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Marine Environmental Assessment of a Trial Site for a Proposed Blue Economy Zone

prepared for

Blue Economy CRC

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Cover photo: Short-beaked common dolphin (*Delphinus delphis*) at proposed Blue Economy Zone trial site (image source: Marine Solutions 2024).

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Executive Summary

Marine Solutions was engaged by the Blue Economy CRC to conduct a benthic assessment for the proposed Blue Economy Zone (BEZ) trial site in the Bass Strait.

The purpose of this study is to provide a detailed site characterisation of the BEZ trial site. Survey methods included benthic habitat survey, flora and fauna survey, multibeam echosounder (MBES) bathymetric mapping, sub-bottom profiling, and sediment sampling.

The benthic habitat survey involving underwater video footage at 30 sites determined the benthic habitat as unconsolidated bioturbated sandy substrate with shell debris. Sparse sponge communities were also observed at all sites.

Opportunistic observations of protected marine species were made from the research vessel. Threatened species observations included the shy albatross (listed as endangered under federal legislation), Wilsons storm petrel (listed as rare under state legislation), and Southern bluefin tuna (listed as Conservation Dependent under federal legislation).

Over 400 hectares were bathymetrically mapped using a multibeam echo sounder including the proposed trial site and a buffer zone. The bathymetry of the proposed trial site ranged from approximately 54.5 m to 60.7 m depth, with shallower areas to the south-west and depth increasing north-eastwards.

The results from the sub-bottom profiling determined very few locations of rocky outcrops. These were located at shallower locations on the southwest bottom of the survey area. The survey found unconsolidated sediment coverage over the majority of the site.

These investigations find the area surveyed likely to be suitable for the proposed BEZ trial site, based on surveyed marine environmental factors.

1 Introduction

1.1 Project Background

As part of its commitment to the strategic development of blue economy activities in Australia's offshore waters, the Blue Economy CRC is undertaking a three-year research trial of offshore aquaculture at a trial site of approximately 100 ha, located 12 km north of Burnie, Tasmania.

Between March 2021 and December 2022, data was collected for a baseline survey in the Bass Strait (Cossu and Frid 2022). Included in the scope of the baseline survey was seafloor mapping, sediment and benthic habitat characterisation, hydrodynamics characterisation, and biological community characterisation. This baseline survey provided initial data to plan for a more detailed site characterisation survey (Marine Solutions 2023), and for industry partners to feed into their project planning processes.

Benthic habitat surveys of the initially proposed site identified the presence of dense sponge communities and bedrock. Due to the natural value of sponge communities and sensitive nature of this habitat type, the originally proposed location was deemed unsuitable for BEZ establishment, and investigations were abandoned at this site. Marine Solutions proposed a site located approximately 700 m north of the original location as an appropriate alternate location for the BEZ trial site (Marine Solutions, 2023) (Figure 1).

This report provides a benthic assessment of the proposed trial site.

1.2 Purpose and Scope

The purpose of this report is to provide a site characterisation of the proposed location in the Bass Strait for a BEZ trial site, based on marine environmental factors.

The scope of this report extends to detailed methods and results from a field survey of the proposed BEZ trial site undertaken in summer 2024.

The project included a detailed survey of the natural values, environment and ecology of the proposed site, including the exploration of

- bathymetry,
- sub bottom profiling,
- benthic habitat mapping,
- flora and fauna, and
- sediment composition.

The scope of this report extends to marine aspects only. The scope does not extend to terrestrial or avian aspects (with the exception of reporting of incidental sighting of bird species in Section 3.1).

1.3 Study Area

The proposed BEZ trial site is located approximately 12 km to the north of Burnie (see Figure 1). The site lies in the coastal waters of the Bass Strait and covers an area of approximately 115 hectares.

The north of Tasmania is home to several of the state's major ports including Burnie which has a long history as an industrial hub with associated pollution issues. Notably, the Tioxide Australia paint pigment factory which produced titanium dioxide, used pyrite to make sulphuric acid as part of the production process. Byproducts of the roast used to be dumped offshore in dump grounds in the area of the proposed trial site (pers comm, Tioxide Australia ex-employee 2023). It is unknown how near the proposed trial site is to the historic dumping grounds. Part of the production process also produced ferro sulphates which were discharged into Bass Strait, colouring the sea rust-red, well out to sea and often many kilometres along the coast (pers comm, Tioxide Australia ex-employee 2023).

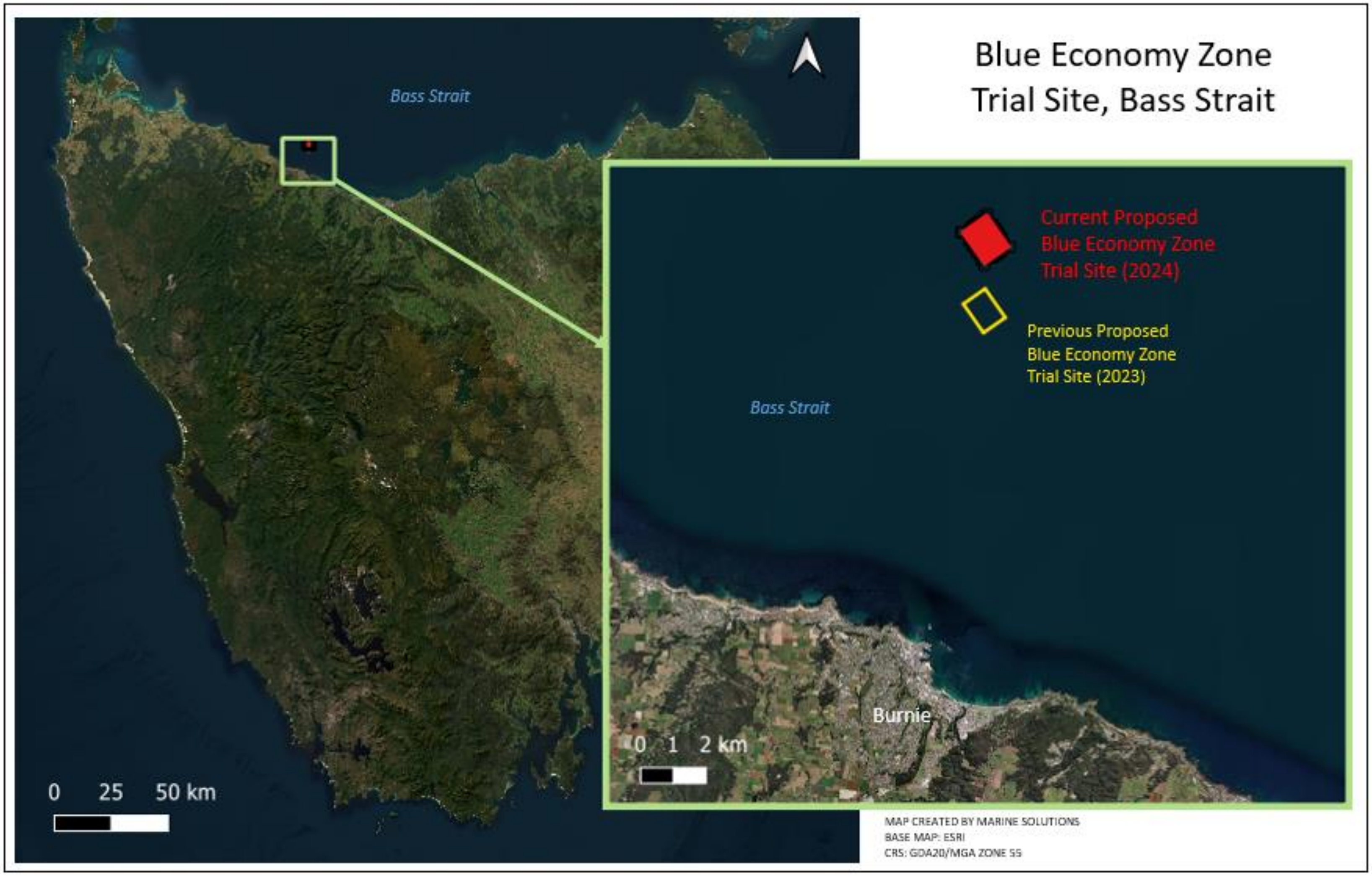


Figure 1. Map showing the original proposed BEZ, which was found to be unsuitable due to the presence of sponge communities and outcropping bedrock, and the new proposed BEZ (the subject of this report).

2 Benthic Habitat Survey

2.1 Methods

Benthic habitat video survey was conducted at 30 sites within the survey area on 30th of January 2024 (Appendix 1). Cameras were deployed from a research vessel (5.8 m monohull survey vessel *Second Solution*). and recorded footage for a minimum of three minutes per site whilst the vessel was adrift. As a result, the transect lines were of varying lengths and in a range of directions.

Video footage was captured with a towed Sony STARVIS IMX307 CMOS camera flown approximately 30-50 cm above the seafloor fitted with 2 x 550 lumen LED underwater video torches. High-definition footage was also recorded using a GoPro Hero8 camera mounted to the camera frame. Footage was captured to obtain detailed information on habitat attributes and to incorporate into benthic habitat classification. Each video was stamped with date, time and positional information. The footage was analysed *post hoc* for dominant flora and fauna, and habitat structure and patchiness. Substrate was analysed based on the Collaborative and Automated Tools for Analysis of Marine Imagery (CATAMI) classification scheme (Althaus *et al* 2014; Appendix 3).

The starting position for each camera deployment is shown in Figure 2.

Figure 2. Benthic habitat survey camera deployment positions.

2.2 Results

The dominant benthic habitat at the sites surveyed comprised sandy substrate interspersed with sponges and, at some sites, seaweed (predominantly *Caulerpa* sp.). Sand observed was coarse, bioturbated, and littered with shell fragments (Figure 3).

The CATAMI Classification Scheme (Althaus *et al*., 2014) defines a range of terms used to describe benthic habitats. The benthos observed in the video surveys was unconsolidated sediment of soft substrate with shell fragments.

Sponges were observed at all 30 survey sites. Sponges were present in a variety of forms including branching, stalked, encrusting, cups, golf balls, tubular and laminar (Figure 3, Figure 4, Figure 5).

Caulerpa sp. observed was sparse and patchy (Figure 4).

Several finfish species were observed including Degen's leatherjacket (*Thamnaconus degeni*), common gurnard perch (*Neosebastes scorpaenoides*) and a gurnard (*Triglidae* sp.). Other marine life observed included doughboy scallops (*Chlamys asperrimus*), seven-armed starfish (*Astrole scabra*) and fanworms (Figure 5).

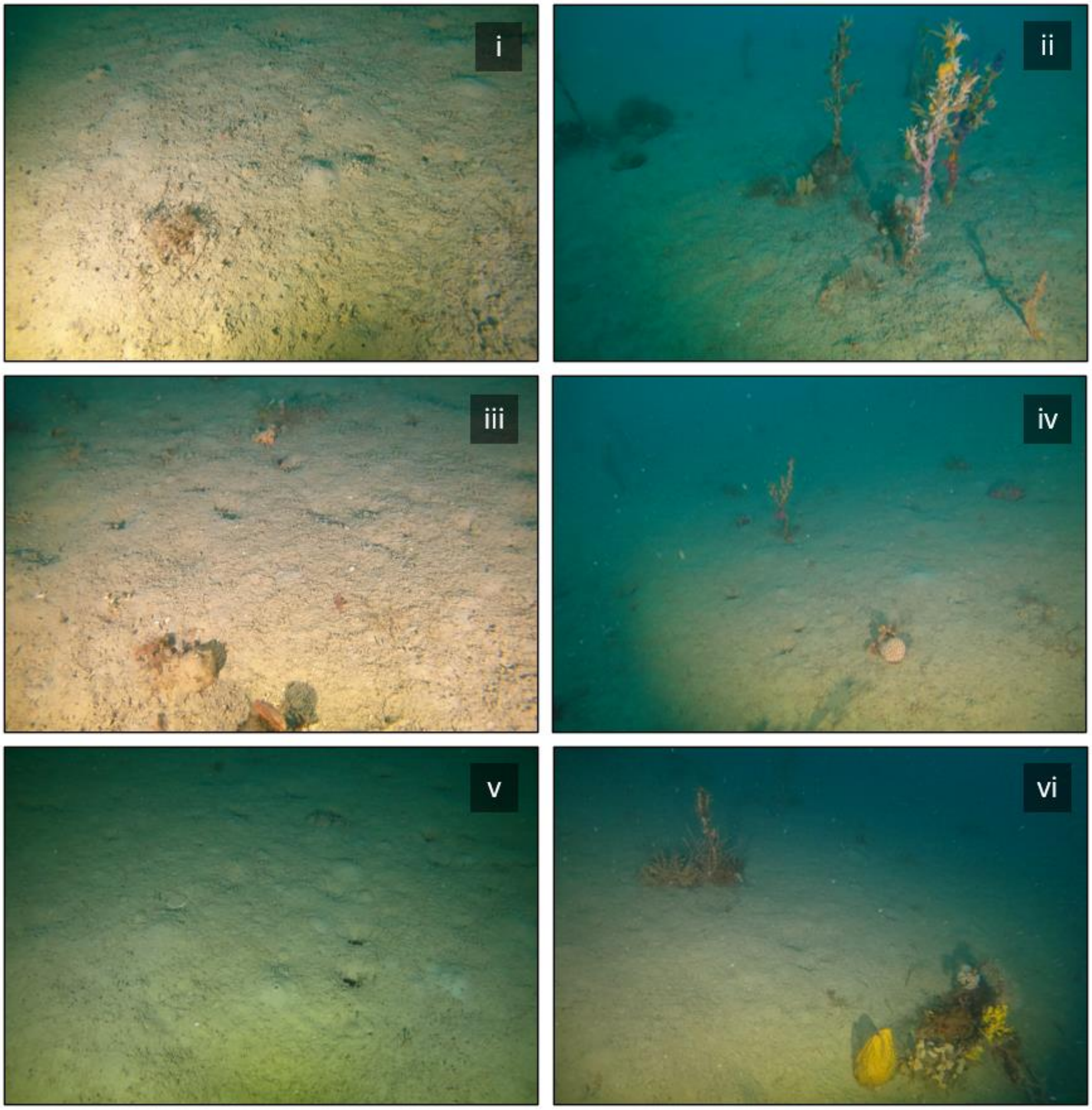


Figure 3. Example images of dominant benthic habitat. Bioturbated soft sediments interspersed with sparse sponges.

Figure 4. Example images of *Caulerpa* sp. densities. In addition to sponges and algae, species include ascidians (iv and v), and zoanthids (vi).

Figure 5. Examples of biota observed in benthic habitat survey including i) doughboy scallop, ii) Dewey's leatherjackets (male and female), iii) common gurnard perch, iv) fanworm, v) gurnard, and vi) seven-armed starfish.

3 Marine Fauna Observed in the Field

3.1 Incidental Sightings

3.1.1 Methods

At all times during the field component of the zone assessment, wherever an EPBC-listed species was sighted incidentally, it was recorded. No targeted surveys were undertaken.

3.1.2 Results

During the zone assessment field study, eight EPBC-listed species were identified within the survey area. These are shown in Table 1.

Table 1. EPBC-listed species identified within the survey area on 30th of January 2024.

Common Name	**Scientific Name**	**Observation Notes**	***EPBC* Listed**			
			Threatened	**Migratory**	**Cetacean**	**Marine**
Southern bluefin tuna	*Thunnus maccoyii*		Conservation dependant			
Common dolphin	*Delphinus delphis*				✓	
Shy albatross	*Thalassarche cauta*	x 2 sitting on the ocean surface	Endangered	✓		✓
Crested tern	*Thalasseus bergii*			✓		✓
Short tailed shearwater	*Puffinius tenuirostris*	Large group, constant presence. Flying and feeding		✓		✓
Wilson's storm petrel	*Oceanites oceanicus*			✓		✓
Fairy prion	*Pahcyptila turtur*					✓
Australasian gannet	*Morus serrator*					✓

4 Bathymetric Mapping

4.1 Methods

Multibeam echosounder (MBES) bathymetric mapping was conducted in conjunction with Veris Surveyors on 19th December 2023 to determine the variation in depth and seafloor habitat types over the extent of the survey area.

The study area was mapped using a Norbit iWBMS STX Narrow Transmit MBES System from an over-side sonar mount on the survey vessel *Nostromo* (6.59m monohull). See Table 2 for the specific data acquisition settings applied.

Over 400 hectares were mapped including the entirety of the proposed trial site and a buffer zone.

Data were processed and provided to Marine Solutions by Veris as separate GeoTIFF and depth contour shape files.

Table 2. Data acquisition settings applied by Veris during bathymetric surveys completed on the 19th of December 2023.

Parameter	Data Acquisition Settings
Sonar Frequency	400 kHz
Sector Coverage	Typically, 90 °
Beam Size	0.9 ° x 0.9 ° beam width at 400 kHz
Beam Spacing	512 beams and equiangular spacing
Pulse Settings	FM Pulse, 80 kHz bandwidth, 500 μs sweep time
Vessel Speed	Typically, between 4 and 5knots
Absorption	115 dB/km
Spreading	40 dB
Static Gain	-15.0 dB

4.2 Results

Bathymetry across the study area is illustrated in Figure 6. Depths vary from approximately 54.5 m to 60.7 m depth across the site with the deepest locations on the northeastern side of the study area. There appears to be a declining depth gradient from the northeast to the southwest where shallower depths are located. Majority of the site represents depths greater than 52 m. The multi-beam mapping also assists in identifying suitable habitat (sediment), and absence of significant rocky outcrops within the study area supporting findings of the sub-bottom profiles in Section 5.2.

Approximate BEZ boundaries overlayed on bathymetric map with depth contours (m) can be seen in Figure 6.

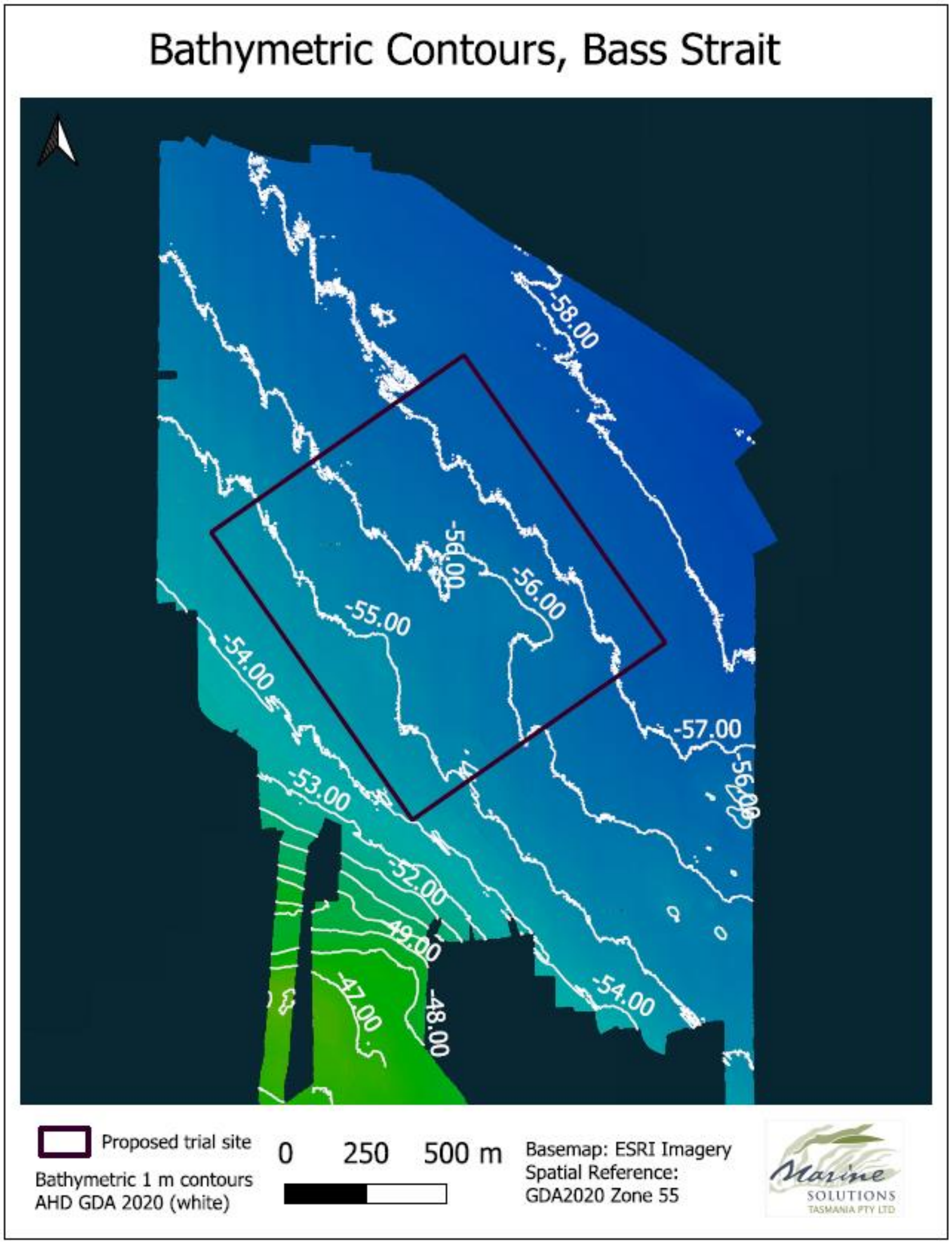


Figure 6. Approximate BEZ boundaries overlayed on multibeam bathymetric map.

5 Sub-bottom Profiling

5.1 Methods

Sub-bottom Profiling (SBP) data was acquired by Nathan Green (Veris) on 4th March 2024. The survey area encompassed the proposed BEZ and a buffer zone. Line spacing was set to 100 metres, running north-south, and east-west across the survey area.

SBP data was acquired using an Innomar SES 2000 COMPACT Parametric Sub-Bottom Profiler operating with the frequency set to 8kHz, and a pulse rate of 2 per second. The transducer was mounted to the vessel on an over-the-side sonar mount and had a draft of approximately 800mm. Vessel speed was limited to 4 knots.

The SBP was controlled using the Innomar SES software and was integrated with a SBG Navisight Apogee RTK system to provide positioning. The starting depth was set approximately 5 metres above the seafloor and a maximum expected penetration setting of 20 metres. Data was collected in MGA2020 Z55 Easting and Northing coordinate system. Horizontal accuracy is expected to be within +/- 0.5m.

BMT analysed the results of 25 low-frequency echographs using Sonarwiz 7. The low-frequency channel for each of the sub-bottom transects were analysed as they contained good useable information on the depth of sediment and sub-surface lamina.

5.2 Results

The seafloor and sub-surface sediment horizons were traced for each file, including the thicknesses of these two horizons and the presence of the third reflector (Figure 7, Figure 8). The first sediment horizon is immediately underneath the seafloor and second horizon is between horizon 1 and the base rock within the region (third reflector).

Horizon 1 layer has a relatively stable thickness and lateral continuity across the survey region other than being replaced with rocky outcrop presence at some shallower locations. Previous studies in the area suggest the upper layer is laminated and that possible seasonal and sand deposits gradually decrease in sand contents and fluvial inputs with depth.

Until ground truthing using physical samples are analysed, the second horizon remains of unknown origin. However, the lack of detail in acoustic return indicates a likely unconsolidated sediment with a low percentage of sand. Additionally, the large distance in which the acoustic ping penetrates this layer suggests it to be of small grain size such as silts and clay and potentially terrestrial origin.

Rocky outcrops were found in shallower regions and sediment depth typically increased with water depth. There was, however, a pattern of shallower sediment along the rise which ran diagonally from northwest to southeast, particularly evident in horizon 2 (Figure 8).

The base rock (below horizon 2) comes to the surface at some locations, which is shown in both the sub-bottom profiling and bathymetry. This occurs at the surface in the far southern and south-eastern survey extents and is shallower in the mid reaches where sediment horizon 2 is very thin.

All echograms and locations within the study area are shown in Annex A of *BMT's Blue Economy CRC Sub-Bottom Acoustic Analysis* report (Appendix 6).

Approximate BEZ boundary overlayed on horizon 1 and horizon 2 thickness contours can be seen in Figure 7 and Figure 8 respectively.

The results of the sub-bottom profile indicate there are variable locations within the survey area with at least 2 m depth of unconsolidated sediment. The survey coverage provided in the survey was extensive, however there are limitations associated with interpolating data within transects.

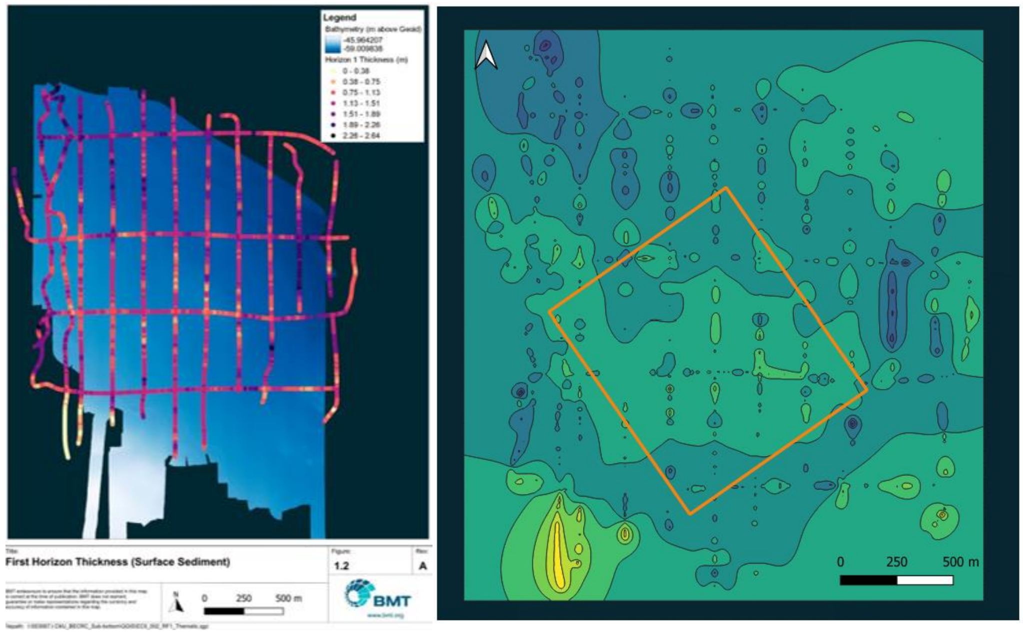


Figure 7. Horizon 1 Thickness. Left image shows data collection tracks (provided by BMT); right image shows interpolated contoured thickness with trial site boundary overlayed.

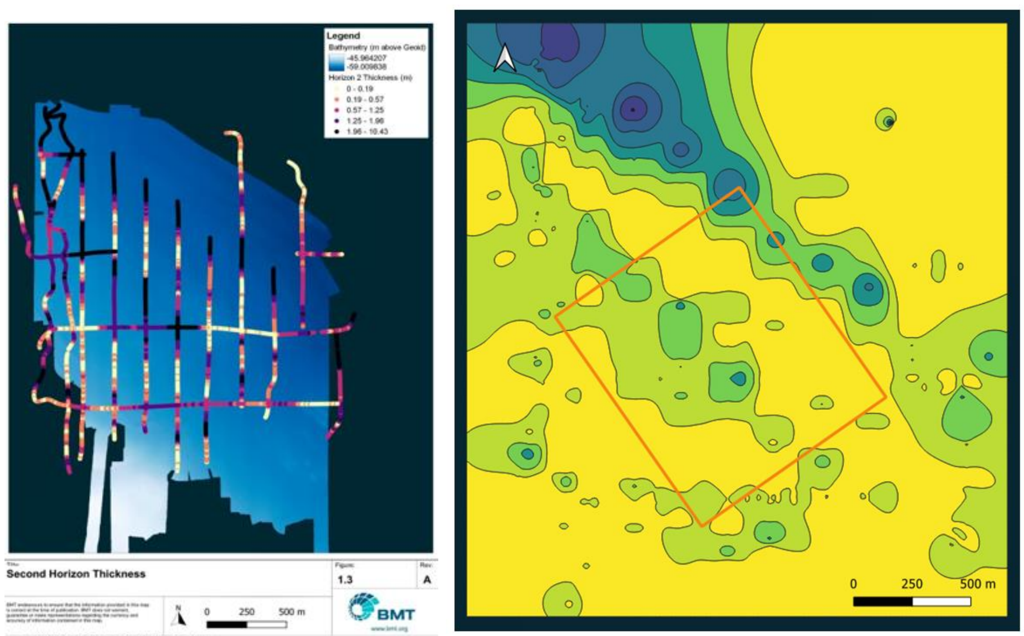


Figure 8. Horizon 2 Thickness. Left image shows data collection tracks (provided by BMT); right image shows interpolated contoured thickness with trial site boundary overlayed.

6 Sediments

6.1 Field Collection

Sediment samples were collected from 24 sites within the survey area on 6th of February 2024 (Figure 9, Appendix 2). Sites were distributed haphazardly throughout the survey area.

The number of particle size, contaminants and benthic infauna sites were chosen to reflect the spatial extent of the area. Sediments were collected for particle size, contaminants and benthic infauna analysis at 14 sites (BEZ 01- BEZ 14). At a further 10 sites, sediments were collected for benthic infauna (BEZ 15 – BEZ 24).

Samples were collected using a winch operated Ponar grab (Figure 10) and transferred to a prewashed and flushed intermediate holding vessel. Each sediment grab sample was labelled and photographed. All sediment samples were analysed for *in situ* detectable characteristics, including layering, colour, texture, and odour.

Samples were collected in clean laboratory glassware for particle size analysis (Section 6.2) and contaminant analysis (Section 6.3). A second subsample was sieved through a 1 mm sieve and retained for benthic infauna analysis (Section 6.4).

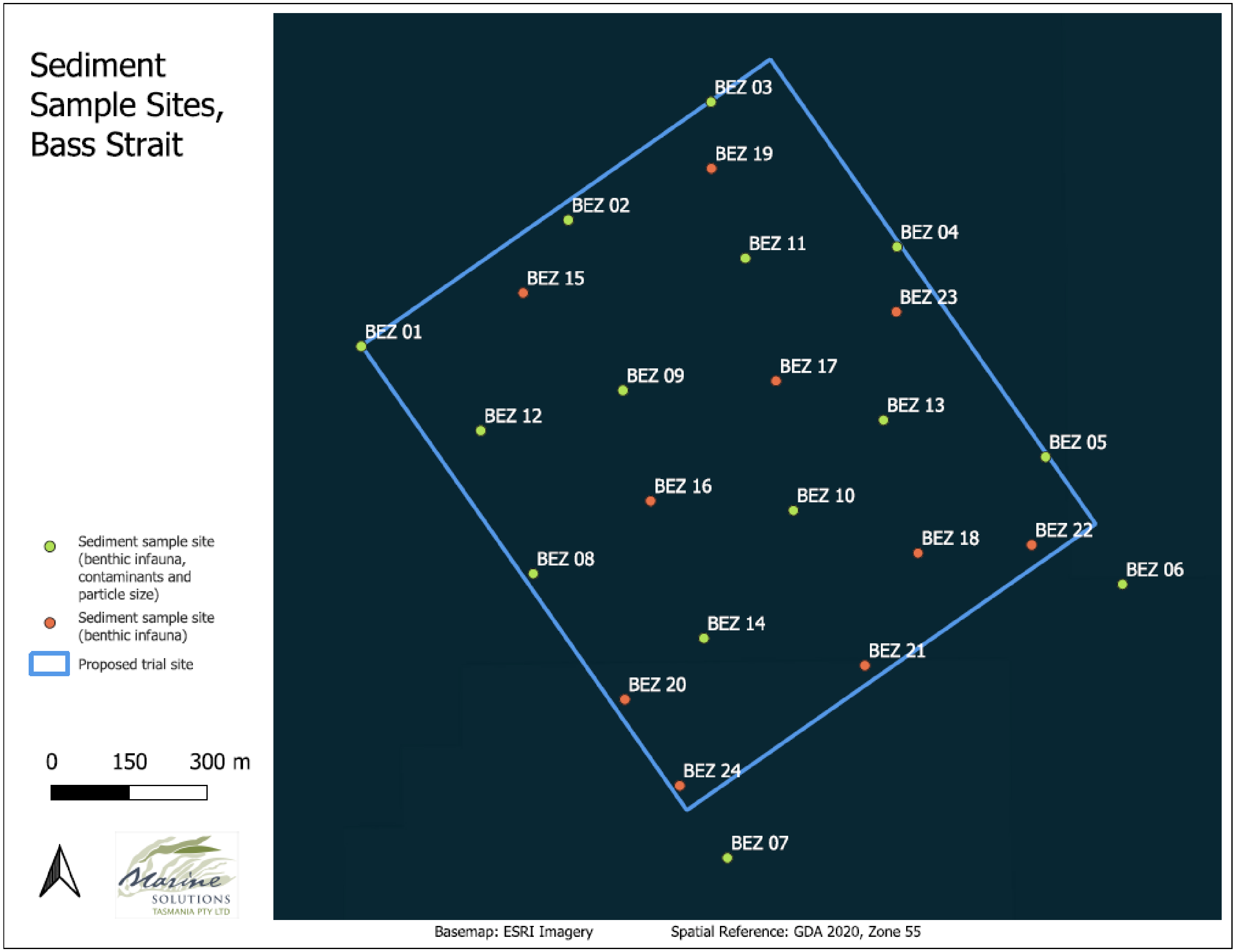


Figure 9. Sediment sampling sites within the BEZ trial site.

Figure 10. The Ponar grab operated from the winch on board the research vessel.

6.2 Particle Size

6.2.1 Methods

Particle size analysis was conducted in-house. Particle size distribution was assessed volumetrically by washing samples through a series of sieves (4 mm, 2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.125 mm and 0.063 mm). The contents of each sieve were drained completely of water and transferred to a measuring cylinder, beginning with the coarsest sediment fraction (4 mm), and working down to the finest (0.063 mm). The volume of sediment in the measuring cylinder was recorded for each sieve size. The sediment fraction <0.063 mm was calculated from the total volume of the sample minus the combined volume of all other size classes.

6.2.2 Results

Particle size was relatively homogenous across all sites (Figure 11). The samples were primarily composed of silt (< 0.063 mm) and fine sand (0.063 - < 0.5 mm). Many of the larger particles present in the samples were fragments of shell and calcareous invertebrate skeletons.

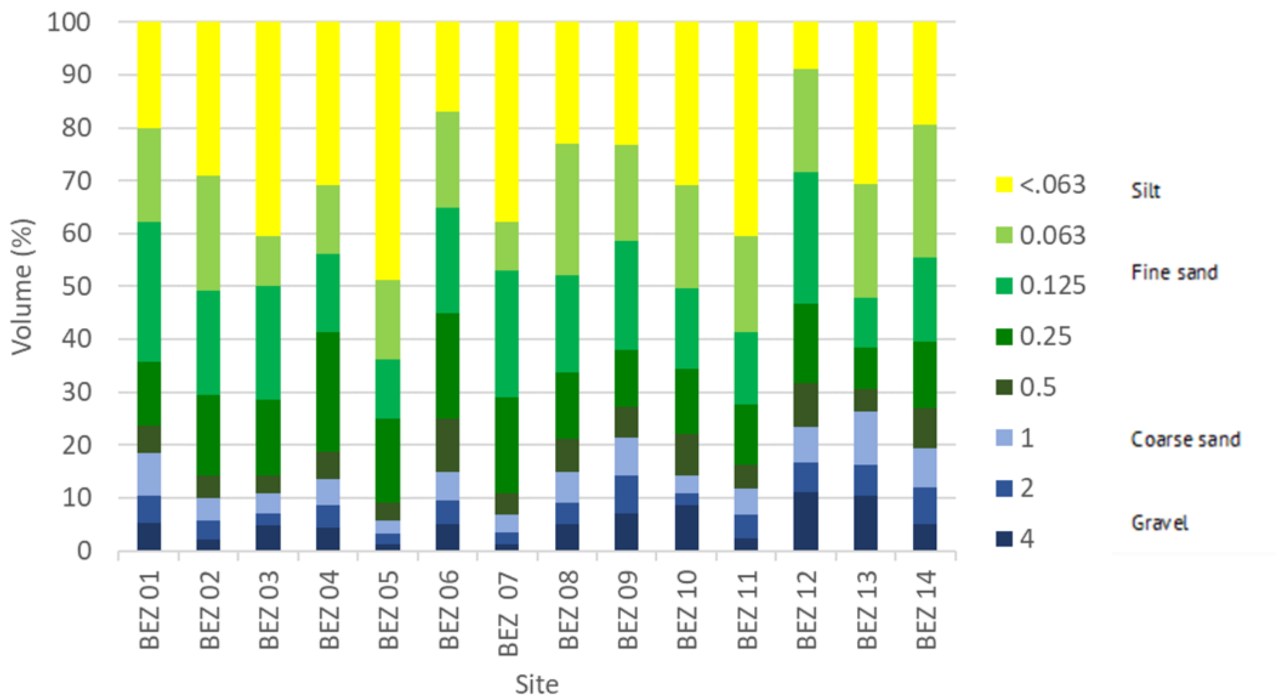


Figure 11. Particle size results for sites BEZ 01 – BEZ 14.

6.3 Contaminants

6.3.1 Methods

Samples were stored in a cool, dark area and sent to Analytical Services Tasmania (AST), NATA accredited laboratory, for analysis. Specifically, the samples were tested for the following parameters:

- Metals including As, Ca, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, S and Zn.

Laboratory results for the above parameters were then compared to the Australian & New Zealand Guidelines (ANZG) toxicant default guideline values (DGVs) and upper guideline values (GV-high) for sediment quality (ANZG 2019).

The DGVs for sediment quality indicate the concentrations below which there is a low risk of unacceptable effects occurring, and should be used, with other lines of evidence, to protect aquatic ecosystems. In contrast, the 'upper' guidelines values (GV-high) provide an indication of concentrations at which one might already expect to observe toxicity-related adverse effects.

6.3.2 Results

Sediment contaminant laboratory results are summarised in Table 3.

Of the analytes with ANZG DGVs, there was only one exceedance of a DGV; site BEZ05 exceeded the DGV for lead, although it remained well below the GV-high value.

Three metals were detected in amounts representing relatively high proportion of total sediment composition. These were calcium (over 30% of all sediments at all sites was composed of calcium), iron (composing 1.13% - 1.64%), and sulphur (composing 0.25% - 0.29%). None of these three metals have DGVs, likely due to an absence of adequate data for these toxicants (ANZG 2019). In the absence of DGVs, the ANZG recommendation is to derive site-specific guideline values from the 80^{th} percentile of a suitable reference site concentration.

It is plausible that historic sea disposal of byproducts from the Tioxide Australia paint pigment factory has contributed to the results found here.

For complete sediment contaminant results, refer Appendix 4.

Table 3. Summary of sediment contaminant laboratory results.

Analyte	ANZG		Results			
	DGV	GV-high	Min	Max	Average	DGV Exceedances
Arsenic	20	70	10	15	12.3	None
Calcium	-		315,000	347,000	332,000	n/a
Cadmium	1.5	10	<0.5	<0.5	<0.5	None
Cobalt	-		3	7	4.4	n/a
Chromium	80	370	21	27	24.1	None
Copper	65	270	10	31	16.9	None
Iron	-		11,300	16,400	13,250	n/a
Manganese	-		75	104	81.8	n/a
Nickle	21	52	9	13	11.5	none
Lead	50	220	16	60	33.3	BEZ05
Sulphur	-		2,540	2,940	2,745	n/a
Zinc	200	410	46	137	77	none

6.4 Benthic Infauna

6.4.1 Methods

Benthic infauna sampling was undertaken to assess the composition and abundance of infauna assemblages in the survey area. Benthic fauna sampling sites corresponded with the sites for sediment analysis. Standard sampling techniques for characterization of marine infauna were used, whereby the contents of single sediment grabs were washed through a 1 mm sieve, preserved in

10% formalin, placed in a labelled, food-grade plastic bag and sent to an infauna data expert, Lynda Avery (*Infauna Data*) for identification to family level.

6.4.2 Results

Benthic infauna across the survey area consisted of a combination of crustaceans, annelid worms, molluscs, echinoderms, nemerteans, nematodes and a single finding of a chordate (ascidian). The most abundant phylum across the sample sites were annelids (segmented worms) which accounted for 60% of total organisms, followed by crustaceans which represented 16.4%. The most abundant organisms were from the family spionidae (marine worms) which accounted for 37% of all organisms observed. This was followed by the ophiuroidea spp (brittle stars), sigalionidea (scale worms), nematoda and tanaidacea spp. (shrimp-like crustaceans). Benthic fauna counts at family level can be found in Appendix 5. A single ascidiacea spp was found at site 14 (noting that ascidians live on the benthos and are not targeted in infauna surveys) and only single families of echinoderms (ophiuroidea), nematodes and nemerteans were found across the survey.

A non-metric multidimensional scaling ordination of the data is provided (Figure 13). This plot represents the relationship between each site across families, i.e. how similar is each site in terms of family composition. Sites that are grouped closely in the plot have more similar family composition than those further away.

There was minimal variation in fauna abundance across sites, evident in the MDS plot produced using PRIMER7. Methodology was suitable for a baseline survey which was expected to be relatively homogenous across sites due to similar habitat however results in the analysis shouldn't be overstated, due to small sample size and single samples rather than duplicates/triplicates.

Findings are consistent with expectations for infauna community composition for environmental conditions of the survey area.

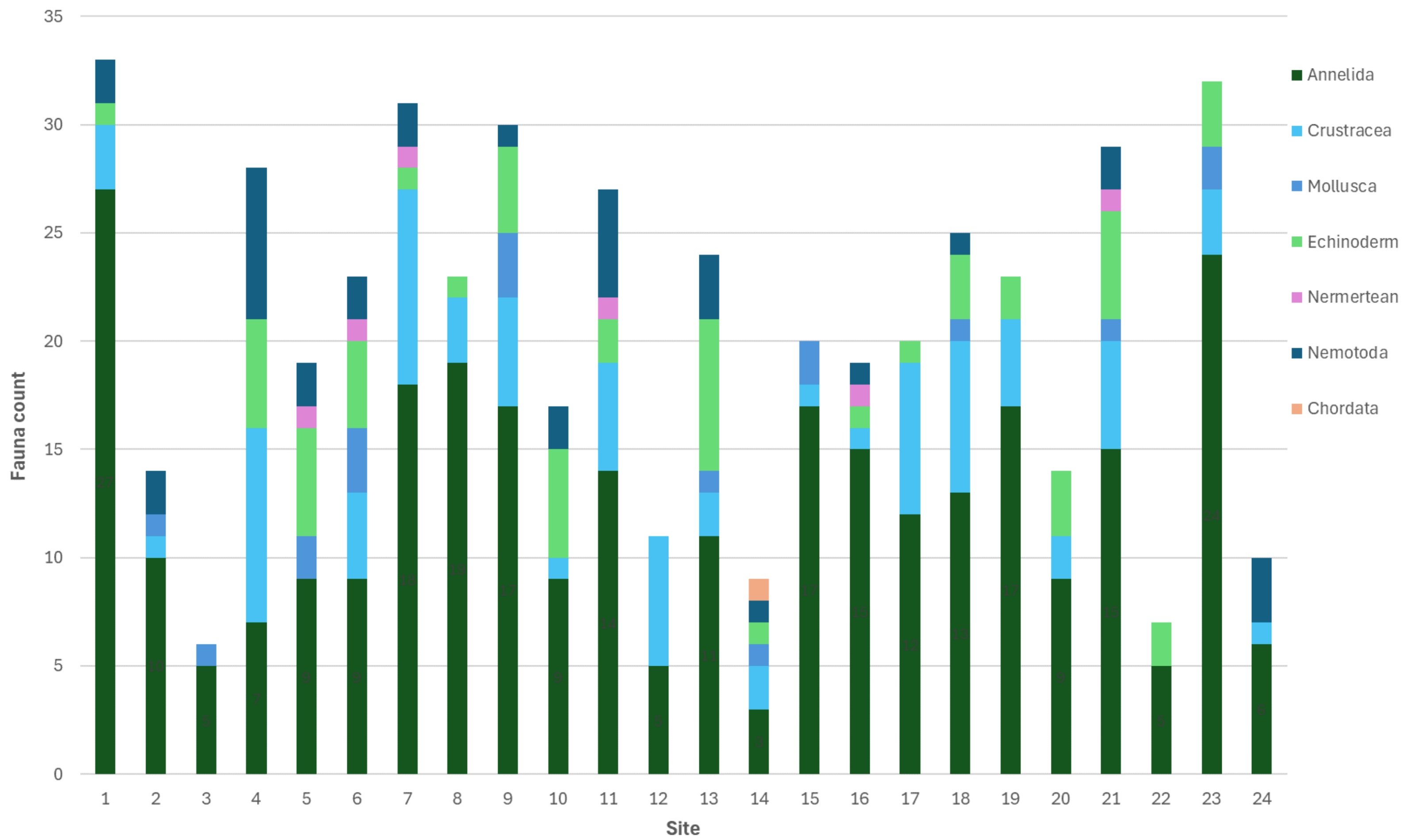


Figure 12. Benthic fauna counts by phylum at each site.

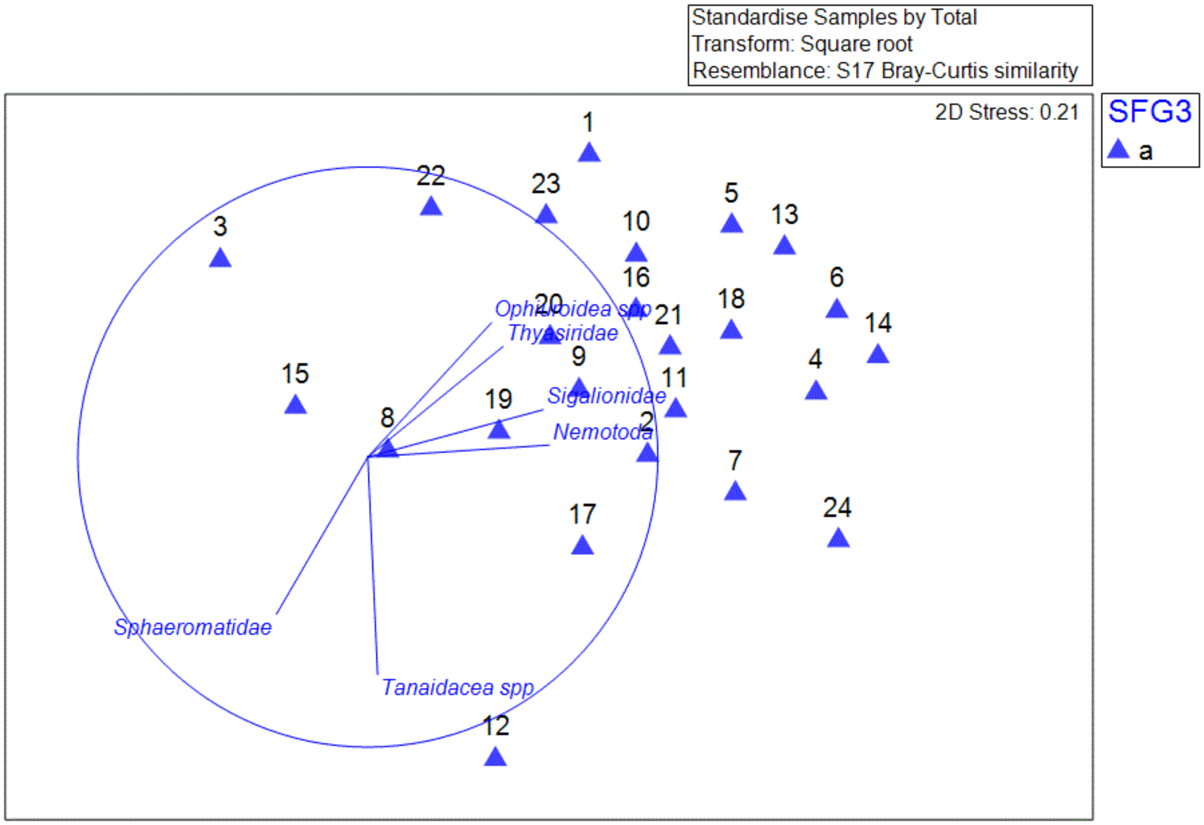


Figure 13. MDS plot of the relationship among sites for invertebrate families. Key families contributing to the differences in sites are shown with vectors indicating the direction of variation in abundance.

7 Conclusions

This report describes benthic conditions in a proposed Blue Economy Zone trial site. Survey methods included multibeam echosounder (MBES) bathymetric mapping, sub-bottom profiling, flora and fauna survey, benthic habitat survey and sediment sampling.

Key findings are:

- The bathymetry of the survey are ranged from approximately 54.5 m to 60.7 m, with depth increasing north-eastwards.
- Sub-bottom profiles indicate very few areas of rocky outcrops, and variable thickness of unconsolidated sediment overlying bedrock throughout the survey area.
- Underwater video surveys determined the benthic habitat as unconsolidated bioturbated sandy substrate with shell debris and sparse sponge presence.
- Sediments are composed of relatively high proportions of calcium, iron and sulphur. Lead exceeded the DGV in a sediment sample at one site, but remained well below GV-high value. It is possible that historic sea disposal of paint factory by products, and/or other industrial inputs, have contributed to the findings of sediment characterisation.
- Protected species observed incidentally during field works included the endangered shy albatross, conservation dependent southern bluefin tuna, three additional migratory birds, and three other species protected under the EPBC Act.

8 References

Althaus F., Hill N., Edwards L., Ferrari R. (2014). CATAMI Classification Scheme for scoring marine biota and substrata in underwater imagery – A pictorial guide to the Collaborative and Annotation Tools for Analysis of Marine Imagery and Video (CATAMI) classification scheme. Version 1.4. Available from: http://catami.org/classification; accessed 20 February 2024.

ANZG (2019) *Toxicant default guideline values for sediment quality*, viewed 12 January 2024, <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants>.

Australian Fisheries Management Authority (AFMA) (2015). School Shark (Galeorhinus galeus) Stock Rebuilding Strategy Revised 2015. Available from: https://www.afma.gov.au/sites/default/files/2023-02/School-Shark-Rebuilding-Strategy.pdf; accessed 12 February 2024.

Bray D. J. and Gomon M. F. (2011). Blue warehou, Seriolella brama. In: Taxonomic Toolkit for Marine Life of Port Philip Bay. Museum Victoria. Available from: http://portphillipmarinelife.net.au/species/6460; accessed 20 February 2024

Bruce BD, Bradford R, Daley R, Green M and Phillips K (2002). Targeted review of biological and ecological information from fisheries research in the south east marine region. Final report. National Oceans Office and CSIRO Marine Research, Hobart. pp. 175.

Bryant, S.L. and Jackson, J.E. (1999). Tasmania's Threatened Fauna Handbook: What, where, and how to protect Tasmania's threatened animals. Threatened Species Unit, Parks and Wildlife Service, Hobart.

Commonwealth of Australia (2024 (a)) EPBC Act Protected Matters Report for coordinates 40.9586S, 145.89807E, Buffer 7000 km. Report created 19th February 2024.

Commonwealth of Australia (2024 (a)) EPBC Act Protected Matters Report for coordinates 40.9586 S, 145.89807 E Buffer 12000 km. Report created 19th February 2024.

Commonwealth of Australia (2021 (b)). National Introduced Marine Pest Information System. Accessed 28/03/2024 https://nimpis.marinepests.gov.au/

Cossu R. and Frid C. (2022). Baseline survey of the Blue Economy Zone CRC.21.002 – Interim Project Report. Place of publication: Blue Economy Cooperative Research Centre.

Department of Climate Change, Energy, Environment and Water (DCCEWW) (2015). Listing Advice Seriolella brama blue warehou. Available from: https://www.environment.gov.au/biodiversity/threatened/species/pubs/69374-listing-advice.pdf; accessed 30 January 2024.

Department of Climate Change, Energy, Environment and Water (DCCEWW) 2021. Green Turtle (Chelonia mydas) Conservation status Available from: https://www.dcceew.gov.au/environment/marine/marine-species/marine-turtles/green Accessed 30 January 2024.

Department of Natural Resources and Environment Tasmania (NRE Tas (2024)) Natural Values

Atlas Report: Authoritative, comprehensive information on Tasmania's natural values. GDA94: 407267.0, 5465254.0. Buffer min: 7000 m, max: 12,000 m. Report created: 19 February 2024 11.33 AM

falls within: 401715, 5457986 Map: 397853, 5452936.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2013). Recovery Plan for the White Shark (Carcharodon carcharias). Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/recovery-plan-white-shark-carcharodon-carcharias; accessed 12 February 2024.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2012) Giant Kelp Maine Forests of South East Australia Ecological Community. Available from: Giant Kelp Marine Forests of South East Australia Ecological Community - fact sheet (dcceew.gov.au). Accessed: 06/07/2023.

Erbe, C. (2012). Effects of underwater noise on marine mammals. In The effects of noise on aquatic life (pp. 17-22). Springer New York.

Gavrilov, G. M., & Markina, N. P. (1979). The feeding ecology of fishes of the genus Seriolella (fam. Nomeidae) on the New Zealand Plateau.

Hamann, M., C. Limpus, G. Hughes, J. Mortimer & N. Pilcher (2006). Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South East Asia. Bangkok: IOSEA Marine Turtle MoU Secretariat.

Limpus, CJ (2009). A biological review of Australian marine turtle species. 6. Leatherback turtle, Dermochelys coriacea (Vandelli). Queensland: Environmental Protection Agency.

Marine Solutions (2023). Blue Economy Zone trial site investigation: bathymetric mapping and benthic habitat survey. Report prepared for Blue Economy CRC, November 2023.

Natural and Cultural Heritage Division (NCH) (2020). Guidelines for Natural Values Surveys - Estuarine and Marine Development Proposals. Department of Primary Industries, Parks, Water and Environment

Tas Fisheries Research Organisation (2022). Tasmanian Wild Fisheries Assessments. Institute of Marine & Antarctic Studies, University of Tasmania. Available from: https://tasfisheriesresearch.org/bw/#:~:text=Blue%20Warehou%20is%20a%20predominantly,sporadically%20abundant%20in%20Tasmanian%20waters; accessed 30 January 2024.

Threatened Species Scientific Committee (TSSC) (2010). Commonwealth Listing Advice on Thunnus maccoyii (Southern Bluefin Tuna). Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/69402-listing-advice.pdf; accessed 20 February 2024.

Threatened Species Scientific Committee (TSSC) (2015). Listing Advice Seriolella brama blue warehou. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/69374-listing-advice.pdf. Accessed 12 February 2024.

Threatened Species Section (TSS) (2024). Australian Grayling (Prototroctes maraena): Species Management Profile for Tasmania's Threatened Species Link. Available from:

https://www.threatenedspecieslink.tas.gov.au/Pages/Australian-Grayling.aspx Department of Natural Resources and Environment Tasmania. Accessed on 18/3/2024.

Whitehead, J. (2008) Derwent Estuary Introduced Marine & intertidal Species Review of distribution, issues, recent actions & management options. Derwent Estuary Program, Hobart.

9 Appendices

Appendix 1. Operational Summary

Date	Personnel*	Time (start)	Time (end)	Cloud	Rain	Swell	Wind	Tide	Works conducted
19/12/2023	N. Green**	*Not recorded*							- Bathymetric mapping
30/01/2024	S. Ibbott E. Johnson I. Thomas	07:30	14:30	4/8	Nil	0-1	5-10 knots SE	Low @ 10:13 am 1.08 m	- Benthic habitat survey
06/02/2024	K. MacAdie A. Ibbott M. Hardy** A. Hardy** J. Davis**	07:30	16:30	3/8	Nil	0-1	10-20 knots SW	Low @ 0220 1450	- Sediment sampling
04/02/2024	N. Green**	*Not recorded*							- Sub bottom profiling

* personnel from Marine Solutions unless otherwise stated

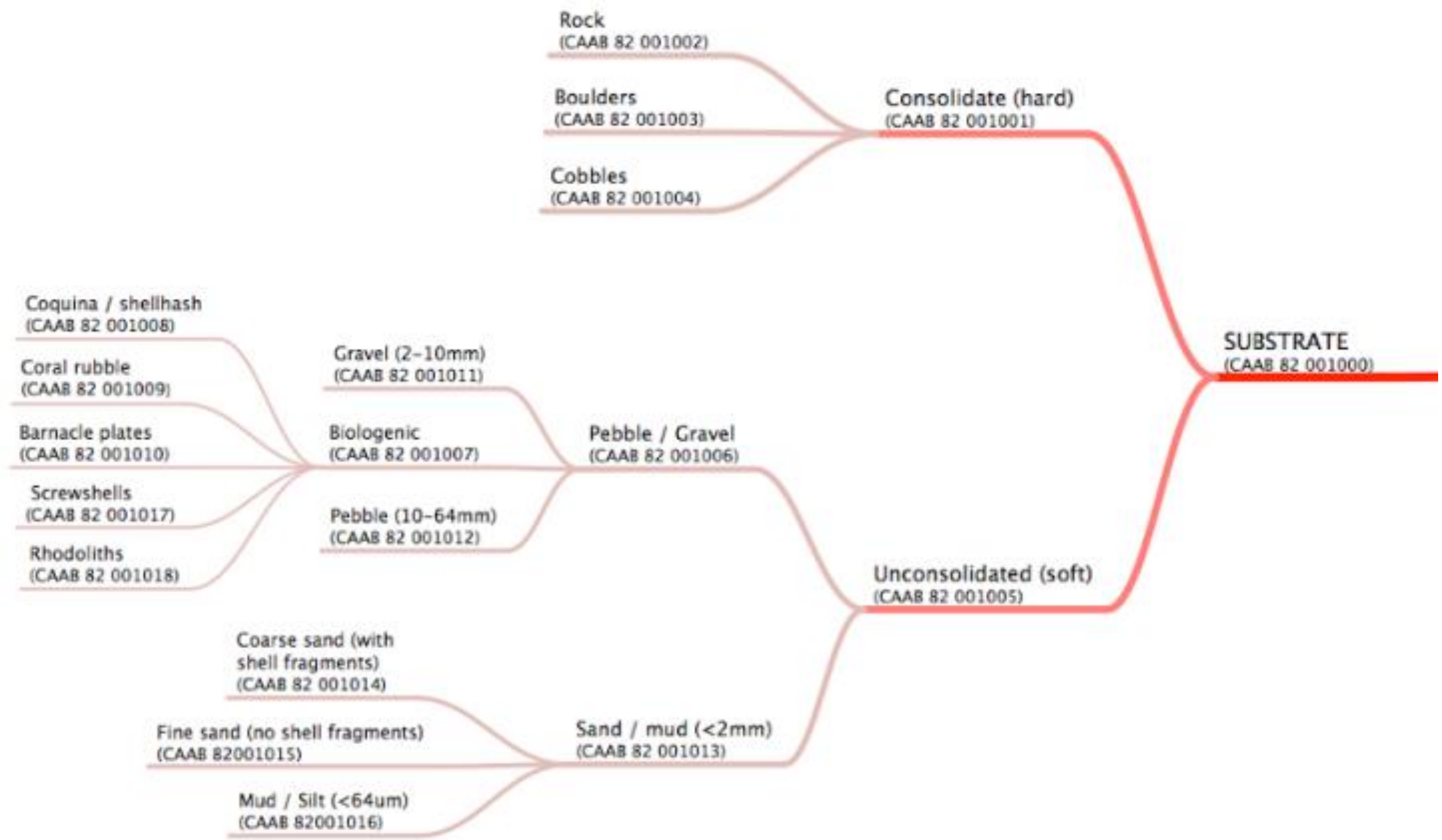
** personnel from third-party contractors *Veris* and *Top Fish*

Appendix 2. GPS Positions of sampling locations

Site Name	Easting	Northing	Notes
BEZ E2	410915.305	5467349.84	Benthic habitat video survey
BEZ N2	410298.274	5468201.58	Benthic habitat video survey
BEZ S2	410238.062	5466886.71	Benthic habitat video survey
BEZ W2	409625.515	5467731.66	Benthic habitat video survey
2	409775.344	5467836.32	Benthic habitat video survey
3	409935.909	5467948.48	Benthic habitat video survey
4	410120.753	5468077.59	Benthic habitat video survey
6	409726.608	5467567.86	Benthic habitat video survey
7	409878.505	5467667.83	Benthic habitat video survey
8	410055.99	5467780.21	Benthic habitat video survey
9	410233.172	5467917.87	Benthic habitat video survey
10	410399.671	5468061.63	Benthic habitat video survey
11	409860.897	5467389.03	Benthic habitat video survey
12	410003.57	5467486.89	Benthic habitat video survey
13	410204.249	5467623.03	Benthic habitat video survey
14	410381.43	5467760.69	Benthic habitat video survey
15	410532.43	5467878.38	Benthic habitat video survey
16	409990	5467217.09	Benthic habitat video survey
17	410148.079	5467340.51	Benthic habitat video survey
18	410345.254	5467467.57	Benthic habitat video survey
19	410529.681	5467603.51	Benthic habitat video survey
20	410659.881	5467702.45	Benthic habitat video survey
21	410117.294	5467047.56	Benthic habitat video survey
22	410281.92	5467179.56	Benthic habitat video survey
23	410466.383	5467311.88	Benthic habitat video survey
24	410656.228	5467447.87	Benthic habitat video survey
25	410791.659	5467520.54	Benthic habitat video survey

Site Name	Easting	Northing	Notes
27	410427.168	5467016.04	Benthic habitat video survey
28	410597.572	5467132.57	Benthic habitat video survey
29	410772.405	5467252.13	Benthic habitat video survey
BEZ 01	409625.515	5467731.66	Particle size, contaminants, infauna, *G. gunnii*
BEZ 02	410023.783	5467974.6	Particle size, contaminants, infauna, *G. gunnii*
BEZ 03	410298.274	5468201.58	Particle size, contaminants, infauna, *G. gunnii*
BEZ 04	410654.666	5467798	Particle size, contaminants, infauna, *G. gunnii*
BEZ 05	410915.305	5467349.84	Particle size, contaminants, infauna, *G. gunnii*
BEZ 06	410594.273	5467117.99	Particle size, contaminants, infauna, *G. gunnii*
BEZ 07	410238.062	5466886.71	Particle size, contaminants, infauna, *G. gunnii*
BEZ 08	409956.221	5467294.48	Particle size, contaminants, infauna, *G. gunnii*
BEZ 09	410128.958	5467647.07	Particle size, contaminants, infauna, *G. gunnii*
BEZ 10	410456.963	5467416.21	Particle size, contaminants, infauna, *G. gunnii*
BEZ 11	410364.342	5467901.07	Particle size, contaminants, infauna, *G. gunnii*
BEZ 12	409855.297	5467569.65	Particle size, contaminants, infauna, *G. gunnii*
BEZ 13	410630.092	5467589.94	Particle size, contaminants, infauna, *G. gunnii*
BEZ 14	410284.723	5467170.23	Particle size, contaminants, infauna, *G. gunnii*
BEZ 15	409936.969	5467834.43	Infauna and *G. gunnii*
BEZ 16	410182.139	5467434.54	Infauna and *G. gunnii*
BEZ 17	410423.222	5467665.11	Infauna and *G. gunnii*
BEZ 18	410696.427	5467334.21	Infauna and *G. gunnii*
BEZ 19	410299.004	5468073.72	Infauna and *G. gunnii*
BEZ 20	410132.603	5467052.75	Infauna and *G. gunnii*
BEZ 21	410656	5467923	Infauna and *G. gunnii*
BEZ 22	410942	5467519	Infauna and *G. gunnii*
BEZ 23	410330	5466748	Infauna and *G. gunnii*
BEZ 24	411090	5467274	Infauna and *G. gunnii*

Appendix 3. CATAMI classification

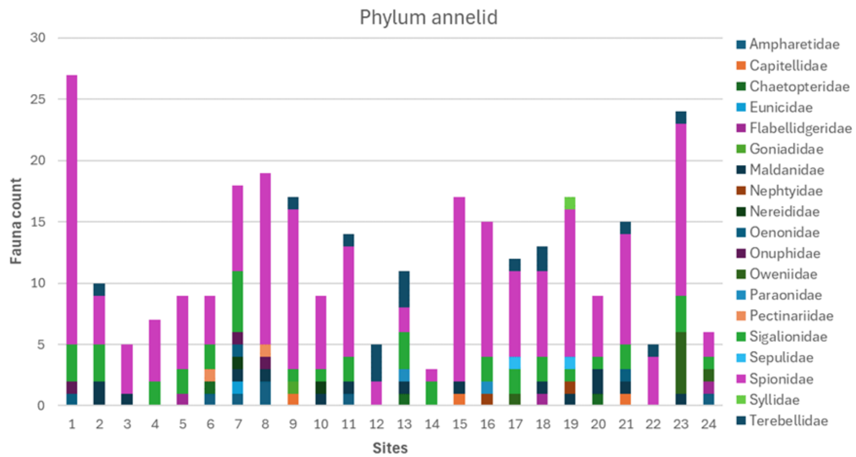


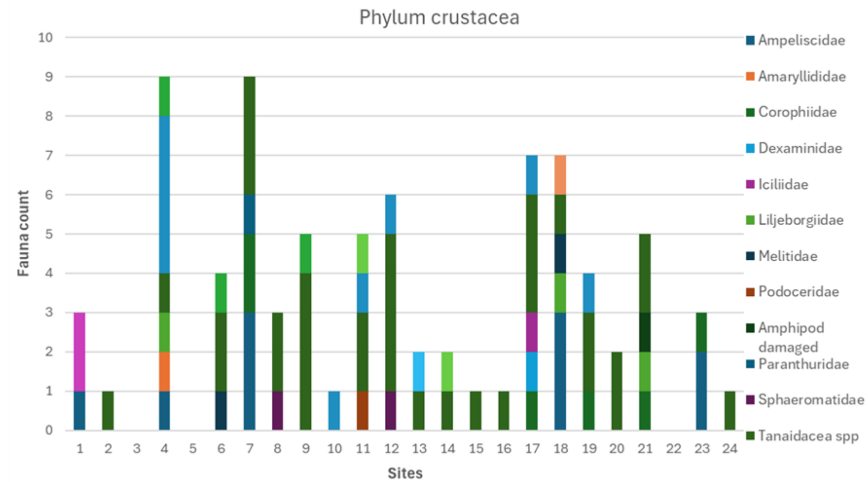
Appendix 4. Sediment Contaminants Laboratory Results

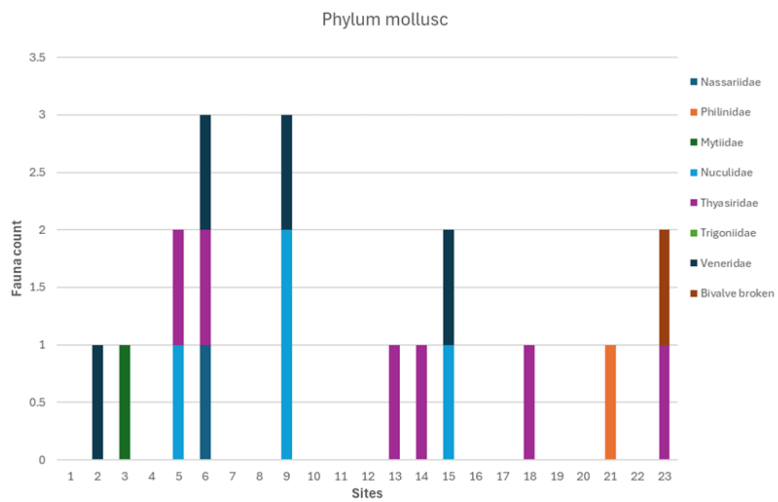
Site	As (mg/kg)	Ca (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	S (mg/kg)	Zn (mg/kg)
DGV / GV-high	20 / 70	*none*	1.5 / 10	*none*	80 / 370	65 / 270	*none*	*none*	21 / 52	50 / 220	*none*	200 / 410
BEZ 01	11	340000	<0.5	3	21	12	11300	79	9	25	2940	57
BEZ 02	12	339000	<0.5	4	23	17	13000	78	11	34	2660	78
BEZ 03	12	330000	<0.5	5	25	22	14000	79	12	44	2690	99
BEZ 04	11	328000	<0.5	5	26	16	13400	76	13	31	2780	75
BEZ 05	15	320000	<0.5	7	26	31	16400	83	13	60	2590	137
BEZ 06	13	315000	<0.5	6	27	21	14900	104	13	39	2610	93
BEZ 07	13	336000	<0.5	4	21	15	12700	88	10	31	2540	69
BEZ 08	12	330000	<0.5	4	23	14	12500	82	11	29	2760	65
BEZ 09	13	324000	<0.5	4	25	14	13500	87	12	27	2850	67
BEZ 10	13	327000	<0.5	5	25	19	13600	78	12	39	2820	86
BEZ 11	10	347000	<0.5	3	24	11	11600	77	12	19	2730	48
BEZ 12	13	336000	<0.5	4	23	17	13300	82	10	35	2810	78
BEZ 13	13	338000	<0.5	5	26	17	13700	77	12	34	2740	80
BEZ 14	11	338000	<0.5	3	23	10	11600	75	11	19	2910	46

Highlighted cells denote the analyte exceeds the ANZG DGV

Appendix 5. Infauna results to family level







Appendix 6. BMT's *Blue Economy CRC Sub-Bottom Acoustic Analysis*

Version Date 26 March 2024. Available from Marine Solutions