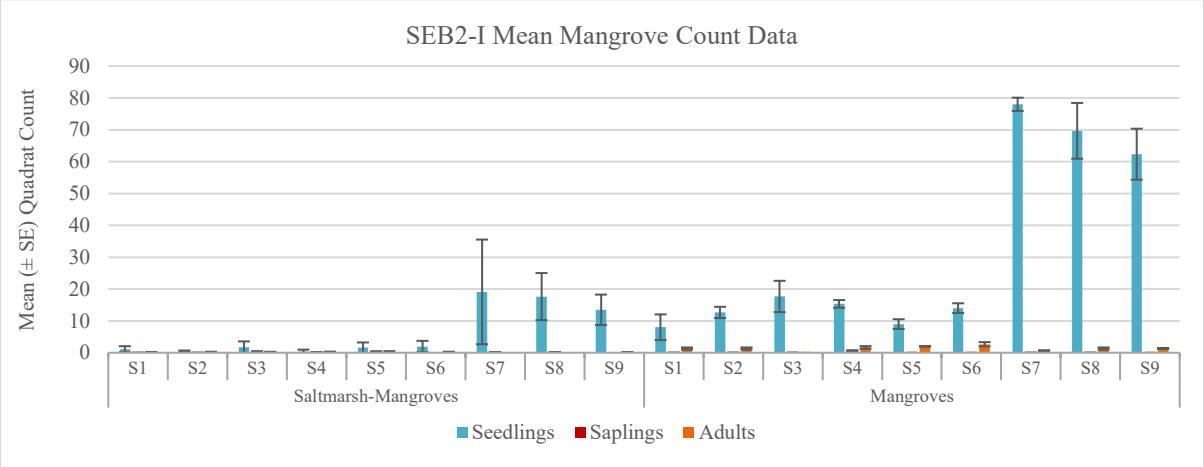



**Figure 51** SEB2-I survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

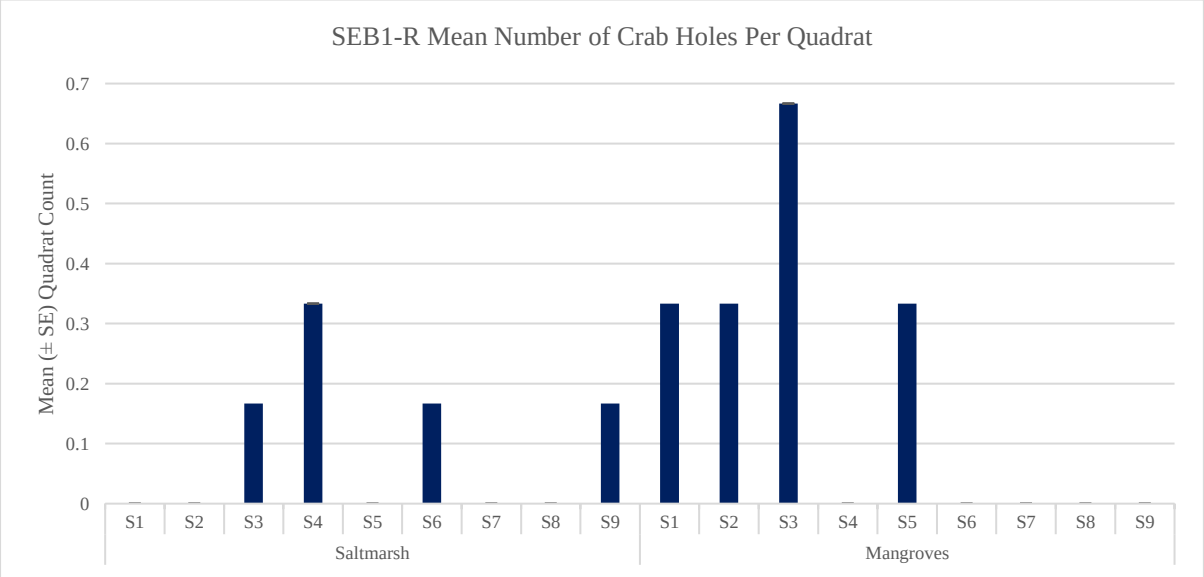



**Figure 52** SEB1-R survey mean quadrat count results for crab holes.

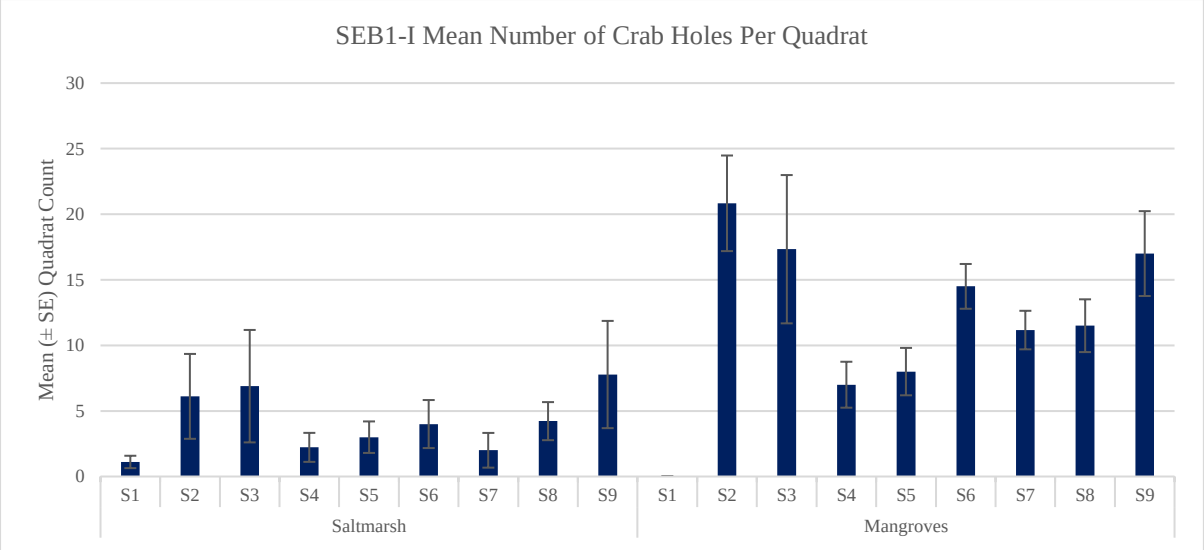



**Figure 53** SEB1-I survey mean quadrat count results for crab holes.

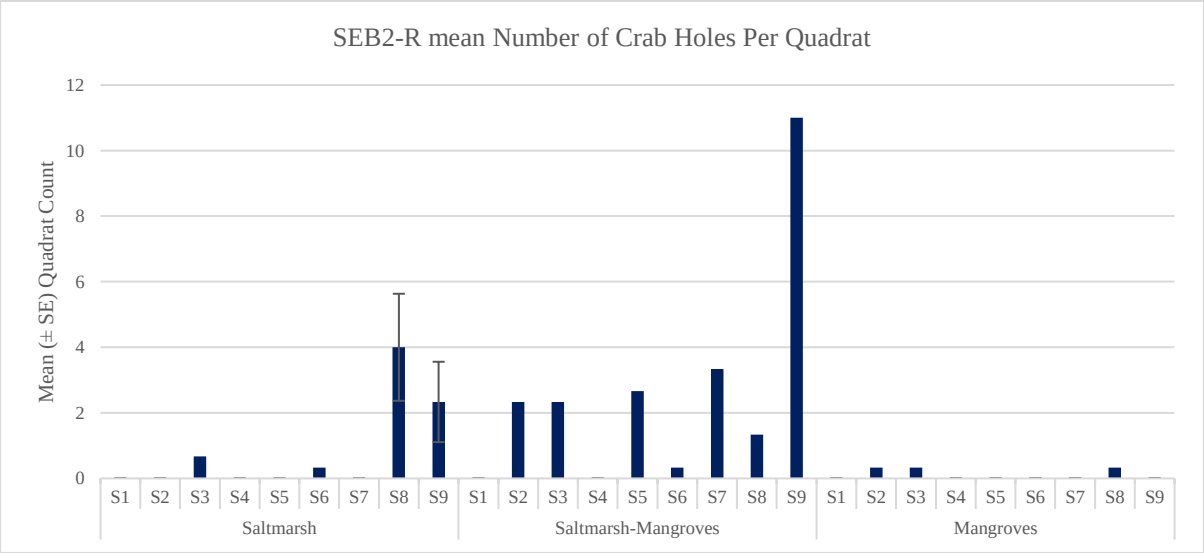



**Figure 54** SEB2-R survey mean quadrat count results for crab holes.

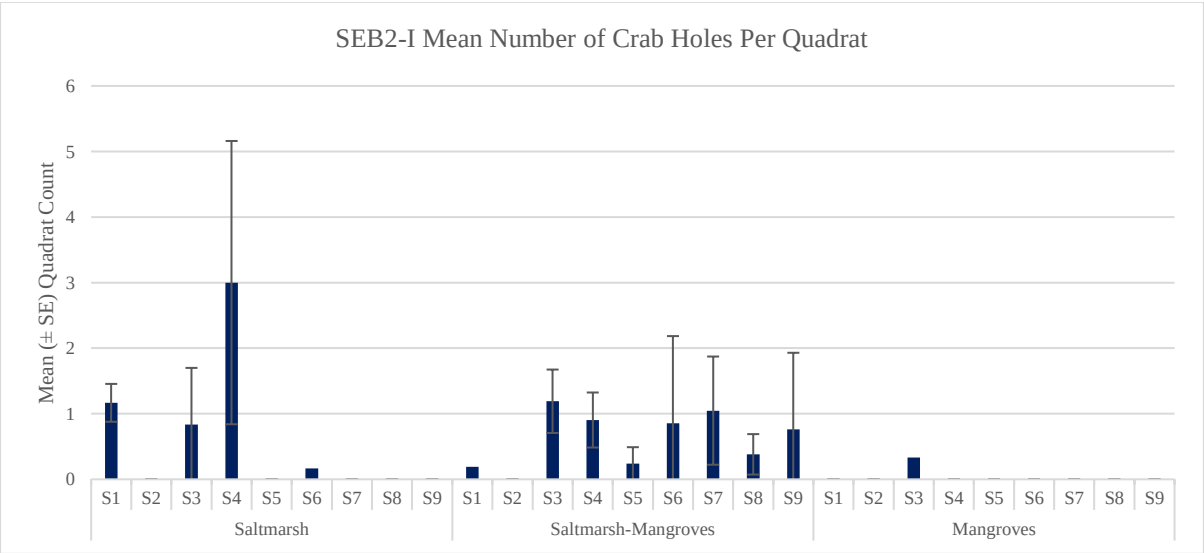



**Figure 55** SEB2-I survey mean quadrat count results for crab holes.

## 2.9. Crookhaven River Upstream (CUP) Sites

The Crookhaven River upstream control location sites (CUP) are situated along the southern bank of the Crookhaven River upstream from the Billys Island. The catchment areas draining to the site foreshores are either predominantly forested (CUP1-R) or agricultural with localised patches of woodland adjacent to the river (CUP1-I and CUP2 sub-sites). A variable width (30 to 100m) swamp oak riparian corridor is generally continuous along the foreshore at CUP1 and CUP2 sub-sites.

The saltmarsh at CUP1 sites comprises a fringing band of *Juncus kraussii-Machaerina juncea* along the upper edges of the riparian corridor which extends out onto the broad, flat mudflats and becomes dominated by *Sporobolus virginicus*, with and increasing frequency of small grey mangroves with distance offshore. Overall, the CUP1 saltmarsh band is broad reaching at least 50m from its inner to outer limits, with sparsely occurring isolated saltmarsh plants (*Sporobolus virginicus*) occurring beyond the outer limits of the transect boundaries. A strip of mature grey mangroves occurs along the banks of the Crookhaven River with oyster leases situated adjacent.

Selection of suitable monitoring sites of saltmarsh complexes along the section of shoreline downstream from CUP1 were limited owing the shape of the foreshore embankments which restrict the establishment and occupation by saltmarsh species (most of the banks are stepped and undercut). The CUP2 sub-sites are located on short, sloped embankments along a section of shoreline which supports intermittently occurring (fragmented) saltmarsh patches. As such, the CUP2 sites support the overall narrowest saltmarsh bandwidth (3 to 8m), comprising opportunistic occupation of mixed species complexes of *Suaeda australis, Sporobolus virginicus*, *Juncus kraussii* and *Samolus repens*.

### 2.9.1. CUP Intertidal Vegetation Transect Results

The mean combined length of saltmarsh plants along each of the four sub-site transects are provided below for CUP1 (**Figures 56** and **57**) and CUP2 (**Figures 58** and **59**). The figures allow for a visual comparison of the individual species occurring in the saltmarsh at each location and the variation between transects within surveys (shown by the standard error bars) and between bi-monthly surveys (bars). Note that there are no error bars for instances where species presence was limited to one transect per survey.

The understorey vegetation of the riparian habitats within the CUP transect plot boundaries were mostly riparian grasses at CUP1 and a mixture of buffalo grass with smaller quantities

of riparian grasses at CUP2 sites, occurring within the upper 3 to 7m of sub-sites' transect limits. Swamp oak trees and saplings were recorded in CUP1 sub-sites above the saltmarsh zone and the overall canopy coverage ranged between 7.4m and 13.8m over all CUP sub-sites. Several other ground species were recorded at from the uppermost limits of the transect plots at CUP1-I, including herbs (*Viola hederacea*, *Lobelia anceps*), vines (*Parsonsia straminea*) and paperbark.

With regards to weed presence at the upstream Crookhaven River monitoring sites, cats ear (*Hypochaeris glabra*) was regularly recorded within all transects at CUP1-I and African boxthorn was recorded from transect 3 at CUP2-I during the middle of the monitoring period. There was no lantana recorded from any of the CUP sub-sites.

An extensive *Sporobolus virginicus-Juncus kraussii* saltmarsh complex occurs along the sandy mudflat shoreline at CUP1 with additional species encountered around the inline site CUP1-I, and saltmarsh plants are confined to a narrow strip along the CUP2 sub-sites:

- *Samolus repens* at CUP1 sub-sites were limited to sporadic observations of single plants which occurred in the inner and middle of the transect lengths. Occurrences at CUP2-I were regular where the species was recorded from the inner limits (around 3 to 5m) of transect 4 for each survey occasion, with measured lengths ranging between 1.1 and 1.5m.
- *Selliera radicans* was present at CUP1-R in the uppermost limits of transects 1 and 4. The transect 1 occurrence was limited to a few leaves recorded for the first survey only, which had died off for the second survey and did not recover for subsequent surveys. Plant length measurements for the transect 4 occurrences ranged between 0.6m and 1.5m over the 18-month monitoring period due to the presence of two patches, one of which was very sparse (a few leaves which died off) and haphazardly recorded. *Selliera radicans* was also present at CUP1-I in small quantities on three survey occasions.
- The only occurrences of *Machaerina juncea* at CUP sites were at the inline site CUP1-I where the species was consistently recorded from the inner limits at all transects for each survey. There were some slight discrepancies in length measurements for one or two surveys at each of the transects, which were attributed to detection of the species for the very sparse sections of the *Machaerina juncea* stands.

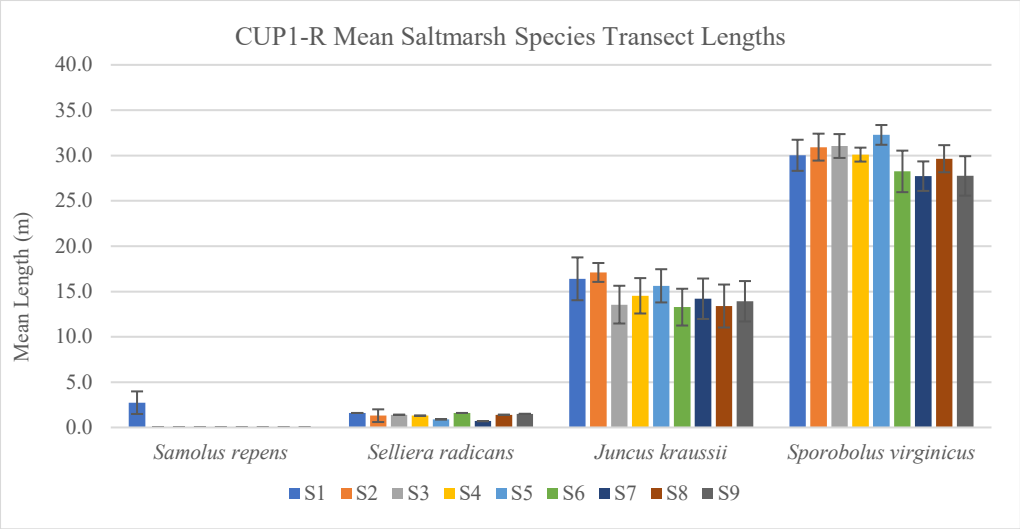



**Figure 56** CUP1-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

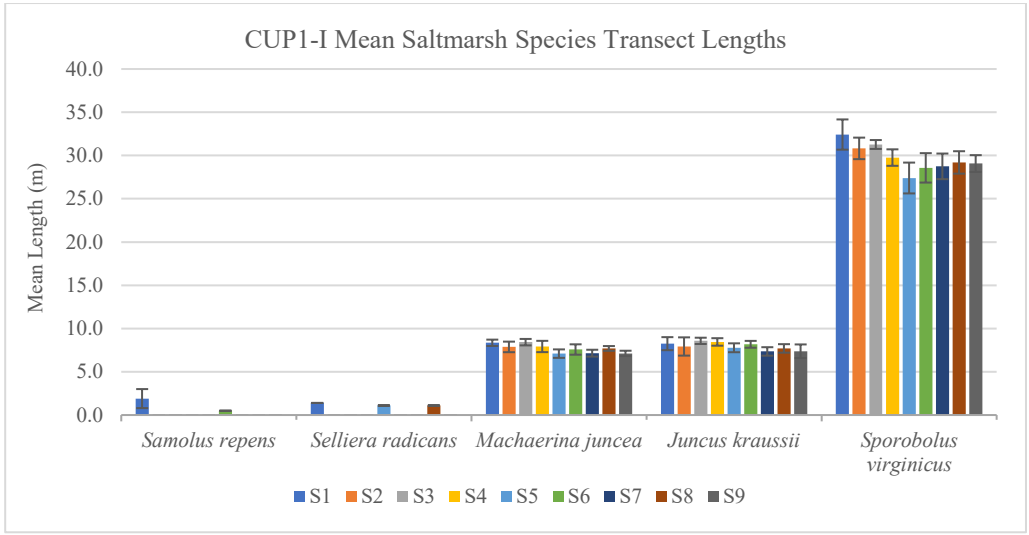



**Figure 57** CUP1-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

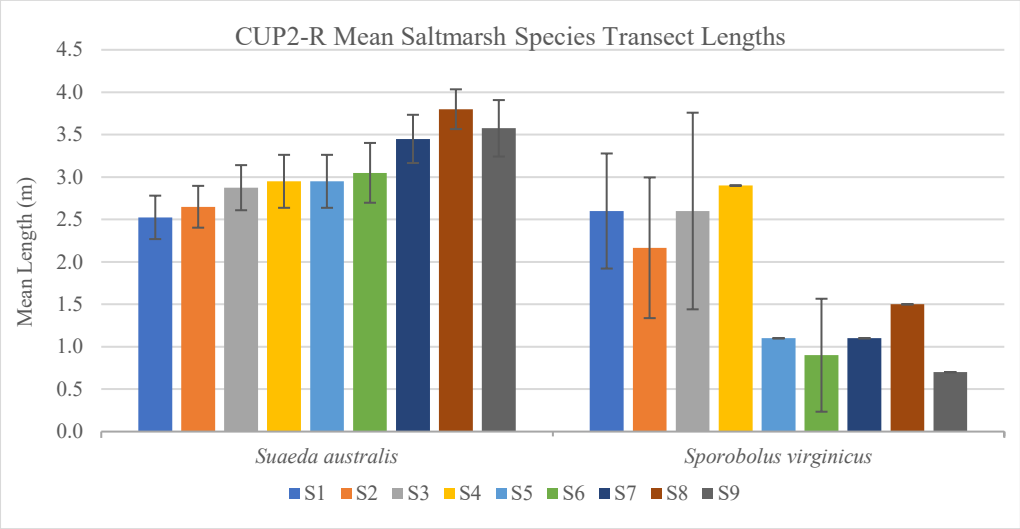



**Figure 58** CUP2-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

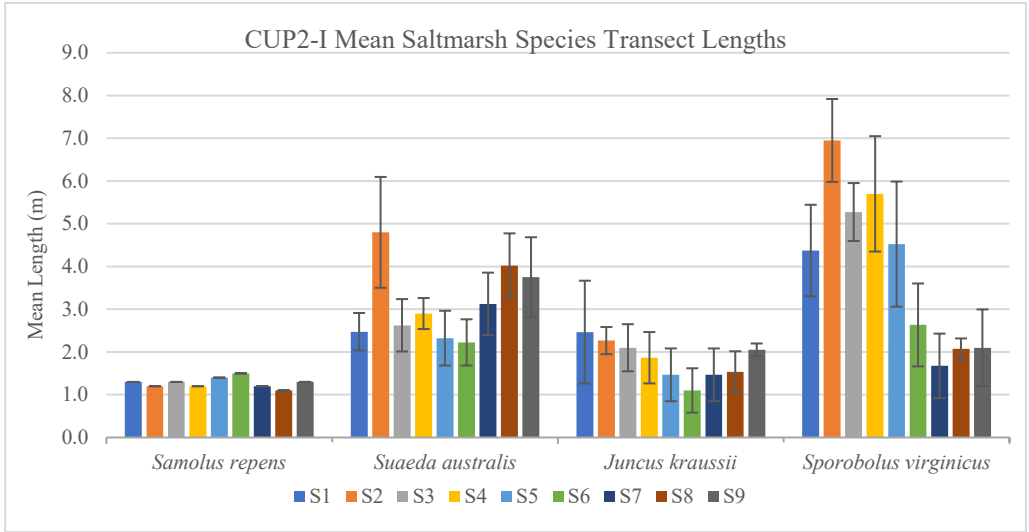



**Figure 59** CUP2-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

- *Suaeda australis* was present in each of the CUP2-R transects with length measurements ranging between 1.8 and 4.5m total length per transect over all survey events. Survey results show that *Suaeda australis* growth at CUP2-R increased over consecutive surveys for all transects with generally even rates of increase across transects which was reflected by the consistency in error bars.
- *Suaeda australis* occurrences at CUP2-I were highly variable within surveys (measured lengths between transects) and between surveys (**Figure 63**). Whereas *Suaeda australis* growths at transects 3 and 4 were relatively stable, most of the fluctuation in CUP2-I mean lengths were attributable to variable measurements recorded at transects 1 and 2 where *Suaeda australis* shrubs were subjected episodic smothering by seagrass wrack. The spike in term 2 *Suaeda australis* mean lengths were due to exposure of new growths of *Suaeda australis* in transects 1 and 2 that were previously smothered by dense seagrass wrack.
- *Sporobolus virginicus-Juncus kraussii* length measurements at CUP1-R were consistent between transects and monitoring events, and occurred as distinct patches of varying density throughout the transect lengths. On most occasions, *Juncus kraussii* patches at CUP1-R occurred further inshore than *Sporobolus virginicus* patches however the overall height range was both species was negligible (1.14 to 0.53m AHD for *Juncus kraussii* and 1.10 to 0.52m AHD for *Sporobolus virginicus*).
- The shoreline along both CUP2 sub-sites were susceptible to accumulations of dense seagrass wrack across the monitoring period, and measurements of *Sporobolus virginicus* at CUP2-R and CUP2-I were highly variable due to wrack smothering. For example, *Sporobolus virginicus* was present as a small (1.8m wide), sparse bed at CUP2-R transect 1 for the first survey and was completely covered by seagrass wrack for the remainder of surveys and was therefore recorded as absent. The continued occupation was later checked during a subsequent survey (by removing the wrack) which confirmed that it had died. Other sparse *Sporobolus virginicus* beds measured in transects 2 and 3 occurred among dense *Suaeda australis* shrubs and their presence was highly variable between surveys.

There was an overlap of 22 to 35m (across all transects) between the outermost occurrences of saltmarsh plants and the innermost mangroves at CUP sub-sites. For all transects, the innermost mangrove occurrences comprised grey mangrove seedlings and saplings which were much further inshore than pneumatophores, which suggests the occupation by juvenile mangrove forms is relatively recent. The mangrove zone within transect plots at CUP2 sub-sites is comparatively narrow (5 to 12m) and with representation mostly from occurrences of pneumatophores, saplings and seedlings.

Site CUP2-I recorded the only river mangrove *Aegiceras corniculatum*, where a small seedling observed in transect 1 for the first survey had perished by the second survey.

### 2.9.2. CUP Intertidal Quadrat Results

The Crookhaven River upstream sub-site mean (± SE) quadrat density results are provided below in **Figures 60** to **63** and were calculated for the main saltmarsh species among riparian, saltmarsh and mangrove zones, with each zone determined by the dominant species according to the Transect Mosaic assemblages (see species classifications in **Appendix Table C-1)**. Quadrat density results for other vegetation (e.g., terrestrial species) are provided in **Appendix C**. Note that there are no error bars for instances where species presence was limited to one quadrat per zone.

**Table 11** presents the characteristic assemblage compositions which contributed to respective zone classifications and corresponding number of quadrats per zone for each survey (S) with dominant species in **bold**. Density measurements were categorised according to species presence across the 5 x 5 grid (i.e., 25 squares) within the 1m x 1m quadrat, with categorical values (see methodology in **Section 2.1.2** for more detail). Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat and pneumatophore cover was determined by a count of occupied grid squares with values recorded as 0 to 25.

The Crookhaven River upstream sites exhibit considerable variability in saltmarsh flora density across the different zones, with distinct species compositions between ridge and inline sites:

- *Selliera radicans* was observed at CUP1-R only, where it formed a moderately dense mat in the riparian-saltmarsh zone, with rare occurrences in the saltmarsh during surveys 4 and 8 (**Figure 60**). After survey 3, its density declined in the riparian-saltmarsh zone and did not fully recover for subsequent surveys.
- *Machaerina juncea* was exclusive to CUP1-I, where it dominated the riparian-saltmarsh zone but maintained equivalent densities to *Juncus kraussii* and *Sporobolus virginicus* in the saltmarsh proper. Its highest densities were recorded in surveys 2 and 3, followed by a reduction over the remaining surveys. Overall, the density of saltmarsh plants remained relatively consistent across all nine surveys at CUP1-I.

| Table 11 Crookhaven River Upstream Sub-Site Intertidal Quadrat Data Zone Classifications | | | | |
|---|---|---|---|---|
| **Site** | **Survey*** | **Transect Mosaic Assemblage** | **Zone Classification** | **# Quadrats / zone** |
| CUP1-R | 2 | **CW** + BS + RG + CS | | |
| | | **JK + SQ** + C + CW + CD | Riparian-Saltmarsh | 3 |
| | | **JK + SQ** + CW | | |
| | | **SQ** + CW | | |
| | | **SQ** + BM | Saltmarsh | 6 |
| | | **JK + SQ** + SP | | |
| | | **BM + SP** + SD + PN + CH | | |
| | | **BM + PN + SD + SP + AD** + SQ + CH | Mangroves | 6 |
| CUP1-I | 1 | **RG** + BJ + CS | | |
| | | **BJ** + JK | Saltmarsh | 9 |
| | | **JK** + BJ + SQ | | |
| | | **BM** + SQ + PN + SD + SP + AD | | |
| | | **SQ** | | |
| | | **SQ** + SD + SP | Mangroves | 6 |
| | | **BM** + PN + SD + SP + AD + SQ | | |
| CUP2-R | 1 | **BM** + CW | Riparian-Saltmarsh | 3 |
| | | **SA** | Saltmarsh | 6 |
| | | **ZW + CW** + PN + SD | | |
| | | **SQ** + PN + SD | | |
| | | **BM + PN + SD** + ZW | | |
| | | **BM** + CW | Mangroves | 3 |
| CUP2-I | 2 | **BG** + RG + CW + NS + AB + PS | Riparian | 3 |
| | | **BM + CW** + CH + D | Saltmarsh-Mangroves | 6 |
| | | **SA** + CW + JK + SQ + SP + AD | | |
| | | **ZW** + SA + SD + SP + SQ + D | | |
| | | **BM** + PN + SD + SP + CH + ZW | Mangroves | 3 |
| Note: | *Indicates the relevant survey from which the mosaic assemblage classifications were extracted. | | | |

- *Suaeda australis* was present at both CUP2 sites, dominating the saltmarsh at CUP2-R but more sporadic in density and consistency of occurrence in the saltmarsh-mangrove zone at CUP2-I, where there was a decrease in *Suaeda australis* during surveys 2–8 and higher densities recorded in surveys 1 and 9.
- *Sporobolus virginicus* was the only species found at all four CUP sub-sites and tended to dominate the intertidal zone at CUP1 sites (particularly at CUP1-R). Although less dense, it was also prominent in the saltmarsh and mangroves at CUP1-I. In contrast, the CUP2 sites showed very low occurrences, with the final four surveys (S6 - S9) indicating a significant reduction in *Sporobolus virginicus*.
- *Juncus kraussii* was present at all sites except CUP2-R, generally in lower abundance compared to *Sporobolus virginicus*. Despite being sporadic at some sites, *Juncus kraussii* was consistently found across the intertidal zone at CUP1-R, from the riparian-saltmarsh to the mangroves. It showed no temporal changes in density in the

saltmarsh at CUP1 sites, but at CUP2-I, its density steadily declined, mirroring the trend of *Sporobolus virginicus*.

Pneumatophores at the Crookhaven River upstream sites almost exclusively occurred in the saltmarsh-mangrove transitional zone, with a higher density seen at CUP2 sites than CUP1 sites (**Figure 64).** CUP2 sites ranged in density from 11.3 ± 1.2 to 23.3 ± 0.9 quadrat grids, whereas CUP1 sites ranged from 0.3 ± 0.0 to 12.7 ± 5.1. Pneumatophores occurrence among saltmarsh habitats at CUP2-R were sporadic and generally recorded at very low densities. CUP1 sub-sites saw a steady increase in pneumatophore density over the 9 surveys with a slightly larger increase in CUP1-I, however this was still at low densities and only up to a maximum of 12.7 ± 5.1 quadrat grids occupied.

The presence of mangroves (seedling, saplings and adult trees) in the CUP sub-site saltmarsh-mangrove and mangrove zones were represented mainly by the seedlings, which were observed at much higher densities compared to saplings and adults. Notably, adult mangroves were rarely detected, with very low densities at CUP2-R and none recorded at CUP2-I. Both inline sites and both ridge sites did not behave similarly across locations, likely owing to differences in the physical attributes of the sites (shoreline length, exposure to tides) (**Figures 65 to 68**):

- Mangrove presence in the saltmarsh zones across all Crookhaven upstream sub-sites were limited to small quantities of seedlings at CUP2-R in surveys 7, 8, and 9.
- Sub-site CUP1-R was the only CUP site to record a decline in seedling density values over surveys 7 to 9. As observed at all the other locations, seedling densities at CUP1-I and both CUP2 sub-sites increased significantly for the final three surveys, 7, 8 and 9, and this trend was also observed in the saltmarsh zone at CUP2-R only.
- While seedling densities were very low at CUP2 sub-sites over surveys 1 to 6 (< 2 seedlings per $m^2$), seedling densities recorded during the latter surveys were higher compared to CUP1 sites.
- Representation of mangrove saplings in sample quadrats were erratic and very low at CUP1 sub-sites, and whilst readings were more consistent and higher from CUP1 sub-sites they were still relatively low compared to seedlings (< 4 seedlings per $m^2$).
- Adult grey mangroves maintained very low but consistent density readings at CUP1 sub-sites.

**Figures 69 to 72** below present the Crookhaven upriver sub-site mean count data for crab holes:

- Crab hole occurrences were predominantly found in the mangroves across all upriver sub-sites, with minimal occurrences in the saltmarsh zones.
- CUP1-R, CUP1-I and CUP2-R expressed greater crab hole densities in the second half of surveys.
- CUP1-R recorded a consistent increase in crab hole densities from S5 to S9, peaking at 30.0 ± 7.3 crab holes per quadrat in survey 9. Prior to that, there were moderate densities in S2 (17.3 ± 6.2), followed by a decline in surveys 3 and 4. This is in similar behaviour to sub sites in South West Bay.
- CUP1-I exhibited lower overall crab hole densities compared to CUP1-R, with a notable peak in S5 (16.0 ± 5.2 per quadrat) and S7 (16.0 ± 6.7). Crab hole counts in later surveys showed increases on early surveys however steadily declined from S7.
- CUP2-R had almost no crab holes in the saltmarsh zone, but a sharp rise occurred in the mangroves during S6 (4.7 ± 1.7 per quadrat), which continued at moderate levels in S7 to S9. Densities from S6 to S9 were significantly larger than all prior surveys. However, CUP2-R had the lowest crab hole densities of all upriver sub-sites.
- CUP2-I displayed a significant spike in crab hole densities in survey 6 (19.0 ± 5.5 per quadrat), though counts were low across the saltmarsh-mangrove and mangrove zones and fluctuated across other surveys. Crab hole densities dropped sharply following S6, with much lower counts recorded in S7 to S9. Low crab hole densities did not follow trends observed at other sites.

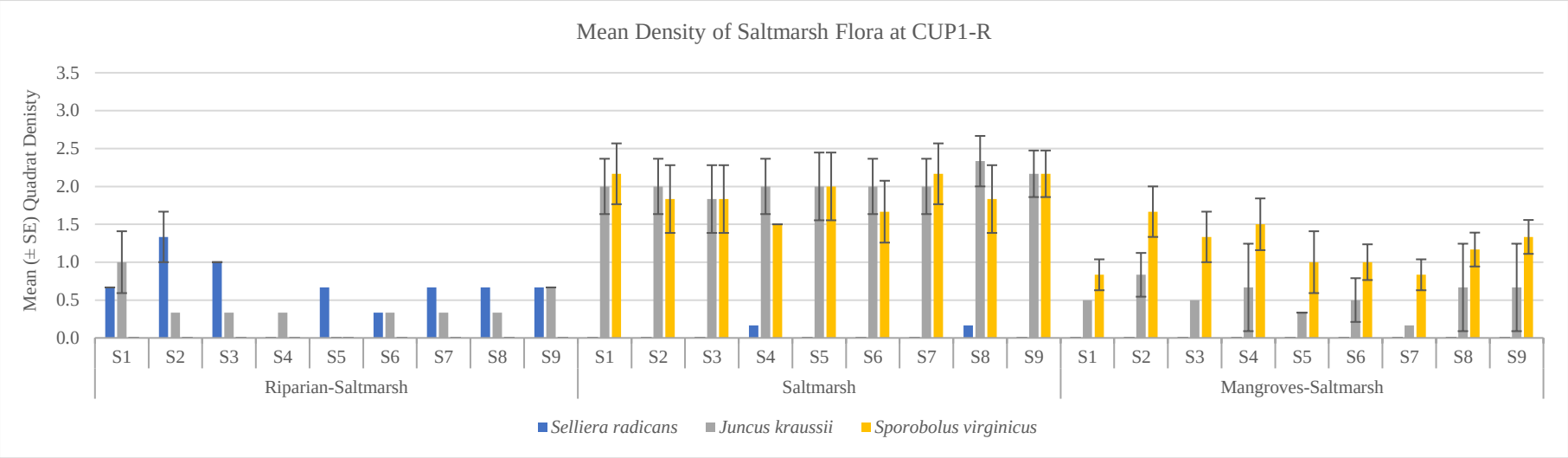



**Figure 60** CUP1-R survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

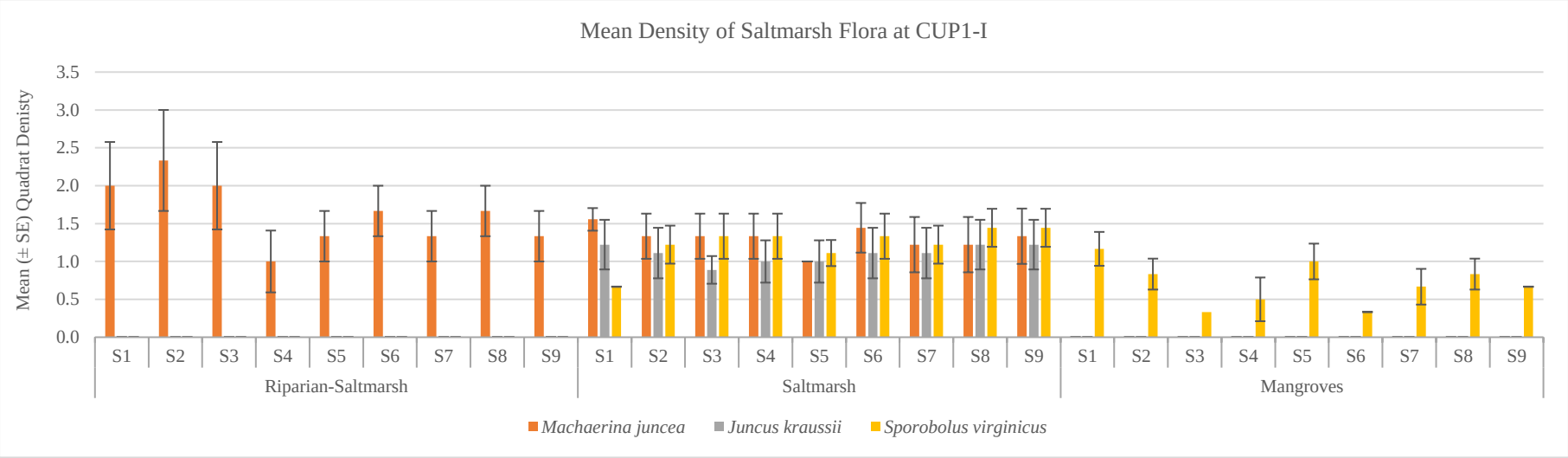



**Figure 61** CUP1-I survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

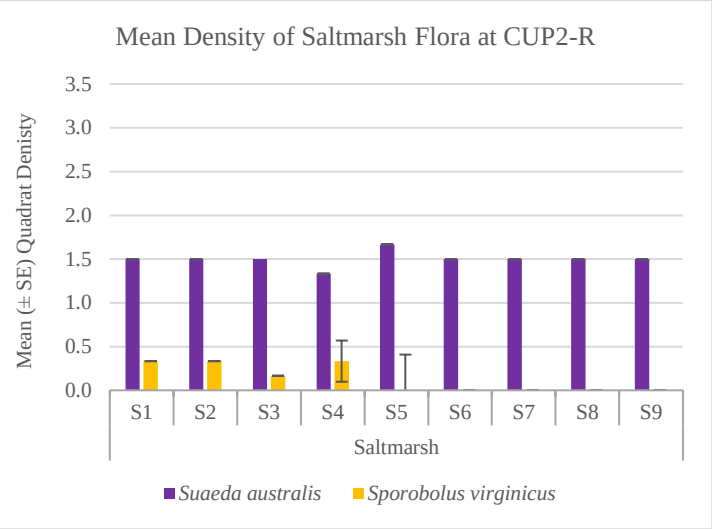



**Figure 62** CUP2-R survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh zone.

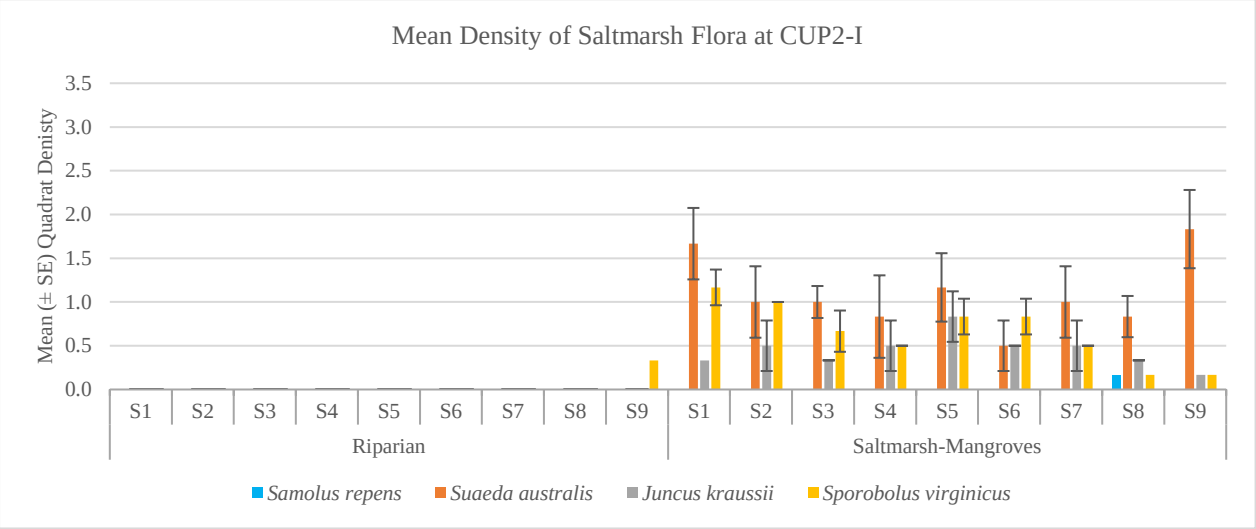



**Figure 63** CUP2-I survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh zone.

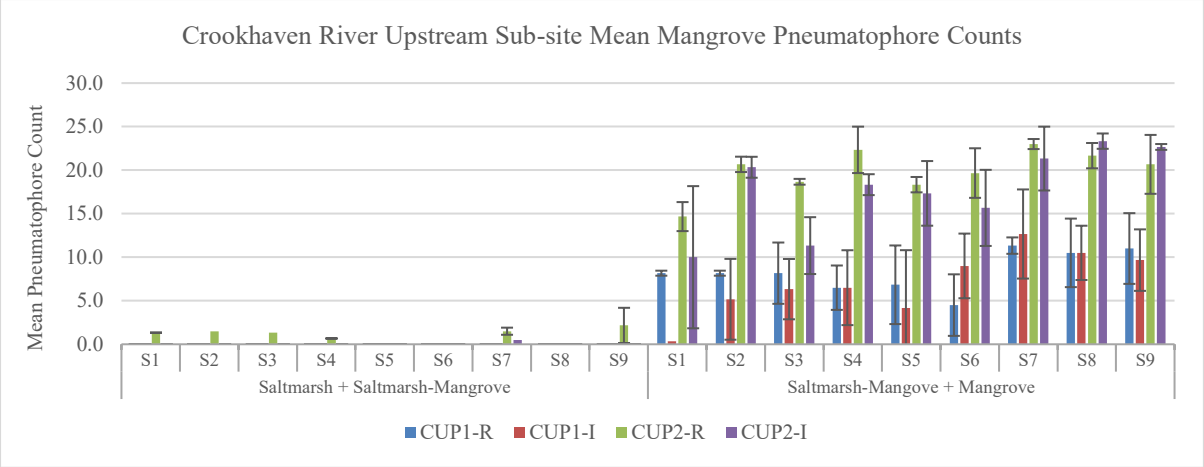



**Figure 64** Crookhaven River upstream sub-site mean mangrove pneumatophore count results in the saltmarsh to mangrove zones (see **Table X** above for respective CUP sub-site zone classifications).

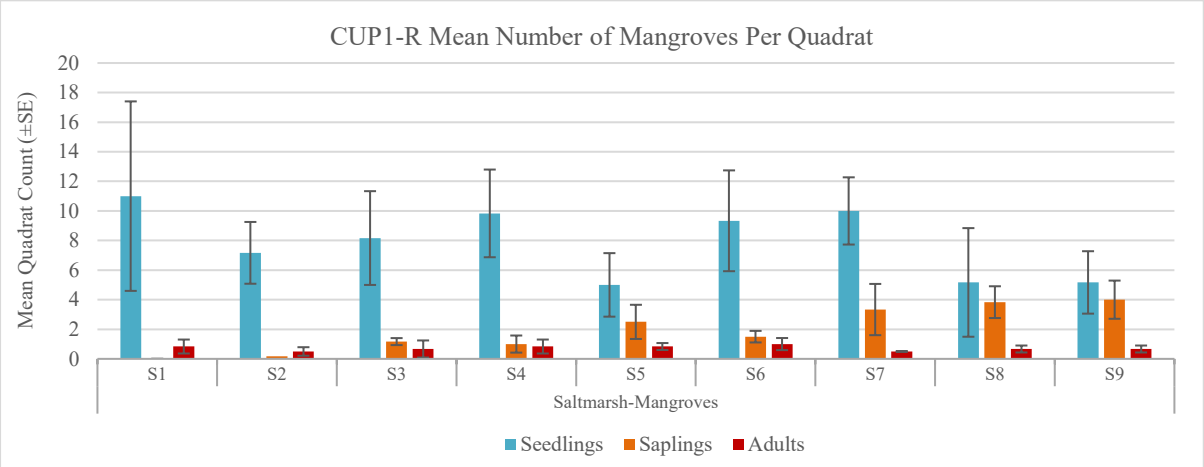



**Figure 65** CUP1-R survey mean quadrat count results for mangroves in the lower saltmarsh to mangrove zone.

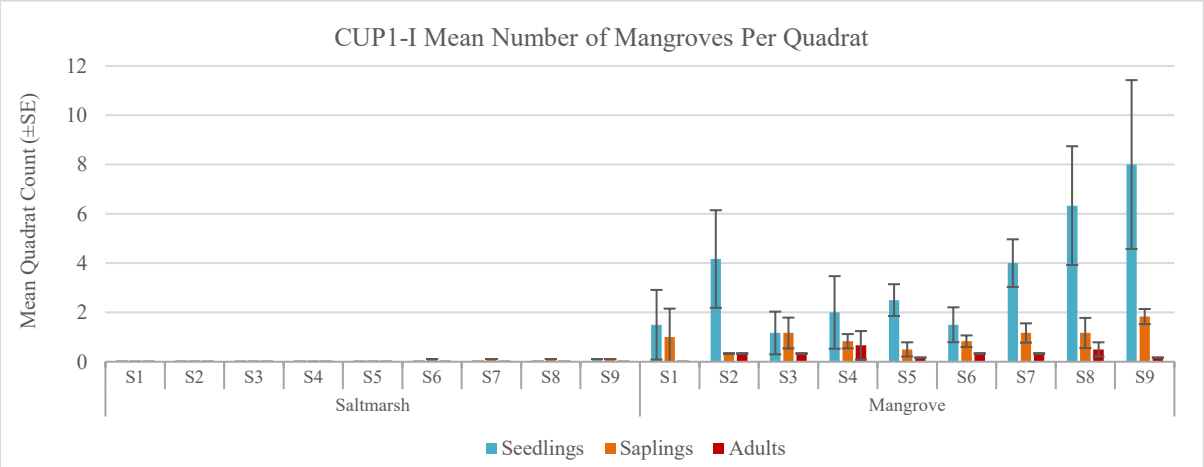



**Figure 66** CUP1-I survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

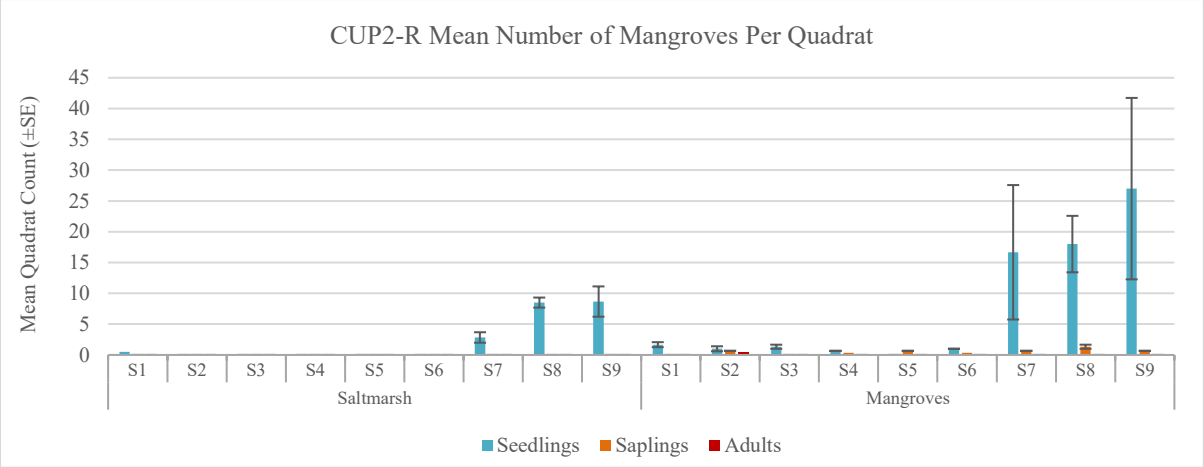



**Figure 67** CUP2-R survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

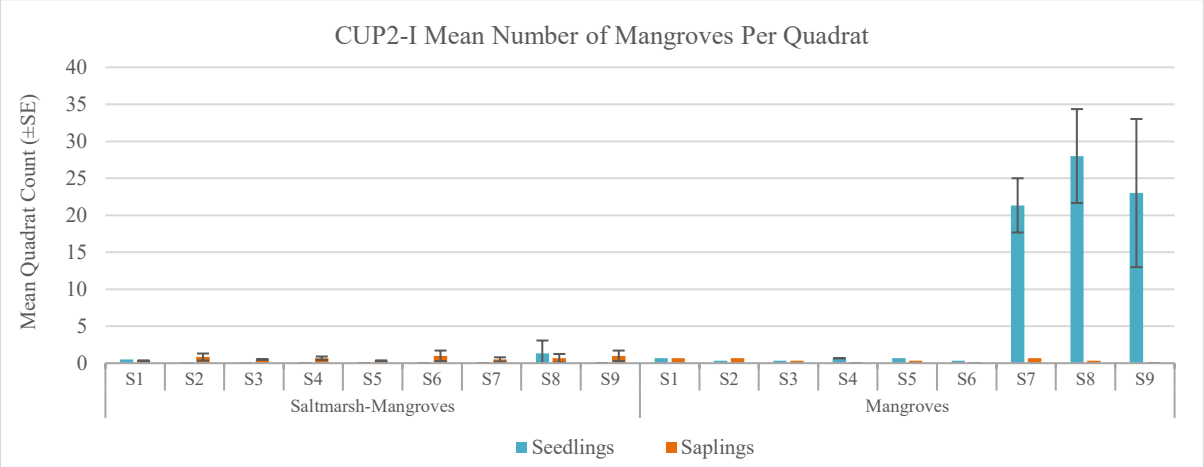



**Figure 68** CUP2-I survey mean quadrat count results for mangroves in the saltmarsh and mangrove zones.

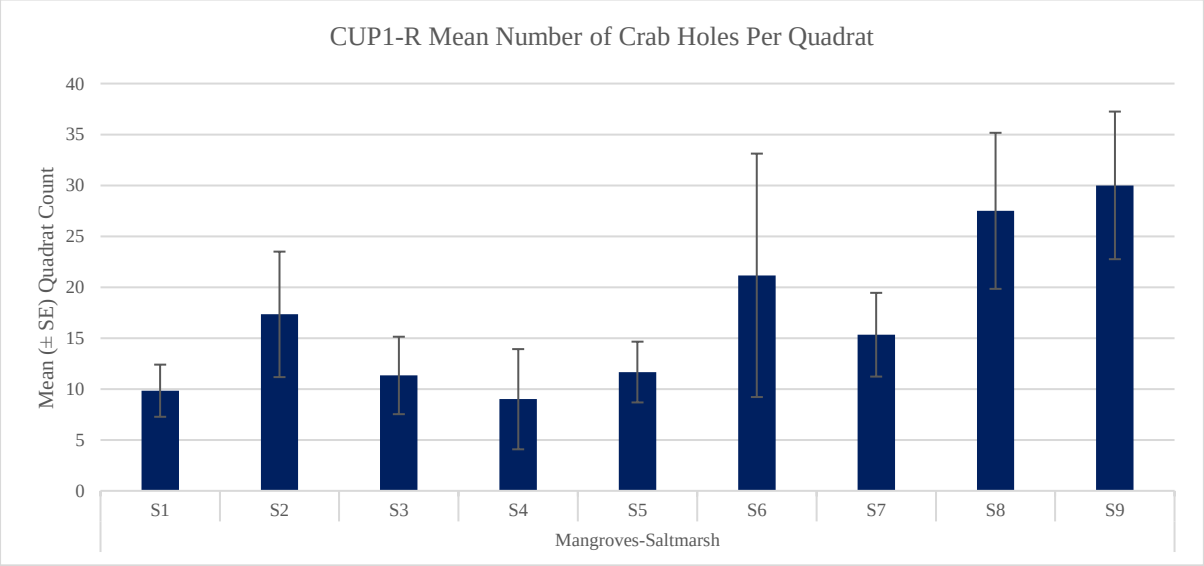



**Figure 69** CUP1-R survey mean quadrat count results for crab holes.

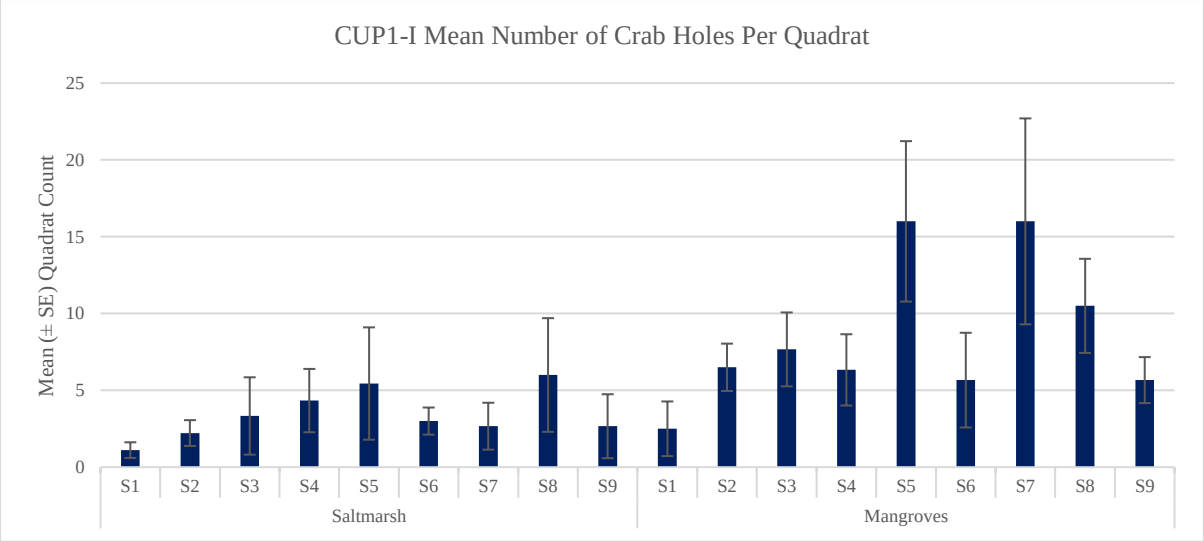



**Figure 70** CUP1-I survey mean quadrat count results for crab holes.

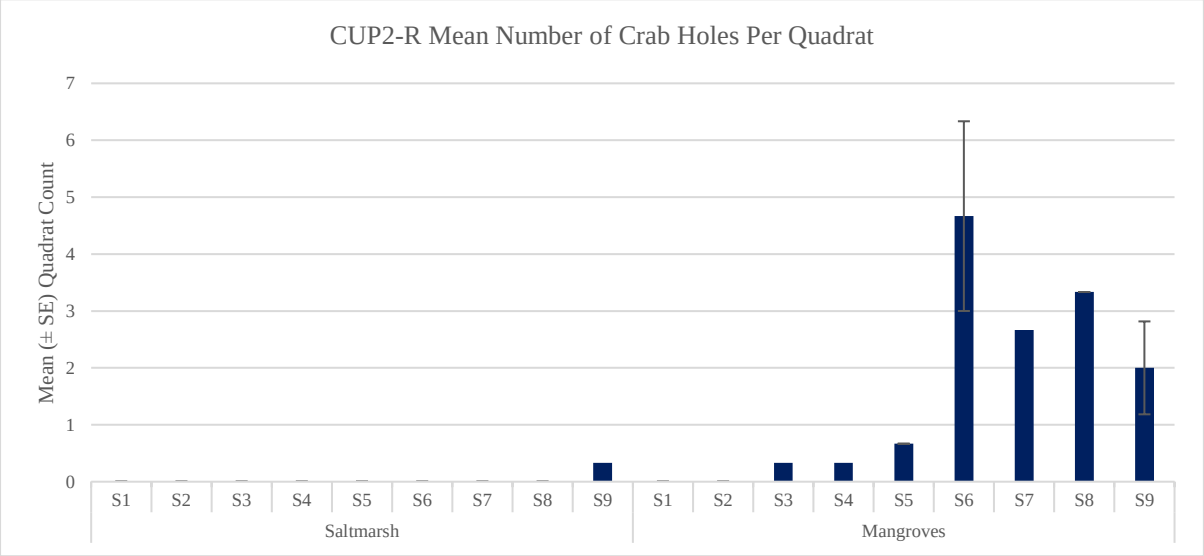



**Figure 71** CUP2-R survey mean quadrat count results for crab holes.

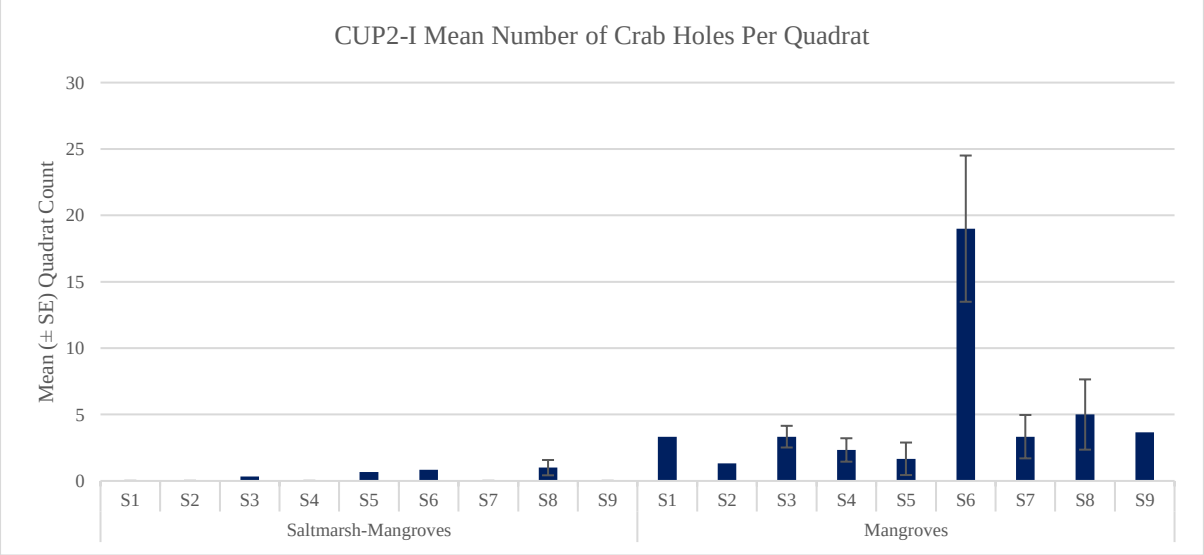



**Figure 72** CUP2-I survey mean quadrat count results for crab holes.

## 2.10. Crookhaven River Downstream (CDN) Sites

The Crookhaven River downstream location sites (CDN) are situated downstream in the Crookhaven estuary along the eastern extent of Goodnight Island (CDN1) and Orient Point (CDN2). Whereas the CDN1 sub-sites are located adjacent to cleared rural-residential land with a narrow fringing swamp oak riparian corridor which extends around the perimeter of Goodnight Island, the catchment area draining to CDN2-I sites is urban-residential. Site CDN2-R is located on a sand berm along the eastern perimeter of Orient Point. The berm supports a narrow (15 to 20m) riparian corridor which transitions into saltmarsh-mangrove intertidal habitats to the west. The CDN sites contained the overall lowest drip line values (**Figure 4** above) which highlight there was minimal overlap between the riparian canopy forming vegetation and upper saltmarsh zones.

The 20 to 30m band of *Sporobolus virginicus* dominated saltmarsh occupies the upper intertidal zone at CDN1, with a mix of sapling and adult grey mangroves occurring among the intertidal mudflats bordered by a fringe of large mature adult grey mangroves around the perimeter of the main Crookhaven River channel. Whereas saltmarsh at CDN2-R comprises a generally narrow (8 to 12m) *Sporobolus virginicus* complex with small quantities of *Suaeda australis,* the CDN2-I is much broader (to 50m) with better representation of *Juncus kraussii.* The broader intertidal mudflats at CDN2 sites support sparse occupation of adult grey mangroves with a continuous fringe of large mature grey mangroves around the perimeter of the main Crookhaven River channel.

### 2.10.1. Intertidal Vegetation Transect Results

The mean combined length of saltmarsh plants along each of the four sub-site transects are provided below for CDN1 (**Figures 73** and **74**) and CDN2 (**Figures 75** and **76**). The figures allow for a visual comparison of the individual species occurring in the saltmarsh at each location and the variation between transects within surveys (shown by the standard error bars) and between bi-monthly surveys (bars). Note that there are no error bars for instances where species presence was limited to one transect per survey.

The riparian habitat understorey at the upper CDN1 sub-sites included short lengths (<1.5m) or couch grasses (*Cynodon dactylon*) with generally small quantities of scurvy weed (*Commelina cyanea*) found infrequently at CDN1-R, and overall, the number of riparian species recorded at CDN sites were relatively few.

Riparian grasses dominated the understorey groundcover vegetation at CDN2-I with higher quantities of couch grass and regular measurements of pigface (*Caprobrutus sp*) at CDN2-R

which were contained mostly in transects 3 and 4. Small quantities of saw-sedge (*Gahnia sp*) were also recorded at CDN2-I. There were very few occurrences of weeds within the CDN sub-site transect plots over the 18-month monitoring period. *Sporobolus virginicus* was the dominant species recorded among each of the CDN sub-site saltmarshes, with variable consistency in representation across the 18-month monitoring period:

- *Selliera radicans* was haphazardly recorded from the upper to middle saltmarsh zone at CDN2-R. The species was only recorded from the uppermost limits of transects 1 and 2 on two survey occasions each, and measurement estimates varied as the growth forms were mainly of very sparse (sometimes single leaves) which were absent for subsequent surveys.
- The only occurrences of *Suaeda australis* at CDN2-R were during the earlier surveys in transects 1 and 2, where growths consisted of isolated shrubs in poor condition (sparse, patchy with many dead branches) which deteriorated over time.
- *Juncus kraussii* was present in distinct, narrow (<3.5m) patches in the upper saltmarsh at CDN1 sub-sites. The absence of *Juncus kraussii* from transects 1 and 3 at CDN1-R contributed to its observed error estimates (SE bars) and CND1-I contained sections of sparse growth around the perimeter of the main (denser) stands which varied in size between surveys. This, and the influence of wrack, were responsible for the observed differences in mean length values between surveys.
- *Sporobolus virginicus* length measurements at CDN1-R were among the most stable of all monitoring sites. Temporal variation of *Sporobolus virginicus* length measurements at CDN1-I reflect a general decline in the length of individual beds across beds. The locations of reduced measurements appeared random and were probably (in part) due to shifting wrack accumulations (both swamp oak detritus and *Zostera* seagrass wrack) and debris that got washed onto *Sporobolus virginicus* beds and mangrove structures.
- *Sporobolus virginicus* was present at CDN2-R as distinct, dense beds. Length measurements were for the most part, consistent between surveys at transects 2 and 4, however there was an increasing trend in bed lengths over the 18-month monitoring period at transect 1 and variable results from transect 3 due to fluctuations of the sparser bed areas.

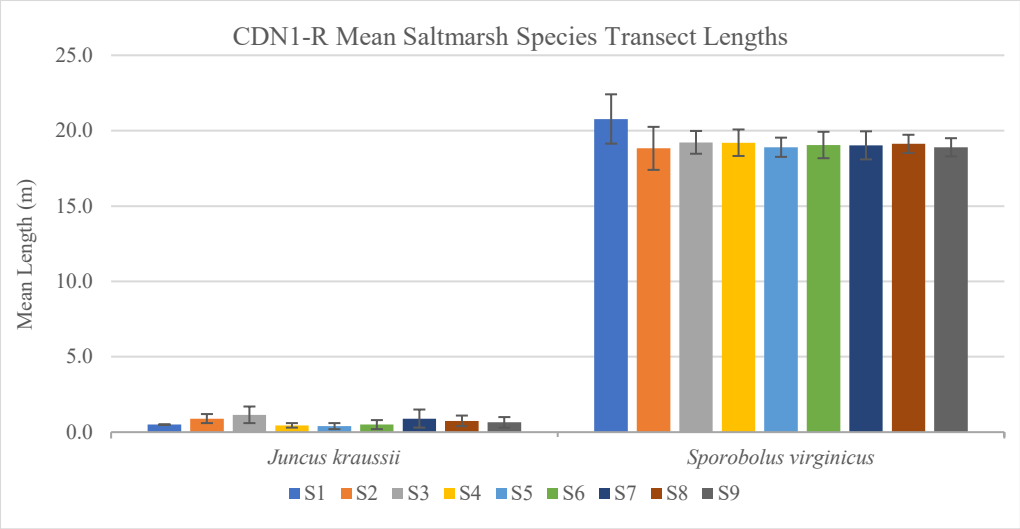



**Figure 73** CDN1-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

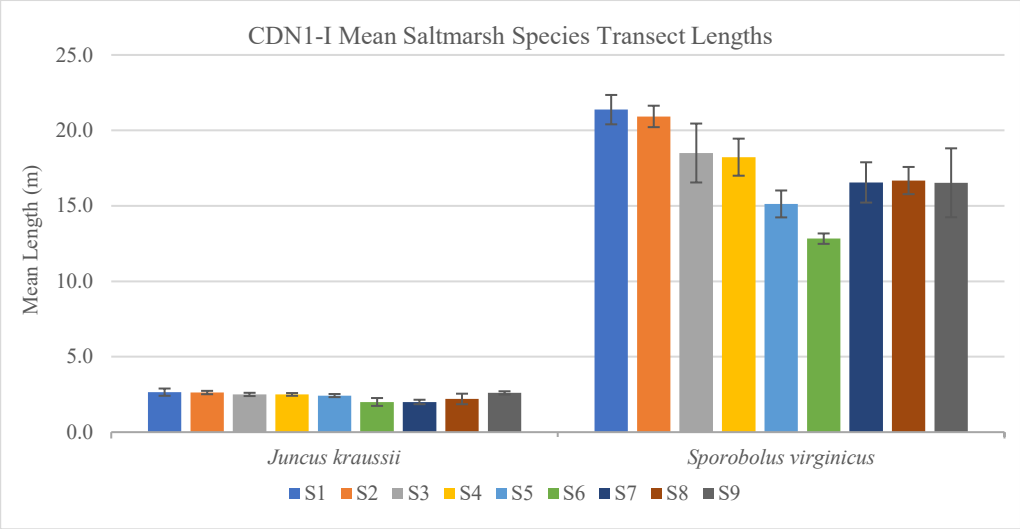



**Figure 74** CDN1-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

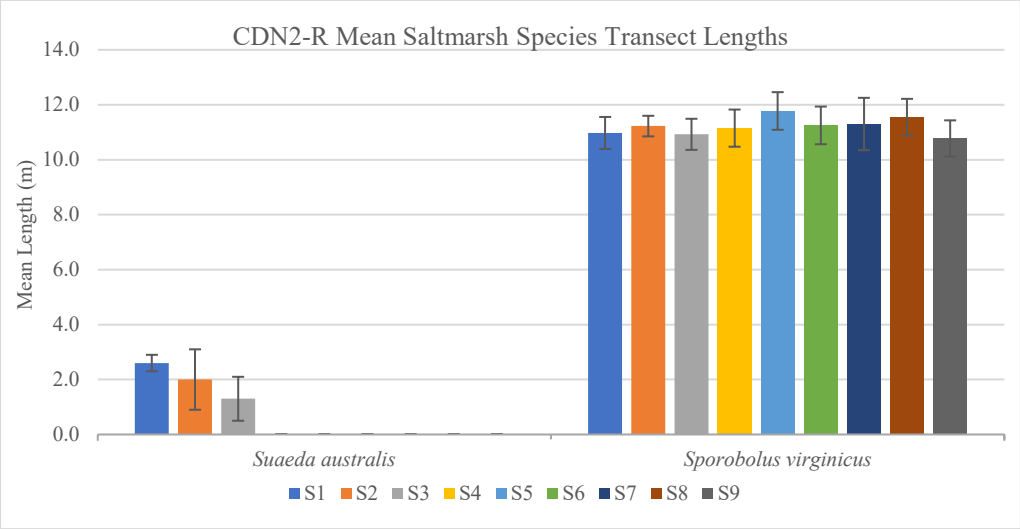



**Figure 75** CDN2-R saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

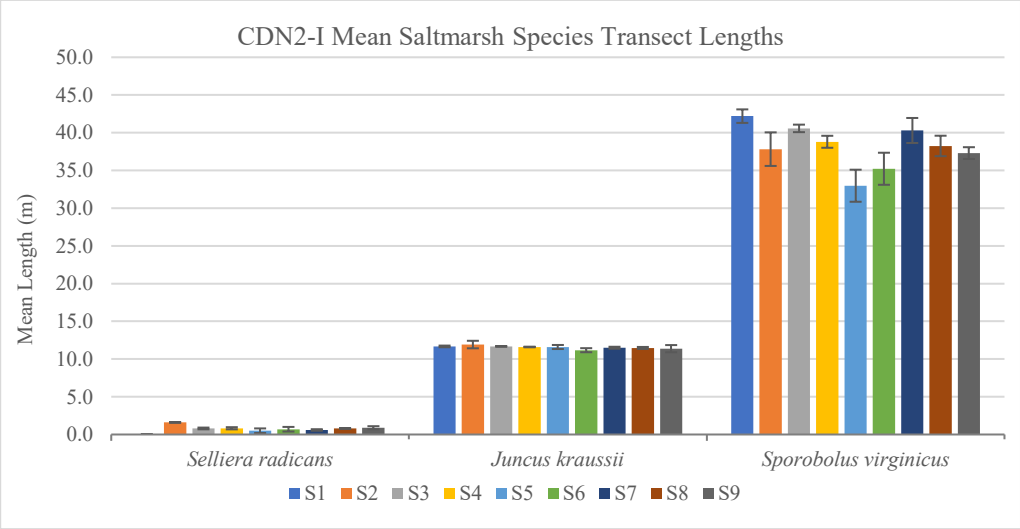



**Figure 76** CDN2-I saltmarsh plant species mean transect length measurements over Surveys (S) 1 to 9.

- *Sporobolus virginicus* bed patches among the mudflats at CDN2-I were distinct and dense, becoming progressively thinner along their inner limits (within dense *Juncus kraussii* stands) and outer limits (among the mangroves). The observed variation in mean *Sporobolus virginicus* length measurements over consecutive surveys were owing mostly to a combination of smothering by wrack and measurements of the sparser bed edges which displayed some fluctuation over time.

The upper limits of the mangrove zone at CDN1-R was contained within the lower limits of the saltmarsh with a variably broad area of overlap (7 to 16m). In some instances, mangrove pneumatophores were recorded above the upper limits of saltmarsh plants at CDN2-I however these were well inshore from the outer seedling limits. Saltmarsh and mangroves were generally distinct at CDN2-R however there were adult mangroves recorded in the middle of transects 1 and 4, and for CDN2-I there was considerable overlap (up to 40m) of saltmarsh plants and mangrove structures (mostly pneumatophores and seedlings).

### 2.10.2. Intertidal Quadrat Results

The Crookhaven River downstream sub-site mean (± SE) quadrat density results are provided below in **Figures 77** to **80** and were calculated for the main saltmarsh species among riparian, saltmarsh and mangrove zones, with each zone determined by the dominant species according to the Transect Mosaic assemblages (see species classifications in **Appendix Table C-1)**. Quadrat density results for other vegetation (e.g., terrestrial species) are also provided in **Appendix C**. Note that there are no error bars for instances where species presence was limited to one quadrat per zone. **Table 12** below presents the characteristic assemblage compositions which contributed to the respective zone classifications and corresponding number of quadrats per zone for each survey (S) with dominant species in **bold**.

Density measurements were categorised according to species presence across the 5 x 5 grid (i.e., 25 squares) within the 1m x 1m quadrat, with categorical values of 1 (<30% of coverage), 2 (30 to 60% coverage) or 3 (>60% coverage). In quadrats with only one individual, a density value of 0.1 was recorded. Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat and pneumatophore cover was determined by a count of occupied grid squares with values recorded as 0 to 25.

| Table 12 Crookhaven River Downstream Sub-Site Intertidal Quadrat Data Zone Classifications | | | | |
|---|---|---|---|---|
| **Site** | **Survey*** | **Transect Mosaic Assemblage** | **Zone Classification** | **# Quadrats / zone** |
| CDN1-R | 1 | **CD** + JK + C + CW | Riparian- Upper Saltmarsh | 3 |
| | | **SQ** + BM + CH | Saltmarsh | 3 |
| | | **SQ + PN** + BM + SD | Saltmarsh-Mangroves | 6 |
| | | **SQ + PN + SD** + SP + BM + Iso AD | | |
| | | **BM + PN + SD + AD** + SP | Mangroves | 3 |
| CDN1-I | 2 | **CD + CW** + EW + D + JK | Riparian-Saltmarsh | 3 |
| | | **JK + SQ** + CW + EW + R + PN | Saltmarsh | 3 |
| | | **BM + SQ + PN** + SD + SP + AD | Saltmarsh-Mangroves | 9 |
| | | **BM + AD** + PN + SD + SP + SQ | | |
| | | **BM + PN + SD + SP** + AD + CH + SQ | | |
| CDN2-R | 1 | **CD** + RG + TT + IC + CA + SO | Riparian-Saltmarsh | 3 |
| | | **SQ** + D + SA + SP | Saltmarsh | 3 |
| | | **SQ + BM** + SD + SP + AD | Saltmarsh-Mangroves | 6 |
| | | **BM** | | |
| | | **BM** + **AD** + PN + SD + SP | Mangroves | 3 |
| CDN2-I | 1 | **RG + CW** + JK + AL + C + GH + ALT | Riparian-Upper Saltmarsh | 3 |
| | | **JK** | Saltmarsh | 6 |
| | | **JK + SQ** + PN + SD + SP | | |
| | | **BM + SQ + PN + SD + SP** | Saltmarsh-Mangroves | 12 |
| | | **SQ** + PN | | |
| | | **BM + SD** + SQ + PN + SP | | |
| | | **BM + PN + SD + SP** + AD + SQ | | |
| | | **BM + AD** + PN + SD + SP | | |
| Note: *Indicates the relevant survey from which the mosaic assemblage classifications were extracted. | | | | |

The Crookhaven River downstream sub-site saltmarshes are dominated by *Sporobolus virginicus* and *Juncus kraussii* complexes, and plant density measurements revealed site specific differences in densities between ridge (R) and inline (I) sites across the intertidal zones:

- *Suaeda australis* was only observed at CDN2-R where it coexisted with dense aggregations of *Sporobolus virginicus* in the saltmarsh zone. *Suaeda australis* had somewhat variable densities recorded over the 18 -month monitoring period with a notable decline occurred in the final three surveys.
- *Selliera radicans* was sparse and only present at CDN2-I in the riparian-upper saltmarsh zone with notable occurrences in surveys 4 and 5, although its overall densities were generally low and sporadic. There was a distinct reduction in its density over the final 3 surveys (S7 to S9).
- *Juncus kraussii* presence was much higher among the inline sites with consistent high-density readings across the riparian to saltmarsh transitional zones, although it's

density gradually declined toward the mangroves zone. *Juncus kraussii* was absent or infrequently recorded in low densities among the CDN ridge sites.

- *Sporobolus virginicus* was the dominant species across all CDN sub-sites. It was particularly abundant in the saltmarsh zone at ridge sites CDN1-R and CDN2-R, showing consistently high densities from S1 to S9, and was also prominent in the saltmarsh-mangrove zone. In contrast, its presence in the saltmarsh was lower at CDN1-I, where it was found in equal densities to *Juncus kraussii* in several surveys with more variable density.

Pneumatophore occurrences among CDN sub-sites was erratic across the intertidal zones with low and temporally variable records in the upper to middle saltmarsh zones (**Figure 81**). Mangrove pneumatophore density increased significantly in the lower saltmarsh and mangrove zones, with the highest densities occurring at CDN1-R and CDN2-I, where nearly 100% of quadrats in the mangrove zone were occupied by pneumatophores. In contrast, only 75-80% of quadrats were occupied in the mangrove zones at CDN1-I and CDN2-R. Although CDN1-I had a lower overall density, it exhibited the widest distribution of pneumatophores across its intertidal shoreline.

Mangrove occupation among the Crookhaven River downstream sub-site intertidal zones were characterised predominantly by the presence of seedlings, which were observed at much higher densities compared to saplings and adults (**Figures 82** to **85** below). Adult mangroves were rarely detected within transect plot quadrats and were for the most part confined to the outer intertidal zones, and both ridge and inline sites exhibited distinct differences in mangrove densities:

- The presence of mangroves amongst CDN sub-site saltmarsh (proper) zones were limited to sporadic observations of low-density seedling occupation at CDN1-R and CDN2-I.
- All CDN sub-sites recorded marked increases in seedling recruitment numbers within quadrats for the latter three surveys. Seedling densities were highest in the outer site reaches (lower saltmarsh to mangrove transitional zones), especially at CDN1-R, which recorded a sharp increase in seedlings which reached over 195.7 ± 40.5 seedlings per quadrat for survey 9. Sub-site CDN1-I also showed a notable increase in seedling densities during the same surveys, though the counts were lower than at CDN1-R, peaking 72.9 ± 19.9 seedlings per quadrat.
- Sub-site CDN1-R mangrove zone was dominated by a single large adult grey mangrove with foliage reaching the ground on all sides and completely covering the zone.

- Although CDN2-R did not display a temporal trend in seedling recruitment in the mangrove zone, there was a noticeable increase in seedling density in the saltmarsh-mangrove zone for the final three surveys.
- Seedling densities in the mangrove zone at CDN1-R showed a small peak over surveys 1 to 3. This was followed by a steady decline through to survey 6 and a significant seedling increase in seedling density for the final three surveys. Site CDN1-R was the only CDN site to indicate increased patterns in seedling recruitment during the summer to autumn period in 2023 (S1 to S3).
- Sapling densities were generally low across all sites with no sub-site recording more than 10 saplings per quadrat. Sub-site CDN2-I had slightly higher sapling densities compared to other sites, particularly in the mangrove-saltmarsh zone, peaking at 8.0 ± 2.5 saplings per quadrat for survey 5. In contrast to the observed trends in seedling density, temporal trends in sapling density did not follow the same pattern across the nine survey events.
- Adult mangroves were infrequently detected across the CDN sub-sites. Sub-site CDN2-I recorded the highest densities of adult mangroves with consistent observations recorded over the 18-month monitoring period. Adult mangroves at sub-sites CDN1-I and CDN2-R comprised dwarf adult grey mangroves but these were generally infrequent or very sparse in occupation.

**Figures 86 to 89** below present the Crookhaven Downstream sub-site mean count data for crab holes:

- Crab hole occurrences were variable across all CDN sub-sites, with most counts recorded in the mangrove and saltmarsh-mangrove zones. The saltmarsh zones showed consistently lower crab hole densities across all sub-sites except CDN1-R.
- CDN1-R did not have consistent temporal crab hole patterns with other downstream sites. Larger values were found higher on the shoreline in the saltmarsh and saltmarsh-mangrove zones, with low counts in the mangroves. CDN1-R exhibited a steady increase in densities in the saltmarsh and saltmarsh-mangrove zones from S1 to S9, with counts peaking in survey 8 (26.3 ± 3.6). Alternatively, the mangrove zone crab hole count remained relatively consistent with a few minor changes over the 9 surveys.
- CDN1-I, CDN2-R and CDN2-I saw a slightly elevated crab hole count from surveys 1 and 2, leading into an increased count for the second half of sampling.
- CDN1-I recorded much lower crab hole densities overall compared to CDN1-R, with large spikes in S2 (10.3 ± 2.7), S7 (9.2 ± 2.8) and S8 (11.3 ± 4.1) in the saltmarsh-mangroves zone. Outside of these spikes crab holes were relatively stable. Crab hole

densities remained low in the saltmarsh zone across all surveys, with very few increases.

- CDN2-R had consistently increasing crab hole counts in the mangroves, with a substantial peak of 57.0 ± 8.1 per quadrat in S8. This trend is similar to that observed in South West Bay. Crab hole counts in the saltmarsh and saltmarsh-mangroves zones remained relatively low, with a gradual rise only observed in later surveys.
- CDN2-I displayed variable crab hole counts, with a significant spike in S6 (25.8 ± 3.8 per quadrat) in the Mangrove zone, followed by a drop in S7 and another peak in S9 (24.8 ± 5.6 per quadrat). Although more sporadic there was still a rough trend of increasing crab hole abundance in later surveys. The saltmarsh zones consistently exhibited very low counts across all surveys.

Overall, Crab hole densities were higher in the mangrove zones across all CDN sub-sites except CDN1-R, with CDN2-R and CDN2-I recording the highest densities. All downstream sites showed variable trends, with peaks during later surveys.

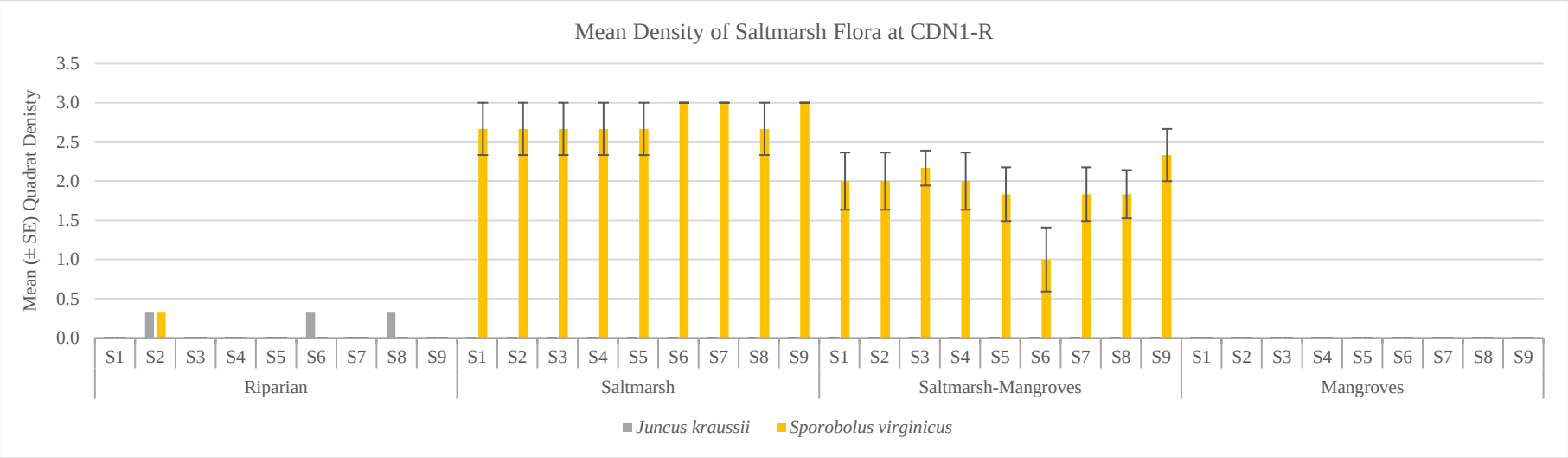



**Figure 77** CDN1-R survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

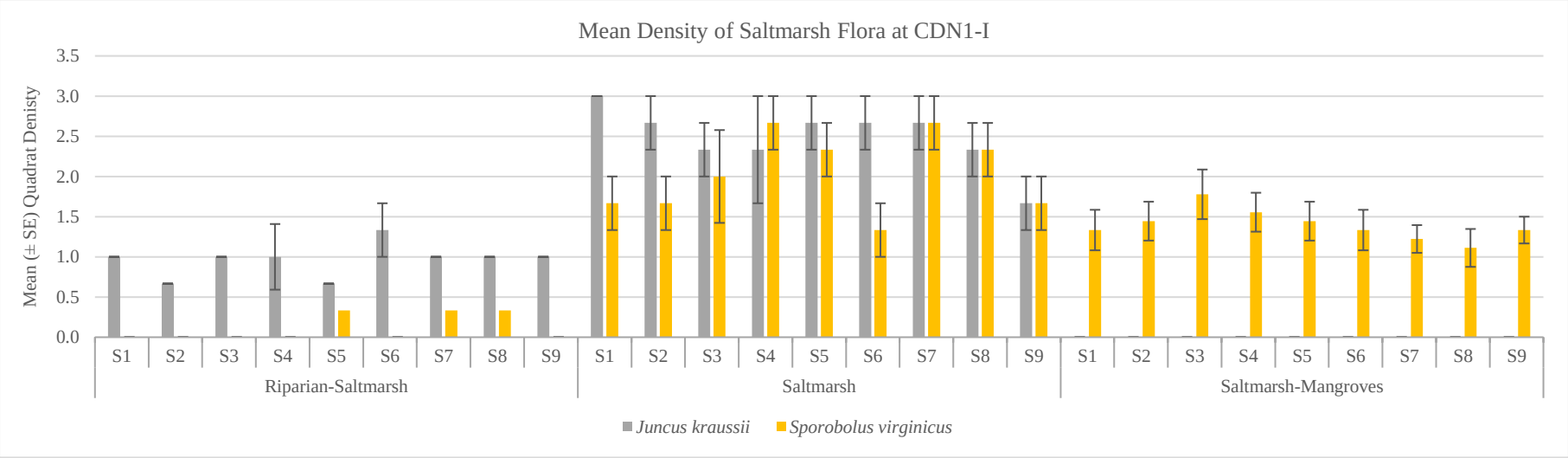



**Figure 78** CDN1-I survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

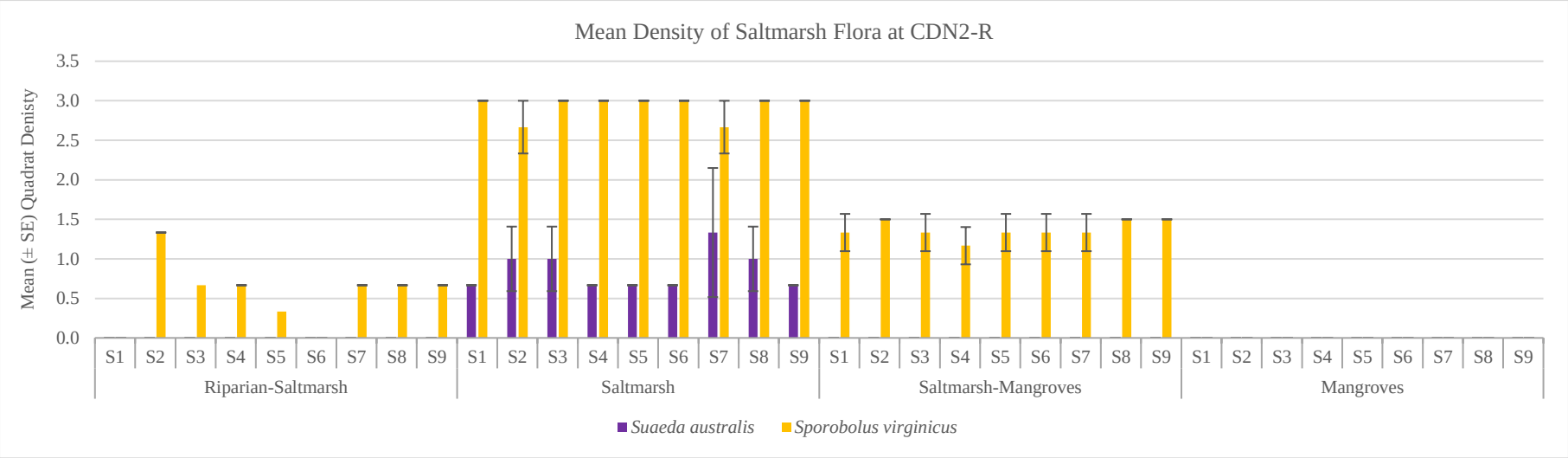



**Figure 79** CDN2-R survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

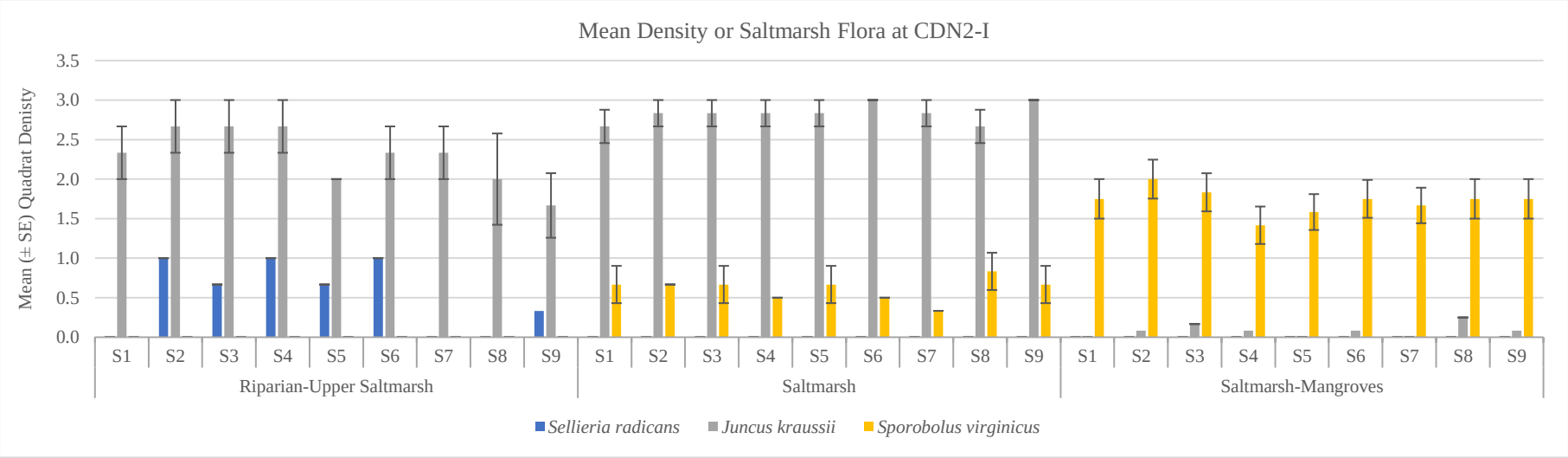



**Figure 80** CDN2-I survey mean quadrat density results for saltmarsh plants among the intertidal saltmarsh and mangrove zones.

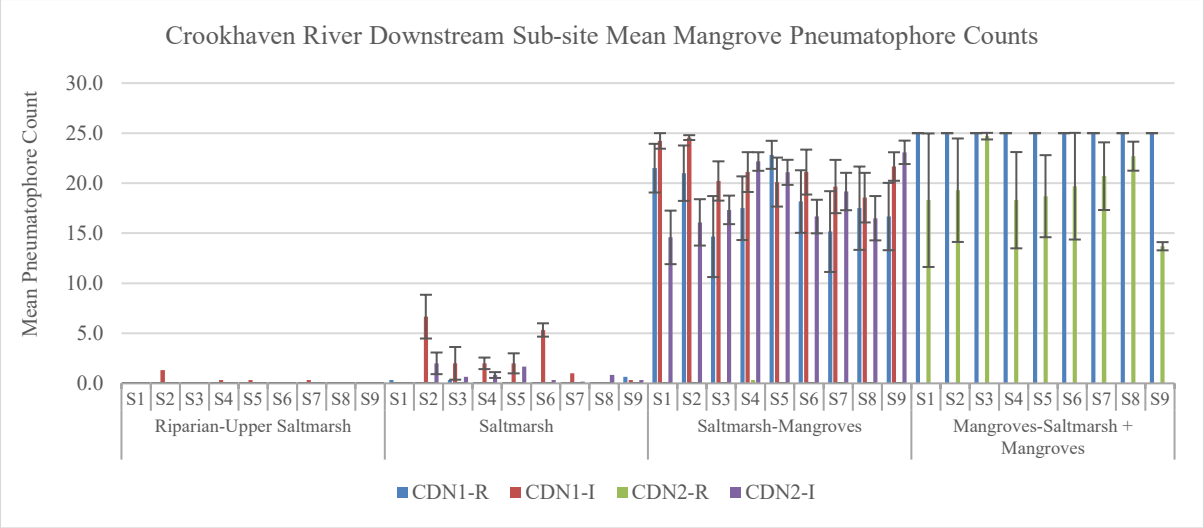



**Figure 81** Crookhaven River downstream site mean mangrove pneumatophore count results (see **Table X** above for respective sub-site zone classifications). Note there were no saltmarsh-mangrove or mangrove zones for inline sub-sites CDN1-I or CDN2-I.

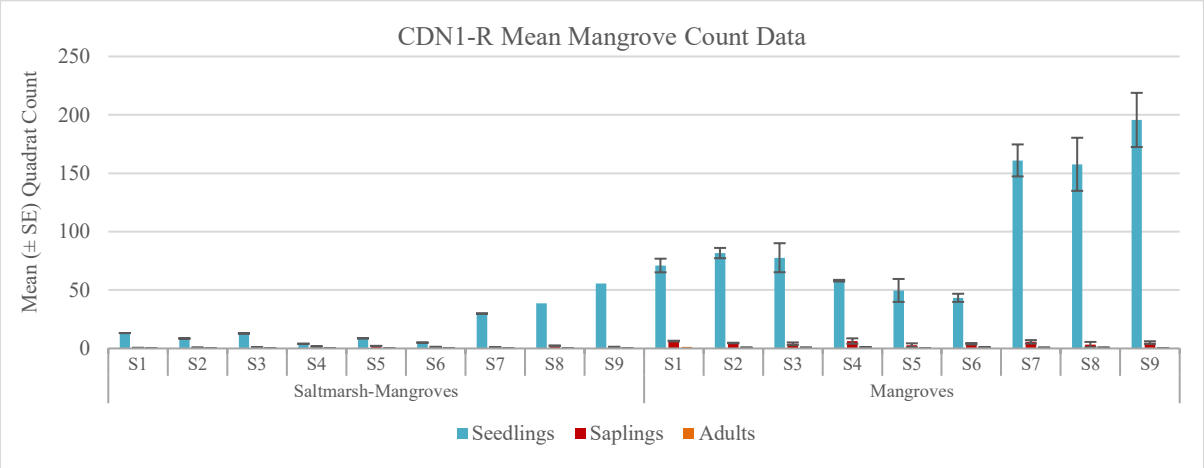



**Figure 82** CDN1-R survey mean quadrat count results for mangroves in the saltmarsh to mangrove zones.

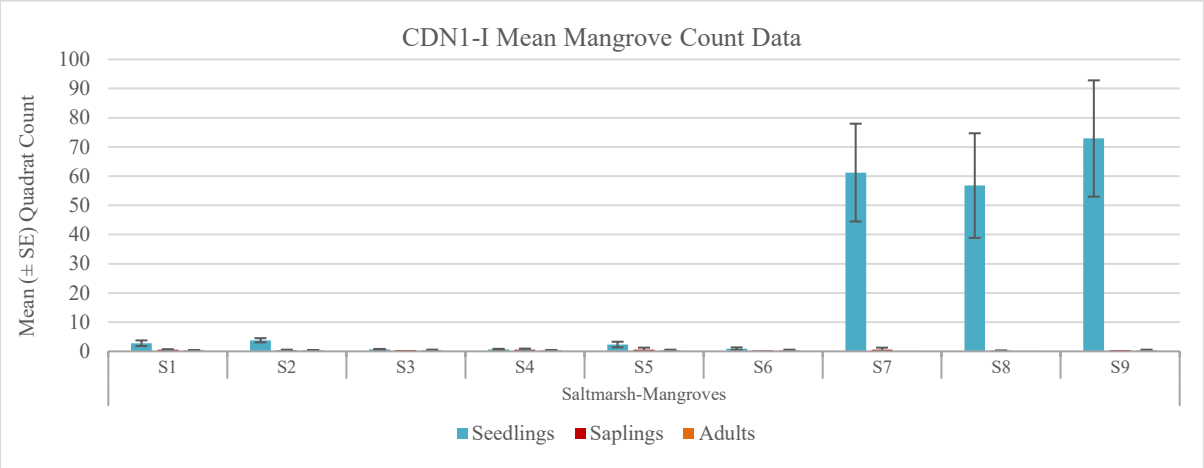



**Figure 83** CDN1-I survey mean quadrat count results for mangroves in the lower saltmarsh to mangrove zone.

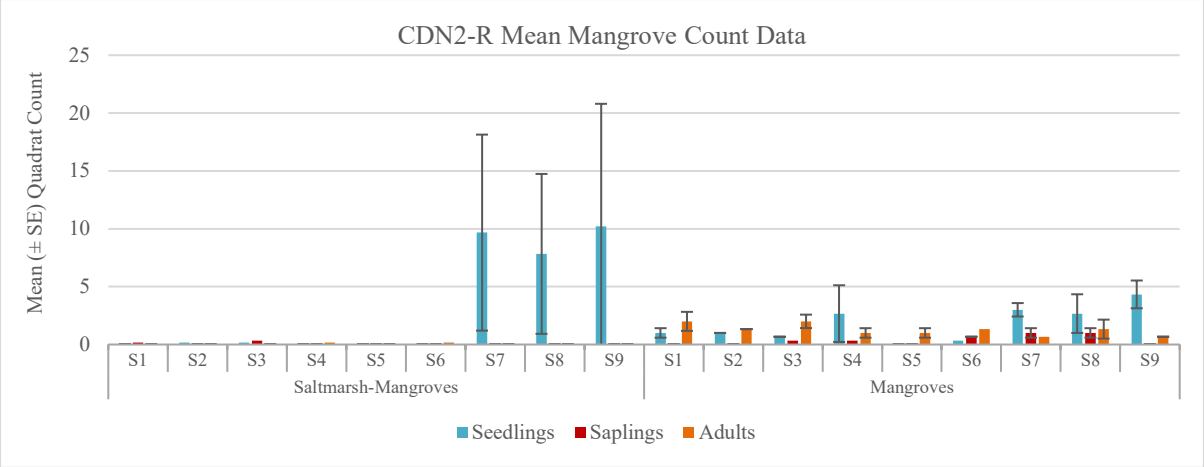



**Figure 84** CDN2-R survey mean quadrat count results for mangroves in the lower saltmarsh to mangrove zones.

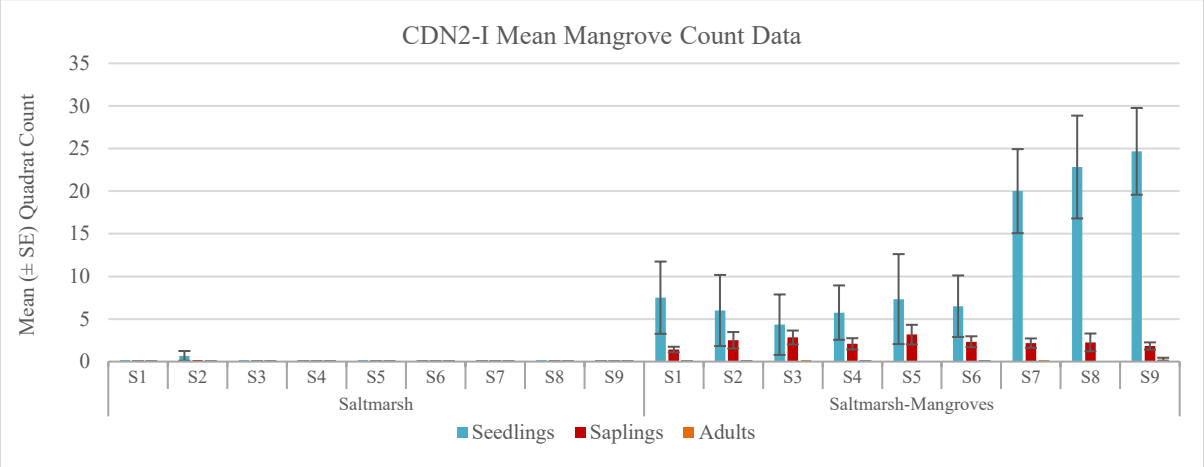



**Figure 85** CDN2-I survey mean quadrat count results for mangroves in the saltmarsh to mangrove zones.

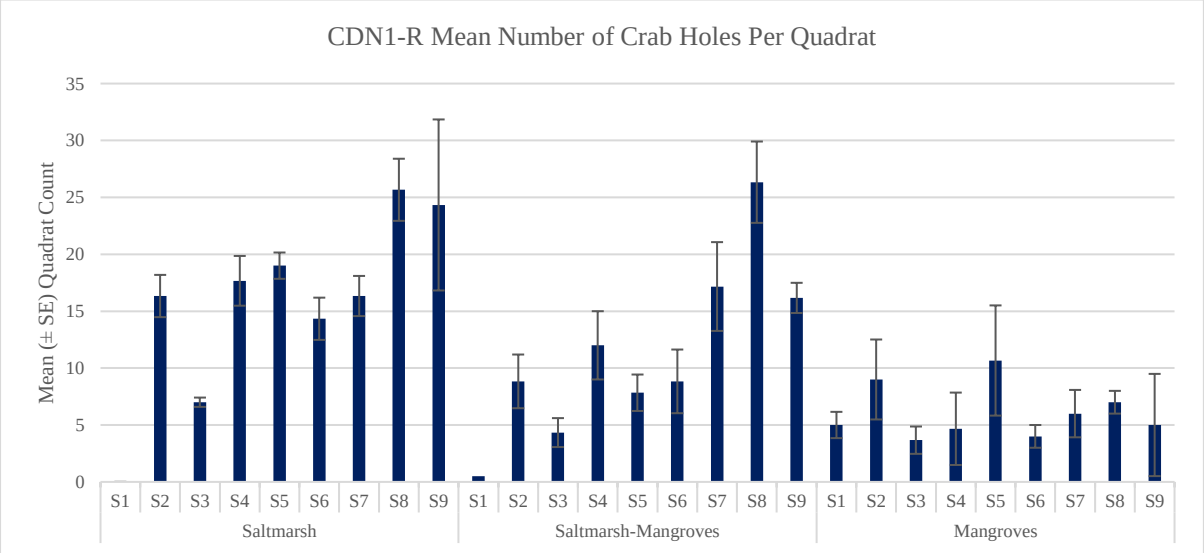



**Figure 86** CDN1-R survey mean quadrat count results for crab holes.

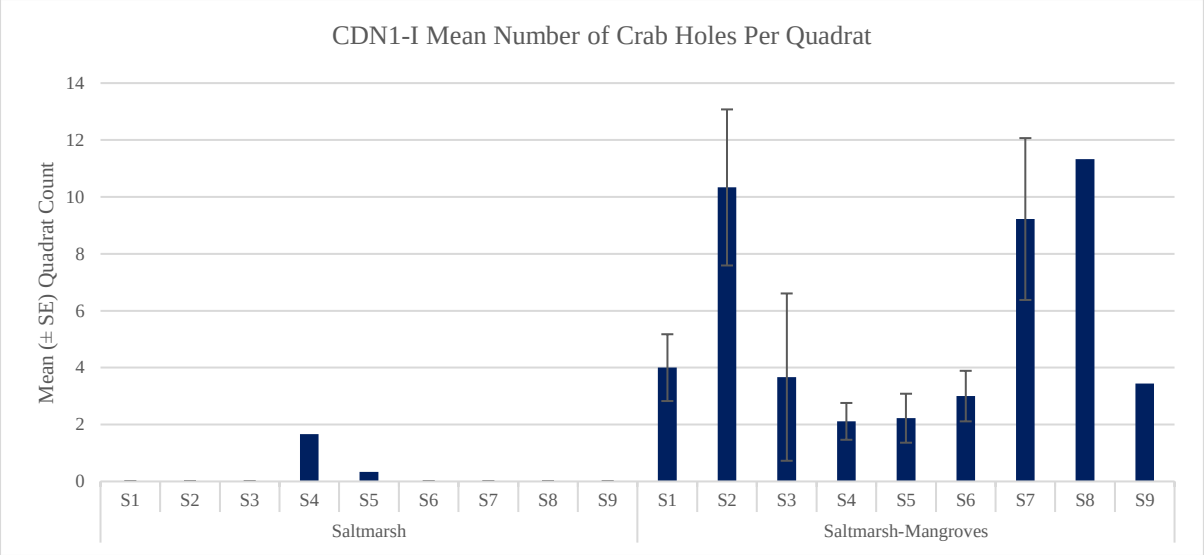



**Figure 87** CDN1-I survey mean quadrat count results for crab holes.

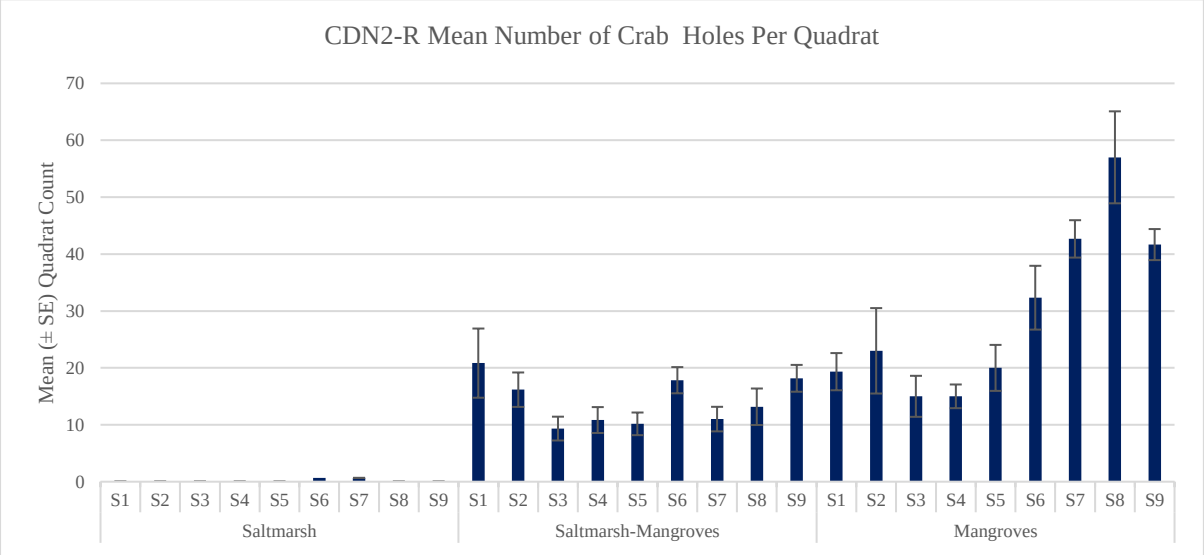



**Figure 88** CDN2-R survey mean quadrat count results for crab holes.

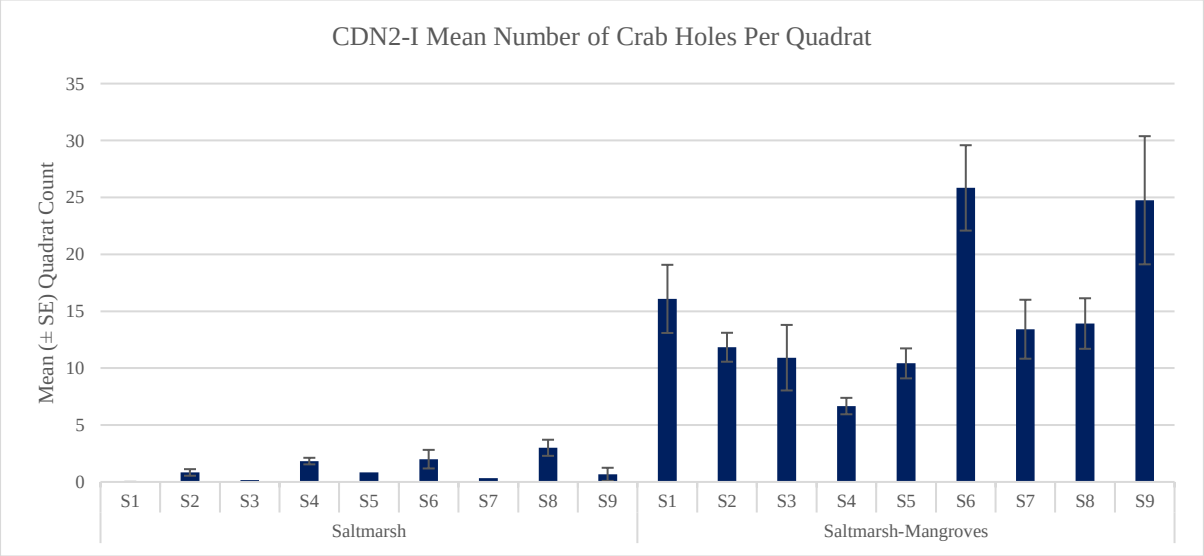



**Figure 89** CDN2-I survey mean quadrat count results for crab holes.

## 2.11. Summary for Intertidal Vegetation Transect Study

The test site saltmarsh communities comprised mostly *Sporobolus virginicus- Juncus kraussii* species complexes with less frequent representation by *Suaeda australis*, *Sarcocornia quinqueflora, Machaerina juncea*, *Selliera radicans* and *Samolus repens.* The control site saltmarshes generally contained similar assemblages for the dominant species, however there were differences in the composition of species between and among locations.

Sources of variation in mean species length measurements included the differences in representation of individual species across different transects within sites, and temporal changes to the measured lengths between surveys. Temporal differences in measured lengths were observed for most species in all locations. Natural factors which affected the inter-survey differences included responses to smothering by wrack (resulting in a reduction of measured lengths) and exposure from wrack removal (resulting an increase in measured lengths), and the disappearance of sparse growths occurring among other dominant species (competition).

It is also noted that where very sparse growths occurred for the 'finer' species (species with thin leaf strands such as *Machaerina juncea* and *Juncus kraussii*), detection capability among other dense vegetation stands was less reliable than the more conspicuous species, and hence presented a source of variation between surveys. A solution is provided in the recommendations below.

Occurrences of bare twig rushes *Machaerina juncea* were limited to ridge sites at BB1 and BB2 and SEB1, and inline sites at BB1, BB2, SWB1, SWB2 and CUP1. When comparing the tidal ranges where *Machaerina juncea* occurs, the upper height limits (in AHD) appear similar among inline and ridge sites (**Table 13**). It is noteworthy however, that the lower limits of occupation are lower for the inline sites compared to the ridge sites.

**Table 13 Tidal Height Comparison for *Machaerina juncea* Occurrences for Inline and Ridge Sites**

| | BB1-R | BB1-I | BB2-R | BB2-I | SWB1-I | SWB2-I | SEB1-R | CUP1-I |
|---|---|---|---|---|---|---|---|---|
| Upper AHD (m) | 1.13 | 1.14 | 1.03 | 1.02 | 1.11 | 1.16 | 1.09 | 1.05 |
| Lower AHD (m) | 0.68 | 0.54 | 0.74 | 0.55 | 0.56 | 0.61 | 1.02 | 0.50 |

As *Machaerina juncea* is known to occupy fresh to brackish or saline swamp habitats, on sandy, waterlogged soils, it is plausible that the inline sites receive increased contributions of runoff or seepage from the riparian slopes (relative to ridge sites), facilitating colonisation of *Machaerina juncea* lower down in the tidal column. It is concluded that *Machaerina juncea*

would be a suitable indicator species among test and control sites for monitoring potential changes in the saltmarsh species composition, including increases in the dominance of wetland species.

Whilst limited in their distribution among the current suite of monitoring sites, other suitable wetland species known to inhabit (freshwater) waterlogged areas include common reed *Phragmites australis* (present from BB1-I) and paperbark *Melaleuca ericifolia* (present from BB1-I and CUP1-I). Common reed stands at BB2-I were most abundant during wet periods in early 2022 and late 2023 to 2024 and absent during the extended dry period during winter 2023, as indicated by its representation in transect length and quadrat density measurements. It is plausible that the presence of common reed is influenced by groundwater seepage contributions from riparian habitats along the foreshore, with higher representation in localised point source seepage paths such as that at inline site BB2-I. The incursion of *Phragmites australis* into saltmarsh areas is indicative of environmental changes (e.g., increased freshwater and nutrient inputs) (Kelleway et al 2007), and any increases to the quantity and duration of freshwater runoff from the development could therefore result in increased frequency and duration of common reed stands at BB2-I.

In the context of potential indicators of mangrove zone encroachment into the lower saltmarsh zone, whilst the occurrences of pneumatophores within transects are not regarded as being representative of the successful occupation of mangrove trees in the lower saltmarsh, they are considered in the context of their potential to compete with saltmarsh plants for nutrients and space.

The establishment of mangrove propagules in the lower saltmarsh would vary seasonally in response to seed dispersal and delivery by tides, and successful colonisation is considered to be dependent upon frequency of tidal inundation which is governed by substrate levels (in AHD) and sea levels. The study shows that there is site specific overlap in the boundaries of the lower saltmarsh and upper mangrove limits, and the study methodology incorporates measures which monitor the temporal placement of respective boundaries. Furthermore, periodic height profiles enable determination of erosion scars which contain the potential to monitor decreases in substrate levels or recession of banks (e.g., through bank undercutting) which contain the lower saltmarsh boundaries.

Recruitment of mangrove seedlings in transect plots were most successful in surveys 7 to 9 (December 2023 to May 2024) with marked increases in the number of grey mangrove seedlings recorded in all locations. Interestingly, there were subtle increases in mangrove seedlings for surveys 1 to 3 (February to May 2023) which suggests that seasonal propagule

dispersal and establishment among the study area intertidal foreshores are somewhat random and sporadic on a year-to-year basis. Notwithstanding, it is expected that seedling densities will decline from that observed during the peak density surveys, with continued monitoring to confirm this.

The diversity of weeds was evident at the urbanised SEB1 sub-sites which contained exclusive occurrences of some invasive species including asparagus fern, nightshade, cape ivory and lantana. While large lantana stands occur along the foreshore of Billys Bay and South West Bay, their presence among saltmarsh habitats is currently limited, however the potential for weed species to be delivered to the foreshore intertidal habitats from roads and drainage pathways associated with the development remains a plausible risk.

### 2.12. Recommendations for Pre-Construction to Construction Intertidal Habitat Monitoring

The estuarine riparian edge and intertidal zone are the closest receivers of potential adverse water and sediment discharge from the development for both construction and operational impacts. Monitoring for possible project associated impact on adjacent riparian edge and inshore estuarine intertidal habitats is predicated on the possibility of increased surface and groundwater runoff volume/frequency, plus altered water quality. Principally increased sediment and nutrient loads, that could be directed through the 100m buffer zone to the intertidal zone habitats via existing site woodland/forested sub-catchment discharge swales. This could result in physical swale erosion, increased riparian zone terrestrial weed diversity, riparian edge sediment deposition and smothering of inshore saltmarsh habitats.

Over the long-term and in line with predicted sea level rise, riparian and saltmarsh habitats could be subjected to increased erosion and deposition from offshore. Saltmarsh will also be susceptible to 'squeeze impact' as intertidal mangrove habitat encroaches upslope with increased mean sea-level impacts on tides. Accordingly, the intertidal monitoring program has been considered the most important, as the front line for estuarine habitat protection.

The preceding sections have provided and discussed the various elements of the riparian to intertidal baseline monitoring program and from this consolidated assessment the following recommendations for continuing pre-construction through to construction monitoring are made:

- Intertidal monitoring to be continued for all the Billys Bay (BB), South East Bay (SE) and South West Bay (SW) sites as shown in **Figure 3** with the four Crookhaven CUp and Crookhaven CDown River sites discontinued.

- Monitoring is recommended to be bi-annual (unless otherwise stated) but with some monitoring elements subject to a rainfall or unexpected event trigger - as detailed below.
- The study should continue with the two fixed ladder transects (plots) arrangements already established at each sub-site and as described in **Section 2.1** but the overall transect lengths should be shortened where required to only penetrate 5 to 10m into mangrove zones.
- The **Section 2.2** Height Profile measurements should be continued at the six monthly interval and the rainfall TARP for visual inspections for riparian edge erosion. Saltmarsh erosion or saltmarsh sediment smothering is to be retained but with a higher trigger of 80 mm rainfall over a 24 hour period plus a TARP requirement for these inspections if there is an unexpected event trigger (e,g,. pre-construction works spill or discharge associated with the project site).
- The **Section 2.3** drip line measurements on the four transect ladder lines are to be continued with mature mangrove drip lines also included with the drip lines estimated via the use of a survey staff set up perpendicularly on each of the transect lines and the measurements for the drip line are to be expressed as meters from the riparian edge rather than from the transect upper peg.
- It is recommended that the continuing estuary intertidal study not include the **Section 2.4** Landscape Mosaic study due to the overall complexity of the field monitoring task and the subjectivity of interpretation of the mosaic results.
- It is recommended that the pre-construction intertidal monitoring include a trial of low-level drone photography of each of the nominated ladder transect plots to replace both the mosaic study element and the down-slope and upslope photography provided to the Baseline Study. This methodology is now routinely used - for example - for both open saltmarsh and seagrass bed area change studies, now that drones have geo-referencing capabilities. The results of the trial would be provided in the final pre-construction report with appropriate recommendations regarding the utility of the method for overall continued intertidal estuary saltmarsh habitat monitoring at West Culburra.
- The **Section 2.5** point-intercept monitoring is to be continued as the prime intertidal estuarine monitoring tool with the main aim to be the description of change in the key saltmarsh plant and key abiotic characteristics as detailed in this Section. That is, transect monitoring is to concentrate on point-intercept measurements on the four ladder lines for riparian edge plants and weeds, saltmarsh plants, bare sediment, terrestrial, seagrass and mangrove seed wrack cover, and mangrove seedlings and crab burrows as described in Section 2.5.

- The use of the point-intercept monitoring in the field is to include having a printed analysis of the previous point intercept survey plus species lists at hand to be able to highlight or pinpoint changes from one survey to the next. This will be an essential tool as whilst it is fairly straight forward to characterise the saltmarshes in terms of the dominant species (e.g. *Juncus-Sporobolus*), however the fluctuation of the species that are less dominant are important as they can provide an indication of 'wet or fresh status' (*Selliera or Baumea*).
- Additionally, as mentioned for **Section 2.3** recommendations above, the distances for the point intercept ladder transect measurements will be standardised by setting each transect zero point at the riparian edge with riparian portions of the transect measured as negative distances up slope and positive distances downslope.
- The potential penetration of mangrove seedlings up slope due to erosion or altered mean sea levels, or simply fortuitous timing of seed dispersal with favourable tides/floods would also be determined by point intercept measures on the four main ladder transect lines. Given the importance of assessing mangrove penetration upslope, additional upslope inter-transect measures can be made from a baseline set at the lower end of the ladder transect plot to better describe mangrove seedling penetration where required. This inter-transect measuring method from down-slope position upslope can also be used for inter transect measures where the site mosaic complexity warrants this.
- It is recommended that the use of random quadrats be discontinued as the data were too variable, indicating that much larger replication of quadrats would be required. As measurements via quadrat have a higher risk of actual plot disturbance this is not an option. It is concluded that the point intercept data is more efficient and the data more relevant to the aims of understanding down slope riparian through saltmarsh to mangrove interactions and change. Ultimately the encroaching of mangroves and crabs (via burrows) into saltmarsh up slope or saltmarsh smothering and retreat downslope are the important drivers of determining the role of construction related runoff to these dynamic interactions.

## 3. ESTUARINE SEAGRASS MONITORING

Increased stormwater runoff can cause potential changes in sediment loads and nutrient concentrations within estuarine environments which can impact seagrass habitats via increased epiphytic sediment deposition, algae growth and encrusting faunal growth. Accordingly, the Condition C17(c) requirement for seagrass monitoring has been met by monitoring changes in seagrass blade epiphytic sediment, and biota (mainly algae) densities utilising replicated Seagrass Artificial Sampling Units (ASUs) at estuarine sites that are located at the estuary water quality and infrastructure oyster monitoring sites, Section 2.2 of the Aquatic Ecology Methodology Addendum Report (MPR 2023) provides the final description of the seagrass habitat monitoring program and **Figure 90** below shows the final adopted seagrass monitoring site locations in relation to the final agreed oyster monitoring sites.

### 3.1. Monitoring Methodology

As the Crookhaven River estuary seagrass assemblage is predominantly *Zostera* seagrass throughout, the Seagrass Artificial Sampling Units (ASUs) were designed to mimic *Zostera* seagrass shoots and blades to be able to quantify algal and sediment accumulations. Each ASU supports four identical 'shoots" each with four "blades" (polypropylene ribbon 5mm wide, <1mm thick and cut to 30cm). The Approved Seagrass monitoring program then included the following set up and analysis details:

- Seagrass ASUs are deployed for 6 to 7 weeks nominally in each two monthly period. Following consultations with oyster farmers for combined oyster and seagrass monitoring site usage, it was more practicable to combine Seagrass and Oyster ASU retrieval and deployment field works on the same day. In practice the formal program achieved the nine required deployments with more flexible start and finish dates, also dictated by practical limitations on field work due inclement weather or tides.
- Following ASU retrieval and laboratory leaf/blade separations individual leaf epiphytic sediment and algae load is scraped clean with total wet epibiota and sediment washed into a pre-weighed foil dish for wet weight determination.
- Foil dishes were then heated to 70˚C for 24 hours and weighed again.
- Oven dried samples are then placed into a muffle furnace at 500˚C for 2 hours, burning off all organic matter to provide sample ash weight.
- The algae to inorganic epiphyte biomass proportions are calculated as follows:
    - Total organic weight (algae) = Dry weight – Ash weight.
    - Total Sediment weight = Ash weight.
    - Sediment and organic weights are expressed as gm/cm$^2$ seagrass surface.




**Figure 90** Final Combined seagrass (red) and oyster sampling sites (blue following consultation with Crookhaven Oyster farmers

### 3.2. Monitoring Program

**Table 14** provides ASU deployment and retrieval dates for the nine Seagrass events over the 18-month sampling period and **Table 15** shows seagrass ASUs deployment and retrieval in relation to daily rainfall over the study period of December 2022 to May 2024. The start and end of each shaded area indicates the deployment and collection of seagrass ASUs. Rainfall totals in red indicate a rain event with >20mm over a 48-hour period and Actual Deployment Rainfall Totals are indicated in bold. Monthly Rainfall Totals and Long-term Averages are included for context only.

**Table 14 Culburra West Seagrass ASU Deployment Periods**

| ASU Sample Schedule | | | | |
|---|---|---|---|---|
| **Survey** | **Deployment** | **Retrieval** | **Duration** | **Rain (# rainfall days)** |
| Survey 1 | 17/12/2022 | 17/01/2023 | 42 | 60 (12) |
| Survey 2 | 6/03/2023 | 4/04/2023 | 45 | 425 (19) |
| Survey 3 | 4/04/2023 | 23/05/2023 | 51 | 145 (22) |
| Survey 4 | 23/05/2023 | 4/07/2023 | 42 | 124 (12) |
| Survey 5 | 3/07/2023 | 15/08/2023 | 43 | 31 (10) |
| Survey 6 | 23/10/2023 | 5/12/2023 | 44 | 375 (20) |
| Survey 7 | 6/12/2023 | 16/01/2024 | 42 | 235 (18) |
| Survey 8 | 13/02/2024 | 25/03/2024 | 41 | 176 (15) |
| Survey 9 | 25/03/2024 | 7/05/2024 | 44 | 278 (15) |

Deployment in relation to rainfall events is summarised as follows:

- **Survey 1** was generally dry (61mm total) with only one 37mm storm event ten days before retrieval.
- **Survey 2** (425mm) included the wetter part of January with three high rainfall events plus the 284mm February storm (22 day prior to retrieval) and smaller one-day isolated events for the remainer of the deployment.
- **Survey 3** (147mm) was generally dry or low rainfall with only two high rainfall events including 35mm, six days prior to ASUs retrieval.
- For **Survey 4** (124mm) had a wet start with most (91mm) falling in the first 7 days, and progressively dryer through to extraction.
- **Survey 5** (32mm) was a continuation of two very dry months and only one 20mm event in the 48 hours before ASU extraction.
- **Survey 6** (377 mm) was a continuation of overall dry conditions but punctuated by a small 36mm rain event 5 days in plus a major three-day rain event delivering 275mm five days prior to extraction. This rain event coincided with a sewerage spill in South East Bay, finishing on the 29th of November 2023.
- **Survey 7** (235mm) commenced on the day following the sewage spill. The rainfall was delivered in three evenly spaced rain events (98mm, 38mm and 65mm) with the final event occurring 48 hours prior to extraction of the ASUs. The river and estuary were noted as very turbid on extraction.

- **Survey** 8 (176mm) was preceded by a 38mm rain event 7 days prior to deployment and experienced 42mm over 6 days, seven days after deployment and 95mm over 4 day, four days before retrieval.

**Table 15 Culburra Treatment Plant Daily Rainfall 2022, 2023 & 2024**
**Estuarine Seagrass Sampling timetable**

| Date | 2022 | | 2023 | | | | | | | | | | | | 2024 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May |
| **1st** | 15 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 |
| **2nd** | 0 | 9 | 0 | 0 | 3 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 11 | 0 | 5 |
| **3rd** | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 2 | 49 |
| **4th** | 1 | 0 | 2 | 0 | 9 | 1 | 0 | 5 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 25 |
| **5th** | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 18 | 17 | 0 | 1 | 8 | 0 | 2 | 48 |
| **6th** | 0 | 2 | 17 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 86 | 27 |
| **7th** | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| **8th** | 0 | 0 | 0 | 24 | 0 | 6 | 16 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 20 |
| **9th** | 0 | 0 | 0 | 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 28 |
| **10th** | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 9 | 17 |
| **11th** | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 34 |
| **12th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 |
| **13th** | 0 | 2 | 0 | 2 | 22 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 135 |
| **14th** | 14 | 0 | 2 | 2 | 5 | 35 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **15th** | 0 | 0 | 0 | 17 | 12 | 6 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 51 | 2 | 10 | 0 | 0 |
| **16th** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 3 | 0 | 0 | 0 |
| **17th** | 3 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 | 0 |
| **18th** | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 52 | 0 | 3 |
| **19th** | 0 | 0 | 23 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 4 |
| **20th** | 2 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 5 | 8 | 9 | 0 |
| **21st** | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 15 | 0 | 0 | 0 |
| **22nd** | 0 | 0 | 1 | 17 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| **23rd** | 0 | 3 | 21 | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 7 | 6 | 4 | 0 | 0 | 0 | 0 |
| **24th** | 0 | 0 | 0 | 0 | 7 | 30 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 | 0 | 22 | 0 | 0 | 0 |
| **25th** | 0 | 0 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | |
| **26th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 32 | 2 | 0 | 0 | 0 | |
| **27th** | 1 | 0 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 7 | 12 | 1 | 2 | 0 | 6 | 0 | 0 | |
| **28th** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 87 | 7 | 0 | 0 | 0 | 0 | |
| **29th** | 0 | 0 | 0 | | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 | 168 | 0 | 0 | 0 | 0 | 0 | |
| **30th** | 0 | 6 | 7 | | 4 | 61 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 1 | | 0 | 6 | |
| **31st** | | 7 | 14 | | 2 | | 0 | | 0 | 2 | | 0 | | 1 | 0 | | 0 | | |
| **Deploy total** | | **62** | | **425** | | **147** | | **124** | | **32** | | | **377** | | **235** | | **175** | | **277** |
| **Monthly total** | 37 | 33 | 119 | 337 | 84 | 309 | 25 | 139 | 12 | 68 | 16 | 62 | 334 | 167 | 325 | 98 | 298 | 119 | 481 |
| **Monthly Average** | 85 | 73 | 98 | 130 | 140 | 112 | 105 | 139 | 84 | 79 | 73 | 87 | 85 | 75 | 98 | 130 | 140 | 112 | 105 |

| **Legend** | | | Consecutive ASU deployment | 20 | High Rainfall Event (>20mm over 48 hours) |
|---|---|---|---|---|---|

### 3.3. Combined Seagrass Survey Results

**Appendix D** provides the full results of the nine bimonthly Seagrass ASU deployments and **Figures 91& 92** provide the Survey Mean ± SD Seagrass ASU Sediment results for the 18-month baseline survey grouped by sites and surveys respectively. **Figures 93 and 94** show the algae accumulation data grouped by site and survey respectively with total rainfall for each survey overlaid on the by-survey graphs. **Figure 95** provides a graphical description of overall Study Mean Seagrass Algae and Sediment results for the complete survey. Note that there are missing data for several sites where the ASUs were lost due to either vandalism or possible removal.

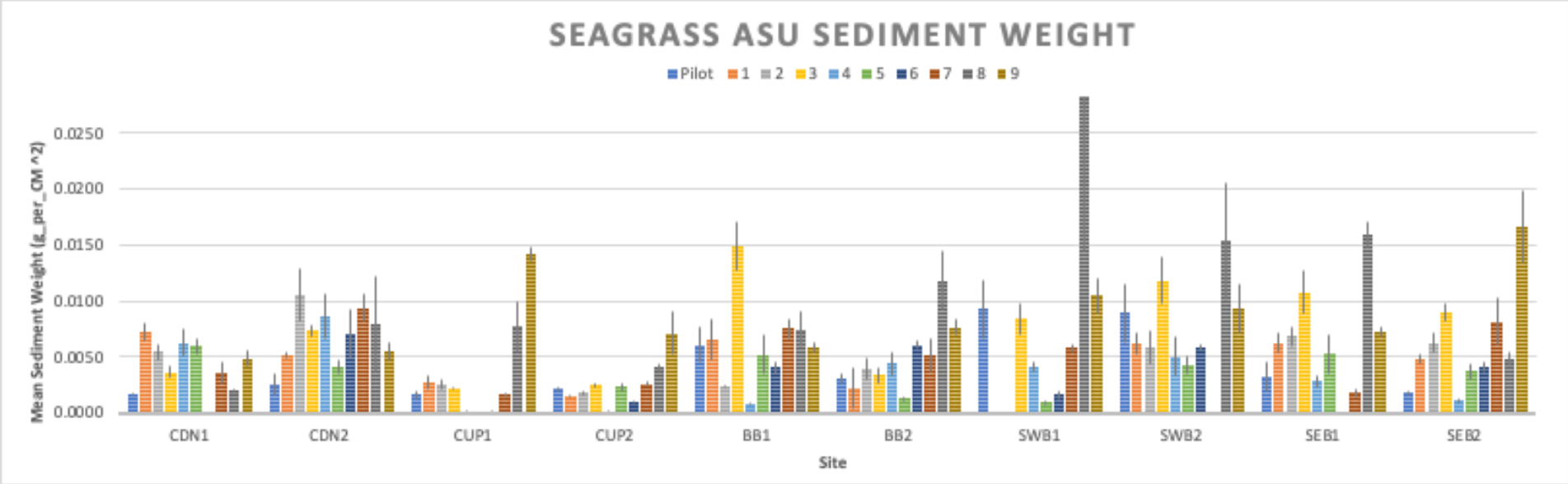



**Figure 91** Seagrass ASU survey sediment accumulation, grouped by site.

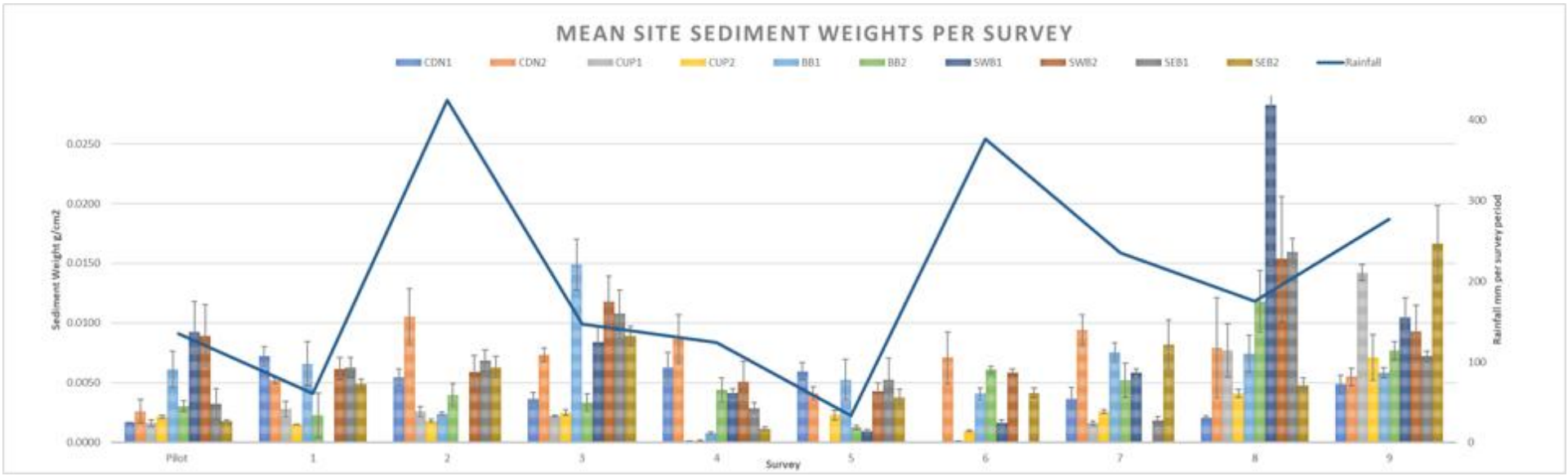



**Figure 92** Seagrass ASU sediment results, grouped by survey with survey rainfall.

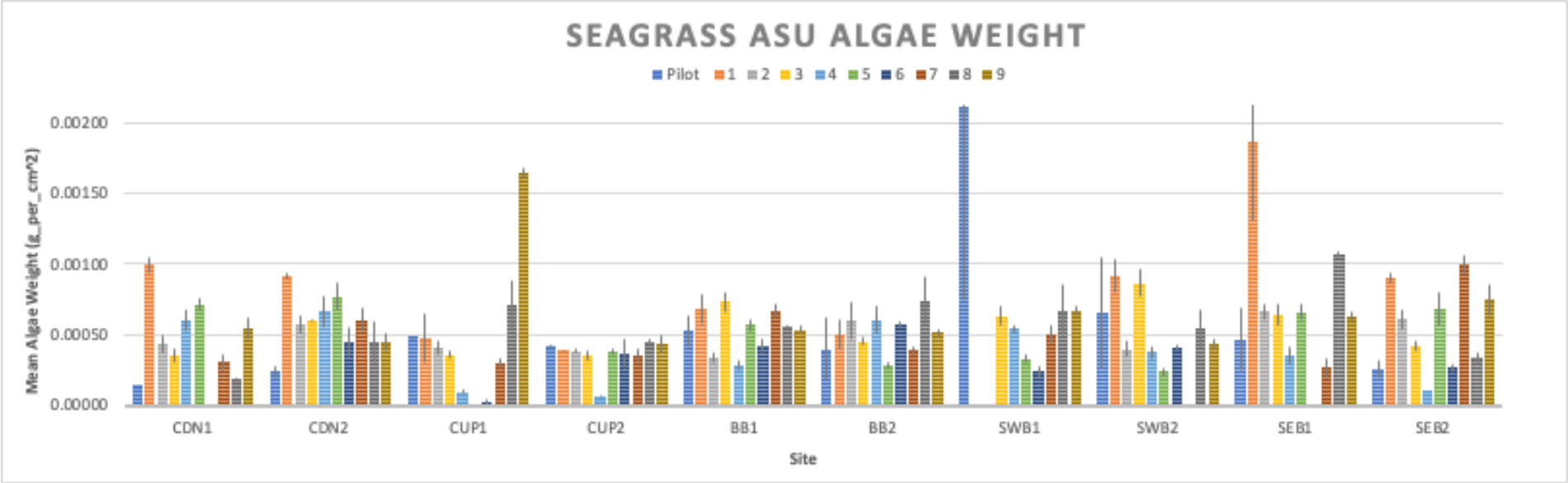



**Figure 93** Seagrass ASU survey algae accumulation results grouped by site.

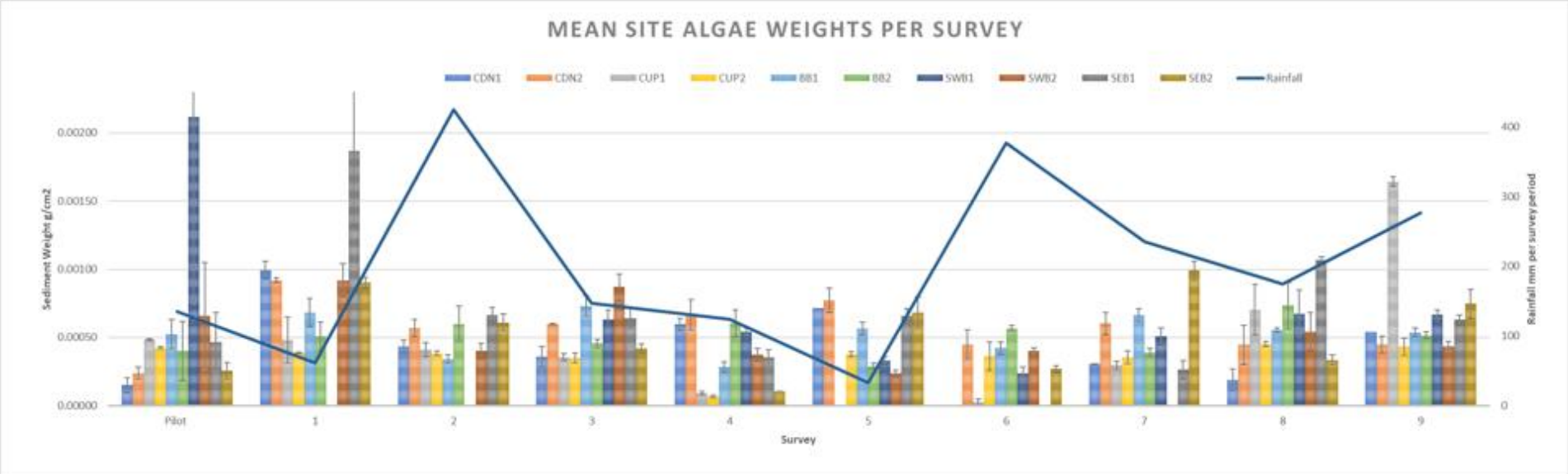



**Figure 94** Seagrass algae results grouped by survey with survey rainfall.

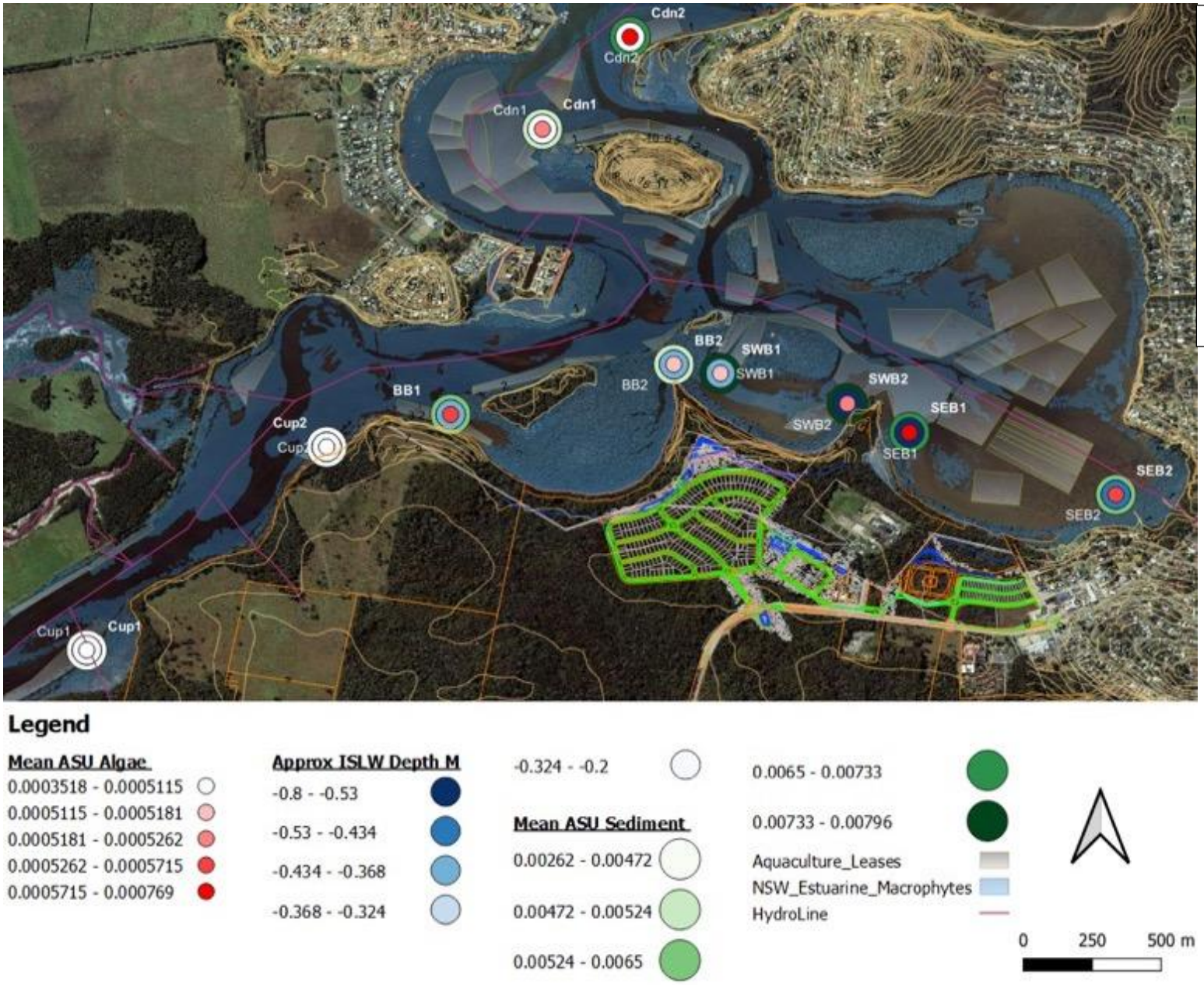



**Figure 95**
Mean algae weights (grams/cm$^2$), **inner dot**, Mean sediment weights (grams/cm$^2$) **inner ring** Approximate depth of seagrass ASU **outer ring**.

### 3.3.1. Seagrass ASU Results by Survey

**For the pre-baseline pilot survey** sediment weights were elevated at BB1 and both SWB sites whilst mean algae weight was mainly elevated at SWB1.

For **Survey 1** the CDN sites had more sediment deposition and algae weight with a spike of algae growth at site SEB1. This may have been due to warmer and sunnier summer waters through November following nutrient laden urban stormwater runoff via South East Bay (SEB) due heavy rainfall through October 2022. However, as sediment results were not elevated for the first survey, the higher algal accumulations were more probably a seasonal response rather than a sole response to the previous wet weather event and sediment mobilisation. Field physical water logging confirmed this period had the warmest water temperature (approx. 24 degrees) for SEB.

**Survey 2** algae weights were relatively low, and sediment accumulation was slightly elevated particularly at CDN2.

During **Survey 3**, sediment levels spiked, presumably in response to heavy rainfall and increased surface water runoff throughout February. This was particularly evident at sites BB1, South West Bay sites, and South East Bay. sites. Although algae levels also rose slightly, they did not increase to the same extent as sediment. This discrepancy may be attributed to lower water temperatures, which likely inhibited algal growth.

**Surveys 4 and 5** showed generally low sediment levels across all sites; however, the downstream sites, CDN1 and CDN2, had elevated sediment levels during Survey 4 compared to other locations. Additionally, algal biomass at the CDN sites was higher than at other sites for both surveys, with SEB sites also showing increased algae levels in Survey 5. The increased algae loads may have related to overall, increased solar radiation as rainfall during both surveys was minimal.

Both **Survey 6** algae and sediment results were low with highest algae and sediment results for CDN2 and BB2. Whilst total rainfall within this period was relatively high, the majority of rainfall only fell within the last week of the deployment period.

**Survey 7** experienced significant rainfall, with 100mm falling mid-deployment and an additional 65mm during the last two days of the period. This led to slightly elevated sediment levels overall, particularly at site SEB2. Algal levels followed a similar trend, with CDN2, BB1, and SEB2 showing the highest increases.

**Survey 8** recorded a moderate amount of rainfall, evenly distributed over the deployment period and prior to it. Sediment levels were slightly elevated at most sites, particularly at SEB1. Algal levels, however, were exceptionally high at SWB1, SWB2, and SEB1, with most other sites also showing elevated algae results.

Whilst **Survey 9** had a fairly large amount of rainfall, overall, both algae and sediment results were lower compared to the former survey though still elevated across the board. Algal results may have been greater for survey 8 as that period had warmer water and may have had clearer water for more light penetration. CUP1 interestingly had a record high algae result and a high sediment result, and SEB2 also had a relatively high sediment result.

### 3.3.2. Seagrass ASU Site Results

**Crookhaven River Upstream CUP**

Cup1 is located at the base of a hydro line (**Figure 67**) that drains from farmland, with a 500-meter bushland buffer. This site also receives stormwaters from a drainage line connected to a farm dam just to the east:

- The upstream sites, Cup1 and Cup2, showed similar trends in both algae and sediment accumulation, consistently recording low values throughout the study period.
- However, in the last two surveys, Cup1 showed significantly higher results for both sediment and algae, while Cup2 had slightly higher sediment values. The algae levels at Cup2 remained consistent with earlier surveys.

**Billys Bay BB**

The two Billy Bay sites are separated at low tide by the Billys Bay mangrove hump. As a result, BB2 experiences Curleys Bay estuarine water conditions similar to SWB, and BB1 is more influenced by upper Crookhaven River estuary water conditions Each site also receives different freshwater runoff due to different land uses in their sub-catchments, consequently:

- Sites BB1 and BB2 results differed across surveys for both sediment and algae accumulation. Over the 18-month study, BB1 recorded slightly higher average algae and sediment levels.
- The sediment results for both sites were also highly variable, with BB1 showing a large spike in survey 3 when BB2 sediment load was low, and BB2 spiking in survey 8 (in line with the SWB sites) while BB1 remained elevated but not low.

**South West Bay SWB**

The South West Bay (SWB) sites are positioned at opposite ends of the bay, approximately 480 meters apart. The SWB sites receive surface runoff from the Culburra industrial area and the Sewage Treatment plant, with surface runoff filtered through at least a 170-meter riparian buffer before entering the estuary:

- SWB sites had the highest average sediment accumulation during the study period.
- Algae accumulation was generally low to moderate, though SWB2 showed elevated algae levels in the first and second surveys and had a higher average algae accumulation over the course of the study.

**South East Bay SEB**

South East Bay receives significant stormwater runoff from Culburra, with SEB1 sited close to the storm-water drainage channel that cuts through the bushland between the Sewage Treatment Plant and the Culburra residential area. SEB2 is located approximately 220 meters away from the town's stormwater canal discharge point and is regularly exposed to freshwater runoff:

- For the first five surveys, sediment results at SEB1 and SEB2 were proportionally very similar. However, as the study progressed and more frequent rain events occurred, these results became more inconsistent.
- Algae accumulation at SEB1 and SEB2 varied inconsistently, with SEB2 showing the highest spike during the first survey.

**Crookhaven River Downstream CDN**

The two CDN sites are separated by a channel running between Orient Point and Goodnight Island. CDN1 is somewhat protected from floodwater flows due to its position in the lee of Goodnight Island. In contrast, CDN2 is more exposed, receiving all water flowing out of the Crookhaven River system. During flood periods, especially with an incoming tide, CDN2 may also be affected by waters from the Shoalhaven River:

- CDN1 and CDN2, exhibited similar trends in algae accumulation, with CDN2 generally recording higher values.
- Sediment accumulation followed a similar pattern, corresponding to algae levels, though sediment buildup was notably greater at CDN2.

### 3.4. Conclusions and Discussion

There is a complex interrelationship between wet weather, associated storm water runoff increasing sediment and nutrient loads within the estuary, sediment accumulations on seagrass, light availability (water clarity) for algal growth, plus seasonal water temperature and algal biomass on seagrass leaves both shading further potential algae growth and aiding sediment accumulations:

- Increased stormwater runoff can cause potential changes in sediment loads and nutrient concentrations, where nutrient enriched waters may promote phytoplankton growth (Phillips et al., 1978) which can increase turbidity (Dennison et al., 1989). This, coupled with increased suspended solids via surface water runoff increases water column light attenuation, especially in estuarine areas.
- This reduced light availability limits algal growth even though the estuary may be under higher nutrient loads (Moore and Wetzel 1999).
- As well as reduced light availability, sediment plumes can also result in the settling of fine sediment particles on seagrass leaves, especially if the plants are already covered by epiphytes that have high potential to trap the sediment (Broderson et al., 2017).

For this baseline study it is evident that rainfall effects both sediment and algae accumulation rates on seagrass blades, and over the 18-month study period, results varied in response to wet weather events, with a combined number of factors including poor water clarity causing low light penetration, water temperature and site hydrology. These influences also appear to require a time delay as while there have been numerous large wet weather events over the nine seagrass ASU deployment periods, many spikes in both sediment and algae were delayed and often recorded in the following survey.

Shallower, more estuarine dominated sites such as the far downstream CDN sites are likely to have more light availability under turbid water conditions, as downstream sites also receive greater tidal flushing. These characteristics help explain the overall lower variability in both algae accumulation and sediment loads at these downstream sites.

The Curleys Bay locations and sites in South East Bay (SEB) and South West Bay (SWB), are subject to more complex hydrological conditions where they all receive different (quality and quantity) land-based run off and are sited with different tidal and wind wave mixing responses. Even though the SEB sites were sited in deeper waters than most other sites, both sites generally recorded elevated algal biomass when compared to other sites, and SEB1 had greater variability in the results with some large spikes. The SWB sites had the largest sediment accumulation spikes throughout the

study. While SWB1 had the largest spike in survey 6, SWB2 generally had slightly larger sediment accumulations, where algal biomass was mostly similar between the two sites.

Whilst the Billys Bay location sites are subject to differing hydrological conditions and runoff inputs, both BB sites displayed relatively consistent algae results with BB1 algae and sediment loads slightly higher across the study period.

The far upstream shallow water sites CUP1 and CUP2 had consistently low algae and sediment accumulation across the study, with a few algae load elevations at CPU1.

The complexity of results for this study underlines the original base contention of the overall baseline study that choosing and selecting appropriate locations/sites for possible Construction and Post Construction Impact assessment will need to take these site-specific confounding factors into account. Notwithstanding, this 18-month baseline study provides some insight into how these site-specific confounding factors contribute to both algal and sediment recruitment spatially and how different locations respond to wet weather and increased surface water runoff. These results can be used to generate a set of preconstruction baseline triggers to monitor the response to any potential development impacted surface water runoff.

### 3.5. Recommendations for Pre-construction to Construction Estuary Seagrass Monitoring

The underlaying basis for the Baseline Seagrass monitoring program was the possibility that increased urban related stormwater runoff could cause potential changes in sediment loads and nutrient concentrations within estuarine environments such that seagrass habitats could be lost via increased epiphytic sediment deposition, excessive algae growth and encrusting faunal growth combined to smother and prevent leaf photosynthesis. The baseline study was also predicated on the basis of insufficient catchment wide seagrass mapping with the last comprehensive mapping (at that time) undertaken by DIPRD Fisheries in 2010 at the tail end of the millennium drought and that was accordingly considered an expression of the maximum extent of seagrass that could be expected in the catchment arising from prolonged seasonal dry weather patterns.

The baseline study therefore examined this for potential seagrass loss by deploying Artificial Seagrass Units (ASUs) to compare sediment and algae uptake at a variety of sites. Whilst the study was successful in providing sediment and algae accumulation data that 'fit' the underlaying science, it also indicated that the estuary

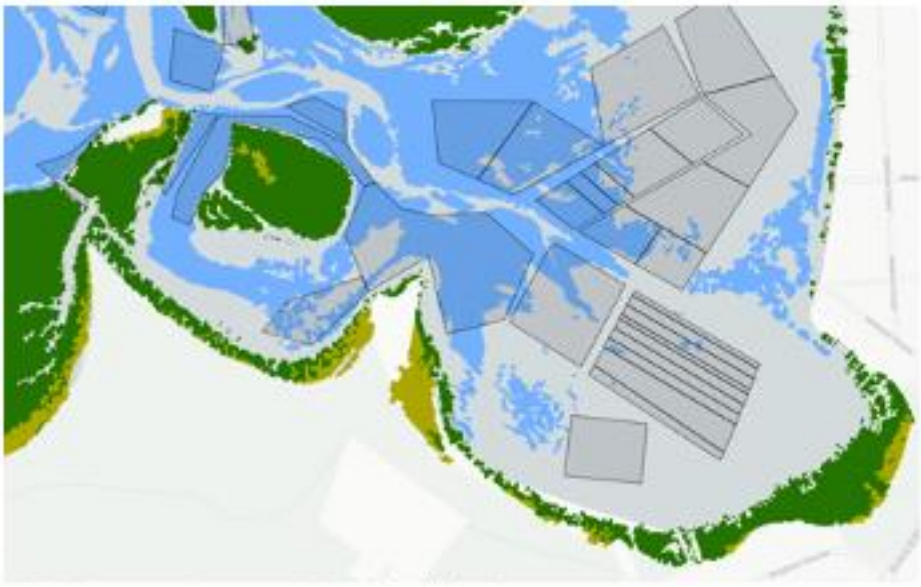
is a complex source of tidal and flood mitigated urban, agricultural and natural bushland sourced sediments and nutrients. It is thus unlikely that seagrass ASUs would be a useful primary tool for possible seagrass impact monitoring of the proposed West Culburra development. Accordingly, it is recommended that the prime basis for remaining pre-construction to construction seagrass monitoring utilise seagrass bed area and condition monitoring as the prime seagrass monitoring tool.

This recommendation arises from the fact that over the period of the baseline study DPIRD Fisheries have re-surveyed the Crookhaven Estuary seagrass beds (2024). Comparison of the 2024 to 2010 survey results both vindicated the original contention that 2010 mapping represented a watershed in seagrass occupation for Curleys Bay and further, the 2024 to 2010 mapping comparisons provided a basis to test the original EIS report contention of more or less permanent (enduring) bed locations and of temporary (transient or opportunistic) seagrass beds locations (**Figure 96,** 2010 2024 seagrass mapping below). This has now allowed for the selection of a mix of enduring and opportunistic beds for continued seagrass bed monitoring. Accordingly, it is recommended that:

- Pre-construction through to operational estuarine monitoring use seasonal monitoring of 12 fixed seagrass plot areas each 50m by 50m in Billys Bay Channels, and in SE and SW Bays - as indicated in **Figure 96** below.
- The 12 test plots will be photographed seasonally with a geo-referenced drone with automated position-setting capabilities (drone position, elevation and level) that provides repeat aerial photographs of the target core seagrass areas for assessing overall area change analysis of selected beds. The drone photographs are to be assessed on computer screens for seagrass bed fragmentation or edge losses with the area estimated based on using a grid system to score cover.
- Divers will visit each plot to confirm actual seagrass occupation of the plots and if there is seagrass, establish up to ten randomly allocated 0.5m by 0.5m quadrats in each seagrass plot, with quadrats only established in seagrass occupied areas (i.e., empty quadrats are not measured or included). For each quadrat the divers will estimate the following seagrass condition indices:
    - Percent *Zostera* and % *Halophila* cover per quadrat.
    - *Zostera* Evenness (Sporadic =1, Intermediate = 2, Even = 3)
    - Total Seagrass Density (High = 3, Medium = 2, Low =1)
    - Attached Algae Density (High = 3), Medium = 2, Low =1)
    - Mean *Zostera* Leaf length (Short =1, Medium = 2, Long =3)

- Overall utilisation of the seagrass beds by fish will be estimated using *Syngnathid* occupation of the beds as a flagship group (*sensu* Shokri et al 2009) and will be evaluated by hand mesh-netting eight randomly located 5m mesh net width (150mm aperture) transects, providing 6 square metres of meshed habitat per site. As for the seagrass quadrat measurements, the fish quadrats will only be established in seagrass patches where and if available.

It is further recommended that if study water quality monitoring reveals consistently higher turbidity/TSS and/or seasonal bed area monitoring reveals specific bed changes, the ASU method should then be considered for re-deployment as a TARP to examine the potential nutrient/sediment basis of any unaccountable losses.



2010 Zostera Seagrass Mapping (blue)



Proposed Drone and GEeild Sampling Sites overlaid onto 2010 mapping



Proposed Drone and Field Sampling sites overlaid onto 2024 mapping

**Figure 96** Changes in Curleys Bay Zostera seagrass occupation from 2010 to 2024 with proposed continuing pre to construction 50 x 50m monitoring sites indicated by red.

# 4. CROOKHAVEN ESTUARY AQUACULTURE OYSTER MONITORING

The adopted and approved oyster monitoring component is based on a *biomonitoring program* approach using commercially cultivated oysters deployed at sites for periods of at six to seven weeks within each two monthly period (i.e., nine surveys), with the aim of documenting bioaccumulation of the nominated pollutants over each survey period (see MPR 2022). As per Condition C18 (e), the project outline was presented to Crookhaven/Shoalhaven oyster industry representatives who made several recommendations to alter the oyster monitoring program including retention of 12 sites rather than the 10 sites recommended, adjusting the actual site locations *in situ* and duplicating the recommended Sydney Rock Oyster Monitoring program to include Pacific Oysters. These recommendations were incorporated into the Monitoring Addendum Report (MPR 2023) and subsequently approved and implemented. **Figure 90** shows the final adopted site locations as recommended and as established in direct partnership with the oyster farmers, who placed suitable in-water infrastructure to hold sample containers to mimic normal farming practice, provided oyster farming containers for the trials and supplied the necessary Sydney Rock and Pacific Oysters batches for each nominally bi-monthly six-to-seven-week deployment survey (nine surveys total).

## 4.1. Oyster Bioaccumulation Monitoring Program

Condition C18 requires monitoring of specified (mandated) environmental indicators (E.coli, metals, Organochlorides and PAH in the Crookhaven River estuary. The adopted monitoring program methods are detailed in MPR (2022) and are summarised as follows:

- For each deployment (survey), 30 SRO and 30 PO oysters are provided from commercial stocks sourced from the lower Crookhaven River outside the three Crookhaven /Curlys Bay study area. Six SRO and six PO oysters are selected, processed in the field laboratory with flesh samples dispatched to the commercial laboratory for the pre-deployment chemical analysis.
- The remining oysters are deployed *in situ* at each site for the required time then retrieved, processed in the field laboratory with flesh samples dispatched to the analysis laboratory for post deployment chemical concentration analysis.

**Table 16** provides Oyster deployment and retrieval dates for the nine full Oyster Bioaccumulation surveys plus the short PO post deployment sample during Survey 9. **Table 17** shows Oyster surveys in relation to daily rainfall over the study period.

| Table 16 Culburra West Oyster Bioaccumulation Study Deployment Periods | | | | |
|---|---|---|---|---|
| **Survey** | **Deployment** | **Retrieval** | **Duration** | **Rain mm & (# rainfall days)** |
| Survey 1 | 24/12/2022 | 7/03/2023 | 43 | 390 (13) |
| Survey 2 | 2203/2023 | 8/05/2023 | 48 | 199 (20) |
| Survey 3 | 16/05/2023 | 27/06/2023 | 43 | 24 (10) |
| Survey 4 | 4/07/2023 | 7/08/2023 | 35 | 15 (7) |
| Survey 5 | 9/08/2023 | 18/09/2023 | 41 | 33 (8) |
| Survey 6 | 10/10/2023 | 20/11/2023 | 42 | 85 (12) |
| Survey 7 | 18/12/2023 | 29/01/2024 | 43 | 241 (19) |
| Survey 8 | 8/02/2024 | 18/03/2024 | 40 | 168 (15) |
| Survey 9 | 2/04/2024 | 13/05/2024 | 42 | 591 (20) |
| Survey 9a | 2/04/2024 | 10/04/2024 | 9 | 101 (6) |

## Table 17 Culburra Treatment Plant Daily Rainfall 2023 & 2024
## Estuarine Oyster Sampling Timetable

| Date | 2023 | | | | | | | | | | | | 2024 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May |
| **1st** | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 |
| **2nd** | 0 | 0 | 3 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 11 | 0 | 5 |
| **3rd** | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 2 | 49 |
| **4th** | 2 | 0 | 9 | 1 | 0 | 5 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 25 |
| **5th** | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 18 | 17 | 0 | 1 | 8 | 0 | 2 | 48 |
| **6th** | 17 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 86 | 27 |
| **7th** | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| **8th** | 0 | 24 | 0 | 6 | 16 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 20 |
| **9th** | 0 | 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 28 |
| **10th** | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 9 | 17 |
| **11th** | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 34 |
| **12th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 |
| **13th** | 0 | 2 | 22 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 135 |
| **14th** | 2 | 2 | 5 | 35 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **15th** | 0 | 17 | 12 | 6 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 51 | 2 | 10 | 0 | 0 |
| **16th** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 3 | 0 | 0 | 0 |
| **17th** | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 | 0 |
| **18th** | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 52 | 0 | 3 |
| **19th** | 23 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 4 |
| **20th** | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 5 | 8 | 9 | 0 |
| **21st** | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 15 | 0 | 0 | 0 |
| **22nd** | 1 | 17 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| **23rd** | 21 | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 7 | 6 | 4 | 0 | 0 | 0 | 0 |
| **24th** | 0 | 0 | 7 | 30 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 | 0 | 22 | 0 | 0 | 0 |
| **25th** | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 |
| **26th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 32 | 2 | 0 | 0 | 0 | 0 |
| **27th** | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 7 | 12 | 1 | 2 | 0 | 6 | 0 | 0 | 0 |
| **28th** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 87 | 7 | 0 | 0 | 0 | 0 | 0 |
| **29th** | 0 | | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 | 168 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30th** | 7 | | 4 | 61 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 1 | | 0 | 6 | 0 |
| **31st** | 14 | | 2 | | 0 | | 0 | 2 | | 0 | | 1 | 0 | | 0 | | 0 |
| **Monthly total** | 121 | 336 | 84 | 163 | 26 | 15 | 12 | 37 | 16 | 63 | 335 | 167 | 90 | 100 | 120 | 118 | 480 |
| **Monthly Average** | 98 | 130 | 140 | 112 | 105 | 139 | 84 | 79 | 73 | 87 | 85 | 75 | 98 | 130 | 140 | 112 | 105 |

| **Legend** | | Consecutive sampling periods | 20 | High Rainfall Event. (>20mm over 48 hours) |
|---|---|---|---|---|
| | | Known Sewage Spill | | Wet Weather Sample |

### 4.2. Crookhaven Estuary Aquaculture Oyster Monitoring Results

**Appendix E** provides the full results of the Nine Oyster Bioaccumulation Surveys, and the following sub-sections describe overall trends for rainfall over each Survey Event, Oyster Condition Index Results, and Oyster Bioaccumulation data for both Sydney Rock Oysters (SRO) and for Pacific Oysters (PO).

#### 4.2.1. Oyster Bioaccumulation Survey Rainfall Summary

Rainfall conditions for each of the nine surveys is summarised as follows:

- **Survey 1** was exceptionally wet with 390mm of rain including a daily record 253mm on the 9th of February (26 days prior to retrieval).
- **Survey 2** had 199mm rainfall, mostly confined to three storms; 44mm mid-April, 30mm late April and 61mm immediately before retrieval. River turbidity was observed to be slightly elevated on the retrieval day.
- **Surveys 3 & 4** were dry periods, and no individual day experienced more than 5mm of rain over the whole period.
- **Survey 5** remained relatively dry with one two-day 15mm event a week after deployment and only 18mm scattered rain for the remaining 34 days.
- **Survey 6** had some more regular showers with three small events, 31mm over two days 17 days into the deployment, 18mm recorded 16 days before retrieval and 19mm at 11 days prior to retrieval.
- **Survey 7** commenced on 27 December, some 19 functionally dry days after the exceptionally high 275mm rainfall event of 28 to 30 November that was also associated with a sewage discharge from the Culburra STP. There was then 151mm rain recorded over nine days commencing three days after deployment, and 65mm over two days two weeks before retrieval.
- **Survey 8** commenced on 8th February 2024 following a 22 day comparatively dry period that was broken with a short two-day storm of 38mm three days prior the deployment. Whilst the 40-day deployment was generally dry, there was 44mm rain over 5 days some 12 days into the deployment, and 83mm over the 48 hours prior to retrieval.
- **Survey 9** oysters experienced an 88mm storm event some 4 days into the deployment with virtually no further rainfall for the next 26 days deployment followed by a continuous large storm event (473mm over the last 11 deployment days, with very high turbidity observed on the retrieval day.
- **Survey 9a** included retrieval of half the deployed Pacific Oysters on 10th of April, nine days after deployment and four days after the initial 88mm rainfall event with a view to understanding whether there is a potential fast uptake and assimilation of pollutants that may have been associated with that storm.

### 4.2.2. Oyster Condition Index Results

As outlined in the approved methodology, the weight, height, shell weight, and flesh weight of oysters were measured both prior to deployment and post deployment for calculating Condition Index, a key industry indicator of oyster health and vitality. Full Condition Index data are provided in **Appendix E** and mean Condition Index results for each of the nine surveys are shown graphically arranged by both survey and by site in **Figure 97** (SROs) and **Figure 98** (POs) below.

PO and SRO CI results over each of the surveys are summarised as follows:

- Over the nine surveys mean background PO CI ranged from 24 in Survey 5 to 44 in Survey 7 and mean background CI for SROs varied from 22 in Survey 1 to 32 in Surveys 3 and 4.
- For all surveys the overall site CI ranges reflected the original Baseline CI in that if the Baseline CI was high the site CIs would be high. That is Site response reflects both initial CI and site dependent resultant CI changes.
- For Pacific Oysters CIs increased for all sites for Surveys 2 and 9, with mixed results for Surveys 5 and 6, definite decreases in Survey 1 and slighter decreases for Surveys 3, 4, 7 and 8.
- For Sydney Rock Oysters there were generally overall increases at most sites for seven of the surveys; Surveys 1 (but not CDN), 2, 3, 5, 6 (but not CUP), 8 (with spikes at CUP and BB sites) and at survey 9 (also with spikes at CUP and SEB). Survey 4 was the only survey with overall lower CI results and Survey 7 had similar or slightly lower site results for half the sites (6) and slightly higher results for the other 6 sites.

### 4.2.3. E.coli results

**Figures 99 & 100** show the end of deployment E.coli results for both oyster species for each of the nine bimonthly surveys. As the detection limit was 1 cfu and as most results were less than detection, the <1 cfu results were ignored.

There were similar trends in E-coli concentrations for Sydney Rock and Pacific oysters. Over the nine surveys there were spot elevated results for individual sites for surveys 1 to 7, with a small cluster of low readings for both species in Surveys 4, 6 and 7. There was no apparent trend in the low detections of E.coli for these surveys, in a lot of cases only one or two sites saw concentrations above detection limits. . Some clusters of low (<10 cfu) concentrations appeared in Survey 9 with 473mm over the last 11 deployment days. Survey 8 saw the highest concentrations and most results across surveys, averaging up to 30 cfu for POs and 70 cfu for SROs. Bimonthly sample 8 experienced

83mm of rain 48 hours prior to retrieval, potentially mobilising or facilitating an E.coli increase. Both species in bimonthly survey 8 saw a downstream gradient with higher concentrations at downstream sites. However, this trend was not observed in any other surveys.

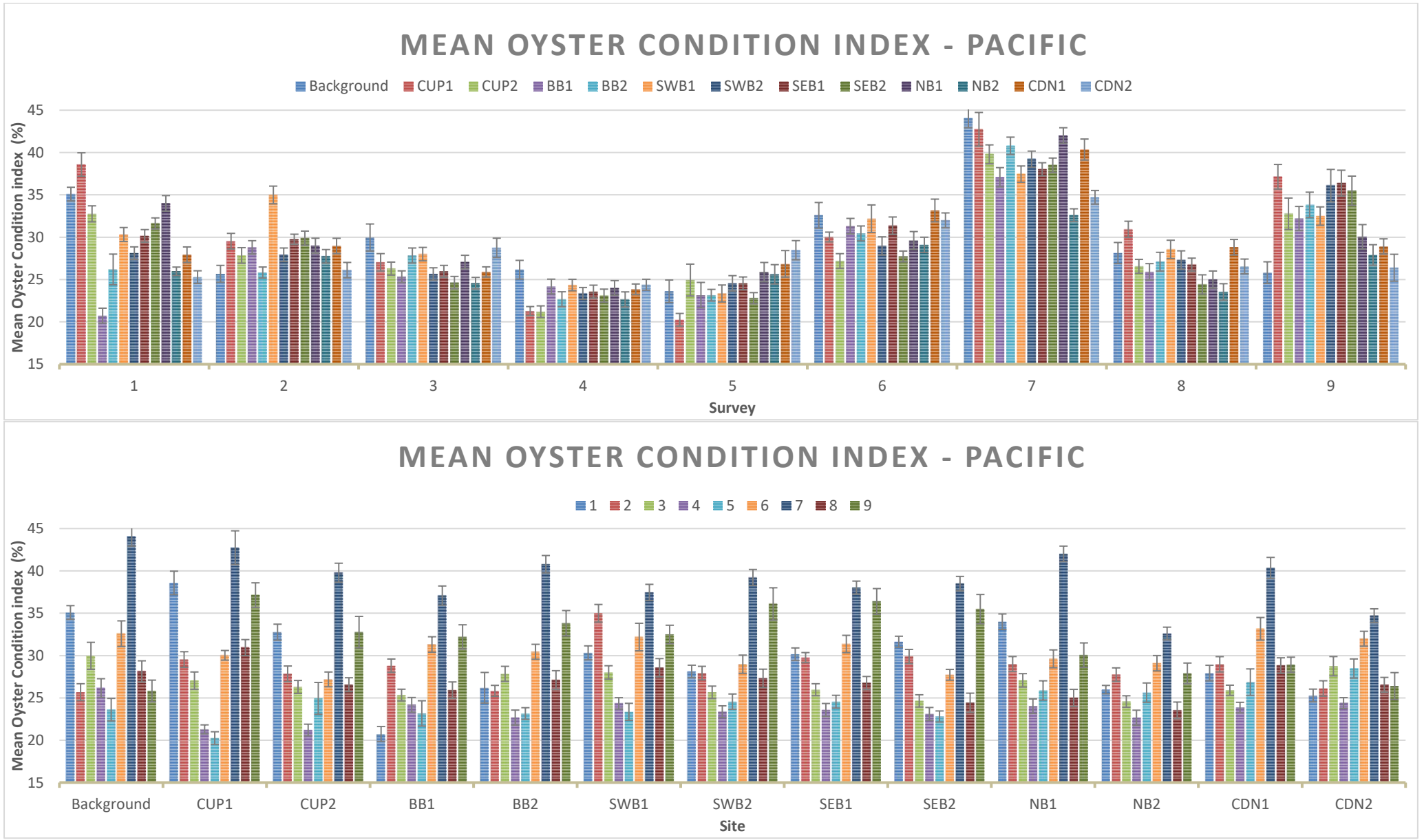



**Figure 97** Average oyster condition index for Pacific Oyster samples at all sites in each of the bimonthly surveys (top) and for all surveys for each site (bottom)

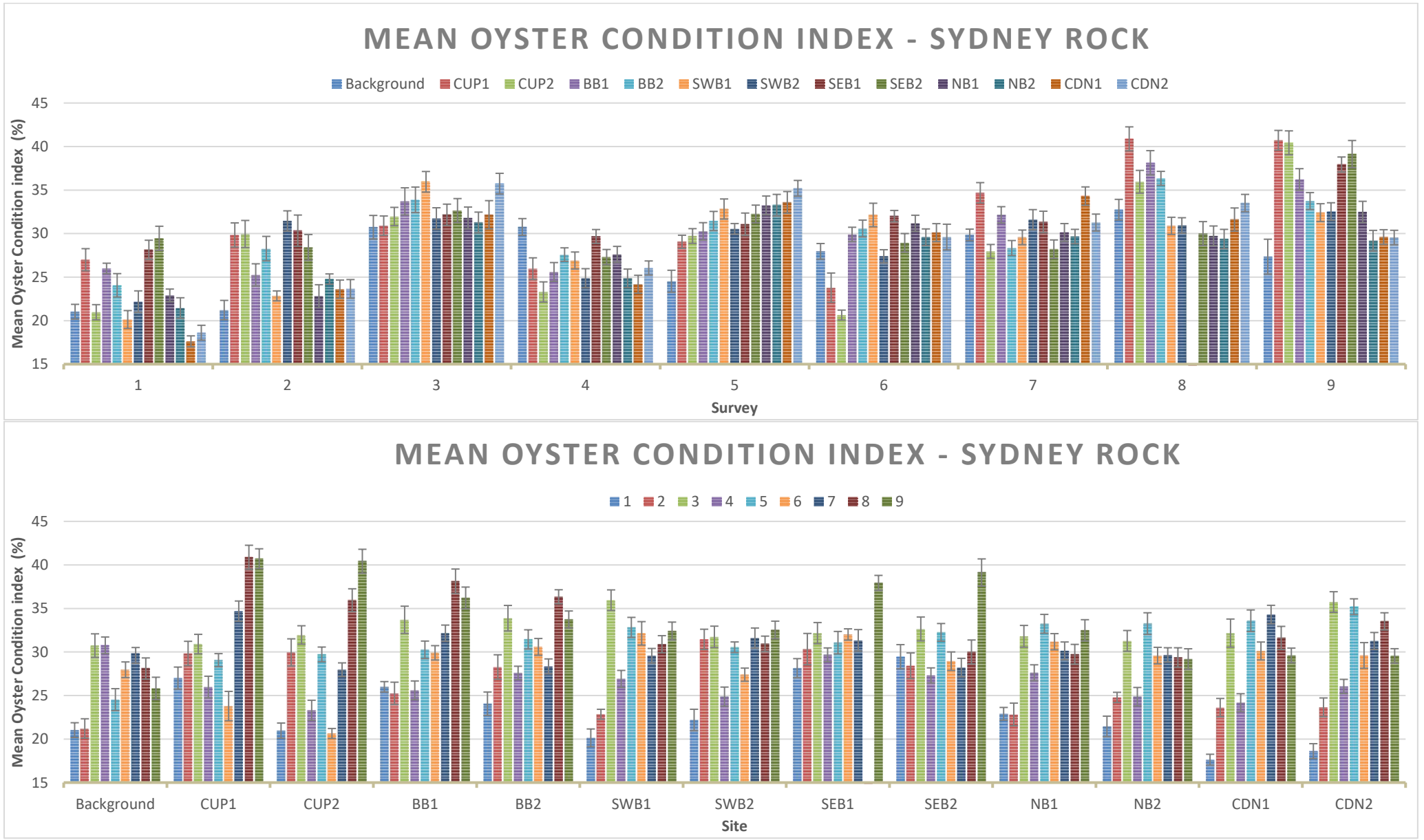



**Figure 98** Average oyster condition index for Sydney Rock Oyster samples at all sites in each of the bimonthly surveys (top) and for all surveys for each site (bottom).

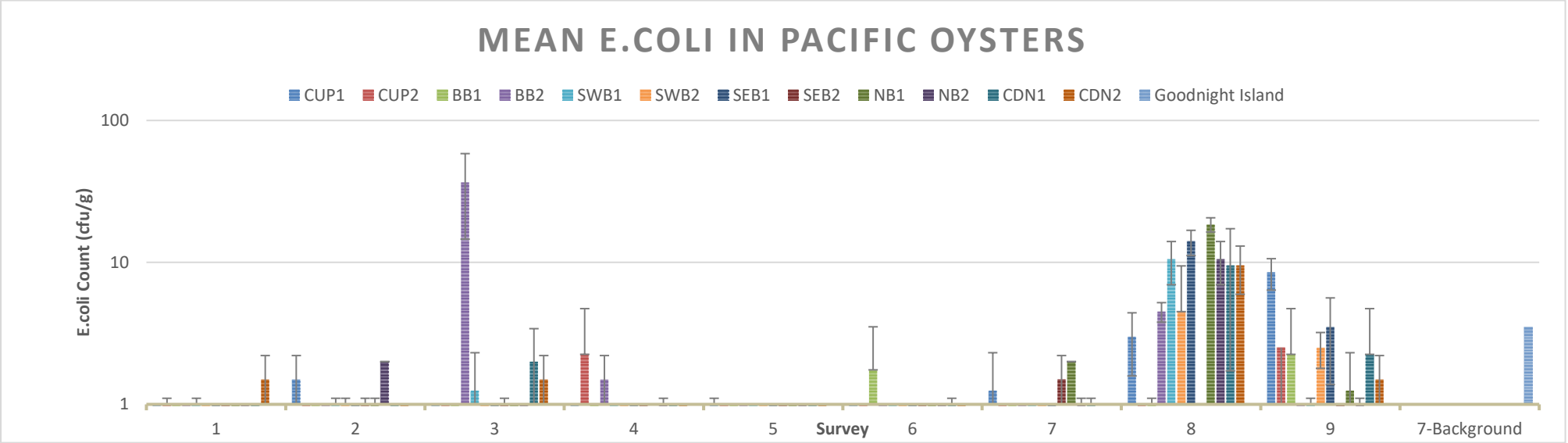



**Figure 99** Average E. coli levels in Pacific Oysters at 12 sites measured over nine surveys in the 18-month sample window.

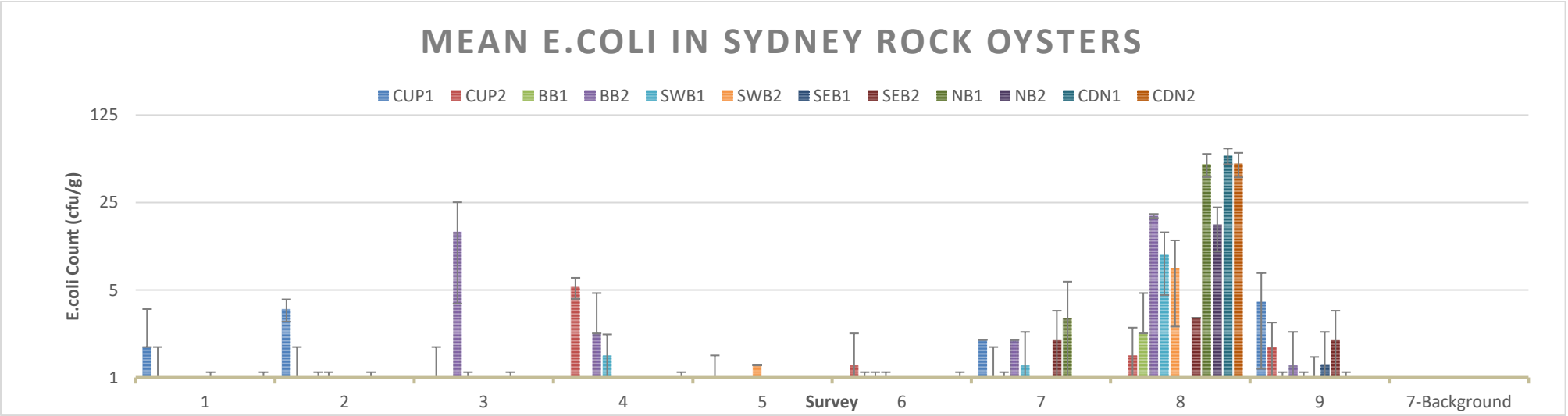



**Figure 100** Average E. coli levels in Sydney Rock Oysters at 12 sites measured over nine surveys in the 18-month sample window.

### 4.3. Metal, Organochloride and PAH Bioaccumulation Results

As per Condition C18(e), the oyster sampling program mandated the testing of oyster flesh for metals (As, Cr, Cu, Hg, Pb, Se and Zinc) and organic contaminants (organochlorines and PAHs). The nominated project NATA registered laboratory was tasked with undertaking the necessary analysis at the lowest possible detection limits as per the scientific literature that notes that expected OCs and PAH concentrations in oysters are generally in the range of micrograms per gram of flesh weight. The full results of the testing plus laboratory analysis reports are provided in **Appendix E** and are summarised below.

#### 4.3.1. Organic Chemical Results

In the event the nominated NATA registered laboratory was unable to meet the µg/gm requirement of organics testing for oyster flesh and were often struggling with meeting µg/kg detection limits with most samples requiring higher detection limits due to 'sample matrix interference' - generally excessive fine sediment.

Pacific oysters saw a higher abundance of PAH detections than Sydney Rock oysters across the 19 analytes and 9 bimonthly surveys. All but four of the PAH analytes appeared in at least one replicate across both species of oysters. Detections of PAHs were very sporadic and very low with no consistent patterns in relation to rainfall or any other observable influence. In Pacific oysters, of the 3950 samples conducted there was a total of 191 replicates returning a result above detection limits. Naphthalene, Fluoranthene and Pyrene were the main PAHs analysed (roughly 40 replicates each), at or above detection across the nine surveys. Naphthalene averaged 13.2µg/kg, Fluoranthene averaged 9.5µg/kg and Pyrene averaged 12.3µg/kg. Although there were results registered for these samples, background data averaged 12.7µg/kg, 33.9µg/kg and 25µg/kg respectively, indicating that there is a sporadic baseline presence of PAH within the Crookhaven river and detections were not always acquired at each site location. The high background means for Fluoranthene and Pyrene is a result of bimonthly sample 9 background results being notable higher, however there was no obvious influence to trigger this spike. In Sydney rock oysters only 3% of replicates registered concentrations above detection limits, with the same analytes as Pacific oysters (Naphthalene, Fluoranthene and Pyrene) returning a larger proportion of results. Although a larger portion in comparison, these analytes were only returning 12-15% of their replicates above detection limits for Sydney Rock oysters, and in very similar ratios for Pacific oysters.

For Organochlorides there was an even smaller number of samples that returned a result above detection, Sydney Rock oysters returned results for six of the 19 analytes, with Pacific oysters seeing one of the analytes above detection limits. Spread across the six analytes above detection for SROs, there were only nine individual replicates that returned a result; therefore 0.002% of replicates were above detection. pp-DDE was the only analyte for Pacific oysters above detection limits with 19 individual replicates, mostly from bimonthly sample 8. pp-DDE is a breakdown product of the pesticide DDE. DDE is banned in

Australia however its break down products such as pp-DDE have a very high persistence in the environment. Some 95% of the results for Pacific Oyster pp-DDE were from Survey 8 suggesting a temporary source or input upstream in the Crookhaven River. Background data did not register any Organochlorides above detection limits, suggesting all detections in bimonthly surveys were a result of bioaccumulation during the oyster's deployment. All the Organochlorides analysed had a very low detectability across both species of oyster in the 9 bimonthly surveys.

### 4.3.2. Metal Analysis Results

The Pilot Study collected and analysed shoreline and lease attached wild Sydney Rock oysters and these results indicated positive results for most sites for Arsenic Copper, Zinc and Selenium and scattered low results for Chromium, Lead and Mercury.

Whilst the overall mean concentrations of metals and metalloids in oyster flesh for this bioaccumulation study were consistently above the mean values for commercial oyster growing estuaries as reported by Ferrell et al (2018) it is important to stress that their study sampled commercially grown oysters that were being harvested for human consumption. Whereas for this study whilst the study oysters were supplied from commercial oyster stock they were not supplied from harvestable stock and in many instances, they were harvested for both initial placement and for final collection assessment when the actual commercial harvest areas were shut down for commercial harvest.

Results for the nine formal bimonthly bioaccumulation surveys are provided in **Appendix E5,** and all metal results are also shown graphically in **Appendix E6 Figures E1 to E167**. Results are summarised below with summary graphing of selected metals:

**Chromium** was detected in 11 of 488 samples (4 from Pacific oysters and 7 from Sydney Rock oysters). The mean chromium concentrations were 1.6 mg/kg for Sydney Rock oysters and 1.5 mg/kg for Pacific oysters. The highest observed concentration, 2 mg/kg, was recorded in Pacific oysters at CUP2 during the fourth bimonthly survey. Sydney Rock oysters returned two results in bimonthly sample two, of 1 and 2mg/kg for SWB1 and CDN1 respectively, however baseline data indicated the deployment of oysters with 2mg/kg of chromium present, suggesting post deployment chromium levels had not been acquired throughout bimonthly sample two. This was the only occurrence with all other chromium detections a result of bioaccumulation throughout deployment due to baseline levels below detection limits. Other chromium detections were sporadic, showing no consistent patterns across sites or sampling periods. These few detections showed no obvious correlation with rainfall events, or any other environmental factors monitored during the study. This indicated that chromium levels in the Crookhaven River—and consequently in oyster tissues—may not be influenced by heavy rainfall or other observed variables. Based on these findings, chromium may not be a significant contaminant of concern at present.

**Lead** was the least detected heavy metal in this study, with only 3 out of 488 samples registering above the detection limit. The detection limit remained stable at <1 mg/kg for most samples, except one with a

limit of <2 mg/kg. Two of the three detected lead concentrations were 1 mg/kg, which are negligible. The only notable detection was a concentration of 32 mg/kg observed in Sydney Rock oysters at site BB1 during the ninth bimonthly survey. This elevated concentration was found in replicate 1, while replicate 2 remained below the detection limit, suggesting the possibility of contamination during processing or analysis rather than representing actual lead levels in the Crookhaven estuary. No other lead detections were recorded during this survey. Given that the regulatory limit for lead in oyster flesh in Australia and New Zealand is 2 mg/kg (Maximum Level of Contaminants and Natural Toxicants, 2015), all detections—except for the anomalous spike—fall well within acceptable limits. Similar to chromium, these low-level detections did not correlate with rainfall events, or any other environmental factors monitored during the study. Based on these findings, lead does not appear to be a significant contaminant of concern at present. It is also noted that mean NSW estuaries lead concentrations for commercial SROs through to 2014 was 0.05mg/kg (Farrell et al 2018).

**Mercury** was detected in 12 out of 488 samples analysed, with 9 detections occurring in Sydney Rock oysters. Detection limits across the nine bimonthly surveys ranged from 0.1 to 0.2 mg/kg. All detected mercury concentrations were exceptionally low, with the highest value recorded at 0.15 mg/kg in Sydney Rock oysters at CUP1 during the 3rd bimonthly sample. Mercury was only detected in bimonthly samples 2 and 3, with no significant rainfall events occurring near the time of oyster collection, suggesting that stormwater runoff may not influence mercury levels in oyster tissue. Although Ferrell et al (2018) reported a mean value of 0.01mg/kg for commercial SROs from NSW oyster growing estuaries, the levels of mercury observed in this study were well below the regulatory limit of 0.5mg per person (FSANZ, 2004), and accordingly mercury does not appear to be a significant contaminant of concern at present.

**Selenium** was detected in approximately half of the analysed samples, with 266 out of 487 replicates above the detection limit (detection limit varied between 2 and 4 mg/kg), with 85% of the detections greater than the low 2 mg/kg, detection limit. Baseline concentrations of Selenium prior to deployment ranged from 2 to 3mg/kg throughout the nine bimonthly samples (average of 2.2mg/kg). Sydney Rock oysters exhibited slightly higher selenium concentrations, averaging 2.9 mg/kg, compared to Pacific oysters which averaged 2.5 mg/kg. The maximum selenium concentration recorded for both oyster species was 5 mg/kg, observed at site SWB2 in bimonthly sample 9 (Sydney Rock oysters) and at site CUP1 in bimonthly sample 2 (Pacific oysters). Ferrell et al (2018) reported a mean value of 0.55mg/kg for commercial SROs from NSW oyster growing estuaries.

A notable trend observed during the 18-month sampling period was an increase in selenium concentrations in oyster flesh following significant rainfall events, with more pronounced increases in Sydney Rock oysters, and similar trends observed in Pacific oysters. The largest spike in selenium in Sydney Rock oyster flesh occurred during bimonthly sample 9 (an average of 4mg/kg), which coincided with a substantial rainfall event: 338 mm of rain fell in the 10 days preceding sample extraction, with an additional 135 mm on the extraction day. Concentrations were near identical across all survey sites suggesting inundations of the estuary and river. This event was the most intense rainfall recorded among the nine bimonthly samples. The second highest detection of selenium, occurring in bimonthly sample

two, had 61mm falling eight days prior to extraction. Bimonthly sample two also saw higher concentrations for replicate one at Billy Bay (BB), South West Bay (SWB), South East Bay (SEB) and North East Bay (NB). The main river sites Crookhaven River Up (CUP) and Crookhaven River Down (CDN) experienced similar concentrations across replicates with none of the spikes as observed above and this may be due to rapid or consistent depuration of Selenium in the main river discharge sites during the seven rainfall free days prior to extraction, whilst sites with differing selenium spikes between replicates (BB, SWB, SEB and NB) were not flushed as rapidly or evenly as the mainstream river sites. The explanation of rapid depuration of Sydney Rock oyster selenium is also illustrated by Study two having an average concentration post-deployment of 3.3mg/kg across all samples, followed by the pre deployment concentrations for bimonthly sample three dropping to <=DL with the Study 3 oysters collected seven days after the extraction of Study two oysters.

High rainfall did not always initiate a selenium concentration spike. Bimonthly sample eight saw 88mm falling in the three days prior to extraction, however this did not result in a concentration increase in Pacific oysters and only a minor increase in Sydney Rock oysters (averaging 2.6mg/kg). Notwithstanding previous low rainfall does predict low selenium concentrations. Bimonthly samples 3, 4, and 5, were taken during the driest four-month period with no rainfall events exceeding 10 mm. Samples did not exhibit any elevated selenium levels. This suggests that significant rainfall events influence selenium concentrations in oyster flesh, a trend observed in both oyster species but more prominently in Sydney Rock Oysters

**Arsenic** was detected from 99% of the samples, where both Pacific and Sydney Rock oysters showed measurable concentrations. **Figure 101** shows site Arsenic concentrations grouped per survey for both POs and SROs. Sydney Rock oysters had an average arsenic concentration of 7.7 mg/kg across 234 samples taken over nine surveys, while Pacific oysters exhibited slightly higher levels, averaging 8.3 mg/kg from 253 samples. Baseline data collected prior to deployment of each bimonthly survey averaged 7.6mg/kg.

Both oyster species displayed a relatively stable baseline of arsenic concentrations throughout the bimonthly surveys irrespective of rainfall except for a notable increase in bimonthly sample 8. In Pacific oysters, arsenic levels showed a clear downstream gradient, peaking at 21 mg/kg at CDN2. Although less pronounced, Sydney Rock oysters also exhibited this trend, with the highest concentration of 13 mg/kg observed at NB2 and CDN1. Elevated arsenic concentrations were also noted at sites BB2 and SWB1 for both oyster species. All concentrations in bimonthly sample 8 were increased from the baseline arsenic concentrations observed prior to deployment. A rainfall event, delivering 30 mm the day before with 52 mm on the day of extraction, may have facilitated the mobilisation of arsenic from a source, contributing to these increased concentrations.

The depuration of oyster arsenic following the bimonthly sample 8 pulse would appear to have been relatively fast, as baseline data from the next batch of oysters collected 13 days post bimonthly sample 8 extraction had lower concentrations of 9mg/kg (SRO) and 6.2mg/kg (PO). Rainfall may not always predict arsenic concentrations in oyster flesh, with a high rainfall sample such as bimonthly sample 9 not only not

resulting in an increase in arsenic levels for both species, but in fact a decline from concentrations observed prior to deployment (**Figure 101**). Thus, the manner (rate, duration) and source of rainfall runoff plus site location in relation to tidal flushing and mixing post rainfall are also relevant to predicting metal uptake and post storm depuration behaviour.

There is a potential for increases in arsenic concentrations with no rainfall influence. Supporting this is the spike of arsenic observed in the baseline result collected prior to bimonthly sample 7, with an average of 22.5mg/kg for Pacific oysters and 7mg/kg in Sydney rock oysters at deployment. The lack of any wet weather event (>20mm rainfall) in the 17 days prior suggests this increase was influenced by other factors. However, it is possible that Comerong, the source location for Pacific oysters retained higher concentrations through hydrological processes following the rainfall event 18 days prior to baseline sampling.

The estuary's rapid flushing of smaller rainfall events within 24 hours may result in prolonged exposure of downstream sites to arsenic-rich stormwater immediately after rain, such as for bimonthly survey 8. Sites like BB2 and SWB1, located near the main Crookhaven channel but within recessed inlets, may have retained arsenic-rich waters slightly longer, enhancing absorption in oyster tissues. Faster growth and higher filtration rates in Pacific oysters may account for their generally higher arsenic concentrations compared to Sydney Rock oysters, supporting observed trends across sites.

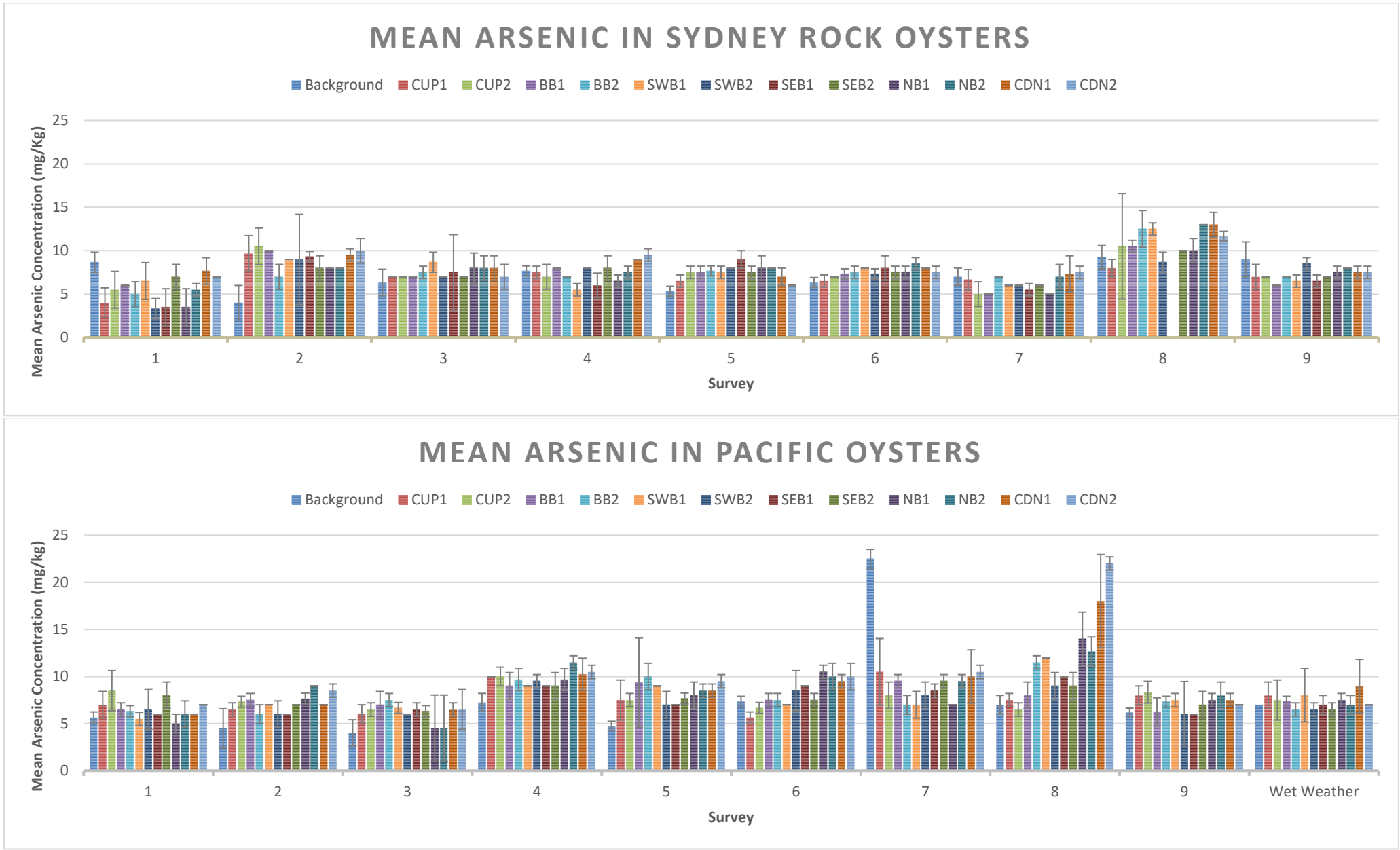



**Figure 101** Arsenic Bioaccumulation Results for SROs and POs over the nine surveys

**Copper (Figure 102)** was consistently detected across all 487 samples, with a detection limit maintained at <1 mg/kg. Copper concentrations were generally higher in Sydney Rock oysters compared to Pacific oysters, with Sydney Rock oysters averaging 94.5 mg/kg across 234 samples, while Pacific oysters averaged 63.8 mg/kg across 253 samples. The baseline data collected prior to deployment averaged 81mg/kg in SROs and 63mg/kg in POs.

The only instance where Pacific oysters exhibited higher copper levels than Sydney Rock oysters was in bimonthly sample 4 at site CUP1, during an exceptionally dry period with no significant rainfall in the preceding two months. This anomaly could be attributed to a localised copper input upstream, potentially from agricultural activities, occurring within 24 hours before oyster extraction. Given the higher filtration rate of Pacific oysters, they may have accumulated copper at a faster rate compared to Sydney Rock oysters under these conditions.

In large rainfall events, Sydney Rock oysters displayed a definitive increase in copper concentration across sites with the most notable spike occurring during bimonthly sample 9, which recorded 338 mm of rain in the 10 days before extraction and an additional 135 mm on the extraction day resulting in 166mg/kg for SROs and 71mg/kg for POs. It should be noted that copper concentrations for sample 9 were already elevated prior to deployment (140mg/kg for SROs and 67mg/kg for POs), itself a probable result of a wet weather copper intake prior to deployment of bimonthly sample 9 oysters. This event was also the most substantial rainfall recorded during the monitoring, and trends observed in any one bimonthly sample were not emulated in other sample events. It can be concluded that all sites show considerable variation over time, with no sites exhibiting consistently higher values throughout the 9 surveys.

Lee *et al*.,(2015) found that Sydney Rock oysters predominantly bioaccumulate metals from suspended sediments and phytoplankton rather than dissolved metals under typical estuarine conditions However, during high rainfall events, the dramatic increase in dissolved metal concentrations shifts the primary uptake pathway to dissolved metals, driving higher bioaccumulation in Sydney Rock oysters. In contrast, Pacific oysters appear to have a bioaccumulation threshold, likely related to their size, beyond which further increases in copper bioavailability do not translate to higher tissue concentrations (Ayling, 1974). This indicates that Sydney Rock oysters may not have the same size-related bioaccumulation limitations as Pacific oysters, allowing them to accumulate greater quantities of metals. This characteristic, along with their increased response to heavy rainfall events, explains why Sydney Rock oysters consistently exhibited higher copper concentrations than Pacific oysters throughout the study.

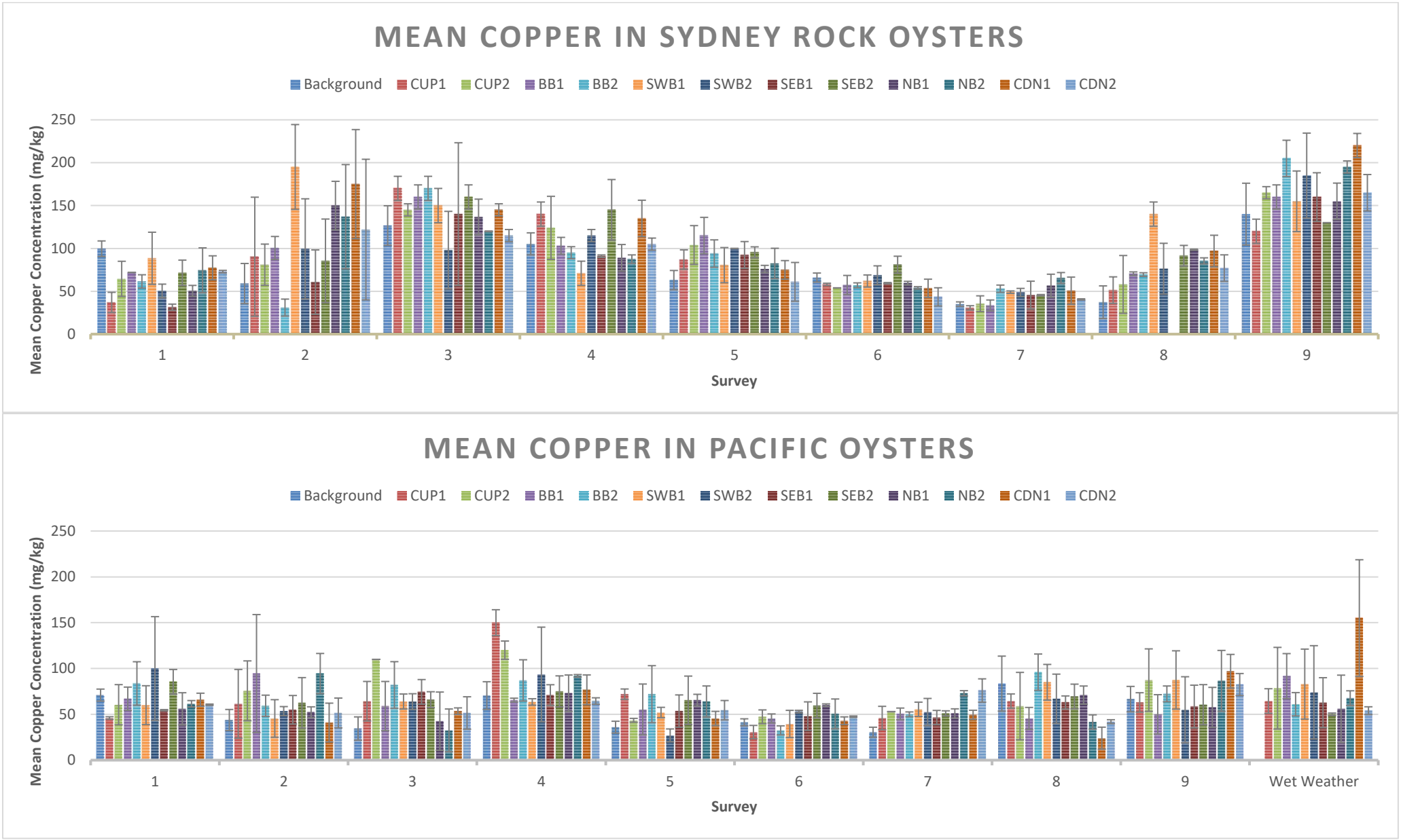



**Figure 102** Copper Bioaccumulation Results for SROs and POs over the nine surveys

**Zinc** concentrations (**Figure 103**) varied significantly between Sydney Rock oysters and Pacific oysters with Sydney Rock oysters consistently exhibiting higher levels. The average zinc concentration in Sydney Rock Oysters was approximately 1140 mg/kg, nearly double that of Pacific Oysters, which averaged 619 mg/kg. Background data also ranged significantly between species with an average of 1067mg/kg in SROs and 534mg/kg in POs. This elevated bioaccumulation in Sydney Rock Oysters is likely due to mechanisms similar to those identified for copper uptake, making them a more sensitive and accurate indicator of zinc contamination in the estuary.

The most pronounced spike in zinc levels occurred during bimonthly sample 9 at all sites, particularly at downstream locations and those near the main Crookhaven River channel. Notable increases were observed in sheltered bay sites such as BB2 that can trap metal-rich waters. This zinc spike coincided with the largest rainfall event during the 18-month study, where 338 mm of rain fell in the 10 days preceding sample collection. Background data suggests that the Crookhaven river contained elevated levels of zinc prior to bimonthly sample 9 (potentially a result of a high rainfall event 14 days prior to background data collection), however rainfall continued to increase concentrations. It can be concluded that although rainfall may influence concentrations, all the sites showed considerable variation over time, with slightly higher concentrations at downstream sites.

Zinc concentrations in Sydney Rock Oysters generally remained higher in high flow areas and in closer proximity to the Crookhaven River, as observed in bimonthly survey 2. This sample showed elevated zinc levels primarily at downstream sites and SWB1, following 61 mm of rain 8 days before retrieval. It is possible that most zinc concentration increases are from an upstream source and flushed through the estuary relatively quickly. The background results and their mostly consistent similarity to bimonthly survey results indicate that there is a baseline of zinc present throughout the river, with a capacity for concentrations to be altered through higher rainfall events and periods.

Notably, zinc concentrations were not solely influenced by rainfall events, as indicated by a 13% increase in average zinc levels during bimonthly sample 3, despite only 24 mm of rainfall during its deployment. This suggests that other sources, such as agricultural runoff, might contribute to zinc spikes, particularly during dry periods. It should be noted that the high background concentration of zinc prior to bimonthly sample 3 may indicate a retention of pre survey zinc accumulation. The relatively consistent zinc levels across all sites in dry periods (such as bimonthly survey 6) imply that the primary input source during these dry periods is likely upstream in the Crookhaven River, with agricultural irrigation possibly washing zinc-containing products into the catchment.

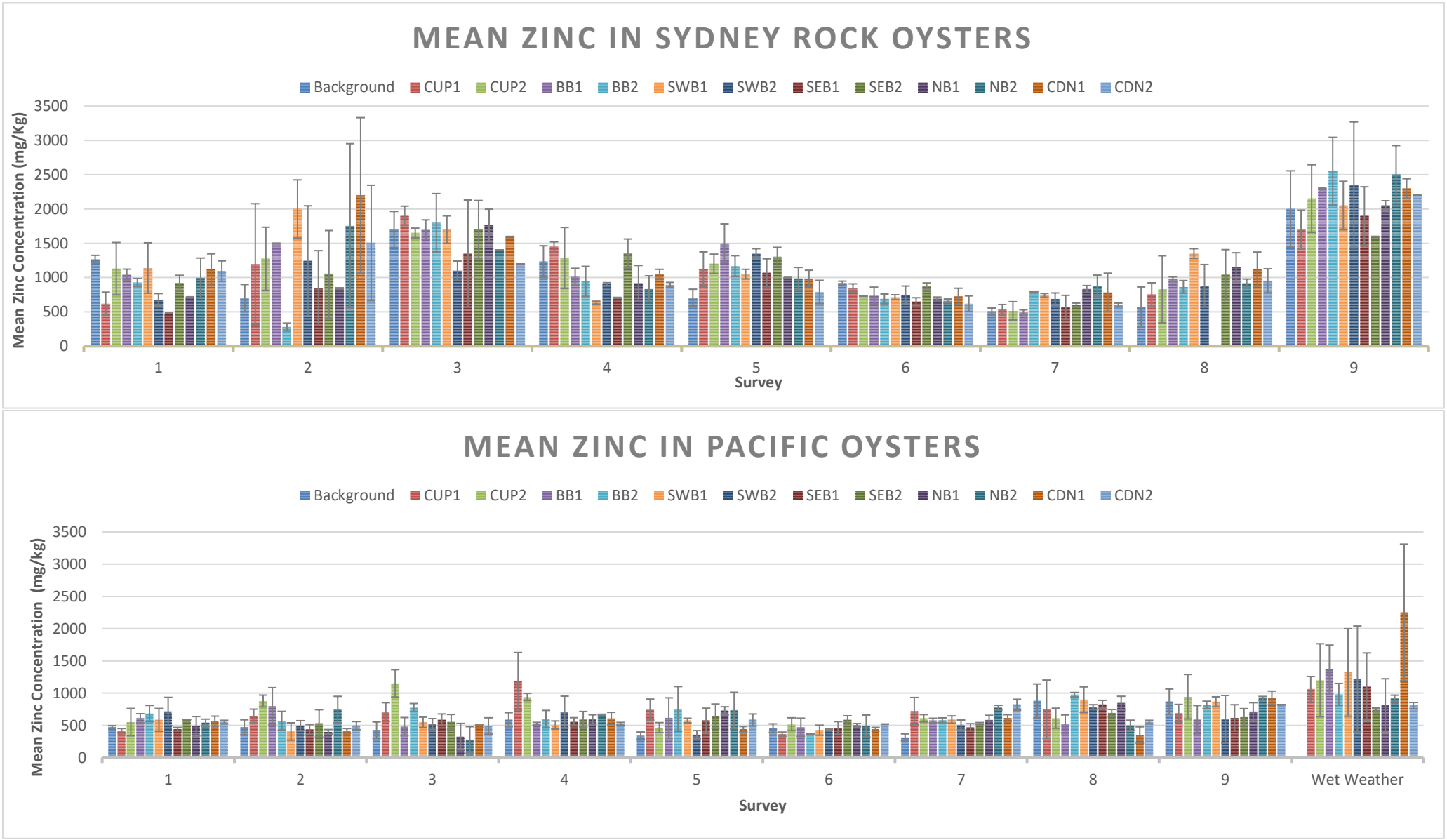



**Figure 103** Zinc Bioaccumulation Results for SROs and POs over the nine surveys

### 4.3.3. Bioaccumulation Survey Conclusions

It is concluded from the metal analysis that the Sydney Rock oyster may be a more appropriate bioindicator of the metal /metalloid concentrations in the Crookhaven river as Pacific Oysters with their larger weight and shell size appear to be limited in their metal accumulation whilst Sydney Rock oysters appear to bioaccumulate most metals tested to higher concentrations across a range of environmental stressors.

Given the problem for the commercial laboratory to be able to meet the necessary low µg/gm detection limits for detecting organics (PAHs and Organochlorides) in oyster flesh, it may be more appropriate to limit testing for organics to water quality testing., with oyster testing for organics only warranted if there are consistent high organic concentrations showing in water sampling results.

## 4.4. Recommendations for Pre-Construction to Construction Oyster Monitoring

The baseline project established the utility of Sydney Rock Oysters for metal bioaccumulation studies in the Crookhaven River as an appropriate impact monitoring tool for subsequent urban construction and operational monitoring but also found that monitoring for trace organic pollutants was more problematic with regards to laboratory analysis abilities, probably necessitating overall larger samples and/or more specialised laboratory analysis techniques, at least for base-line evaluations. The study also found correlations for both initial deployment concentrations and for weather related (wet and dry) events with site differences most likely associated with the complex flood and tidal mixing behaviours for the various sites.

Accordingly for continued bioaccumulation monitoring, it is recommended that:

- The use of Sydney Rock Oysters alone is considered sufficient for oyster contamination biomonitoring purposes.
- Routine monitoring analysis for sub-samples to be confined to metals and metalloids, As, Cd, Cu, Zn and Se.
- Sub-sampling and initial sample preparation for lab analysis will follow the methodology of the base-line study.
- SRO metal bioaccumulation studies to be confined to the seven Billys Bay and South Curleys Bay established sites (i.e., BB1, BB2, SW1. SW2, SE1, SE2 and NB1).
- The deployment period be increased to seasonal deployment with overlap (i.e deployment of next seasonal oysters around 1 to 2 weeks prior to final removal of

previous deployment oysters.)

- As per the baseline study, the Reference Oysters will be sub-sampled for metal analysis to provide initial deployment baseline data for each site.
- All sites will then be sub-sampled two weeks after deployment to provide information on site reaction to the initial base-line concentrations and then at the end of the seasonal deployment.
- All sites will also be sub-sampled once per season for two possible significant wet or dry events and only if they occur; once within a week after a significant wet weather event of 80mm or more rain in the preceding 24 hours and once within a week after a significant dry period defined as four weeks with less than 5mm on any one day and less than 20mm total over the period.
- Additional during-season sub-sampling for analysis to be coordinated with water quality monitoring, with sub-sampling for analysis only to be undertaken in response to high water quality metal or organic pollutant results (from the water quality sampling program) or to specific catchment events (possible sewage spill event for instance).
- Additional monitoring for possible organic pollutant uptake in oysters to only be undertaken if there are consistent high organic concentrations indicated from the water quality sampling program and then only on a site-by-site basis - depending on proximity to effected water sample site.

## 5. LAKE WOLLUMBOOLA FRESHWATER BIOTA MONITORING

Section 2.3 of the Approved Aquatic Ecology Methodology Report and Section 2.4 of the August 2023 Aquatic Ecology Monitoring Addendum Report provide the original rationale and methodology for the adopted Lake Wollumboola Freshwater Biota Monitoring Program undertaken at six sites in three creeks shown in **Figure 104** below, where deployment of Artificial Sampling Units (ASUs) and electrofishing was required to be undertaken over six seasonal sampling events in the 18-month monitoring period.

Weather conditions over the monitoring period (October 2022 to May 2024) are provided in **Section 5.1** below, and the Lake Wollumboola Freshwater Biota Monitoring Program survey results are presented in **Section 3**.

Within each creek, site selection was governed by a combination of water availability (persistence) at the upstream site and salinity influence from connection with Lake Wollumboola at the downstream sites. An ASU pilot study commenced in October 2022, six weeks prior to the first six-month monitoring term to determine suitable upstream and downstream sampling locations within each creek. The up and downstream locations of Downs Creek sites were the only sites to be relocated prior to deployment of the Term 1 ASUs. Following the first Six-Monthly Monitoring Term undertaken for the project, the following recommendations were made to the adopted Artificial Sampling Unit (ASU) sample methodology:

- Extending the seasonal deployment time for ASUs from six weeks to twelve weeks to allow for increased colonisation by stream macroinvertebrates,
- Undertake additional quantitative macroinvertebrate sweep netting of available detritus habitats at each site, comprising two replicates of 5m sweep samples of pool edge and benthic habitats, to complement the ASU sampling program.

**Table 18** presents the daily rainfall between October 2022 to June 2024 with the pink shaded areas showing the consecutive seasonal ASU deployment periods and electrofishing results shaded in yellow or green. **Table 19** below provides a summary of the seasonal deployment dates for Freshwater ASUs and the dates for electrofishing sampling.




**Figure 104** Freshwater Monitoring Site Locations.

## Table 18 Culburra Treatment Plant Daily Rainfall 2022, 2023 & 2024
## Freshwater Biota (ASU and Electrofishing) Sampling and Water Quality Metering Timetable

| Date | 2022 | | | 2023 | | | | | | | | | | | | 2024 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
| **1st** | 22 | 15 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 4 |
| **2nd** | 7 | 0 | 9 | 0 | 0 | 3 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 11 | 0 | 5 | 11 |
| **3rd** | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 2 | 49 | 0 |
| **4th** | 0 | 1 | 0 | 2 | 0 | 9 | 1 | 0 | 5 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 25 | 0 |
| **5th** | 3 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 18 | 17 | 0 | 1 | 8 | 0 | 2 | 48 | 6 |
| **6th** | 28 | 0 | 2 | 17 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 86 | 27 | 187 |
| **7th** | 5 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 76 |
| **8th** | 2 | 0 | 0 | 0 | 24 | 0 | 6 | 16 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 20 | 16 |
| **9th** | 75 | 0 | 0 | 0 | 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 28 | 0 |
| **10th** | 3 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 9 | 17 | 0 |
| **11th** | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 34 | 0 |
| **12th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 |
| **13th** | 0 | 0 | 2 | 0 | 2 | 22 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 135 | 3 |
| **14th** | 3 | 14 | 0 | 2 | 2 | 5 | 35 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **15th** | 0 | 0 | 0 | 0 | 17 | 12 | 6 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 51 | 2 | 10 | 0 | 0 | 25 |
| **16th** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 3 | 0 | 0 | 0 | 17 |
| **17th** | 2 | 3 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 | 0 | 0 |
| **18th** | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 52 | 0 | 3 | 1 |
| **19th** | 0 | 0 | 0 | 23 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 4 | 0 |
| **20th** | 0 | 2 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 5 | 8 | 9 | 0 | 0 |
| **21st** | 21 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 15 | 0 | 0 | 0 | 0 |
| **22nd** | 5 | 0 | 0 | 1 | 17 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **23rd** | 15 | 0 | 3 | 21 | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 7 | 6 | 4 | 0 | 0 | 0 | 0 | 28 |
| **24th** | 8 | 0 | 0 | 0 | 0 | 7 | 30 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 | 0 | 22 | 0 | 0 | 0 | 1 |
| **25th** | 37 | 0 | 0 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **26th** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 32 | 2 | 0 | 0 | 0 | 0 | 0 |
| **27th** | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 7 | 12 | 1 | 2 | 0 | 6 | 0 | 0 | 0 | 0 |
| **28th** | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 87 | 7 | 0 | 0 | 0 | 0 | 0 | |
| **29th** | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 | 168 | 0 | 0 | 0 | 0 | 0 | 0 | |
| **30th** | 0 | 0 | 6 | 7 | | 4 | 61 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 1 | | 0 | 6 | 0 | |
| **31st** | 0 | | 7 | 14 | | 2 | | 0 | | 0 | 2 | | 0 | | 1 | 0 | | 0 | | 0 | |
| **Monthly total** | 239 | 37 | 33 | 119 | 337 | 84 | 162 | 25 | 15 | 12 | 36 | 16 | 62 | 334 | 167 | 90 | 98 | 123 | 119 | 481 | 377 |
| **Monthly Average** | 86 | 89 | 75 | 98 | 130 | 140 | 112 | 111 | 141 | 83 | 79 | 72 | 86 | 89 | 75 | 98 | 130 | 140 | 112 | 111 | 141 |

| **Legend** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Consecutive ASU deployments | | Electrofishing | | Water quality metering | | Combined electrofishing and water quality metering |
| | 20 | High Rainfall Event. (>20mm over 48 hours) | | | | | | |

| Table 19 Culburra West Freshwater ASU and Electrofishing Monitoring | | | | | |
|---|---|---|---|---|---|
| | ASU Sample Schedule | | | | Electrofishing |
| | Deployment | Retrieval | Duration | Rain (# rainfall days) | Date/s |
| **Pilot ASU** | 17/10/2022 | 6/12/2022 | 57 days | 139 mm (20) | |
| **Term 1 Summer** | 6/12/2022 | 17/1/2023 | 41 days | 60mm (14) | 27-28/3/2023 |
| **Term 2 Autumn** | 1/3/2023 | 26/4/2023 | 57 days | 183 mm (27) | 4-5/7/2023 |
| **Term 3 Winter** | 9/6/2023 | 28/8/2023 | 81 days | 49 mm (20) | 11/9/2023 |
| **Term 4 Spring** | 28/8/2023 | 27/11/2023 | 92 days | 144 mm (26) | 27/11/2023 |
| **Term 5 Summer** | 27/11/2023 | 6/3/2024 | 101 days | 645 mm (50) | 27-28/3/2024 |
| **Term 6 Autumn** | 6/3/2024 | 27/5/2024 | 83 days | 707 mm (30) | 26-27/6/2024 |

## 5.1. Culburra Freshwater Monitoring Weather Conditions and Water Levels

Daily rainfall is recorded at Bureau of Meteorology (BOM) Culburra Treatment Plant gauge (68083). **Figure 105** below provides the monthly totals compared to the long-term mean monthly rainfall totals (acquired since 1962) for the duration of the monitoring period.

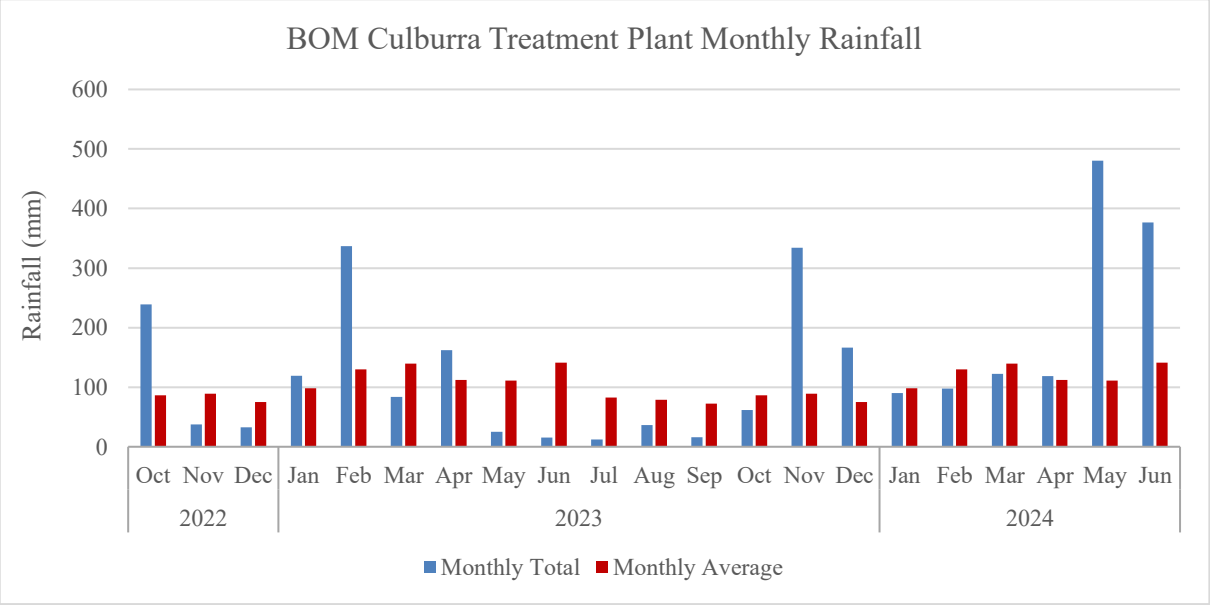



**Figure 105** Culburra monthly rainfall from October 2022 to June 2024

For the most part, weather conditions were variable and characterised by close to average rainfall on a month-to-month basis with periodic intense weather events, and whilst the autumn to spring period in 2023 was very dry with steadily declining water levels (reaching their lowest levels in late November), consistent wet weather patterns prevailed

over the tail end of the monitoring period:

- The period leading into the ASU pilot study was consistently wet with above average precipitation (198mm) in September 2022 and 149mm over the two-week period leading into the ASU deployment in October (data not shown here), and while there was initially some decent rainfall over the first two weeks of deployment (90mm), there remainder of the pilot ASU deployment period recorded below average rain. The retrieval of the pilot study ASU samples was undertaken under lower water levels than when deployed, with WCUp samples being only recently exposed.
- The six-week Season 1 period (December 2022 to January 2023) was relatively dry with only 60mm recorded over the duration of deployment, however for sample retrieval there was surface water present at all sites except WCUp which was dry.
- February 23 was very wet with 337mm, including one intense rainfall day where 253mm was recorded on 9th February.
- The Season 2 ASU deployment period (March to late April) recorded below average rainfall and despite 63mm being recorded soon after the Term 2 ASU sample retrieval, weather conditions from May to August were increasingly dry with only 21% of the combined monthly average rain falling over the four-month period (53mm).
- The Season 3 ASU samples were deployed on June 9th with relatively low water levels noted at all sites, and for the Term 3 ASU retrieval in late August the water levels were even lower with WCUp site pool basin being completely dry (no samples collected). Water levels at downstream Wattle Creek site WCDn had retreated to a shallow (30cm deep) small pool around 8m in length for the 3rd electrofishing survey undertaken on September 11th, 2023.
- The Season 4 deployment period for ASU's (late August to late November) was for the most part dry with only 85mm recorded over the first two months, and while there was more consistent light rainfall totalling 59mm throughout November prior to ASU sample retrieval, all sites sustained low water levels or were dry upon retrieval. As a result, there were no ASU samples available from WCUp or SCUp (dry), and water levels at downstream Wattle Creek site WCDn were slightly lower than that encountered for previous electrofishing survey (see **Figure 106** below).
- Water levels throughout the study area were replenished over the days following the Term 4 retrieval/ Term 5 deployment on the 27th of November, with 275mm recorded over last three days in November.
- Season 5 (late November 2023 to early March 2024) was the overall longest ASU deployment period (101 days) with the most regular rainfall activity (50% rainfall days), with higher-than-average rainfall quantities owing to the intense wet weather

event in late November and rainfall activity in December. It is likely that all site Term 5 ASUs were submerged for the whole deployment.



**Figure 106A** Contrasting dry and wet conditions experienced at Wattle Creek upstream site WCUp on 27/11/2023 (left) and the following day on 28/11/2023 (right).



**Figure 106B** Contrasting dry and wet conditions experienced at Wattle Creek downstream site WCDn on 27/11/2023 where surface waters were contained in a small refuge pool (left) and the following a rainfall event the day after on 28/11/2023 (right).

- The Season 6 deployment period (early March to late May) was characterised by brief dry periods (10 days to two weeks in duration) interrupted by brief, intense storm activity, including an 11-day event in early May which recorded 468mm. Overall, the Term 6 period had the highest rainfall quantity (707mm) when compared to the other terms (equivalent to 8.5mm per day).

Following the late November 2023 rain event, Lake Wollumboola water levels rose rapidly from 0.55m to 1.44m over a period of 2 days (**Figure 107** below). For the 27th and 28th March 2024 survey work, the Lake Wollumboola water level (1.63m AHD) had inundated the lower reaches of South Creek to at least 230m above SCDn, and the downstream limits of Wattle Creek to around 70m downstream from WCDn. This was followed by a further increase in lake water level in early April (peaking at 2.17m AHD on the 5th of May) and subsequent decline (below 0.5m AHD) following the breaching of the lake mouth on the 6th May 2024. With regards to site samples, the following observations are noted:

- Downstream Wattle Creek site WCDn Term 6 ASU samples would have been subjected to backed up saline lake waters for at least four weeks duration, between April 7th and May 5th, 2024.
- Most of the SCDn Term 5 and Term 6 (excluding the final three weeks) ASU samples would have been subjected to backed up saline lake waters.
- It is unlikely that any of the other sites would have been inundated by backed up lake waters for any significant amount of time.

### 5.2. Culburra Freshwater Site Metered Water Quality Results

The dates of water quality metering are shown in **Table 18** above, and the full water quality logging data including depth profile readings provided in **Appendix F**. Summary water quality metering results are provided for surface and bottom samples on a creek-by-creek basis in **Sections 5.2.1 to 5.2.3** below for Wattle, Downs and South Creeks respectively. In the absence of site-specific water quality guidelines, the summary tables include the ANZG 2018 Default Guideline Value (DGV) ranges for slightly disturbed Lowland Rivers for comparison. Note that summary statistics are provided for the same depth zones as the ASUs were deployed (i.e., surface readings -S) only for WCUp and SCUp, surface and bottom (-B) for all remaining sites.

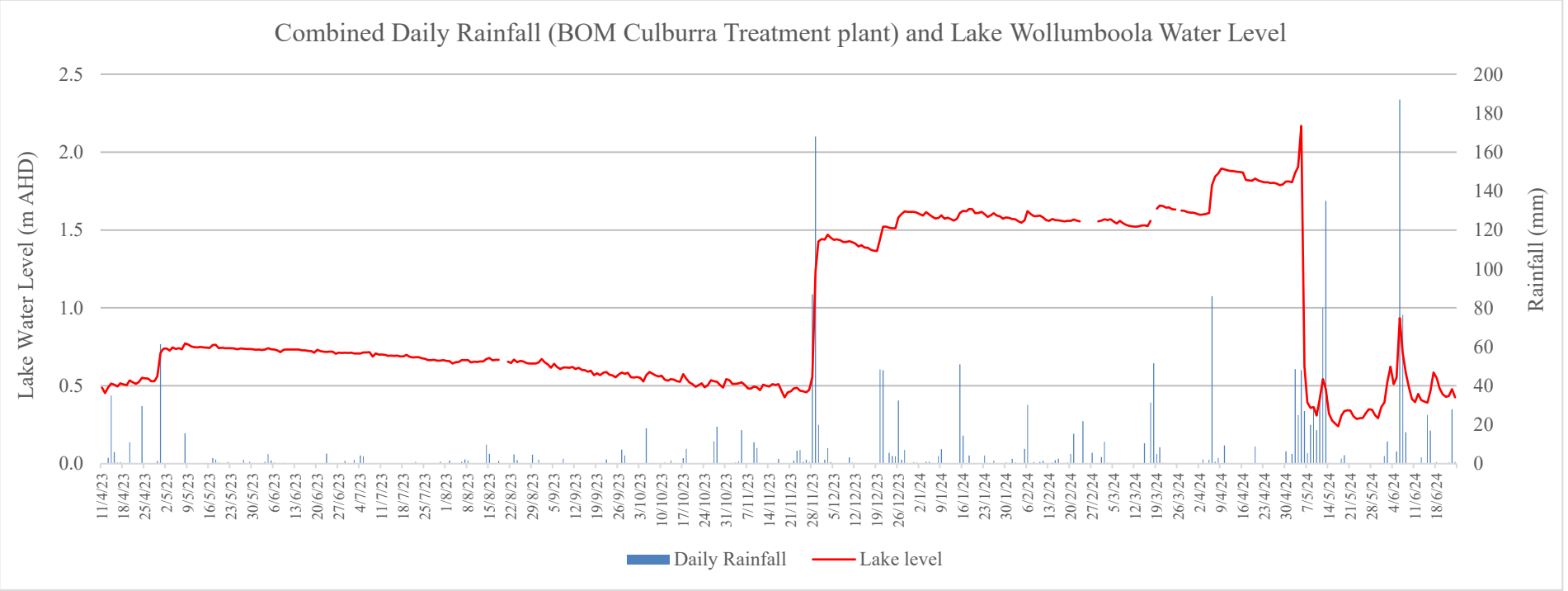



**Figure 107** Lake Wollumboola water level and daily rainfall April 2023 to June 2024

In addition to the summary tables, comparison summary boxplots are provided in **Figure 108** that graphically compares the summary statistical results for each site (including surface and bottom samples) over the complete sampling program to date:

- The box plots incorporate identification of 'outlier' values. Consequently, the 'whiskers' for the box plots only indicate maximum and minimum values when the data are all within 1.5 Inter Quartile Ranges (IQRs) either side of the IQR.
- The line through the middle of the box shows the median (50 percentile) for the data and the cross (X) shows the mean value for the data.
- If there are outlier data (i.e. values outside this range), they are shown as small circles located on both sides or on one side of the whiskers (depending whether the outliers are very low or very high value) and the whiskers on the sides that have outliers then show the 1.5 IQR limits for the data. Outliers will then indicate the relevant minimum or maximum value.

Where possible, depth profiling was undertaken where water quality readings are recorded at successive depths to determine if there is layering present in site pools (differences in water quality between surface and bottom waters). As they relate to aquatic ecology, the most important variations observed among site pools over the monitoring period were reductions in dissolved oxygen with depth or increases in conductivity (salinity), and they were mostly associated with drier periods with lower rates of mixing. Pool depths varied according to location and water availability, with WCUp and SCUp supporting the overall shallowest maximum depths (during baseflow conditions) at 0.4m and 0.5m respectively. Each of the other sites contain maximum pool depths ranging between 0.7m (SCDn) and 0.9m (DCUp and WCDn). Wet weather water quality metering was undertaken on three occasions during the monitoring period.

- On January 24th, 2023, the day after a 21mm rainfall event (combined 47mm over the previous 5 days),
- On November 28th, 2023, where 87mm fell over the course of the day (the event that caused Lake Wollumboola to fill). Water quality readings were also recorded at the sites which contained water on the day prior (November 27th) following an extended dry period (see **Figures 106A** and **106B**).
- In the middle of an extended wet weather event on May 8th, 2024, following 159mm recorded over the previous six days and 20mm on the day of metering.

Both other water quality metering events undertaken post November 28th were under relatively wet conditions, and while the dates would not be classified as a wet weather event sampling, the January 3rd, 2024, sampling was undertaken following 153mm

recorded over the two weeks prior and the March 27th, 2024, sampling was undertaken following 107mm over the previous 12 days.

### 5.2.1. Wattle Creek Metered Water Quality

**Table 20** summarises Wattle Creek Water Quality results. Wattle Creek upstream site WCUp was the first site to become dry following periods of no rainfall, owing the pool morphology (broad, shallow basin) with higher degree of exposure to sunlight than other locations. There were no readings recorded for the January, July, September and November (27th, not 28th) 2023 dates as the site was dry:

- WCUp-S supported the overall highest mean and maximum water temperature among all sites, and its highest temperature (28.4°C) was recorded in December 2022 when surface water had contracted to a small pool (4m x 5m and maximum depth of 15cm), being considerably higher than the range of temperatures recorded at other sites for the same survey (16.9°C at DCDn-B to 23.8°C at WCDn-S) (**Figure 108**).
- For the most part water conductivity at WCUp was generally consistent between dates and while most readings were within the ANZG 2018 DGV range (314 to 503 µS/cm (**Table 20**)), the May 2024 wet weather event conductivity was much lower (138 µS/cm), and reflective of the freshwater runoff at the time of survey.
- WCUp-S supported the highest dissolved oxygen (DO) levels as indicated by its mean value (71.5 ± 24.2% saturation), and while WCUp-S recorded the overall highest DO concentrations (among all sites) on four of its nine sample events, the DO levels were for the most part, below the ANZG 2018 DGV range of 85 to 110% saturation.
- WCUp was the only site to support moderate to high levels of submerged aquatic vegetation (charophytes) which would have contributed to photosynthetic derived DO levels within the site.
- Water pH was slightly acidic and consistent throughout the monitoring period ranging between 5.1 and 6.6 pH units, most of the which were below the ANZG 2018 DGV range (6.5 to 8.0 pH units). While some of the lowest values were recorded during wet conditions in November 2023 (5.2 pH units) and January 2024 (5.1 pH units), there were no consistent trends regarding water availability.

| Table 20 Wattle Creek Summary Water Quality Statistics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Site | | Temp °C | Cond µS/cm | Sal ppt | DO %sat | DO mg/l | pH Units | Turb ntu |
| ANZG 2018 | | | 125-2200 | | 85-110 | | 6.5-8.0 | 6-50 |
| WCUp-S n=9 | Min | 12.5 | 138 | 0.1 | 41.9 | 3.8 | 5.1 | 0.1 |
| | Max | 28.4 | 503 | 0.3 | 119.4 | 9.4 | 6.6 | 21.8 |
| | Mean | 19.5 | 381.0 | 0.2 | 71.5 | 6.6 | 5.8 | 6.4 |
| | SD | 4.6 | 108.9 | 0.1 | 24.2 | 2.1 | 0.5 | 7.1 |
| | | | | | | | | |
| WCDn-S n=13 | Min | 11.5 | 133 | 0.1 | 14.4 | 1.3 | 5.0 | 0.5 |
| | Max | 27.4 | 2311 | 1.2 | 96.2 | 7.9 | 6.7 | 44.4 |
| | Mean | 19.1 | 1050.1 | 0.5 | 45.2 | 4.2 | 5.9 | 15.5 |
| | SD | 5.2 | 679.5 | 0.3 | 24.0 | 2.2 | 0.5 | 12.2 |
| | | | | | | | | |
| WCDn-B n=13 | Min | 11.1 | 133 | 0.1 | 9.3 | 0.9 | 5.1 | 4.1 |
| | Max | 26.8 | 3347 | 1.7 | 98.9 | 7.9 | 6.7 | 61.1 |
| | Mean | 18.2 | 1506.8 | 0.8 | 35.4 | 3.3 | 6.0 | 21.0 |
| | SD | 4.5 | 943.6 | 0.5 | 27.2 | 2.3 | 0.4 | 15.9 |

- Water turbidity was mostly low at WCUp-S, with the high values associated with wet weather events, and all values were within or below the ANZG 2018 DGV range (6 to 50 NTU).

Downstream Wattle Creek site WCDn is contained among a more conventional channel compared to the upstream site, with distinct banks of generally shallow slope ad continuous, dense riparian vegetation (mostly *Gahnia*) along the bank edges. Water quality at WCDn varied between the surface and bottom samples for some survey events, where notable reductions in conductivity or DO were observed:

- The WCDn water temperature range was similar to WCUp but slightly lower in terms of each of the other temperature summary statistics (**Table 20**, **Figure 108**), and the only occasion where a notable difference was recorded between depth readings was for the summer January 2023 sample event where a reduction of 4.3°C was observed between surface (27.4°C) and bottom (23.1°C) waters.
- Water conductivity values at WCDn were highly variable, being generally higher for the dry survey events. The largest decreases in conductivity were observed for the October 2022 metering event where the bottom waters (3347 µS/cm) were 6.6 times higher than the surface waters (508 µS/cm), in January 2024 where bottom waters (1516 µS/cm) were 3.1 times higher than the surface waters (492 µS/cm), and March 2023 where bottom waters (2609 µS/cm) were 2.1 times higher than the surface waters (1261 µS/cm). In contrast, there were negligible differences for the

wet weather events in November 2023 (355 µS/cm for surface and bottom readings) and May 2024 (133 µS/cm for surface and bottom readings).

- With regards to the ANZG 2018 DGV range for conductivity, there was one value for the surface sample which exceeded the range (dry survey on November 27th, 2023), and three occasions where bottom samples exceeded the range (October 2022, March 2023 and November 27th 2023).
- Dissolved oxygen levels at WCDn were low to moderate (< 50 % saturation) for most dates. Except for the wet weather event, sampling in November 2023 and May 2024, where WCDn recorded its highest DO levels which were almost identical to WCUp, WCDn site supported much lower DO levels throughout the depth profile when compared to WCUp for the same dates.
- When comparing DO levels throughout the water column, there were notable reductions in DO in January 2023 between surface (43.6% sat) and bottom (23.4% sat), in March 2023 between surface (41.4% sat) and bottom (10.0% sat), and in January 2024 between surface (48.5% sat) and bottom (12.1% sat).
- The November 27th, 2023, date was the only occasion where DO values fell within the ANZG 2018 DGV range, for both surface and bottom samples (96.2 and 98.9% sat respectively).
- Water pH was similar to WCUp with a mean value of 5.9 ± 0.5% pH units at WCDn-S (surface readings) and 6.0 ± 0.4 pH units for WCDn-B (bottom readings).
- There were no consistent trends regarding depth profiling on a survey-to-survey basis, which was mixed between both increases and decreases in water pH values with depth over consecutive surveys. While most of the pH results at WCDn were below the ANZG 2018 DGV range, the surface and bottom readings recorded on November 27th, 2023 (6.68 and 6.72 pH units respectively) were the only results to fall within the DGV range.
- Water turbidity at WCDn was highly variable between sample dates. The elevated sample value for the bottom reading in January 2023 (61.1 NTU) would likely have resulted from the probe coming into contact with the bottom sediments, as the surface and middle readings were much lower (at 27.3 and 29.0 NTU respectively). Notwithstanding, the turbidity values were higher at WCDn compared to WCUp for all but two occasions (the March and May 2024 sample events).

### 5.2.2. Downs Creek

**Table 21** summarises Downs Creek Water Quality results. Note that the summary does not include readings recorded during the initial pilot study ASU deployment date (18/10/22) as the Downs Creek site locations were moved upstream following the pilot ASU deployment period. In parallel with the ASU sample deployment, both surface and

bottom water quality depth readings were recorded owing to the available depths at both the upstream and downstream Downs Creek monitoring sites.

**Table 21 Downs Creek Summary Water Quality Statistics**

| Site | | Temp °C | Cond µS/cm | Sal ppt | DO %sat | DO mg/l | pH Units | Turb ntu |
|---|---|---|---|---|---|---|---|---|
| ANZG 2018 | | | 125-2200 | | 85-110 | | 6.5-8.0 | 6-50 |
| DCUp-S n=12 | Min | 11.4 | 96 | 0.0 | 34.7 | 3.2 | 5.0 | 1.3 |
| | Max | 24.5 | 1331 | 0.7 | 99.1 | 10.8 | 7.7 | 24.9 |
| | Mean | 19.0 | 654.8 | 0.3 | 65.5 | 6.2 | 6.6 | 11.2 |
| | SD | 4.6 | 376.6 | 0.2 | 19.4 | 2.2 | 0.8 | 7.7 |
| | | | | | | | | |
| DCUp-B n=12 | Min | 11.0 | 98 | 0.0 | 12.2 | 1.1 | 5.1 | 1.4 |
| | Max | 21.6 | 1784 | 0.9 | 93.6 | 10.0 | 7.7 | 23.3 |
| | Mean | 17.5 | 812.0 | 0.4 | 48.5 | 4.8 | 6.6 | 11.8 |
| | SD | 3.6 | 491.1 | 0.3 | 28.2 | 3.0 | 0.7 | 8.2 |
| | | | | | | | | |
| DCDn-S n=11 | Min | 11.7 | 89 | 0.0 | 12.7 | 1.2 | 4.9 | 8.6 |
| | Max | 22.1 | 791 | 0.4 | 92.5 | 9.1 | 6.7 | 69.2 |
| | Mean | 17.3 | 359.1 | 0.2 | 47.1 | 4.6 | 5.7 | 21.7 |
| | SD | 3.8 | 182.4 | 0.1 | 25.1 | 2.7 | 0.6 | 17.1 |
| | | | | | | | | |
| DCDn-B n=11 | Min | 10.7 | 92 | 0.0 | 6.2 | 0.6 | 4.9 | 8.8 |
| | Max | 19.2 | 807 | 0.4 | 92.3 | 9.1 | 6.8 | 68.8 |
| | Mean | 16.3 | 414.5 | 0.2 | 36.2 | 3.6 | 6.0 | 28.6 |
| | SD | 3.2 | 203.3 | 0.1 | 27.7 | 2.8 | 0.7 | 19.4 |

Site DCUp is located just downstream from Culburra Rd pipe culvert and is one of the most permanent aquatic habitats among the monitoring sites. The pool shape is relatively broad and deep compared to channel sections downstream, with moderate coverage provided by riparian vegetation:

- The surface and bottom water temperatures were generally consistent with WCDn and were marginally higher for the surface water readings compared to the bottom samples. The largest decreases in temperature between surface and bottom waters at DCUp were in January 2023 (3.5°C) and in January 2024 (3.9°C).
- In January 2023 there was a marked 3.3-fold increase between the surface water conductivity reading (548 µS/cm) and bottom reading (1784 µS/cm) at DCUp, yet for the most part, there were no substantial differences in conductivity levels between surface and bottom readings with most surveys recording less than 100 µS/cm difference. Notwithstanding, all conductivity readings were within the ANZG 2018 DGV range.

- The DO levels at DCUp surface (DCUp-S) were relatively high compared to most other sites and occasions (**Figure 106**, and as noted for the Wattle Creek sites, instances where there were reductions (depletions) of oxygen with depth were confined to the warmer months.
- Over all sample dates, the largest differences were observed in December 2022 between surface (52.3% sat) and bottom (26.6% sat) readings, January 2023 between surface (40.6% sat) and bottom (12.2% sat), in March 2023 between surface (73.8% sat) and bottom (34.9% sat), and in January 2024 between surface (64.1% sat) and bottom (12.4% sat).
- The DCUp DO levels were within the ANZG 2018 DGV range on only two occasions; in July 2023 (90.9 to 99.1% sat) and during the May 2024 wet weather event (93.6 to 94.2% sat). For each of the other surveys the DO levels for both surface and bottom samples were below ANZG 2018 DGV range.
- Water pH values at DCUp were mildly acidic to alkaline and were the overall highest when compared to the other monitoring sites (**Figure 107**). On most sample dates depth profiling showed minor increases between the surface and bottom readings.
- The pH levels at DCUp recorded during the wet periods in November 2023, January and May 2024 were the overall lowest (<5.9 pH units), with all the sample readings recorded post November 2023 were below the ANZG 2018 DGV range.
- Water turbidity results were generally low for both surface and bottom samples (<25 NTU) and were below the upper limit of the ANZG 2018 DGV range.

Downs Creek downstream site DCDn is located in a channelised section of creek below the confluence of two sub-catchment branches and dries up quicker than the upstream site DCUp (drying completely on one occasion for the November 27$^{th}$, 2023, survey). The site comprises a narrow meandering channel with dense riparian vegetation (particularly *Gahnia*) providing shade over the site pools:

- Compared to DCUp, the water temperatures at DCDn were marginally lower for both surface and bottom readings for 10 of the 11 surveys, which are reflected in the comparisons of the mean temperature values for surface (17.3 ± 3.8°C) and bottom (16.3 ± 3.2°C) readings provided in **Table 21** above. The largest decrease in temperature between surface and bottom waters at DCDn was in December 2022 (3.3°C) however for the remainder of profiles there were no major differences.
- Water conductivity values were relatively low compared to DCUp and Wattle Creek downstream site WCDn (**Figure 108**), with a maximum conductivity value of 807 µS/cm recorded for the DCDn bottom sample in January 2023. The most significant increase in conductivity between surface and bottom waters was in

December 2022 and was relatively minor compared to other sites, where there was a difference of 210 µS/cm recorded between the surface (438 µS/cm) and bottom (638 µS/cm).

- The DCDn conductivity for the May 2024 wet weather event (range of 89 to 92 µS/cm) were the only values outside the ANZG 2018 DGV range of 125 to 2200 µS/cm.
- As noted for other sites where surface and bottom results within sites were compared, the DO concentrations of bottom waters at DCDn were on average lower than surface waters (**Table 21**, **Figure 108**). While there were negligible differences (between surface and bottom readings) for most surveys, these differences were attributable reductions in DO in December 2022 between surface (35.7% sat) and bottom (10.5% sat), in June 2023 between surface (80.3% sat) and bottom (43.0% sat), and in January 2024 between surface (35.8% sat) and bottom (10.9% sat).
- The June surface reading and the May 2024 wet weather profile results (92.3 to 92.5% sat) were the only DO concentrations that fell within ANZG 2018 DGV range of 85 to 110% saturation at DCDn, all the other values were below the range.
- Dissolved oxygen levels at DCDn for the March 23rd, 2023, date were extremely low throughout the water column (12.7% sat at the surface to 6.2% sat at the bottom).
- The DCDn surface water pH results were the lowest among the Downs Creek samples (**Figure 108**), and for the most part, increased with increasing depth throughout the profile and being highest for the bottom sample. While only one of the surface readings fell within the range of the ANZG 2018 DGV range, four of the bottom samples were within the range.
- Turbidity results at DCDn were highly variable between consecutive surveys and were the second highest among the six monitoring sites.

### 5.2.3. South Creek

**Table 22** summarises South Creek Water Quality results. South Creek upstream site SCUp contains physical attributes consistent with the upstream Wattle Creek site WCUp; it is contained in a swampy area comprising a broad and flat (generally shallow) channel basin with dense vegetation occupying parts of the site pool (*Gahnia*), however there is a higher degree of coverage over the pool area provided by overhanging riparian vegetation. As a result of the shallow and broad pool basin, surface water dries up over extended periods of dry weather, such as that encountered for the September and November (27th) 2023 survey events.

| Table 22 South Creek Summary Water Quality Statistics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Site | | Temp °C | Cond µS/cm | Sal ppt | DO %sat | DO mg/l | pH Units | Turb ntu |
| ANZG 2018 | | | 125-2200 | | 85-110 | | 6.5-8.0 | 6-50 |
| SCUp-S n=11 | Min | 10.4 | 150 | 0.1 | 16.9 | 1.6 | 4.6 | 10.4 |
| | Max | 24.1 | 327 | 0.3 | 100.7 | 9.3 | 6.2 | 75.8 |
| | Mean | 17.6 | 235.0 | 0.1 | 39.3 | 3.8 | 5.6 | 37.5 |
| | SD | 4.3 | 58.1 | 0.1 | 26.0 | 2.5 | 0.4 | 22.2 |
| | | | | | | | | |
| SCDn-S n=11 | Min | 11.1 | 105 | 0.0 | 28.1 | 2.2 | 4.7 | 1.3 |
| | Max | 24.8 | 16470 | 9.6 | 93.0 | 9.3 | 6.8 | 54.1 |
| | Mean | 19.1 | 3608.5 | 2.0 | 62.6 | 5.9 | 5.5 | 18.6 |
| | SD | 4.5 | 5367.1 | 3.1 | 17.6 | 1.9 | 0.6 | 20.0 |
| | | | | | | | | |
| SCDn-B n=11 | Min | 11.2 | 105 | 0.0 | 3.6 | 0.3 | 4.4 | 1.5 |
| | Max | 23.2 | 22300 | 13.4 | 91.8 | 9.2 | 7.0 | 85.2 |
| | Mean | 18.2 | 6560.4 | 3.8 | 44.8 | 4.3 | 5.5 | 17.5 |
| | SD | 4.1 | 8616.0 | 5.2 | 25.9 | 2.8 | 0.8 | 24.9 |

As for WCUp, the ability for layering to occur and subsequently measure by depth profiling was limited by the shallowness of the site:

- Compared to surface samples at WCUp, the water temperatures recorded throughout the monitoring period were relatively low at SCUp-S (**Figure 108**).
- SCUp-S recorded the overall lowest range of conductivity values compared to all other sites (150 to 327 µS/cm) and were therefore within the ANZG 2018 DGV range (125 to 2200 µS/cm) for lowland rivers. As noted for the other sites, the lower conductivity values were associated with wet weather events (185 µS/cm in November 2023 and 150 µS/cm May 2024).
- With the exception of the wet weather survey records for November 2023 (100.7% sat) and May 2024 (64.9 to 73.0% sat), the DO levels at SCUp-S were among the lowest of the study sites and were below ANZG 2018 DGV range.
- The depth profile undertaken at SCUp in October 2022 for surface (41.7% sat) and bottom (5.3% sat at 0.4m depth) readings indicated that anoxic zones occurred near the water sediment interface.
- Site SCUp-S recorded the lowest mean pH over all surface sample sites (at 5.6 ± 0.4 pH units) and the highest turbidity (37.5 ± 2.2 NTU) which was highly variable between survey events. All the SCUp pH results were below the ANZG 2018 DGV range (**Table 22**).

Downstream South Creek monitoring site SCDn was in an incised channel with gently sloping banks. While the section of South Creek is subjected to saline groundwater inputs when Lake Wollumboola water levels are low, the site would have been interacting (mixing) with backed up lake water from Lake Wollumboola during the prolonged lake filling event from at least late December 2023 to early May 2024. Note that the summary Boxplot **Figure 108** does not include the upper limits of the SCDn-S and SCDn-B conductivity results as the scale was too high. As for SCUp, the SCDn was dry on two occasions (September and November 2023):

- Water temperatures were for the most part, consistent with other sites on a survey-to-survey basis, however the temperatures were slightly elevated during periods of lake water inundation in January and March 2024, reaching 24.8 and 22.2°C respectively for surface water readings.
- Water conductivity was highly variable owing both to the groundwater salinity contribution and lake water mixing in the latter stages of the 18-month period, and as a result SCDn recorded the highest overall mean values with considerable variation for the surface (3608.5 ± 5367.1 µS/cm) and bottom (6560.4 ± 8616.0 µS/cm) samples (**Table 22**).
- In addition to the wet weather monitoring event in May 2024 (105 to 106 µS/cm), the three metering occasions from March to June 2023 period recorded relatively low conductivity values (911 to 1487 µS/cm).
- The remainder of depth profiles documented some significant increases in conductivity between surface and bottom waters:
    - In October 2022 there were significant increases in conductivity values from the surface (541 µS/cm) to the bottom (15130 µS/cm or 8.8 ppt salinity) with regular increases in conductivity levels over successive depth increments throughout the depth profile (full results provided in **Appendix F**). There was no direct connection with Lake Wollumboola at the time of metering as the lower section of South Creek (below SCDn) was discharging streamflow's downstream.
- The overall highest conductivity values were recorded during the period of connection with Lake Wollumboola in January 2024 (11730 µS/cm at surface to 21420 µS/cm at the bottom) and March 2024 (16470 µS/cm to 22300 µS/cm) where water quality at SCDn would have reflected the mixing of lake waters and residual catchment sourced freshwater contributions from upstream.
- Dissolved oxygen levels at SCDn surface (SCDn-S) were relatively high compared to SCDn-B and most other sites (**Figure 108**), owing to consistent records of relatively high DO levels throughout the monitoring period when other sites were displaying fluctuating DO levels on a survey-to-survey basis. Notwithstanding, the

wet weather event in May 2024 was the only occasion where DO levels were within the ANZG 2018 DGV range (91.8 to 93.0% sat).

- Compared to the other monitoring sites, SCDn recorded some of the largest decreases in DO levels between surface and bottom waters, which occurred mostly during the warmer months. The largest differences were observed in December 2022 between surface (50.0% sat) and bottom (3.6% sat) in March 2024 between surface (80.5% sat) and bottom (30.6% sat).
- Despite the connection with Lake Wollumboola lake waters (saltwater has higher pH of around 8.1 to 8.2 pH units), SCDn recorded the overall lowest pH values with mean values of 5.5 ± 0.6 pH units (SCDn-S) and 5.5 ± 0.8 pH units (SCDn-B) (**Table 22**, **Figure 108**). In contrast to other sites, there was a decrease in pH values with depth for most surveys, the most notable in December 2022 between surface (6.21 pH units) and bottom (5.72 pH units) and November (28$^{th}$) 2023 between surface (5.09 pH units) and bottom (4.56 pH units), however for the surveys with lake connection there was an increase observed between surface (5.62 pH units) and bottom (6.35 pH units) for the March 29024 survey.
- Water turbidity results were variable between surveys, this was reflected in the high stand deviation values for SCDn-S and SCDn-B (**Table 22**).

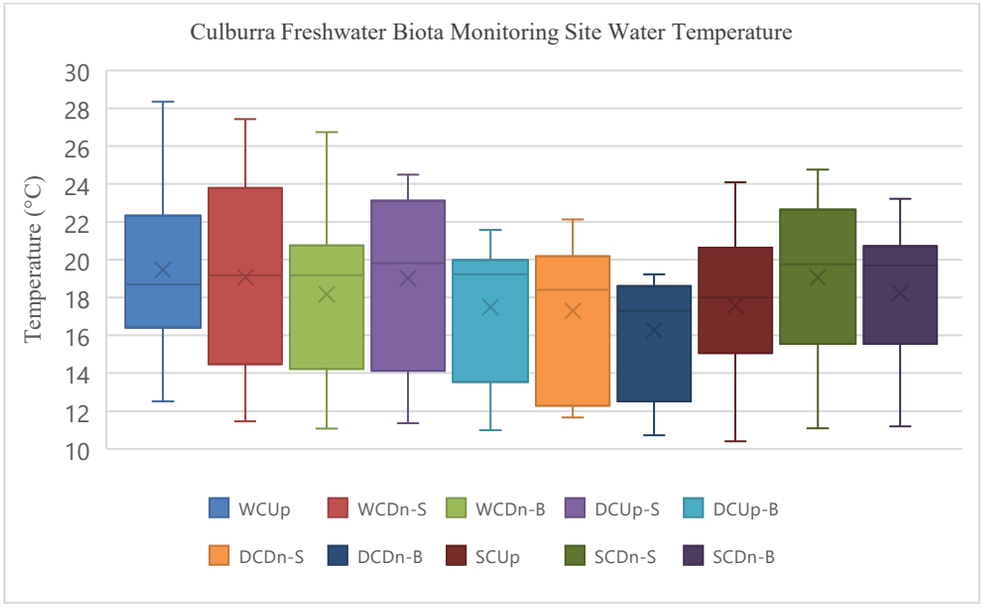



**Figure 108A** Freshwater site surface and bottom temperature boxplot results.

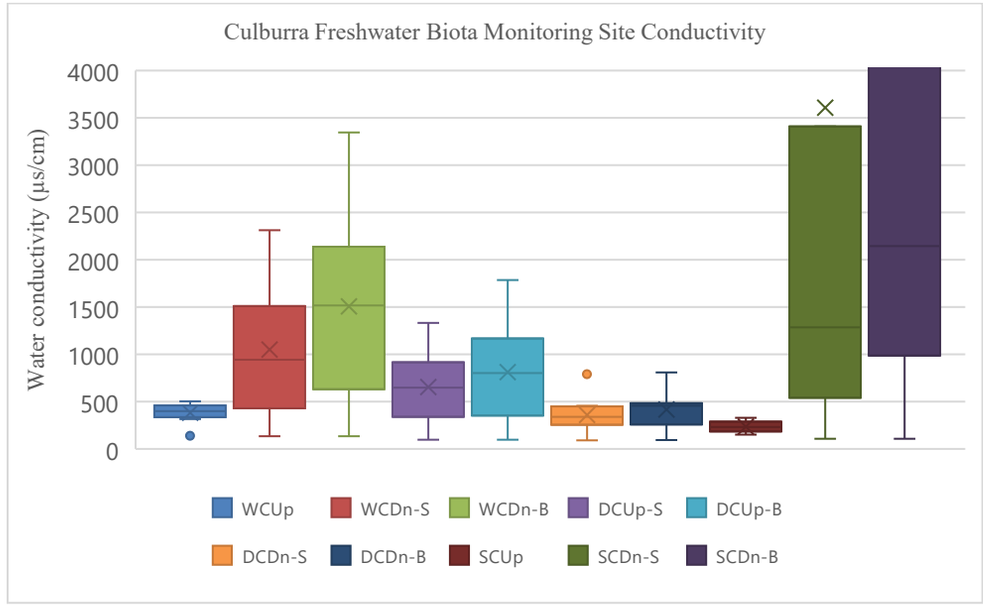



**Figure 108B** Freshwater monitoring site surface & bottom DO boxplot results.

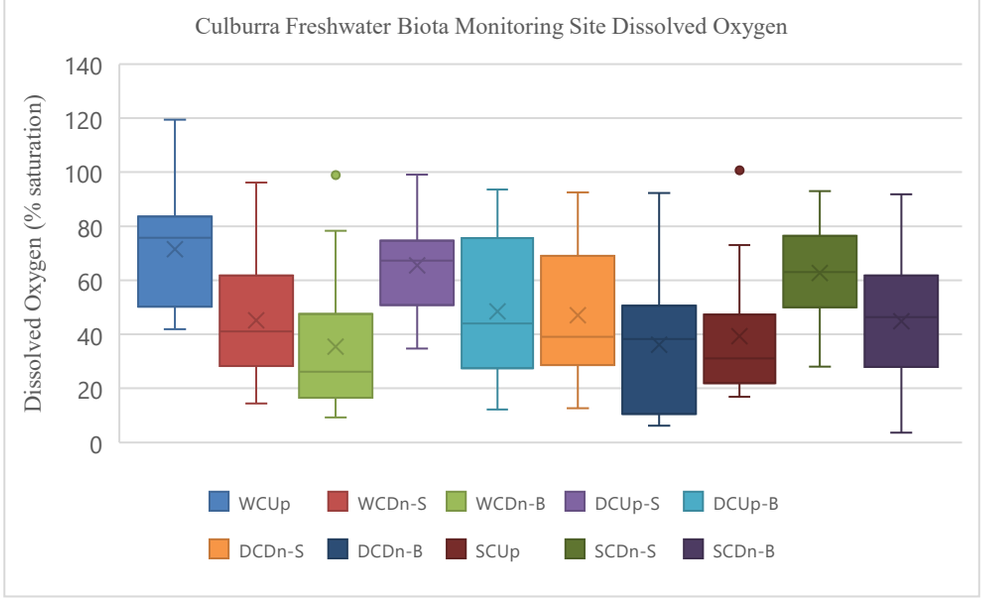



**Figure 108C** Freshwater monitoring site surface and bottom DO boxplot results

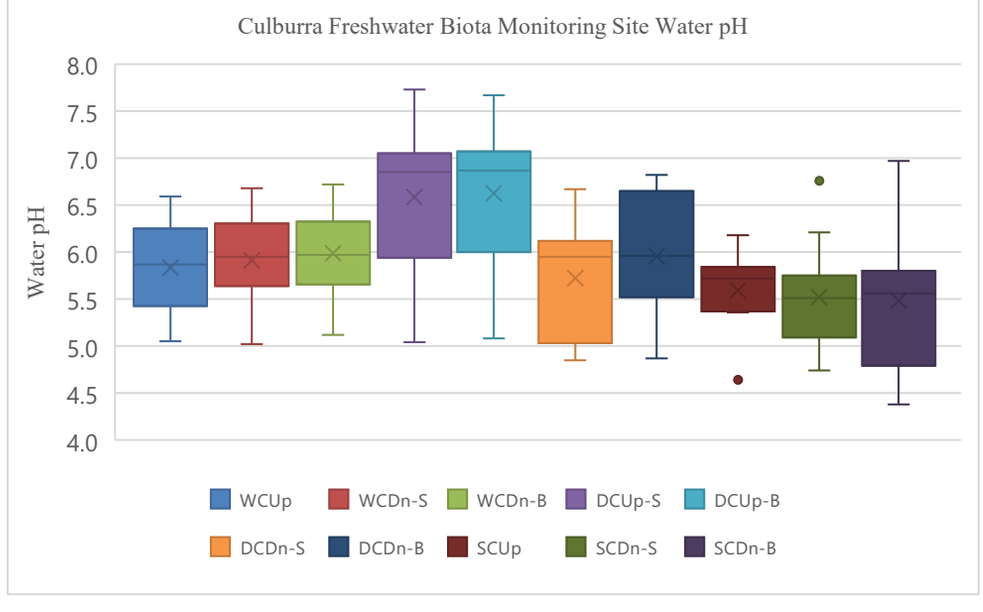



**Figure 108D** Freshwater monitoring site surface & bottom DO boxplot results.

## 5.3. Culburra ASU Macroinvertebrate Monitoring Results

The full ASU macroinvertebrate taxa abundance and diversity (richness) results for the six seasonal surveys are provided in **Appendix F** with an overall summary in **Section 5.3.1** below. The ASU seasonal deployment periods are shown in **Table 19** above and **Sections 5.3.2** to **5.3.4** provide summaries of the results for Wattle Creek, Downs Creek and South Creek, and include the individual site mean ASU macroinvertebrate taxa abundance and diversity (richness), where the mean values are calculated from three replicates per site for each survey, and include standard error (± SE) values as a measure of variation between replicates.

### 5.3.1. Overview of Sampling Results

**Table 23** and Figure below provides an overview of the complete monitoring term ASU macroinvertebrate results, broken down according to each Seasonal Survey period with the macroinvertebrate abundance and diversity (richness) data presented for combined creek results and individual site results. Note that the individual site data are a combination of the three replicate samples processed for each survey occasion.

A total of 194 ASU replicate samples were collected and there were empty samples for Wattle Creek upstream site WCUp in Seasons 1, 3 and 4, for South Creek site SCUp in Season 4 (dry). Downstream Wattle Creek site WCDn Season 6 ASU samples would have been subjected to backed up saline lake water for at least four weeks duration between April 7$^{th}$ and May 5$^{th}$, 2024, and most of the SCDn Season 5 and Season 6 (excluding the final three weeks) ASU samples would also have been subjected to backed up saline water.

A total of 11,105 invertebrate specimens comprising 23 macroinvertebrate taxa were counted from the 194 ASU samples collected from the six creek sites over the study period (pilot period and Seasons 1 to 6). Overall, the ASU macroinvertebrate results varied with respect to location and deployment survey:

- The were considerable differences in the number and diversity of macroinvertebrates recorded between surveys, which ranged from 412 specimens (comprising only five macroinvertebrate taxa) in Season 2 to 3059 specimens (12 taxa) in Season 4 (**Table 23**).
- Nine of the 194 replicate samples didn't contain any specimens, all were bottom samples retrieved from Downs and South Creeks.
- A total of 37% of the samples supported less than 10 specimens and 70% of the overall samples contained 3 taxa or less.

## Table 23 Culburra Freshwater Monitoring ASU Macroinvertebrate Summary Results

| | | | Wattle Creek | | | Downs Creek | | | | South Creek | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WCUp-S | WCDn-S | WCDn-B | *DCUp-S | *DCUp-B | *DCDn-S | *DCDn-B | SCUp | SCDn-S | SCDn-B | Total |
| **Pilot** | **Creek** | Total Abundance | | 1511 | | | 45 | | | | 253 | | 1809 |
| | | Total Diversity | | 11 | | | 8 | | | | 12 | | 18 |
| | **Sample** | Total Abundance | 169 | 1325 | 17 | 28 | | 12 | 5 | 33 | 110 | 110 | |
| | | No. of taxa | 9 | 5 | 2 | 5 | | 4 | 1 | 7 | 8 | 3 | |
| | | Chironominae % | 2% | 99% | 88% | 71% | | 0% | 100% | 42% | 46% | 88% | 84% |
| | | | WCUp | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp-S | SCDn-S | SCDn-B | Total |
| **Term 1** | **Creek** | Total Abundance | | 1048 | | | 491 | | | | 289 | | 1828 |
| | | Total Diversity | | 6 | | | 9 | | | | 12 | | 15 |
| | **Sample** | Total Abundance | Dry | 766 | 282 | 339 | 1 | 146 | 5 | 97 | 141 | 51 | |
| | | No. of taxa | Dry | 4 | 5 | 6 | 1 | 6 | 2 | 8 | 8 | 5 | |
| | | Chironominae % | Dry | 99% | 99% | 94% | 100% | 89% | 60% | 82% | 77% | 69% | 94% |
| | | | WCUp-S | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp-S | SCDn-S | SCDn-B | Total |
| **Term 2** | **Creek** | Total Abundance | | 127 | | | 216 | | | | 69 | | 412 |
| | | Total Diversity | | 3 | | | 4 | | | | 2 | | 5 |
| | **Sample** | Total Abundance | 42 | 66 | 19 | 32 | 150 | 11 | 23 | 28 | 34 | 7 | |
| | | No. of taxa | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | |
| | | Chironominae % | 98% | 98% | 100% | 81% | 100% | 91% | 96% | 71% | 76% | 86% | 93% |
| | | | WCUp-S | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp-S | SCDn-S | SCDn-B | Total |
| **Term 3** | **Creek** | Total Abundance | | 1157 | | | 225 | | | | 312 | | 1694 |
| | | Total Diversity | | 7 | | | 11 | | | | 9 | | 15 |
| | **Sample** | Total Abundance | Dry | 503 | 654 | 56 | 98 | 50 | 21 | 25 | 189 | 98 | |
| | | No. of taxa | Dry | 6 | 5 | 4 | 7 | 7 | 5 | 4 | 7 | 3 | |
| | | Chironominae % | Dry | 98% | 99% | 91% | 91% | 68% | 81% | 88% | 83% | 94% | 94% |
| | | | WCUp-S | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp-S | SCDn-S | SCDn-B | Total |
| **Term 4** | **Creek** | Total Abundance | | 2544 | | | 365 | | | | 150 | | 3059 |
| | | Total Diversity | | 9 | | | 15 | | | | 10 | | 12 |
| | **Sample** | Total Abundance | Dry | 1487 | 1057 | 246 | 53 | 33 | 33 | Dry | 61 | 89 | |
| | | No. of taxa | Dry | 5 | 4 | 5 | 1 | 5 | 4 | Dry | 6 | 4 | |
| | | Chironominae % | Dry | 92% | 92% | 90% | 100% | 76% | 82% | Dry | 82% | 88% | 92% |
| | | | WCUp | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp | SCDn-S | SCDn-B | Total |
| **Term 5** | **Creek** | Total Abundance | | 470 | | | 145 | | | | 28 | | 643 |
| | | Total Diversity | | 9 | | | 6 | | | | 5 | | 11 |
| | **Sample** | Total Abundance | 200 | 265 | 5 | 96 | 30 | 16 | 3 | 21 | 7 | 0 | |
| | | No. of taxa | 9 | 4 | 1 | 5 | 1 | 3 | 2 | 3 | 3 | 0 | |
| | | Chironominae % | 72% | 98% | 100% | 75% | 100% | 75% | 33% | 90% | 43% | 0% | 85% |
| | | | WCUp | WCDn-S | WCDn-B | DCUp-S | DCUp-B | DCDn-S | DCDn-B | SCUp | SCDn-S | SCDn-B | Total |
| **Term 6** | **Creek** | Total Abundance | | 766 | | | 407 | | | 487 | | | 1660 |
| | | Total Diversity | | 11 | | | 9 | | | 10 | | | 16 |
| | **Sample** | Total Abundance | 595 | 159 | 12 | 67 | 243 | 58 | 39 | 253 | 117 | 117 | |
| | | No. of taxa | 11 | 2 | 1 | 4 | 6 | 7 | 5 | 6 | 7 | 4 | |
| | | Chironominae % | 48% | 97% | 100% | 69% | 91% | 53% | 56% | 66% | 15% | 9% | 58% |
| **Note:** | *For the pilot term the Downs Creek sites were located further downstream. | | | | | | | | | | | | |

- Over the Survey 1 to 6 monitoring period, the Wattle Creek sites recorded the highest macroinvertebrate abundance with 66% of the specimens collected, compared to 20% from Downs Creek and 14% from the South Creek sites.
- With regards to creek abundances for individual surveys, the Wattle Creek samples recorded 84% of the 1809 specimens collected in pilot study, and 83% of the 3059 specimens collected in Season 4 (all from WCDn as WCUp was dry). In contrast, there were only 45 specimens (or 2% of the 1809 total) recorded from Downs Creek for the pilot study (prior to re-locating the site for Survey 1), however the abundance varied between 12% (Season 4) and 52% (Season 2) over the remainder of the monitoring period. The macroinvertebrate abundance from the South Creek sites was also variable and ranged between 4% (Season 5) and 29% (Season 6) of the total abundance.
- With regards to depth, for the deeper sites with both surface and bottom sample ASUs (WCDn, DCUp, DCDn and SCDn) the surface samples often contained the highest abundance of macroinvertebrates compared to bottom samples, and between Surveys 1 and 6, the surface samples supported 68% of the total abundance. For the pilot study, there was also a large difference in abundance between the Wattle Creek site WCDn surface sample (1325 individuals) and bottom sample (17 individuals).

For macroinvertebrates colonising ASU's, the following are relevant:

- There were only two EPT taxa recorded over all samples, and they included mayfly family Leptophlebiidae (*Atalophlebia*) and caddis-fly family Leptoceridae (including *Leptorussa* and *Lectrides*). The EPT diversity (richness) is the number of insect families belonging to the Orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) that are present in a sample. While members of these groups tend to be sensitive to pollution and other disturbances (making them a useful indicator of instream health), both genera recorded from the study sites are regarded as relatively tolerant to pollution and capable of occupying ephemeral streams
- The pilot study period contained the overall highest diversity with 18 of the 23 taxa present, and the Season 6 diversity was also relatively high with 16 taxa.
- The overall combined assemblage was dominated by insects (fly larvae, beetles, dragonfly and damselfly larvae, caddis-flies and mayflies) with 15 taxa, and the remainder being made up of five crustaceans (copepods, water fleas and seed shrimps), freshwater mites, worms and limpets.
- The bloodworm (or midge-fly larvae) sub-family Chironominae were by far the dominant taxa making up 86% of the total abundance and occurring in 178 of the 194 replicate samples.

- Overall, the macroinvertebrate community abundance colonising the ASU samples were dominated by five taxa which accounted for 96% of the total specimens collected, however except for bloodworms, these taxa were recorded from less than one quarter of all replicate samples. These included Chironominae, bloodworm sub-family Tanypodinae, seed shrimps (Ostracoda) and copepod families Cyclopidae and Centropagidae.
- Some of the ASU replicate bottom samples contained no specimens (two reps from DCUp-B and one rep from DCDn-B Season 1, one rep from SCDn-B Season 2, one rep from DCDn-B and all three from SCDn-B in Season 5), or very small abundance values (<10 specimens) of only one taxa.

### 5.3.2. Wattle Creek ASU macroinvertebrate results

The Wattle Creek site mean macroinvertebrate taxa abundance and diversity (richness results are shown below in **Figure 109**.

Note that there were no samples analysed at WCUp in Seasons 1, 3 and 4 (dry), and downstream Wattle Creek site WCDn Survey 6 ASU samples would have been subjected to backed up saline lake water for at least four weeks duration between April 7$^{th}$ and May 5$^{th}$, 2024.

### 5.3.3. Downs Creek ASU macroinvertebrate results

Downs Creek site mean macroinvertebrate taxa abundance and diversity (richness results are shown below in **Figure 1010**. Following the pilot study deployment period (October 2022 to December 2022), the site locations for both Downs Creek sites were moved upstream.

### 5.3.4. South Creek ASU macroinvertebrate results

The South Creek site mean macroinvertebrate taxa abundance and diversity (richness results are shown below in **Figure 111**. Note that there were no samples analysed at the upstream site SCUp in Season 4 (dry), and there were only 2 replicates processed for SCUp for the pilot study as one replicate sample was lost during deployment. Most of the SCDn Survey 5 and Survey 6 (excluding the final three weeks) ASU samples would have been subjected to saline lake water backed up from Lake Wollumboola.

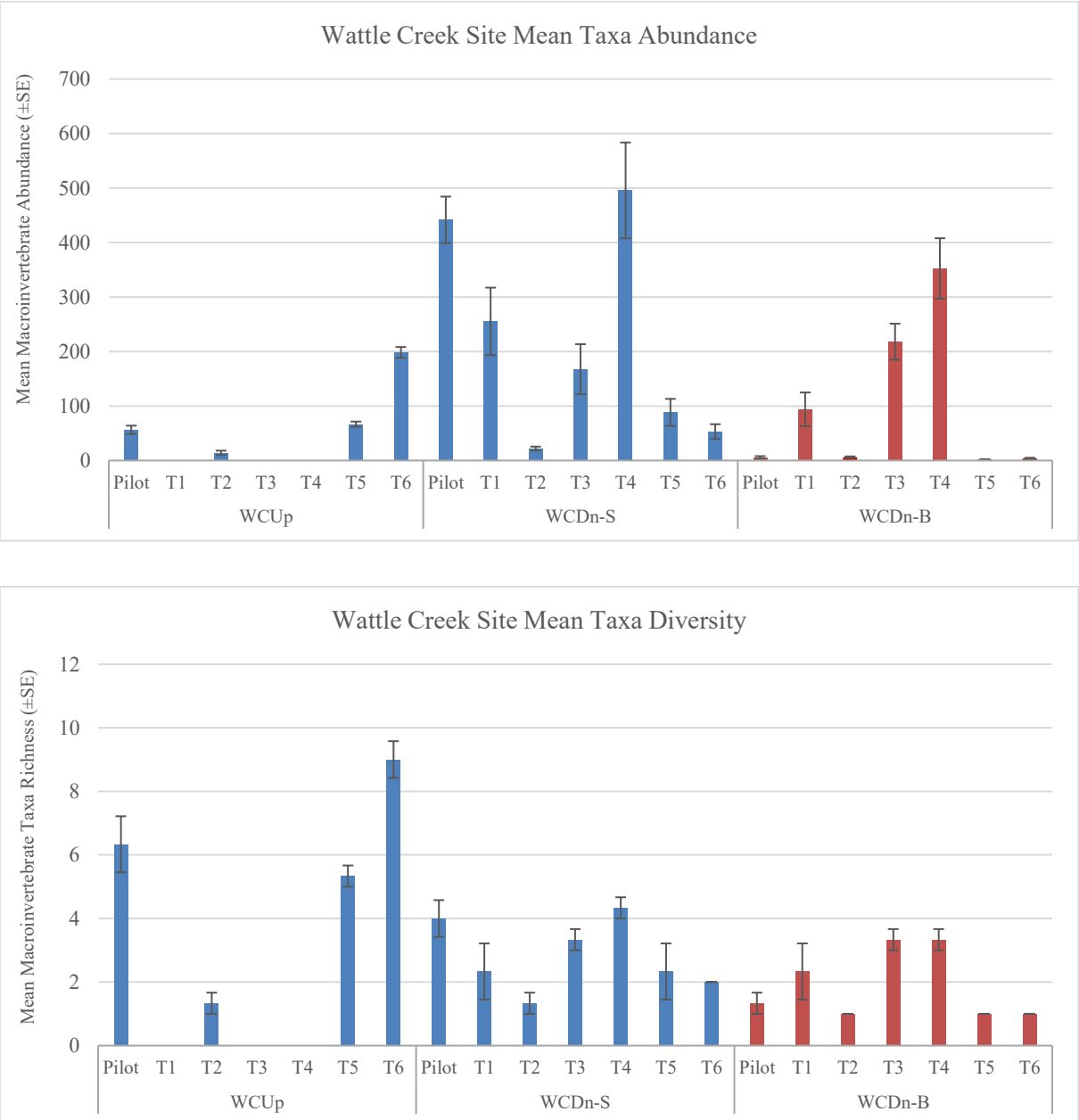



**Figure 109** Wattle Creek Mean Taxa Abundance and Diversity over six seasonal surveys

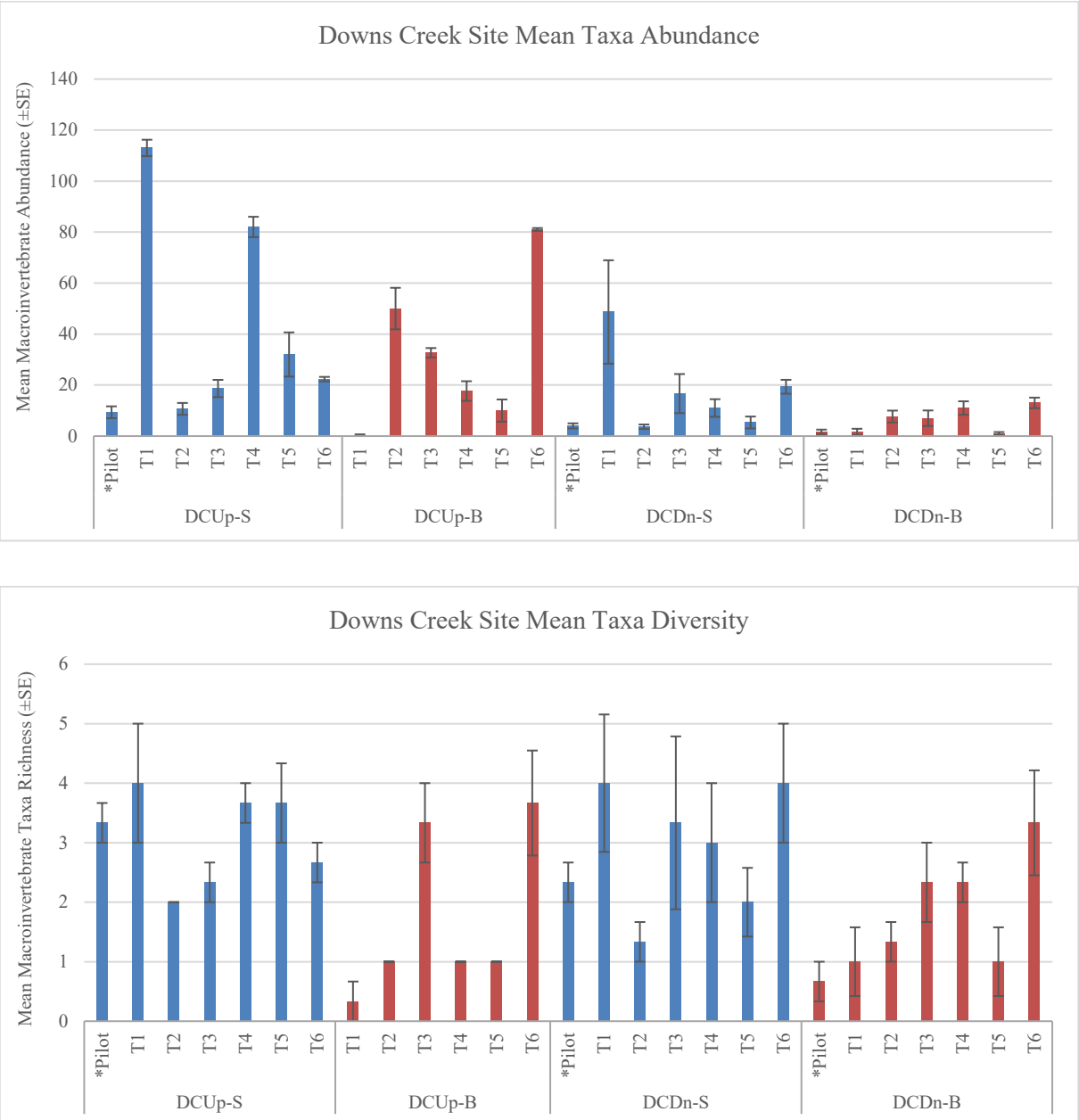
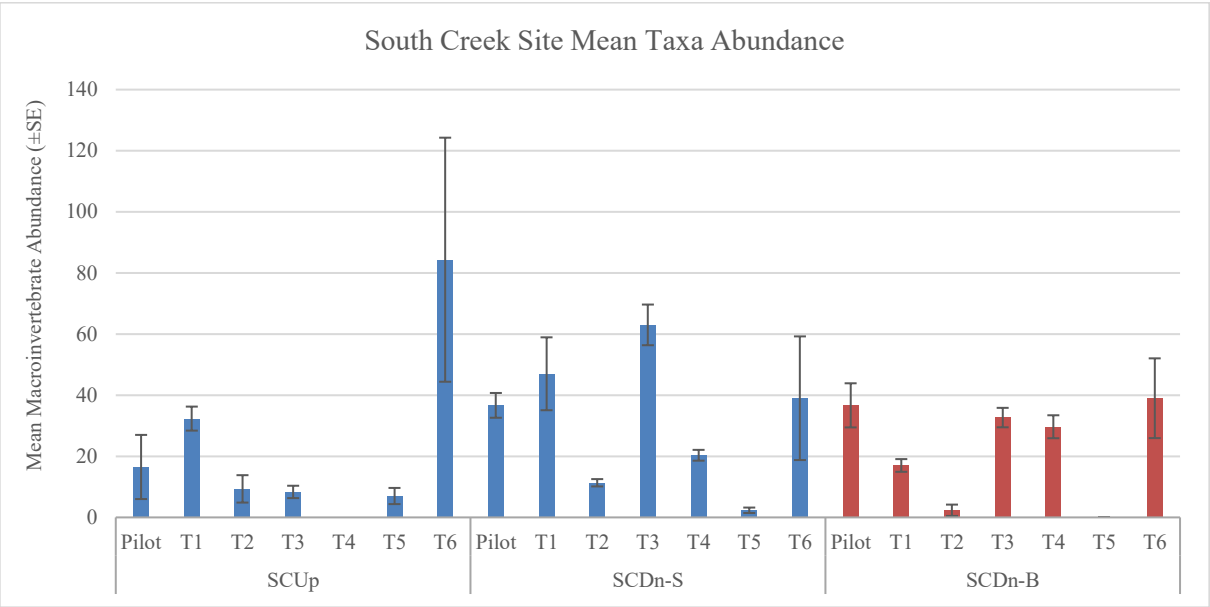



**Figure 110** Downs Creek Mean Taxa Abundance and Diversity over six seasonal surveys



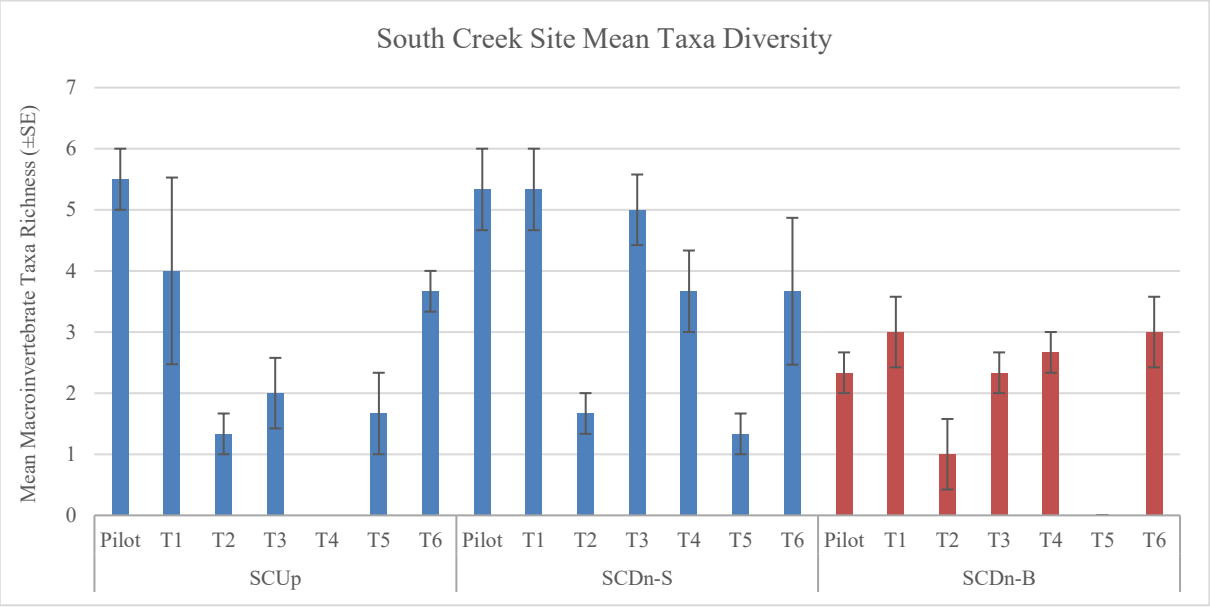




**Figure 111** Wattle Creek Mean Taxa Abundance and Diversity over six seasonal surveys

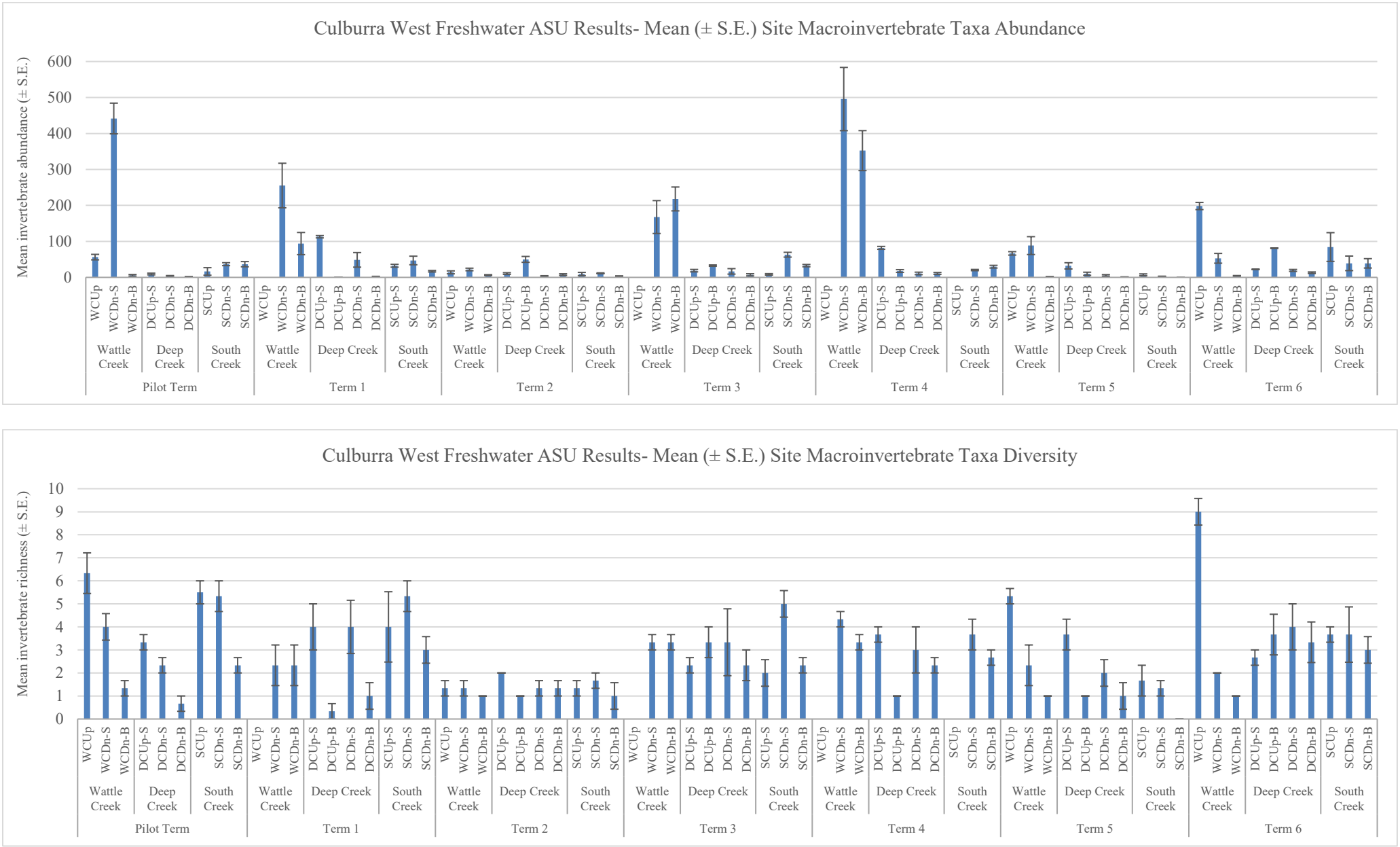



**Figure 112** Combined Abundance and Diversity Results for all sites over the Pilot plus six seasonal surveys.

### 5.4. Electrofishing Monitoring Program

Electrofishing was undertaken in the same creek locations as ASU's were deployed, with two sites (an upstream and downstream site) in each of Wattle, Downs and South Creeks. The electrofishing sample dates are shown in **Table 19** above and the complete electrofishing results for Surveys 1 to 6 are provided in **Appendix F.**

**Table 24** shows electrofishing effort over Surveys 1 to 6. Wattle Creek site WCUp was the most frequently dry site (Season 2 to 4) and DCDn plus both South Creek sites were dry for Seasons 3 and 4.

**Table 24 Culburra Electrofishing Sample Effort- Number of Samples per Term**

| | Wattle Creek | | Downs Creek | | South Creek | |
|---|---|---|---|---|---|---|
| | WCUp | WCDn | DCUp | DCDn | SCUp | SCDn |
| Survey 1 | 3 | 3 | 3 | 3 | 3 | 3 |
| Survey 2 | Dry | 3 | 3 | 3 | 3 | 3 |
| Survey 3 | Dry | 1 | 3 | Dry | Dry | Dry |
| Survey 4 | Dry | 1 | 3 | Dry | Dry | Dry |
| Survey 5 | 3 | 3 | 3 | 3 | 3 | NS |
| Survey 6 | 3 | 3 | 3 | 3 | 3 | 3 |
| Note: | NS – Not sampled due to exceedance of salinity threshold for electro fisher. | | | | | |

Electrofishing fishing effort comprised three replicated 3-minute shots at each site for each survey period, however there were fewer replicates sampled for the drier surveys where pools were too small to humanely undertake repeated electrofishing samples.

#### 5.4.1. Combined Electrofishing Survey Results

**Figure 113** provides a summary of the combined 6 survey sampling program. A total of 1464 fish comprising four native species and one widespread introduced pest species were recorded from the study area sites between Surveys 1 and 6:

- Two, small native gudgeons (striped gudgeons *Gobiomorphus australis* and empire gudgeons *Hypseleotris compressa*) were the most captured species and accounted for 81% of the fish abundance. Striped gudgeons were recorded from all sites and empire gudgeons were recorded from all sites except WCUp.
- The other native species included short finned eels *Anguilla australis* which made up only 5% of the total abundance and were found at all sites except WCUp and SCUp, common jollytail *Galaxias maculatus* which made up 4% of the total abundance and occurred at all sites.

- The introduced plague minnow *Gambusia holbrooki* were recorded from all sites and made up 10% of total abundance (142 individuals) over all electrofishing sample events.

By far the highest number of fish were recorded from Downs Creek sites DCUp (601 fish) and DCDn (377 fish), most of which were striped gudgeons and empire gudgeons (**Figure 114**). In contrast, there were only 8 fish recorded from WCUp which were spread evenly over Terms 1 and 5.

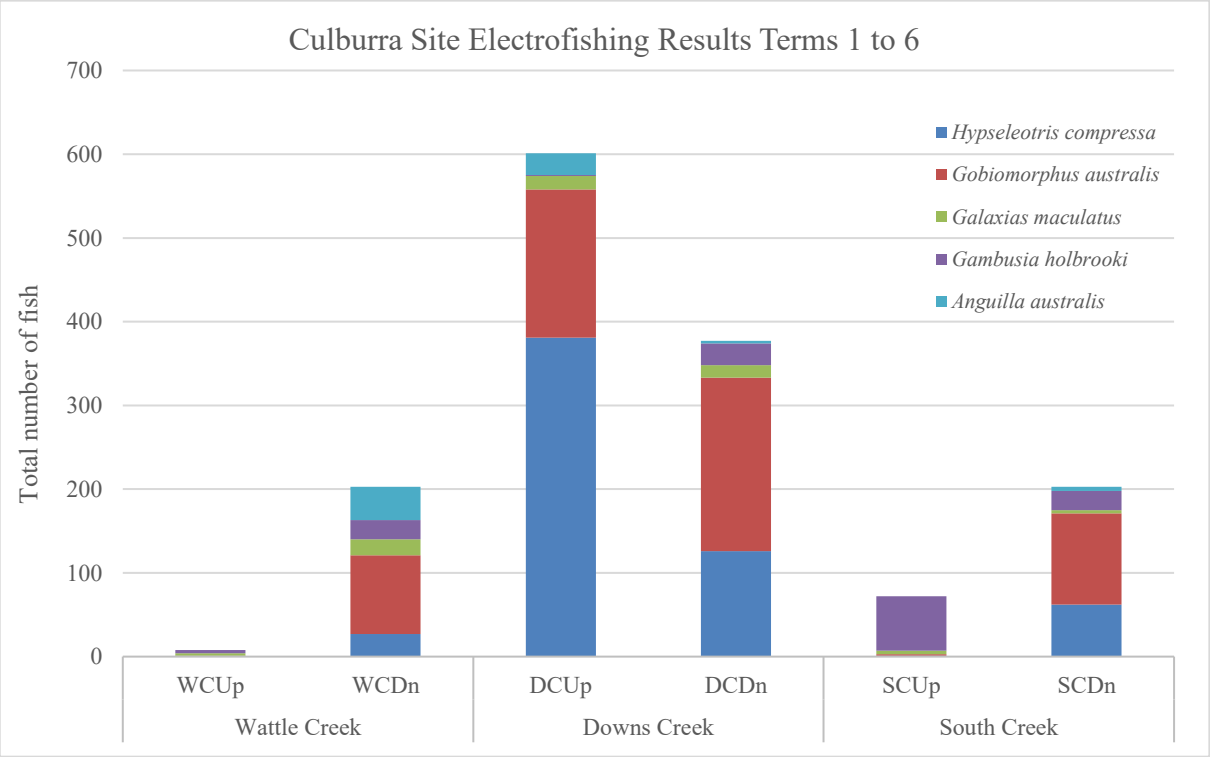



**Figure 113** Combined site electrofishing results for Terms 1 to 6.

### 5.4.2. Comparison of Creek Fish Abundance Results

**Figures 114 to 116** below shows the individual site mean replicate (± standard error SE) fish abundances for the three creek sites.

**Wattle Creek**

For Wattle Creek there were time limited replicates (less than 3 minutes) sampled at WCDn in Survey 3 and 4 owing to limited water availability:

- Upstream Wattle Creek site WCUp recorded the overall lowest abundance and diversity (richness) of fish, which were limited to two common jollytail and one plague minnow in Term 1 and one striped gudgeon plus three plague minnows in Term 5 (there were no fish recorded from WCUp in Term 6).

- All five fish species were recorded from WCDn, with striped gudgeons making up 46% of the total catch. There were 48 fish and 22 fish recorded from the single samples in Terms 3 and 4 respectively, with short finned eels comprising half of the catch during the dry surveys.

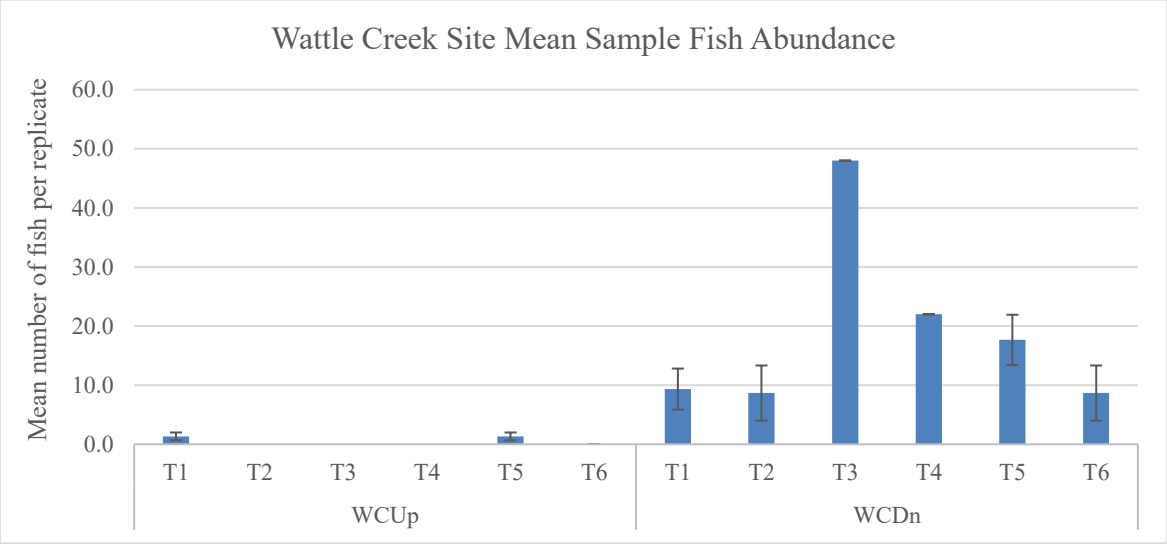



**Figure 114** Wattle Creek site mean (±SE) fish abundance results Terms 1 to 6.

**Downs Creek**

- Downs Creek sites supported the highest mean fish abundances on a survey-to-survey basis, reaching 45.3 ± 10.5 fish per 3-minute shot at DCUp in Season 4 .
- Site DCUp retained the most water during the monitoring period and was the only site which could support the full replicated sampling for each Term survey. However, DCUp did also support the overall highest variation among replicates (as indicated by the SE bars in **Figure 115** below), owing to the differences in numbers of fish recovered throughout the site length which consisted of a broad, open (and deep) pool near the Culburra Rd culvert and narrow meandering channel downstream.
- Striped gudgeons and empire gudgeons made up 93% of the total abundance at DCUp, with only one plague minnow recorded over all surveys.
- Downstream site DCDn was dry for Seasons 3 and 4, however for the Season 2 and 6 surveys DCDn recorded high mean abundances comparable with DCUp. As for DCUp, the fish counts at DCDn were dominated by striped gudgeons and empire gudgeons which accounted for 88% of the total catch.

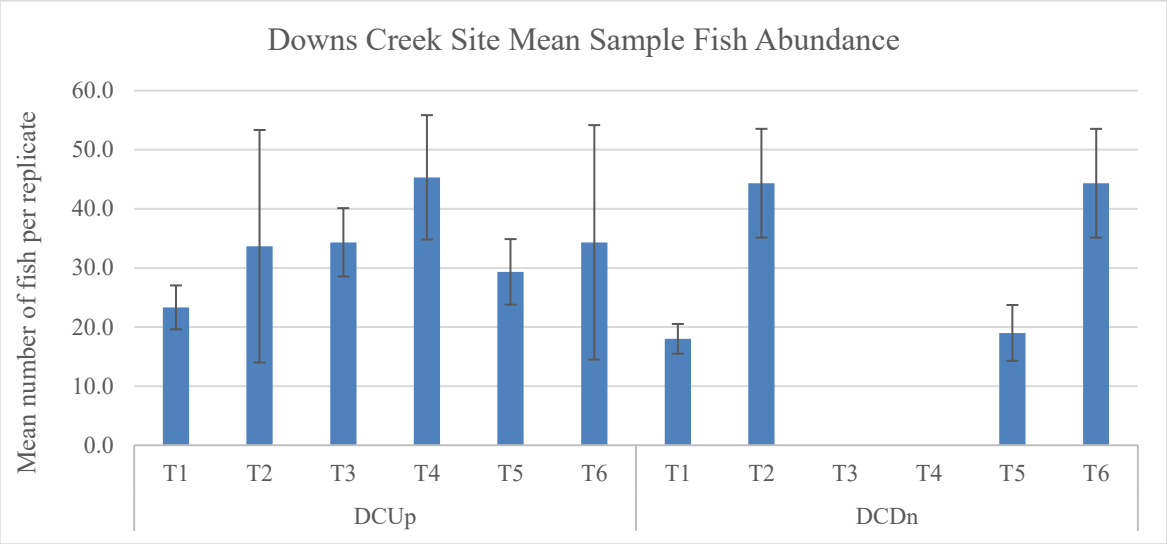



**Figure 115** Downs Creek site mean (±SE) fish abundance results Terms 1 to 6.

**South Creek**

- Both South Creek sites were dry for Season 3 and 4 surveys, there were no fish recorded at SCUp in Survey 5 and downstream site SCDn was too saline for electrofishing during the Survey 5 sample event due to backed up lake water.
- There were 24 fish recorded at SCUp for each of the Seasons 1, 2 and 6 with varying degrees of variation attributable to the differing numbers of fish recorded between replicates. While there were four species recorded for the first survey (striped and empire gudgeons, common jollytail and plague minnow), the latter surveys comprised plague minnows only. Overall, plague minnow comprised 90% of the total abundance at SCUp.
- Striped gudgeons accounted for 54% of the total abundance and empire gudgeons made up 31% of the abundance over the three surveys at SCDn.

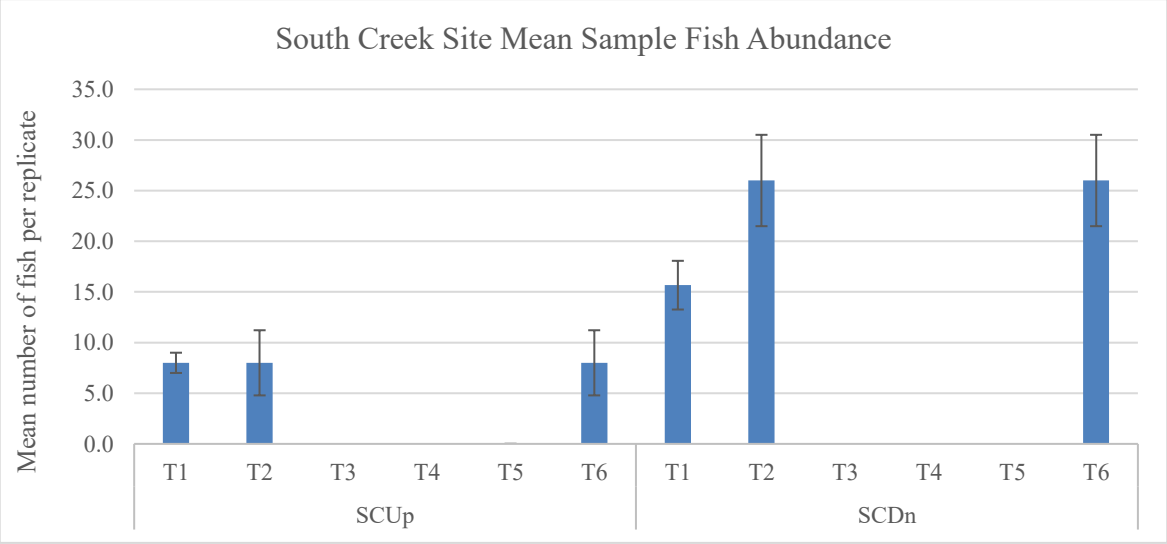



**Figure 116** South Creek site mean (±SE) fish abundance results Terms 1 to 6.

## 5.5. Freshwater Biota Monitoring Conclusions and Recommendations

### 5.5.1. Lk Wollumboola Freshwater Creek Runoff & Water Quality

Analysis of the water quality results show how the study area creeks respond to rainfall. Each of the creek-lines are ephemeral drainages which support surface flow following periods of extended rainfall, and water levels recede to disconnected pools of varying longevity during extended dry periods such as the conditions experienced throughout the middle of 2023. With regards to its influence on the biota monitoring results (macroinvertebrates and fish), the water quality of the study area creeks exhibited highly variable conditions throughout alternating periods of wet and dry weather, and the biota occupying the study area pools require some tolerance to fluctuating salinity and oxygen levels.

***Salinity***

Salinity, as indicated by conductivity (µs/cm) for the low range 'freshwater' creek habitats, is sourced from groundwater contributions. Following rainfall, each of the creek-lines experience reductions in conductivity owing to low conductivity rainfall catchment runoff and as runoff ceases, conductivity gradually increases due to the expression of groundwater seepage particularly for the downstream sites in each creek system. On regular occasions it was observed that pool habitats supported a salinity gradient between surface and bottom waters with a freshwater layer on the surface with increasing conductivity levels for the bottom layers.

Higher salinity levels are also experienced via direct connection with Lake Wollumboola when lake levels are high, a phenomenon which occurred in the downstream limits of South Creek bounding SCDn between November 2023 and May 2024, and in the downstream limits of Wattle Creek at WCDn for around four weeks duration in April to May 2024.

***Dissolved Oxygen***

The dissolved oxygen levels among the study area creeks are related both to flow conditions and internal (within pool) processes which become more influential during dry periods when mixing ceases. Sources of oxygen to the aquatic environments include where atmospheric oxygen is absorbed into the water column by turbulence during flow events, or through photosynthesis from primary producers (macrophytes, algae or phytoplankton), and the main source of oxygen loss includes respiration by decomposers and primary producers and high-water temperatures (loss to the atmosphere). It is likely that the breakdown of detrital reservoirs by decomposers (both microbial and macroinvertebrate

communities) contribute to the depletion of dissolved oxygen, particularly in the warmer months.

Whereas most sites supported their highest dissolved oxygen levels during the November 28th, 2023, and May 2024 flow events, observations of the lowest DO concentrations, or the highest variation between surface and bottom waters (oxygen depletion at the sediment water interface), was during no flow conditions between December and March when water temperatures were higher. As an indication of the anaerobic conditions experienced on the pool bottom, **Figure 117** below shows that the ASU bottom samples retrieved in December 2023 that had been subjected to prolonged anoxic conditions, as indicated by the black stained chopstick bundles and strong sulphur odour, whereas the surface ASU replicates, which were tethered to the same brick, were unstained.




**Figure 117** Comparison of the surface (left) and bottom (right) ASU sample replicates from WCDn in December 2022.

Furthermore, the quantities of detrital loads are mediated by flow event scouring, which is higher for the inline, channelised sites (Downs Creek sites and SCDn), compared to the swampier sites contained in broad flat channels (WCUp, WCDn and SCUp) which tend to accumulate detritus during flow events (for example, see floating particulate material at WCUp and WCDn in **Figure 106** above).

### 5.5.2. Assessment of Macroinvertebrate ASU Methodology

The adopted macroinvertebrate sampling methodology using artificial sampling units was selected for this program in part to meet the Condition C17(e) prohibition on "rapid assessment methods such as AusRivAS methodology" which appeared to exclude dip net mesh sampling methods. As this study has turned out, the ASU sampling method has yielded highly variable and overall limited results over the 18-month freshwater biota monitoring period.

Once the metered water quality sampling confirmed the prevalence of bottom salinity impacts, the ASU program also needed to be expanded with the deployment of both surface and bottom ASUs to compensate for the potential influences of known depth dependant water quality stressors (salinity and dissolved oxygen) on macroinvertebrate results.

The second limitation on use of ASU deployments in this situation where the creeks are ephemeral was the need to deploy the ASUs over extended time periods (up to a whole season) that for this location then included extended periods of drying out that then confounded any objective to understand how a colonising assemblage would develop and differ between seasons.

Accordingly, it was concluded that given the ephemeral nature of the Lake Wollumboola feeder creeks (especially the mandated sampling creek - Wattle Creek) the dependence on any sampling methodology that requires extended deployment of sampling apparatus such as ASUs or Traps are not going to work in this environment and that targeted sampling using dip nets is going to be required. To this end we conducted a sweep netting survey of the six Creek sites at the end of the 18-month ASU Survey 6 that deployed ASUs from 6 March to 23 May 2024, and then compared the results from the two surveys. This comparison is provided in **Section 5.5.3.** here below.

### 5.5.3. Creek Sweep Netting Macroinvertebrate Survey

Between 25$^{th}$ to 27$^{th}$ June 2024. sweep netting was undertaken at the three creek up and down stream sites utilised for the ASU sampling program, with replicate sweep netting along pool and channel edges. At each site, two replicates of five metres of aquatic habitats were sampled using a triangular hoop dip net. Sample contents were sorted in the field and stored in ethanol for processing the lab.

Compared to the ASU macroinvertebrate samples, there were generally higher diversities

of taxa recorded for the sweep net samples with better representation of a broader range of macro-invertebrates in site samples:

- There were 1030 individuals recorded over the six sample sites. Wattle Creek sites WCUp and WCDn plus South Creek site SCUp contributed the most to the overall site abundances with 25%, 28% and 32% respectively.
- There were 31 macroinvertebrate taxa recorded from the sweep net samples, and the individual site diversity ranged between 5 taxa at SCDn and 20 taxa at WCUp.
- There were eleven macroinvertebrate taxa recorded from the single sweep netting survey event that were not detected during the entire ASU monitoring period. These included three dipterans (snipe fly family Athericidae, phantom midge family Chaoboridae and mosquito larvae), mayfly family Baetidae, three hemipterans (water boatmen family Corixidae, water strider family Hydrometridae and small water strider family Mesovellidae), three odonata (dragonfly families Libellulidae and Telephlebiidae and damselflies Lestidae) and freshwater shrimp family Atyidae.
- The only two taxa that were recorded from the ASU samples and were absent from the sweep net samples were two micro-crustacea (calanoid and harpacticoid copepods).

It was clear that sweep-netting from this single survey yielded higher richness values (number of different macroinvertebrate taxa collected) at each location, including taxa that were not detected among ASU samples over the entire 18-month monitoring period.

Whilst it is generally not relevant to compare absolute abundance values between both methods given the differences in macroinvertebrate collection techniques, which involve passive recruitment of macroinvertebrates to ASUs over a long period (up to 12 weeks) and the active sampling of a defined length of pool habitats by sweep net sampling, it is however, possible to compare the composition of ASU and sweep netting samples by standardising the abundance data for the constituent major taxa groups. **Figure 118** (below) of relative abundances for the two survey methods indicates that for most sites:

- The representation of major taxonomic groups was more evenly spread across the sweep netting (SW) samples when compared to the ASU samples, which were for the most part dominated by fly taxa (bloodworm family Chironominae).
- There was also better representation of EPT taxa (mayflies and caddis-flies) in the sweep net samples, and in general, a broader range of taxa life histories and functional feeding groups.

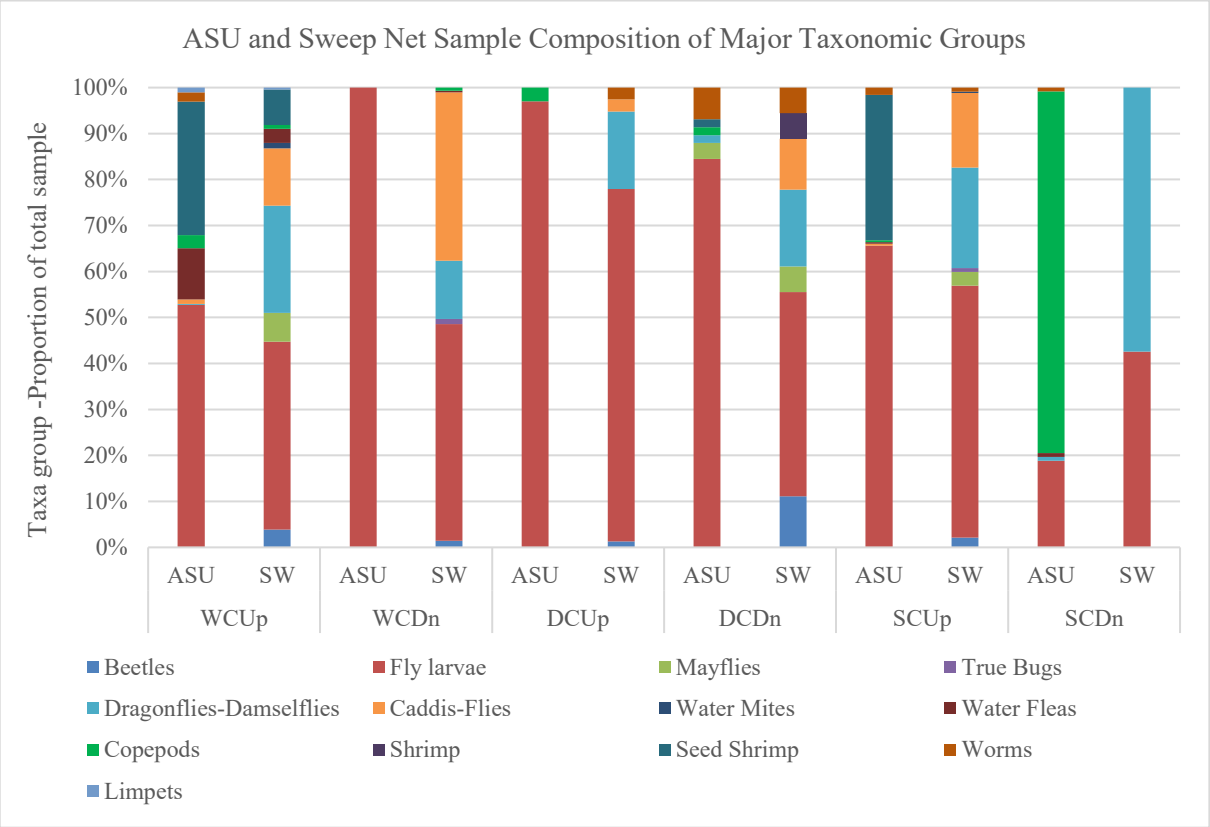



**Figure 118** Composition of taxonomic groups according to site and sample type. ASU = ASU sample types and SW = Sweep Netting. The replicate (n) abundance values were pooled for each site, taken from the Term 6 surface ASU results (n=3) and the June 2024 sweep netting (n=2).

This more complete representation of the overall macroinvertebrate assemblage is considered an important factor for understanding potential impacts as different macroinvertebrate taxa inherit variable responses to potential impacts (e.g., tolerances to toxicants due to physiology, tolerances to altered flow regime due to microhabitat occupation), and it is logical to suppose that a monitoring program designed to detect impacts should be predicated on utilising as wide an array of *available* macroinvertebrates as possible.

With regards to diversity measures, the macroinvertebrate richness values were very low across ASU samples with 78% of samples containing three taxa or less. The Shannon Diversity index (H') is a commonly used measure of community diversity which takes into account both the abundance and evenness (the relative composition of each taxa to the total abundance) of a sample, with higher values indicating a more diverse macroinvertebrate community. **Figure 119** below provides a comparison of the mean (± SE) Shannon diversity values for ASU samples and the sweep netting survey results:

- For the most part, within site H' values were higher for surface ASU samples compared to the bottom samples for a given Survey.

- Whereas WCDn surface sample (WCDn-S) contained the highest mean abundance values for the Pilot period and Seasons 1, 4 and 5, the H' values were relatively low owing to the dominance of a bloodworm family Chironominae).
- Both Wattle Creek sites and SCUp sweep net samples supported the most diverse macroinvertebrate communities (as indicated by the relatively high H' values), owing to the composition of the relatively high taxa richness and abundance results.

It is also worth noting that there were variations in taxa composition among sweep net samples for the inline (channelised) sites, with very low abundance values recorded at DCDn (18 individuals) and generally fewer groups represented (DCUp and SCDn; **Figure 118** above), which contributed to their relatively low H' values (**Figure 119**).

Finally, it is also likely that the sweep net sample event was indicative of a wet weather event impact, as these observations are attributed to the loss of detrital reservoirs and associated macroinvertebrate communities from the wet weather event scouring 18 days prior to sampling. It is expected that the inline sites contained within narrow, incised channel basins at DCUp, DCDn and SCDn are more susceptible to scouring impacts (and loss of macroinvertebrates) than WCUp, WCDn and SCUp, which could accumulate organisms through downstream macroinvertebrate drift.
It is also expected that sweep net sample results from DCUp and DCDn would improve following periods of stability, to a point where H' values would eventually surpass those of WCUp and SCUp, by macroinvertebrate colonisation and population growth.

### 5.5.4. Macroinvertebrate Sampling Conclusions

On balance and given the specific site ephemeral and salinity plus dissolved oxygen confounding factors for the three Lake Wollumboola Creeks, future macroinvertebrate monitoring studies should adopt a properly replicated sweep net sampling regime that needs to be coupled to a metered water quality sampling program that will allow sampling to be targeted to well defined antecedent creek behaviour (i.e., time since last dry, frequency and duration of antecedent rain and season).

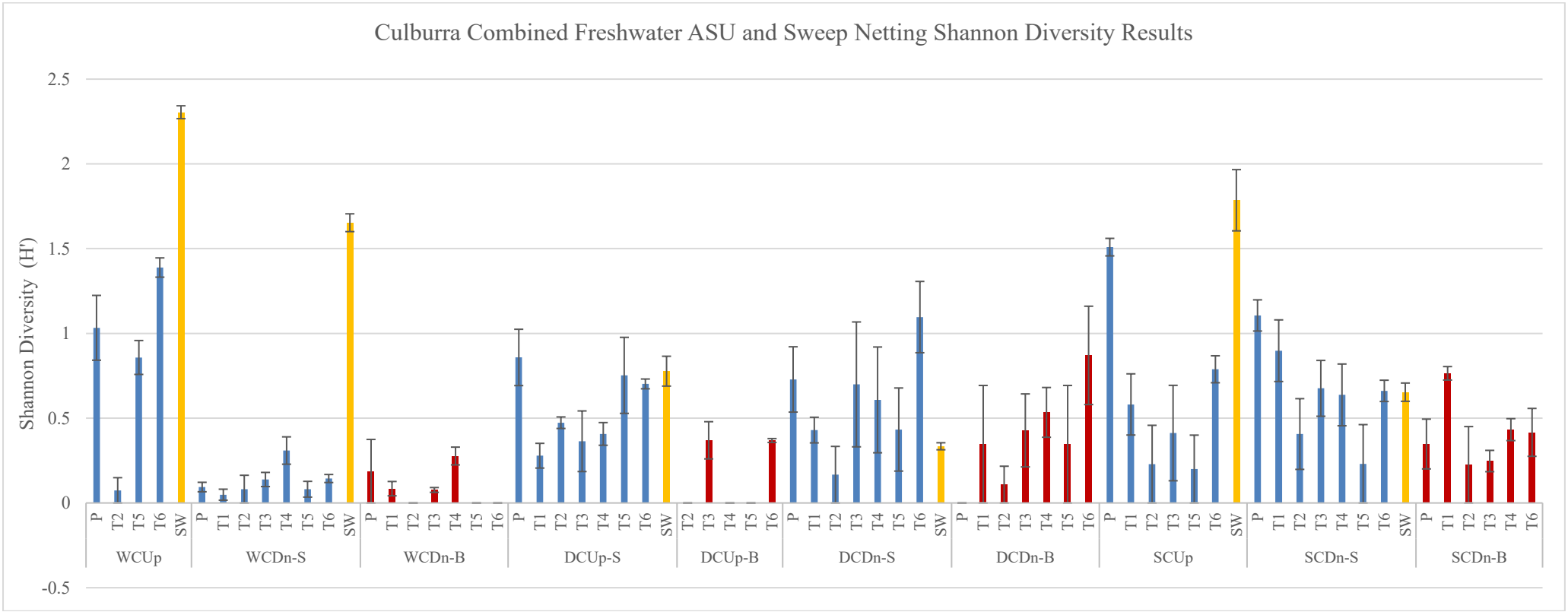



**Figure 119** Mean (± SE) Shannon Diversity (H') results grouped according to site. Sweep netting results are shown as yellow bars and grouped with surface samples (-S). ASU samples are coloured blue for surface samples and red for bottom samples. Samples which contained no individuals were omitted from the analysis (9 samples in total), and those samples which contained one individual are represented as zero values in the chart.

## 5.6. Recommendations for Pre-Construction to Construction Aquatic Monitoring

The Baseline study has demonstrated both the ephemeral nature of the study drainages and the complexity of lower creek sites in relation to groundwater salinity and back flooding from the lake itself. Accordingly, the nominated ASU macroinvertebrate study component was severely hampered by the ephemeral nature of the creek sites. So much so that over a full season the ASUs were often only underwater for a small proportion of the deployment time. As a consequence, final assemblage results were more related to (a) whether there was water around the ASU at the time of collection and (b) if so, how long had that last wetting lasted.

Accordingly, measuring potential impacts to aquatic ecology in these ephemeral creeks, and timing of monitoring events will need to take into account climatic cues. This will need to be coupled to a metered water quality sampling program that will allow sampling to be targeted to well defined antecedent creek behaviour (i.e., time since last dry, frequency and duration of antecedent rain and season).

For the continuing pre-construction through to Construction monitoring period the following freshwater ecology monitoring is recommended:

- It is recommended that the South Creek sites be deleted from the study as the Downs Creek sites provide ample reference data for comparisons with Wattle Creek data.
- The existing Downs and Wattle Creek sites are to be retained with an additional site W2 in Wattle Creek between Culburra Rd and WCUp. Whilst this section of Wattle Creek is highly ephemeral, water quality metering, macroinvertebrate sampling and electrofishing has been undertaken at this site during aquatic ecology studies for other projects.
- Given the specific site ephemeral and salinity plus dissolved oxygen confounding factors for the Lake Wollumboola Creeks, it is recommended that continuing macroinvertebrate monitoring studies for the pre-construction period abandon the ASU sampling method and adopt the properly replicated sweep net aquatic macroinvertebrate sampling regime trialled in June 2024, as detailed and reported in **Section 5.5.3** in this report. The sampling is to include the adopted metered water quality sampling and the existing electro fishing sampling methods also as described in this report.

In terms of timing it is recommended that these studies be undertaken seasonally,

and given the ephemeral nature of the creeks it is recommended the following restrictions be adopted to better standardise the impacts of the ephemeral nature of the creeks:

- No sampling to occur during dry periods (when W2, WCUp or WCDn are dry),
- No sampling to occur within four weeks of pool filling (following prolonged dry periods), allowing time for the macroinvertebrate community to become established. In this respect staged samples (i.e. sampling at 3 weeks after filling and then at 6 to 8 weeks).
- Two replicate samples per site/per survey with samples sorted live in the field.
- Water quality metering (using a submersible probe) to be undertaken at all sites bi-monthly.

# REFERENCES

ANZECC/ARMCANZ (2000) *Australian and New Zealand guidelines for fresh and marine water quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

Ayling, G.M. (1974) 'Uptake of cadmium, zinc, copper, lead and chromium in the Pacific oyster *Crassostrea gigas* grown in the Tamar River, Tasmania', *Water Research*, 8, pp. 729-738.

Bayne, B.L. (2002) 'A physiological comparison between Pacific oysters *Crassostrea gigas* and Sydney rock oysters *Saccostrea glomerata*: Food, feeding and growth in a shared estuarine habitat', *Marine Ecology Progress Series*, 232, pp. 163-178.

Brodersen, E.K., Kathrine, J.H., Schrameyer, V., Floytrup, A., Rasheed, A.M., Ralph, J.P. & Michael, K.P. (2017) 'Sediment resuspension and deposition on seagrass leaves impedes internal plant aeration and promotes phytotoxic $H_2S$ intrusion', *Frontiers in Plant Science*, 8, p. 657.

Chapman, M.G. & Roberts, D. E. (2004) 'Use of seagrass wrack in restoring disturbed Australian saltmarshes', *Ecological Management & Restoration,* 5(3) pp. 183-190.

Dennison, W.C., Marshall, G.J. & Wigand, C. (1989) 'Effect of "brown tide" shading on eelgrass (*Zostera marina* L.) distributions', *Coastal Estuaries Studies*, 35, pp. 675-679.

Farrell, H., Baker, P., Webster, G., Jansson, E., Szabo, E., & Zammit, A. (2018) 'An Assessment of Potential Heavy Metal Contaminants in Bivalve Shellfish from Aquaculture Zones along the Coast of New South Wales, Australia', *Food Protection Trends,* 38(1).

Food Standards Australia New Zealand (FSANZ) (2004) *Mercury in fish – Background to the mercury in fish advisory statement*.

Food Standards Australia New Zealand (FSANZ) (2006) *Safe Seafood Australia: A guide to the Australian Primary Production and Processing Standard for Seafood*. 2nd Edition.

Kelleway, J., Williams, R.J. & Allen, C.B. (2007) *An assessment of the saltmarsh of the Parramatta River and Sydney Harbour*. NSW Department of Primary Industries – Fisheries Final Report Series No. 90.

Kumbier, K., Carvalho, R. C., Vafeidis, A. T., and Woodroffe, C. D. (2018) 'Investigating compound flooding in an estuary using hydrodynamic modelling: a case study from the Shoalhaven River, Australia', *Nat. Hazards Earth Syst. Sci.,* 18, 463–477.

Lee, J.H., Birch, G.F., Cresswell, T., Johansen, M.P., Adams, M.S. & Simpson, S.L. (2015) 'Dietary ingestion of fine sediments and microalgae represent the dominant route of exposure and metal accumulation for Sydney rock oyster (*Saccostrea glomerata*): A biokinetic model for zinc', *Aquatic Toxicology*, 167, pp. 46-54.

MPR (2019) Culburra West Development Proposal. Aquatic Ecology Assessment Report. Prepared for Sealark Pty Ltd by Marine Pollution Research Pty Ltd, November 2019.

MPR (2020) Revised Culburra Beach Concept Plan Aquatic Ecology Assessment Report. Prepared for Sealark Pty Ltd by Marine Pollution Research Pty Ltd, April 2020.

MPR (2021) Revised West Culburra Beach Concept Plan. Addendum to Aquatic Ecology Assessment Report. Prepared for Sealark Pty Ltd by Marine Pollution Research Pty Ltd, August 2021.

MPR (2022) West Culburra Mixed Use Development Approval Conditions of Consent - Baseline Monitoring Program For COCs C17 & C18 - Aquatic Ecology Requirements. Final Monitoring Report (Post Pilot Studies) Prepared for Sealark Pty Ltd, Marine Pollution Research Pty Ltd, November 2022

MPR (2023) West Culburra Mixed Use Development. Condition17f Aquatic Ecology Monitoring Addendum Arising from first Six-Monthly Baseline Aquatic Ecology Report. Addendum prepared for Sealark Pty Ltd, Marine Pollution Research Pty Ltd, August 2023

MPR (2023a) West Culburra Mixed Use Development. First Six Monthly Concept Approval Baseline Aquatic Ecology Data Repo. Prepared for Sealark Pty Ltd by Marine Pollution Research Pty Ltd, July 2023.

MPR (2024) West Culburra Mixed Use Development. Second Six Monthly Concept Approval Baseline Aquatic Ecology Data Repo. Prepared for Sealark Pty Ltd by Marine Pollution Research Pty Ltd, January 2024.

Martens & Associates Pty Ltd (2022) *Baseline Water Quality Monitoring - Methodology Plan: Mixed Use Development at West Culburra, NSW*. Prepared for Sealark Pty Ltd, July 2022.

Moore, K.A. & Wetzel, R.L. (1999) 'Seasonal variations in eelgrass (Zostera marina L.) responses to nutrient enrichment and reduced light availability in experimental ecosystems.' Gloucester Point, VA: The Virginia Institute of Marine Science, School of Marine Science, College of William and Mary.

New Zealand Gazette (2015) *Schedule 19 – Maximum Levels of Contaminants and Natural Toxicants – Food Standards (Proposal P1025 – Code Revision) Variation—Australia New Zealand Food Standards Code – Amendment No. 154*.

Phillips, G.L., Eminson, D. & Moss, D. (1978) 'A mechanism to account for macrophyte decline in progressively eutrophicated freshwaters', *Aquatic Botany*, 4, pp. 103-126.

Ralph, P.J., Tomasko, D., Moore, K.A., Seddon, S. & Macinnis-Ng, C.M.O. (2006) 'Human impacts on seagrasses: Eutrophication, sedimentation and contamination', in Larkum, A.W.D., Orth, R.J. & Duarte, C.M. (eds.) *Seagrasses: Biology, Ecology and Conservation*. Dordrecht: Springer, pp. 567-59

Shokri M R, Gladstone W, Jelbart J (2009) The effectiveness of seahorses and pipefish (pisces: Syngnathidae) as a flagship group to evaluate the conservation value of estuarine seagrass beds. Aquatic conserve: Mar' Freshw. Ecosyst. 19: 588-595 (2009)

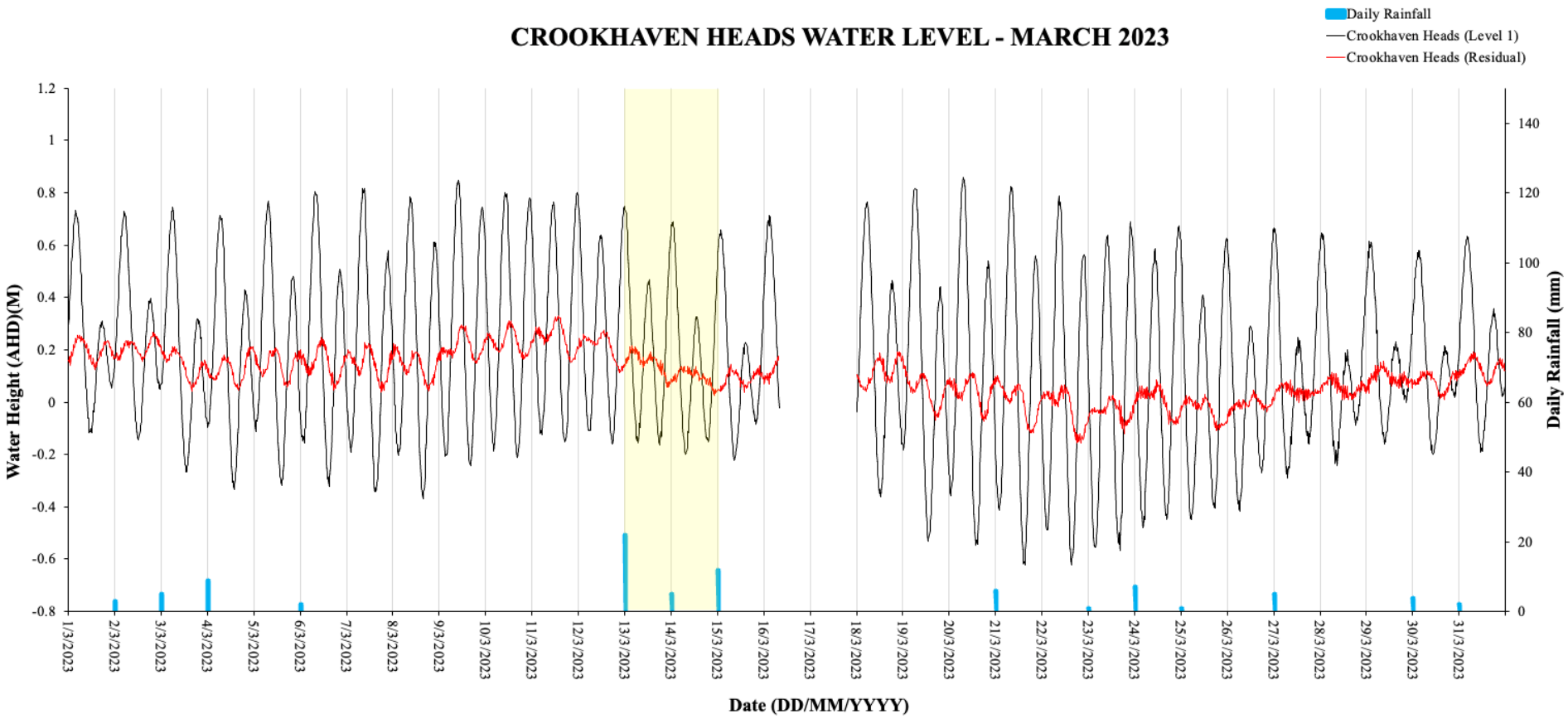
# APPENDICES

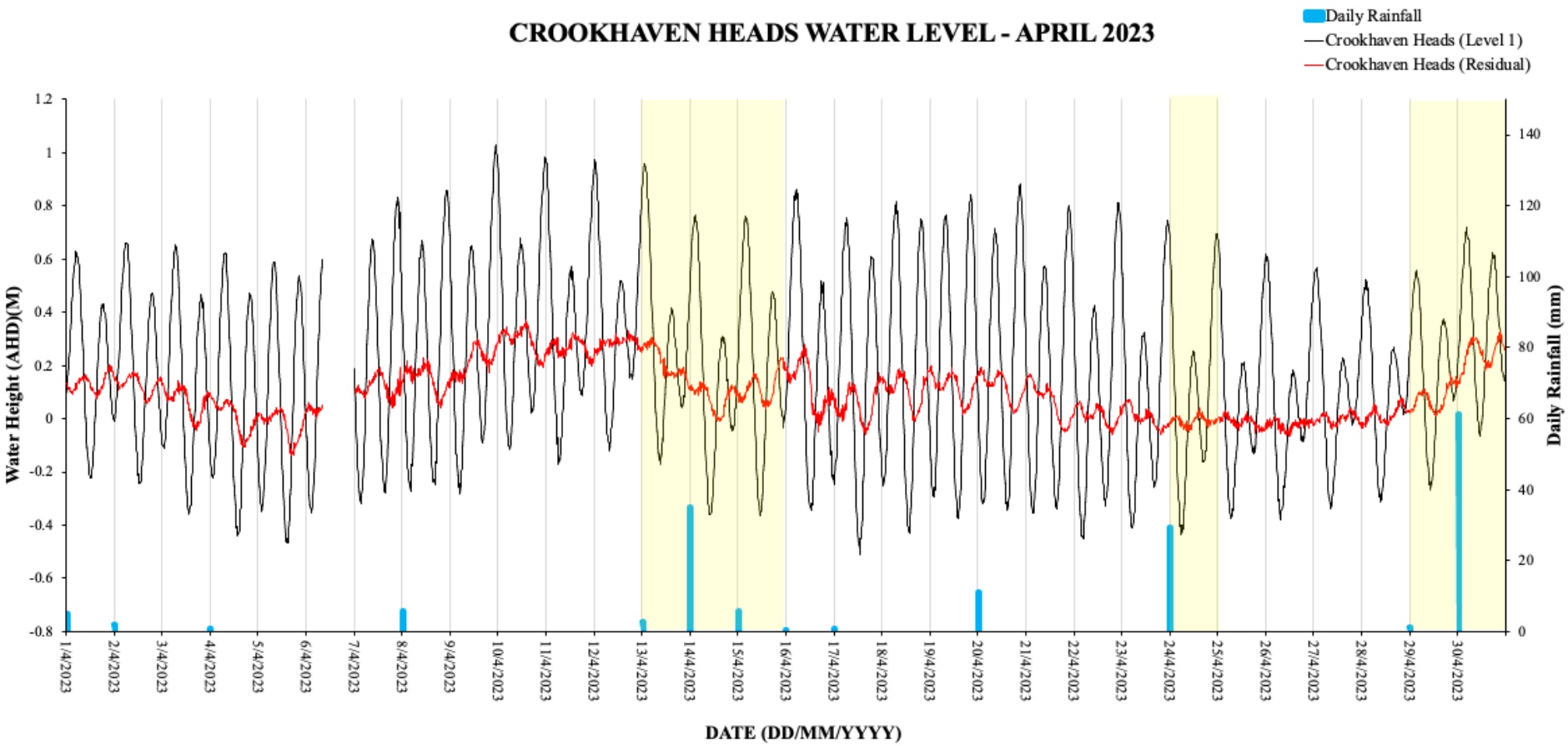
# APPENDIX A
# CULBURRA RAINFALL 2022, 2023 & 2024

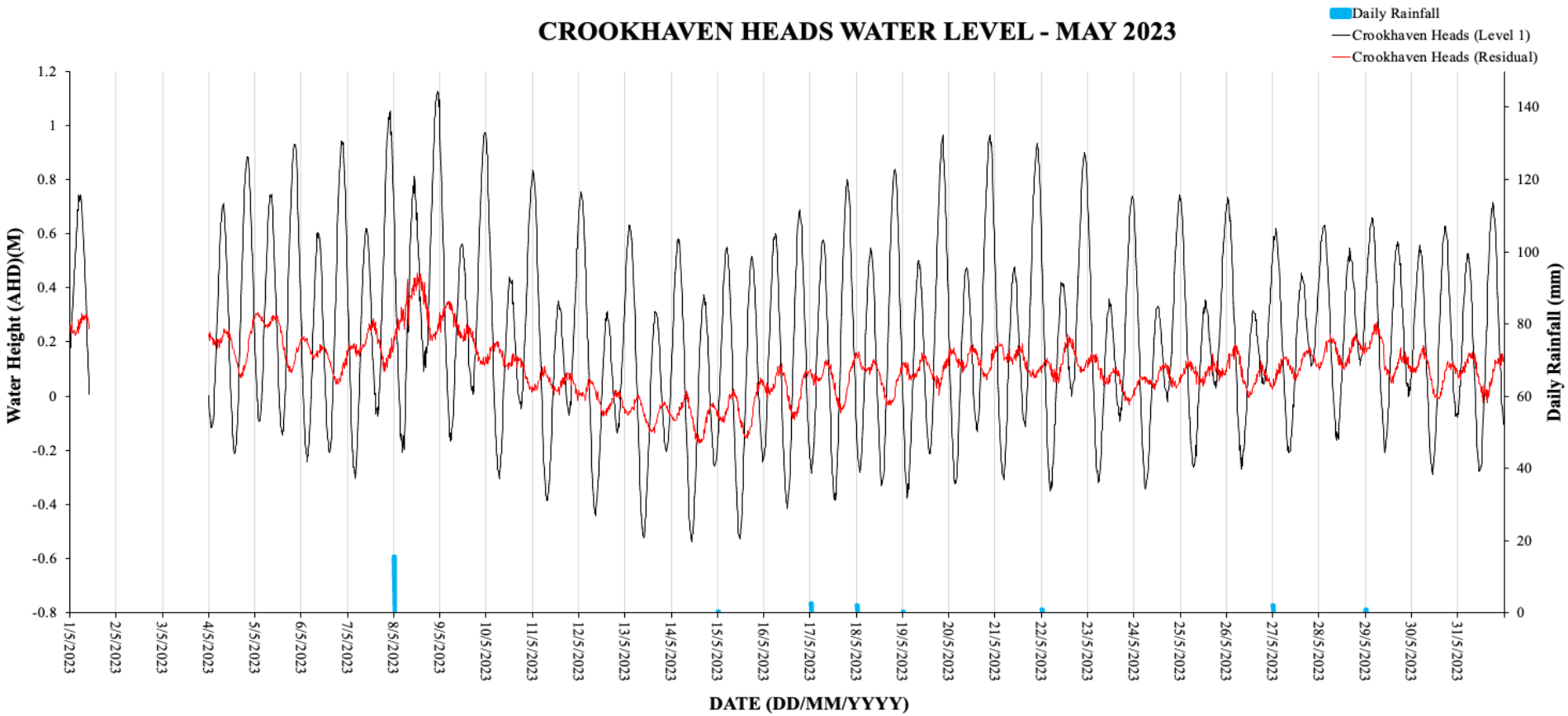
## 2022, 2023 & 2024 Culburra Treatment Plant Daily Rainfall

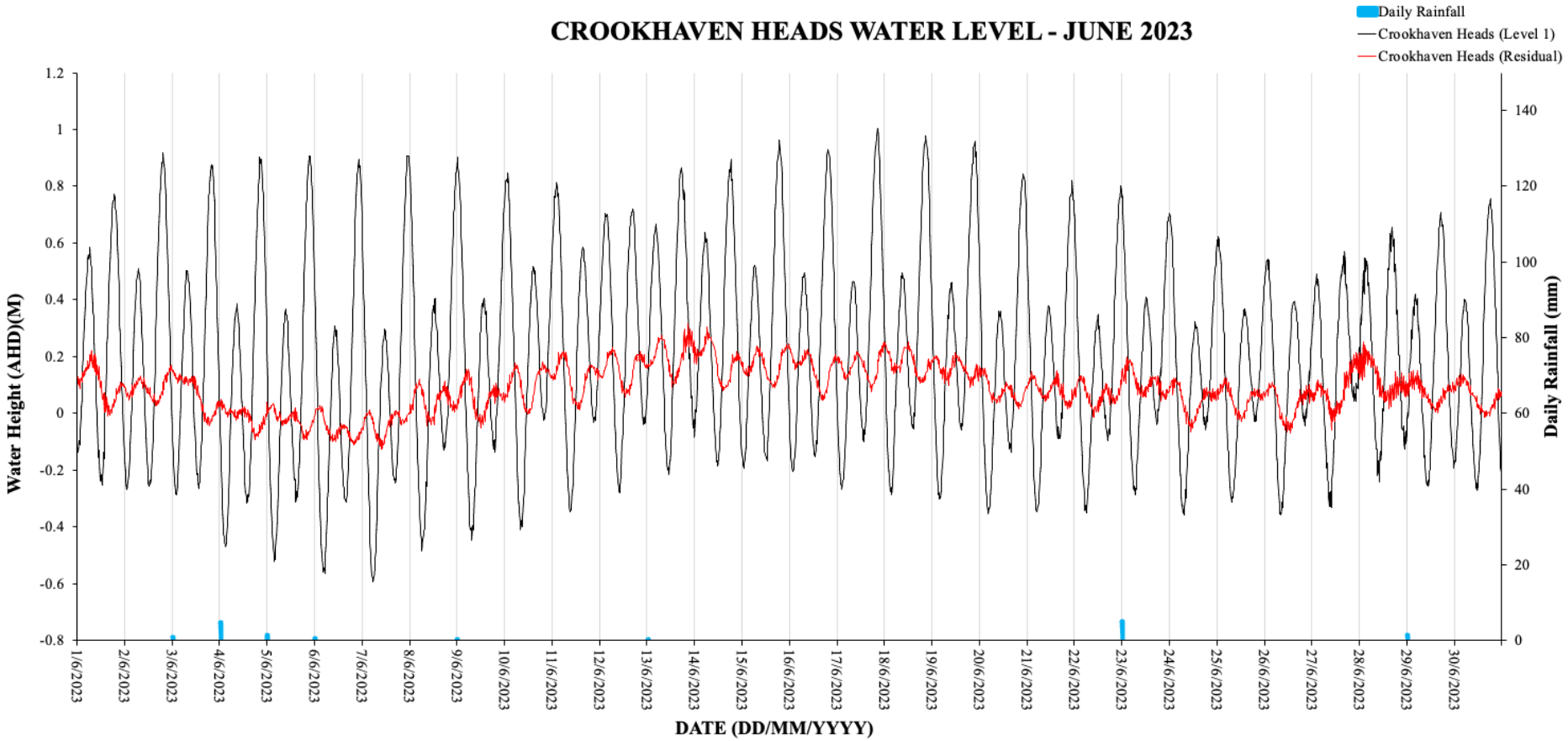
| Date | 2022 | | | | | | | 2023 | | | | | | | | | | | | 2024 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
| **1st** | 0 | 1 | 0 | 0 | 22 | 15 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 4 |
| **2nd** | 0 | 127 | 0 | 0 | 7 | 0 | 9 | 0 | 0 | 3 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 11 | 0 | 5 | 11 |
| **3rd** | 0 | 48 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 2 | 49 | 0 |
| **4th** | 0 | 64 | 1 | 21 | 0 | 1 | 0 | 2 | 0 | 9 | 1 | 0 | 5 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 25 | 0 |
| **5th** | 0 | 33 | 2 | 3 | 3 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 18 | 17 | 0 | 1 | 8 | 0 | 2 | 48 | 6 |
| **6th** | 0 | 5 | 0 | 1 | 28 | 0 | 2 | 17 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 86 | 27 | 187 |
| **7th** | 0 | 7 | 0 | 1 | 5 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 76 |
| **8th** | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 24 | 0 | 6 | 16 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 20 | 16 |
| **9th** | 0 | 0 | 2 | 1 | 75 | 0 | 0 | 0 | 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 28 | 0 |
| **10th** | 0 | 22 | 4 | 1 | 3 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 9 | 17 | 0 |
| **11th** | 0 | 33 | 0 | 29 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 34 | 0 |
| **12th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 |
| **13th** | 0 | 0 | 1 | 21 | 0 | 0 | 2 | 0 | 2 | 22 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 135 | 3 |
| **14th** | 0 | 2 | 0 | 0 | 3 | 14 | 0 | 2 | 2 | 5 | 35 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **15th** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 12 | 6 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 51 | 2 | 10 | 0 | 0 | 25 |
| **16th** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 3 | 0 | 0 | 0 | 17 |
| **17th** | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 | 0 | 0 |
| **18th** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 52 | 0 | 3 | 1 |
| **19th** | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 23 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 4 | 0 |
| **20th** | 9 | 21 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 5 | 8 | 9 | 0 | 0 |
| **21st** | 1 | 23 | 2 | 0 | 21 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 15 | 0 | 0 | 0 | 0 |
| **22nd** | 0 | 2 | 0 | 38 | 5 | 0 | 0 | 1 | 17 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **23rd** | 0 | 10 | 0 | 8 | 15 | 0 | 3 | 21 | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 7 | 6 | 4 | 0 | 0 | 0 | 0 | 28 |
| **24th** | 0 | 6 | 8 | 2 | 8 | 0 | 0 | 0 | 0 | 7 | 30 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 4 | 0 | 22 | 0 | 0 | 0 | 1 |
| **25th** | 0 | 0 | 0 | 5 | 37 | 0 | 0 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **26th** | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 32 | 2 | 0 | 0 | 0 | 0 | 0 |
| **27th** | 0 | 0 | 4 | 5 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 7 | 12 | 1 | 2 | 0 | 6 | 0 | 0 | 0 | 0 |
| **28th** | 0 | 0 | 1 | 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 19 | 87 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| **29th** | 0 | 1 | 0 | 20 | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 | 168 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30th** | 0 | 0 | 2 | 29 | 0 | 0 | 6 | 7 | | 4 | 61 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 1 | | 0 | 6 | 0 | 0 |
| **31st** | | 0 | 0 | | 0 | | 7 | 14 | | 2 | | 0 | | 0 | 2 | | 0 | | 1 | 0 | | 0 | | 0 | 0 |
| Monthly total (mm) | 9.7 | 411 | 30 | 198 | 239 | 37.4 | 32.7 | 119 | 337 | 83.6 | 162 | 25.3 | 15.4 | 12 | 36.2 | 16.2 | 61.7 | 334 | 167 | 90 | 97.8 | 123 | 119 | 481 | 377 |
| Monthly Average (mm) | 139 | 84 | 79.3 | 73.4 | 86.7 | 84.9 | 73.3 | 98.1 | 130 | 140 | 112 | 105 | 139 | 84 | 79.3 | 73.4 | 86.7 | 84.9 | 74.9 | 98 | 130 | 140 | 112 | 111 | 141 |
| Legend | XX | High Rainfall Event (>20mm over 48 hours) | | | | | | | | | | | | | | | | | | | | | | | |
| | | 18-month Baseline Sampling Period | | | | | | | | | | | | | | | | | | | | | | | |

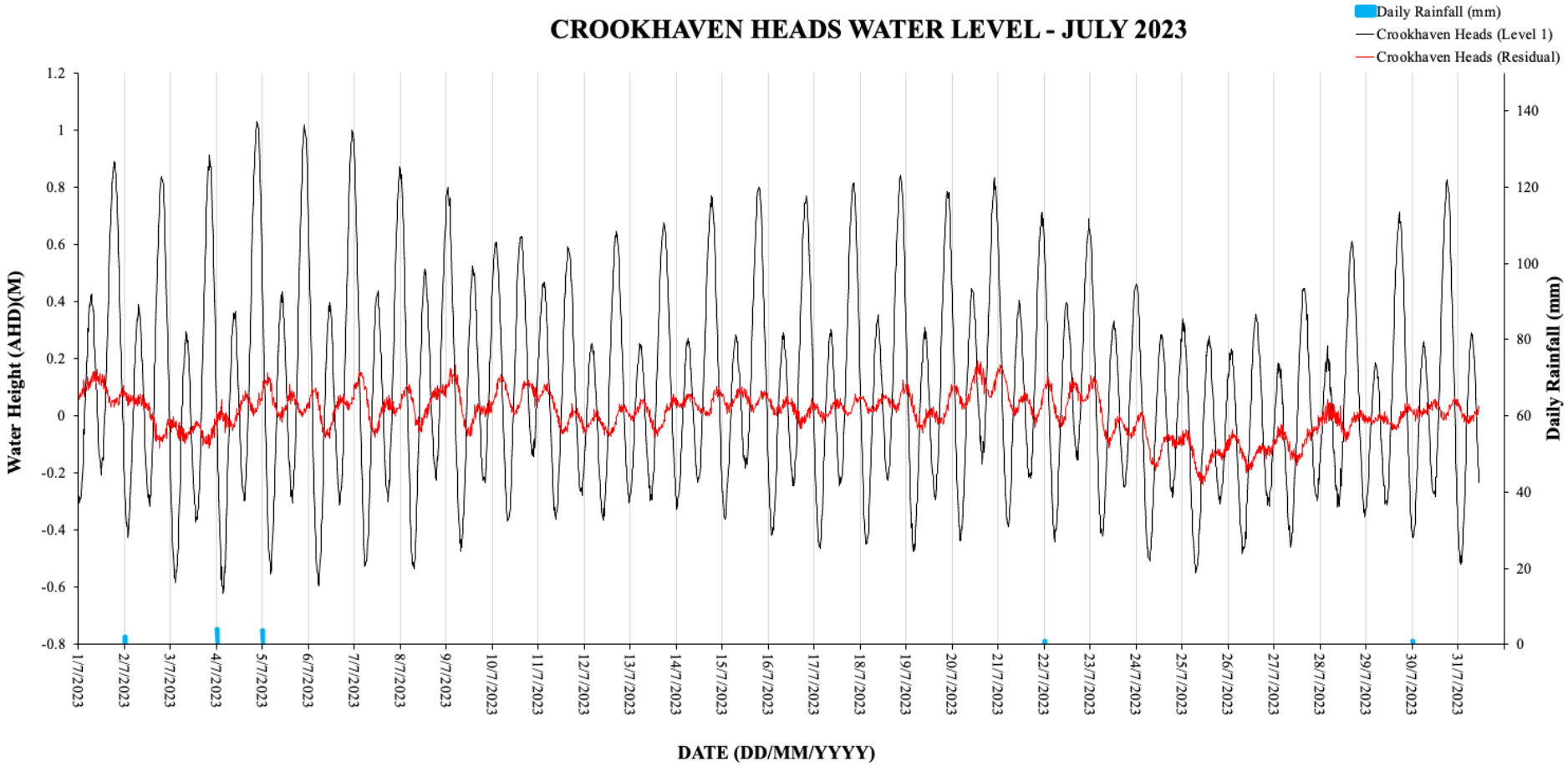
# APPENDIX B
# CROOKHAVEN RIVER TIDE, GREENWELL POINT TIDE & LAKE WOLLUMBOOLA WATER LEVEL DATA

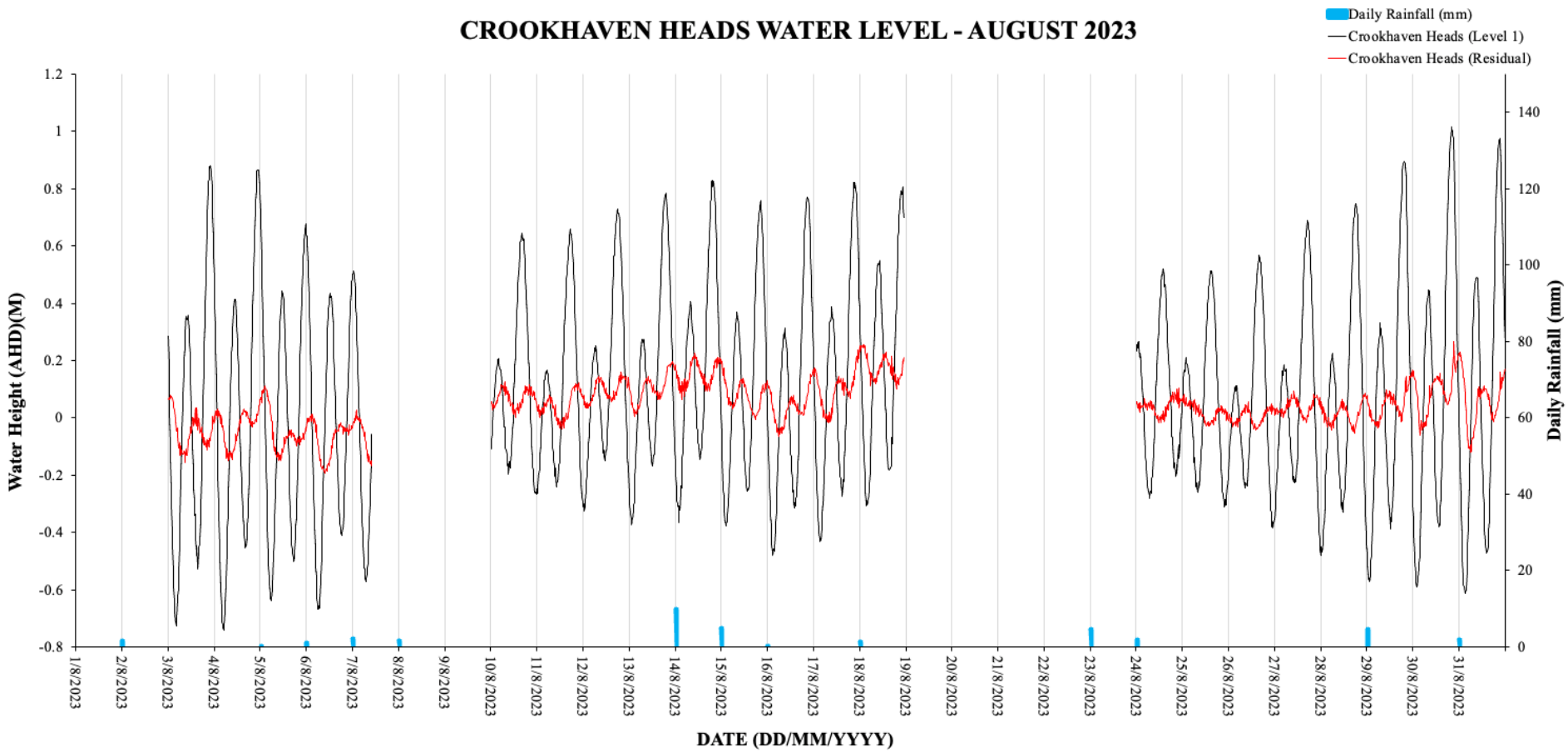

CROOKHAVEN HEADS WATER LEVEL - MARCH 2023
Daily Rainfall
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/3/2023
2/3/2023
3/3/2023
4/3/2023
5/3/2023
6/3/2023
7/3/2023
8/3/2023
9/3/2023
10/3/2023
11/3/2023
12/3/2023
13/3/2023
14/3/2023
15/3/2023
16/3/2023
17/3/2023
18/3/2023
19/3/2023
20/3/2023
21/3/2023
22/3/2023
23/3/2023
24/3/2023
25/3/2023
26/3/2023
27/3/2023
28/3/2023
29/3/2023
30/3/2023
31/3/2023

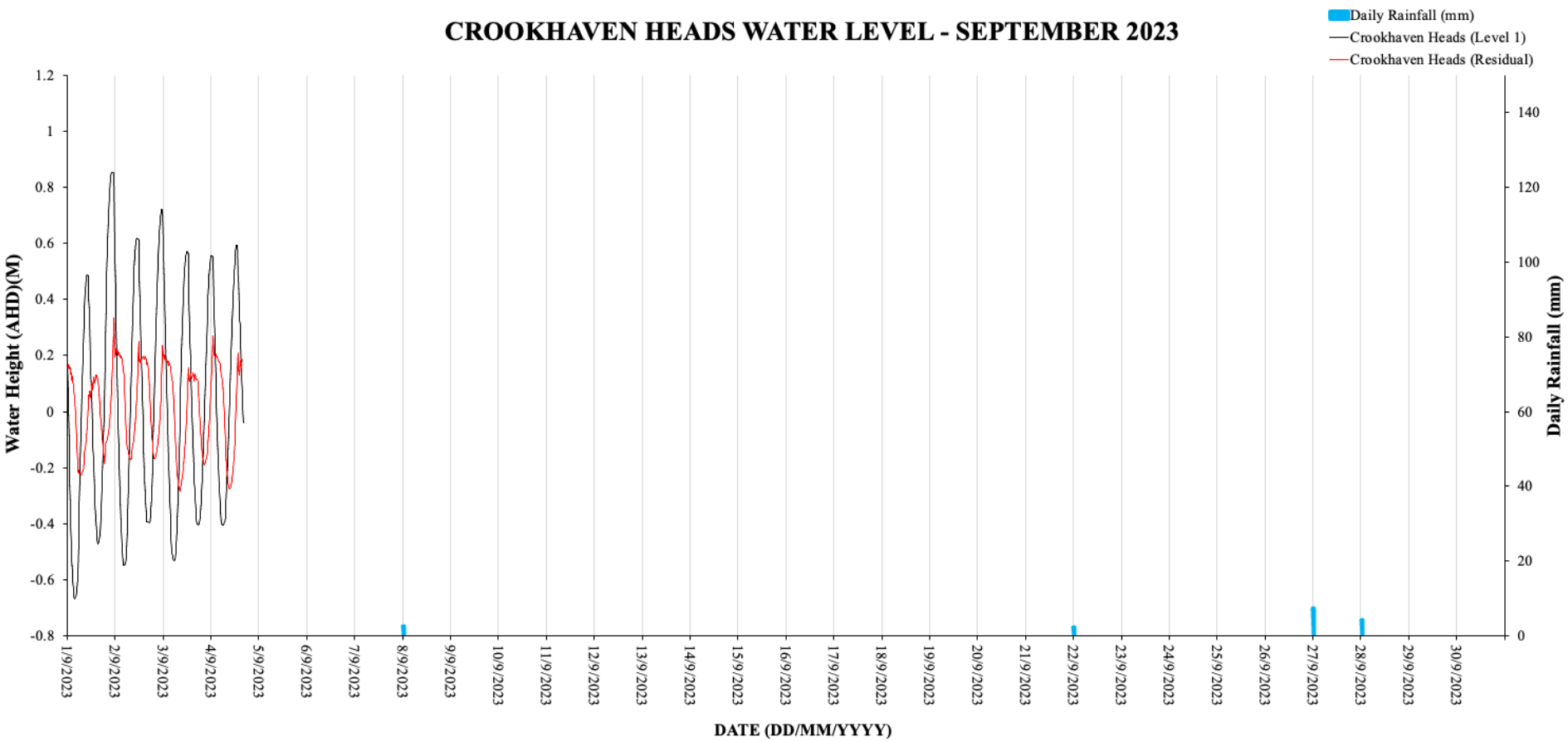

CROOKHAVEN HEADS WATER LEVEL - APRIL 2023
Daily Rainfall
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/4/2023
2/4/2023
3/4/2023
4/4/2023
5/4/2023
6/4/2023
7/4/2023
8/4/2023
9/4/2023
10/4/2023
11/4/2023
12/4/2023
13/4/2023
14/4/2023
15/4/2023
16/4/2023
17/4/2023
18/4/2023
19/4/2023
20/4/2023
21/4/2023
22/4/2023
23/4/2023
24/4/2023
25/4/2023
26/4/2023
27/4/2023
28/4/2023
29/4/2023
30/4/2023

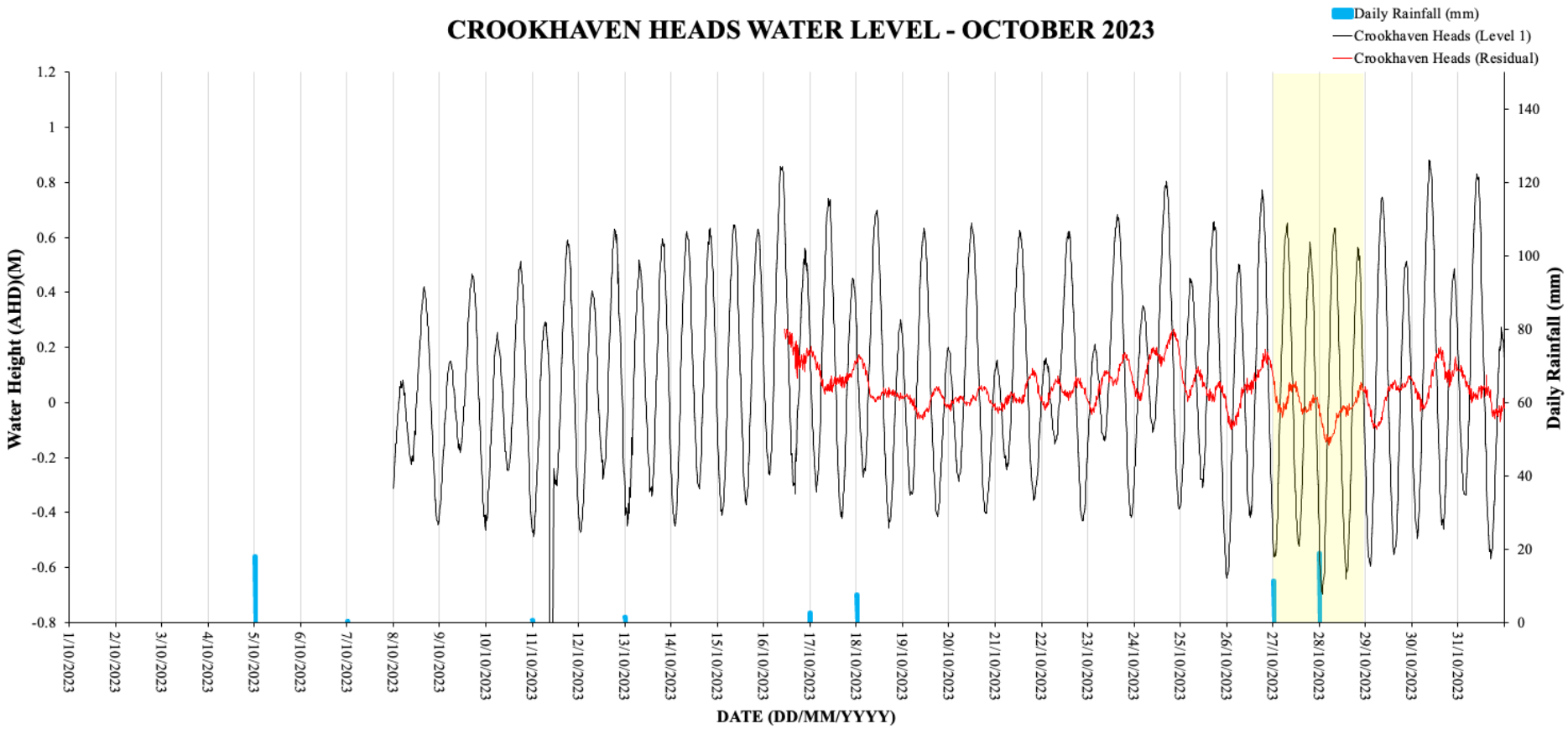

CROOKHAVEN HEADS WATER LEVEL - MAY 2023
Daily Rainfall
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/5/2023
2/5/2023
3/5/2023
4/5/2023
5/5/2023
6/5/2023
7/5/2023
8/5/2023
9/5/2023
10/5/2023
11/5/2023
12/5/2023
13/5/2023
14/5/2023
15/5/2023
16/5/2023
17/5/2023
18/5/2023
19/5/2023
20/5/2023
21/5/2023
22/5/2023
23/5/2023
24/5/2023
25/5/2023
26/5/2023
27/5/2023
28/5/2023
29/5/2023
30/5/2023
31/5/2023

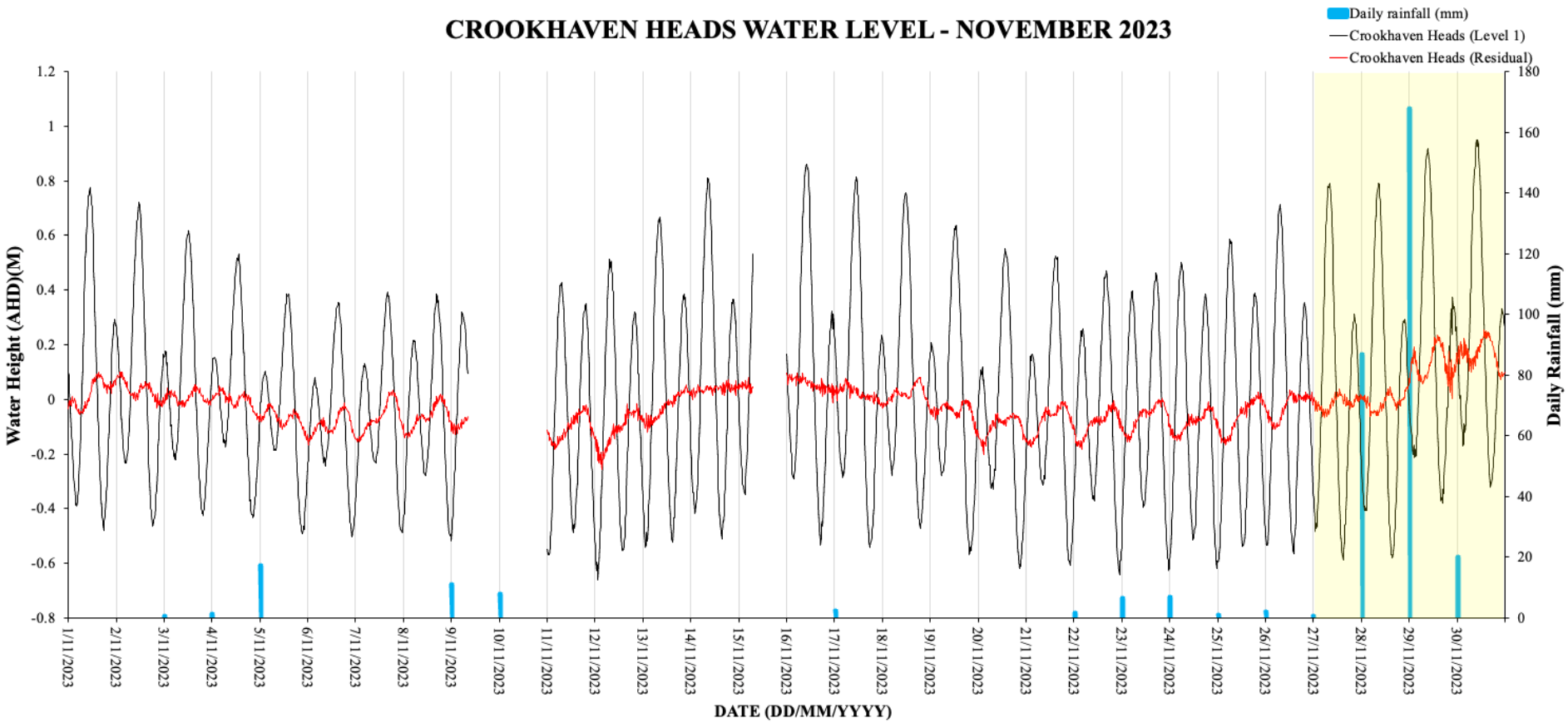

CROOKHAVEN HEADS WATER LEVEL - JUNE 2023
Daily Rainfall
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/6/2023
2/6/2023
3/6/2023
4/6/2023
5/6/2023
6/6/2023
7/6/2023
8/6/2023
9/6/2023
10/6/2023
11/6/2023
12/6/2023
13/6/2023
14/6/2023
15/6/2023
16/6/2023
17/6/2023
18/6/2023
19/6/2023
20/6/2023
21/6/2023
22/6/2023
23/6/2023
24/6/2023
25/6/2023
26/6/2023
27/6/2023
28/6/2023
29/6/2023
30/6/2023

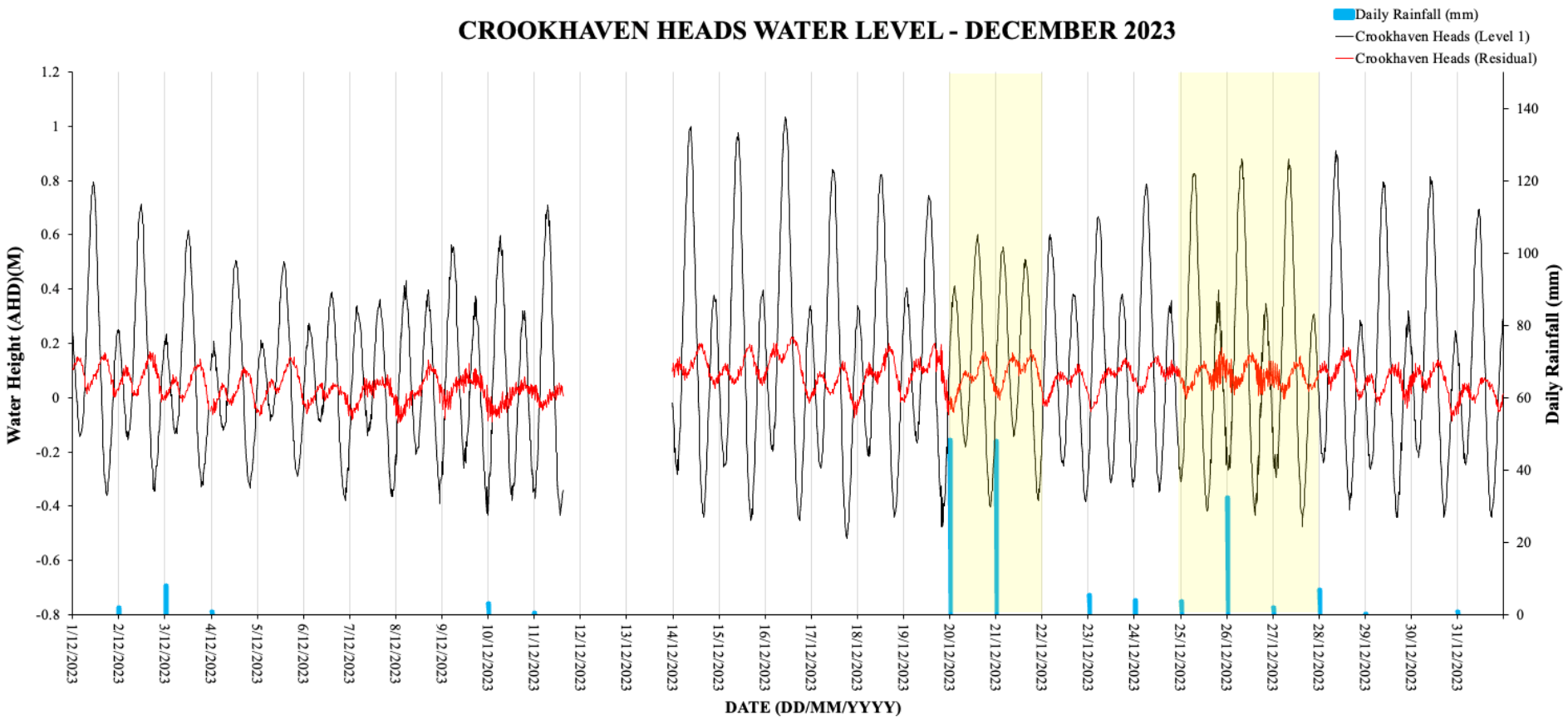

CROOKHAVEN HEADS WATER LEVEL - JULY 2023
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/7/2023
2/7/2023
3/7/2023
4/7/2023
5/7/2023
6/7/2023
7/7/2023
8/7/2023
9/7/2023
10/7/2023
11/7/2023
12/7/2023
13/7/2023
14/7/2023
15/7/2023
16/7/2023
17/7/2023
18/7/2023
19/7/2023
20/7/2023
21/7/2023
22/7/2023
23/7/2023
24/7/2023
25/7/2023
26/7/2023
27/7/2023
28/7/2023
29/7/2023
30/7/2023
31/7/2023

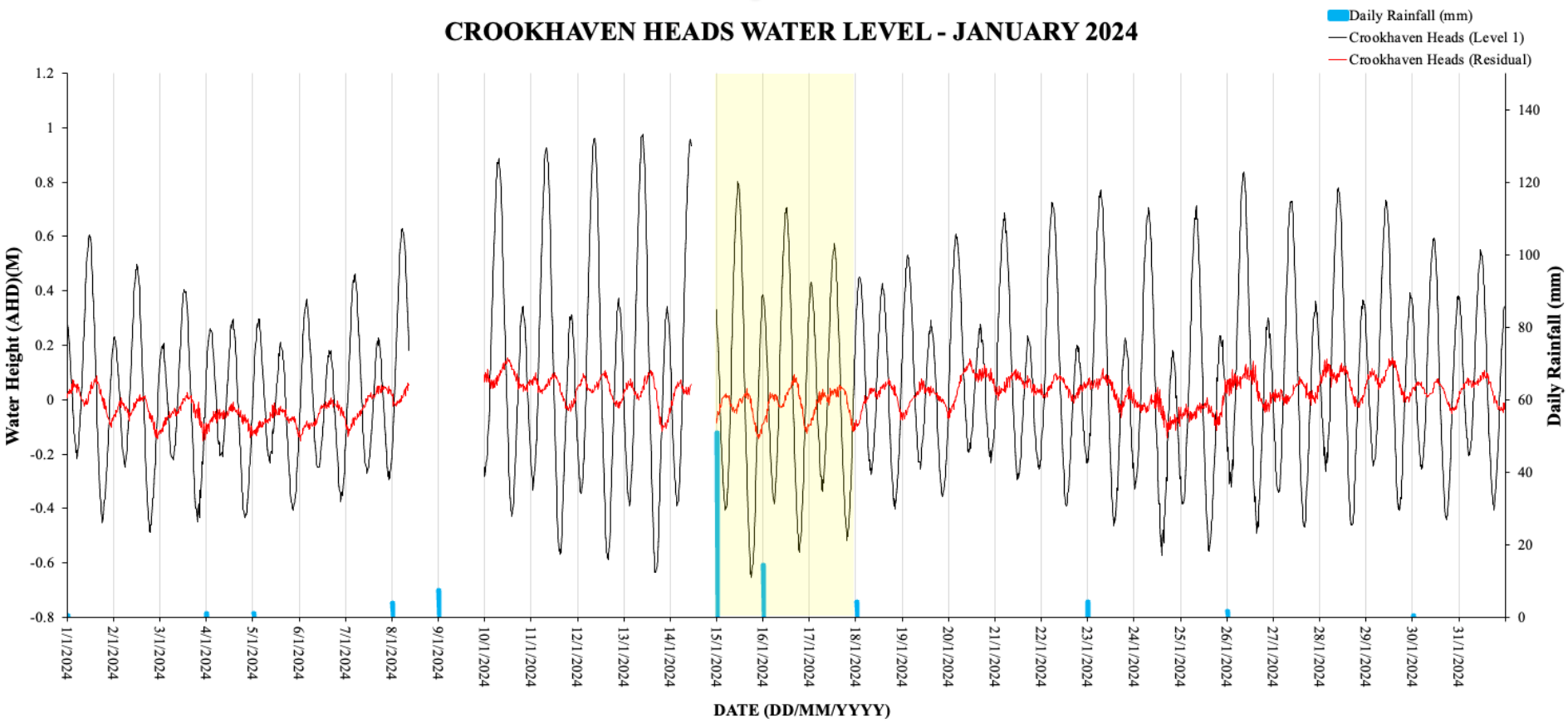

CROOKHAVEN HEADS WATER LEVEL - AUGUST 2023
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/8/2023
2/8/2023
3/8/2023
4/8/2023
5/8/2023
6/8/2023
7/8/2023
8/8/2023
9/8/2023
10/8/2023
11/8/2023
12/8/2023
13/8/2023
14/8/2023
15/8/2023
16/8/2023
17/8/2023
18/8/2023
19/8/2023
20/8/2023
21/8/2023
22/8/2023
23/8/2023
24/8/2023
25/8/2023
26/8/2023
27/8/2023
28/8/2023
29/8/2023
30/8/2023
31/8/2023

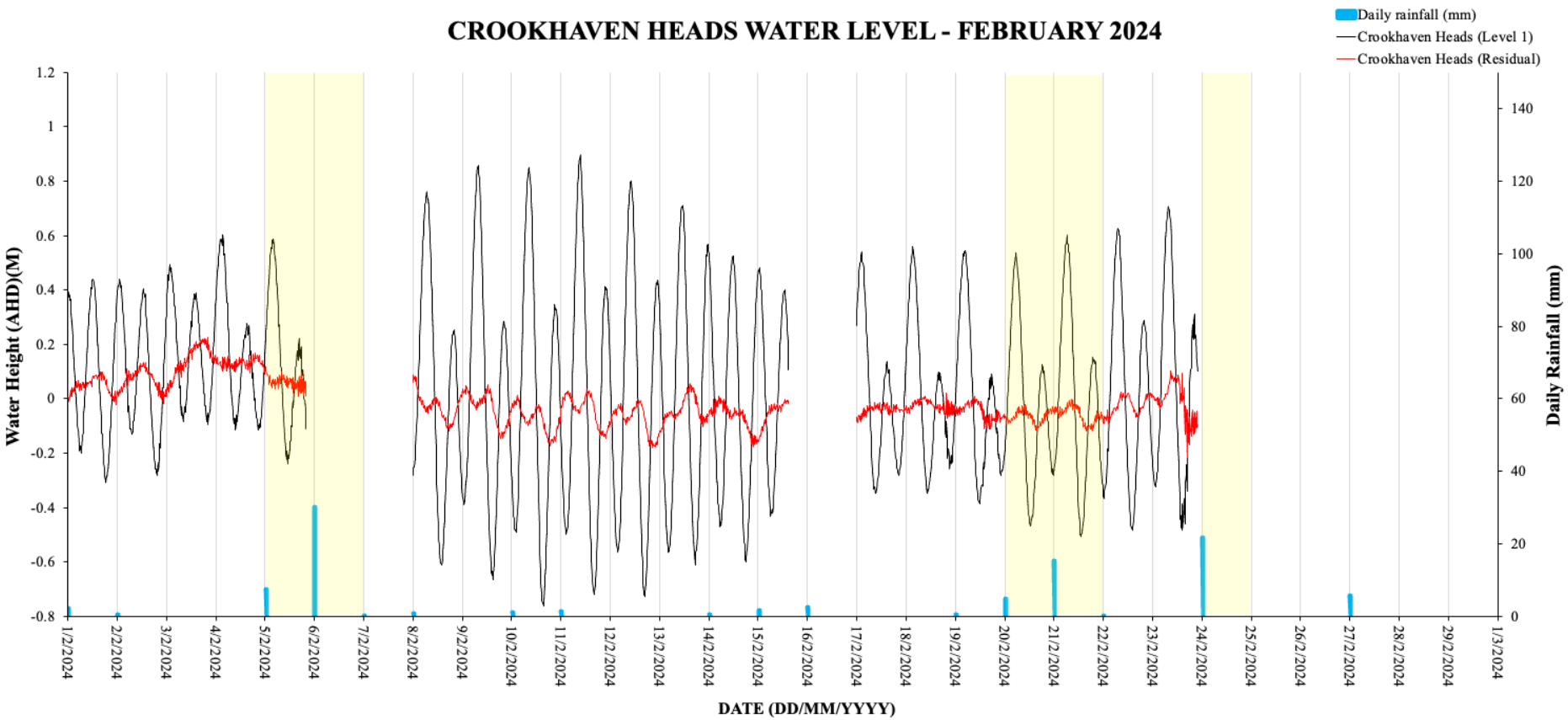

CROOKHAVEN HEADS WATER LEVEL - SEPTEMBER 2023
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/9/2023
2/9/2023
3/9/2023
4/9/2023
5/9/2023
6/9/2023
7/9/2023
8/9/2023
9/9/2023
10/9/2023
11/9/2023
12/9/2023
13/9/2023
14/9/2023
15/9/2023
16/9/2023
17/9/2023
18/9/2023
19/9/2023
20/9/2023
21/9/2023
22/9/2023
23/9/2023
24/9/2023
25/9/2023
26/9/2023
27/9/2023
28/9/2023
29/9/2023
30/9/2023

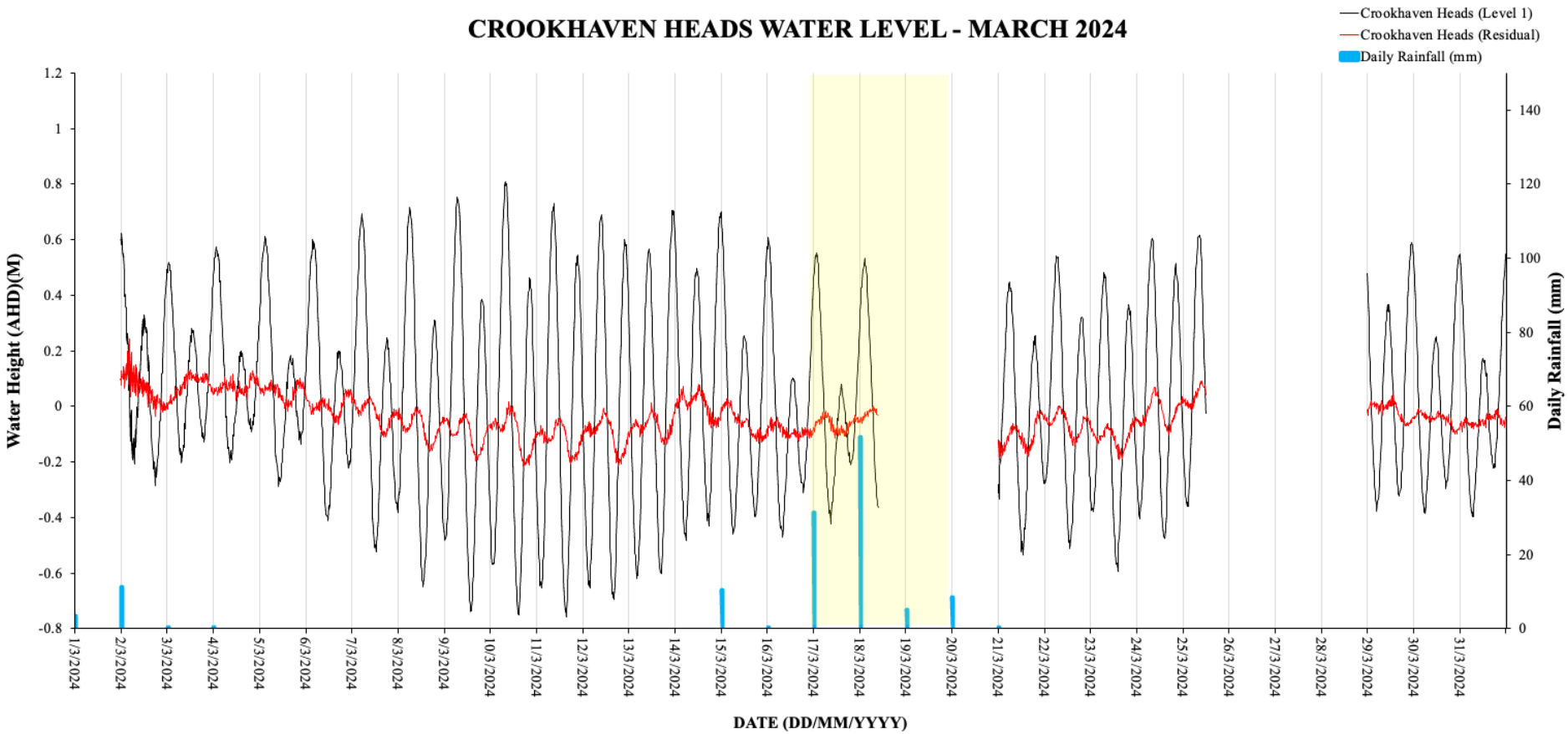

CROOKHAVEN HEADS WATER LEVEL - OCTOBER 2023
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/10/2023
2/10/2023
3/10/2023
4/10/2023
5/10/2023
6/10/2023
7/10/2023
8/10/2023
9/10/2023
10/10/2023
11/10/2023
12/10/2023
13/10/2023
14/10/2023
15/10/2023
16/10/2023
17/10/2023
18/10/2023
19/10/2023
20/10/2023
21/10/2023
22/10/2023
23/10/2023
24/10/2023
25/10/2023
26/10/2023
27/10/2023
28/10/2023
29/10/2023
30/10/2023
31/10/2023

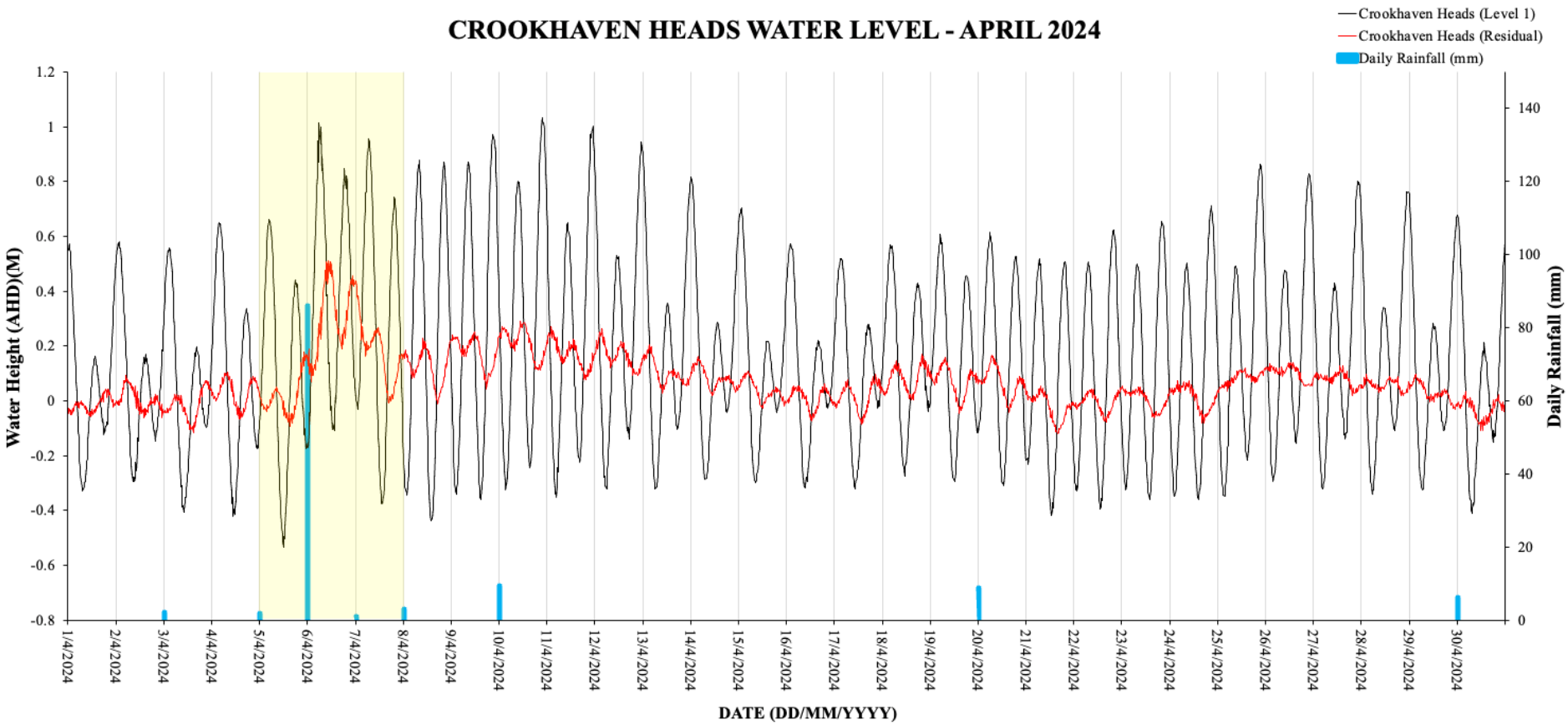

CROOKHAVEN HEADS WATER LEVEL - NOVEMBER 2023
Daily rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
180
160
140
120
100
80
60
40
20
0
1/11/2023
2/11/2023
3/11/2023
4/11/2023
5/11/2023
6/11/2023
7/11/2023
8/11/2023
9/11/2023
10/11/2023
11/11/2023
12/11/2023
13/11/2023
14/11/2023
15/11/2023
16/11/2023
17/11/2023
18/11/2023
19/11/2023
20/11/2023
21/11/2023
22/11/2023
23/11/2023
24/11/2023
25/11/2023
26/11/2023
27/11/2023
28/11/2023
29/11/2023
30/11/2023

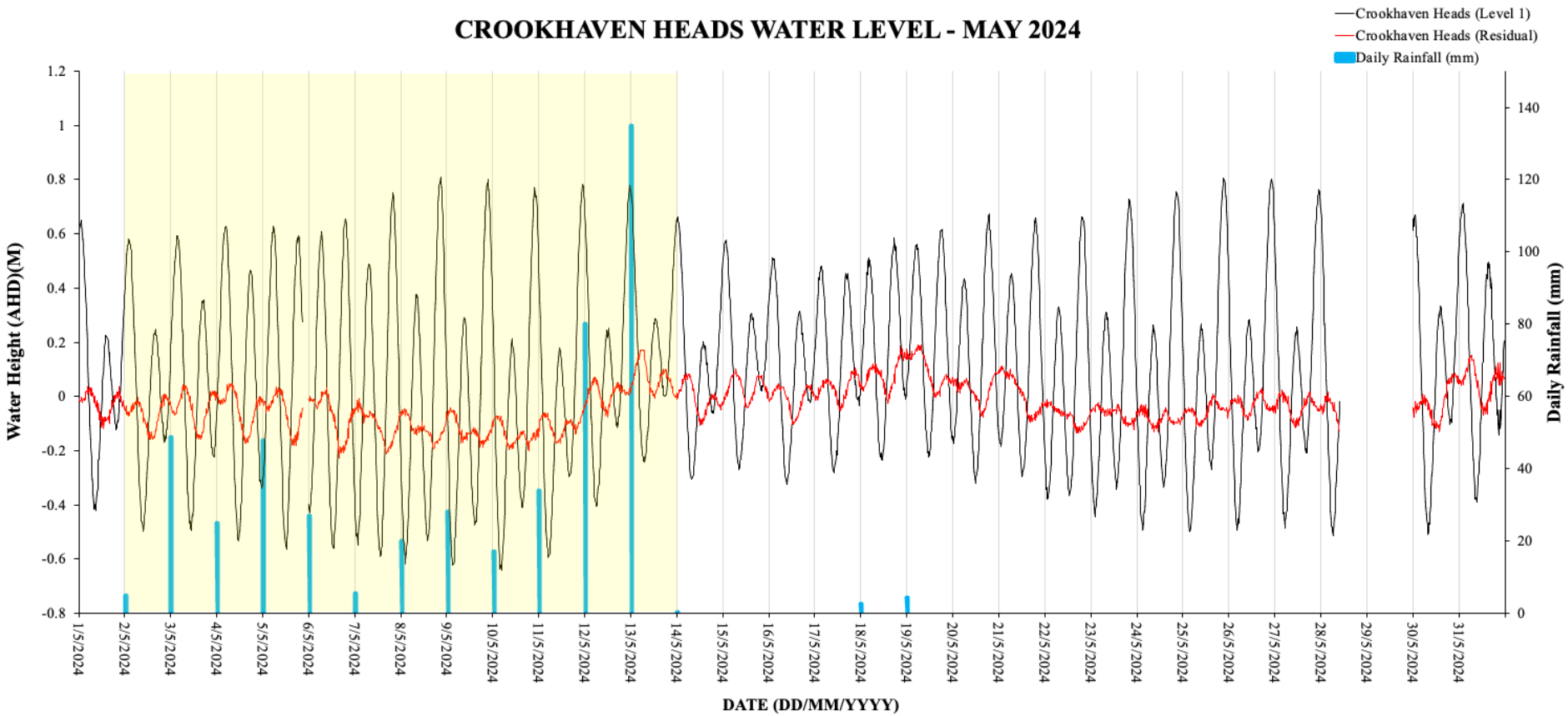

CROOKHAVEN HEADS WATER LEVEL - DECEMBER 2023
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/12/2023
2/12/2023
3/12/2023
4/12/2023
5/12/2023
6/12/2023
7/12/2023
8/12/2023
9/12/2023
10/12/2023
11/12/2023
12/12/2023
13/12/2023
14/12/2023
15/12/2023
16/12/2023
17/12/2023
18/12/2023
19/12/2023
20/12/2023
21/12/2023
22/12/2023
23/12/2023
24/12/2023
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29/12/2023
30/12/2023
31/12/2023

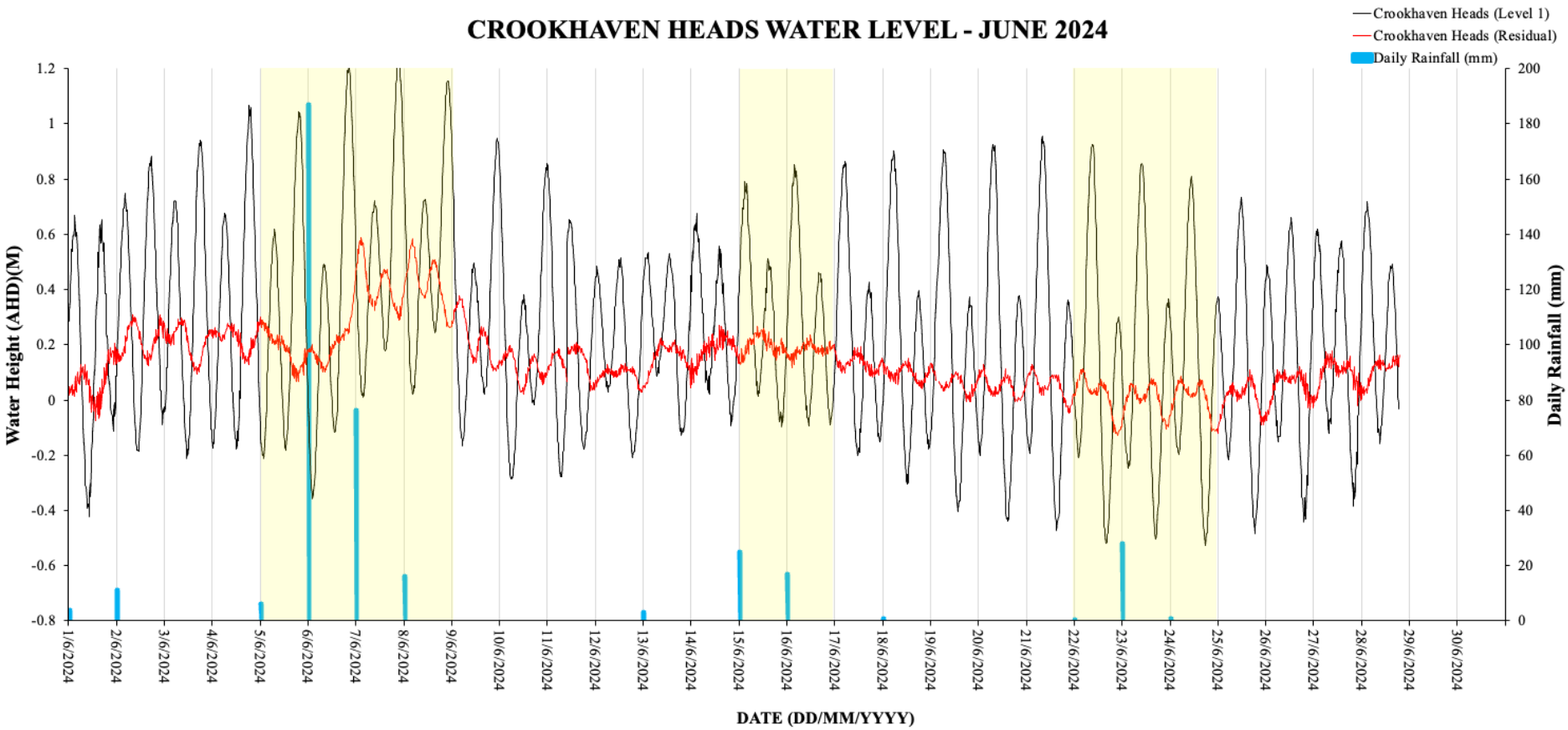

CROOKHAVEN HEADS WATER LEVEL - JANUARY 2024
Daily Rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

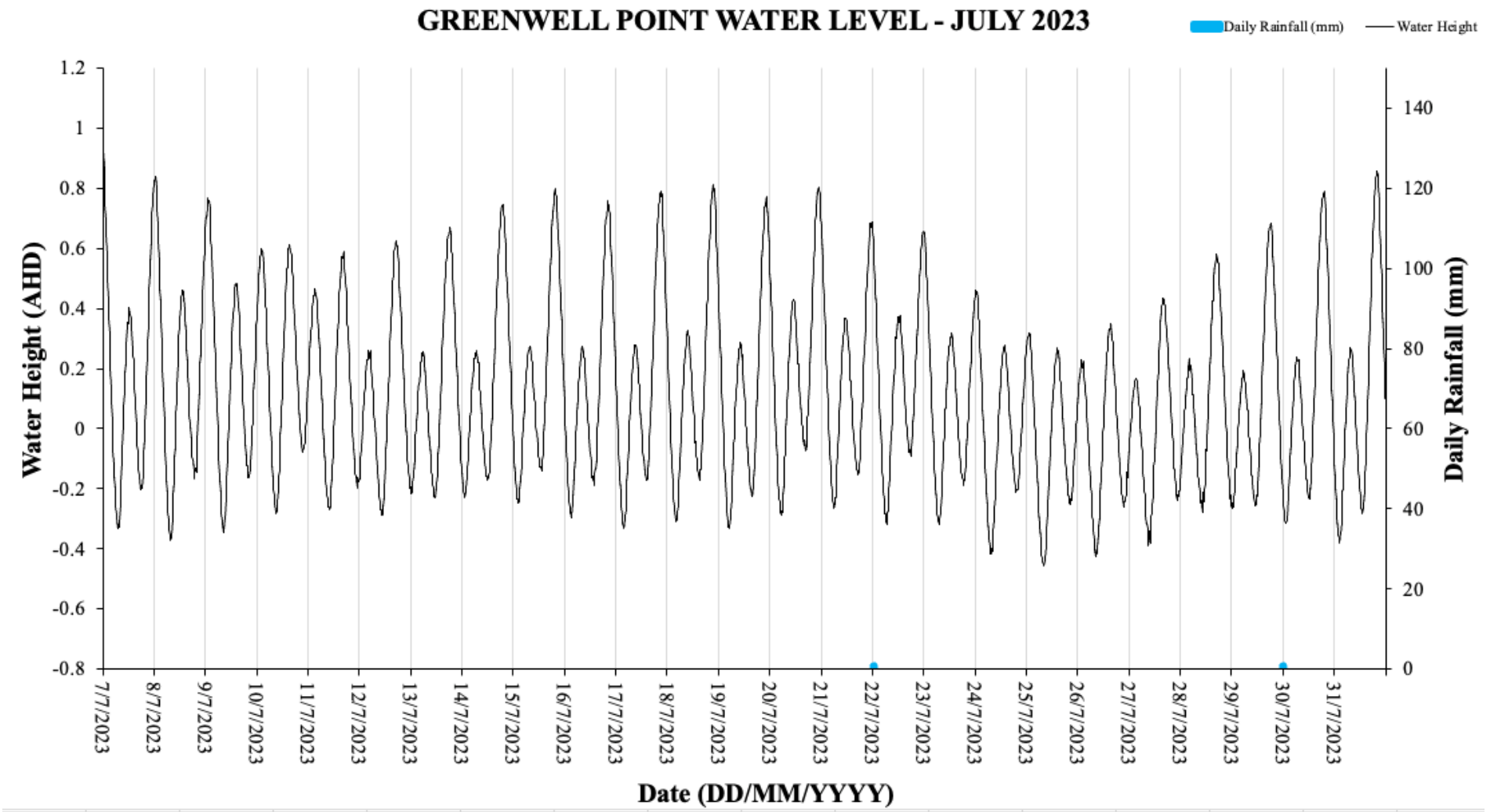

CROOKHAVEN HEADS WATER LEVEL - FEBRUARY 2024
Daily rainfall (mm)
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

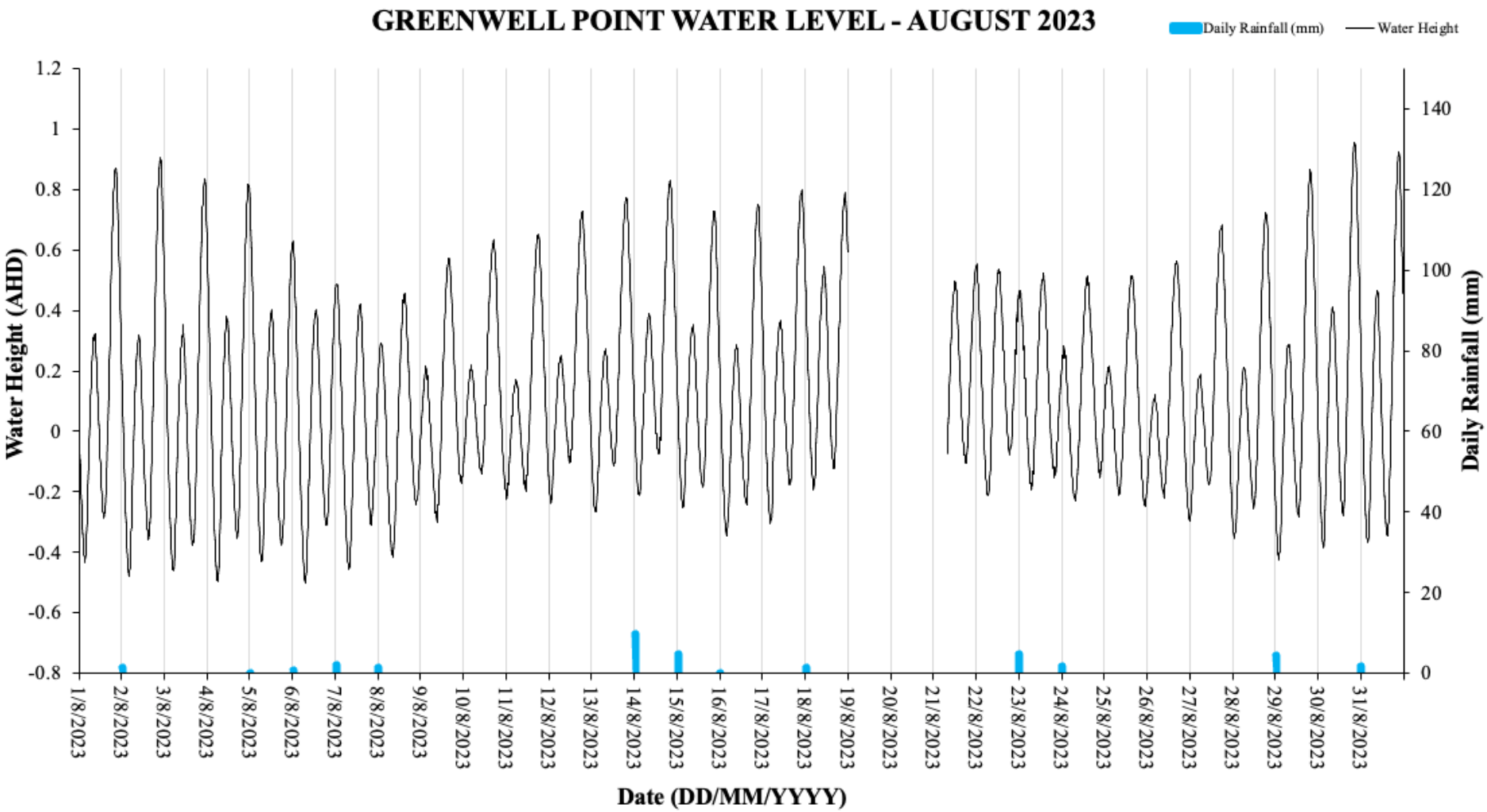

CROOKHAVEN HEADS WATER LEVEL - MARCH 2024
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Daily Rainfall (mm)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

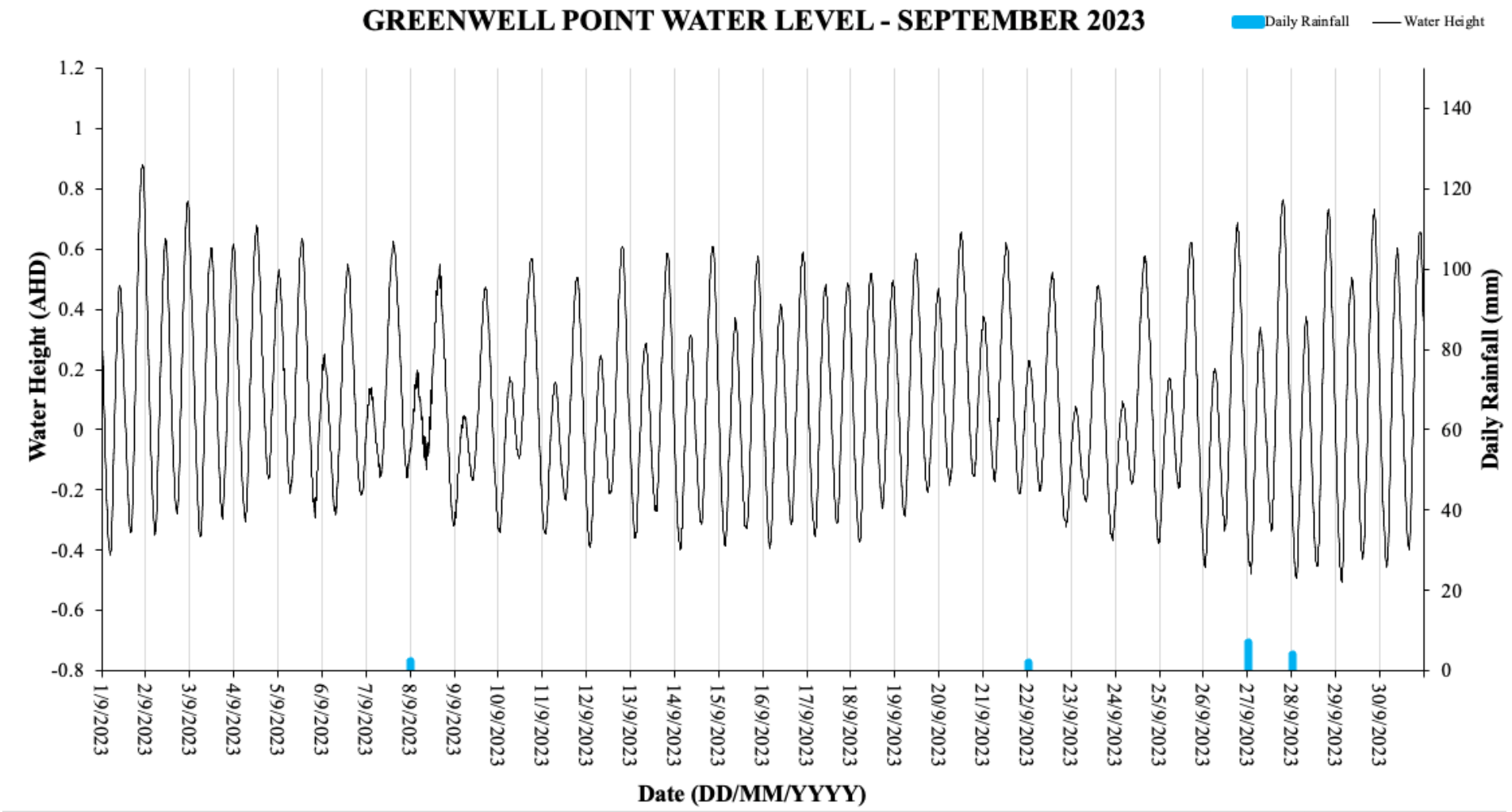

CROOKHAVEN HEADS WATER LEVEL - APRIL 2024
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Daily Rainfall (mm)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

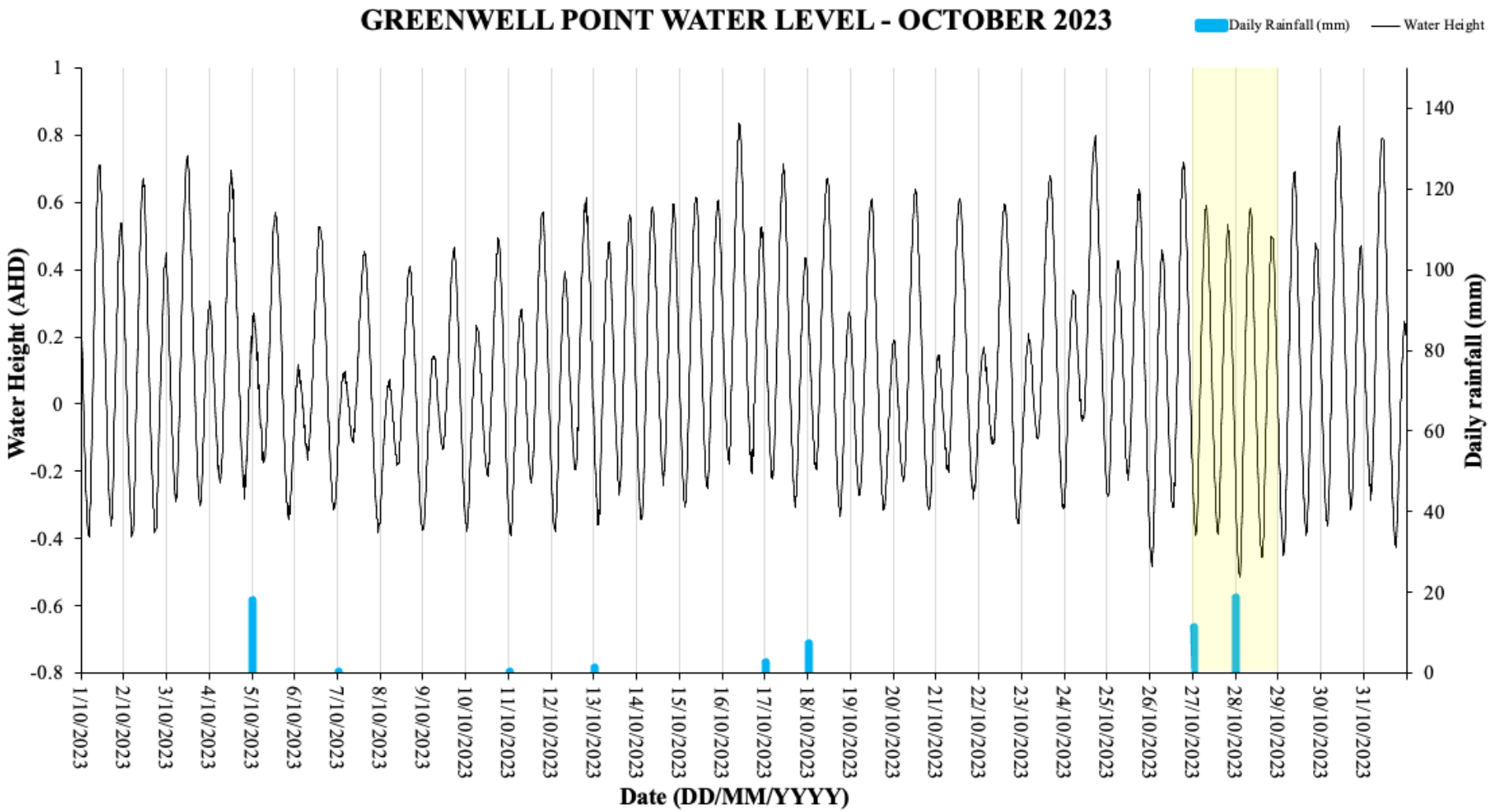

CROOKHAVEN HEADS WATER LEVEL - MAY 2024
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Daily Rainfall (mm)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

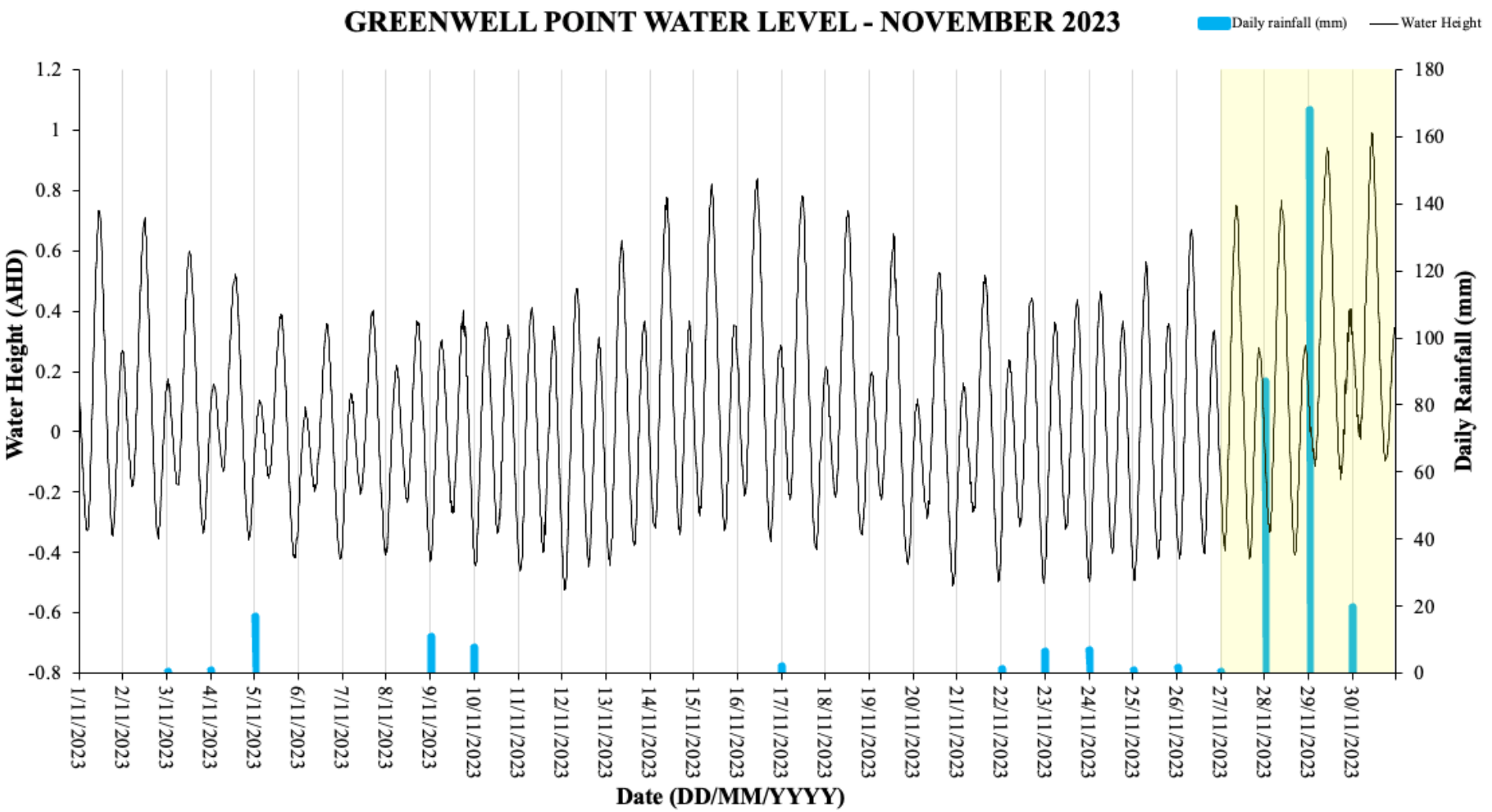

CROOKHAVEN HEADS WATER LEVEL - JUNE 2024
Crookhaven Heads (Level 1)
Crookhaven Heads (Residual)
Daily Rainfall (mm)
Water Height (AHD)(M)
Daily Rainfall (mm)
DATE (DD/MM/YYYY)

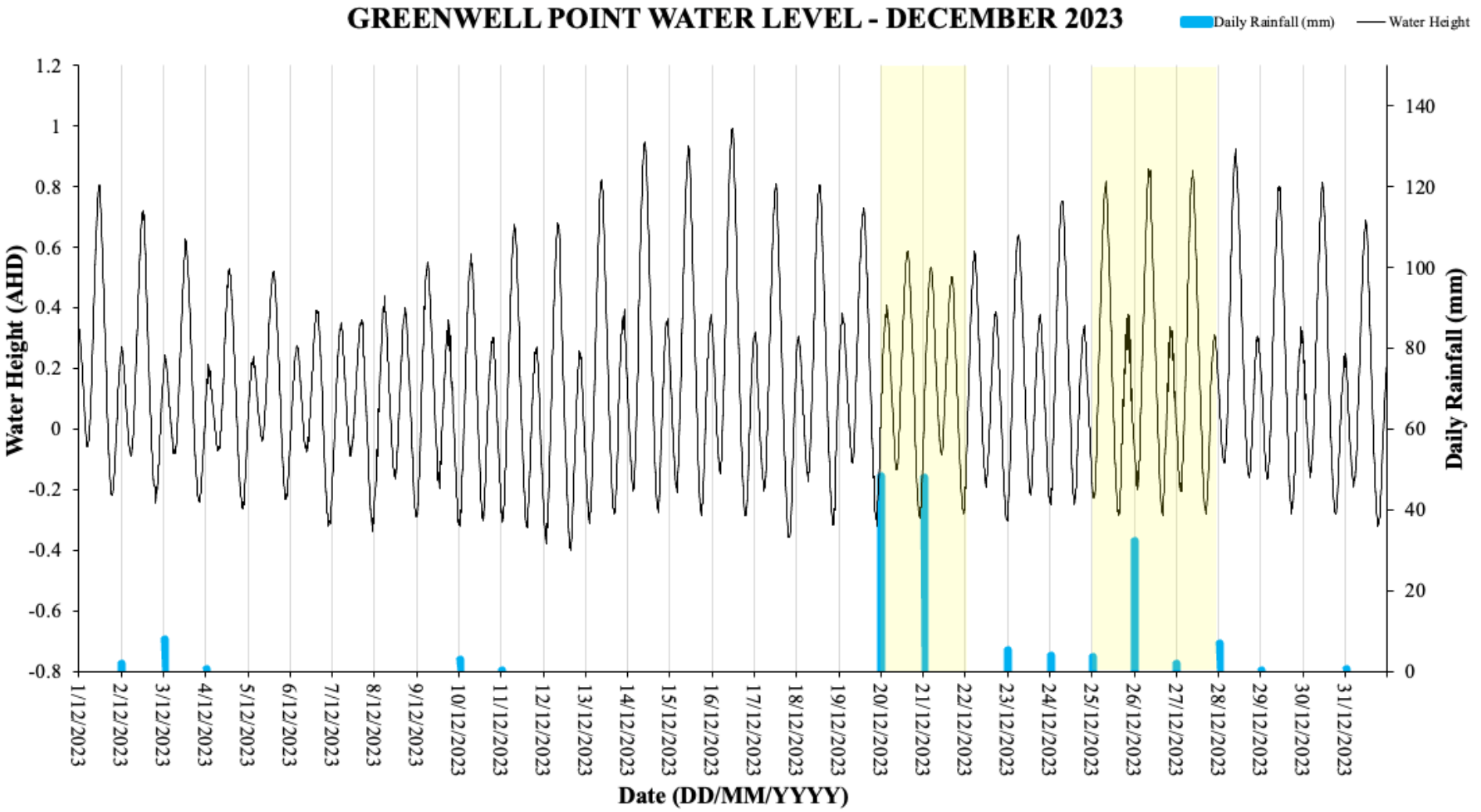

GREENWELL POINT WATER LEVEL - JULY 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
7/7/2023
8/7/2023
9/7/2023
10/7/2023
11/7/2023
12/7/2023
13/7/2023
14/7/2023
15/7/2023
16/7/2023
17/7/2023
18/7/2023
19/7/2023
20/7/2023
21/7/2023
22/7/2023
23/7/2023
24/7/2023
25/7/2023
26/7/2023
27/7/2023
28/7/2023
29/7/2023
30/7/2023
31/7/2023

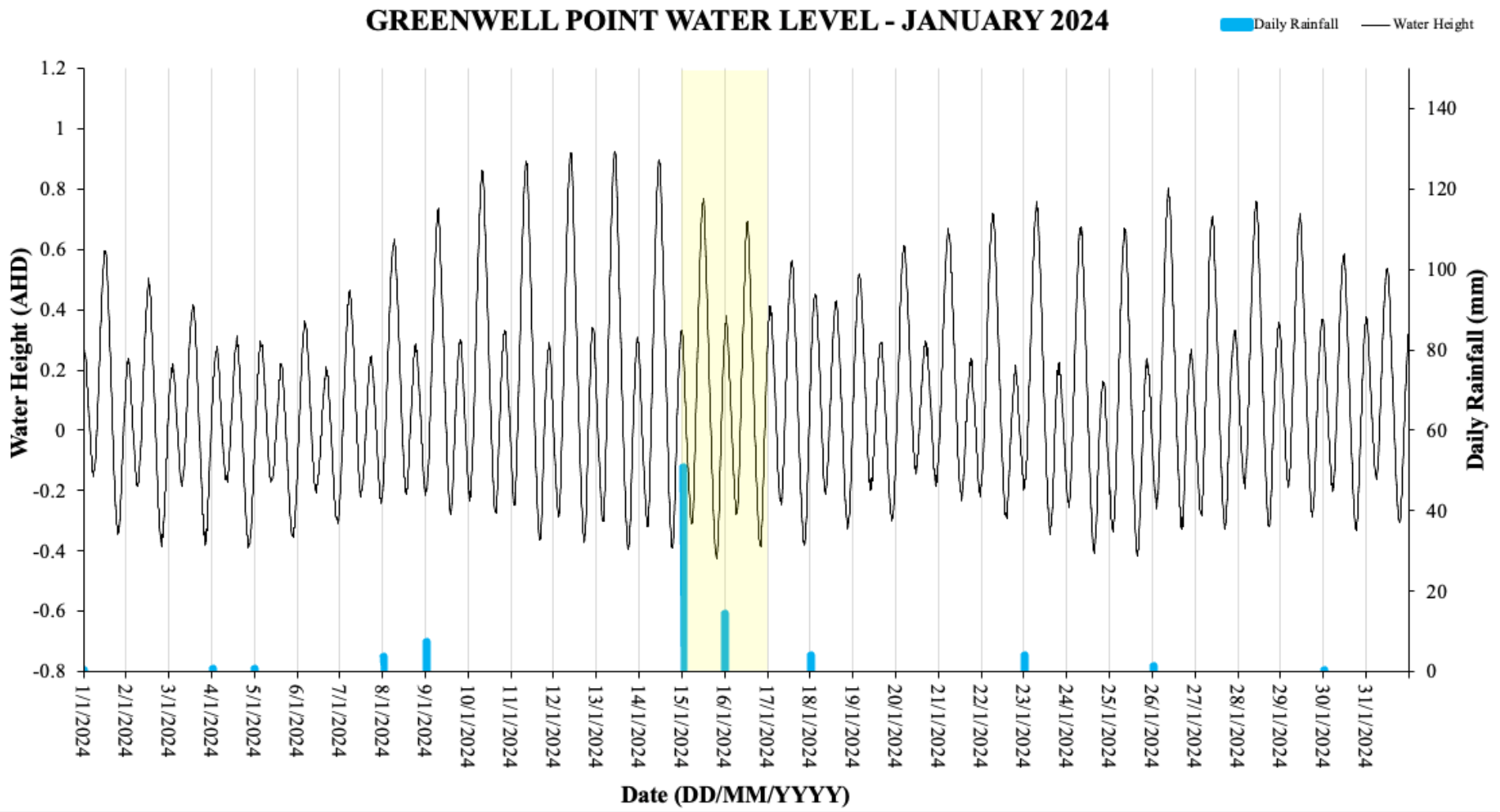

GREENWELL POINT WATER LEVEL - AUGUST 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/8/2023
2/8/2023
3/8/2023
4/8/2023
5/8/2023
6/8/2023
7/8/2023
8/8/2023
9/8/2023
10/8/2023
11/8/2023
12/8/2023
13/8/2023
14/8/2023
15/8/2023
16/8/2023
17/8/2023
18/8/2023
19/8/2023
20/8/2023
21/8/2023
22/8/2023
23/8/2023
24/8/2023
25/8/2023
26/8/2023
27/8/2023
28/8/2023
29/8/2023
30/8/2023
31/8/2023

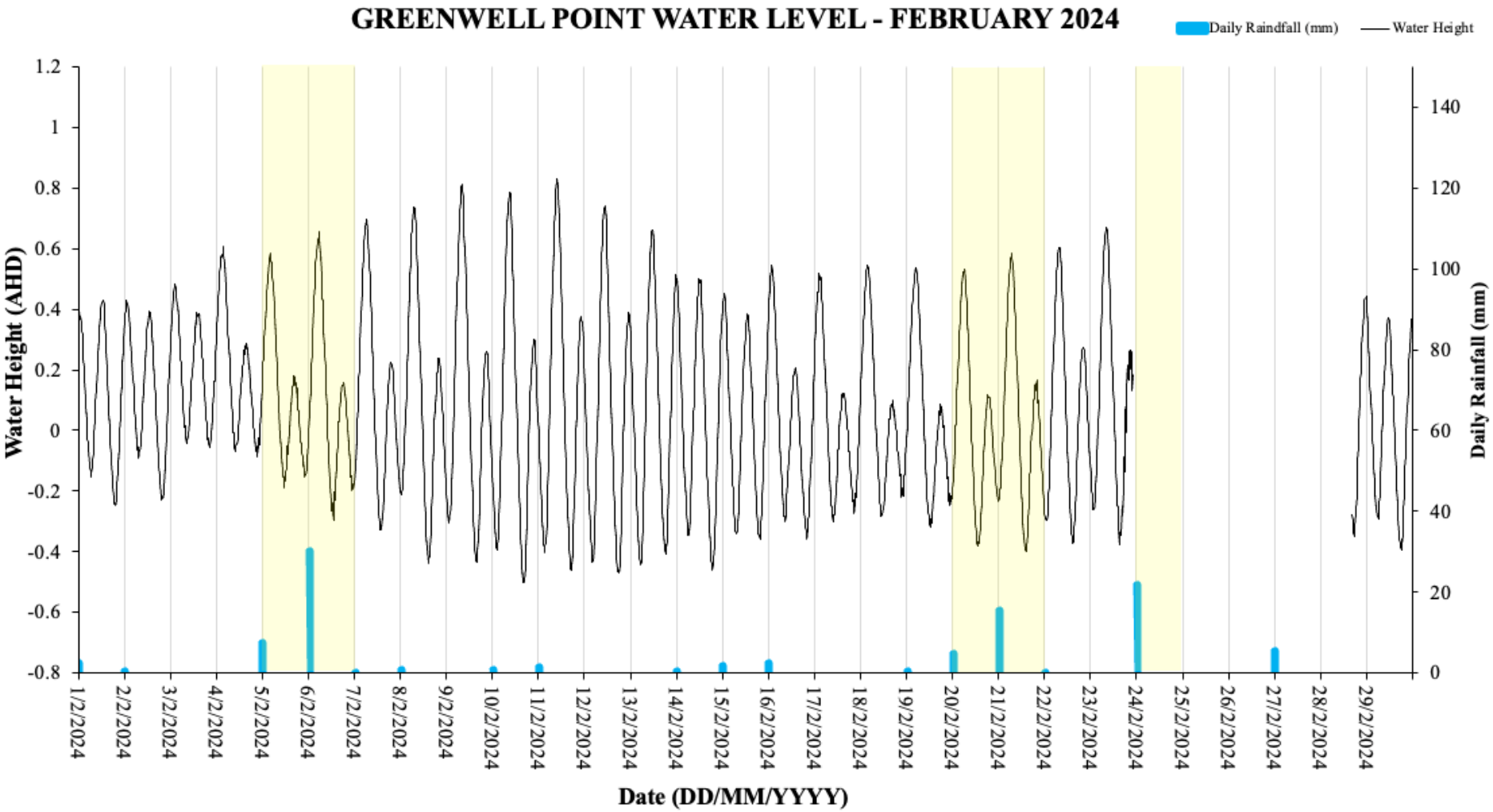

GREENWELL POINT WATER LEVEL - SEPTEMBER 2023
Daily Rainfall
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/9/2023
2/9/2023
3/9/2023
4/9/2023
5/9/2023
6/9/2023
7/9/2023
8/9/2023
9/9/2023
10/9/2023
11/9/2023
12/9/2023
13/9/2023
14/9/2023
15/9/2023
16/9/2023
17/9/2023
18/9/2023
19/9/2023
20/9/2023
21/9/2023
22/9/2023
23/9/2023
24/9/2023
25/9/2023
26/9/2023
27/9/2023
28/9/2023
29/9/2023
30/9/2023

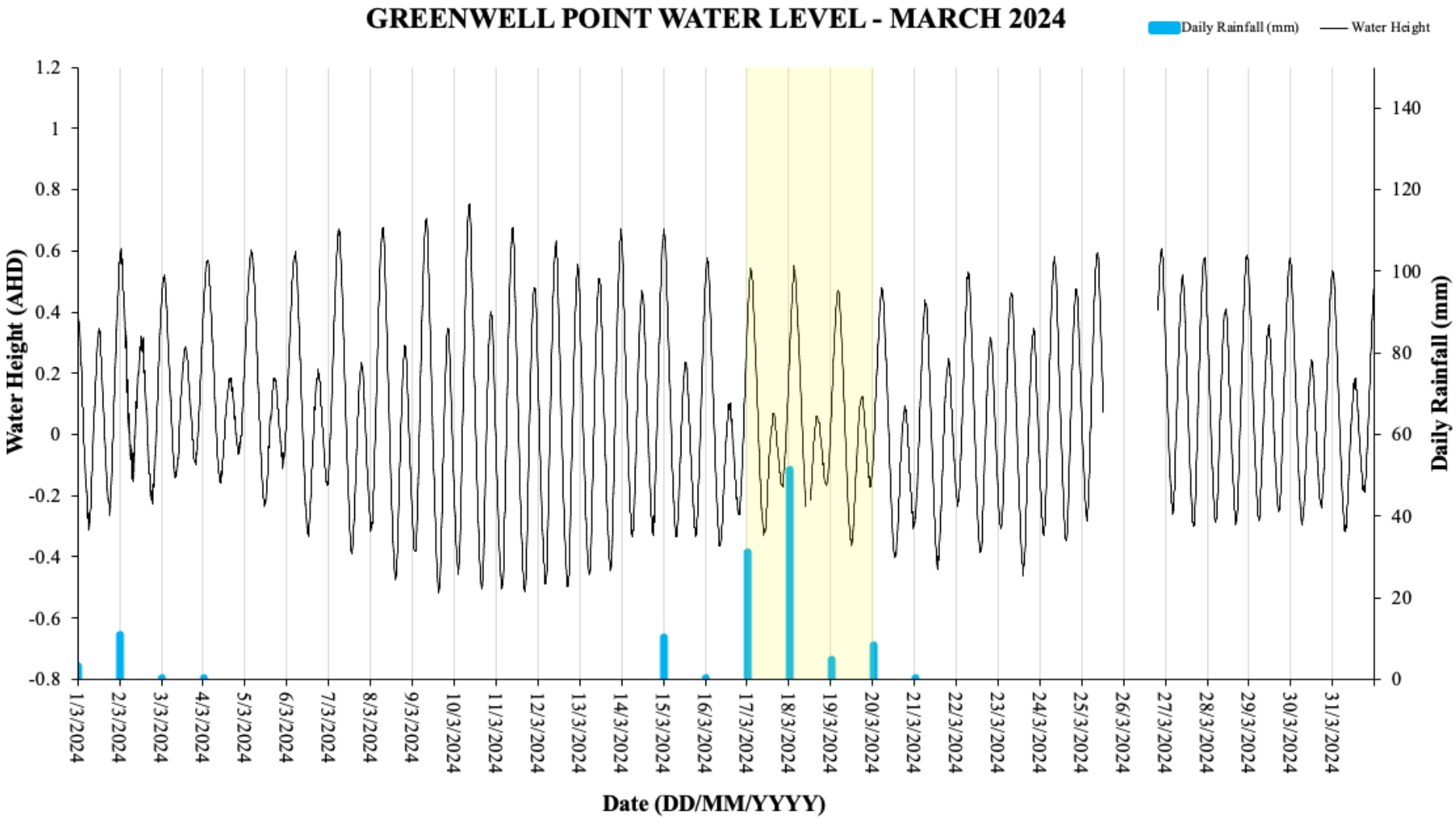

GREENWELL POINT WATER LEVEL - OCTOBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily rainfall (mm)
Date (DD/MM/YYYY)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/10/2023
2/10/2023
3/10/2023
4/10/2023
5/10/2023
6/10/2023
7/10/2023
8/10/2023
9/10/2023
10/10/2023
11/10/2023
12/10/2023
13/10/2023
14/10/2023
15/10/2023
16/10/2023
17/10/2023
18/10/2023
19/10/2023
20/10/2023
21/10/2023
22/10/2023
23/10/2023
24/10/2023
25/10/2023
26/10/2023
27/10/2023
28/10/2023
29/10/2023
30/10/2023
31/10/2023

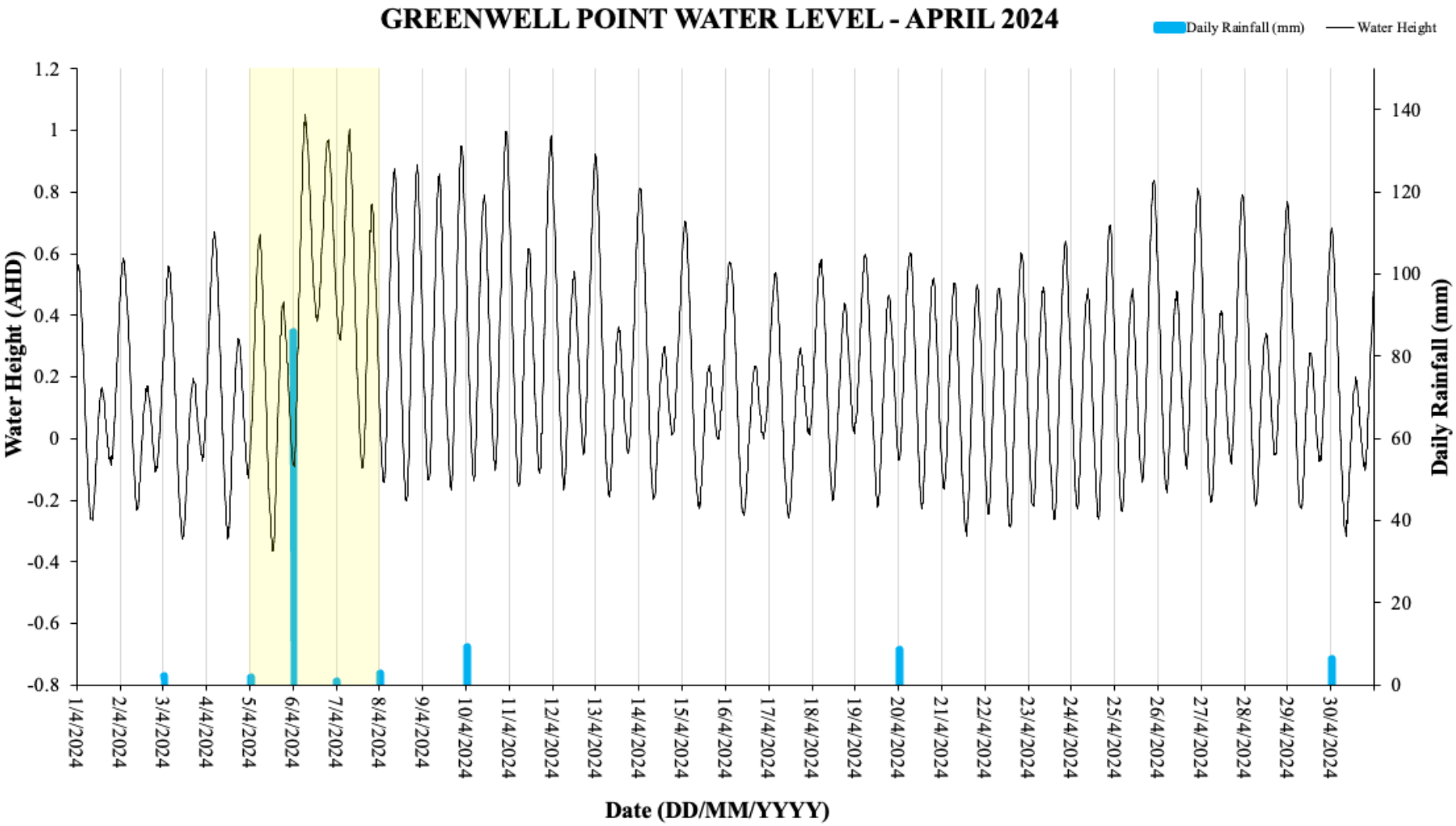

GREENWELL POINT WATER LEVEL - NOVEMBER 2023
Daily rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
180
160
140
120
100
80
60
40
20
0
1/11/2023
2/11/2023
3/11/2023
4/11/2023
5/11/2023
6/11/2023
7/11/2023
8/11/2023
9/11/2023
10/11/2023
11/11/2023
12/11/2023
13/11/2023
14/11/2023
15/11/2023
16/11/2023
17/11/2023
18/11/2023
19/11/2023
20/11/2023
21/11/2023
22/11/2023
23/11/2023
24/11/2023
25/11/2023
26/11/2023
27/11/2023
28/11/2023
29/11/2023
30/11/2023

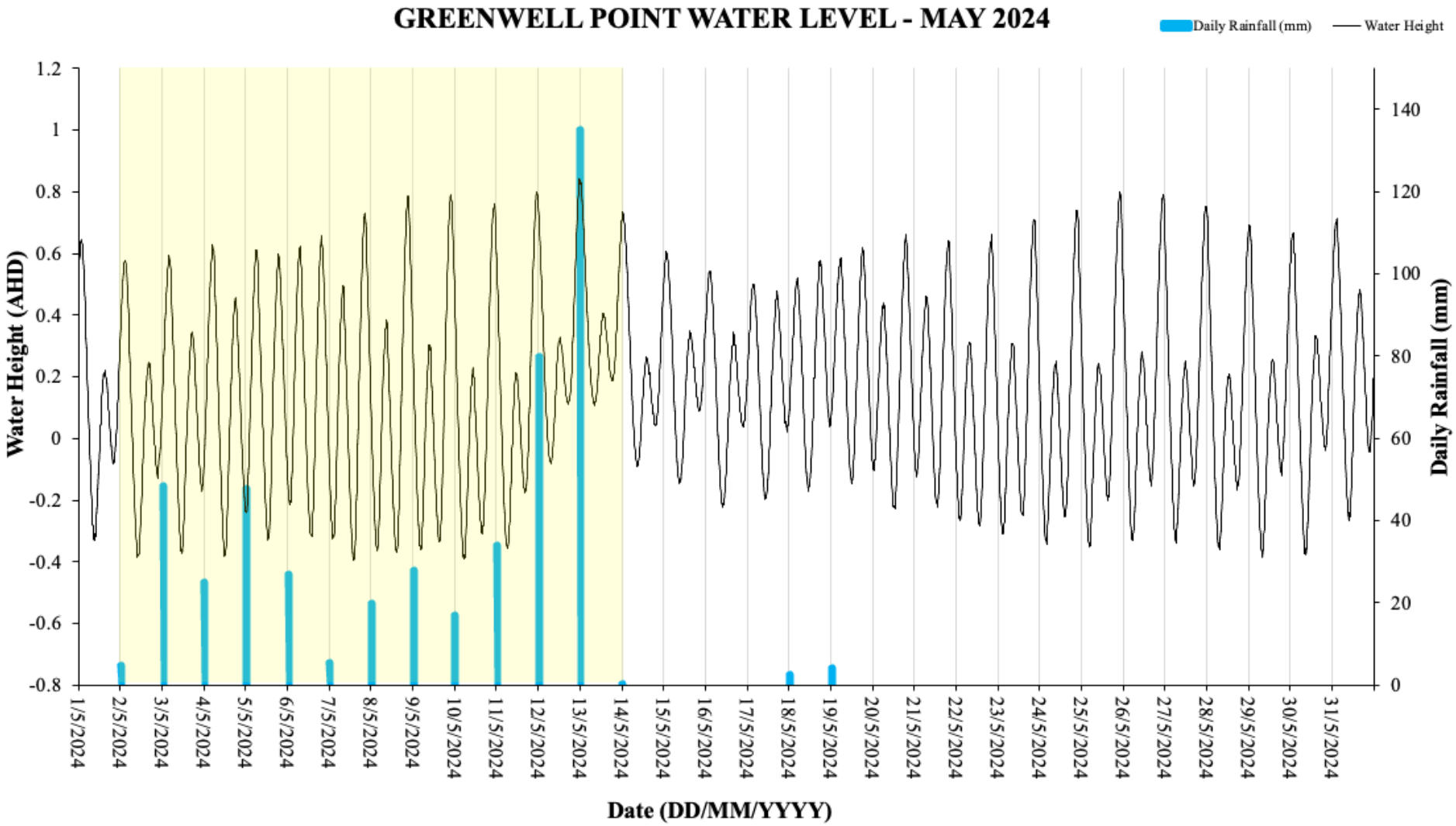

GREENWELL POINT WATER LEVEL - DECEMBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/12/2023
2/12/2023
3/12/2023
4/12/2023
5/12/2023
6/12/2023
7/12/2023
8/12/2023
9/12/2023
10/12/2023
11/12/2023
12/12/2023
13/12/2023
14/12/2023
15/12/2023
16/12/2023
17/12/2023
18/12/2023
19/12/2023
20/12/2023
21/12/2023
22/12/2023
23/12/2023
24/12/2023
25/12/2023
26/12/2023
27/12/2023
28/12/2023
29/12/2023
30/12/2023
31/12/2023

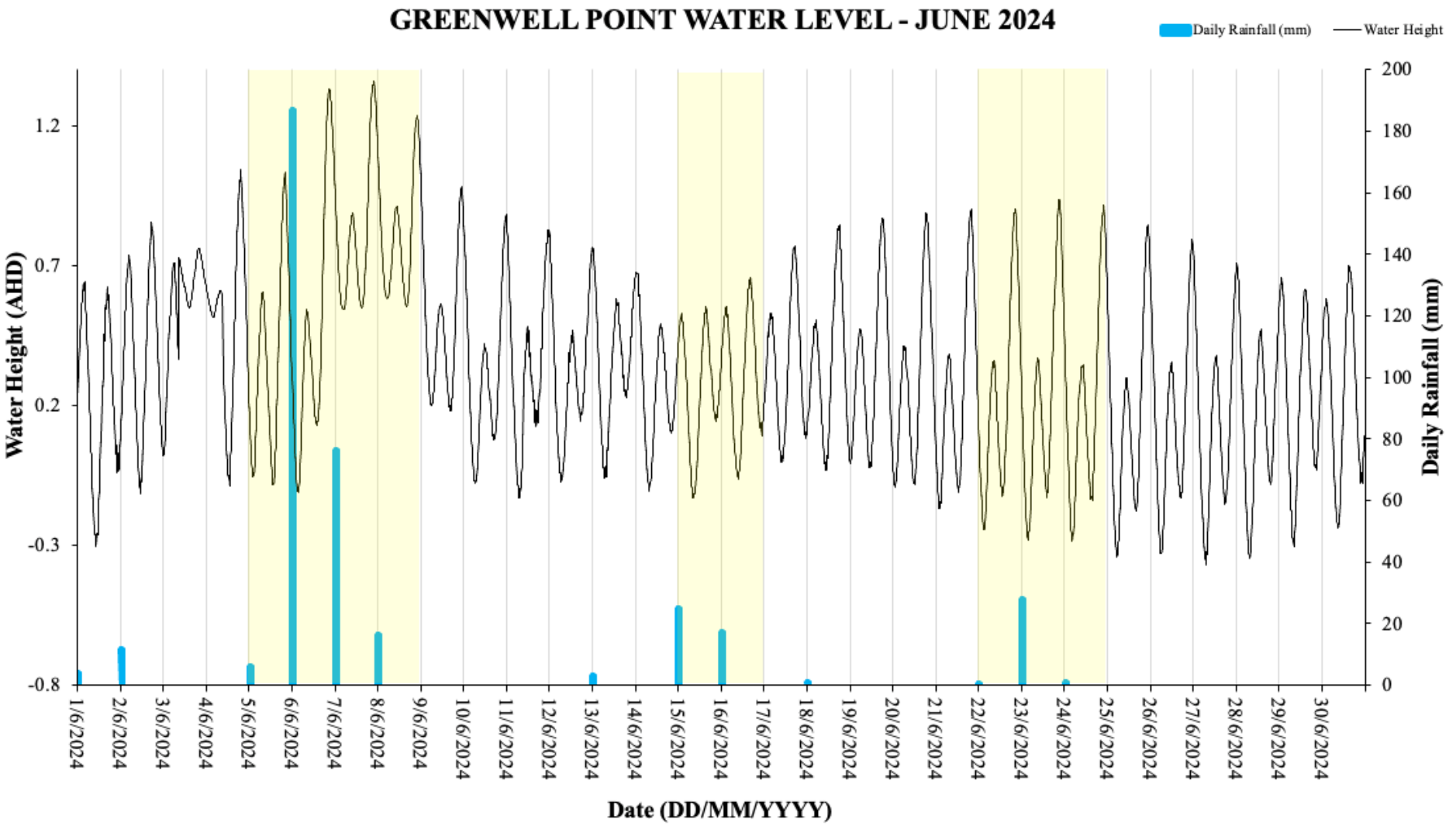

GREENWELL POINT WATER LEVEL - JANUARY 2024
Daily Rainfall
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/1/2024
2/1/2024
3/1/2024
4/1/2024
5/1/2024
6/1/2024
7/1/2024
8/1/2024
9/1/2024
10/1/2024
11/1/2024
12/1/2024
13/1/2024
14/1/2024
15/1/2024
16/1/2024
17/1/2024
18/1/2024
19/1/2024
20/1/2024
21/1/2024
22/1/2024
23/1/2024
24/1/2024
25/1/2024
26/1/2024
27/1/2024
28/1/2024
29/1/2024
30/1/2024
31/1/2024

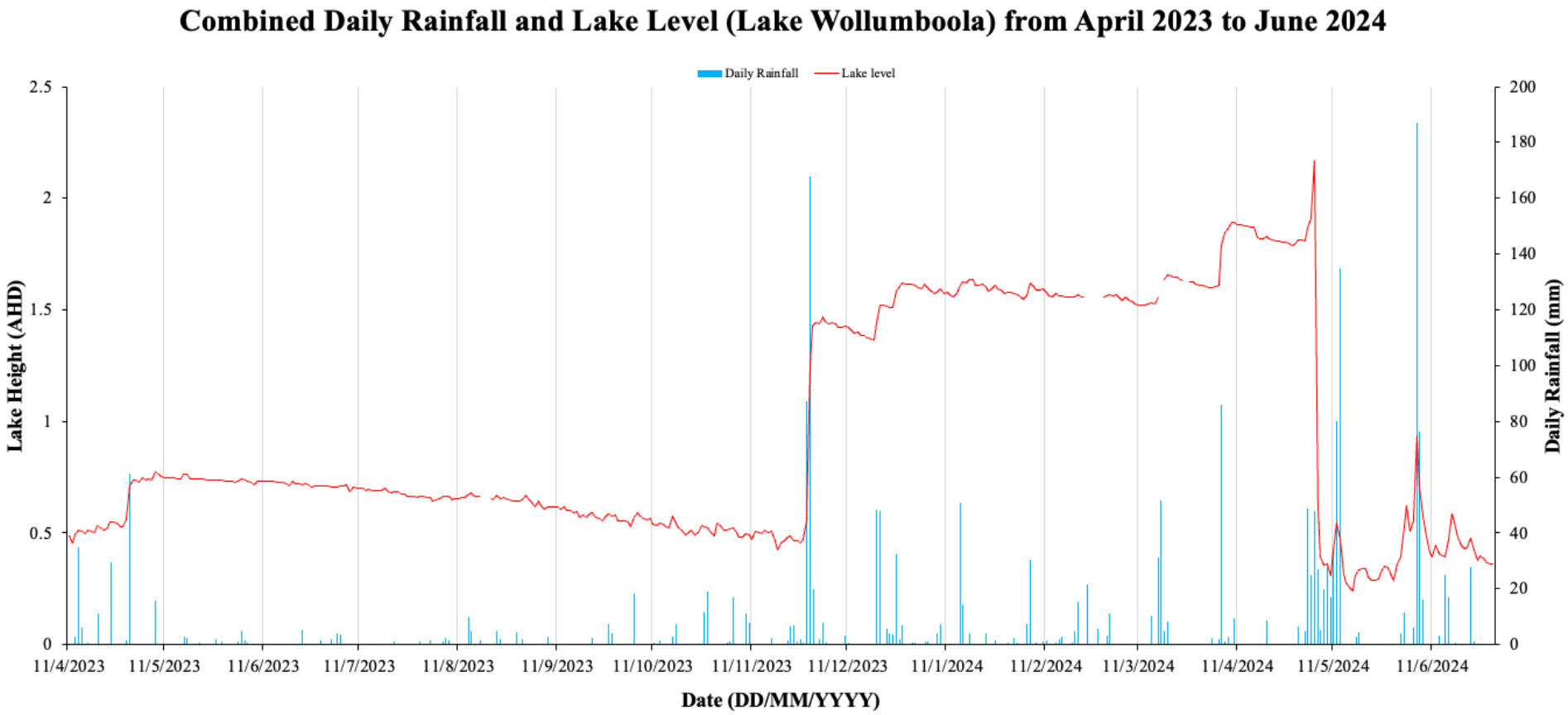

GREENWELL POINT WATER LEVEL - FEBRUARY 2024
Daily Raindfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/2/2024
2/2/2024
3/2/2024
4/2/2024
5/2/2024
6/2/2024
7/2/2024
8/2/2024
9/2/2024
10/2/2024
11/2/2024
12/2/2024
13/2/2024
14/2/2024
15/2/2024
16/2/2024
17/2/2024
18/2/2024
19/2/2024
20/2/2024
21/2/2024
22/2/2024
23/2/2024
24/2/2024
25/2/2024
26/2/2024
27/2/2024
28/2/2024
29/2/2024
Date (DD/MM/YYYY)

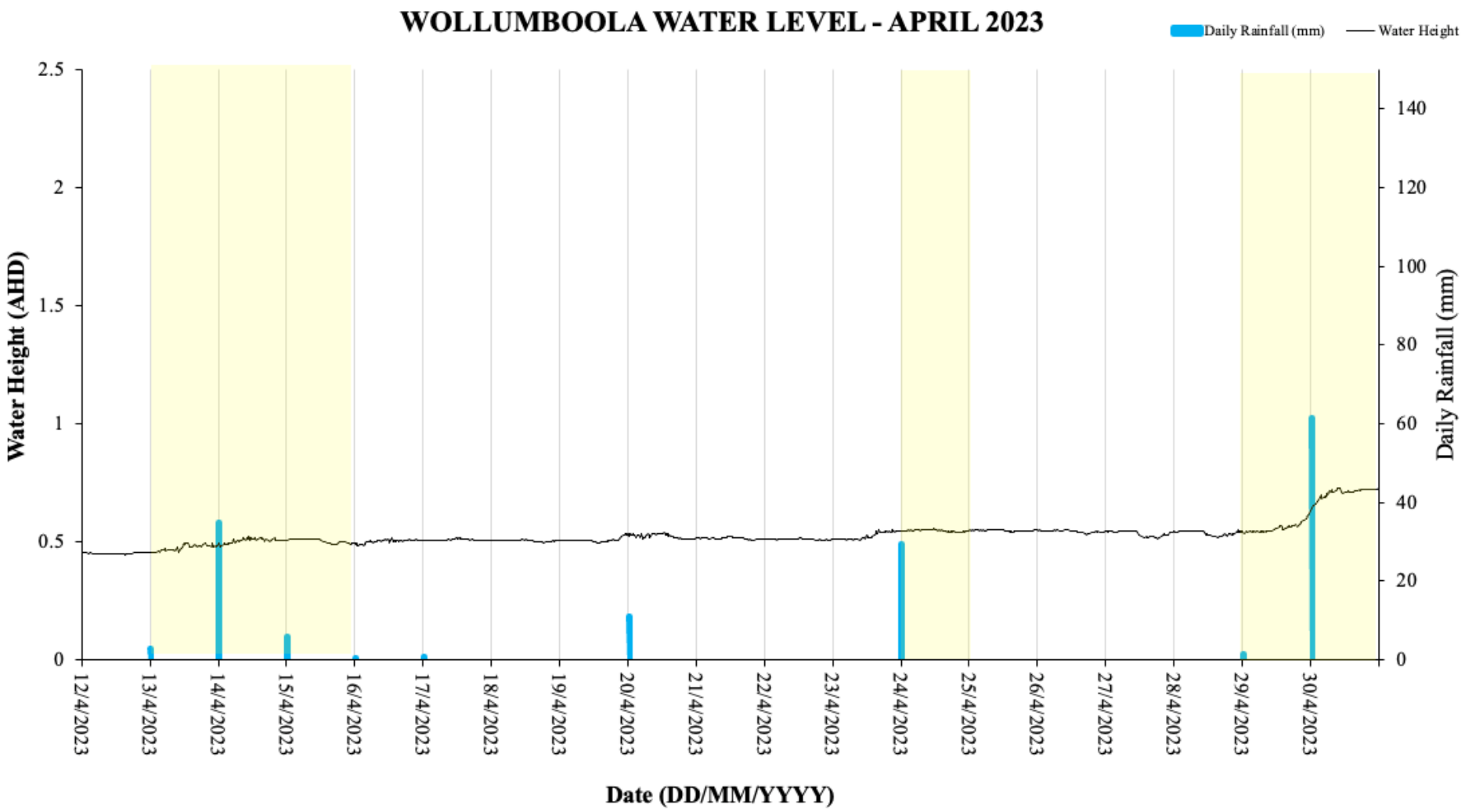

GREENWELL POINT WATER LEVEL - MARCH 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/3/2024
2/3/2024
3/3/2024
4/3/2024
5/3/2024
6/3/2024
7/3/2024
8/3/2024
9/3/2024
10/3/2024
11/3/2024
12/3/2024
13/3/2024
14/3/2024
15/3/2024
16/3/2024
17/3/2024
18/3/2024
19/3/2024
20/3/2024
21/3/2024
22/3/2024
23/3/2024
24/3/2024
25/3/2024
26/3/2024
27/3/2024
28/3/2024
29/3/2024
30/3/2024
31/3/2024

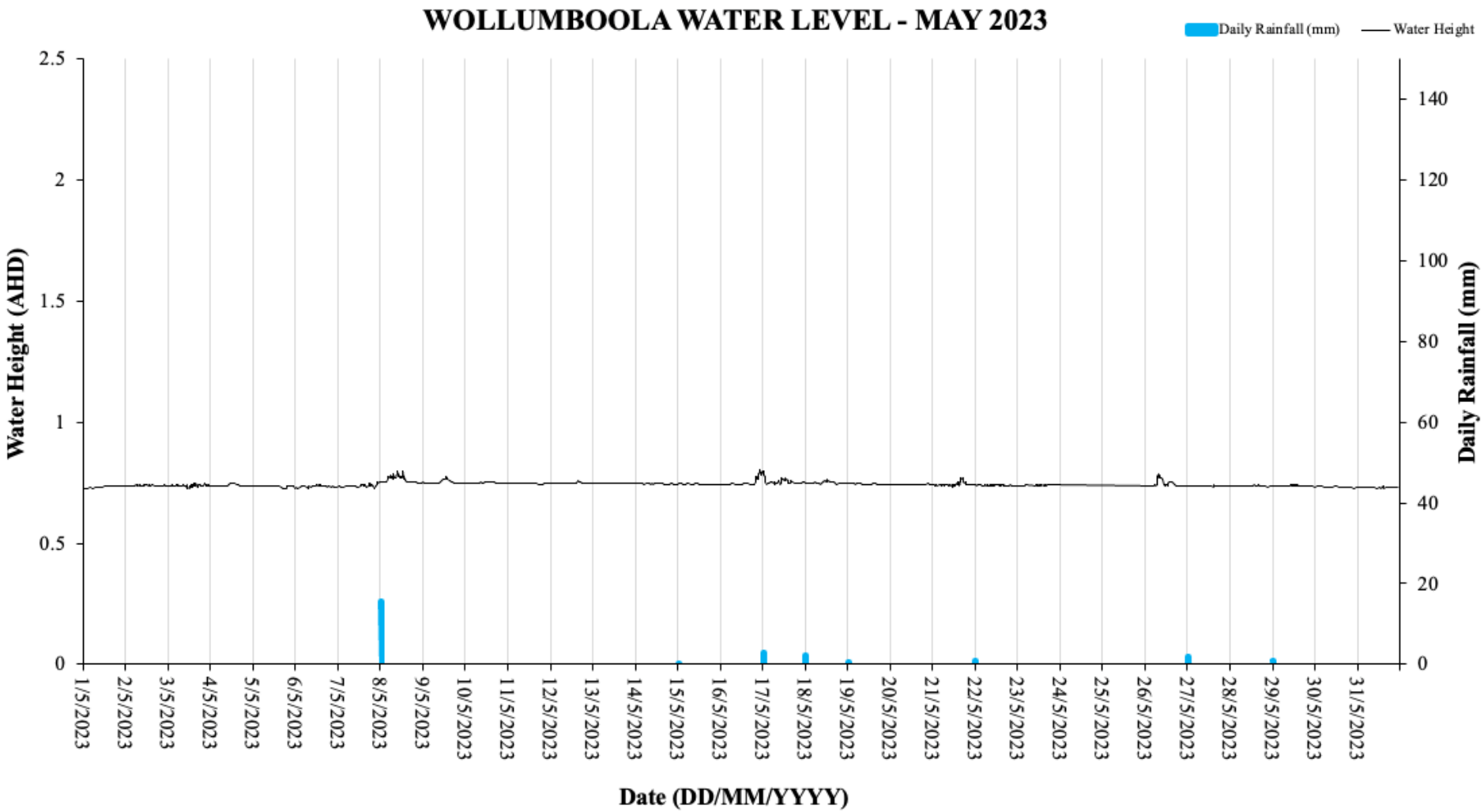

GREENWELL POINT WATER LEVEL - APRIL 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/4/2024
2/4/2024
3/4/2024
4/4/2024
5/4/2024
6/4/2024
7/4/2024
8/4/2024
9/4/2024
10/4/2024
11/4/2024
12/4/2024
13/4/2024
14/4/2024
15/4/2024
16/4/2024
17/4/2024
18/4/2024
19/4/2024
20/4/2024
21/4/2024
22/4/2024
23/4/2024
24/4/2024
25/4/2024
26/4/2024
27/4/2024
28/4/2024
29/4/2024
30/4/2024

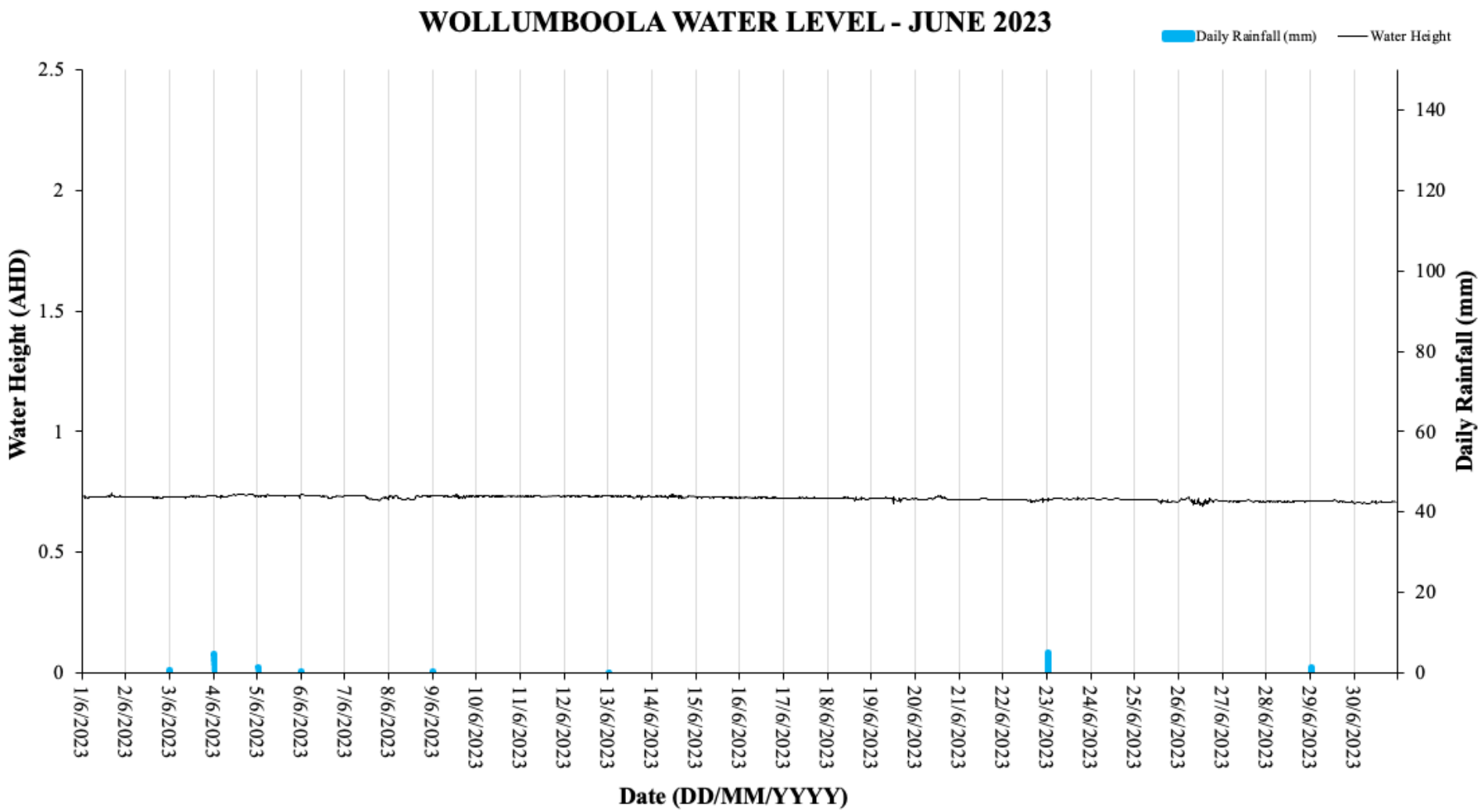

GREENWELL POINT WATER LEVEL - MAY 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
140
120
100
80
60
40
20
0
1/5/2024
2/5/2024
3/5/2024
4/5/2024
5/5/2024
6/5/2024
7/5/2024
8/5/2024
9/5/2024
10/5/2024
11/5/2024
12/5/2024
13/5/2024
14/5/2024
15/5/2024
16/5/2024
17/5/2024
18/5/2024
19/5/2024
20/5/2024
21/5/2024
22/5/2024
23/5/2024
24/5/2024
25/5/2024
26/5/2024
27/5/2024
28/5/2024
29/5/2024
30/5/2024
31/5/2024

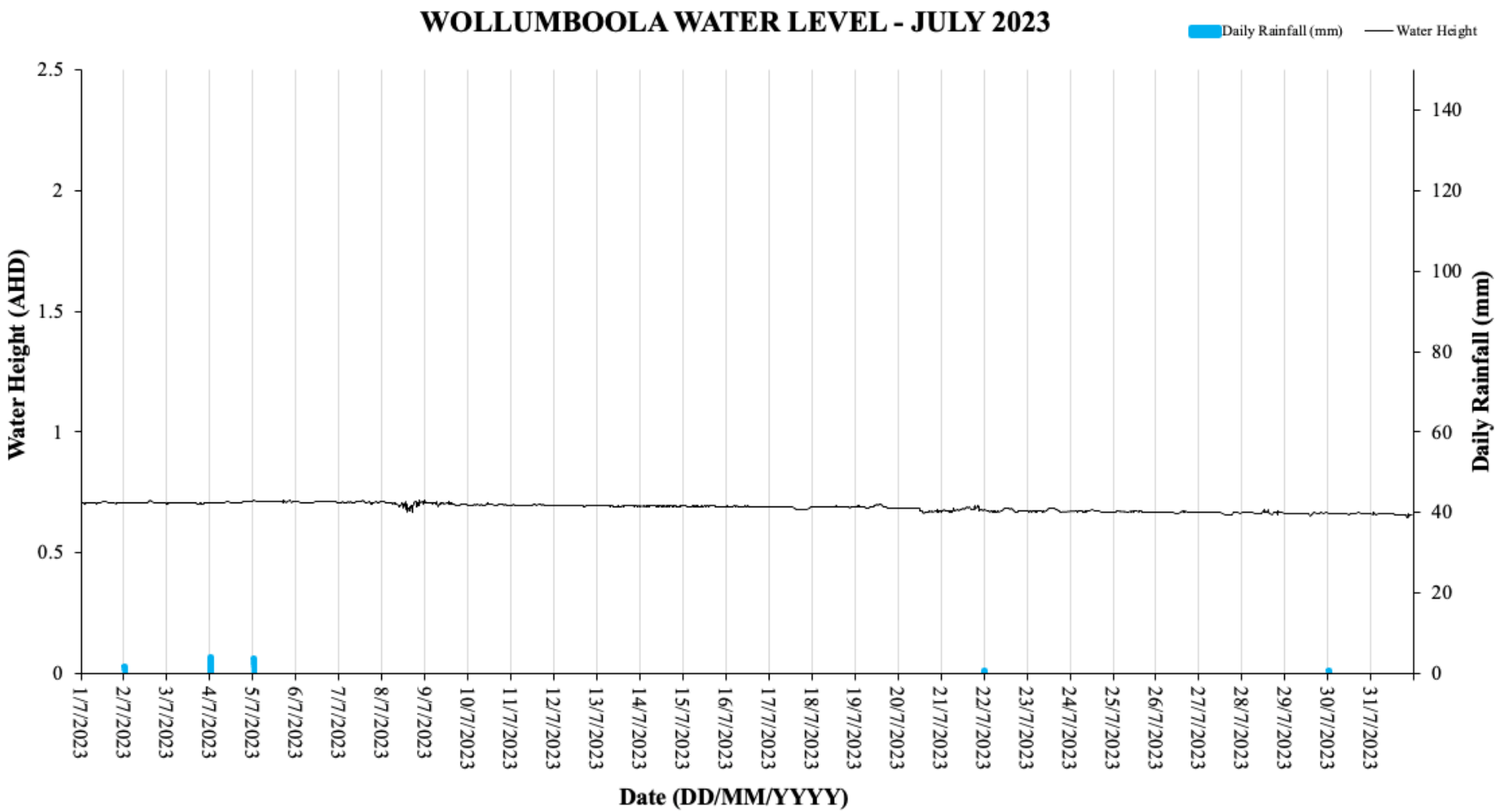

GREENWELL POINT WATER LEVEL - JUNE 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
1.2
0.7
0.2
-0.3
-0.8
200
180
160
140
120
100
80
60
40
20
0
1/6/2024
2/6/2024
3/6/2024
4/6/2024
5/6/2024
6/6/2024
7/6/2024
8/6/2024
9/6/2024
10/6/2024
11/6/2024
12/6/2024
13/6/2024
14/6/2024
15/6/2024
16/6/2024
17/6/2024
18/6/2024
19/6/2024
20/6/2024
21/6/2024
22/6/2024
23/6/2024
24/6/2024
25/6/2024
26/6/2024
27/6/2024
28/6/2024
29/6/2024
30/6/2024
Date (DD/MM/YYYY)

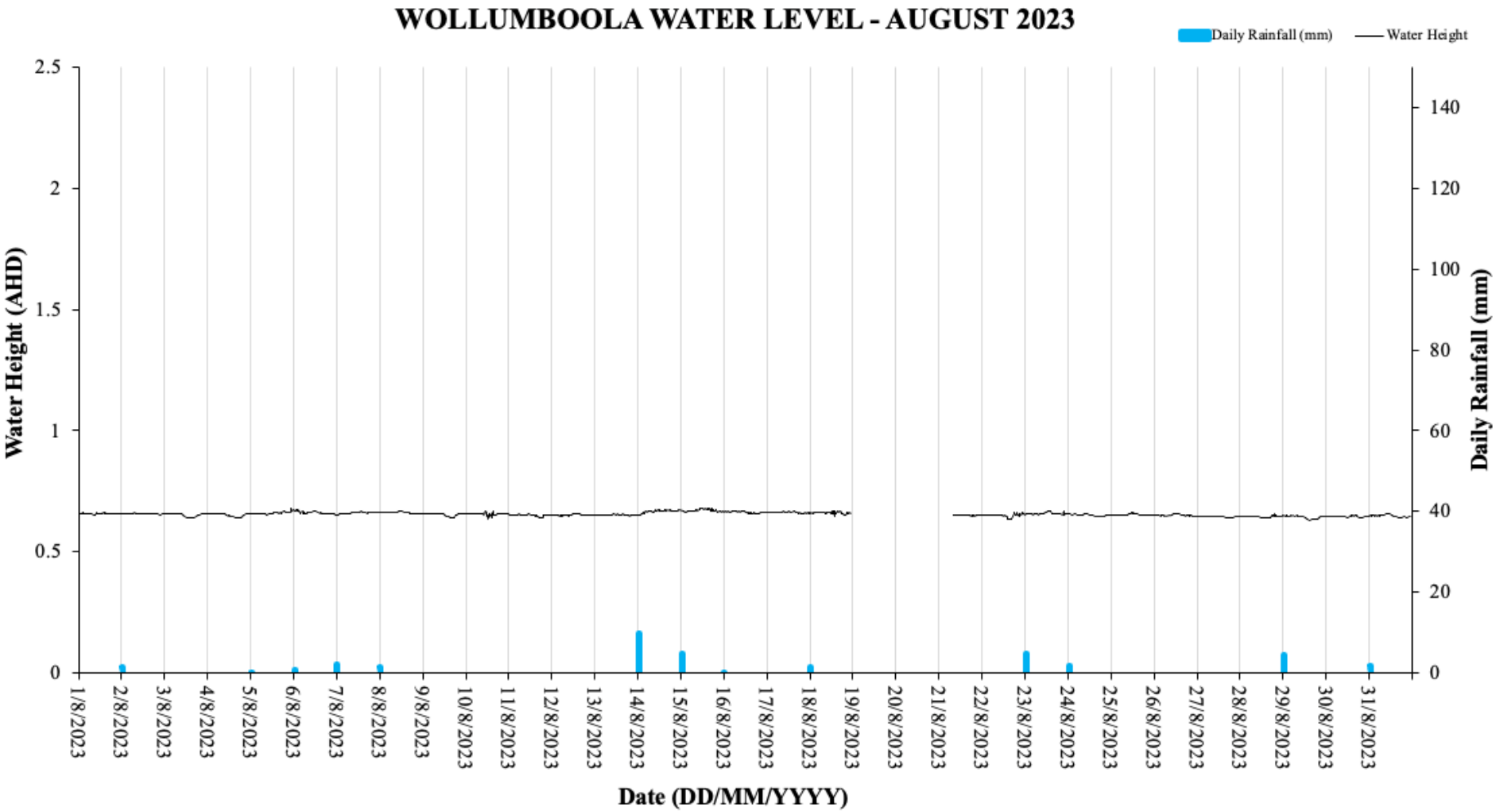

Combined Daily Rainfall and Lake Level (Lake Wollumboola) from April 2023 to June 2024
Daily Rainfall
Lake level
Lake Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
200
180
160
140
120
100
80
60
40
20
0
11/4/2023
11/5/2023
11/6/2023
11/7/2023
11/8/2023
11/9/2023
11/10/2023
11/11/2023
11/12/2023
11/1/2024
11/2/2024
11/3/2024
11/4/2024
11/5/2024
11/6/2024
Date (DD/MM/YYYY)

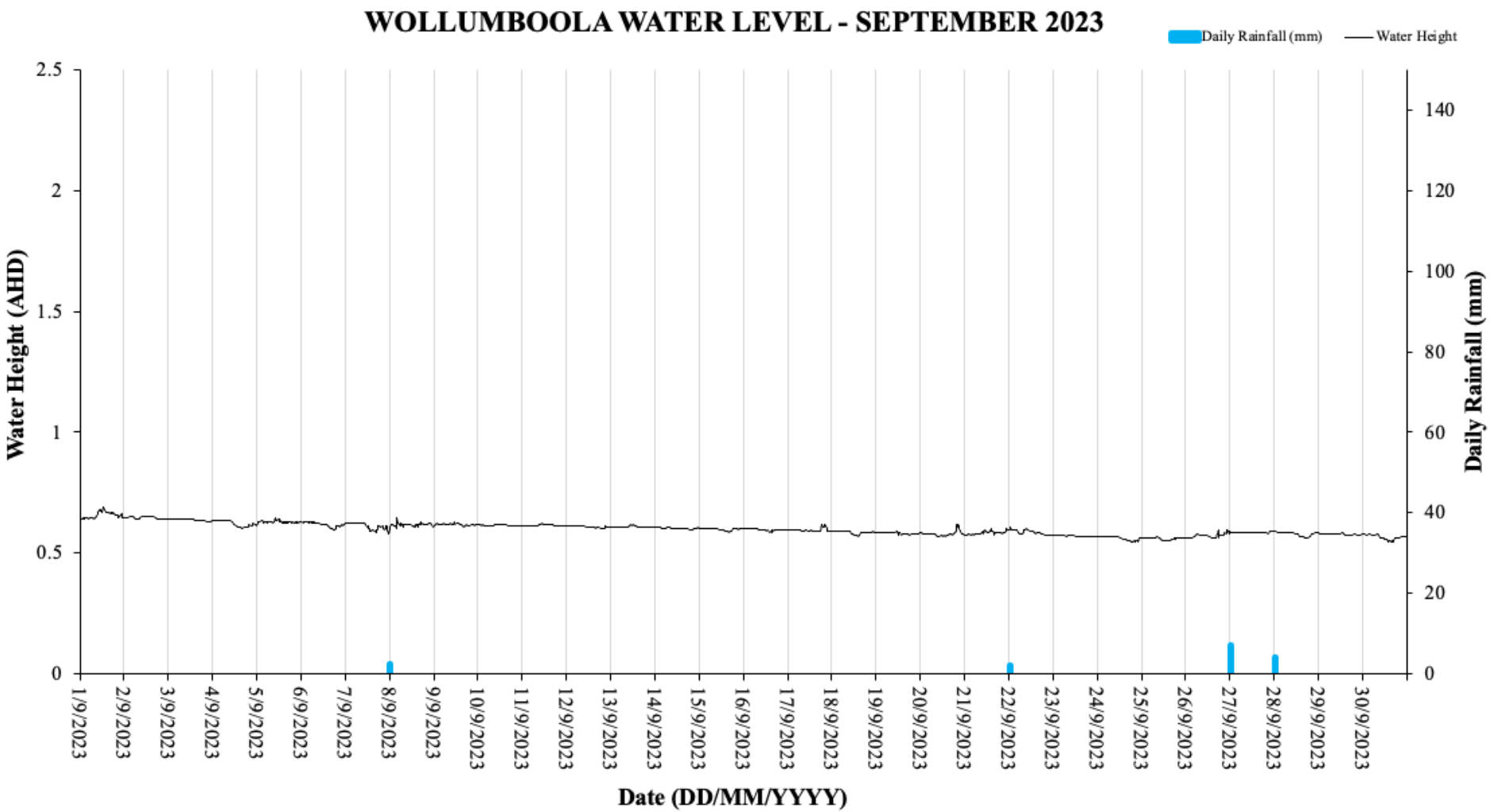

WOLLUMBOOLA WATER LEVEL - APRIL 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
12/4/2023
13/4/2023
14/4/2023
15/4/2023
16/4/2023
17/4/2023
18/4/2023
19/4/2023
20/4/2023
21/4/2023
22/4/2023
23/4/2023
24/4/2023
25/4/2023
26/4/2023
27/4/2023
28/4/2023
29/4/2023
30/4/2023
Date (DD/MM/YYYY)

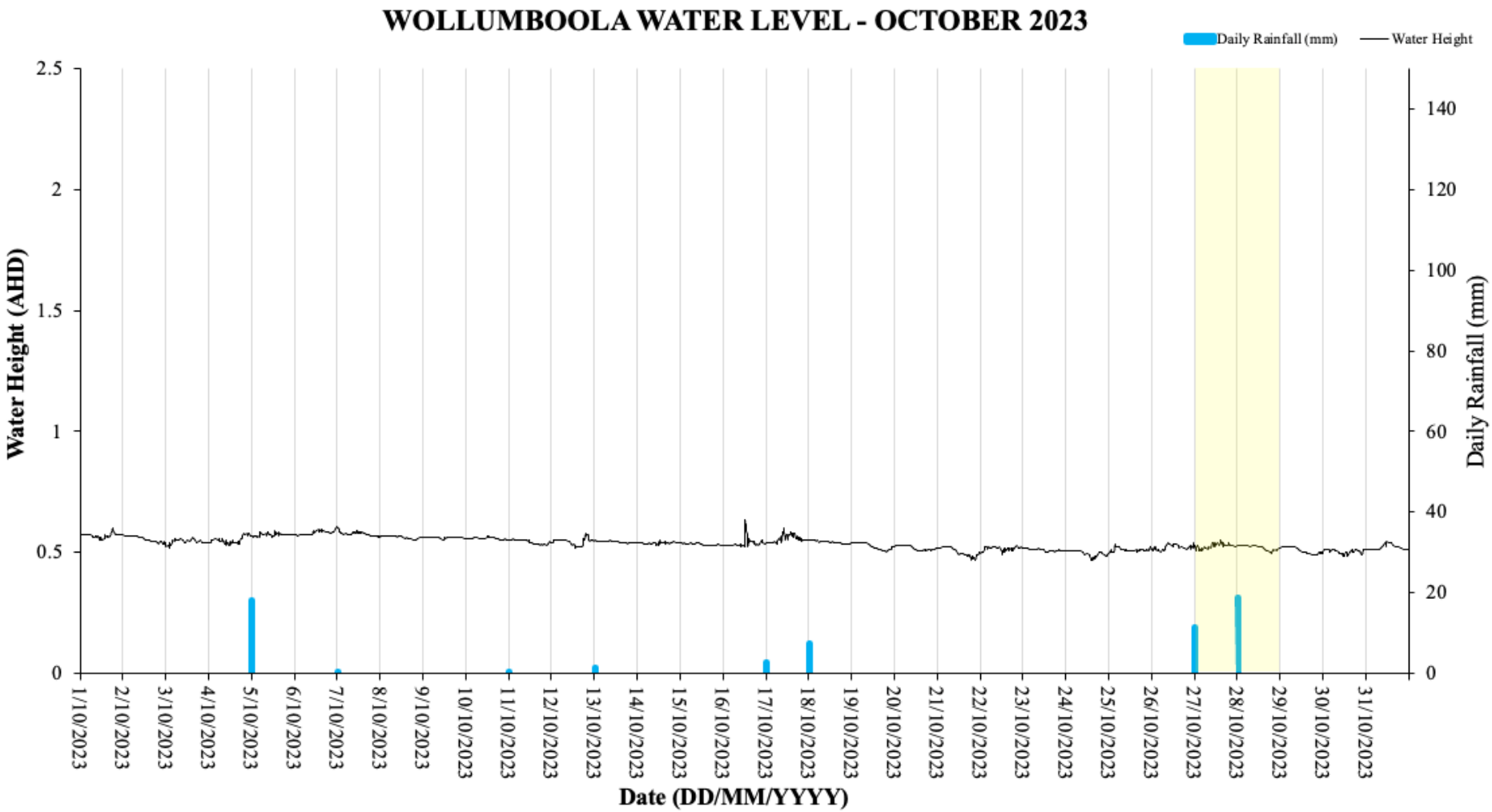

WOLLUMBOOLA WATER LEVEL - MAY 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/5/2023
2/5/2023
3/5/2023
4/5/2023
5/5/2023
6/5/2023
7/5/2023
8/5/2023
9/5/2023
10/5/2023
11/5/2023
12/5/2023
13/5/2023
14/5/2023
15/5/2023
16/5/2023
17/5/2023
18/5/2023
19/5/2023
20/5/2023
21/5/2023
22/5/2023
23/5/2023
24/5/2023
25/5/2023
26/5/2023
27/5/2023
28/5/2023
29/5/2023
30/5/2023
31/5/2023
Date (DD/MM/YYYY)

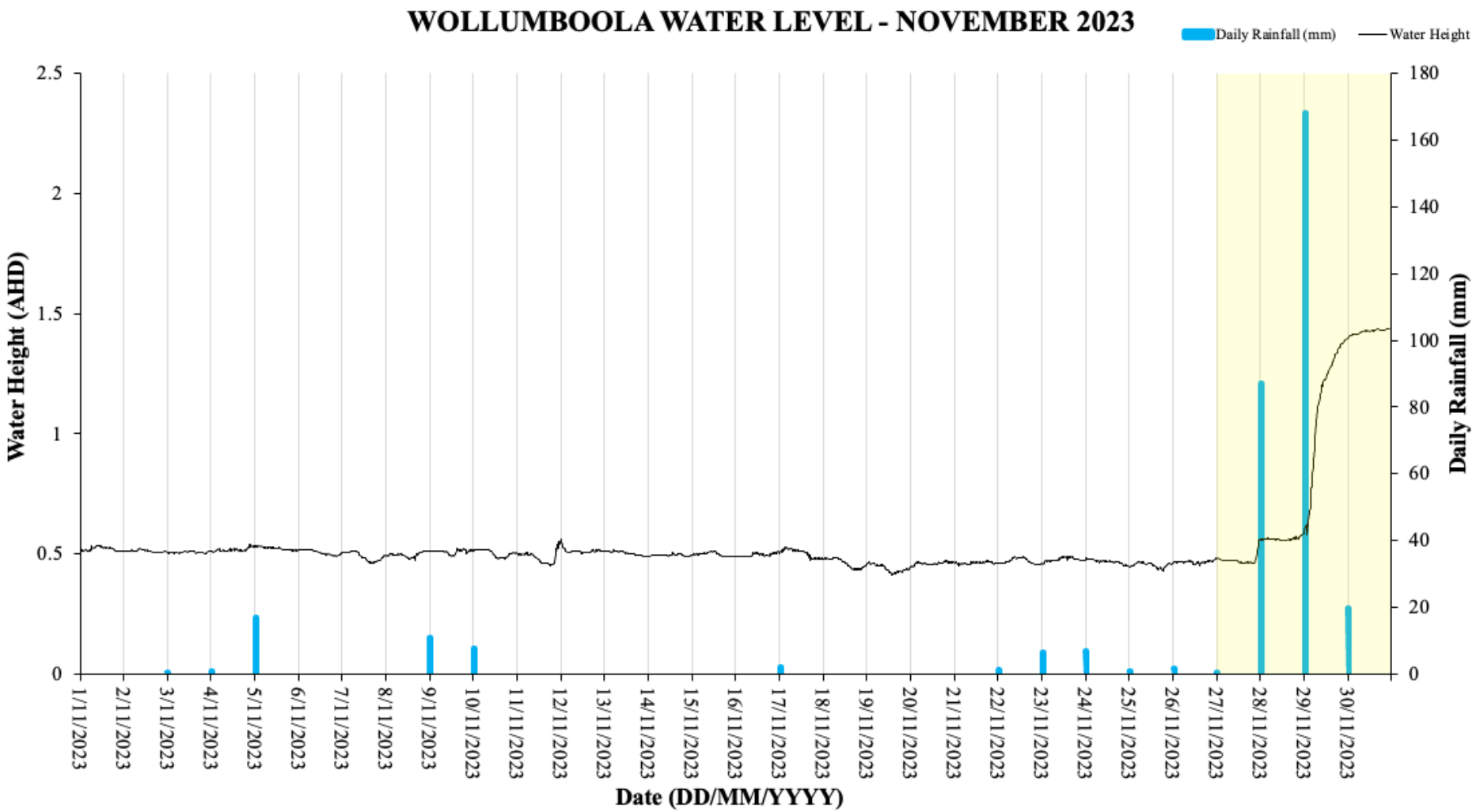

WOLLUMBOOLA WATER LEVEL - JUNE 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/6/2023
2/6/2023
3/6/2023
4/6/2023
5/6/2023
6/6/2023
7/6/2023
8/6/2023
9/6/2023
10/6/2023
11/6/2023
12/6/2023
13/6/2023
14/6/2023
15/6/2023
16/6/2023
17/6/2023
18/6/2023
19/6/2023
20/6/2023
21/6/2023
22/6/2023
23/6/2023
24/6/2023
25/6/2023
26/6/2023
27/6/2023
28/6/2023
29/6/2023
30/6/2023
Date (DD/MM/YYYY)

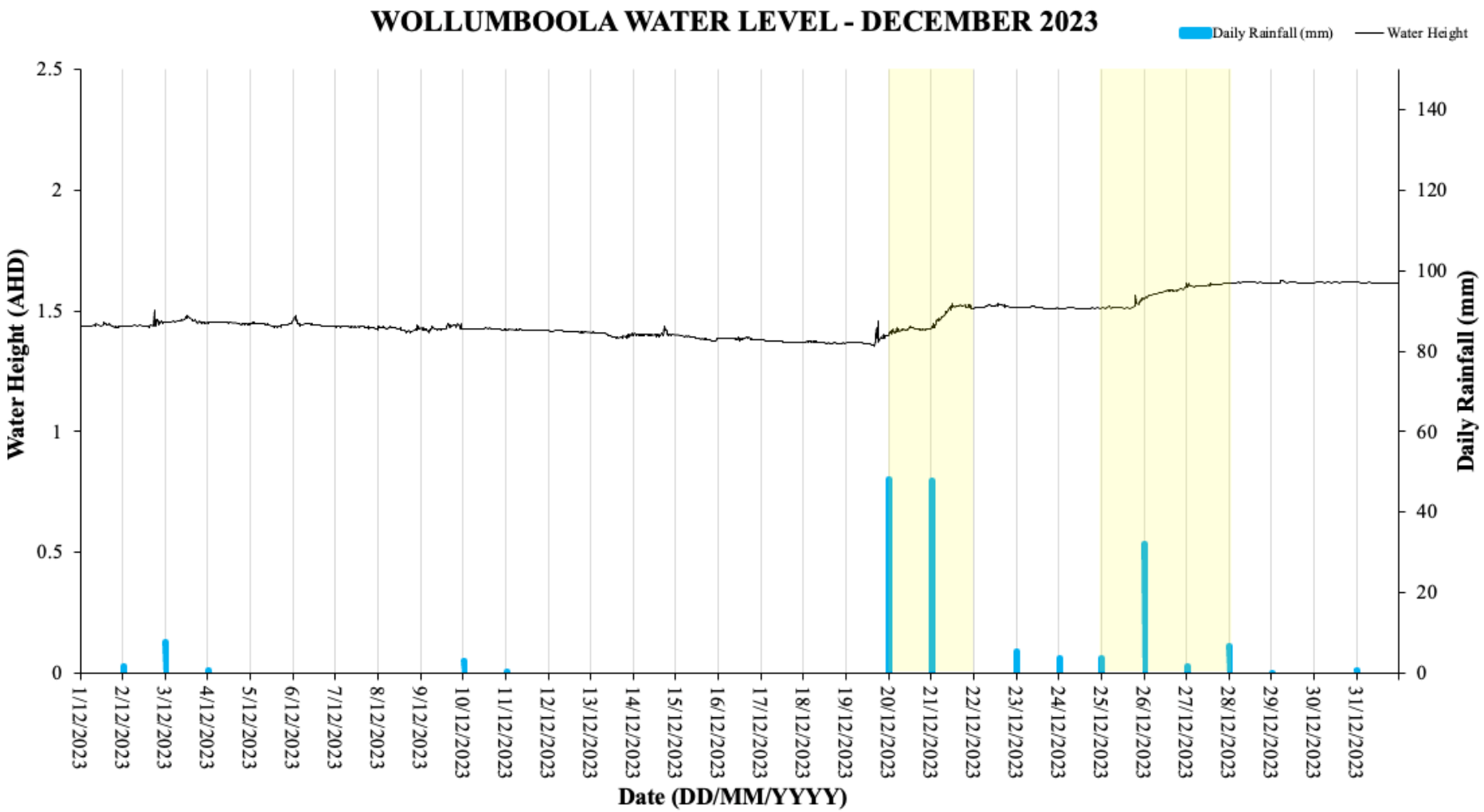

WOLLUMBOOLA WATER LEVEL - JULY 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/7/2023
2/7/2023
3/7/2023
4/7/2023
5/7/2023
6/7/2023
7/7/2023
8/7/2023
9/7/2023
10/7/2023
11/7/2023
12/7/2023
13/7/2023
14/7/2023
15/7/2023
16/7/2023
17/7/2023
18/7/2023
19/7/2023
20/7/2023
21/7/2023
22/7/2023
23/7/2023
24/7/2023
25/7/2023
26/7/2023
27/7/2023
28/7/2023
29/7/2023
30/7/2023
31/7/2023
Date (DD/MM/YYYY)

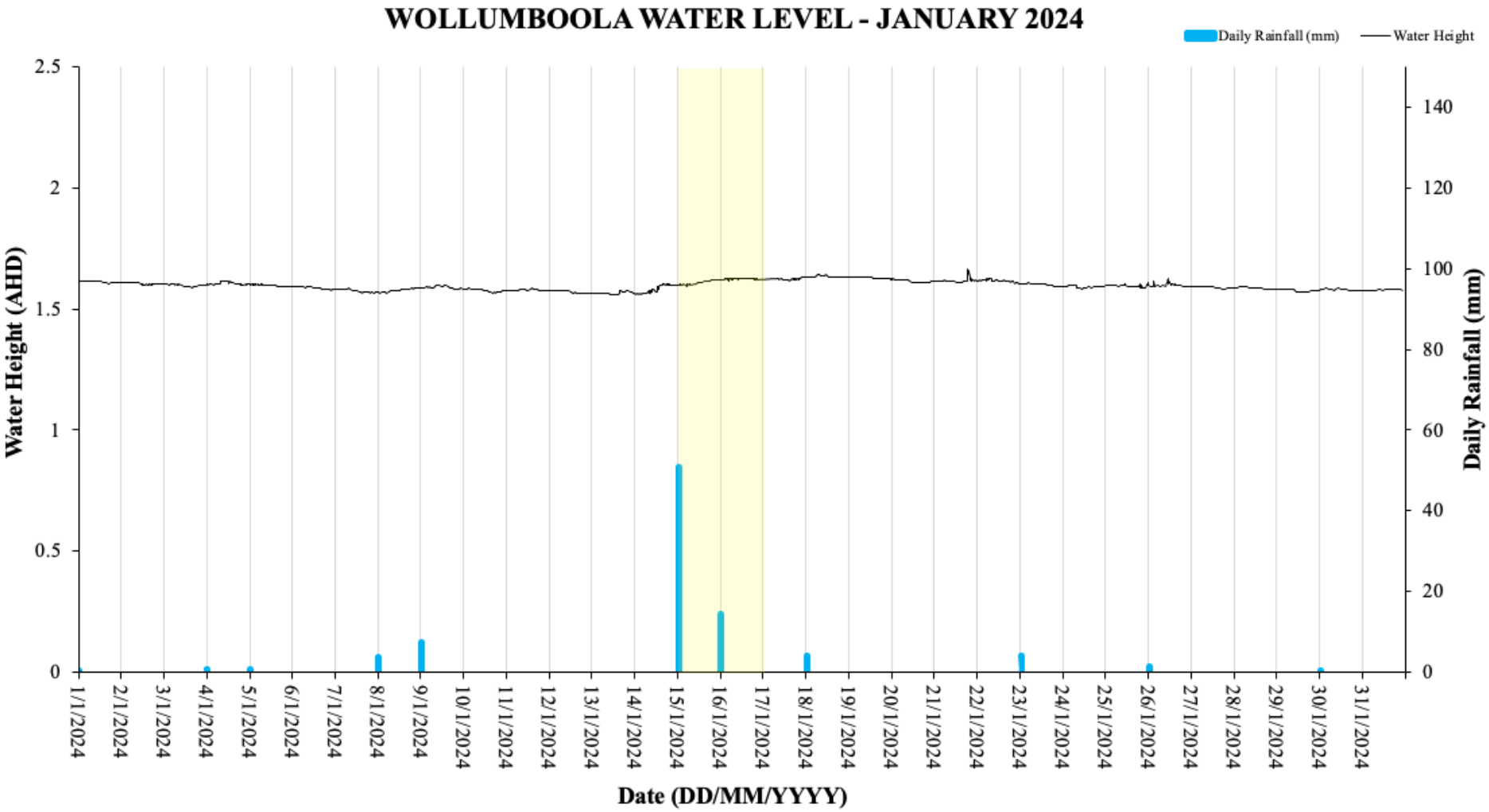

WOLLUMBOOLA WATER LEVEL - AUGUST 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/8/2023
2/8/2023
3/8/2023
4/8/2023
5/8/2023
6/8/2023
7/8/2023
8/8/2023
9/8/2023
10/8/2023
11/8/2023
12/8/2023
13/8/2023
14/8/2023
15/8/2023
16/8/2023
17/8/2023
18/8/2023
19/8/2023
20/8/2023
21/8/2023
22/8/2023
23/8/2023
24/8/2023
25/8/2023
26/8/2023
27/8/2023
28/8/2023
29/8/2023
30/8/2023
31/8/2023

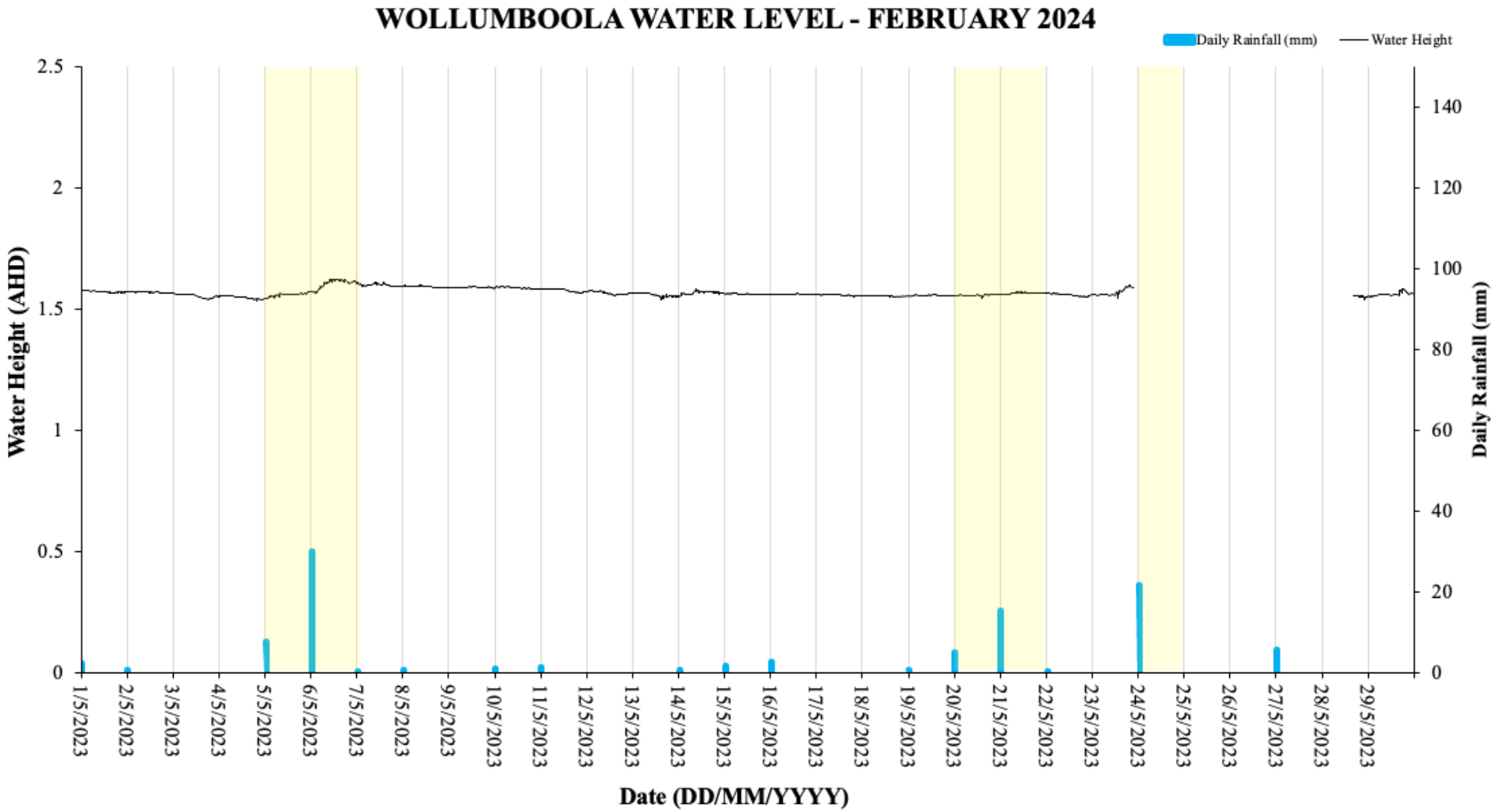

WOLLUMBOOLA WATER LEVEL - SEPTEMBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/9/2023
2/9/2023
3/9/2023
4/9/2023
5/9/2023
6/9/2023
7/9/2023
8/9/2023
9/9/2023
10/9/2023
11/9/2023
12/9/2023
13/9/2023
14/9/2023
15/9/2023
16/9/2023
17/9/2023
18/9/2023
19/9/2023
20/9/2023
21/9/2023
22/9/2023
23/9/2023
24/9/2023
25/9/2023
26/9/2023
27/9/2023
28/9/2023
29/9/2023
30/9/2023
Date (DD/MM/YYYY)

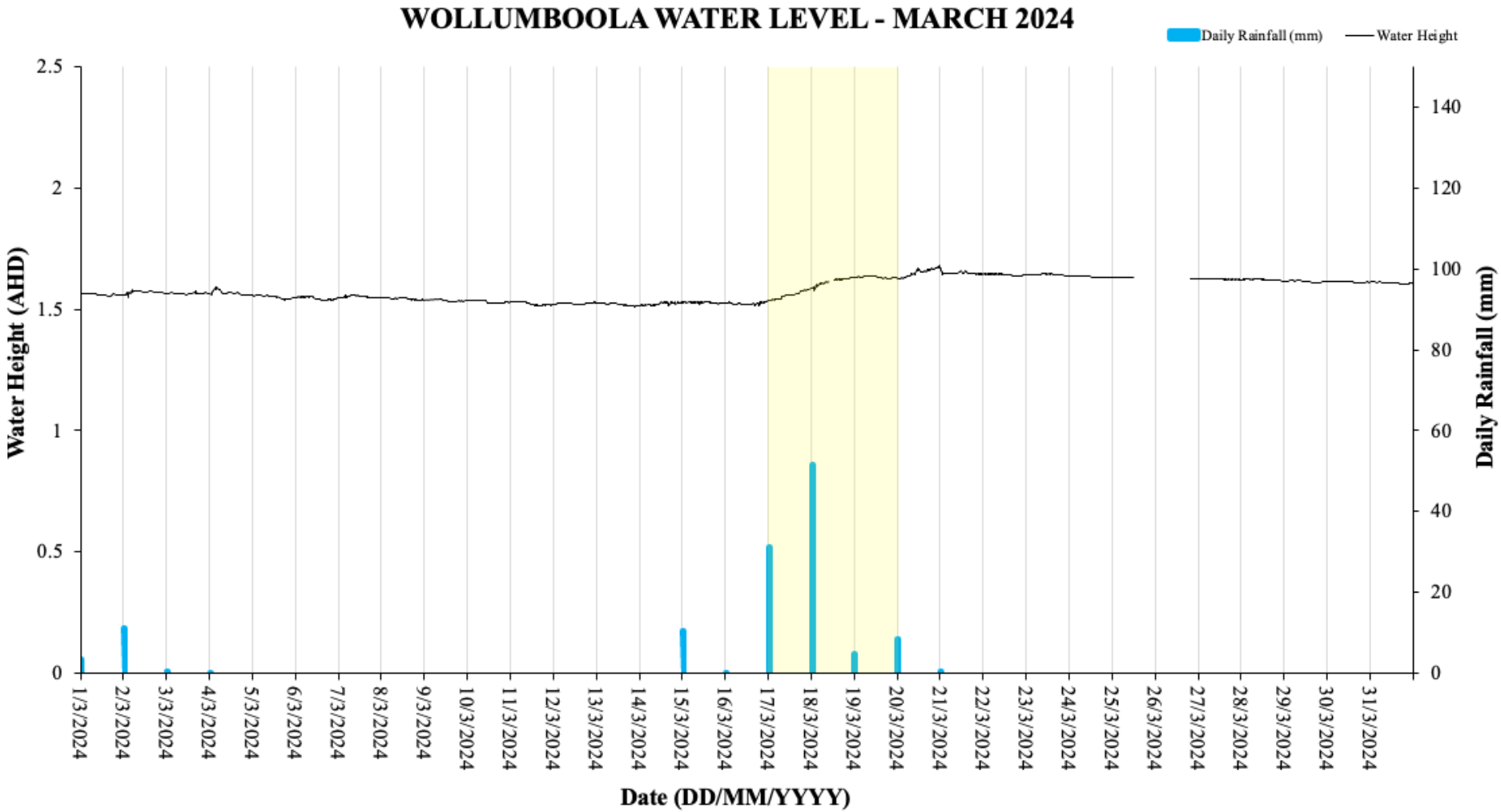

WOLLUMBOOLA WATER LEVEL - OCTOBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/10/2023
2/10/2023
3/10/2023
4/10/2023
5/10/2023
6/10/2023
7/10/2023
8/10/2023
9/10/2023
10/10/2023
11/10/2023
12/10/2023
13/10/2023
14/10/2023
15/10/2023
16/10/2023
17/10/2023
18/10/2023
19/10/2023
20/10/2023
21/10/2023
22/10/2023
23/10/2023
24/10/2023
25/10/2023
26/10/2023
27/10/2023
28/10/2023
29/10/2023
30/10/2023
31/10/2023

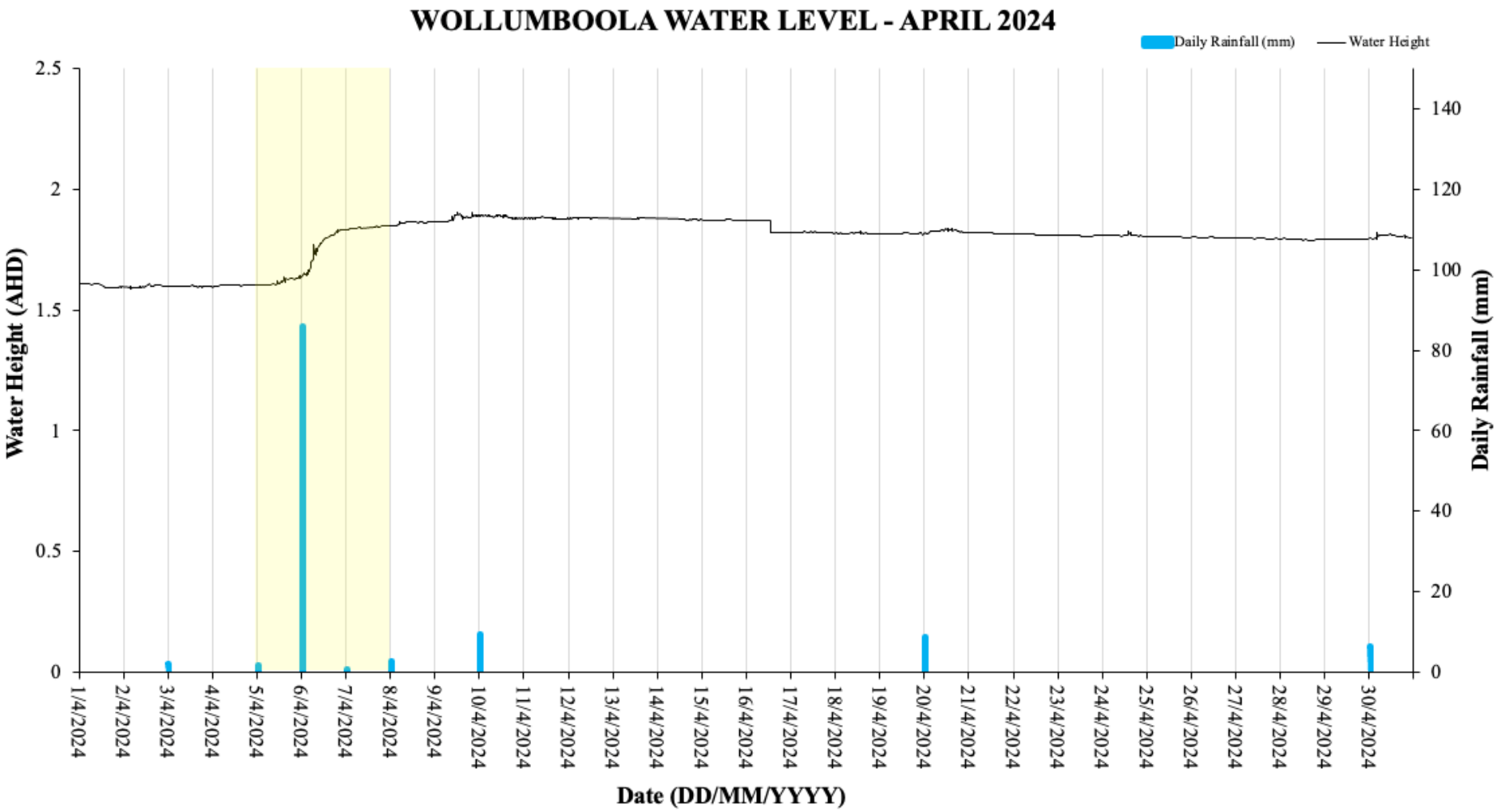

WOLLUMBOOLA WATER LEVEL - NOVEMBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
180
160
140
120
100
80
60
40
20
0
1/11/2023
2/11/2023
3/11/2023
4/11/2023
5/11/2023
6/11/2023
7/11/2023
8/11/2023
9/11/2023
10/11/2023
11/11/2023
12/11/2023
13/11/2023
14/11/2023
15/11/2023
16/11/2023
17/11/2023
18/11/2023
19/11/2023
20/11/2023
21/11/2023
22/11/2023
23/11/2023
24/11/2023
25/11/2023
26/11/2023
27/11/2023
28/11/2023
29/11/2023
30/11/2023

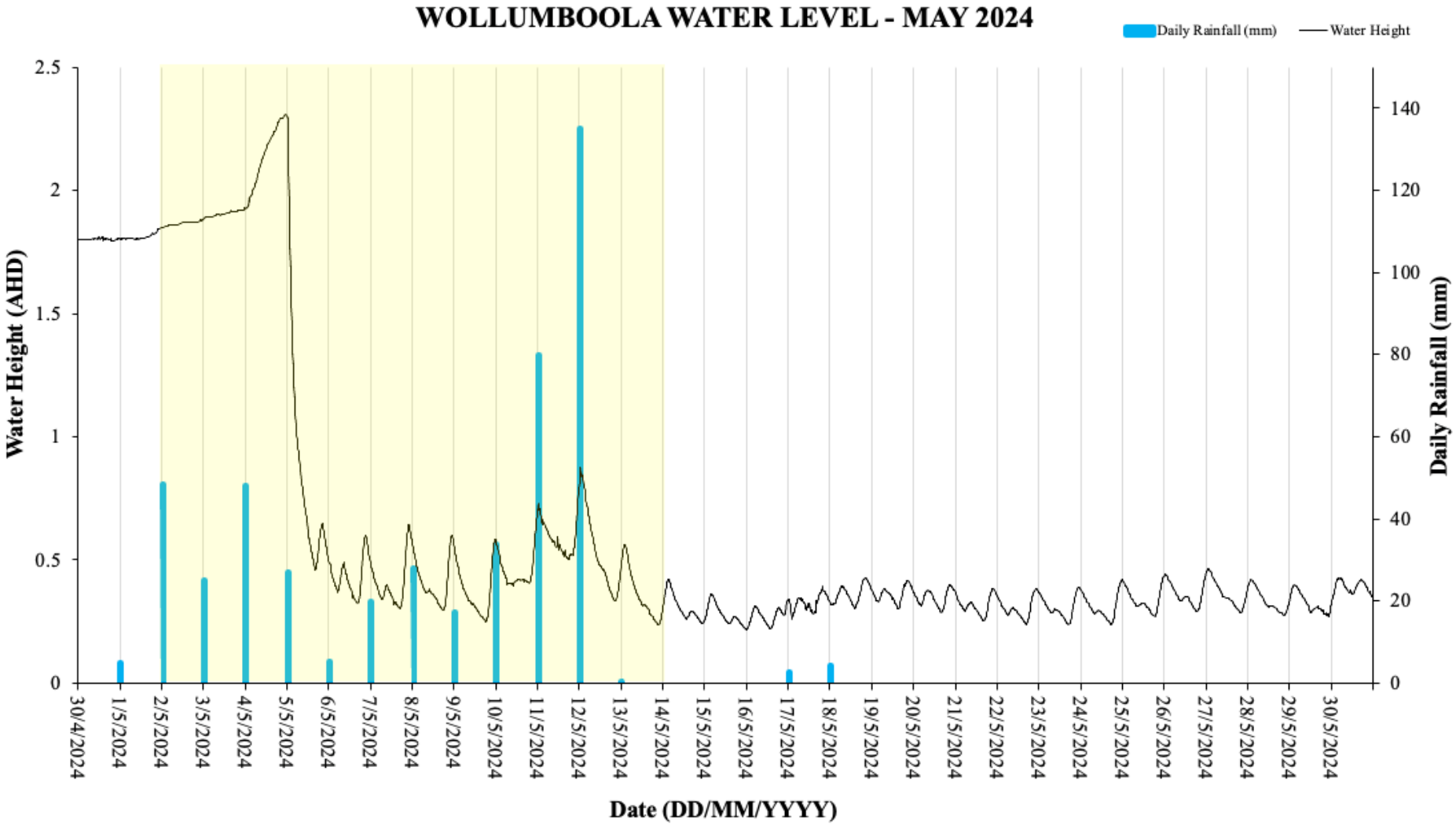

WOLLUMBOOLA WATER LEVEL - DECEMBER 2023
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/12/2023
2/12/2023
3/12/2023
4/12/2023
5/12/2023
6/12/2023
7/12/2023
8/12/2023
9/12/2023
10/12/2023
11/12/2023
12/12/2023
13/12/2023
14/12/2023
15/12/2023
16/12/2023
17/12/2023
18/12/2023
19/12/2023
20/12/2023
21/12/2023
22/12/2023
23/12/2023
24/12/2023
25/12/2023
26/12/2023
27/12/2023
28/12/2023
29/12/2023
30/12/2023
31/12/2023

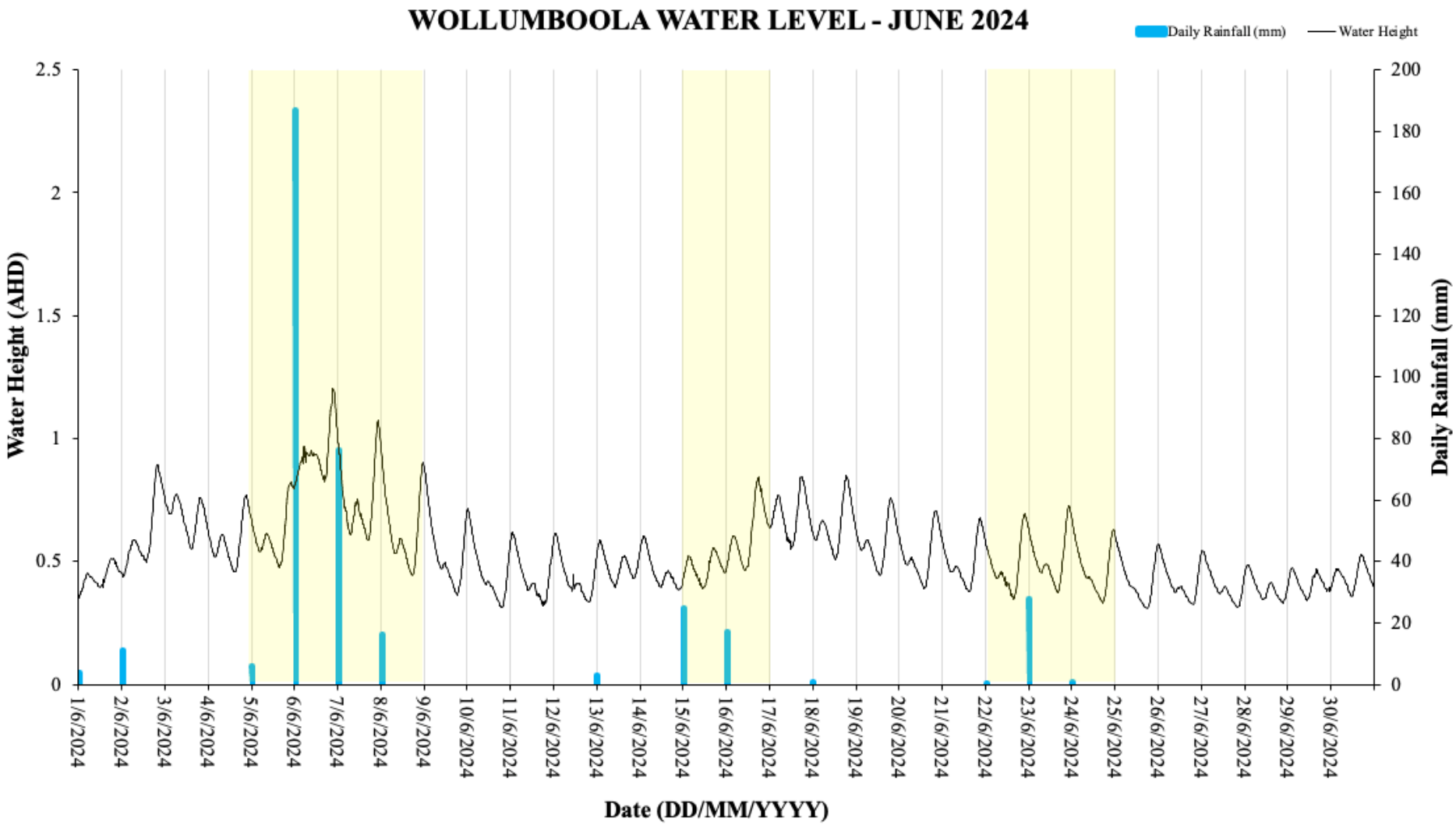

WOLLUMBOOLA WATER LEVEL - JANUARY 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/1/2024
2/1/2024
3/1/2024
4/1/2024
5/1/2024
6/1/2024
7/1/2024
8/1/2024
9/1/2024
10/1/2024
11/1/2024
12/1/2024
13/1/2024
14/1/2024
15/1/2024
16/1/2024
17/1/2024
18/1/2024
19/1/2024
20/1/2024
21/1/2024
22/1/2024
23/1/2024
24/1/2024
25/1/2024
26/1/2024
27/1/2024
28/1/2024
29/1/2024
30/1/2024
31/1/2024


WOLLUMBOOLA WATER LEVEL - FEBRUARY 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/5/2023
2/5/2023
3/5/2023
4/5/2023
5/5/2023
6/5/2023
7/5/2023
8/5/2023
9/5/2023
10/5/2023
11/5/2023
12/5/2023
13/5/2023
14/5/2023
15/5/2023
16/5/2023
17/5/2023
18/5/2023
19/5/2023
20/5/2023
21/5/2023
22/5/2023
23/5/2023
24/5/2023
25/5/2023
26/5/2023
27/5/2023
28/5/2023
29/5/2023
Date (DD/MM/YYYY)


WOLLUMBOOLA WATER LEVEL - MARCH 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/3/2024
2/3/2024
3/3/2024
4/3/2024
5/3/2024
6/3/2024
7/3/2024
8/3/2024
9/3/2024
10/3/2024
11/3/2024
12/3/2024
13/3/2024
14/3/2024
15/3/2024
16/3/2024
17/3/2024
18/3/2024
19/3/2024
20/3/2024
21/3/2024
22/3/2024
23/3/2024
24/3/2024
25/3/2024
26/3/2024
27/3/2024
28/3/2024
29/3/2024
30/3/2024
31/3/2024


WOLLUMBOOLA WATER LEVEL - APRIL 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
1/4/2024
2/4/2024
3/4/2024
4/4/2024
5/4/2024
6/4/2024
7/4/2024
8/4/2024
9/4/2024
10/4/2024
11/4/2024
12/4/2024
13/4/2024
14/4/2024
15/4/2024
16/4/2024
17/4/2024
18/4/2024
19/4/2024
20/4/2024
21/4/2024
22/4/2024
23/4/2024
24/4/2024
25/4/2024
26/4/2024
27/4/2024
28/4/2024
29/4/2024
30/4/2024


WOLLUMBOOLA WATER LEVEL - MAY 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
2.5
2
1.5
1
0.5
0
140
120
100
80
60
40
20
0
30/4/2024
1/5/2024
2/5/2024
3/5/2024
4/5/2024
5/5/2024
6/5/2024
7/5/2024
8/5/2024
9/5/2024
10/5/2024
11/5/2024
12/5/2024
13/5/2024
14/5/2024
15/5/2024
16/5/2024
17/5/2024
18/5/2024
19/5/2024
20/5/2024
21/5/2024
22/5/2024
23/5/2024
24/5/2024
25/5/2024
26/5/2024
27/5/2024
28/5/2024
29/5/2024
30/5/2024
Date (DD/MM/YYYY)


WOLLUMBOOLA WATER LEVEL - JUNE 2024
Daily Rainfall (mm)
Water Height
Water Height (AHD)
Daily Rainfall (mm)
Date (DD/MM/YYYY)
2.5
2
1.5
1
0.5
0
200
180
160
140
120
100
80
60
40
20
0
1/6/2024
2/6/2024
3/6/2024
4/6/2024
5/6/2024
6/6/2024
7/6/2024
8/6/2024
9/6/2024
10/6/2024
11/6/2024
12/6/2024
13/6/2024
14/6/2024
15/6/2024
16/6/2024
17/6/2024
18/6/2024
19/6/2024
20/6/2024
21/6/2024
22/6/2024
23/6/2024
24/6/2024
25/6/2024
26/6/2024
27/6/2024
28/6/2024
29/6/2024
30/6/2024

# APPENDIX C
# ESTUARY INTERTIDAL MONITORING DATA

## C1 INTERTIDAL SPECIES CODES

## C2 INTERTIDAL HEIGHT PROFILES

## C3 INTERTIDAL TRANSECT LENGTHS

## C4 INTERTIDAL QUADRAT DENSITIES

## C5 INTERTIDAL MOSAIC PLOTS

## C6 INTERTIDAL TRANSECT DRIPLINE RESULTS

## C7 PRE TO POST WET WEATHER SITE PHOTOS

## C8 SITE TRANSECT PHOTOS

# APPENDIX C1

# INTERTIDAL SPECIES CODING

# Culburra Intertidal Species Coding and Identification

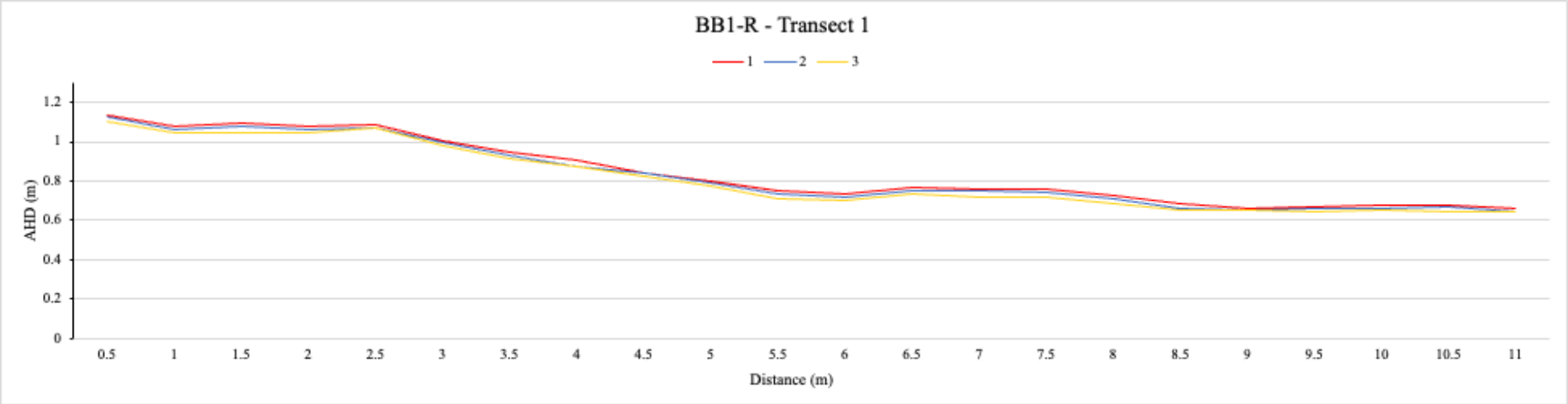
| Vegetation Type | Identification | Status | Zonation | Description | Classification | Occurrence | Coding |
|---|---|---|---|---|---|---|---|
| Mangrove | *Avicennia marina* | N | M | A | B | C | AM |
| | *Aegiceras corniculatum* | N | M | A | B | C | RM |
| | Pneumatophores | N | M | A | B | C | PN |
| | Seedling | N | M | J | B | C | SD |
| | Sapling | N | M | J | B | C | SP |
| | Adult | N | M | A | B | C | AD |
| Plant | *Alternanthera denticulata* | N | R | E | B | U | ALT |
| | *Asparagus aethiopicus* | I | R | W | B | C | AF |
| | *Bryophyta sp.* | N | R | R | B | U | BR |
| | *Carpobrotus glaucescens* | N | S | U | B | U | CA |
| | *Commelina cyanaea* | N | R | R | B | U | WM |
| | *Cynodon dactylon* | N | R | G | B | C | CD |
| | *Delairea odorata* | I | R | W | B | U | CI |
| | *Dianella caerulea* | N | R | G | B | U | CG |
| | *Gahnia sieberiana* | N | R | G | B | U | GH |
| | *Hydrocotyle bonariensis* | I | R | E | B | C | HD |
| | *Hypochaeris glabra* | I | R | W | B | U | HY |
| | *Juncus kraussii* | N | S | U | B | C | JK |
| | *Lantana camara* | I | R | W | B | C | LC |
| | *Lobelia anceps* | N | R | E | B | C | AL |
| | *Machaerina juncea* | N | S | U | B | C | BJ |
| | *Oplismenus hirtellus* | I | R | W | B | U | OP |
| | *Parsonsia straminea* | N | R | R | B | C | PS |
| | *Phragmites australis* | N | S | U | B | U | PA |
| | *Pittosporum undulatum* | N | R | R | B | U | PT |
| | Plant Seedling | N | R | R | B | U | TR |
| | *Ranunculus sp.* | N | R | E | B | C | RN |
| | Riparian Grass | I | R | G | B | C | RG |
| | *Rumex sagittatus* | I | R | W | B | U | MK |
| | *Samolus repens* | N | S | U | B | C | SE |
| | *Sarcocornia quinqueflora* | N | S | L | B | U | GW |
| | *Sarcopetalum harveynum* | N | R | R | B | U | IP |

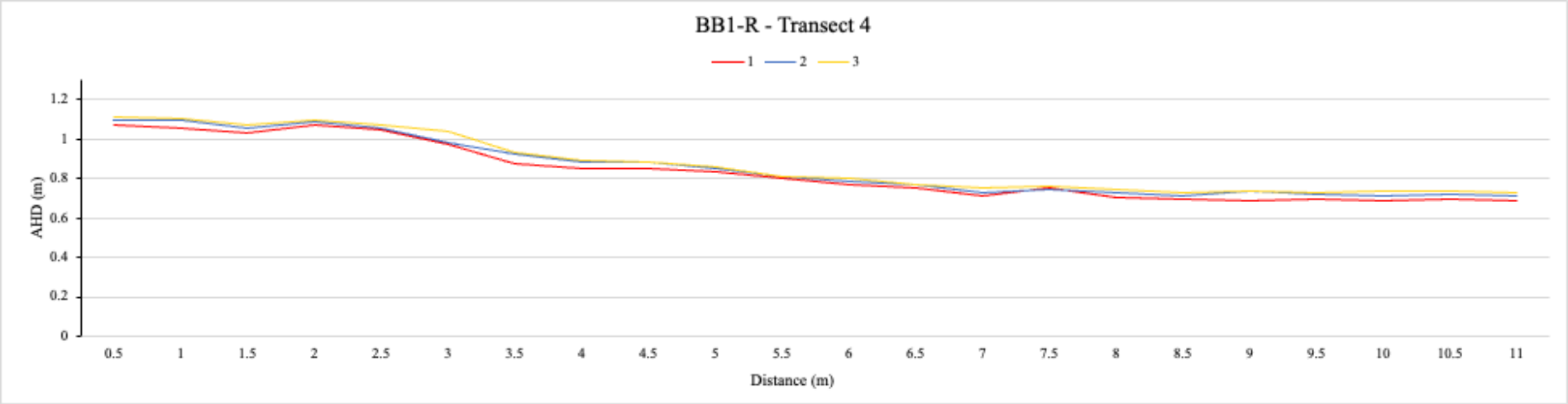
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Sellieria radicans* | N | S | U | B | C | BS |
| | *Senna Pendula var. glabrata* | I | R | W | B | U | SG |
| | *Solanum pungetium* | I | R | W | B | U | NS |
| | *Sonchus oleraceus* | I | R | W | B | U | SO |
| | *Sphaeromorphaea australis* | N | R | R | B | U | SH |
| | *Sporobolus virginicus* | N | S | L | B | C | SQ |
| | *Stenotaphrum secundatum* | I | R | W | B | C | BG |
| | *Suaeda australis* | N | S | L | B | C | SA |
| | *Tetragonia tetragonoides* | N | S | U | B | C | TT |
| | *Viola hederacea* | N | R | R | B | C | AV |
| | *Wahlenbergia capillaris* | N | R | R | B | U | WAH |
| Tree | *Casuarina equisetifolia* | N | R | R | B | C | C |
| | *Casuarina equisetifolia* sapling | N | R | R | B | C | CS |
| | Cyprus.sp. | N | R | R | B | U | CP |
| | *Lycium ferocissimum* | I | R | R | B | U | AB |
| | *Melaleuca ericifolia* | N | S | R | B | C | ML |
| Abiotic | Bare mud | N | M | na | A | C | BM |
| | Casuarina wrack | N | S | na | A | C | CW |
| | Crab Holes | N | M | na | A | C | CH |
| | Debris | N | M | na | A | C | D |
| | Eucalyptus wrack | N | R | na | A | U | EW |
| | Rubbish | I | S | na | A | C | R |
| | *Zostera* wrack | N | M | na | A | C | ZW |

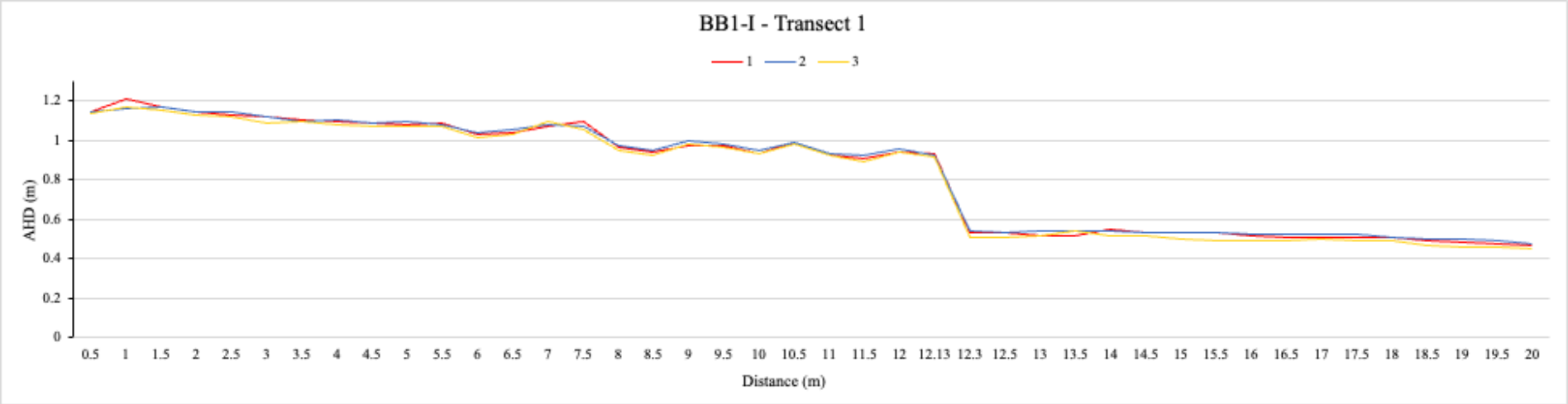
| | | |
|---|---|---|
| Legend | Status | N = Native, I = Introduced |
| | Zonation | R = Riparian, S = Saltmarsh, M = Mangroves |
| | Description | W = Weeds, G = Grasses, E = Wetland, R = Ranging Riparian (dry to wet), U = Upper saltmarsh, L = Lower Saltmarsh, A = Adult Mangrove, J = Juvenile Mangrove, na = unclassifiable |
| | Classification | A = Abiotic, B = Biotic |
| | Occurrence | C = Common (greater than 5 site occurrences), U = Uncommon (less than 5 site occurrences) |
| | Coding | Shortened two to three letter code to identify plant species or genus |

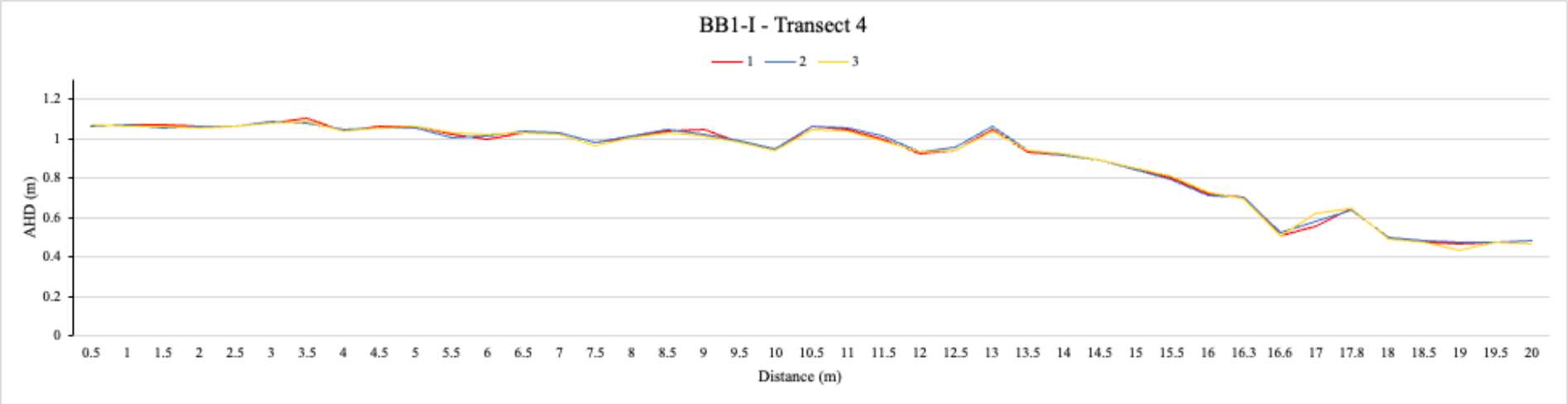
# APPENDIX C2

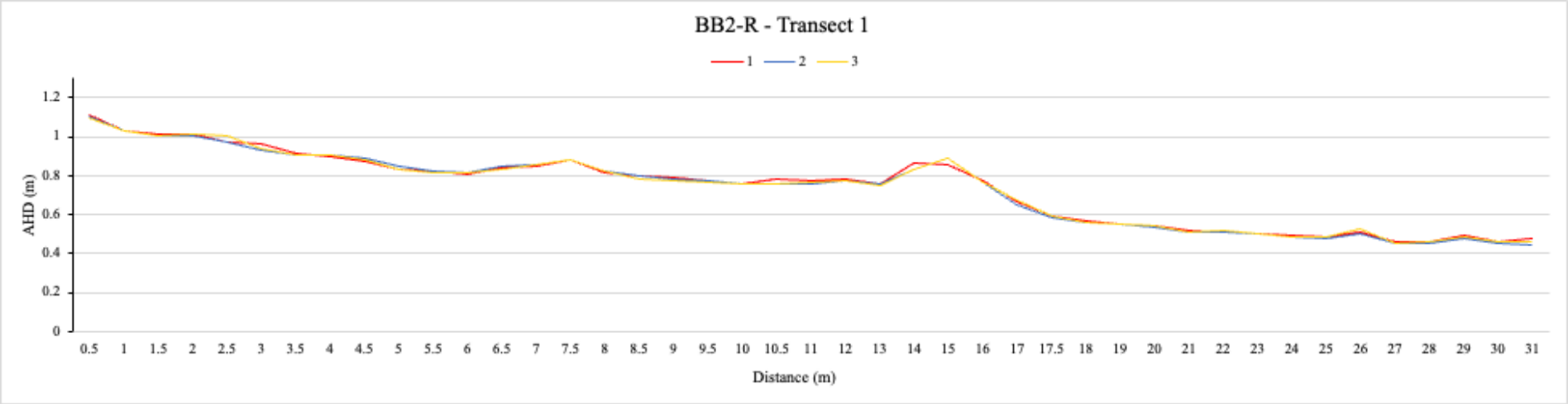
# SIX-MONTHLY
# INTERTIDAL HEIGHT PROFILE

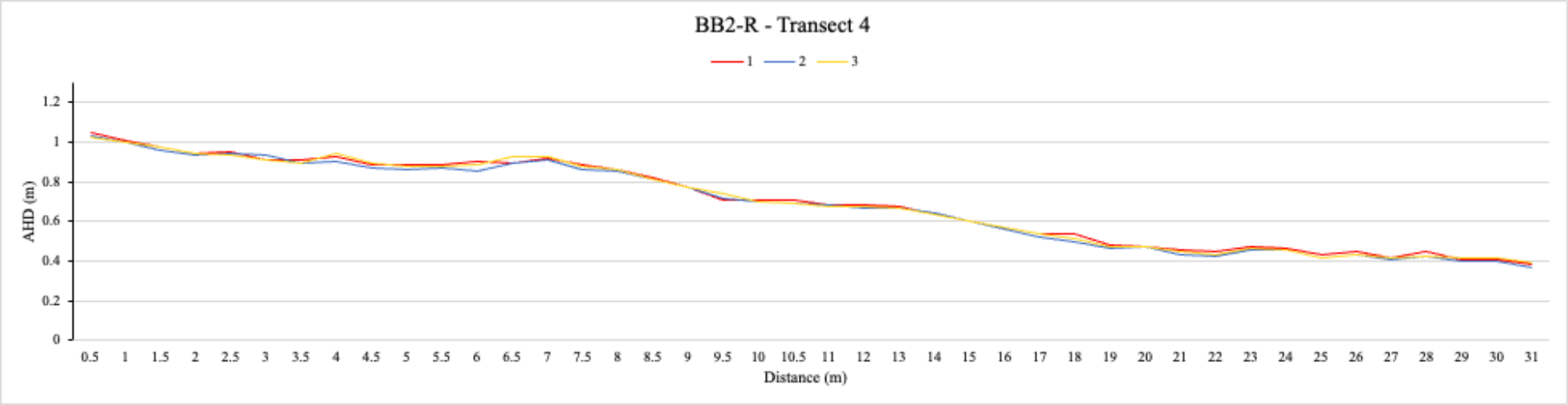

BB1-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
Distance (m)

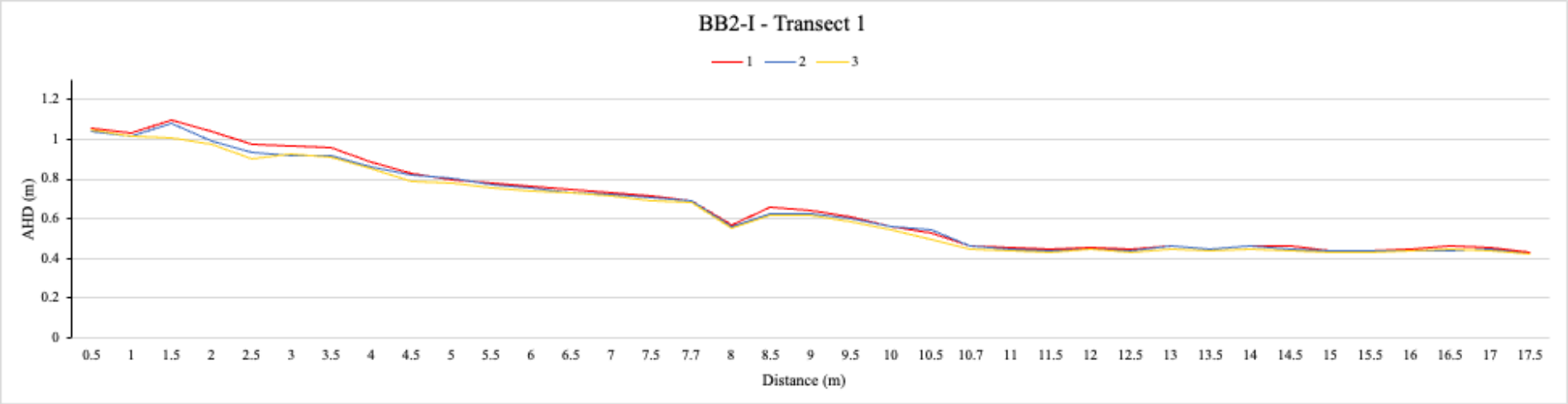

BB1-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
Distance (m)

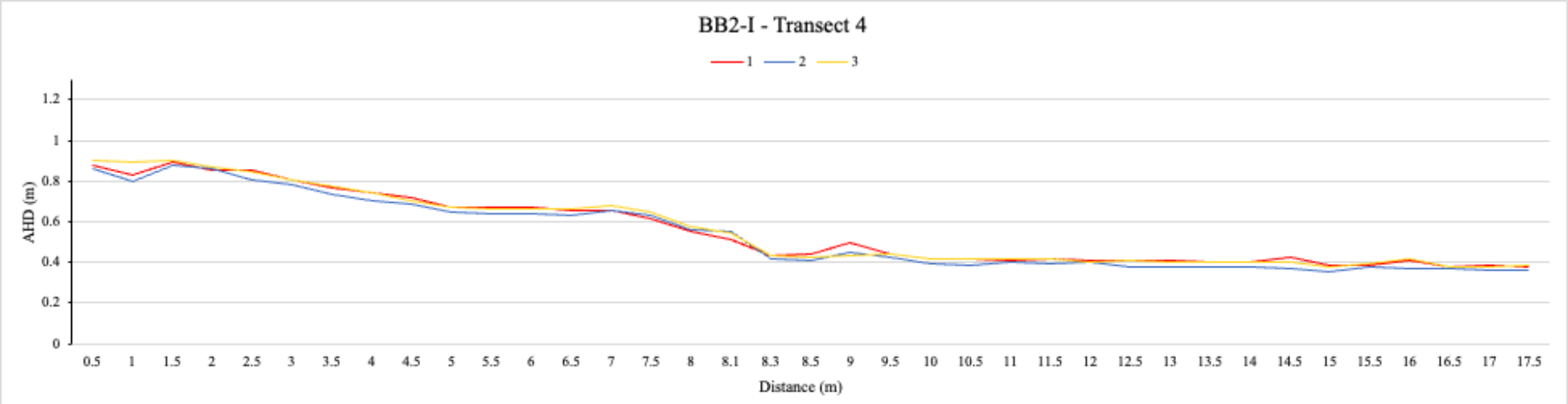

BB1-I - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.13 12.3 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 19 19.5 20
Distance (m)

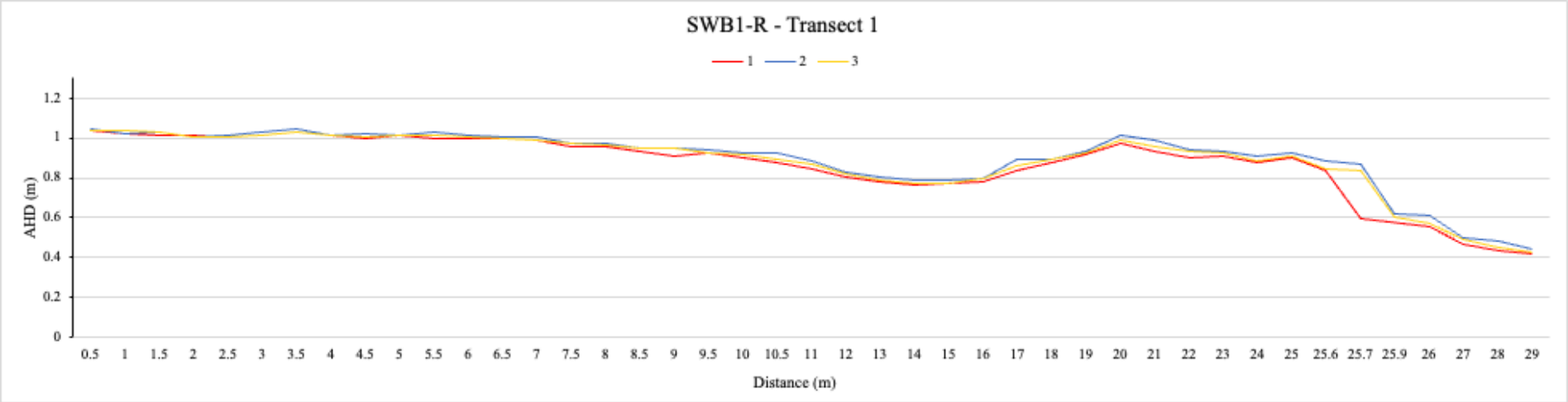

BB1-I - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.3 16.6 17 17.8 18 18.5 19 19.5 20
Distance (m)

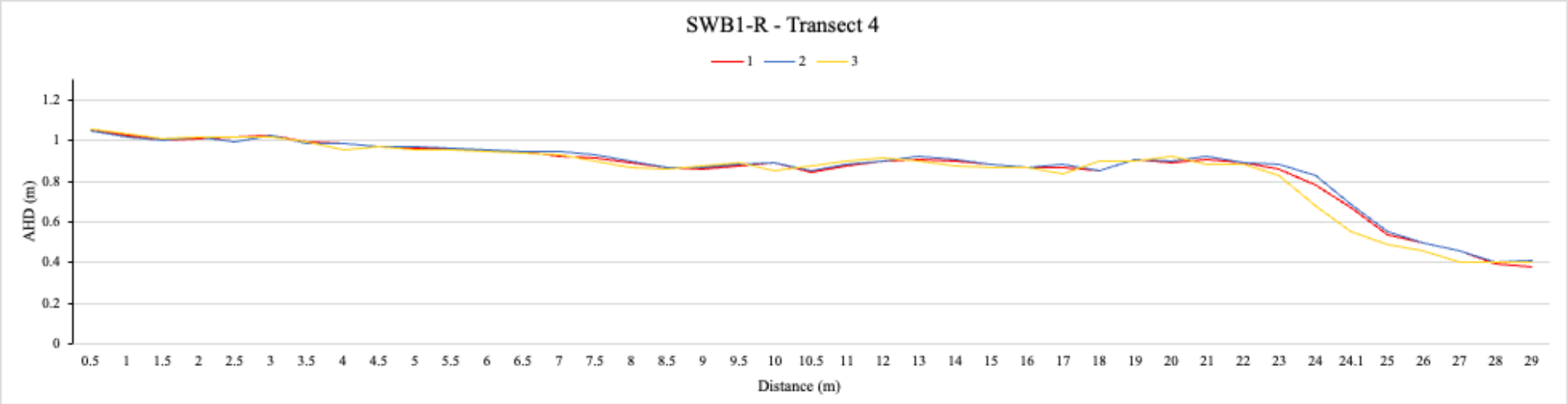

BB2-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 17.5 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Distance (m)

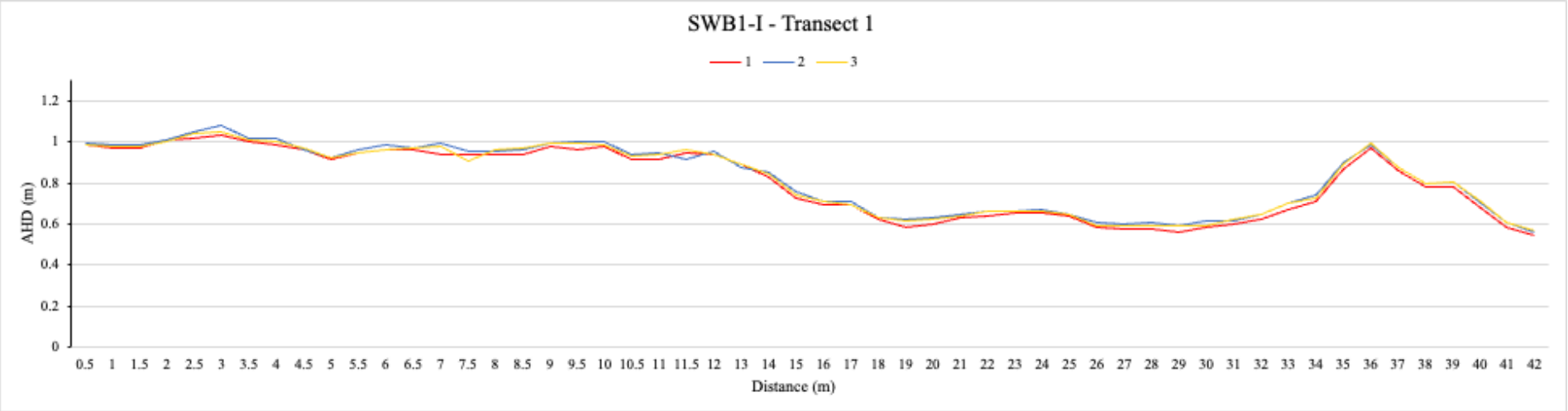

BB2-R - Transect 4
1
2
3
AHD (m)
1.2
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0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Distance (m)

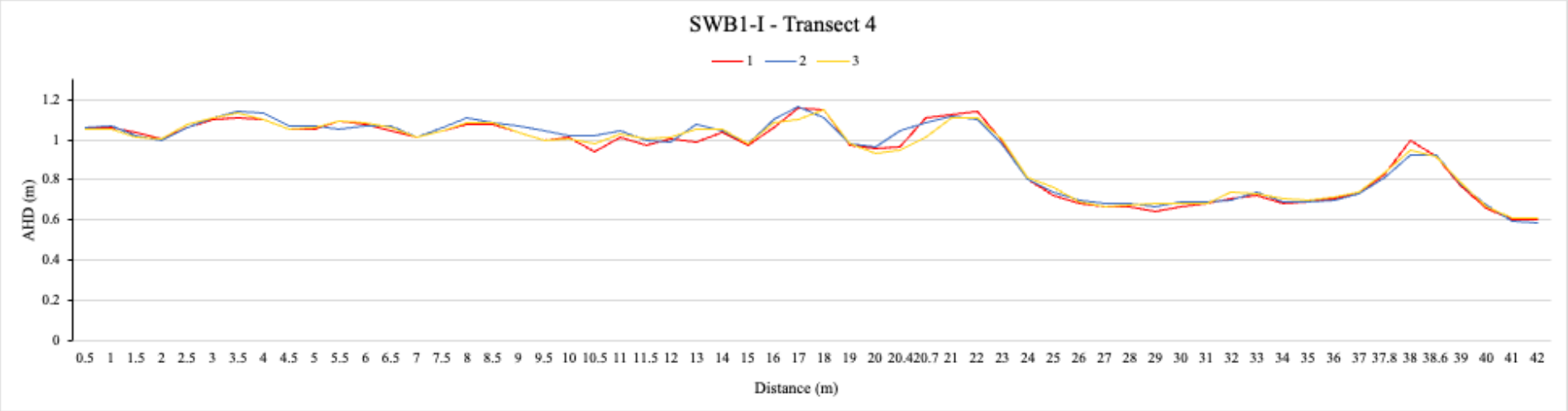

BB2-I - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 7.7 8 8.5 9 9.5 10 10.5 10.7 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5
Distance (m)

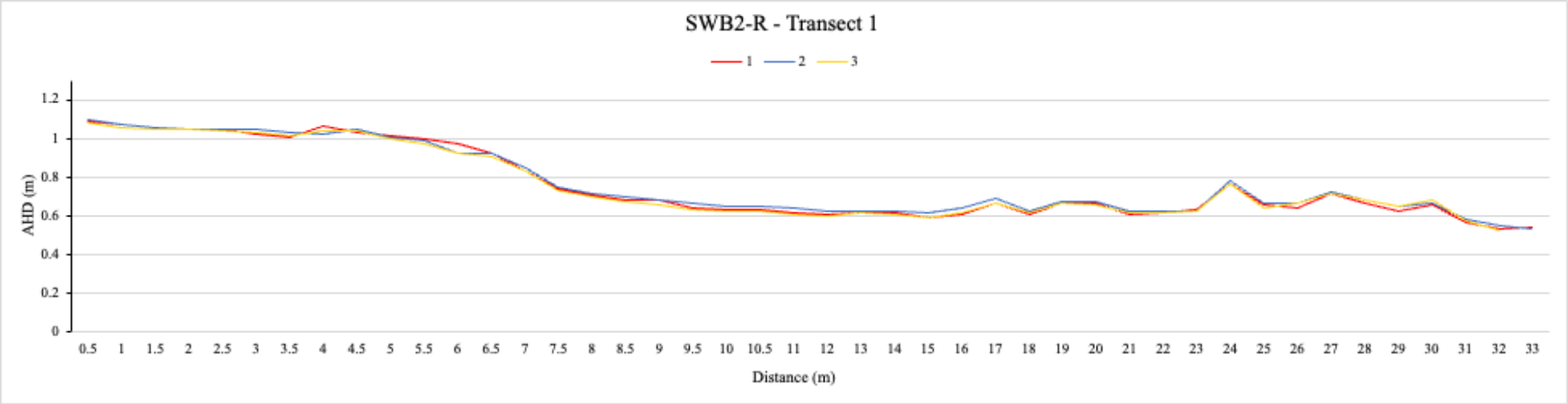

BB2-I - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.1 8.3 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5
Distance (m)

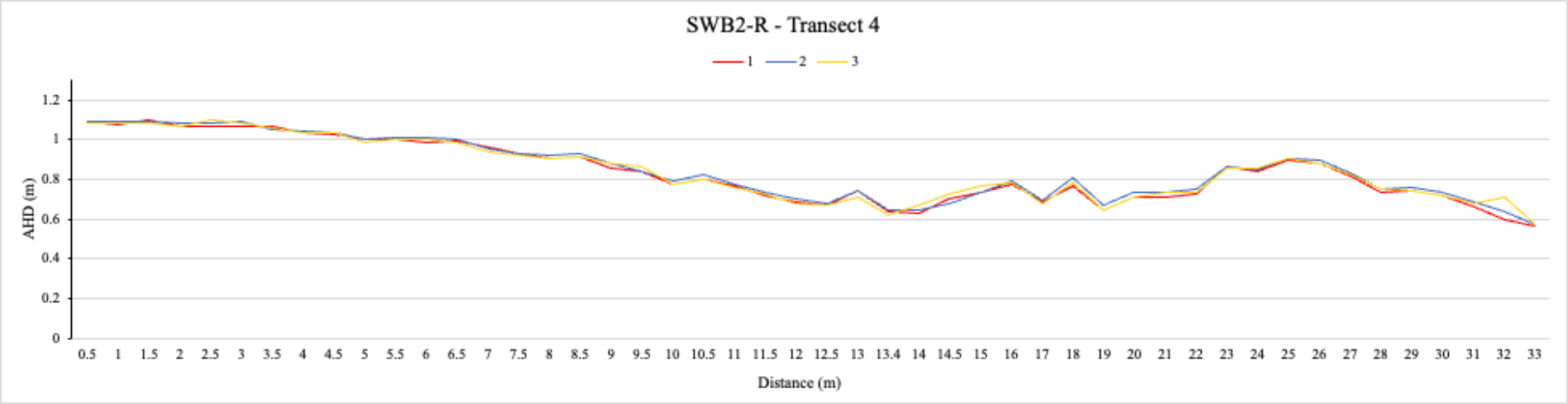

SWB1-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 25.6 25.7 25.9 26 27 28 29
Distance (m)

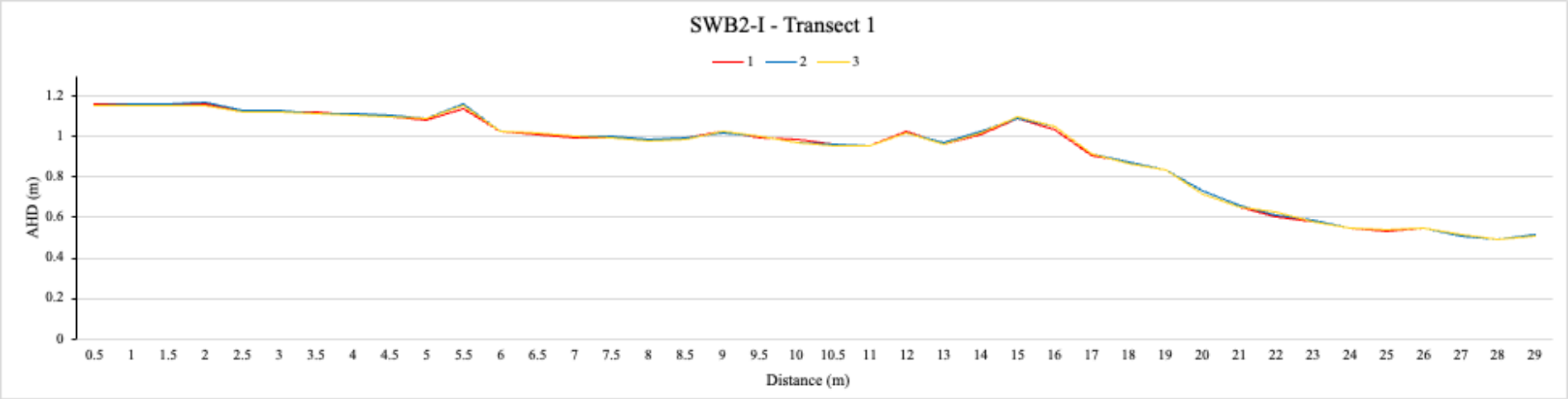

SWB1-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 24.1 25 26 27 28 29
Distance (m)

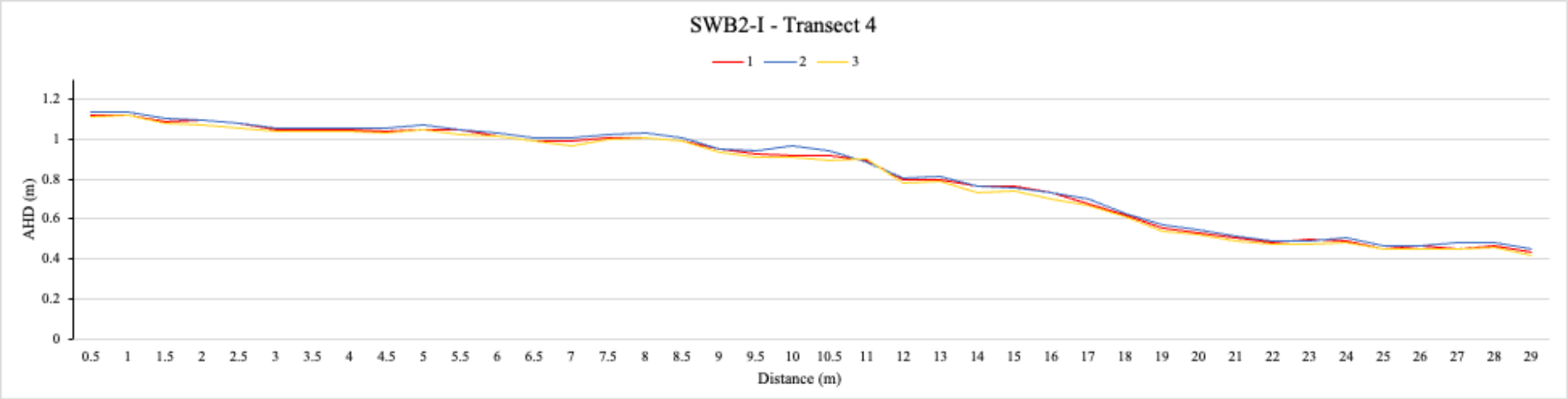

SWB1-I - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
Distance (m)

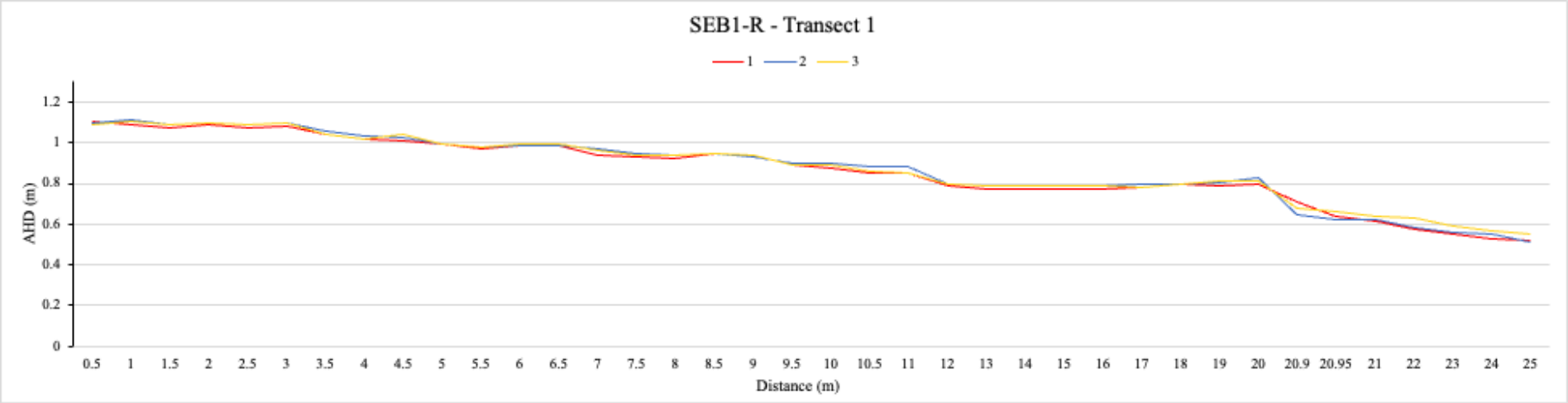

SWB1-I - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 13 14 15 16 17 18 19 20 20.4 20.7 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 37.8 38 38.6 39 40 41 42
Distance (m)

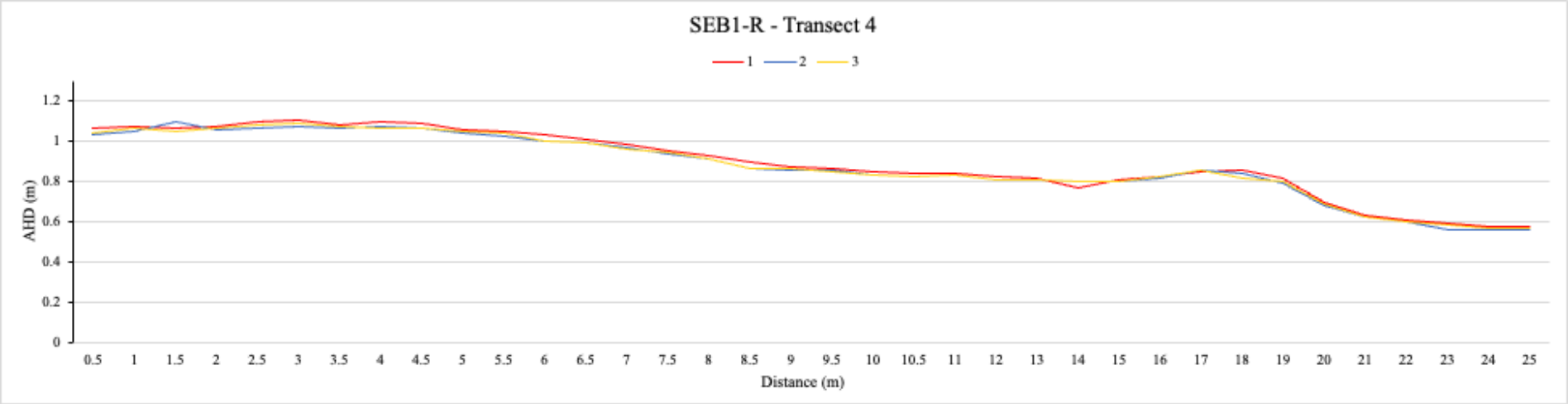

SWB2-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Distance (m)

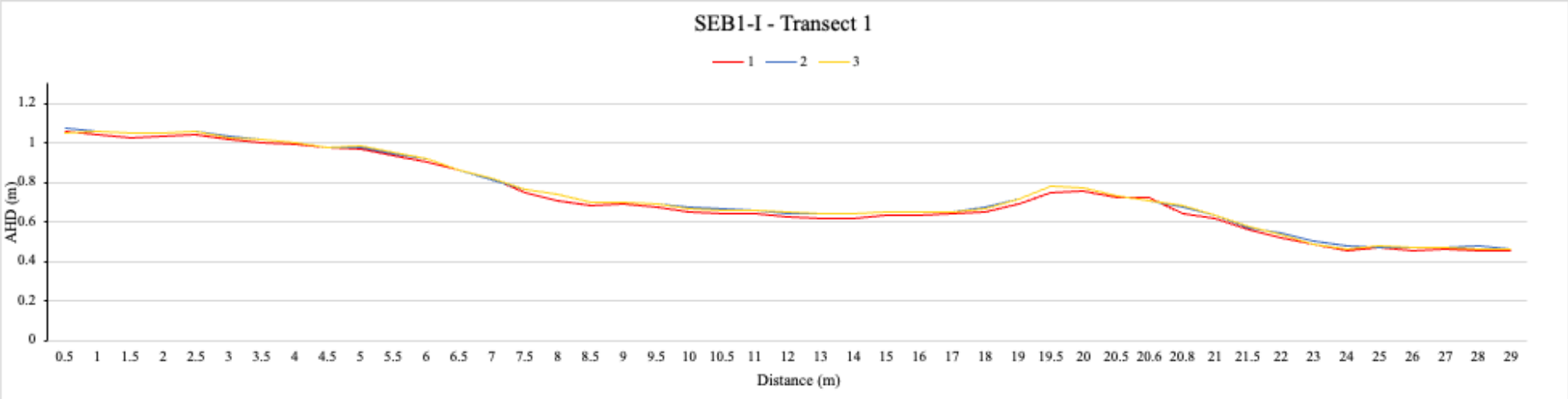

SWB2-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.4 14 14.5 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Distance (m)

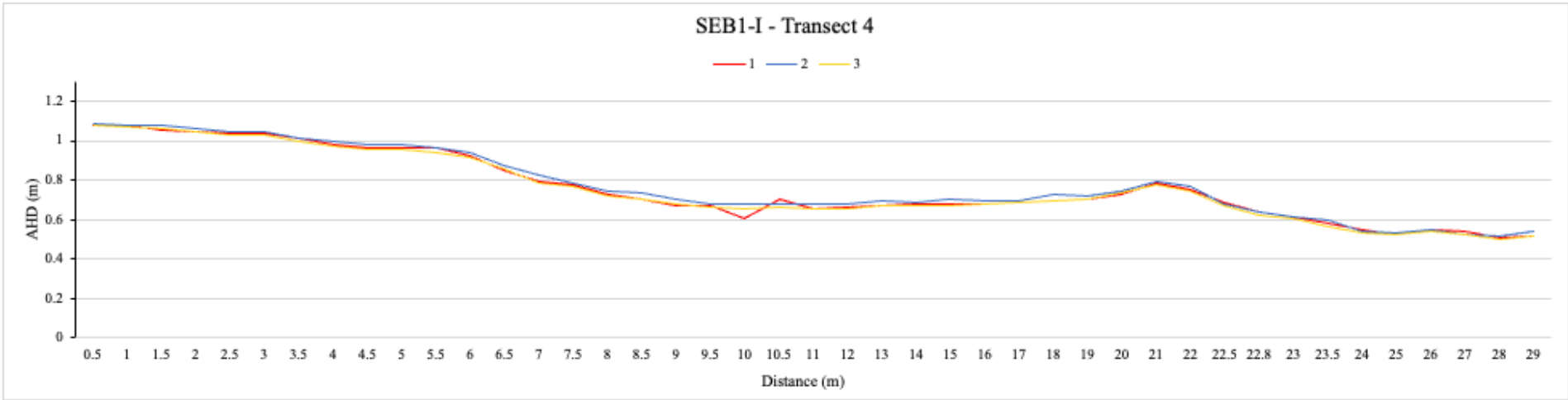

SWB2-I - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

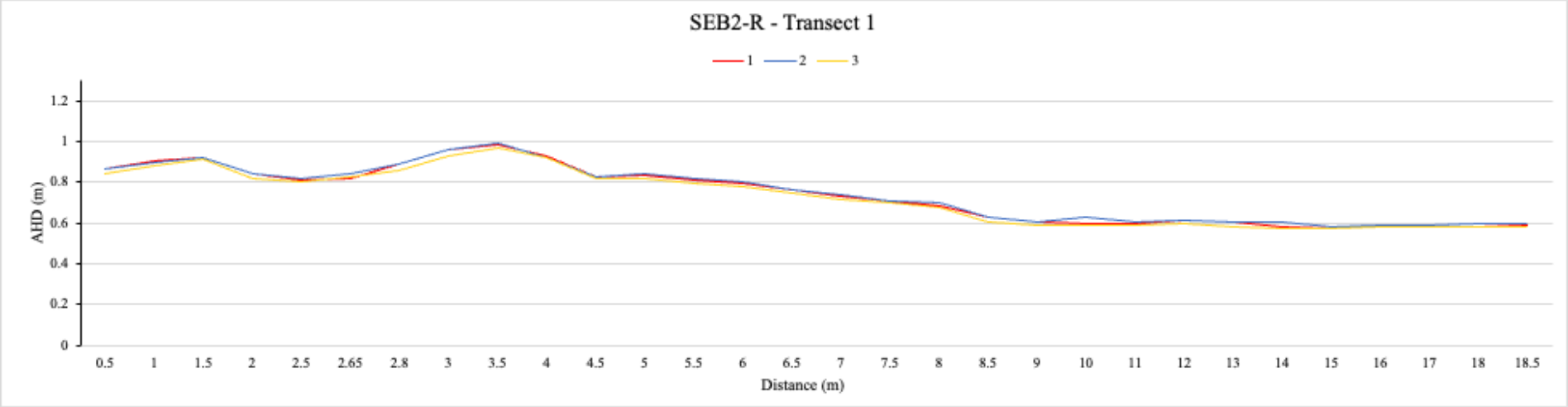

SWB2-I - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

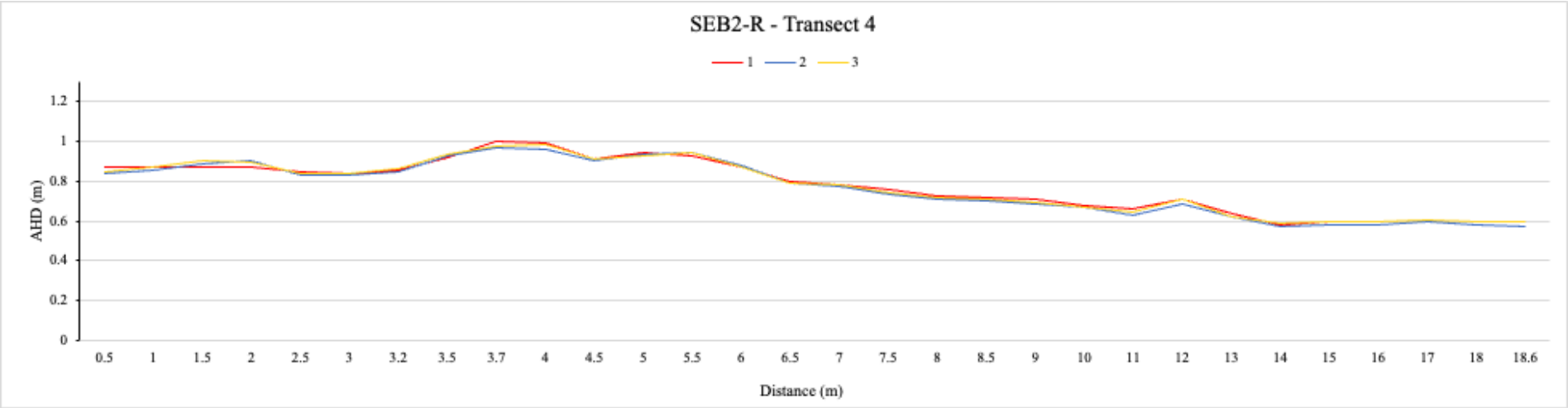

SEB1-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 20.9 20.95 21 22 23 24 25
Distance (m)

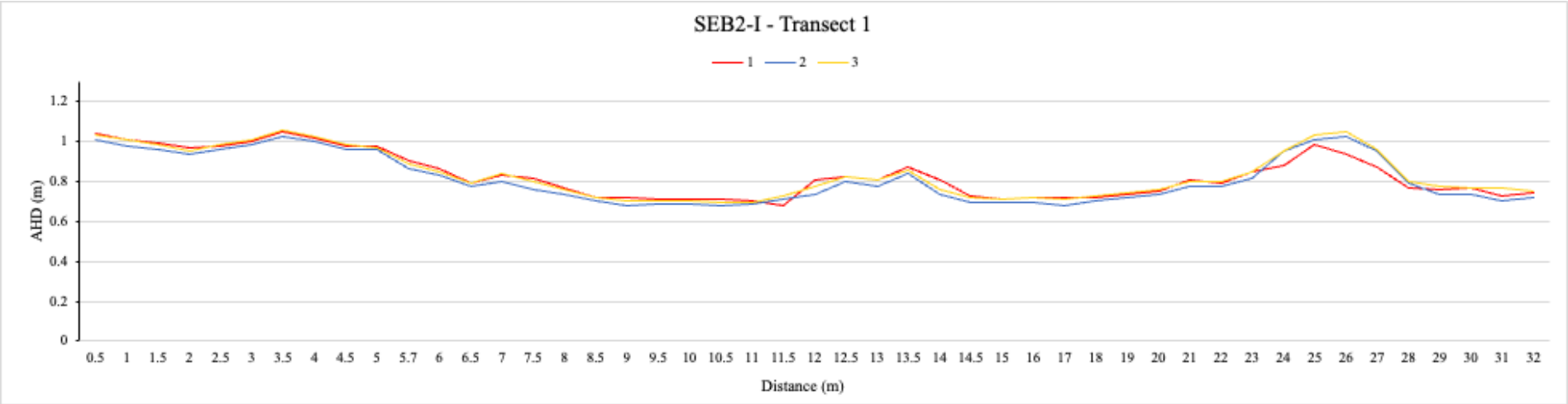

SEB1-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (m)

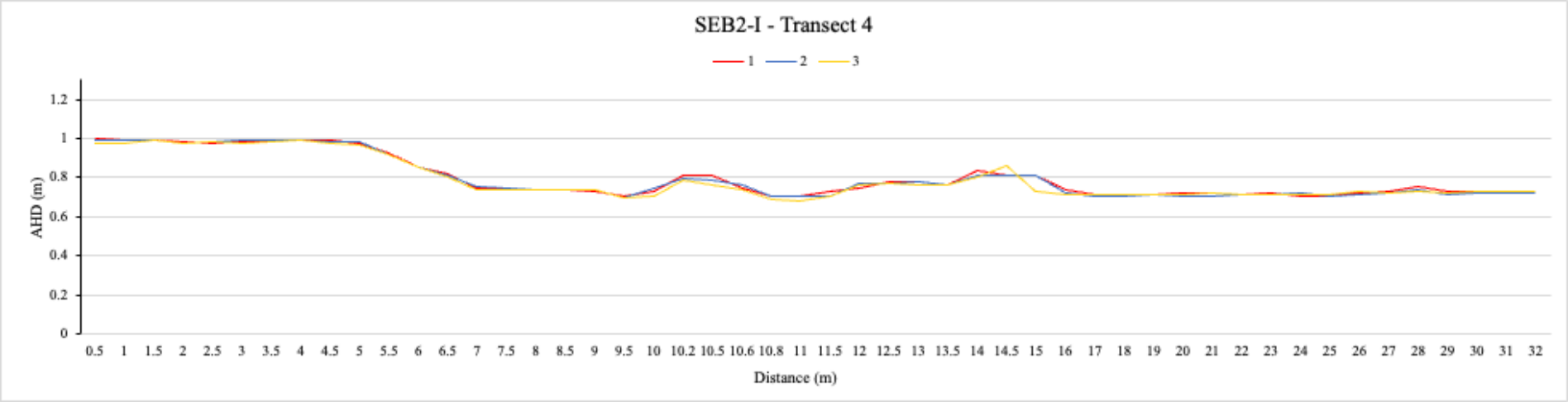

SEB1-I - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 19.5 20 20.5 20.6 20.8 21 21.5 22 23 24 25 26 27 28 29
Distance (m)

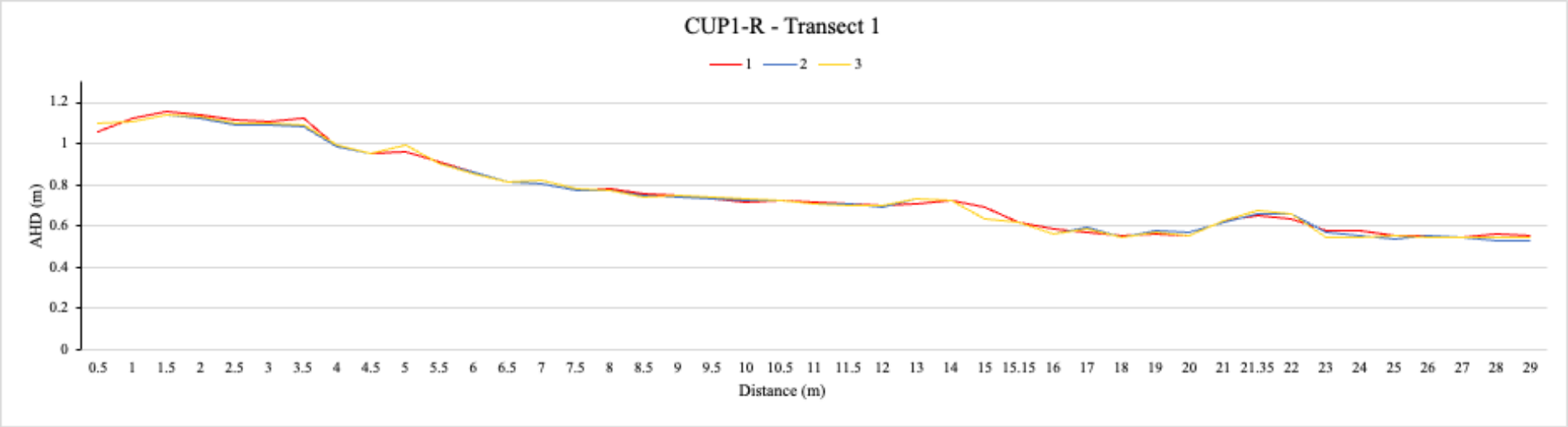

SEB1-I - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 22.5 22.8 23 23.5 24 25 26 27 28 29
Distance (m)

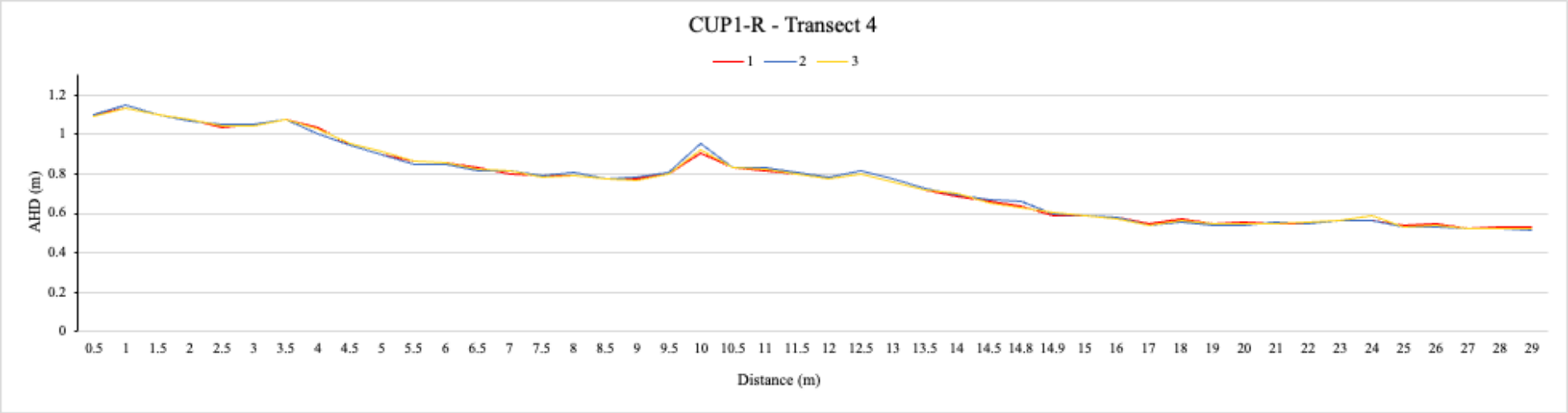

SEB2-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 2.65 2.8 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 10 11 12 13 14 15 16 17 18 18.5
Distance (m)

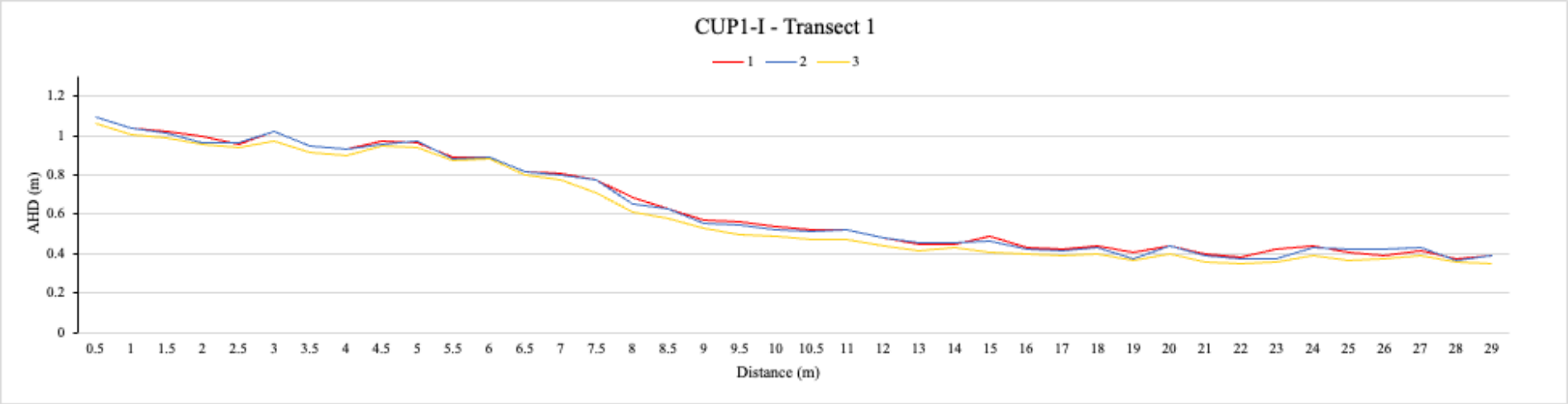

SEB2-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.2 3.5 3.7 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 10 11 12 13 14 15 16 17 18 18.6
Distance (m)

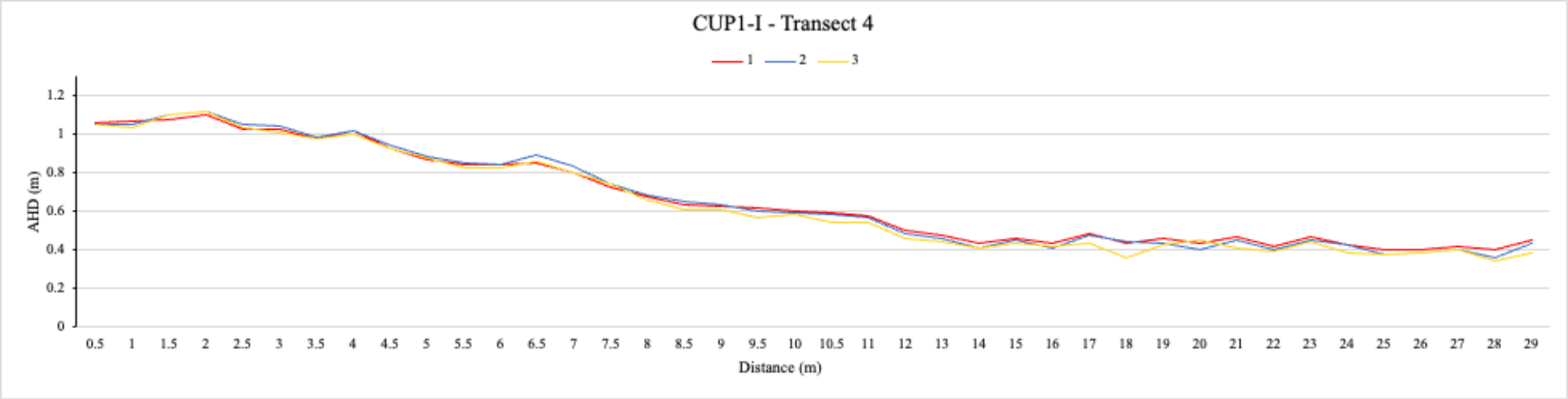

SEB2-I - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.7 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Distance (m)

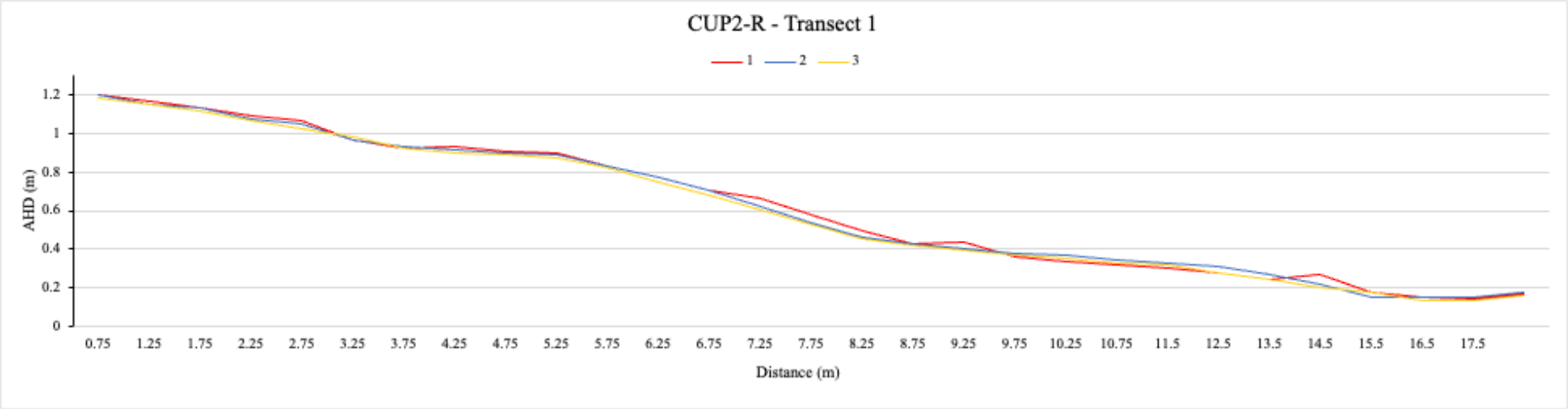

SEB2-I - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.2 10.5 10.6 10.8 11 11.5 12 12.5 13 13.5 14 14.5 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Distance (m)

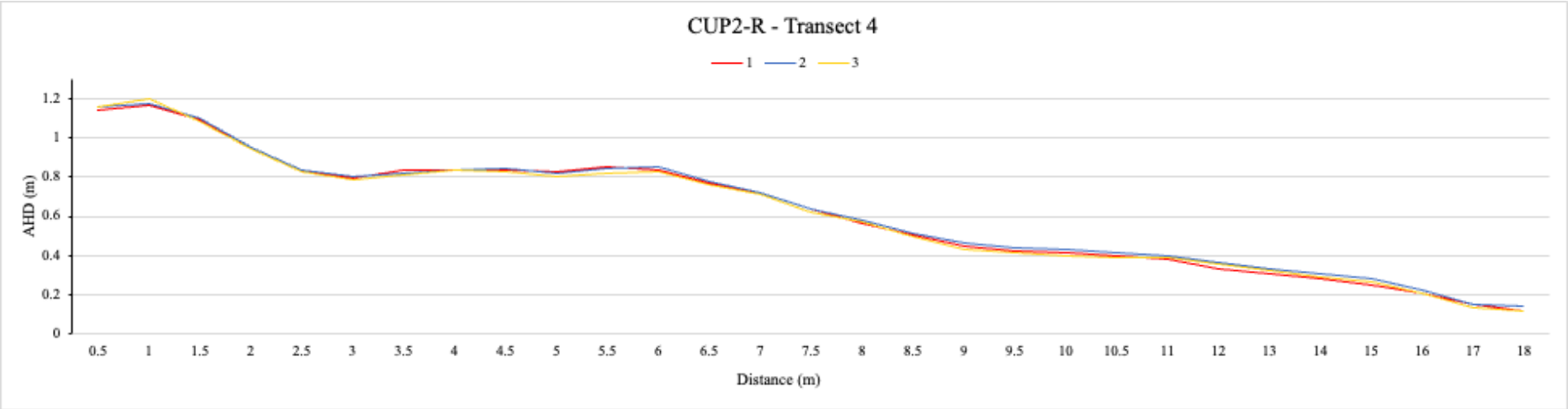

CUP1-R - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 13 14 15 15.15 16 17 18 19 20 21 21.35 22 23 24 25 26 27 28 29
Distance (m)

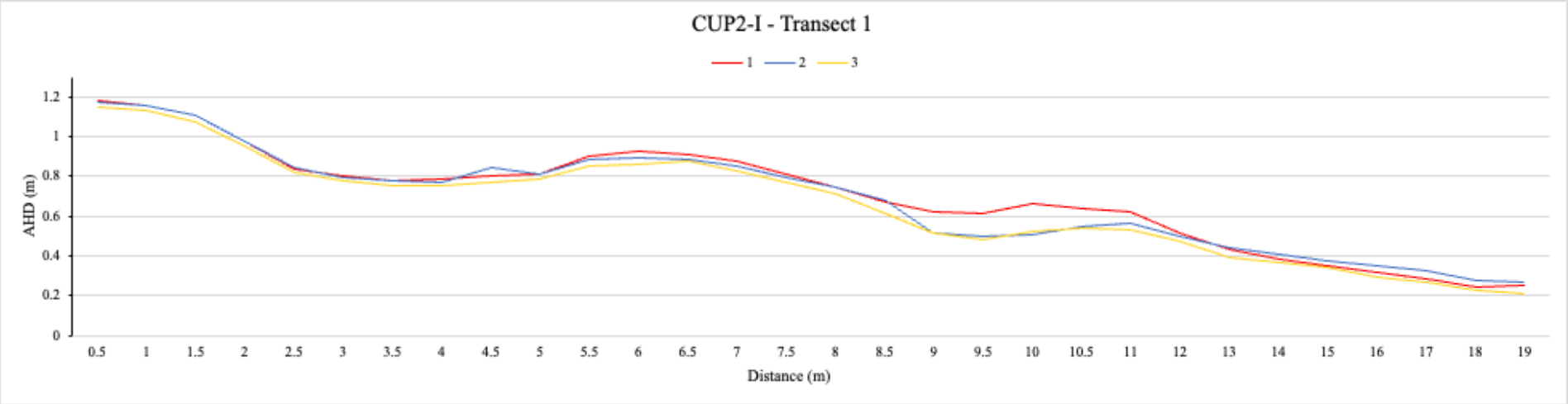

CUP1-R - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 14.8 14.9 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

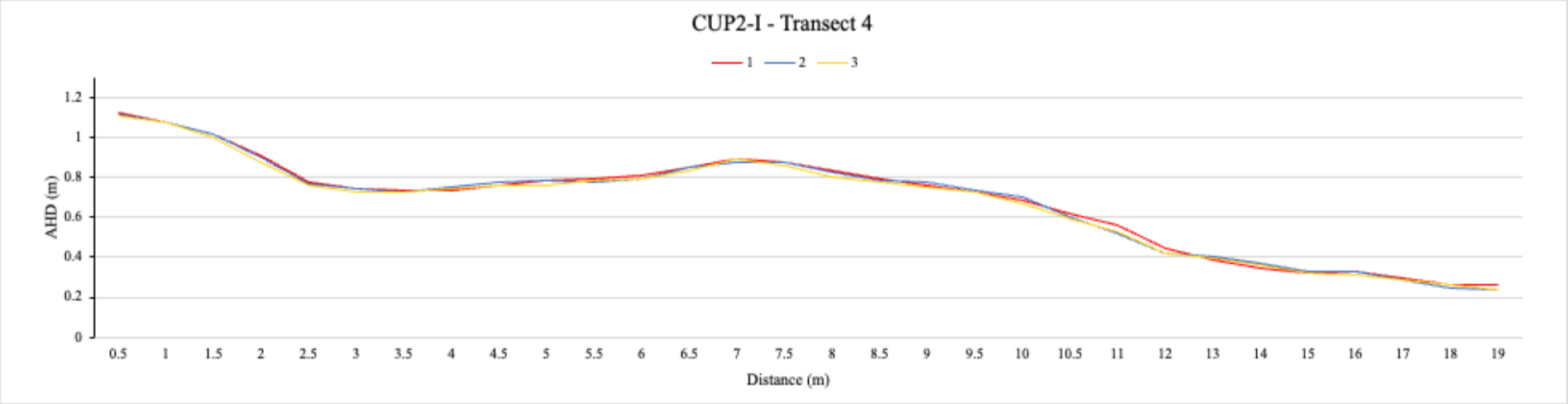

CUP1-I - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

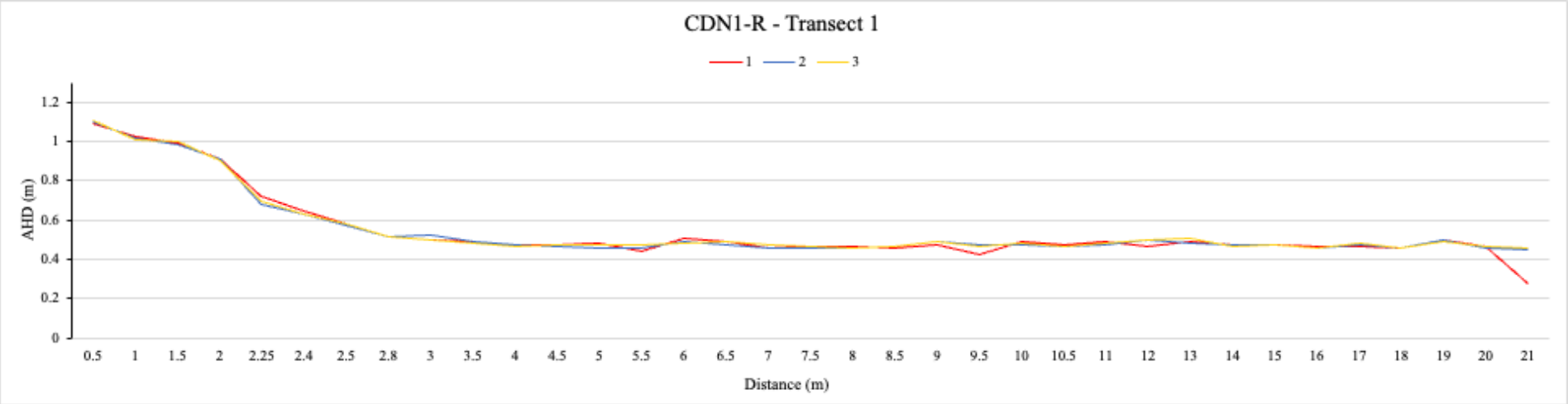

CUP1-I - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

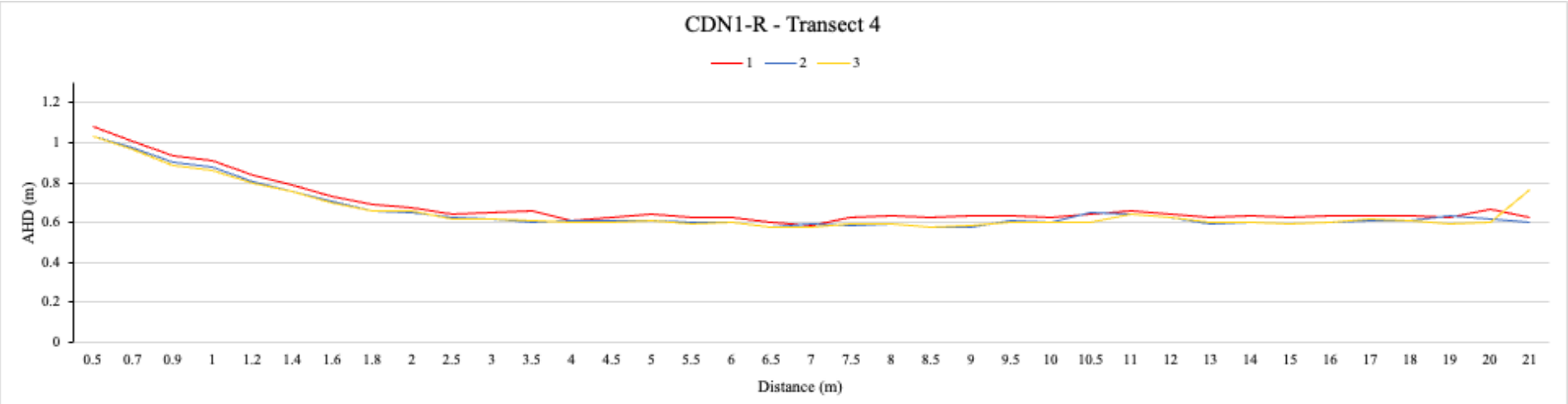

CUP2-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.75 1.25 1.75 2.25 2.75 3.25 3.75 4.25 4.75 5.25 5.75 6.25 6.75 7.25 7.75 8.25 8.75 9.25 9.75 10.25 10.75 11.5 12.5 13.5 14.5 15.5 16.5 17.5
Distance (m)

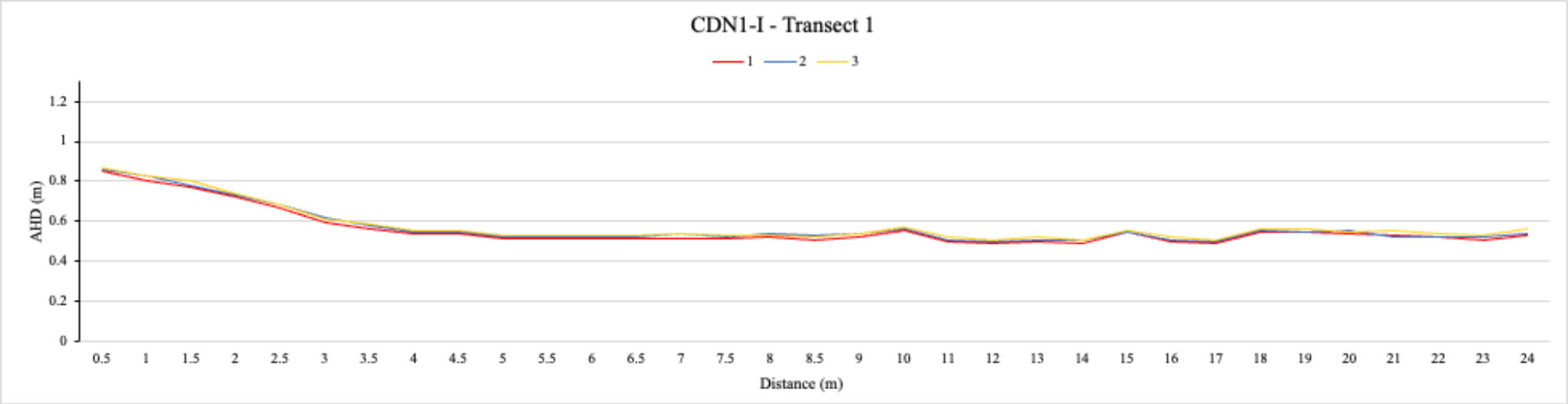

CUP2-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18
Distance (m)

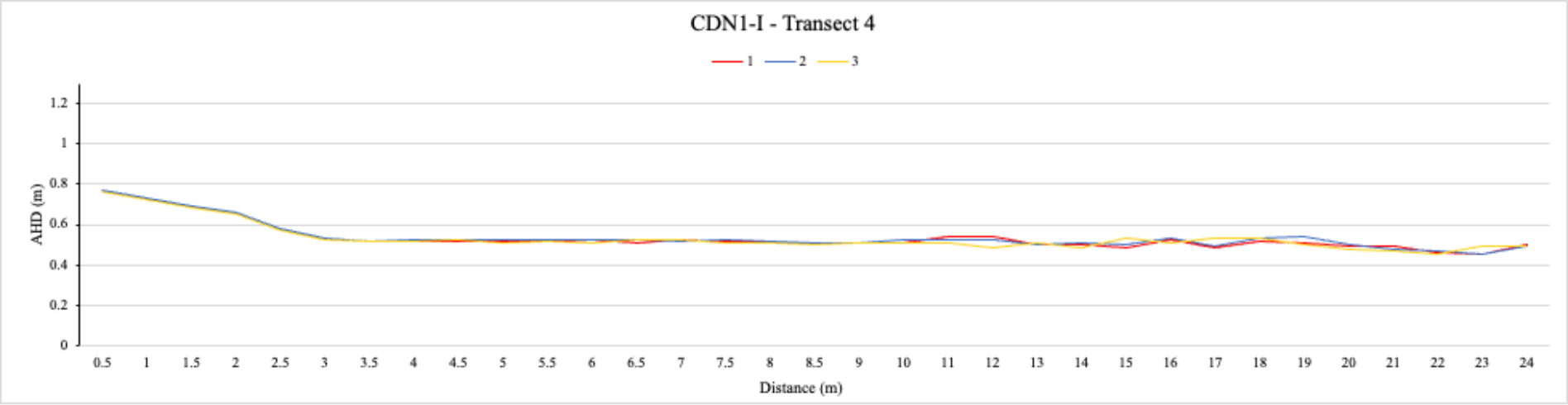

CUP2-I - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19
Distance (m)

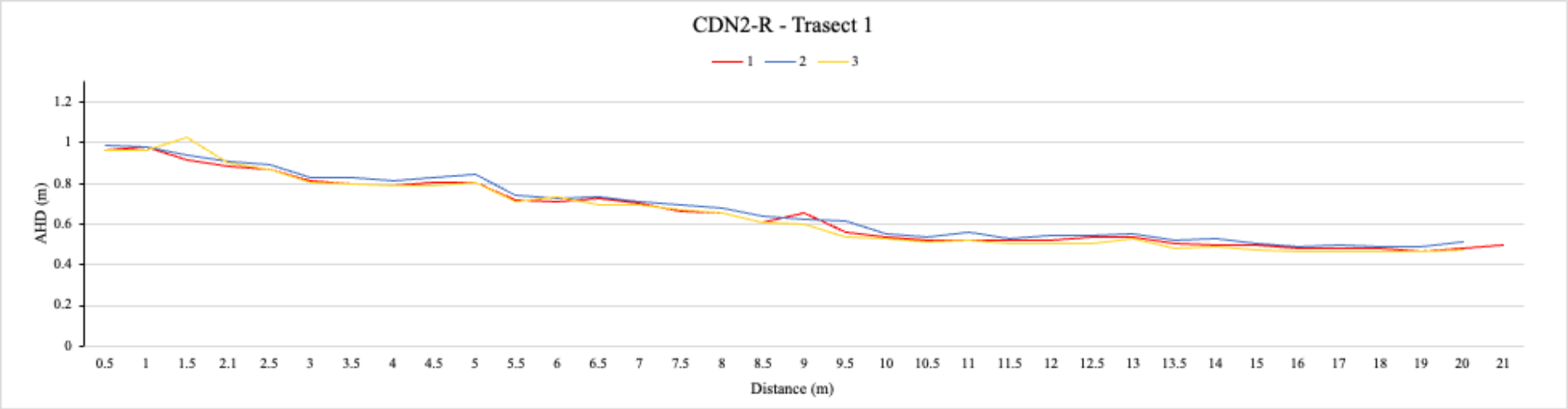

CUP2-I - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19
Distance (m)

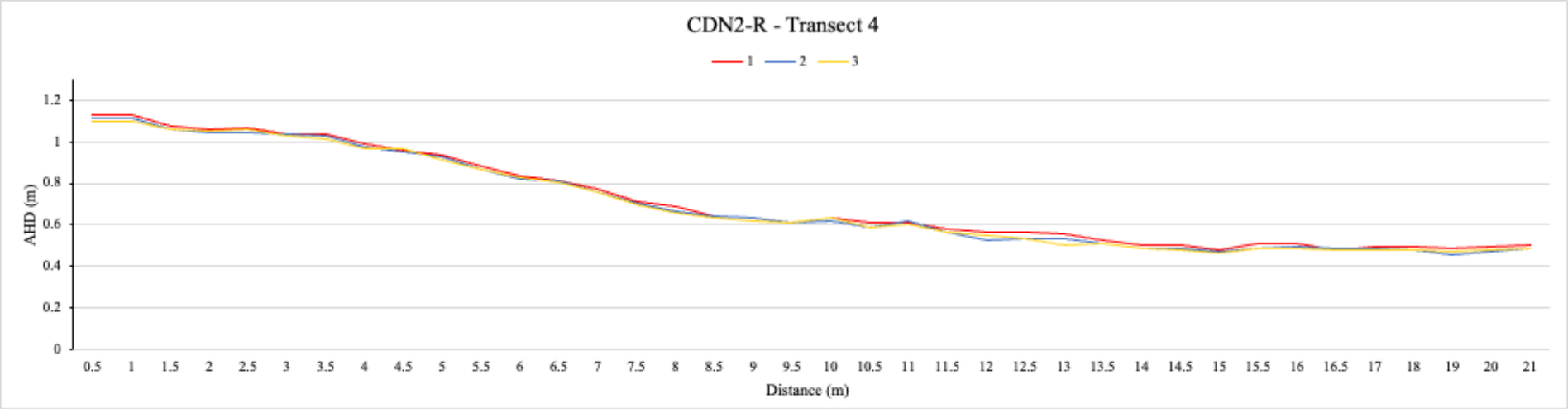

CDN1-R - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.25 2.4 2.5 2.8 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21
Distance (m)

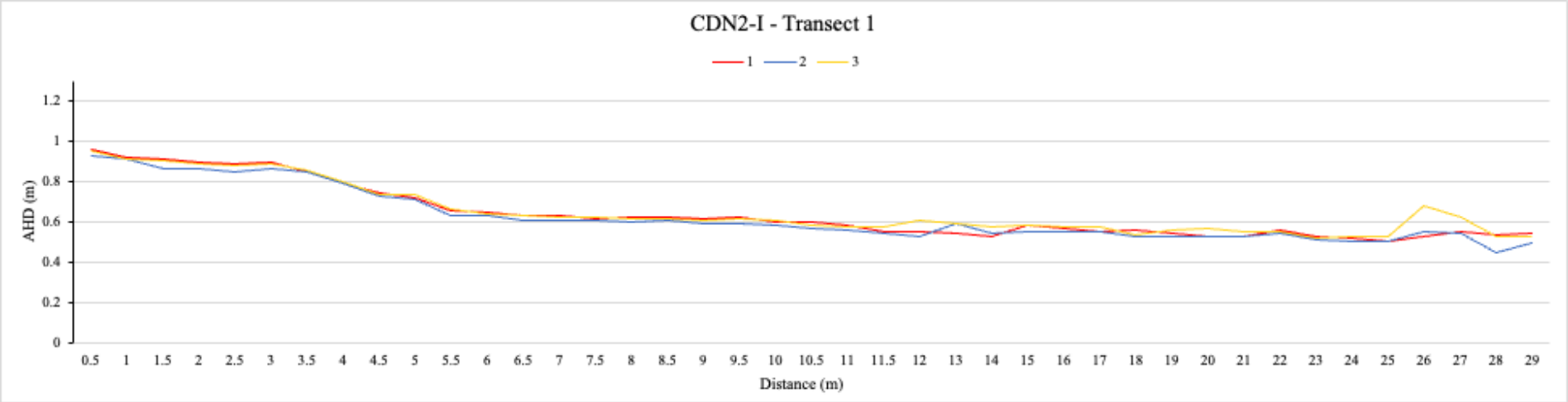

CDN1-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 0.7 0.9 1 1.2 1.4 1.6 1.8 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 12 13 14 15 16 17 18 19 20 21
Distance (m)

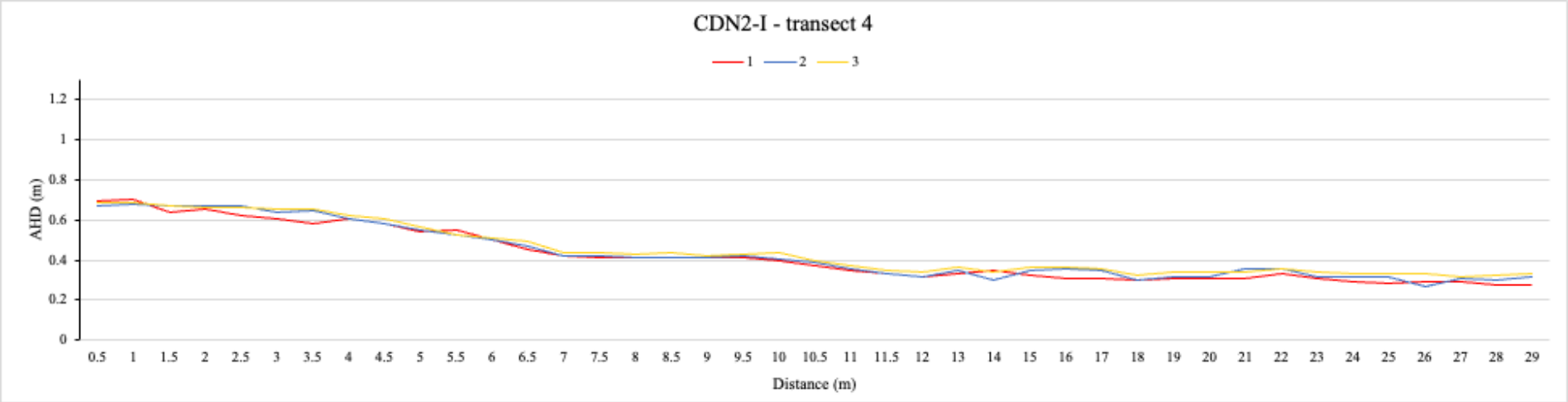

CDN1-I - Transect 1
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Distance (m)


CDN1-I - Transect 4
1
2
3
AHD (m)
0
0.2
0.4
0.6
0.8
1
1.2
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Distance (m)


CDN2-R - Trasect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2.1 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 15 16 17 18 19 20 21
Distance (m)

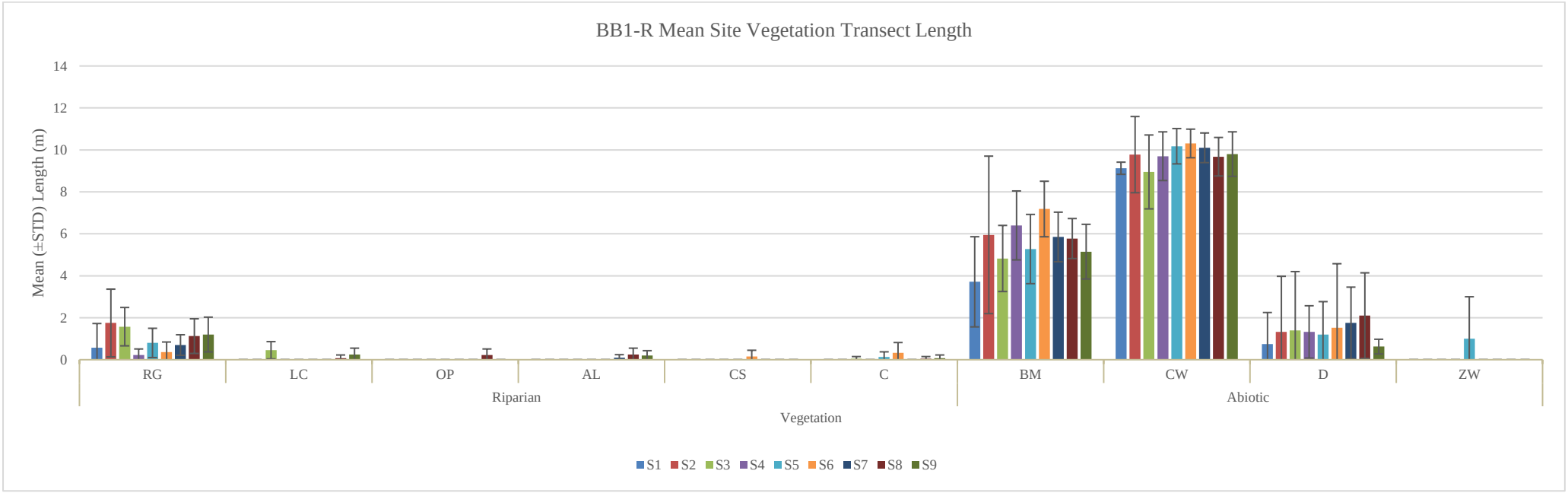

CDN2-R - Transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 18 19 20 21
Distance (m)

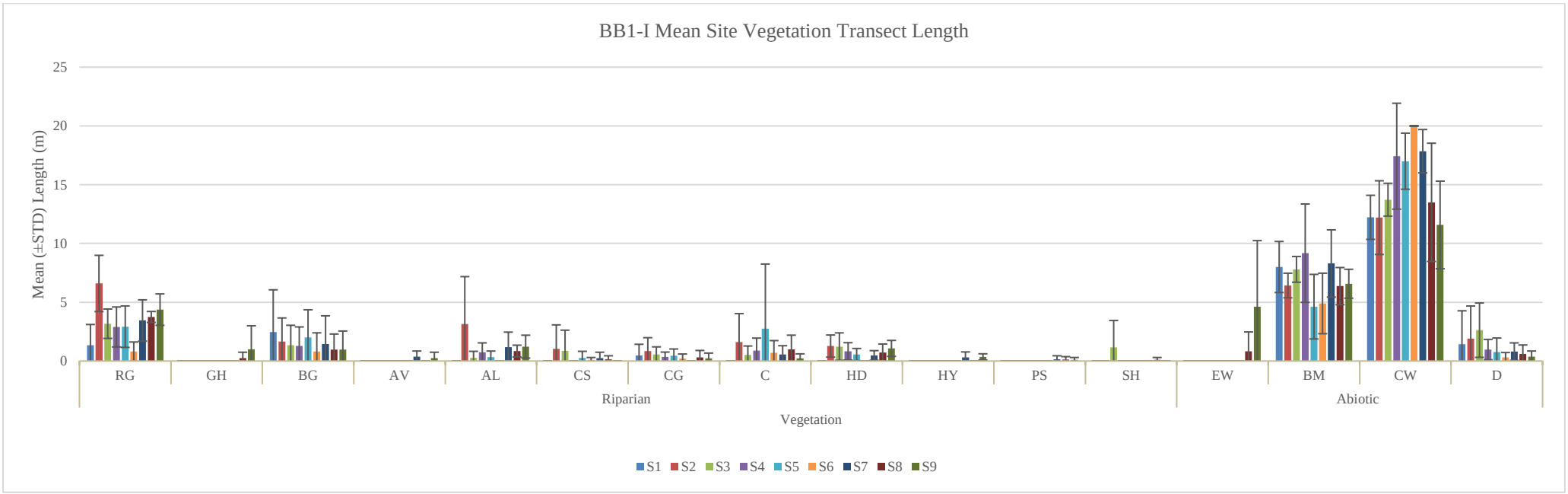

CDN2-I - Transect 1
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

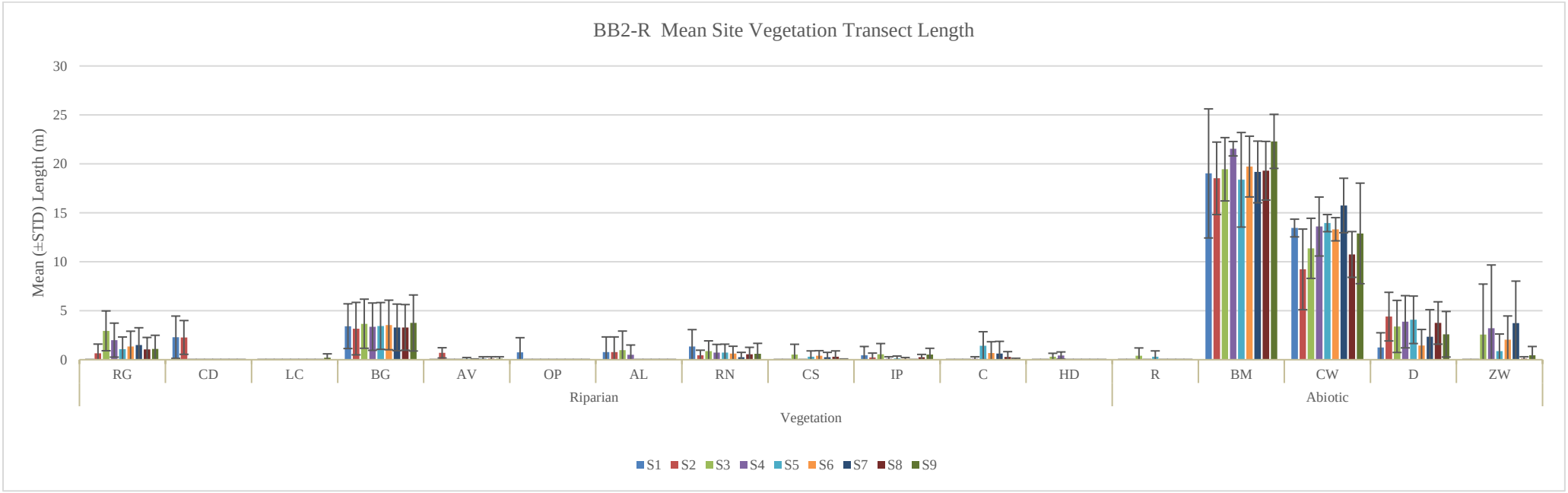

CDN2-I - transect 4
1
2
3
AHD (m)
1.2
1
0.8
0.6
0.4
0.2
0
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Distance (m)

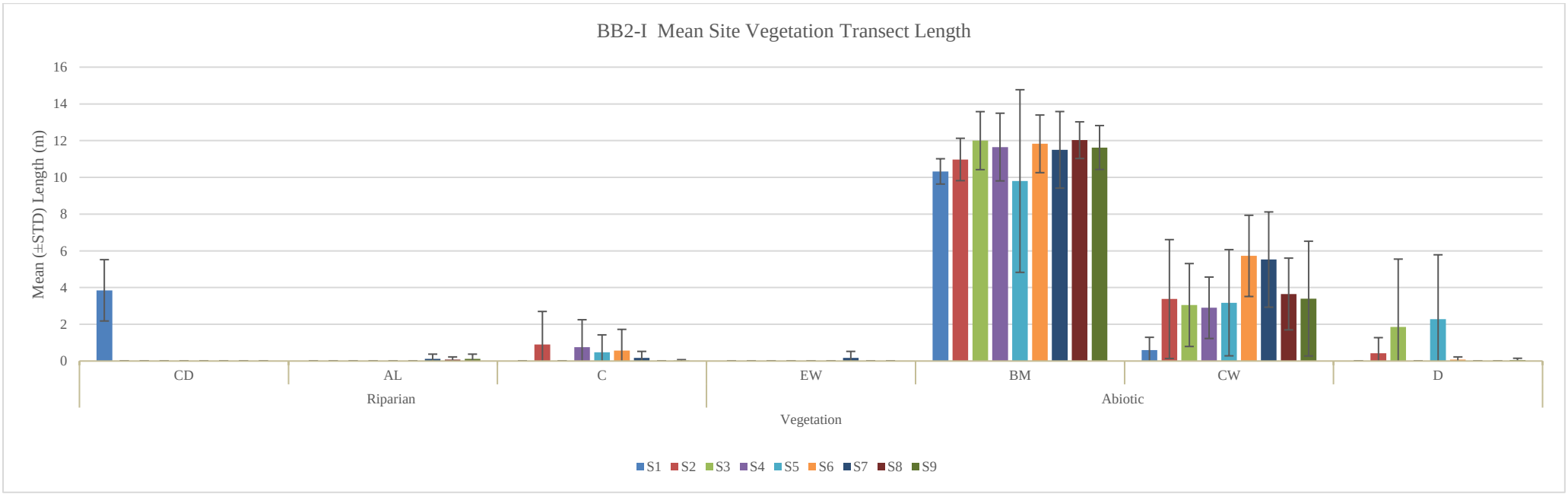
# APPENDIX C3

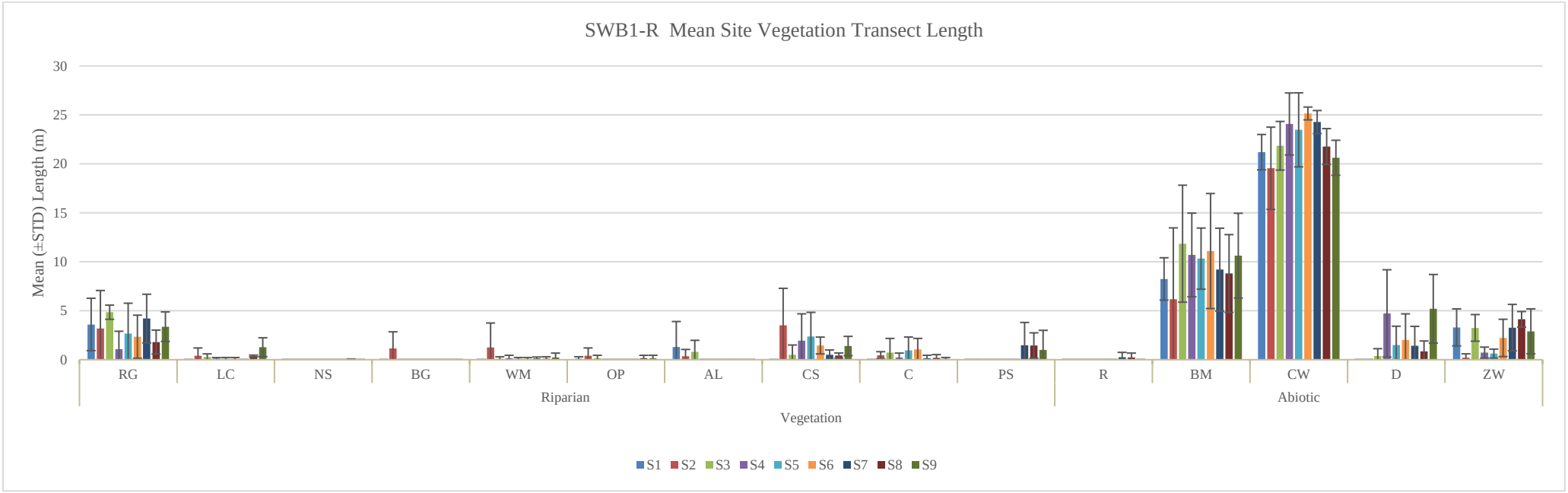
# BIMONTHLY
# INTERTIDAL TRANSECT VEGETATION LENGTHS

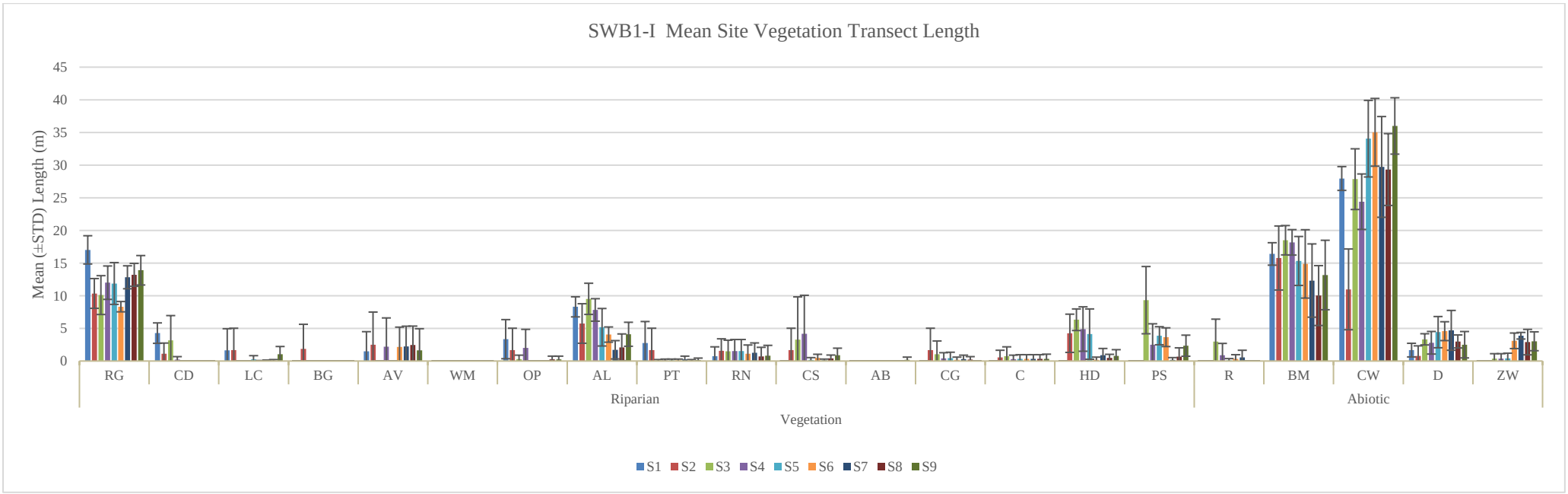

BB1-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
14
12
10
8
6
4
2
0
RG
LC
OP
AL
CS
C
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

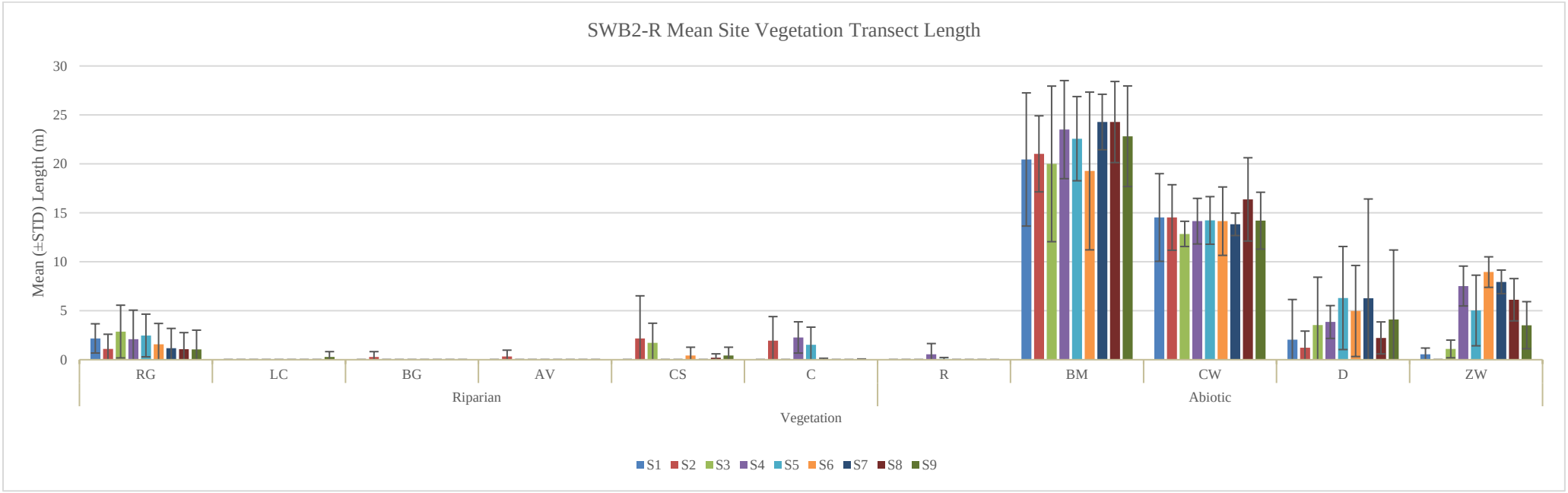

BB1-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
25
20
15
10
5
0
RG
GH
BG
AV
AL
CS
CG
C
HD
HY
PS
SH
EW
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

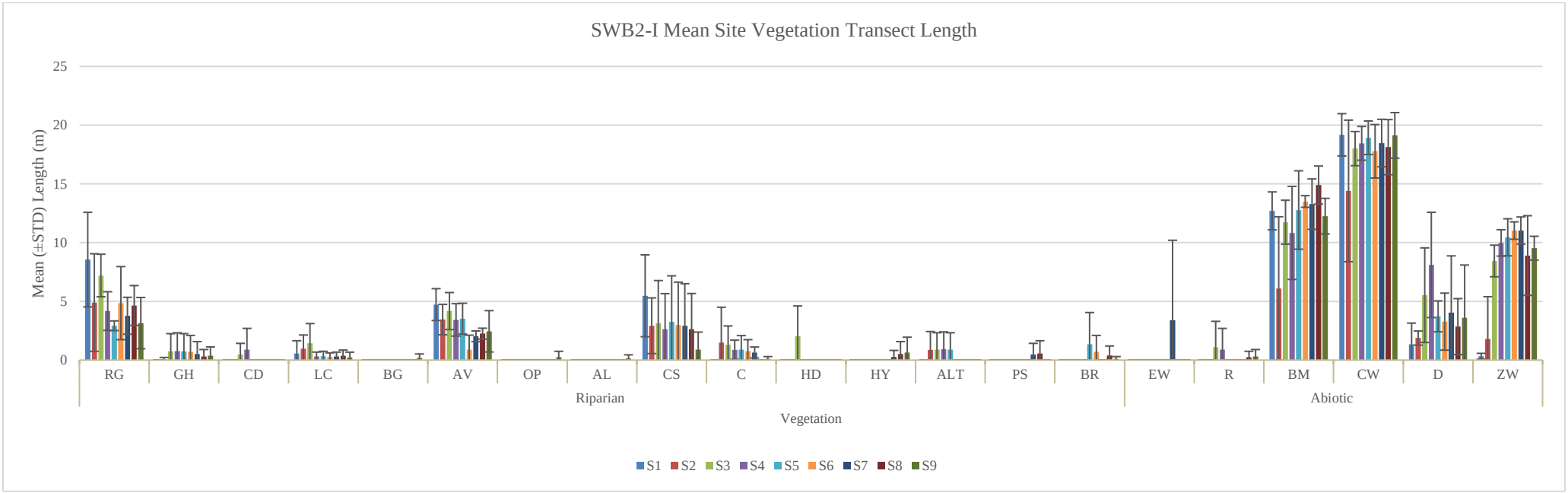

BB2-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
30
25
20
15
10
5
0
RG
CD
LC
BG
AV
OP
AL
RN
CS
IP
C
HD
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

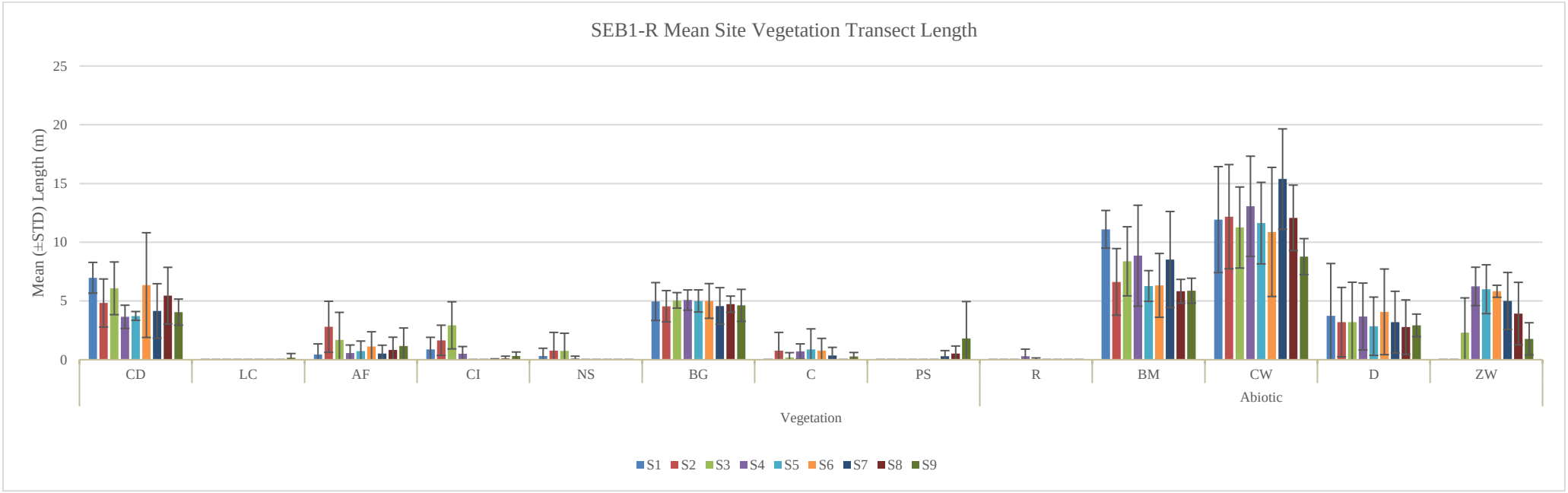

BB2-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
16
14
12
10
8
6
4
2
0
CD
AL
C
EW
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

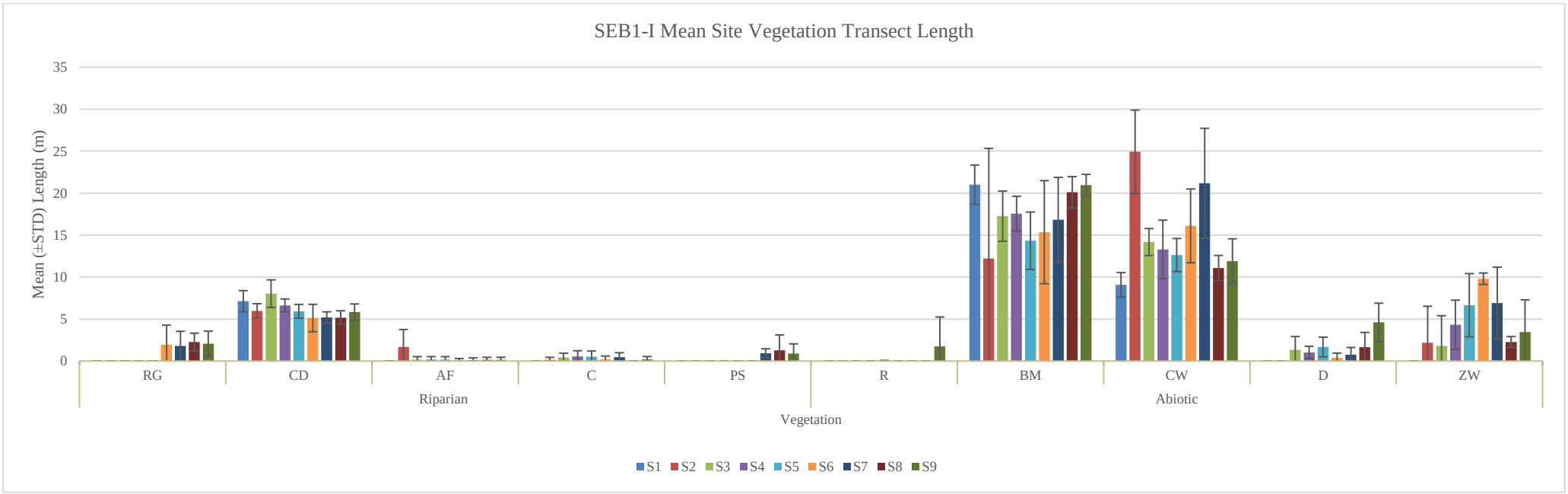

SWB1-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
30
25
20
15
10
5
0
RG
LC
NS
BG
WM
OP
AL
CS
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

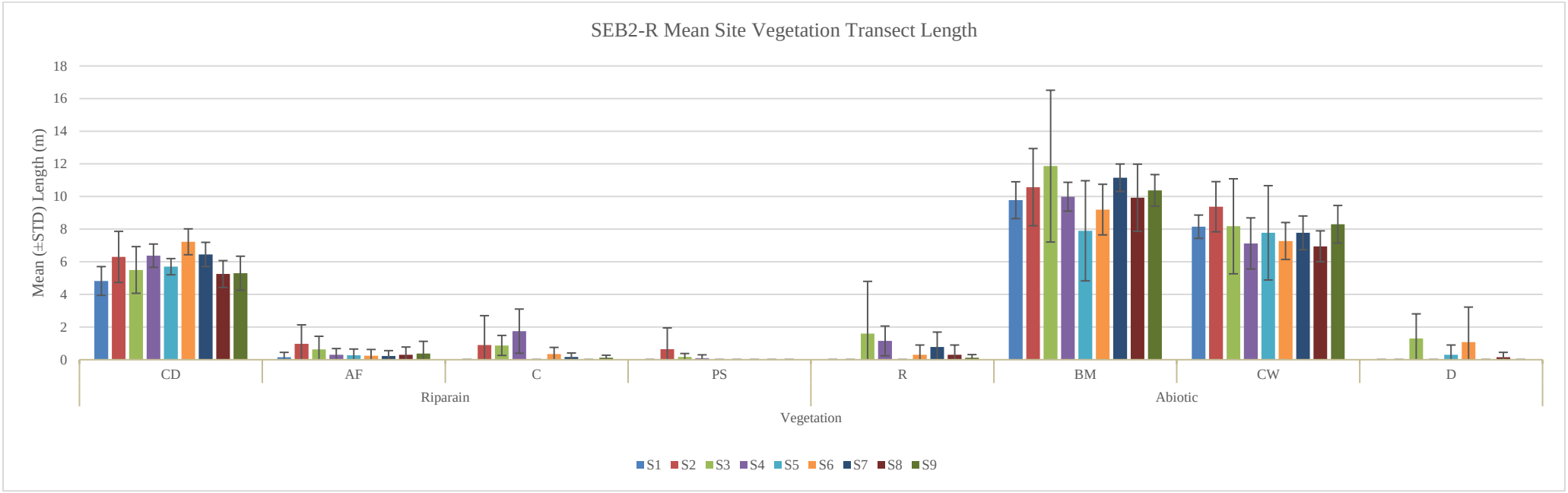

SWB1-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
45
40
35
30
25
20
15
10
5
0
RG
CD
LC
BG
AV
WM
OP
AL
PT
RN
CS
AB
CG
C
HD
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

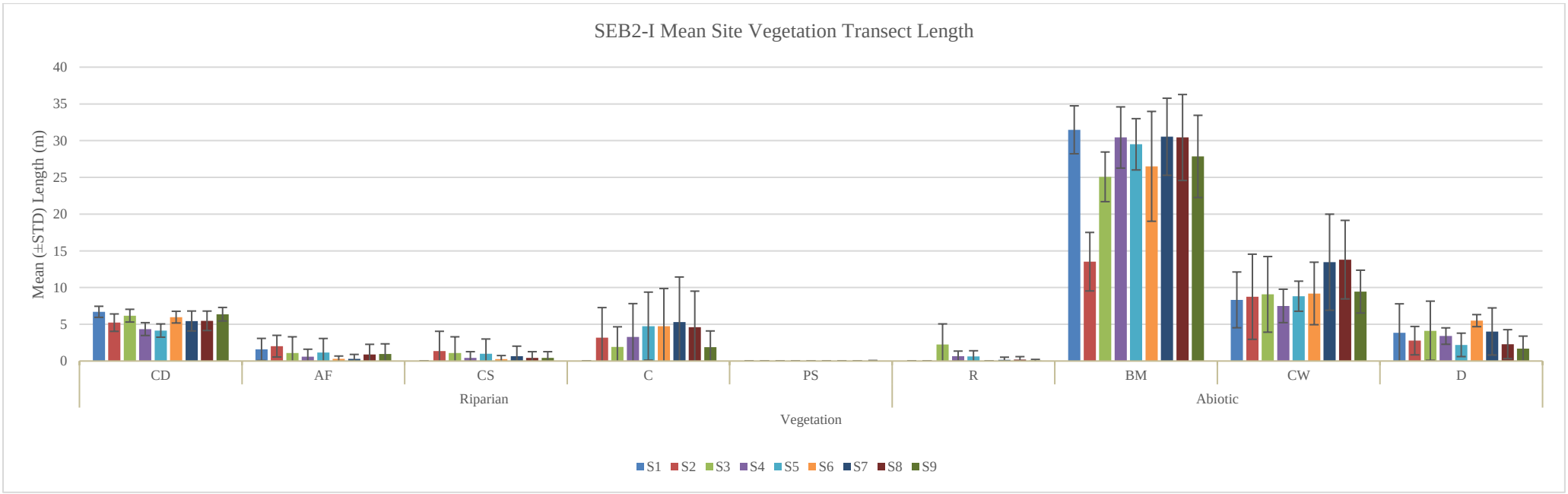

SWB2-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
30
25
20
15
10
5
0
RG
LC
BG
AV
CS
C
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

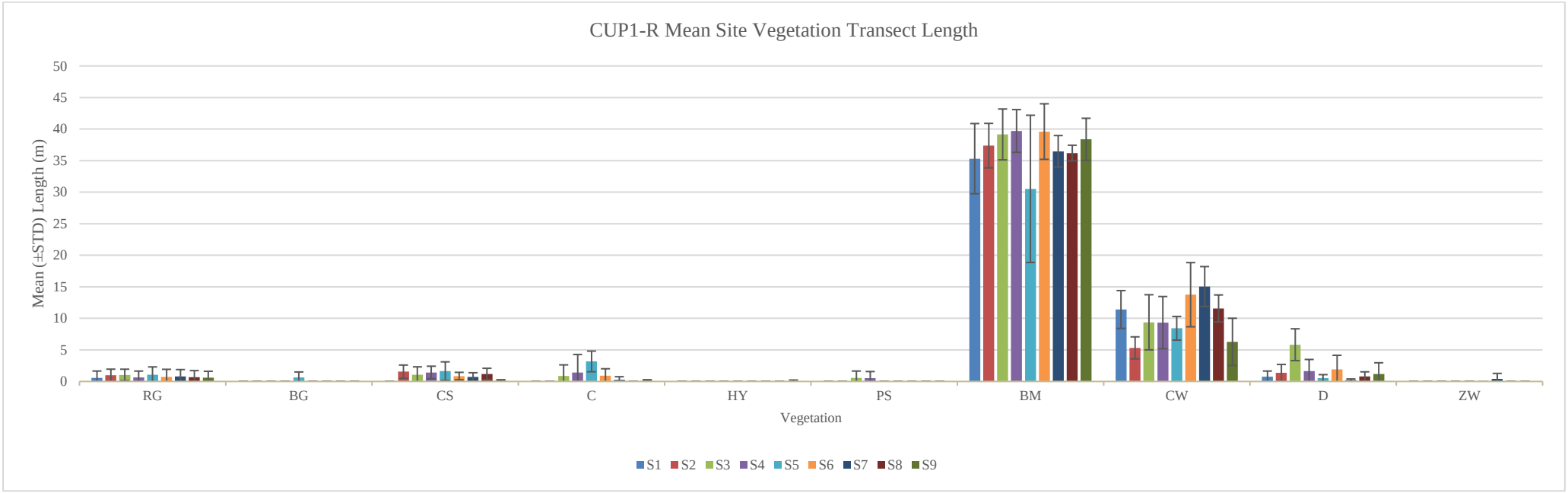

SWB2-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
25
20
15
10
5
0
RG
GH
CD
LC
BG
AV
OP
AL
CS
C
HD
HY
ALT
PS
BR
EW
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

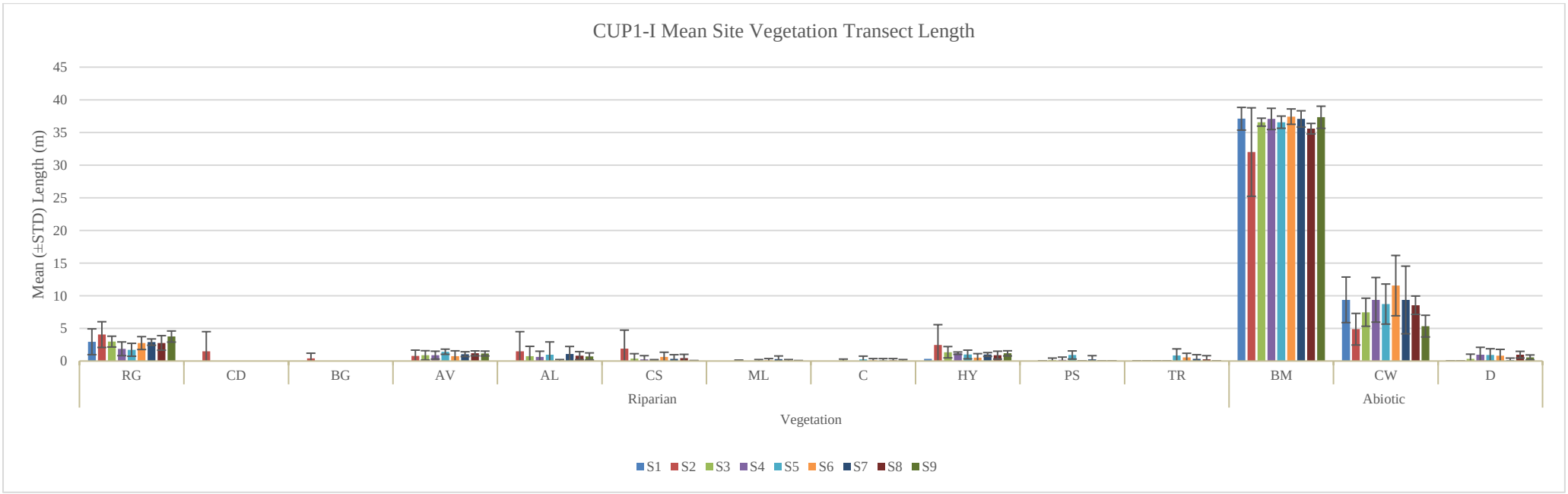

SEB1-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
25
20
15
10
5
0
CD
LC
AF
CI
NS
BG
C
PS
R
BM
CW
D
ZW
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

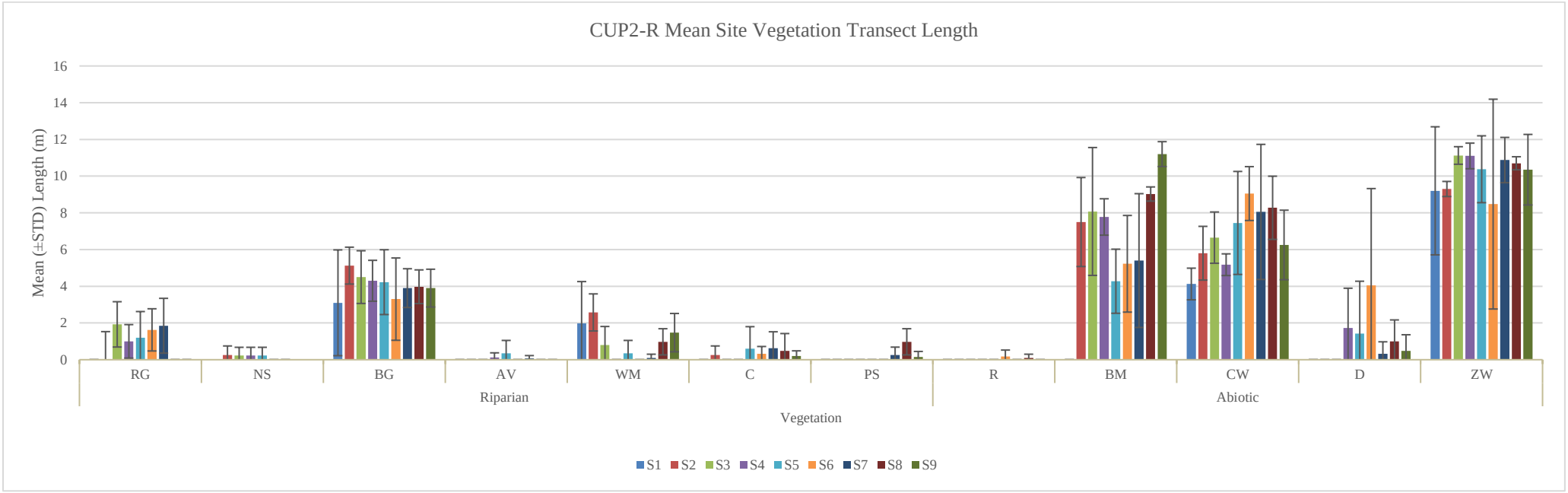

SEB1-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
35
30
25
20
15
10
5
0
RG
CD
AF
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

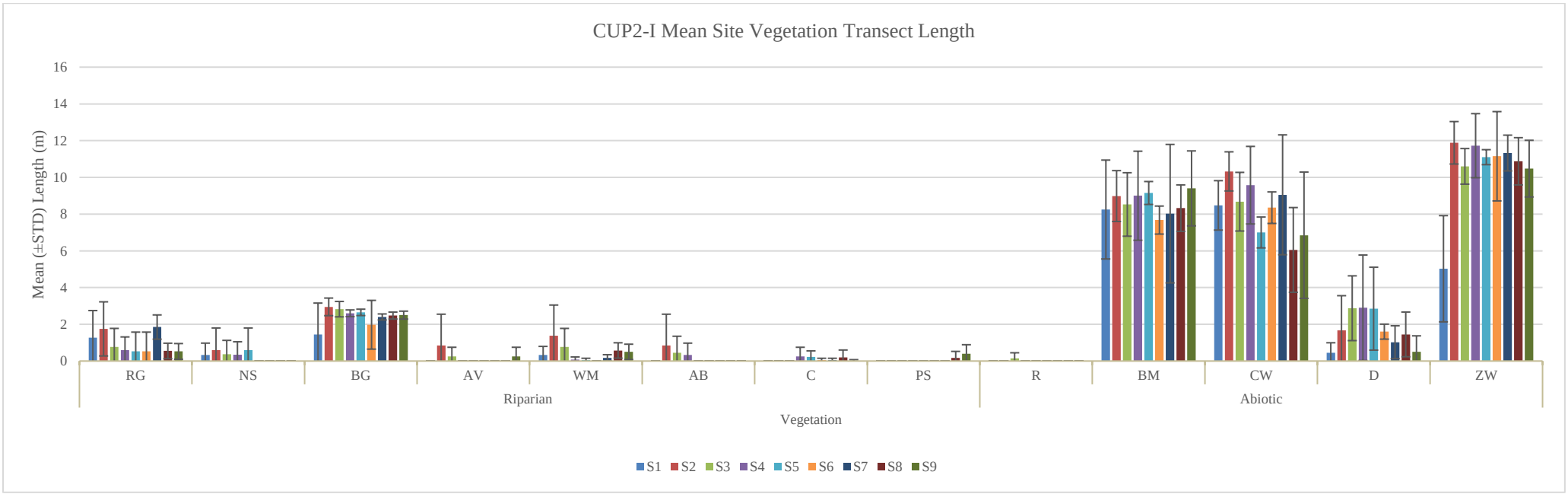

SEB2-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
18
16
14
12
10
8
6
4
2
0
CD
AF
C
PS
R
BM
CW
D
Riparain
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

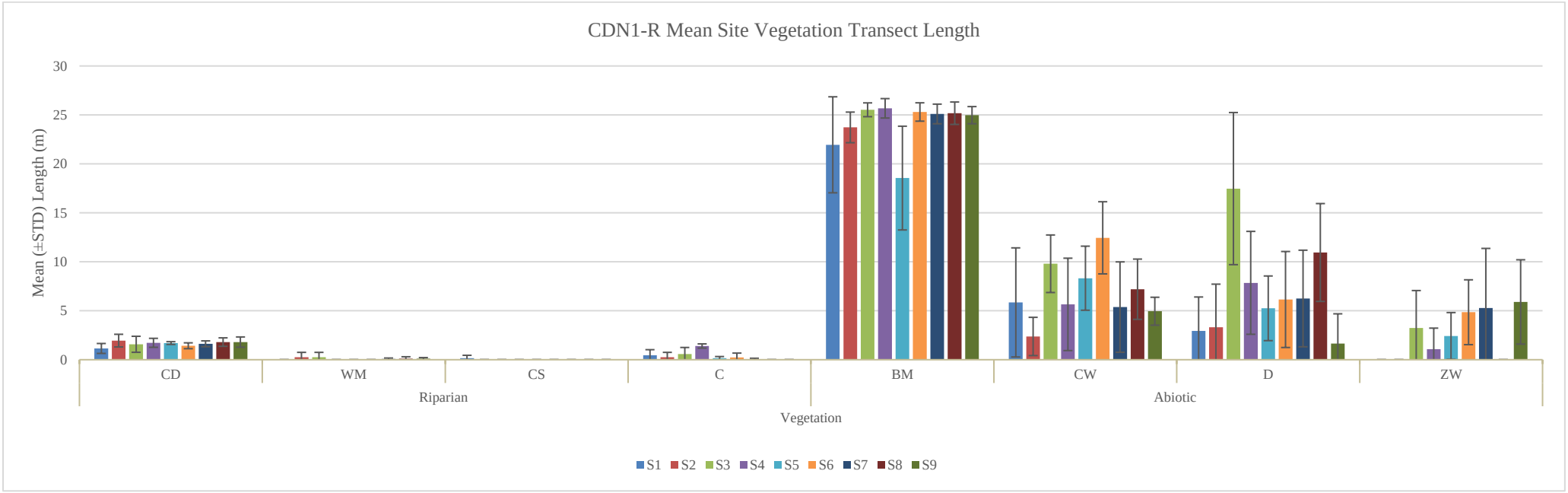

SEB2-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
40
35
30
25
20
15
10
5
0
CD
AF
CS
C
PS
R
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

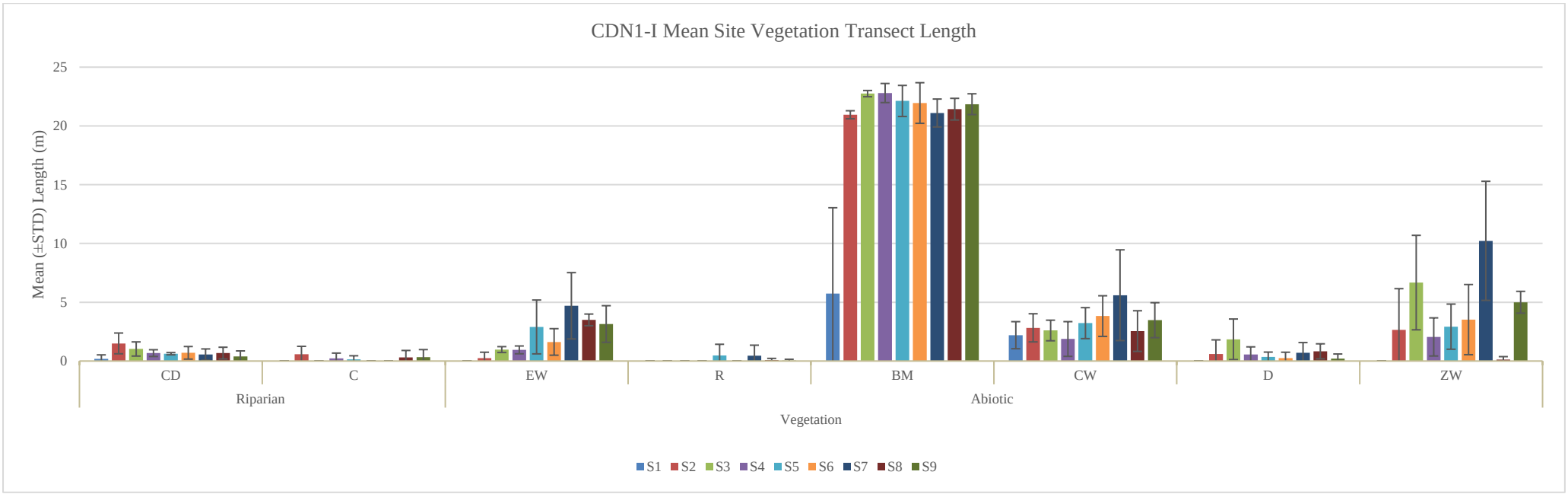

CUP1-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
50
45
40
35
30
25
20
15
10
5
0
RG
BG
CS
C
HY
PS
BM
CW
D
ZW
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

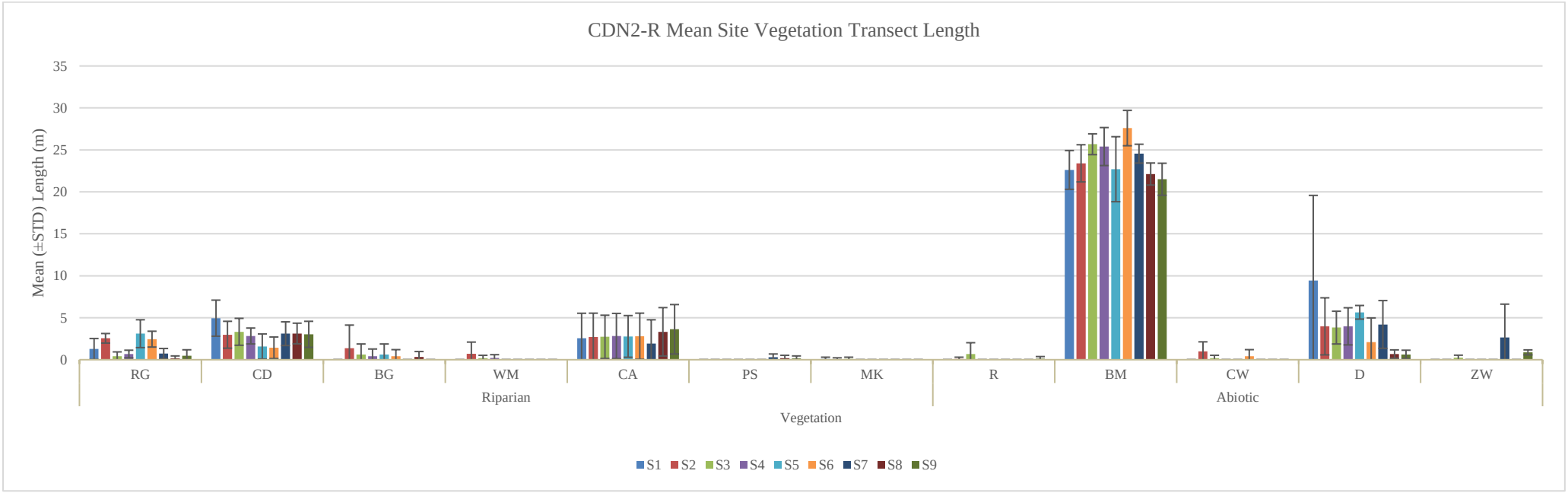

CUP1-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
45
40
35
30
25
20
15
10
5
0
RG
CD
BG
AV
AL
CS
ML
C
HY
PS
TR
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

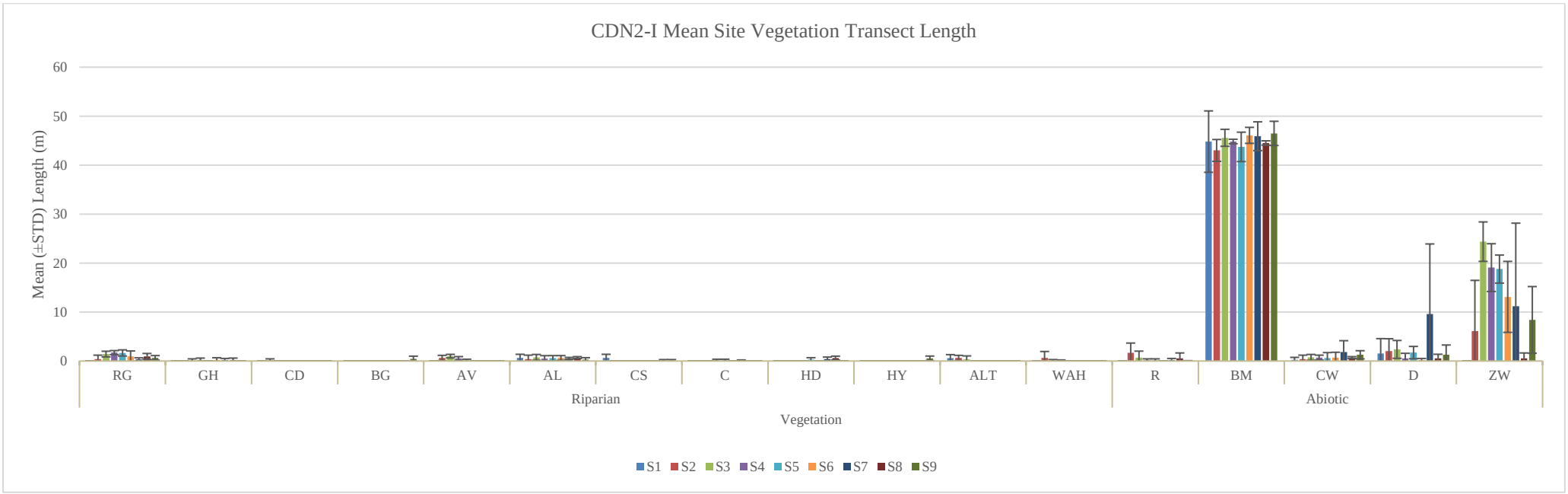

CUP2-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
16
14
12
10
8
6
4
2
0
RG
NS
BG
AV
WM
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9


CUP2-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
16
14
12
10
8
6
4
2
0
RG
NS
BG
AV
WM
AB
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9


CDN1-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
30
25
20
15
10
5
0
CD
WM
CS
C
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

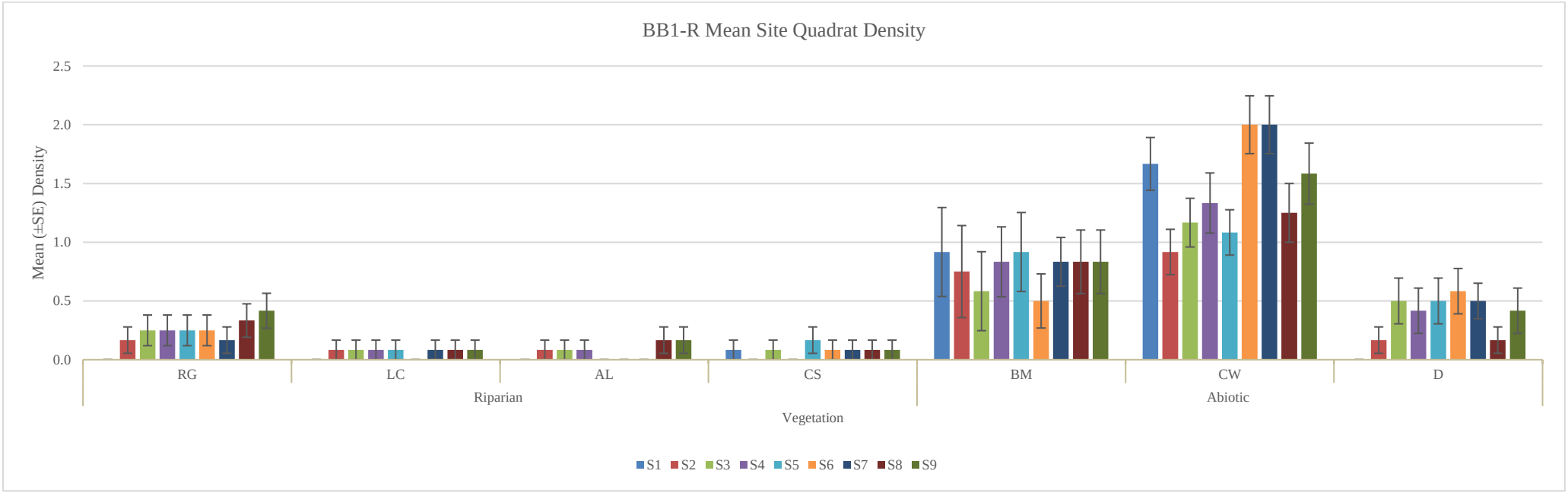

CDN1-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
25
20
15
10
5
0
CD
C
EW
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

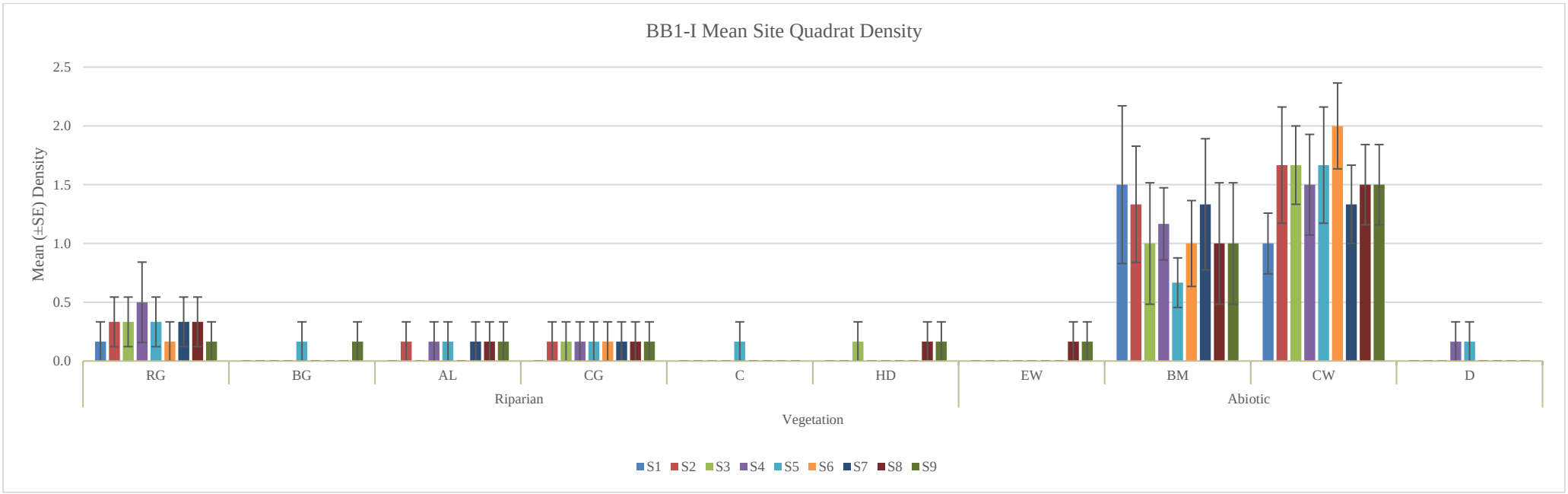

CDN2-R Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
35
30
25
20
15
10
5
0
RG
CD
BG
WM
CA
PS
MK
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

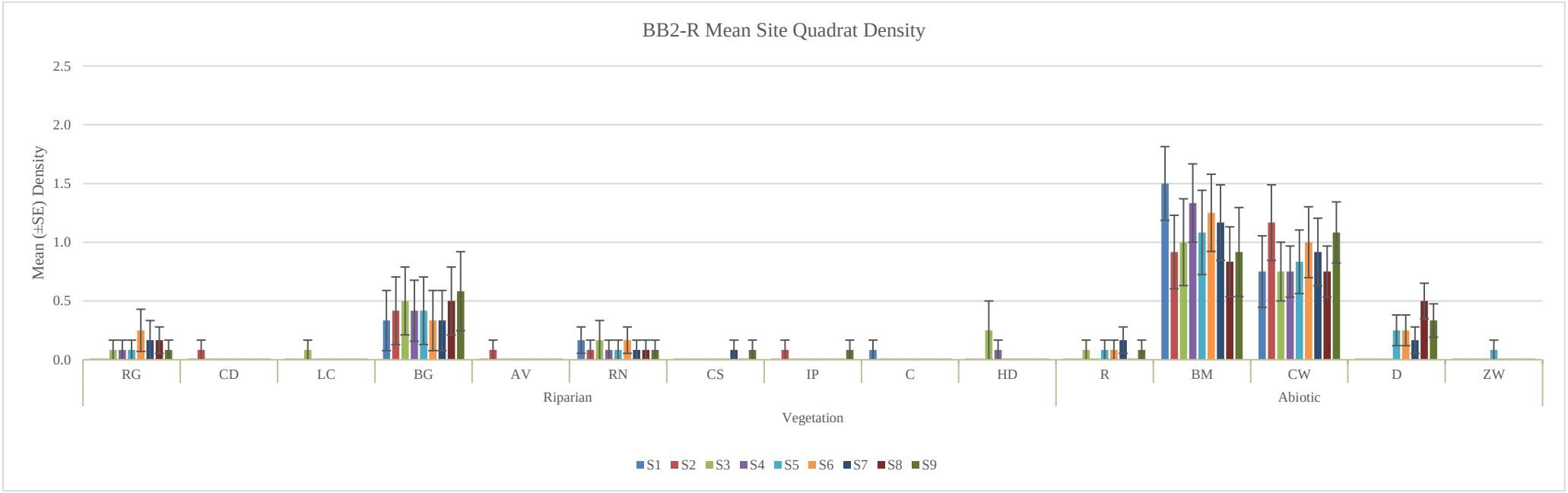

CDN2-I Mean Site Vegetation Transect Length
Mean (±STD) Length (m)
60
50
40
30
20
10
0
RG
GH
CD
BG
AV
AL
CS
C
HD
HY
ALT
WAH
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

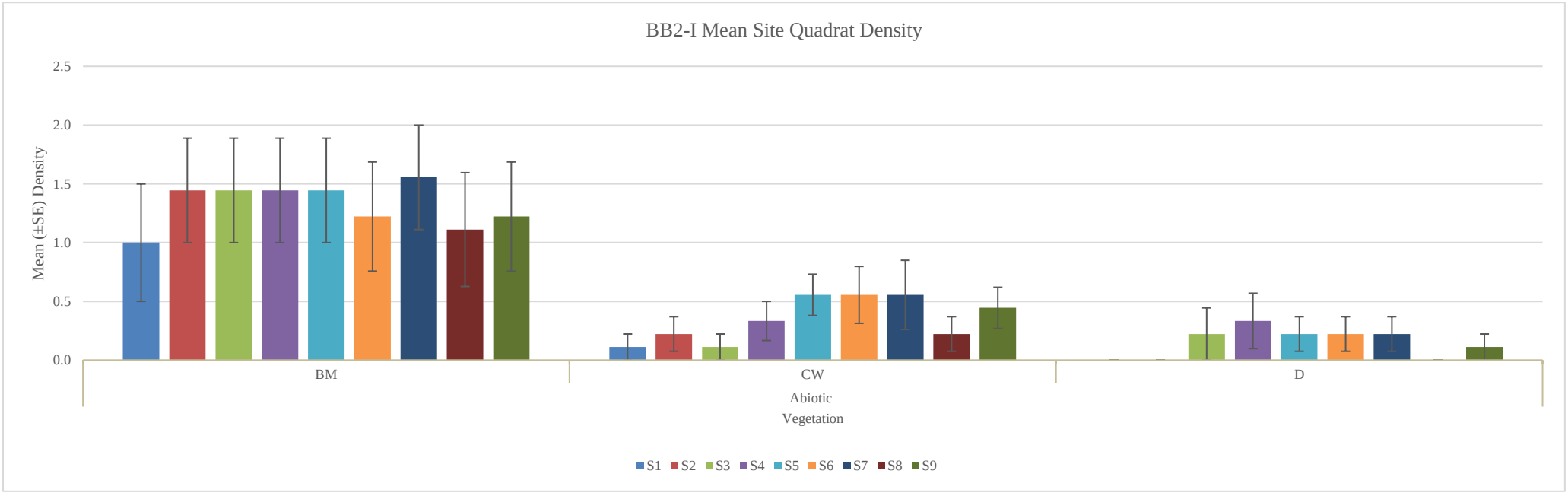
# APPENDIX C4

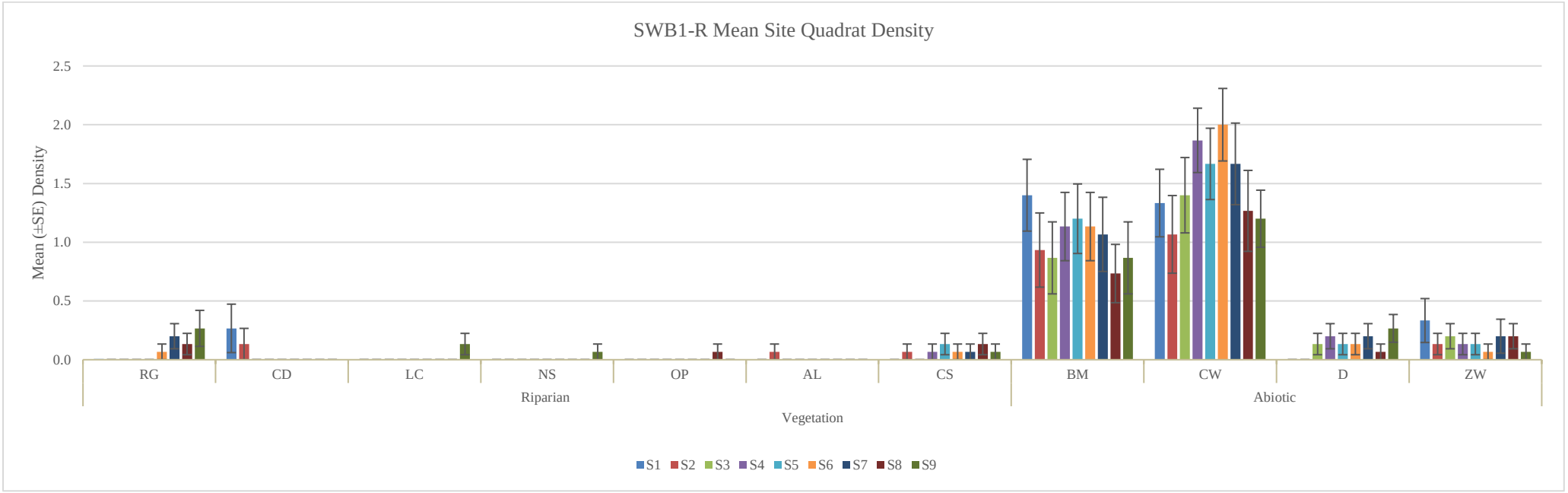
# BIMONTHLY
# INTERTIDAL QUADRAT DENSITIES AND COUNTS

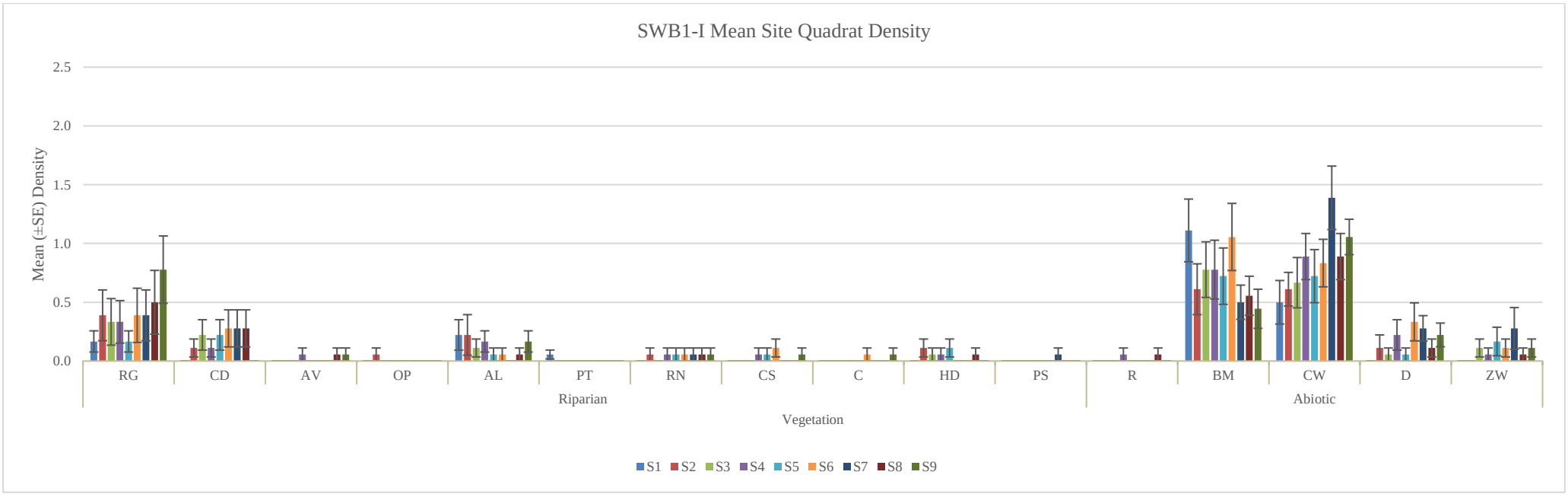

BB1-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
LC
AL
CS
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

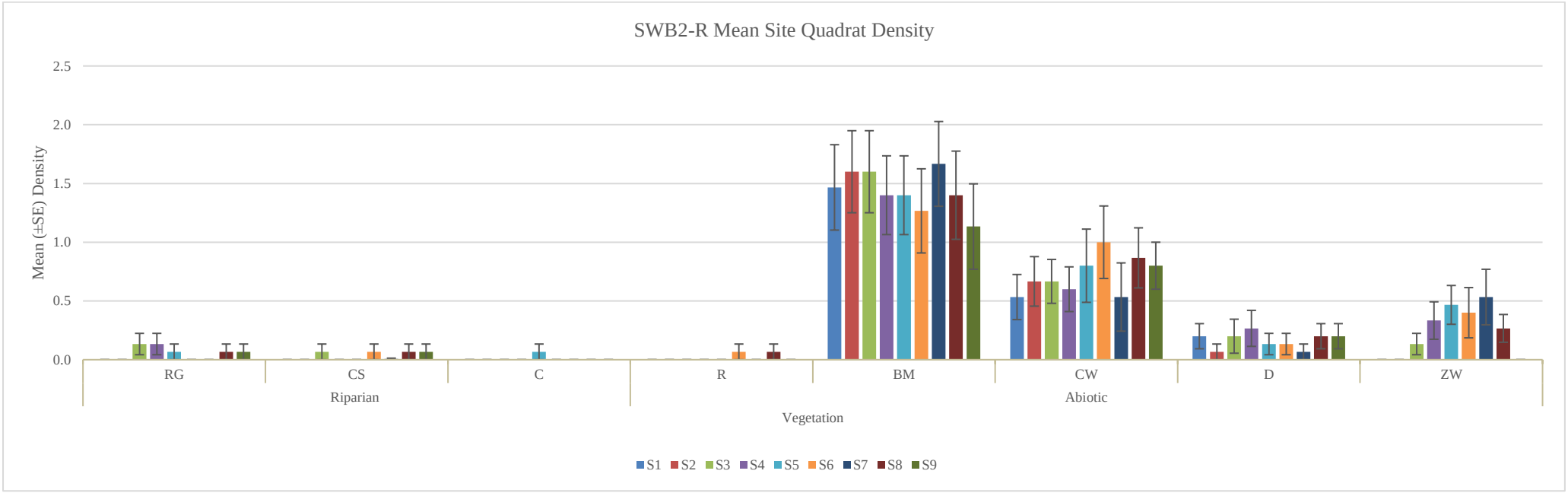

BB1-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
BG
AL
CG
C
HD
EW
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

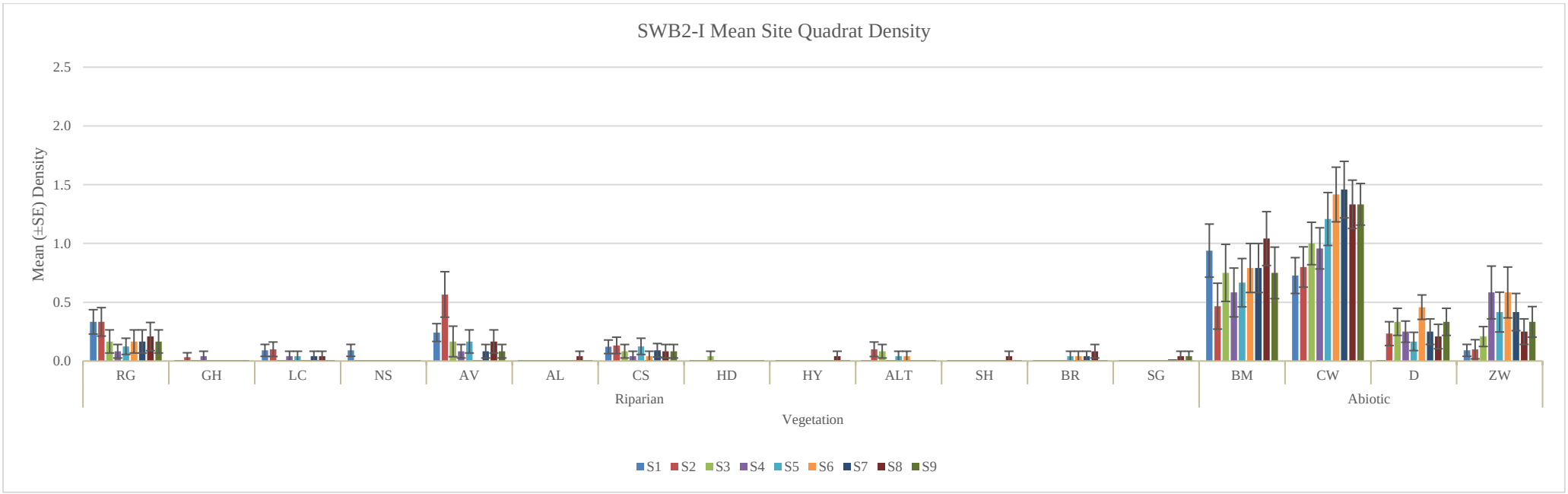

BB2-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
LC
BG
AV
RN
CS
IP
C
HD
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

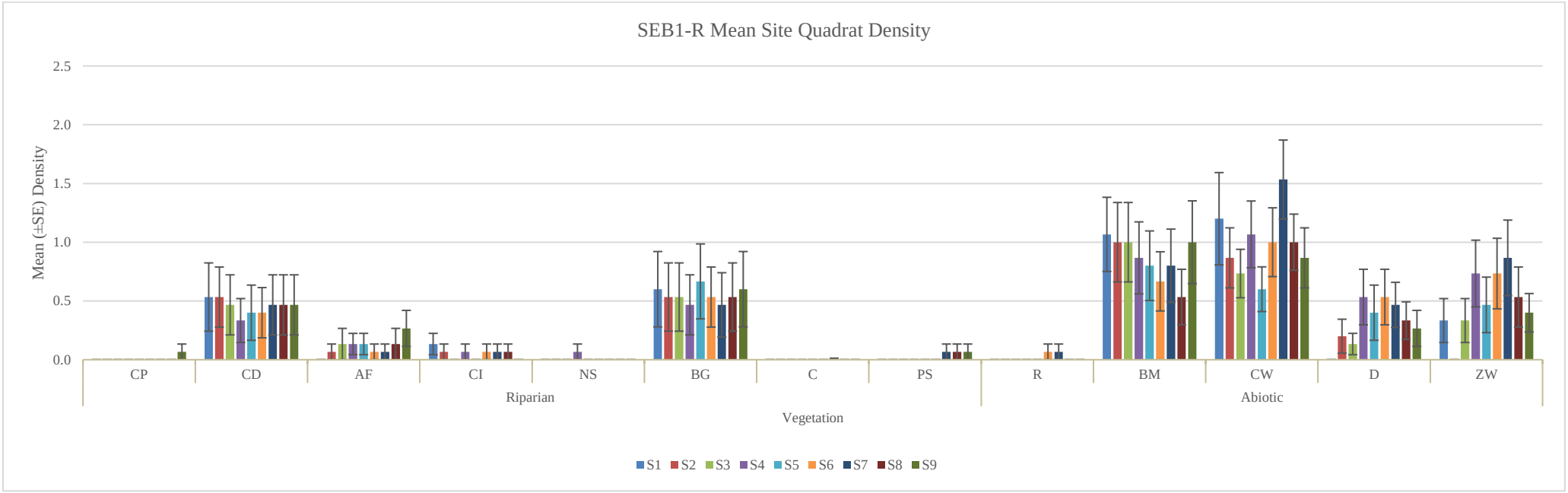

BB2-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
BM
CW
D
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

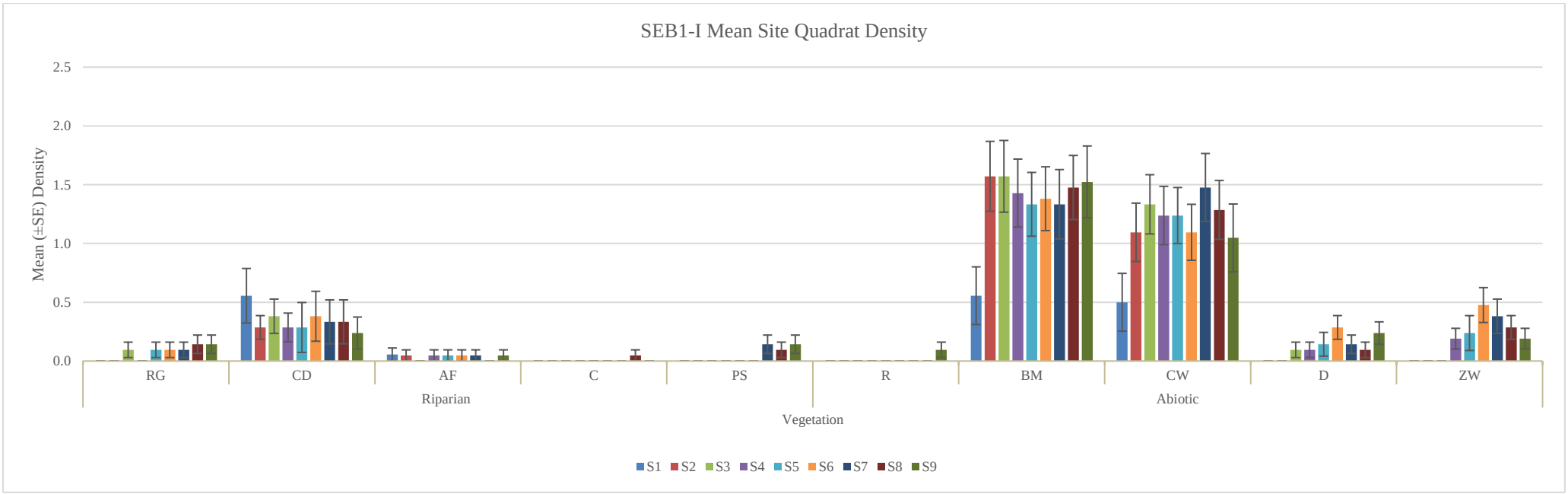

SWB1-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
LC
NS
OP
AL
CS
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

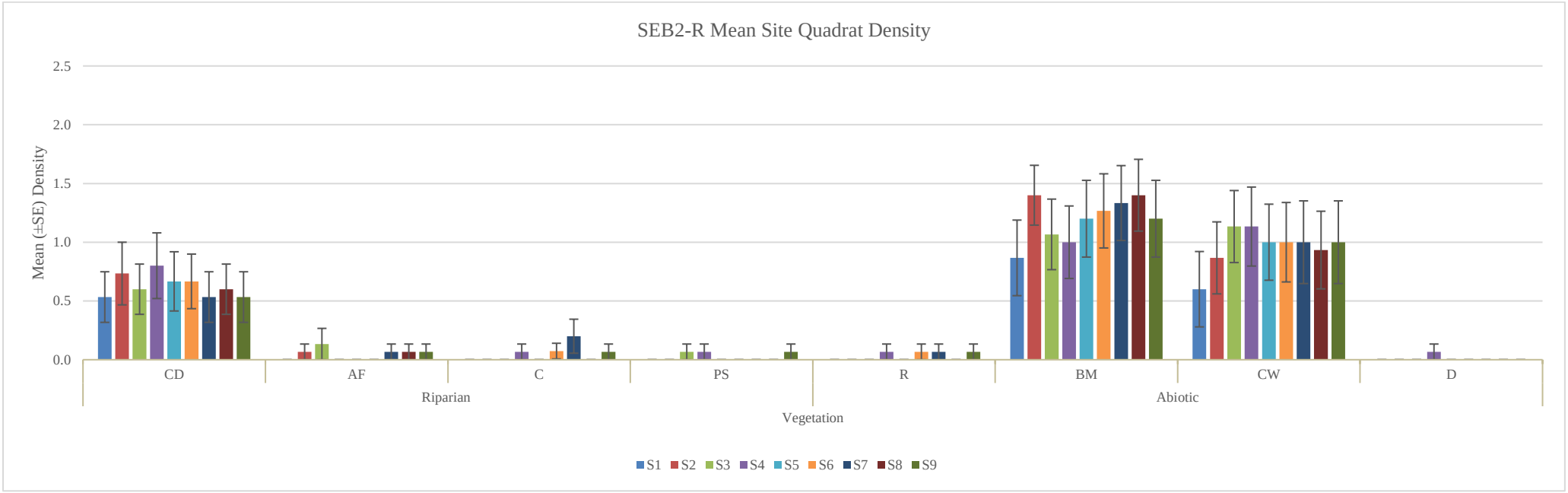

SWB1-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
AV
OP
AL
PT
RN
CS
C
HD
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

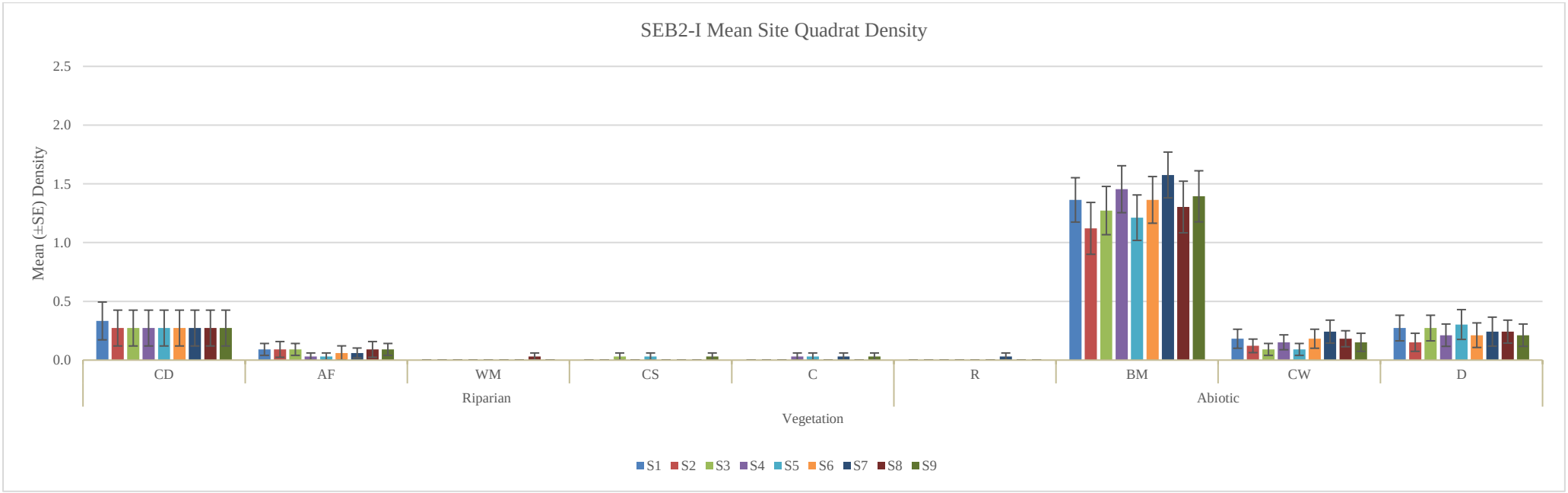

SWB2-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CS
C
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

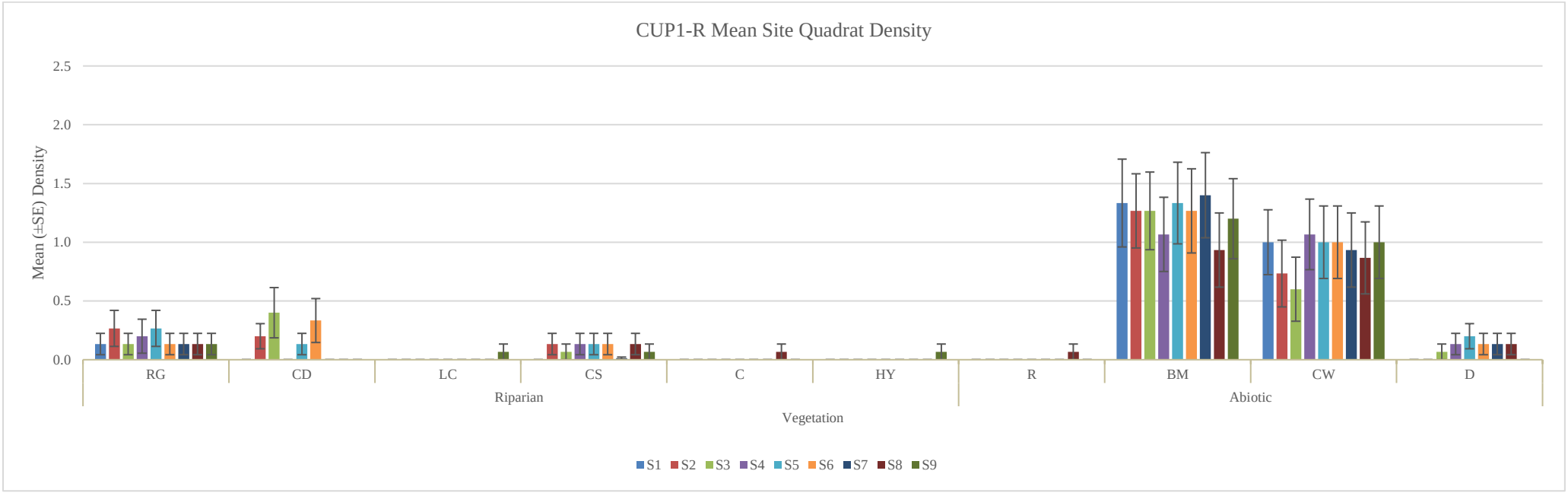

SWB2-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
GH
LC
NS
AV
AL
CS
HD
HY
ALT
SH
BR
SG
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

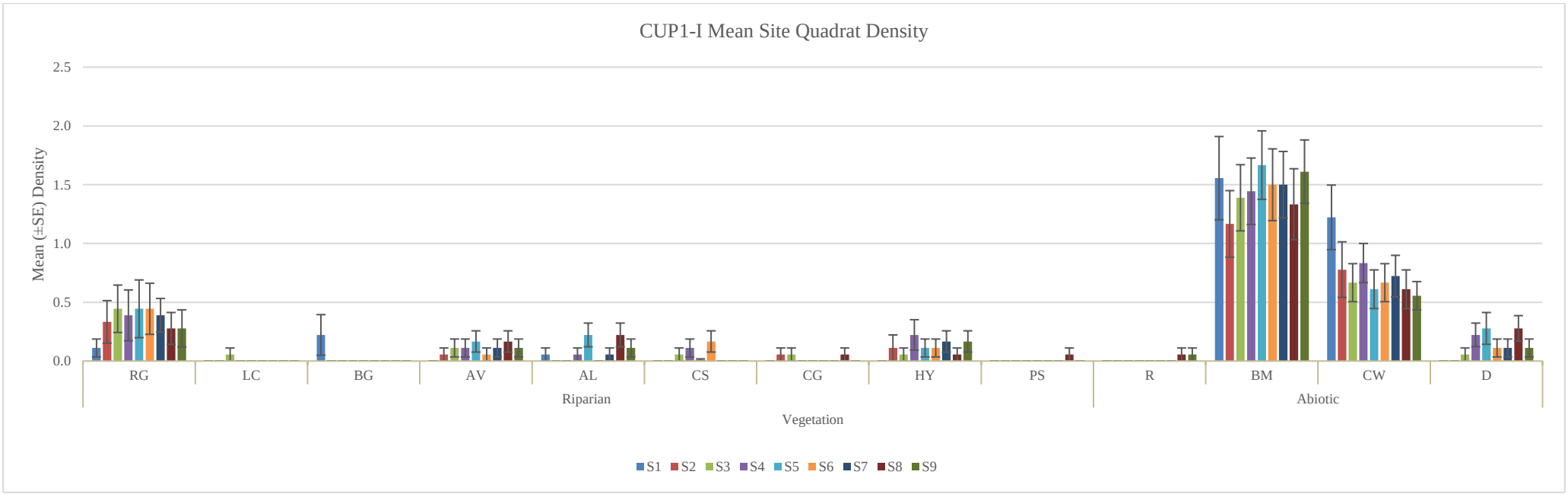

SEB1-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
CP
CD
AF
CI
NS
BG
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

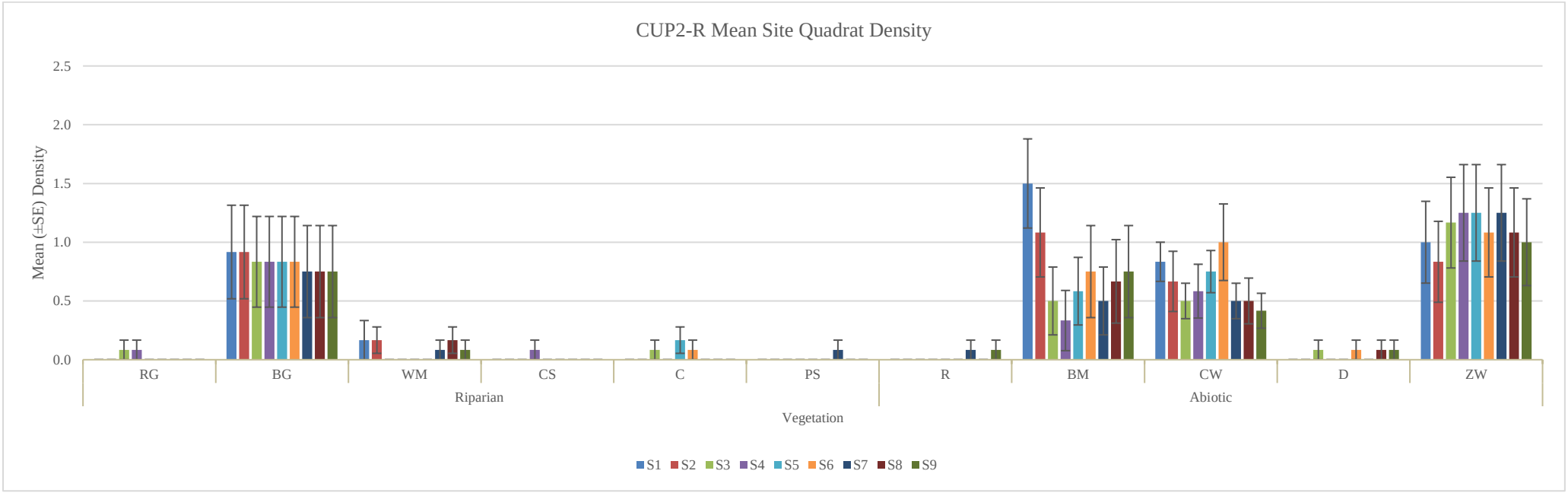

SEB1-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
AF
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

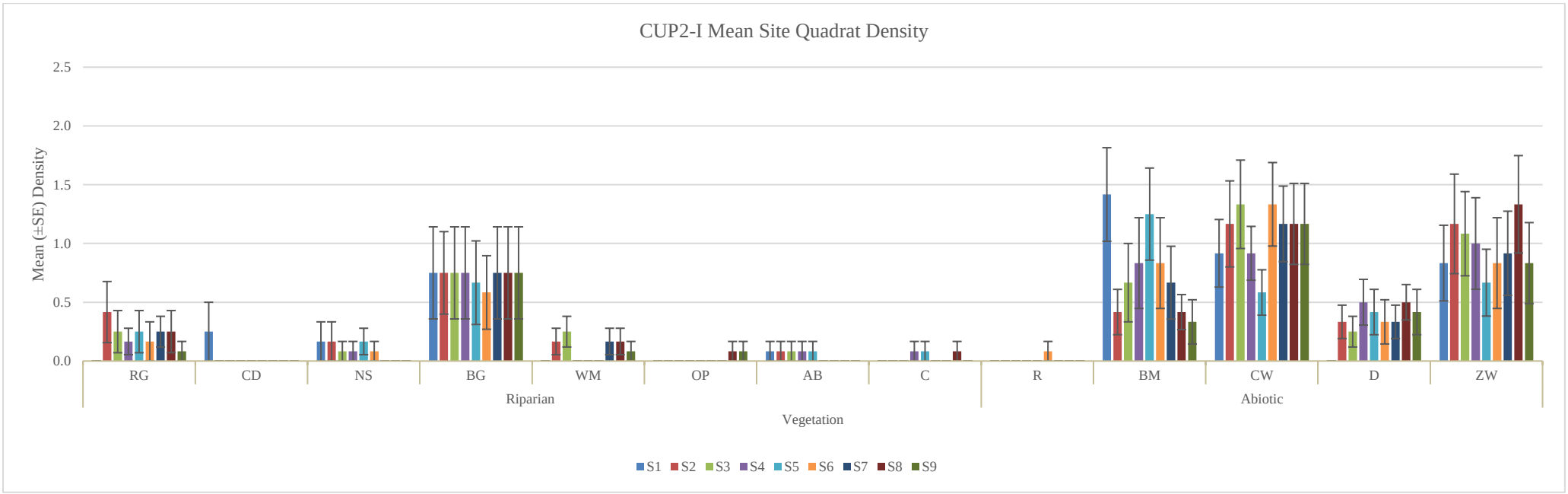

SEB2-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
CD
AF
C
PS
R
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

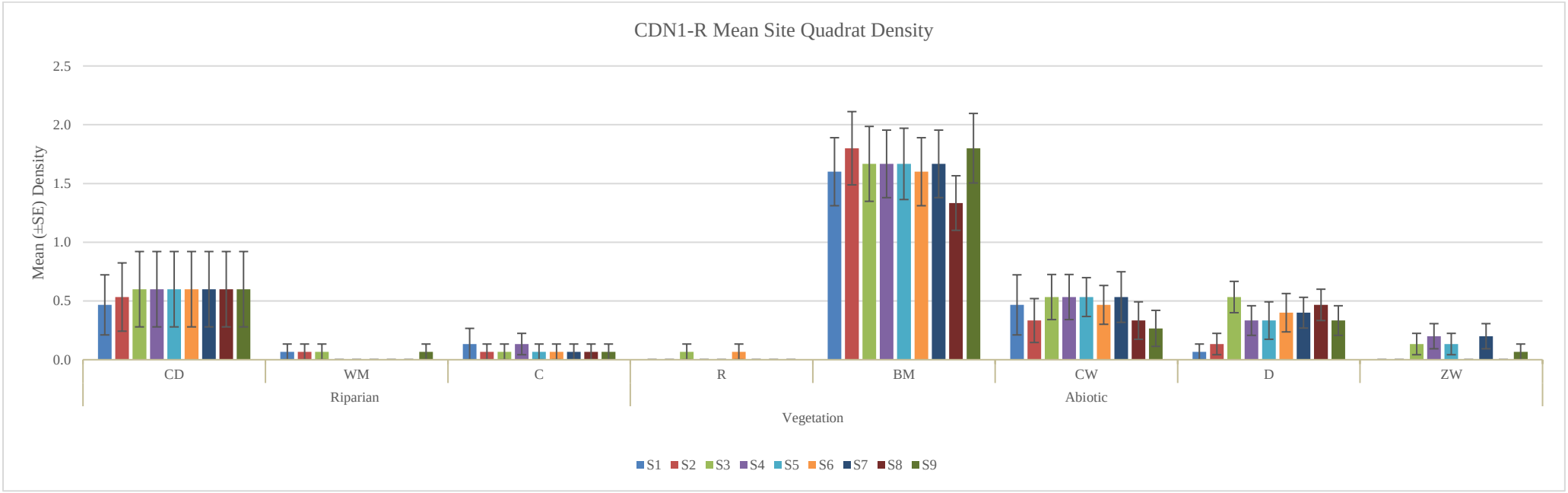

SEB2-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
CD
AF
WM
CS
C
R
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

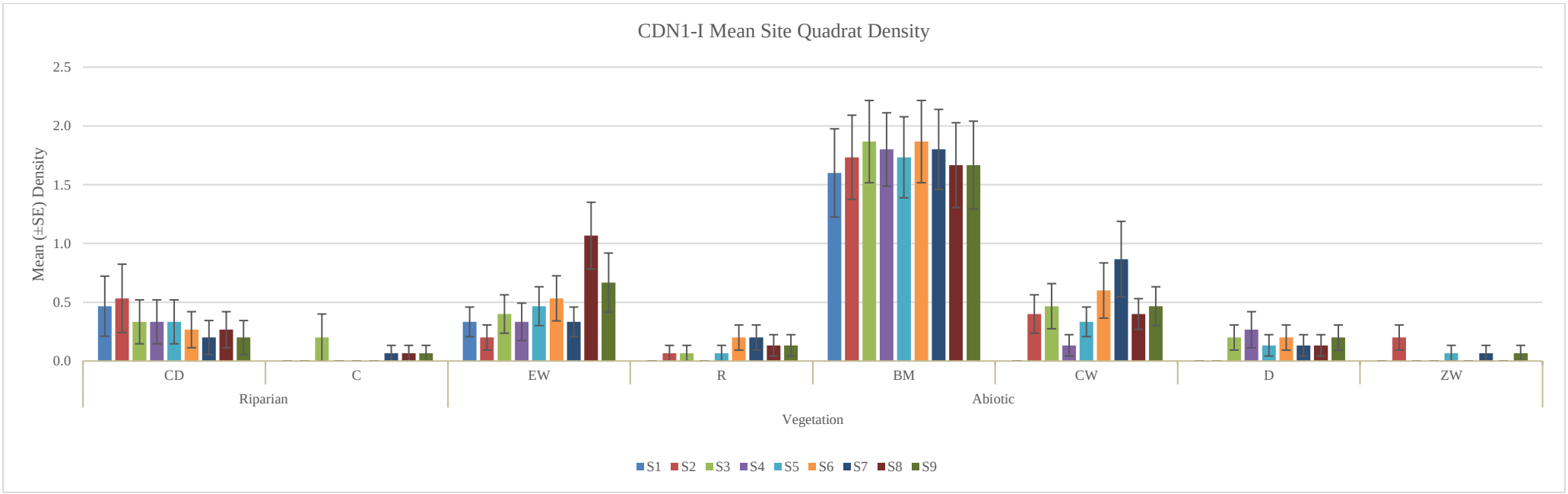

CUP1-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
LC
CS
C
HY
R
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

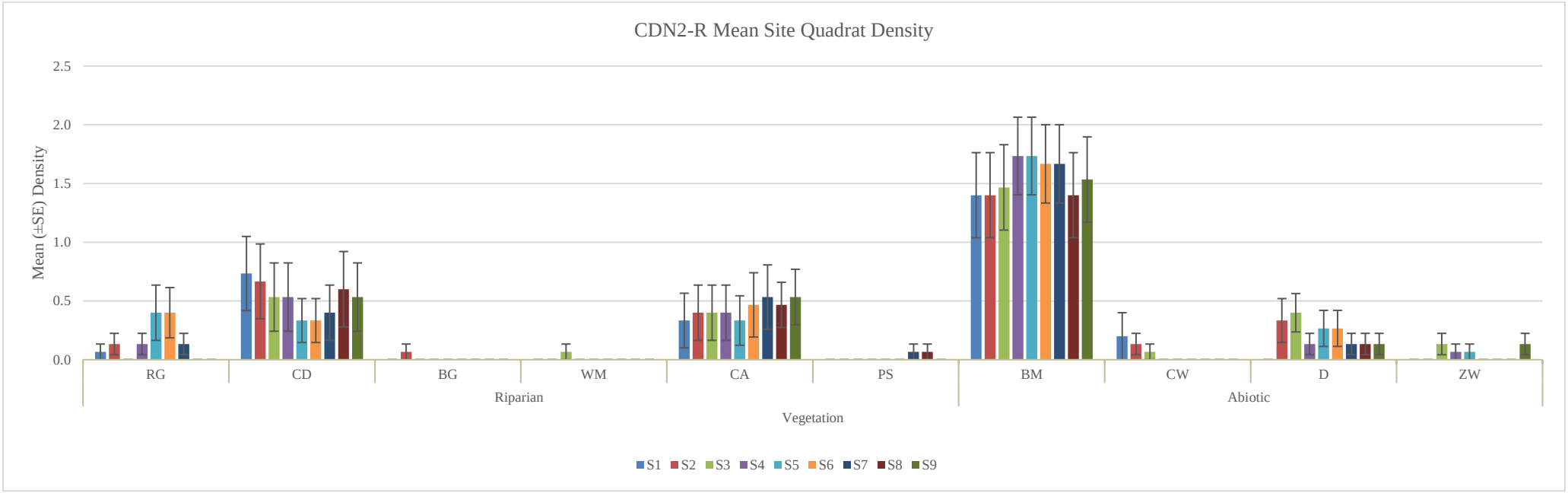

CUP1-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
LC
BG
AV
AL
CS
CG
HY
PS
R
BM
CW
D
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

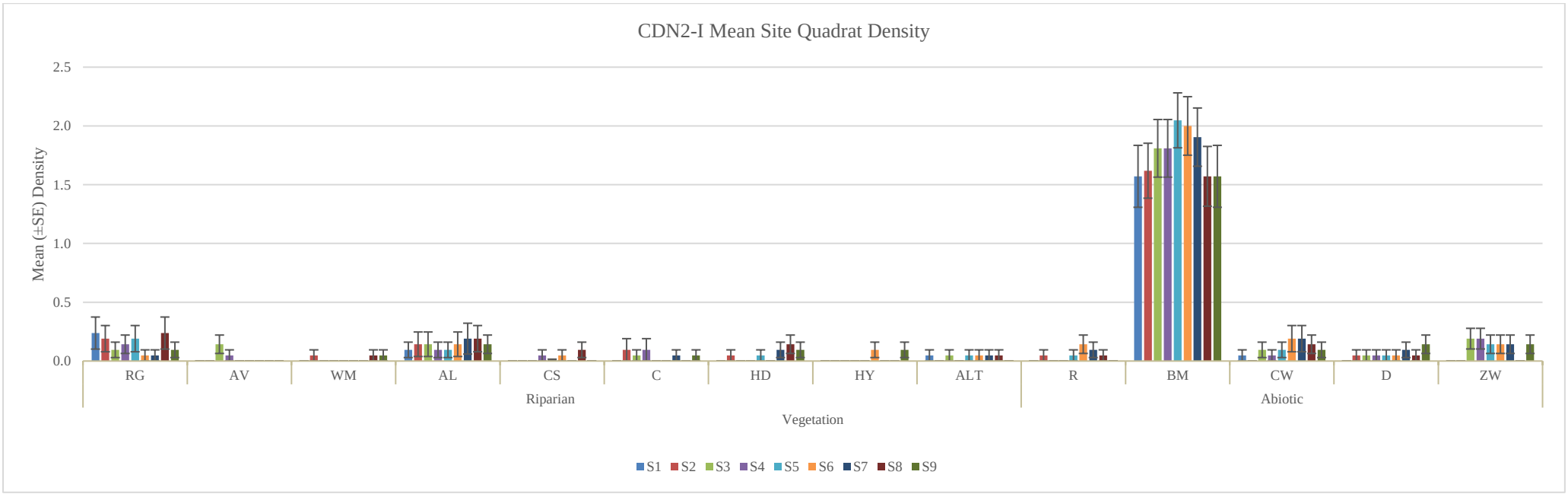

CUP2-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
BG
WM
CS
C
PS
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

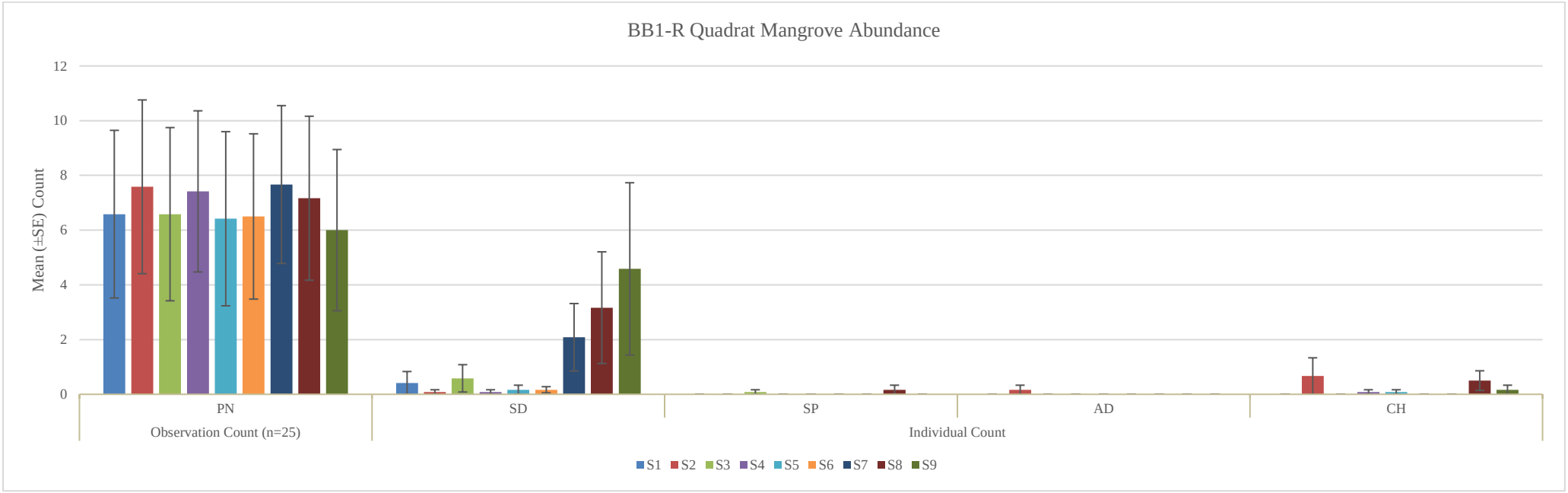

CUP2-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
NS
BG
WM
OP
AB
C
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

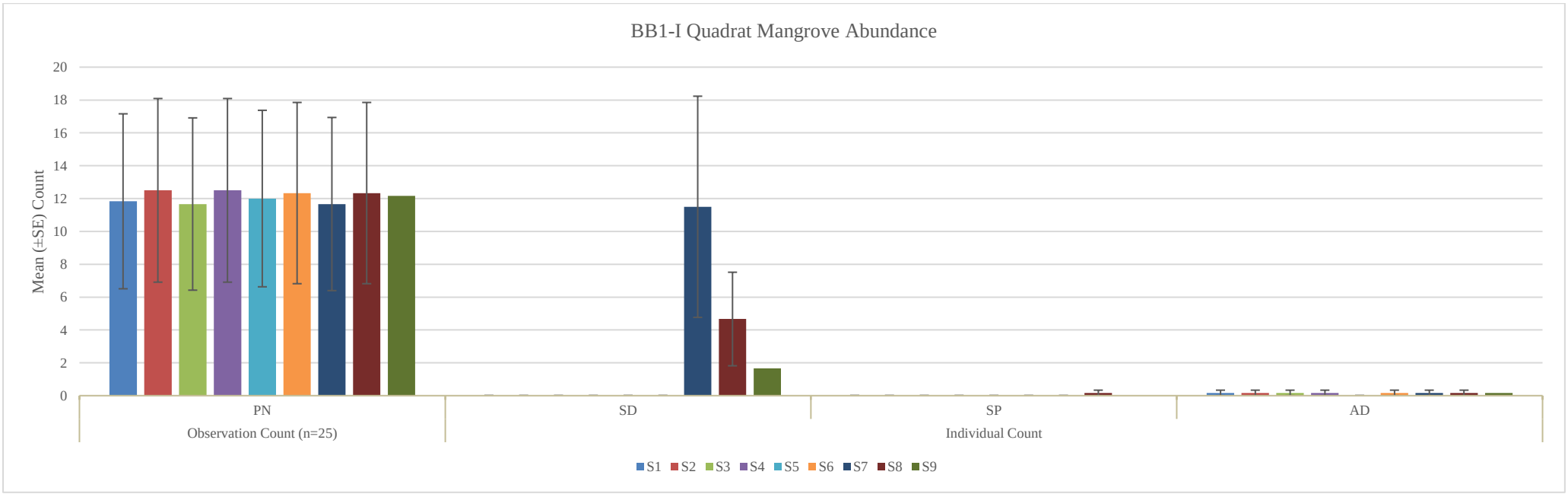

CDN1-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
CD
WM
C
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

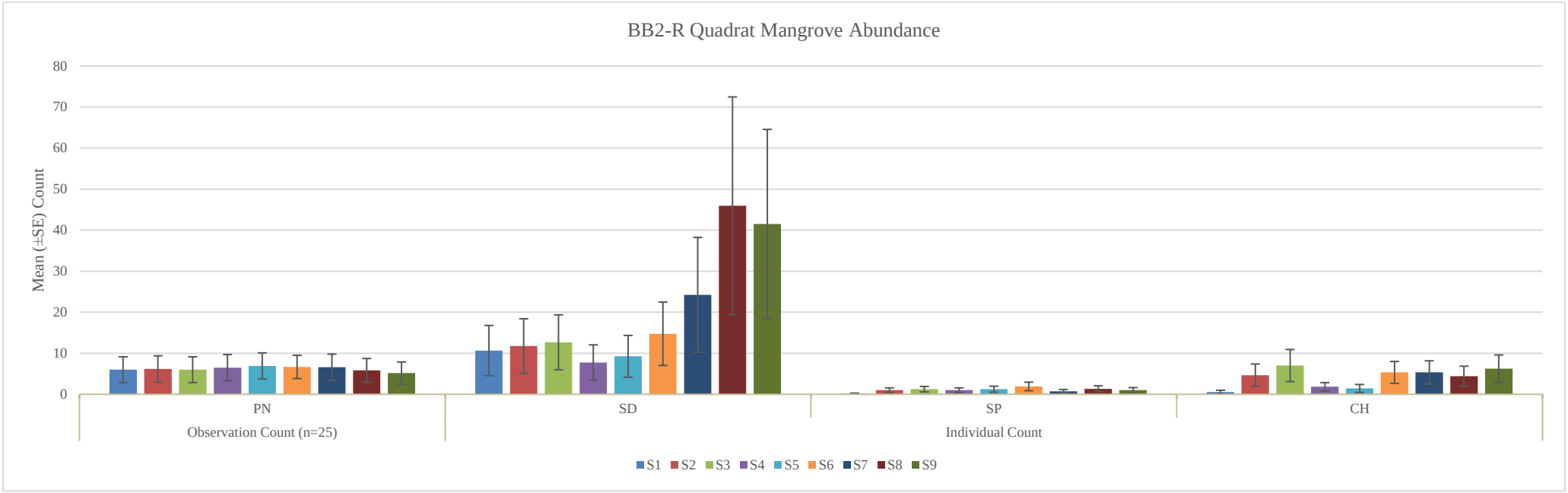

CDN1-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
CD
C
EW
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

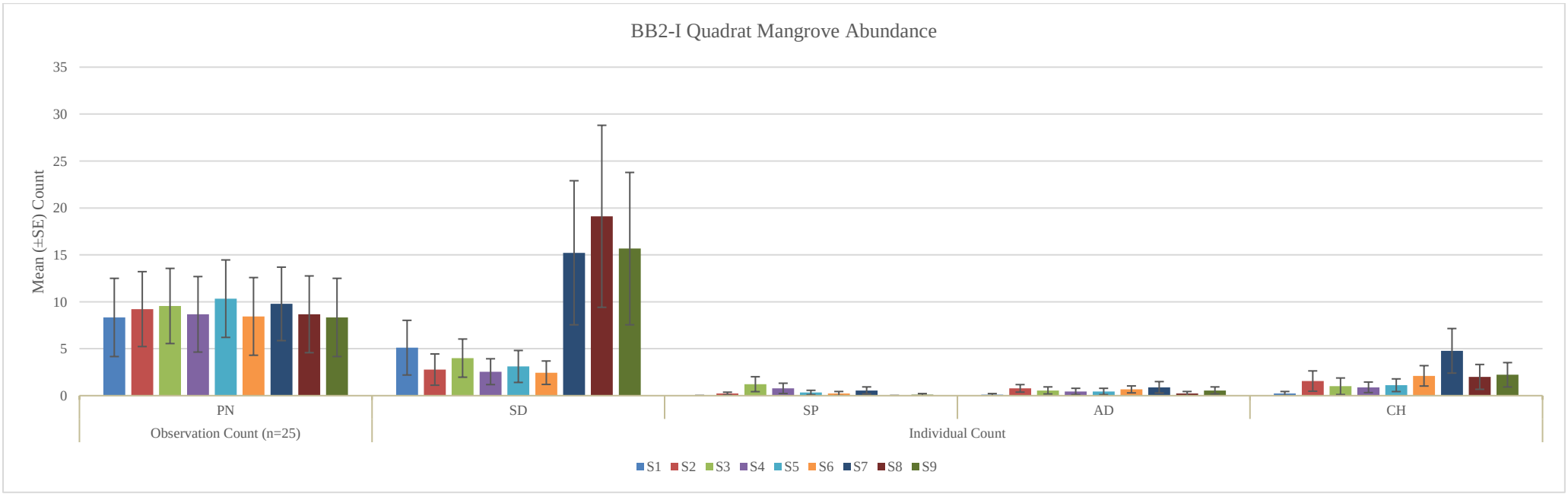

CDN2-R Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
CD
BG
WM
CA
PS
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

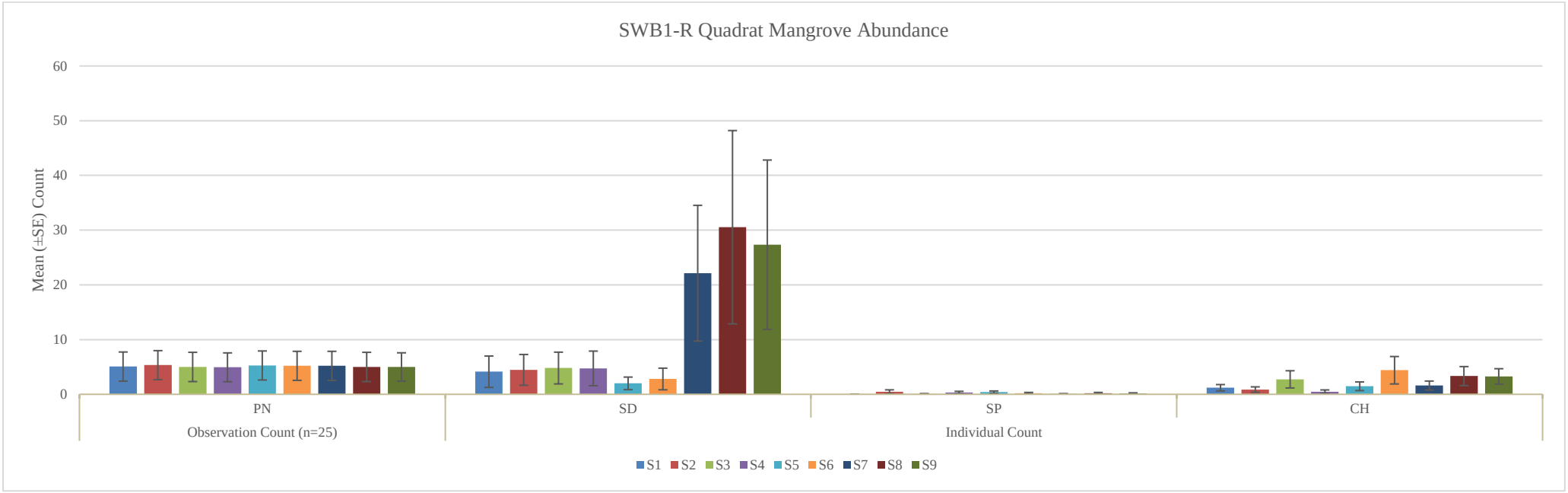

CDN2-I Mean Site Quadrat Density
Mean (±SE) Density
2.5
2.0
1.5
1.0
0.5
0.0
RG
AV
WM
AL
CS
C
HD
HY
ALT
R
BM
CW
D
ZW
Riparian
Abiotic
Vegetation
S1 S2 S3 S4 S5 S6 S7 S8 S9

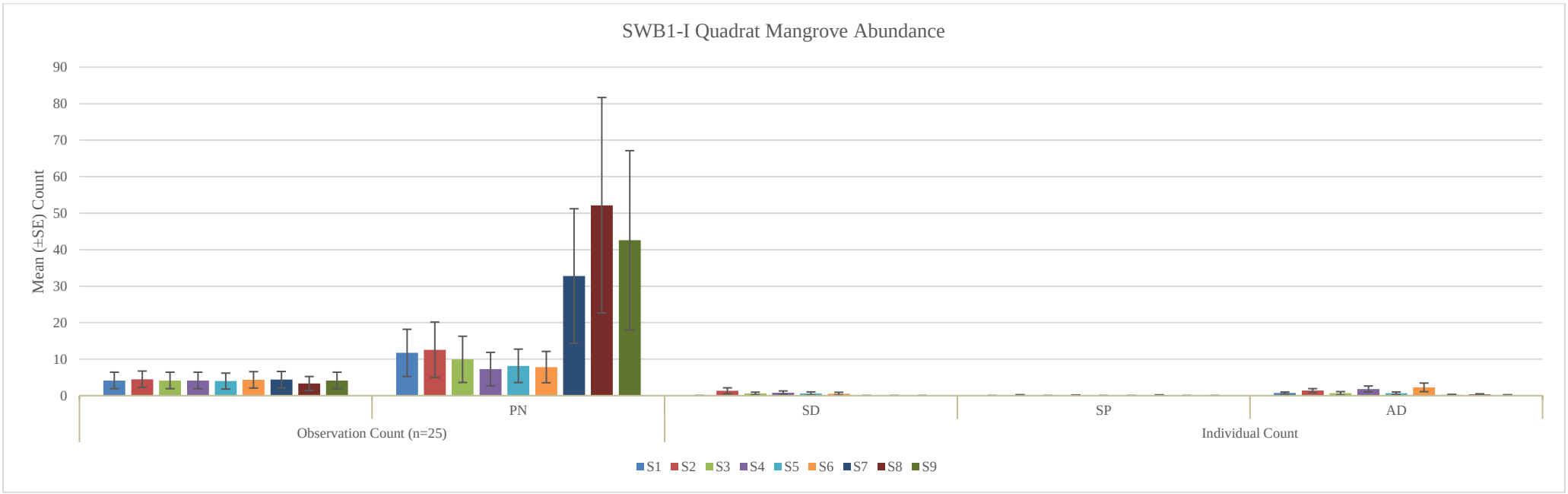

BB1-R Quadrat Mangrove Abundance
Mean (±SE) Count
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

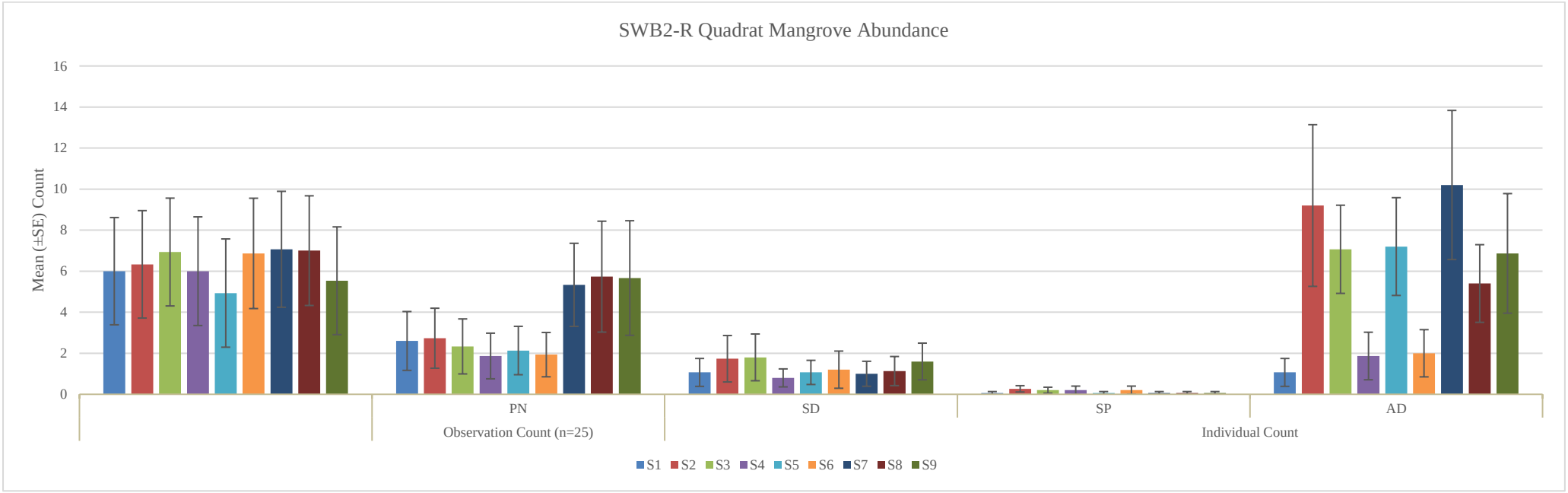

BB1-I Quadrat Mangrove Abundance
Mean (±SE) Count
20
18
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

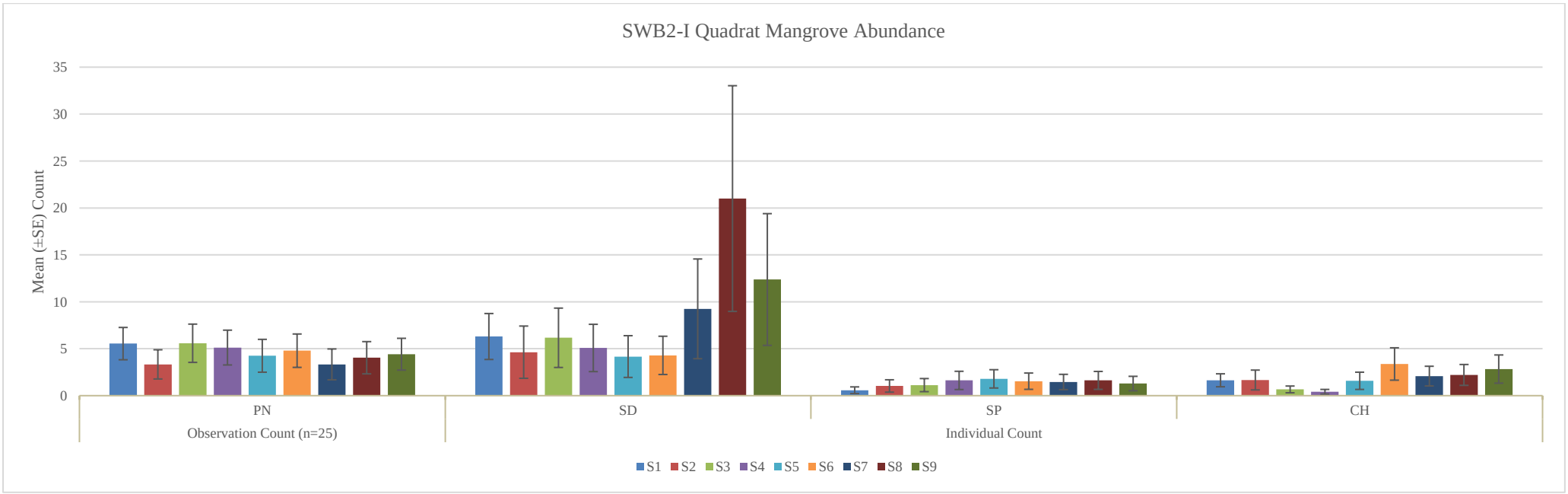

BB2-R Quadrat Mangrove Abundance
Mean (±SE) Count
80
70
60
50
40
30
20
10
0
PN
SD
SP
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

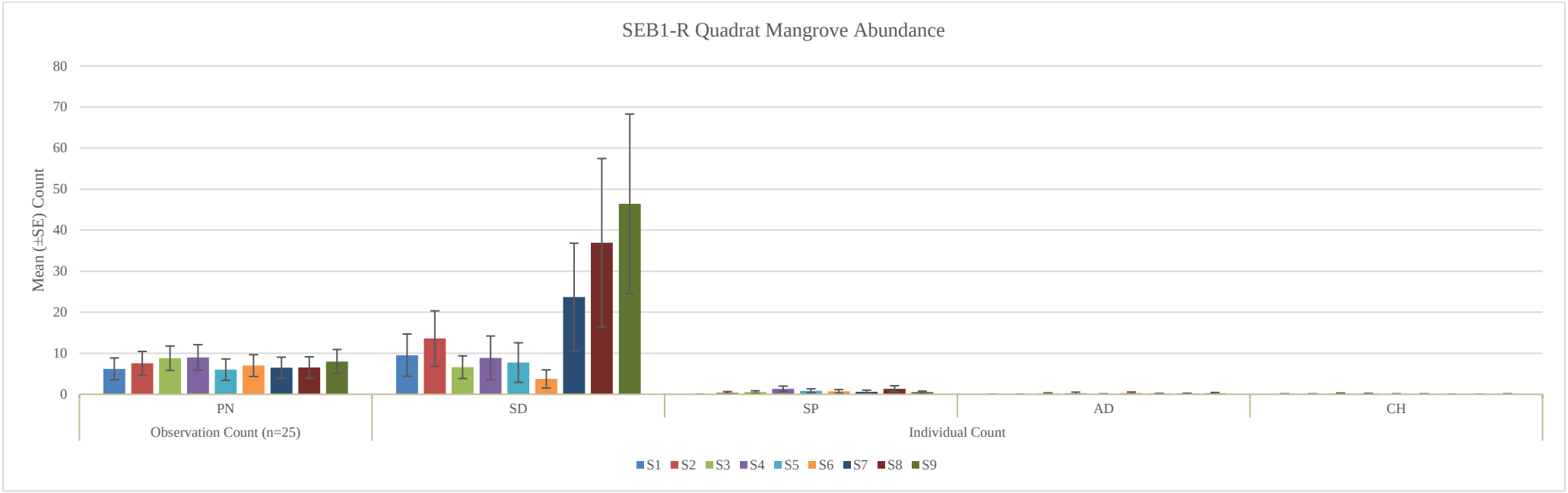

BB2-I Quadrat Mangrove Abundance
Mean (±SE) Count
35
30
25
20
15
10
5
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

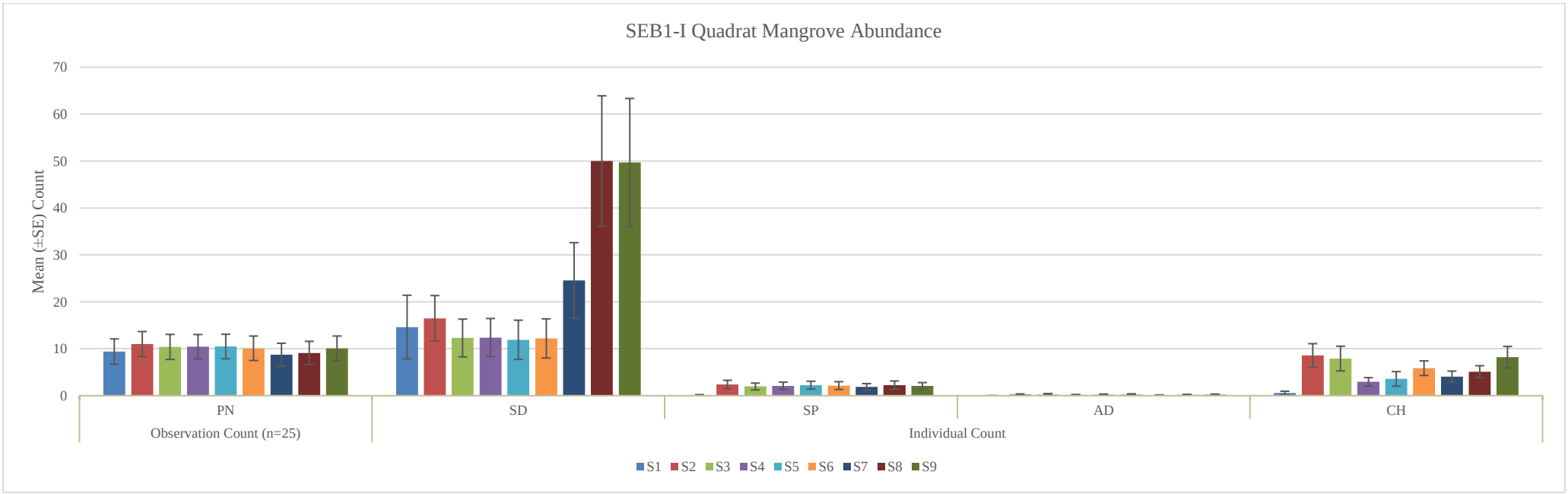

SWB1-R Quadrat Mangrove Abundance
Mean (±SE) Count
60
50
40
30
20
10
0
PN
SD
SP
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

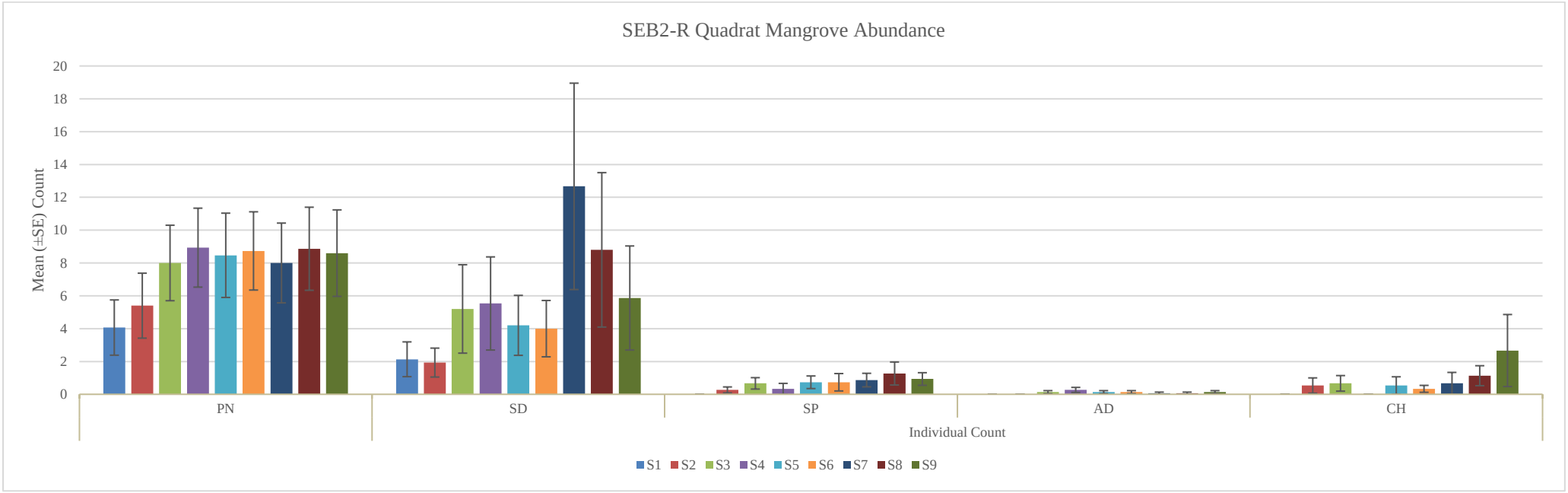

SWB1-I Quadrat Mangrove Abundance
Mean (±SE) Count
90
80
70
60
50
40
30
20
10
0
PN
SD
SP
AD
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

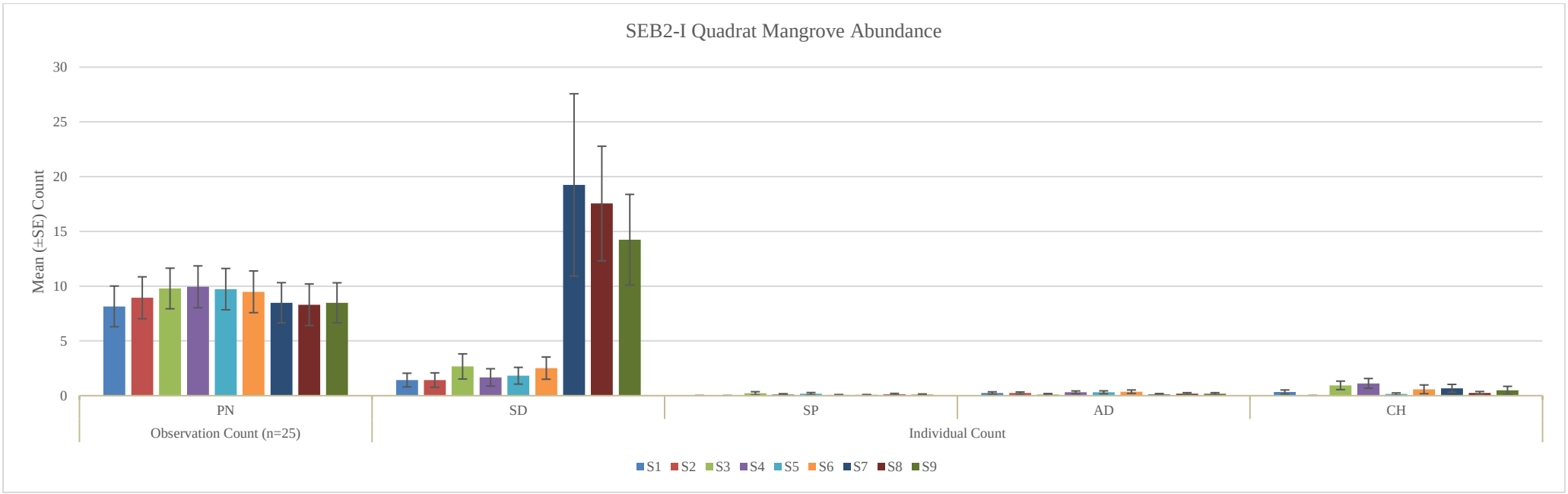

SWB2-R Quadrat Mangrove Abundance
Mean (±SE) Count
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

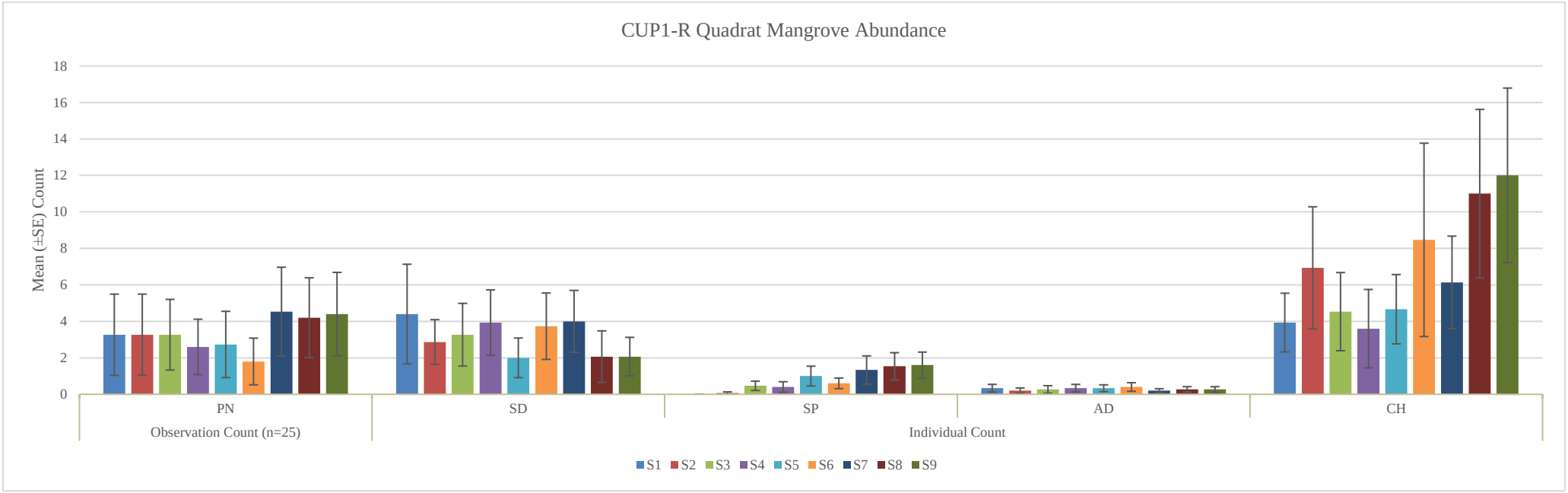

SWB2-I Quadrat Mangrove Abundance
Mean (±SE) Count
35
30
25
20
15
10
5
0
PN
SD
SP
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

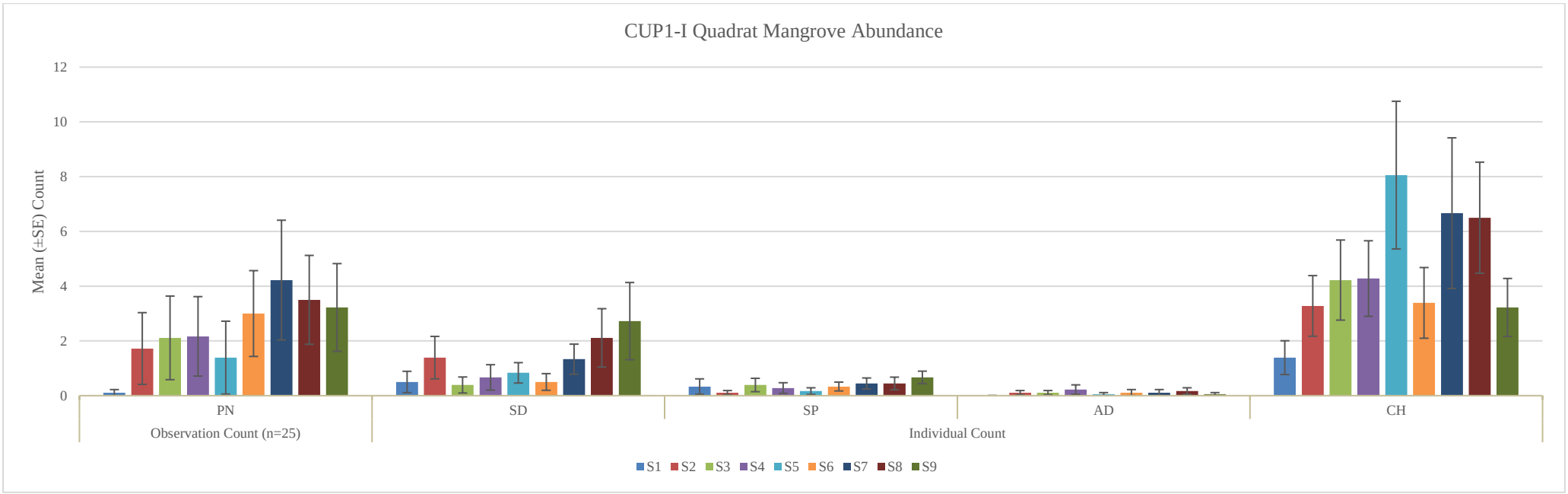

SEB1-R Quadrat Mangrove Abundance
Mean (±SE) Count
80
70
60
50
40
30
20
10
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

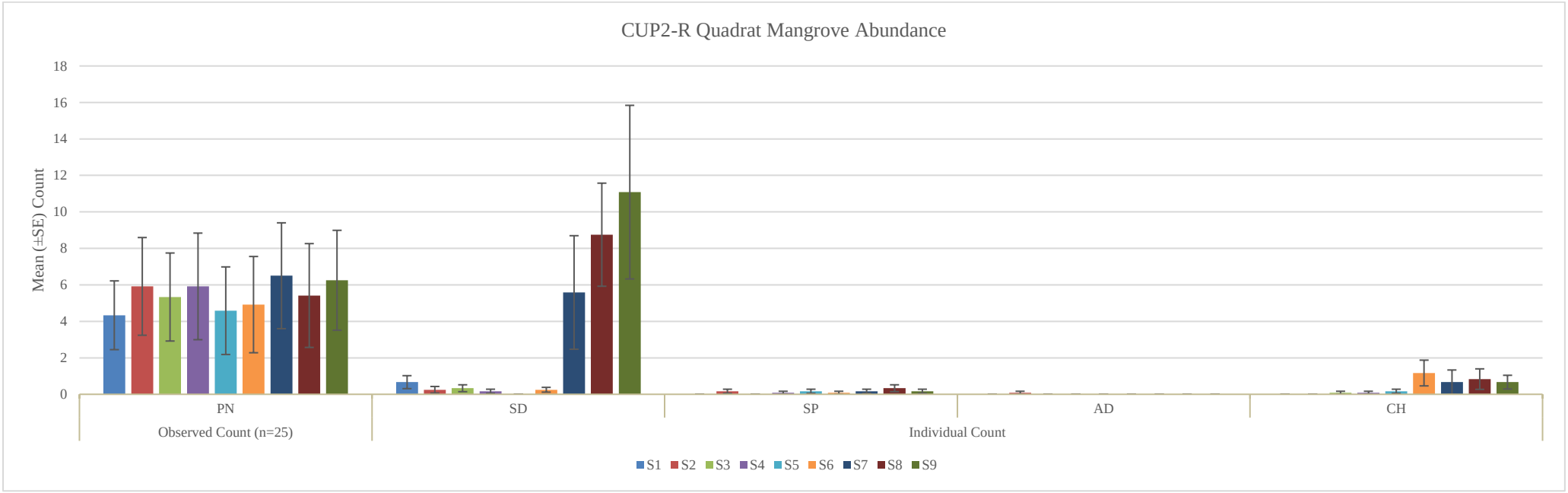

SEB1-I Quadrat Mangrove Abundance
Mean (±SE) Count
70
60
50
40
30
20
10
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

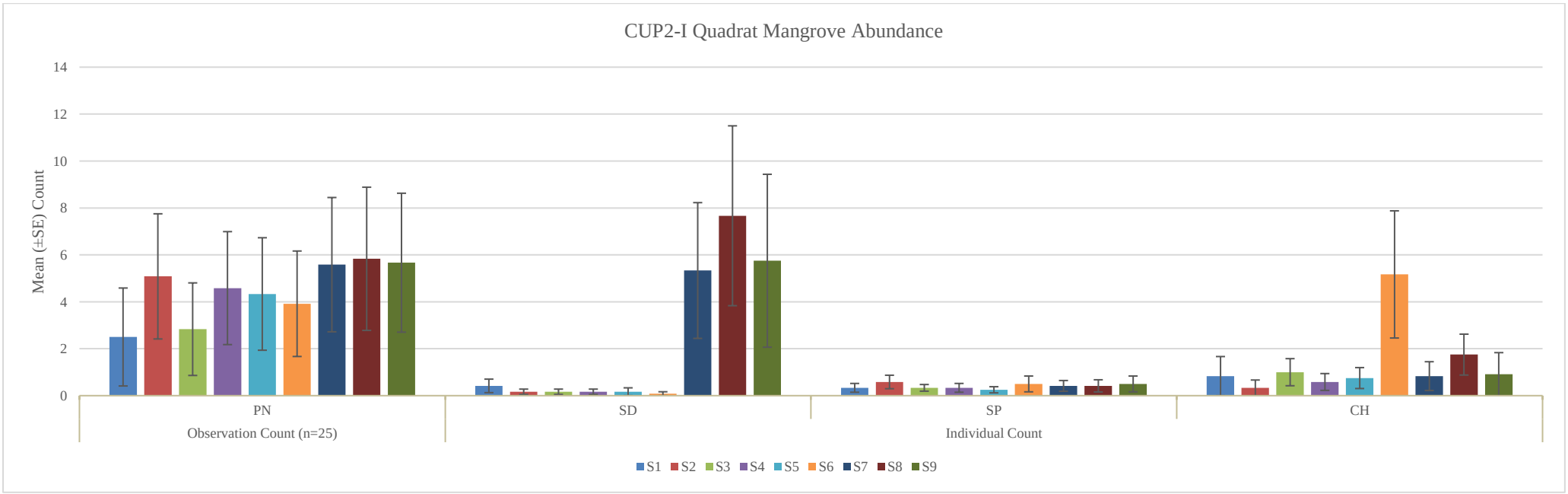

SEB2-R Quadrat Mangrove Abundance
Mean (±SE) Count
20
18
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

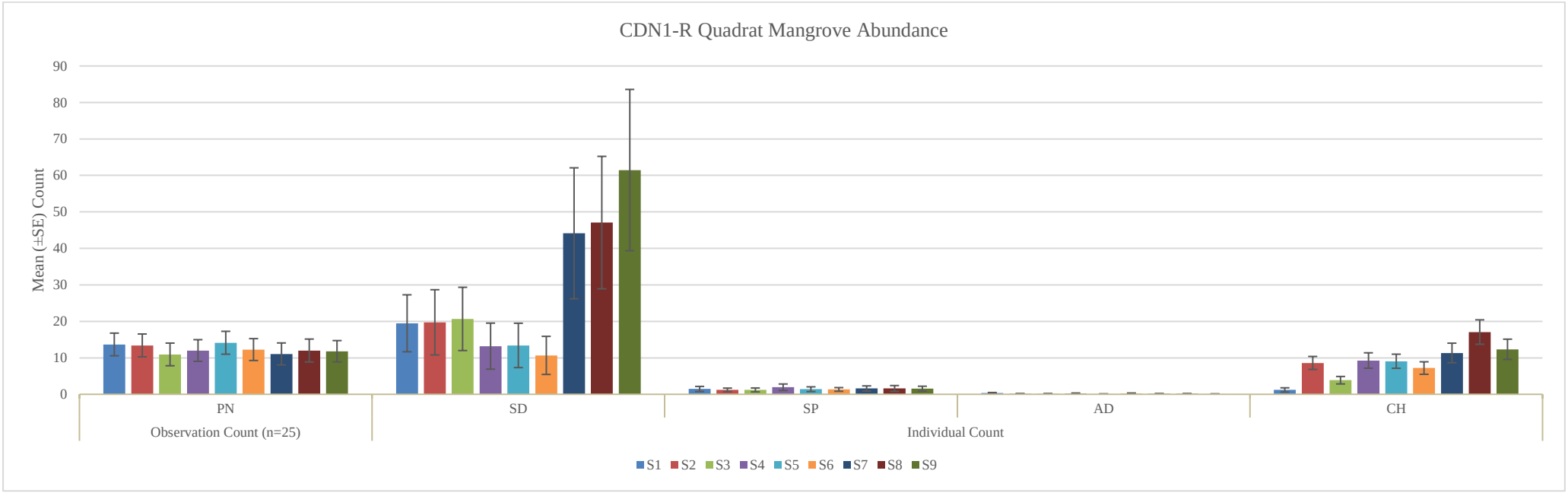

SEB2-I Quadrat Mangrove Abundance
Mean (±SE) Count
30
25
20
15
10
5
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

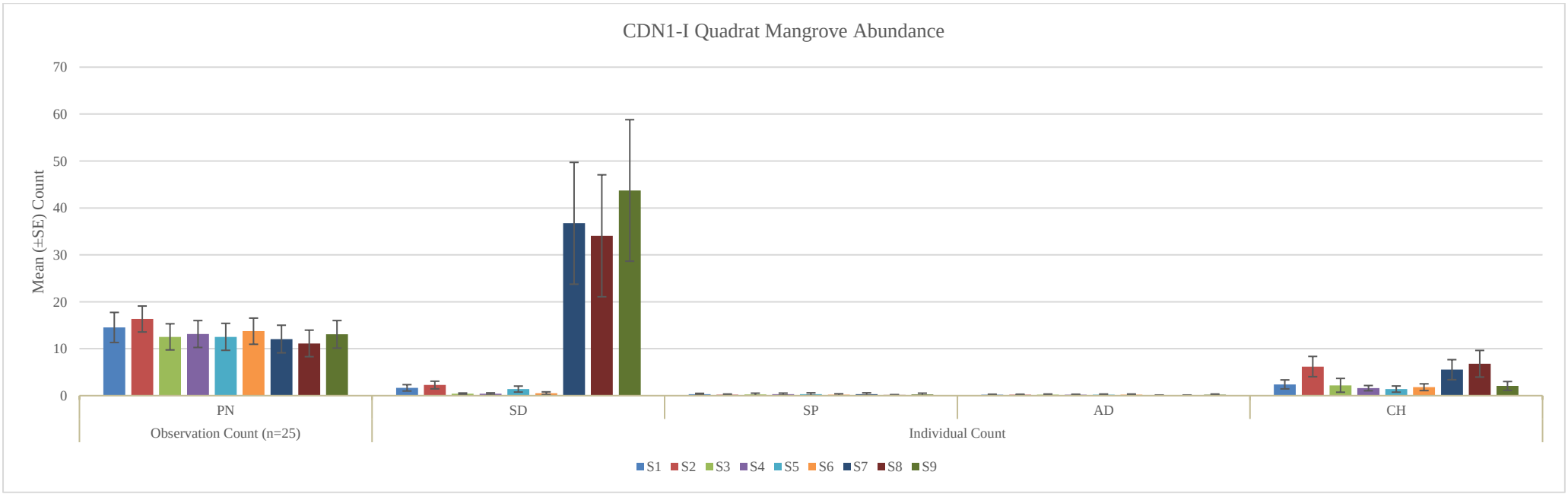

CUP1-R Quadrat Mangrove Abundance
Mean (±SE) Count
18
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

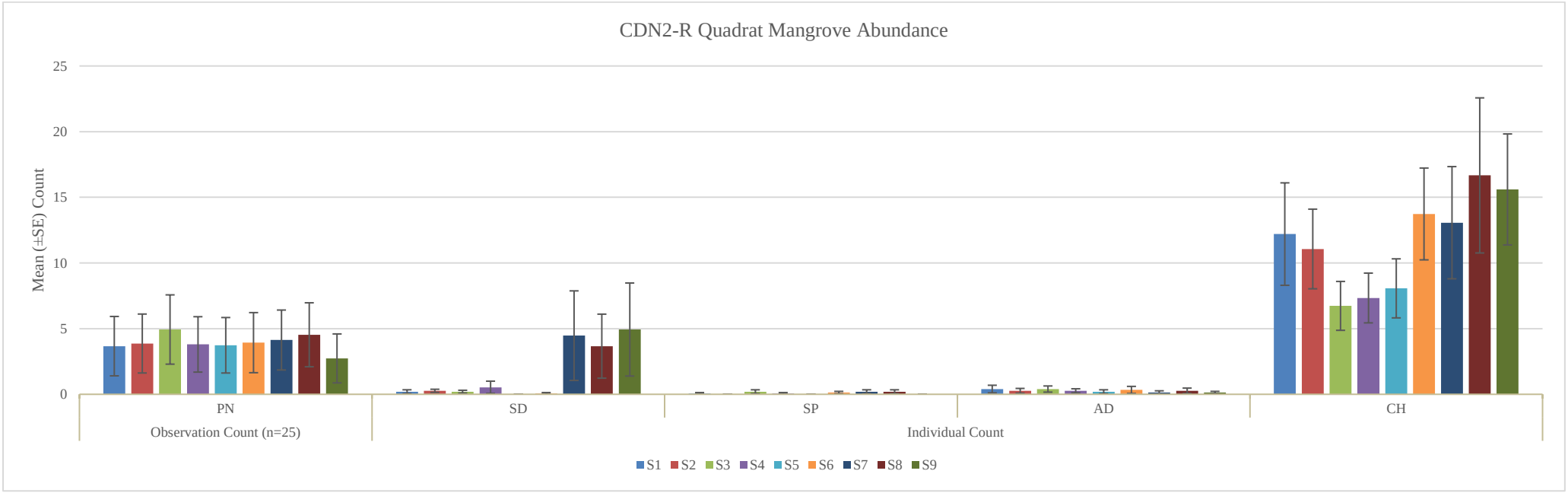

CUP1-I Quadrat Mangrove Abundance
Mean (±SE) Count
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

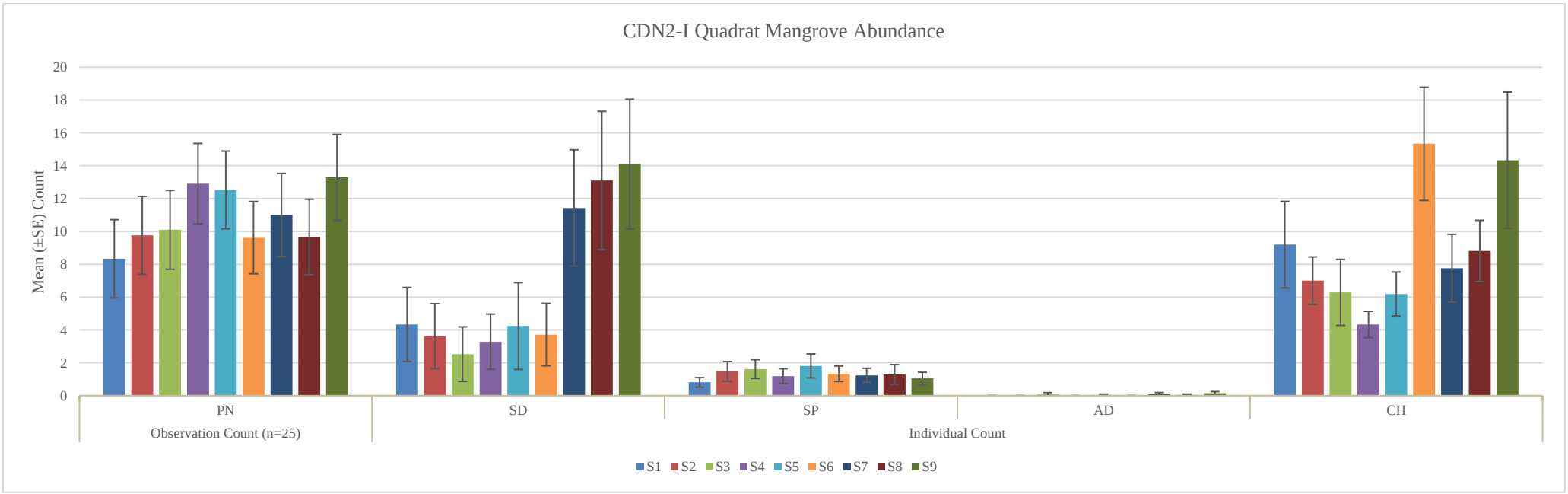

CUP2-R Quadrat Mangrove Abundance
Mean (±SE) Count
18
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Observed Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9


CUP2-I Quadrat Mangrove Abundance
Mean (±SE) Count
14
12
10
8
6
4
2
0
PN
SD
SP
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9


CDN1-R Quadrat Mangrove Abundance
Mean (±SE) Count
90
80
70
60
50
40
30
20
10
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9


CDN1-I Quadrat Mangrove Abundance
Mean (±SE) Count
70
60
50
40
30
20
10
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

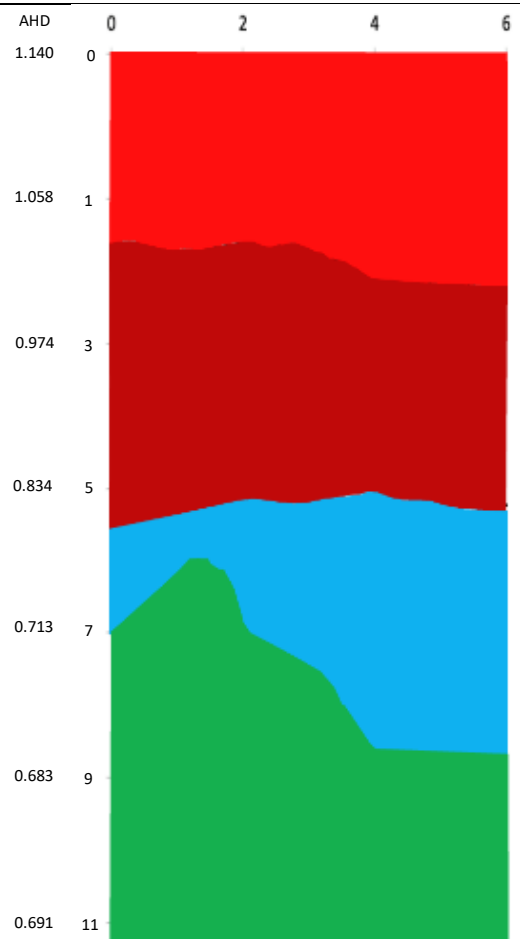
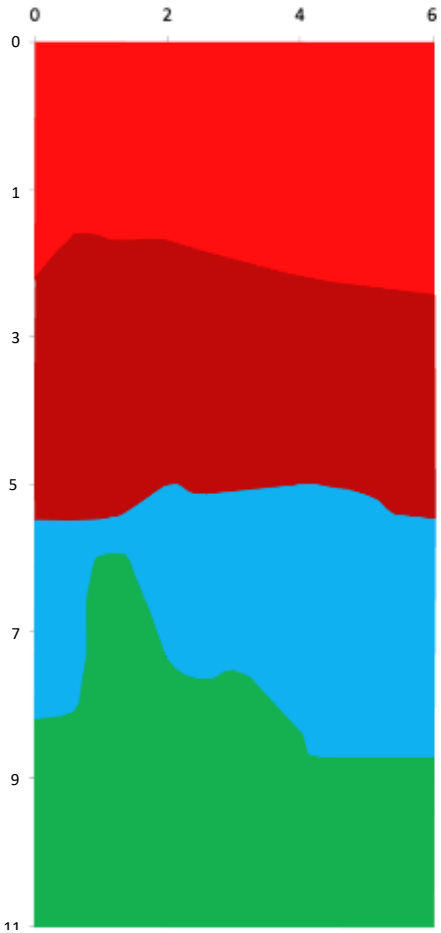
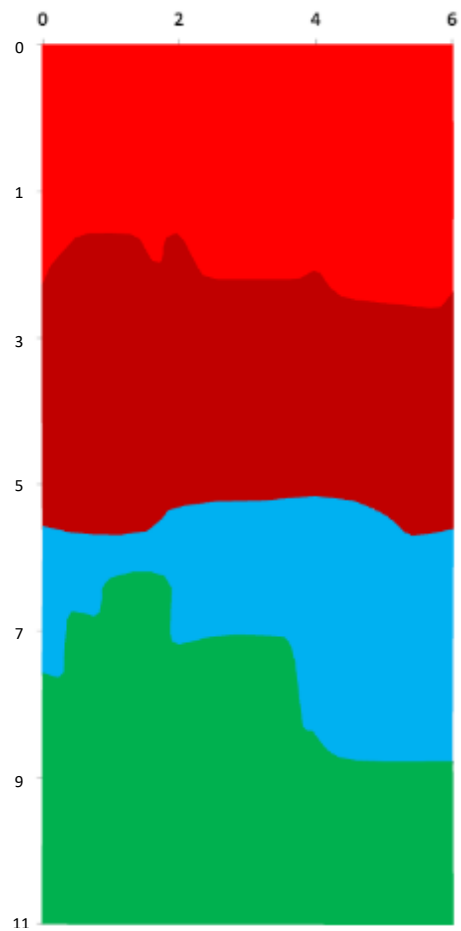

CDN2-R Quadrat Mangrove Abundance
Mean (±SE) Count
25
20
15
10
5
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9


CDN2-I Quadrat Mangrove Abundance
Mean (±SE) Count
20
18
16
14
12
10
8
6
4
2
0
PN
SD
SP
AD
CH
Observation Count (n=25)
Individual Count
S1 S2 S3 S4 S5 S6 S7 S8 S9

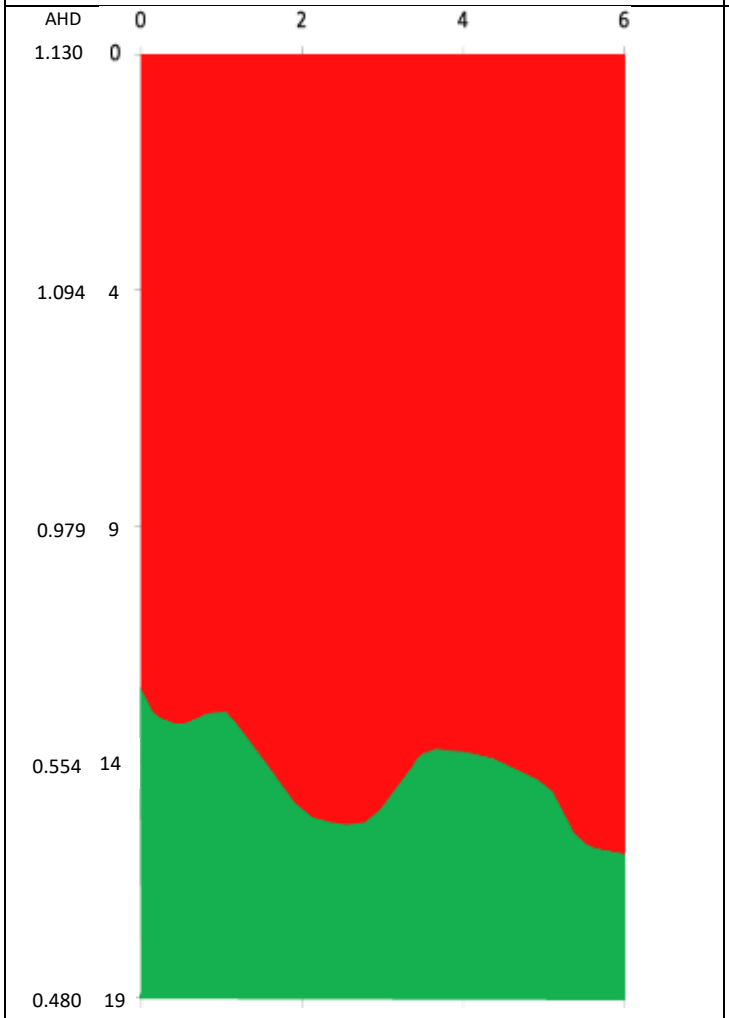
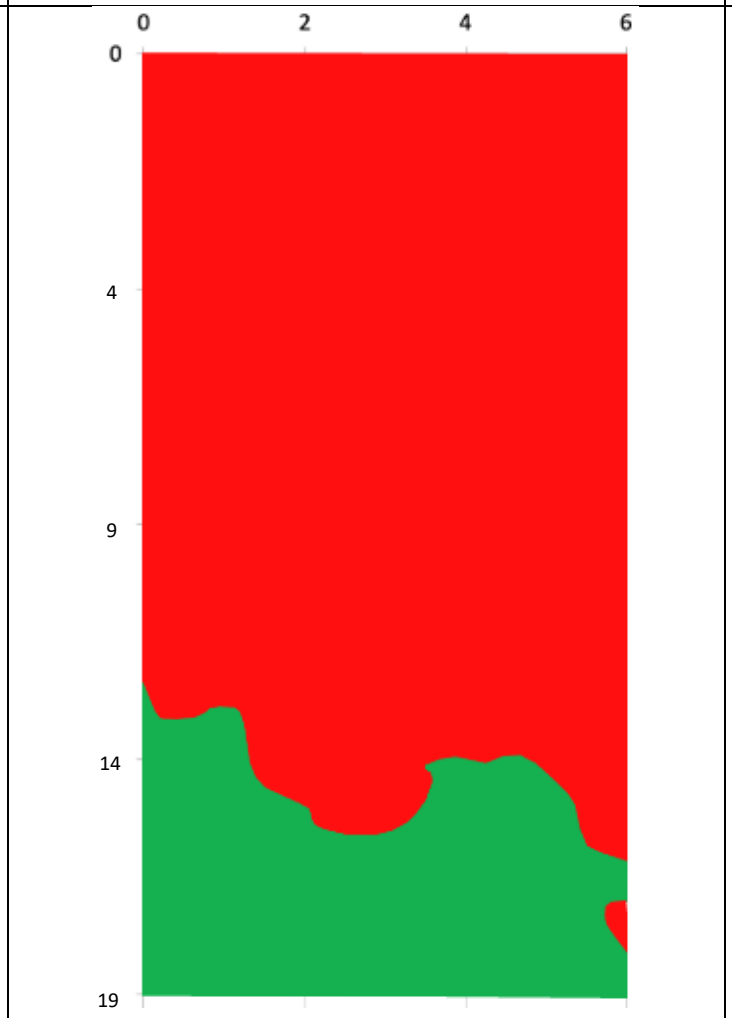
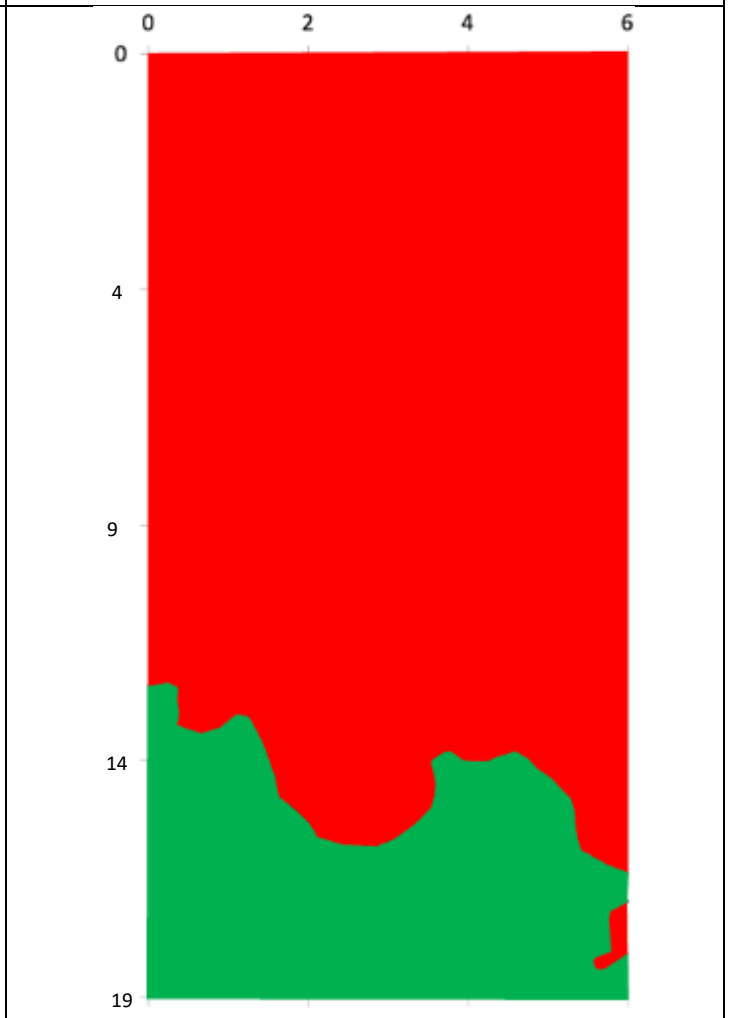
# APPENDIX C5

# SIX-MONTHLY
# INTERTIDAL MOSAIC PLOTS

# BB1-R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|
|  |  |  |
| **BS** + C + LC + Little BJ | **BS** + RG + LC + CW + Little BJ | **BS** + LC + BJ + AL + CW + RG + D |
| **JK** + **BJ** + Little SQ | **JK + BJ** + CS + Little SQ + AL | **JK + BJ** + AL + CW + SQ + CS |
| **SQ** + JK | **SQ** + JK + PN + CW + BM | **SQ** + Sparse JK + PN + CW + D + BM |
| **BM** + PN + SD + AD | **BM + CW** + PN + SD + AD | **BM + CW + SD** + PN + SD + AD + CH |

# BB1-I – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|
|  |  |  |



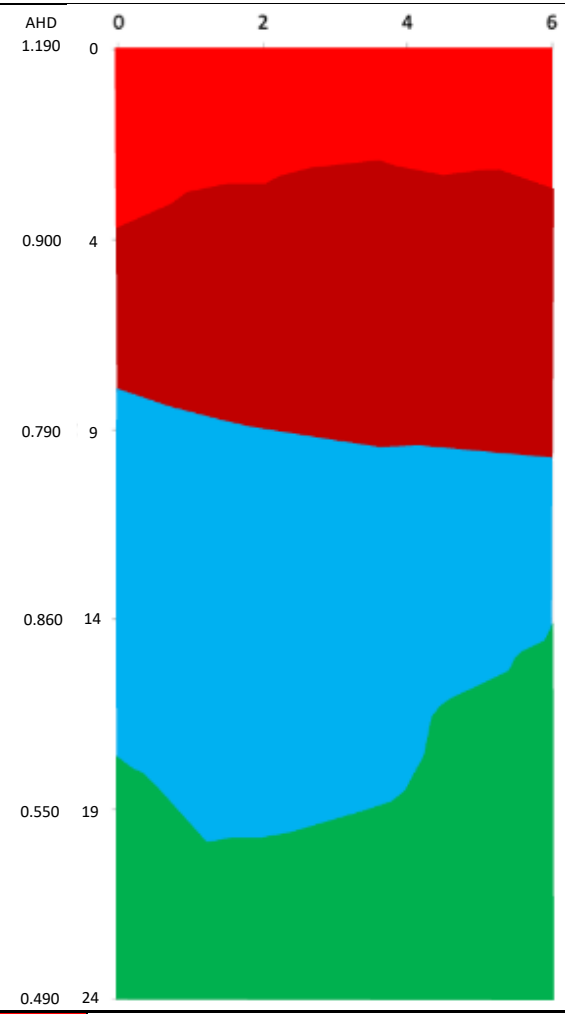
| | |
|---|---|
| | **JK + BJ** + CG + BG + PS + HD + AV + AL |
| | **BM + CW + AD** + PN |

| | |
|---|---|
| | **JK + BJ + CW** + SQ + CG + BG + PS + HD + AV + AL |
| | **BM + CW + AD** + PN + SP |

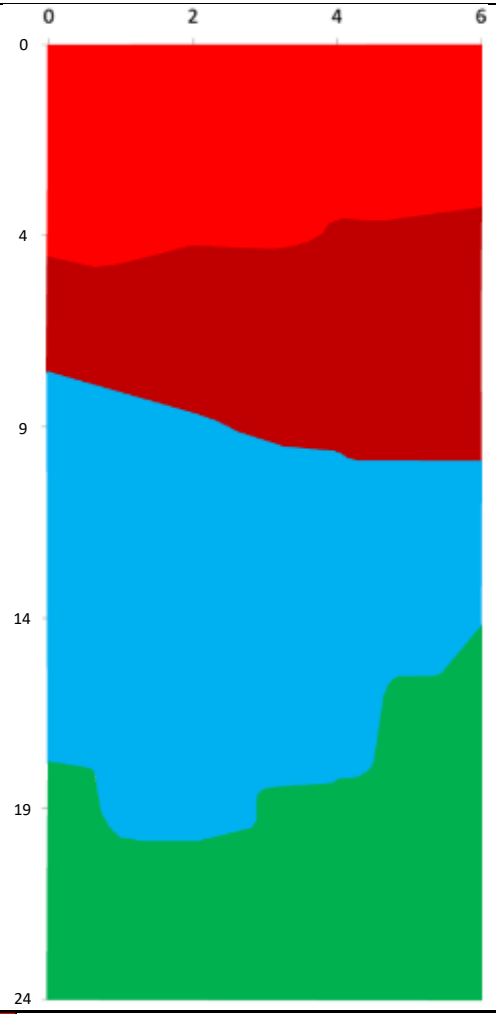
| | |
|---|---|
| | **JK + BJ + CW** + SQ + HD + AL + BG + CG + RG + EW + HY + PS |
| | **BM + CW + AD** + PN + SD + SP |

# BB2-R – Transect Mosaic

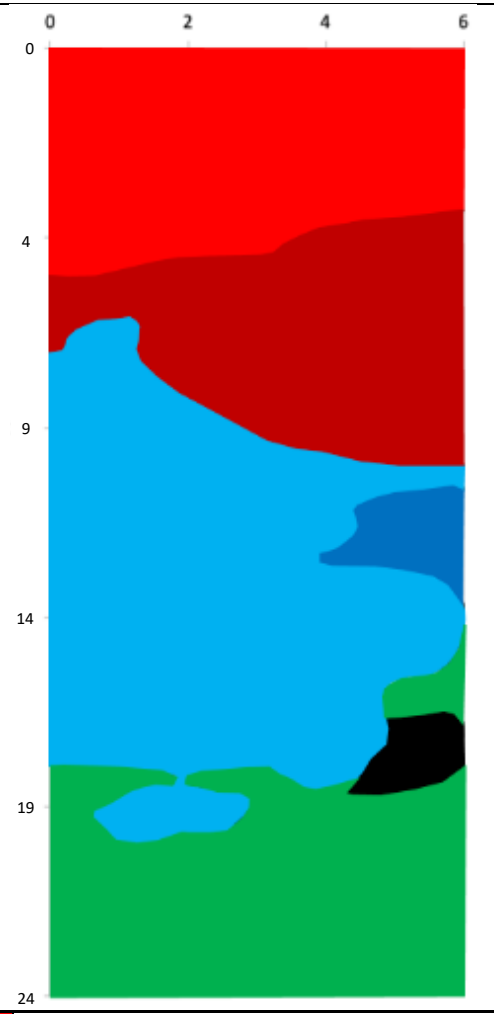
| 1 | 2 | 3 |
|---|---|---|




| | |
|---|---|
| | **BG** + BS + RN + JK + LC + CW + PT + IP |
| | **JK + CW** + C + Sparse SQ |
| | **JK + SQ** + CW + D |
| | **BM + PN + SD + SP** + AD + Sparse SQ |

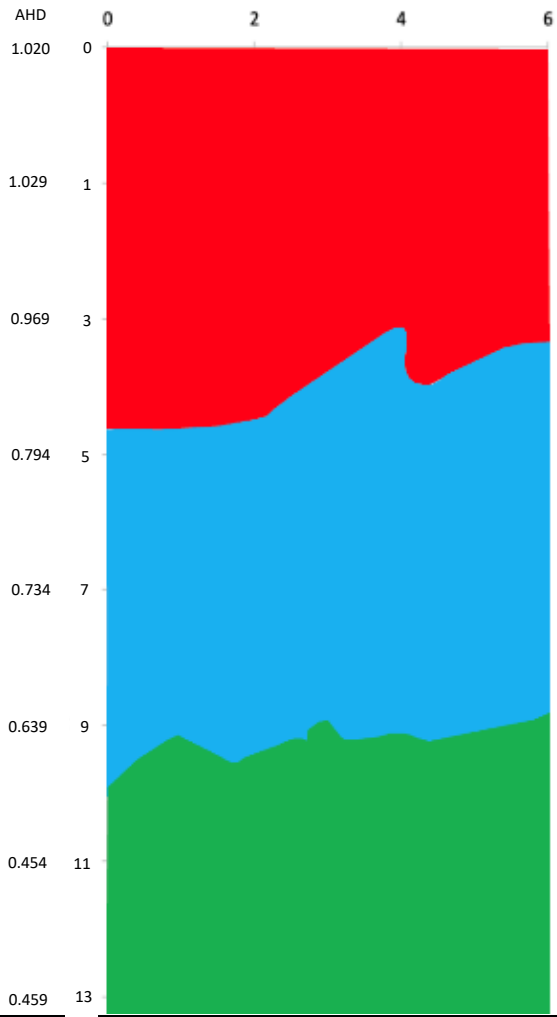
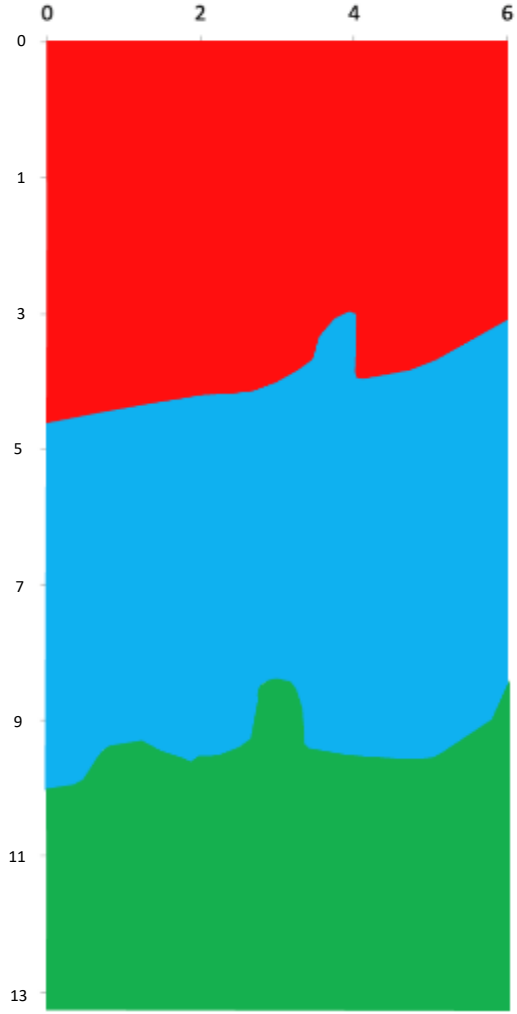
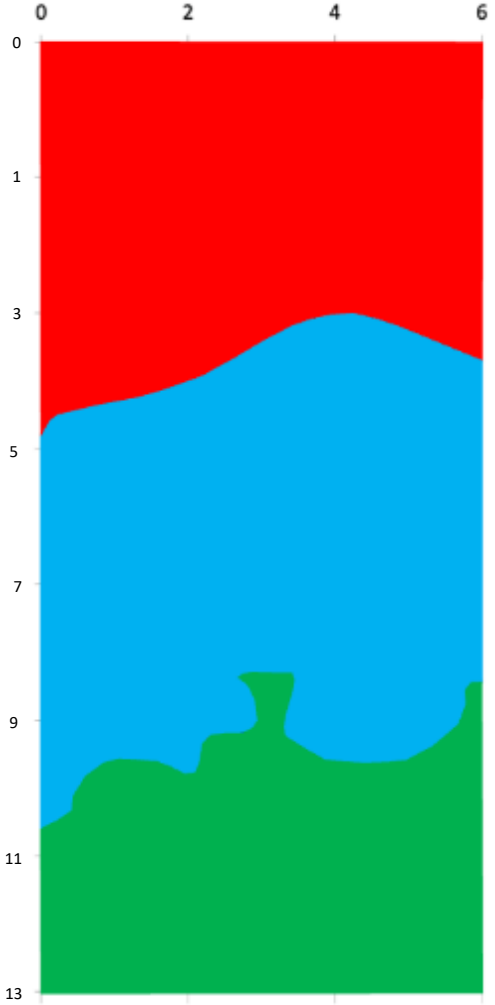



| | |
|---|---|
| | **BG** + RG + CW + BS + RN + JK + C + IP |
| | **JK + CW** + C + D + Sparse SQ |
| | **JK + SQ** + CW + R + Some PN + D |
| | **BM + PN + SD + SP** + AD + SQ + CH |



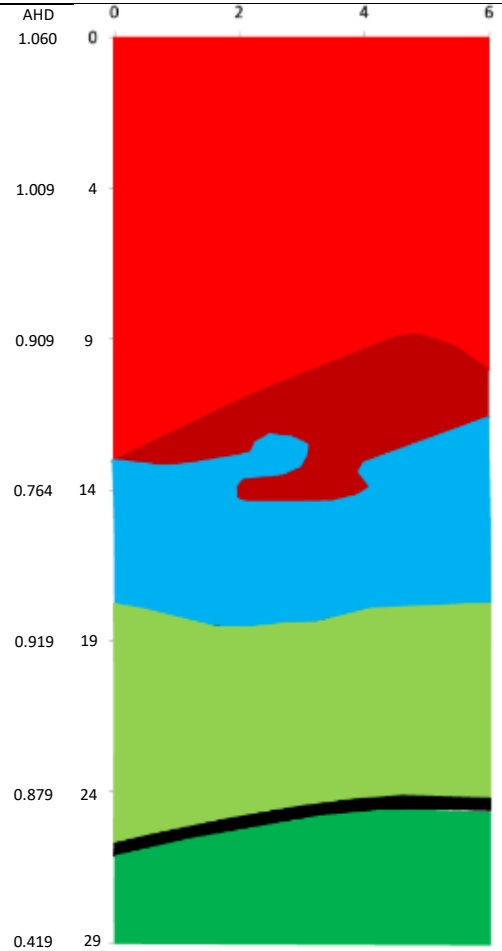

| | |
|---|---|
| | **BG** + RG + CW + BS + RN + JK + C + IP + CS + AV |
| | **JK + CW** + D + C + R + Sparse SQ + SE |
| | **JK + SQ** + D + CW + R + PN |
| | **CW + D** + SQ + BM |
| | **CW** + D |
| | **BM + PN + SD + SP** + AD + SQ + CH |

## BB2-I – Transect Mosaic

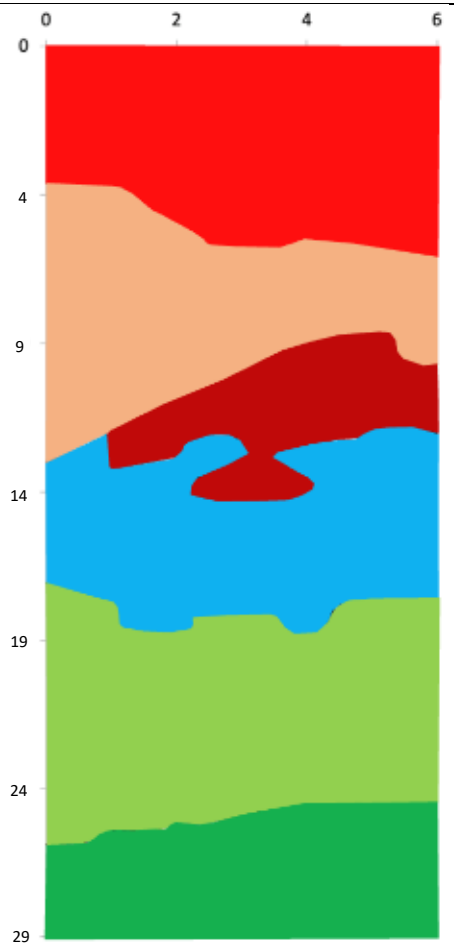
| 1 | 2 | 3 |
|---|---|---|
|  |  |  |
| **BJ + ML** + C + little JK + SQ + PA | **BJ + ML** + CW + C + Little JK + SQ | **BJ + ML** + CW + PA + SQ + Little JK |
| **JK + SQ** + PA | **JK + SQ** + Some BJ | **JK + SQ** + Some BJ + PN + CW + PA |
| **BM + PN + SD + AD** | **BM + PN + SD + SP + AD** | **BM + PN + SD + SP + AD** + CH |

# SWB1-R– Transect Mosaic

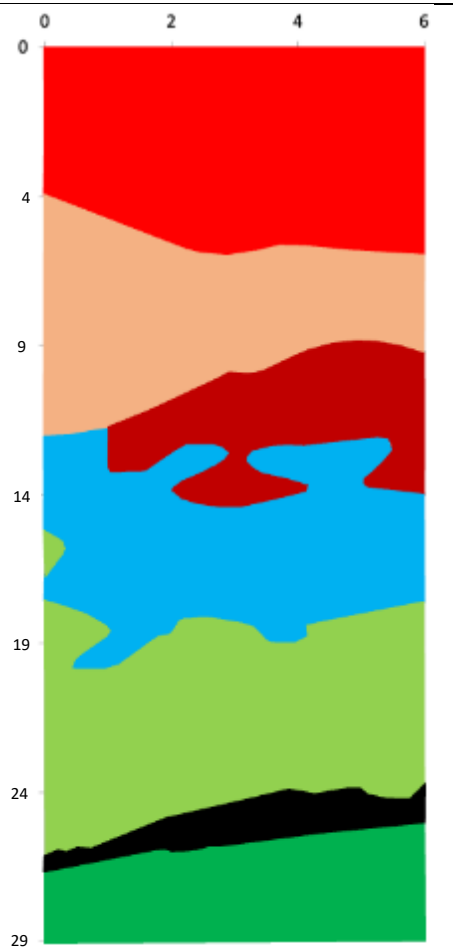
| 1 | 2 | 3 |
|---|---|---|




| | |
|---|---|
| | **CW** + BS + SQ + C + JK + AL |
| | **JK + CW** + Little SQ |
| | **SQ + CW** + JK |
| | **SQ** + JK |
| | **ZW** |
| | **BM** + PN + SD |

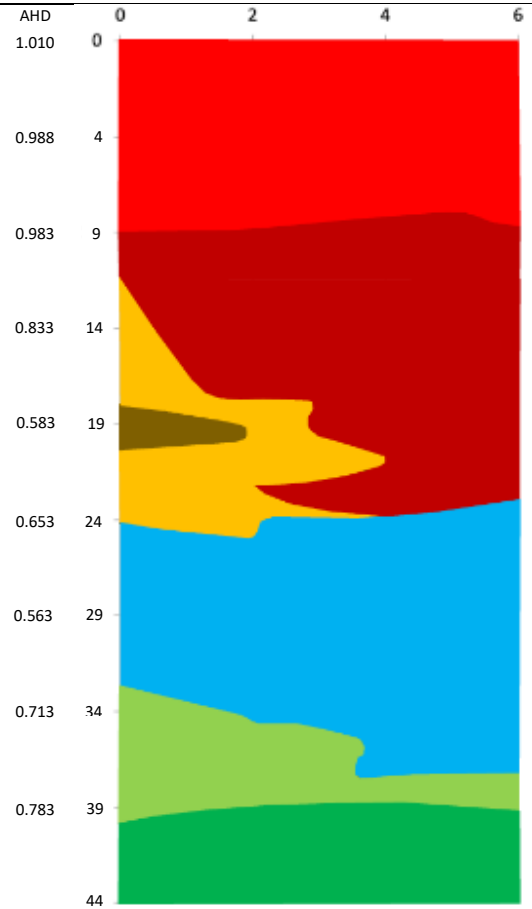
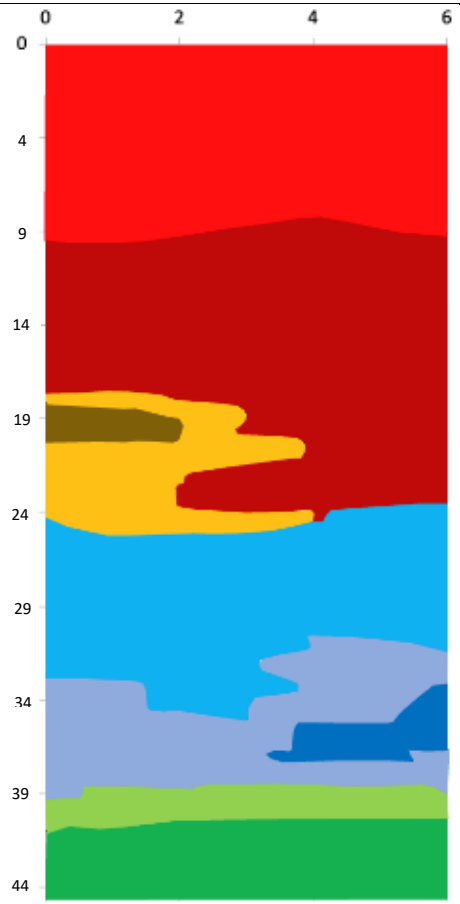
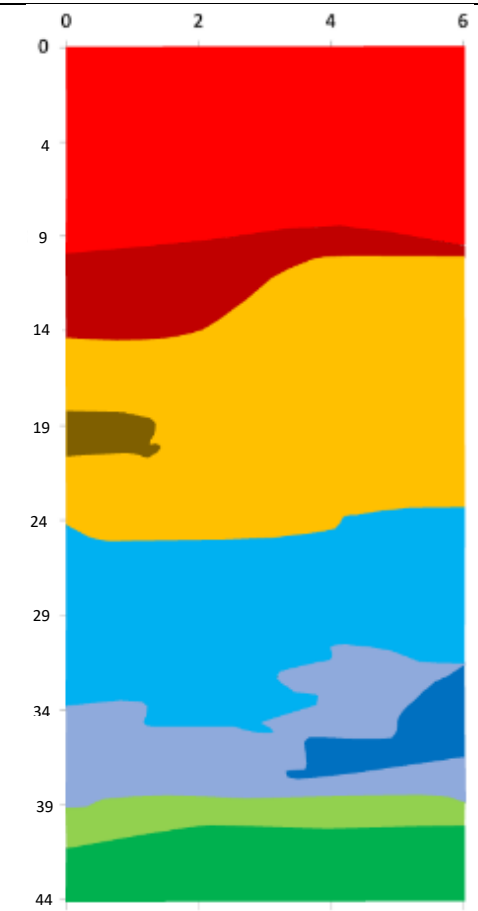



| | |
|---|---|
| | **CW** + BS + PS + RG |
| | **CW** + Some SQ + JK + D + CS |
| | **JK + CW** + SQ + Little SE |
| | **SQ + CW** + BM + SE + Little JK |
| | **SQ** + JK + CW + CS |
| | **BM** + PN + SD + SP + CH |




| | |
|---|---|
| | **CW + BS** + PS + RG + TT + NS + LC + Some SQ |
| | **CW + TT** + SQ + D + CS + Little JK |
| | **JK + CW** + SQ + Little GW + SE + PN |
| | **SQ + CW** + BM + SE + Some PN + CH |
| | **SQ** + JK + CW + CS |
| | **ZW** + PN + SD + BM |
| | **BM** + PN + SD + SP + CH |

# SWB1-I – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|
|  |  |  |



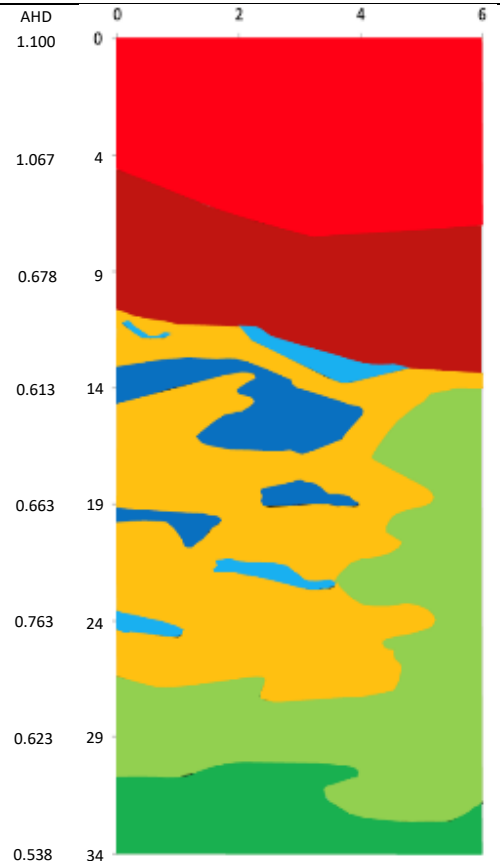
| | |
|---|---|
| | **RG** + CW + AL + BS + LC + PT + C |
| | **RG** + BJ + JK + C + PT |
| | **SQ + JK** + BJ + C + BM + CW |
| | **BM** |
| | **SQ** + **Clumped JK** + BM |
| | **SQ + JK** + C |
| | **SQ + PN + SD + BM** + AD |

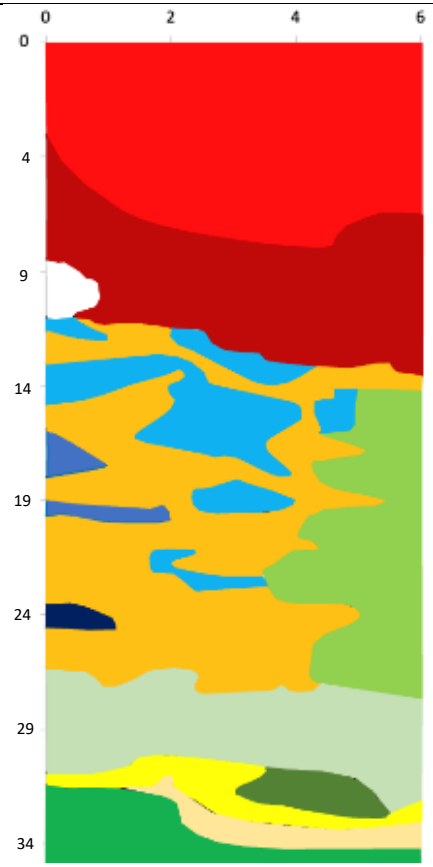
| | |
|---|---|
| | **RG** + RN + BS + HD + JK + BJ + PT + LC + AL + PS + CW |
| | **RG** + BJ + JK + C |
| | **SQ + JK + CW** + BJ + BM + C |
| | **BM** + CW + CH |
| | **SQ** + BM |
| | **JK + SQ** + CW + R + Very little SA |
| | **SQ** + BM + PN |
| | **SD + SQ** + PN + SP + BM + Edging JK |
| | **PN + SD + BM** + SP + AD + SQ |

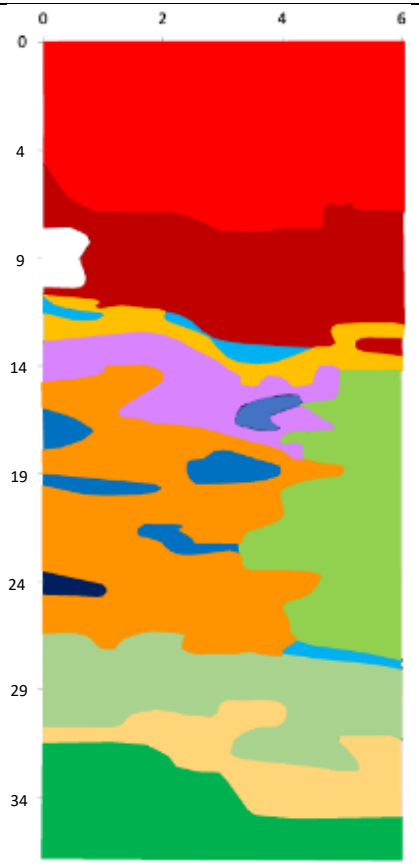
| | |
|---|---|
| | **RG** + JK + BJ + HD + AL + AV + BS + HY + PS + PT + CW + D + LC + RN + C |
| | **RG** + JK + BJ |
| | **JK + SQ + CW** + BJ + C |
| | **BM** + CW |
| | **SQ** + BM + Some CW |
| | **JK + SQ** + CW + R |
| | **SQ** + BM + PN + CH |
| | **SD + SQ** + PN + SP + BM + ZW + CW + CH + D |
| | **PN + SD + BM** + SP + AD + D + SQ + CH |

# SWB2-R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



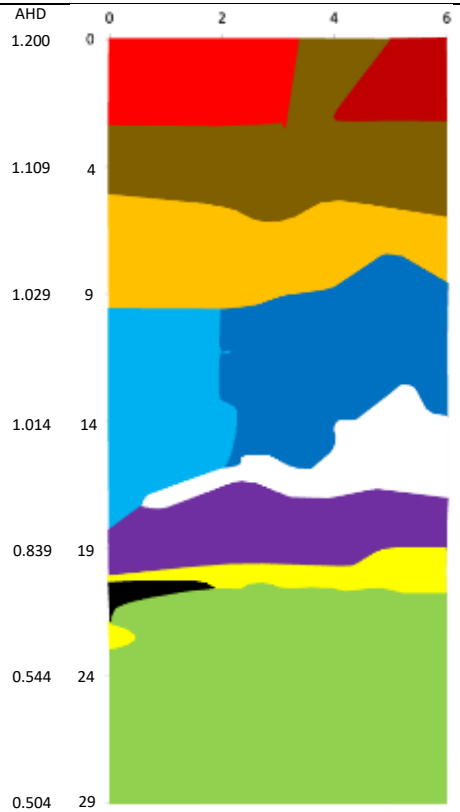

| | |
|---|---|
| | **BS** + JK + C + CW + CS |
| | **JK** + Little SQ + C |
| | **BM** + PN + SD |
| | **SQ** |
| | **SQ + PN** |
| | **JK + SQ** |
| | **b** |

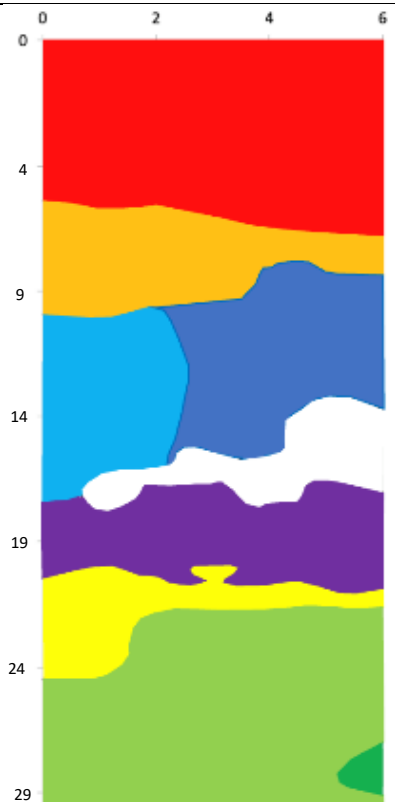
| | |
|---|---|
| | **BS** + JK + C + CS + CW |
| | **JK** + SQ + CW + C |
| | **CW** |
| | **SQ** + BM |
| | **SQ + PN** + BM |
| | **SQ + JK** + BM + PN |
| | **BM** + Sparse PN |
| | **JK + SQ** |
| | **JK + SQ** + CH + BM + CW |
| | **JK + SQ** + BM + PN + SD + SP + ZW |
| | **ZW** + PN + SD + SP + BM |
| | **BM + PN + SD + SP** + ZW |
| | **BM+ PN + SD + SP + AD** + ZW |

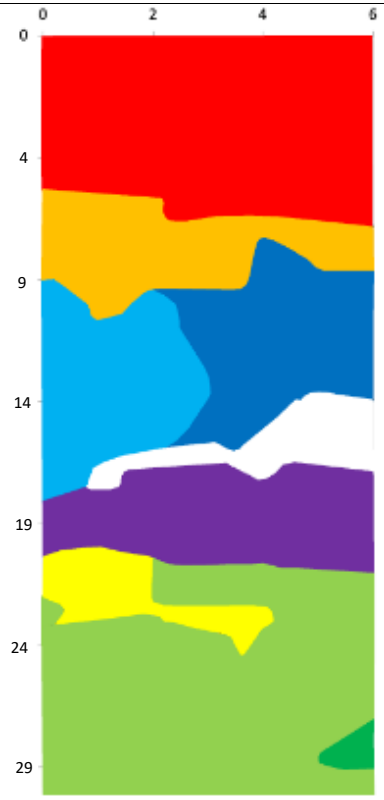
| | |
|---|---|
| | **BS** + JK + C + CS + CW + Some RG |
| | **JK** + SQ + CW + C + D |
| | **CW** |
| | **SQ** + BM + CW |
| | **BM** + CW + CH |
| | **SQ** + **CH** + BM |
| | **SQ +PN + SD** + BM + CH |
| | **SQ + JK** + BM + PN + CH |
| | **BM** + CH + PN + SD |
| | **JK + SQ** |
| | **JK + SQ** + CH + BM + CW + ZW + Some SD + PN |
| | **BM + PN + SD + SP** + CH + D |
| | **BM + PN + SD + SP + AD** + CH |

# SWB2-I - Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



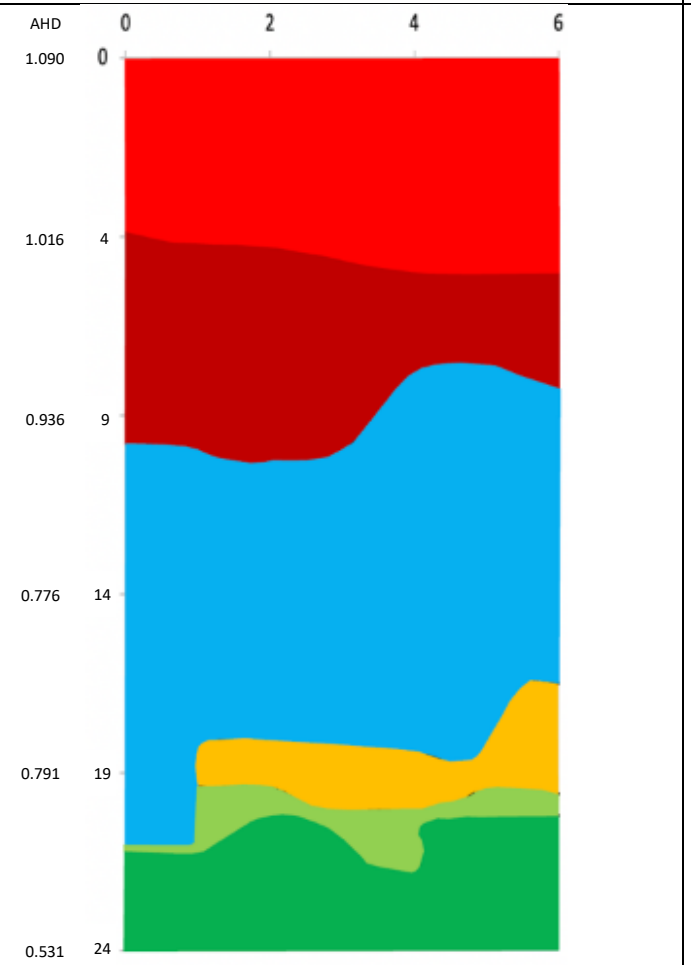

| | |
|---|---|
| | **BS** + **AV** + BJ + BG + CS + NS + BR |
| | **BS** + **LC** + BJ + AV + RG |
| | **BS** + **AV** + BJ + CS + RG |
| | **BS** + **JK** + BJ |
| | **JK** + BJ |
| | **BJ** |
| | **CW** + BJ + JK |
| | **JK** + **SQ** |
| | **CW** + **BM** + SQ + PN + SD + Edging JK |
| | **CW** |
| | **BM** + **PN** + **SD** + SP |

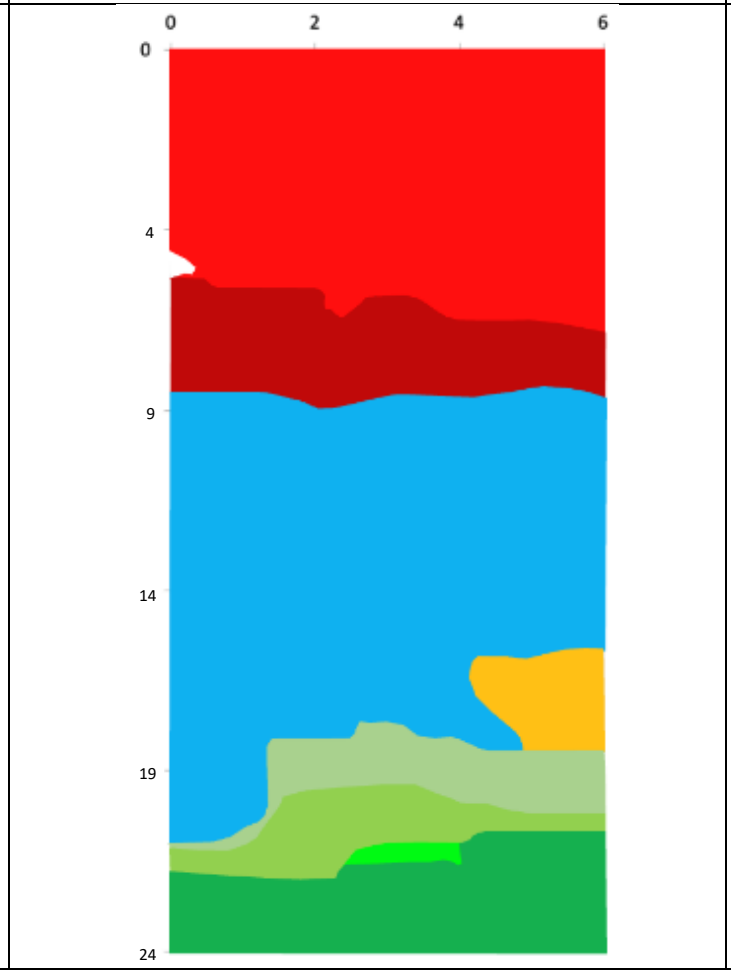
| | |
|---|---|
| | **BS** + **AV** + **CW** + ALT + LC + BJ + RG + CS + GH + SG + MA + BR |
| | **BS** + **JK** + BJ + CW |
| | **JK** + **CW** + BJ + D + C |
| | **BJ** + **CW** |
| | **CW** + JK + Little SQ |
| | **JK** + **SQ** + BM + CW + Edging SD |
| | **CW** + PN + SD + SP + D |
| | **BM** + **PN** + **SD** + SP + CH + ZW + D |
| | **BM** + **PN** + **SD** + **AD** + SP + ZW |

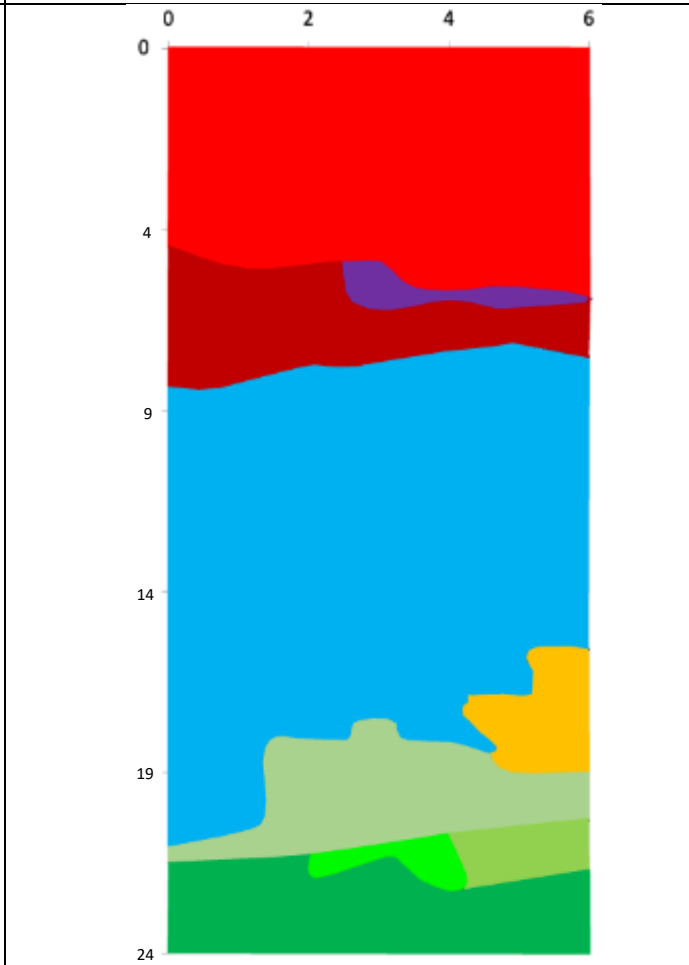
| | |
|---|---|
| | **BS** + **AV** + **CW** + BG + CS + SG + HY + LC + D + GH + BJ + RG + BR |
| | **BS** + **JK** + BJ + CW |
| | **JK** + **CW** + BJ |
| | **BJ** + **CW** |
| | **CW** + BM + D + Some SQ + JK |
| | **JK** + **SQ** + BM + CW + D + PN + Edging SD |
| | **CW** + **ZW** + PN + SD + BM + CH |
| | **BM** + **PN** + **SD** + SP + CH + ZW + CW + SQ |
| | **BM** + **PN** + **SD** + **AD** + SP + ZW + CW + CH |

# SEB1–R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



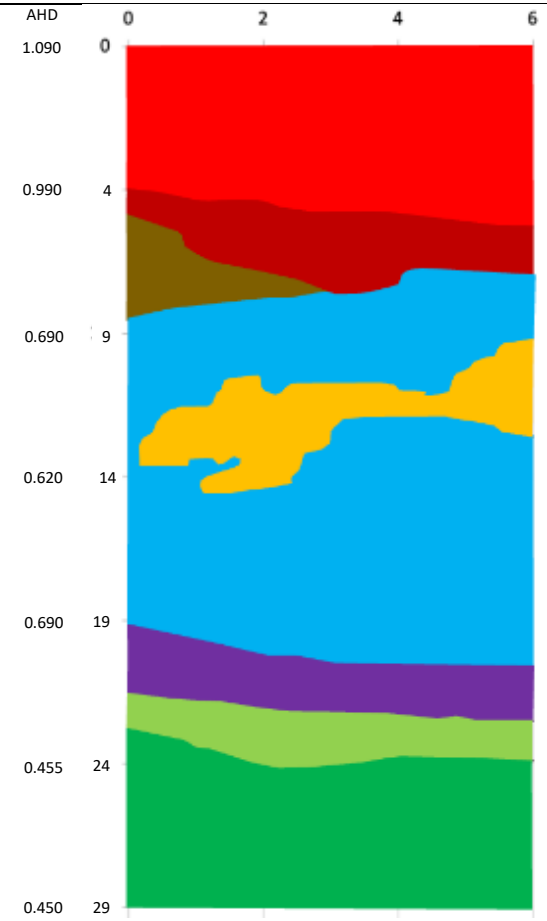

| | |
|---|---|
| | **BG** + RG + C + Little JK + CI + NS + AF |
| | **JK** + CD + SQ + TT |
| | **JK** + **SQ** + Little SA |
| | **SA** + JK + SQ |
| | **PN** + **SA** + SD + SQ |
| | **BM** + **PN** + **SD** + **SP** + **AD** |

| | |
|---|---|
| | **BG** + **CW** + TT + AF + PS + Sparse CD |
| | **JK** |
| | **JK** + **CW** + CD + SQ |
| | **JK** + **SQ** |
| | **SA** + JK + PN + CW + Some SQ |
| | **SA** + PN + SQ + D + CW + ZW |
| | **Dense ZW** + **D** + SA + SD + SQ + BM + PN + SP |
| | **BM** + **SQ** + PN + SD + SP + SQ |
| | **BM** + **PN** + **SD** + **SP** + **AD** |

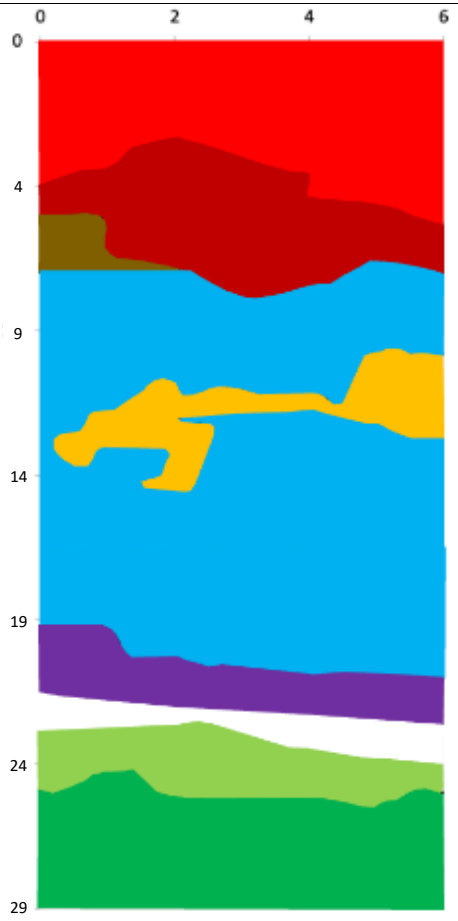
| | |
|---|---|
| | **BG** + **CW** + AF + CI + TT + PS |
| | **TT** + **CW** + CD |
| | **JK** + **CW** + CD + SQ + Some TT |
| | **JK** + **SQ** |
| | **SA** + JK + PN + D + SQ |
| | **SA** + **Dense CW** + PN + SQ + ZW + D + SD + BM |
| | **BM** + **SD** + PN |
| | **BM** + **SQ** + PN + SD + SP |
| | **BM** + **PN** + **SD** + **SP** + **AD** + Sparse ZW + CH |

# SEB1-I – Transect Mosaic

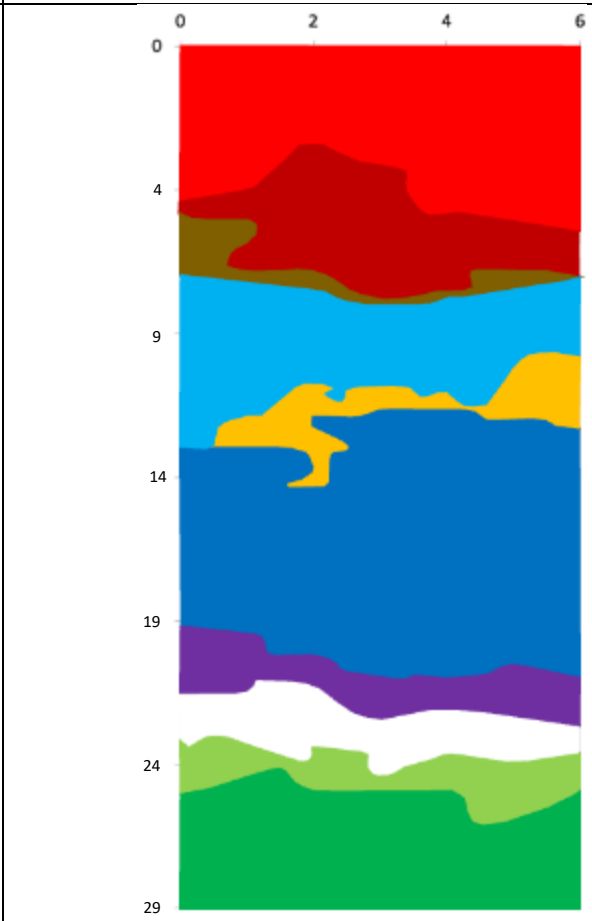
| 1 | 2 | 3 |
|---|---|---|




| | |
|---|---|
| | **CW** + CD |
| | **JK** + **CD** + SQ |
| | **CD** + **SQ** |
| | **SQ** |
| | **BM** |
| | **JK** + **SQ** |
| | **BM** + **PN** + SD + sparse SQ |
| | **BM** + **AD** + PN, SP, SD |



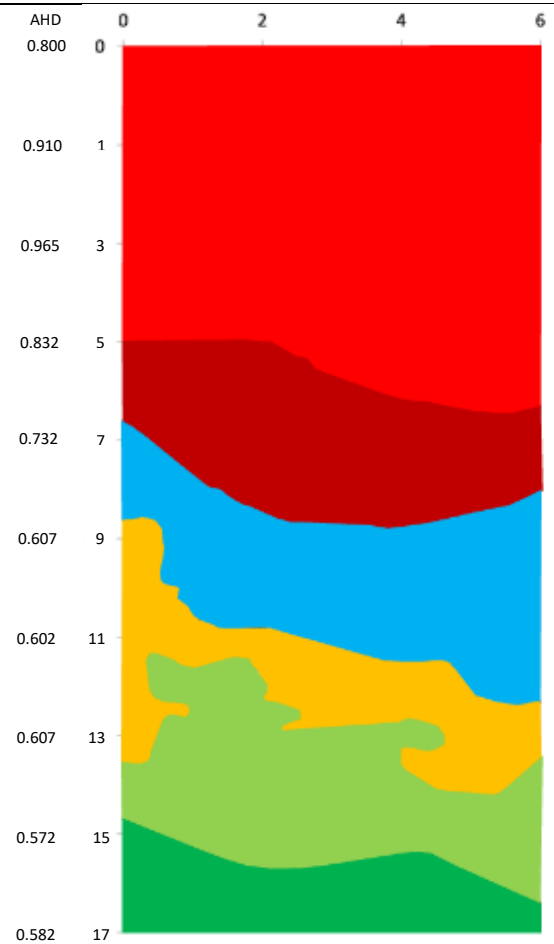

| | |
|---|---|
| | **CW** + AF + PS + C + CD + D + Iso JK |
| | **JK** + **CD** + **CW** + C |
| | **CD** + **SQ** + CW |
| | **SQ** + CW |
| | **BM** |
| | **JK** + **SQ** + CW |
| | **SQ** + **ZW** + **CW** + BM + PN + SD + CH |
| | **BM** + **PN** + SD + SP + CH |
| | **BM** + **PN** + **SD** + SP + AD + CH + Little CW |

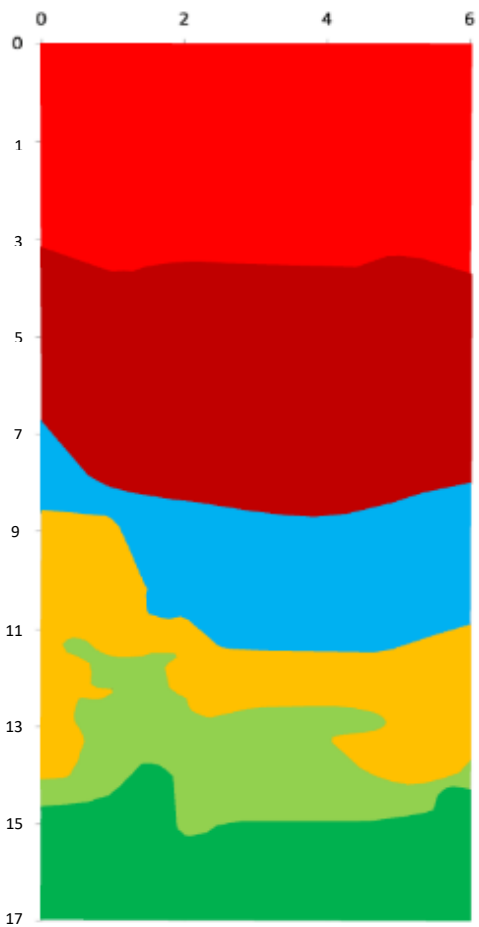


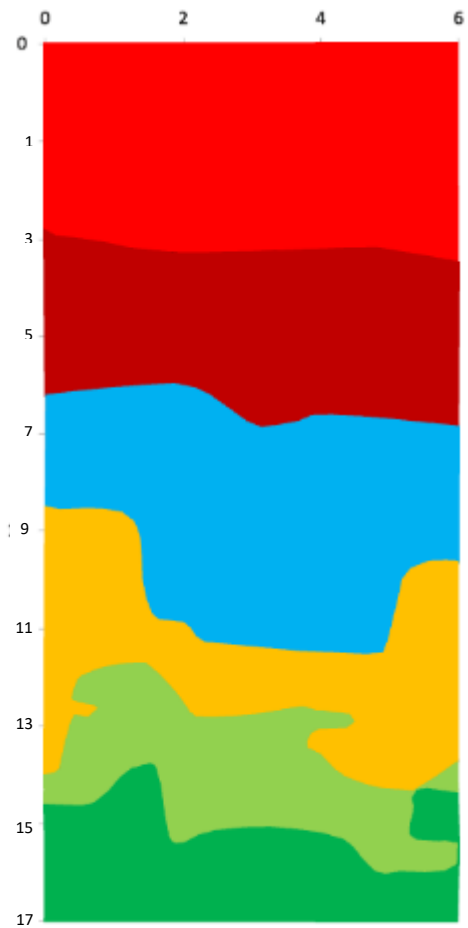

| | |
|---|---|
| | **CW** + AF + PS + C + TT + RG + Iso JK |
| | **JK** + **CD** + **CW** + C |
| | **CD** + **SQ** + CW |
| | **SQ** |
| | **BM** + CH |
| | **SQ** + BM + CH |
| | **JK** + **SQ** + BM + CW + CH + Some PN + SD |
| | **SQ** + **ZW** + **CW** + BM + PN + SD + CH |
| | **BM** + **PN** + **SD** + SP + CH |
| | **BM** + **PN** + **SD** + SP + AD + CH + Some CW |

# SEB2-R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



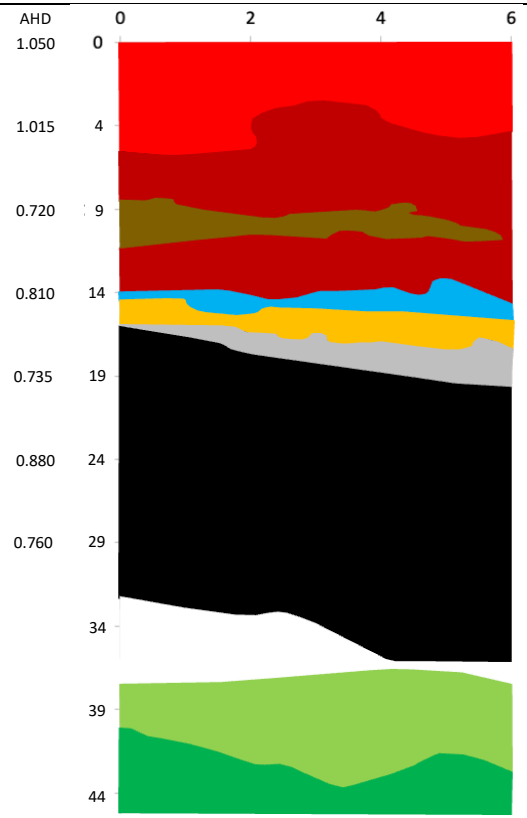

| | |
|---|---|
| | **CW** + CD + AF + IP + PN + C + D |
| | **CD + SQ +** JK + CW + Some PN |
| | **SQ** + JK + Little CH +PN |
| | **BM** + Less Dense **SQ** + PN + CH |
| | **BM** + PN + SD + SP |
| | **BM + AD** + PN + SD + SP + CH |

| | |
|---|---|
| | **CW** + CD + AF + C + Sparse JK |
| | **CD + SQ** + JK + Some PN |
| | **SQ** + JK |
| | **BM +** Less Dense **SQ** + PN + Edging SD |
| | **BM** + PN + SP |
| | **BM + AD** + PN + SD + SP + CH |

| | |
|---|---|
| | **CW** + CD + AF + PS + C + Very Sparse PN |
| | **CD + SQ** + JK + CW + Some PN |
| | **SQ** + JK + Some PN |
| | **BM** + Less dense **SQ** + PN + Sparse SD |
| | **BM** + PN + SD + SP |
| | **BM + AD** + PN + SD + SP + CH |

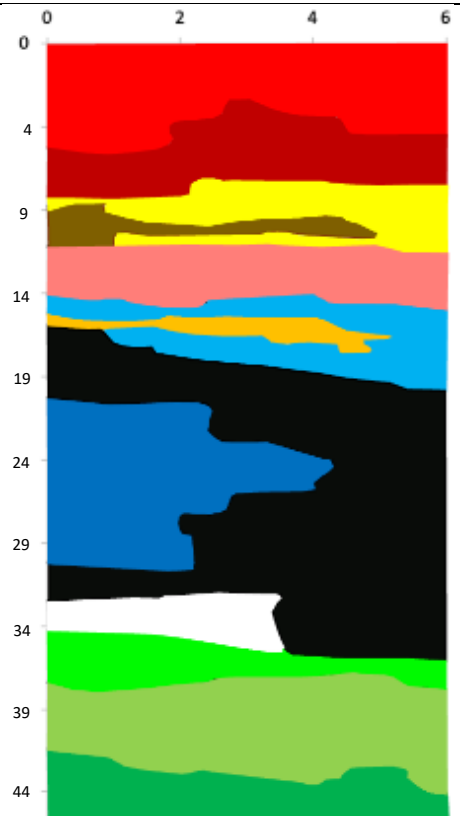
# SEB2-I – Transect Mosaic

## 1



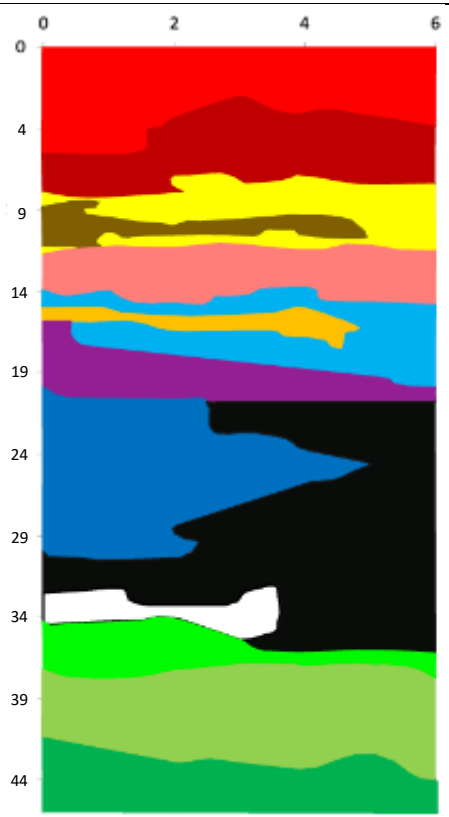

| | |
|---|---|
| | **CD** + CW + CS + AF + RG + Sparse JK |
| | **SQ + JK** |
| | **BM** + Few PN |
| | **SQ** + PN |
| | **BM** + PN + Sparse SQ + SD |
| | **SQ** + AD + PN |
| | **JK** |
| | **JK** + RM (>1.5m and budding) + AD (>1.5m) + PN |
| | **SQ + SP + AD** + PN + SD |
| | **BM** + **AD** + PN + SD |

## 2



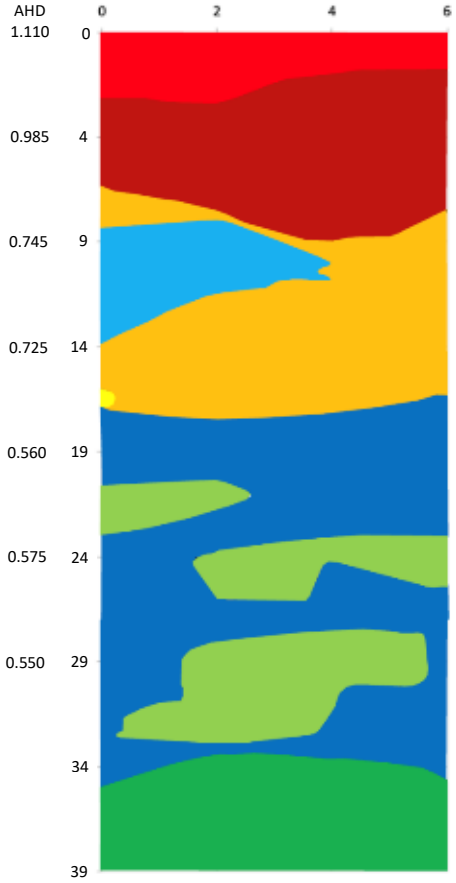
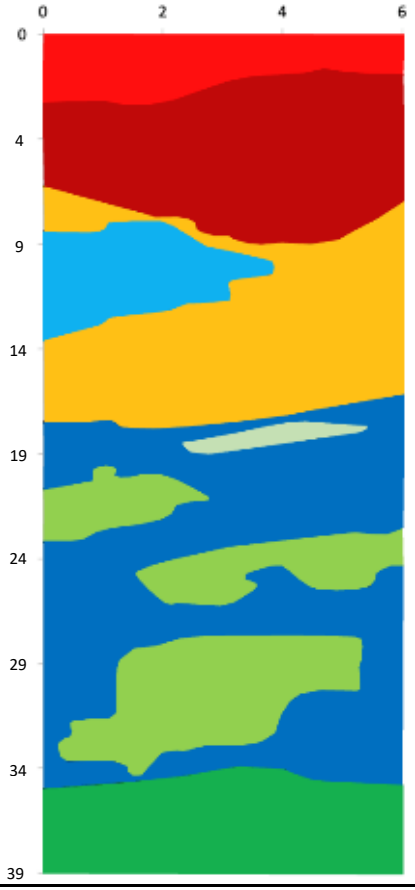
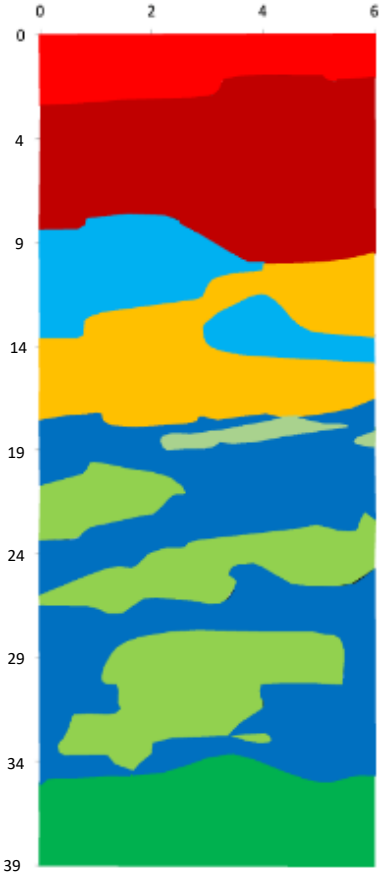

| | |
|---|---|
| | **CD** + CW + CS + AF + Edging SQ + Sparse JK |
| | **JK + SQ** + CW |
| | **SQ** + D + Some PN |
| | **BM** + Some PN |
| | **JK + SQ** + CH + Some PN |
| | **SQ + PN** + SD + AD + BM |
| | **BM** + PN |
| | **JK** + PN + BM |
| | **JK + C** + CW + SQ + PN |
| | **JK** + RM + PN + BM + SP |
| | **JK** + PN + SD + SP + BM + D + R + Some SQ |
| | **SQ + SP + AD** + BM + PN + SD + D + RM Seedlings |
| | **BM + AD** + PN + SD + SP |

## 3



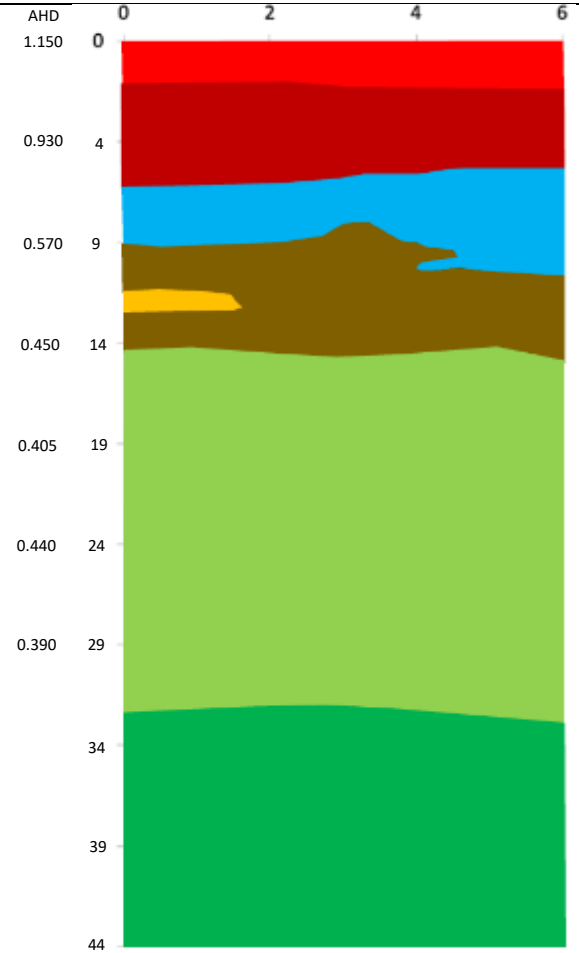

| | |
|---|---|
| | **CD** + CW + CS + AF + Sparse SQ + R |
| | **JK + SQ** + CW + Some D |
| | **SQ + D** + Some PN + Very little JK |
| | **BM** + Some PN |
| | **JK + SQ** + CH + Some PN |
| | **SQ + PN + SD** + AD + BM + CH |
| | **BM + SD** + PN + Some SQ + CH |
| | **JK** + PN + SQ + Some SD |
| | **JK** + PN + BM |
| | **JK + C** + CW + BM + Some SQ +PN |
| | **JK** + RM + PN + BM + SD + SP |
| | **JK** + PN + SD + SP + BM + Some SQ |
| | **SQ + SP + AD** + PN + SD + R + BM + D + Some Juv RM |
| | **BM + AD** + PN + SD + SP |

# CUP1-R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|
|  |  |  |
| **CW** + C + CS + BS + AL | **CW** + BS + RG + CS | **CW** + BS + RG + CS + BM + LC + HY |
| **JK + SQ** + CD + C | **JK + SQ** + C + CW + CD | **JK + SQ** + CW + C |
| **JK + SQ** | **JK + SQ** + CW | **JK + SQ** + CW |
| **SQ** | **SQ** + Little CW | **SQ** + Little CW |
| **BM** | **SQ** + BM | **SQ** + BM + CH |
| **BM + SP** + PN + SD + SQ | **JK + SQ** + SP | **JK + SQ + SD** + CH + SP |
| **JK + SQ** | **BM + SP** + SD + Little PN + CH | **BM + SP** + PN + SD + CH |
| **BM + PN + SD + AD** + sparse SQ | **BM + PN + SD + SP + AD** + SQ + CH | **BM + PN + SD + SP + AD** + SQ + CH |

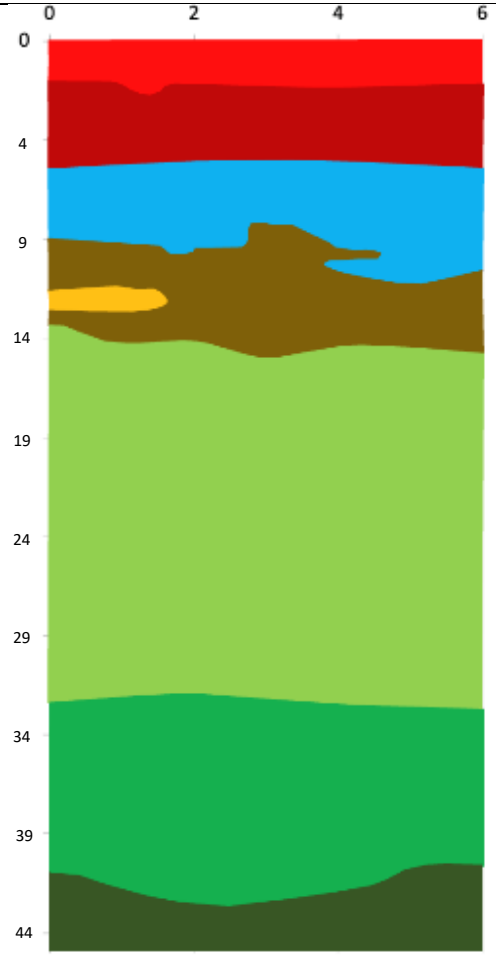
# CUP1-I – Transect Mosaic

## 1



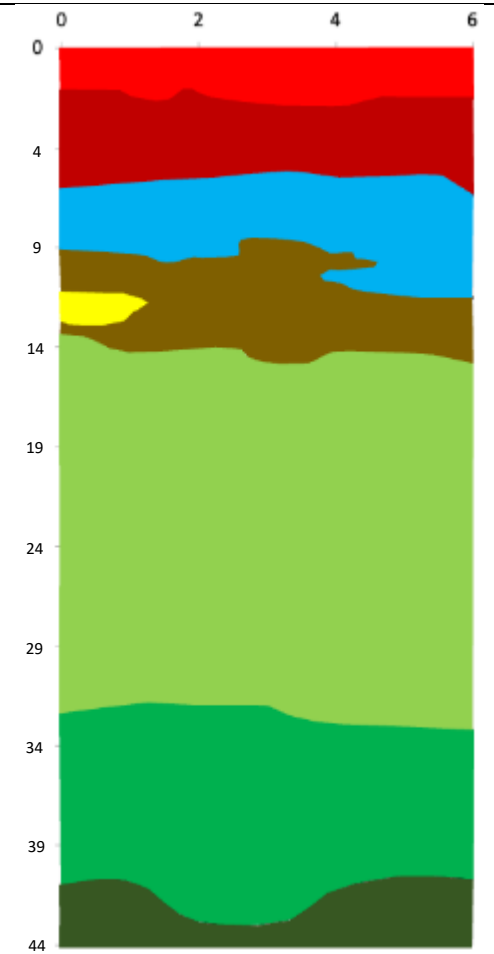

| | |
|---|---|
| | **RG** + BJ + CS |
| | **BJ** + JK |
| | **JK** + BJ + SQ |
| | **BM** + Little SQ + PN + SD + SP + AD |
| | **SQ** |
| | **SQ** + SD + SP |
| | **BM** + PN + SD + SP + AD + Sparse SQ |

## 2



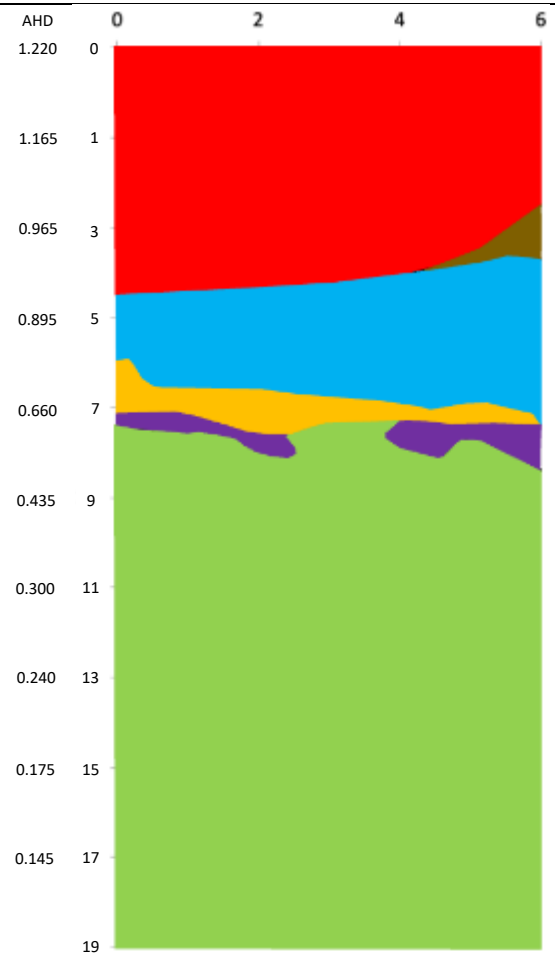
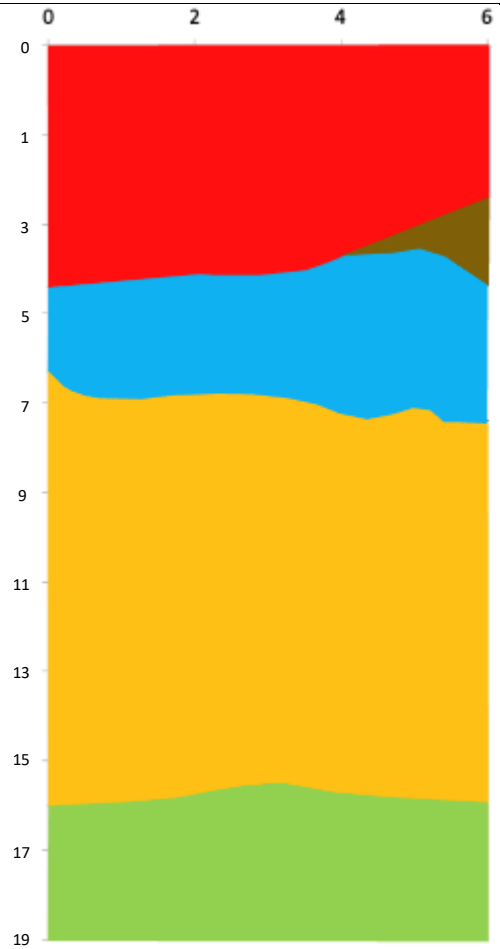
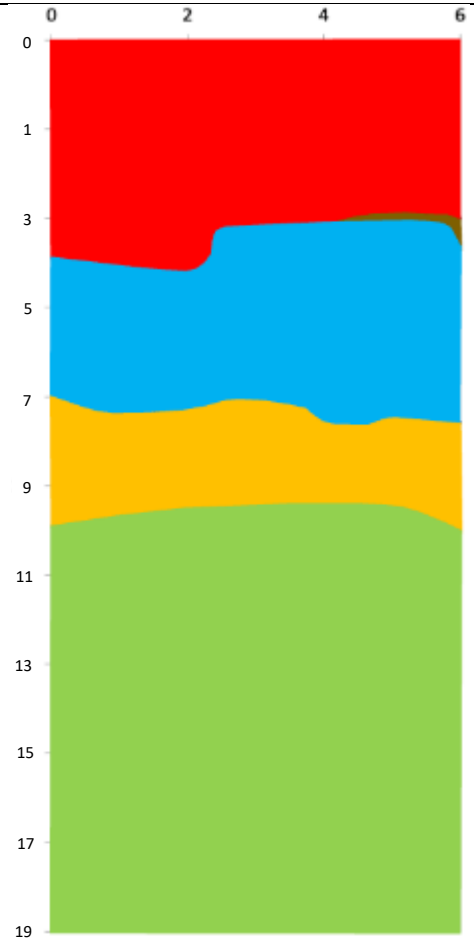

| | |
|---|---|
| | **RG** + CW + AV + HY + AL + CS + BS + Little BJ |
| | **BJ** + CW + JK + AL |
| | **JK** + SQ + Little BJ |
| | **BM + CW** + PN + SD + SP + AD (All mangroves in low density) |
| | **SQ** + BM |
| | **SQ** + BM + Very sparse SD + SP |
| | **BM + SP** + PN + SD + BM + Sparse SQ |
| | **BM + PN + AD** + SD + SP + Very sparse SQ |

## 3



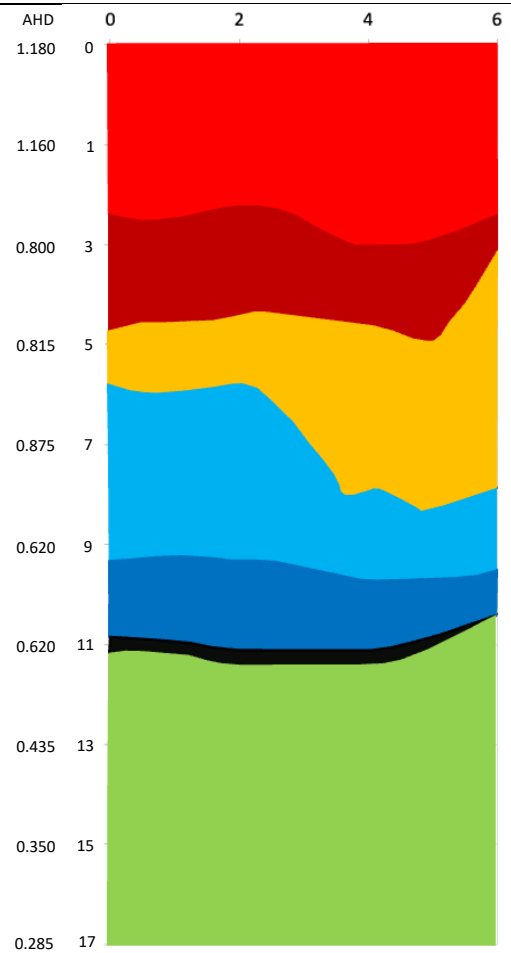

| | |
|---|---|
| | **RG** + CW + AV + HY + AL + CS + BJ + BM + CG |
| | **BJ** + JK + CW + AL + ML |
| | **JK** + BJ + BM + CW + SQ + CH |
| | **BM** + **CW** + PN + SD + SP + AD + CH + R |
| | **SQ + BM** + PN + SD + CW |
| | **SQ** + BM + CH + Sparse SD +SP |
| | **BM + SP** + PN + SD + CH + SQ + BM |
| | **BM + PN + AD** + SD + SP + Very sparse SQ + CH |

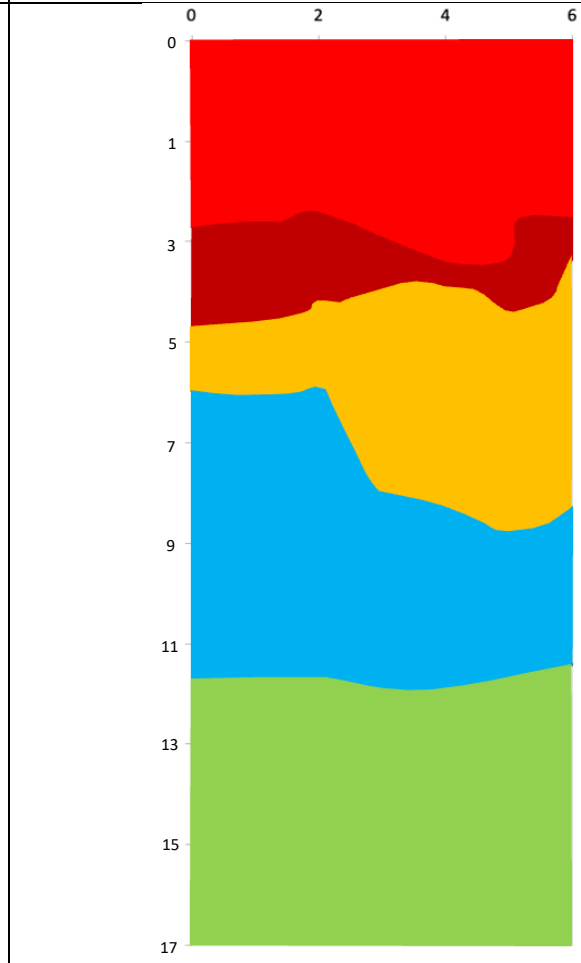
# CUP2-R– Transect Mosaic

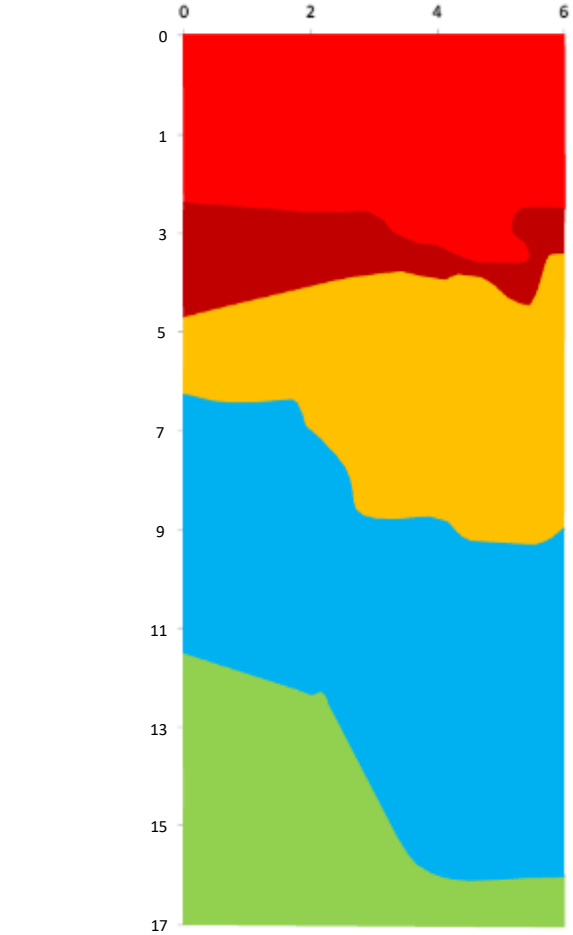
| 1 | 2 | 3 |
|---|---|---|
|  |  |  |
| **BG** + TT + WM + CW | **BG** + CW + TT + WM + PS + NS | **BG** + CW + TT + WM + OP |
| **BM** + CW | **BM + CW** + CH | **CW + BM** + CH |
| **SA** | **SA** + Little SQ | **SA** |
| **ZW + CW** + PN + SD | **ZW** covering PN + SD + SP + SQ | **ZW** covering PN + SD + SP + D + R |
| **SQ** + PN + SD | **BM + PN + SD** + SP + Little ZW | **BM + PN + SD** + SP + D + ZW + CH |
| **BM + PN + SD** + ZW | | |

# CUP2-I – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



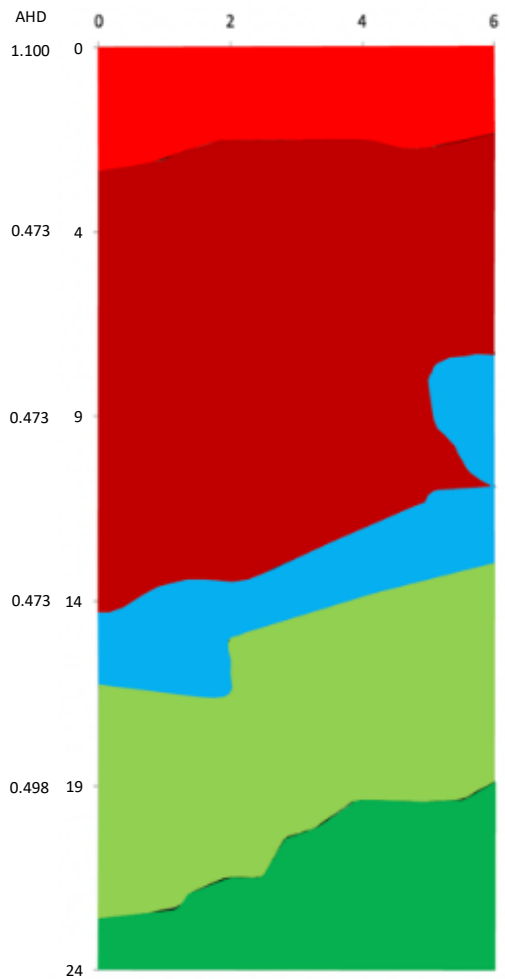

| | |
|---|---|
| | **BG** + RG + TT + AB + NS + CD |
| | **BM** + AD + SQ |
| | **SA** + JK + AD |
| | **ZW** Covering SQ + SA + PN +SD + SP |
| | **BM + SQ** + SA + PN + SD + SP |
| | **ZW** |
| | **BM** + PN + SD + SP |

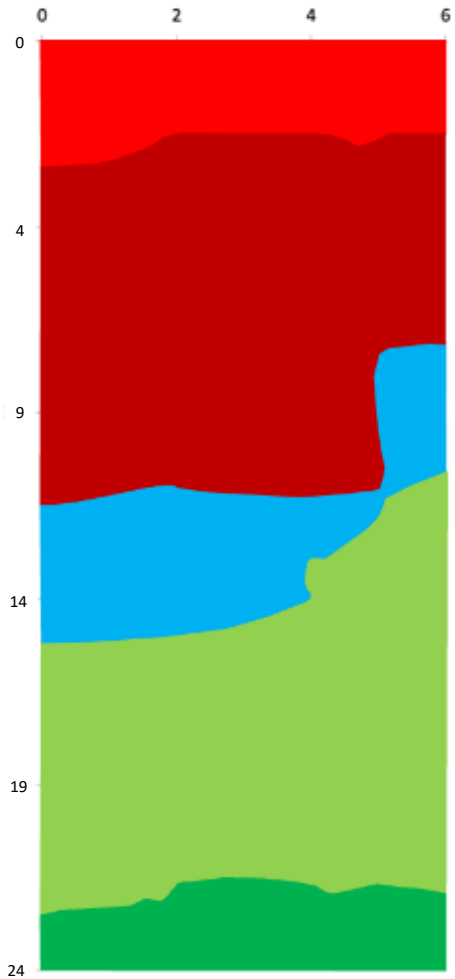
| | |
|---|---|
| | **BG** + RG + CW + NS + Dead AB + PS |
| | **BM + CW** + CH + D |
| | **SA** + CW + JK + SQ + SP + AD |
| | Dense **ZW** covering SA + SD + SP + SQ + D |
| | **BM** + PN + SD + SP + CH + ZW |

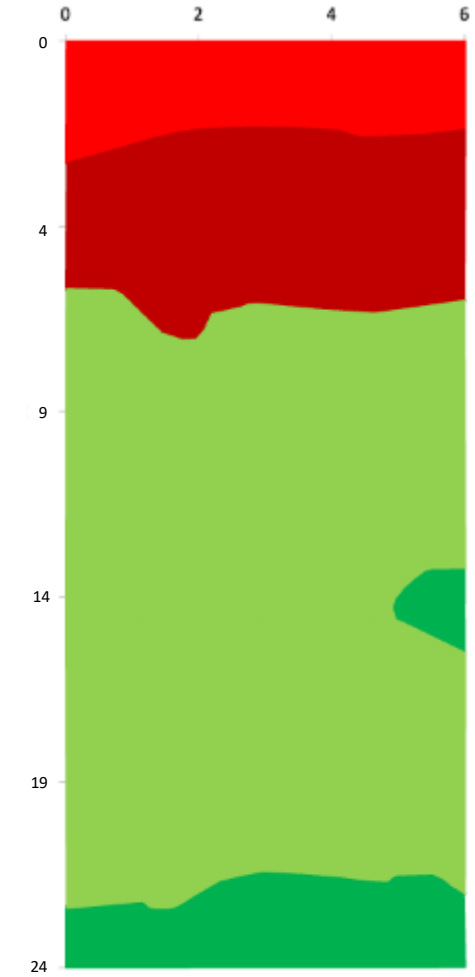
| | |
|---|---|
| | **BG** + RG + OP + WM + NS + SQ + CW + TT |
| | **CW + BM** + D + CH + Some PN |
| | **SA** + SD + SP + SQ + JK |
| | Dense **ZW** covering SA + SD + SP + SQ + D |
| | **BM** + **SD** + P + SP + CH + BM + ZW + D |

# CDN1-R – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



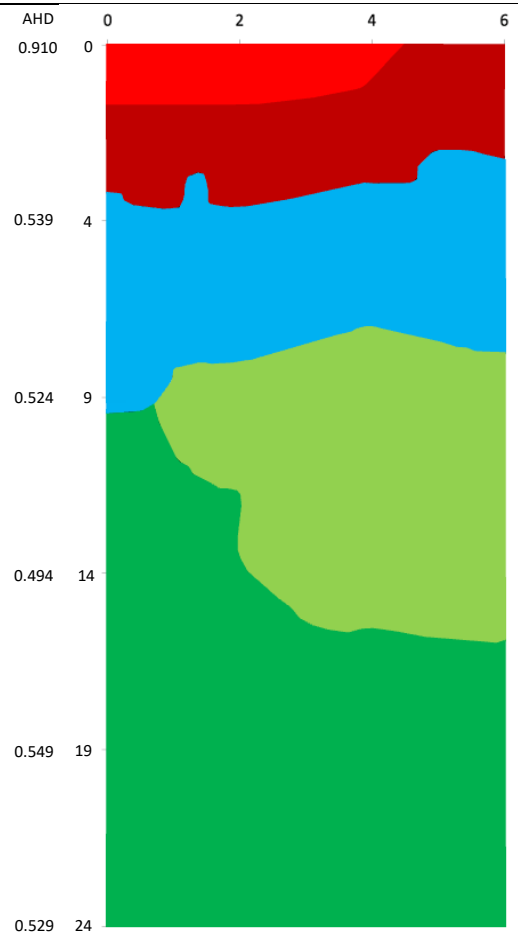

| | |
|---|---|
| | **CD** + JK + C + CW |
| | **SQ** + BM + CH |
| | **SQ** + **PN** + BM + some SD |
| | **SQ** + **PN** + **SD** + SP + BM + Iso AD |
| | **BM** + **PN** + **SD** + **AD** + SP |

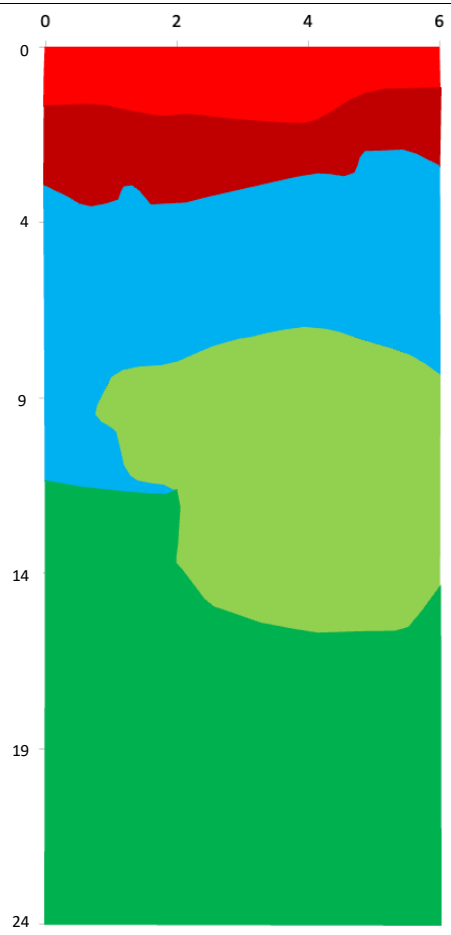
| | |
|---|---|
| | **CD** + JK + C + CW + WM |
| | **SQ** + BM + CH + Iso SD + D |
| | **SQ** + **PN** + BM + CH + D + CW |
| | **SQ** + **PN** + **SD** + SP + BM + CH + Iso AD |
| | **BM** + **PN** + **SD** + **AD** + SP + CW + ZW + D + CH |

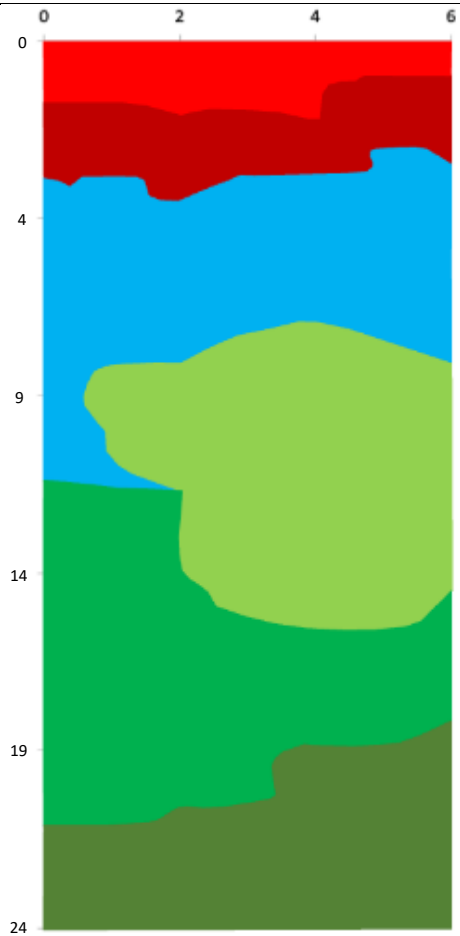
| | |
|---|---|
| | **CD** + JK + C + CW + WM + TT |
| | **SQ** + BM + CH + SD + D |
| | **SQ** + **PN** + **SD** + SP + BM + CH + D |
| | **BM** + **PN** + **SD** + **AD** + SP + CW + D + CH |

# CDN1-I – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|



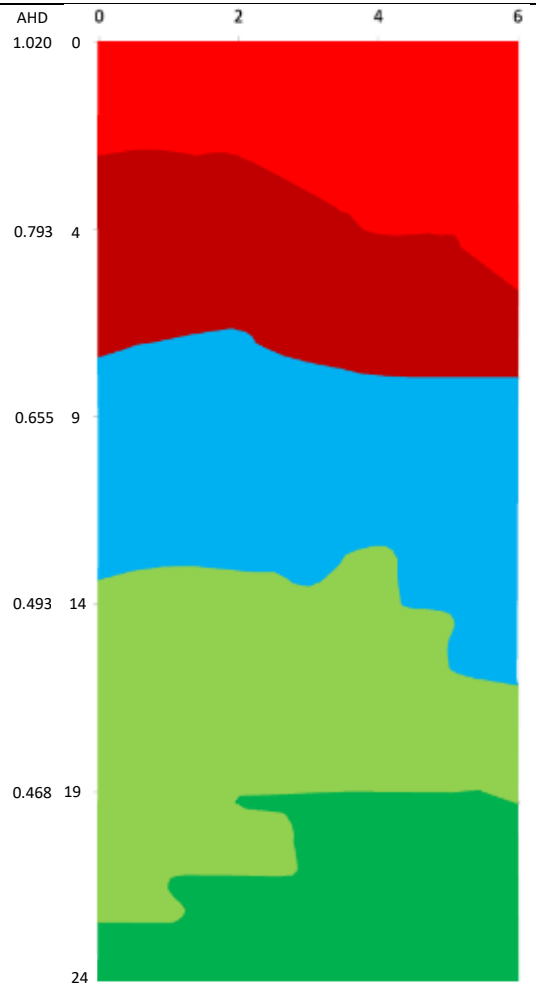
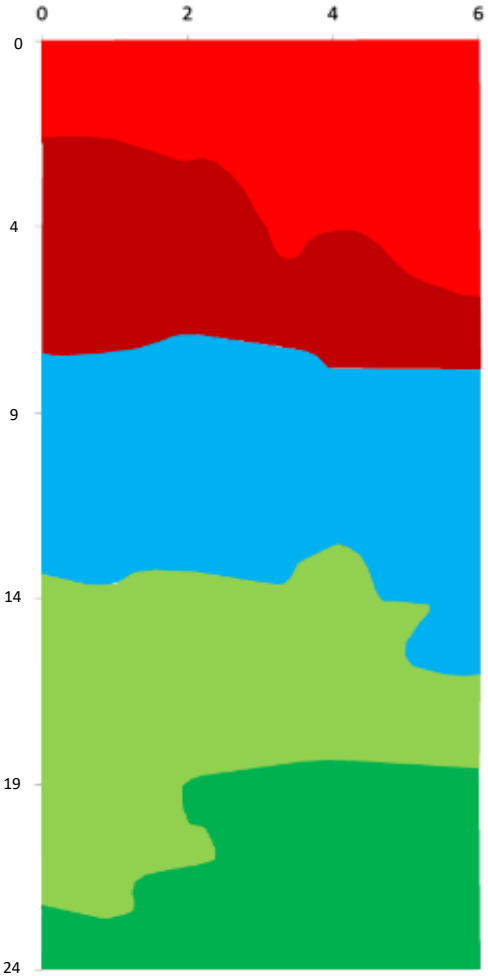
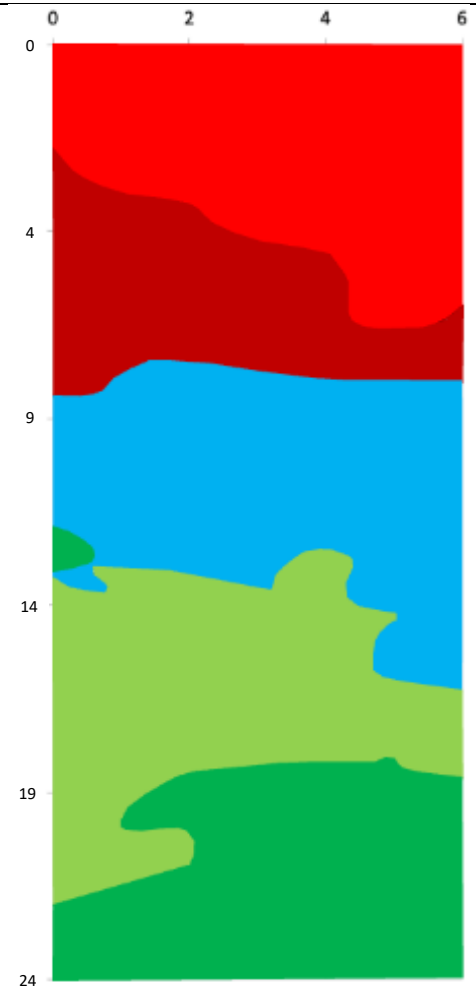




| | |
|---|---|
| | **CW** + CD + JK + EW |
| | **JK + SQ** + CW + EW + R |
| | **BM + SQ + PN** + Iso AD + SP |
| | **BM + AD** + PN + SP + SD + sparse SQ |
| | **BM + PN + SD + SP** + AD + sparse SQ |

| | |
|---|---|
| | **CD + CW** + EW + D + JK |
| | **JK + SQ** + CW + EW + R + PN |
| | **BM + SQ + PN** + Very sparse SD + SP + Iso AD |
| | **BM + AD** + PN + SD + SP + Very sparse SQ |
| | **BM + PN + SD + SP** + AD + CH + SQ |

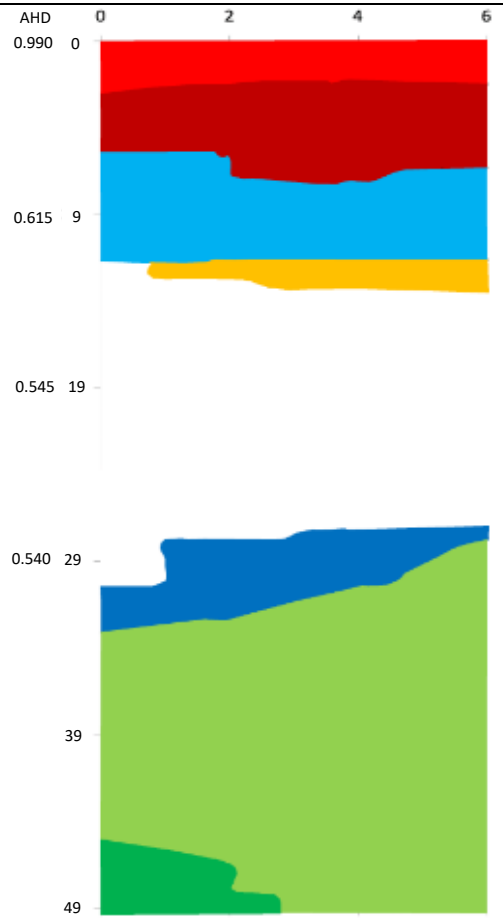
| | |
|---|---|
| | **CD + CW** + EW + D + JK |
| | **JK + SQ** + CW + EW + R + PN |
| | **BM + SQ + PN + SD** + CH + SP + Iso AD |
| | **BM + AD** + PN + SD + SP + Very sparse SQ |
| | **BM + PN + SD + SP** + AD + BM + CH + SQ |
| | Dense **ZW** + PN + SD + SP + AD + BM + CH + Little SQ |

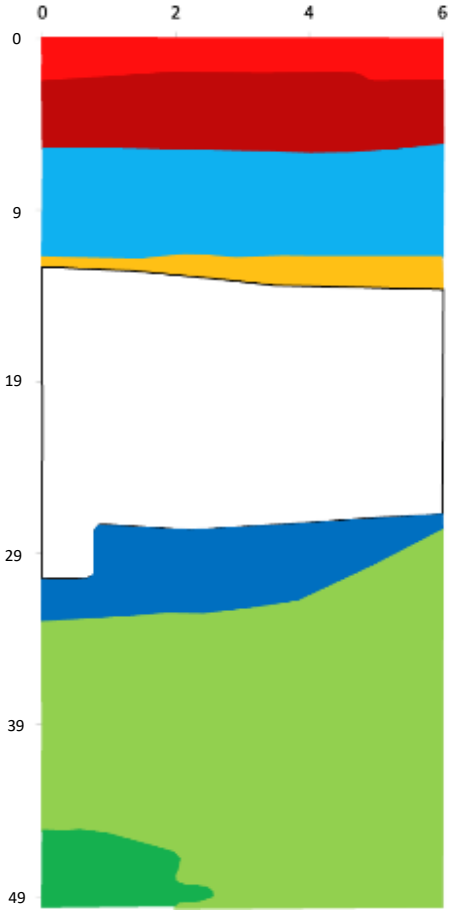
# CDN2-R – Transect Mosaic

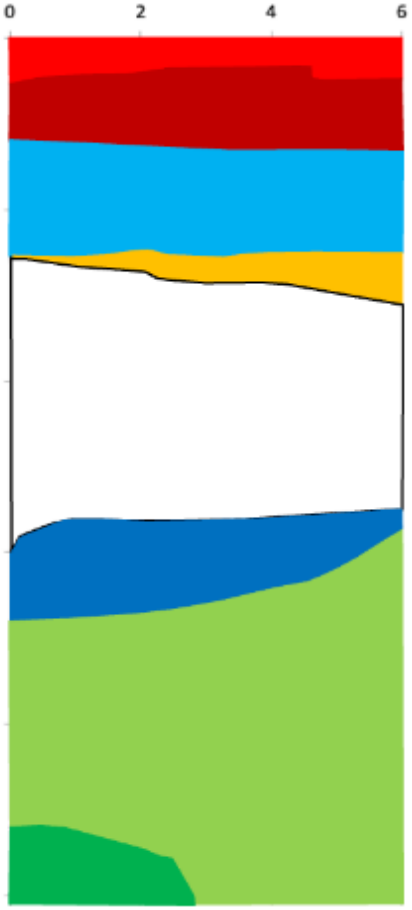
| 1 | 2 | 3 |
|---|---|---|
|  |  |  |
| **CD** + RG + TT + IC + CA + SO<br>**SQ** + D + SA + SP<br>**SQ + BM** + SD + SP + AD<br>**BM**<br>**BM** + **AD** + PN + SD + SP | **RG + CD** + TT + IC + CA<br>**SQ** + D + SA + SD + SP<br>**SQ + BM** + SD + SP + Iso AD + CH<br>**BM** + CH<br>**BM + AD** + CH + PN + SD + SP | **RG + CD** + **CA** + TT + Edging SQ + IC<br>**SQ** + D + SA + ZW + SD + SP + R<br>**SQ + BM** + SD + SP + Iso AD + CH<br>**BM** + CH + SD<br>**BM + AD** + **SD** + PN + SP + CH |

# CDN2-I – Transect Mosaic

| 1 | 2 | 3 |
|---|---|---|




| | |
|---|---|
| | **RG + CW** + JK + AL + C + GH + ALT |
| | **JK** |
| | **JK + SQ** + PN + SD + SP |
| | **BM + SQ + PN + SD + SP** |
| | **SQ** + PN |
| | **BM + SD** + SQ + PN + SP |
| | **BM + PN + SD + SP** + AD + SQ |
| | **BM + AD** + PN + SD + SP |

| | |
|---|---|
| | **RG** + CW + JK + AL + C + ALT + BS + HD + CS |
| | **JK** |
| | **JK + SQ** + PN + SD + SP + BM |
| | **BM + PN + SD + SP** + SQ |
| | **SQ** + BM + PN |
| | **BM + SD + SP** + PN + SQ + CH |
| | **BM + PN + SD + SP** + AD + CH + SQ |
| | **BM + AD** + PN + SD + SP |

| | |
|---|---|
| | **RG** + CW + JK + AL + C + ALT + BS + HD + CS + HY |
| | **JK** |
| | **JK + SQ** + PN + SD + SP + BM |
| | **BM + PN + SD + SP** + CH + SQ |
| | **SQ** + PN + SD + CH + BM |
| | **BM + SD + SP** + PN + SQ + CH |
| | **BM + PN + SD + SP** + AD + CH + SQ |
| | **BM + AD** + PN + SD + SP |

# APPENDIX C-6

# SIX-MONTHLY
# INTERTIDAL TRANSECT RIPARIAN DRIP LINE MEASUREMENTS

| Biannual Intertidal Transect Riparian Drip Line Measurements | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | 1 | | | | 2 | | | | 3 | | | |
| | Transect | | | | Transect | | | | Transect | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| CUP1-I | 12.1 | 12.2 | 12.1 | 13.4 | 12.2 | 12.3 | 11.9 | 13.4 | 12.3 | 12.1 | 11.8 | 13.8 |
| CUP1-R | 11.4 | 10.8 | 10.9 | 10 | 11.7 | 10.5 | 11 | 10.5 | 14 | 12.4 | 12.1 | 8.9 |
| CUP2-I | 8 | 8.3 | 8.7 | 7.7 | 8.1 | 8.4 | 8.5 | 7.4 | 8.1 | 8.4 | 8.8 | 7.6 |
| CUP2-R | 11.3 | 6.8 | 6.7 | 7.8 | 11.2 | 10.6 | 5.8 | 7.9 | 11.2 | 10.3 | 6.4 | 7.8 |
| BB1-I | 18.5 | 18.2 | 17.5 | 17.7 | 18.9 | 18.3 | 17.7 | 17.8 | 21 | 21 | 21 | 21 |
| BB1-R | 10.5 | 7.3 | 8.6 | 11.9 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| BB2-I | 6.9 | 5.6 | 3.7 | 6.3 | 6.9 | 5.6 | 3.9 | 10.4 | 7.5 | 6 | 4.7 | 6.3 |
| BB2-R | 11 | 11 | 11.4 | 11 | 15.5 | 15 | 11.9 | 11.2 | 16.8 | 11.2 | 11.7 | 11.3 |
| SWB1-I | 25 | 27.3 | 29 | 27 | 25.6 | 26.9 | 28.9 | 27.3 | 25.5 | 28.1 | 26.1 | 28.7 |
| SWB1-R | 14.2 | 13.2 | 12.6 | 19.1 | 22.9 | 14.1 | 21.4 | 23.5 | 23.3 | 23 | 24.1 | 24.1 |
| SWB2-I | 20.2 | 18.6 | 17.9 | 18 | 22.1 | 19.2 | 18.2 | 18.7 | 22 | 19.6 | 19.2 | 19.9 |
| SWB2-R | 12.2 | 15.1 | 14.5 | 14.3 | 12.9 | 15.1 | 16.3 | 15.5 | - | - | - | - |
| SEB1-I | 11.6 | 10 | 10.5 | 9.8 | 11.5 | 10 | 10.2 | 9.5 | 11.8 | 10.1 | 10.6 | 10 |
| SEB1-R | 9.6 | 9.3 | 11.1 | 2.6 | 10.3 | 9.5 | 11.2 | 0 | 10.5 | 10 | 11.6 | 13 |
| SEB2-I | 4.5 | 7.5 | 7.6 | 9.2 | 4.9 | 4.7 | 8.2 | 10.4 | 6.2 | 8.4 | 9.1 | 10.8 |
| SEB2-R | 8.4 | 9.1 | 8.9 | 8.7 | 8.6 | 9.2 | 8.9 | 9.2 | 9.1 | 9.7 | 9.1 | 10 |
| CDN1-I | 5.3 | 5.6 | 5.5 | 3.5 | 5.6 | 5.5 | 5.3 | 3.5 | 4.5 | 6.2 | 5.3 | 4.4 |
| CDN1-R | 4.4 | 3.5 | 3.6 | 2.7 | 4.5 | 3.6 | 4.8 | 2.7 | 5.1 | 4.3 | 3.8 | 2.9 |
| CDN2-I | 1.8 | 1.5 | 0 | 1.6 | 2 | 1.8 | 0 | 0 | 3.5 | 2.8 | 1.5 | 2.2 |
| CDN2-R | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 1.3 | 0 | 0 | 1.1 | 1.4 |

# APPENDIX C7

# PRE & POST WET WEATHER SITE CHECKS

**SEB2-R** – Looking up transect 1







**SEB2-R** – Looking down transect 1





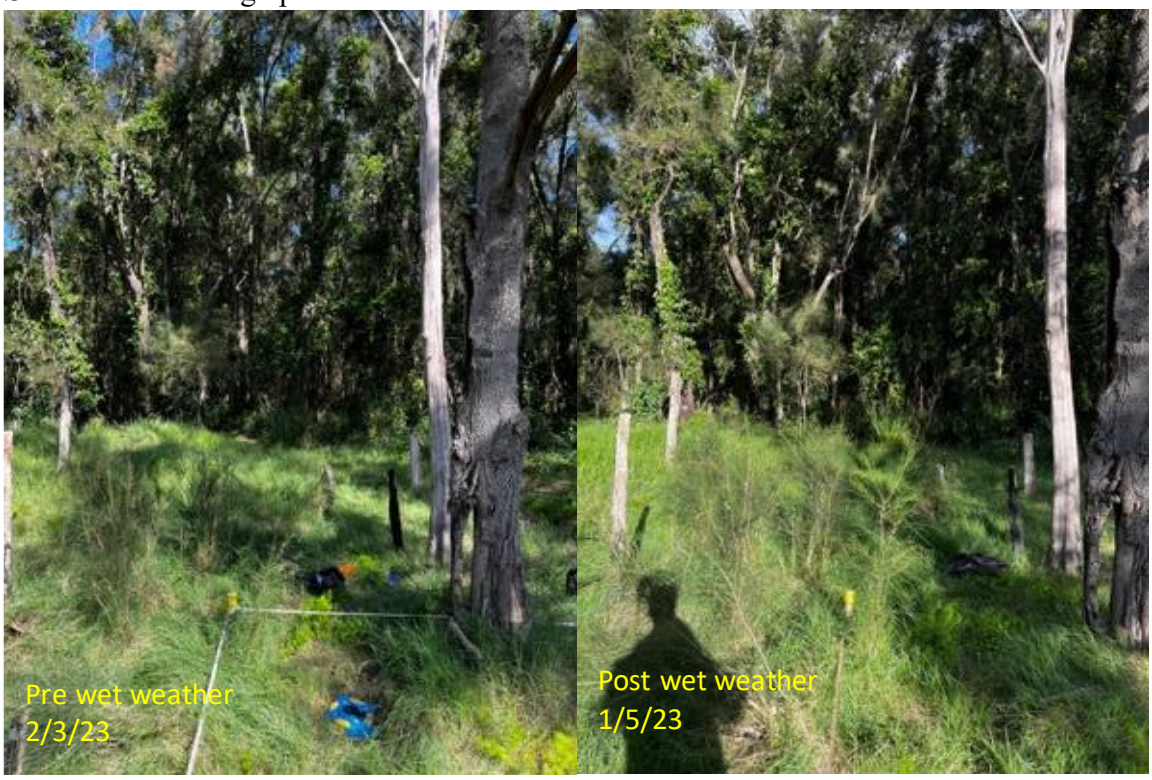

**SEB2-R** – Looking up transect 4




**SEB2-R** – Looking down transect 4



**SEB2-I** – Looking up transect 1




**SEB2-I** – Looking down transect 1



**SEB2-I** – Looking up transect 4







**SEB2-I** – Looking down transect 4






**SWB2-I –** Looking up transect 1




**SWB2-I** – Looking down transect 1



**SWB2-I** – Looking up transect 4




**SWB2-I** – Looking down transect 4



**SWB2-R** – Looking up transect 1




**SWB2-R** – Looking down transect 1



**SWB2-R** – Looking up transect 4




**SWB2-R** – Looking down transect 4



# APPENDIX C8

# TRANSECT SITE PHOTOS

## CUP1-I Transect 1 Site photos

Looking up transect 1

16/5/23



24/8/23



18/4/24



Photos not taken

Looking down transect 1

16/5/23



24/8/23



18/4/24



Photos not taken

## CUP1-R Transect 1 Site photos

Looking up transect 1

Photos not taken

4/5/23



22/8/23



17/4/24



Looking down transect 1

Photos not taken

4/5/23



22/8/23



17/4/24



## CUP2-I Transect 1 Site photos

**Looking up transect 1**

4/5/23



23/8/23



18/4/24



Photos not taken

**Looking down transect 1**

4/5/23



23/8/23



18/4/24



Photos not taken

## CUP2-R Transect 1 Site photos

Looking up transect 1

3/3/23



4/5/23



23/8/23



18/4/24



Looking down transect 1

3/3/23



4/5/23



23/8/23



18/4/24



## BB1-I Transect 1 Site photos

Looking up transect 1

12/4/23



5/5/23



22/8/23



17/4/24



Looking down transect 1

12/4/23



5/5/23



22/8/23



17/4/24



## BB1-R Transect 1 Site photos

Looking up transect 1

12/4/23



5/5/23



22/8/23



17/4/24



Looking down transect 1

12/4/23



5/5/23



22/8/23



17/4/24



## BB2-I Transect 1 Site photos

Looking up transect 1

12/4/23



3/5/23



21/8/23



17/4/24



Looking down transect 1

12/4/23



3/5/23



21/8/23



17/4/24



## BB2-R Transect 1 Site photos

Looking up transect 1

29/3/23



3/5/23



21/8/23



17/4/24



Looking down transect 1

29/3/23



3/5/23



21/8/23



17/4/24



## SWB1-I Transect 1 Site photos

Looking up Transect 1

21/3/23



2/5/23



3/8/23



16/4/24



Looking down transect 1

21/3/23



2/5/23



3/8/23



16/4/24



## SWB1-R Transect 1 Site photos

Looking up transect 1

21/3/23



2/5/23



3/8/23



16/4/24



Looking down transect 1

21/3/23



2/5/23



3/8/23



16/4/24



## SWB2-I Transect 1 Site photos

Looking up transect 1

6/3/23



2/5/23



2/8/23



15/4/24



Looking down transect 1

6/3/23



2/5/23



2/8/23



15/4/24



## SWB2-R Transect 1 Site photos

Looking up transect 1

20/3/23



2/5/23



24/8/23



16/4/24



Looking down transect 1

20/3/23



2/5/23



24/8/23



16/4/24



## SEB1-I Transect 1 Site photos

**Looking up transect 1**

1/3/23



Photos not taken – Camera broken

31/7/23



8/4/24



**Looking down transect 1**

1/3/23



Photos not taken – Camera broken

31/7/23



8/4/24



## SEB1-R Transect 1 Site photos

**Looking up transect 1**

2/3/23



Photos not taken – Camera broken

1/8/23



11/4/24



**Looking down transect 1**

2/3/23



Photos not taken – Camera broken

1/8/23



11/4/24



## SEB2-I Transect 1 Site photos

Looking up transect 1

2/2/23



1/5/23



1/8/23



15/4/24



Looking down transect 1

2/2/23



1/5/23



1/8/23



15/4/24



## SEB2-R Transect 1 Site photos

Looking up Transect 1

2/2/23



1/5/23



1/8/23



11/4/24



Looking down transect 1

2/2/23



1/5/23



1/8/23



11/4/24



## CDN1-I Transect 1 Site photos

Looking up transect 1

28/2/23



24/5/23



25/8/23



22/4/24



Looking down transect 1

28/2/23



24/5/23



25/8/23



22/4/24



## CDN1-R Transect 1 Site photos

Looking up transect 1

28/2/23



24/5/23



25/8/23



22/4/24



Looking down transect 1

28/2/23



24/5/23



25/8/23



22/4/24



## CDN2-I Transect 1 Site photos

Looking up transect 1

27/2/23



17/5/23



24/8/23



22/4/24



Looking down transect 1

27/2/23



17/5/23



24/8/23



22/4/24



## CDN2-R Transect 1 Site photos

Looking up transect 1

27/2/23



17/5/23



25/9/23



22/4/24



Looking down transect 1

27/2/23



17/5/23



25/9/23



22/4/24



# APPENDIX D
# BIMONTHLY
# SUBTIDAL SEAGRASS MONITORING DATA

## Crookhaven River & Estuary Subtidal Seagrass Data

| Site | Term | Rep | # leaves | Foil weight | Dry Weight | Ash Weight | Actual Dry | Actual Ash | Total Organic | Leaf Length | Leaf Area | Sediment Weight (cm^2) | Algae Weight (cm^2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CDN1 | Pilot | 1 | 20 | 2.53 | 1.85 | 3.51 | 1.07 | 0.98 | 0.09 | 25 | 30 | 0.00163 | 0.00015 |
| CDN1 | Pilot | 2 | 20 | 2.66 | 1.89 | 3.68 | 1.11 | 1.02 | 0.09 | 25 | 30 | 0.00170 | 0.00015 |
| CDN2 | Pilot | 1 | 20 | 2.97 | 3.10 | 5.13 | 2.33 | 2.16 | 0.17 | 25 | 30 | 0.00360 | 0.00028 |
| CDN2 | Pilot | 2 | 19 | 2.66 | 1.81 | 3.58 | 1.03 | 0.92 | 0.11 | 25 | 30 | 0.00161 | 0.00019 |
| CUP1 | Pilot | 1 | 17 | 2.71 | 1.96 | 3.69 | 1.23 | 0.98 | 0.25 | 25 | 30 | 0.00192 | 0.00049 |
| CUP1 | Pilot | 2 | 18 | 2.44 | 1.75 | 3.16 | 0.98 | 0.72 | 0.26 | 25 | 30 | 0.00133 | 0.00048 |
| CUP2 | Pilot | 1 | 20 | 2.91 | 2.37 | 4.27 | 1.61 | 1.36 | 0.25 | 25 | 30 | 0.00227 | 0.00042 |
| CUP2 | Pilot | 2 | 20 | 3.05 | 2.24 | 4.26 | 1.47 | 1.21 | 0.26 | 25 | 30 | 0.00202 | 0.00043 |
| BB1 | Pilot | 1 | 20 | 2.57 | 5.72 | 7.15 | 4.96 | 4.58 | 0.38 | 25 | 30 | 0.00763 | 0.00063 |
| BB1 | Pilot | 2 | 20 | 2.70 | 3.70 | 5.43 | 2.98 | 2.73 | 0.25 | 25 | 30 | 0.00455 | 0.00042 |
| BB2 | Pilot | 1 | 20 | 2.72 | 2.45 | 4.28 | 1.67 | 1.56 | 0.11 | 25 | 30 | 0.00260 | 0.00018 |
| BB2 | Pilot | 2 | 20 | 2.44 | 3.18 | 4.53 | 2.46 | 2.09 | 0.37 | 25 | 30 | 0.00348 | 0.00062 |
| SWB1 | Pilot | 1 | 18 | 2.60 | 6.26 | 6.22 | 5.50 | 3.62 | 1.88 | 25 | 30 | 0.00670 | 0.00348 |
| SWB1 | Pilot | 2 | 20 | 2.46 | 8.27 | 9.55 | 7.54 | 7.09 | 0.45 | 25 | 30 | 0.01182 | 0.00075 |
| SWB2 | Pilot | 1 | 13 | 2.70 | 5.65 | 7.19 | 4.90 | 4.49 | 0.41 | 25 | 30 | 0.01151 | 0.00105 |
| SWB2 | Pilot | 2 | 20 | 2.41 | 4.68 | 6.22 | 3.97 | 3.81 | 0.16 | 25 | 30 | 0.00635 | 0.00027 |
| SEB1 | Pilot | 1 | 20 | 2.06 | 2.03 | 3.21 | 1.30 | 1.15 | 0.15 | 25 | 30 | 0.00192 | 0.00025 |
| SEB1 | Pilot | 2 | 20 | 2.50 | 3.88 | 5.20 | 3.11 | 2.70 | 0.41 | 25 | 30 | 0.00450 | 0.00068 |
| SEB2 | Pilot | 1 | 19 | 2.11 | 1.79 | 3.06 | 1.06 | 0.95 | 0.11 | 25 | 30 | 0.00167 | 0.00019 |
| SEB2 | Pilot | 2 | 20 | 2.47 | 2.09 | 3.61 | 1.33 | 1.14 | 0.19 | 25 | 30 | 0.00190 | 0.00032 |
| CDN1 | Term_1 | 1 | 16 | 2.42 | 7.86 | 7.26 | 5.44 | 4.84 | 0.60 | 30 | 36 | 0.00840 | 0.00104 |
| CDN1 | Term_1 | 2 | 16 | 2.71 | 6.47 | 5.96 | 3.76 | 3.25 | 0.51 | 30 | 36 | 0.00564 | 0.00089 |
| CDN1 | Term_1 | 3 | 16 | 2.76 | 7.73 | 7.12 | 4.97 | 4.36 | 0.61 | 30 | 36 | 0.00757 | 0.00106 |
| CDN2 | Term_1 | 1 | 16 | 2.46 | 5.82 | 5.30 | 3.36 | 2.84 | 0.52 | 30 | 36 | 0.00493 | 0.00090 |
| CDN2 | Term_1 | 2 | 16 | 2.54 | 6.32 | 5.80 | 3.78 | 3.26 | 0.52 | 30 | 36 | 0.00566 | 0.00090 |
| CDN2 | Term_1 | 3 | 16 | 2.98 | 6.37 | 5.82 | 3.39 | 2.84 | 0.55 | 30 | 36 | 0.00493 | 0.00095 |
| CUP1 | Term_1 | 1 | 16 | 3.11 | 4.29 | 4.18 | 1.18 | 1.07 | 0.11 | 30 | 36 | 0.00186 | 0.00019 |
| CUP1 | Term_1 | 2 | 16 | 3.06 | 4.78 | 4.51 | 1.72 | 1.45 | 0.27 | 30 | 36 | 0.00252 | 0.00047 |
| CUP1 | Term_1 | 3 | 15 | 3.18 | 5.76 | 5.34 | 2.58 | 2.16 | 0.42 | 30 | 36 | 0.00400 | 0.00078 |
| CUP2 | Term_1 | 1 | 16 | 2.75 | 3.85 | 3.63 | 1.10 | 0.88 | 0.22 | 30 | 36 | 0.00153 | 0.00038 |
| CUP2 | Term_1 | 2 | 16 | 2.57 | 3.63 | 3.40 | 1.06 | 0.83 | 0.23 | 30 | 36 | 0.00144 | 0.00040 |
| CUP2 | Term_1 | 3 | 16 | 2.62 | 3.72 | 3.50 | 1.10 | 0.88 | 0.22 | 30 | 36 | 0.00153 | 0.00038 |
| BB1 | Term_1 | 1 | 16 | 2.08 | 5.09 | 4.76 | 3.01 | 2.68 | 0.33 | 30 | 36 | 0.00465 | 0.00057 |
| BB1 | Term_1 | 2 | 16 | 3.00 | 9.44 | 8.93 | 6.44 | 5.93 | 0.51 | 30 | 36 | 0.01030 | 0.00089 |
| BB1 | Term_1 | 3 | 16 | 2.34 | 5.48 | 5.14 | 3.14 | 2.80 | 0.34 | 30 | 36 | 0.00486 | 0.00059 |
| BB2 | Term_1 | 1 | 16 | 2.13 | 3.60 | 3.27 | 1.47 | 1.14 | 0.33 | 30 | 36 | 0.00198 | 0.00057 |
| BB2 | Term_1 | 2 | 16 | 2.67 | 4.59 | 4.29 | 1.92 | 1.62 | 0.30 | 30 | 36 | 0.00281 | 0.00052 |
| BB2 | Term_1 | 3 | 16 | 2.78 | 4.20 | 3.95 | 1.42 | 1.17 | 0.25 | 30 | 36 | 0.00203 | 0.00043 |
| SWB1 | Term_1 | 1 | | | | | | | | | | | |
| SWB1 | Term_1 | 2 | | | | | | | | | | | |
| SWB1 | Term_1 | 3 | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWB2 | Term_1 | 1 | 16 | 2.70 | 5.62 | 5.22 | 2.92 | 2.52 | 0.40 | 30 | 36 | 0.00438 | 0.00069 |
| SWB2 | Term_1 | 2 | 16 | 2.51 | 6.86 | 6.30 | 4.35 | 3.79 | 0.56 | 30 | 36 | 0.00658 | 0.00097 |
| SWB2 | Term_1 | 3 | 16 | 2.65 | 7.61 | 6.98 | 4.96 | 4.33 | 0.63 | 30 | 36 | 0.00752 | 0.00109 |
| SEB1 | Term_1 | 1 | 12 | 2.70 | 5.93 | 5.42 | 3.23 | 2.72 | 0.51 | 30 | 36 | 0.00630 | 0.00118 |
| SEB1 | Term_1 | 2 | 16 | 2.48 | 7.75 | 6.91 | 5.27 | 4.43 | 0.84 | 30 | 36 | 0.00769 | 0.00146 |
| SEB1 | Term_1 | 3 | 16 | 2.90 | 7.35 | 5.64 | 4.45 | 2.74 | 1.71 | 30 | 36 | 0.00476 | 0.00297 |
| SEB2 | Term_1 | 1 | 16 | 2.67 | 5.54 | 5.06 | 2.87 | 2.39 | 0.48 | 30 | 36 | 0.00415 | 0.00083 |
| SEB2 | Term_1 | 2 | 16 | 2.47 | 5.78 | 5.22 | 3.31 | 2.75 | 0.56 | 30 | 36 | 0.00477 | 0.00097 |
| SEB2 | Term_1 | 3 | 16 | 3.03 | 6.83 | 6.31 | 3.80 | 3.28 | 0.52 | 30 | 36 | 0.00569 | 0.00090 |
| CDN1 | Term_2 | 1 | 16 | 1.69 | 5.98 | 5.66 | 4.29 | 3.97 | 0.32 | 30 | 36 | 0.00689 | 0.00056 |
| CDN1 | Term_2 | 2 | 15 | 1.69 | 4.41 | 4.23 | 2.72 | 2.54 | 0.18 | 30 | 36 | 0.00470 | 0.00033 |
| CDN1 | Term_2 | 3 | 16 | 1.69 | 4.66 | 4.42 | 2.97 | 2.73 | 0.24 | 30 | 36 | 0.00474 | 0.00042 |
| CDN2 | Term_2 | 1 | 17 | 1.70 | 10.34 | 9.94 | 8.64 | 8.24 | 0.40 | 30 | 36 | 0.01346 | 0.00065 |
| CDN2 | Term_2 | 2 | 15 | 1.70 | 8.65 | 8.32 | 6.95 | 6.62 | 0.33 | 30 | 36 | 0.01226 | 0.00061 |
| CDN2 | Term_2 | 3 | 16 | 1.70 | 5.34 | 5.08 | 3.64 | 3.38 | 0.26 | 30 | 36 | 0.00587 | 0.00045 |
| CUP1 | Term_2 | 1 | 16 | 1.70 | 3.51 | 3.28 | 1.81 | 1.58 | 0.23 | 30 | 36 | 0.00274 | 0.00040 |
| CUP1 | Term_2 | 2 | 16 | 1.70 | 3.86 | 3.57 | 2.16 | 1.87 | 0.29 | 30 | 36 | 0.00325 | 0.00050 |
| CUP1 | Term_2 | 3 | 12 | 1.70 | 2.60 | 2.46 | 0.90 | 0.76 | 0.14 | 30 | 36 | 0.00176 | 0.00032 |
| CUP2 | Term_2 | 1 | 15 | 1.70 | 2.80 | 2.60 | 1.10 | 0.90 | 0.20 | 30 | 36 | 0.00167 | 0.00037 |
| CUP2 | Term_2 | 2 | 16 | 1.70 | 3.16 | 2.92 | 1.46 | 1.22 | 0.24 | 30 | 36 | 0.00212 | 0.00042 |
| CUP2 | Term_2 | 3 | 16 | 1.68 | 2.84 | 2.63 | 1.16 | 0.95 | 0.21 | 30 | 36 | 0.00165 | 0.00036 |
| BB1 | Term_2 | 1 | 16 | 1.72 | 3.47 | 3.24 | 1.75 | 1.52 | 0.23 | 30 | 36 | 0.00264 | 0.00040 |
| BB1 | Term_2 | 2 | 16 | 1.71 | 3.25 | 3.06 | 1.54 | 1.35 | 0.19 | 30 | 36 | 0.00234 | 0.00033 |
| BB1 | Term_2 | 3 | 16 | 1.70 | 3.09 | 2.92 | 1.39 | 1.22 | 0.17 | 30 | 36 | 0.00212 | 0.00030 |
| BB2 | Term_2 | 1 | 15 | 1.70 | 4.87 | 4.45 | 3.17 | 2.75 | 0.42 | 30 | 36 | 0.00509 | 0.00078 |
| BB2 | Term_2 | 2 | 16 | 1.67 | 3.07 | 2.87 | 1.40 | 1.20 | 0.20 | 30 | 36 | 0.00208 | 0.00035 |
| BB2 | Term_2 | 3 | 16 | 1.67 | 4.82 | 4.43 | 3.15 | 2.76 | 0.39 | 30 | 36 | 0.00479 | 0.00068 |
| SWB1 | Term_2 | 1 | | | | | | | | | | | |
| SWB1 | Term_2 | 2 | | | | | | | | | | | |
| SWB1 | Term_2 | 3 | | | | | | | | | | | |
| SWB2 | Term_2 | 1 | 16 | 1.68 | 4.76 | 4.54 | 3.08 | 2.86 | 0.22 | 30 | 36 | 0.00497 | 0.00038 |
| SWB2 | Term_2 | 2 | 16 | 1.67 | 6.95 | 6.66 | 5.28 | 4.99 | 0.29 | 30 | 36 | 0.00866 | 0.00050 |
| SWB2 | Term_2 | 3 | 16 | 1.67 | 4.17 | 3.99 | 2.50 | 2.32 | 0.18 | 30 | 36 | 0.00403 | 0.00031 |
| SEB1 | Term_2 | 1 | 14 | 1.67 | 6.37 | 5.98 | 4.70 | 4.31 | 0.39 | 30 | 36 | 0.00855 | 0.00077 |
| SEB1 | Term_2 | 2 | 16 | 1.70 | 5.87 | 5.51 | 4.17 | 3.81 | 0.36 | 30 | 36 | 0.00661 | 0.00063 |
| SEB1 | Term_2 | 3 | 13 | 1.68 | 4.46 | 4.18 | 2.78 | 2.50 | 0.28 | 30 | 36 | 0.00534 | 0.00060 |
| SEB2 | Term_2 | 1 | 15 | 1.67 | 4.34 | 4.08 | 2.67 | 2.41 | 0.26 | 30 | 36 | 0.00446 | 0.00048 |
| SEB2 | Term_2 | 2 | 16 | 1.68 | 6.37 | 5.99 | 4.69 | 4.31 | 0.38 | 30 | 36 | 0.00748 | 0.00066 |
| SEB2 | Term_2 | 3 | 19 | 1.69 | 6.87 | 6.40 | 5.18 | 4.71 | 0.47 | 30 | 36 | 0.00689 | 0.00069 |
| CDN1 | Term_3 | 1 | 16 | 1.72 | 4.66 | 4.40 | 2.94 | 2.68 | 0.26 | 30 | 36 | 0.00465 | 0.00045 |
| CDN1 | Term_3 | 2 | 16 | 1.73 | 3.76 | 3.59 | 2.03 | 1.86 | 0.17 | 30 | 36 | 0.00323 | 0.00030 |
| CDN1 | Term_3 | 3 | 16 | 1.78 | 3.79 | 3.60 | 2.01 | 1.82 | 0.19 | 30 | 36 | 0.00316 | 0.00033 |
| CDN2 | Term_3 | 1 | 16 | 1.76 | 6.80 | 6.46 | 5.04 | 4.70 | 0.34 | 30 | 36 | 0.00816 | 0.00059 |
| CDN2 | Term_3 | 2 | 15 | 1.85 | 5.56 | 5.24 | 3.71 | 3.39 | 0.32 | 30 | 36 | 0.00628 | 0.00059 |
| CDN2 | Term_3 | 3 | 16 | 1.76 | 6.49 | 6.14 | 4.73 | 4.38 | 0.35 | 30 | 36 | 0.00760 | 0.00061 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CUP1 | Term_3 | 1 | 16 | 1.73 | 3.38 | dropped | 1.65 | | | 30 | 36 | | |
| CUP1 | Term_3 | 2 | 16 | 1.73 | 3.20 | 2.98 | 1.47 | 1.25 | 0.22 | 30 | 36 | 0.00217 | 0.00038 |
| CUP1 | Term_3 | 3 | 16 | 1.75 | 3.26 | 3.07 | 1.51 | 1.32 | 0.19 | 30 | 36 | 0.00229 | 0.00033 |
| CUP2 | Term_3 | 1 | 15 | 1.74 | 3.56 | 3.33 | 1.82 | 1.59 | 0.23 | 30 | 36 | 0.00294 | 0.00043 |
| CUP2 | Term_3 | 2 | 15 | 1.72 | 3.17 | 3.00 | 1.45 | 1.28 | 0.17 | 30 | 36 | 0.00237 | 0.00031 |
| CUP2 | Term_3 | 3 | 16 | 1.73 | 3.15 | 2.97 | 1.42 | 1.24 | 0.18 | 30 | 36 | 0.00215 | 0.00031 |
| BB1 | Term_3 | 1 | 15 | 1.78 | 10.12 | 9.75 | 8.34 | 7.97 | 0.37 | 30 | 36 | 0.01476 | 0.00069 |
| BB1 | Term_3 | 2 | 16 | 1.76 | 9.54 | 9.14 | 7.78 | 7.38 | 0.40 | 30 | 36 | 0.01281 | 0.00069 |
| BB1 | Term_3 | 3 | 16 | 1.74 | 12.06 | 11.59 | 10.32 | 9.85 | 0.47 | 30 | 36 | 0.01710 | 0.00082 |
| BB2 | Term_3 | 1 | 15 | 1.76 | 4.39 | 4.14 | 2.63 | 2.38 | 0.25 | 30 | 36 | 0.00441 | 0.00046 |
| BB2 | Term_3 | 2 | 16 | 1.74 | 3.13 | 2.90 | 1.39 | 1.16 | 0.23 | 30 | 36 | 0.00201 | 0.00040 |
| BB2 | Term_3 | 3 | 16 | 1.78 | 4.17 | 3.88 | 2.39 | 2.10 | 0.29 | 30 | 36 | 0.00365 | 0.00050 |
| SWB1 | Term_3 | 1 | 15 | 1.72 | 6.75 | 6.40 | 5.03 | 4.68 | 0.35 | 30 | 36 | 0.00867 | 0.00065 |
| SWB1 | Term_3 | 2 | 15 | 1.74 | 7.86 | 7.46 | 6.12 | 5.72 | 0.40 | 30 | 36 | 0.01059 | 0.00074 |
| SWB1 | Term_3 | 3 | 16 | 1.77 | 5.50 | 5.21 | 3.73 | 3.44 | 0.29 | 30 | 36 | 0.00597 | 0.00050 |
| SWB2 | Term_3 | 1 | 14 | 1.78 | 8.14 | 7.71 | 6.36 | 5.93 | 0.43 | 30 | 36 | 0.01177 | 0.00085 |
| SWB2 | Term_3 | 2 | 16 | 1.74 | 11.29 | 10.69 | 9.55 | 8.95 | 0.60 | 30 | 36 | 0.01554 | 0.00104 |
| SWB2 | Term_3 | 3 | 16 | 1.78 | 6.89 | 6.48 | 5.11 | 4.70 | 0.41 | 30 | 36 | 0.00816 | 0.00071 |
| SEB1 | Term_3 | 1 | 16 | 1.77 | 7.96 | 7.58 | 6.19 | 5.81 | 0.38 | 30 | 36 | 0.01009 | 0.00066 |
| SEB1 | Term_3 | 2 | 16 | 1.71 | 10.48 | 10.04 | 8.77 | 8.33 | 0.44 | 30 | 36 | 0.01446 | 0.00076 |
| SEB1 | Term_3 | 3 | 14 | 1.78 | 5.97 | 5.72 | 4.19 | 3.94 | 0.25 | 30 | 36 | 0.00782 | 0.00050 |
| SEB2 | Term_3 | 1 | 14 | 1.69 | 7.00 | 6.77 | 5.31 | 5.08 | 0.23 | 30 | 36 | 0.01008 | 0.00046 |
| SEB2 | Term_3 | 2 | 15 | 1.69 | 5.89 | 5.70 | 4.20 | 4.01 | 0.19 | 30 | 36 | 0.00743 | 0.00035 |
| SEB2 | Term_3 | 3 | 16 | 1.69 | 7.28 | 7.02 | 5.59 | 5.33 | 0.26 | 30 | 36 | 0.00925 | 0.00045 |
| CDN1 | Term 4 | 1 | 14 | 1.86 | 6.29 | 5.94 | 4.43 | 4.08 | 0.35 | 30 | 36 | 0.00810 | 0.00069 |
| CDN1 | Term 4 | 2 | 16 | 1.85 | 6.20 | 5.83 | 4.35 | 3.98 | 0.37 | 30 | 36 | 0.00691 | 0.00064 |
| CDN1 | Term 4 | 3 | 16 | 1.85 | 4.31 | 4.05 | 2.46 | 2.20 | 0.26 | 30 | 36 | 0.00382 | 0.00045 |
| CDN2 | Term 4 | 1 | 16 | 2.04 | 9.84 | 9.33 | 7.80 | 7.29 | 0.51 | 30 | 36 | 0.01266 | 0.00089 |
| CDN2 | Term 4 | 2 | 16 | 1.96 | 6.26 | 5.96 | 4.30 | 4.00 | 0.30 | 30 | 36 | 0.00694 | 0.00052 |
| CDN2 | Term 4 | 3 | 16 | 1.84 | 5.83 | 5.49 | 3.99 | 3.65 | 0.34 | 30 | 36 | 0.00634 | 0.00059 |
| CUP1 | Term 4 | 1 | 12 | 1.91 | 2.00 | 1.96 | 0.09 | 0.05 | 0.04 | 30 | 36 | 0.00012 | 0.00009 |
| CUP1 | Term 4 | 2 | 12 | 1.84 | 1.96 | 1.91 | 0.12 | 0.07 | 0.05 | 30 | 36 | 0.00016 | 0.00012 |
| CUP1 | Term 4 | 3 | 12 | 1.87 | 1.94 | 1.91 | 0.07 | 0.04 | 0.03 | 30 | 36 | 0.00009 | 0.00007 |
| CUP2 | Term 4 | 1 | 16 | 1.96 | 2.08 | 2.03 | 0.12 | 0.07 | 0.05 | 30 | 36 | 0.00012 | 0.00009 |
| CUP2 | Term 4 | 2 | 15 | 1.87 | 1.98 | 1.95 | 0.11 | 0.08 | 0.03 | 30 | 36 | 0.00015 | 0.00006 |
| CUP2 | Term 4 | 3 | 15 | 1.81 | 1.95 | 1.92 | 0.14 | 0.11 | 0.03 | 30 | 36 | 0.00020 | 0.00006 |
| BB1 | Term 4 | 1 | 16 | 2.00 | 2.49 | 2.37 | 0.49 | 0.37 | 0.12 | 30 | 36 | 0.00064 | 0.00021 |
| BB1 | Term 4 | 2 | 16 | 1.90 | 2.52 | 2.33 | 0.62 | 0.43 | 0.19 | 30 | 36 | 0.00075 | 0.00033 |
| BB1 | Term 4 | 3 | 16 | 1.88 | 2.61 | 2.43 | 0.73 | 0.55 | 0.18 | 30 | 36 | 0.00095 | 0.00031 |
| BB2 | Term 4 | 1 | 16 | 1.99 | 4.33 | 4.01 | 2.34 | 2.02 | 0.32 | 30 | 36 | 0.00351 | 0.00056 |
| BB2 | Term 4 | 2 | 14 | 1.96 | 5.59 | 5.19 | 3.63 | 3.23 | 0.40 | 30 | 36 | 0.00641 | 0.00079 |
| BB2 | Term 4 | 3 | 15 | 1.84 | 3.85 | 3.60 | 2.01 | 1.76 | 0.25 | 30 | 36 | 0.00326 | 0.00046 |
| SWB1 | Term 4 | 1 | 16 | 1.93 | 4.64 | 4.33 | 2.71 | 2.40 | 0.31 | 30 | 36 | 0.00417 | 0.00054 |
| SWB1 | Term 4 | 2 | 15 | 1.96 | 4.83 | 4.51 | 2.87 | 2.55 | 0.32 | 30 | 36 | 0.00472 | 0.00059 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWB1 | Term 4 | 3 | 15 | 1.97 | 4.12 | 3.85 | 2.15 | 1.88 | 0.27 | 30 | 36 | 0.00348 | 0.00050 |
| SWB2 | Term 4 | 1 | 15 | 1.67 | 4.30 | 4.10 | 2.63 | 2.43 | 0.20 | 30 | 36 | 0.00450 | 0.00037 |
| SWB2 | Term 4 | 2 | 15 | 1.67 | 3.15 | 2.99 | 1.48 | 1.32 | 0.16 | 30 | 36 | 0.00244 | 0.00030 |
| SWB2 | Term 4 | 3 | 14 | 1.67 | 6.08 | 5.85 | 4.41 | 4.18 | 0.23 | 30 | 36 | 0.00829 | 0.00046 |
| SEB1 | Term 4 | 1 | 16 | 1.67 | 4.15 | 3.88 | 2.48 | 2.21 | 0.27 | 30 | 36 | 0.00384 | 0.00047 |
| SEB1 | Term 4 | 2 | 16 | 1.68 | 3.25 | 3.09 | 1.57 | 1.41 | 0.16 | 30 | 36 | 0.00245 | 0.00028 |
| SEB1 | Term 4 | 3 | 16 | 1.67 | 3.17 | 2.99 | 1.50 | 1.32 | 0.18 | 30 | 36 | 0.00229 | 0.00031 |
| SEB2 | Term 4 | 1 | 16 | 1.68 | 2.50 | 2.44 | 0.82 | 0.76 | 0.06 | 30 | 36 | 0.00132 | 0.00010 |
| SEB2 | Term 4 | 2 | 16 | 1.66 | 2.19 | 2.13 | 0.53 | 0.47 | 0.06 | 30 | 36 | 0.00082 | 0.00010 |
| SEB2 | Term 4 | 3 | 16 | 1.66 | 2.50 | 2.44 | 0.84 | 0.78 | 0.06 | 30 | 36 | 0.00135 | 0.00010 |
| CDN1 | Term 5 | 1 | 16 | 1.61 | 6.30 | 5.84 | 4.69 | 4.23 | 0.46 | 30 | 36 | 0.00734 | 0.00080 |
| CDN1 | Term 5 | 2 | 18 | 1.61 | 5.66 | 5.24 | 4.05 | 3.63 | 0.42 | 30 | 36 | 0.00560 | 0.00065 |
| CDN1 | Term 5 | 3 | 13 | 1.61 | 4.26 | 3.93 | 2.65 | 2.32 | 0.33 | 30 | 36 | 0.00496 | 0.00071 |
| CDN2 | Term 5 | 1 | 16 | 1.61 | 5.16 | 4.61 | 3.55 | 3.00 | 0.55 | 30 | 36 | 0.00521 | 0.00095 |
| CDN2 | Term 5 | 2 | 15 | 1.63 | 3.99 | 3.62 | 2.36 | 1.99 | 0.37 | 30 | 36 | 0.00369 | 0.00069 |
| CDN2 | Term 5 | 3 | 16 | 1.62 | 3.98 | 3.59 | 2.36 | 1.97 | 0.39 | 30 | 36 | 0.00342 | 0.00068 |
| CUP1 | Term 5 | 1 | | | | | | | | | | | |
| CUP1 | Term 5 | 2 | | | | | | | | | | | |
| CUP1 | Term 5 | 3 | | | | | | | | | | | |
| CUP2 | Term 5 | 1 | 12 | 1.62 | 2.54 | 2.36 | 0.92 | 0.74 | 0.18 | 30 | 36 | 0.00171 | 0.00042 |
| CUP2 | Term 5 | 2 | 14 | 1.63 | 3.34 | 3.16 | 1.71 | 1.53 | 0.18 | 30 | 36 | 0.00304 | 0.00036 |
| CUP2 | Term 5 | 3 | 13 | 1.61 | 2.79 | 2.62 | 1.18 | 1.01 | 0.17 | 30 | 36 | 0.00216 | 0.00036 |
| BB1 | Term 5 | 1 | 17 | 1.60 | 6.91 | 6.56 | 5.31 | 4.96 | 0.35 | 30 | 36 | 0.00810 | 0.00057 |
| BB1 | Term 5 | 2 | 16 | 1.60 | 3.17 | 2.89 | 1.57 | 1.29 | 0.28 | 30 | 36 | 0.00224 | 0.00049 |
| BB1 | Term 5 | 3 | 16 | 1.62 | 5.11 | 4.74 | 3.49 | 3.12 | 0.37 | 30 | 36 | 0.00542 | 0.00064 |
| BB2 | Term 5 | 1 | 15 | 1.56 | 2.27 | 2.12 | 0.71 | 0.56 | 0.15 | 30 | 36 | 0.00104 | 0.00028 |
| BB2 | Term 5 | 2 | 16 | 1.54 | 2.40 | 2.25 | 0.86 | 0.71 | 0.15 | 30 | 36 | 0.00123 | 0.00026 |
| BB2 | Term 5 | 3 | 16 | 1.55 | 2.61 | 2.42 | 1.06 | 0.87 | 0.19 | 30 | 36 | 0.00151 | 0.00033 |
| SWB1 | Term 5 | 1 | 12 | 1.53 | 2.16 | 2.01 | 0.63 | 0.48 | 0.15 | 30 | 36 | 0.00111 | 0.00035 |
| SWB1 | Term 5 | 2 | 16 | 1.55 | 2.02 | 1.86 | 0.47 | 0.31 | 0.16 | 30 | 36 | 0.00054 | 0.00028 |
| SWB1 | Term 5 | 3 | 16 | 1.53 | 2.38 | 2.17 | 0.85 | 0.64 | 0.21 | 30 | 36 | 0.00111 | 0.00036 |
| SWB2 | Term 5 | 1 | 16 | 1.54 | 3.46 | 3.35 | 1.92 | 1.81 | 0.11 | 30 | 36 | 0.00314 | 0.00019 |
| SWB2 | Term 5 | 2 | 15 | 1.55 | 4.73 | 4.59 | 3.18 | 3.04 | 0.14 | 30 | 36 | 0.00563 | 0.00026 |
| SWB2 | Term 5 | 3 | 16 | 1.56 | 4.03 | 3.88 | 2.47 | 2.32 | 0.15 | 30 | 36 | 0.00403 | 0.00026 |
| SEB1 | Term 5 | 1 | 16 | 1.55 | 4.67 | 4.23 | 3.12 | 2.68 | 0.44 | 30 | 36 | 0.00465 | 0.00076 |
| SEB1 | Term 5 | 2 | 16 | 1.55 | 6.84 | 6.50 | 5.29 | 4.95 | 0.34 | 30 | 36 | 0.00859 | 0.00059 |
| SEB1 | Term 5 | 3 | 16 | 1.56 | 3.39 | 3.03 | 1.83 | 1.47 | 0.36 | 30 | 36 | 0.00255 | 0.00063 |
| SEB2 | Term 5 | 1 | 16 | 1.57 | 3.20 | 2.93 | 1.63 | 1.36 | 0.27 | 30 | 36 | 0.00236 | 0.00047 |
| SEB2 | Term 5 | 2 | 16 | 1.56 | 4.32 | 3.90 | 2.76 | 2.34 | 0.42 | 30 | 36 | 0.00406 | 0.00073 |
| SEB2 | Term 5 | 3 | 16 | 1.54 | 4.79 | 4.30 | 3.25 | 2.76 | 0.49 | 30 | 36 | 0.00479 | 0.00085 |
| CDN1 | Term_6 | 1 | | | | | | | | | | | |
| CDN1 | Term_6 | 2 | | | | | | | | | | | |
| CDN1 | Term_6 | 3 | | | | | | | | | | | |
| CDN2 | Term_6 | 1 | 13 | 1.54 | 6.20 | 5.94 | 4.66 | 4.40 | 0.26 | 30 | 36 | 0.00940 | 0.00056 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CDN2 | Term_6 | 2 | 12 | 1.56 | 5.74 | 5.50 | 4.18 | 3.94 | 0.24 | 30 | 36 | 0.00912 | 0.00056 |
| CDN2 | Term_6 | 3 | 12 | 1.57 | 2.86 | 2.76 | 1.29 | 1.19 | 0.10 | 30 | 36 | 0.00275 | 0.00023 |
| CUP1 | Term_6 | 1 | 16 | 1.57 | 1.66 | 1.62 | 0.09 | 0.05 | 0.04 | 30 | 36 | 0.00009 | 0.00007 |
| CUP1 | Term_6 | 2 | 16 | 1.56 | 1.66 | 1.65 | 0.10 | 0.09 | 0.01 | 30 | 36 | 0.00016 | 0.00002 |
| CUP1 | Term_6 | 3 | 16 | 1.57 | 1.64 | 1.65 | 0.07 | 0.08 | -0.01 | 30 | 36 | 0.00014 | -0.00002 |
| CUP2 | Term_6 | 1 | 16 | 1.57 | 2.35 | 2.08 | 0.78 | 0.51 | 0.27 | 30 | 36 | 0.00089 | 0.00047 |
| CUP2 | Term_6 | 2 | | | | | | | | | | | |
| CUP2 | Term_6 | 3 | 16 | 1.58 | 2.34 | 2.19 | 0.76 | 0.61 | 0.15 | 30 | 36 | 0.00106 | 0.00026 |
| BB1 | Term_6 | 1 | 16 | 1.57 | 4.46 | 4.22 | 2.89 | 2.65 | 0.24 | 30 | 36 | 0.00460 | 0.00042 |
| BB1 | Term_6 | 2 | 16 | 1.56 | 4.47 | 4.18 | 2.91 | 2.62 | 0.29 | 30 | 36 | 0.00455 | 0.00050 |
| BB1 | Term_6 | 3 | 16 | 1.55 | 3.49 | 3.29 | 1.94 | 1.74 | 0.20 | 30 | 36 | 0.00302 | 0.00035 |
| BB2 | Term_6 | 1 | 16 | 1.58 | 5.21 | 4.90 | 3.63 | 3.32 | 0.31 | 30 | 36 | 0.00576 | 0.00054 |
| BB2 | Term_6 | 2 | 15 | 1.61 | 5.53 | 5.23 | 3.92 | 3.62 | 0.30 | 30 | 36 | 0.00670 | 0.00056 |
| BB2 | Term_6 | 3 | 16 | 1.59 | 5.27 | 4.92 | 3.68 | 3.33 | 0.35 | 30 | 36 | 0.00578 | 0.00061 |
| SWB1 | Term_6 | 1 | 16 | 1.61 | 2.72 | 2.61 | 1.11 | 1.00 | 0.11 | 30 | 36 | 0.00174 | 0.00019 |
| SWB1 | Term_6 | 2 | 16 | 1.60 | 2.32 | 2.21 | 0.72 | 0.61 | 0.11 | 30 | 36 | 0.00106 | 0.00019 |
| SWB1 | Term_6 | 3 | 16 | 1.55 | 2.92 | 2.73 | 1.37 | 1.18 | 0.19 | 30 | 36 | 0.00205 | 0.00033 |
| SWB2 | Term_6 | 1 | 15 | 1.56 | 4.84 | 4.62 | 3.28 | 3.06 | 0.22 | 30 | 36 | 0.00567 | 0.00041 |
| SWB2 | Term_6 | 2 | 16 | 1.55 | 5.49 | 5.24 | 3.94 | 3.69 | 0.25 | 30 | 36 | 0.00641 | 0.00043 |
| SWB2 | Term_6 | 3 | 16 | 1.55 | 4.90 | 4.69 | 3.35 | 3.14 | 0.21 | 30 | 36 | 0.00545 | 0.00036 |
| SEB1 | Term_6 | 1 | | | | | | | | | | | |
| SEB1 | Term_6 | 2 | | | | | | | | | | | |
| SEB1 | Term_6 | 3 | | | | | | | | | | | |
| SEB2 | Term_6 | 1 | 15 | 1.54 | 4.17 | 4.03 | 2.63 | 2.49 | 0.14 | 30 | 36 | 0.00461 | 0.00026 |
| SEB2 | Term_6 | 2 | 7 | 1.54 | 2.75 | 2.67 | 1.21 | 1.13 | 0.08 | 30 | 36 | 0.00448 | 0.00032 |
| SEB2 | Term_6 | 3 | 16 | 1.54 | 3.60 | 3.47 | 2.06 | 1.93 | 0.13 | 30 | 36 | 0.00335 | 0.00023 |
| CDN1 | Term_7 | 1 | 16 | 1.66 | 5.13 | 4.89 | 3.47 | 3.23 | 0.24 | 30 | 36 | 0.00561 | 0.00042 |
| CDN1 | Term_7 | 2 | 16 | 1.62 | 3.22 | 3.07 | 1.60 | 1.45 | 0.15 | 30 | 36 | 0.00252 | 0.00026 |
| CDN1 | Term_7 | 3 | 16 | 1.64 | 3.42 | 3.28 | 1.78 | 1.64 | 0.14 | 30 | 36 | 0.00285 | 0.00024 |
| CDN2 | Term_7 | 1 | 16 | 1.63 | 5.85 | 5.59 | 4.22 | 3.96 | 0.26 | 30 | 36 | 0.00688 | 0.00045 |
| CDN2 | Term_7 | 2 | 15 | 1.63 | 7.81 | 7.42 | 6.18 | 5.79 | 0.39 | 30 | 36 | 0.01072 | 0.00072 |
| CDN2 | Term_7 | 3 | 17 | 1.63 | 8.50 | 8.11 | 6.87 | 6.48 | 0.39 | 30 | 36 | 0.01059 | 0.00064 |
| CUP1 | Term_7 | 1 | 15 | 1.65 | 2.63 | 2.47 | 0.98 | 0.82 | 0.16 | 30 | 36 | 0.00152 | 0.00030 |
| CUP1 | Term_7 | 2 | 16 | 1.65 | 2.99 | 2.79 | 1.34 | 1.14 | 0.20 | 30 | 36 | 0.00198 | 0.00035 |
| CUP1 | Term_7 | 3 | 17 | 1.64 | 2.63 | 2.48 | 0.99 | 0.84 | 0.15 | 30 | 36 | 0.00137 | 0.00025 |
| CUP2 | Term_7 | 1 | 16 | 1.65 | 3.49 | 3.25 | 1.84 | 1.60 | 0.24 | 30 | 36 | 0.00278 | 0.00042 |
| CUP2 | Term_7 | 2 | 16 | 1.63 | 3.09 | 2.94 | 1.46 | 1.31 | 0.15 | 30 | 36 | 0.00227 | 0.00026 |
| CUP2 | Term_7 | 3 | 16 | 1.63 | 3.40 | 3.18 | 1.77 | 1.55 | 0.22 | 30 | 36 | 0.00269 | 0.00038 |
| BB1 | Term_7 | 1 | 16 | 1.67 | 6.64 | 6.22 | 4.97 | 4.55 | 0.42 | 30 | 36 | 0.00790 | 0.00073 |
| BB1 | Term_7 | 2 | 16 | 1.66 | 7.10 | 6.70 | 5.44 | 5.04 | 0.40 | 30 | 36 | 0.00875 | 0.00069 |
| BB1 | Term_7 | 3 | 16 | 1.72 | 5.45 | 5.12 | 3.73 | 3.40 | 0.33 | 30 | 36 | 0.00590 | 0.00057 |
| BB2 | Term_7 | 1 | 16 | 1.62 | 6.46 | 6.20 | 4.84 | 4.58 | 0.26 | 30 | 36 | 0.00795 | 0.00045 |
| BB2 | Term_7 | 2 | 16 | 1.60 | 4.41 | 4.21 | 2.81 | 2.61 | 0.20 | 30 | 36 | 0.00453 | 0.00035 |
| BB2 | Term_7 | 3 | 16 | 1.62 | 3.62 | 3.41 | 2.00 | 1.79 | 0.21 | 30 | 36 | 0.00311 | 0.00036 |
| SWB1 | Term_7 | 1 | 9 | 1.62 | 3.58 | 3.43 | 1.96 | 1.81 | 0.15 | 30 | 36 | 0.00559 | 0.00046 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWB1 | Term_7 | 2 | 15 | 1.62 | 4.90 | 4.56 | 3.28 | 2.94 | 0.34 | 30 | 36 | 0.00544 | 0.00063 |
| SWB1 | Term_7 | 3 | 16 | 1.58 | 5.57 | 5.32 | 3.99 | 3.74 | 0.25 | 30 | 36 | 0.00649 | 0.00043 |
| SWB2 | Term_7 | 1 | | | | | | | | | | | |
| SWB2 | Term_7 | 2 | | | | | | | | | | | |
| SWB2 | Term_7 | 3 | | | | | | | | | | | |
| SEB1 | Term_7 | 1 | 10 | 1.58 | 2.19 | 2.12 | 0.61 | 0.54 | 0.07 | 30 | 36 | 0.00150 | 0.00019 |
| SEB1 | Term_7 | 2 | 14 | 1.58 | 3.06 | 2.86 | 1.48 | 1.28 | 0.20 | 30 | 36 | 0.00254 | 0.00040 |
| SEB1 | Term_7 | 3 | 15 | 1.58 | 2.46 | 2.35 | 0.88 | 0.77 | 0.11 | 30 | 36 | 0.00143 | 0.00020 |
| SEB2 | Term_7 | 1 | 16 | 1.65 | 6.39 | 5.85 | 4.74 | 4.20 | 0.54 | 30 | 36 | 0.00729 | 0.00094 |
| SEB2 | Term_7 | 2 | 16 | 1.63 | 9.24 | 8.59 | 7.61 | 6.96 | 0.65 | 30 | 36 | 0.01208 | 0.00113 |
| SEB2 | Term_7 | 3 | 14 | 1.65 | 4.74 | 4.28 | 3.09 | 2.63 | 0.46 | 30 | 36 | 0.00522 | 0.00091 |
| CDN1 | Term_8 | 1 | 13 | 1.59 | 2.78 | 2.69 | 1.19 | 1.10 | 0.09 | 30 | 36 | 0.00235 | 0.00019 |
| CDN1 | Term_8 | 2 | 16 | 1.58 | 2.78 | 2.67 | 1.20 | 1.09 | 0.11 | 30 | 36 | 0.00189 | 0.00019 |
| CDN1 | Term_8 | 3 | 16 | 1.55 | 2.78 | 2.67 | 1.23 | 1.12 | 0.11 | 30 | 36 | 0.00194 | 0.00019 |
| CDN2 | Term_8 | 1 | 16 | 1.53 | 11.29 | 10.88 | 9.76 | 9.35 | 0.41 | 30 | 36 | 0.01623 | 0.00071 |
| CDN2 | Term_8 | 2 | 16 | 1.53 | 4.62 | 4.39 | 3.09 | 2.86 | 0.23 | 30 | 36 | 0.00497 | 0.00040 |
| CDN2 | Term_8 | 3 | 16 | 1.52 | 3.11 | 2.98 | 1.59 | 1.46 | 0.13 | 30 | 36 | 0.00253 | 0.00023 |
| CUP1 | Term_8 | 1 | 16 | 1.53 | 6.01 | 5.60 | 4.48 | 4.07 | 0.41 | 30 | 36 | 0.00707 | 0.00071 |
| CUP1 | Term_8 | 2 | 12 | 1.53 | 7.08 | 6.64 | 5.55 | 5.11 | 0.44 | 30 | 36 | 0.01183 | 0.00102 |
| CUP1 | Term_8 | 3 | 16 | 1.53 | 4.18 | 3.96 | 2.65 | 2.43 | 0.22 | 30 | 36 | 0.00422 | 0.00038 |
| CUP2 | Term_8 | 1 | 13 | 1.55 | 3.93 | 3.71 | 2.38 | 2.16 | 0.22 | 30 | 36 | 0.00462 | 0.00047 |
| CUP2 | Term_8 | 2 | 17 | 1.55 | 4.44 | 4.15 | 2.89 | 2.60 | 0.29 | 30 | 36 | 0.00425 | 0.00047 |
| CUP2 | Term_8 | 3 | 16 | 1.52 | 3.74 | 3.50 | 2.22 | 1.98 | 0.24 | 30 | 36 | 0.00344 | 0.00042 |
| BB1 | Term_8 | 1 | 17 | 1.54 | 8.32 | 7.96 | 6.78 | 6.42 | 0.36 | 30 | 36 | 0.01049 | 0.00059 |
| BB1 | Term_8 | 2 | 16 | 1.54 | 4.90 | 4.59 | 3.36 | 3.05 | 0.31 | 30 | 36 | 0.00530 | 0.00054 |
| BB1 | Term_8 | 3 | 15 | 1.54 | 5.35 | 5.06 | 3.81 | 3.52 | 0.29 | 30 | 36 | 0.00652 | 0.00054 |
| BB2 | Term_8 | 1 | 16 | 1.54 | 8.57 | 8.19 | 7.03 | 6.65 | 0.38 | 30 | 36 | 0.01155 | 0.00066 |
| BB2 | Term_8 | 2 | 15 | 1.54 | 5.80 | 5.54 | 4.26 | 4.00 | 0.26 | 30 | 36 | 0.00741 | 0.00048 |
| BB2 | Term_8 | 3 | 11 | 1.59 | 8.53 | 8.11 | 6.94 | 6.52 | 0.42 | 30 | 36 | 0.01646 | 0.00106 |
| SWB1 | Term_8 | 1 | 16 | 1.59 | 33.90 | 33.32 | 32.31 | 31.73 | 0.58 | 30 | 36 | 0.05509 | 0.00101 |
| SWB1 | Term_8 | 2 | 16 | 1.60 | 13.48 | 13.13 | 11.88 | 11.53 | 0.35 | 30 | 36 | 0.02002 | 0.00061 |
| SWB1 | Term_8 | 3 | 16 | 1.60 | 7.34 | 7.11 | 5.74 | 5.51 | 0.23 | 30 | 36 | 0.00957 | 0.00040 |
| SWB2 | Term_8 | 1 | 16 | 1.61 | 8.53 | 8.31 | 6.92 | 6.70 | 0.22 | 30 | 36 | 0.01163 | 0.00038 |
| SWB2 | Term_8 | 2 | 16 | 1.61 | 6.88 | 6.63 | 5.27 | 5.02 | 0.25 | 30 | 36 | 0.00872 | 0.00043 |
| SWB2 | Term_8 | 3 | 16 | 1.60 | 16.86 | 16.39 | 15.26 | 14.79 | 0.47 | 30 | 36 | 0.02568 | 0.00082 |
| SEB1 | Term_8 | 1 | 16 | 1.59 | 12.18 | 11.58 | 10.59 | 9.99 | 0.60 | 30 | 36 | 0.01734 | 0.00104 |
| SEB1 | Term_8 | 2 | 16 | 1.61 | 11.90 | 11.26 | 10.29 | 9.65 | 0.64 | 30 | 36 | 0.01675 | 0.00111 |
| SEB1 | Term_8 | 3 | 15 | 1.60 | 9.61 | 9.04 | 8.01 | 7.44 | 0.57 | 30 | 36 | 0.01378 | 0.00106 |
| SEB2 | Term_8 | 1 | 16 | 1.58 | 5.16 | 4.94 | 3.58 | 3.36 | 0.22 | 30 | 36 | 0.00583 | 0.00038 |
| SEB2 | Term_8 | 2 | 16 | 1.58 | 4.56 | 4.35 | 2.98 | 2.77 | 0.21 | 30 | 36 | 0.00481 | 0.00036 |
| SEB2 | Term_8 | 3 | 16 | 1.59 | 3.89 | 3.74 | 2.30 | 2.15 | 0.15 | 30 | 36 | 0.00373 | 0.00026 |
| CDN1 | Term_9 | 1 | 16 | 1.62 | 5.68 | 5.28 | 4.06 | 3.66 | 0.40 | 30 | 36 | 0.00635 | 0.00069 |
| CDN1 | Term_9 | 2 | 16 | 1.60 | 4.38 | 4.09 | 2.78 | 2.49 | 0.29 | 30 | 36 | 0.00432 | 0.00050 |
| CDN1 | Term_9 | 3 | 16 | 1.64 | 4.19 | 3.94 | 2.55 | 2.30 | 0.25 | 30 | 36 | 0.00399 | 0.00043 |
| CDN2 | Term_9 | 1 | 16 | 1.63 | 5.69 | 5.37 | 4.06 | 3.74 | 0.32 | 30 | 36 | 0.00649 | 0.00056 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CDN2 | Term_9 | 2 | 14 | 1.61 | 3.84 | 3.67 | 2.23 | 2.06 | 0.17 | 30 | 36 | 0.00409 | 0.00034 |
| CDN2 | Term_9 | 3 | 16 | 1.61 | 5.29 | 5.03 | 3.68 | 3.42 | 0.26 | 30 | 36 | 0.00594 | 0.00045 |
| CUP1 | Term_9 | 1 | 16 | 1.62 | 10.10 | 9.19 | 8.48 | 7.57 | 0.91 | 30 | 36 | 0.01314 | 0.00158 |
| CUP1 | Term_9 | 2 | 16 | 1.63 | 11.51 | 10.53 | 9.88 | 8.90 | 0.98 | 30 | 36 | 0.01545 | 0.00170 |
| CUP1 | Term_9 | 3 | 16 | 1.62 | 10.65 | 9.70 | 9.03 | 8.08 | 0.95 | 30 | 36 | 0.01403 | 0.00165 |
| CUP2 | Term_9 | 1 | 7 | 1.63 | 4.52 | 4.38 | 2.89 | 2.75 | 0.14 | 30 | 36 | 0.01091 | 0.00056 |
| CUP2 | Term_9 | 2 | 16 | 1.60 | 4.44 | 4.24 | 2.84 | 2.64 | 0.20 | 30 | 36 | 0.00458 | 0.00035 |
| CUP2 | Term_9 | 3 | 17 | 1.60 | 5.41 | 5.17 | 3.81 | 3.57 | 0.24 | 30 | 36 | 0.00583 | 0.00039 |
| BB1 | Term_9 | 1 | 16 | 1.58 | 5.01 | 4.70 | 3.43 | 3.12 | 0.31 | 30 | 36 | 0.00542 | 0.00054 |
| BB1 | Term_9 | 2 | 16 | 1.65 | 5.82 | 5.48 | 4.17 | 3.83 | 0.34 | 30 | 36 | 0.00665 | 0.00059 |
| BB1 | Term_9 | 3 | 16 | 1.72 | 5.12 | 4.84 | 3.40 | 3.12 | 0.28 | 30 | 36 | 0.00542 | 0.00049 |
| BB2 | Term_9 | 1 | 16 | 1.72 | 5.79 | 5.52 | 4.07 | 3.80 | 0.27 | 30 | 36 | 0.00660 | 0.00047 |
| BB2 | Term_9 | 2 | 16 | 1.67 | 6.17 | 5.87 | 4.50 | 4.20 | 0.30 | 30 | 36 | 0.00729 | 0.00052 |
| BB2 | Term_9 | 3 | 16 | 1.73 | 7.32 | 7.00 | 5.59 | 5.27 | 0.32 | 30 | 36 | 0.00915 | 0.00056 |
| SWB1 | Term_9 | 1 | 12 | 1.70 | 6.23 | 5.92 | 4.53 | 4.22 | 0.31 | 30 | 36 | 0.00977 | 0.00072 |
| SWB1 | Term_9 | 2 | 16 | 1.70 | 6.69 | 6.34 | 4.99 | 4.64 | 0.35 | 30 | 36 | 0.00806 | 0.00061 |
| SWB1 | Term_9 | 3 | 16 | 1.76 | 9.97 | 9.58 | 8.21 | 7.82 | 0.39 | 30 | 36 | 0.01358 | 0.00068 |
| SWB2 | Term_9 | 1 | 16 | 1.70 | 4.87 | 4.66 | 3.17 | 2.96 | 0.21 | 30 | 36 | 0.00514 | 0.00036 |
| SWB2 | Term_9 | 2 | 16 | 1.70 | 7.90 | 7.64 | 6.20 | 5.94 | 0.26 | 30 | 36 | 0.01031 | 0.00045 |
| SWB2 | Term_9 | 3 | 16 | 1.73 | 9.20 | 8.92 | 7.47 | 7.19 | 0.28 | 30 | 36 | 0.01248 | 0.00049 |
| SEB1 | Term_9 | 1 | 16 | 1.69 | 5.85 | 5.51 | 4.16 | 3.82 | 0.34 | 30 | 36 | 0.00663 | 0.00059 |
| SEB1 | Term_9 | 2 | 17 | 1.72 | 6.35 | 5.98 | 4.63 | 4.26 | 0.37 | 30 | 36 | 0.00696 | 0.00060 |
| SEB1 | Term_9 | 3 | 16 | 1.75 | 6.77 | 6.37 | 5.02 | 4.62 | 0.40 | 30 | 36 | 0.00802 | 0.00069 |
| SEB2 | Term_9 | 1 | 16 | 1.71 | 15.31 | 14.77 | 13.60 | 13.06 | 0.54 | 30 | 36 | 0.02267 | 0.00094 |
| SEB2 | Term_9 | 2 | 16 | 1.68 | 8.80 | 8.47 | 7.12 | 6.79 | 0.33 | 30 | 36 | 0.01179 | 0.00057 |
| SEB2 | Term_9 | 3 | 16 | 1.72 | 11.06 | 10.64 | 9.34 | 8.92 | 0.42 | 30 | 36 | 0.01549 | 0.00073 |
| Blank rows represent lost samples. | | | | | | | | | | | | | |

# APPENDIX E
# ESTUARY OYSTER MONITORING DATA

## E1 PILOT-WILD SYDNEY ROCK OYSTER CONDITION INDEX RAW DATA

## E2 BACKGROUND OYSTER CONDITION INDEX RAW DATA

## E3 PACIFIC & SYDNEY ROCK OYSTER CONDITION INDEX RAW DATA

## E4 PILOT-WILD SYDNEY ROCK OYSTER MEAN METAL CONCENTRATIONS

## E5 LABORATORY ANALYSIS SUMMARY TABLES

## E6 OYSTER METAL ANALYSIS GRAPHS

# APPENDIX E1

# PILOT - WILD SYDNEY ROCK OYSTER CONDITION INDEX

| Crookhaven Estuary & River Wild Sydney Rock Oyster Condition Index | | | | | | |
|---|---|---|---|---|---|---|
| **Site** | **Sub-site** (S=Shore, L=Lease) | **Replicate** | **Shell Height** | **Total Weight** | **Shell Weight** | **Flesh Weight** |
| CUP1 | S | 1 | 65 | 40.32 | 27.54 | 9.01 |
| CUP1 | S | 2 | 70 | 51.06 | 38.55 | 9.96 |
| CUP1 | S | 3 | 68 | 44.56 | 35.01 | 7.02 |
| CUP1 | S2 | 1 | 65 | 47.55 | 36.71 | 7.39 |
| CUP1 | S2 | 2 | 61 | 40.26 | 28.09 | 6.46 |
| CUP1 | S2 | 3 | 70 | 30.78 | 23.30 | 5.71 |
| CUP2 | S | 1 | 44 | 13.33 | 10.12 | 2.10 |
| CUP2 | S | 2 | 62 | 15.41 | 11.25 | 3.26 |
| CUP2 | S | 3 | 44 | 9.56 | 7.34 | 1.50 |
| CUP2 | L | 1 | 52 | 32.21 | 25.11 | 5.74 |
| CUP2 | L | 2 | 56 | 29.11 | 21.20 | 6.25 |
| CUP2 | L | 3 | 59 | 28.45 | 20.77 | 5.45 |
| BB1 | S | 1 | 75 | 31.54 | 23.50 | 5.30 |
| BB1 | S | 2 | 67 | 26.09 | 18.61 | 4.02 |
| BB1 | S | 3 | 94 | 57.57 | 40.23 | 8.63 |
| BB1 | L | 1 | 82 | 62.86 | 48.41 | 10.33 |
| BB1 | L | 2 | 51 | 28.01 | 21.16 | 5.02 |
| BB1 | L | 3 | 72 | 35.40 | 31.32 | 4.08 |
| BB2 | S | 1 | 68 | 29.11 | 21.39 | 3.97 |
| BB2 | S | 2 | 69 | 24.08 | 18.26 | 3.59 |
| BB2 | S | 3 | 62 | 32.12 | 25.22 | 2.92 |
| BB2 | L | 1 | 68 | 25.49 | 18.34 | 4.72 |
| BB2 | L | 2 | 74 | 44.36 | 32.69 | 7.83 |
| BB2 | L | 3 | 75 | 52.04 | 40.10 | 7.11 |
| SWB1 | S | 1 | 60 | 31.22 | 24.74 | 3.35 |
| SWB1 | S | 2 | 40 | 9.99 | 8.74 | 0.70 |
| SWB1 | S | 3 | 46 | 11.04 | 8.81 | 1.40 |
| SWB1 | L | 1 | 103 | 53.43 | 40.22 | 7.75 |
| SWB1 | L | 2 | 75 | 42.62 | 30.92 | 7.30 |
| SWB1 | L | 3 | 70 | 18.00 | 13.69 | 3.25 |
| SWB2 | S | 1 | 56 | 24.34 | 18.65 | 3.30 |
| SWB2 | S | 2 | 74 | 27.98 | 21.59 | 4.04 |
| SWB2 | S | 3 | 46 | 14.37 | 12.17 | 2.01 |
| SEB1 | S | 1 | 76 | 26.16 | 19.10 | 4.81 |
| SEB1 | S | 2 | 60 | 32.83 | 25.21 | 5.73 |
| SEB1 | S | 3 | 53 | 19.54 | 14.03 | 3.56 |
| SEB1 | L | 1 | 55 | 24.88 | 19.54 | 3.92 |
| SEB1 | L | 2 | 85 | 39.19 | 30.90 | 6.64 |
| SEB1 | L | 3 | 74 | 57.42 | 45.18 | 9.20 |
| SEB2 | S | 1 | 82 | 49.23 | 35.84 | 9.29 |
| SEB2 | S | 2 | 100 | 64.70 | 47.05 | 12.57 |
| SEB2 | S | 3 | 95 | 37.50 | 24.15 | 12.71 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SEB2 | S2 | 1 | 63 | 29.95 | 21.65 | 5.88 |
| SEB2 | S2 | 2 | 74 | 38.48 | 25.46 | 9.26 |
| SEB2 | S2 | 3 | 67 | 32.03 | 23.47 | 5.24 |
| SWB2 | L | 1 | 60 | 35.66 | 28.60 | 5.03 |
| SWB2 | L | 2 | 79 | 74.94 | 54.77 | 9.42 |
| SWB2 | L | 3 | 53 | 20.51 | 16.33 | 2.32 |
| NB1 | S | 1 | 50 | 11.28 | 8.62 | 1.57 |
| NB1 | S | 2 | 60 | 25.55 | 20.76 | 2.07 |
| NB1 | S | 3 | 68 | 23.51 | 18.86 | 3.60 |
| NB1 | L | 1 | 79 | 35.17 | 27.45 | 4.69 |
| NB1 | L | 2 | 57 | 17.09 | 14.01 | 2.90 |
| NB1 | L | 3 | 69 | 26.80 | 20.40 | 4.05 |
| NB2 | S | 1 | 70 | 21.33 | 16.14 | 3.35 |
| NB2 | S | 2 | 54 | 10.51 | 8.39 | 1.80 |
| NB2 | S | 3 | 70 | 26.63 | 18.52 | 2.75 |
| NB2 | L | 1 | 61 | 32.55 | 25.40 | 4.23 |
| NB2 | L | 2 | 80 | 38.72 | 25.75 | 8.47 |
| NB2 | L | 3 | 64 | 19.89 | 16.64 | 1.98 |
| CDN1 | S | 1 | 65 | 26.11 | 19.90 | 2.81 |
| CDN1 | S | 2 | 60 | 18.51 | 12.89 | 1.82 |
| CDN1 | S | 3 | 55 | 13.60 | 10.62 | 1.74 |
| CDN1 | L | 1 | 60 | 18.24 | 13.92 | 3.09 |
| CDN1 | L | 2 | 60 | 22.10 | 17.49 | 3.26 |
| CDN1 | L | 3 | 50 | 19.36 | 14.57 | 2.79 |
| CDN2 | S | 1 | 66 | 24.81 | 20.61 | 2.19 |
| CDN2 | S | 2 | 67 | 20.68 | 16.36 | 1.76 |
| CDN2 | S | 3 | 58 | 26.08 | 21.51 | 2.37 |
| CDN2 | L | 1 | 54 | 18.70 | 15.61 | 1.95 |
| CDN2 | L | 2 | 51 | 29.69 | 23.84 | 3.11 |
| CDN2 | L | 3 | 69 | 16.01 | 14.66 | 1.35 |

# APPENDIX E2

# BACKGROUND OYSTER CONDITION INDEX

| Crookhaven Estuary & River Pre Survey Background Oyster Condition Index | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Replicate** | **Species** | **Oyster** | **Survey** | **Shell Height** | **Total Weight** | **Shell Weight** | **Flesh Weight** |
| B1 | SR | 1 | 1 | 60 | 38.82 | 23.57 | 6.76 |
| B1 | SR | 2 | 1 | 60 | 37.40 | 27.77 | 4.7 |
| B1 | SR | 3 | 1 | 56 | 47.25 | 39.1 | 6.2 |
| B1 | SR | 4 | 1 | 53 | 22.16 | 16.06 | 4.72 |
| B1 | SR | 5 | 1 | 65 | 36.15 | 25.95 | 8.92 |
| B1 | SR | 6 | 1 | 57 | 39.51 | 30.36 | 5.85 |
| B1 | SR | 7 | 1 | 53 | 39.89 | 31.74 | 5.66 |
| B1 | SR | 8 | 1 | 62 | 29.19 | 23.93 | 5.2 |
| B1 | SR | 9 | 1 | 58 | 28.30 | 23.68 | 4.44 |
| B1 | SR | 10 | 1 | 57 | 34.52 | 28.63 | 5.06 |
| B1 | SR | 11 | 1 | 60 | 31.43 | 24.22 | 4.96 |
| B1 | SR | 12 | 1 | 59 | 34.28 | 26.3 | 3.21 |
| B2 | SR | 1 | 1 | 60 | 39.02 | 29.08 | 6.83 |
| B2 | SR | 2 | 1 | 58 | 34.75 | 27.92 | 6.1 |
| B2 | SR | 3 | 1 | 59 | 38.88 | 28.16 | 6.89 |
| B2 | SR | 4 | 1 | 58 | 31.80 | 23.88 | 6.42 |
| B2 | SR | 5 | 1 | 63 | 39.94 | 32.15 | 4.91 |
| B2 | SR | 6 | 1 | 56 | 40.14 | 29.1 | 5.95 |
| B2 | SR | 7 | 1 | 60 | 45.36 | 34.78 | 7.25 |
| B2 | SR | 8 | 1 | 61 | 35.83 | 28.51 | 6.11 |
| B2 | SR | 9 | 1 | 59 | 41.88 | 32.23 | 5.15 |
| B2 | SR | 10 | 1 | 59 | 39.63 | 32.61 | 6.73 |
| B2 | SR | 11 | 1 | 65 | 34.94 | 26.91 | 4.11 |
| B2 | SR | 12 | 1 | 57 | 27.00 | 20.08 | 4.87 |
| B3 | SR | 1 | 1 | 55 | 38.42 | 30.61 | 7.58 |
| B3 | SR | 2 | 1 | 55 | 28.50 | 19.47 | 6.58 |
| B3 | SR | 3 | 1 | 57 | 31.21 | 24.92 | 4.75 |
| B3 | SR | 4 | 1 | 60 | 33.17 | 23.27 | 5.71 |
| B3 | SR | 5 | 1 | 55 | 32.78 | 25.03 | 5.76 |
| B3 | SR | 6 | 1 | 68 | 42.69 | 32.29 | 5.53 |
| B3 | SR | 7 | 1 | 59 | 36.61 | 27.51 | 6.05 |
| B3 | SR | 8 | 1 | 64 | 47.17 | 35.29 | 7.36 |
| B3 | SR | 9 | 1 | 60 | 41.71 | 32.95 | 5.06 |
| B3 | SR | 10 | 1 | 74 | 53.70 | 41.55 | 6.73 |
| B3 | SR | 11 | 1 | 53 | 26.14 | 21.81 | 3.58 |
| B3 | SR | 12 | 1 | 60 | 29.16 | 23.24 | 4.62 |
| B1 | P | 1 | 1 | 75 | 45.62 | 27.37 | 9.77 |
| B1 | P | 2 | 1 | 70 | 53.3 | 31.1 | 11.21 |
| B1 | P | 3 | 1 | 83 | 72.65 | 42.56 | 20.57 |
| B1 | P | 4 | 1 | 73 | 54.07 | 34.91 | 10.93 |
| B1 | P | 5 | 1 | 83 | 82.4 | 52.36 | 18.97 |
| B1 | P | 6 | 1 | 87 | 68.68 | 51.01 | 17.16 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1 | P | 7 | 1 | 100 | 89.94 | 54.52 | 19.17 |
| B1 | P | 8 | 1 | 83 | 55.63 | 34.13 | 11.95 |
| B1 | P | 9 | 1 | 67 | 42.2 | 31.04 | 10.33 |
| B1 | P | 10 | 1 | 78 | 45.63 | 27.8 | 11.61 |
| B1 | P | 11 | 1 | 76 | 59.44 | 36.45 | 12.66 |
| B1 | P | 12 | 1 | 66 | 37.67 | 26.66 | 9.5 |
| B2 | P | 1 | 1 | 74 | 54.51 | 35.14 | 12.21 |
| B2 | P | 2 | 1 | 84 | 68.35 | 42.95 | 14.09 |
| B2 | P | 3 | 1 | 80 | 66.42 | 40.77 | 16.16 |
| B2 | P | 4 | 1 | 70 | 41.98 | 30.06 | 9.6 |
| B2 | P | 5 | 1 | 75 | 51.98 | 35.33 | 11.12 |
| B2 | P | 6 | 1 | 80 | 55.76 | 40.9 | 13.03 |
| B2 | P | 7 | 1 | 77 | 47.04 | 30.45 | 8.91 |
| B2 | P | 8 | 1 | 84 | 65.47 | 41.19 | 13.36 |
| B2 | P | 9 | 1 | 90 | 78.53 | 49.94 | 13 |
| B2 | P | 10 | 1 | 76 | 54.68 | 37.05 | 13.53 |
| B2 | P | 11 | 1 | 69 | 49.88 | 30.36 | 11.73 |
| B2 | P | 12 | 1 | 77 | 45.4 | 32.52 | 11.07 |
| B3 | P | 1 | 1 | 80 | 59.39 | 33.17 | 13.93 |
| B3 | P | 2 | 1 | 74 | 51.67 | 31.66 | 9.4 |
| B3 | P | 3 | 1 | 74 | 66.36 | 39.21 | 15.74 |
| B3 | P | 4 | 1 | 90 | 70.03 | 43.29 | 13.35 |
| B3 | P | 5 | 1 | 75 | 48.97 | 32.4 | 10.14 |
| B3 | P | 6 | 1 | 71 | 43.86 | 26.78 | 9.84 |
| B3 | P | 7 | 1 | 79 | 49.55 | 39.14 | 10.29 |
| B3 | P | 8 | 1 | 80 | 45.93 | 33.64 | 10.39 |
| B3 | P | 9 | 1 | 79 | 77.79 | 48.32 | 20.8 |
| B3 | P | 10 | 1 | 71 | 49.75 | 36.55 | 12.06 |
| B3 | P | 11 | 1 | 77 | 57.2 | 35.52 | 15.04 |
| B3 | P | 12 | 1 | 80 | 65.8 | 38.91 | 15.84 |
| B1 | SR | 1 | 2 | 59 | 25.31 | 18.65 | 4.81 |
| B1 | SR | 2 | 2 | 60 | 30.71 | 23.55 | 4.71 |
| B1 | SR | 3 | 2 | 57 | 26.1 | 19.35 | 4.73 |
| B1 | SR | 4 | 2 | 65 | 40.56 | 33.85 | 4.75 |
| B1 | SR | 5 | 2 | 66 | 29.64 | 23.88 | 5.06 |
| B1 | SR | 6 | 2 | 61 | 32.89 | 24.94 | 6.71 |
| B2 | SR | 1 | 2 | 56 | 30.2 | 22.96 | 4.24 |
| B2 | SR | 2 | 2 | 60 | 28.22 | 22.51 | 2.99 |
| B2 | SR | 3 | 2 | 57 | 22.55 | 16.47 | 4.29 |
| B2 | SR | 4 | 2 | 56 | 22.97 | 17.2 | 3.92 |
| B2 | SR | 5 | 2 | 65 | 32.03 | 26.4 | 4.5 |
| B2 | SR | 6 | 2 | 71 | 33.9 | 26.09 | 4.49 |
| B3 | SR | 1 | 2 | 60 | 32.63 | 23.28 | 6.73 |
| B3 | SR | 2 | 2 | 55 | 23.54 | 17.3 | 4.26 |
| B3 | SR | 3 | 2 | 56 | 28.16 | 20.94 | 5.1 |
| B3 | SR | 4 | 2 | 53 | 31.26 | 24 | 4.77 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B3 | SR | 5 | 2 | 60 | 27.08 | 22.27 | 3.54 |
| B3 | SR | 6 | 2 | 64 | 29.73 | 23.04 | 4.84 |
| B1 | P | 1 | 2 | 100 | 124.33 | 72.1 | 23.12 |
| B1 | P | 2 | 2 | 110 | 128.28 | 71.82 | 21.83 |
| B1 | P | 3 | 2 | 77 | 67.97 | 38.52 | 12.71 |
| B1 | P | 4 | 2 | 62 | 41.82 | 23 | 6.4 |
| B1 | P | 5 | 2 | 103 | 139.07 | 86.52 | 24.95 |
| B1 | P | 6 | 2 | 80 | 90.04 | 55.07 | 11.72 |
| B2 | P | 1 | 2 | 105 | 135.75 | 89.9 | 17.65 |
| B2 | P | 2 | 2 | 97 | 65.97 | 39.49 | 11.58 |
| B2 | P | 3 | 2 | 102 | 87.75 | 52.59 | 11.24 |
| B2 | P | 4 | 2 | 98 | 100.27 | 63.65 | 15.21 |
| B2 | P | 5 | 2 | 88 | 85.61 | 48.8 | 13.49 |
| B2 | P | 6 | 2 | 96 | 87.56 | 52.49 | 10.68 |
| B3 | P | 1 | 2 | 104 | 104.83 | 60.04 | 15.32 |
| B3 | P | 2 | 2 | 106 | 124.37 | 72.17 | 19.72 |
| B3 | P | 3 | 2 | 111 | 113.58 | 70.52 | 17.93 |
| B3 | P | 4 | 2 | 77 | 44.35 | 26.42 | 7.02 |
| B3 | P | 5 | 2 | 100 | 127.53 | 77.55 | 16.09 |
| B3 | P | 6 | 2 | 96 | 99.26 | 60.16 | 12.63 |
| B1 | SR | 1 | 3 | 64 | 18.51 | 13.96 | 2.97 |
| B1 | SR | 2 | 3 | 76 | 22.29 | 14.05 | 5.28 |
| B1 | SR | 3 | 3 | 61 | 17.42 | 11.2 | 4.05 |
| B1 | SR | 4 | 3 | 70 | 25.14 | 15.11 | 4.6 |
| B1 | SR | 5 | 3 | 62 | 19.64 | 13.38 | 4.25 |
| B1 | SR | 6 | 3 | 57 | 15.72 | 11.74 | 2.02 |
| B2 | SR | 1 | 3 | 68 | 27.62 | 18.75 | 7.41 |
| B2 | SR | 2 | 3 | 64 | 21.94 | 14.64 | 4.33 |
| B2 | SR | 3 | 3 | 65 | 35.54 | 25.53 | 7.37 |
| B2 | SR | 4 | 3 | 75 | 24.21 | 16.59 | 5.12 |
| B2 | SR | 5 | 3 | 68 | 25.42 | 16.94 | 6 |
| B2 | SR | 6 | 3 | 70 | 20.35 | 17.69 | 5.55 |
| B3 | SR | 1 | 3 | 74 | 17.84 | 12.76 | 3.64 |
| B3 | SR | 2 | 3 | 61 | 17.39 | 11.56 | 3.85 |
| B3 | SR | 3 | 3 | 68 | 20.44 | 14.86 | 4.9 |
| B3 | SR | 4 | 3 | 63 | 15.2 | 11.44 | 3.55 |
| B3 | SR | 5 | 3 | 70 | 23.02 | 17.1 | 3.8 |
| B3 | SR | 6 | 3 | 49 | 16.47 | 11.27 | 3.95 |
| B1 | P | 1 | 3 | 76 | 55.31 | 37.51 | 15.04 |
| B1 | P | 2 | 3 | 116 | 196.36 | 140.03 | 28.81 |
| B1 | P | 3 | 3 | 70 | 47.9 | 26.15 | 11.2 |
| B1 | P | 4 | 3 | 66 | 31.41 | 23.37 | 7.65 |
| B1 | P | 5 | 3 | 102 | 126.54 | 81.82 | 20.55 |
| B1 | P | 6 | 3 | 77 | 75.89 | 46.12 | 13.51 |
| B2 | P | 1 | 3 | 79 | 61.23 | 39.55 | 14.35 |
| B2 | P | 2 | 3 | 97 | 130.9 | 87.65 | 20.94 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B2 | P | 3 | 3 | 83 | 62.72 | 47.71 | 14.1 |
| B2 | P | 4 | 3 | 100 | 103.51 | 63.5 | 16.4 |
| B2 | P | 5 | 3 | 71 | 46.47 | 35.67 | 10.53 |
| B2 | P | 6 | 3 | 76 | 36.17 | 23.21 | 9.35 |
| B3 | P | 1 | 3 | 64 | 35.88 | 24.99 | 5.72 |
| B3 | P | 2 | 3 | 110 | 167.34 | 110.62 | 24.4 |
| B3 | P | 3 | 3 | 98 | 156.88 | 103.14 | 26.95 |
| B3 | P | 4 | 3 | 70 | 41.43 | 27.14 | 9.86 |
| B3 | P | 5 | 3 | 63 | 34.62 | 26.35 | 6.6 |
| B3 | P | 6 | 3 | 62 | 32.79 | 21.41 | 6.62 |
| B1 | SR | 1 | 4 | 74 | 23.05 | 16.35 | 5.03 |
| B1 | SR | 2 | 4 | 66 | 18.79 | 12.4 | 4.05 |
| B1 | SR | 3 | 4 | 68 | 32.14 | 19.92 | 6.5 |
| B1 | SR | 4 | 4 | 56 | 14.49 | 10.14 | 3.01 |
| B1 | SR | 5 | 4 | 67 | 26.29 | 12.59 | 3.84 |
| B1 | SR | 6 | 4 | 54 | 18.81 | 13.48 | 3.83 |
| B2 | SR | 1 | 4 | 70 | 34.34 | 25.44 | 7.18 |
| B2 | SR | 2 | 4 | 60 | 19.68 | 13.5 | 4.39 |
| B2 | SR | 3 | 4 | 58 | 18.18 | 11.55 | 4.06 |
| B2 | SR | 4 | 4 | 65 | 20.32 | 14.5 | 3.09 |
| B2 | SR | 5 | 4 | 65 | 29.26 | 18.95 | 6.48 |
| B2 | SR | 6 | 4 | 70 | 28.53 | 17.55 | 7.19 |
| B3 | SR | 1 | 4 | 68 | 25.09 | 16.85 | 5.15 |
| B3 | SR | 2 | 4 | 63 | 22.06 | 15.51 | 5.04 |
| B3 | SR | 3 | 4 | 63 | 21.24 | 15.11 | 4.34 |
| B3 | SR | 4 | 4 | 85 | 28.58 | 18.72 | 4.9 |
| B3 | SR | 5 | 4 | 69 | 18.39 | 12.94 | 3.86 |
| B3 | SR | 6 | 4 | 58 | 16.18 | 11.25 | 3.26 |
| B1 | P | 1 | 4 | 79 | 69.64 | 57.18 | 11.8 |
| B1 | P | 2 | 4 | 82 | 72.52 | 47.76 | 11.98 |
| B1 | P | 3 | 4 | 75 | 80.06 | 58.02 | 10.91 |
| B1 | P | 4 | 4 | 75 | 52.51 | 30.67 | 10.27 |
| B1 | P | 5 | 4 | 87 | 98.18 | 65.51 | 17.77 |
| B1 | P | 6 | 4 | 93 | 93.58 | 68.08 | 22.07 |
| B2 | P | 1 | 4 | 86 | 61.63 | 48.54 | 12.09 |
| B2 | P | 2 | 4 | 85 | 100.87 | 69.73 | 14.86 |
| B2 | P | 3 | 4 | 97 | 82.2 | 58.37 | 13.56 |
| B2 | P | 4 | 4 | 86 | 108.89 | 74.59 | 17.7 |
| B2 | P | 5 | 4 | 94 | 110.09 | 89.29 | 19.95 |
| B2 | P | 6 | 4 | 93 | 77.28 | 59.56 | 14.07 |
| B3 | P | 1 | 4 | 84 | 74.21 | 49.65 | 12.27 |
| B3 | P | 2 | 4 | 86 | 83.36 | 62.7 | 18.52 |
| B3 | P | 3 | 4 | 75 | 60.1 | 43.84 | 13.38 |
| B3 | P | 4 | 4 | 84 | 101.99 | 79.4 | 19.94 |
| B3 | P | 5 | 4 | 80 | 79.7 | 46.96 | 16.82 |
| B3 | P | 6 | 4 | 88 | 68.18 | 48.26 | 13.77 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1 | SR | 1 | 5 | 65 | 25.98 | 17.83 | 4.51 |
| B1 | SR | 2 | 5 | 69 | 24.41 | 16.83 | 3.22 |
| B1 | SR | 3 | 5 | 65 | 30.59 | 20.62 | 5.19 |
| B1 | SR | 4 | 5 | 60 | 29.66 | 19.91 | 6.79 |
| B1 | SR | 5 | 5 | 70 | 23.59 | 16.91 | 4.29 |
| B1 | SR | 6 | 5 | 60 | 25.5 | 16.13 | 4.06 |
| B2 | SR | 1 | 5 | 61 | 20.34 | 13.48 | 3.66 |
| B2 | SR | 2 | 5 | 65 | 25.15 | 18.45 | 3.62 |
| B2 | SR | 3 | 5 | 65 | 16.95 | 11.98 | 3.05 |
| B2 | SR | 4 | 5 | 60 | 21.6 | 15.37 | 3.6 |
| B2 | SR | 5 | 5 | 60 | 22.66 | 16.48 | 3.06 |
| B2 | SR | 6 | 5 | 65 | 20.11 | 13.53 | 5.46 |
| B3 | SR | 1 | 5 | 65 | 21.97 | 15.46 | 3.33 |
| B3 | SR | 2 | 5 | 60 | 24.48 | 16.19 | 3.7 |
| B3 | SR | 3 | 5 | 63 | 20.23 | 14.14 | 3.13 |
| B3 | SR | 4 | 5 | 61 | 26.96 | 19.77 | 4.26 |
| B3 | SR | 5 | 5 | 64 | 29.13 | 20.54 | 4.15 |
| B3 | SR | 6 | 5 | 63 | 18.82 | 11.9 | 2.9 |
| B1 | P | 1 | 5 | 102 | 201.3 | 128.26 | 36.59 |
| B1 | P | 2 | 5 | 103 | 135.56 | 81.66 | 26.03 |
| B1 | P | 3 | 5 | 102 | 156.15 | 96.61 | 21.08 |
| B1 | P | 4 | 5 | 97 | 155.19 | 112.38 | 15.38 |
| B1 | P | 5 | 5 | 90 | 133.31 | 95.86 | 22.09 |
| B1 | P | 6 | 5 | 91 | 101.72 | 72.31 | 15.1 |
| B2 | P | 1 | 5 | 86 | 86.22 | 58.64 | 12.06 |
| B2 | P | 2 | 5 | 99 | 68.75 | 38.86 | 10.72 |
| B2 | P | 3 | 5 | 108 | 203.91 | 130.19 | 29.81 |
| B2 | P | 4 | 5 | 105 | 173.56 | 117.75 | 29.87 |
| B2 | P | 5 | 5 | 106 | 177.91 | 118.88 | 28.71 |
| B2 | P | 6 | 5 | 100 | 154.87 | 96.21 | 31.4 |
| B3 | P | 1 | 5 | 110 | 106.72 | 65.68 | 15.41 |
| B3 | P | 2 | 5 | 87 | 97.82 | 56.69 | 18.64 |
| B3 | P | 3 | 5 | 100 | 88.99 | 72.73 | 12.28 |
| B3 | P | 4 | 5 | 88 | 127.89 | 85.95 | 20.4 |
| B3 | P | 5 | 5 | 100 | 197.74 | 125.19 | 26.4 |
| B3 | P | 6 | 5 | 92 | 93.11 | 65.57 | 9.16 |
| B1 | SR | 1 | 6 | 78 | 37.89 | 28.61 | 8.42 |
| B1 | SR | 2 | 6 | 79 | 41.52 | 29.39 | 9 |
| B1 | SR | 3 | 6 | 84 | 53.02 | 33.2 | 8.94 |
| B1 | SR | 4 | 6 | 81 | 55.59 | 39.31 | 11.6 |
| B1 | SR | 5 | 6 | 73 | 40.51 | 28.23 | 8.23 |
| B1 | SR | 6 | 6 | 73 | 30.73 | 20.46 | 7.47 |
| B2 | SR | 1 | 6 | 67 | 36.58 | 25.41 | 8.3 |
| B2 | SR | 2 | 6 | 65 | 33.51 | 24.17 | 6 |
| B2 | SR | 3 | 6 | 87 | 54.49 | 37.95 | 10.81 |
| B2 | SR | 4 | 6 | 64 | 29.73 | 23.3 | 4.28 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B2 | SR | 5 | 6 | 73 | 37.41 | 28.39 | 8.7 |
| B2 | SR | 6 | 6 | 81 | 44.28 | 30.7 | 9.01 |
| B3 | SR | 1 | 6 | 87 | 42.02 | 30.37 | 7.86 |
| B3 | SR | 2 | 6 | 61 | 22.03 | 15.51 | 4.14 |
| B3 | SR | 3 | 6 | 70 | 39.95 | 32.08 | 7.72 |
| B3 | SR | 4 | 6 | 70 | 29.57 | 22.35 | 5.95 |
| B3 | SR | 5 | 6 | 62 | 29.6 | 22.38 | 5.85 |
| B3 | SR | 6 | 6 | 86 | 41.79 | 29.97 | 8.21 |
| B1 | P | 1 | 6 | 96 | 89.18 | 54.87 | 22.61 |
| B1 | P | 2 | 6 | 80 | 67.04 | 43.93 | 16.16 |
| B1 | P | 3 | 6 | 85 | 100.15 | 58.9 | 21.26 |
| B1 | P | 4 | 6 | 87 | 93.58 | 62.33 | 14.05 |
| B1 | P | 5 | 6 | 85 | 79.9 | 45.87 | 16.87 |
| B1 | P | 6 | 6 | 84 | 73.77 | 46.55 | 16.02 |
| B2 | P | 1 | 6 | 86 | 86.03 | 51.24 | 20.72 |
| B2 | P | 2 | 6 | 81 | 52.71 | 35.37 | 11.23 |
| B2 | P | 3 | 6 | 81 | 72.36 | 48.44 | 14.07 |
| B2 | P | 4 | 6 | 74 | 83.36 | 53.64 | 14.59 |
| B2 | P | 5 | 6 | 86 | 79.11 | 48.26 | 16.8 |
| B2 | P | 6 | 6 | 81 | 85.68 | 50.37 | 16.41 |
| B3 | P | 1 | 6 | 80 | 87.71 | 39.05 | 11.67 |
| B3 | P | 2 | 6 | 82 | 64.23 | 41.64 | 11.03 |
| B3 | P | 3 | 6 | 94 | 102.6 | 85.94 | 18.47 |
| B3 | P | 4 | 6 | 84 | 72.36 | 53.51 | 14.41 |
| B3 | P | 5 | 6 | 74 | 67.6 | 37.96 | 17.32 |
| B3 | P | 6 | 6 | 79 | 71.09 | 45.92 | 14.89 |
| B1-E.coli | SR | 1 | 7 | 63 | 34.14 | 25 | 7.65 |
| B1-E.coli | SR | 2 | 7 | 65 | 26.76 | 19.19 | 6.16 |
| B1-E.coli | SR | 3 | 7 | 67 | 25.6 | 17.58 | 6.7 |
| B1-E.coli | SR | 4 | 7 | 66 | 25.71 | 18.91 | 5.67 |
| B1-E.coli | SR | 5 | 7 | 65 | 25.3 | 18.63 | 5.96 |
| B1-E.coli | SR | 6 | 7 | 66 | 32.25 | 24.08 | 6.6 |
| B2-E.coli | SR | 1 | 7 | 68 | 28.19 | 20.41 | 5.21 |
| B2-E.coli | SR | 2 | 7 | 65 | 16.08 | 12.04 | 2.82 |
| B2-E.coli | SR | 3 | 7 | 61 | 24.98 | 18.93 | 4.7 |
| B2-E.coli | SR | 4 | 7 | 65 | 27.17 | 19.98 | 6.41 |
| B2-E.coli | SR | 5 | 7 | 68 | 25.72 | 18.58 | 5.32 |
| B2-E.coli | SR | 6 | 7 | 65 | 41.14 | 29.2 | 10.05 |
| B3-E.coli | SR | 1 | 7 | 67 | 28.51 | 20.04 | 7.23 |
| B3-E.coli | SR | 2 | 7 | 58 | 32.26 | 22.76 | 7.12 |
| B3-E.coli | SR | 3 | 7 | 63 | 24.31 | 17.53 | 5.19 |
| B3-E.coli | SR | 4 | 7 | 60 | 22.28 | 16.32 | 5.14 |
| B3-E.coli | SR | 5 | 7 | 62 | 19.48 | 12.92 | 3.75 |
| B3-E.coli | SR | 6 | 7 | 66 | 20.08 | 14.62 | 3.53 |
| B1-E.coli | P | 1 | 7 | 100 | 82.57 | 57.77 | 18.02 |
| B1-E.coli | P | 2 | 7 | 71 | 28.8 | 17.23 | 7.22 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1-E.coli | P | 3 | 7 | 73 | 25.3 | 15.04 | 7.77 |
| B1-E.coli | P | 4 | 7 | 67 | 28.12 | 16.33 | 7.03 |
| B1-E.coli | P | 5 | 7 | 69 | 25.6 | 15.81 | 7.28 |
| B1-E.coli | P | 6 | 7 | 64 | 39.66 | 24.19 | 10.54 |
| B2-E.coli | P | 1 | 7 | 68 | 21.32 | 13.86 | 6.51 |
| B2-E.coli | P | 2 | 7 | 61 | 26.61 | 13.69 | 7.02 |
| B2-E.coli | P | 3 | 7 | 67 | 29.05 | 16.06 | 8.4 |
| B2-E.coli | P | 4 | 7 | 66 | 29.91 | 19.32 | 8.77 |
| B2-E.coli | P | 5 | 7 | 60 | 21.48 | 13.18 | 5.8 |
| B2-E.coli | P | 6 | 7 | 69 | 43.04 | 26.34 | 9.75 |
| B3-E.coli | P | 1 | 7 | 68 | 45.14 | 32.09 | 11.97 |
| B3-E.coli | P | 2 | 7 | 54 | 16.53 | 9.87 | 5.31 |
| B3-E.coli | P | 3 | 7 | 59 | 24.88 | 16.41 | 7.34 |
| B3-E.coli | P | 4 | 7 | 68 | 25.52 | 17.09 | 7.72 |
| B3-E.coli | P | 5 | 7 | 70 | 24.4 | 13.78 | 6.63 |
| B3-E.coli | P | 6 | 7 | 72 | 36.8 | 28.27 | 8.43 |
| B1 | SR | 1 | 7 | 61 | 20.58 | 15.16 | 3.85 |
| B1 | SR | 2 | 7 | 60 | 26.71 | 18.21 | 6.73 |
| B1 | SR | 3 | 7 | 63 | 21.15 | 15.9 | 3.72 |
| B1 | SR | 4 | 7 | 70 | 26.23 | 17.94 | 6.71 |
| B1 | SR | 5 | 7 | 68 | 27.64 | 20.49 | 5.5 |
| B1 | SR | 6 | 7 | 65 | 20.42 | 15.01 | 4.17 |
| B2 | SR | 1 | 7 | 64 | 24.66 | 19.08 | 4.68 |
| B2 | SR | 2 | 7 | 65 | 35.93 | 24.82 | 9.34 |
| B2 | SR | 3 | 7 | 65 | 24.65 | 18.04 | 6.86 |
| B2 | SR | 4 | 7 | 66 | 36.81 | 26.25 | 8.31 |
| B2 | SR | 5 | 7 | 65 | 20.76 | 15.72 | 4.15 |
| B2 | SR | 6 | 7 | 63 | 34.81 | 24.39 | 9.15 |
| B3 | SR | 1 | 7 | 65 | 27.18 | 20.06 | 5.38 |
| B3 | SR | 2 | 7 | 66 | 29.1 | 22 | 6.34 |
| B3 | SR | 3 | 7 | 62 | 21.64 | 16.13 | 4.21 |
| B3 | SR | 4 | 7 | 64 | 27.83 | 19.67 | 6.27 |
| B3 | SR | 5 | 7 | 60 | 17.41 | 12.52 | 3.12 |
| B3 | SR | 6 | 7 | 63 | 29.19 | 20.87 | 4.52 |
| B1 | P | 1 | 7 | 75 | 34.87 | 20.79 | 9.79 |
| B1 | P | 2 | 7 | 69 | 28.76 | 20.49 | 8.09 |
| B1 | P | 3 | 7 | 64 | 23.77 | 13.95 | 7.68 |
| B1 | P | 4 | 7 | 85 | 51.32 | 32.71 | 14.65 |
| B1 | P | 5 | 7 | 86 | 58.07 | 35.43 | 15.22 |
| B1 | P | 6 | 7 | 70 | 25.24 | 16.68 | 7.9 |
| B2 | P | 1 | 7 | 76 | 42.86 | 25.3 | 9.71 |
| B2 | P | 2 | 7 | 87 | 72.91 | 44.45 | 17.13 |
| B2 | P | 3 | 7 | 56 | 13.94 | 8.69 | 4.19 |
| B2 | P | 4 | 7 | 59 | 21.85 | 12.42 | 6.05 |
| B2 | P | 5 | 7 | 70 | 39.8 | 23.3 | 10.44 |
| B2 | P | 6 | 7 | 85 | 53.09 | 32.73 | 13.54 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B3 | P | 1 | 7 | 79 | 45.35 | 29.37 | 13.1 |
| B3 | P | 2 | 7 | 90 | 75.55 | 50.59 | 20.79 |
| B3 | P | 3 | 7 | 64 | 26.09 | 15.77 | 6.58 |
| B3 | P | 4 | 7 | 71 | 40.72 | 24.85 | 10.3 |
| B3 | P | 5 | 7 | 60 | 29.65 | 18.75 | 8.15 |
| B1 | SR | 1 | 8 | 61 | 18.51 | 12.51 | 4.01 |
| B1 | SR | 1 | 8 | 58 | 29.19 | 22.44 | 5.73 |
| B1 | SR | 1 | 8 | 60 | 26.19 | 18.9 | 5.83 |
| B1 | SR | 1 | 8 | 60 | 27.27 | 18.59 | 6.63 |
| B1 | SR | 1 | 8 | 61 | 24.27 | 17.03 | 5.23 |
| B1 | SR | 1 | 8 | 53 | 27.27 | 20.66 | 5.18 |
| B2 | SR | 2 | 8 | 57 | 20.44 | 14.77 | 4.11 |
| B2 | SR | 2 | 8 | 58 | 21.18 | 14.06 | 5.42 |
| B2 | SR | 2 | 8 | 56 | 27.44 | 18.57 | 5.65 |
| B2 | SR | 2 | 8 | 60 | 19.47 | 12.5 | 4.99 |
| B2 | SR | 2 | 8 | 58 | 17.05 | 11.77 | 4.04 |
| B2 | SR | 2 | 8 | 59 | 13.64 | | |
| B3 | SR | 3 | 8 | 56 | 16.7 | 10.99 | 4.55 |
| B3 | SR | 3 | 8 | 56 | 21.41 | 15.15 | 5.62 |
| B3 | SR | 3 | 8 | 64 | 21.37 | 15.85 | 4.19 |
| B3 | SR | 3 | 8 | 57 | 24.65 | 17.43 | 5.19 |
| B3 | SR | 3 | 8 | 54 | 11.09 | 7.68 | 2.64 |
| B3 | SR | 3 | 8 | 58 | 18.41 | 12.82 | 4.7 |
| B1 | P | 1 | 8 | 100 | 171.68 | 105.94 | 34.34 |
| B1 | P | 1 | 8 | 125 | | 153.24 | 46.43 |
| B1 | P | 1 | 8 | 99 | 145.69 | 93.49 | 32.82 |
| B1 | P | 1 | 8 | 120 | | 169.44 | 39.96 |
| B1 | P | 1 | 8 | 95 | 116.96 | 84.65 | 27.07 |
| B1 | P | 1 | 8 | 100 | 200.78 | 137.06 | 37.15 |
| B2 | P | 2 | 8 | 110 | | 165.33 | 34.65 |
| B2 | P | 2 | 8 | 100 | 137.71 | 89.54 | 15.65 |
| B2 | P | 2 | 8 | 100 | 197.72 | 128.3 | 41.92 |
| B2 | P | 2 | 8 | 106 | | 168.5 | 35.26 |
| B2 | P | 2 | 8 | 110 | | 185.67 | 40.21 |
| B2 | P | 2 | 8 | 116 | | 138.58 | 41.41 |
| B3 | P | 3 | 8 | 104 | | 152.76 | 44.62 |
| B3 | P | 3 | 8 | 115 | 188.5 | 123.39 | 41.66 |
| B3 | P | 3 | 8 | 95 | 184.67 | 122.9 | 37.34 |
| B3 | P | 3 | 8 | 108 | 166.73 | 108.97 | 33.52 |
| B3 | P | 3 | 8 | 99 | 167.2 | 123.26 | 30.48 |
| B3 | P | 3 | 8 | 108 | 193.68 | 125.46 | 42 |
| B1 | SR | 1 | 9 | 53 | 16.21 | 10.58 | 3.87 |
| B1 | SR | 1 | 9 | 59 | 22.83 | 1498 | 5.68 |
| B1 | SR | 1 | 9 | 55 | 31.55 | 21.21 | 6.37 |
| B1 | SR | 1 | 9 | 82 | 23.17 | 14.95 | 6.36 |
| B1 | SR | 1 | 9 | 55 | 19.61 | 13.56 | 3.6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1 | SR | 1 | 9 | 60 | 28.48 | 21.31 | 4.49 |
| B2 | SR | 2 | 9 | 58 | 21.5 | 14.27 | 4.49 |
| B2 | SR | 2 | 9 | 57 | 18.76 | 13.07 | 4.45 |
| B2 | SR | 2 | 9 | 61 | 18.66 | 13.64 | 3.61 |
| B2 | SR | 2 | 9 | 61 | 19.48 | 13.92 | 3.73 |
| B2 | SR | 2 | 9 | 61 | 20.75 | 14.25 | 4.36 |
| B2 | SR | 2 | 9 | 59 | 18.83 | 11.74 | 2.79 |
| B3 | SR | 3 | 9 | 65 | 23.46 | 16.69 | 4.3 |
| B3 | SR | 3 | 9 | 60 | 24.3 | 16.4 | 5.34 |
| B3 | SR | 3 | 9 | 65 | 22.35 | 15.84 | 4.25 |
| B3 | SR | 3 | 9 | 63 | 28.48 | 20.43 | 5.45 |
| B3 | SR | 3 | 9 | 59 | 20.45 | 14.18 | 3.18 |
| B3 | SR | 3 | 9 | 58 | 21.48 | 15.11 | 4.19 |
| B1 | P | 1 | 9 | 117 | 189.11 | 126.63 | 30.32 |
| B1 | P | 1 | 9 | 112 | 185.4 | 113.7 | 41.58 |
| B1 | P | 1 | 9 | 112 | 172.11 | 111.49 | 32.62 |
| B1 | P | 1 | 9 | 107 | 189.84 | 129.72 | 30.45 |
| B1 | P | 1 | 9 | 98 | 201.34 | 134.01 | 25.06 |
| B1 | P | 1 | 9 | 115 | 150.42 | 97.38 | 20.43 |
| B2 | P | 2 | 9 | 99 | 153.31 | 89.66 | 26.43 |
| B2 | P | 2 | 9 | 128 | 161.47 | 105.8 | 24.18 |
| B2 | P | 2 | 9 | 116 | 172.43 | 118.87 | 22.25 |
| B2 | P | 2 | 9 | 110 | 206.74 | 140.66 | 30.75 |
| B2 | P | 2 | 9 | 113 | 197.92 | 124.51 | 34.61 |
| B2 | P | 2 | 9 | 112 | 160.68 | 103.4 | 23.14 |
| B3 | P | 3 | 9 | 101 | 103.72 | 69.49 | 14.23 |
| B3 | P | 3 | 9 | 105 | 118.87 | 70.9 | 25.62 |
| B3 | P | 3 | 9 | 80 | 107.94 | 66.91 | 21.67 |
| B3 | P | 3 | 9 | 106 | 121.48 | 75.47 | 21.53 |
| B3 | P | 3 | 9 | 92 | 167.55 | 110.4 | 29.13 |
| B3 | P | 3 | 9 | 73 | 62.35 | 38.75 | 9.63 |

# APPENDIX E3

# PACIFIC & SYDNEY ROCK OYSTER CONDITION INDEX

| Crookhaven River & Estuary Oyster Monitoring Condition Index | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site** | **Species** | **Replicate** | **Survey** | **Shell Height** | **Total Weight** | **Shell Weight** | **Flesh Weight** |
| CUP1 | SR | 1 | 1 | 57.75 | 34.61 | 25.55 | 6.87 |
| CUP1 | SR | 2 | 1 | 58.42 | 33.23 | 24.63 | 6.37 |
| CUP2 | SR | 1 | 1 | 62.50 | 35.35 | 26.87 | 5.78 |
| CUP2 | SR | 2 | 1 | 59.92 | 32.92 | 26.27 | 5.34 |
| BB1 | SR | 1 | 1 | 57.00 | 31.54 | 22.78 | 6.07 |
| BB1 | SR | 2 | 1 | 58.42 | 32.82 | 23.99 | 5.98 |
| BB2 | SR | 1 | 1 | 60.33 | 33.53 | 28.63 | 6.03 |
| BB2 | SR | 2 | 1 | 60.67 | 34.65 | 26.17 | 6.15 |
| SWB1 | SR | 1 | 1 | 59.67 | 33.90 | 26.71 | 5.54 |
| SWB1 | SR | 2 | 1 | 64.08 | 39.37 | 30.91 | 5.75 |
| SWB2 | SR | 1 | 1 | 59.75 | 33.52 | 26.10 | 5.63 |
| SWB2 | SR | 2 | 1 | 56.08 | 29.92 | 22.72 | 4.97 |
| SEB1 | SR | 1 | 1 | 60.00 | 34.88 | 26.55 | 6.89 |
| SEB1 | SR | 2 | 1 | 59.00 | 30.70 | 22.91 | 6.64 |
| SEB2 | SR | 1 | 1 | 57.83 | 29.95 | 22.26 | 6.51 |
| SEB2 | SR | 2 | 1 | 58.75 | 34.74 | 26.07 | 7.39 |
| NB1 | SR | 1 | 1 | 59.25 | 31.22 | 23.63 | 5.24 |
| NB1 | SR | 2 | 1 | 59.17 | 30.67 | 23.17 | 5.30 |
| NB2 | SR | 1 | 1 | 59.58 | 31.93 | 23.47 | 6.03 |
| NB2 | SR | 2 | 1 | 57.33 | 31.30 | 24.32 | 5.18 |
| CDN1 | SR | 1 | 1 | 61.83 | 38.03 | 28.08 | 5.03 |
| CDN1 | SR | 2 | 1 | 59.08 | 34.61 | 27.53 | 4.61 |
| CDN2 | SR | 1 | 1 | 58.75 | 32.42 | 25.60 | 4.57 |
| CDN2 | SR | 2 | 1 | 58.17 | 30.60 | 24.19 | 4.83 |
| CUP1 | P | 1 | 1 | 84.17 | 73.12 | 44.35 | 17.20 |
| CUP1 | P | 2 | 1 | 84.67 | 71.56 | 42.74 | 16.11 |
| CUP2 | P | 1 | 1 | 86.17 | 82.04 | 50.97 | 15.68 |
| CUP2 | P | 2 | 1 | 84.25 | 71.81 | 45.46 | 15.48 |
| BB1 | P | 1 | 1 | 80.67 | 65.64 | 42.09 | 8.70 |
| BB1 | P | 2 | 1 | 78.83 | 63.74 | 42.27 | 8.43 |
| BB2 | P | 1 | 1 | 81.83 | 70.16 | 45.87 | 9.09 |
| BB2 | P | 2 | 1 | 83.00 | 69.69 | 44.82 | 14.83 |
| SWB1 | P | 1 | 1 | 84.00 | 73.42 | 44.72 | 13.80 |
| SWB1 | P | 2 | 1 | 83.58 | 71.04 | 46.07 | 14.01 |
| SWB2 | P | 1 | 1 | 78.75 | 71.09 | 44.66 | 12.89 |
| SWB2 | P | 2 | 1 | 79.75 | 74.18 | 49.88 | 13.44 |
| SEB1 | P | 1 | 1 | 78.17 | 68.85 | 43.54 | 13.03 |
| SEB1 | P | 2 | 1 | 82.42 | 84.15 | 54.33 | 16.27 |
| SEB2 | P | 1 | 1 | 78.00 | 74.17 | 47.04 | 14.59 |
| SEB2 | P | 2 | 1 | 79.33 | 75.02 | 47.80 | 15.38 |
| NB1 | P | 1 | 1 | 93.00 | 79.58 | 52.04 | 17.12 |
| NB1 | P | 2 | 1 | 91.50 | 83.11 | 50.77 | 18.33 |
| NB2 | P | 1 | 1 | 80.25 | 65.52 | 42.01 | 10.83 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NB2 | P | 2 | 1 | 82.58 | 71.56 | 46.63 | 12.13 |
| CDN1 | P | 1 | 1 | 79.73 | 63.15 | 41.78 | 11.81 |
| CDN1 | P | 2 | 1 | 79.67 | 69.61 | 45.43 | 12.84 |
| CDN2 | P | 1 | 1 | 76.08 | 62.24 | 42.49 | 10.85 |
| CDN2 | P | 2 | 1 | 79.08 | 67.58 | 43.78 | 11.06 |
| CUP1 | SR | 1 | 2 | 60.17 | 27.71 | 21.10 | 6.26 |
| CUP1 | SR | 2 | 2 | 58.42 | 27.55 | 21.16 | 6.02 |
| CUP2 | SR | 1 | 2 | 54.00 | 28.41 | 21.41 | 6.42 |
| CUP2 | SR | 2 | 2 | 56.75 | 24.13 | 18.14 | 5.36 |
| BB1 | SR | 1 | 2 | 56.67 | 26.41 | 19.50 | 4.85 |
| BB1 | SR | 2 | 2 | 58.17 | 28.95 | 22.61 | 5.98 |
| BB2 | SR | 1 | 2 | 59.58 | 27.30 | 20.67 | 5.94 |
| BB2 | SR | 2 | 2 | 57.08 | 24.30 | 18.92 | 5.14 |
| SWB1 | SR | 1 | 2 | 59.33 | 31.38 | 23.88 | 5.45 |
| SWB1 | SR | 2 | 2 | 61.42 | 32.46 | 25.14 | 5.50 |
| SWB2 | SR | 1 | 2 | 59.08 | 32.81 | 24.84 | 7.65 |
| SWB2 | SR | 2 | 2 | 56.25 | 28.01 | 20.53 | 6.64 |
| SEB1 | SR | 1 | 2 | 57.58 | 25.63 | 19.70 | 5.94 |
| SEB1 | SR | 2 | 2 | 57.67 | 36.17 | 27.32 | 7.77 |
| SEB2 | SR | 1 | 2 | 57.25 | 31.87 | 24.06 | 6.84 |
| SEB2 | SR | 2 | 2 | 60.83 | 30.06 | 23.62 | 6.23 |
| NB1 | SR | 1 | 2 | 61.83 | 29.11 | 22.98 | 5.26 |
| NB1 | SR | 2 | 2 | 59.33 | 30.05 | 23.74 | 5.09 |
| NB2 | SR | 1 | 2 | 58.92 | 26.11 | 19.67 | 5.16 |
| NB2 | SR | 2 | 2 | 58.82 | 28.11 | 21.22 | 5.09 |
| CDN1 | SR | 1 | 2 | 57.75 | 29.11 | 22.53 | 5.16 |
| CDN1 | SR | 2 | 2 | 59.25 | 29.99 | 23.21 | 5.72 |
| CDN2 | SR | 1 | 2 | 58.33 | 29.85 | 22.00 | 5.00 |
| CDN2 | SR | 2 | 2 | 58.67 | 29.71 | 22.55 | 5.41 |
| CUP1 | P | 1 | 2 | 97.83 | 121.82 | 77.10 | 21.78 |
| CUP1 | P | 2 | 2 | 99.25 | 110.45 | 68.98 | 21.42 |
| CUP2 | P | 1 | 2 | 94.00 | 105.10 | 66.36 | 18.70 |
| CUP2 | P | 2 | 2 | 95.33 | 118.20 | 75.28 | 20.52 |
| BB1 | P | 1 | 2 | 101.42 | 125.82 | 80.54 | 23.44 |
| BB1 | P | 2 | 2 | 102.50 | 119.98 | 76.05 | 21.57 |
| BB2 | P | 1 | 2 | 101.17 | 119.43 | 76.05 | 20.40 |
| BB2 | P | 2 | 2 | 96.33 | 116.30 | 74.69 | 18.61 |
| SWB1 | P | 1 | 2 | 78.00 | 65.03 | 38.73 | 12.84 |
| SWB1 | P | 2 | 2 | 72.25 | 54.96 | 32.14 | 11.83 |
| SWB2 | P | 1 | 2 | 71.17 | 52.55 | 34.62 | 9.49 |
| SWB2 | P | 2 | 2 | 80.00 | 69.50 | 45.44 | 12.47 |
| SEB1 | P | 1 | 2 | 70.50 | 59.35 | 38.68 | 11.47 |
| SEB1 | P | 2 | 2 | 73.17 | 63.59 | 41.99 | 12.23 |
| SEB2 | P | 1 | 2 | 73.92 | 70.27 | 45.48 | 13.51 |
| SEB2 | P | 2 | 2 | 76.83 | 73.31 | 47.84 | 13.88 |
| NB1 | P | 1 | 2 | 84.58 | 80.78 | 53.60 | 15.31 |
| NB1 | P | 2 | 2 | 80.25 | 76.31 | 49.29 | 15.23 |

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|---|---|---|---|---|---|---|---|
| NB2 | P | 1 | 2 | 77.83 | 67.16 | 46.37 | 12.37 |
| NB2 | P | 2 | 2 | 73.17 | 62.27 | 39.10 | 11.21 |
| CDN1 | P | 1 | 2 | 72.42 | 61.78 | 39.83 | 11.45 |
| CDN1 | P | 2 | 2 | 71.75 | 63.00 | 39.30 | 11.35 |
| CDN2 | P | 1 | 2 | 76.08 | 74.74 | 50.22 | 12.57 |
| CDN2 | P | 2 | 2 | 72.75 | 65.45 | 42.32 | 11.41 |
| Cup1 | SR | 1 | 3 | 62.92 | 19.78 | 13.68 | 4.11 |
| Cup1 | SR | 2 | 3 | 63.58 | 19.00 | 13.10 | 3.94 |
| Cup2 | SR | 1 | 3 | 63.42 | 19.42 | 13.02 | 4.23 |
| Cup2 | SR | 2 | 3 | 63.58 | 18.19 | 12.24 | 3.73 |
| BB1 | SR | 1 | 3 | 58.50 | 16.40 | 11.29 | 3.56 |
| BB1 | SR | 2 | 3 | 60.58 | 18.09 | 12.39 | 4.32 |
| BB2 | SR | 1 | 3 | 60.58 | 17.98 | 11.99 | 3.99 |
| BB2 | SR | 2 | 3 | 63.83 | 19.24 | 13.62 | 4.42 |
| SWB1 | SR | 1 | 3 | 62.75 | 18.66 | 12.71 | 4.45 |
| SWB1 | SR | 2 | 3 | 63.92 | 19.19 | 12.94 | 4.80 |
| SWB2 | SR | 1 | 3 | 61.58 | 18.39 | 12.40 | 3.98 |
| SWB2 | SR | 2 | 3 | 61.58 | 18.61 | 12.91 | 3.97 |
| SEB1 | SR | 1 | 3 | 62.67 | 19.00 | 12.89 | 4.30 |
| SEB1 | SR | 2 | 3 | 62.50 | 19.68 | 13.72 | 4.18 |
| SEB2 | SR | 1 | 3 | 64.50 | 18.58 | 12.50 | 4.27 |
| SEB2 | SR | 2 | 3 | 62.33 | 18.03 | 12.40 | 3.80 |
| NB1 | SR | 1 | 3 | 62.08 | 20.26 | 14.00 | 4.25 |
| NB1 | SR | 2 | 3 | 66.25 | 21.42 | 14.69 | 4.83 |
| NB2 | SR | 1 | 3 | 67.17 | 19.67 | 13.58 | 4.16 |
| NB2 | SR | 2 | 3 | 64.67 | 21.67 | 15.05 | 4.74 |
| CDN1 | SR | 1 | 3 | 61.33 | 19.60 | 13.54 | 4.31 |
| CDN1 | SR | 2 | 3 | 61.67 | 19.50 | 13.26 | 3.95 |
| CDN2 | SR | 1 | 3 | 64.00 | 20.42 | 13.96 | 4.87 |
| CDN2 | SR | 2 | 3 | 62.00 | 20.27 | 14.14 | 5.09 |
| CUP1 | P | 1 | 3 | 85.08 | 93.80 | 62.22 | 15.07 |
| CUP1 | P | 2 | 3 | 83.67 | 89.32 | 54.62 | 15.89 |
| CUP2 | P | 1 | 3 | 83.42 | 90.81 | 58.41 | 15.22 |
| CUP2 | P | 2 | 3 | 88.08 | 101.58 | 64.17 | 16.76 |
| BB1 | P | 1 | 3 | 90.33 | 108.38 | 70.22 | 17.79 |
| BB1 | P | 2 | 3 | 89.17 | 99.46 | 65.97 | 16.02 |
| BB2 | P | 1 | 3 | 89.83 | 104.92 | 67.52 | 18.30 |
| BB2 | P | 2 | 3 | 80.67 | 79.41 | 48.16 | 13.75 |
| SWB1 | P | 1 | 3 | 89.00 | 101.48 | 61.77 | 17.37 |
| SWB1 | P | 2 | 3 | 87.33 | 92.42 | 58.72 | 15.86 |
| SWB2 | P | 1 | 3 | 94.92 | 122.58 | 78.54 | 20.16 |
| SWB2 | P | 2 | 3 | 97.25 | 127.09 | 81.67 | 20.30 |
| SEB1 | P | 1 | 3 | 88.42 | 110.63 | 72.20 | 17.89 |
| SEB1 | P | 2 | 3 | 90.08 | 117.13 | 75.70 | 19.87 |
| SEB2 | P | 1 | 3 | 82.17 | 88.96 | 57.51 | 13.86 |
| SEB2 | P | 2 | 3 | 90.50 | 118.80 | 79.45 | 19.27 |
| NB1 | P | 1 | 3 | 92.00 | 98.87 | 64.77 | 17.66 |

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|---|---|---|---|---|---|---|---|
| NB1 | P | 2 | 3 | 89.92 | 98.08 | 65.65 | 16.94 |
| NB2 | P | 1 | 3 | 90.58 | 95.38 | 64.36 | 15.73 |
| NB2 | P | 2 | 3 | 92.33 | 112.78 | 74.67 | 18.65 |
| CDN1 | P | 1 | 3 | 92.50 | 129.57 | 85.15 | 21.62 |
| CDN1 | P | 2 | 3 | 93.83 | 123.25 | 692.16 | 20.62 |
| CDN2 | P | 1 | 3 | 90.08 | 110.15 | 69.06 | 19.09 |
| CDN2 | P | 2 | 3 | 79.92 | 87.80 | 54.74 | 15.37 |
| CUP1 | SR | 1 | 4 | 67.58 | 24.10 | 16.55 | 3.99 |
| CUP1 | SR | 2 | 4 | 68.50 | 24.20 | 16.35 | 4.36 |
| CUP2 | SR | 1 | 4 | 67.33 | 25.46 | 17.36 | 3.72 |
| CUP2 | SR | 2 | 4 | 69.50 | 23.59 | 16.02 | 3.89 |
| BB1 | SR | 1 | 4 | 68.08 | 25.34 | 17.37 | 4.30 |
| BB1 | SR | 2 | 4 | 65.00 | 22.58 | 15.18 | 3.83 |
| BB2 | SR | 1 | 4 | 72.33 | 26.23 | 17.92 | 4.84 |
| BB2 | SR | 2 | 4 | 69.50 | 23.64 | 15.74 | 4.33 |
| SWB1 | SR | 1 | 4 | 67.92 | 27.70 | 19.88 | 5.38 |
| SWB1 | SR | 2 | 4 | 66.08 | 24.82 | 17.14 | 4.48 |
| SWB2 | SR | 1 | 4 | 70.50 | 25.14 | 17.53 | 4.53 |
| SWB2 | SR | 2 | 4 | 69.58 | 25.75 | 17.90 | 4.25 |
| SEB1 | SR | 1 | 4 | 69.92 | 24.64 | 16.68 | 5.17 |
| SEB1 | SR | 2 | 4 | 63.75 | 21.42 | 14.70 | 4.11 |
| SEB2 | SR | 1 | 4 | 64.67 | 22.64 | 15.63 | 4.17 |
| SEB2 | SR | 2 | 4 | 68.17 | 22.45 | 15.37 | 4.34 |
| NB1 | SR | 1 | 4 | 68.25 | 24.36 | 16.57 | 4.76 |
| NB1 | SR | 2 | 4 | 72.50 | 27.14 | 18.40 | 4.72 |
| NB2 | SR | 1 | 4 | 69.08 | 24.66 | 17.34 | 3.82 |
| NB2 | SR | 2 | 4 | 67.08 | 23.90 | 16.38 | 4.45 |
| CDN1 | SR | 1 | 4 | 71.42 | 27.15 | 18.36 | 4.45 |
| CDN1 | SR | 2 | 4 | 66.25 | 21.52 | 14.92 | 3.50 |
| CDN2 | SR | 1 | 4 | 75.58 | 29.03 | 19.77 | 5.29 |
| CDN2 | SR | 2 | 4 | 62.17 | 20.77 | 14.58 | 3.70 |
| CUP1 | P | 1 | 4 | 80.67 | 88.66 | 56.37 | 12.49 |
| CUP1 | P | 2 | 4 | 82.75 | 88.64 | 59.13 | 11.91 |
| CUP2 | P | 1 | 4 | 82.67 | 86.36 | 58.13 | 12.07 |
| CUP2 | P | 2 | 4 | 84.83 | 91.92 | 62.41 | 13.10 |
| BB1 | P | 1 | 4 | 82.83 | 92.16 | 59.85 | 14.53 |
| BB1 | P | 2 | 4 | 81.75 | 93.71 | 60.02 | 14.31 |
| BB2 | P | 1 | 4 | 85.17 | 83.15 | 55.38 | 13.49 |
| BB2 | P | 2 | 4 | 82.17 | 89.49 | 61.76 | 13.43 |
| SWB1 | P | 1 | 4 | 85.67 | 97.73 | 64.84 | 15.00 |
| SWB1 | P | 2 | 4 | 85.42 | 94.65 | 61.26 | 15.56 |
| SWB2 | P | 1 | 4 | 80.67 | 92.08 | 60.33 | 14.55 |
| SWB2 | P | 2 | 4 | 80.83 | 88.60 | 60.29 | 13.35 |
| SEB1 | P | 1 | 4 | 83.75 | 90.53 | 59.76 | 14.36 |
| SEB1 | P | 2 | 4 | 83.50 | 96.69 | 62.71 | 14.21 |
| SEB2 | P | 1 | 4 | 83.25 | 95.38 | 62.30 | 14.69 |
| SEB2 | P | 2 | 4 | 82.33 | 92.55 | 59.37 | 13.38 |

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|---|---|---|---|---|---|---|---|
| NB1 | P | 1 | 4 | 87.58 | 92.24 | 63.99 | 16.41 |
| NB1 | P | 2 | 4 | 87.08 | 96.30 | 68.43 | 15.16 |
| NB2 | P | 1 | 4 | 82.92 | 92.46 | 61.60 | 13.24 |
| NB2 | P | 2 | 4 | 83.58 | 85.94 | 54.65 | 12.55 |
| CDN1 | P | 1 | 4 | 82.55 | 99.21 | 65.93 | 15.42 |
| CDN1 | P | 2 | 4 | 82.67 | 92.36 | 59.86 | 14.14 |
| CDN2 | P | 1 | 4 | 84.67 | 91.23 | 62.31 | 14.34 |
| CDN2 | P | 2 | 4 | 87.17 | 98.54 | 62.33 | 15.95 |
| CUP1 | SR | 1 | 5 | 64.08 | 25.47 | 18.67 | 5.33 |
| CUP1 | SR | 2 | 5 | 65.00 | 24.51 | 17.33 | 5.05 |
| CUP2 | SR | 1 | 5 | 61.92 | 23.46 | 16.47 | 4.74 |
| CUP2 | SR | 2 | 5 | 63.58 | 23.77 | 17.17 | 5.16 |
| BB1 | SR | 1 | 5 | 63.42 | 25.16 | 17.60 | 5.60 |
| BB1 | SR | 2 | 5 | 64.08 | 24.75 | 18.12 | 5.14 |
| BB2 | SR | 1 | 5 | 64.33 | 23.99 | 17.01 | 5.32 |
| BB2 | SR | 2 | 5 | 65.08 | 25.96 | 18.38 | 5.74 |
| SWB1 | SR | 1 | 5 | 66.75 | 26.99 | 19.34 | 6.29 |
| SWB1 | SR | 2 | 5 | 65.25 | 25.82 | 18.79 | 5.62 |
| SWB2 | SR | 1 | 5 | 64.17 | 27.34 | 19.50 | 5.91 |
| SWB2 | SR | 2 | 5 | 64.17 | 26.85 | 19.43 | 5.56 |
| SEB1 | SR | 1 | 5 | 64.25 | 27.46 | 19.85 | 6.22 |
| SEB1 | SR | 2 | 5 | 64.42 | 25.79 | 18.60 | 5.55 |
| SEB2 | SR | 1 | 5 | 63.33 | 27.01 | 19.29 | 5.97 |
| SEB2 | SR | 2 | 5 | 63.83 | 25.31 | 17.72 | 5.88 |
| NB1 | SR | 1 | 5 | 68.83 | 29.84 | 20.45 | 7.27 |
| NB1 | SR | 2 | 5 | 67.42 | 27.01 | 19.51 | 5.88 |
| NB2 | SR | 1 | 5 | 66.00 | 27.17 | 19.56 | 6.28 |
| NB2 | SR | 2 | 5 | 65.75 | 27.87 | 19.60 | 6.68 |
| CDN1 | SR | 1 | 5 | 65.92 | 458.90 | 18.68 | 6.53 |
| CDN1 | SR | 2 | 5 | 65.50 | 27.56 | 20.30 | 6.27 |
| CDN2 | SR | 1 | 5 | 65.83 | 220.46 | 19.13 | 6.74 |
| CDN2 | SR | 2 | 5 | 64.92 | 29.70 | 20.90 | 7.22 |
| CUP1 | P | 1 | 5 | 91.83 | 101.03 | 71.91 | 15.91 |
| CUP1 | P | 2 | 5 | 89.00 | 108.43 | 71.93 | 13.11 |
| CUP2 | P | 1 | 5 | 93.60 | 117.86 | 67.61 | 17.72 |
| CUP2 | P | 2 | 5 | 91.00 | 106.19 | 70.89 | 15.35 |
| BB1 | P | 1 | 5 | 94.50 | 113.42 | 72.47 | 16.76 |
| BB1 | P | 2 | 5 | 101.00 | 125.73 | 158.82 | 19.73 |
| BB2 | P | 1 | 5 | 93.10 | 103.66 | 69.64 | 17.08 |
| BB2 | P | 2 | 5 | 89.10 | 110.94 | 76.23 | 17.11 |
| SWB1 | P | 1 | 5 | 98.00 | 127.37 | 175.90 | 20.62 |
| SWB1 | P | 2 | 5 | 95.70 | 126.62 | 84.06 | 20.22 |
| SWB2 | P | 1 | 5 | 89.20 | 99.73 | 66.23 | 16.76 |
| SWB2 | P | 2 | 5 | 91.70 | 112.12 | 75.91 | 18.09 |
| SEB1 | P | 1 | 5 | 92.60 | 115.83 | 77.57 | 19.21 |
| SEB1 | P | 2 | 5 | 96.00 | 115.57 | 82.17 | 19.33 |
| SEB2 | P | 1 | 5 | 100.30 | 116.05 | 79.62 | 18.46 |

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|---|---|---|---|---|---|---|---|
| SEB2 | P | 2 | 5 | 94.70 | 117.03 | 87.45 | 19.82 |
| NB1 | P | 1 | 5 | 98.00 | 111.76 | 83.94 | 21.60 |
| NB1 | P | 2 | 5 | 95.40 | 118.80 | 79.26 | 20.74 |
| NB2 | P | 1 | 5 | 95.10 | 115.06 | 77.94 | 20.07 |
| NB2 | P | 2 | 5 | 94.80 | 112.59 | 76.17 | 18.32 |
| CDN1 | P | 1 | 5 | 95.60 | 115.91 | 78.51 | 20.22 |
| CDN1 | P | 2 | 5 | 92.00 | 101.17 | 66.63 | 17.12 |
| CDN2 | P | 1 | 5 | 96.90 | 109.86 | 76.29 | 21.22 |
| CDN2 | P | 2 | 5 | 96.50 | 106.68 | 74.56 | 21.38 |
| CUP1 | SR | 1 | 6 | 74.75 | 34.65 | 26.69 | 7.17 |
| CUP1 | SR | 2 | 6 | 71.67 | 35.23 | 35.23 | 7.15 |
| CUP2 | SR | 1 | 6 | 73.08 | 38.20 | 38.12 | 7.89 |
| CUP2 | SR | 2 | 6 | 73.33 | 35.13 | 33.32 | 7.24 |
| BB1 | SR | 1 | 6 | 74.83 | 35.60 | 26.07 | 7.50 |
| BB1 | SR | 2 | 6 | 76.08 | 36.37 | 27.74 | 8.71 |
| BB2 | SR | 1 | 6 | 76.42 | 39.20 | 29.24 | 9.24 |
| BB2 | SR | 2 | 6 | 72.83 | 37.92 | 28.12 | 8.37 |
| SWB1 | SR | 1 | 6 | 74.67 | 41.06 | 29.49 | 8.92 |
| SWB1 | SR | 2 | 6 | 71.50 | 35.11 | 25.20 | 8.23 |
| SWB2 | SR | 1 | 6 | 70.50 | 33.95 | 25.89 | 6.80 |
| SWB2 | SR | 2 | 6 | 73.33 | 39.07 | 28.72 | 7.92 |
| SEB1 | SR | 1 | 6 | 72.42 | 38.90 | 28.29 | 9.02 |
| SEB1 | SR | 2 | 6 | 71.92 | 38.62 | 27.59 | 8.78 |
| SEB2 | SR | 1 | 6 | 70.18 | 32.03 | 25.24 | 7.34 |
| SEB2 | SR | 2 | 6 | 68.00 | 30.36 | 24.33 | 7.26 |
| NB1 | SR | 1 | 6 | 73.25 | 41.36 | 30.39 | 9.22 |
| NB1 | SR | 2 | 6 | 72.83 | 40.07 | 29.36 | 9.37 |
| NB2 | SR | 1 | 6 | 71.67 | 38.52 | 28.93 | 8.60 |
| NB2 | SR | 2 | 6 | 71.58 | 34.05 | 26.03 | 7.41 |
| CDN1 | SR | 1 | 6 | 73.67 | 35.52 | 26.39 | 8.46 |
| CDN1 | SR | 2 | 6 | 70.25 | 35.76 | 26.72 | 7.67 |
| CDN2 | SR | 1 | 6 | 70.00 | 31.91 | 24.13 | 7.96 |
| CDN2 | SR | 2 | 6 | 69.50 | 36.67 | 28.83 | 8.74 |
| CUP1 | P | 1 | 6 | 83.29 | 82.24 | 5636.91 | 16.39 |
| CUP1 | P | 2 | 6 | 80.83 | 78.68 | 48.68 | 13.91 |
| CUP2 | P | 1 | 6 | 81.50 | 72.80 | 47.21 | 13.65 |
| CUP2 | P | 2 | 6 | 80.42 | 76.02 | 50.41 | 12.68 |
| BB1 | P | 1 | 6 | 80.42 | 83.56 | 55.95 | 17.47 |
| BB1 | P | 2 | 6 | 81.58 | 80.80 | 53.47 | 16.40 |
| BB2 | P | 1 | 6 | 82.83 | 86.19 | 56.64 | 18.14 |
| BB2 | P | 2 | 6 | 82.25 | 83.88 | 55.24 | 15.55 |
| SWB1 | P | 1 | 6 | 82.92 | 78.43 | 51.36 | 16.14 |
| SWB1 | P | 2 | 6 | 82.75 | 88.30 | 54.88 | 17.16 |
| SWB2 | P | 1 | 6 | 79.08 | 82.11 | 53.27 | 16.29 |
| SWB2 | P | 2 | 6 | 79.92 | 78.10 | 50.84 | 13.97 |
| SEB1 | P | 1 | 6 | 80.33 | 87.34 | 56.95 | 17.73 |
| SEB1 | P | 2 | 6 | 81.50 | 84.23 | 55.72 | 17.20 |

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|---|---|---|---|---|---|---|---|
| SEB2 | P | 1 | 6 | 80.75 | 73.99 | 49.44 | 13.64 |
| SEB2 | P | 2 | 6 | 81.83 | 84.38 | 55.41 | 15.33 |
| NB1 | P | 1 | 6 | 84.25 | 94.91 | 63.48 | 18.78 |
| NB1 | P | 2 | 6 | 83.58 | 92.92 | 62.49 | 18.07 |
| NB2 | P | 1 | 6 | 79.25 | 81.93 | 55.86 | 16.45 |
| NB2 | P | 2 | 6 | 79.58 | 76.65 | 52.79 | 14.84 |
| CDN1 | P | 1 | 6 | 84.08 | 69.37 | 43.66 | 15.36 |
| CDN1 | P | 2 | 6 | 81.50 | 81.83 | 54.03 | 16.21 |
| CDN2 | P | 1 | 6 | 85.17 | 89.98 | 59.47 | 18.65 |
| CDN2 | P | 2 | 6 | 86.83 | 89.02 | 58.82 | 18.63 |
| CUP1 | SR | 1 | 7 | 57.58 | 25.08 | 18.16 | 6.20 |
| CUP1 | SR | 2 | 7 | 63.83 | 26.74 | 19.30 | 6.73 |
| CUP2 | SR | 1 | 7 | 62.58 | 28.27 | 20.42 | 5.73 |
| CUP2 | SR | 2 | 7 | 63.17 | 24.86 | 17.77 | 4.95 |
| BB1 | SR | 1 | 7 | 63.17 | 27.32 | 19.62 | 6.18 |
| BB1 | SR | 2 | 7 | 62.75 | 24.57 | 17.50 | 5.76 |
| BB2 | SR | 1 | 7 | 65.58 | 26.65 | 19.16 | 5.61 |
| BB2 | SR | 2 | 7 | 62.17 | 25.22 | 18.22 | 4.93 |
| SWB1 | SR | 1 | 7 | 63.42 | 25.00 | 18.04 | 5.28 |
| SWB1 | SR | 2 | 7 | 65.08 | 28.96 | 20.72 | 6.20 |
| SWB2 | SR | 1 | 7 | 63.42 | 28.46 | 20.25 | 6.09 |
| SWB2 | SR | 2 | 7 | 60.83 | 23.75 | 16.70 | 5.46 |
| SEB1 | SR | 1 | 7 | 63.17 | 26.38 | 18.76 | 5.71 |
| SEB1 | SR | 2 | 7 | 62.17 | 27.06 | 19.45 | 6.22 |
| SEB2 | SR | 1 | 7 | 64.67 | 31.09 | 22.38 | 6.78 |
| SEB2 | SR | 2 | 7 | 62.75 | 32.47 | 23.62 | 6.21 |
| NB1 | SR | 1 | 7 | 63.50 | 27.93 | 20.92 | 6.21 |
| NB1 | SR | 2 | 7 | 67.17 | 30.21 | 21.91 | 6.52 |
| NB2 | SR | 1 | 7 | 64.42 | 31.39 | 22.54 | 6.52 |
| NB2 | SR | 2 | 7 | 62.50 | 23.01 | 16.80 | 5.12 |
| CDN1 | SR | 1 | 7 | 63.67 | 24.68 | 17.63 | 6.21 |
| CDN1 | SR | 2 | 7 | 62.50 | 27.93 | 20.20 | 6.63 |
| CDN2 | SR | 1 | 7 | 64.67 | 30.72 | 22.37 | 7.15 |
| CDN2 | SR | 2 | 7 | 62.92 | 28.49 | 20.41 | 6.22 |
| CUP1 | P | 1 | 7 | 74.75 | 46.60 | 26.74 | 11.27 |
| CUP1 | P | 2 | 7 | 76.33 | 46.58 | 27.83 | 10.77 |
| CUP2 | P | 1 | 7 | 73.83 | 39.88 | 24.07 | 9.03 |
| CUP2 | P | 2 | 7 | 67.67 | 38.21 | 22.86 | 9.42 |
| BB1 | P | 1 | 7 | 76.08 | 47.85 | 29.09 | 10.36 |
| BB1 | P | 2 | 7 | 72.50 | 42.82 | 26.00 | 9.51 |
| BB2 | P | 1 | 7 | 77.75 | 43.22 | 24.93 | 10.52 |
| BB2 | P | 2 | 7 | 77.50 | 51.43 | 30.22 | 11.29 |
| SWB1 | P | 1 | 7 | 72.92 | 46.99 | 28.01 | 10.72 |
| SWB1 | P | 2 | 7 | 65.91 | 34.86 | 21.00 | 7.64 |
| SWB2 | P | 1 | 7 | 69.17 | 35.96 | 22.75 | 8.75 |
| SWB2 | P | 2 | 7 | 71.25 | 36.83 | 22.18 | 8.74 |
| SEB1 | P | 1 | 7 | 66.92 | 38.78 | 24.55 | 9.12 |

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|---|---|---|---|---|---|---|---|
| SEB1 | P | 2 | 7 | 66.92 | 35.46 | 22.08 | 8.50 |
| SEB2 | P | 1 | 7 | 65.25 | 37.28 | 23.68 | 8.67 |
| SEB2 | P | 2 | 7 | 68.50 | 42.21 | 25.55 | 10.04 |
| NB1 | P | 1 | 7 | 77.75 | 55.15 | 33.36 | 14.21 |
| NB1 | P | 2 | 7 | 84.08 | 59.34 | 37.08 | 14.81 |
| NB2 | P | 1 | 7 | 79.92 | 56.13 | 35.34 | 10.87 |
| NB2 | P | 2 | 7 | 68.67 | 37.71 | 23.72 | 7.89 |
| CDN1 | P | 1 | 7 | 75.50 | 45.27 | 26.51 | 10.94 |
| CDN1 | P | 2 | 7 | 78.42 | 49.45 | 29.01 | 13.00 |
| CDN2 | P | 1 | 7 | 71.83 | 48.46 | 31.01 | 10.61 |
| CDN2 | P | 2 | 7 | 67.67 | 39.72 | 24.95 | 8.67 |
| CUP1 | SR | 1 | 8 | 57.50 | 25.06 | 17.77 | 7.03 |
| CUP1 | SR | 2 | 8 | 58.00 | 22.87 | 16.06 | 6.57 |
| CUP2 | SR | 1 | 8 | 57.75 | 24.46 | 17.52 | 6.51 |
| CUP2 | SR | 2 | 8 | 60.00 | 19.59 | 14.14 | 4.84 |
| BB1 | SR | 1 | 8 | 57.33 | 24.82 | 17.44 | 6.70 |
| BB1 | SR | 2 | 8 | 58.08 | 21.98 | 15.61 | 5.81 |
| BB2 | SR | 1 | 8 | 58.25 | 21.64 | 15.40 | 5.52 |
| BB2 | SR | 2 | 8 | 54.58 | 19.80 | 14.10 | 5.13 |
| SWB1 | SR | 1 | 8 | 58.17 | 24.68 | 17.76 | 5.41 |
| SWB1 | SR | 2 | 8 | 57.75 | 20.26 | 14.63 | 4.57 |
| SWB2 | SR | 1 | 8 | 59.25 | 24.49 | 17.68 | 5.43 |
| SWB2 | SR | 2 | 8 | 57.75 | 20.63 | 14.88 | 4.59 |
| SEB1 | SR | 1 | 8 | | | | |
| SEB1 | SR | 2 | 8 | | | | |
| SEB2 | SR | 1 | 8 | 58.08 | 23.06 | 141.74 | 5.01 |
| SEB2 | SR | 2 | 8 | 57.42 | 22.82 | 16.96 | 4.86 |
| NB1 | SR | 1 | 8 | 58.67 | 27.11 | 19.74 | 5.69 |
| NB1 | SR | 2 | 8 | 57.33 | 20.76 | 15.21 | 4.51 |
| NB2 | SR | 1 | 8 | 58.58 | 22.94 | 16.59 | 4.72 |
| NB2 | SR | 2 | 8 | 56.17 | 20.18 | 14.67 | 4.31 |
| CDN1 | SR | 1 | 8 | 57.00 | 21.10 | 14.99 | 4.83 |
| CDN1 | SR | 2 | 8 | 56.25 | 21.08 | 15.33 | 4.53 |
| CDN2 | SR | 1 | 8 | 58.92 | 23.81 | 16.94 | 5.70 |
| CDN2 | SR | 2 | 8 | 55.00 | 20.84 | 15.09 | 4.88 |
| CUP1 | P | 1 | 8 | 94.50 | 155.28 | 102.80 | 31.34 |
| CUP1 | P | 2 | 8 | 91.08 | 122.83 | 83.94 | 25.14 |
| CUP2 | P | 1 | 8 | 94.25 | 135.52 | 96.08 | 25.17 |
| CUP2 | P | 2 | 8 | 85.92 | 97.44 | 66.16 | 17.39 |
| BB1 | P | 1 | 8 | 96.58 | 152.22 | 103.06 | 27.96 |
| BB1 | P | 2 | 8 | 84.25 | 92.67 | 69.81 | 16.40 |
| BB2 | P | 1 | 8 | 96.08 | 141.91 | 98.58 | 26.00 |
| BB2 | P | 2 | 8 | 88.00 | 110.68 | 75.65 | 21.90 |
| SWB1 | P | 1 | 8 | 94.58 | 144.35 | 110.01 | 28.36 |
| SWB1 | P | 2 | 8 | 89.42 | 105.59 | 68.57 | 20.76 |
| SWB2 | P | 1 | 8 | 95.50 | 144.14 | 99.30 | 25.04 |
| SWB2 | P | 2 | 8 | 88.08 | 90.50 | 61.19 | 17.93 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SEB1 | P | 1 | 8 | 91.75 | 131.65 | 90.66 | 22.63 |
| SEB1 | P | 2 | 8 | 84.50 | 88.16 | 59.43 | 17.42 |
| SEB2 | P | 1 | 8 | 93.08 | 129.35 | 95.30 | 22.92 |
| SEB2 | P | 2 | 8 | 86.50 | 100.24 | 73.30 | 17.80 |
| NB1 | P | 1 | 8 | 95.17 | 140.69 | 96.71 | 25.95 |
| NB1 | P | 2 | 8 | 80.92 | 87.17 | 61.21 | 14.43 |
| NB2 | P | 1 | 8 | 93.08 | 145.07 | 109.32 | 23.96 |
| NB2 | P | 2 | 8 | 92.50 | 101.49 | 80.43 | 20.15 |
| CDN1 | P | 1 | 8 | 95.92 | 126.89 | 92.35 | 25.88 |
| CDN1 | P | 2 | 8 | 85.42 | 75.40 | 51.16 | 14.61 |
| CDN2 | P | 1 | 8 | 90.67 | 155.25 | 108.88 | 28.59 |
| CDN2 | P | 2 | 8 | 89.36 | 99.71 | 79.80 | 20.10 |
| CUP1 | SR | 1 | 9 | 56.92 | 20.97 | 14.36 | 5.65 |
| CUP1 | SR | 2 | 9 | 58.25 | 20.71 | 14.27 | 5.90 |
| CUP2 | SR | 1 | 9 | 58.75 | 22.09 | 15.11 | 6.05 |
| CUP2 | SR | 2 | 9 | 57.42 | 20.04 | 13.77 | 5.49 |
| BB1 | SR | 1 | 9 | 61.08 | 24.37 | 17.11 | 5.91 |
| BB1 | SR | 2 | 9 | 60.17 | 231.34 | 15.54 | 5.66 |
| BB2 | SR | 1 | 9 | 58.92 | 24.34 | 16.97 | 5.68 |
| BB2 | SR | 2 | 9 | 59.42 | 24.48 | 17.11 | 5.70 |
| SWB1 | SR | 1 | 9 | 60.67 | 25.01 | 17.19 | 5.42 |
| SWB1 | SR | 2 | 9 | 58.00 | 21.80 | 15.24 | 4.98 |
| SWB2 | SR | 1 | 9 | 60.50 | 24.48 | 17.04 | 5.75 |
| SWB2 | SR | 2 | 9 | 59.00 | 23.04 | 16.38 | 5.10 |
| SEB1 | SR | 1 | 9 | 59.33 | 227.49 | 16.38 | 6.33 |
| SEB1 | SR | 2 | 9 | 58.67 | 38.05 | 14.90 | 5.45 |
| SEB2 | SR | 1 | 9 | 60.00 | 23.60 | 16.34 | 6.49 |
| SEB2 | SR | 2 | 9 | 57.58 | 22.98 | 15.92 | 6.00 |
| NB1 | SR | 1 | 9 | 59.58 | 23.35 | 16.05 | 5.61 |
| NB1 | SR | 2 | 9 | 59.00 | 20.59 | 14.71 | 4.31 |
| NB2 | SR | 1 | 9 | 58.50 | 23.73 | 16.51 | 4.68 |
| NB2 | SR | 2 | 9 | 57.92 | 21.39 | 14.94 | 4.33 |
| CDN1 | SR | 1 | 9 | 58.00 | 23.87 | 16.90 | 4.72 |
| CDN1 | SR | 2 | 9 | 58.75 | 20.82 | 14.63 | 4.54 |
| CDN2 | SR | 1 | 9 | 59.00 | 23.04 | 16.67 | 4.62 |
| CDN2 | SR | 2 | 9 | 58.33 | 21.96 | 15.20 | 4.67 |
| CUP1 | P | 1 | 9 | 104.78 | 117.89 | 76.67 | 28.41 |
| CUP1 | P | 2 | 9 | 108.63 | 140.75 | 90.13 | 32.51 |
| CUP2 | P | 1 | 9 | 104.78 | 127.69 | 83.21 | 27.81 |
| CUP2 | P | 2 | 9 | 110.44 | 138.58 | 104.56 | 36.66 |
| BB1 | P | 1 | 9 | 100.50 | 133.76 | 86.43 | 29.75 |
| BB1 | P | 2 | 9 | 110.38 | 184.65 | 124.20 | 36.28 |
| BB2 | P | 1 | 9 | 92.00 | 118.98 | 76.90 | 26.92 |
| BB2 | P | 2 | 9 | 110.00 | 167.99 | 114.73 | 36.59 |
| SWB1 | P | 1 | 9 | 94.60 | 111.27 | 71.13 | 23.38 |
| SWB1 | P | 2 | 9 | 113.75 | 177.43 | 116.80 | 37.25 |
| SWB2 | P | 1 | 9 | 100.40 | 137.15 | 88.72 | 33.51 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SWB2 | P | 2 | 9 | 108.50 | 178.97 | 121.58 | 39.47 |
| SEB1 | P | 1 | 9 | 98.70 | 140.76 | 94.04 | 35.27 |
| SEB1 | P | 2 | 9 | 107.13 | 173.99 | 122.22 | 40.95 |
| SEB2 | P | 1 | 9 | 99.50 | 127.30 | 82.92 | 30.74 |
| SEB2 | P | 2 | 9 | 111.13 | 169.32 | 113.90 | 38.76 |
| NB1 | P | 1 | 9 | 96.90 | 119.72 | 78.98 | 25.07 |
| NB1 | P | 2 | 9 | 113.00 | 161.03 | 117.11 | 33.22 |
| NB2 | P | 1 | 9 | 104.44 | 151.12 | 100.87 | 30.24 |
| NB2 | P | 2 | 9 | 108.00 | 165.16 | 111.68 | 29.10 |
| CDN1 | P | 1 | 9 | 96.70 | 109.83 | 72.30 | 22.35 |
| CDN1 | P | 2 | 9 | 104.13 | 144.40 | 91.50 | 26.68 |
| CDN2 | P | 1 | 9 | 87.70 | 103.91 | 68.65 | 19.27 |
| CDN2 | P | 2 | 9 | 109.50 | 128.48 | 106.54 | 25.48 |

# APPENDIX E4

# PILOT - WILD SYDNEY ROCK OYSTER MEAN METAL CONCENTRATIONS

| Pilot-Wild Sydney Rock Oyster Metal Concentrations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site** | **Area** | **Arsenic** | **Chromium** | **Copper** | **Lead** | **Mercury** | **Selenium** | **Zinc** |
| | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Cup1-S | Shoreline | 5.0 | 0.5 | 104.5 | 0.5 | 0.15 | 2.0 | 1800 |
| Cup1-S2 | Shoreline 2 | 5.0 | 0.5 | 56.5 | 0.5 | 0.2 | 2.0 | 1550 |
| Cup2-S | Shoreline | 5.5 | 5.0 | 109.5 | 1.25 | 0.3 | 2.25 | 2550 |
| Cup2-L | Lease | 3.0 | 0.75 | 89.5 | 0.5 | 0.125 | 1.0 | 1550 |
| BB1-S | Shoreline | 5.0 | 0.5 | 185 | 0.5 | 0.25 | 2.0 | 2800 |
| BB1-L | Lease | 4.0 | 0.5 | 109.5 | 0.5 | 0.1 | 1.5 | 1900 |
| BB2-S | Shoreline | 5.5 | 0.75 | 130.5 | 0.75 | 0.25 | 2.5 | 2950 |
| BB2-L | Lease | 3.5 | 0.5 | 140 | 0.5 | 0.125 | 1.0 | 2250 |
| NB1-S | Shoreline | 4.0 | 3.0 | 275 | 1.25 | 0.4 | 1.5 | 4600 |
| NB1-L | Lease | 6.0 | 0.5 | 131.5 | 0.5 | 0.15 | 2.0 | 2400 |
| NB2-L | Shoreline | 4.5 | 2.75 | 90.5 | 1.0 | 0.225 | 1.25 | 1475 |
| Cdn1-S | Lease | 8.5 | 3.0 | 126 | 1.0 | 0.25 | 3.0 | 2650 |
| Cdn1-L | Shoreline | 8.0 | 5.25 | 109.5 | 0.75 | 0.15 | 3.0 | 2150 |
| Cdn2-S | Lease | 5.0 | 3.0 | 150 | 0.75 | 0.25 | 2.0 | 2100 |
| Cdn2-L | Shoreline | 4.0 | 3.0 | 81 | 0.75 | 0.2 | 1.0 | 1225 |
| NB2-S | Lease | 9.5 | 5.0 | 505 | 1.5 | 0.6 | 6.0 | 6900 |

# APPENDIX E5

# LABORATORY ANALYSIS SUMMARY TABLES

## CUP1 – PAH

| Table E5 CUP1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 12 |
| n > DL | 5 | 0 | 0 | 0 | 1 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Min | 6 | <DL | <DL | <DL | - | <DL | 2 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 72 |
| Median | 5 | <DL | <DL | <DL | - | <DL | 2 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 |
| Mean | 4 | <DL | <DL | <DL | - | <DL | 4 | 5 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 89 |
| SD | 4 | <DL | <DL | <DL | - | <DL | 5 | 7 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 31 |
| 80th percentile | 6 | <DL | <DL | <DL | - | <DL | 5 | 5 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 102 |
| Max | 12 | <DL | <DL | <DL | 1 | <DL | 16 | 24 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 123 |

| Table E6 CUP1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 14 |
| n > DL | 5 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Min | 2 | <DL | <DL | <DL | 3 | <DL | 2 | 2 | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 68 |
| Median | 2 | <DL | <DL | <DL | 3 | <DL | 2 | 2 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 |
| Mean | 3 | <DL | <DL | <DL | 3 | <DL | 3 | 3 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 84 |
| SD | 3 | <DL | <DL | <DL | 2 | <DL | 2 | 2 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 28 |
| 80th percentile | 5 | <DL | <DL | <DL | 5 | <DL | 5 | 5 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 103 |
| Max | 10 | <DL | <DL | <DL | 4 | <DL | 3 | 3 | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 114 |

## CUP1 – OCs & E.coli

| Table E7 CUP1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 16 | 22 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 63 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 94 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 89 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 28 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 104 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 125 | 2 |

| Table E8 CUP1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 17 | 22 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 16 | 3 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | - | <DL | <DL | 65 | 3 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | - | <DL | <DL | 98 | 1 |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | - | <DL | <DL | 93 | 1 |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | - | <DL | <DL | 29 | 2 |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | - | <DL | <DL | 103 | 2 |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | 3 | <DL | <DL | 135 | 4 |

## CUP1-Metals

| Table E9 CUP1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 22 |
| n > DL | 21 | 0 | 21 | 0 | 0 | 12 | 21 |
| Min | 5 | <DL | 26 | <DL | <DL | 2 | 340 |
| Median | 7 | <DL | 59 | <DL | <DL | 2 | 625 |
| Mean | 7 | <DL | 64 | <DL | <DL | 2 | 645 |
| SD | 2 | <DL | 34 | <DL | <DL | 1 | 294 |
| 80th percentile | 9 | <DL | 76 | <DL | <DL | 3 | 848 |
| Max | 13 | <DL | 160 | <DL | <DL | 4 | 1500 |

| Table E10 CUP1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 22 | 22 | 22 | 22 | 21 | 22 | 22 |
| n > DL | 21 | 0 | 22 | 0 | 2 | 10 | 22 |
| Min | 5 | <DL | 11 | <DL | 0.1 | 2 | 180 |
| Median | 7 | <DL | 64 | <DL | - | 2 | 915 |
| Mean | 7 | <DL | 81 | <DL | - | 2 | 1061 |
| SD | 2 | <DL | 51 | <DL | - | 1 | 544 |
| 80th percentile | 8 | <DL | 130 | <DL | - | 3 | 1580 |
| Max | 12 | <DL | 180 | <DL | 0.2 | 4 | 2000 |

## CUP2 – PAH

| Table E11 CUP2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 13 |
| n > DL | 4 | 0 | 0 | 1 | 1 | 0 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Min | 7 | <DL | <DL | - | - | <DL | 2 | 2 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 |
| Median | 1 | <DL | <DL | - | - | <DL | 1 | 1 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 89 |
| Mean | 4 | <DL | <DL | - | - | <DL | 4 | 6 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 74 |
| SD | 6 | <DL | <DL | - | - | <DL | 8 | 12 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 44 |
| 80th percentile | 5 | <DL | <DL | - | - | <DL | 5 | 5 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 97 |
| Max | 28 | <DL | <DL | 1 | 2 | <DL | 29 | 46 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 120 |

| Table E12 CUP2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 13 |
| n > DL | 5 | 0 | 1 | 0 | 2 | 0 | 2 | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Min | 8 | <DL | - | <DL | 2 | <DL | 3 | 2 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 62 |
| Median | 5 | <DL | - | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| Mean | 5 | <DL | - | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| SD | 5 | <DL | - | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 14 |
| 80th percentile | 8 | <DL | - | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 101 |
| Max | 18 | <DL | 2 | <DL | 3 | <DL | 3 | 4 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 107 |

## CUP2 – OCs & E.coli

| Table E13 CUP2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 16 | 23 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 67 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 75 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 40 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 103 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 124 | 1 |

| Table E14 CUP2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 14 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 61 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 97 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 18 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 102 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 128 | 1 |

## CUP2 – Metals

| Table E15 CUP2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| n > DL | 22 | 1 | 22 | 1 | 0 | 10 | 22 |
| Min | 6 | - | 33 | - | <DL | 2 | 400 |
| Median | 7 | - | 66 | - | <DL | 2 | 710 |
| Mean | 8 | - | 75 | - | <DL | 2 | 755 |
| SD | 1 | - | 32 | - | <DL | 1 | 265 |
| 80th percentile | 9 | - | 110 | - | <DL | 3 | 930 |
| Max | 11 | 2 | 130 | 1 | <DL | 4 | 1300 |

| Table E16 CUP2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| n > DL | 17 | 0 | 17 | 0 | 0 | 10 | 17 |
| Min | 4 | <DL | 29 | <DL | <DL | 2 | 420 |
| Median | 7 | <DL | 84 | <DL | <DL | 2 | 1035 |
| Mean | 7 | <DL | 89 | <DL | <DL | 2 | 1158 |
| SD | 3 | <DL | 50 | <DL | <DL | 1 | 590 |
| 80th percentile | 9 | <DL | 146 | <DL | <DL | 3 | 1600 |
| Max | 12 | <DL | 170 | <DL | <DL | 4 | 2500 |

## BB1 – PAH

| Table E17 BB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 13 |
| n > DL | 4 | 0 | 0 | 1 | 1 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Min | 7 | <DL | <DL | - | - | <DL | 2 | 3 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 73 |
| Median | 1 | <DL | <DL | - | - | <DL | 1 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 91 |
| Mean | 5 | <DL | <DL | - | - | <DL | 3 | 4 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 79 |
| SD | 7 | <DL | <DL | - | - | <DL | 5 | 6 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 38 |
| 80th percentile | 5 | <DL | <DL | - | - | <DL | 5 | 5 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 98 |
| Max | 28 | <DL | <DL | 1 | 2 | <DL | 22 | 26 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 129 |

| Table E18 BB1 Syndey Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 20 | 20 | 20 | 20 | 20 | 19 | 19 | 19 | 14 |
| n > DL | 3 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 13 |
| Min | 1 | <DL | <DL | <DL | 1 | <DL | 3 | 4 | <DL | <DL | <DL | 1 | <DL | <DL | - | <DL | <DL | <DL | <DL | 67 |
| Median | 1 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | - | <DL | <DL | <DL | <DL | 87 |
| Mean | 3 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | - | <DL | <DL | <DL | <DL | 80 |
| SD | 3 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | - | <DL | <DL | <DL | <DL | 26 |
| 80th percentile | 5 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | - | <DL | <DL | <DL | <DL | 91 |
| Max | 8 | <DL | <DL | <DL | 2 | <DL | 3 | 4 | <DL | <DL | <DL | 1 | <DL | <DL | 1 | <DL | <DL | <DL | <DL | 107 |

## BB1 – OCs & E.coli

| Table E19 BB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 15 | 22 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 89 | <DL |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | <DL |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 | <DL |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 39 | <DL |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 112 | <DL |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 139 | <DL |

| Table E20 BB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 15 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 60 | <DL |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 97 | <DL |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 88 | <DL |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 31 | <DL |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 105 | <DL |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 127 | <DL |

## BB1 – Metals

| Table BB1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| n > DL | 21 | 1 | 21 | 0 | 0 | 10 | 21 |
| Min | 4 | - | 20 | <DL | <DL | 2 | 280 |
| Median | 8 | - | 54 | <DL | <DL | 2 | 575 |
| Mean | 7 | - | 56 | <DL | <DL | 2 | 552 |
| SD | 2 | - | 26 | <DL | <DL | 1 | 193 |
| 80th percentile | 9 | - | 66 | <DL | <DL | 3 | 652 |
| Max | 10 | 2 | 140 | <DL | <DL | 3 | 1000 |

| Table E22 BB1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 19 | 0 | 19 | 1 | 0 | 8 | 19 |
| Min | 5 | <DL | 29 | - | <DL | 2 | 470 |
| Median | 7 | <DL | 91 | - | <DL | 2 | 1100 |
| Mean | 7 | <DL | 95 | - | <DL | 2 | 1225 |
| SD | 2 | <DL | 43 | - | <DL | 1 | 542 |
| 80th percentile | 8 | <DL | 134 | - | <DL | 3 | 1620 |
| Max | 11 | <DL | 170 | 32 | <DL | 4 | 2300 |

## BB2 – PAH

| Table E23 BB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 13 |
| n > DL | 3 | 0 | 0 | 0 | 2 | 1 | 4 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Min | 8 | <DL | <DL | <DL | 5 | - | 1 | 2 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 74 |
| Median | 5 | <DL | <DL | <DL | - | - | 3 | 2 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 |
| Mean | 5 | <DL | <DL | <DL | - | - | 3 | 3 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 95 |
| SD | 6 | <DL | <DL | <DL | - | - | 4 | 4 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 16 |
| 80th percentile | 5 | <DL | <DL | <DL | - | - | 5 | 5 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 101 |
| Max | 21 | <DL | <DL | <DL | 6 | 1 | 19 | 21 | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 135 |

| Table E24 BB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 17 | 19 | 19 | 19 | 19 | 19 | 17 | 17 | 17 | 12 |
| n > DL | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| Min | 7 | <DL | <DL | <DL | <DL | <DL | 2 | 4 | <DL | 1 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 60 |
| Median | - | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 84 |
| Mean | - | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 83 |
| SD | - | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 15 |
| 80th percentile | - | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 100 |
| Max | 9 | <DL | <DL | <DL | <DL | <DL | 4 | 4 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 104 |

## BB2 – OCs & E.coli

| Table E25 BB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 15 | 23 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 62 | 21 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 17 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 103 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 121 | 52 |

| Table E26 BB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 11 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 3 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | 79 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | 97 | 1 |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | 101 | 4 |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | 14 | 7 |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | 102 | 5 |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | 2 | <DL | <DL | <DL | <DL | <DL | 129 | 22 |

**BB2 – Metals**

| Table E27 BB2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| n > DL | 23 | 0 | 23 | 0 | 2 | 10 | 23 |
| Min | 5 | <DL | 29 | <DL | 0.1 | 2 | 370 |
| Median | 7 | <DL | 64 | <DL | - | 2 | 700 |
| Mean | 8 | <DL | 71 | <DL | - | 2 | 673 |
| SD | 2 | <DL | 23 | <DL | - | 1 | 189 |
| 80th percentile | 9 | <DL | 98 | <DL | - | 3 | 838 |
| Max | 12 | <DL | 110 | <DL | 0.1 | 3 | 1000 |

| Table E28 BB2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 19 | 0 | 19 | 0 | 0 | 10 | 19 |
| Min | 4 | <DL | 24 | <DL | <DL | 2 | 240 |
| Median | 7 | <DL | 71 | <DL | <DL | 2 | 930 |
| Mean | 8 | <DL | 93 | <DL | <DL | 2 | 1116 |
| SD | 2 | <DL | 55 | <DL | <DL | 1 | 659 |
| 80th percentile | 8 | <DL | 130 | <DL | <DL | 3 | 1380 |
| Max | 14 | <DL | 220 | <DL | <DL | 4 | 2900 |

## SWB1 – PAH

| Table E29 SWB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 12 |
| n > DL | 3 | 0 | 0 | 0 | 2 | 2 | 4 | 4 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Min | 10 | <DL | <DL | <DL | 6 | 1 | 3 | 3 | <DL | 1 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 71 |
| Median | 5 | <DL | <DL | <DL | - | - | 4 | 3 | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 88 |
| Mean | 4 | <DL | <DL | <DL | - | - | 4 | 5 | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 |
| SD | 4 | <DL | <DL | <DL | - | - | 6 | 8 | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 31 |
| 80th percentile | 10 | <DL | <DL | <DL | - | - | 5 | 5 | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 104 |
| Max | 11 | <DL | <DL | <DL | 10 | 1 | 26 | 32 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 125 |

| Table E30 SWB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 17 | 19 | 19 | 19 | 19 | 19 | 17 | 17 | 17 | 11 |
| n > DL | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Min | 6 | <DL | <DL | <DL | 2 | <DL | 3 | 3 | <DL | - | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| Median | - | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 91 |
| Mean | - | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| SD | - | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 32 |
| 80th percentile | - | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 102 |
| Max | 8 | <DL | <DL | <DL | 2 | <DL | 3 | 4 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 125 |

## SWB1 – OCs & E.coli

| Table E31 SWB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 14 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 69 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 91 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 27 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 100 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 3 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 114 | 1 |

| Table E32 SWB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 13 | 18 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 33 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 99 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 139 | 1 |

**SWB1 – Metals**

| Table E33 SWB1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| n > DL | 20 | 0 | 20 | 0 | 1 | 12 | 20 |
| Min | 5 | <DL | 29 | <DL | - | 2 | 310 |
| Median | 7 | <DL | 61 | <DL | - | 2 | 550 |
| Mean | 8 | <DL | 63 | <DL | - | 2 | 612 |
| SD | 2 | <DL | 20 | <DL | - | 1 | 196 |
| 80th percentile | 9 | <DL | 73 | <DL | - | 2 | 730 |
| Max | 12 | <DL | 110 | <DL | 0.1 | 4 | 1100 |

| Table E34 SWB1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 19 | 1 | 19 | 0 | 2 | 12 | 19 |
| Min | 5 | - | 48 | <DL | 0.1 | 2 | 620 |
| Median | 8 | - | 110 | <DL | - | 2 | 1300 |
| Mean | 8 | - | 112 | <DL | - | 2 | 1287 |
| SD | 2 | - | 52 | <DL | - | 1 | 552 |
| 80th percentile | 9 | - | 154 | <DL | - | 3 | 1740 |
| Max | 13 | 1 | 230 | <DL | 0.1 | 4 | 2300 |

## SWB2- PAH

| Table E35 SWB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 10 |
| n > DL | 2 | 0 | 0 | 0 | 2 | 0 | 3 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Min | 10 | <DL | <DL | <DL | 5 | <DL | 3 | 2 | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 65 |
| Median | - | <DL | <DL | <DL | - | <DL | 3 | 2 | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| Mean | - | <DL | <DL | <DL | - | <DL | 3 | 4 | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| SD | - | <DL | <DL | <DL | - | <DL | 3 | 5 | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 9 |
| 80th percentile | - | <DL | <DL | <DL | - | <DL | 5 | 5 | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| Max | 11 | <DL | <DL | <DL | 5 | <DL | 14 | 19 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 98 |

| Table E36 SWB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 8 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 74 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 94 |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 18 |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 114 |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 119 |

## SWB2- OCs & E.coli

| Table E37 SWB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 10 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 60 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 94 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 18 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 102 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 111 | 1 |

| Table E38 SWB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 11 | 13 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 75 | <DL |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 100 | <DL |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 106 | <DL |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 18 | <DL |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 130 | <DL |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 136 | <DL |

**SWB2 – Metals**

| Table E39 SWB2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 18 | 0 | 18 | 1 | 0 | 9 | 18 |
| Min | 5 | <DL | 22 | - | <DL | 2 | 310 |
| Median | 7 | <DL | 57 | - | <DL | 2 | 530 |
| Mean | 7 | <DL | 60 | - | <DL | 2 | 538 |
| SD | 2 | <DL | 33 | - | <DL | 1 | 211 |
| 80th percentile | 9 | <DL | 71 | - | <DL | 3 | 742 |
| Max | 10 | <DL | 140 | 1 | <DL | 4 | 880 |

| Table E40 SWB2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| n > DL | 10 | 0 | 11 | 0 | 0 | 6 | 11 |
| Min | 4 | <DL | 42 | <DL | <DL | 2 | 580 |
| Median | 8 | <DL | 95 | <DL | <DL | 2 | 905 |
| Mean | 6 | <DL | 81 | <DL | <DL | 2 | 936 |
| SD | 3 | <DL | 38 | <DL | <DL | 1 | 422 |
| 80th percentile | 8 | <DL | 110 | <DL | <DL | 2 | 1280 |
| Max | 9 | <DL | 130 | <DL | <DL | 4 | 1600 |

## SEB1 – PAH

| Table E41 SEB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 8 |
| n > DL | 5 | 0 | 0 | 0 | 2 | 0 | 4 | 4 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Min | 11 | <DL | <DL | <DL | 1 | <DL | 3 | 3 | <DL | 2 | 2 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 67 |
| Median | 5 | <DL | <DL | <DL | - | <DL | 3 | 3 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| Mean | 5 | <DL | <DL | <DL | - | <DL | 4 | 4 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| SD | 6 | <DL | <DL | <DL | - | <DL | 5 | 7 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 12 |
| 80th percentile | 11 | <DL | <DL | <DL | - | <DL | 5 | 5 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 84 |
| Max | 19 | <DL | <DL | <DL | 1 | <DL | 18 | 26 | <DL | 2 | 2 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 105 |

| Table E42 SEB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 18 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 17 | 18 | 19 | 19 | 19 | 18 | 16 | 16 | 16 | 10 |
| n > DL | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Min | <DL | <DL | <DL | <DL | 2 | <DL | 3 | 2 | <DL | - | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 76 |
| Median | <DL | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 85 |
| Mean | <DL | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 83 |
| SD | <DL | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 32 |
| 80th percentile | <DL | <DL | <DL | <DL | - | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 109 |
| Max | <DL | <DL | <DL | <DL | 2 | <DL | 3 | 4 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 113 |

## SEB1 – OCs & E.coli

| Table E43 SEB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 9 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 66 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 99 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 95 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 16 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 107 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 116 | 16 |

| Table E44 SEB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 12 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 91 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 95 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 32 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 111 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 125 | 1 |

## SEB1 – Metals

| Table E45 SEB1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 19 | 1 | 19 | 0 | 0 | 12 | 19 |
| Min | 6 | - | 30 | <DL | <DL | 2 | 340 |
| Median | 7 | - | 58 | <DL | <DL | 2 | 510 |
| Mean | 8 | - | 58 | <DL | <DL | 2 | 546 |
| SD | 2 | - | 14 | <DL | <DL | 1 | 145 |
| 80th percentile | 9 | - | 67 | <DL | <DL | 3 | 674 |
| Max | 10 | 1 | 84 | <DL | <DL | 3 | 870 |

| Table E46 SEB1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Aluminium | Arsenic | Chromium | Copper | Lead | Mercury | Selenium |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 17 | 0 | 18 | 0 | 0 | 10 | 18 |
| Min | 5 | <DL | 19 | <DL | <DL | 2 | 240 |
| Median | 7 | <DL | 80 | <DL | <DL | 2 | 710 |
| Mean | 7 | <DL | 80 | <DL | <DL | 2 | 897 |
| SD | 3 | <DL | 48 | <DL | <DL | 1 | 526 |
| 80th percentile | 9 | <DL | 114 | <DL | <DL | 3 | 1300 |
| Max | 10 | <DL | 180 | <DL | <DL | 4 | 2200 |

## SEB2 – PAH

| Table E47 SEB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 9 |
| n > DL | 5 | 0 | 0 | 0 | 3 | 0 | 4 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Min | 11 | <DL | <DL | <DL | 2 | <DL | 3 | 4 | <DL | 1 | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 |
| Median | 5 | <DL | <DL | <DL | 1 | <DL | 4 | 4 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 82 |
| Mean | 6 | <DL | <DL | <DL | 3 | <DL | 5 | 6 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 79 |
| SD | 6 | <DL | <DL | <DL | 3 | <DL | 8 | 12 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 6 |
| 80th percentile | 12 | <DL | <DL | <DL | 5 | <DL | 5 | 5 | <DL | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 84 |
| Max | 20 | <DL | <DL | <DL | 11 | <DL | 33 | 44 | <DL | 1 | 3 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 |

| Table E48 SEB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 11 |
| n > DL | 3 | 0 | 0 | 0 | 2 | 0 | 4 | 5 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Min | 7 | <DL | <DL | <DL | 2 | <DL | 3 | 3 | <DL | - | - | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 |
| Median | 1 | <DL | <DL | <DL | - | <DL | 2 | 2 | <DL | - | - | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 79 |
| Mean | 3 | <DL | <DL | <DL | - | <DL | 3 | 4 | <DL | - | - | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 88 |
| SD | 3 | <DL | <DL | <DL | - | <DL | 4 | 5 | <DL | - | - | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 20 |
| 80th percentile | 5 | <DL | <DL | <DL | - | <DL | 5 | 5 | <DL | - | - | 3 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 |
| Max | 9 | <DL | <DL | <DL | 3 | <DL | 13 | 18 | <DL | 2 | 2 | 6 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 138 |

## SEB2 – OCs & E.coli

| Table E49 SEB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 11 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 73 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 14 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 99 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 115 | 1 |

| Table E50 SEB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 12 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 74 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 15 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 104 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 117 | 1 |

**SEB2 – Metals**

| Table E51 SEB2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| n > DL | 20 | 0 | 20 | 0 | 0 | 12 | 20 |
| Min | 6 | <DL | 42 | <DL | <DL | 2 | 380 |
| Median | 8 | <DL | 66 | <DL | <DL | 2 | 570 |
| Mean | 8 | <DL | 66 | <DL | <DL | 2 | 594 |
| SD | 1 | <DL | 17 | <DL | <DL | 1 | 110 |
| 80th percentile | 9 | <DL | 80 | <DL | <DL | 3 | 680 |
| Max | 10 | <DL | 95 | <DL | <DL | 4 | 860 |

| Table E52 SEB2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| n > DL | 18 | 0 | 18 | 0 | 0 | 14 | 18 |
| Min | 6 | <DL | 45 | <DL | <DL | 2 | 580 |
| Median | 7 | <DL | 96 | <DL | <DL | 2 | 1200 |
| Mean | 8 | <DL | 101 | <DL | <DL | 2 | 1160 |
| SD | 1 | <DL | 39 | <DL | <DL | 1 | 408 |
| 80th percentile | 9 | <DL | 130 | <DL | <DL | 3 | 1500 |
| Max | 10 | <DL | 170 | <DL | <DL | 4 | 2000 |

## NB1 – PAH

| Table E53 NB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 13 |
| n > DL | 4 | 0 | 0 | 0 | 1 | 0 | 4 | 5 | 0 | 3 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 13 |
| Min | 9 | <DL | <DL | <DL | - | <DL | 2 | 1 | <DL | 1 | 3 | 1 | - | - | - | <DL | <DL | <DL | <DL | 66 |
| Median | 5 | <DL | <DL | <DL | - | <DL | 2 | 2 | <DL | 2 | - | - | - | - | - | <DL | <DL | <DL | <DL | 86 |
| Mean | 5 | <DL | <DL | <DL | - | <DL | 3 | 4 | <DL | 3 | - | - | - | - | - | <DL | <DL | <DL | <DL | 94 |
| SD | 5 | <DL | <DL | <DL | - | <DL | 3 | 4 | <DL | 2 | - | - | - | - | - | <DL | <DL | <DL | <DL | 18 |
| 80th percentile | 9 | <DL | <DL | <DL | - | <DL | 5 | 5 | <DL | 5 | - | - | - | - | - | <DL | <DL | <DL | <DL | 110 |
| Max | 19 | <DL | <DL | <DL | 2 | <DL | 13 | 17 | <DL | 8 | 10 | 5 | 4 | 2 | 4 | <DL | <DL | <DL | <DL | 128 |

| Table E54 NB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 18 | 20 | 20 | 20 | 18 | 19 | 19 | 19 | 11 |
| n > DL | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Min | 1 | <DL | <DL | <DL | <DL | <DL | 2 | 2 | <DL | - | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 |
| Median | 1 | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 77 |
| Mean | 2 | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 81 |
| SD | 2 | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 33 |
| 80th percentile | 5 | <DL | <DL | <DL | <DL | <DL | - | - | <DL | - | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 |
| Max | 6 | <DL | <DL | <DL | <DL | <DL | 3 | 3 | <DL | 2 | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 139 |

## NB1 – OCs & E.coli

| Table E55 NB1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 16 | 23 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 14 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 111 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 127 | 1 |

| Table E56 NB1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 14 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 13 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | - | 67 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | - | 94 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | - | 91 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | - | 33 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | - | <DL | <DL | <DL | - | 104 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | 1 | <DL | <DL | <DL | 1 | 153 | 1 |

## NB1 – Metals

| Table E57 NB1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 22 | 22 | 22 | 22 | 21 | 22 | 22 |
| n > DL | 21 | 1 | 22 | 0 | 0 | 15 | 22 |
| Min | 4 | - | 20 | <DL | <DL | 2 | 180 |
| Median | 8 | - | 59 | <DL | <DL | 2 | 545 |
| Mean | 8 | - | 59 | <DL | <DL | 2 | 563 |
| SD | 3 | - | 15 | <DL | <DL | 1 | 172 |
| 80th percentile | 10 | - | 72 | <DL | <DL | 3 | 676 |
| Max | 16 | 1 | 85 | <DL | <DL | 3 | 920 |

| Table E58 NB1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 18 | 0 | 19 | 0 | 1 | 10 | 19 |
| Min | 5 | <DL | 46 | <DL | - | 2 | 680 |
| Median | 7 | <DL | 98 | <DL | - | 2 | 1000 |
| Mean | 7 | <DL | 99 | <DL | - | 2 | 1143 |
| SD | 2 | <DL | 42 | <DL | - | 1 | 489 |
| 80th percentile | 9 | <DL | 134 | <DL | - | 3 | 1660 |
| Max | 11 | <DL | 170 | <DL | 0 | 4 | 2100 |

## NB2 – PAH

| Table E59 NB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 14 |
| n > DL | 4 | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Min | 10 | <DL | <DL | - | 5 | - | 3 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 61 |
| Median | 3 | <DL | <DL | - | - | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 83 |
| Mean | 5 | <DL | <DL | - | - | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 84 |
| SD | 5 | <DL | <DL | - | - | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 31 |
| 80th percentile | 10 | <DL | <DL | - | - | - | - | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 107 |
| Max | 15 | <DL | <DL | 1 | 7 | 1 | 11 | 11 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 128 |

| Table E60 NB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 10 |
| n > DL | 2 | 0 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Min | 6 | <DL | <DL | <DL | - | <DL | 2 | 1 | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 66 |
| Median | - | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 85 |
| Mean | - | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 88 |
| SD | - | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 21 |
| 80th percentile | - | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 |
| Max | 10 | <DL | <DL | <DL | 2 | <DL | 2 | 1 | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 137 |

## NB2 – OCs & E.coli

| Table E61 NB2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 14 | 20 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 63 | 2 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 31 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 127 | 2 |

| Table E62 NB2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 12 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 76 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 97 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 98 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 15 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 110 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 124 | 1 |

**NB2 – Metals**

| Table E63 NB2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 18 | 0 | 19 | 0 | 0 | 11 | 19 |
| Min | 5 | <DL | 16 | <DL | <DL | 2 | 130 |
| Median | 9 | <DL | 63 | <DL | <DL | 2 | 600 |
| Mean | 9 | <DL | 65 | <DL | <DL | 2 | 620 |
| SD | 3 | <DL | 25 | <DL | <DL | 1 | 214 |
| 80th percentile | 11 | <DL | 84 | <DL | <DL | 3 | 836 |
| Max | 14 | <DL | 110 | <DL | <DL | 4 | 940 |

| Table E64 NB2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| n > DL | 18 | 1 | 18 | 0 | 0 | 11 | 18 |
| Min | 5 | - | 53 | <DL | <DL | 2 | 640 |
| Median | 8 | - | 90 | <DL | <DL | 2 | 965 |
| Mean | 8 | - | 100 | <DL | <DL | 2 | 1213 |
| SD | 2 | - | 46 | <DL | <DL | 1 | 653 |
| 80th percentile | 9 | - | 120 | <DL | <DL | 3 | 1400 |
| Max | 13 | 1 | 200 | <DL | <DL | 4 | 2800 |

## CDN1 – PAH

| Table E65 CDN1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 14 |
| n > DL | 4 | 0 | 0 | 1 | 2 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Min | 10 | <DL | <DL | - | 4 | - | 2 | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 67 |
| Median | 5 | <DL | <DL | - | - | - | - | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 |
| Mean | 5 | <DL | <DL | - | - | - | - | 3 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 85 |
| SD | 4 | <DL | <DL | - | - | - | - | 3 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 29 |
| 80th percentile | 10 | <DL | <DL | - | - | - | - | 5 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 106 |
| Max | 11 | <DL | <DL | 1 | 7 | 1 | 4 | 11 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 110 |

| Table E66 CDN1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 9 |
| n > DL | 5 | 2 | 0 | 0 | 3 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Min | 6 | 2 | <DL | <DL | 1 | 1 | 2 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 72 |
| Median | 2 | - | <DL | <DL | 1 | - | 2 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 86 |
| Mean | 4 | - | <DL | <DL | 2 | - | 2 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 89 |
| SD | 5 | - | <DL | <DL | 2 | - | 2 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 18 |
| 80th percentile | 6 | - | <DL | <DL | 5 | - | 5 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 107 |
| Max | 16 | 2 | <DL | <DL | 4 | 2 | 2 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 121 |

## CDN1 – OCs & E.coli

| Table E67 CDN1 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 13 | 21 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 79 | <DL |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 99 | <DL |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 90 | <DL |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 29 | <DL |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 102 | <DL |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 117 | <DL |

| Table E68 CDN1 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 16 | 21 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 72 | <DL |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 93 | <DL |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | <DL |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 13 | <DL |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 100 | <DL |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 124 | <DL |

## CDN1 – Metals

| Table E69 CDN1 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| n > DL | 20 | 0 | 20 | 0 | 0 | 7 | 20 |
| Min | 6 | <DL | 24 | <DL | <DL | 2 | 350 |
| Median | 8 | <DL | 55 | <DL | <DL | 2 | 520 |
| Mean | 10 | <DL | 58 | <DL | <DL | 2 | 554 |
| SD | 5 | <DL | 22 | <DL | <DL | 1 | 160 |
| 80th percentile | 11 | <DL | 74 | <DL | <DL | 2 | 650 |
| Max | 25 | <DL | 110 | <DL | <DL | 3 | 1000 |

| Table E70 CDN1 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| n > DL | 21 | 4 | 21 | 0 | 3 | 13 | 21 |
| Min | 5 | 1 | 41 | <DL | 0.1 | 2 | 570 |
| Median | 8 | 1 | 87 | <DL | 0.1 | 2 | 1100 |
| Mean | 8 | 1 | 108 | <DL | 0.1 | 2 | 1271 |
| SD | 2 | 1 | 58 | <DL | 0.0 | 1 | 611 |
| 80th percentile | 9 | 1 | 150 | <DL | 0.1 | 3 | 1600 |
| Max | 14 | 3 | 230 | <DL | 0.1 | 4 | 3000 |

## CDN2 – PAH

| Table E71 CDN2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 11 |
| n > DL | 4 | 0 | 0 | 0 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Min | 11 | <DL | <DL | <DL | 2 | <DL | 3 | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 60 |
| Median | 5 | <DL | <DL | <DL | - | <DL | 2 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 88 |
| Mean | 5 | <DL | <DL | <DL | - | <DL | 3 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 91 |
| SD | 5 | <DL | <DL | <DL | - | <DL | 4 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 17 |
| 80th percentile | 11 | <DL | <DL | <DL | - | <DL | 5 | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 100 |
| Max | 14 | <DL | <DL | <DL | 7 | <DL | 14 | 16 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 119 |

| Table E72 CDN2 Syndey Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PAH's | | | | | | | | | | | | | | | | | | | |
| | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Total +ve PAH's | Benzo(a)pyrene TEQ calc (zero) | Benzo(a)pyrene TEQ calc(half) | Benzo(a)pyrene TEQ calc(PQL) | Surrogate p-Terphenyl-d14 |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 9 |
| n > DL | 4 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Min | 9 | <DL | <DL | <DL | 3 | <DL | 1 | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 70 |
| Median | 2 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 87 |
| Mean | 4 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 79 |
| SD | 5 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 32 |
| 80th percentile | 7 | <DL | <DL | <DL | - | <DL | - | - | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 96 |
| Max | 18 | <DL | <DL | <DL | 10 | <DL | 2 | 1 | <DL | <DL | <DL | 1 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 108 |

## CDN2 – OCs & E.coli

| Table E73 CDN2 Pacific Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 12 | 18 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 2 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 75 | 1 |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 95 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 95 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 15 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | - | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 105 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 2 | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 125 | 2 |

| Table E74 CDN2 Sydney Rock Oyster Summary Statistics | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OC's + E.coli | | | | | | | | | | | | | | | | | | | | |
| | HCB | alpha-BHC | gamma-BHC | beta-BHC | Heptachlor | delta-BHC | Aldrin | Heptachlor Epoxide | gamma-Chlordane | alpha-chlordane | Endosulfan I | pp-DDE | Dieldrin | Endrin | pp-DDD | Endosulfan II | pp-DDT | Endrin Aldehyde | Endosulfan Sulphate | Surrogate TCMX | E.coli |
| | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | % | cfu/g |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 15 | 19 |
| n > DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 1 |
| Min | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 69 | - |
| Median | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 98 | - |
| Mean | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 92 | - |
| SD | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 29 | - |
| 80th percentile | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 111 | - |
| Max | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | <DL | 123 | 1 |

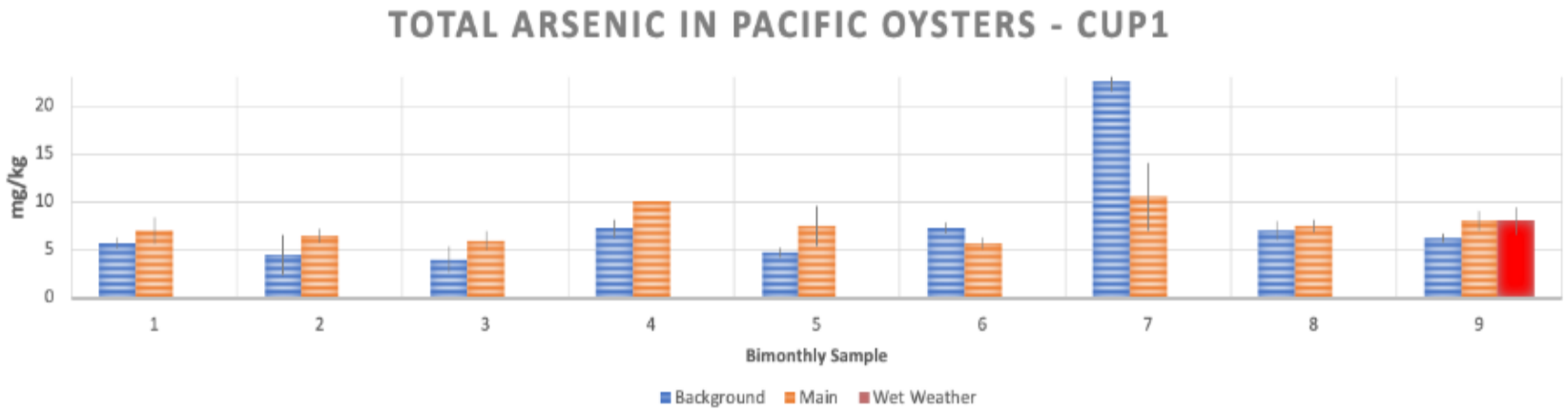
## CDN2 – Metals

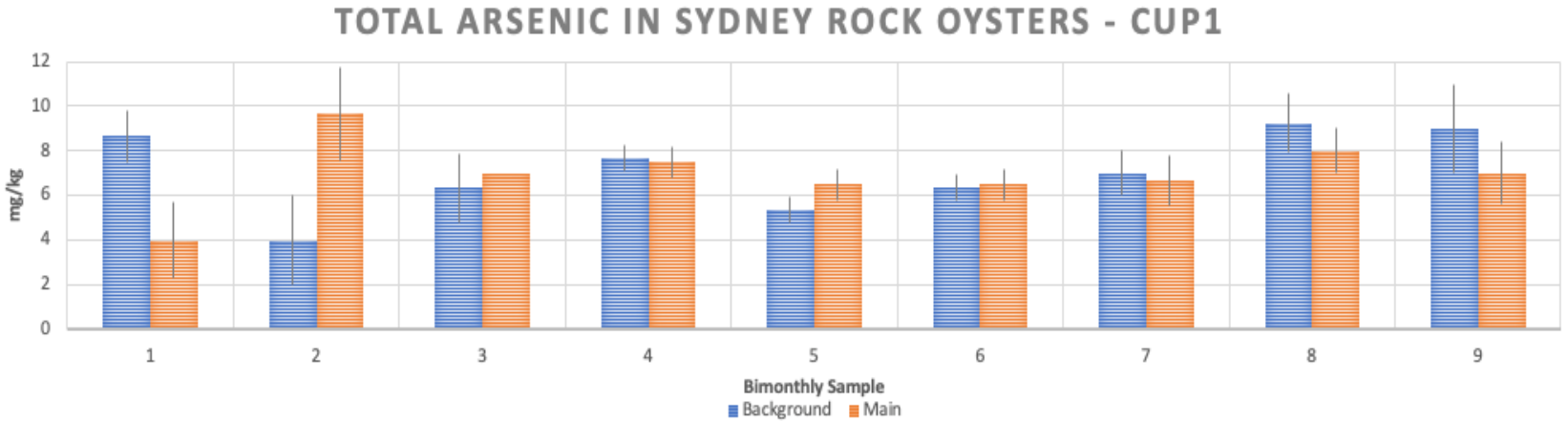
| Table E75 CDN2 Pacific Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| n > DL | 18 | 0 | 18 | 0 | 0 | 10 | 18 |
| Min | 5 | <DL | 39 | <DL | <DL | 2 | 400 |
| Median | 9 | <DL | 62 | <DL | <DL | 2 | 540 |
| Mean | 10 | <DL | 59 | <DL | <DL | 2 | 596 |
| SD | 4 | <DL | 15 | <DL | <DL | 1 | 135 |
| 80th percentile | 11 | <DL | 67 | <DL | <DL | 3 | 716 |
| Max | 21 | <DL | 91 | <DL | <DL | 3 | 880 |

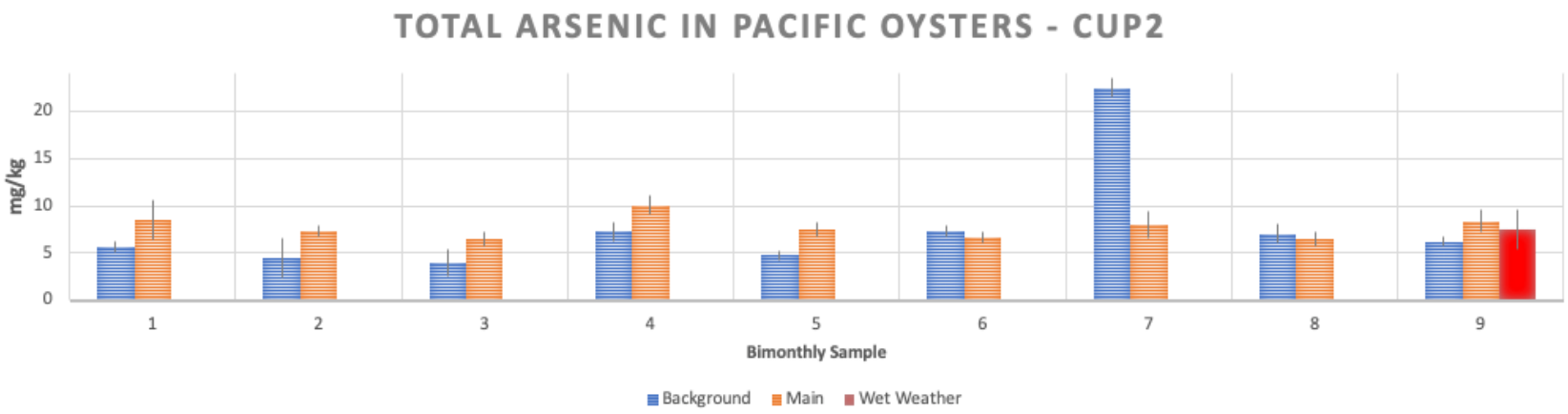
| Table E76 CDN2 Sydney Rock Oyster Summary Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Metals | | | | | | |
| | Arsenic | Chromium | Copper | Lead | Mercury | Selenium | Zinc |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Sample size (n) | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| n > DL | 19 | 1 | 19 | 0 | 1 | 11 | 19 |
| Min | 6 | - | 36 | <DL | - | 2 | 540 |
| Median | 8 | - | 76 | <DL | - | 2 | 920 |
| Mean | 8 | - | 88 | <DL | - | 2 | 1088 |
| SD | 2 | - | 44 | <DL | - | 1 | 522 |
| 80th percentile | 10 | - | 114 | <DL | - | 3 | 1200 |
| Max | 12 | 1 | 180 | <DL | 0.1 | 4 | 2200 |

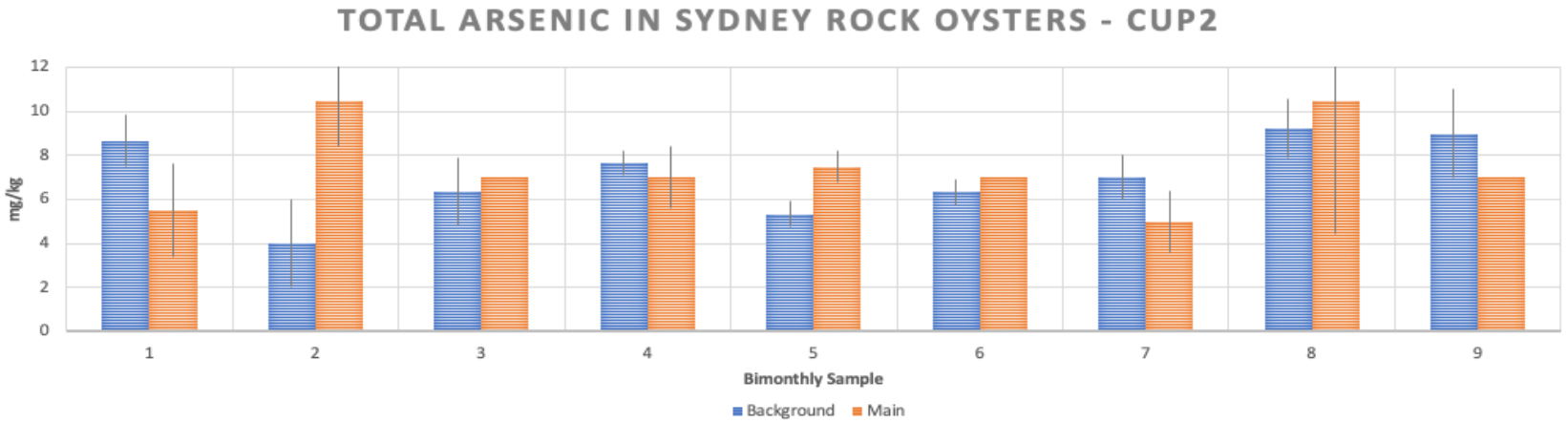
# APPENDIX E6

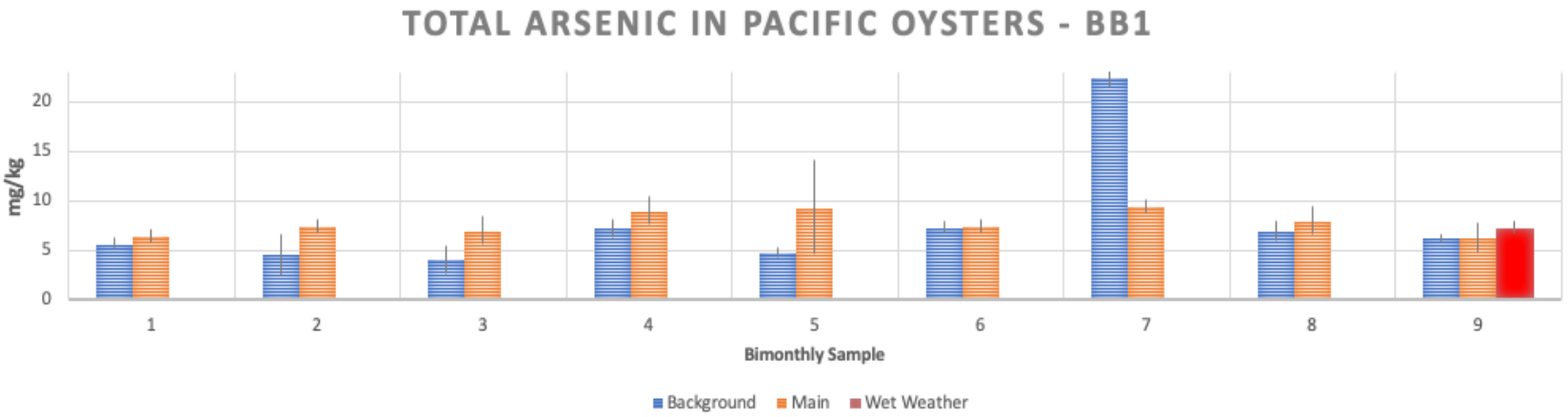
# OYSTER METAL ANALYSIS GRAPHS

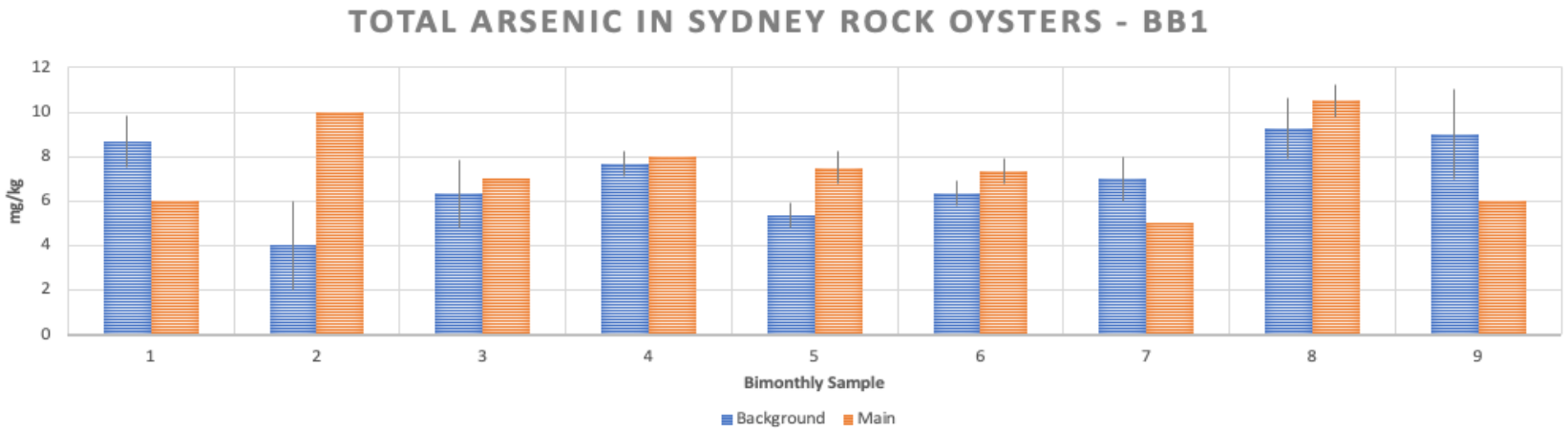

TOTAL ARSENIC IN PACIFIC OYSTERS - CUP1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

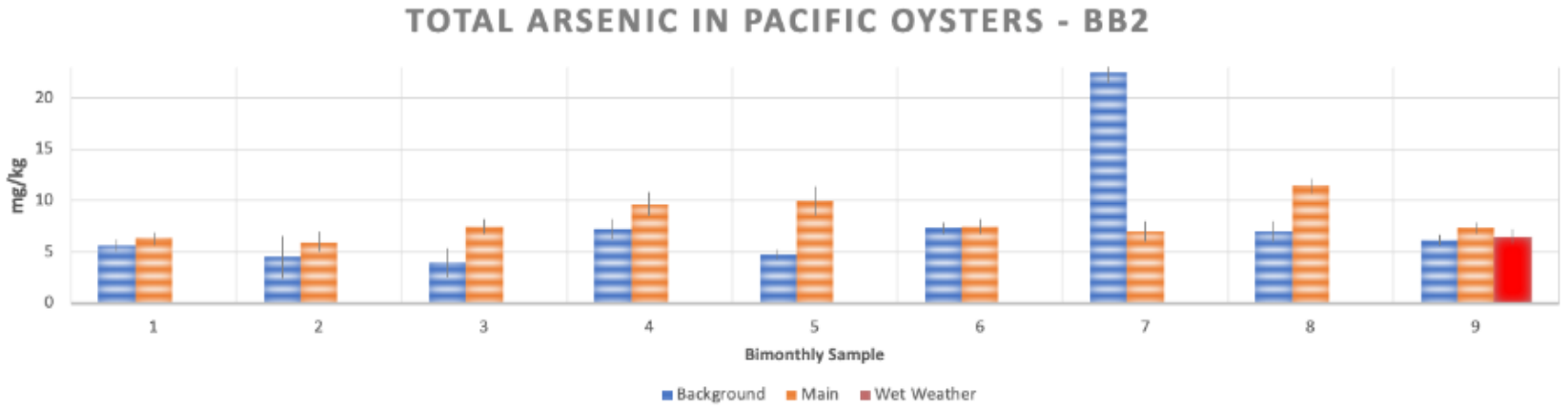

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

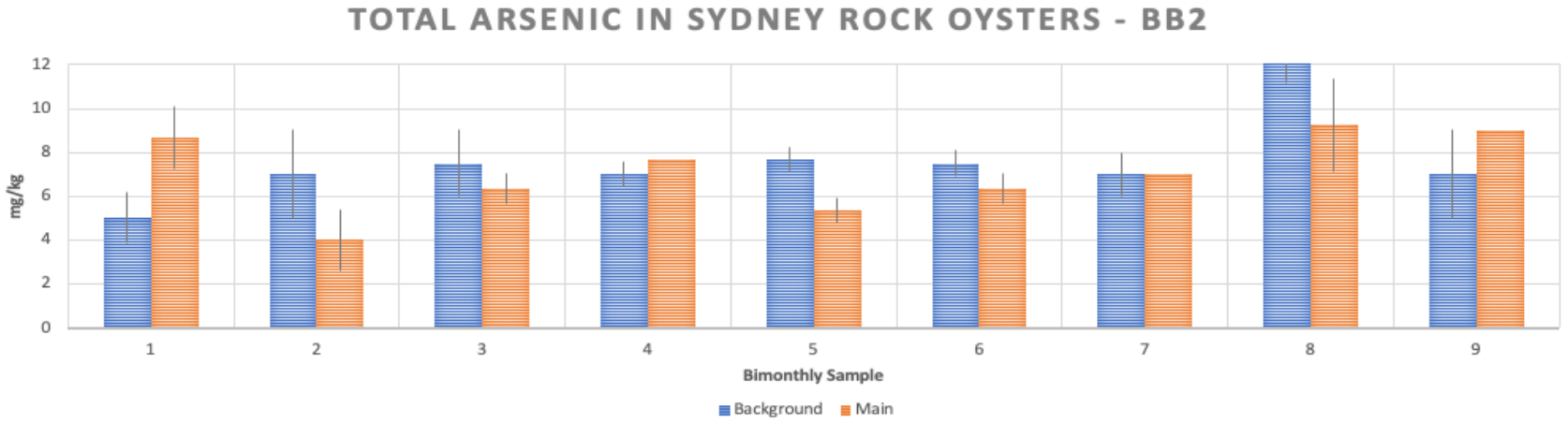

TOTAL ARSENIC IN PACIFIC OYSTERS - CUP2
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

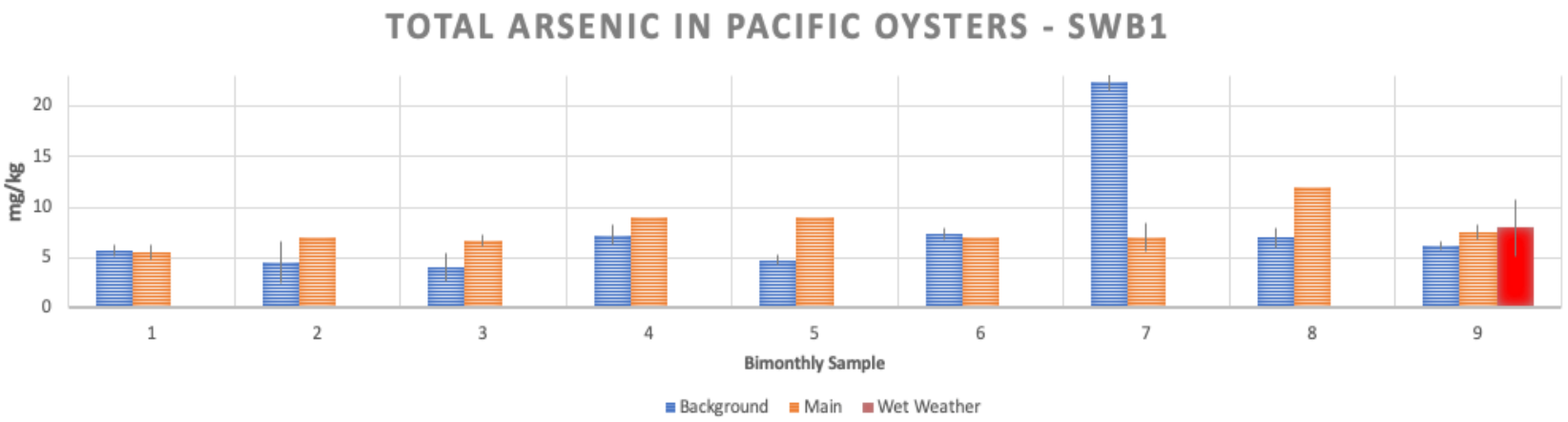

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

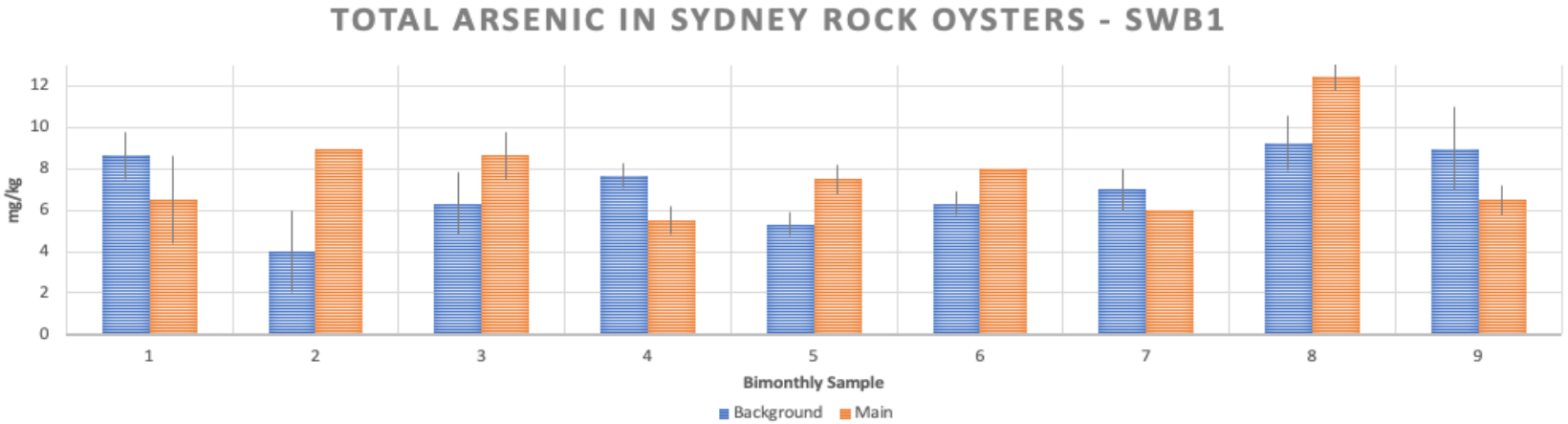

TOTAL ARSENIC IN PACIFIC OYSTERS - BB1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

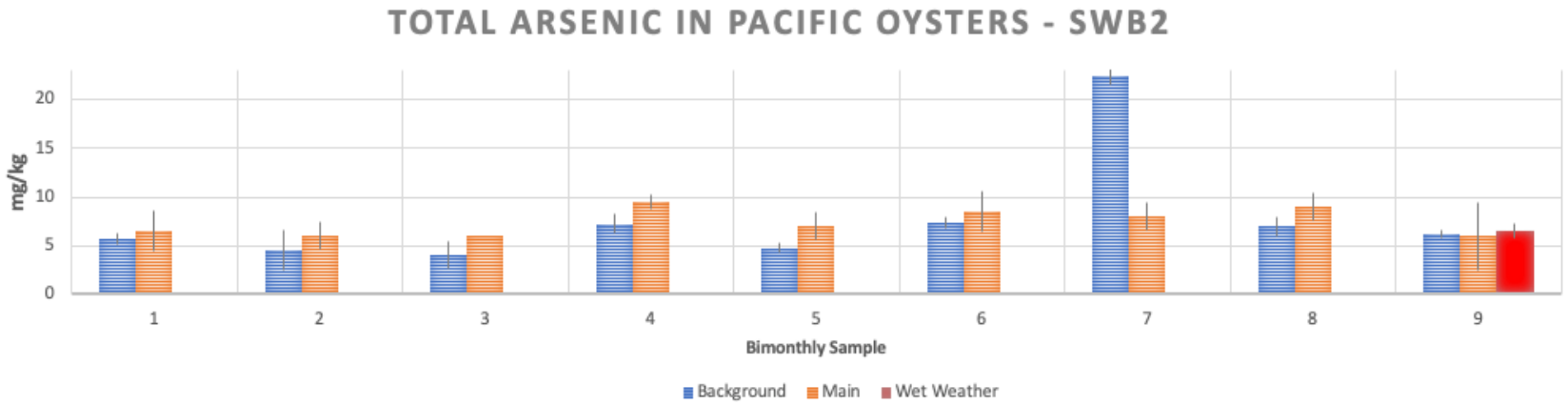

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - BB1
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

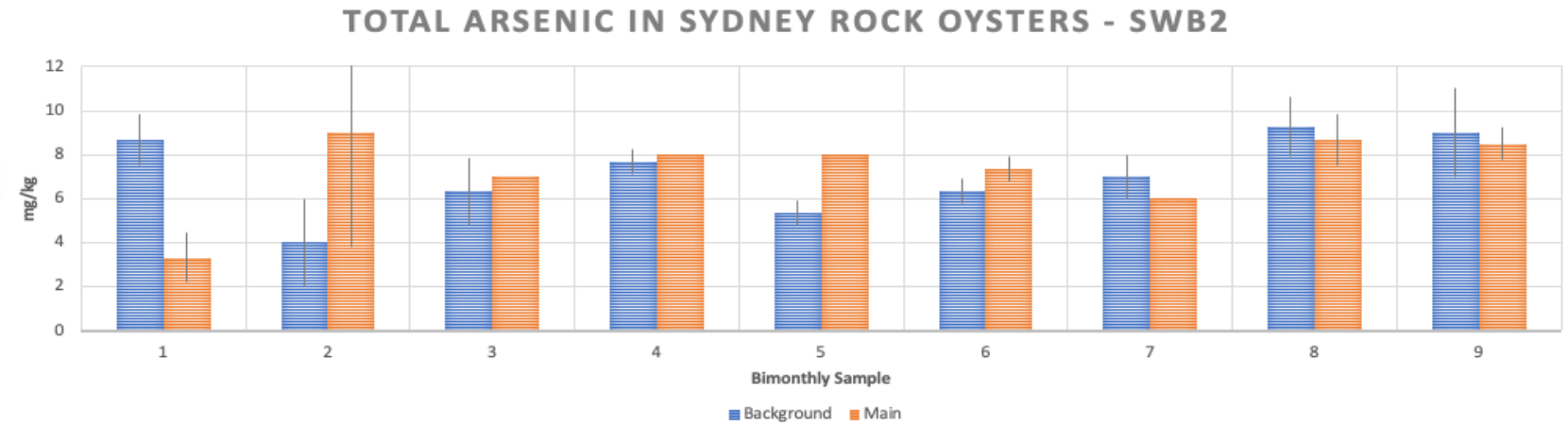

TOTAL ARSENIC IN PACIFIC OYSTERS - BB2
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

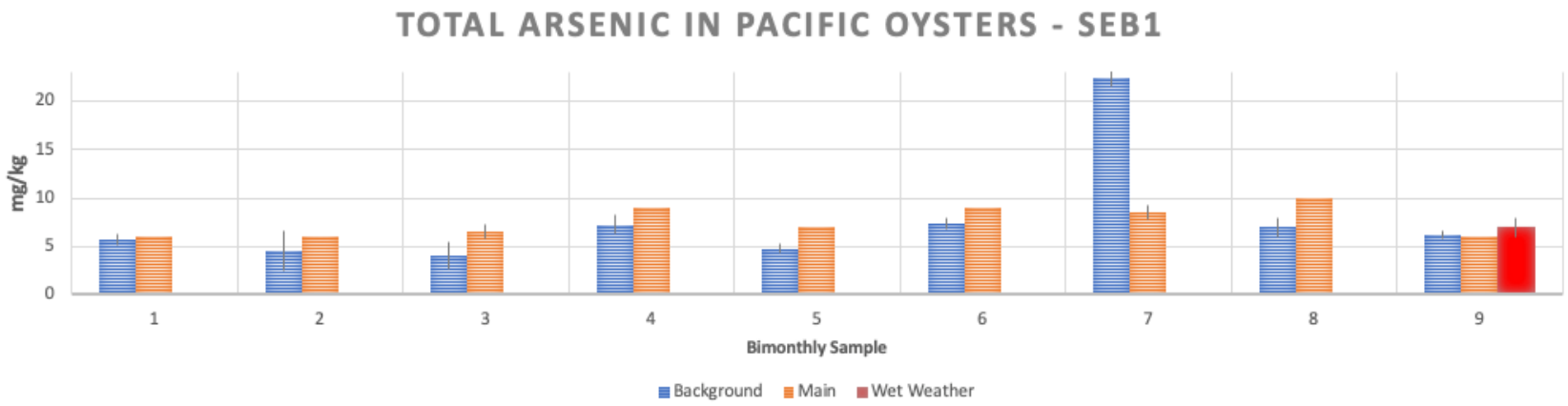

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - BB2
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

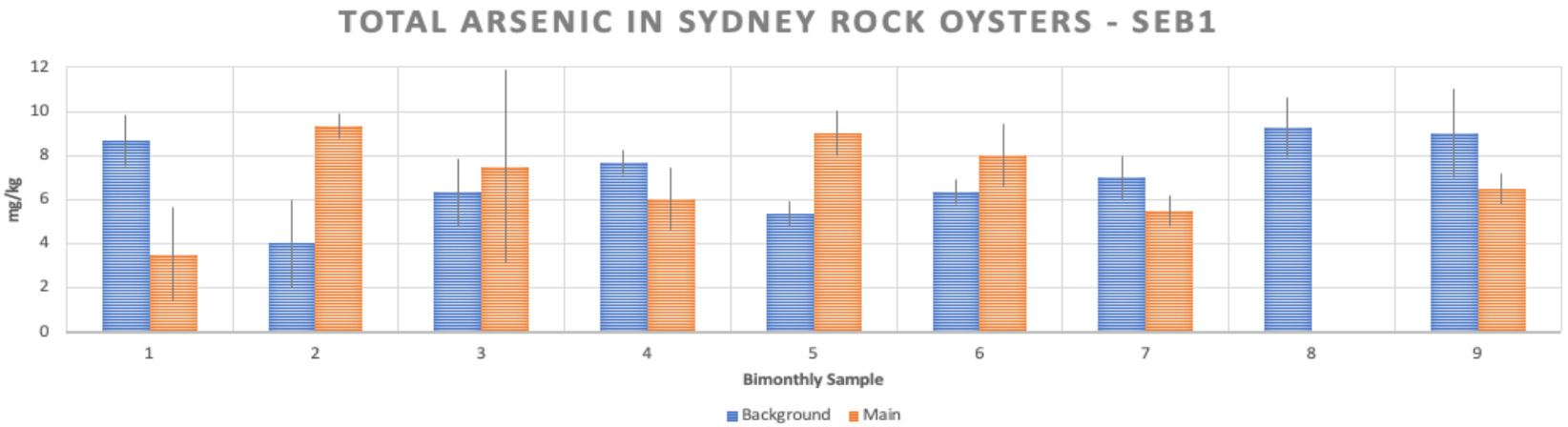

TOTAL ARSENIC IN PACIFIC OYSTERS - SWB1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

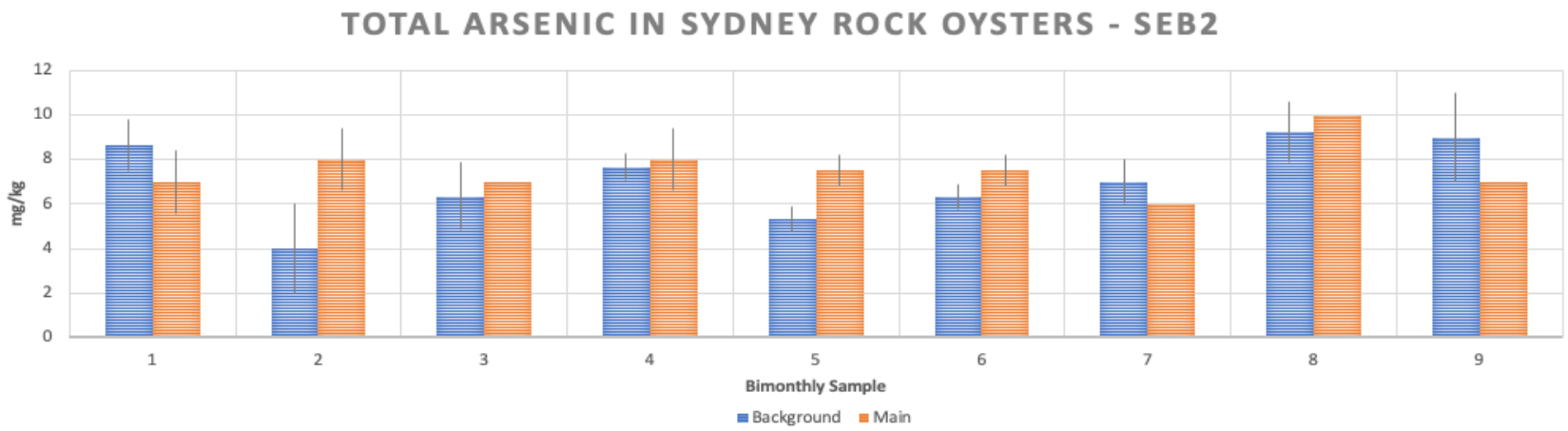

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - SWB1
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

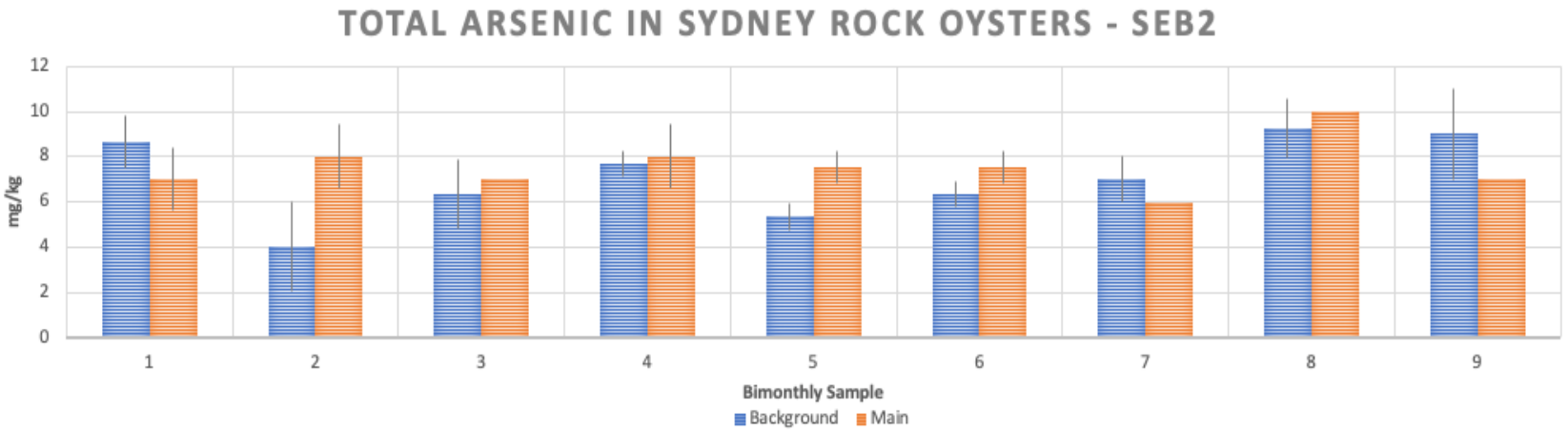

TOTAL ARSENIC IN PACIFIC OYSTERS - SWB2
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

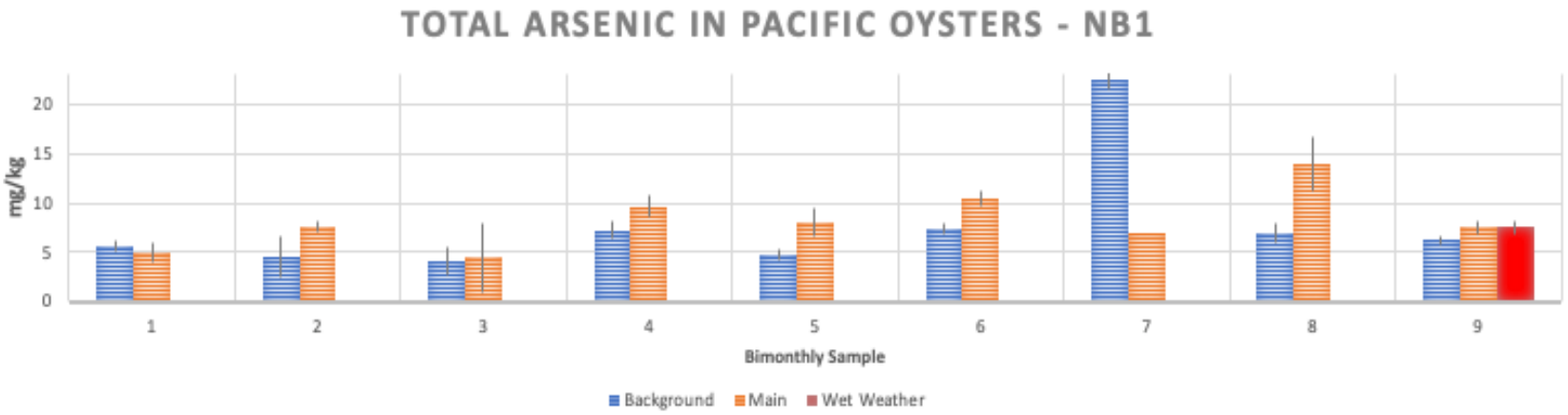

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

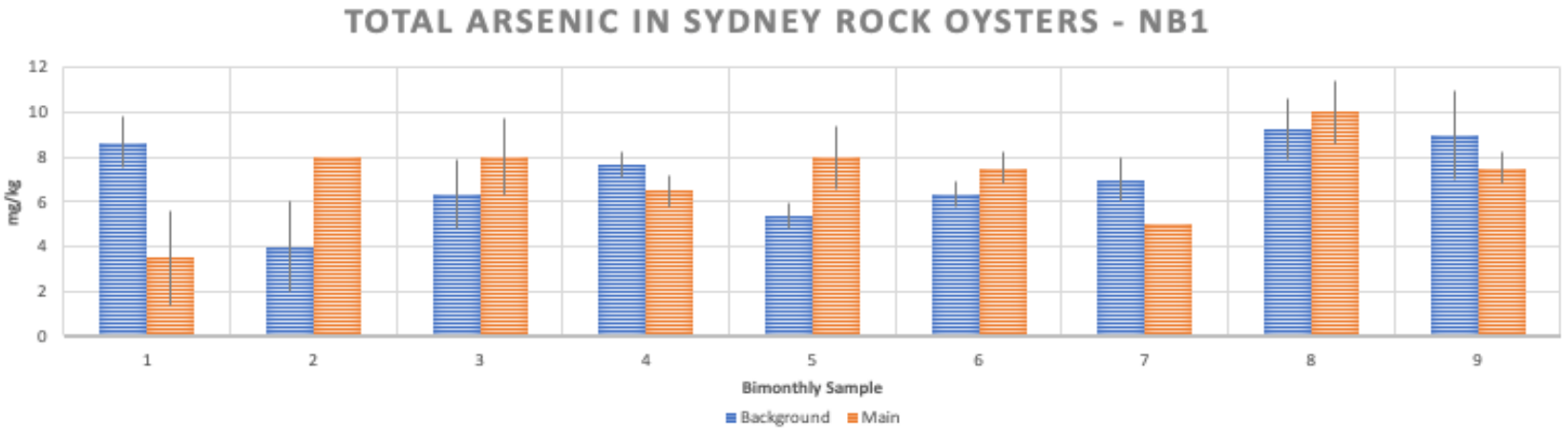

TOTAL ARSENIC IN PACIFIC OYSTERS - SEB1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

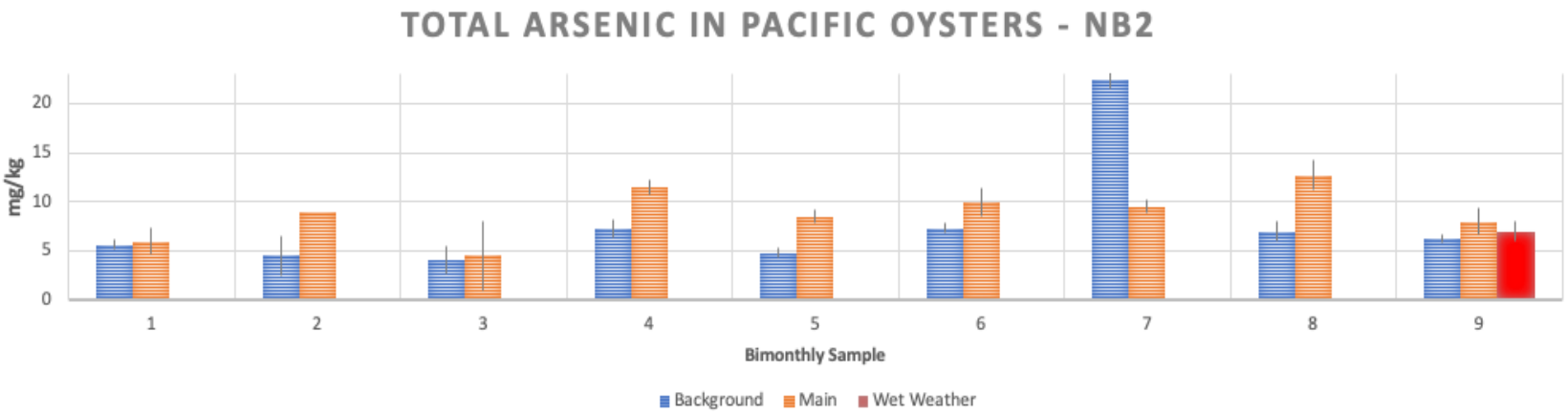

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

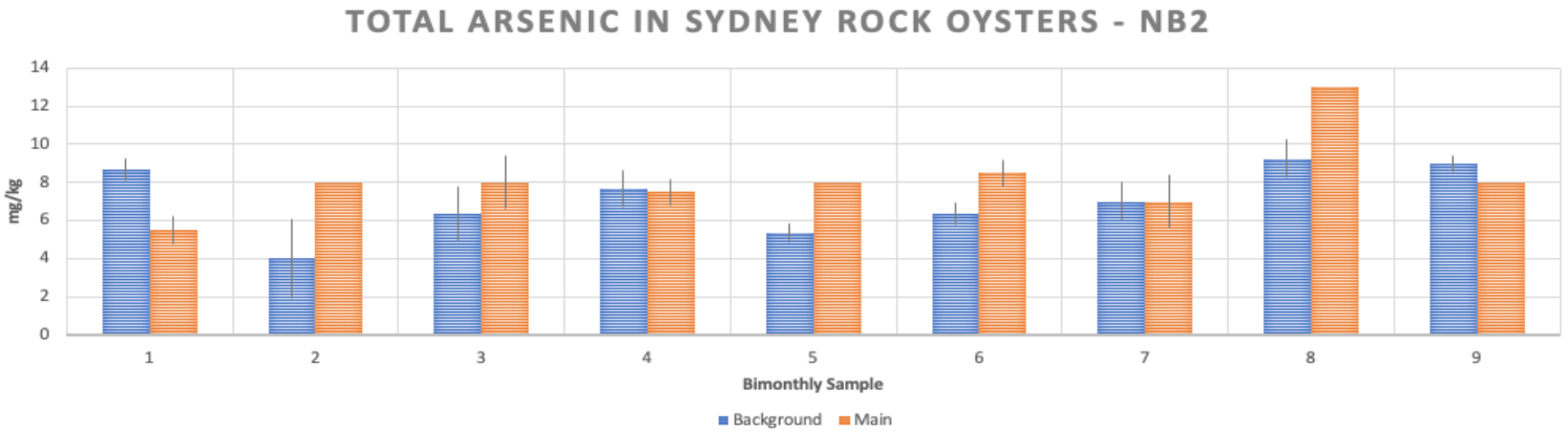

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
0
2
4
6
8
10
12
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

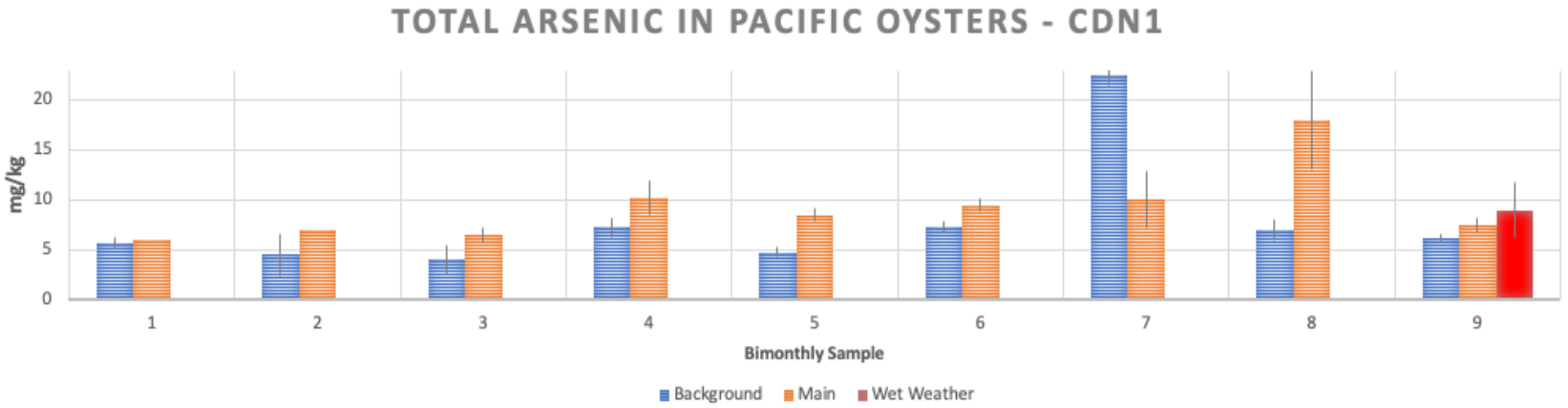

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
0
2
4
6
8
10
12
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

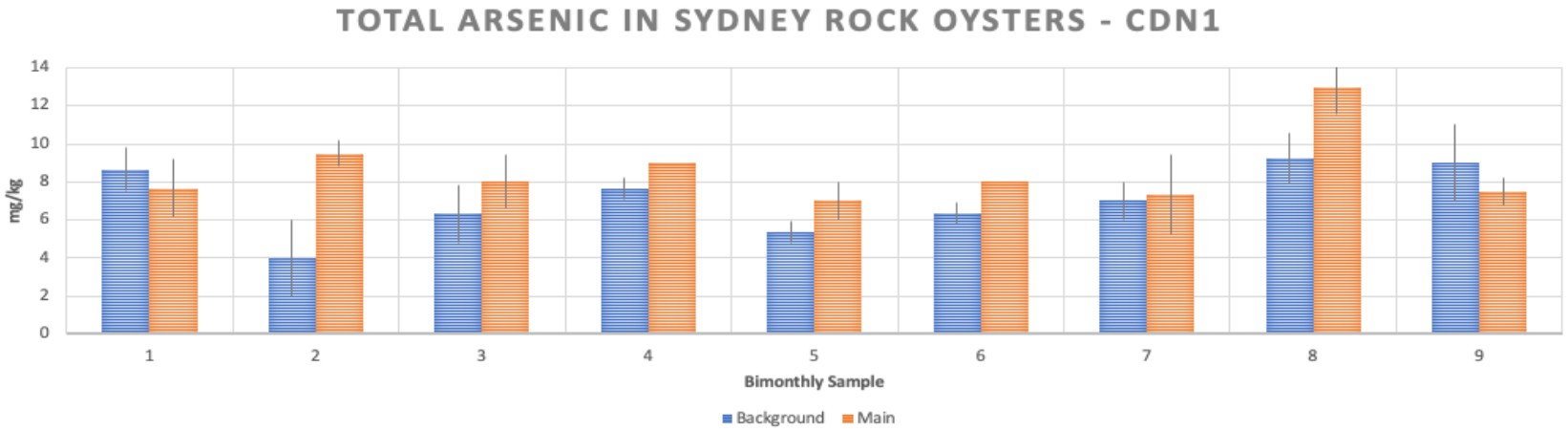

TOTAL ARSENIC IN PACIFIC OYSTERS - NB1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

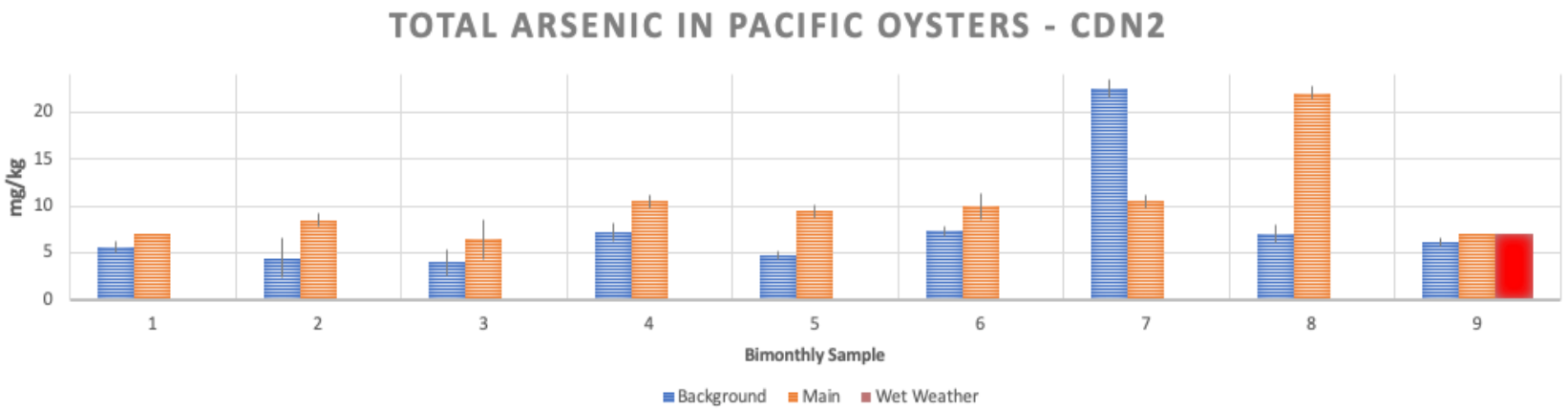

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - NB1
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

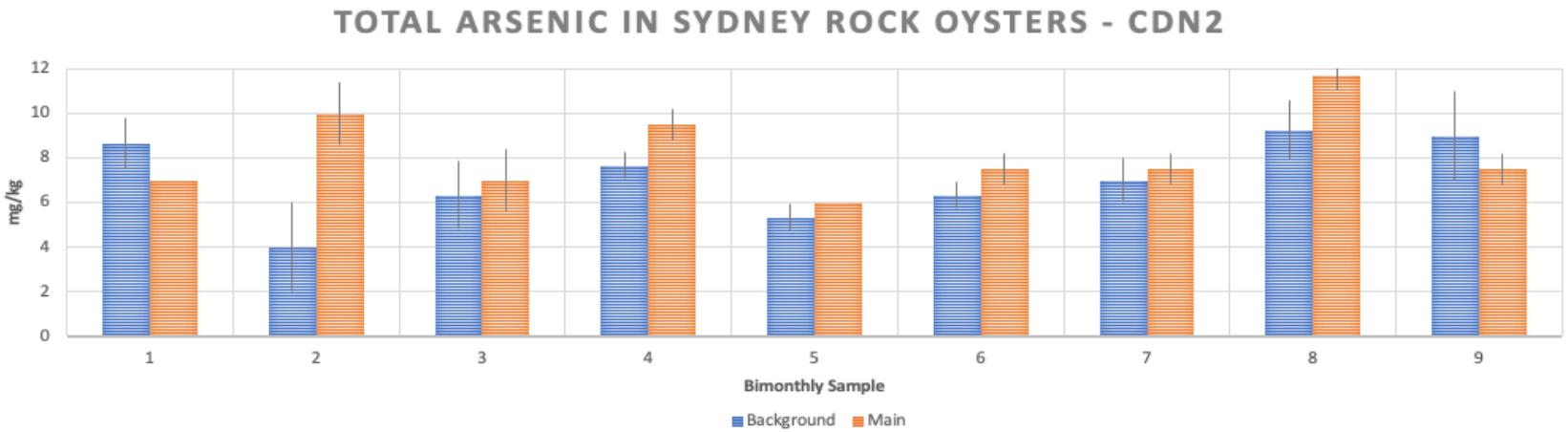

TOTAL ARSENIC IN PACIFIC OYSTERS - NB2
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

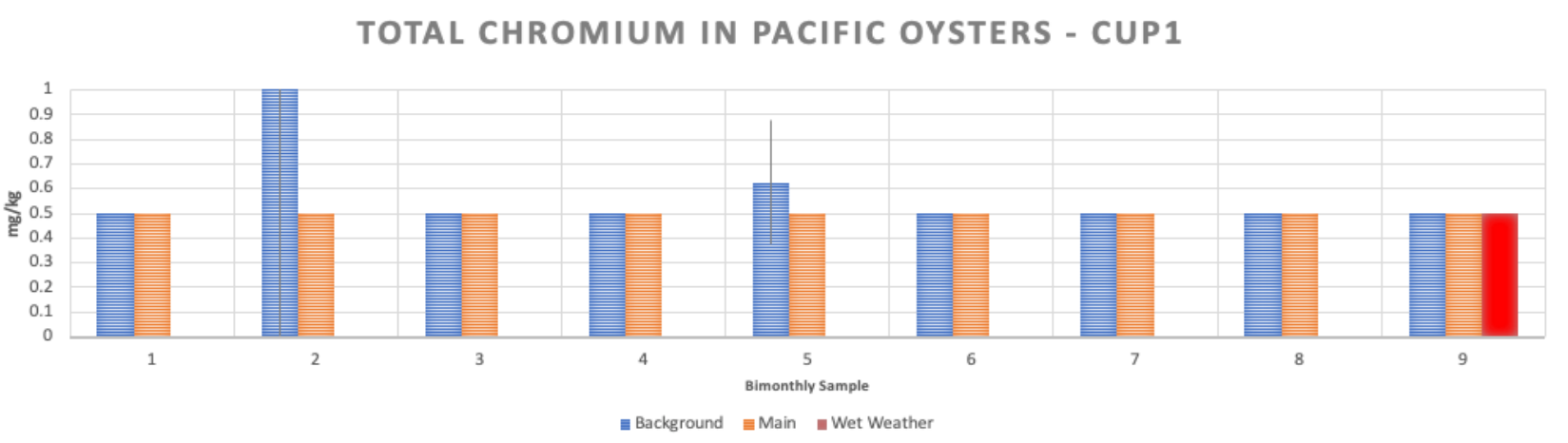

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - NB2
mg/kg
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

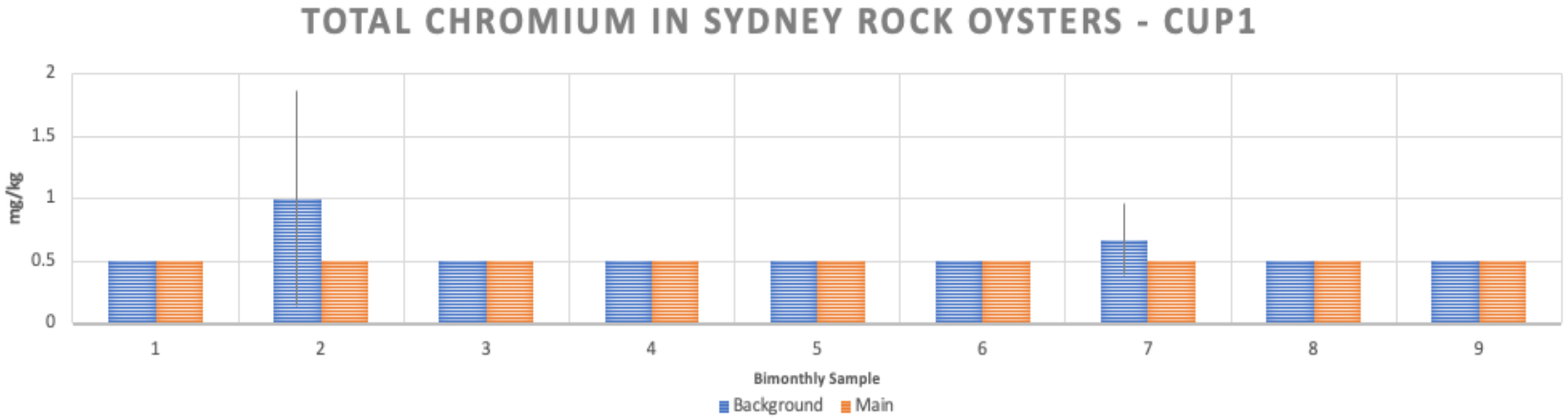

TOTAL ARSENIC IN PACIFIC OYSTERS - CDN1
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

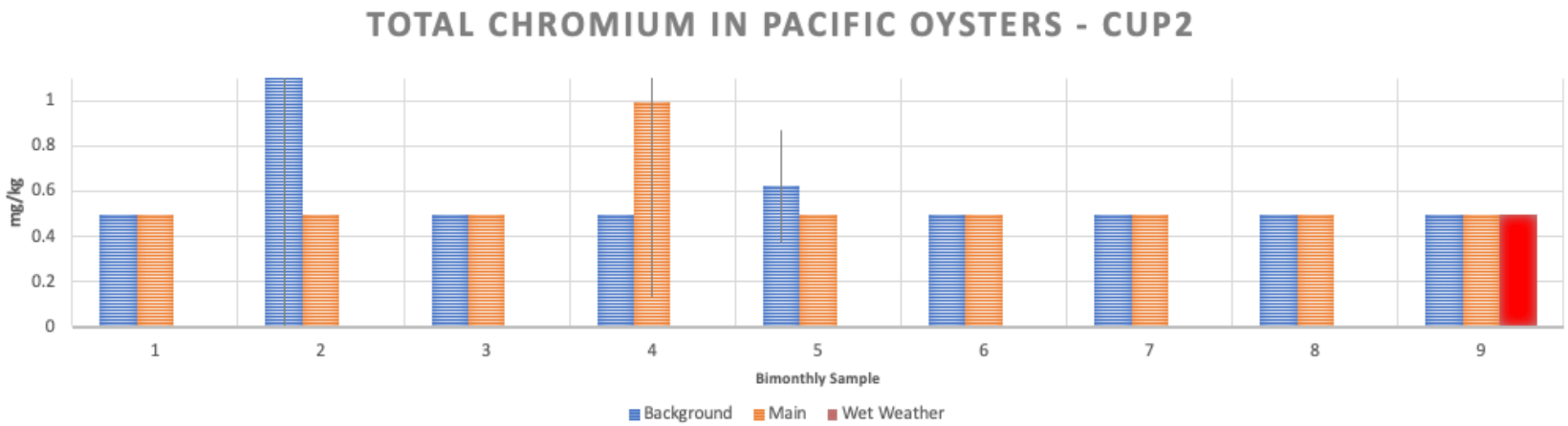

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

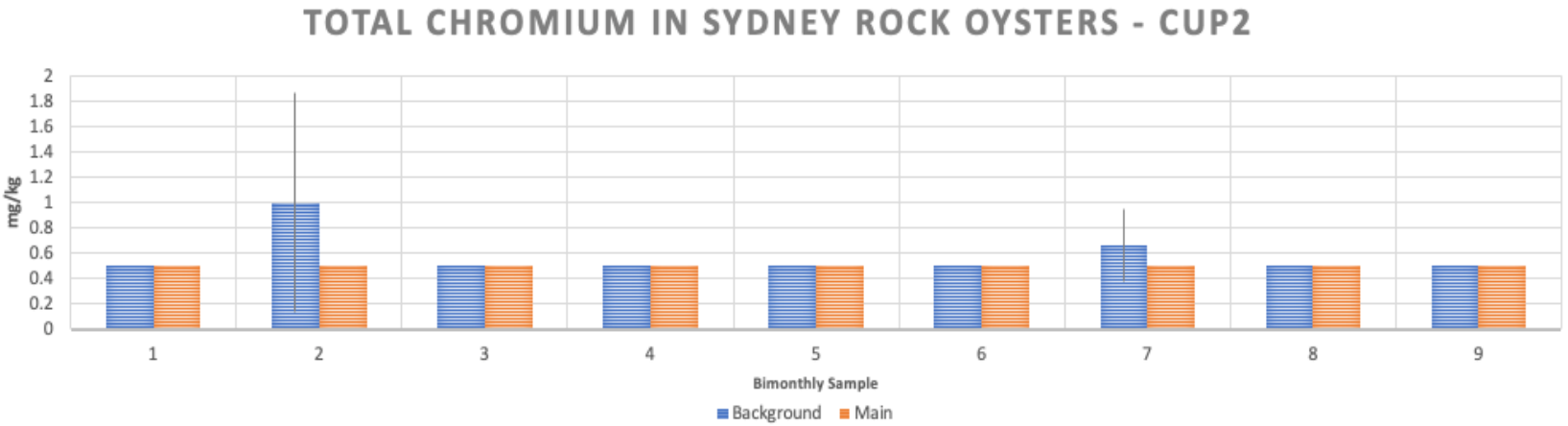

TOTAL ARSENIC IN PACIFIC OYSTERS - CDN2
mg/kg
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

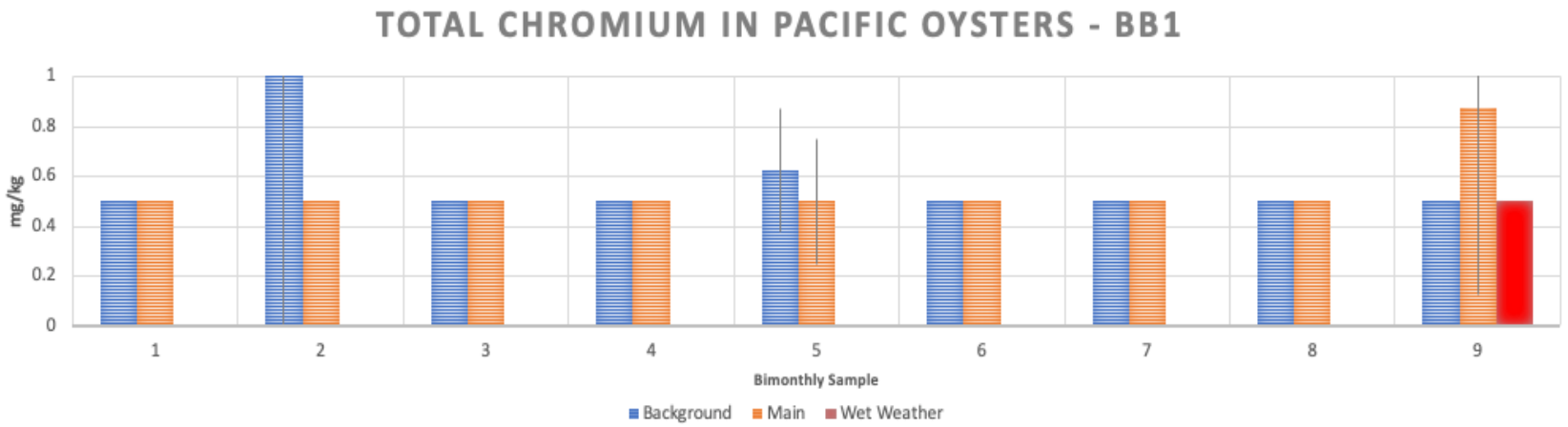

TOTAL ARSENIC IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

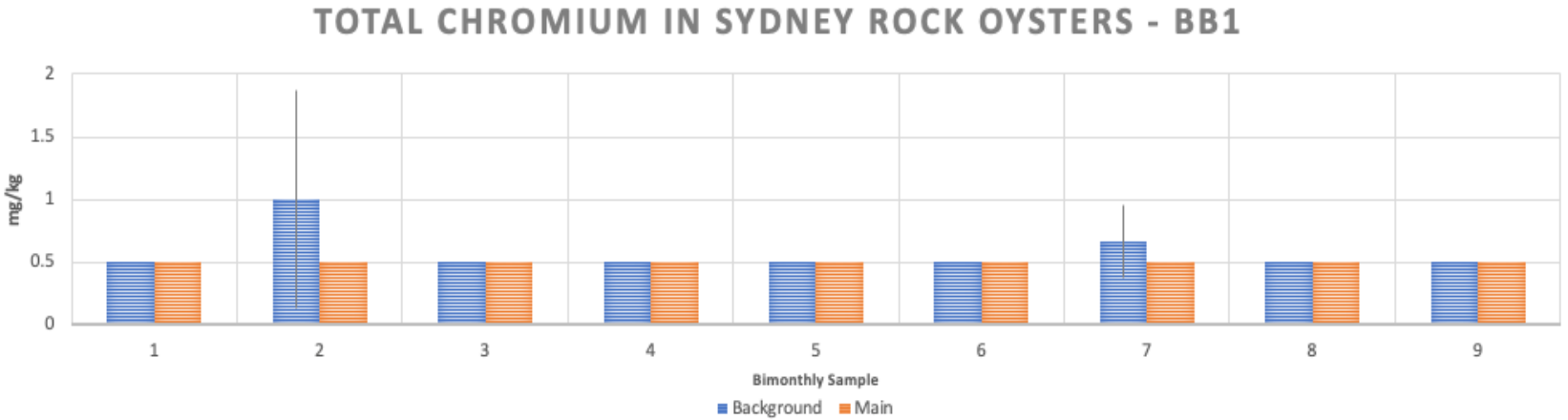

TOTAL CHROMIUM IN PACIFIC OYSTERS - CUP1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

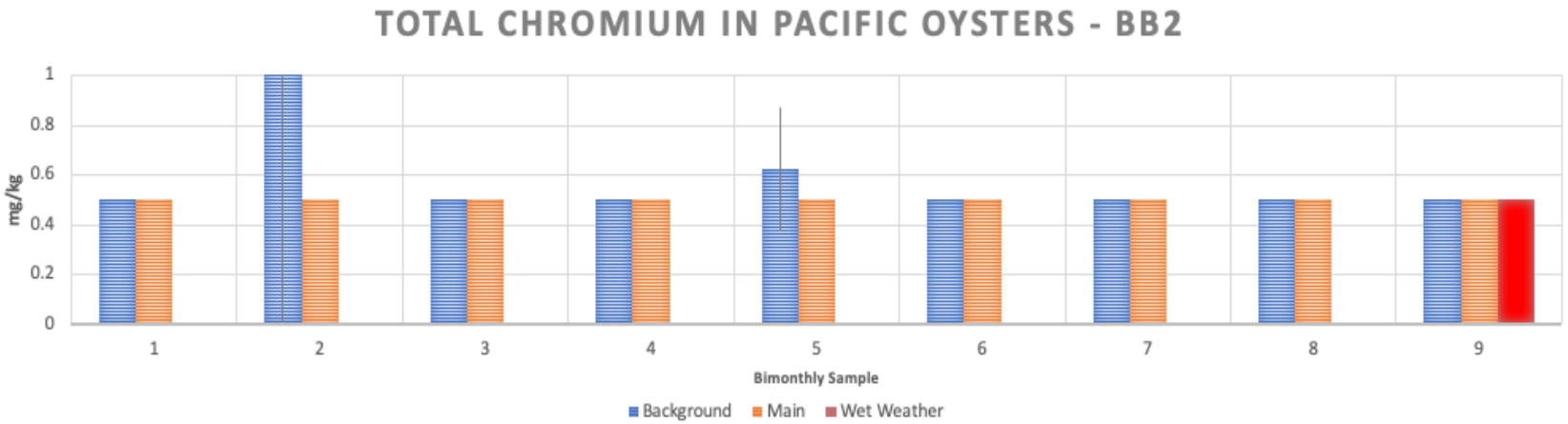

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

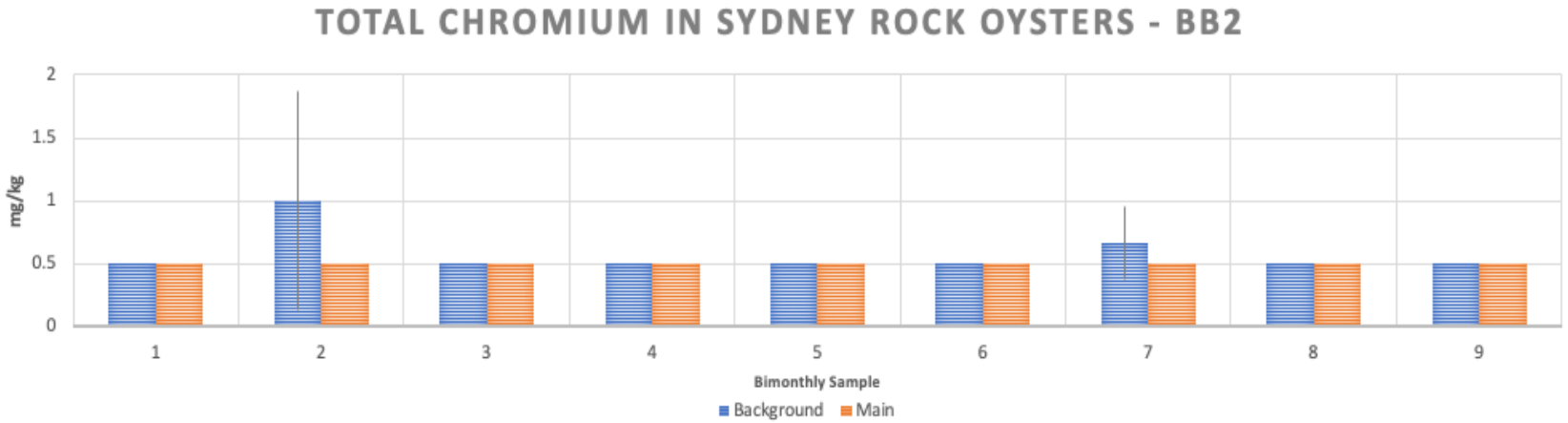

TOTAL CHROMIUM IN PACIFIC OYSTERS - CUP2
mg/kg
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

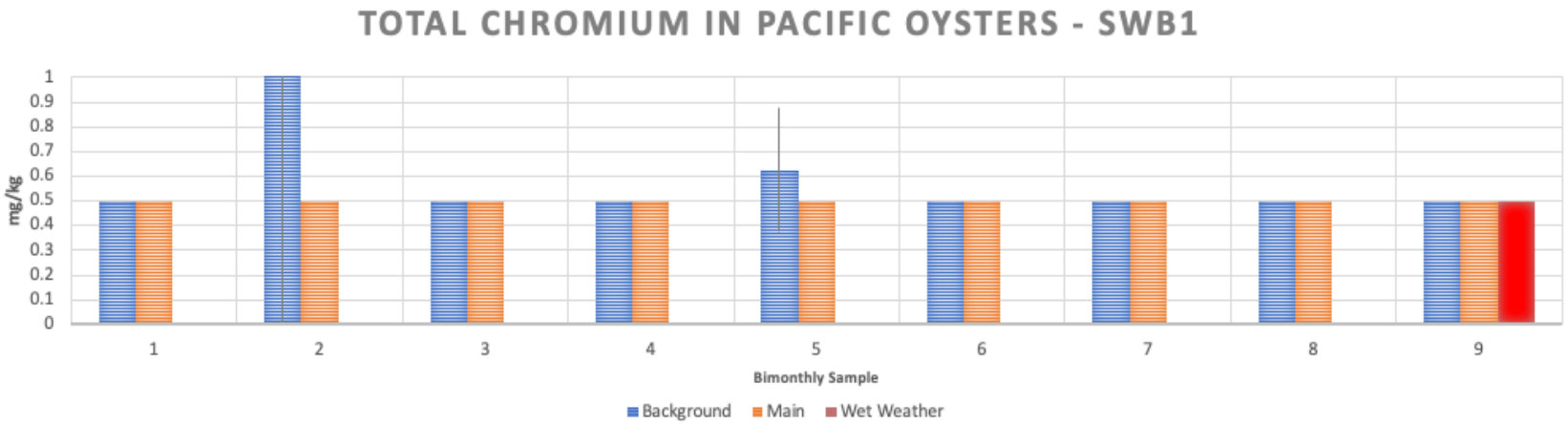

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

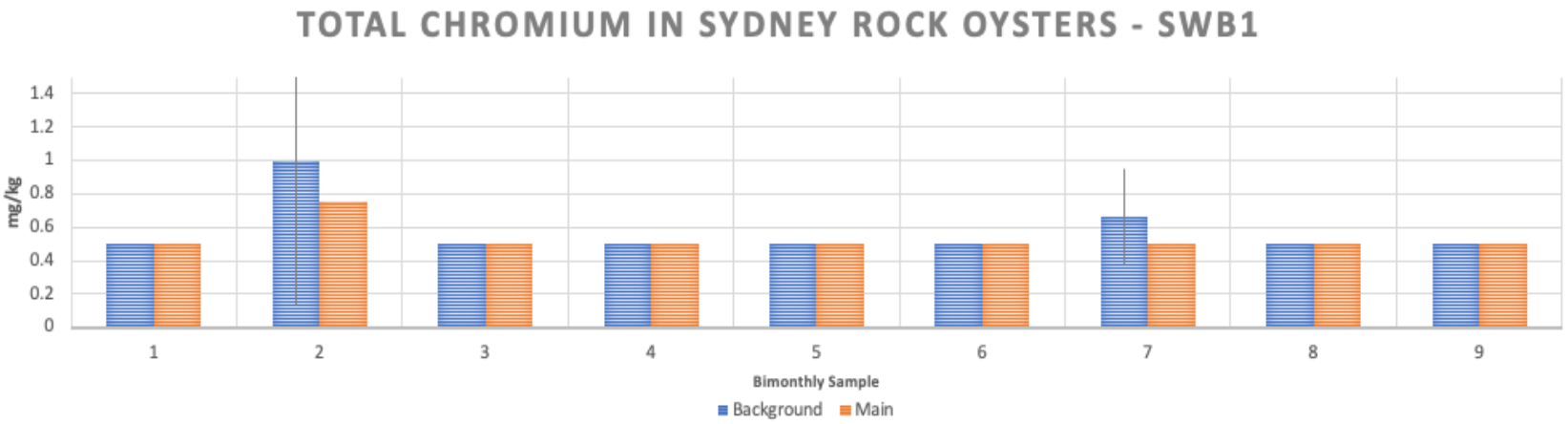

TOTAL CHROMIUM IN PACIFIC OYSTERS - BB1
mg/kg
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

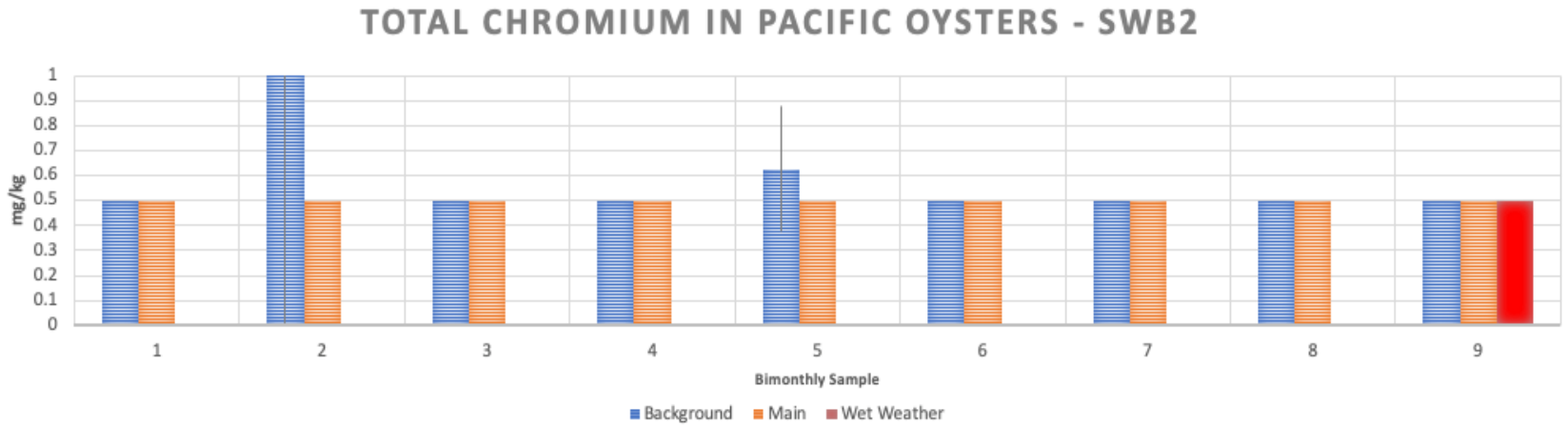

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - BB1
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

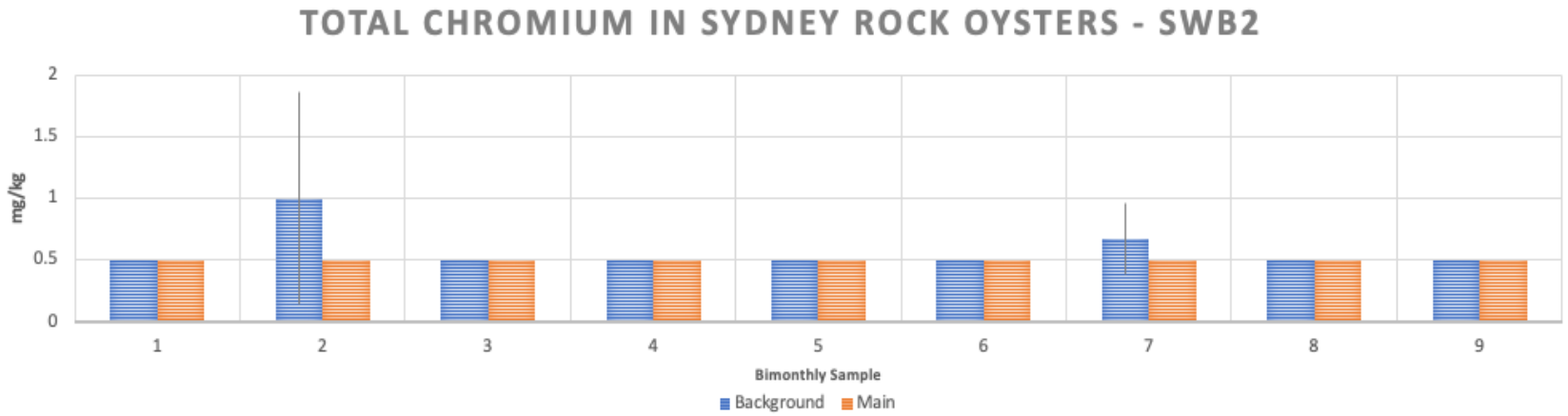

TOTAL CHROMIUM IN PACIFIC OYSTERS - BB2
mg/kg
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

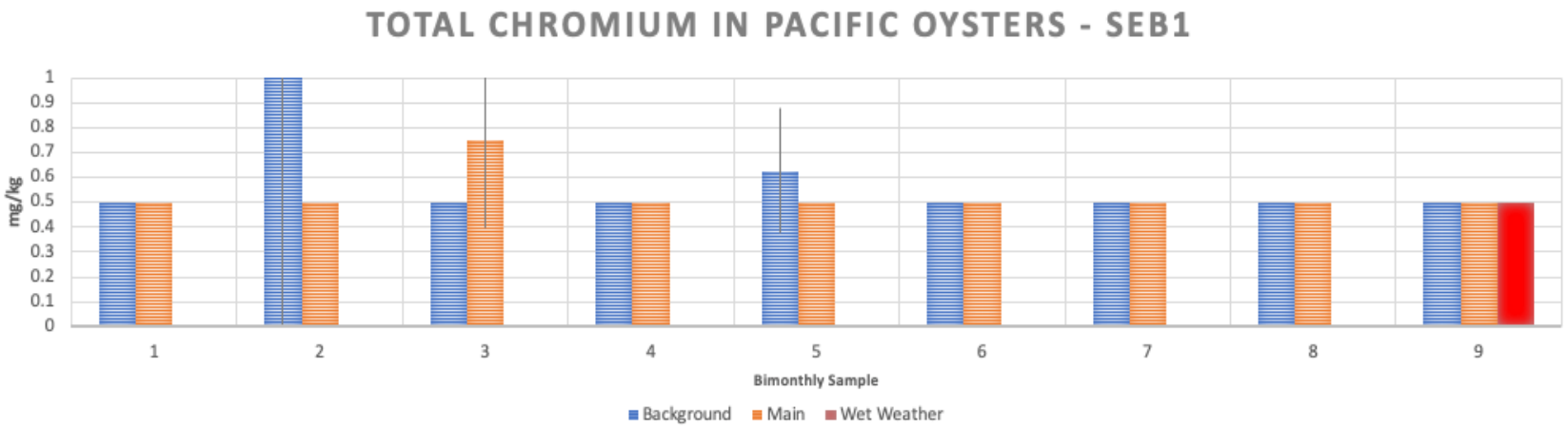

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - BB2
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

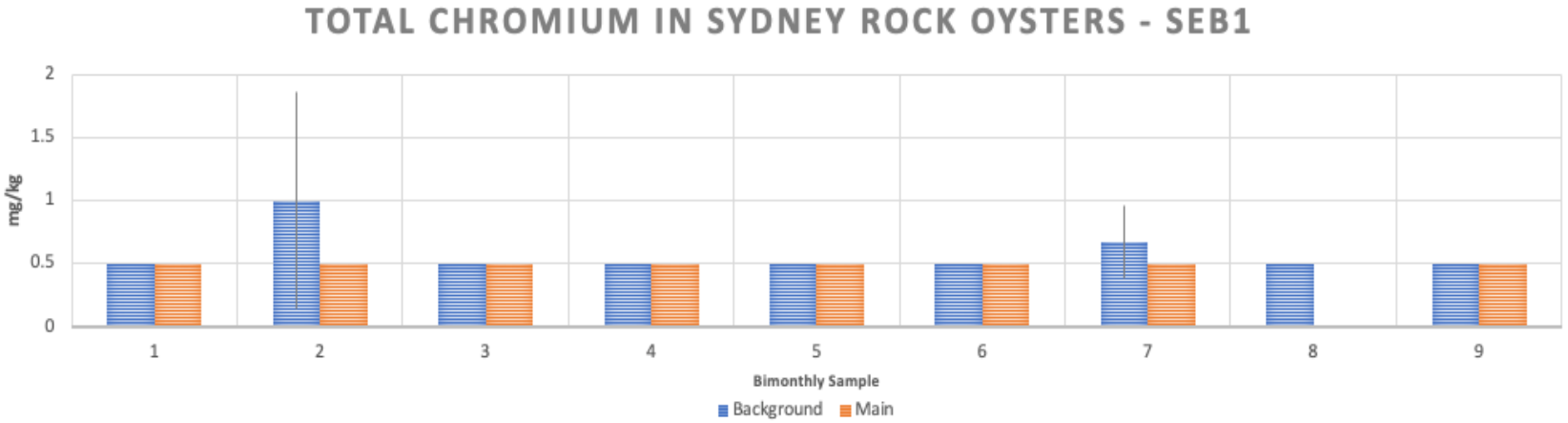

TOTAL CHROMIUM IN PACIFIC OYSTERS - SWB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

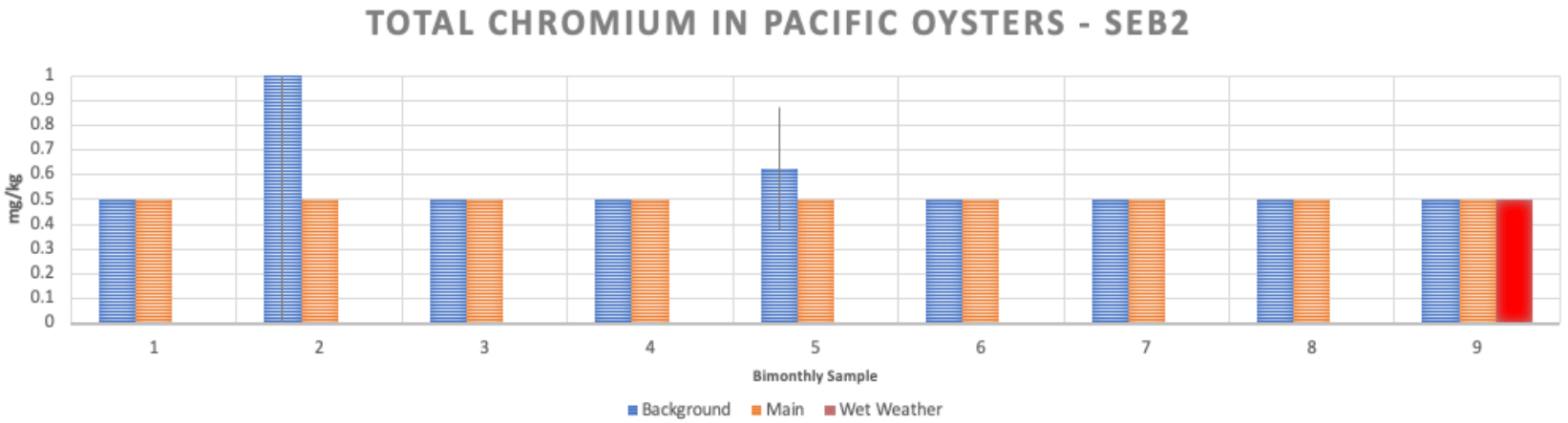

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - SWB1
mg/kg
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

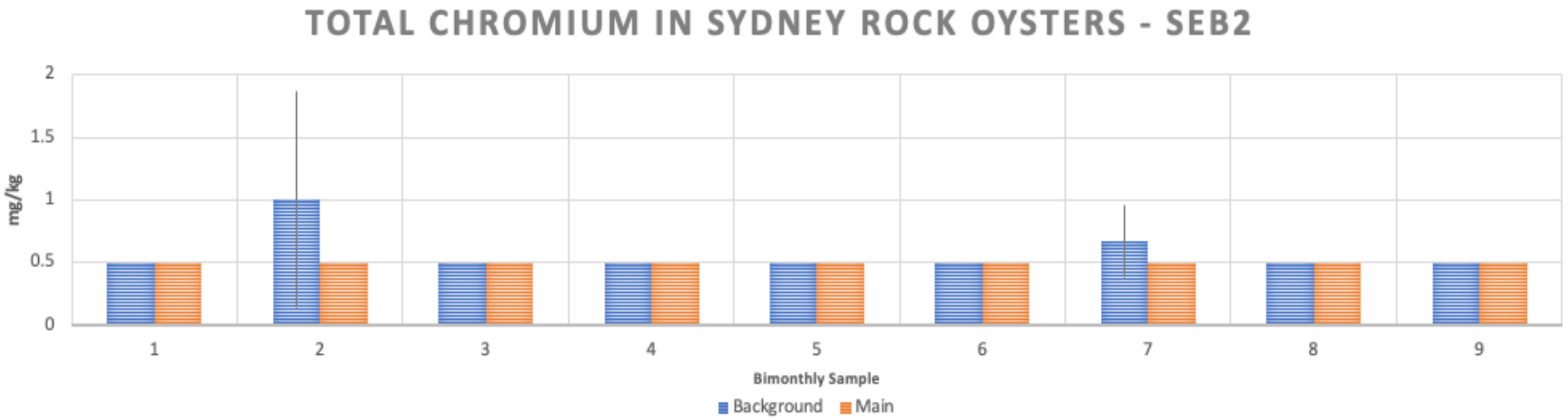

TOTAL CHROMIUM IN PACIFIC OYSTERS - SWB2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

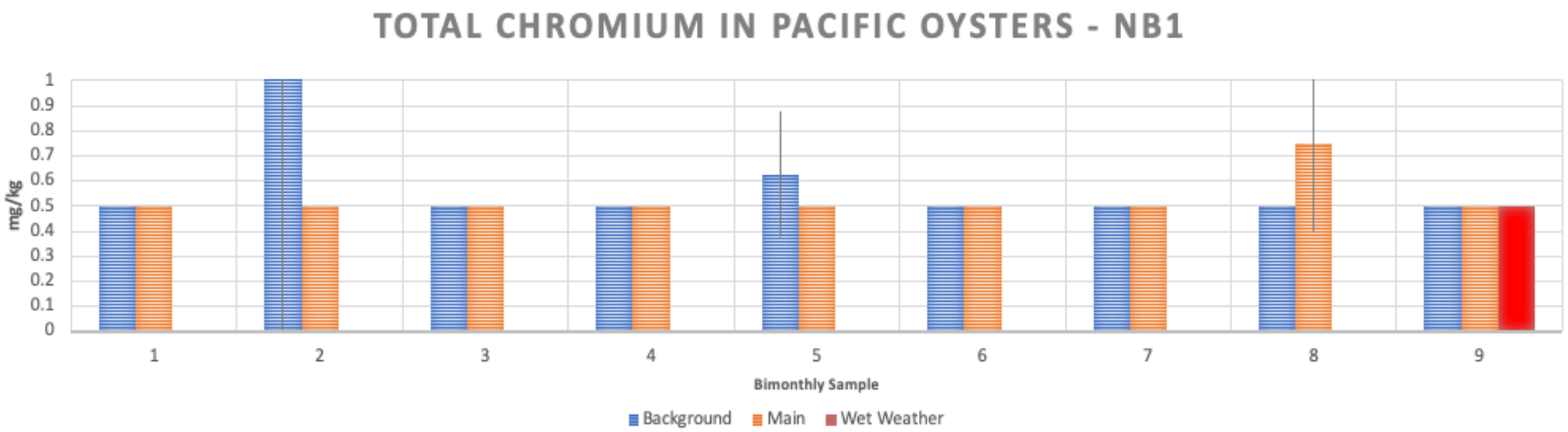

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

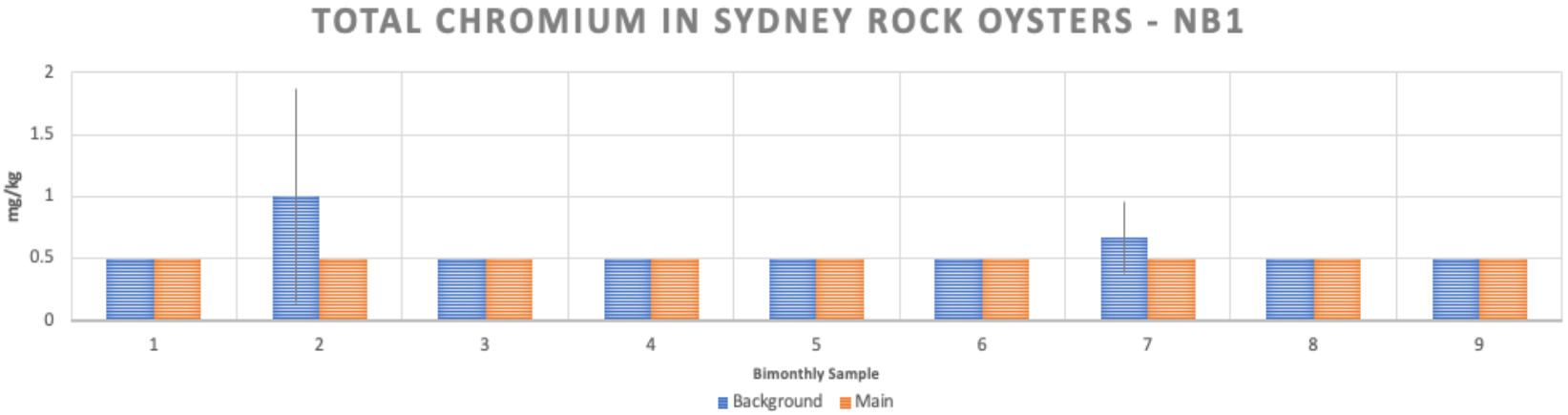

TOTAL CHROMIUM IN PACIFIC OYSTERS - SEB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

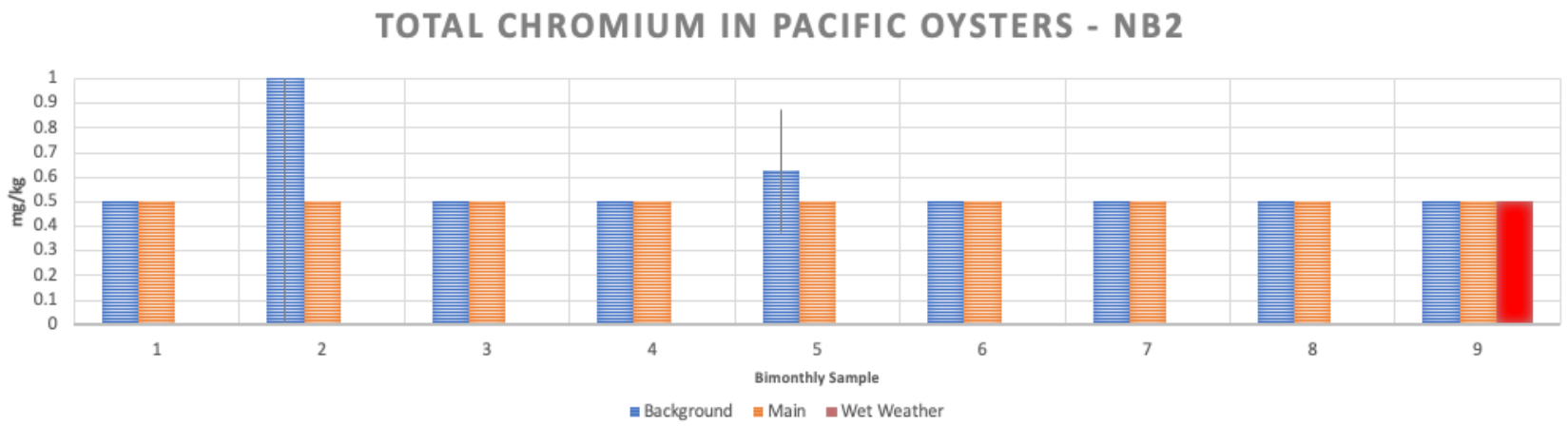

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

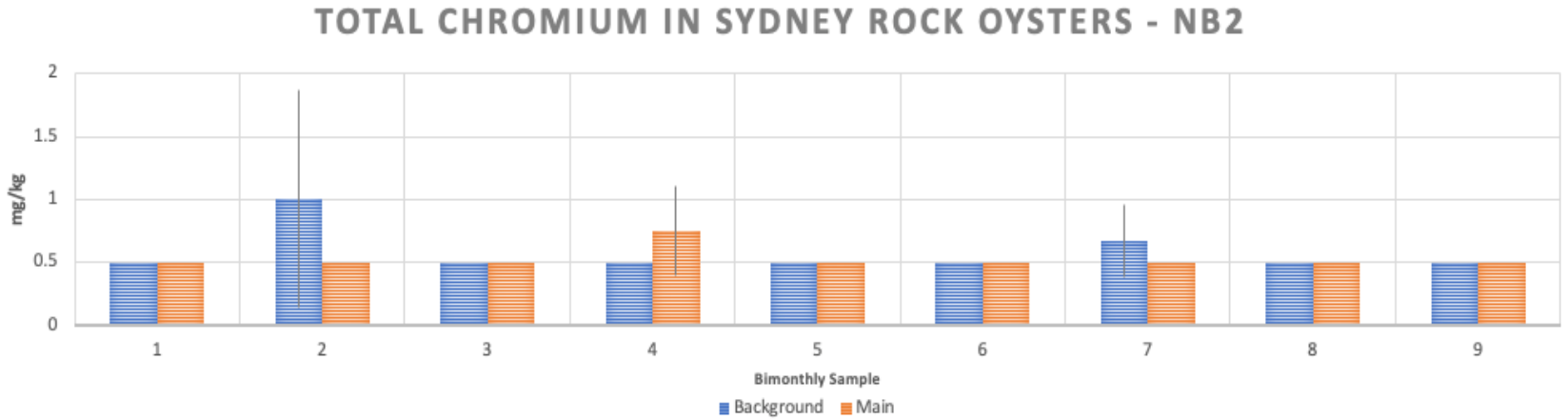

TOTAL CHROMIUM IN PACIFIC OYSTERS - SEB2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

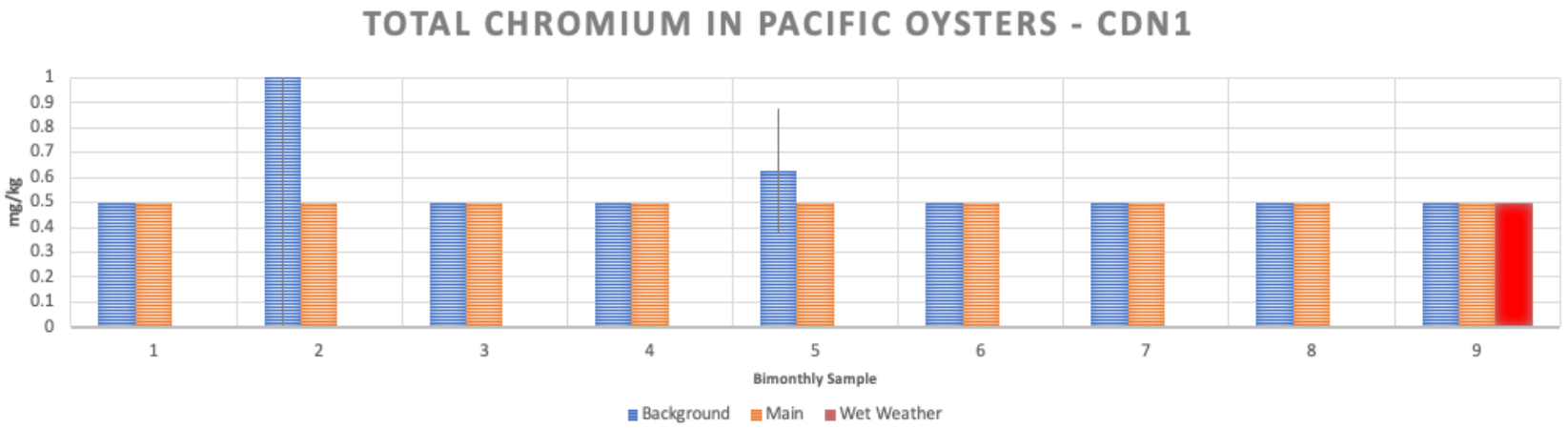

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

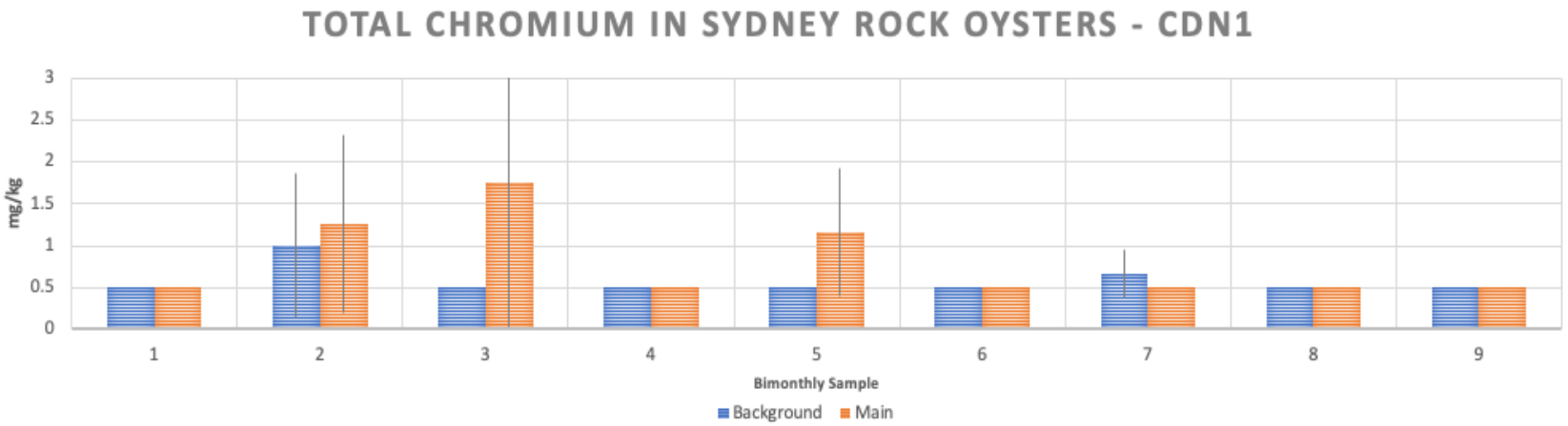

TOTAL CHROMIUM IN PACIFIC OYSTERS - NB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

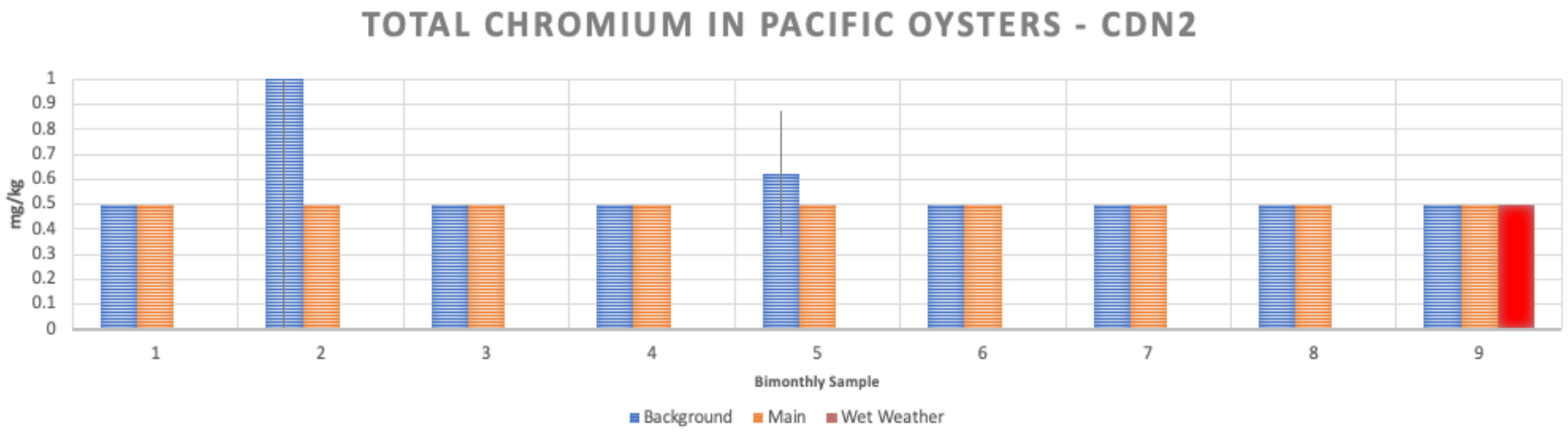

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - NB1
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

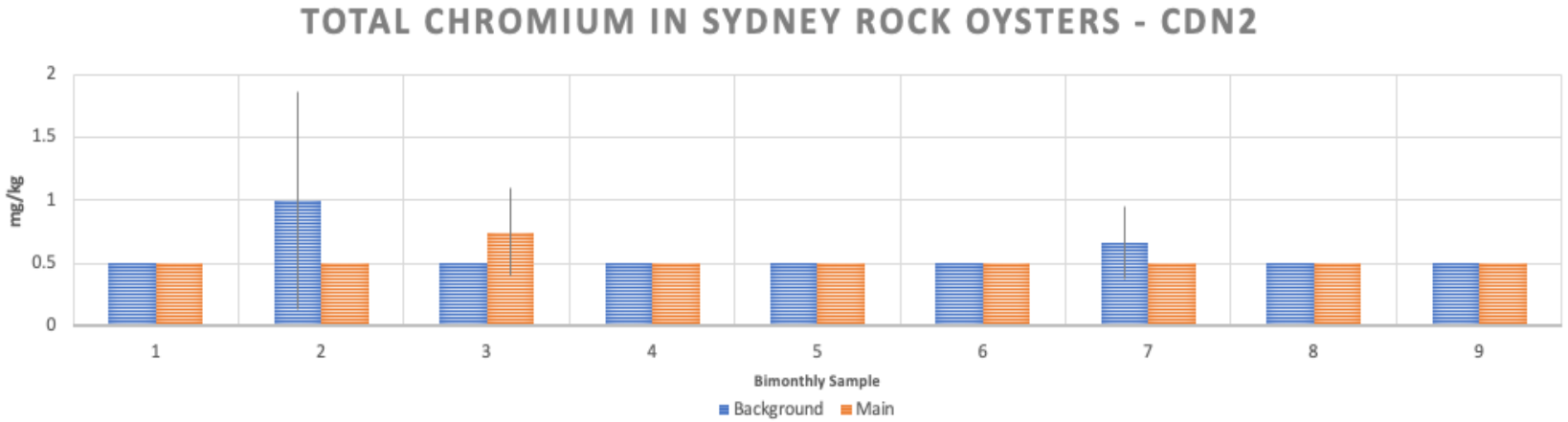

TOTAL CHROMIUM IN PACIFIC OYSTERS - NB2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

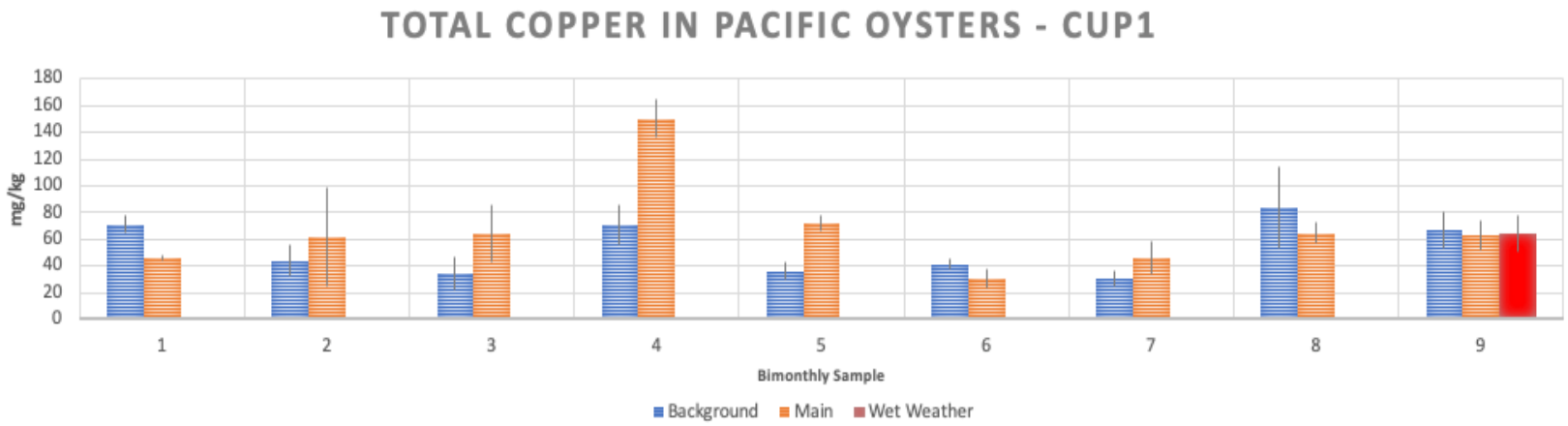

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - NB2
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

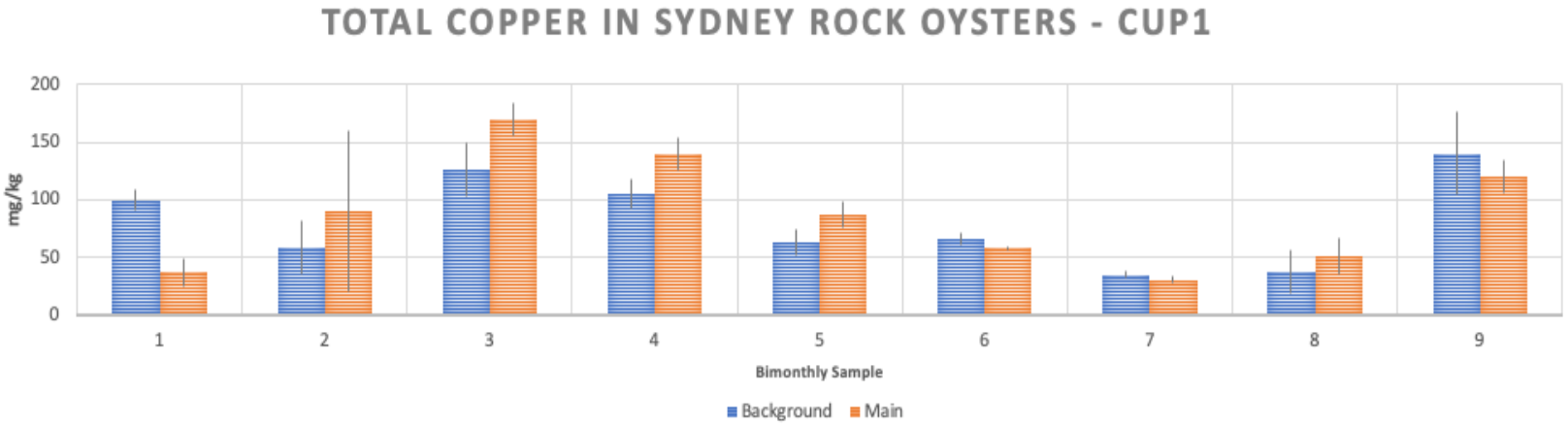

TOTAL CHROMIUM IN PACIFIC OYSTERS - CDN1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

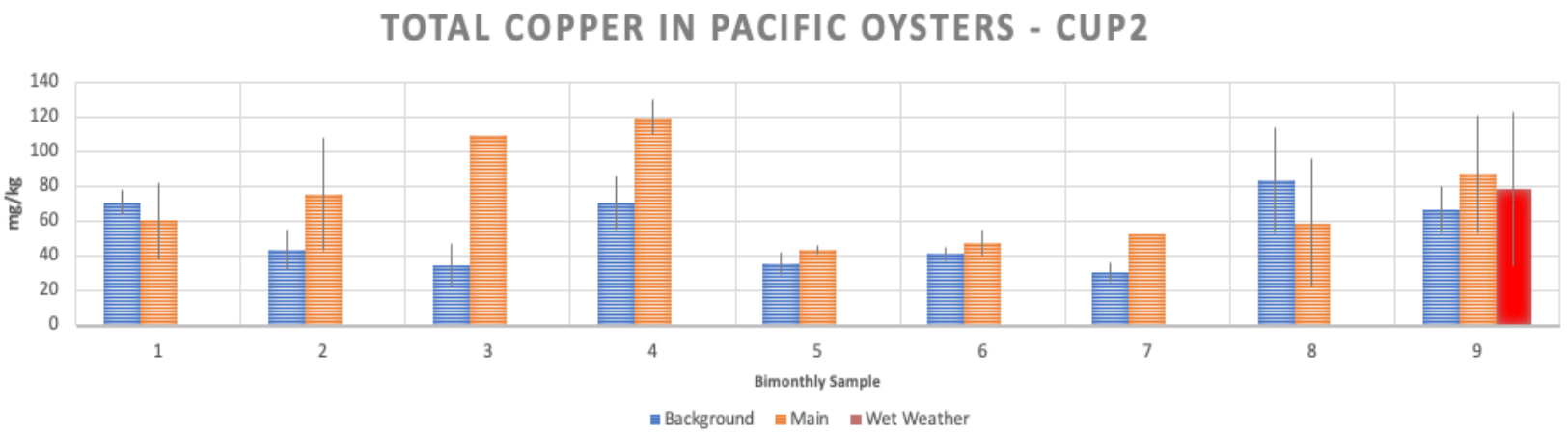

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

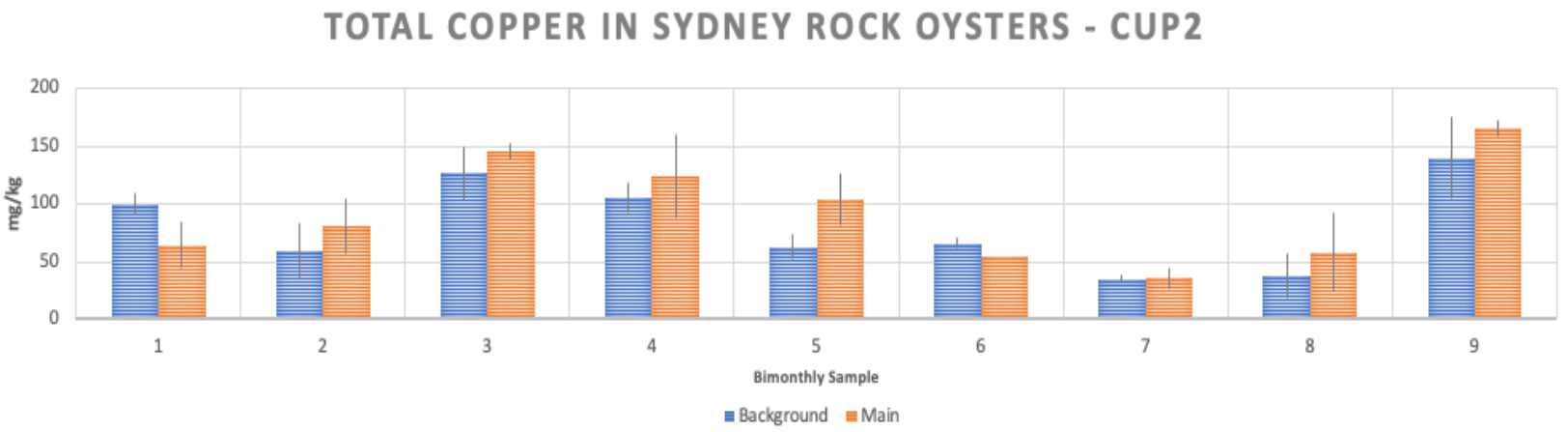

TOTAL CHROMIUM IN PACIFIC OYSTERS - CDN2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

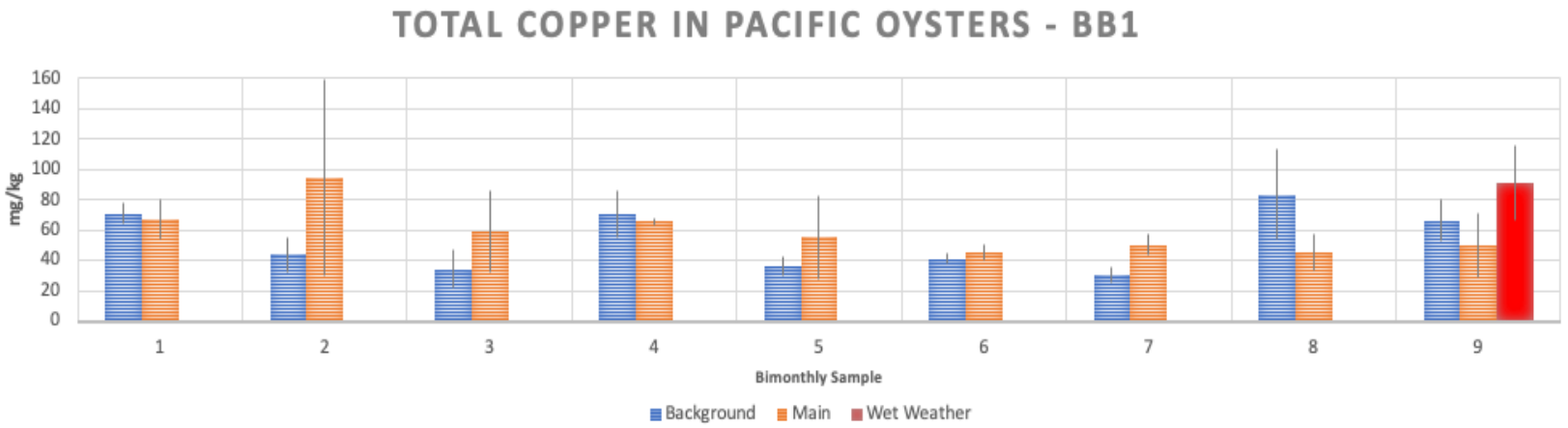

TOTAL CHROMIUM IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

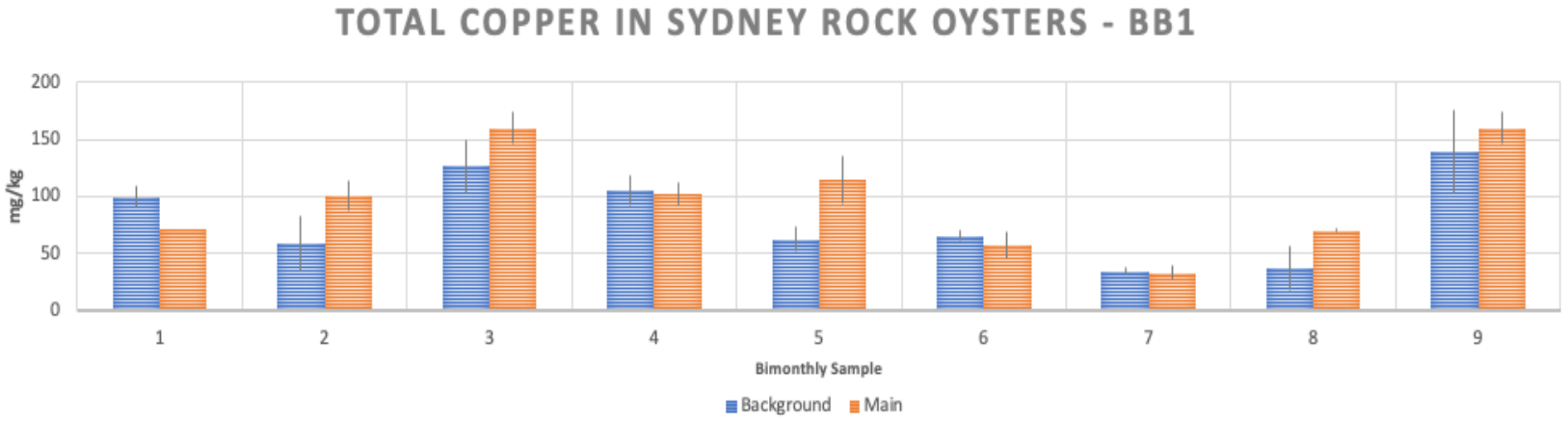

TOTAL COPPER IN PACIFIC OYSTERS - CUP1
mg/kg
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

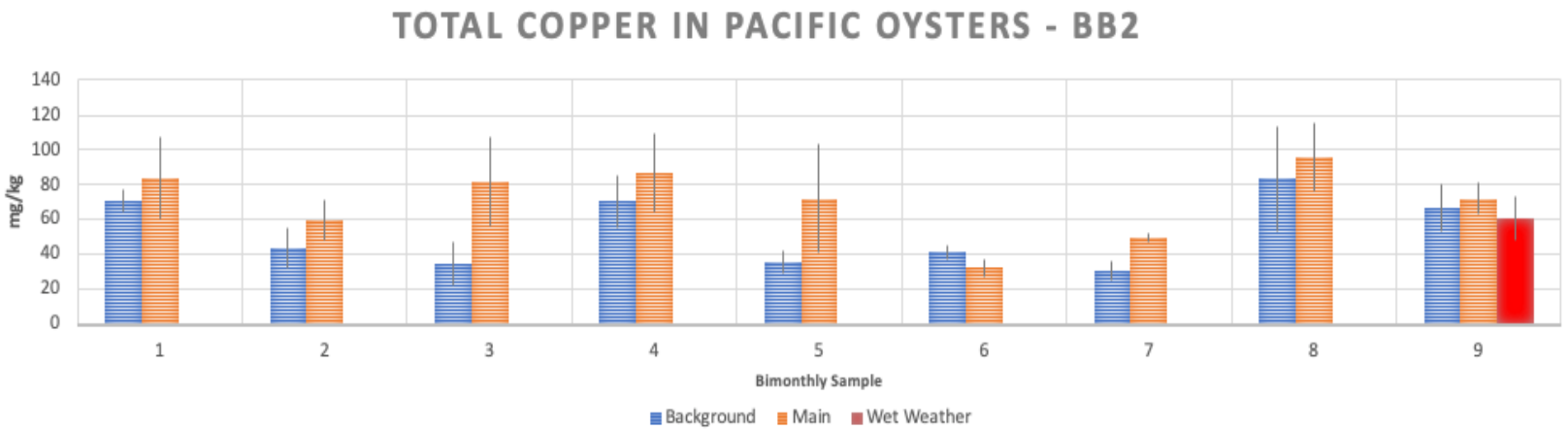

TOTAL COPPER IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

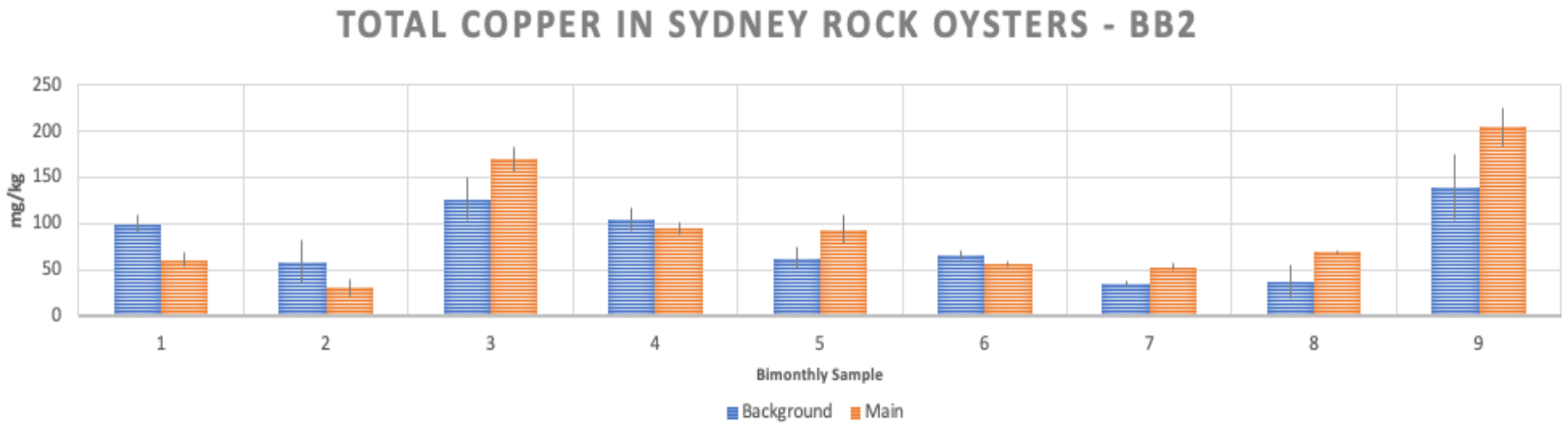

TOTAL COPPER IN PACIFIC OYSTERS - CUP2
mg/kg
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

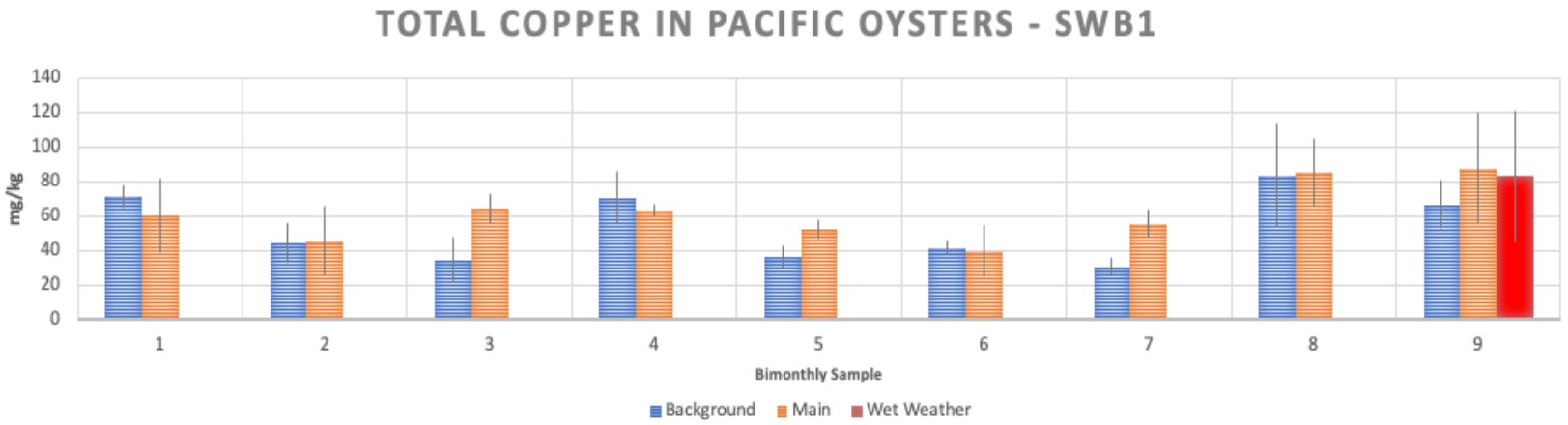

TOTAL COPPER IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

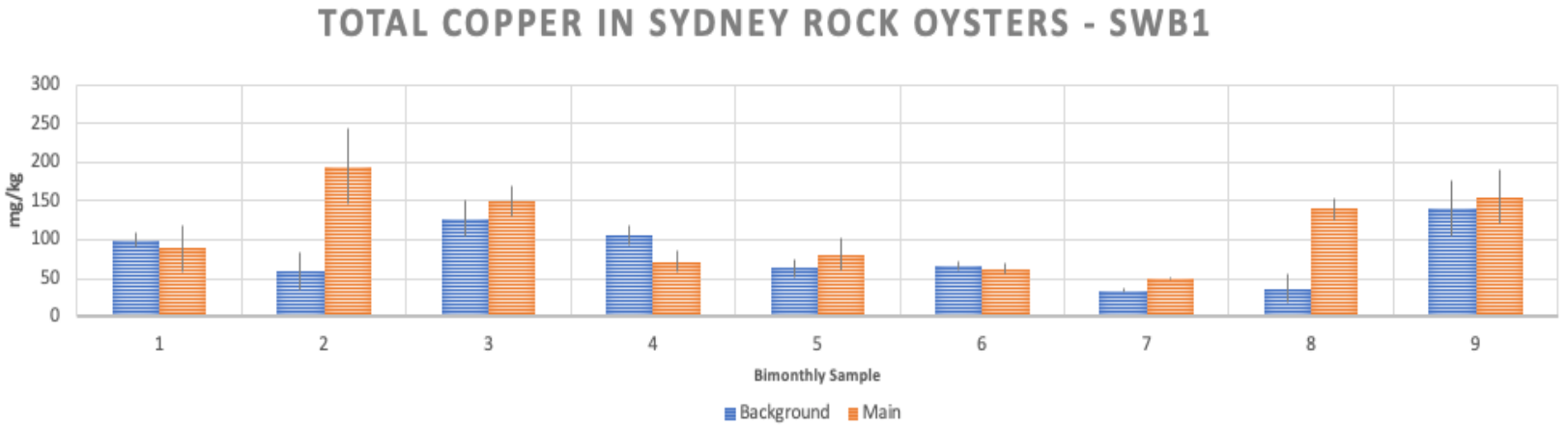

TOTAL COPPER IN PACIFIC OYSTERS - BB1
mg/kg
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

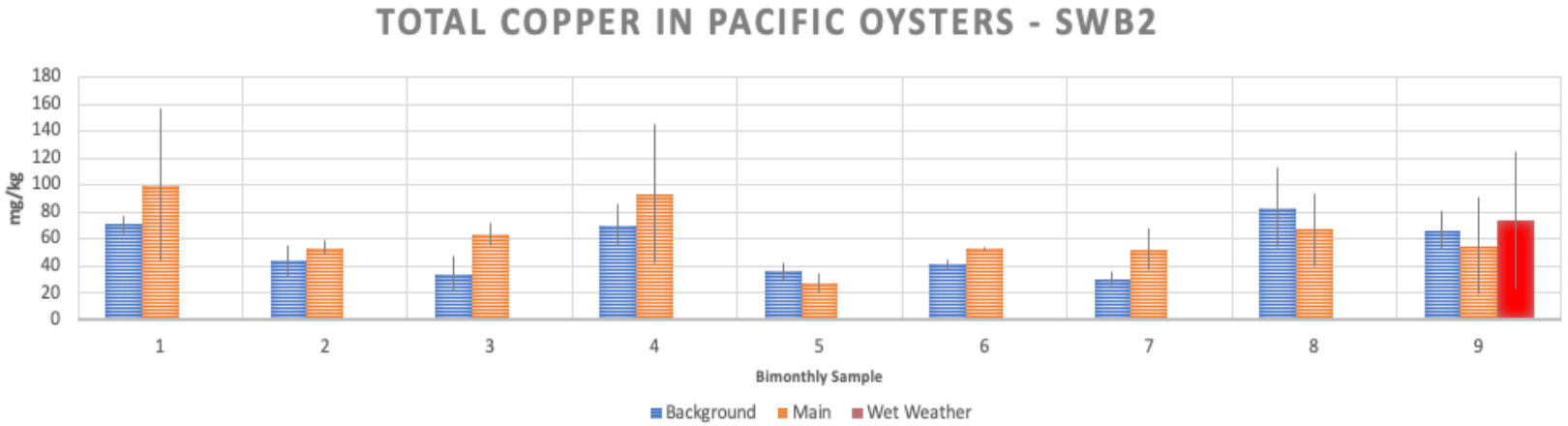

TOTAL COPPER IN SYDNEY ROCK OYSTERS - BB1
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

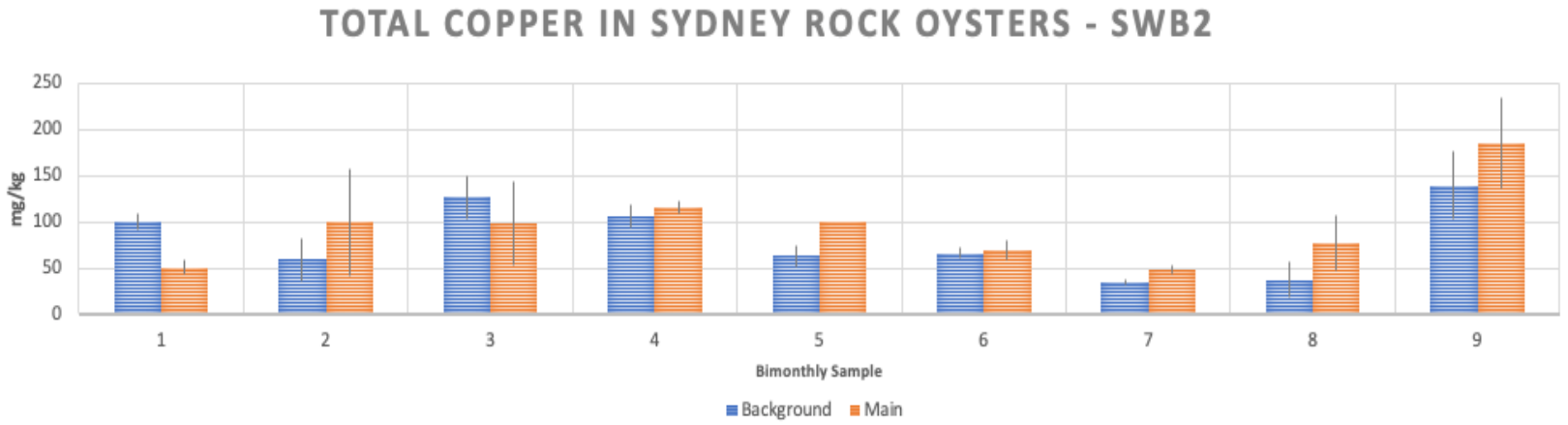

TOTAL COPPER IN PACIFIC OYSTERS - BB2
mg/kg
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

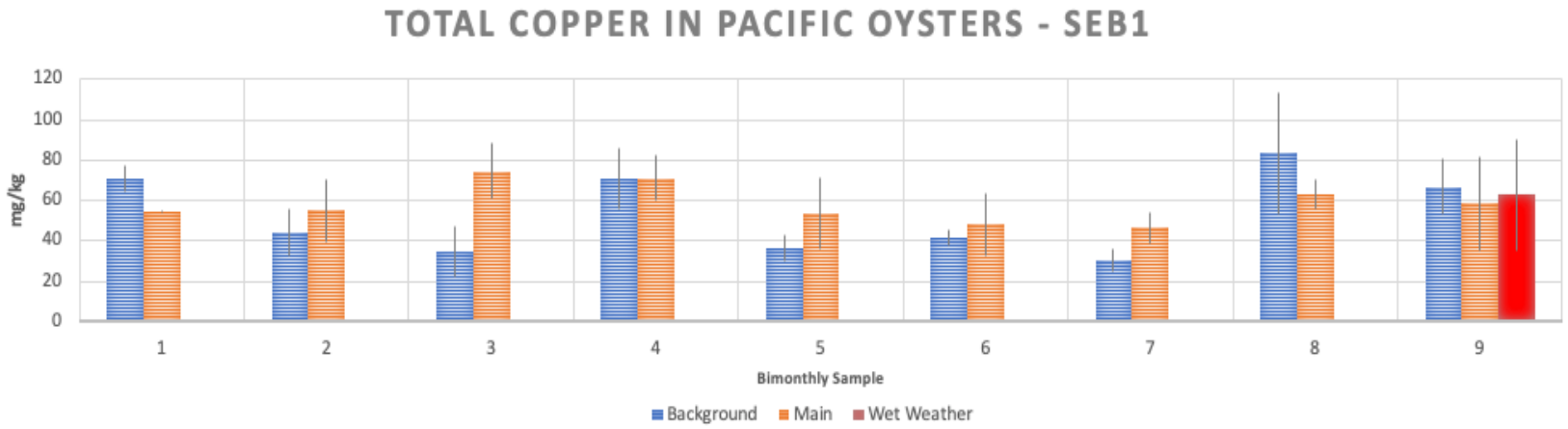

TOTAL COPPER IN SYDNEY ROCK OYSTERS - BB2
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

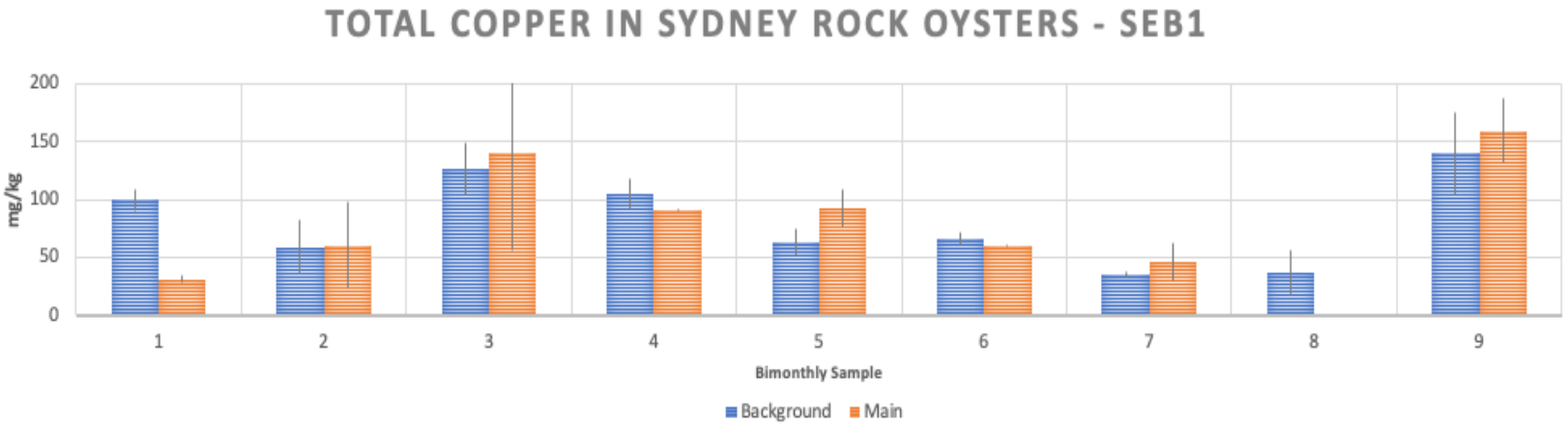

TOTAL COPPER IN PACIFIC OYSTERS - SWB1
mg/kg
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

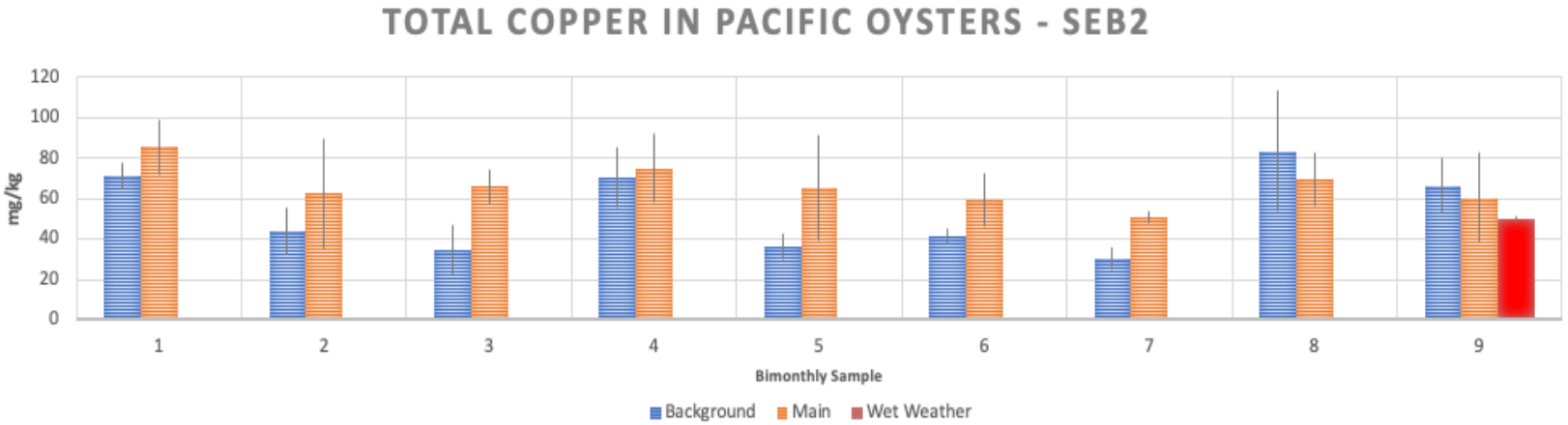

TOTAL COPPER IN SYDNEY ROCK OYSTERS - SWB1
mg/kg
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

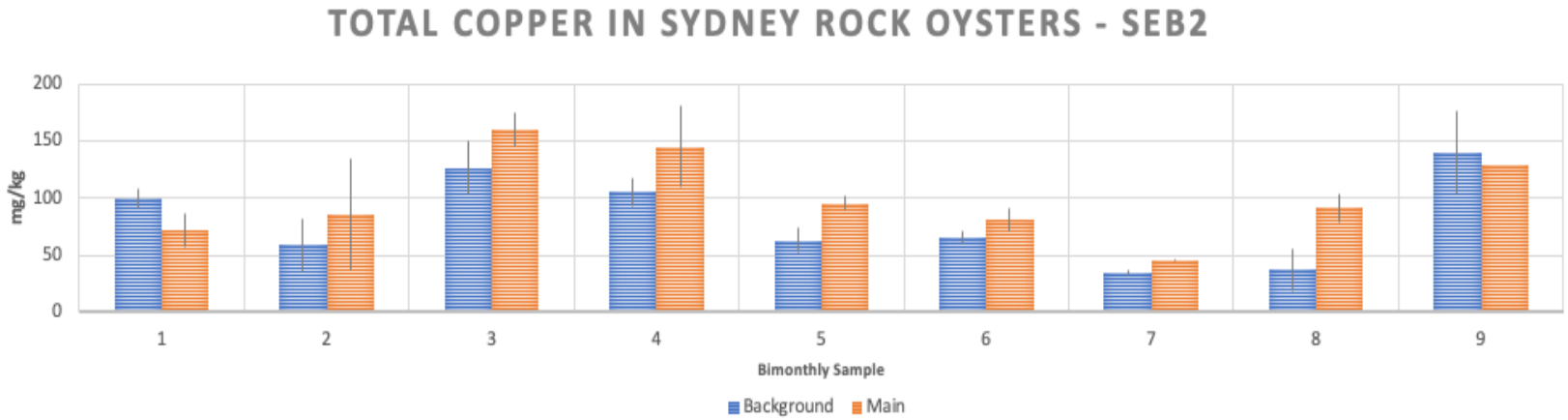

TOTAL COPPER IN PACIFIC OYSTERS - SWB2
mg/kg
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

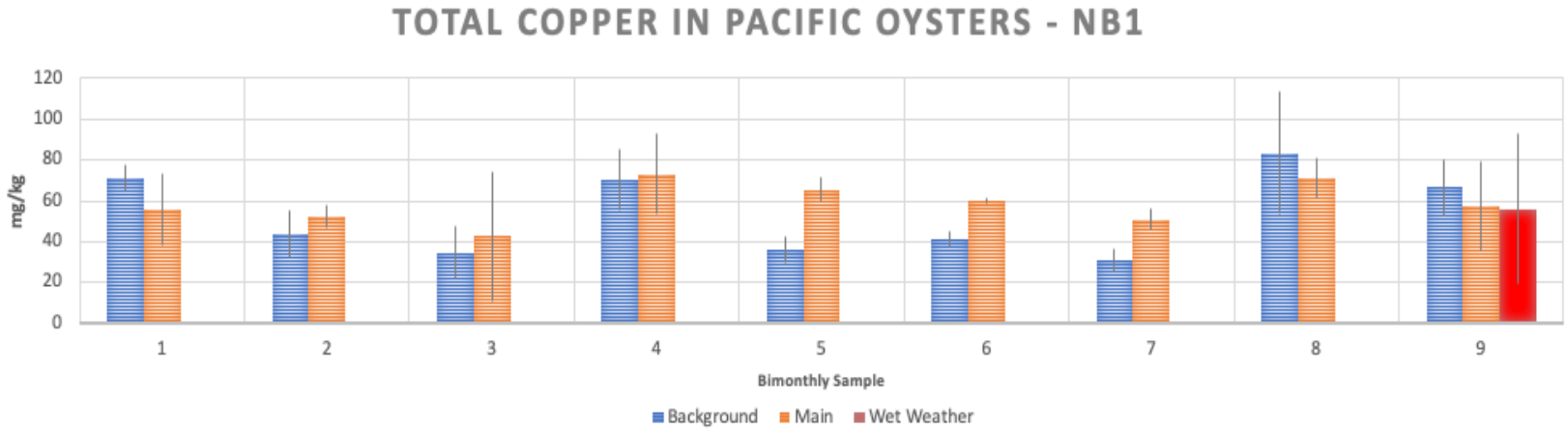

TOTAL COPPER IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

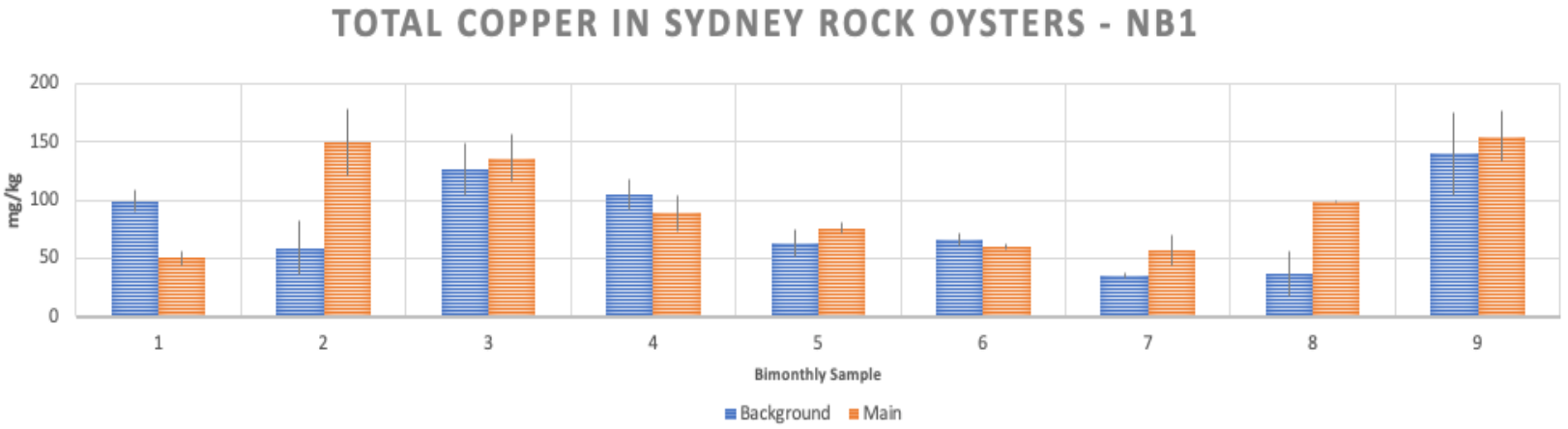

TOTAL COPPER IN PACIFIC OYSTERS - SEB1
mg/kg
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

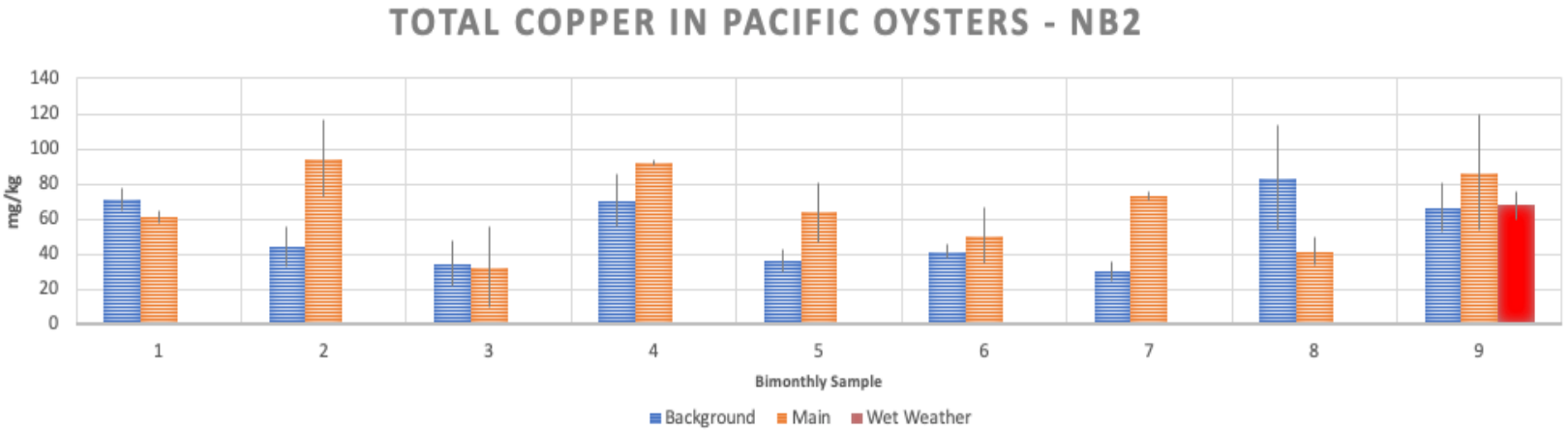

TOTAL COPPER IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

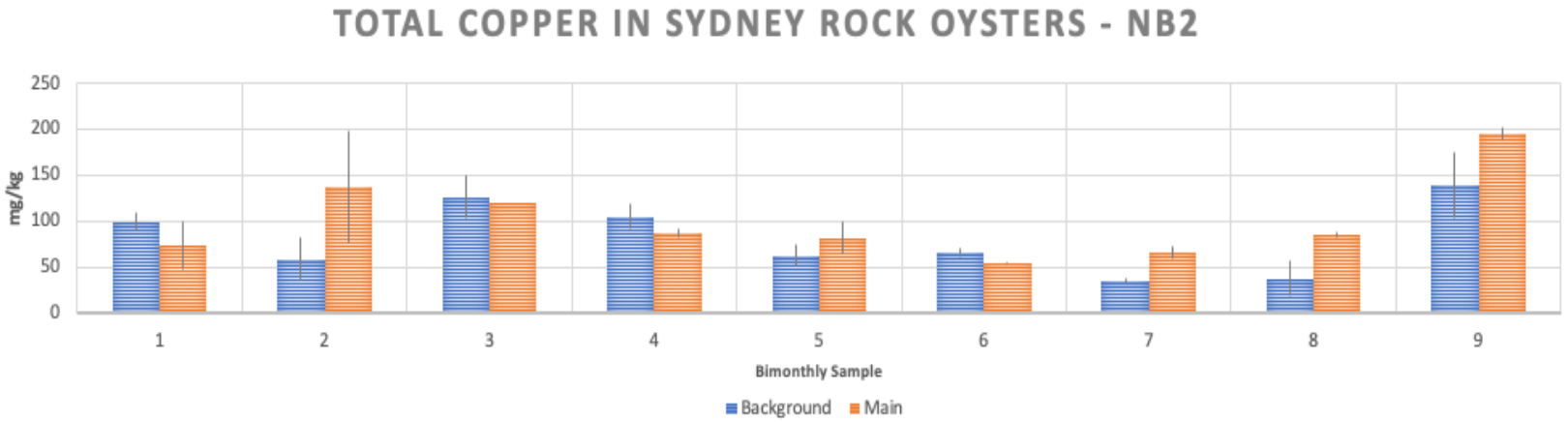

TOTAL COPPER IN PACIFIC OYSTERS - SEB2
mg/kg
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

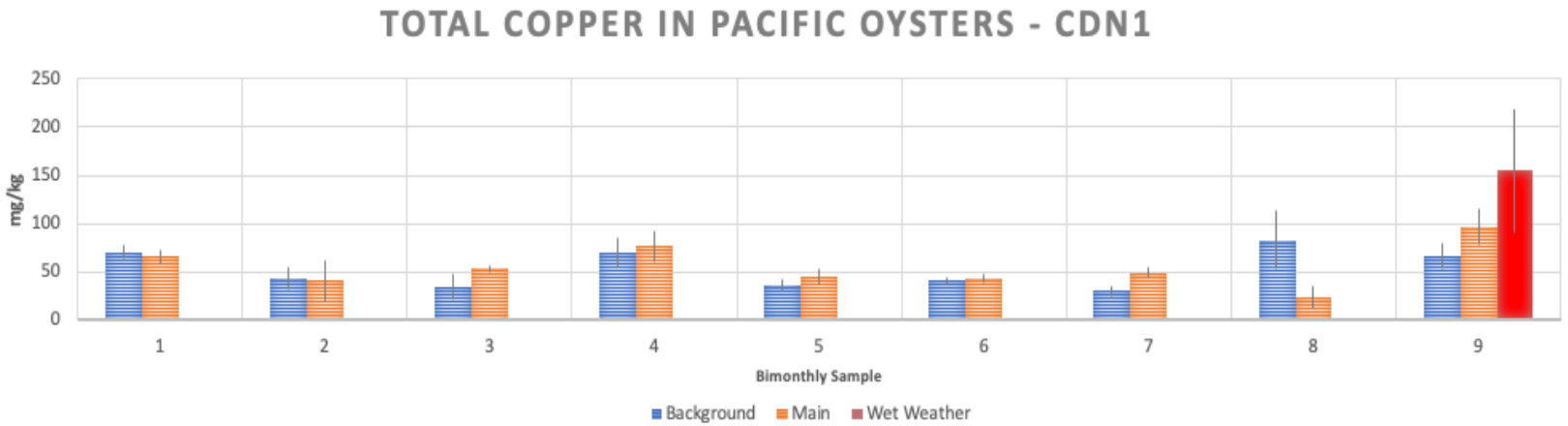

TOTAL COPPER IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

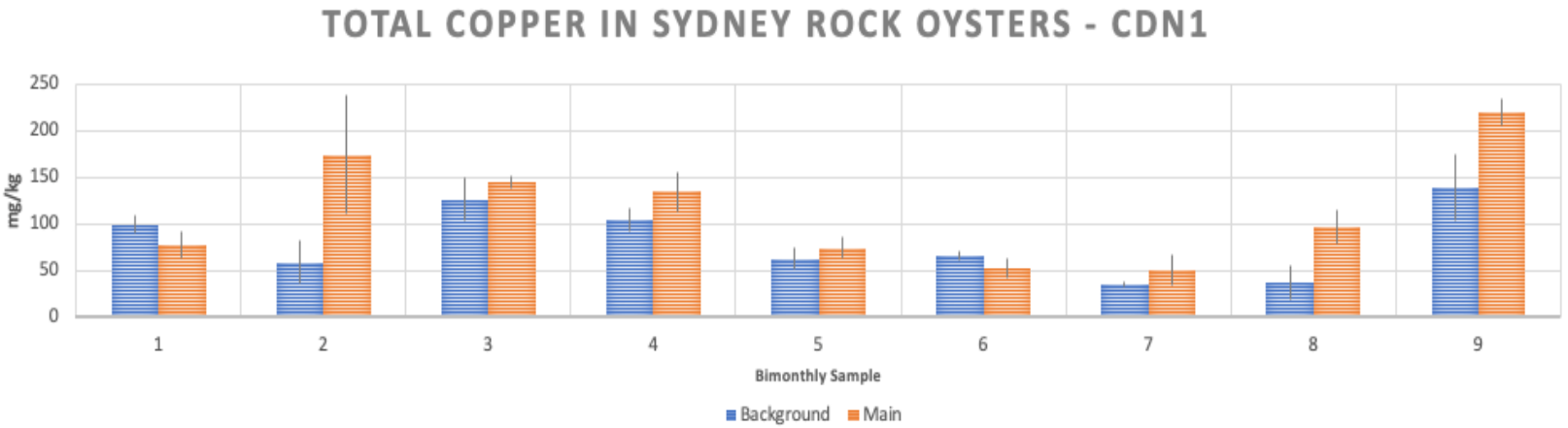

TOTAL COPPER IN PACIFIC OYSTERS - NB1
mg/kg
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

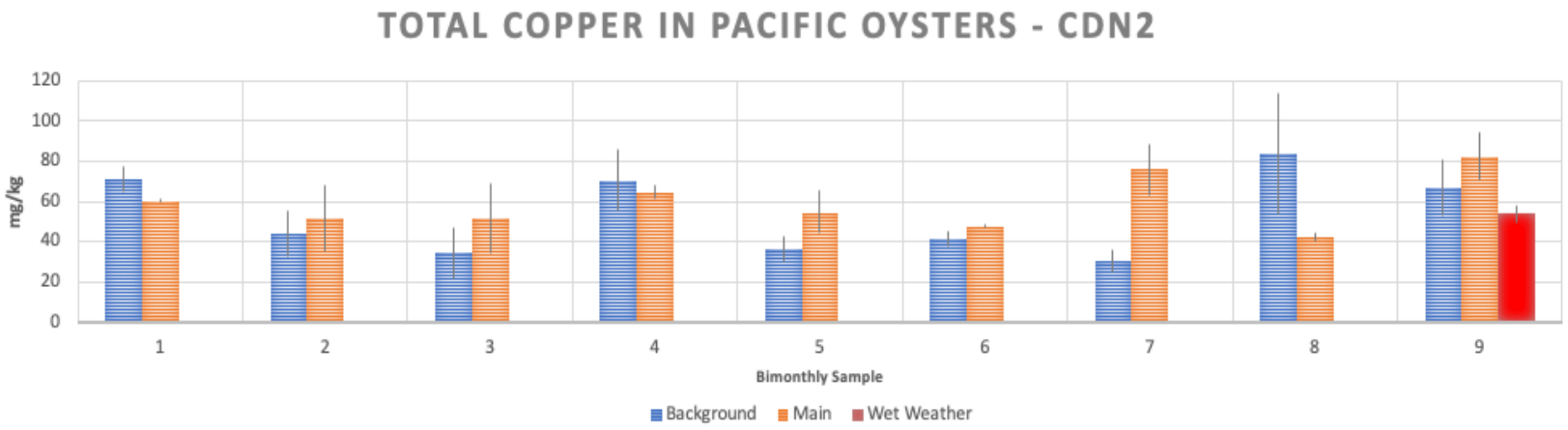

TOTAL COPPER IN SYDNEY ROCK OYSTERS - NB1
mg/kg
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

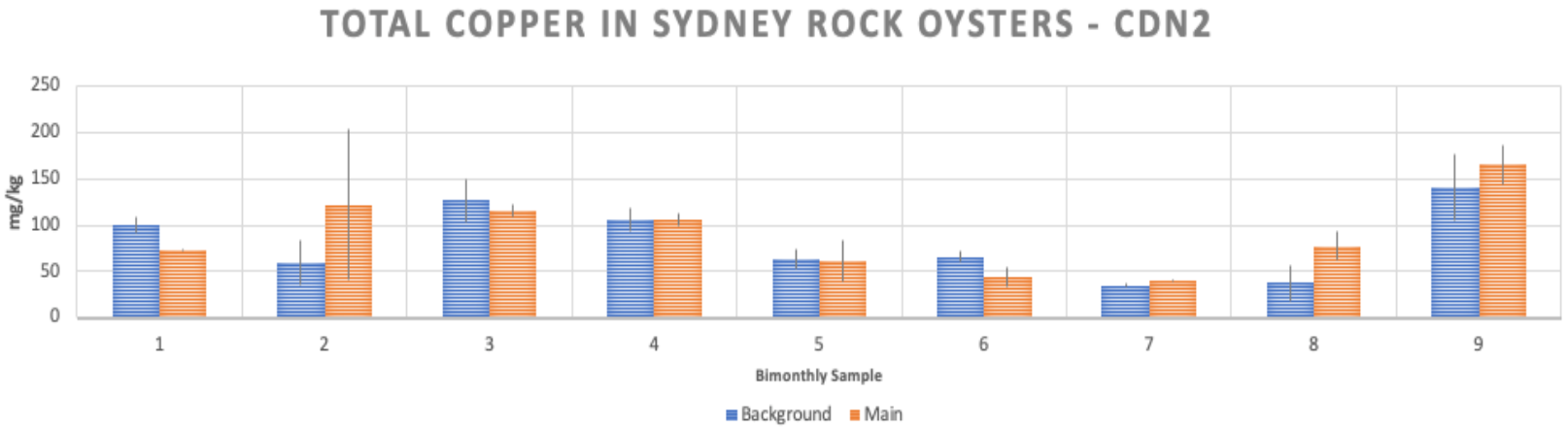

TOTAL COPPER IN PACIFIC OYSTERS - NB2
mg/kg
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

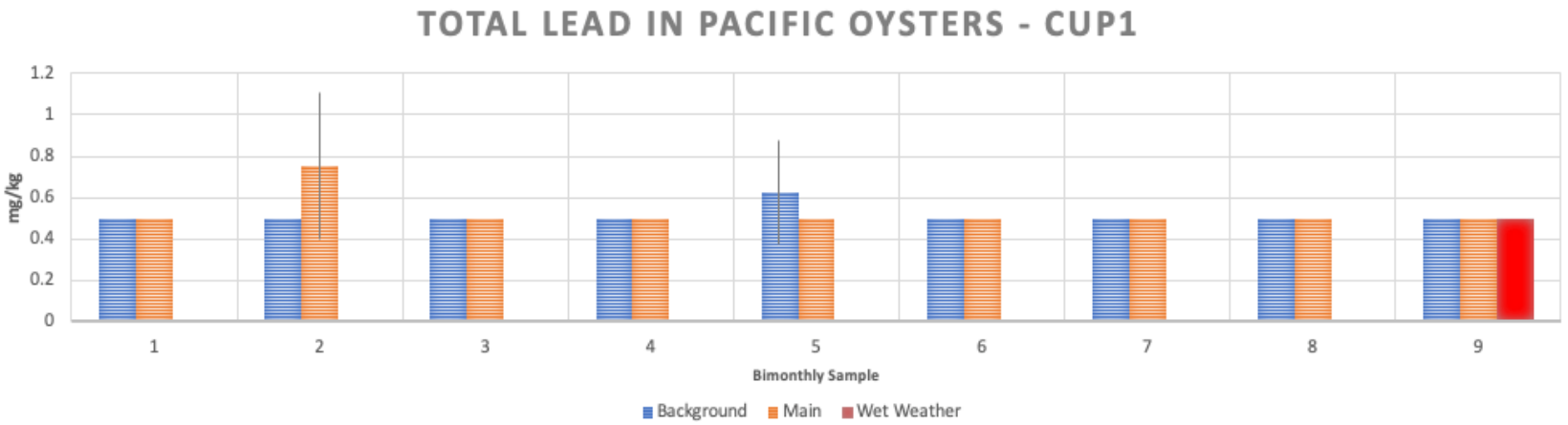

TOTAL COPPER IN SYDNEY ROCK OYSTERS - NB2
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

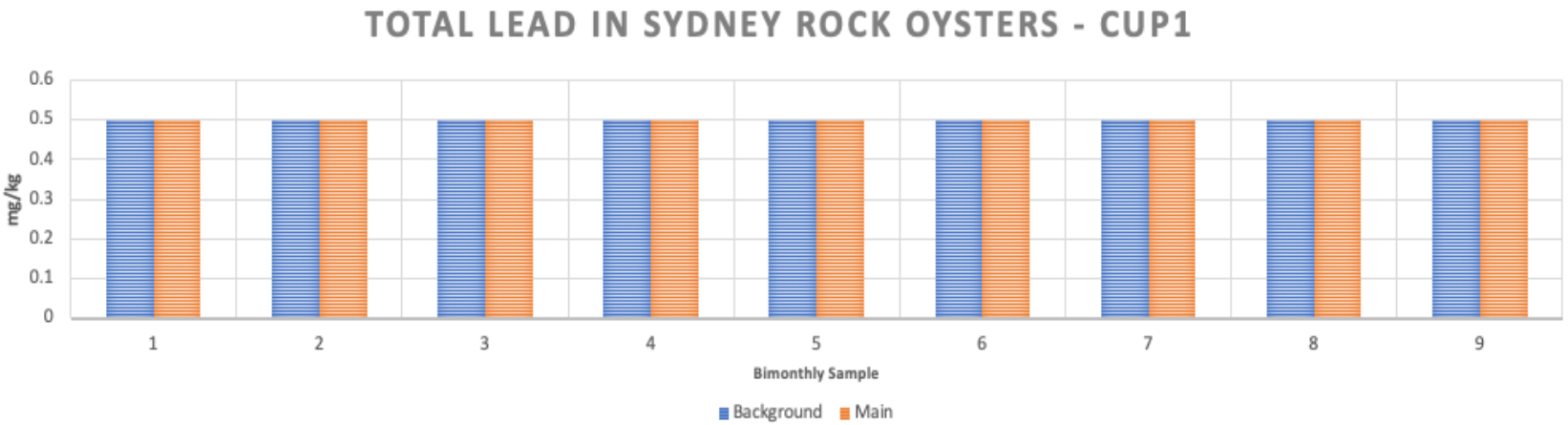

TOTAL COPPER IN PACIFIC OYSTERS - CDN1
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

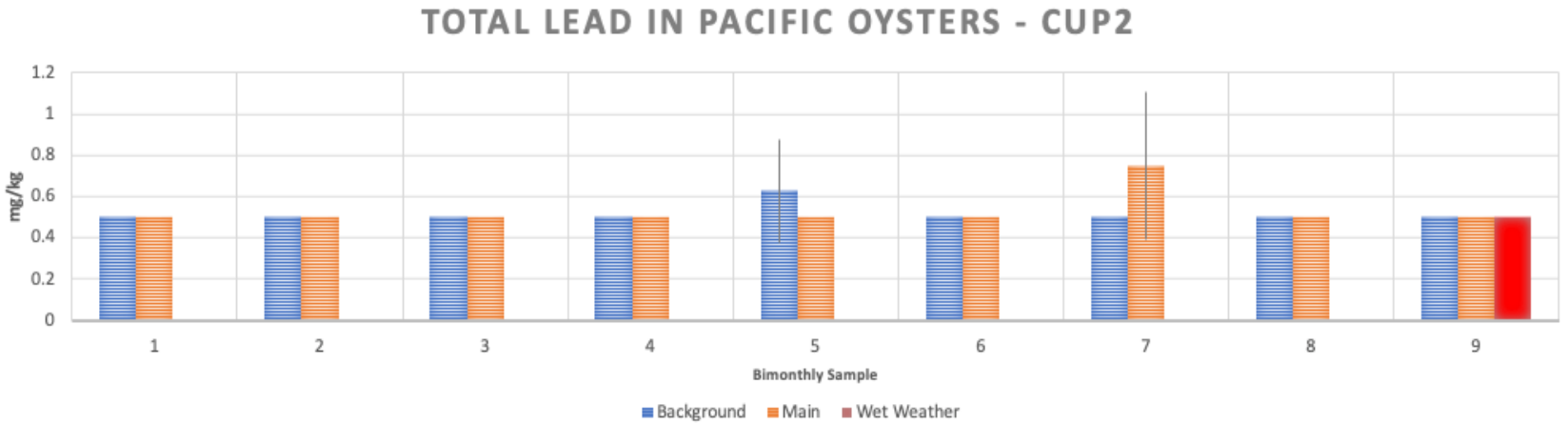

TOTAL COPPER IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

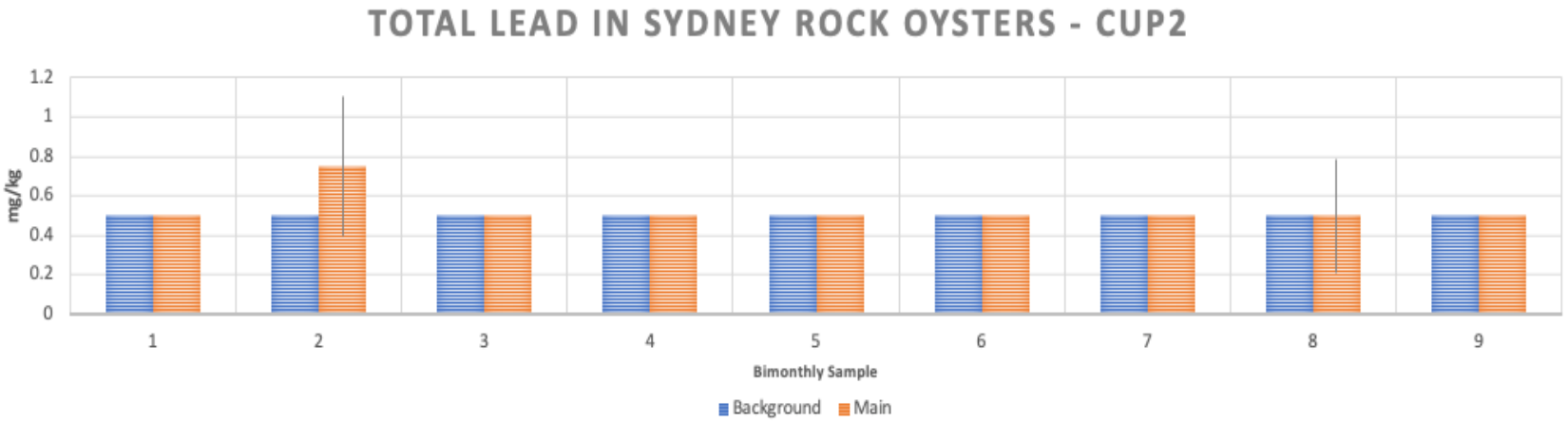

TOTAL COPPER IN PACIFIC OYSTERS - CDN2
mg/kg
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

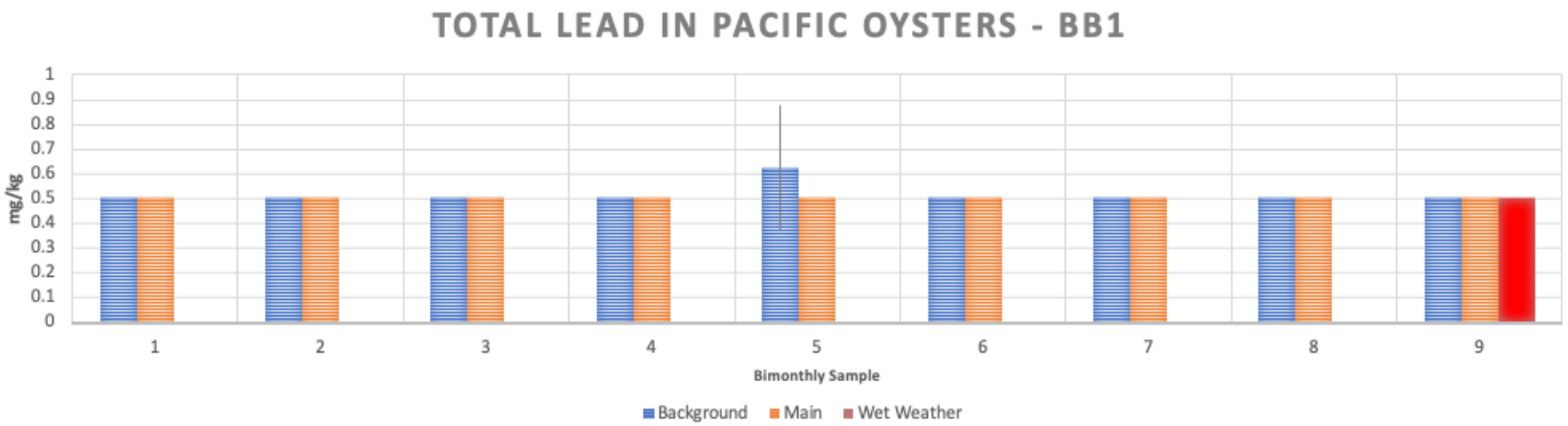

TOTAL COPPER IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

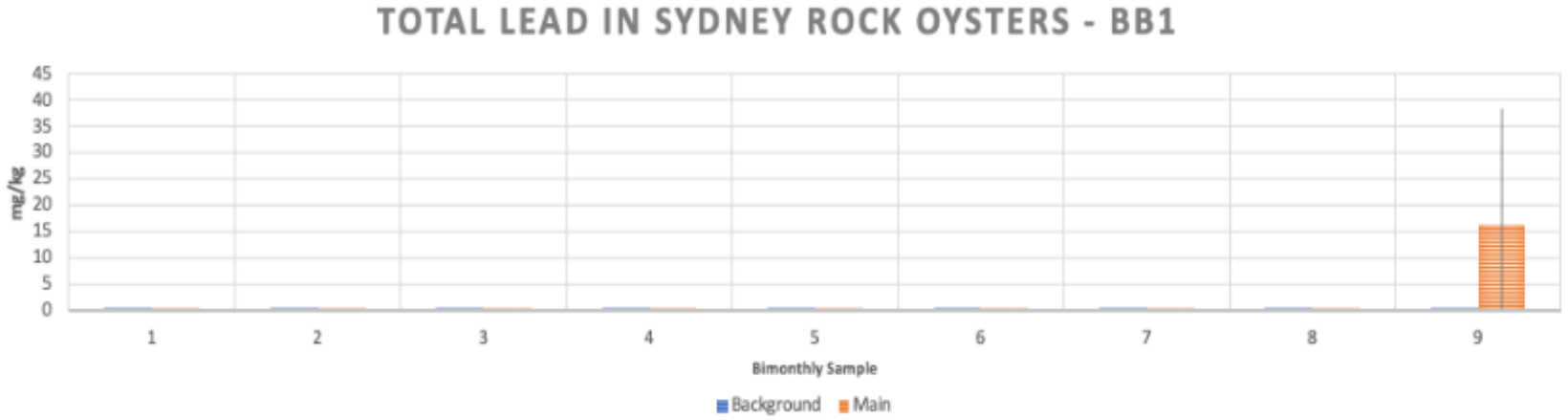

TOTAL LEAD IN PACIFIC OYSTERS - CUP1
mg/kg
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

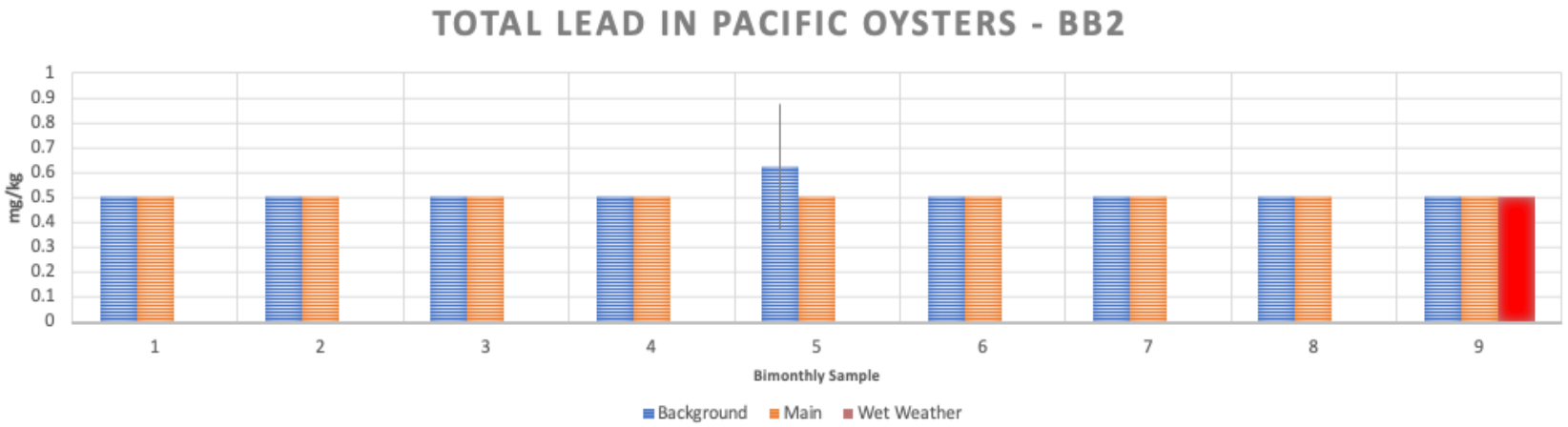

TOTAL LEAD IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

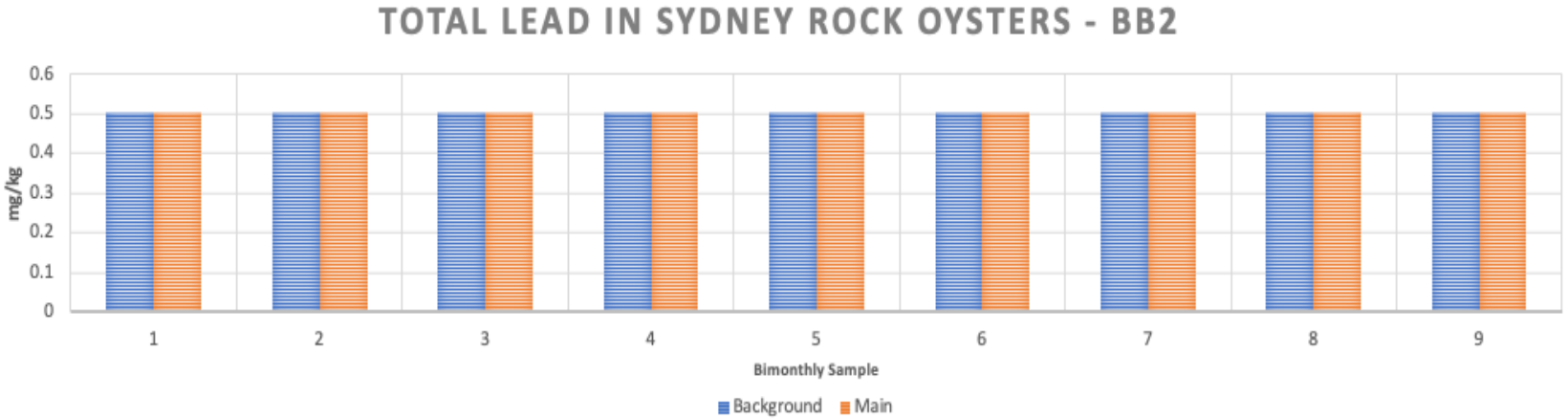

TOTAL LEAD IN PACIFIC OYSTERS - CUP2
mg/kg
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

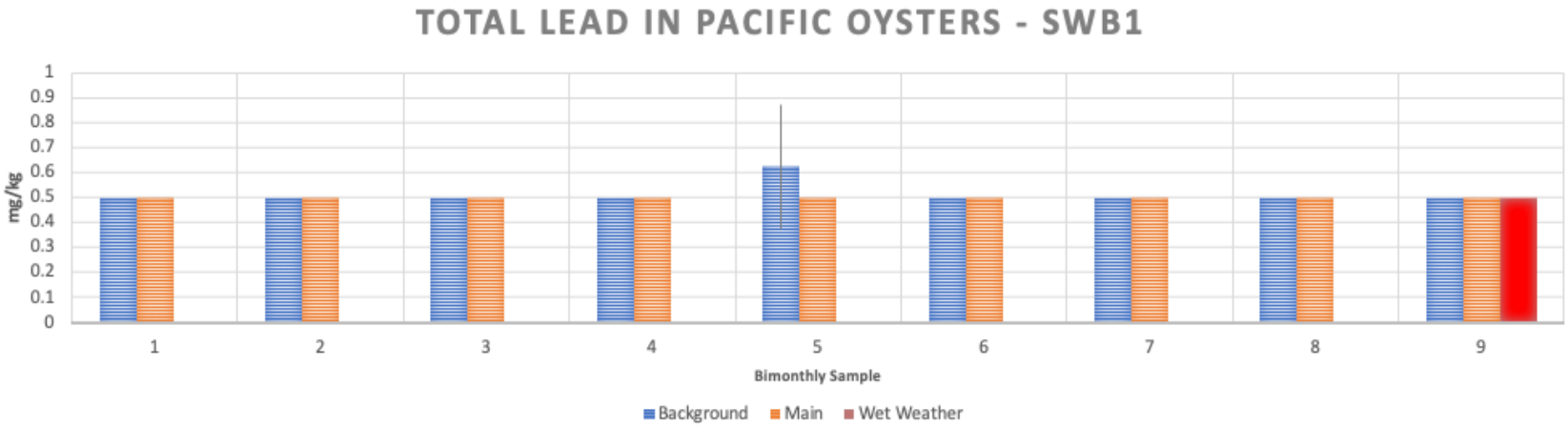

TOTAL LEAD IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

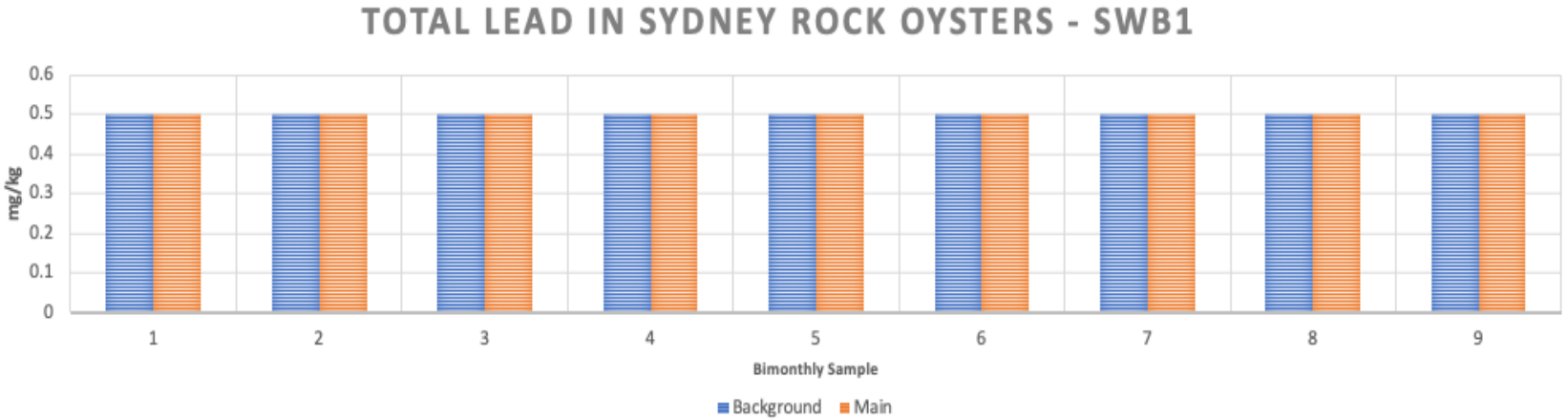

TOTAL LEAD IN PACIFIC OYSTERS - BB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

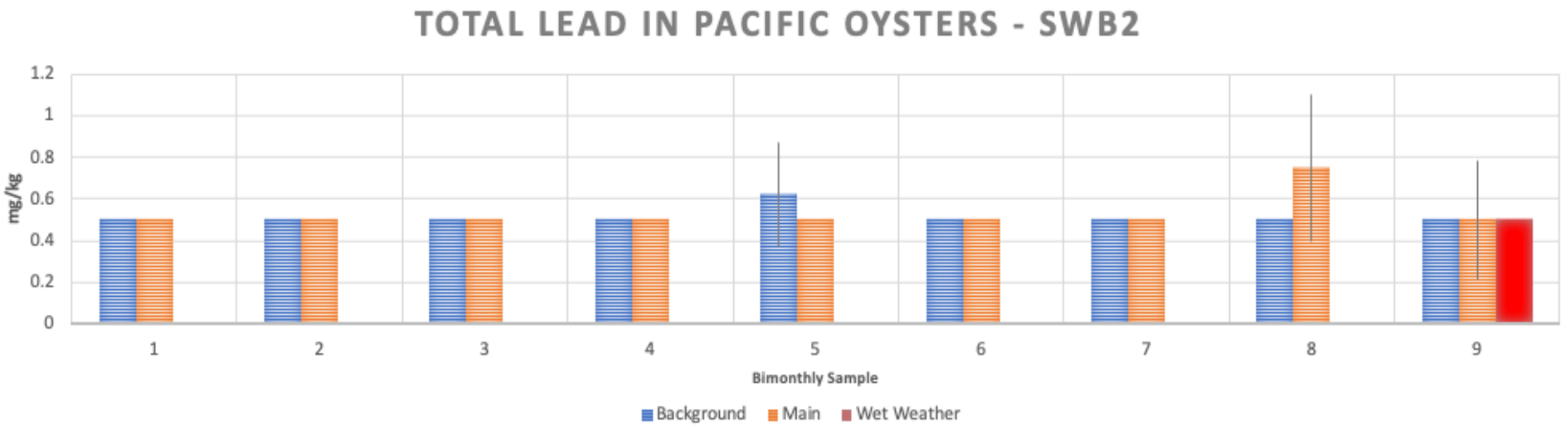

TOTAL LEAD IN SYDNEY ROCK OYSTERS - BB1
mg/kg
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

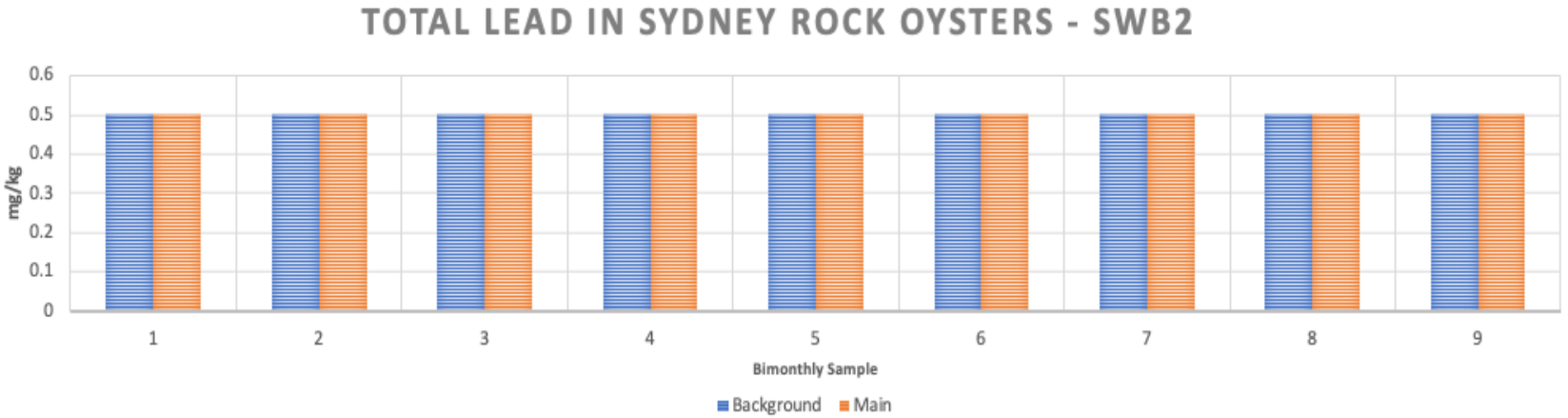

TOTAL LEAD IN PACIFIC OYSTERS - BB2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

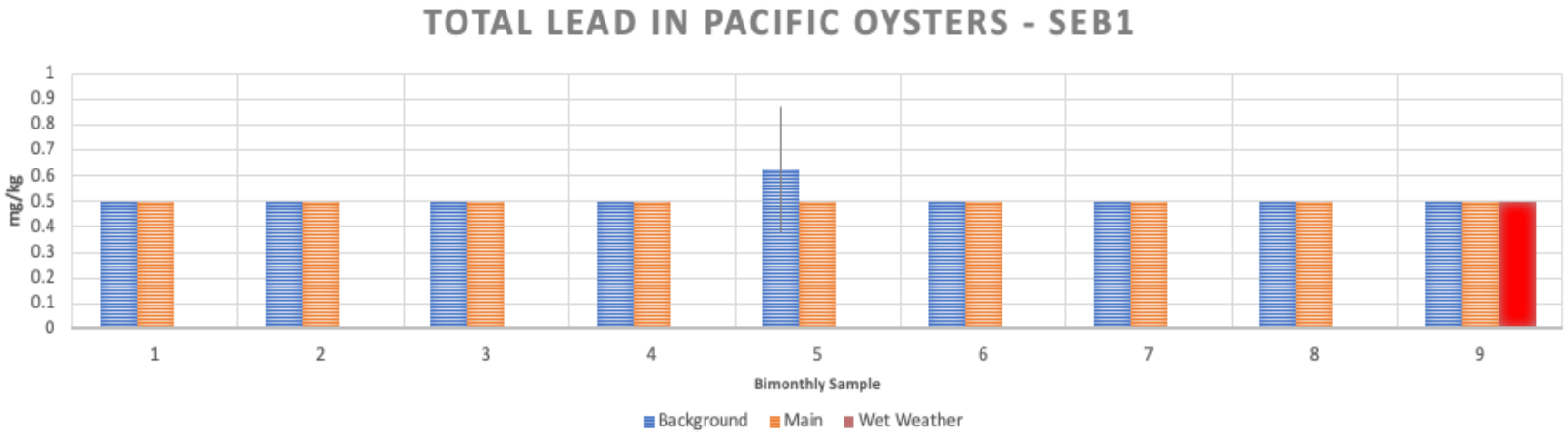

TOTAL LEAD IN SYDNEY ROCK OYSTERS - BB2
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

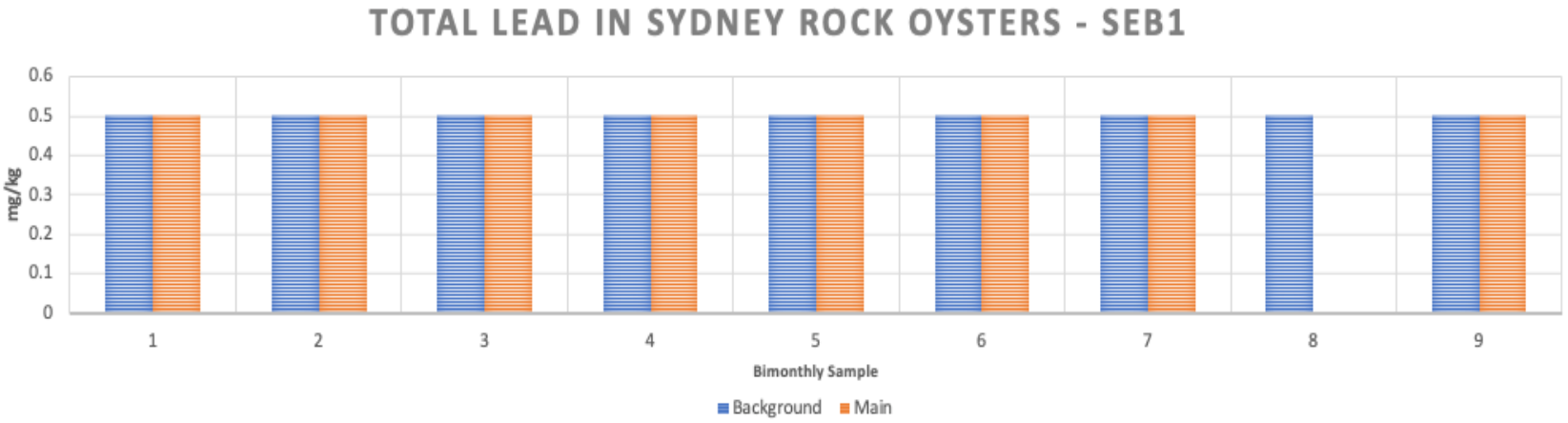

TOTAL LEAD IN PACIFIC OYSTERS - SWB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

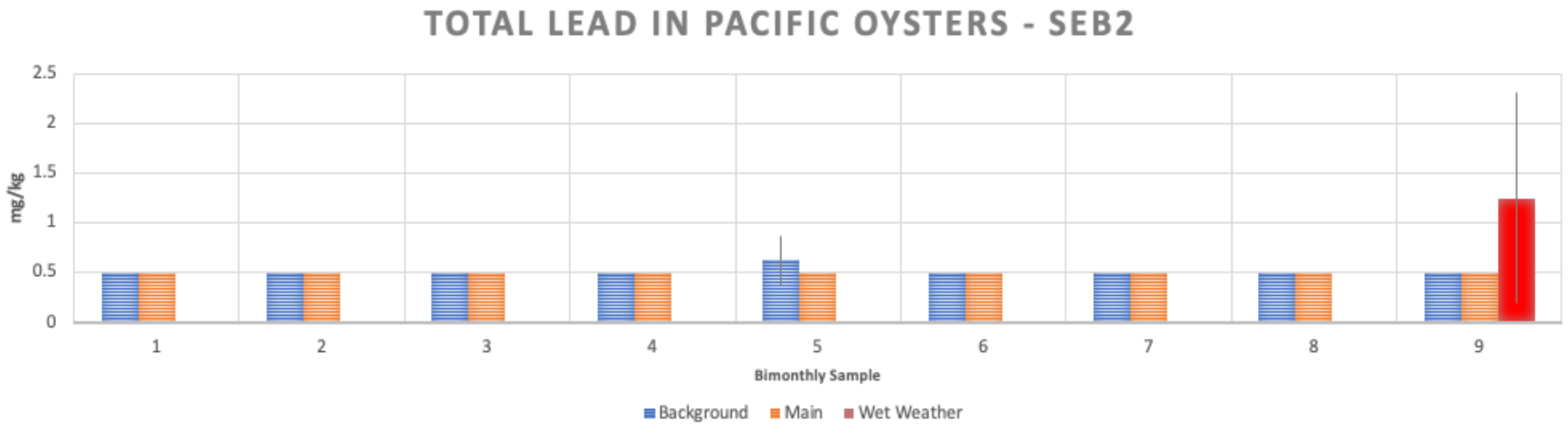

TOTAL LEAD IN SYDNEY ROCK OYSTERS - SWB1
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

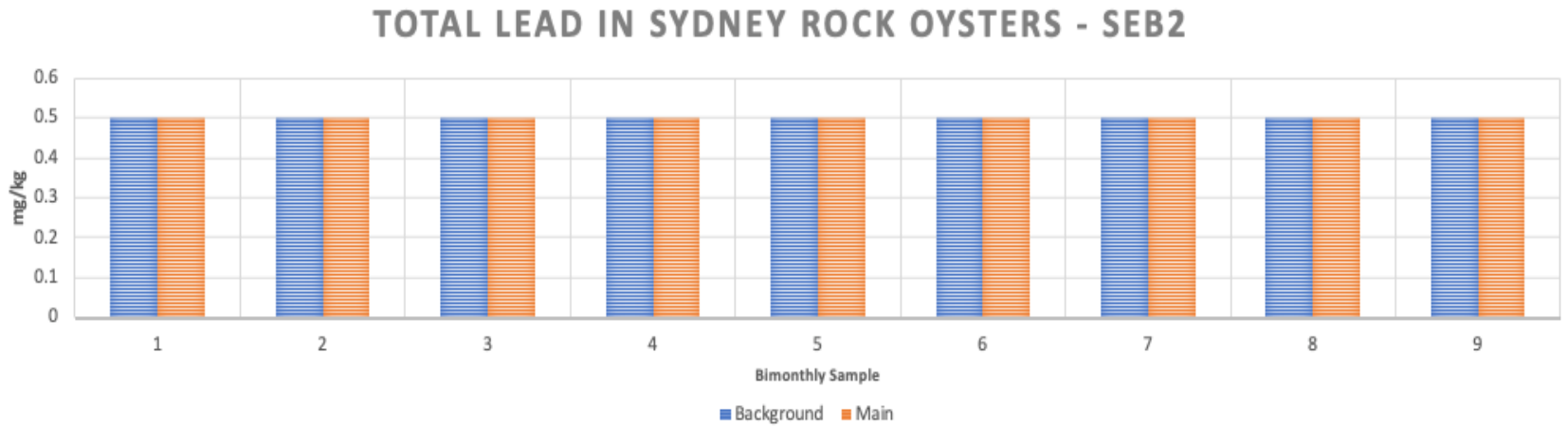

TOTAL LEAD IN PACIFIC OYSTERS - SWB2
mg/kg
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

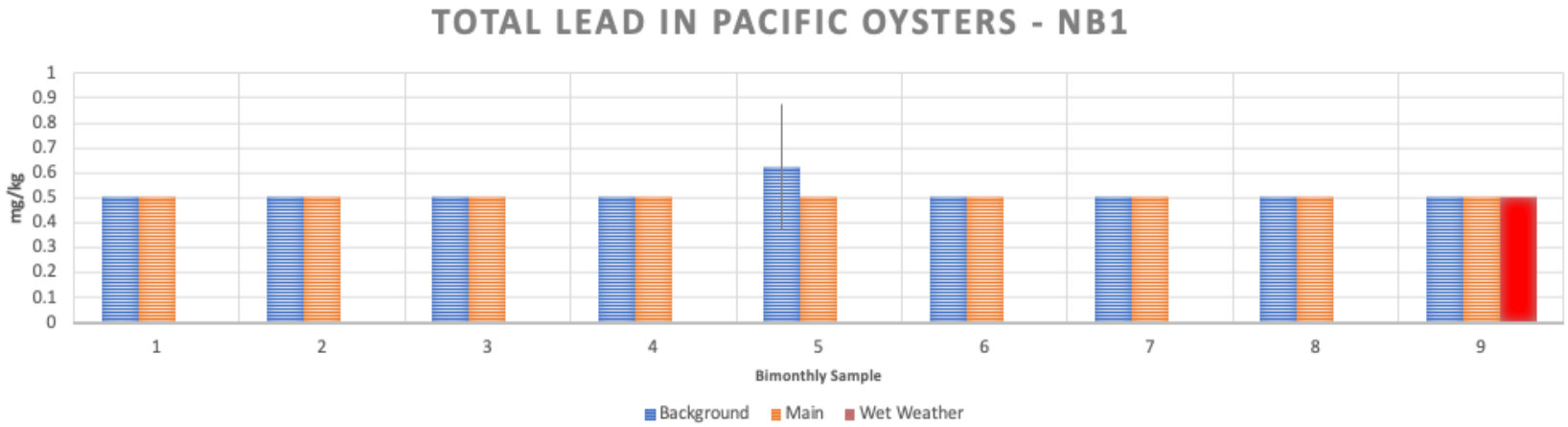

TOTAL LEAD IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

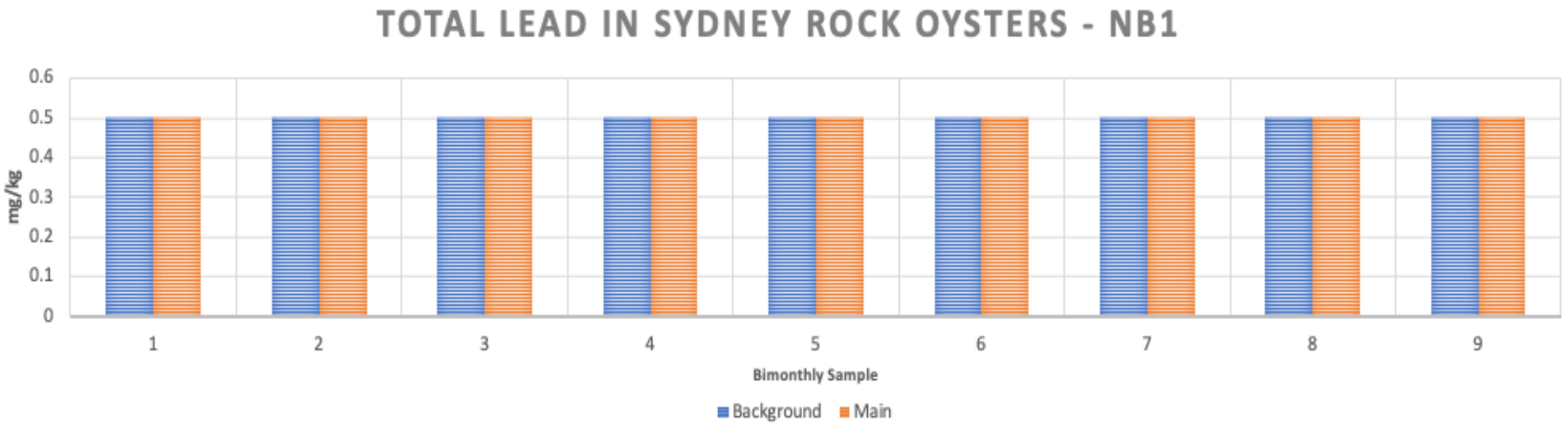

TOTAL LEAD IN PACIFIC OYSTERS - SEB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

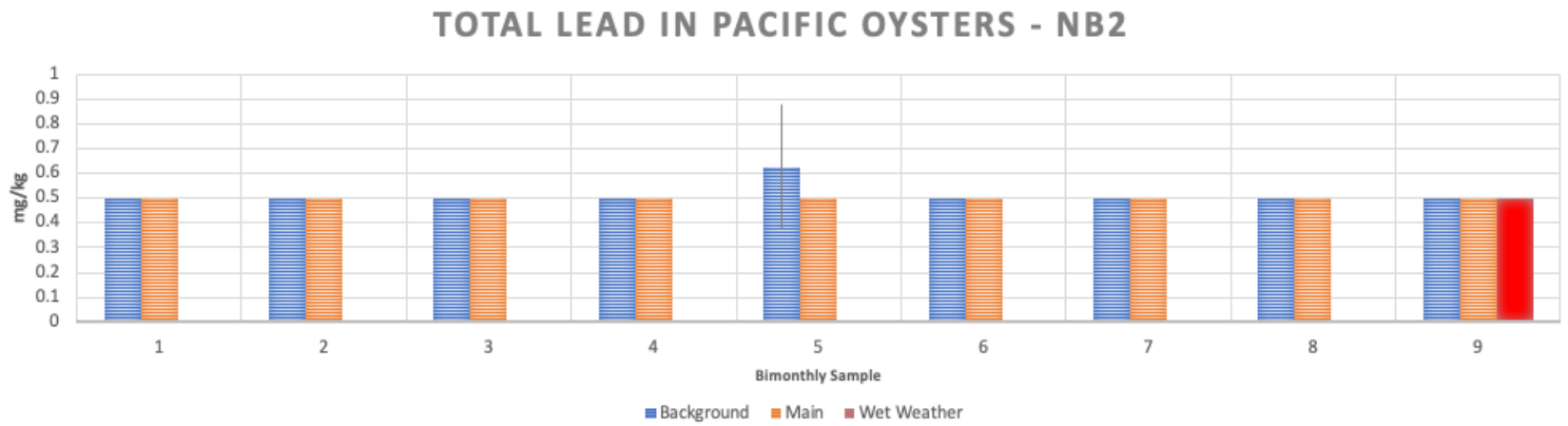

TOTAL LEAD IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

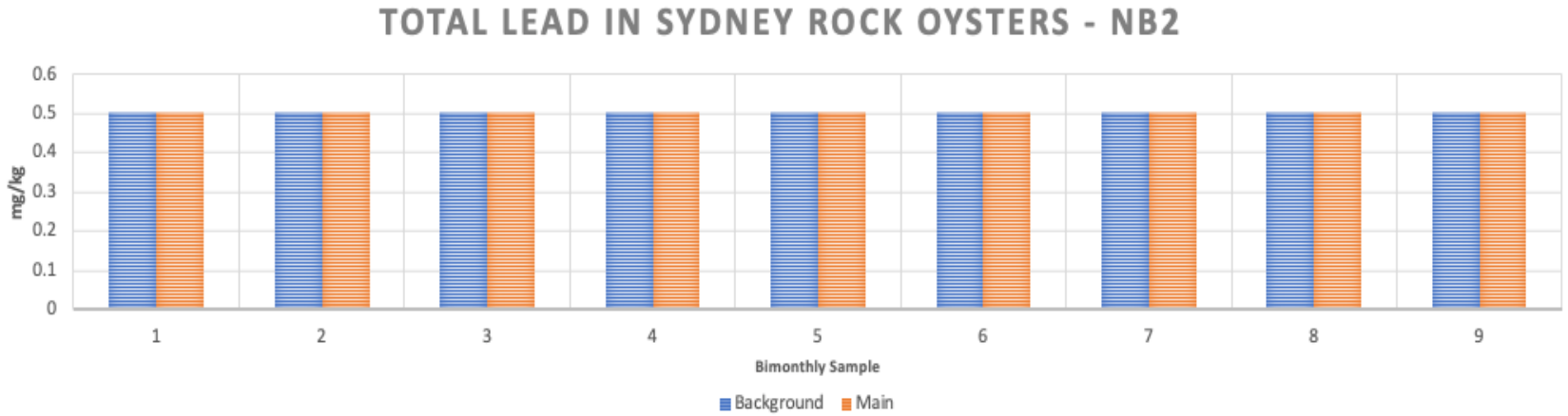

TOTAL LEAD IN PACIFIC OYSTERS - SEB2
mg/kg
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

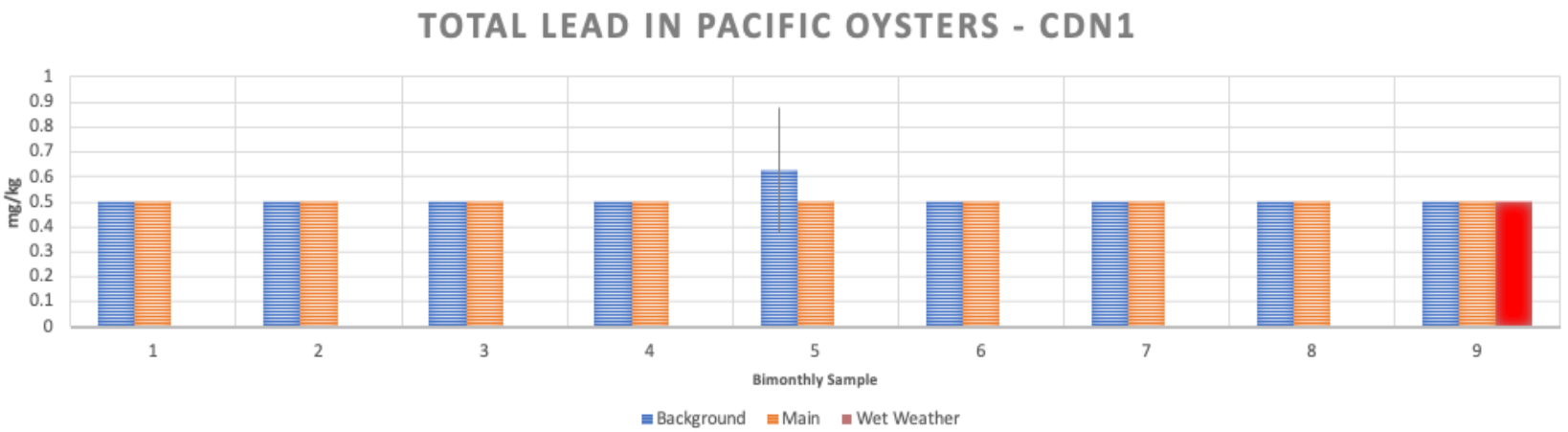

TOTAL LEAD IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

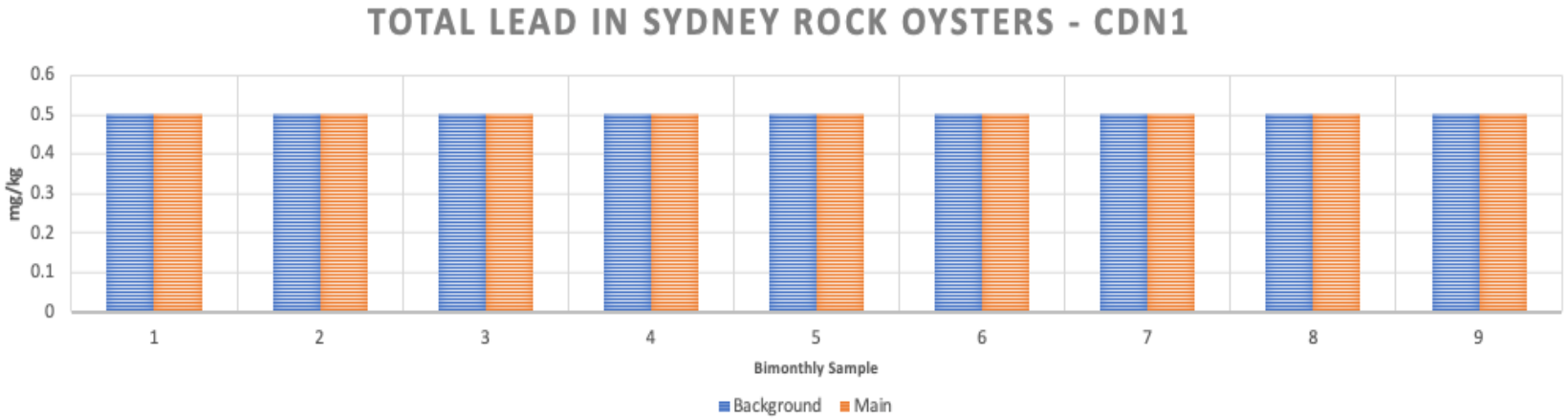

TOTAL LEAD IN PACIFIC OYSTERS - NB1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

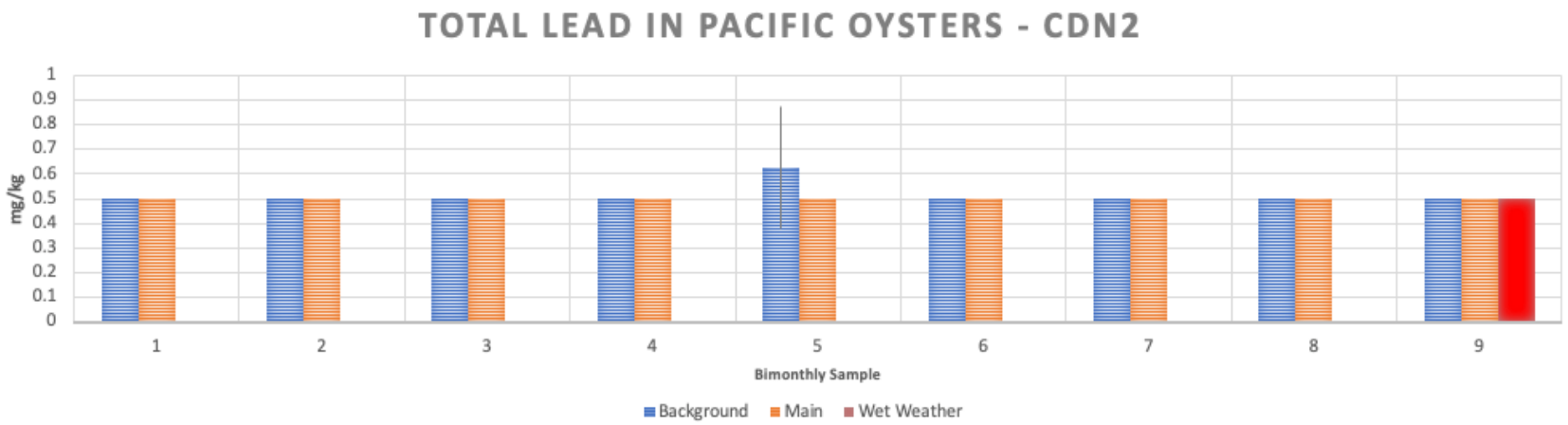

TOTAL LEAD IN SYDNEY ROCK OYSTERS - NB1
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

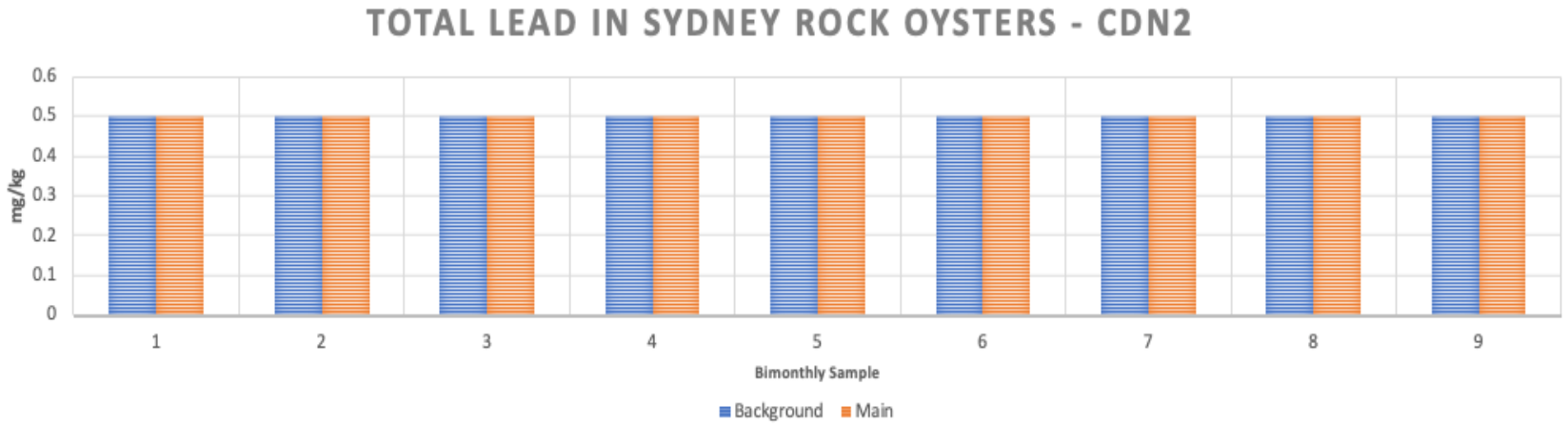

TOTAL LEAD IN PACIFIC OYSTERS - NB2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

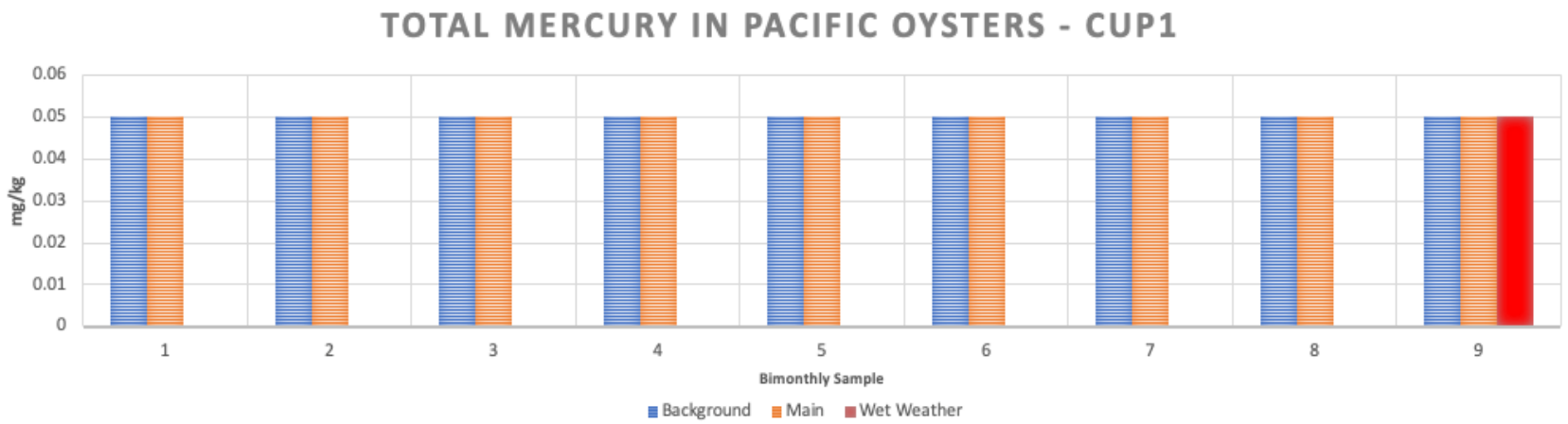

TOTAL LEAD IN SYDNEY ROCK OYSTERS - NB2
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

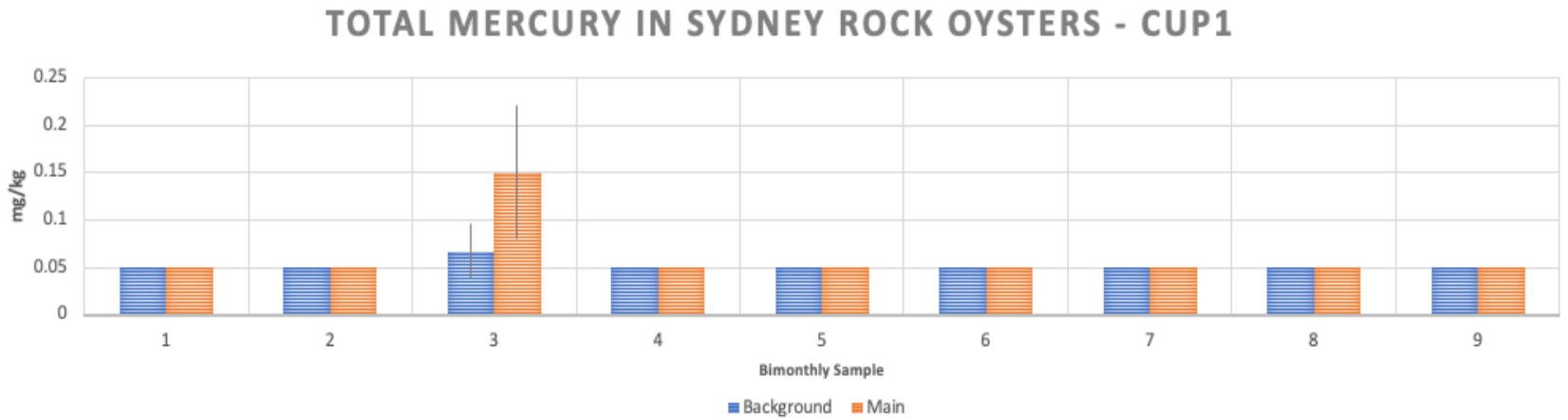

TOTAL LEAD IN PACIFIC OYSTERS - CDN1
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

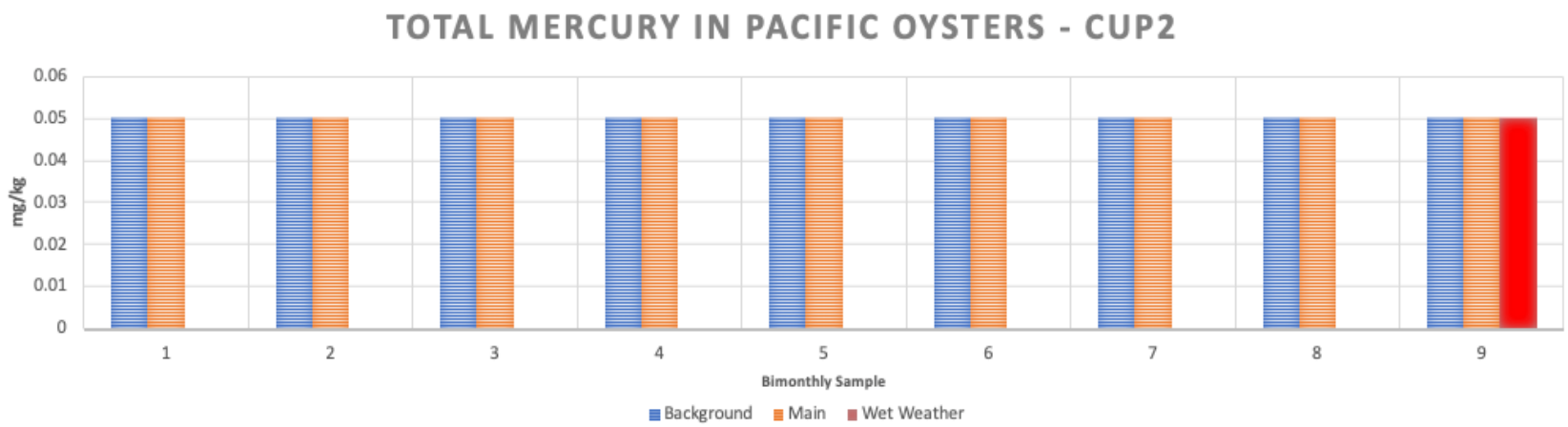

TOTAL LEAD IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

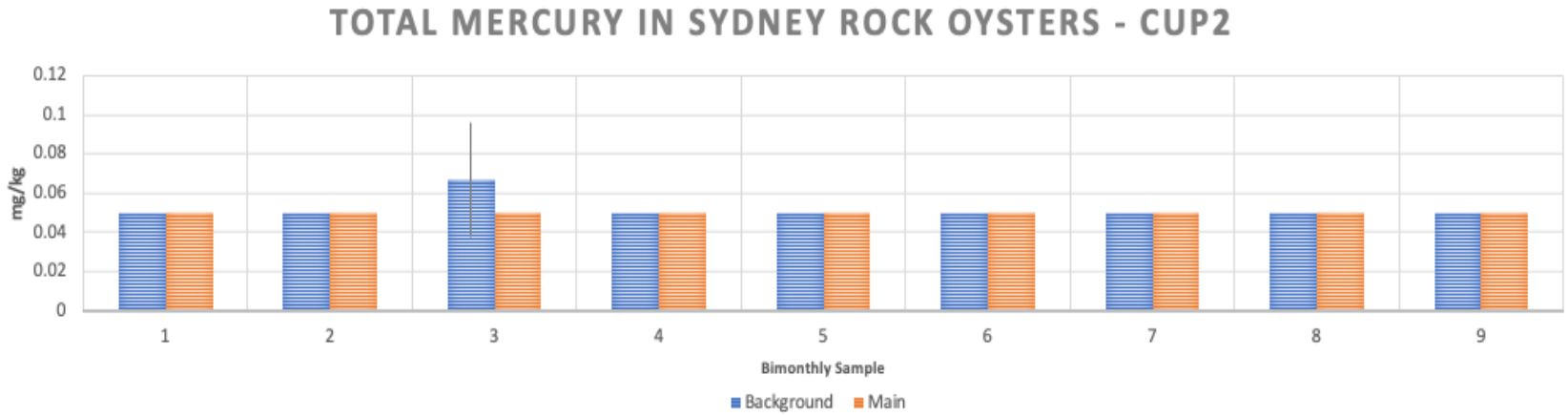

TOTAL LEAD IN PACIFIC OYSTERS - CDN2
mg/kg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

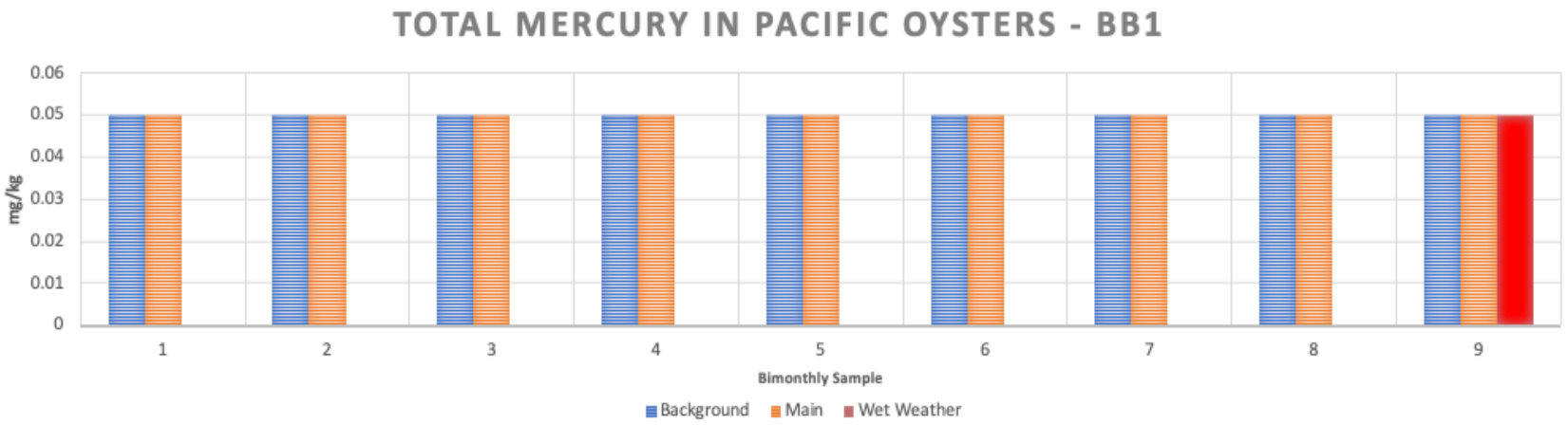

TOTAL LEAD IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

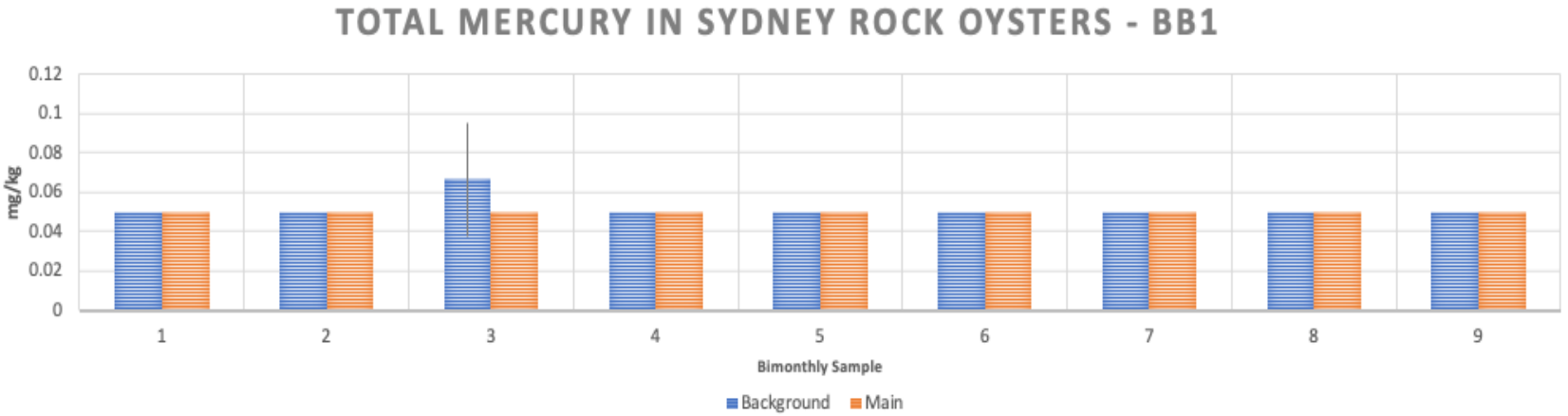

TOTAL MERCURY IN PACIFIC OYSTERS - CUP1
0.06
0.05
0.04
0.03
0.02
0.01
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

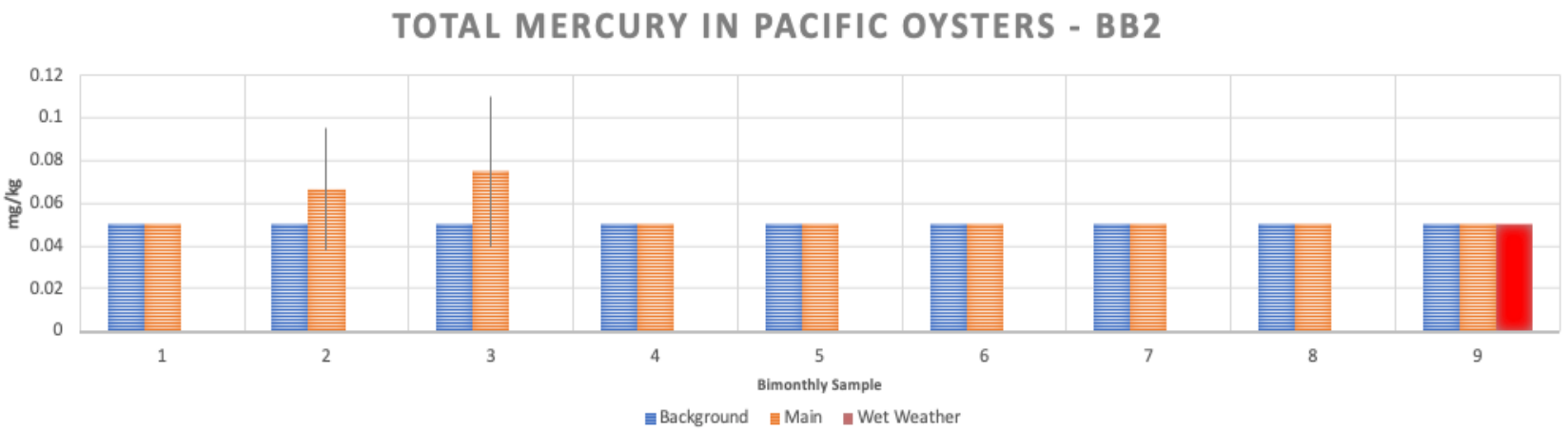

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - CUP1
0.25
0.2
0.15
0.1
0.05
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

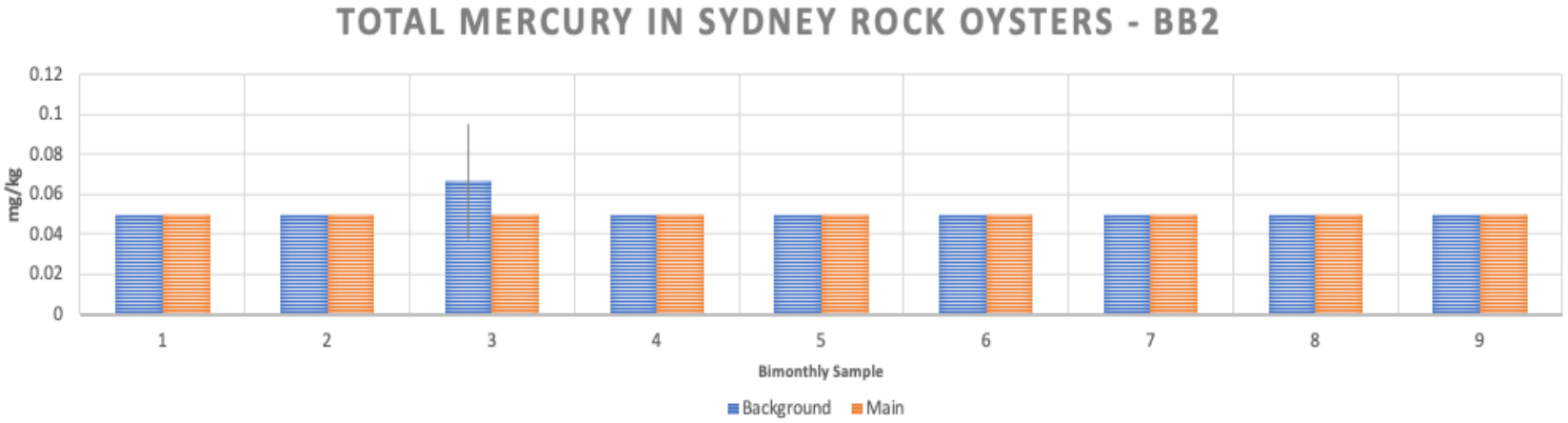

TOTAL MERCURY IN PACIFIC OYSTERS - CUP2
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

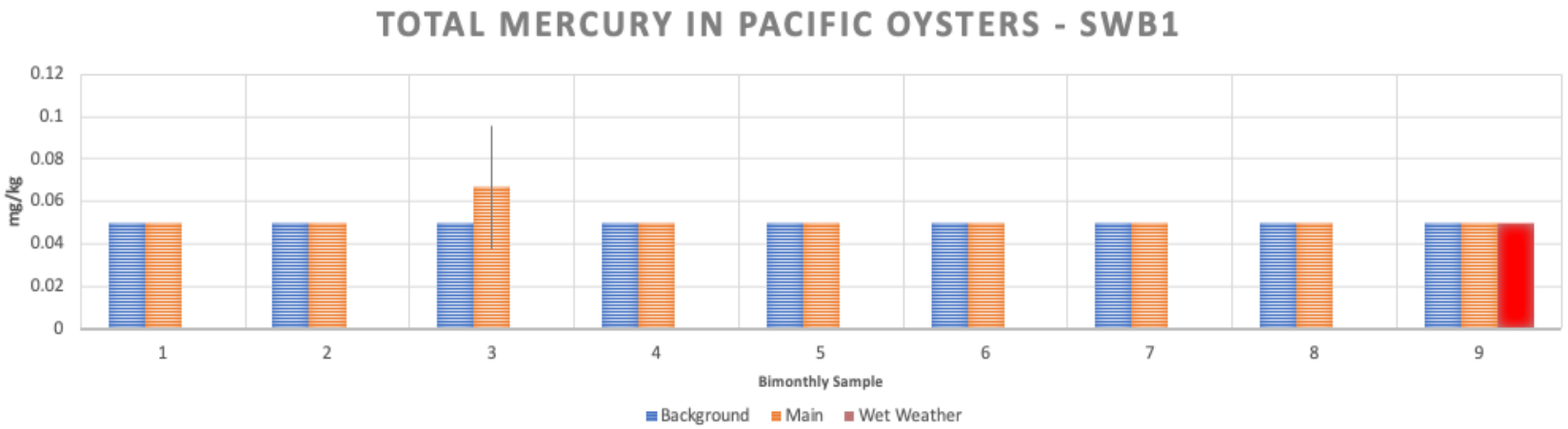

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

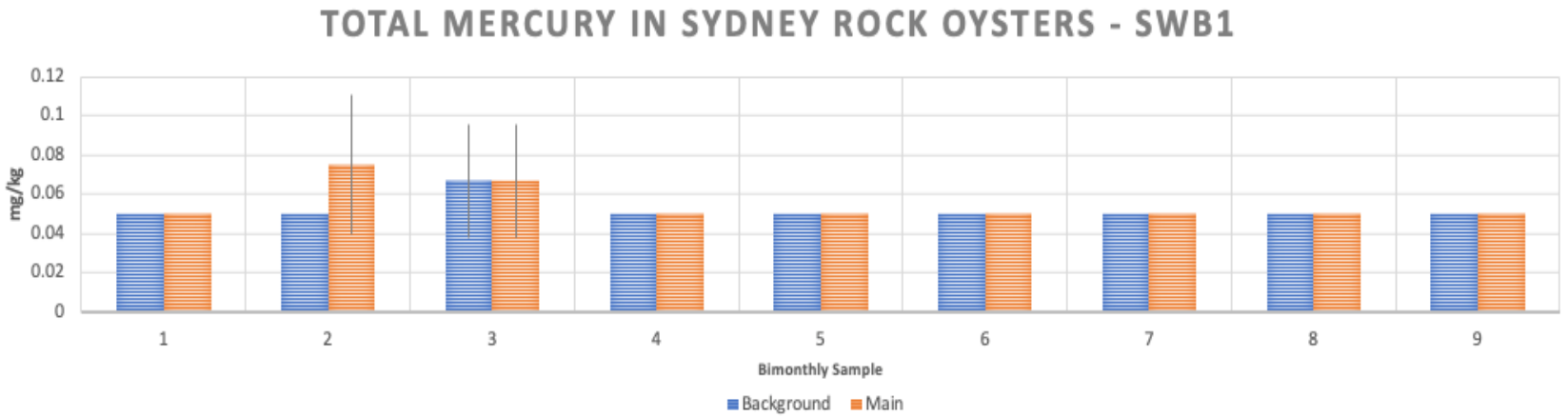

TOTAL MERCURY IN PACIFIC OYSTERS - BB1
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

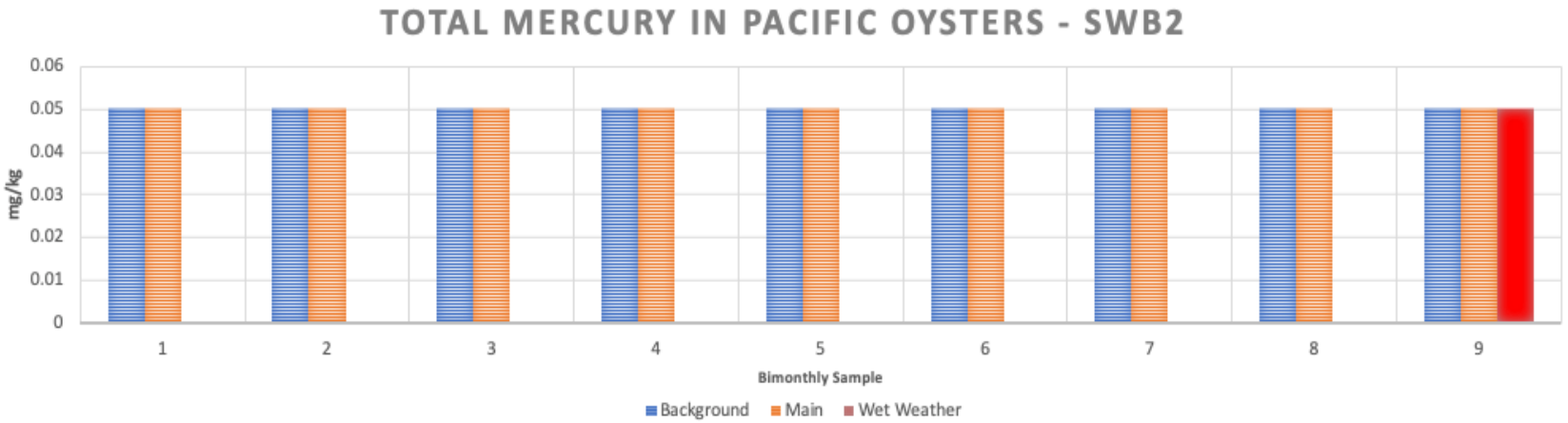

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - BB1
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

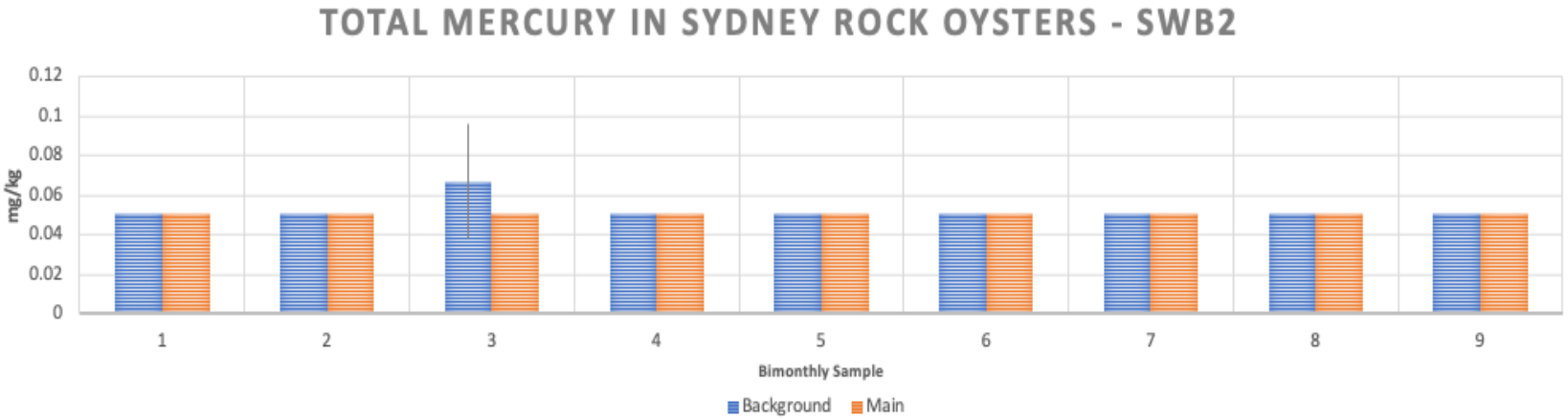

TOTAL MERCURY IN PACIFIC OYSTERS - BB2
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

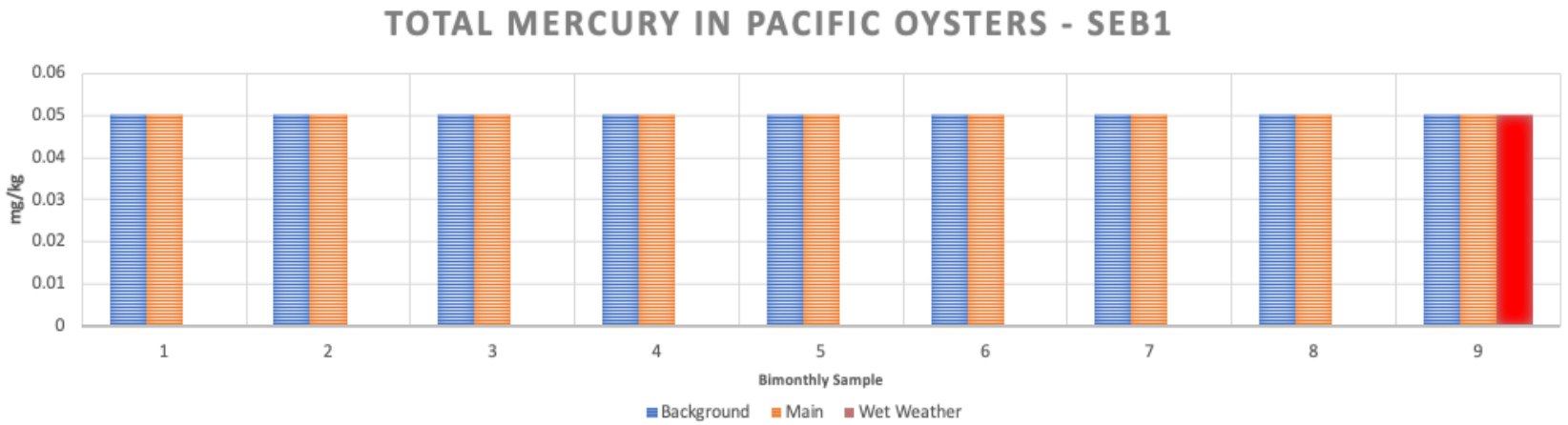

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - BB2
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

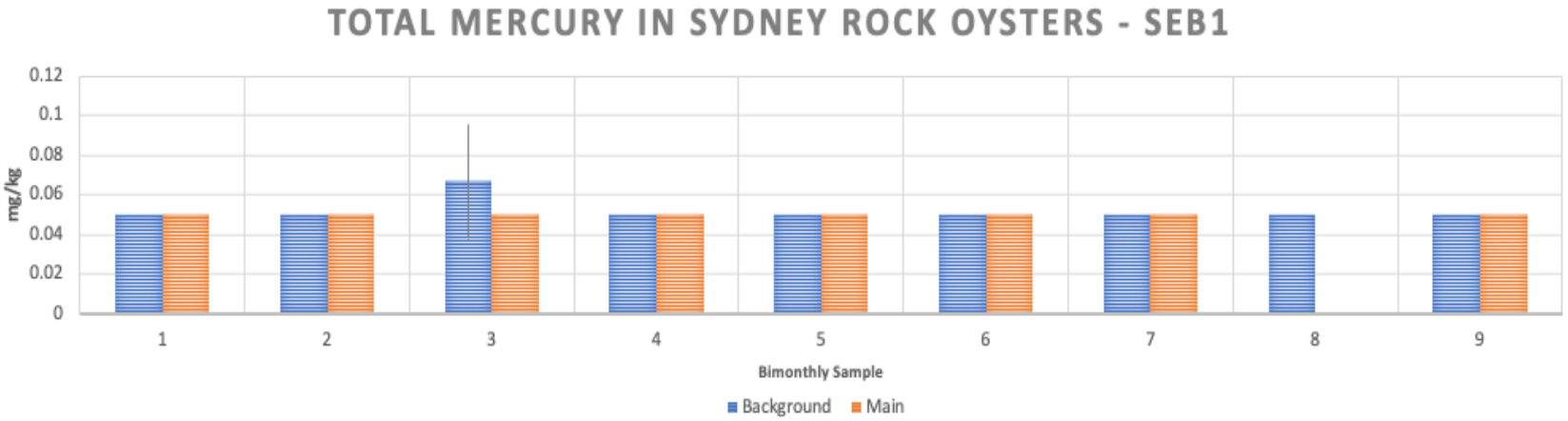

TOTAL MERCURY IN PACIFIC OYSTERS - SWB1
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

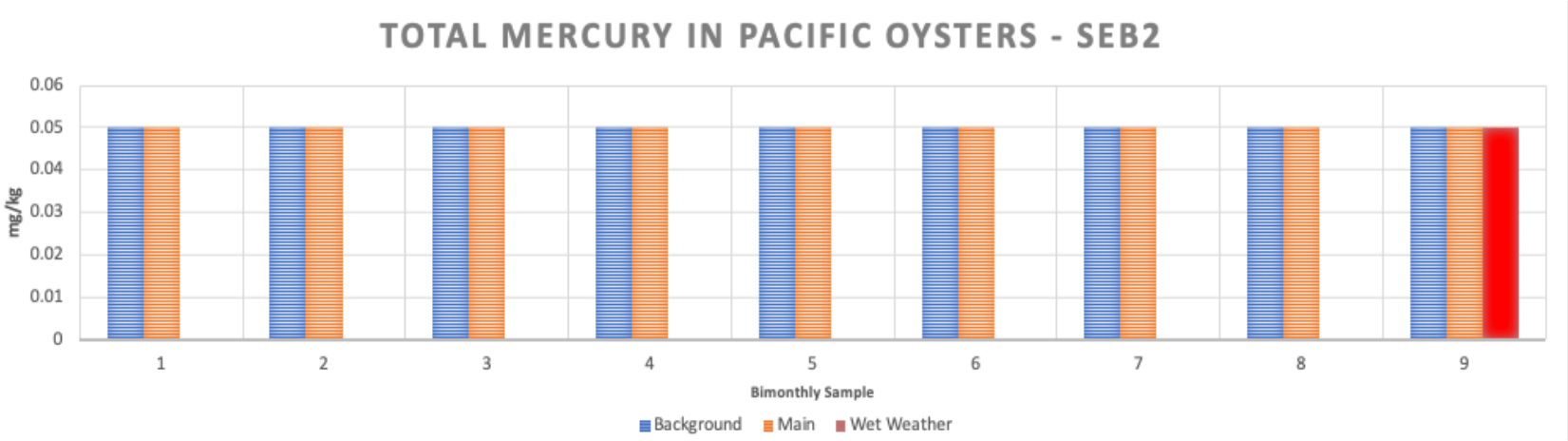

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - SWB1
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

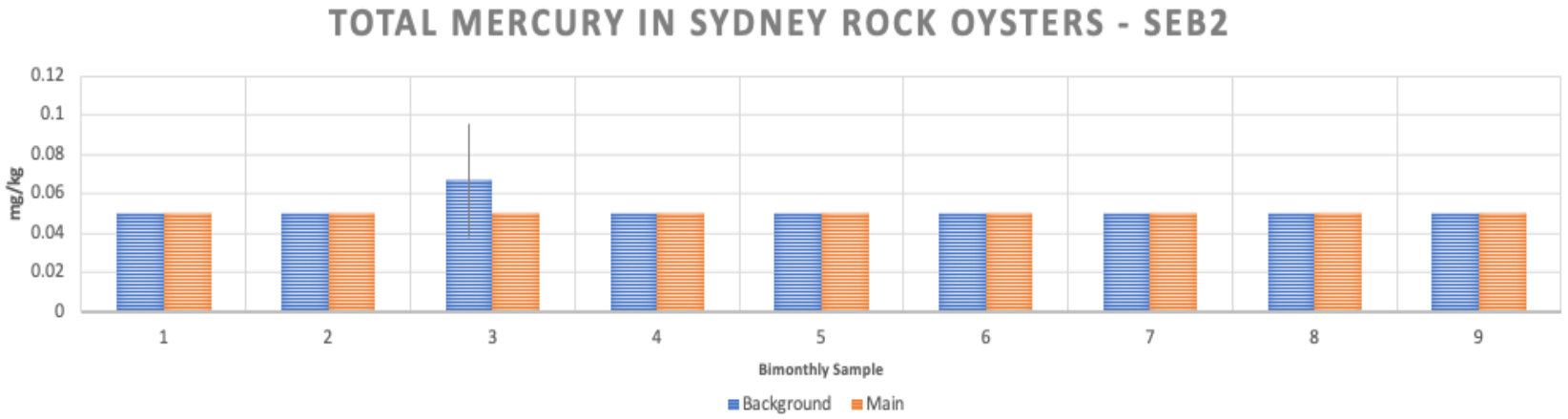

TOTAL MERCURY IN PACIFIC OYSTERS - SWB2
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

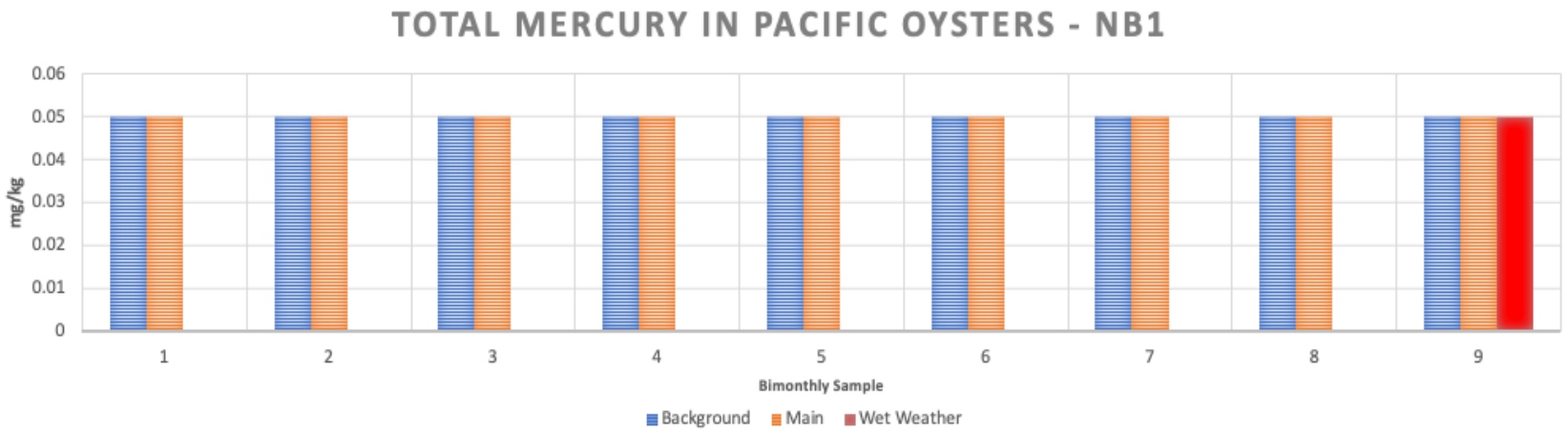

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

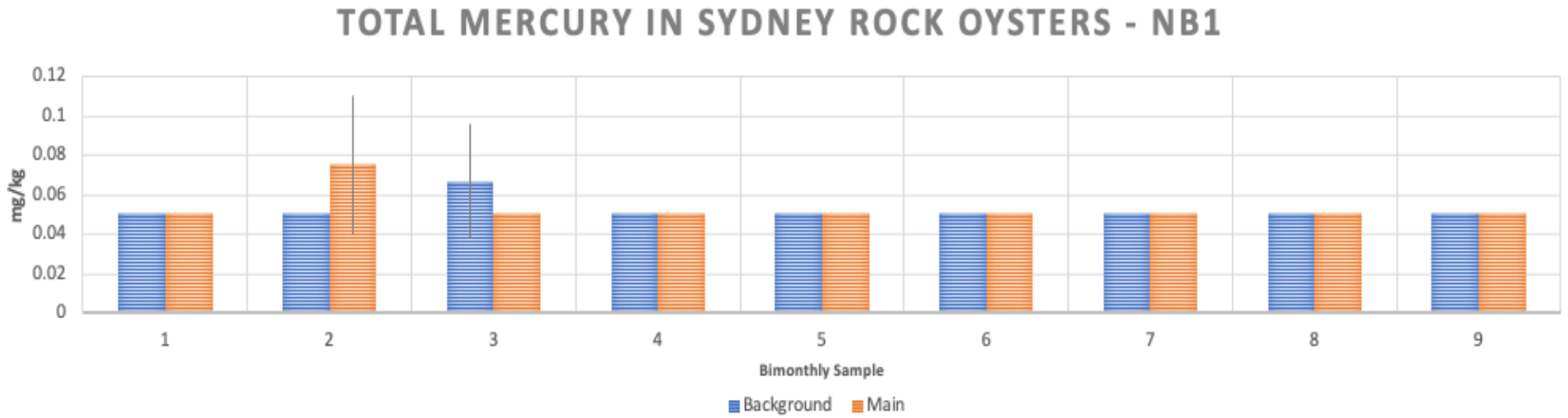

TOTAL MERCURY IN PACIFIC OYSTERS - SEB1
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

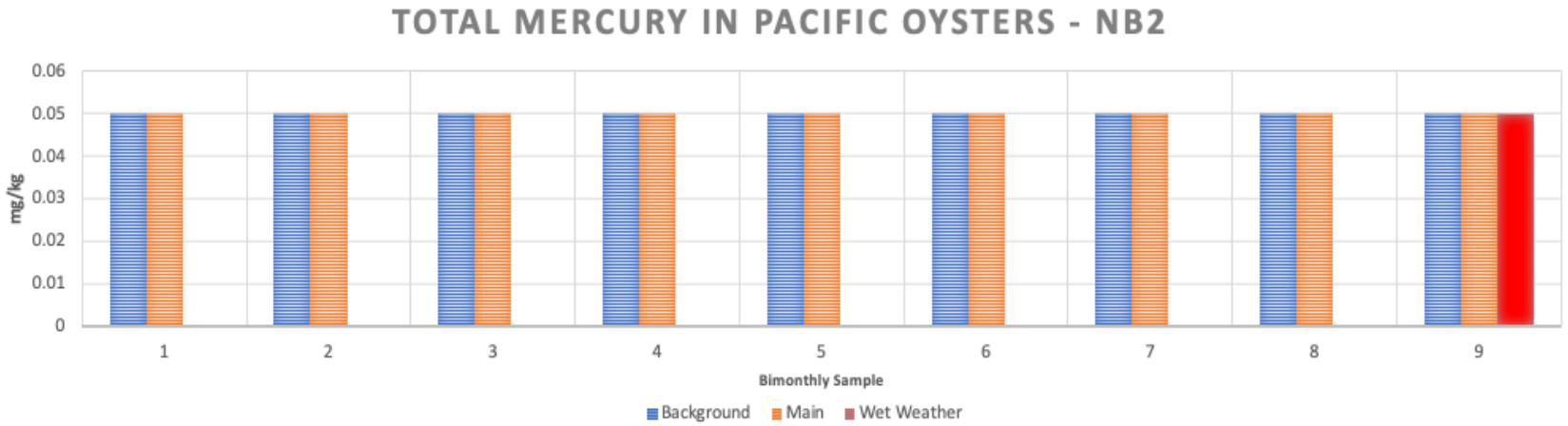

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

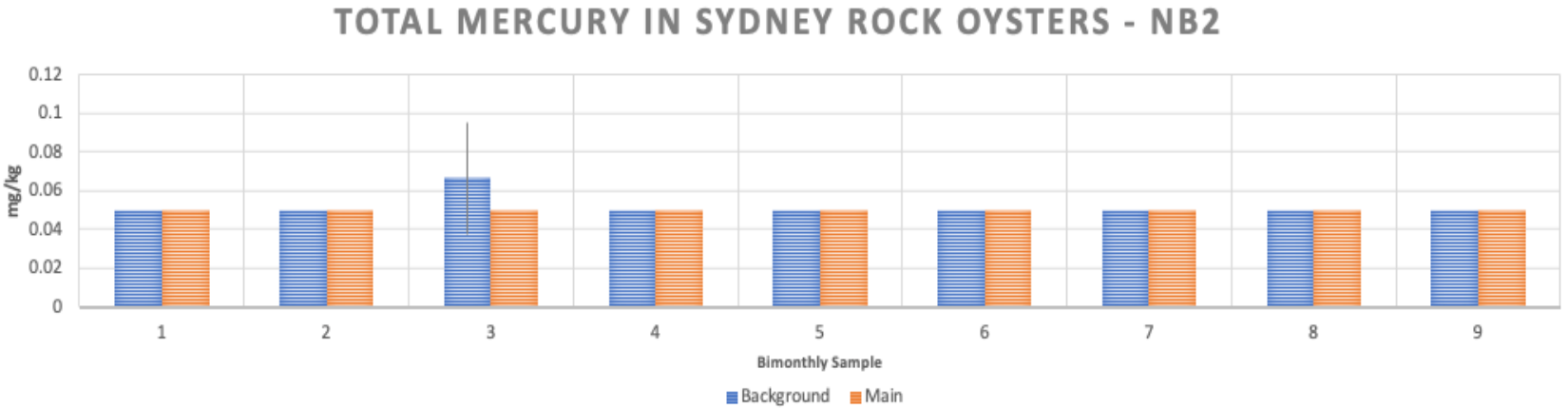

TOTAL MERCURY IN PACIFIC OYSTERS - SEB2
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

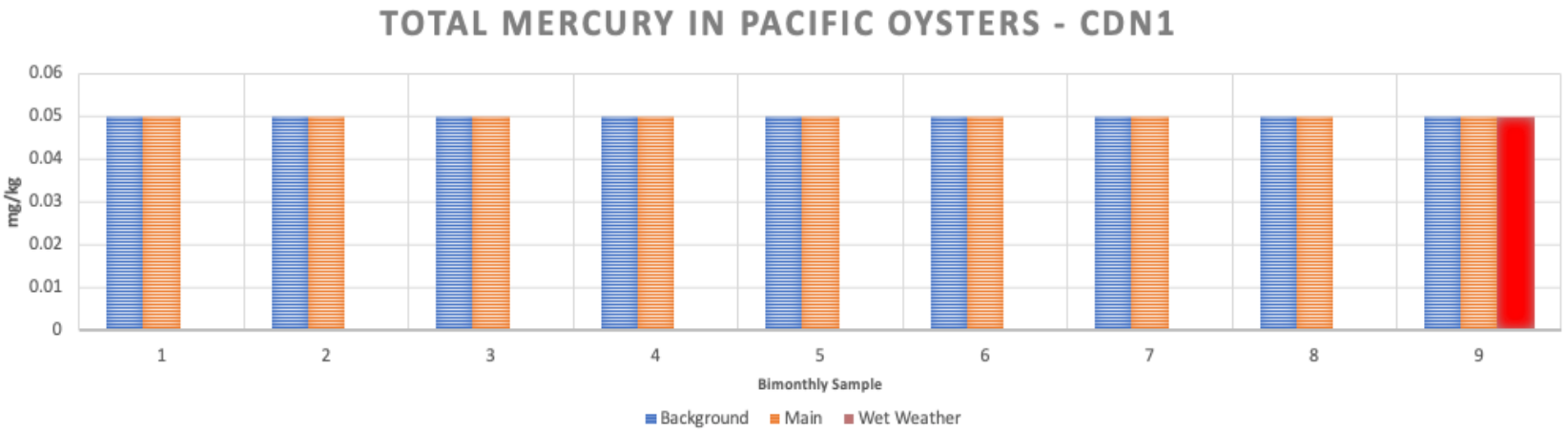

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

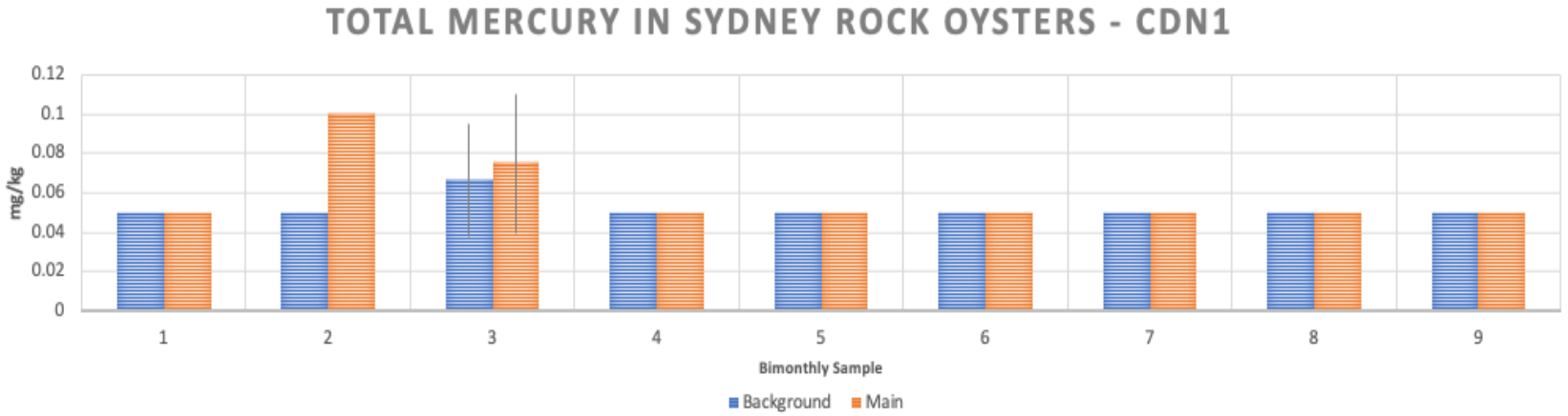

TOTAL MERCURY IN PACIFIC OYSTERS - NB1
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

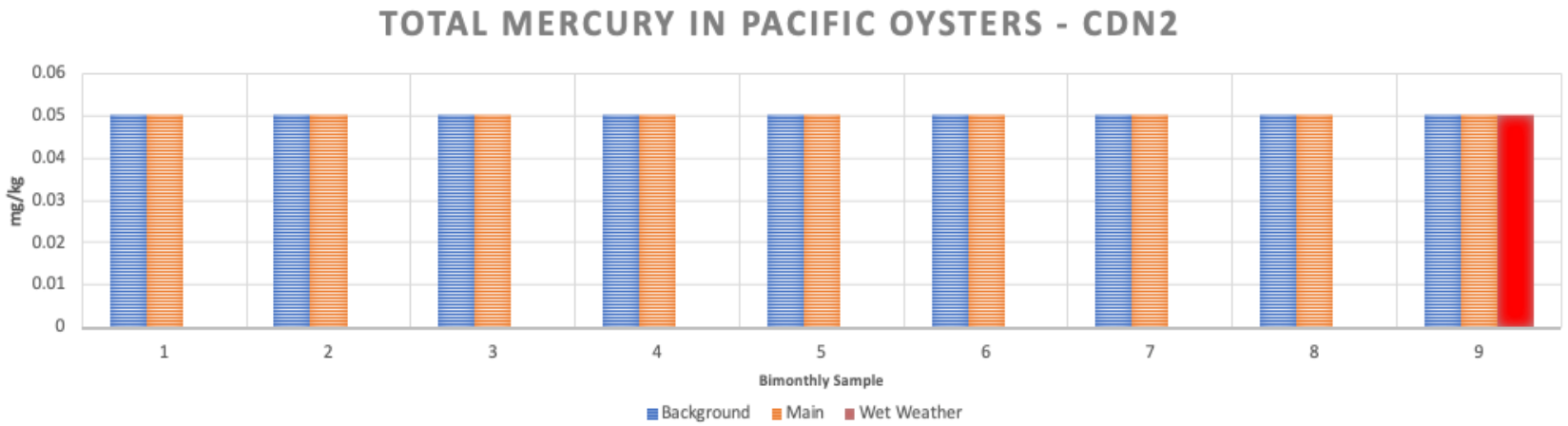

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - NB1
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

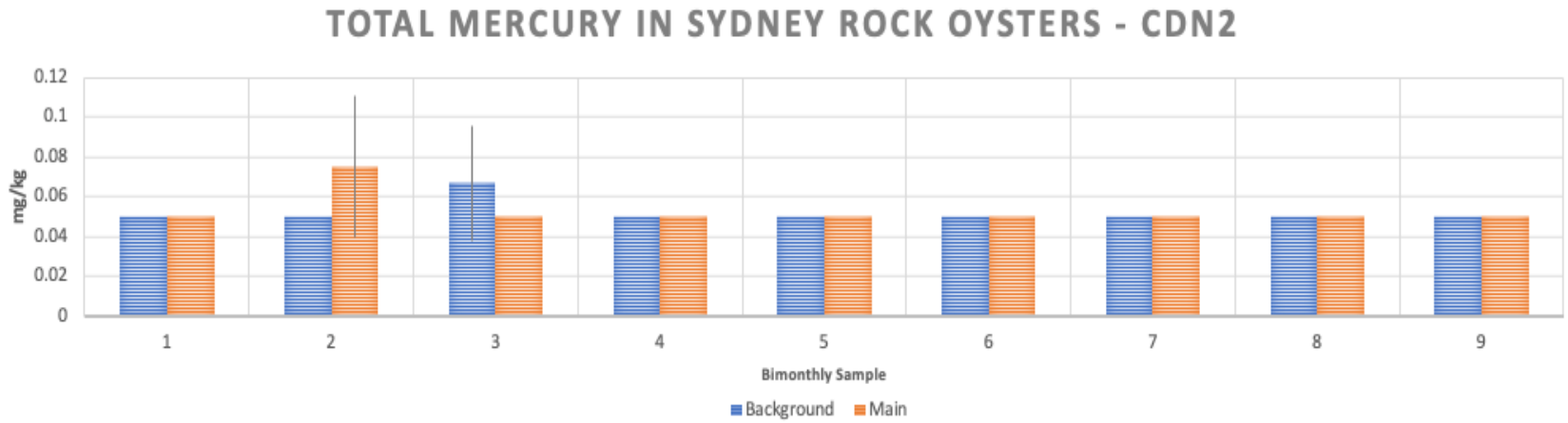

TOTAL MERCURY IN PACIFIC OYSTERS - NB2
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

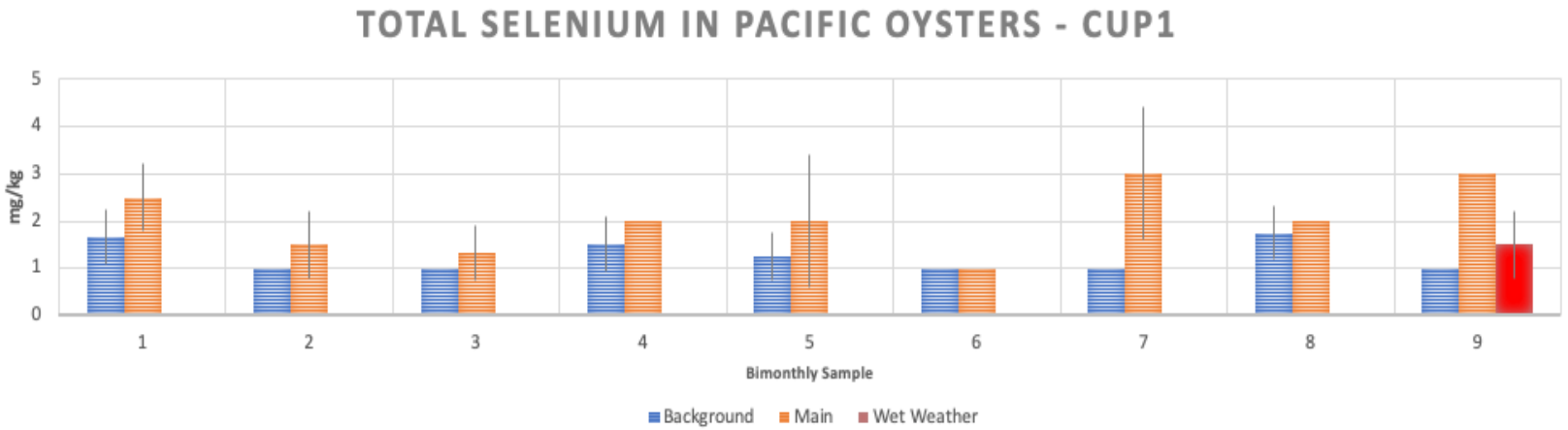

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - NB2
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

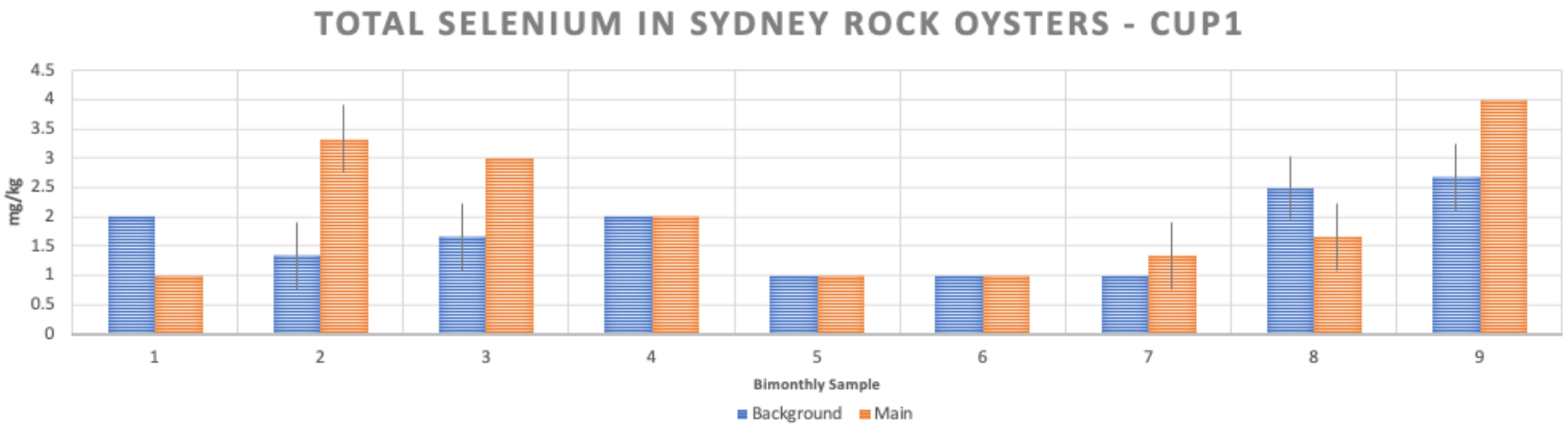

TOTAL MERCURY IN PACIFIC OYSTERS - CDN1
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

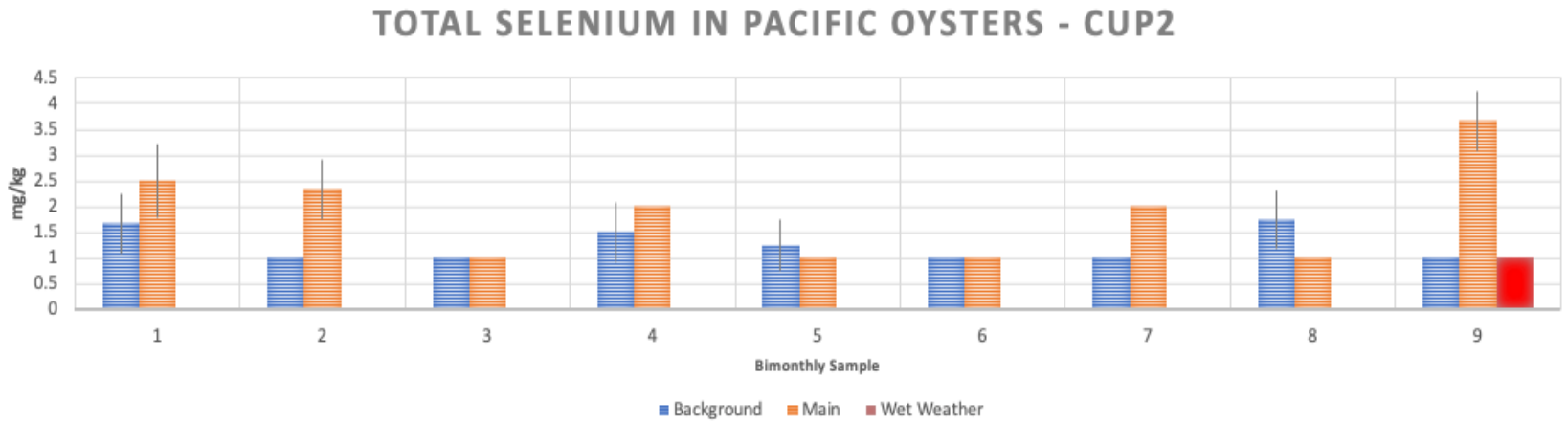

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

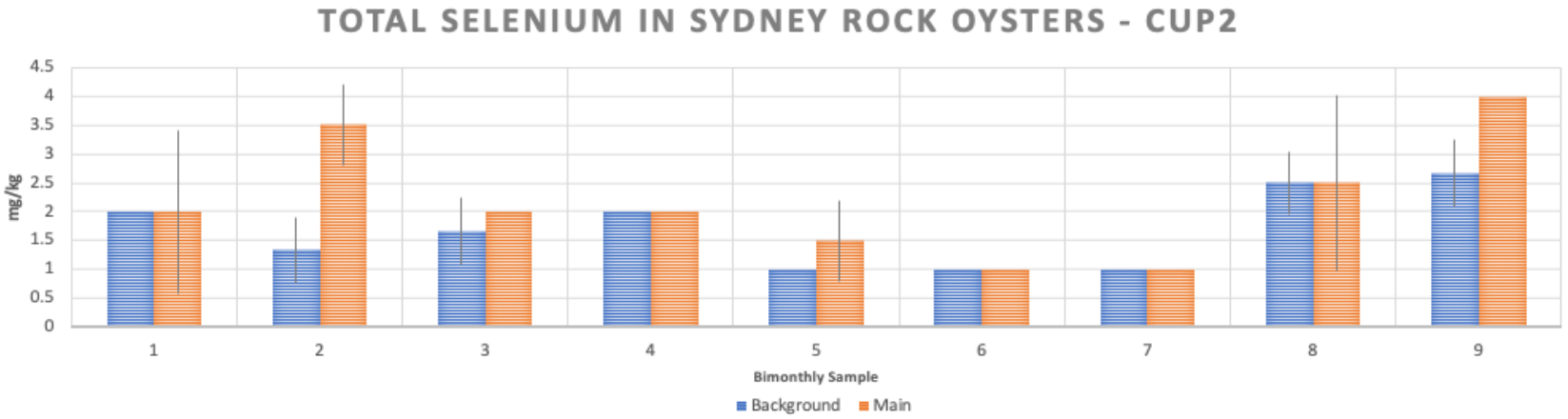

TOTAL MERCURY IN PACIFIC OYSTERS - CDN2
mg/kg
0.06
0.05
0.04
0.03
0.02
0.01
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

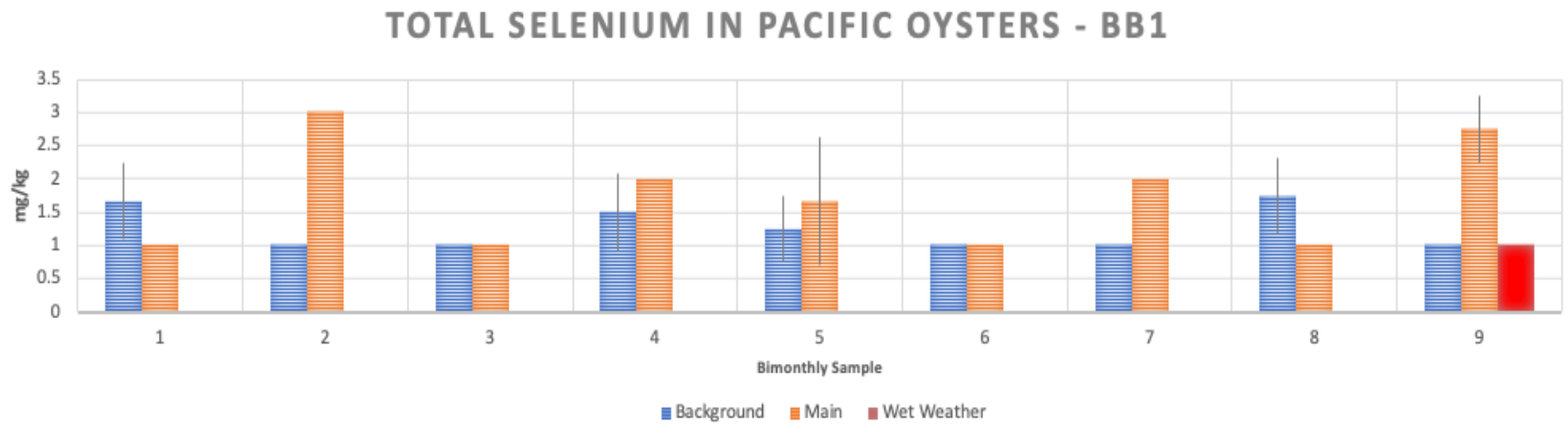

TOTAL MERCURY IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
0.12
0.1
0.08
0.06
0.04
0.02
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

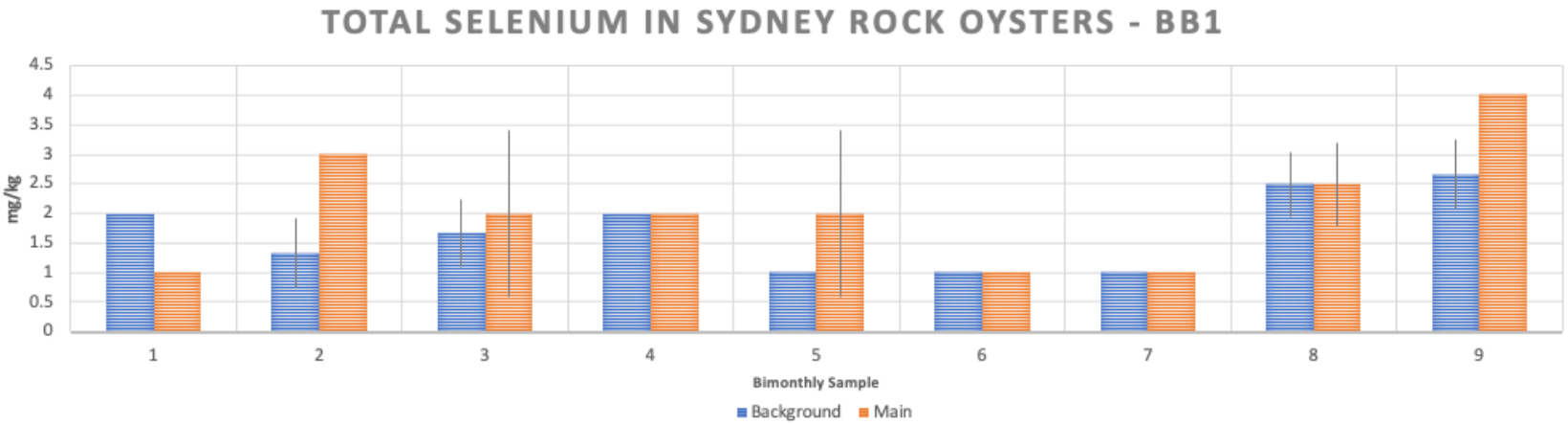

TOTAL SELENIUM IN PACIFIC OYSTERS - CUP1
mg/kg
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

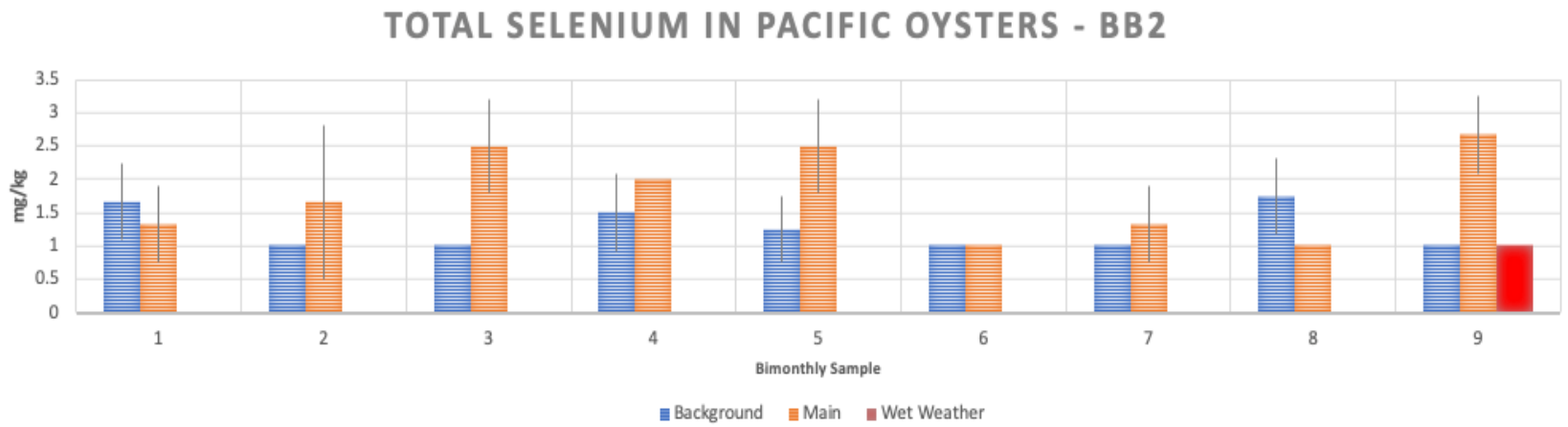

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

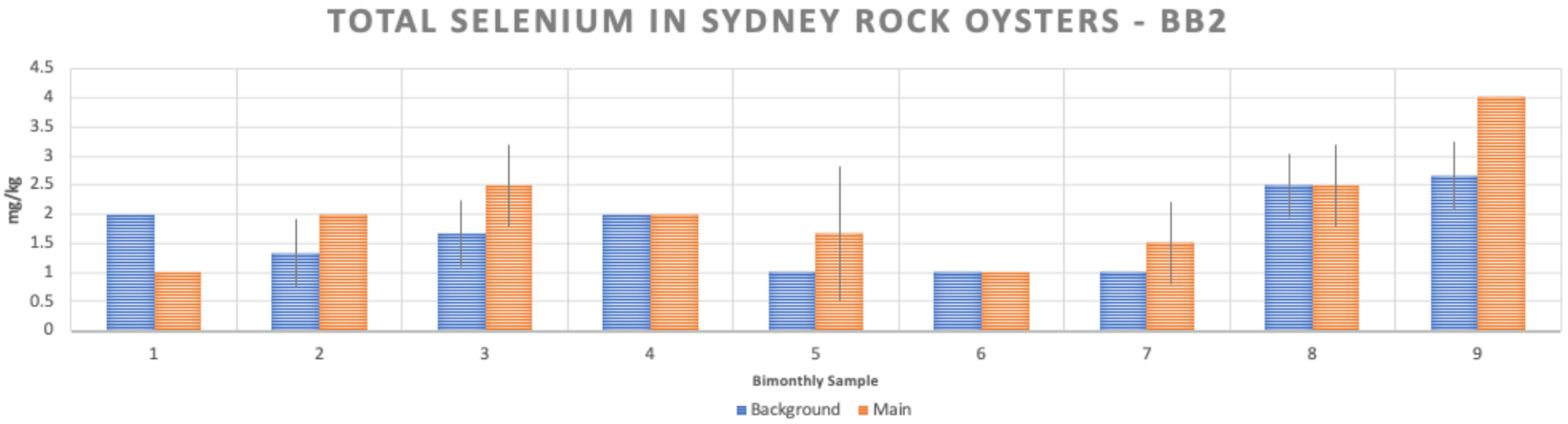

TOTAL SELENIUM IN PACIFIC OYSTERS - CUP2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

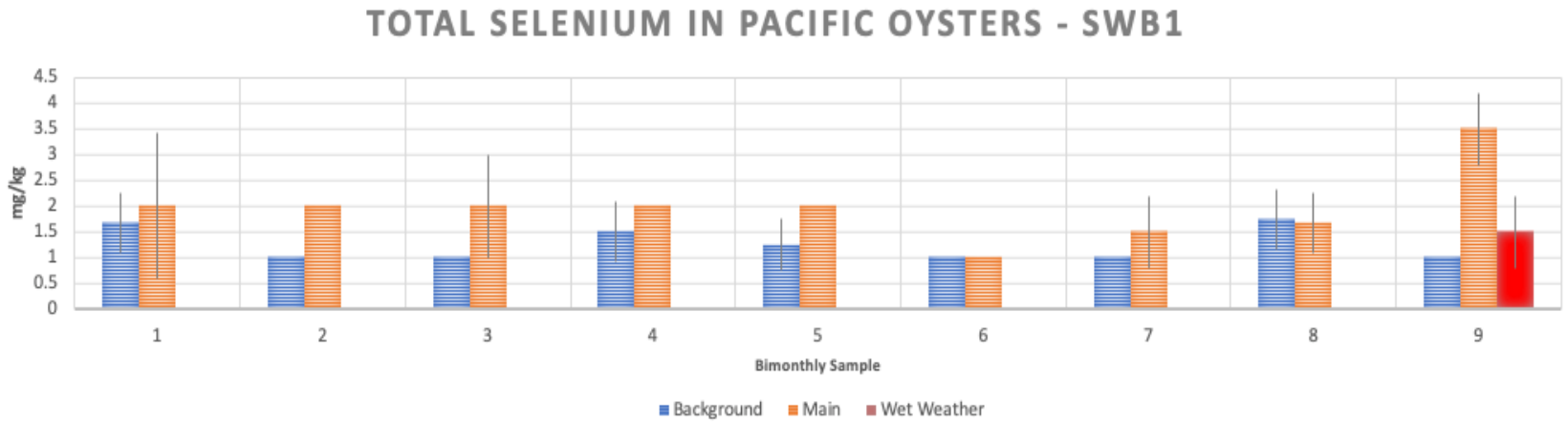

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - CUP2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

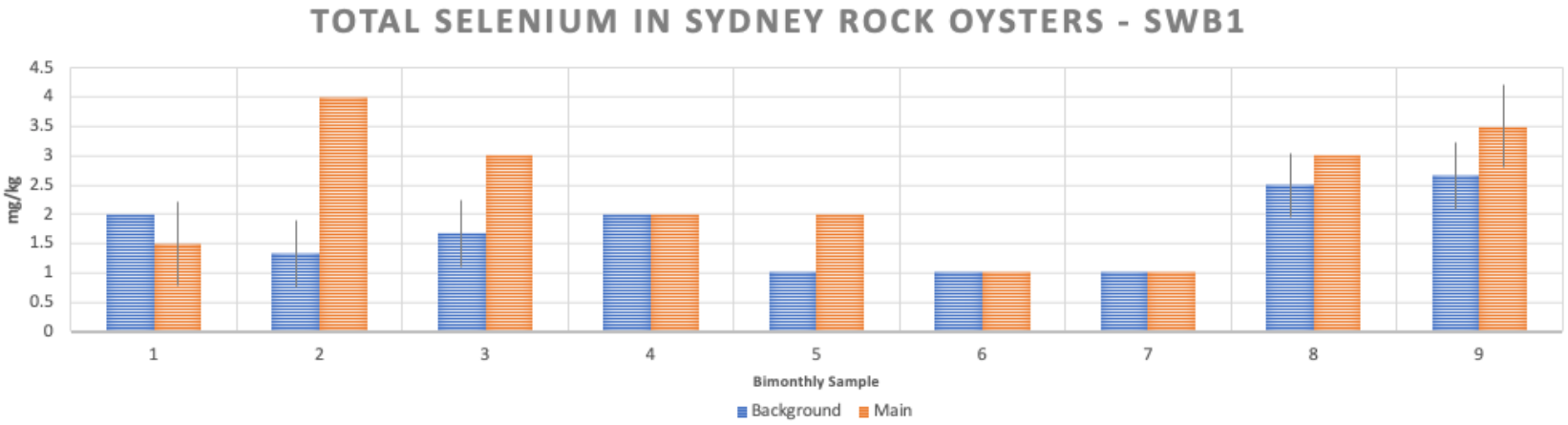

TOTAL SELENIUM IN PACIFIC OYSTERS - BB1
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

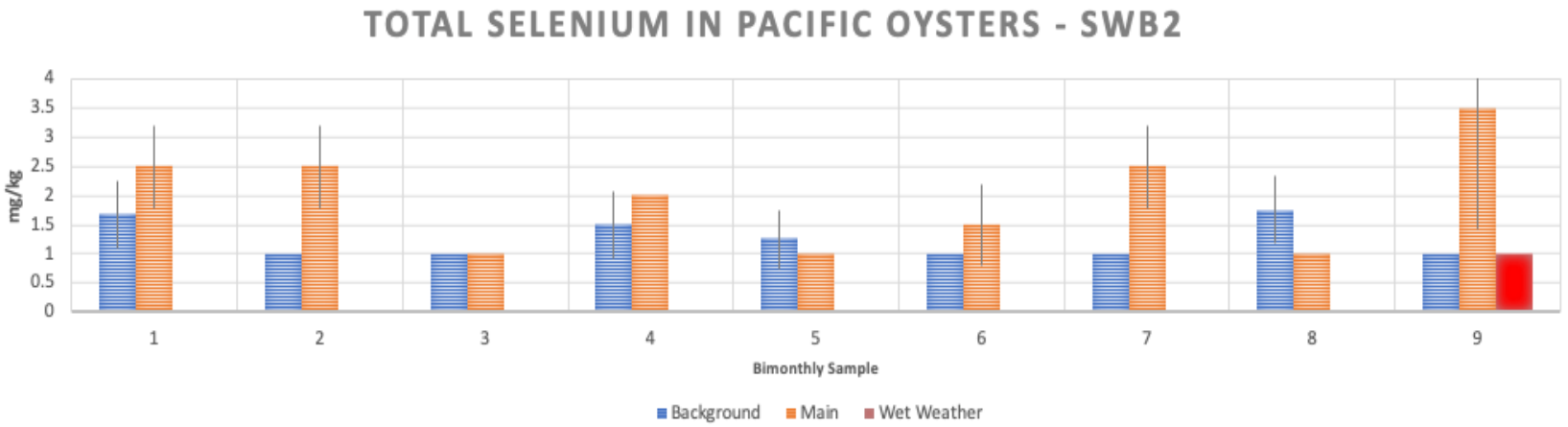

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - BB1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

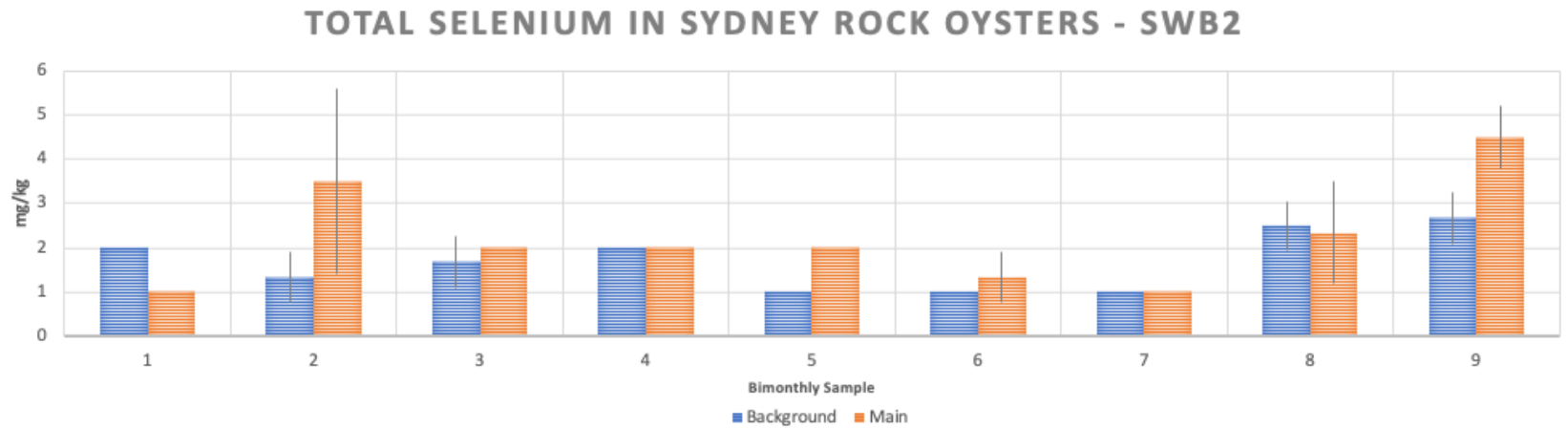

TOTAL SELENIUM IN PACIFIC OYSTERS - BB2
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

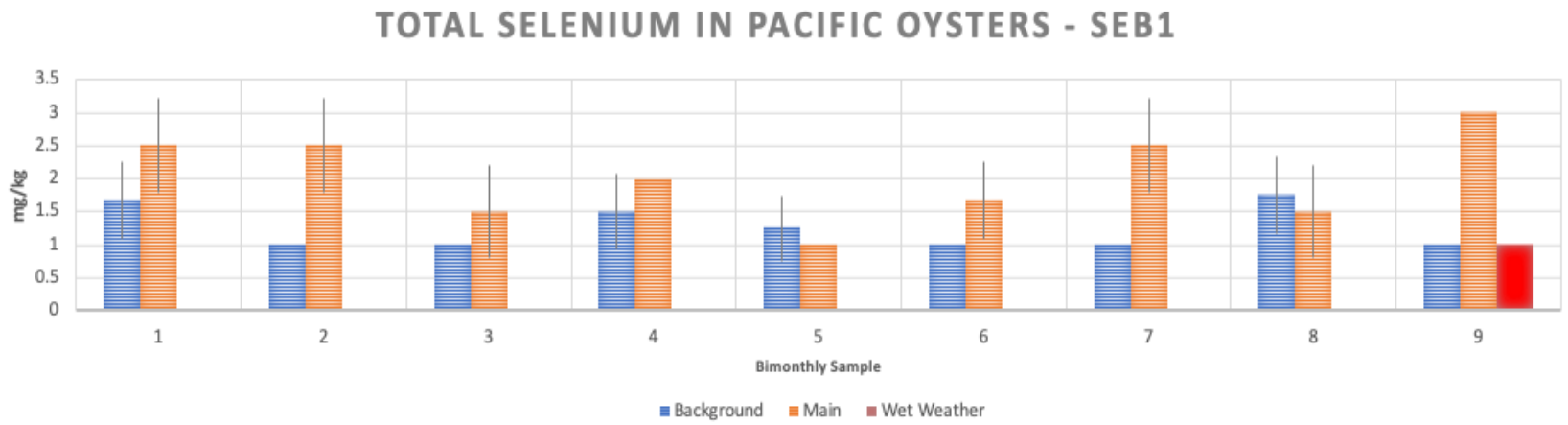

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - BB2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

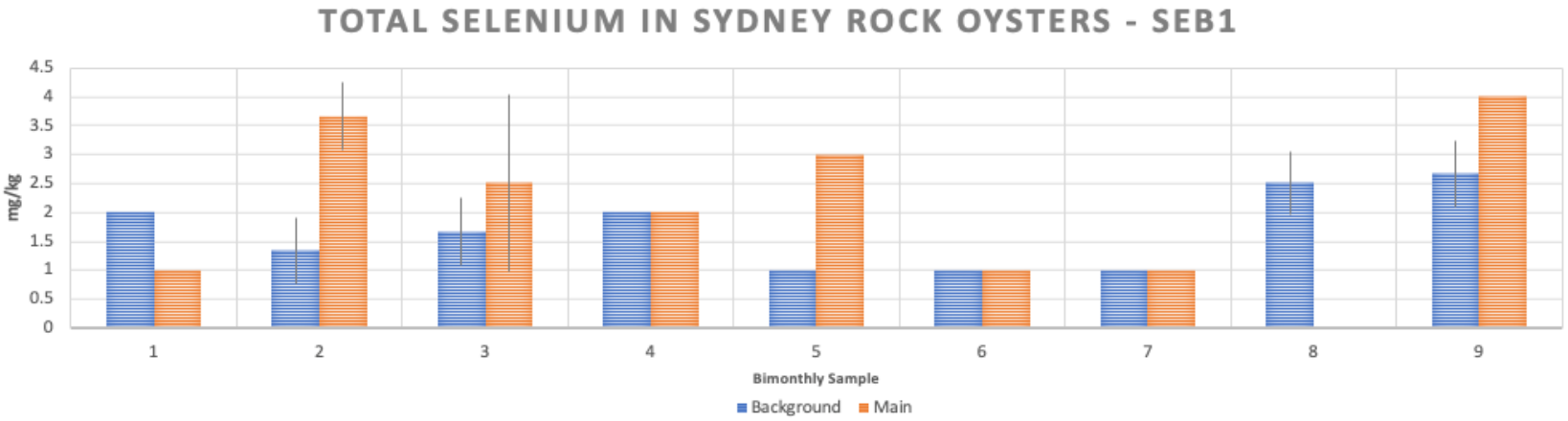

TOTAL SELENIUM IN PACIFIC OYSTERS - SWB1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

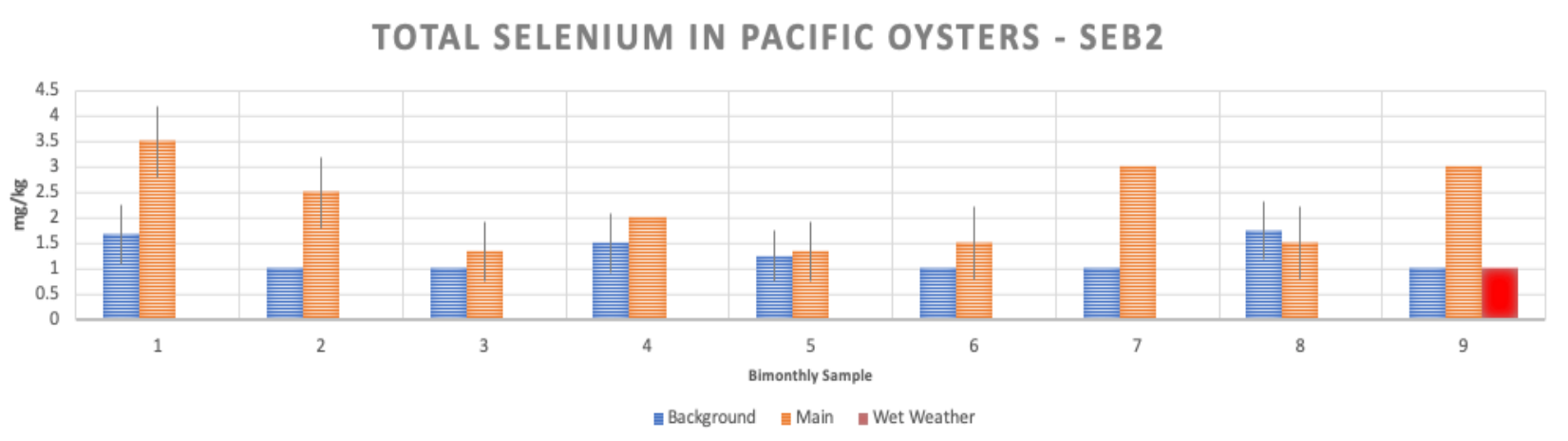

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - SWB1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

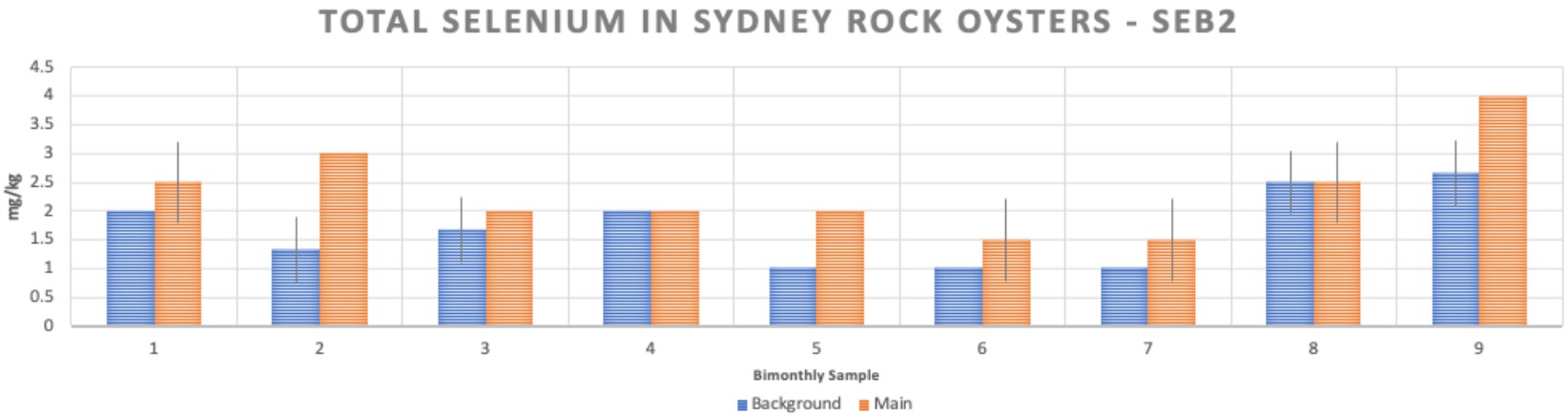

TOTAL SELENIUM IN PACIFIC OYSTERS - SWB2
mg/kg
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

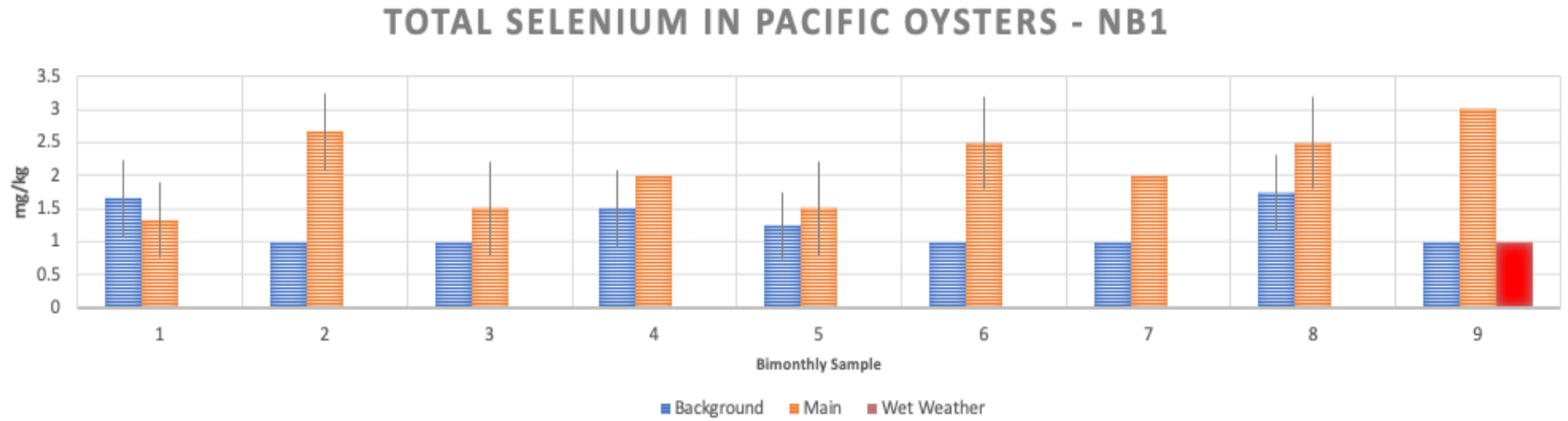

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

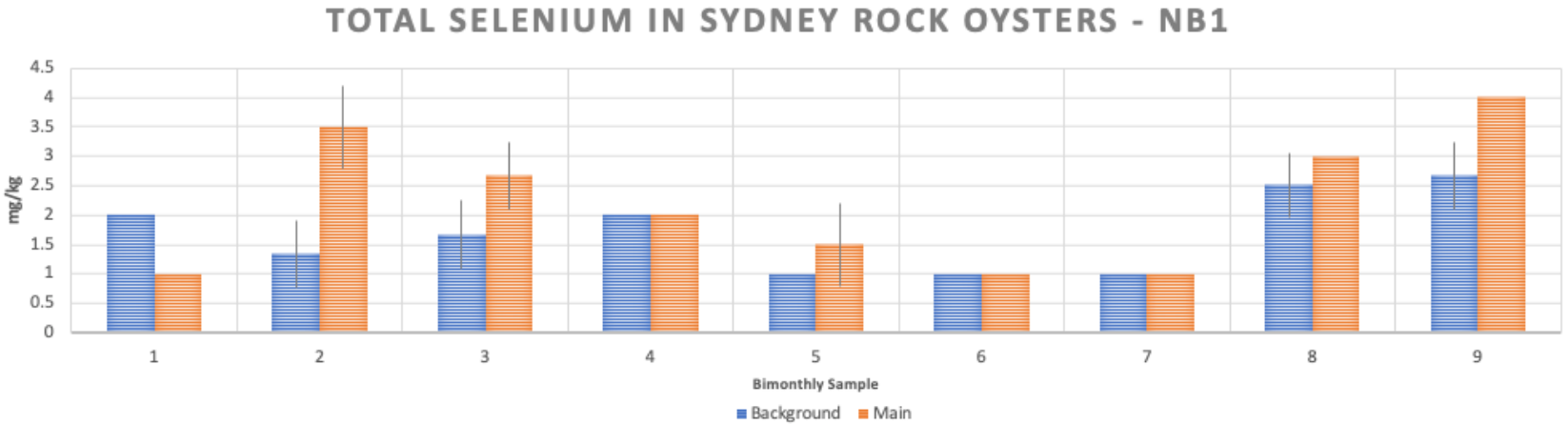

TOTAL SELENIUM IN PACIFIC OYSTERS - SEB1
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

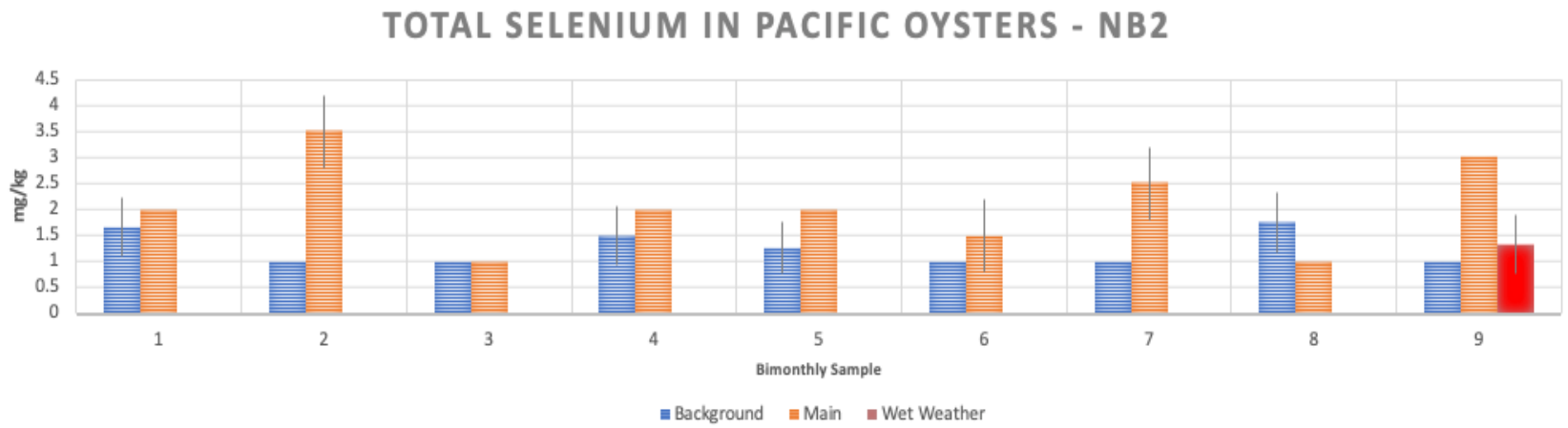

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

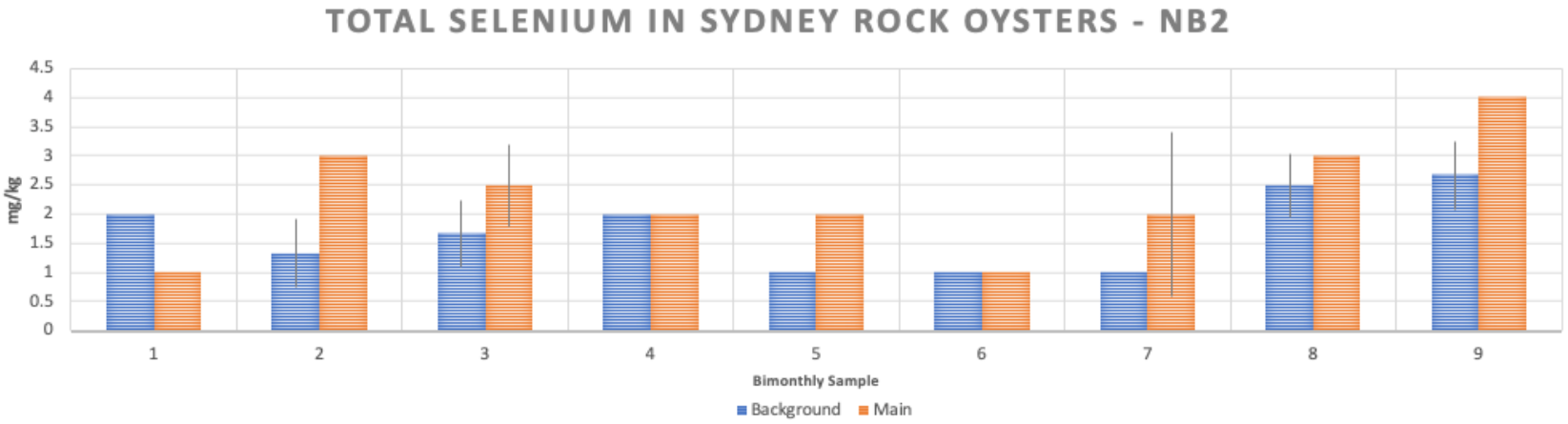

TOTAL SELENIUM IN PACIFIC OYSTERS - SEB2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

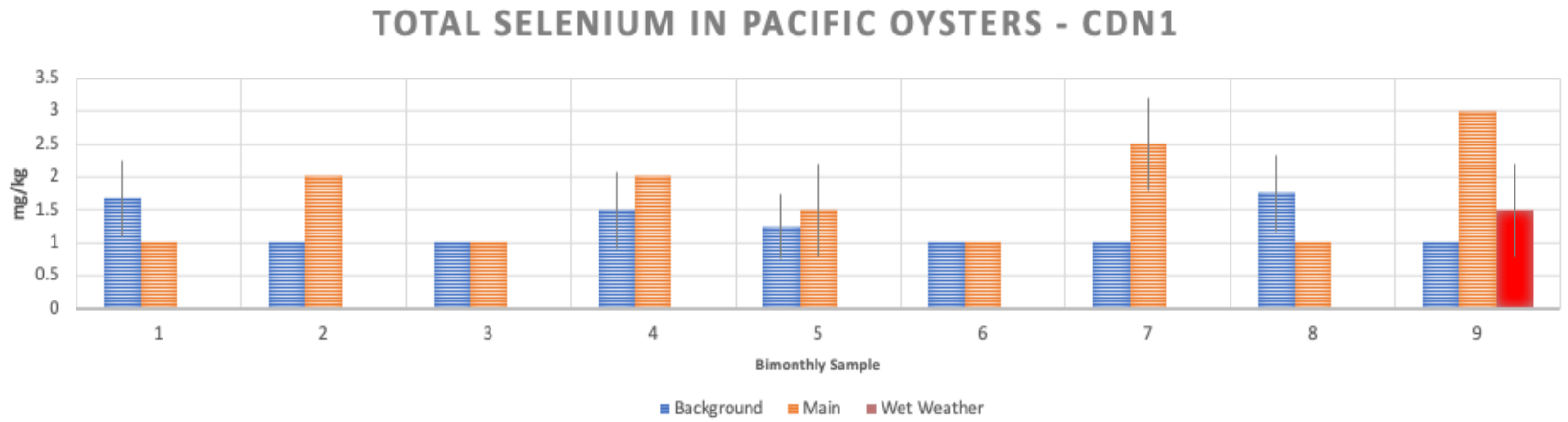

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

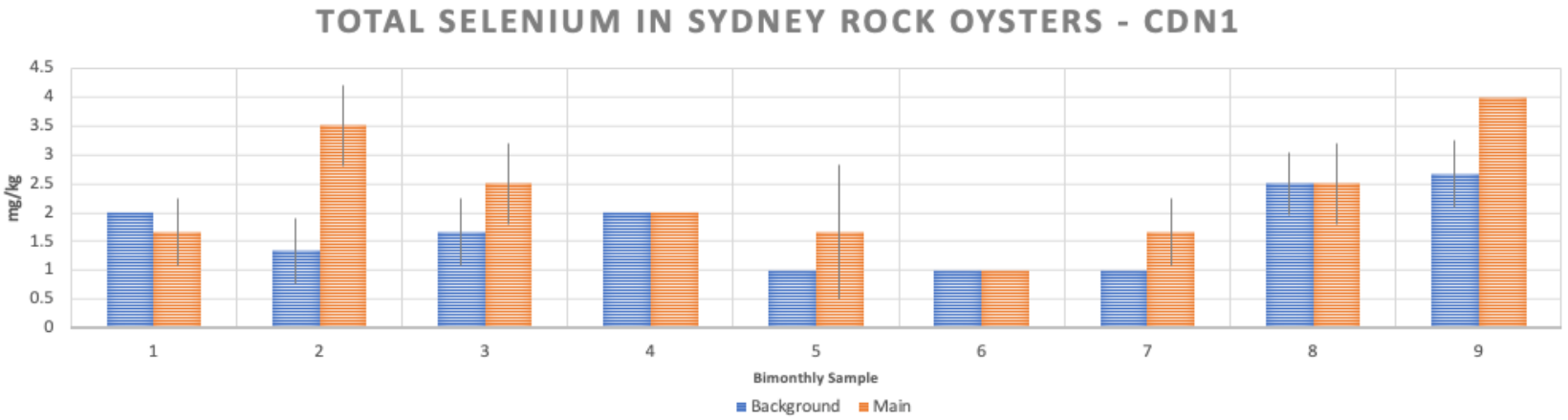

TOTAL SELENIUM IN PACIFIC OYSTERS - NB1
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

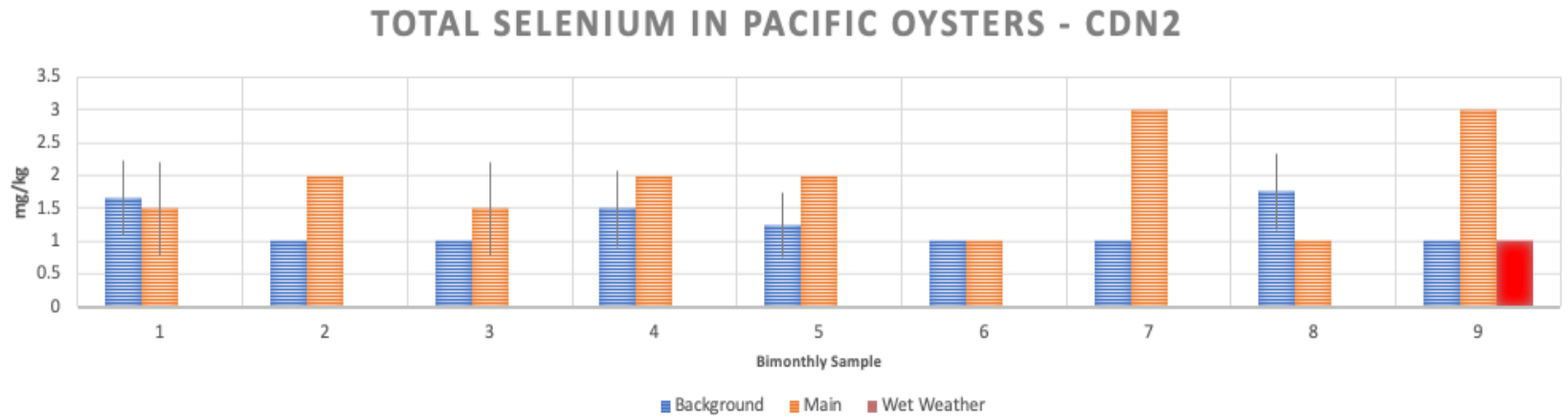

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - NB1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

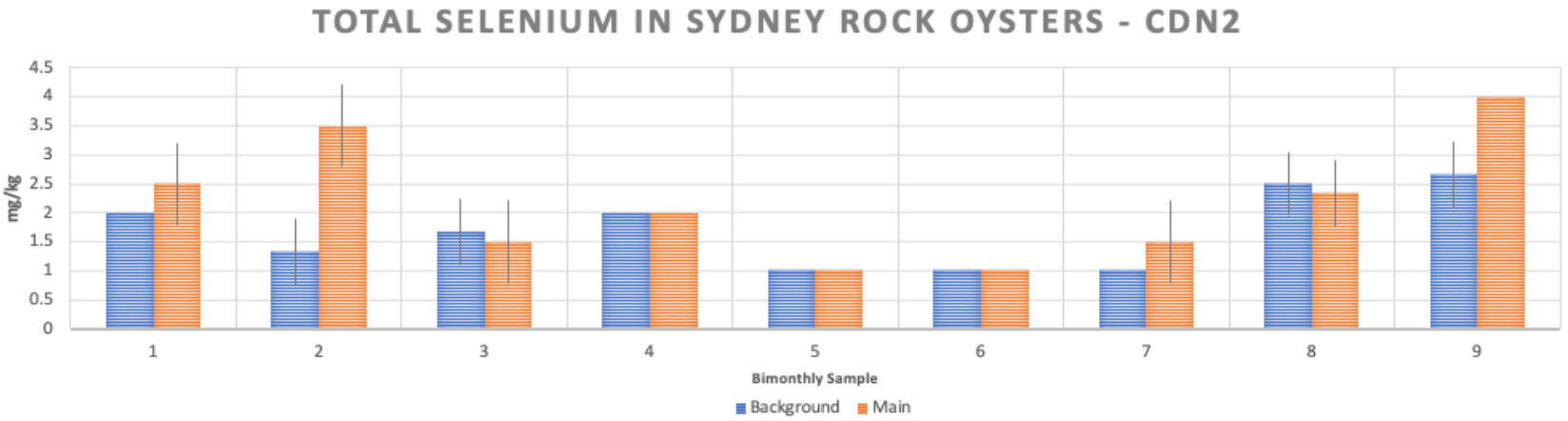

TOTAL SELENIUM IN PACIFIC OYSTERS - NB2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

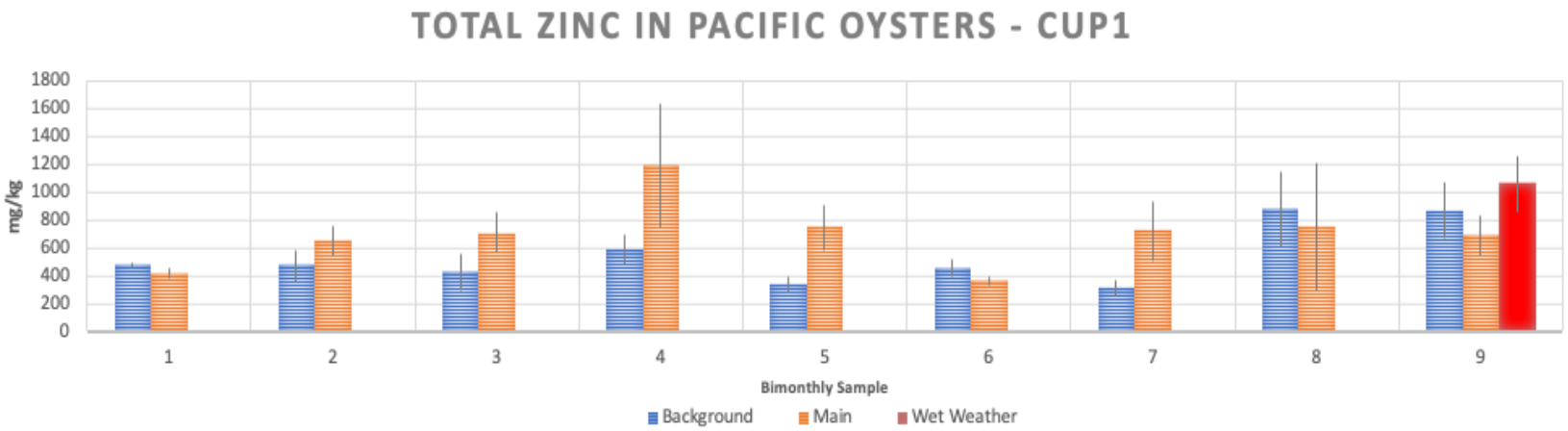

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - NB2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

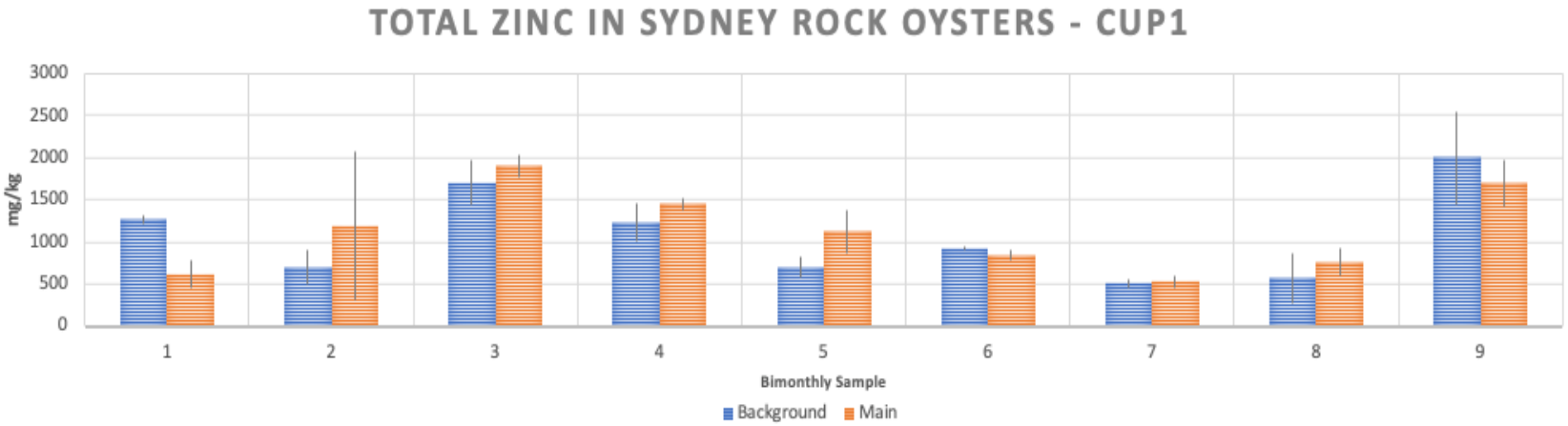

TOTAL SELENIUM IN PACIFIC OYSTERS - CDN1
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

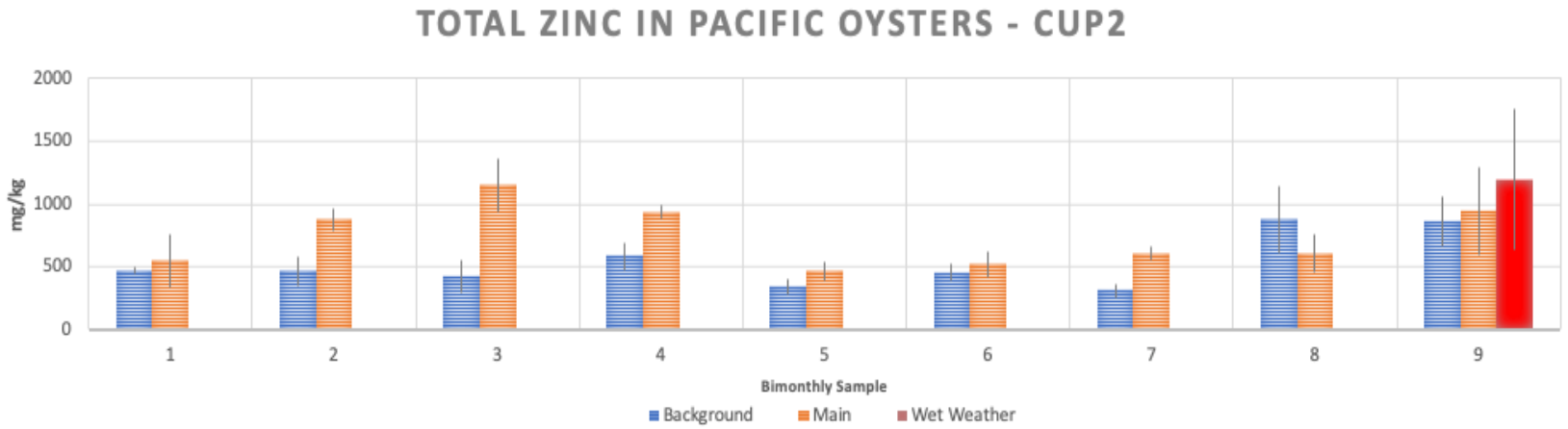

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

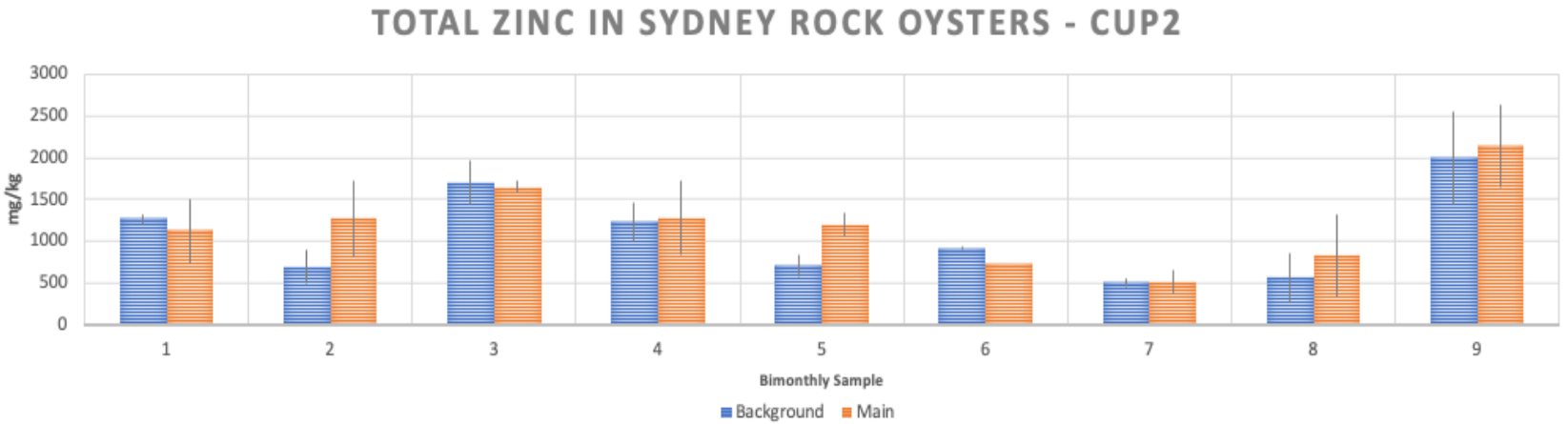

TOTAL SELENIUM IN PACIFIC OYSTERS - CDN2
mg/kg
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

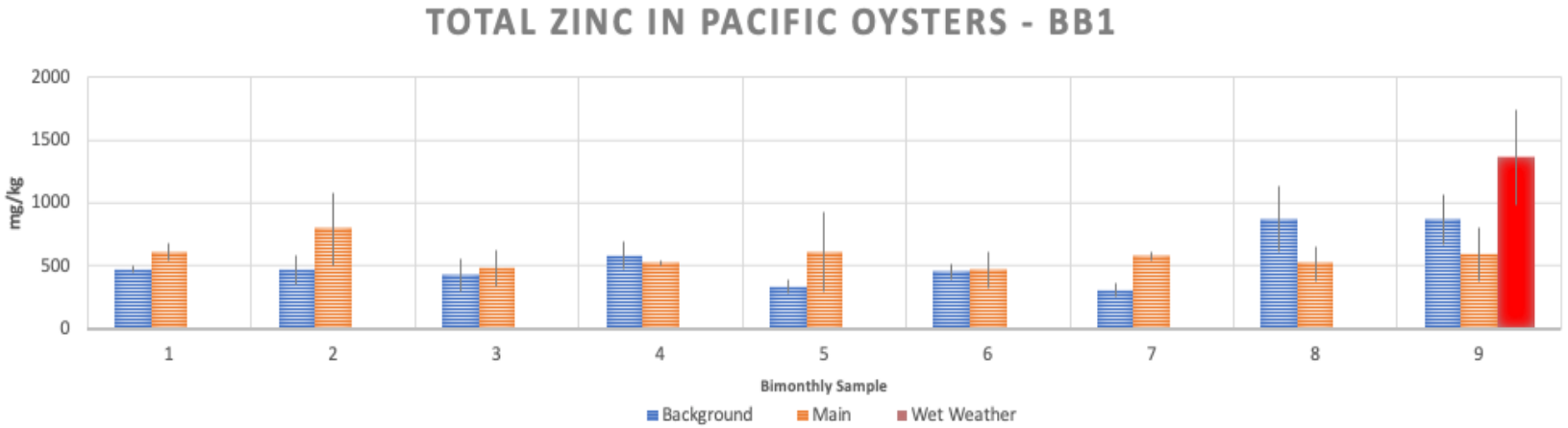

TOTAL SELENIUM IN SYDNEY ROCK OYSTERS - CDN2
mg/kg
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

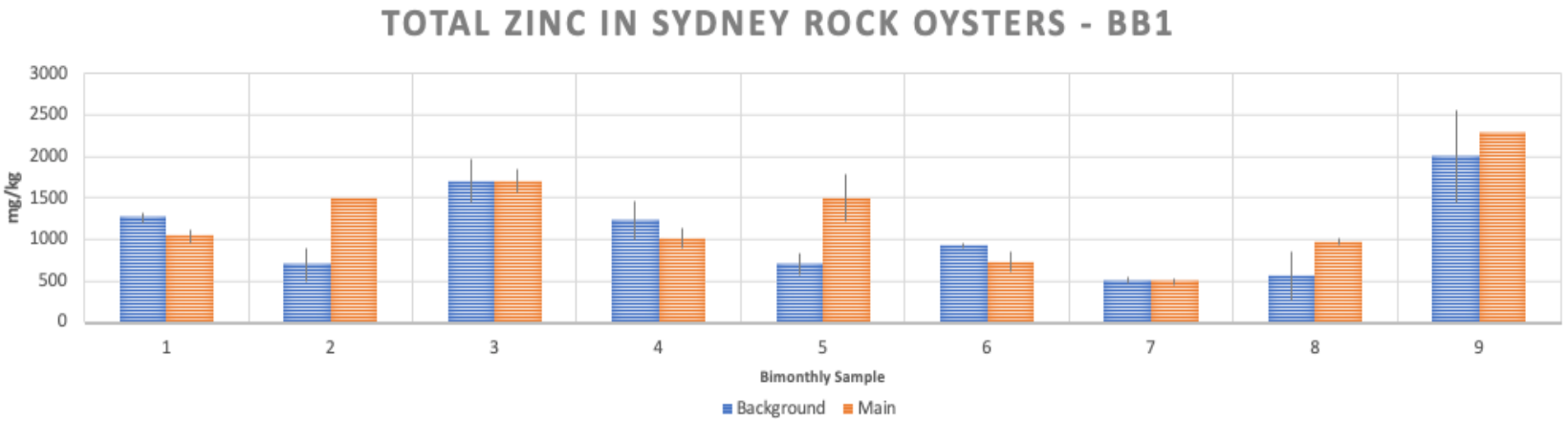

TOTAL ZINC IN PACIFIC OYSTERS - CUP1
mg/kg
1800
1600
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

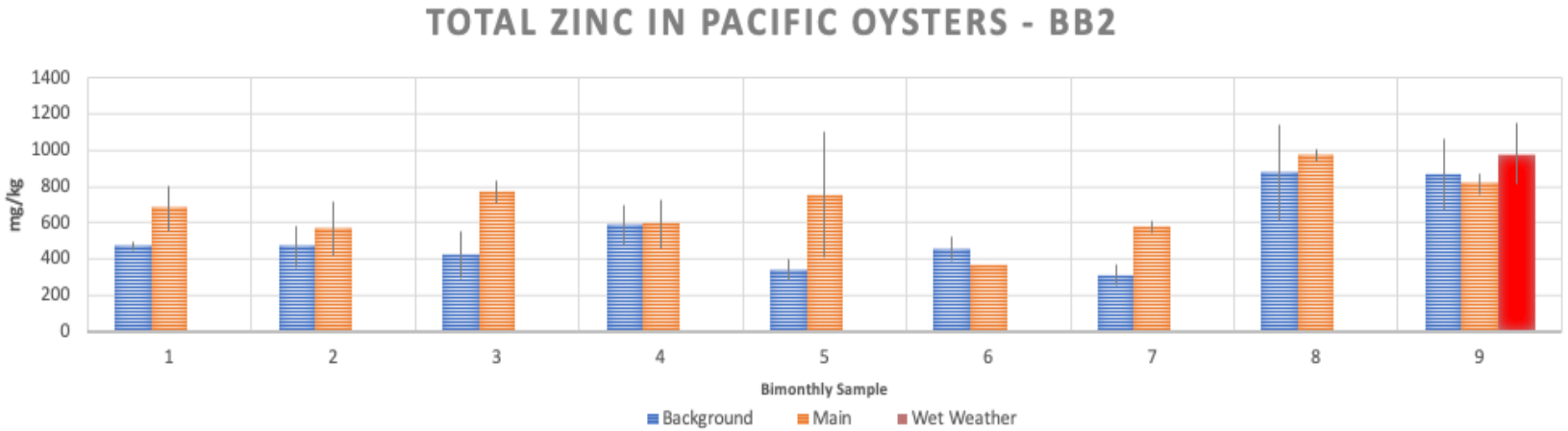

TOTAL ZINC IN SYDNEY ROCK OYSTERS - CUP1
mg/kg
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

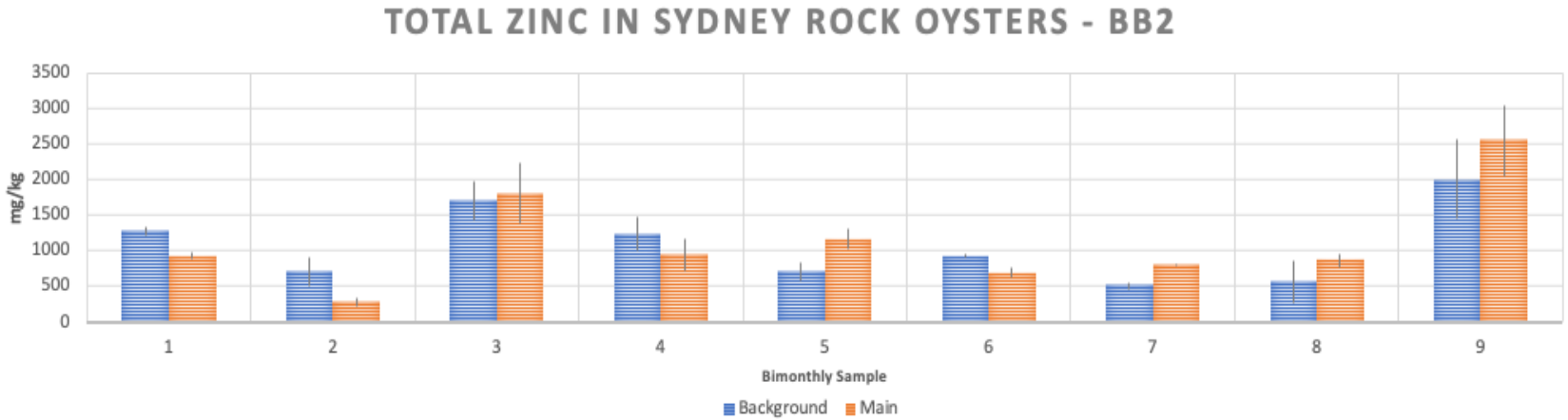

TOTAL ZINC IN PACIFIC OYSTERS - CUP2
2000
1500
1000
500
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

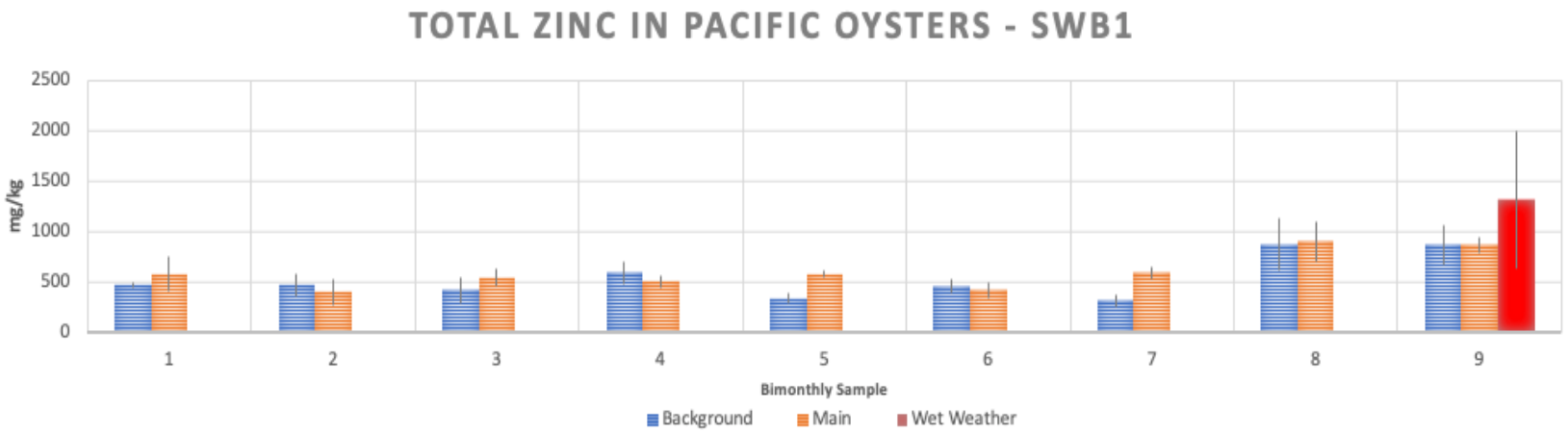

TOTAL ZINC IN SYDNEY ROCK OYSTERS - CUP2
3000
2500
2000
1500
1000
500
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

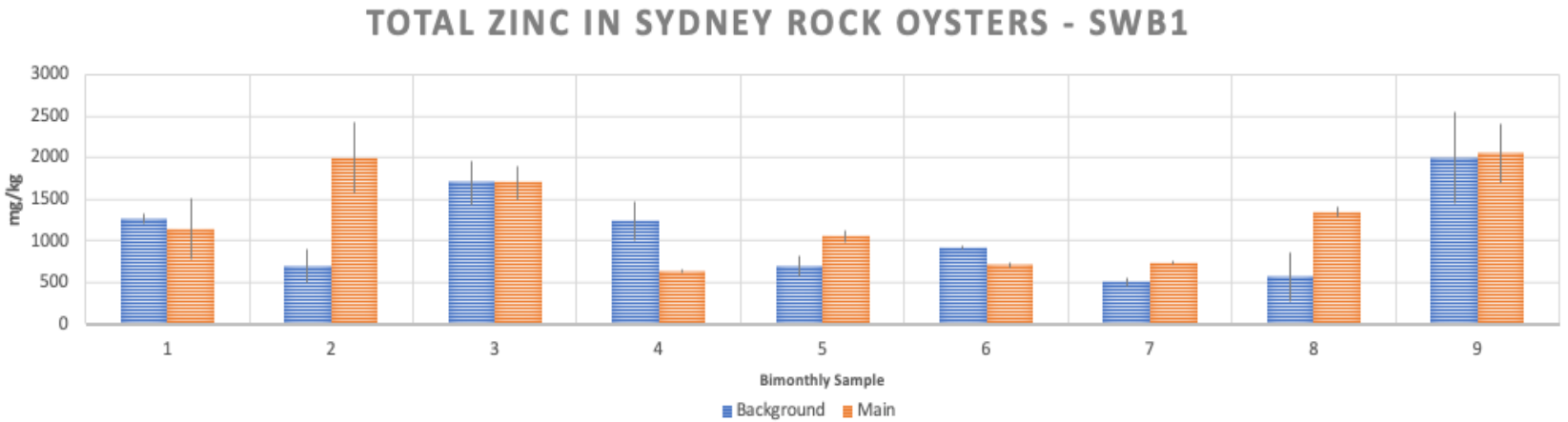

TOTAL ZINC IN PACIFIC OYSTERS - BB1
mg/kg
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

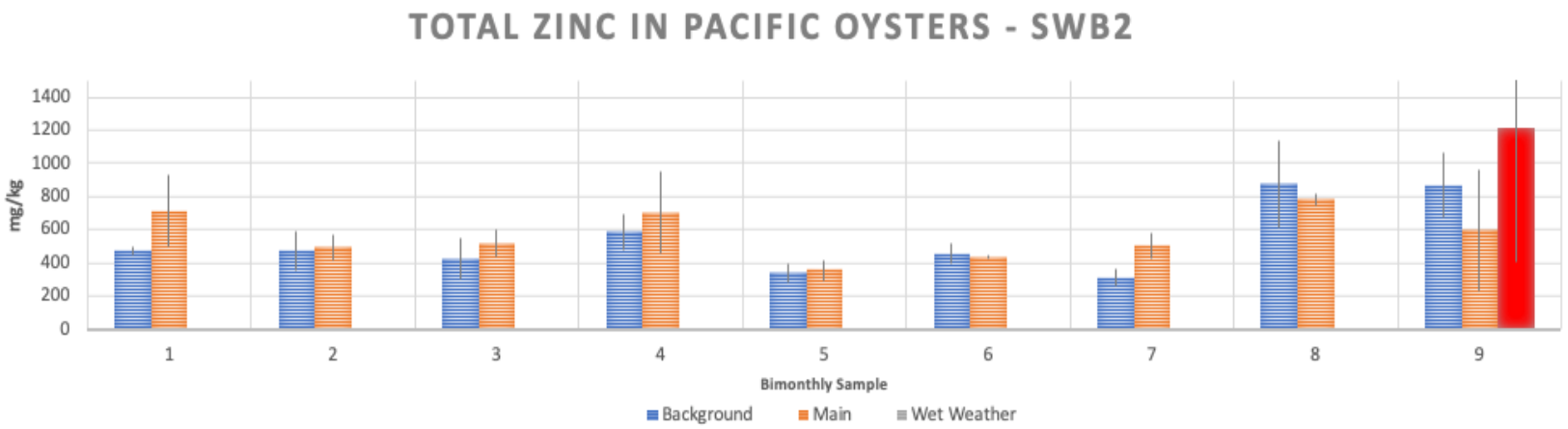

TOTAL ZINC IN SYDNEY ROCK OYSTERS - BB1
mg/kg
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

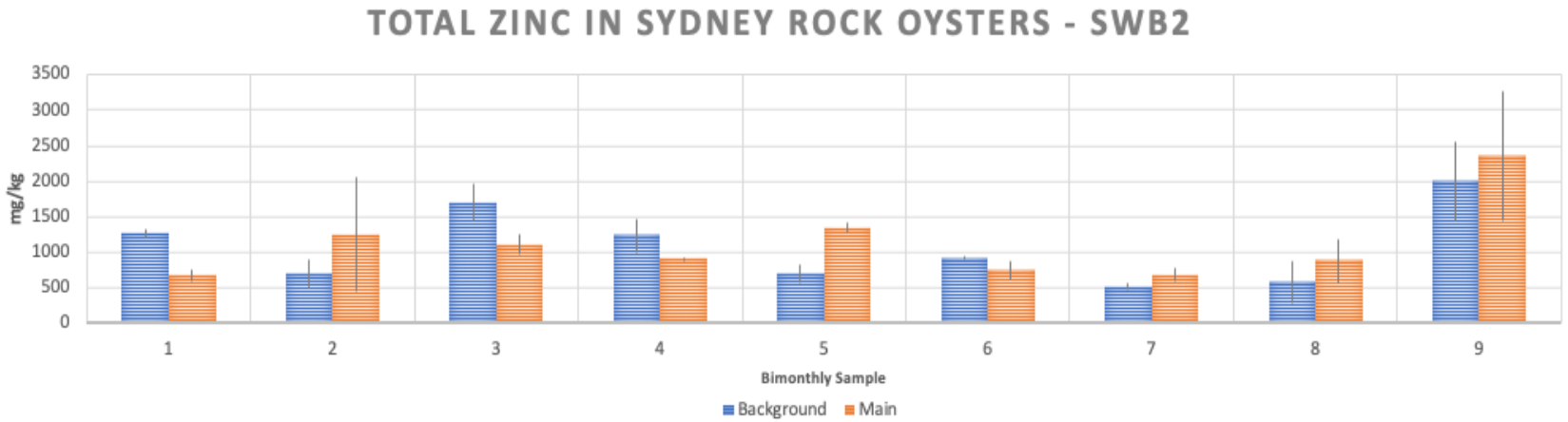

TOTAL ZINC IN PACIFIC OYSTERS - BB2
mg/kg
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

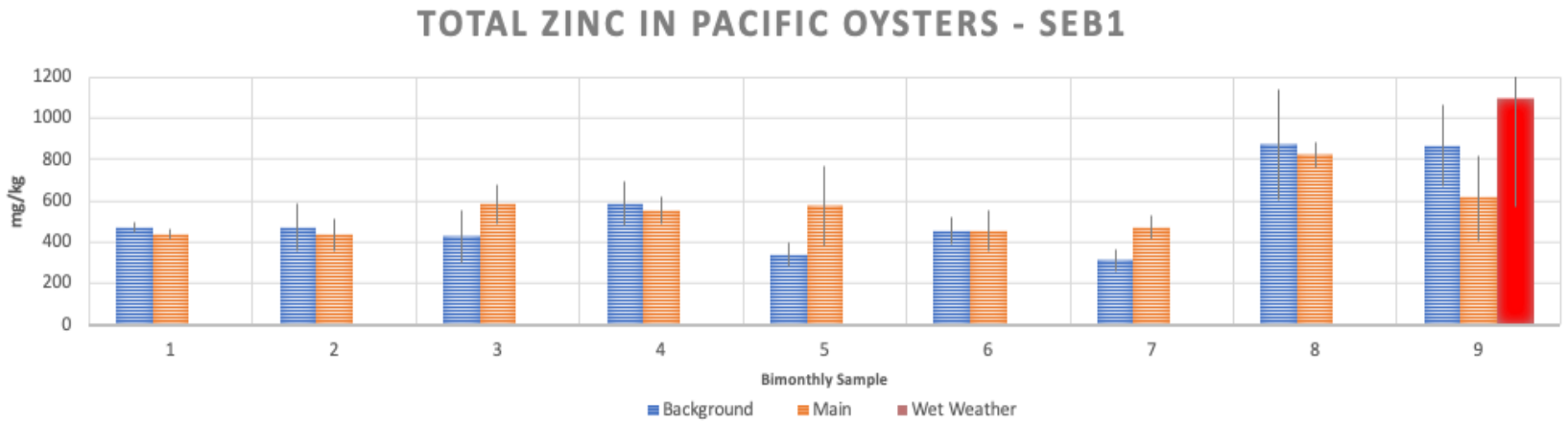

TOTAL ZINC IN SYDNEY ROCK OYSTERS - BB2
mg/kg
3500
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

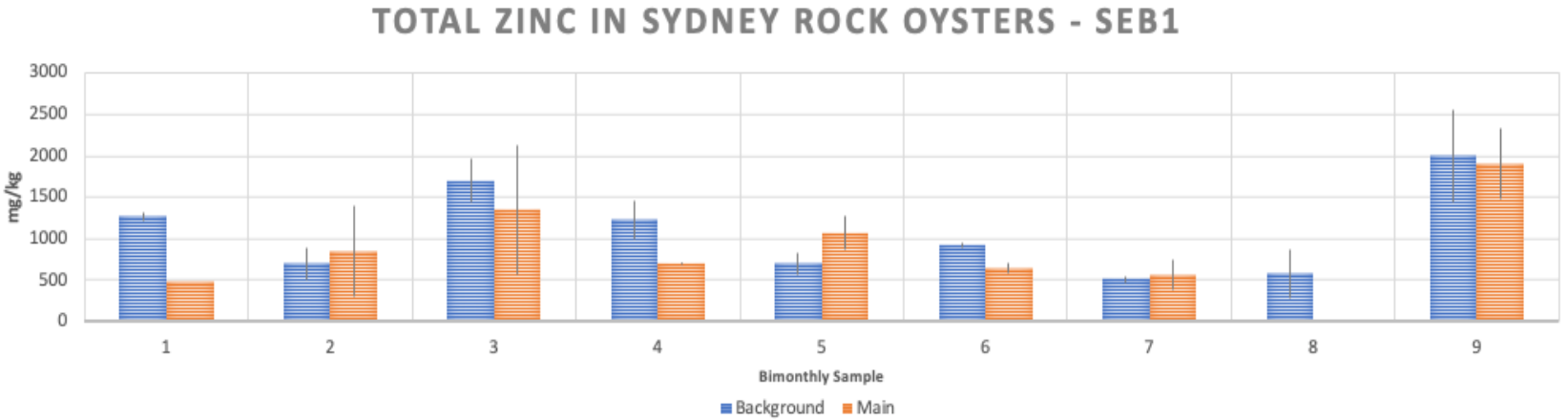

TOTAL ZINC IN PACIFIC OYSTERS - SWB1
2500
2000
1500
1000
500
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

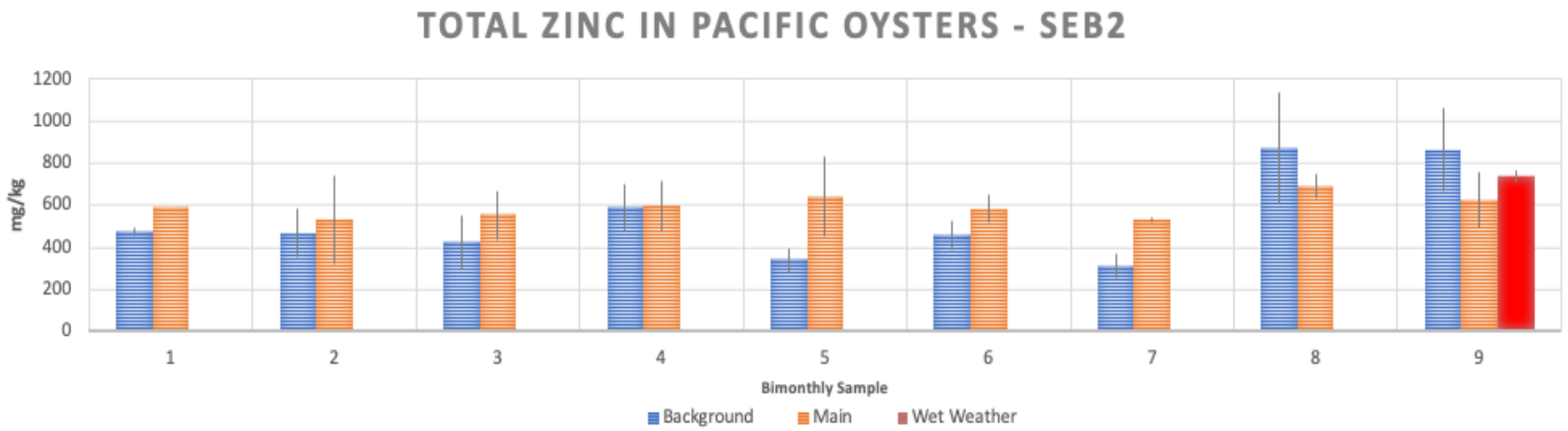

TOTAL ZINC IN SYDNEY ROCK OYSTERS - SWB1
3000
2500
2000
1500
1000
500
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

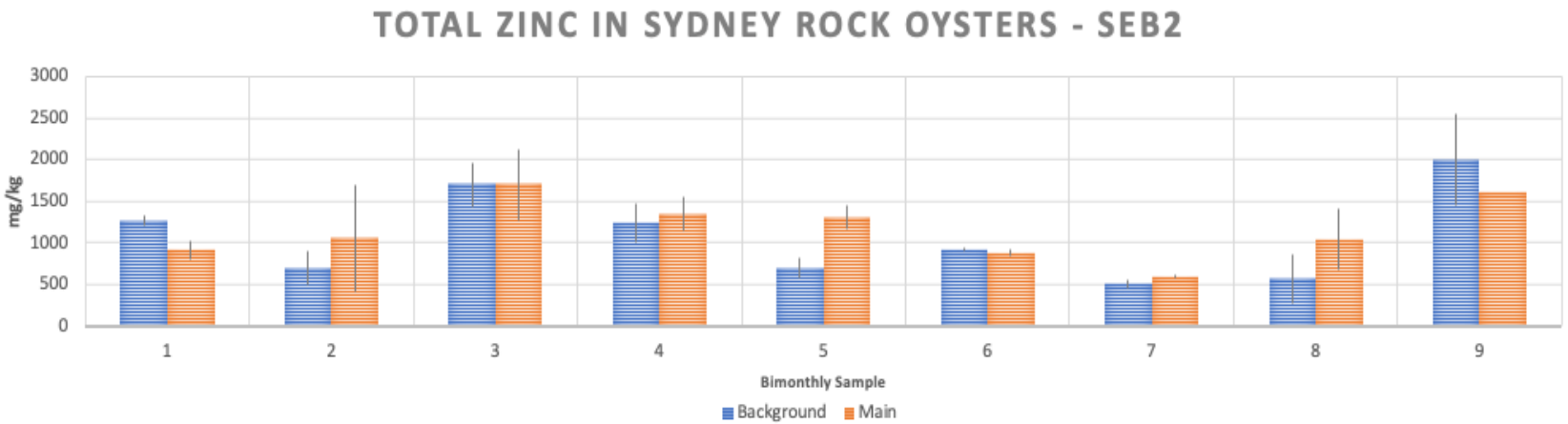

TOTAL ZINC IN PACIFIC OYSTERS - SWB2
mg/kg
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

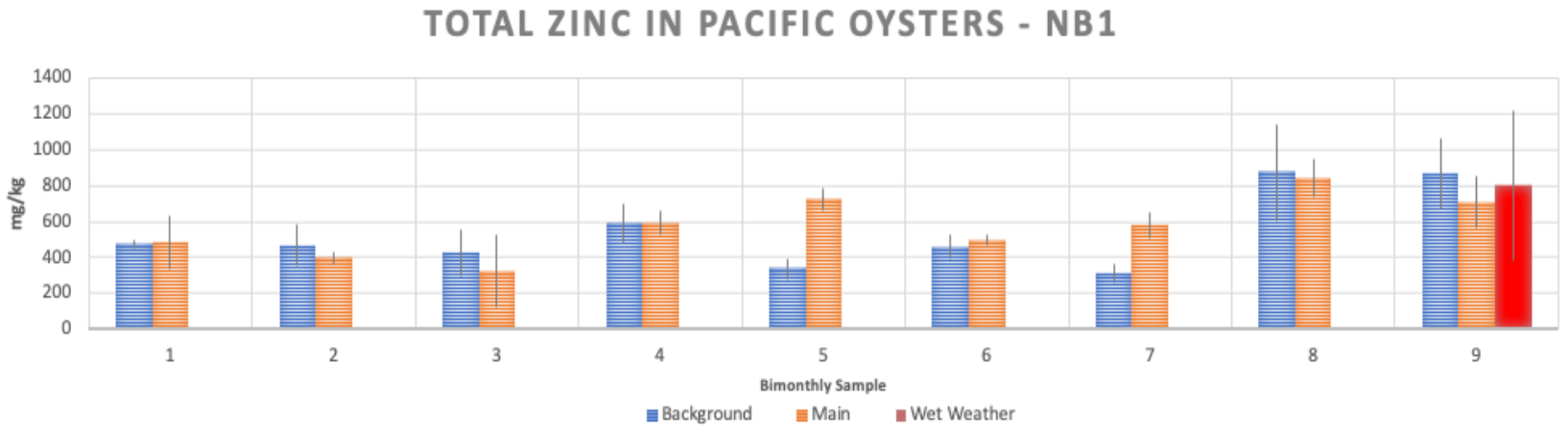

TOTAL ZINC IN SYDNEY ROCK OYSTERS - SWB2
mg/kg
3500
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

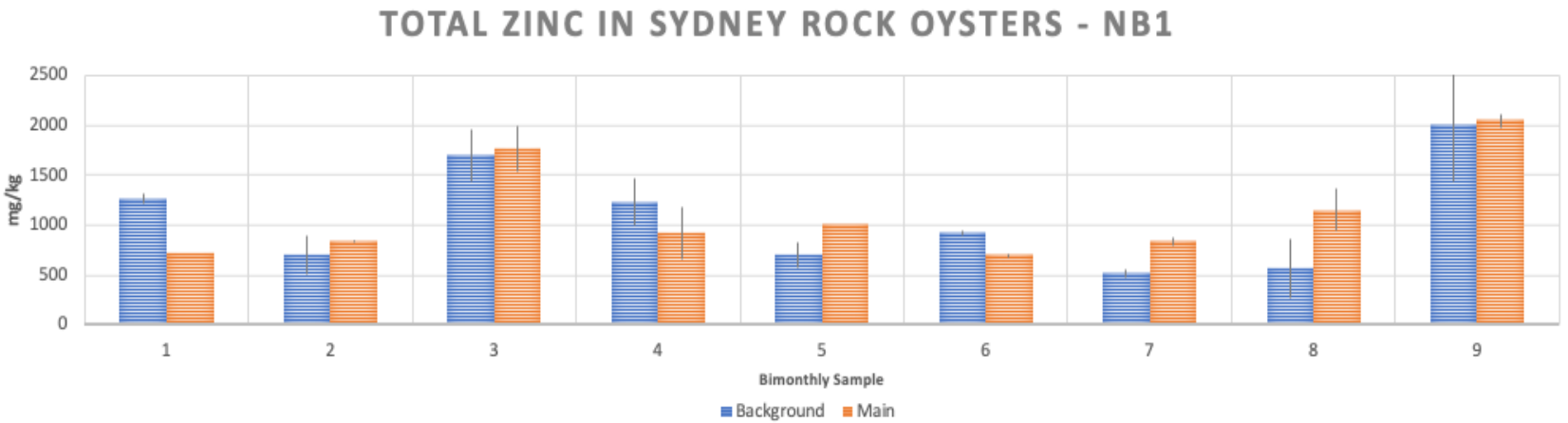

TOTAL ZINC IN PACIFIC OYSTERS - SEB1
mg/kg
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

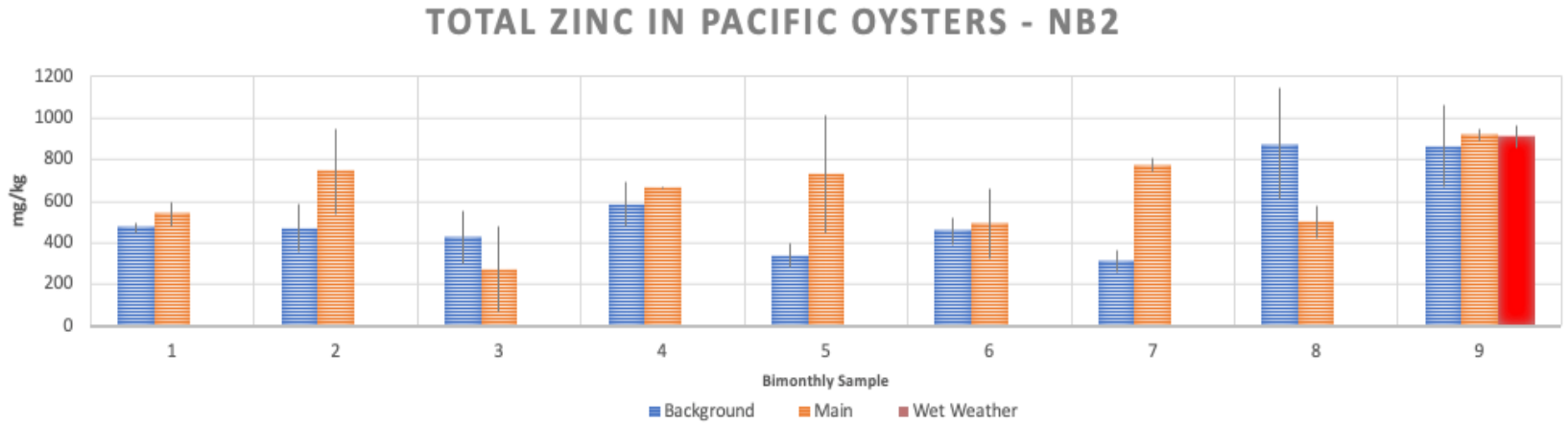

TOTAL ZINC IN SYDNEY ROCK OYSTERS - SEB1
mg/kg
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

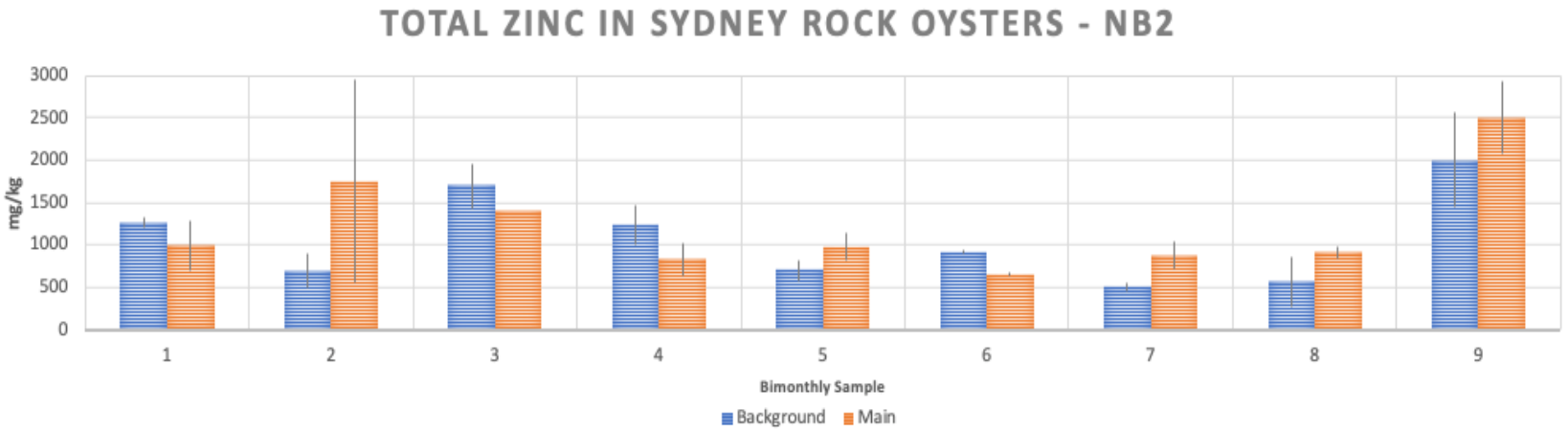

TOTAL ZINC IN PACIFIC OYSTERS - SEB2
mg/kg
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

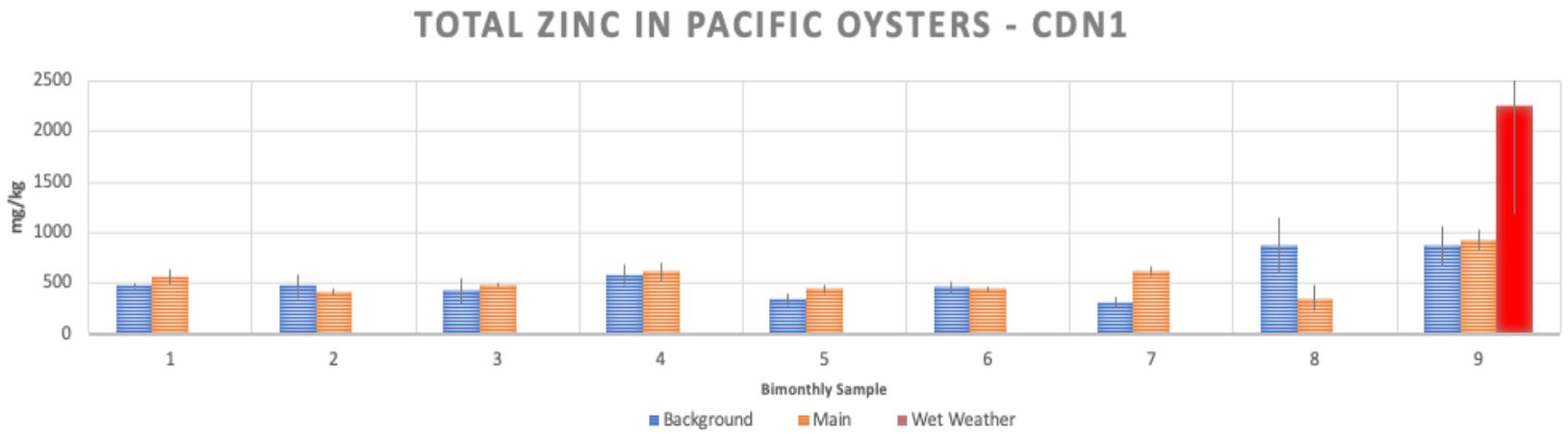

TOTAL ZINC IN SYDNEY ROCK OYSTERS - SEB2
mg/kg
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

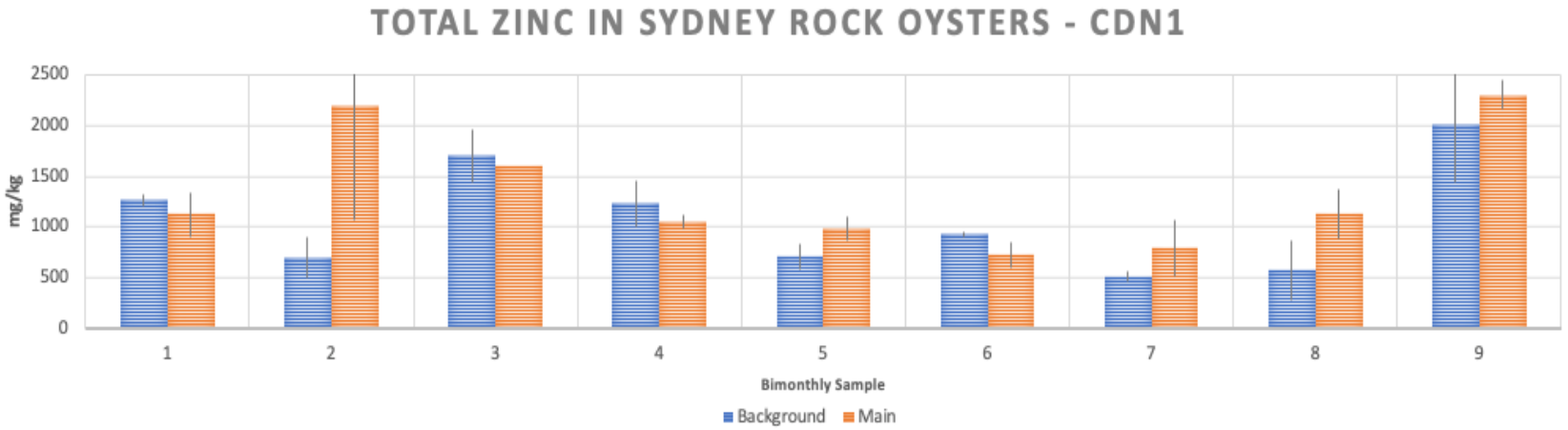

TOTAL ZINC IN PACIFIC OYSTERS - NB1
mg/kg
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather

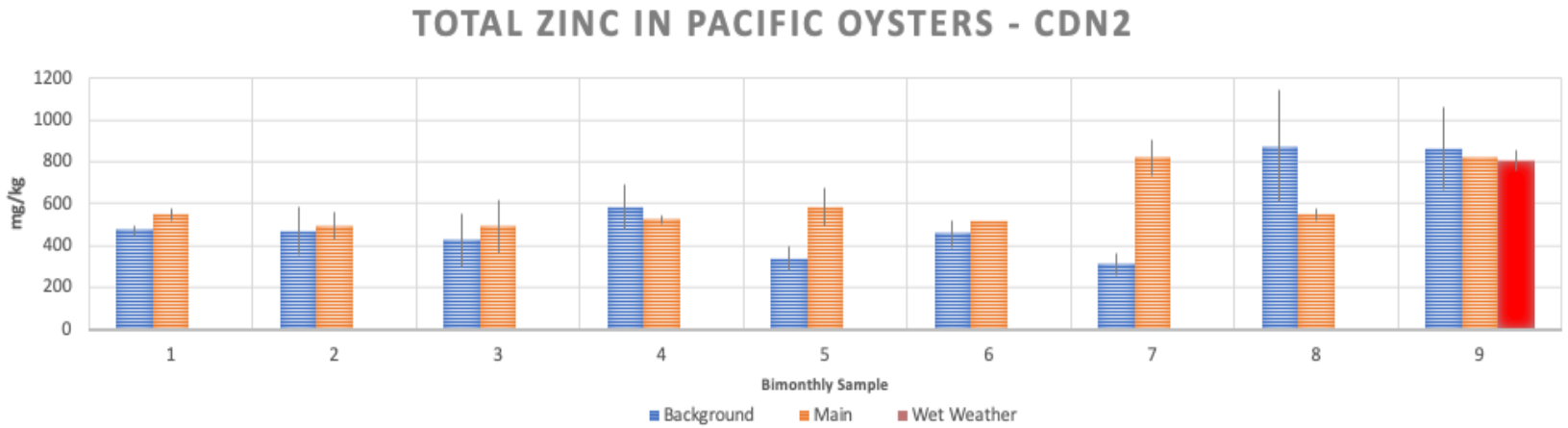

TOTAL ZINC IN SYDNEY ROCK OYSTERS - NB1
mg/kg
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

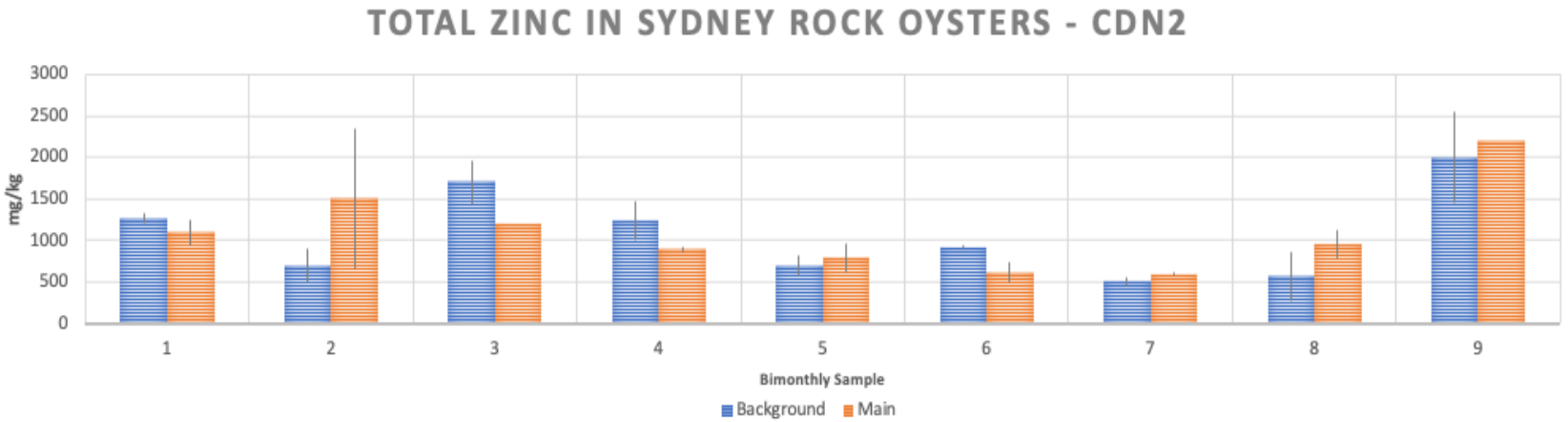

TOTAL ZINC IN PACIFIC OYSTERS - NB2
mg/kg
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather


TOTAL ZINC IN SYDNEY ROCK OYSTERS - NB2
mg/kg
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main


TOTAL ZINC IN PACIFIC OYSTERS - CDN1
mg/kg
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather


TOTAL ZINC IN SYDNEY ROCK OYSTERS - CDN1
mg/kg
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main


TOTAL ZINC IN PACIFIC OYSTERS - CDN2
1200
1000
800
600
400
200
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main
Wet Weather


TOTAL ZINC IN SYDNEY ROCK OYSTERS - CDN2
3000
2500
2000
1500
1000
500
0
mg/kg
1
2
3
4
5
6
7
8
9
Bimonthly Sample
Background
Main

# APPENDIX F
# FRESHWATER MONITORING DATA

## F1.1 WATTLE CREEK WATER QUALITY DATA

## F1.2 DOWNS CREEK WATER QUALITY DATA

## F1.3 SOUTH CREEK WATER QUALITY DATA

## F1.4 SITE WATER LEVEL LOG

## F2.1 ASU MACROINVERTEBRATE PILOT RESULTS

## F2.2 ASU MACROINVERTEBRATE RESULTS TERM 1

## F2.3 ASU MACROINVERTEBRATE RESULTS TERM 2

## F2.4 ASU MACROINVERTEBRATE RESULTS TERM 3

## F2.5 ASU MACROINVERTEBRATE RESULTS TERM 4

## F2.6 ASU MACROINVERTEBRATE RESULTS TERM 5

## F2.7 ASU MACROINVERTEBRATE RESULTS TERM 6

## F3 ELECTROFISHING FISH CATCH RESULTS

# APPENDIX F1

# WATER QUALITY DATA

| Appendix Table F1.1 Wattle Creek Water Quality Profiling Results December 2022 to May 2024 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Creek** | **Site** | **Date** | **Time** | **Depth** | **Temp** | **Cond** | **Sal** | **DO** | **DO** | **pH** | **Turb** | **MGA 56** | |
| | | | | M | °C | µS/cm | ppt | %sat | mg/l | Units | ntu | Easting | Northing |
| Wattle Creek | WCUP | 6/12/2022 | 13:26 | 0.1 | 28.35 | 400 | 0.19 | 119.4 | 9.27 | 6.59 | 4.9 | 294632 | 6131715 |
| Wattle Creek | WCUP | 23/3/2023 | 13.26 | 0.1 | 18.69 | 482 | 0.23 | 42.6 | 3.97 | 5.74 | 0.1 | 294632 | 6131715 |
| Wattle Creek | WCUP | 23/3/2023 | 9:00 | 0.2 | 18.69 | 482 | 0.23 | 40.0 | 3.73 | 5.78 | 0.2 | 294632 | 6131715 |
| Wattle Creek | WCUP | 28/3/23 | 9:00 | 0.1 | 20.31 | 503 | 0.24 | 41.9 | 3.78 | 5.87 | 0.2 | 294632 | 6131715 |
| Wattle Creek | WCUP | 28/3/23 | 8.02 | 0.2 | 20.32 | 504 | 0.24 | 41.5 | 3.74 | 5.88 | 1.0 | 294632 | 6131715 |
| Wattle Creek | WCUP | 6/9/2023 | 8.02 | 0.1 | 12.51 | 435 | 0.32 | 88.0 | 9.37 | 5.66 | 2.1 | 294632 | 6131715 |
| Wattle creek | WCUP | 28/11/2023 | 11.33 | 0.1 | 19.61 | 428 | 0.19 | 58.0 | 5.31 | 5.19 | 2.7 | 294632 | 6131715 |
| Wattle creek | WCUP | 28/11/2023 | 11.33 | 0.2 | 19.58 | 424 | 0.19 | 57.5 | 5.27 | 5.19 | 2.5 | 294632 | 6131715 |
| Wattle creek | WCUP | 3/1/2024 | 16.16 | 0.1 | 24.36 | 355 | 0.16 | 75.7 | 6.32 | 5.05 | 7.1 | 294632 | 6131715 |
| Wattle creek | WCUP | 3/1/2024 | 16.16 | 0.3 | 23.67 | 223 | 0.09 | 75.8 | 6.41 | 5.07 | 57.3 | 294632 | 6131715 |
| Wattle creek | WCUP | 8/5/2024 | 12.31 | 0.1 | 16.06 | 138 | 0.05 | 78.0 | 7.70 | 5.92 | 21.8 | 294632 | 6131715 |
| Wattle creek | WCUP | 8/5/2024 | 12.31 | 0.2 | 16.07 | 138 | 0.05 | 77.8 | 7.67 | 5.95 | 20.1 | 294632 | 6131715 |
| Wattle creek | WCUP | 8/5/2024 | 12.31 | 0.3 | 16.04 | 141 | 0.06 | 77.3 | 7.63 | 5.97 | 35.4 | 294632 | 6131715 |
| Wattle Creek | WCDN | 6/12/2022 | 14:10 | 0.1 | 23.79 | 1589 | 0.77 | 21.9 | 1.84 | 6.25 | 60.4 | 294760 | 6131659 |
| Wattle Creek | WCDN | 6/12/2022 | 14:10 | 0.3 | 21.47 | 1633 | 0.8 | 37.4 | 3.29 | 6.22 | 64.9 | 294760 | 6131659 |
| Wattle Creek | WCDN | 6/12/2022 | 14:11 | 0.7 | 19.23 | 1758 | 0.87 | 26.1 | 2.4 | 6.19 | 38.9 | 294760 | 6131659 |
| Wattle Creek | WCDN | 24/1/2023 | | 0.1 | 27.4 | 1988 | 1.01 | 43.6 | 3.4 | 6.44 | 27.3 | 294760 | 6131659 |
| Wattle Creek | WCDN | 24/1/2023 | | 0.2 | 23.9 | 1965 | 1.00 | 31.3 | 2.6 | 6.52 | 29.0 | 294760 | 6131659 |
| Wattle Creek | WCDN | 24/1/2023 | | 0.3 | 23.1 | 1960 | 1.00 | 23.4 | 2.0 | 6.54 | 61.1 | 294760 | 6131659 |
| Wattle Creek | WCDN | 23/3/2023 | | 0.1 | 19.2 | 1426 | 0.72 | 14.4 | 1.3 | 5.80 | 12.7 | 294760 | 6131659 |
| Wattle Creek | WCDN | 23/3/2023 | | 0.2 | 19.2 | 1438 | 0.72 | 13.3 | 1.2 | 5.82 | 16.3 | 294760 | 6131659 |
| Wattle Creek | WCDN | 23/3/2023 | | 0.3 | 19.3 | 1528 | 0.77 | 12.2 | 1.1 | 5.91 | 19.5 | 294760 | 6131659 |
| Wattle Creek | WCDN | 23/3/2023 | | 0.4 | 19.8 | 1924 | 0.98 | 9.3 | 0.9 | 6.06 | 19.4 | 294760 | 6131659 |
| Wattle Creek | WCDN | 28/3/23 | 8:42 | 0.1 | 20.13 | 1261 | 0.63 | 41.1 | 3.71 | 5.97 | 0.5 | 294760 | 6131659 |
| Wattle Creek | WCDN | 28/3/23 | 8:42 | 0.1 | 20.13 | 1267 | 0.63 | 37.3 | 3.37 | 6.00 | 0.6 | 294760 | 6131659 |
| Wattle Creek | WCDN | 28/3/23 | 8:44 | 0.2 | 19.92 | 1708 | 0.88 | 13.5 | 1.22 | 6.10 | 16.6 | 294760 | 6131659 |
| Wattle Creek | WCDN | 28/3/23 | 8:44 | 0.4 | 19.76 | 2181 | 1.13 | 11.1 | 1.01 | 6.19 | 23.5 | 294760 | 6131659 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wattle Creek | WCDN | 28/3/23 | 8:45 | 0.5 | 19.67 | 2609 | 1.30 | 10.0 | 0.91 | 6.28 | 25.6 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:22 | 0.1 | 12.48 | 844 | 0.54 | 65.8 | 7.00 | 5.95 | 44.4 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:23 | 0.2 | 12.44 | 842 | 0.54 | 53.5 | 5.70 | 5.90 | 44.0 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:23 | 0.3 | 12.35 | 842 | 0.54 | 49.4 | 5.27 | 5.89 | 43.2 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:23 | 0.4 | 12.29 | 849 | 0.54 | 46.0 | 4.92 | 5.88 | 41.9 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:23 | 0.5 | 12.25 | 862 | 0.55 | 42.8 | 4.58 | 5.86 | 42.8 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:23 | 0.6 | 12.24 | 872 | 0.55 | 40.0 | 4.28 | 5.84 | 43.5 | 294760 | 6131659 |
| Wattle Creek | WCDN | 9/6/23 | 11:24 | 0.7 | 12.25 | 871 | 0.55 | 35.2 | 3.76 | 5.8 | 42.1 | 294760 | 6131659 |
| Wattle Creek | WCDN | 5/7/23 | 11:59 | 0.1 | 11.45 | 943 | 0.59 | 30.7 | 3.34 | 5.72 | 10.8 | 294760 | 6131659 |
| Wattle Creek | WCDN | 5/7/23 | 11:59 | 0.2 | 11.42 | 945 | 0.59 | 28.9 | 3.15 | 5.72 | 10.7 | 294760 | 6131659 |
| Wattle Creek | WCDN | 5/7/23 | 11:59 | 0.3 | 11.25 | 957 | 0.59 | 28.4 | 3.1 | 5.73 | 10.9 | 294760 | 6131659 |
| Wattle Creek | WCDN | 5/7/23 | 11:59 | 0.4 | 11.03 | 988 | 0.61 | 27.8 | 3.06 | 5.78 | 10.9 | 294760 | 6131659 |
| Wattle Creek | WCDN | 5/7/23 | 11:59 | 0.5 | 11.07 | 1094 | 0.67 | 26.2 | 2.87 | 5.85 | 20.0 | 294760 | 6131659 |
| Wattle Creek | WCDN | 11/9/2023 | 17:08 | 0.4 | 12.7 | 1433 | 0.7 | 31.0 | 3.28 | 6.36 | 26.6 | 294760 | 6131659 |
| Wattle Creek | WCDN | 11/9/2023 | 17:08 | 0.4 | 13.05 | 1436 | 0.7 | 26.9 | 2.82 | 6.35 | 26.4 | 294760 | 6131659 |
| Wattle Creek | WCDN | 11/9/2023 | 17:08 | 0.4 | 12.65 | 1440 | 0.7 | 26.4 | 2.79 | 6.37 | 23.6 | 294760 | 6131659 |
| Wattle Creek | WCDN | 27/11/2023 | 19:45 | 0.3 | 26.57 | 2311 | 1.17 | 96.2 | 7.67 | 6.68 | 18.3 | 294760 | 6131659 |
| Wattle Creek | WCDN | 27/11/2023 | 19:45 | 0.3 | 26.59 | 2310 | 1.16 | 94 | 7.49 | 6.69 | 18.3 | 294760 | 6131659 |
| Wattle Creek | WCDN | 27/11/2023 | 19:45 | 0.3 | 26.75 | 2315 | 1.17 | 98.9 | 7.86 | 6.72 | 21.3 | 294760 | 6131659 |
| Wattle creek | WCDN | 28/11/2023 | 17:43 | 0.3 | 19.17 | 355 | 0.15 | 57.8 | 5.34 | 5.12 | 5.3 | 294760 | 6131659 |
| Wattle creek | WCDN | 28/11/2023 | 17:43 | 0.6 | 19.17 | 355 | 0.15 | 57.7 | 5.33 | 5.12 | 5.2 | 294760 | 6131659 |
| Wattle creek | WCDN | 3/1/2024 | 20:30 | 0.7 | 23.78 | 492 | 0.22 | 48.5 | 4.09 | 5.02 | 4.9 | 294760 | 6131659 |
| Wattle creek | WCDN | 3/1/2024 | 20:31 | 1.0 | 22.17 | 576 | 0.27 | 32.2 | 2.81 | 5.02 | 10.1 | 294760 | 6131659 |
| Wattle creek | WCDN | 3/1/2024 | 20:32 | 1.2 | 20.6 | 942 | 0.46 | 12.5 | 1.12 | 5.36 | 5.4 | 294760 | 6131659 |
| Wattle creek | WCDN | 3/1/2024 | 20:33 | 1.5 | 20.02 | 1516 | 0.74 | 12.1 | 1.09 | 5.51 | 7.5 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.41 | 0.1 | 16.2 | 133 | 0.05 | 80.0 | 7.86 | 5.56 | 21.7 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.41 | 0.2 | 16.2 | 132 | 0.05 | 79.1 | 7.77 | 5.49 | 21.0 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.42 | 0.3 | 16.2 | 132 | 0.05 | 79.0 | 7.77 | 5.49 | 20.6 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.42 | 0.4 | 16.2 | 133 | 0.05 | 78.9 | 7.76 | 5.53 | 21.4 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.42 | 0.5 | 16.2 | 132 | 0.05 | 78.8 | 7.75 | 5.56 | 20.2 | 294760 | 6131659 |
| Wattle creek | WCDN | 8/5/24 | 12.43 | 0.6 | 16.2 | 133 | 0.05 | 78.3 | 7.70 | 5.49 | 22.1 | 294760 | 6131659 |

| Appendix Table F1.2 Downs Creek Water Quality Profiling Results December 2022 to May 2024 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Creek** | **Site** | **Date** | **Time** | **Depth** | **Temp** | **Cond** | **Sal** | **DO** | **DO** | **pH** | **Turb** | **MGA 56** | |
| | | | | M | °C | µS/cm | ppt | %sat | mg/l | Units | ntu | Easting | Northing |
| Downs Creek | DCUP | 6/12/2022 | 16:58 | 0.1 | 22.07 | 935 | 0.47 | 52.3 | 4.55 | 7.05 | 7.4 | 293653 | 6131705 |
| Downs Creek | DCUP | 6/12/2022 | 16:58 | 0.2 | 21.99 | 936 | 0.47 | 52.5 | 4.58 | 7.05 | 7.4 | 293653 | 6131705 |
| Downs Creek | DCUP | 6/12/2022 | 16:58 | 0.3 | 20.61 | 935 | 0.47 | 50.5 | 4.52 | 6.99 | 9.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 6/12/2022 | 16:59 | 0.6 | 19.97 | 958 | 0.48 | 40.1 | 3.64 | 6.94 | 17.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 6/12/2022 | 16:59 | 0.8 | 19.13 | 1176 | 0.59 | 26.6 | 2.45 | 6.72 | 22.9 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:14 | 0.1 | 23.4 | 548 | 0.27 | 40.6 | 3.45 | 6.8 | 14.6 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:15 | 0.2 | 20.96 | 534 | 0.26 | 35.1 | 3.13 | 6.85 | 16.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:15 | 0.3 | 20.6 | 528 | 0.26 | 30.6 | 2.75 | 6.85 | 15.4 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:15 | 0.4 | 20.6 | 778 | 0.38 | 23.7 | 2.12 | 6.88 | 23.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:16 | 0.5 | 20.63 | 1128 | 0.57 | 16.0 | 1.43 | 6.95 | 37.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 24/1/2023 | 10:16 | 0.6 | 19.88 | 1784 | 0.91 | 12.2 | 1.11 | 6.97 | 9.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 23/3/2023 | 9:22 | 0.1 | 19.55 | 743 | 0.36 | 34.7 | 3.18 | 7.05 | 1.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 23/3/2023 | 9:23 | 0.2 | 19.55 | 741 | 0.36 | 32.7 | 3.00 | 7.07 | 0.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 23/3/2023 | 9:23 | 0.3 | 19.54 | 739 | 0.35 | 32.2 | 2.95 | 7.08 | 0.6 | 293653 | 6131705 |
| Downs Creek | DCUP | 23/3/2023 | 9:23 | 0.4 | 19.54 | 762 | 0.37 | 30.1 | 2.76 | 7.08 | 1.4 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:26 | 0.1 | 22.27 | 411 | 0.21 | 73.8 | 6.41 | 6.92 | 1.8 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:27 | 0.2 | 21.33 | 616 | 0.3 | 68.2 | 6.03 | 6.99 | 2.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:27 | 0.3 | 20.73 | 651 | 0.32 | 62.8 | 5.62 | 7.04 | 1.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:27 | 0.4 | 20.71 | 651 | 0.32 | 57.1 | 5.11 | 7.07 | 0.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:28 | 0.5 | 20.58 | 657 | 0.32 | 55.1 | 4.94 | 7.08 | 0.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:28 | 0.6 | 20.41 | 684 | 0.34 | 45.5 | 4.1 | 7.06 | 1.9 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/3/2023 | 13:28 | 0.7 | 20.36 | 698 | 0.34 | 34.9 | 3.15 | 7.04 | 3.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 10:59 | 0.1 | 12.71 | 837 | 0.54 | 50.4 | 5.34 | 6.9 | 4.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 11:00 | 0.2 | 12.69 | 837 | 0.53 | 48.4 | 5.12 | 6.93 | 4.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 11:00 | 0.3 | 12.68 | 838 | 0.53 | 48.1 | 5.1 | 6.93 | 4.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 11:00 | 0.4 | 12.67 | 848 | 0.54 | 48.0 | 5.09 | 6.93 | 4.2 | 293653 | 6131705 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Downs Creek | DCUP | 9/6/2023 | 11:01 | 0.5 | 12.66 | 858 | 0.54 | 47.8 | 5.07 | 6.93 | 4.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 11:01 | 0.6 | 12.65 | 868 | 0.55 | 47.8 | 5.07 | 6.93 | 4.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 9/6/2023 | 11:01 | 0.7 | 12.65 | 875 | 0.55 | 47.5 | 5.04 | 6.93 | 4.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 4/7/2023 | 11:50 | 0.1 | 11.36 | 1133 | 0.67 | 99.1 | 10.81 | 7.73 | 8.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 4/7/2023 | 11:50 | 0.2 | 11.34 | 1135 | 0.67 | 93.3 | 10.18 | 7.7 | 8.4 | 293653 | 6131705 |
| Downs Creek | DCUP | 4/7/2023 | 11:50 | 0.3 | 11.13 | 1138 | 0.68 | 92.3 | 10.12 | 7.69 | 8.8 | 293653 | 6131705 |
| Downs Creek | DCUP | 4/7/2023 | 11:50 | 0.4 | 10.98 | 1142 | 0.68 | 90.9 | 10 | 7.67 | 9.1 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:57 | 0.3 | 13.44 | 1331 | 0.64 | 70.7 | 7.36 | 7.19 | 6.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:58 | 0.5 | 12.88 | 1330 | 0.64 | 69.7 | 7.34 | 7.18 | 3.8 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:58 | 0.7 | 12.63 | 1328 | 0.64 | 69 | 7.32 | 7.19 | 3.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:58 | 0.8 | 12.41 | 1332 | 0.65 | 68 | 7.25 | 7.2 | 3.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:59 | 1.0 | 12.31 | 1333 | 0.64 | 66.4 | 7.09 | 7.21 | 3.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 11/9/2023 | 14:59 | 0.8 | 12.27 | 1335 | 0.52 | 64.3 | 6.87 | 7.22 | 3.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/11/2023 | 16:10 | 0.3 | 24.49 | 854 | 0.4 | 70.5 | 5.86 | 6.72 | 9.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/11/2023 | 16:11 | 0.5 | 22.72 | 842 | 0.4 | 70.0 | 6.02 | 6.78 | 5.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/11/2023 | 16:11 | 0.6 | 22.12 | 840 | 0.4 | 59.6 | 5.19 | 6.81 | 4.6 | 293653 | 6131705 |
| Downs Creek | DCUP | 27/11/2023 | 16:11 | 0.9 | 21.57 | 843 | 0.4 | 49.8 | 4.38 | 6.81 | 8.6 | 293653 | 6131705 |
| Downs Creek | DCUP | 28/11/2023 | 17:22 | 0.4 | 20.09 | 337 | 0.14 | 74.9 | 6.8 | 5.83 | 17.7 | 293653 | 6131705 |
| Downs Creek | DCUP | 28/11/2023 | 17:22 | 0.6 | 19.57 | 332 | 0.14 | 77.5 | 7.1 | 5.86 | 16.1 | 293653 | 6131705 |
| Downs Creek | DCUP | 28/11/2023 | 17:23 | 1.0 | 19.31 | 338 | 0.14 | 79.4 | 7.31 | 5.85 | 18.0 | 293653 | 6131705 |
| Downs Creek | DCUP | 3/1/2024 | 20:00 | 0.9 | 23.9 | 294 | 0.13 | 64.1 | 5.4 | 5.53 | 17.8 | 293653 | 6131705 |
| Downs Creek | DCUP | 3/1/2024 | 20:00 | 0.9 | 23.86 | 294 | 0.13 | 63.7 | 5.37 | 5.54 | 17.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 3/1/2024 | 20:01 | 1.0 | 21.01 | 272 | 0.12 | 29.2 | 2.6 | 5.53 | 16.1 | 293653 | 6131705 |
| Downs Creek | DCUP | 3/1/2024 | 20:02 | 1.1 | 20.02 | 298 | 0.13 | 12.4 | 1.13 | 5.67 | 17.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.28 | 0.1 | 16.17 | 96 | 0.04 | 94.2 | 9.28 | 5.04 | 24.9 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.29 | 0.2 | 16.16 | 96 | 0.04 | 93.9 | 9.24 | 5.04 | 23.5 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.29 | 0.3 | 16.18 | 96 | 0.04 | 93.8 | 9.23 | 5.06 | 23.1 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.29 | 0.4 | 16.15 | 98 | 0.04 | 93.7 | 9.23 | 5.06 | 23.2 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.3 | 0.5 | 16.18 | 97 | 0.04 | 93.6 | 9.21 | 5.08 | 23.3 | 293653 | 6131705 |
| Downs Creek | DCUP | 8/5/2024 | 11.3 | 0.6 | 16.17 | 98 | 0.04 | 93.6 | 9.21 | 5.08 | 23.3 | 293653 | 6131705 |
| Downs Creek | DCDN | 6/12/2022 | 16:27 | 0.2 | 20.19 | 438 | 0.22 | 35.7 | 3.23 | 6.43 | 14.8 | 293770 | 6131386 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Downs Creek | DCDN | 6/12/2022 | 16:27 | 0.3 | 18.64 | 480 | 0.24 | 19.3 | 1.8 | 6.43 | 13.0 | 293770 | 6131386 |
| Downs Creek | DCDN | 6/12/2022 | 16:27 | 0.6 | 16.86 | 648 | 0.33 | 10.5 | 1.02 | 6.58 | 11.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 24/1/2023 | 10:04 | 0.1 | 19.9 | 791 | 0.39 | 52.0 | 4.73 | 5.21 | 8.6 | 293770 | 6131386 |
| Downs Creek | DCDN | 24/1/2023 | 10:04 | 0.2 | 19.12 | 800 | 0.4 | 53.3 | 4.92 | 5.25 | 5.7 | 293770 | 6131386 |
| Downs Creek | DCDN | 24/1/2023 | 10:05 | 0.3 | 18.78 | 800 | 0.4 | 51.6 | 4.8 | 5.29 | 5.1 | 293770 | 6131386 |
| Downs Creek | DCDN | 24/1/2023 | 10:05 | 0.4 | 18.6 | 802 | 0.4 | 49.1 | 4.58 | 5.32 | 4.7 | 293770 | 6131386 |
| Downs Creek | DCDN | 24/1/2023 | 10:05 | 0.5 | 18.51 | 807 | 0.4 | 46.4 | 4.34 | 5.52 | 18.5 | 293770 | 6131386 |
| Downs Creek | DCDN | 23/3/2023 | 9:14 | 0.1 | 18.41 | 271 | 0.12 | 19.8 | 1.86 | 5.98 | 20.6 | 293770 | 6131386 |
| Downs Creek | DCDN | 23/3/2023 | 9:15 | 0.2 | 18.4 | 270 | 0.12 | 15.5 | 1.46 | 6.01 | 19.0 | 293770 | 6131386 |
| Downs Creek | DCDN | 23/3/2023 | 9:15 | 0.3 | 18.4 | 271 | 0.12 | 12.9 | 1.21 | 6.03 | 18.8 | 293770 | 6131386 |
| Downs Creek | DCDN | 23/3/2023 | 9:16 | 0.4 | 18.52 | 376 | 0.17 | 10.2 | 0.96 | 6.65 | 18.3 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:22 | 0.1 | 20.3 | 338 | 0.17 | 12.7 | 1.15 | 6.12 | 22.0 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:22 | 0.2 | 19.45 | 342 | 0.17 | 10.0 | 0.92 | 6.31 | 12.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:23 | 0.3 | 19.09 | 346 | 0.17 | 8.2 | 0.76 | 6.52 | 12.8 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:23 | 0.4 | 18.83 | 377 | 0.18 | 7.4 | 0.69 | 6.67 | 17.3 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:24 | 0.5 | 18.7 | 420 | 0.21 | 6.8 | 0.63 | 6.76 | 19.2 | 293770 | 6131386 |
| Downs Creek | DCDN | 27/3/2023 | 15:24 | 0.6 | 18.61 | 483 | 0.24 | 6.2 | 0.58 | 6.82 | 24.3 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:47 | 0.1 | 12.27 | 375 | 0.28 | 80.3 | 8.6 | 5.95 | 13.1 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:47 | 0.2 | 12.16 | 374 | 0.28 | 67.9 | 7.29 | 5.93 | 13.5 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:48 | 0.3 | 12.11 | 376 | 0.28 | 61.1 | 6.56 | 5.89 | 13 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:48 | 0.4 | 12.05 | 382 | 0.28 | 56.9 | 6.13 | 5.84 | 12.5 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:48 | 0.5 | 12.23 | 417 | 0.3 | 49.8 | 5.33 | 5.94 | 19.0 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:48 | 0.6 | 12.44 | 457 | 0.32 | 45.6 | 4.86 | 6.08 | 18.5 | 293770 | 6131386 |
| Downs Creek | DCDN | 9/6/2023 | 11:49 | 0.7 | 12.51 | 477 | 0.33 | 43.0 | 4.58 | 6.15 | 17.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 4/7/2023 | 14:29 | 0.1 | 11.85 | 449 | 0.3 | 69.0 | 7.46 | 6.01 | 8.8 | 293770 | 6131386 |
| Downs Creek | DCDN | 4/7/2023 | 14:29 | 0.2 | 11.55 | 441 | 0.3 | 69.2 | 7.54 | 5.96 | 8.7 | 293770 | 6131386 |
| Downs Creek | DCDN | 4/7/2023 | 14:29 | 0.3 | 10.97 | 438 | 0.3 | 70.0 | 7.72 | 5.93 | 8.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 4/7/2023 | 14:29 | 0.4 | 10.78 | 449 | 0.31 | 69.5 | 7.7 | 5.91 | 8.8 | 293770 | 6131386 |
| Downs Creek | DCDN | 11/9/2023 | 16:32 | 0.2 | 11.65 | 454 | 0.2 | 39.1 | 4.25 | 6.67 | 69.2 | 293770 | 6131386 |
| Downs Creek | DCDN | 11/9/2023 | 16:32 | 0.2 | 11.64 | 455 | 0.2 | 38.3 | 4.17 | 6.65 | 68.8 | 293770 | 6131386 |
| Downs Creek | DCDN | 28/11/2023 | 17:13 | 0.4 | 19.31 | 293 | 0.12 | 52.1 | 4.8 | 4.89 | 19.5 | 293770 | 6131386 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Downs Creek | DCDN | 28/11/2023 | 17:13 | 0.5 | 19.28 | 293 | 0.12 | 51.7 | 4.76 | 4.89 | 18.7 | 293770 | 6131386 |
| Downs Creek | DCDN | 28/11/2023 | 17:13 | 0.6 | 19.27 | 292 | 0.12 | 51.3 | 4.73 | 4.9 | 18.3 | 293770 | 6131386 |
| Downs Creek | DCDN | 3/1/2024 | 19:46 | 0.8 | 22.13 | 253 | 0.11 | 35.8 | 3.12 | 5.03 | 12.4 | 293760 | 6131344 |
| Downs Creek | DCDN | 3/1/2024 | 19:46 | 0.8 | 22.21 | 252 | 0.11 | 35.2 | 3.07 | 5.03 | 12.0 | 293760 | 6131344 |
| Downs Creek | DCDN | 3/1/2024 | 19:47 | 1.1 | 19.53 | 228 | 0.1 | 16.0 | 1.47 | 5.24 | 20.3 | 293760 | 6131344 |
| Downs Creek | DCDN | 3/1/2024 | 19:48 | 1.2 | 18.97 | 256 | 0.11 | 10.9 | 1.01 | 5.56 | 22.8 | 293760 | 6131344 |
| Downs Creek | DCDN | 8/5/2024 | 11:47 | 0.1 | 16.1 | 89 | 0.03 | 92.5 | 9.11 | 4.85 | 31.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 8/5/2024 | 11:48 | 0.2 | 16.1 | 90 | 0.03 | 92.3 | 9.09 | 4.85 | 31.9 | 293770 | 6131386 |
| Downs Creek | DCDN | 8/5/2024 | 11:48 | 0.3 | 16.1 | 91 | 0.03 | 92.4 | 9.11 | 4.85 | 31.5 | 293770 | 6131386 |
| Downs Creek | DCDN | 8/5/2024 | 11:48 | 0.4 | 16.1 | 92 | 0.03 | 92.4 | 9.10 | 4.87 | 31.3 | 293770 | 6131386 |
| Downs Creek | DCDN | 8/5/2024 | 11:48 | 0.5 | 16.1 | 92 | 0.03 | 92.3 | 9.09 | 4.87 | 54.8 | 293770 | 6131386 |

| Appendix Table F1.3 South Creek Water Quality Profiling Results December 2022 to May 2024 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Creek | Site | Date | Time | Depth | Temp | Cond | Sal | DO | DO | pH | Turb | MGA 56 | |
| | | | | M | °C | µS/cm | ppt | %sat | mg/l | Units | ntu | Easting | Northing |
| South Creek | SCUp | 7/12/2022 | 16:34 | 0.1 | 20.63 | 211 | 0.12 | 25.9 | 2.32 | 5.72 | 31.2 | 293479 | 6130734 |
| South Creek | SCUp | 7/12/2022 | 16:35 | 0.2 | 20.11 | 258 | 0.14 | 18.3 | 1.66 | 5.69 | 30.2 | 293479 | 6130734 |
| South Creek | SCUp | 24/1/2023 | 8:50 | 0.1 | 24.09 | 216 | 0.1 | 32.8 | 2.76 | 5.84 | 75.8 | 293479 | 6130734 |
| South Creek | SCUp | 23/3/2023 | 9:55 | 0.1 | 18 | 289 | 0.13 | 16.9 | 1.6 | 5.8 | 10.4 | 293479 | 6130734 |
| South Creek | SCUp | 23/3/2023 | 9:55 | 0.2 | 17.96 | 289 | 0.14 | 15.1 | 1.43 | 5.81 | 10 | 293479 | 6130734 |
| South Creek | SCUp | 28/3/2023 | 10:45 | 0.1 | 19.45 | 291 | 0.14 | 31.1 | 2.86 | 5.76 | 49.0 | 293479 | 6130734 |
| South Creek | SCUp | 28/3/2023 | 10:45 | 0.3 | 19.42 | 297 | 0.11 | 27.0 | 2.49 | 5.77 | 24.2 | 293479 | 6130734 |
| South Creek | SCUp | 9/6/2023 | 10:07 | 0.1 | 10.96 | 238 | 0.22 | 21.9 | 2.42 | 5.36 | 14.8 | 293479 | 6130734 |
| South Creek | SCUP | 5/7/2023 | 8:26 | 0.1 | 10.4 | 327 | 0.27 | 47.3 | 5.29 | 5.52 | 17.7 | 293479 | 6130734 |
| South Creek | SCUP | 5/7/2023 | 8:27 | 0.2 | 10.4 | 342 | 0.28 | 50.1 | 5.61 | 5.48 | 12.9 | 293479 | 6130734 |
| South Creek | SCUP | 5/7/2023 | 8:27 | 0.3 | 10.4 | 342 | 0.28 | 50.6 | 5.66 | 5.47 | 12.4 | 293479 | 6130734 |
| South Creek | SCUP | 5/7/2023 | 8:27 | 0.4 | 10.4 | 342 | 0.28 | 51.0 | 5.7 | 5.47 | 12.3 | 293479 | 6130734 |
| South Creek | SCUP | 3/1/2024 | 19:13 | 0.7 | 22.53 | 288 | 0.13 | 22.4 | 1.94 | 5.42 | 27.7 | 293479 | 6130734 |
| South Creek | SCUP | 3/1/2024 | 19:14 | 0.7 | 22.46 | 289 | 0.12 | 22.2 | 1.92 | 5.42 | 27.9 | 293479 | 6130734 |
| South Creek | SCUP | 3/1/2024 | 19:15 | 0.7 | 20.36 | 363 | 0.16 | 10.4 | 0.94 | 5.55 | 29.1 | 293479 | 6130734 |
| South Creek | SCUP | 8/5/2024 | 10:52 | 0.1 | 15.5 | 150 | 0.06 | 73.0 | 7.29 | 5.37 | 55.4 | 293479 | 6130734 |
| South Creek | SCUP | 8/5/2024 | 10:54 | 0.2 | 15.2 | 152 | 0.06 | 64.9 | 6.52 | 5.48 | 54.4 | 293479 | 6130734 |
| South Creek | SCDN | 7/12/2022 | 15:00 | 0.1 | 22.69 | 2014 | 1.02 | 58.7 | 5.04 | 4.74 | 11.3 | 293784 | 6130827 |
| South Creek | SCDN | 7/12/2022 | 15:00 | 0.2 | 21.7 | 2116 | 1.06 | 64.6 | 5.65 | 4.66 | 32.6 | 293784 | 6130827 |
| South Creek | SCDN | 7/12/2022 | 15:01 | 0.4 | 20.5 | 2754 | 1.41 | 57.5 | 5.14 | 4.42 | 10.8 | 293784 | 6130827 |
| South Creek | SCDN | 7/12/2022 | 15:01 | 0.5 | 20.57 | 2871 | 1.47 | 52.4 | 4.67 | 4.38 | 19.4 | 293784 | 6130827 |
| South Creek | SCDN | 24/1/2023 | 9:04 | 0.1 | 21.65 | 3408 | 1.8 | 63.1 | 5.50 | 5.75 | 14.9 | 293784 | 6130827 |
| South Creek | SCDN | 24/1/2023 | 9:04 | 0.2 | 21.0 | 3378 | 1.78 | 59.8 | 5.27 | 5.76 | 11.0 | 293784 | 6130827 |
| South Creek | SCDN | 24/1/2023 | 9:04 | 0.3 | 20.78 | 3380 | 1.78 | 55.4 | 4.91 | 5.75 | 4.5 | 293784 | 6130827 |
| South Creek | SCDN | 24/1/2023 | 9:05 | 0.4 | 20.63 | 3487 | 1.85 | 52.1 | 4.63 | 5.73 | 9.0 | 293784 | 6130827 |
| South Creek | SCDN | 23/3/2023 | 9:44 | 0.1 | 18.78 | 1213 | 0.6 | 47 | 4.37 | 5.51 | 1.3 | 293784 | 6130827 |
| South Creek | SCDN | 23/3/2023 | 9:44 | 0.2 | 18.76 | 1208 | 0.6 | 44.4 | 4.12 | 5.54 | 0.8 | 293784 | 6130827 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South Creek | SCDN | 23/3/2023 | 9:45 | 0.3 | 19.12 | 1413 | 0.71 | 27.9 | 2.58 | 5.80 | 11.1 | 293784 | 6130827 |
| South Creek | SCDN | 28/3/2023 | 11:56 | 0.1 | 20.72 | 911 | 0.31 | 46.4 | 4.15 | 5.39 | 61.3 | 293784 | 6130827 |
| South Creek | SCDN | 28/3/2023 | 11:55 | 0.2 | 21.55 | 1461 | 0.74 | 59.5 | 5.22 | 5.39 | 1.6 | 293784 | 6130827 |
| South Creek | SCDN | 28/3/2023 | 11:55 | 0.3 | 20.87 | 1487 | 0.75 | 57.6 | 5.13 | 5.36 | 1.8 | 293784 | 6130827 |
| South Creek | SCDN | 9/6/2023 | 9:53 | 0.1 | 11.63 | 989 | 0.62 | 63.1 | 6.84 | 5.10 | 3.3 | 293784 | 6130827 |
| South Creek | SCDN | 9/6/2023 | 9:53 | 0.2 | 11.56 | 986 | 0.61 | 61.8 | 6.71 | 5.07 | 3.0 | 293784 | 6130827 |
| South Creek | SCDN | 5/7/2023 | 9:40 | 0.1 | 11.09 | 1283 | 0.79 | 76.4 | 8.38 | 4.95 | 1.3 | 293784 | 6130827 |
| South Creek | SCDN | 5/7/2023 | 9:40 | 0.2 | 11.09 | 1304 | 0.8 | 75.9 | 8.32 | 4.92 | 1.3 | 293784 | 6130827 |
| South Creek | SCDN | 5/7/2023 | 9:40 | 0.3 | 11.09 | 1325 | 0.81 | 75.6 | 8.29 | 4.89 | 1.5 | 293784 | 6130827 |
| South Creek | SCDN | 5/7/2023 | 9:41 | 0.4 | 11.18 | 1397 | 0.85 | 70.4 | 7.71 | 4.79 | 24.2 | 293784 | 6130827 |
| South Creek | SCDN | 28/11/2023 | 16:38 | 0.3 | 19.76 | 479 | 0.22 | 69.7 | 6.36 | 5.09 | 53.5 | 293784 | 6130827 |
| South Creek | SCDN | 28/11/2023 | 16:38 | 0.4 | 19.73 | 479 | 0.21 | 69.6 | 6.36 | 5.07 | 55.5 | 293784 | 6130827 |
| South Creek | SCDN | 28/11/2023 | 16:38 | 0.5 | 19.67 | 481 | 0.21 | 69.5 | 6.36 | 5.06 | 53.7 | 293784 | 6130827 |
| South Creek | SCDN | 28/11/2023 | 16:39 | 0.7 | 19.66 | 2821 | 1.44 | 58.8 | 5.34 | 4.44 | 44.9 | 293784 | 6130827 |
| South Creek | SCDN | 3/1/2024 | 18:54 | 0.8 | 24.76 | 8000 | 6.68 | 28.1 | 2.24 | 5.62 | 10.2 | 293784 | 6130843 |
| South Creek | SCDN | 3/1/2024 | 18:56 | 1.0 | 23.50 | 8000 | 12.21 | 10.4 | 0.82 | 6.26 | 7.9 | 293784 | 6130843 |
| South Creek | SCDN | 3/1/2024 | 18:56 | 1.2 | 23.46 | 8000 | 12.65 | 10.0 | 0.79 | 6.31 | 6.6 | 293784 | 6130843 |
| South Creek | SCDN | 3/1/2024 | 18:56 | 1.4 | 23.22 | 8000 | 12.83 | 9.6 | 0.76 | 6.35 | 5.5 | 293784 | 6130843 |
| South Creek | SCDN | 3/1/2024 | 18:56 | 1.3 | 23.16 | 8000 | 12.85 | 9.3 | 0.74 | 6.36 | 5.5 | 293784 | 6130843 |
| South Creek | SCDN | 8/5/24 | 10:34 | 0.1 | 15.6 | 105 | 0.04 | 93.0 | 9.28 | 5.59 | 35.2 | 293784 | 6130843 |
| South Creek | SCDN | 8/5/24 | 10:35 | 0.2 | 15.6 | 106 | 0.04 | 92.1 | 9.19 | 5.58 | 33.9 | 293784 | 6130843 |
| South Creek | SCDN | 8/5/24 | 10:35 | 0.3 | 15.6 | 105 | 0.04 | 91.8 | 9.16 | 5.57 | 34.2 | 293784 | 6130843 |
| South Creek | SCDN | 8/5/24 | 10:36 | 0.4 | 15.6 | 105 | 0.04 | 91.8 | 9.16 | 5.55 | 47.0 | 293784 | 6130843 |
| South Creek | SCDN | 8/5/24 | 10:36 | 0.5 | 15.6 | 105 | 0.04 | 91.8 | 9.16 | 5.56 | 85.2 | 293784 | 6130843 |

## Appendix Table F1.4 – Site Water Level Log

| Site | Term 1 | | Term 2 | | Term 3 | | Term 4 | | Term 5 | | Term 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deployment 21/12/2022 | Collection 17/01/2023 | Deployment 1/03/2023 | Collection 26/04/2023 | Deployment 9/06/2023 | Collection 28/08/2023 | Deployment 28/08/2023 | Collection 27/11/2023 | Deployment 27/11/2023 | Collection 6/3/2024 | Deployment 6/3/2024 | Collection 27/5/2024 |
| WCDN | Wet | Wet | Wet | Wet | Wet - low | Wet - low | Wet - low | Wet - low | Wet -low | Wet | Wet | Wet |
| WCUP | Wet | Wet | Wet | Dry | Wet | Dry | Dry | Dry | Dry | Wet | Wet | Wet |
| DCDN | Wet | Wet | Wet | Wet | Wet - low | Wet | Wet - low | Wet - low | Wet - low | Wet | Wet | Wet |
| DCUP | Wet | Wet | Wet | Wet | Wet | Wet | Wet | Wet | Wet | Wet | Wet | Wet |
| SCDN | Wet | Wet | Wet | Wet | Wet | Wet | Wet - low | Wet - low | Wet - low | Wet | Wet | Wet |
| SCUP | Wet | Wet | Wet | Dry | Wet - low | Dry | Dry | Dry | Dry | Wet | Wet | Wet |

# APPENDIX F2

# MACROINVERTEBRATE RESULTS

**Appendix Table F-2.1**

**West Culburra Freshwater Articifial Sampling Unit Macroinvertebrate Pilot Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage L | N | A | Pilot WCUp-S 1 | 2 | 3 | WCDn-S 1 | 2 | 3 | WCDn-B 1 | 2 | 3 | DCUp-S 1 | 2 | 3 | DCDn-S 1 | 2 | 3 | DCDn-B 1 | 2 | 3 | SCUp-S 1 | 2 | 3 | SCDn-S 1 | 2 | 3 | SCDn-B 1 | 2 | 3 | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | 20 | 20 | 54 | | | | | | | | | | | | | | | 2 | 6 | | | | | | | | 102 | 5 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | 2 | 1 | | | | | | | | | | | | | | | 1 | | | | | | | | | 4 | 3 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | 2 | | | | | | | | 2 | 1 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | 2 | 1 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | 2 | | 1 | 464 | 493 | 349 | 6 | 1 | 8 | 11 | 3 | 6 | | | | 3 | | 2 | 1 | 13 | | 22 | 13 | 16 | 28 | 23 | 46 | 1511 | 21 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | 1 | | | 1 | 3 | 2 | | | | 1 | | 1 | 1 | | | | | | 1 | 2 | | 11 | 13 | 21 | 8 | 1 | 3 | 70 | 15 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | 2 | 2 |
| Arthropoda | Insecta | Odonata | Epiproctopho | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctopho | Corduliidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | | | | | 1 | | | | | | 1 | | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | 1 | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | 3 | 3 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | 1 | | 2 | | | | | | | | | | | 3 | 2 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | 3 | 2 | 1 | 1 | 2 | 2 | 2 | | | | | | | 5 | 1 | | | | | | | | | | 19 | 9 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | 29 | 17 | 11 | | | | | | | | | | 1 | 1 | | | | 2 | | | | | | 1 | | | 62 | 7 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | | 3 | | 4 | | | | | 1 | 2 | | | | | | | 1 | 2 | | 2 | 1 | 3 | | | | 19 | 9 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| | | | | | | | Total invertebrate abundance per site: | | | | 59 | 42 | 68 | 469 | 498 | 358 | 8 | 1 | 8 | 13 | 5 | 10 | 3 | 6 | 3 | 3 | 0 | 2 | 6 | 27 | | 36 | 30 | 44 | 37 | 24 | 49 | 1809 | |
| | | | | | | | Total number of invertebrate taxa per site: | | | | 8 | 6 | 5 | 4 | 3 | 5 | 2 | 1 | 1 | 3 | 3 | 4 | 3 | 2 | 2 | 1 | 0 | 1 | 5 | 6 | | 4 | 6 | 6 | 3 | 2 | 2 | | 18 |

**Appendix Table F-2.2**

**West Culburra Freshwater Articifial Sampling Unit Term 1 Macroinvertebrate Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage L | N | A | Term 1 WCUp-S 1 Dry | 2 Dry | 3 Dry | WCDn-S 1 | 2 | 3 | WCDn-B 1 | 2 | 3 | DCUp-S 1 | 2 | 3 | DCUp-B 1 | 2 | 3 | DCDn-S 1 | 2 | 3 | DCDn-B 1 | 2 | 3 | SCUp-S 1 | 2 | 3 | SCDn-S 1 | 2 | 3 | SCDn-B 1 | 2 | 3 | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | | | | | 1 | | | | | | | | | | | | 1 | | | | | | | | | 2 | 2 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | 1 | | 1 | 2 | | | | | | | | | | 4 | 3 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 4 | 1 | | | | 7 | 3 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | | | | 376 | 170 | 215 | 138 | 105 | 35 | 116 | 98 | 104 | 1 | | | 28 | 23 | 79 | 2 | | 1 | 31 | 24 | 25 | 15 | 53 | 41 | 13 | 7 | 15 | 1715 | 24 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | | | | | | | 1 | | | 2 | 9 | 3 | | | | 1 | | 2 | | | | | 1 | 2 | 4 | 6 | 4 | 3 | 6 | 1 | 45 | 14 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Epiproctopho | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctopho | Corduliidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | | | | | | 2 | 5 | 4 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | | | | | | 2 | 5 | 4 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 3 | 2 | 2 | | | 9 | 4 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 | 1 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | | | | | 1 | 1 | 1 | | | | 1 | | | | | | | | | | | | | | 1 | | | | | 5 | 5 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | | | | | | 1 | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | | | | 2 | 1 | | | 1 | | 2 | | | | 2 | 2 | 5 | | | | 4 | 5 | | | | | | | | 24 | 9 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 1 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | | | | 376 | 171 | 219 | 141 | 105 | 36 | 119 | 108 | 112 | 1 | 0 | 0 | 32 | 25 | 89 | 4 | 0 | 1 | 40 | 30 | 27 | 25 | 66 | 50 | 18 | 13 | 20 | 1828 | |
| | | | | | | | otal number of invertebrate taxa per site: | | | | | | | 1 | 2 | 4 | 4 | 1 | 2 | 3 | 3 | 6 | 1 | 0 | 0 | 4 | 2 | 6 | 2 | 0 | 1 | 7 | 3 | 2 | 6 | 4 | 6 | 3 | 2 | 4 | | 16 |

**Appendix Table F-2.3**
**West Culburra Freshwater Articifial Sampling Unit Term 2 Macroinvertebrate Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage L | N | A | Term 2 WCUp-S 1 | 2 | 3 | WCDn-S 1 | 2 | 3 | WCDn-B 1 | 2 | 3 | DCUp-S 1 | 2 | 3 | DCUp-B 1 | 2 | 3 | DCDn-S 1 | 2 | 3 | DCDn-B 1 | 2 | 3 | SCUp-S 1 | 2 | 3 | SCDn-S 1 | 2 | 3 | SCDn-B 1 | 2 | 3 | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | 16 | 19 | 6 | 25 | 14 | 26 | 8 | 4 | 7 | 11 | 5 | 10 | 48 | 37 | 65 | 2 | 4 | 4 | 9 | 10 | 3 | 3 | 7 | 10 | 7 | 12 | 7 | 5 | 1 | | 385 | 29 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | | | | | | | | | | 2 | 1 | 3 | | | | | | | | | | | | 8 | 2 | | 6 | 1 | | | | 23 | 7 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Corduliidae | | | Dragonflies | x | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | 1 | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | 17 | 19 | 6 | 25 | 15 | 26 | 8 | 4 | 7 | 13 | 6 | 13 | 48 | 37 | 65 | 2 | 5 | 4 | 10 | 10 | 3 | 3 | 7 | 18 | 9 | 12 | 13 | 6 | 1 | 0 | 412 | |
| | | | | | | | otal number of invertebrate taxa per site: | | | | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 0 | | 5 |

**Appendix Table F-2.4**
**West Culburra Freshwater Articifial Sampling Unit Term 3 Macroinvertebrate Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage L | N | A | Term 3 WCUp-S 1 | 2 | 3 | WCDn-S 1 | 2 | 3 | WCDn-B 1 | 2 | 3 | DCUp-S 1 | 2 | 3 | DCUp-B 1 | 2 | 3 | DCDn-S 1 | 2 | 3 | DCDn-B 1 | 2 | 3 | SCUp-S 1 | 2 | 3 | SCDn-S 1 | 2 | 3 | SCDn-B 1 | 2 | 3 | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Dry | Dry | Dry | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | | | | | | | | | | | | | | 4 | | | | | | | | | 1 | 1 | | | | 6 | 3 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | 3 | 1 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | | | | 116 | 120 | 255 | 242 | 254 | 150 | 9 | 22 | 20 | 30 | 28 | 31 | 19 | 6 | 9 | 9 | 7 | 1 | 3 | 11 | 8 | 66 | 54 | 37 | 25 | 30 | 37 | 1599 | 27 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | | | | | | 2 | | | | | | | | | 2 | 1 | | | | | | | | | 1 | 4 | | | | 10 | 5 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Corduliidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | 1 | | | | 1 | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | | | 1 | 4 | 1 | 2 | | | | | | | | 1 | 5 | 2 | | | | | | | | | | | | | 16 | 7 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | | | | | | | | 1 | | 2 | 1 | | 2 | 1 | | | | | | | | | | | | 1 | | | | | 9 | 7 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | | | | | 2 | | 1 | 1 | 1 | | | 1 | | | 1 | 1 | | | | | | | | | | 4 | 3 | 6 | | | | 21 | 10 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | | | | | | | | | | | | | 1 | | | 2 | | | | 1 | | | 1 | | | 3 | 1 | 4 | 1 | 3 | 1 | 18 | 10 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | | 1 | | | 1 | | 1 | 1 | | | | | | | 1 | | | | | | | | | | | | | | 5 | 5 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | | | | | | 1 | 2 | | 1 | 1 | 7 | 6 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | | | | 118 | 126 | 259 | 246 | 256 | 152 | 12 | 23 | 21 | 34 | 29 | 35 | 32 | 9 | 9 | 11 | 9 | 1 | 5 | 12 | 8 | 75 | 62 | 52 | 27 | 33 | 38 | 1694 | |
| | | | | | | | otal number of invertebrate taxa per site: | | | | | | | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 4 | 2 | 4 | 6 | 3 | 1 | 3 | 3 | 1 | 3 | 2 | 1 | 5 | 4 | 6 | 3 | 2 | 2 | | 16 |

**Appendix Table F-2.5**

**West Culburra Freshwater Articifial Sampling Unit Term 4 Macroinvertebrate Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage | | | Term 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | L | N | A | WCUp | | | WCDn-S | | | WCDn-B | | | DCUp-S | | | DCUp-B | | | DCDn-S | | | DCDn-B | | | SCUp | | | SCDn-S | | | SCDn-B | | | | |
| | | | | | | | | | | | Dry | Dry | Dry | | | | | | | | | | | | | | | | | | | Dry | Dry | Dry | | | | | | | | | |
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | | | | | | | | | | | | | 1 | | 2 | 2 | | | | | | | | | | | | 5 | 3 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | 1 | | 3 | | 1 | | | | | | | | | | | | | | | | | | | | | | 7 | 4 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | 2 | | 1 | 1 | | 1 | | | | | | | | | | 5 | 4 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | 4 | 3 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | | | | 605 | 311 | 459 | 382 | 360 | 233 | 75 | 66 | 80 | 12 | 16 | 25 | 7 | 5 | 13 | 9 | 4 | 14 | | | | 21 | 14 | 15 | 19 | 27 | 32 | 2804 | 24 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | | | | | | | | | | 5 | 6 | 5 | | | | | | | | | | | | | | | | | | 16 | 3 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Corduliidae | | | Dragonflies | x | | | | | | | | | | | | 2 | 1 | | | | | | | 2 | | | | | | | | | | | | 8 | 6 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | | | | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 2 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | | | | 43 | 39 | 9 | 46 | 18 | 11 | 4 | | | | | | 1 | | | | | | | | | | 1 | 2 | 1 | 3 | 2 | 4 | 184 | 14 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | | 7 | 5 | 2 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | 20 | 6 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | | | | 658 | 356 | 473 | 431 | 381 | 245 | 86 | 74 | 86 | 12 | 16 | 25 | 11 | 5 | 17 | 12 | 6 | 15 | | | | 23 | 17 | 21 | 23 | 30 | 36 | 3059 | |
| | | | | | | | otal number of invertebrate taxa per site: | | | | | | | 5 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 1 | 1 | 1 | 4 | 1 | 4 | 3 | 2 | 2 | | | | 3 | 3 | 5 | 3 | 3 | 2 | | 12 |

**Appendix Table F-2.6**

**West Culburra Freshwater Articifial Sampling Unit Term 5 Macroinvertebrate Results**

| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | Life Stage | | | Term 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Abundance | Richness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | L | N | A | WCUp | | | WCDn-S | | | WCDn-B | | | DCUp-S | | | DCUp-B | | | DCDn-S | | | DCDn-B | | | SCUp | | | SCDn-S | | | SCDn-B | | | | |
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | 60 | 39 | 44 | 64 | 134 | 62 | 2 | 2 | 1 | 14 | 40 | 18 | 9 | 18 | 3 | 1 | 6 | 5 | 1 | | | 2 | 8 | 9 | 2 | | 1 | | | | 545 | 24 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | 13 | 13 | 14 | | 1 | 1 | | | | 2 | 6 | 7 | | | | | 1 | 1 | | | | | | | | | | | | 59 | 10 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Aeshnidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Epiproctophe | Corduliidae | | | Dragonflies | x | | | | 1 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | 2 | 2 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | 1 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 2 | 2 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | | 1 | | | | | | | | 1 | 1 | 4 | | | | | | | | | | | | | | | | | | | 7 | 4 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | 1 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | 1 | | 1 | | 1 | | | | | | | 2 | | | | | | | | | | | | | | | 2 | | | | 7 | 5 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | 1 | 6 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 3 |
| Annelida | Oligochaeta | | | | | | Worms | | | | | | 2 | | 2 | | | | | | | | | | | | 2 | | 1 | | 1 | | | | | | | | | | 8 | 5 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | 76 | 60 | 64 | 64 | 138 | 63 | 2 | 2 | 1 | 17 | 47 | 32 | 9 | 18 | 3 | 1 | 9 | 6 | 2 | 0 | 1 | 2 | 8 | 11 | 4 | 2 | 1 | 0 | 0 | 0 | 643 | |
| | | | | | | | otal number of invertebrate taxa per site: | | | | 5 | 5 | 6 | 1 | 4 | 2 | 1 | 1 | 1 | 3 | 3 | 5 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 0 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | | 11 |

| **Appendix Table F-2.7** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **West Culburra Freshwater Articifial Sampling Unit Term 6 Macroinvertebrate Results** | | | | | | | | | Life Stage | | | Term 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | WCUp | | | WCDn-S | | | WCDn-B | | | DCUp-S | | | DCUp-B | | | DCDn-S | | | DCDn-B | | | SCUp | | | SCDn-S | | | SCDn-B | | | | |
| Phylum | Class | Order | Sub-Order | Family | Sub-Family | Genus/spp | Common Name | L | N | A | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | Abundance | Richness |
| Arthropoda | Insecta | Coleoptera | | Dytiscidae | | | Diving Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydraenidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrochidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Hydrophilidae | | | Scavenger Water Beetles | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Coleoptera | | Scirtidae | | | Marsh Beetles | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Diptera | | Ceratopogonidae | | | Biting Midges | x | | | | 1 | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | 3 | 3 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Chironominae | | Bloodworms | x | | | 89 | 83 | 112 | 36 | 40 | 78 | 3 | 6 | 3 | 16 | 16 | 14 | 74 | 75 | 71 | 12 | 6 | 13 | 9 | 6 | 7 | 3 | 88 | 75 | 7 | 10 | | 1 | 8 | 2 | 963 | 29 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Orthocladiinae | | Bloodworms | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | | | 2 | 1 | 6 | 4 |
| Arthropoda | Insecta | Diptera | | Chironomidae | Tanypodinae | | Bloodworms | x | | | 10 | 12 | 7 | 1 | 2 | 2 | | | | 4 | 4 | 10 | 5 | 4 | 9 | 4 | 4 | 10 | | 3 | 8 | | | | | 2 | | | | | 101 | 18 |
| Arthropoda | Insecta | Ephemeroptera | | Leptophlebiidae | | | Mayflies | | x | | | | | | | | | | | | | | | | | 2 | | | | 1 | | | | | | | | | | 3 | 2 |
| Arthropoda | Insecta | Odonata | Epiproctoph | Aeshnidae | | | Dragonflies | x | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Epiproctoph | Corduliidae | | | Dragonflies | x | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 1 | 1 |
| Arthropoda | Insecta | Odonata | Zygoptera | Argiolestidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Insecta | Odonata | Zygoptera | Coenagrionidae | | | Damselflies | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | 1 |
| Arthropoda | Insecta | Trichoptera | | Leptoceridae | | | Caddisflies | x | | | | 3 | 3 | | | | | | | | | | | 1 | | | | | 1 | 1 | | | 1 | | | | | | | 10 | 6 |
| Arthropoda | Arachnida | Acarina | Hydracarina | | | | Freshwater Mites | | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Arthropoda | Branchiopoda | | Cladocera | | | | Water Fleas | | | x | 14 | 22 | 30 | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | 2 | | 70 | 6 |
| Arthropoda | Copepoda | Calanoida | | Centropagidae | | | Copepods | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 33 | 57 | 2 | 27 | 53 | 21 | 193 | 6 |
| Arthropoda | Copepoda | Cyclopoida | | Cyclopidae | | | Copepods | | | | 3 | 5 | | | | | | | | 2 | | | | | | | 1 | | | | | | | 1 | | | | | | | 12 | 5 |
| Arthropoda | Copepoda | Harpacticoida | | | | | Copepods | | | | 5 | 3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 3 |
| Arthropoda | Ostracoda | | | | | | Seed Shrimps | | | | 57 | 61 | 55 | | | | | | | | | | | 1 | | | 1 | | | | | | 5 | 54 | 21 | | | | | | 255 | 8 |
| Annelida | Oligochaeta | | | | | | Worms | | | | 1 | 4 | 7 | | | | | | | | | | 1 | 1 | | 2 | 2 | | | 1 | 2 | | | 2 | 2 | | | 1 | | | 26 | 12 |
| Mollusca | Gastropoda | | | Planorbidae | | | Limpets | | | | 4 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 3 |
| Chordata | Osteichthyes | | | Eleotridae | | *Gobiomorphus australis* | Striped Gudgeon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Chordata | Osteichthyes | | | Eleotridae | | *Hypseleotris compressa* | Empire Gudgeon | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | Total invertebrate abundance per site: | | | | 183 | 195 | 217 | 37 | 42 | 80 | 3 | 6 | 3 | 22 | 21 | 24 | 81 | 82 | 80 | 21 | 14 | 23 | 10 | 12 | 17 | 9 | 145 | 99 | 41 | 73 | 3 | 28 | 65 | 24 | 1660 | 23 |
| | | | | | | | otal number of invertebrate taxa per site: | | | | 8 | 10 | 9 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 4 | 5 | 2 | 5 | 5 | 2 | 2 | 5 | 3 | 3 | 4 | 4 | 3 | 6 | 2 | 2 | 4 | 3 | | |

# APPENDIX F3

# ELECTROFISHING FISH CATCH RESULTS

| Appendix Table F3 Electrofishing Survey Results Terms 1 to 6 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Term | Date | Site | Rep | Empire Gudgeon *Hypseleotris compressa* | Striped Gudgeon *Giobiomorphus australis* | Common Jollytail *Galaxias maculatus* | Plague Minnow *Gambusia holbrooki* | Short-Finned Eel *Anguilla australis* | Tadpole |
| 1 | 28/3/23 | WCUp | 1 | | | | | | |
| 1 | 28/3/23 | WCUp | 2 | | | 90 | | | |
| 1 | 28/3/23 | WCUp | 2 | | | 86 | | | |
| 1 | 28/3/23 | WCUp | 3 | | | | 40 | | |
| 1 | 28/3/23 | WCUp | 3 | | | 91 | | | |
| 1 | 28/3/23 | WCDn | 1 | | | 60 | | | |
| 1 | 28/3/23 | WCDn | 1 | | 75 | | | | |
| 1 | 28/3/23 | WCDn | 1 | 60 | | | | | |
| 1 | 28/3/23 | WCDn | 2 | | 70 | | | | |
| 1 | 28/3/23 | WCDn | 2 | | | 90 | | | |
| 1 | 28/3/23 | WCDn | 2 | | 75 | | | | |
| 1 | 28/3/23 | WCDn | 2 | 65 | | | | | |
| 1 | 28/3/23 | WCDn | 2 | | | 70 | | | |
| 1 | 28/3/23 | WCDn | 2 | | | | 50 | | |
| 1 | 28/3/23 | WCDn | 2 | | | | | 120 | |
| 1 | 28/3/23 | WCDn | 2 | 55 | | | | | |
| 1 | 28/3/23 | WCDn | 2 | | 65 | | | | |
| 1 | 28/3/23 | WCDn | 2 | | | 64 | | | |
| 1 | 28/3/23 | WCDn | 3 | | 63 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 58 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 64 | | | | |
| 1 | 28/3/23 | WCDn | 3 | 59 | | | | | |
| 1 | 28/3/23 | WCDn | 3 | 54 | | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 68 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 50 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | | | 32 | | |
| 1 | 28/3/23 | WCDn | 3 | | | 75 | | | |
| 1 | 28/3/23 | WCDn | 3 | | | | 30 | | |
| 1 | 28/3/23 | WCDn | 3 | | 69 | | | | |
| 1 | 28/3/23 | WCDn | 3 | 53 | | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 50 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | 43 | | | | |
| 1 | 28/3/23 | WCDn | 3 | | | 79 | | | |
| 1 | 27/3/23 | DCUp | 1 | | | | 48 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 27/3/23 | DCUp | 1 | 32 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 25 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 29 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 40 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 50 | | | | |
| 1 | 27/3/23 | DCUp | 1 | 42 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 37 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 31 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 31 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 31 | | | | |
| 1 | 27/3/23 | DCUp | 1 | 48 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 42 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 38 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 28 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 52 | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 38 | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 43 | | | | |
| 1 | 27/3/23 | DCUp | 1 | | | 81 | | | |
| 1 | 27/3/23 | DCUp | 1 | 38 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 45 | | | | |
| 1 | 27/3/23 | DCUp | 1 | 38 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 40 | | | | |
| 1 | 27/3/23 | DCUp | 1 | 25 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 46 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 42 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | 44 | | | | | |
| 1 | 27/3/23 | DCUp | 1 | | 45 | | | | |
| 1 | 27/3/23 | DCUp | 2 | 46 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | 41 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 54 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 46 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 50 | | | | |
| 1 | 27/3/23 | DCUp | 2 | 44 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | 40 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 44 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 38 | | | | |
| 1 | 27/3/23 | DCUp | 2 | 32 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 41 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 47 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 45 | | | | |
| 1 | 27/3/23 | DCUp | 2 | 29 | | | | | |
| 1 | 27/3/23 | DCUp | 2 | | 41 | | | | |
| 1 | 27/3/23 | DCUp | 2 | | | 70 | | | |
| 1 | 27/3/23 | DCUp | 3 | 46 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 27/3/23 | DCUp | 3 | 41 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 44 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 23 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 47 | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 56 | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 57 | | | | |
| 1 | 27/3/23 | DCUp | 3 | 40 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 60 | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 50 | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 45 | | | | |
| 1 | 27/3/23 | DCUp | 3 | 40 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 38 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 50 | | | | |
| 1 | 27/3/23 | DCUp | 3 | 26 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | | 51 | | | | |
| 1 | 27/3/23 | DCUp | 3 | 46 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 46 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 41 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 21 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 29 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 20 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 23 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 24 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 30 | | | | | |
| 1 | 27/3/23 | DCUp | 3 | 305 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | | 47 | | | | |
| 1 | 27/3/23 | DCDn | 1 | | 55 | | | | |
| 1 | 27/3/23 | DCDn | 1 | | 54 | | | | |
| 1 | 27/3/23 | DCDn | 1 | 33 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | 35 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | 34 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | | 47 | | | | |
| 1 | 27/3/23 | DCDn | 1 | | 12 | | | | |
| 1 | 27/3/23 | DCDn | 1 | 35 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | 48 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | 44 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | 31 | | | | | |
| 1 | 27/3/23 | DCDn | 1 | | | | | 110 | |
| 1 | 27/3/23 | DCDn | 2 | | 120 | | | | |
| 1 | 27/3/23 | DCDn | 2 | | | 90 | | | |
| 1 | 27/3/23 | DCDn | 2 | | 25 | | | | |
| 1 | 27/3/23 | DCDn | 2 | 52 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 34 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 39 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 27/3/23 | DCDn | 2 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | | 40 | | | | |
| 1 | 27/3/23 | DCDn | 2 | 42 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 40 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 40 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 30 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 28 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | | 60 | | | | |
| 1 | 27/3/23 | DCDn | 2 | | 50 | | | | |
| 1 | 27/3/23 | DCDn | 2 | 50 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 45 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 2 | | 45 | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 128 | | | | |
| 1 | 27/3/23 | DCDn | 3 | 42 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 50 | | | | |
| 1 | 27/3/23 | DCDn | 3 | 32 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 144 | | | | |
| 1 | 27/3/23 | DCDn | 3 | 34 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 50 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 41 | | | | |
| 1 | 27/3/23 | DCDn | 3 | 44 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 36 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 42 | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 55 | | | | |
| 1 | 27/3/23 | DCDn | 3 | 39 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 40 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 47 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 40 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 38 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | 35 | | | | | |
| 1 | 27/3/23 | DCDn | 3 | | 40 | | | | |
| 1 | 28/3/23 | SCUp | 1 | | | | | | 1 |
| 1 | 28/3/23 | SCUp | 1 | | | | 47 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 30 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 21 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 21 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 19 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 22 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 23 | | |
| 1 | 28/3/23 | SCUp | 1 | | | | 21 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 28/3/23 | SCUp | 1 | | | | 23 | | |
| 1 | 28/3/23 | SCUp | 1 | 56 | | | | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 41 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 21 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 33 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 11 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 30 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 21 | | |
| 1 | 28/3/23 | SCUp | 2 | | | | 21 | | |
| 1 | 28/3/23 | SCUp | 3 | | | | 20 | | |
| 1 | 28/3/23 | SCUp | 3 | | 41 | | | | |
| 1 | 28/3/23 | SCUp | 3 | | 59 | | | | |
| 1 | 28/3/23 | SCUp | 3 | | | 64 | | | |
| 1 | 28/3/23 | SCUp | 3 | | | 40 | | | |
| 1 | 28/3/23 | SCUp | 3 | | | 64 | | | |
| 1 | 28/3/23 | SCUp | 3 | | | 70 | | | |
| 1 | 28/3/23 | SCDn | 1 | 40 | | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 35 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 33 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 41 | | | | |
| 1 | 28/3/23 | SCDn | 1 | 39 | | | | | |
| 1 | 28/3/23 | SCDn | 1 | 40 | | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 36 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 37 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 43 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 31 | | | | |
| 1 | 28/3/23 | SCDn | 1 | 50 | | | | | |
| 1 | 28/3/23 | SCDn | 1 | 29 | | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 35 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 41 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 40 | | | | |
| 1 | 28/3/23 | SCDn | 1 | | 34 | | | | |
| 1 | 28/3/23 | SCDn | 1 | 42 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | 40 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | 45 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | 28 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | 34 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 30 | | | | |
| 1 | 28/3/23 | SCDn | 2 | 33 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | 42 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 46 | | | | |
| 1 | 28/3/23 | SCDn | 2 | 45 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 38 | | | | |
| 1 | 28/3/23 | SCDn | 2 | 48 | | | | | |

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| 1 | 28/3/23 | SCDn | 2 | | 40 | | | | |
| 1 | 28/3/23 | SCDn | 2 | 41 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | | | | 40 | | |
| 1 | 28/3/23 | SCDn | 2 | 45 | | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 31 | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 32 | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 35 | | | | |
| 1 | 28/3/23 | SCDn | 2 | | 45 | | | | |
| 1 | 28/3/23 | SCDn | 3 | | 68 | | | | |
| 1 | 28/3/23 | SCDn | 3 | | | | | 450 | |
| 1 | 28/3/23 | SCDn | 3 | 45 | | | | | |
| 1 | 28/3/23 | SCDn | 3 | 40 | | | | | |
| 1 | 28/3/23 | SCDn | 3 | 44 | | | | | |
| 1 | 28/3/23 | SCDn | 3 | | 32 | | | | |
| 1 | 28/3/23 | SCDn | 3 | | 32 | | | | |
| 1 | 28/3/23 | SCDn | 3 | 32 | | | | | |
| 1 | 28/3/23 | SCDn | 3 | | 51 | | | | |
| 1 | 28/3/23 | SCDn | 3 | 31 | | | | | |
| 1 | 28/3/23 | SCDn | 3 | 49 | | | | | |
| 2 | 5/7/23 | WCDn | 1 | | | 89 | | | |
| 2 | 5/7/23 | WCDn | 1 | | | 79 | | | |
| 2 | 5/7/23 | WCDn | 1 | | | 85 | | | |
| 2 | 5/7/23 | WCDn | 1 | | | | 19 | | |
| 2 | 5/7/23 | WCDn | 2 | | | 86 | | | |
| 2 | 5/7/23 | WCDn | 2 | | | 100 | | | |
| 2 | 5/7/23 | WCDn | 2 | | | | 20 | | |
| 2 | 5/7/23 | WCDn | 2 | | | | 20 | | |
| 2 | 5/7/23 | WCDn | 3 | | 159 | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 134 | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 140 | | | | |
| 2 | 5/7/23 | WCDn | 3 | 57 | | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 70 | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 69 | | | | |
| 2 | 5/7/23 | WCDn | 3 | 64 | | | | | |
| 2 | 5/7/23 | WCDn | 3 | | | 102 | | | |
| 2 | 5/7/23 | WCDn | 3 | | 61 | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 59 | | | | |
| 2 | 5/7/23 | WCDn | 3 | 62 | | | | | |
| 2 | 5/7/23 | WCDn | 3 | 59 | | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 50 | | | | |
| 2 | 5/7/23 | WCDn | 3 | 51 | | | | | |
| 2 | 5/7/23 | WCDn | 3 | | 61 | | | | |
| 2 | 5/7/23 | WCDn | 3 | | | | 25 | | |
| 2 | 5/7/23 | WCDn | 3 | | 62 | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| 2 | 5/7/23 | WCDn | 3 | | | | | 480 | |
| 2 | 4/7/23 | DCUp | 1 | | 120 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | | | | 340 | |
| 2 | 4/7/23 | DCUp | 1 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 45 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 50 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 55 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 34 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 42 | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 40 | | | | |
| 2 | 4/7/23 | DCUp | 1 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 48 | | | | |
| 2 | 4/7/23 | DCUp | 1 | 41 | | | | | |
| 2 | 4/7/23 | DCUp | 1 | | 42 | | | | |
| 2 | 4/7/23 | DCUp | 1 | 22 | | | | | |
| 2 | 4/7/23 | DCUp | 1 | 51 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | | | | | 100 | |
| 2 | 4/7/23 | DCUp | 2 | 25 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | 30 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 55 | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 41 | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 45 | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 48 | | | | |
| 2 | 4/7/23 | DCUp | 2 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | 34 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 30 | | | | |
| 2 | 4/7/23 | DCUp | 2 | | 31 | | | | |
| 2 | 4/7/23 | DCUp | 2 | 41 | | | | | |
| 2 | 4/7/23 | DCUp | 2 | 40 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 111 | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 124 | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 129 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 42 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 51 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 110 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 45 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 45 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 58 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 41 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 48 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 49 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 51 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 52 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 40 | | | | | |

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| 2 | 4/7/23 | DCUp | 3 | 37 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 52 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 47 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | | | | 146 | |
| 2 | 4/7/23 | DCUp | 3 | 48 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | | | | 700 | |
| 2 | 4/7/23 | DCUp | 3 | | 68 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 34 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 53 | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 51 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 42 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 43 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 21 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 22 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 39 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 32 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 29 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 31 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 29 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 42 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 32 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 40 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 32 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 35 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 34 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 25 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 40 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 29 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 29 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 49 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 39 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 41 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 44 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 50 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 35 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 29 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 40 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |

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| 2 | 4/7/23 | DCUp | 3 | 38 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 22 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 31 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 44 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 40 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 40 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | | 44 | | | | |
| 2 | 4/7/23 | DCUp | 3 | 46 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 36 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 38 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 45 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 22 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 22 | | | | | |
| 2 | 4/7/23 | DCUp | 3 | 24 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 60 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 53 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 63 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 51 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 44 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 59 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 51 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 52 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 55 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 22 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | | 74 | | | |
| 2 | 4/7/23 | DCDn | 1 | | 60 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 50 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 45 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 25 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 42 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 29 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 41 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 55 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 53 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 59 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 46 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 52 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 46 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 45 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 55 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 30 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 39 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 59 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 51 | | | | |

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| 2 | 4/7/23 | DCDn | 1 | | 56 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 41 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 50 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 43 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 42 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 32 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 46 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 44 | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 59 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 42 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 40 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 39 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 50 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 98 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 39 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 41 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 46 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 80 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 39 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 42 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 40 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 52 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | | 31 | | | | |
| 2 | 4/7/23 | DCDn | 1 | 22 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 32 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 40 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 36 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 30 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 25 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 32 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 22 | | | | | |
| 2 | 4/7/23 | DCDn | 1 | 34 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 65 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 49 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 50 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 51 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 49 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 53 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 34 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 36 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 40 | | | | |

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| 2 | 4/7/23 | DCDn | 2 | | 43 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 30 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 43 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 22 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 39 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 40 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 41 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | 36 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 30 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 29 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 36 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 37 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 36 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 35 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 25 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 30 | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 41 | | | | |
| 2 | 4/7/23 | DCDn | 2 | 39 | | | | | |
| 2 | 4/7/23 | DCDn | 2 | | 29 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 60 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 44 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 32 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 40 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 45 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 3 | 44 | | | | | |
| 2 | 4/7/23 | DCDn | 3 | 52 | | | | | |
| 2 | 4/7/23 | DCDn | 3 | | | 84 | | | |
| 2 | 4/7/23 | DCDn | 3 | | | 91 | | | |
| 2 | 4/7/23 | DCDn | 3 | | | 93 | | | |
| 2 | 4/7/23 | DCDn | 3 | | | 89 | | | |
| 2 | 4/7/23 | DCDn | 3 | | | 115 | | | |
| 2 | 4/7/23 | DCDn | 3 | | 53 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 45 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 37 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 38 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 42 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 36 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 28 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 51 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 52 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 39 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 34 | | | | |

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| 2 | 4/7/23 | DCDn | 3 | | 41 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 42 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 36 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 38 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 32 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 44 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 42 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 35 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 33 | | | | |
| 2 | 4/7/23 | DCDn | 3 | 41 | | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 39 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 32 | | | | |
| 2 | 4/7/23 | DCDn | 3 | 31 | | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 32 | | | | |
| 2 | 4/7/23 | DCDn | 3 | | 34 | | | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 21 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 24 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 24 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 26 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 24 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 23 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 19 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 15 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 23 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 23 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 26 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 22 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 20 | | |
| 2 | 5/7/23 | SCUp | 1 | | | | 23 | | |
| 2 | 5/7/23 | SCUp | 2 | | | | 44 | | |
| 2 | 5/7/23 | SCUp | 2 | | | | 43 | | |
| 2 | 5/7/23 | SCUp | 2 | | | | 42 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 25 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 24 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 17 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 40 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 23 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 15 | | |
| 2 | 5/7/23 | SCUp | 3 | | | | 22 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 29 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 30 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 32 | | |
| 2 | 5/7/23 | SCDn | 1 | | 31 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | | 70 | | | |

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| 2 | 5/7/23 | SCDn | 1 | | 44 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 34 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 34 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 32 | | |
| 2 | 5/7/23 | SCDn | 1 | | 35 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 36 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 35 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 33 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 24 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 39 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 32 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 33 | | |
| 2 | 5/7/23 | SCDn | 1 | | | | 32 | | |
| 2 | 5/7/23 | SCDn | 1 | | 31 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 32 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 33 | | | | |
| 2 | 5/7/23 | SCDn | 1 | | 42 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 50 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 45 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 54 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | | 62 | | | |
| 2 | 5/7/23 | SCDn | 2 | | 51 | | | | |
| 2 | 5/7/23 | SCDn | 2 | 51 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 41 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 45 | | | | |
| 2 | 5/7/23 | SCDn | 2 | | | | 26 | | |
| 2 | 5/7/23 | SCDn | 2 | 39 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 53 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 56 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 54 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 52 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 44 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 49 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | | 49 | | | | |
| 2 | 5/7/23 | SCDn | 2 | 50 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 40 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 58 | | | | | |
| 2 | 5/7/23 | SCDn | 2 | 36 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | | | | | 350 | |
| 2 | 5/7/23 | SCDn | 3 | | 42 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 54 | | | | |
| 2 | 5/7/23 | SCDn | 3 | 44 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | 32 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 49 | | | | |

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| 2 | 5/7/23 | SCDn | 3 | | 51 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 49 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | | | 26 | | |
| 2 | 5/7/23 | SCDn | 3 | | 38 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 51 | | | | |
| 2 | 5/7/23 | SCDn | 3 | 47 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 57 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 34 | | | | |
| 2 | 5/7/23 | SCDn | 3 | 45 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | 44 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | 39 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 33 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 46 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 32 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 35 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 44 | | | | |
| 2 | 5/7/23 | SCDn | 3 | 72 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | 42 | | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 51 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 45 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 54 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 61 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 50 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 46 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 50 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 34 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | | | | 26 | |
| 2 | 5/7/23 | SCDn | 3 | | 31 | | | | |
| 2 | 5/7/23 | SCDn | 3 | | 32 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 350 | |
| 3 | 11/9/23 | WCDn | 1 | | 54 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | 84 | | | |
| 3 | 11/9/23 | WCDn | 1 | | 51 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | 60 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | 24 | | |
| 3 | 11/9/23 | WCDn | 1 | 53 | | | | | |
| 3 | 11/9/23 | WCDn | 1 | 51 | | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 140 | |
| 3 | 11/9/23 | WCDn | 1 | | | | 20 | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 155 | |
| 3 | 11/9/23 | WCDn | 1 | | 67 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | 56 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | 20 | | |
| 3 | 11/9/23 | WCDn | 1 | 51 | | | | | |

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| 3 | 11/9/23 | WCDn | 1 | | | | | 160 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 170 | |
| 3 | 11/9/23 | WCDn | 1 | 44 | | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 60 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 195 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 110 | |
| 3 | 11/9/23 | WCDn | 1 | | 60 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | 65 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | 24 | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 270 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 190 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 120 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 110 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 110 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 270 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 180 | |
| 3 | 11/9/23 | WCDn | 1 | | 60 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | 59 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 105 | |
| 3 | 11/9/23 | WCDn | 1 | | 54 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 120 | |
| 3 | 11/9/23 | WCDn | 1 | | 85 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | 62 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 150 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 460 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 126 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 130 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 140 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 130 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 120 | |
| 3 | 11/9/23 | WCDn | 1 | | | | | 290 | |
| 3 | 11/9/23 | WCDn | 1 | | 56 | | | | |
| 3 | 11/9/23 | WCDn | 1 | | | | 22 | | |
| 3 | 11/9/23 | DCUp | 1 | | 55 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 50 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 48 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 41 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | | | | 150 | |
| 3 | 11/9/23 | DCUp | 1 | 50 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 32 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 42 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 43 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 35 | | | | | |

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| 3 | 11/9/23 | DCUp | 1 | 40 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 50 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 44 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 44 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 38 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 50 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 29 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 31 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 38 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 33 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 54 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 57 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 44 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 29 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 42 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 30 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 28 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | | | | 85 | |
| 3 | 11/9/23 | DCUp | 1 | | 114 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 29 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 31 | | | | | |
| 3 | 11/9/23 | DCUp | 1 | | | | | 420 | |
| 3 | 11/9/23 | DCUp | 1 | | | | | 250 | |
| 3 | 11/9/23 | DCUp | 1 | | 55 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 40 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 70 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 55 | | | | |
| 3 | 11/9/23 | DCUp | 1 | | 35 | | | | |
| 3 | 11/9/23 | DCUp | 1 | 32 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 20 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | | | | 200 | |
| 3 | 11/9/23 | DCUp | 2 | | 40 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 39 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 38 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 45 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 31 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 38 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 36 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 47 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 39 | | | | |

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| 3 | 11/9/23 | DCUp | 2 | 33 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 35 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 31 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 31 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 39 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 44 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 30 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 32 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 23 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 24 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 54 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 45 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 42 | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 43 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 44 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 34 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | | | | 75 | |
| 3 | 11/9/23 | DCUp | 2 | | 30 | | | | |
| 3 | 11/9/23 | DCUp | 2 | 33 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 22 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 39 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 31 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 41 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | 40 | | | | | |
| 3 | 11/9/23 | DCUp | 2 | | 28 | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | | | 380 | |
| 3 | 11/9/23 | DCUp | 3 | | | 64 | | | |
| 3 | 11/9/23 | DCUp | 3 | 45 | | | | | |
| 3 | 11/9/23 | DCUp | 3 | 35 | | | | | |
| 3 | 11/9/23 | DCUp | 3 | | 45 | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 62 | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 75 | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 55 | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 62 | | | |
| 3 | 11/9/23 | DCUp | 3 | | 62 | | | | |
| 3 | 11/9/23 | DCUp | 3 | | 50 | | | | |
| 3 | 11/9/23 | DCUp | 3 | 34 | | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 61 | | | |
| 3 | 11/9/23 | DCUp | 3 | | | | | 20 | |
| 3 | 11/9/23 | DCUp | 3 | 55 | | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 68 | | | |
| 3 | 11/9/23 | DCUp | 3 | | 50 | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | 62 | | | |
| 3 | 11/9/23 | DCUp | 3 | 45 | | | | | |

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| 3 | 11/9/23 | DCUp | 3 | 35 | | | | | |
| 3 | 11/9/23 | DCUp | 3 | | | | | 140 | |
| 3 | 11/9/23 | DCUp | 3 | | | | | 210 | |
| 3 | 11/9/23 | DCUp | 3 | | | | | 354 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 190 | |
| 4 | 27/11/23 | WCDn | 1 | | 63 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | 78 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 140 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 380 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 160 | |
| 4 | 27/11/23 | WCDn | 1 | | 46 | | | | |
| 4 | 27/11/23 | WCDn | 1 | 60 | | | | | |
| 4 | 27/11/23 | WCDn | 1 | | 72 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | 64 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 295 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 400 | |
| 4 | 27/11/23 | WCDn | 1 | | 73 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | 56 | | | | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 175 | |
| 4 | 27/11/23 | WCDn | 1 | | 65 | | | | |
| 4 | 27/11/23 | WCDn | 1 | 55 | | | | | |
| 4 | 27/11/23 | WCDn | 1 | | | | 37 | | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 150 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 170 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 120 | |
| 4 | 27/11/23 | WCDn | 1 | | | | | 70 | |
| 4 | 27/11/23 | DCUp | 1 | | | | | 300 | |
| 4 | 27/11/23 | DCUp | 1 | | 100 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 60 | | | | |
| 4 | 27/11/23 | DCUp | 1 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 35 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 49 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 41 | | | | |
| 4 | 27/11/23 | DCUp | 1 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 26 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 54 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 48 | | | | |
| 4 | 27/11/23 | DCUp | 1 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 52 | | | | |

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| 4 | 27/11/23 | DCUp | 1 | | 48 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 33 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 39 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 46 | | | | |
| 4 | 27/11/23 | DCUp | 1 | 36 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 32 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | 41 | | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 40 | | | | |
| 4 | 27/11/23 | DCUp | 1 | | 54 | | | | |
| 4 | 27/11/23 | DCUp | 1 | 39 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 31 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 39 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 43 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 54 | | | | |
| 4 | 27/11/23 | DCUp | 2 | | | | | 200 | |
| 4 | 27/11/23 | DCUp | 2 | | | 68 | | | |
| 4 | 27/11/23 | DCUp | 2 | | 28 | | | | |
| 4 | 27/11/23 | DCUp | 2 | 50 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 54 | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 50 | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 40 | | | | |
| 4 | 27/11/23 | DCUp | 2 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 27 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 55 | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 44 | | | | |
| 4 | 27/11/23 | DCUp | 2 | 39 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 34 | | | | |
| 4 | 27/11/23 | DCUp | 2 | 34 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 29 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 29 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | 39 | | | | |
| 4 | 27/11/23 | DCUp | 2 | 27 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 40 | | | | | |

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| 4 | 27/11/23 | DCUp | 2 | 49 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 37 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 44 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 34 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 36 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | | | 70 | | | |
| 4 | 27/11/23 | DCUp | 2 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 2 | 31 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | | | | 270 | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | | 65 | | | |
| 4 | 27/11/23 | DCUp | 3 | | 90 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 40 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 52 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 55 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 54 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | | 89 | | | |
| 4 | 27/11/23 | DCUp | 3 | | 42 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 48 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 38 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 48 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 44 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 35 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 47 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 50 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 100 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 51 | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 53 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 41 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 34 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 33 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 52 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 43 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 32 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 36 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 47 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 31 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | | 81 | | | |

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| 4 | 27/11/23 | DCUp | 3 | 37 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 40 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 53 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 33 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 30 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 33 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 34 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 39 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 41 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 59 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 29 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 48 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 53 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 42 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 41 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 28 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | | | | 220 | |
| 4 | 27/11/23 | DCUp | 3 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 38 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 36 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 35 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | | 42 | | | | |
| 4 | 27/11/23 | DCUp | 3 | 22 | | | | | |
| 4 | 27/11/23 | DCUp | 3 | 27 | | | | | |
| 5 | 27/3/24 | WCUp | 1 | | | | 35 | | |
| 5 | 27/3/24 | WCUp | 1 | | | | 10 | | |
| 5 | 27/3/24 | WCUp | 3 | | 82 | | | | |
| 5 | 27/3/24 | WCUp | 3 | | | | 34 | | |
| 5 | 27/3/24 | WCDn | 1 | | 74 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 59 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 61 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 73 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 59 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 51 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 81 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 82 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 62 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 74 | | | | |

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| 5 | 27/3/24 | WCDn | 1 | | 62 | | | | |
| 5 | 27/3/24 | WCDn | 1 | | 62 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 55 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 50 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 70 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 79 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 75 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 70 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 65 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 72 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 64 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 69 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 74 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 71 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 59 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 74 | | | | |
| 5 | 27/3/24 | WCDn | 2 | | 83 | | | | |
| 5 | 27/3/24 | WCDn | 3 | 58 | | | | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 35 | | |
| 5 | 27/3/24 | WCDn | 3 | | 75 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 78 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 76 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 71 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 70 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 60 | | | | |
| 5 | 27/3/24 | WCDn | 3 | 51 | | | | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 31 | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 24 | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 23 | | |
| 5 | 27/3/24 | WCDn | 3 | 49 | | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 71 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 49 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 29 | | |
| 5 | 27/3/24 | WCDn | 3 | | | | 34 | | |
| 5 | 27/3/24 | WCDn | 3 | | 63 | | | | |
| 5 | 27/3/24 | WCDn | 3 | 46 | | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 50 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 46 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 71 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 50 | | | | |
| 5 | 27/3/24 | WCDn | 3 | | 48 | | | | |
| 5 | 27/3/24 | WCDn | 3 | 62 | | | | | |
| 5 | 27/3/24 | WCDn | 3 | | | | | 250 | |
| 5 | 27/3/24 | DCUp | 1 | | 74 | | | | |

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| 5 | 27/3/24 | DCUp | 1 | 46 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 31 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | | | | | 550 | |
| 5 | 27/3/24 | DCUp | 1 | | 60 | | | | |
| 5 | 27/3/24 | DCUp | 1 | | 70 | | | | |
| 5 | 27/3/24 | DCUp | 1 | 42 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 37 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | | 71 | | | | |
| 5 | 27/3/24 | DCUp | 1 | 41 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 38 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 33 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 44 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 49 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | | 50 | | | | |
| 5 | 27/3/24 | DCUp | 1 | 48 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 35 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 29 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 34 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 33 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 39 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 34 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | | | 53 | | | |
| 5 | 27/3/24 | DCUp | 1 | 35 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 46 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 49 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 49 | | | | | |
| 5 | 27/3/24 | DCUp | 1 | 30 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 30 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 30 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 31 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 52 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 46 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 65 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 75 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 44 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 46 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 29 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 31 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 34 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | | | | | 62 | |
| 5 | 27/3/24 | DCUp | 2 | | 51 | | | | |

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| 5 | 27/3/24 | DCUp | 2 | 50 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | | 83 | | | | |
| 5 | 27/3/24 | DCUp | 2 | 52 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 49 | | | | | |
| 5 | 27/3/24 | DCUp | 2 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 43 | | | | |
| 5 | 27/3/24 | DCUp | 3 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 27 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 52 | | | | |
| 5 | 27/3/24 | DCUp | 3 | 54 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 39 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 37 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 42 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 45 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 39 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 134 | | | | |
| 5 | 27/3/24 | DCUp | 3 | 64 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 57 | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 54 | | | | |
| 5 | 27/3/24 | DCUp | 3 | 41 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 49 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 36 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 44 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 39 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | | | | 135 | |
| 5 | 27/3/24 | DCUp | 3 | 51 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 35 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | | 50 | | | | |
| 5 | 27/3/24 | DCUp | 3 | 35 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 36 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 44 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 30 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 29 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 44 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 34 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 38 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 46 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 30 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 25 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 56 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 40 | | | | | |
| 5 | 27/3/24 | DCUp | 3 | 26 | | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 65 | | | | |

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| 5 | 27/3/24 | DCDn | 1 | | 75 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 76 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 74 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 50 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | | 70 | | | |
| 5 | 27/3/24 | DCDn | 1 | | 56 | | | | |
| 5 | 27/3/24 | DCDn | 1 | 34 | | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 65 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 47 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 52 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 63 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | | | 34 | | |
| 5 | 27/3/24 | DCDn | 1 | | | | 33 | | |
| 5 | 27/3/24 | DCDn | 1 | | | | 31 | | |
| 5 | 27/3/24 | DCDn | 1 | | 73 | | | | |
| 5 | 27/3/24 | DCDn | 1 | | 47 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 36 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 34 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 33 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 33 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 28 | | |
| 5 | 27/3/24 | DCDn | 2 | | 66 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | | | | 350 | |
| 5 | 27/3/24 | DCDn | 2 | | | | | 350 | |
| 5 | 27/3/24 | DCDn | 2 | | 61 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | 70 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 33 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 31 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 31 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 22 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 29 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 28 | | |
| 5 | 27/3/24 | DCDn | 2 | | 51 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | 44 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | 49 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 39 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 36 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 36 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 37 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 35 | | |
| 5 | 27/3/24 | DCDn | 2 | | | | 29 | | |
| 5 | 27/3/24 | DCDn | 2 | | 60 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | 49 | | | | |
| 5 | 27/3/24 | DCDn | 2 | | 57 | | | | |

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| 5 | 27/3/24 | DCDn | 3 | | | | 25 | | |
| 5 | 27/3/24 | DCDn | 3 | | 79 | | | | |
| 5 | 27/3/24 | DCDn | 3 | | 75 | | | | |
| 5 | 27/3/24 | DCDn | 3 | 47 | | | | | |
| 5 | 27/3/24 | DCDn | 3 | | | | 27 | | |
| 5 | 27/3/24 | DCDn | 3 | | | | 29 | | |
| 5 | 27/3/24 | DCDn | 3 | | 75 | | | | |
| 5 | 27/3/24 | DCDn | 3 | | | | 26 | | |
| 5 | 27/3/24 | DCDn | 3 | | | 80 | | | |
| 5 | 27/3/24 | DCDn | 3 | 51 | | | | | |
| 5 | 27/3/24 | DCDn | 3 | | | | 34 | | |
| 5 | 27/3/24 | DCDn | 3 | | | | 38 | | |
| 5 | 28/3/24 | WES | 1 | 73 | | | | | |
| 5 | 28/3/24 | WES | 1 | 77 | | | | | |
| 5 | 28/3/24 | WES | 1 | 82 | | | | | |
| 5 | 28/3/24 | WES | 1 | | 76 | | | | |
| 5 | 28/3/24 | WES | 2 | | 77 | | | | |
| 6 | 26/6/24 | WCUp | 1 | | | | 25 | | |
| 6 | 26/6/24 | WCUp | 1 | | | | 15 | | |
| 6 | 26/6/24 | WCUp | 1 | | | | 25 | | |
| 6 | 26/6/24 | WCUp | 2 | | | | 23 | | |
| 6 | 26/6/24 | WCUp | 2 | | | | 24 | | |
| 6 | 26/6/24 | WCUp | 2 | | | | 23 | | |
| 6 | 27/6/24 | DCUp | 1 | 51 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 52 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 39 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 41 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 25 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 30 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | | 55 | | | | |
| 6 | 27/6/24 | DCUp | 1 | 50 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 32 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 60 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | | 66 | | | | |
| 6 | 27/6/24 | DCUp | 1 | 48 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 49 | | | | | |
| 6 | 27/6/24 | DCUp | 1 | 35 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 46 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 52 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 56 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 54 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 59 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 31 | | | | |

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| 6 | 27/6/24 | DCUp | 2 | | 52 | | | | |
| 6 | 27/6/24 | DCUp | 2 | 32 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 29 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 36 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 35 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 52 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 31 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 49 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 39 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 29 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 30 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 40 | | | | |
| 6 | 27/6/24 | DCUp | 2 | 31 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 46 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 49 | | | | |
| 6 | 27/6/24 | DCUp | 2 | 53 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 36 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 55 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 46 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 39 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 61 | | | | |
| 6 | 27/6/24 | DCUp | 2 | | 43 | | | | |
| 6 | 27/6/24 | DCUp | 2 | 35 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 63 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | | | | | 95 | |
| 6 | 27/6/24 | DCUp | 2 | 45 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 49 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 30 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 2 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 70 | | | | |
| 6 | 27/6/24 | DCUp | 3 | 31 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 36 | | | | |
| 6 | 27/6/24 | DCUp | 3 | 30 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 38 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 31 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 41 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 56 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 35 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 64 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 45 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 55 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 45 | | | | | |

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| 6 | 27/6/24 | DCUp | 3 | 33 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 45 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 44 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 56 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 59 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 76 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 57 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 83 | | | | |
| 6 | 27/6/24 | DCUp | 3 | 72 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 42 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 38 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 39 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 62 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 77 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 64 | | | | |
| 6 | 27/6/24 | DCUp | 3 | | 46 | | | | |
| 6 | 27/6/24 | DCUp | 3 | 38 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | | | | 32 | | |
| 6 | 27/6/24 | DCUp | 3 | 29 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 26 | | | | | |
| 6 | 27/6/24 | DCUp | 3 | 25 | | | | | |
| 6 | 27/6/24 | DCDn | 1 | 51 | | | | | |
| 6 | 27/6/24 | DCDn | 1 | 55 | | | | | |
| 6 | 27/6/24 | DCDn | 1 | 61 | | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 51 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 49 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 54 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 79 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 74 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 59 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 57 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 42 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 44 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 64 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 54 | | | | |
| 6 | 27/6/24 | DCDn | 1 | | 40 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 69 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 66 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 75 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 70 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 75 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 82 | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| 6 | 27/6/24 | DCDn | 2 | | 48 | | | | |
| 6 | 27/6/24 | DCDn | 2 | | | | 32 | | |
| 6 | 27/6/24 | DCDn | 2 | | 45 | | | | |
| 6 | 27/6/24 | DCDn | 2 | 54 | | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 54 | | | | |
| 6 | 27/6/24 | DCDn | 2 | 52 | | | | | |
| 6 | 27/6/24 | DCDn | 2 | 50 | | | | | |
| 6 | 27/6/24 | DCDn | 2 | | 42 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 82 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 69 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 71 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 51 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 59 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 67 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | 50 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | 84 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 64 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 64 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | 62 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 54 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 50 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | | | 35 | | |
| 6 | 27/6/24 | DCDn | 3 | | 82 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 64 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 54 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 65 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | | | 32 | | |
| 6 | 27/6/24 | DCDn | 3 | 58 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 48 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 85 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 51 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 81 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 69 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 45 | | | | |
| 6 | 27/6/24 | DCDn | 3 | 47 | | | | | |
| 6 | 27/6/24 | DCDn | 3 | | 41 | | | | |
| 6 | 27/6/24 | DCDn | 3 | | | | 32 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 22 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 20 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 15 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 20 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 30 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 15 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 26/6/24 | SCUp | 3 | | | | 35 | | |
| 6 | 26/6/24 | SCUp | 1 | | | | 30 | | |
| 6 | 26/6/24 | SCUp | 3 | | | | 25 | | |
| 6 | 26/6/24 | SCDn | 2 | | | | 10 | | |
| 6 | 26/6/24 | SCDn | 2 | | | | 10 | | |
| 6 | 26/6/24 | SCDn | 1 | 42 | | | | | |
| 6 | 26/6/24 | SCDn | 1 | | 45 | | | | |