MAPPING OF INSHORE MARINE HABITATS IN THE CRADLE COAST REGION; FROM WEST HEAD TO ROBBINS PASSAGE

V. Lucieer, M. Lawler, M. Morffew and A. Pender

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Executive Summary

This study presents the first continuous baseline inventory of marine habitat maps for the North West Tasmanian coastline from West Head to Robbins Passage. These results contribute to the knowledge and database of SeaMap Tasmania providing information on marine benthic habitat distribution and extent on 39,529 ha of the Boags Bioregion, which falls within NRM Cradle Coast region.

The production of these maps involved extensive field surveys and the use of archived aerial photography in depths less than eight meters. Habitat boundaries were logged in the field using a combination of echo sounder and video analysis of the seabed, with the video also used to identify the dominant macroalgae and seagrasses present. Habitats were defined at two hierarchical levels but are presented in the maps at the highest hierarchical level being reef and sand. Further analysis on the structuring and profile of reef is provided in subsequent statistical analyses. All spatial data and algal analysis results are stored in a GIS spatial database. The habitat maps presented in this report are available at; http://www.utas.edu.au/tafi/SeaMap/ .

The marine area of this section of the North West coast of Tasmania has a diverse range of habitats ranging from sheltered seagrass beds through to moderately sheltered reef and offshore sponge gardens. This study provides natural resource managers, industry and the community with the information needed to contribute to biodiversity conservation and natural resource management on the north west coast of Tasmania. It provides further information needed to define and measure marine habitat extents in Tasmanian waters and to improve impact assessments. This information is essential to the protection and maintenance of the condition of sub tidal marine habitats in the Cradle Coast NRM region.

Table of Contents

1. Introduction

This study presents the first continuous baseline inventory of marine habitat maps for the north west Tasmanian coastline from West Head to Robbins Passage. These results contribute to the knowledge and database of SeaMap Tasmania, providing information on marine benthic habitat distribution and extent in the western half of the Boags Bioregion, which falls within NRM Cradle Coast region. These data are required by managers, industry and the community to contribute to sustainable natural resource management in the nearshore shallow marine waters of this region.

Previous studies in the region have either focussed on assessing specific areas for marine farm development (eg. Mitchell, 2003), potential Marine Protected Area (MPA) locations (Barrett and Wilcox, 2001; Barrett *et al.*, 2001), the distribution of selected seagrass beds (Rees, 1993), or have been completed at a very coarse scale (Edyvane *et al.*, 2000). This mapping project builds upon the data collected under the SeaMap Tasmania project and significantly increases the breadth of knowledge regarding subtidal habitats in Tasmanian coastal waters.

Habitat has previously been defined as "plant and animal communities as the characterising elements of the biotic environment, together with abiotic factors operating at a particular scale" (SGMHM Report, 2000). As this definition indicates, combinations of biological and physical parameters of the habitat are normally required to explain where a particular species or community is found. However, physical characteristics can often be reliably used to separate representative areas at the higher levels of the hierarchy of classification (Day and Roff, 2000), assuming that the important physical characters are known (e.g., wave energy, currents, nutrient load, substrate type, turbidity, water temperature).

The main objectives of this report are to:

- Provide detailed marine habitat maps at 1:25,000 scale of the shallow coastal waters to within 1.5 kms of the coastline.
- Compile a spatial database for all the seagrass and adjacent habitat types and publish the maps on the Land Information System Tasmania (LIST) web mapping site and the SeaMap Tasmania website (http://www.utas.edu.au/tafi/SeaMap/).
- To provide crucial information to the relevant Councils to assist in land use decision-making within the relevant catchments.
- To communicate the findings to stakeholders and the community.

The outputs of the project include:

- The production of 1:25,000 marine habitat maps in the identified areas published in hard copy form and on the Internet.

- Production of a report detailing the biological and physical structure within the mapping areas and the extent of key habitat types.

- Generation of a DVD with *Image Mapper* software for viewing video linked to habitat maps and representative images and statistics of biological communities (Appendix 2).

2. Methods

The area captured in this mapping research report completes 200 km of the north western boundary of the NRM Cradle Coast region from West Head to Robbins Passage. The maps presented in this report have been expanded to include the area from Badger Head to the Tamar River to complete the area up to the boundary of the Tamar River (a distance of 5 kms).

Information on the distribution of benthic habitats in this report was colleted through a combination of aerial photography (both archival and via aerial survey), acoustic surveys, underwater video and visual observations. The first step in the mapping process was the examination of aerial photographs from DPIW's aerial photography library. These often gave good resolution of boundaries between seagrass, reef and unvegetated habitats to approximately 10 m depth, but did not include information on depth and habitat structure. Extensive ground-truthing from the FRV *Nubeena II* provided substantial additional habitat information, and physical data on depth, relief and substrate type that was not available from the photographs. The 1.5 km limit was considered as the offshore boundary for this mapping project. SeaMap Tasmania protocol usually dictates that the mapping is completed to the 40 m contour but for the majority of this region the 40 m contour was too far from shore to survey in a small vessel. Field ground-truthing and survey work involved a series of transects perpendicular to the coast at distances no greater than 200 m apart in areas of coastal reef. Over broad areas of soft sediments, transects were conducted at greater intervals but with sufficient coverage to provide a reliable estimate of the areas bathymetry. The final maps were produced using the combined aerial photographs and field data to determine the most likely position of habitat boundaries. To determine the correlation of physical data to the biotic component of habitat type, regular video transects were conducted perpendicular to the coast, and biotic elements and physical variables recorded.

2.1 Selection of Aerial Photographs

The aerial photography archives of ILS (Information Land Services) DPIW, were searched to identify photographs that covered the selected area between West Head and Robbins Passage. Forty-seven colour aerial photographs at 1:24,000 were selected based on a calm water surface, suitable sun glint, water clarity, and camera angle for determining sub-surface features through the water column. Images taken between 2000 and 2005 were selected to provide the most recent coverage, with good resolution and water penetration. Appendix 3 lists the aerial photographs selected and

their coverage.

2.2 Scanning of Aerial Photographs

The selected archival aerial photographs were captured with an A3 flat bed colour scanner at 600 DPI (dots per inch). The scanned images were stored as 24 bit colour TIFF images and viewed in the field as MrSID wavelet compressed images.

2.3 Registering and Rectification of Aerial Photographs:

Each image was georectified using ArcGIS 9.0 (Environmental Systems Research Institute (ESRI)) to the LIST (Land Information Services Tasmania) 1: 25 K coastline coverage in GDA94. To rectify, a minimum of 15-ground control points were selected for each image. The RMS (root mean square) error is an indicator of the position of each pixel relative to its location in the real world. The average RMS error calculated for the images was ~ 0.00015 degrees

2.4 Capturing data from Aerial Photographs

The aerial photographs were displayed in *ArcGIS 9.1*. True colour images generally store data using twenty-four bits per pixel. Each pixel is composed of three eight-bit bands representing the red, green and blue colour components. Images are stored as raster data, where each cell in the image has a row and column number. The images were displayed with the coastline information overlayed over the top of the image.

In order to clearly identify certain features such as reef, sand and seagrass, the colour intensity and contrast of the image was altered via “stretching” each band. For multi-band images, a compositing process allows the creation of a true colour image by identifying the three bands used to represent the red, green and blue colour components. These three colour components can be altered using a linear or logarithmic scale to reduce or increase the intensity of that band.

The quality of the imagery accessed for this project was consistently high and consequently the aerial photographs were used as a primary source of information to aid in determining the boundaries of the habitat type. Please note, however, that due to the ambiguities inherent in interpretation of through-water imagery in the shallow subtidal environment, careful checking in the field was required to confirm the habitat types.

2.5 Field Data Collection

Habitat boundaries and attributes from the coastline to 1.5 km from the coast were determined using an echo sounder and video surveys. The details of the field surveys are covered in the following sections.

2.5.1 Acoustic Data Collection

The benthic substrate from Badger Head to Robbins Passage was mapped using a Simrad ES60 acoustic echo sounder. A series of parallel transects were conducted along the coastline. Transects were spaced approximately 200 m apart, and ran from shore to a baseline established 1.5 km from shore. The echo sounder was set to ping every 0.5 seconds, with a pulse length of 0.256 ms and a power setting of 100 W. The output from the echo sounder along with positional information from an OmniLite132 differential GPS unit was logged using the Simrad ES60 software (v.1.5.2.76 Kongsberg, Simrad).

The logged sounder output was imported into EchoView 3.30 (SonarData) for classification. Different benthic substrates were determined based on changes in the thickness and intensity of the echo sounder output. Harder substrates, which reflect more acoustic energy, appear with a stronger second echo, while rougher substrates, which scatter more of the acoustic energy, appear with a longer tail on the first echo. Seagrass could also be distinguished based on the presence of acoustic reflectance above the sounder detected bottom. These acoustically different echo returns were related back to substrate type based on ground truth information collected by underwater video. The echo sounder output was visually classified as reef, cobble, sand, or seagrass.

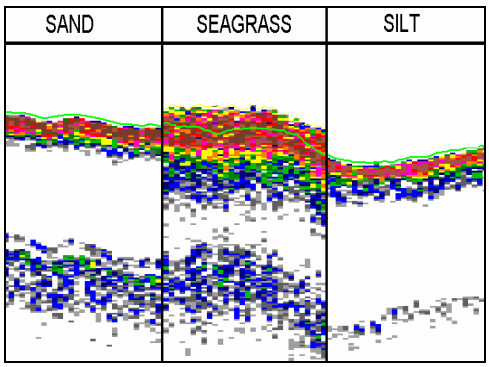


Figure 1. An example of the acoustic echo returns from sand, seagrass and silt habitats.

Field data was sampled at fixed time intervals adhering to a “zigzag” pattern of transects perpendicular to the coast. These transects were run at 200 m intervals along the coast, or more frequently where habitats changed rapidly or had patchy distributions. *ArcPad* 6.0 was employed in the field to display previous transects and help maintain a regular field-sampling regime. Habitat was broadly categorised into four main groupings. These consisted of reef, cobble, unconsolidated substrates and seagrass. Each of these broad categories was broken down into numerous sub-categories based on relief for reefs, dominant sediment type for unconsolidated substrates and blade density for seagrasses (see Table 1 for detailed descriptions).

The only elements of the biotic community that could be readily distinguished on the sounder were dense beds of the macroalgae *Macrocystis angustifolia* and seagrass, mostly *Heterozostera tasmanica*. The remaining biotic components required video drops for identification.

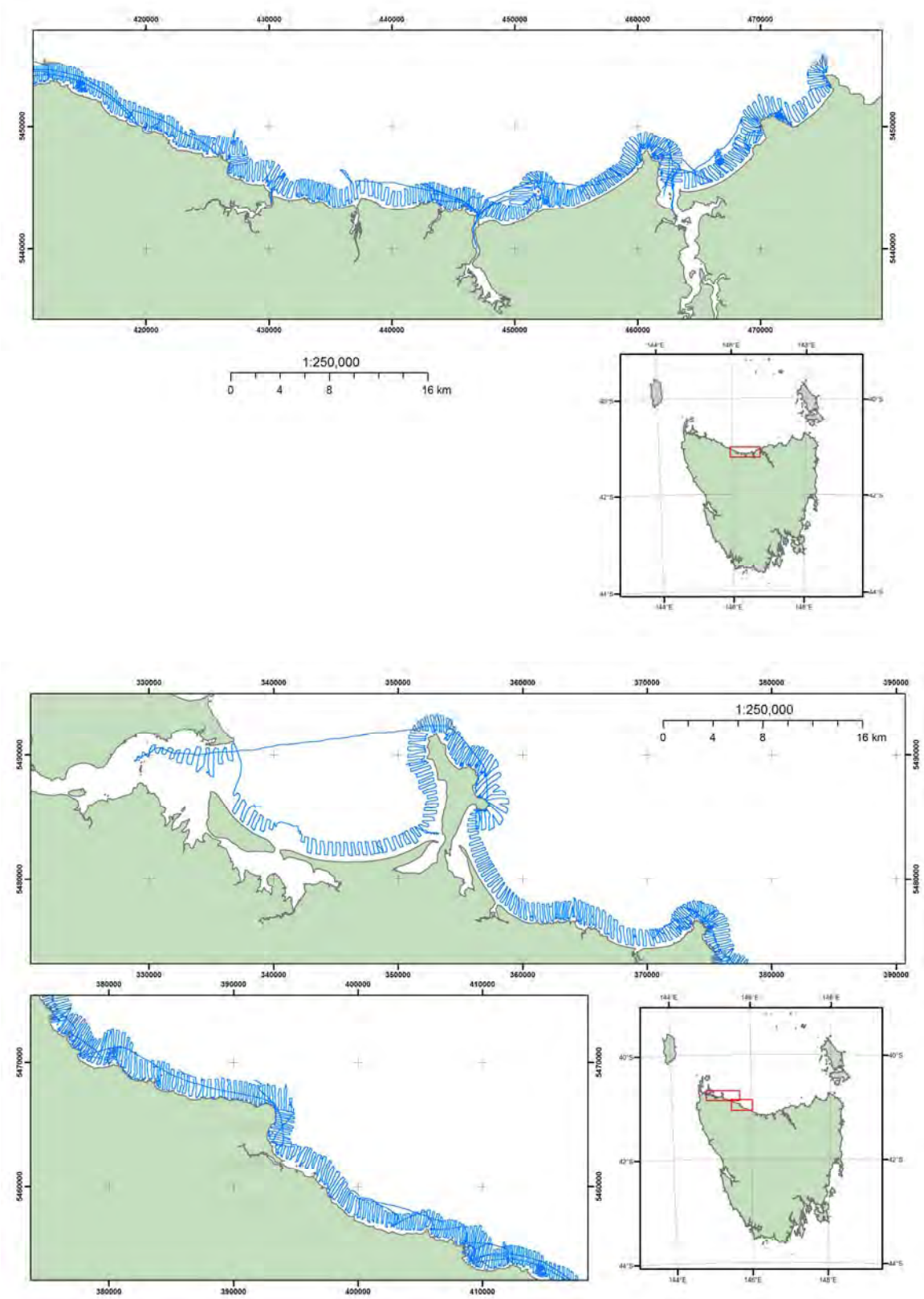


Figure 2. Acoustic transects sampled from West Head to Robbins Passage in 2006.

2.5.2 Bathymetric Layers

Bathymetric data was recorded by the ES60 echo sounder. Logged data files were imported into EchoView 3.30 where the sounder detected bottom was checked for anomalies, corrected for the transducer depth and exported as a comma delimited text file containing depth and position.

2.5.3 Tidal correction of bathymetric data

Depth measurements from the Simrad ES60 were tidally corrected. These depths were corrected for tidal variation based on the predicted tide heights from the National Tidal Facility (http://www.bom.gov.au/oceanography/tides/). The tidal cycle can be described by a harmonic equation:

$$D_i = D[h_1+(h_2-h_1)*(\cos(\pi*((t-t_1)/(t_2-t_1)+1))+1)/2]$$

Where D_i is corrected depth and D is measured depth, $h_{1,2}$ correspond to the heights of the high and low tides, $t_{1,2}$ are the times of the high and low tides with t being the current time. This formula calculates the height of the tidal cycle for a given time and a given location and then applies this as a correction to the measured field data. All depth measures were corrected to Mean Sea Level based on the available standard port measurements.

2.5.4 Video Data Collection

A submersible digital video camera, MorphCam (MorphVision, NSW, Australia) was deployed at selected locations throughout the study region (Figure 3). This was used to verify the aerial photography and echo sounder substrate classification and obtain more detailed information on algal distribution. Positional information was recorded for each video drop as a series of GPS co-ordinates and also as a direct overlay of the GPS output (position, date and time) onto the video. The video was analysed for dominant flora and fauna for each habitat type.

The total percentage covers of all algal and seagrass species was recorded over five second blocks of video. Dominant species were identified to the lowest taxonomic level possible. Percentage cover was recorded in accordance with a 0-4 number scoring system where 0 = no algae, 1 = 0 – 25 % cover, 2 = 25 – 50 % cover, 3 = 50 – 75 % cover, 4 = 75 – 100 % cover. The dominant algal communities for each habitat type were examined for each of the reporting sections in 5 m depth bins based on this video data. A minimum of 30 replicates from each combination of habitat type, depth bin and reporting section were completed for the analysis, where this criteria was not met the algal data were not analysed for that class.

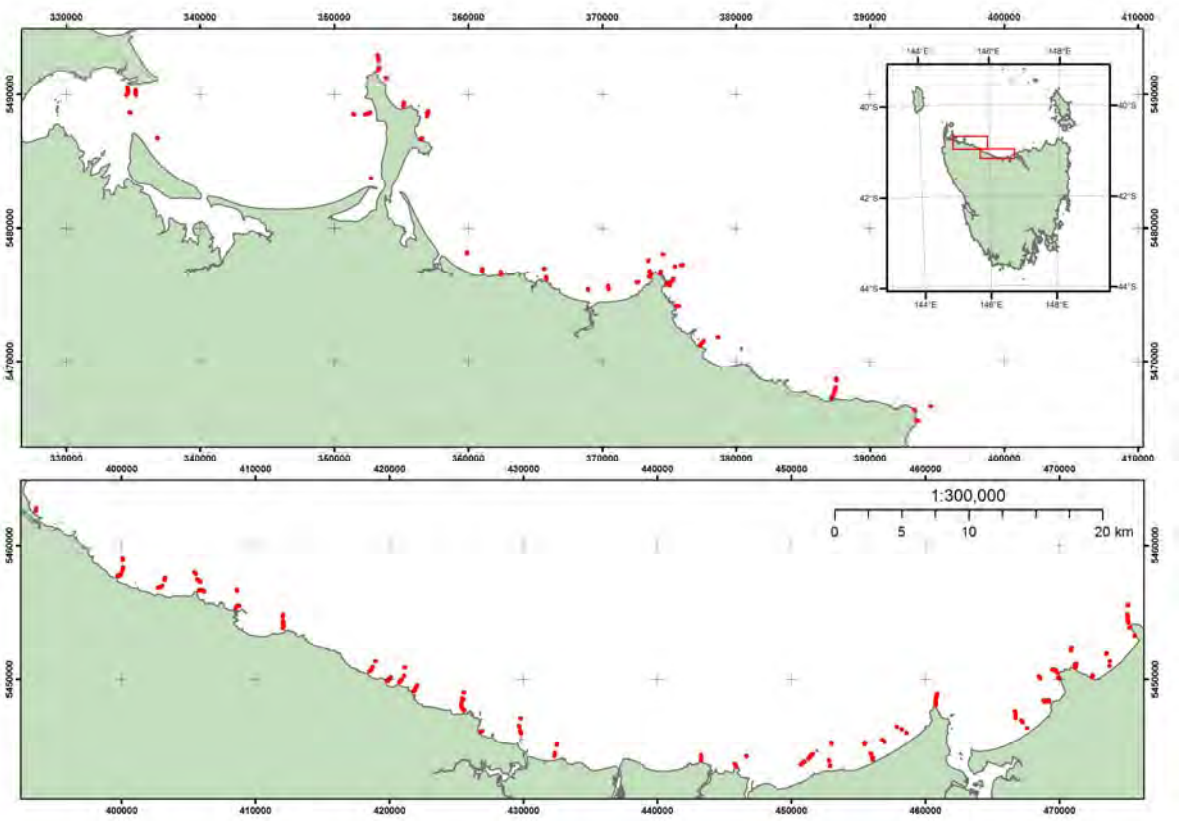


Figure 3. Distribution of video transects on the NW coast.

The trends in algal cover were also examined from east to west across the entire region. These trends were most apparent in the 0 – 5 and 5 – 10 m depth bins. For this analysis the algae were divided into broad groupings. The classification of 'thallus brown algae', referred to in the bar graphs of this analysis, is used to describe large brown algae with fleshy thalli, as opposed to filamentous brown algae, which have filamentous thalli. Along the north coast of Tasmania this group comprises a broad grouping of species including the following main species *Phyllospora comosa*, *Ecklonia radiata*, *Acrocarpia paniculata*, *Carpoglussum confluens*, *Cystophora* spp., *Sargassum* spp., *Caulocystis* sp., and *Seirococcus axillaris*. *Ecklonia radiata* has been presented separately from this group to show the specific trends in this species.

There are limitations to using video to survey algal communities including water clarity and weather conditions. The ability to identify many algae to species level is not possible given the resolution of the video. Often algae can only be identified to genus level (i.e. *Cystophora* sp.) or functional groupings (i.e. turfing algae). Video can only be deployed in water depth where the vessel could survey, thus depths less than ~1 m were not surveyed in sheltered areas, and often as deep as 3 – 4 m in more exposed areas. This coupled with the large tidal range (> 2 m) along this coast resulted in many of the intertidal and immediate subtidal algae not being consistently sampled across the study region.

2.5.5 Algal ID validation

Many of the turfing algal species could not be identified from the video transects due to the speed and resolution of the video sampling. An algal dredge was used to samples at locations corresponding to the video drops where large amounts of turf were observed. The algal dredge, made from a plate of aluminium with tapering slots to capture the algae, was towed along the reef for several minutes to collect algae. The algal sample was labelled and stored for identification in the laboratory using a microscope. The major species were identified to the lowest taxonomic level.

2.5.6 Sediment Sampling

Sediment samples were taken at regular intervals to confirm the sounder classification of the unconsolidated substrate using a Van Veen grab. A representative sample of the surface sediment was taken for particle size analysis. This sample was processed using a wet sieving method and the resulting particle size data classified using the Wentworth scale.

2.6 Cartography

The classified data files from Echo View 3.30 were imported into ArcGIS 9.1 as point data and was used to generate shapefiles of the different habitat types by on-screen digitising. At the 1:2,000 scale, the points were carefully connected to form polygons of similar habitat type. The outer (deeper) boundary of the polygon was generally identified in the field and with these points overlaid on aerial photographs, a habitat boundary was identified and a polygon drafted. The aerial photographs were primarily used to help in determining the boundaries between sand and reef that were initially attributed from the field data. The underwater video documentation was used to help verify the habitat type and the interface between different substrates. In some instances, reefs covered by sand and not seen in the aerial photo were picked up by the echo sounder. Likewise, low plant biomass areas observed from photographs that reflected as predominantly sand on the echo sounder have been recorded as sand, unless the plant biomass was found from video drops to be seagrass beds.

The classification table followed for the mapping of habitats on this section of coast is shown in Table 1.

Reef
Reef The term reef applied to any consolidated substrate, typically consists of rocky outcroppings. It may be of any profile or rugosity.
Medium profile reef The term medium profile reef referred to areas where the bottom was hard bedrock and the relief changed regularly. Changes in depth are usually from 1-4 m over short distances.
Low profile reef This definition referred to hard bedrock bottom type when there was very little change in the relief. This category occasionally overlapped with the patchy reef and hard sand categories.
Cobble This definition referred to a hard bottom type consisting of small rocks generally less than 30 cm in diameter.
Unconsolidated Substrates
Sand Sand was the most commonly encountered unconsolidated substrate. It represents the coarser end of a scale of sediments from silt to sand, was mostly found to be fine sand within the Cradle Coast region.
Vegetated unconsolidated substrate
Seagrass The "seagrass" category referred to the "dense" areas of seagrass where the substrate, usually sand, was completely covered by seagrass and the patch size was greater than 20 m wide. Three species of seagrass commonly occurred sub-tidally within this region. These being *Heterozostera tasmanica*, *Amphibolis antarctica* and *Posidonia australis*.

Table 1. Map Legend and definitions of substrate types and habitat categories used in this study.

The field data were assessed for errors before cartography commenced. The resulting habitat polygons are the basis of the habitat maps forming the main body of this report, which were summarised to establish the extent of each habitat class for each reporting section (as shown in Figure 4).

2.7 Contouring

A depth surface was generated from the field-collected data through the interpolation of depth (*z*) values. Interpolation is the procedure of predicting the values of attributes at unsampled sites from measurements made at point locations within the same area or region. This transformation is based on the Triangular Irregular Network (TIN) data model. Contours in ArcGIS 9.0 were created by interpolating the point data into a TIN and then creating contours from that TIN. The contour coverage provides another source of information from which the habitat polygons can be

verified against, especially for seagrass, which has a maximum growth limitation. The contour intervals were generated every 2 m to a maximum depth of 40 m.

3. Results

For the purpose of analysis the project is broken down into nine reporting sections (A-I) for description and analysis as shown in Figure 4. The extent of each habitat type is presented for each of these areas along with the statistics of the algal and seagrass analysis.

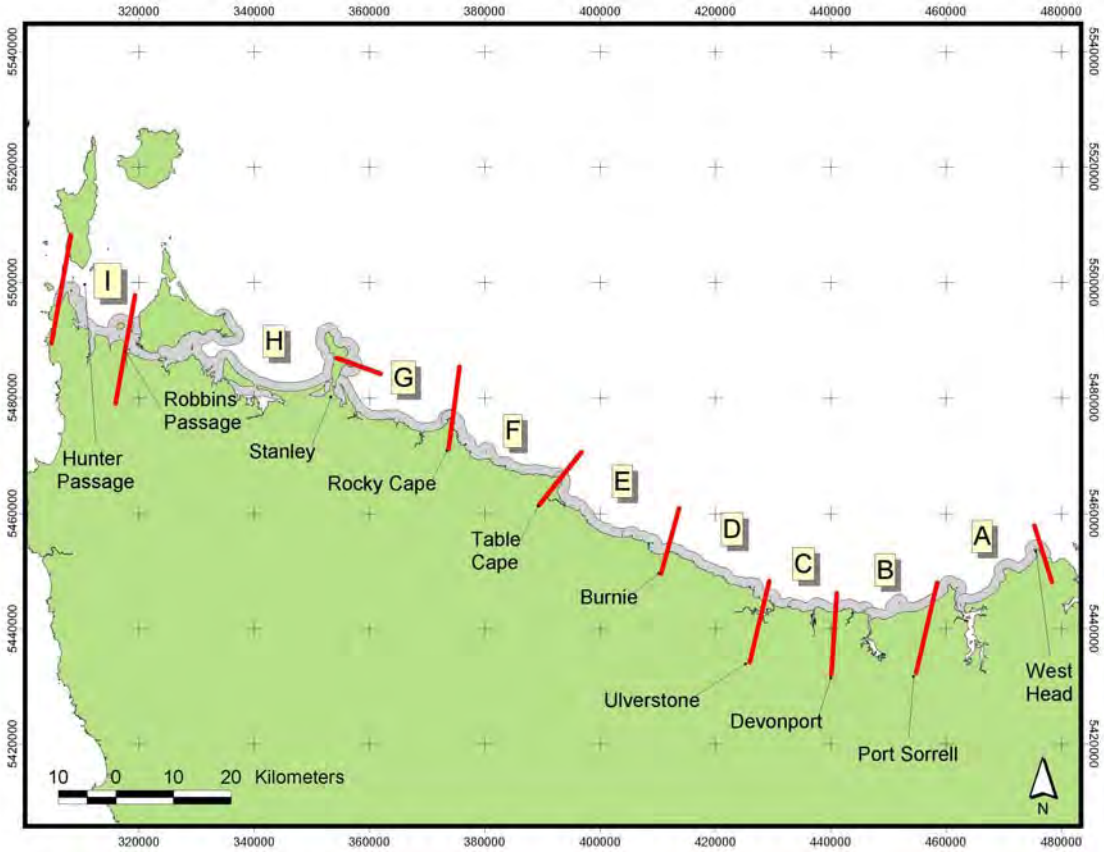


Figure 4. The location of the nine reporting sections mapped within the Cradle Coast NRM region.

3.1 Bathymetry

Depth and GPS position were constantly recorded during the field surveys. From this data bathymetric contours could be generated to 40-meters. These bathymetric results are at a finer scale than those currently available from marine charts. While the fine scale contours are printed on the 1:25,000 habitats maps (Section 3.12 and Appendix 1), an overview of the bathymetry within the 2006-mapped region is presented in Figure 5.

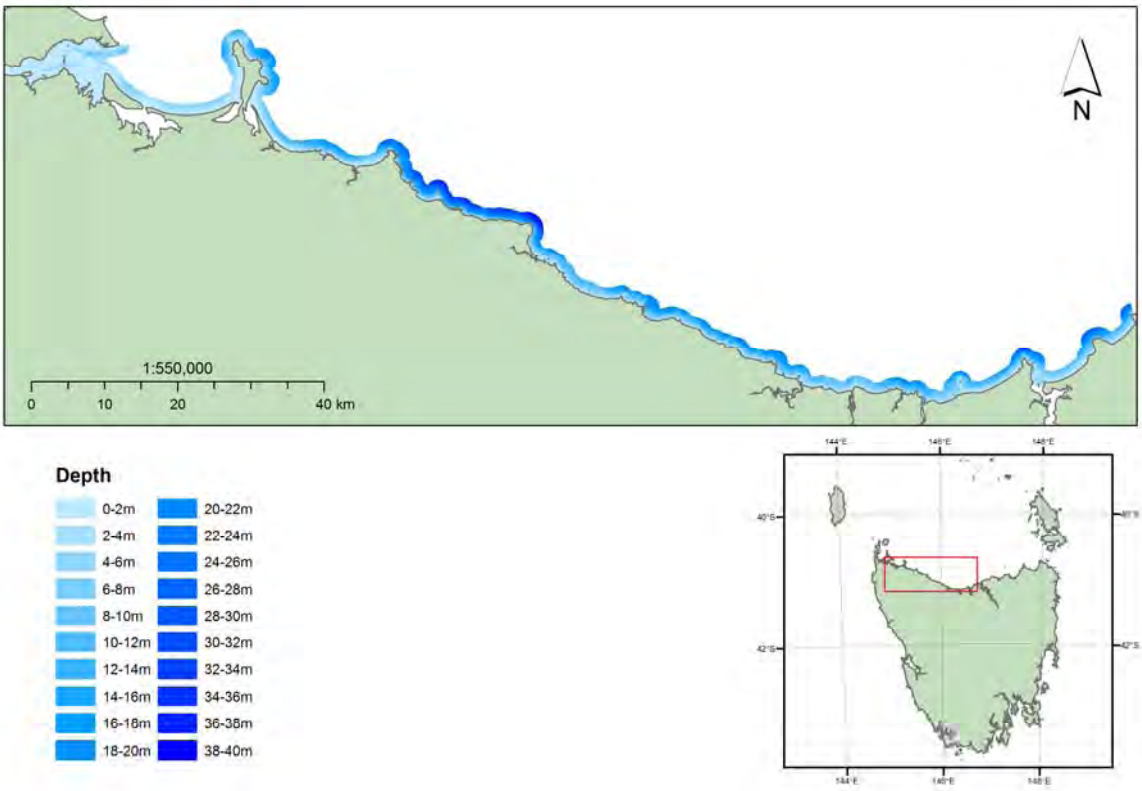


Figure 5. Bathymetry of the NW Coastline from West Head to Robbins Passage NW Tasmania

3.2 Section A; West Head to Port Sorell

3.2.1 Habitat Distribution

The distribution of the four dominant habitats, reef, cobble, sand and seagrass, in Section A was quantified in two metre depth bins (Table 2). In the near shore zone to 12 m depth, reef habitat dominates a narrow band close to the shoreline. Small amounts of seagrass are observed to 8 meters.

Depth (m)	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	0	110.1	387.4	0
2-4	0	98.5	401.2	0.4
4-6	0	73	397.6	1.1
6-8	0	74.1	335.5	0.9
8-10	0	74.9	278.7	
10-12	0	66.5	222.4	
12-14	0	41	168.6	
14-16	0	41.1	167.8	
16-18	0	30.6	147.9	
18-20	0	29.1	134.8	
20-22	0	39.4	120.9	
22-24	0	55.4	101.2	
24-26	0	51.1	87.2	
26-28	0	46.8	54.9	
28-30	0	11.9	12.1	
30+	0		15.2	
Total	**0**	**843.5**	**3033.4**	**2.4**

Table 2. Distribution of habitat types in Section A by depth

3.2.2 Algal Analysis

The algal structure on reef habitat between West Head and Point Sorell (Section A) consisted of a mix of algaes dominated by fucoid species, typical of the north coast algal communities (Figure 6). The overall algal cover was estimated at 90 % in the 0 – 5 m depth, decreasing to between 70 and 80 % below 10 m. The cover of canopy algae species decreased more rapidly to less than 50 % cover by the 10 – 15 m depth range and less than 5 % by the 15 – 20 m depth range.

In shallow waters (< 5m), algal species were dominated by a mix of *Ecklonia radiata* and the fucoid algal species *Phyllospora comosa*, *Acrocarpia paniculata* and *Cystophora* spp. Several other fucoid algae were also present in low amounts in this depth range. In 5 – 10 m the amount of *A. paniculata* decreased, while the amount of *P. comosa*, *C.* spp. and *E. radiata* remained relatively constant. In the 10 – 15 m depth range *E. radiata* was relatively common, however the amounts of *P. comosa*, *A. paniculata* and *Cystophora* spp. all reduced. Below 10 m mixed turfing algae became dominant. This consisted of a mix of both small red and small brown turfing

algae, with *Halopteris paniculata*, *Ptilonia* spp., *Champia* sp., *Delisea hypneoides* and *Gracilaria secundata* the most common species. Significant amounts of the green algae, *Caulerpa* sp., were present below 15 m depth. Between 20 – 25 m a large portion of red turfing algae was present, but this reverted to mixed red and brown turfing algae in depths greater than 25 m. Below the 15 m depth contour, the presence of sponges increased to an estimated coverage of 20 to 40 % of the area surveyed by video, which consisted of a mix of small encrusting sponges, finger sponges and *Carteriospongia sp. Macrocystis angustifolia* was observed from the vessel in the 0 – 5 m depth range on the eastern side of Point Sorell.

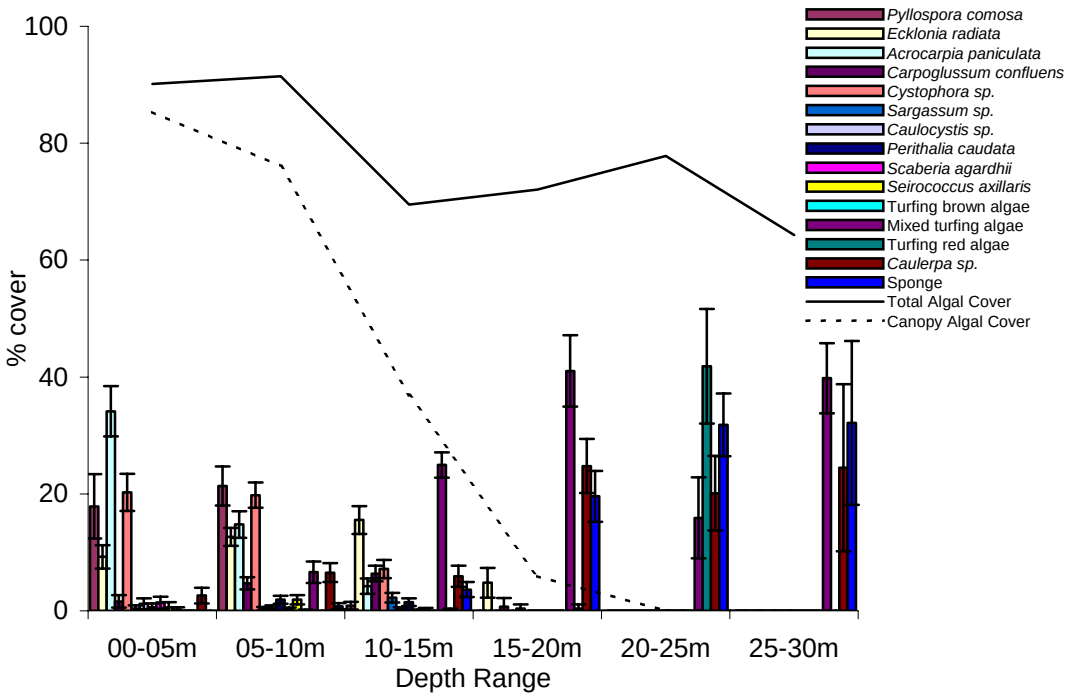


Figure 6. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between West Head and Point Sorell (Section A)

Large areas of cobble habitat were not identified on the acoustic record in section A, however small amounts of cobble were observed on the video. The algal species present on the cobble habitat were different from those present on the reef habitat within this section of coastline as shown in Figure 7. The total algal cover was consistently less on the cobble compared to that on the reef, ranging between 28 and 58 % cover. Below 10 m the algal community was predominantly *Acrocarpia paniculata*, *Cystophora* spp. and turfing brown algae, with lesser amounts of *E. radiata* and several fucoid algae. In the 10 – 15 m depth strata mixed turfing algae became more common (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*), and below this depth, along with *Caulerpa* sp., these were the only algae present. A large amount of sponge, ~20 % cover, was present in the 15 –20 m depth range.

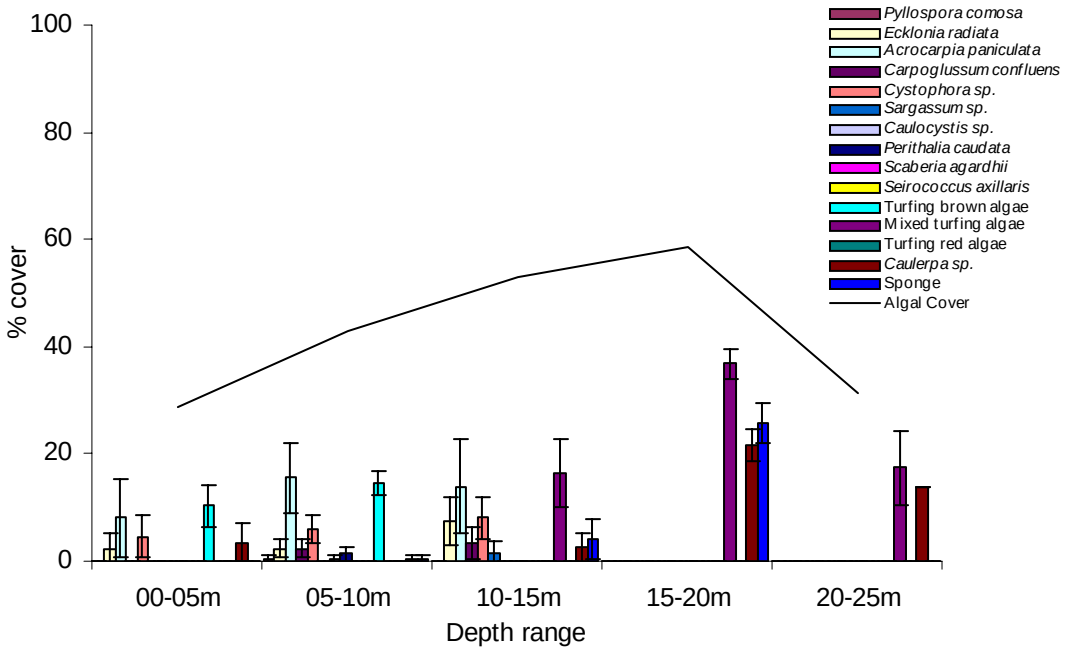


Figure 7. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between West Head and Point Sorell (Section A)

3.2.3 Seagrass Distribution

Sparse *Heterozostera tasmanica* beds, between 5 and 22 m off both Bakers Beach and Badgers Beach, were identified from the video analysis. Percentage covers from 25 % to 40 % (Figure 8) was observed. The peak abundance of this species was in the 15 – 20 m depth range. An unquantifiable amount of the seagrass species *Amphibolis antarctica* was observed on some of the shallow reef.

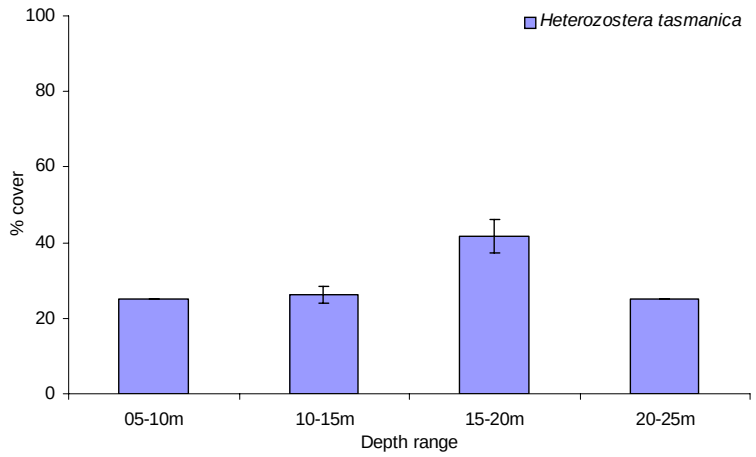


Figure 8. Mean percentage cover (±s.e.) for seagrass (*Heterozostera tasmanica*) between West Head and Point Sorell section A.

3.3 Section B; Point Sorell to Lillico Beach

3.3.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section B is quantified, by depth, in Table 3. Within section B seagrass species were more common in the depth range of 2-4 m than in Section A. Cobble habitat became predominant in depths < 22 m, which is a feature of the seabed that continues from Section B to the west of the study site.

Depth (m)	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	19.7	103.6	284	7.2
2-4	108.2	121.7	171.7	26.8
4-6	153.9	125.8	178.4	8
6-8	126.2	158.2	177.5	0.1
8-10	135.4	194.8	143.6	
10-12	198.8	194.6	101.3	
12-14	230.8	195.2	62.6	
14-16	153.7	113	59.1	
16-18	140.4	39	66.5	
18-20	119.3	17.4	41.4	
20-22	32.4	12.5	42.9	
22-24	9	9.2	34.2	
24-26		0.8	22.9	
26-28			18.5	
28-30			12.5	
30+			15	
Total	**1427.8**	**1285.8**	**1432.1**	**42.1**

Table 3. Distribution of habitat types in Section B by depth

3.3.2 Algal Distribution

The reef habitat between Point Sorell and Lillico Beach (Section B) had a high cover of algae in the 0 – 5 m depth range (> 80 %), however this decreased to 60 % between 5 m and 20 m (Figure 9). The cover of canopy forming algal species dropped off more rapidly, with very few of these species below 10 m depth. The algal structure up to 10 m depth, was dominated by *Acrocarpia paniculata* (30 – 40 % cover), with *Ecklonia radiata* and *Cystophora* spp. around 20 % cover each, in the 0 – 5m depth range and decreasing to less than 10 % below this. Small quantities of *Carpoglossum confluens*, *Sargassum* sp., *Caulocystis* sp. *Perithalia caudata*, *Xiphopohra chondrophylla*, turfing red and brown algae and *Caulerpa* sp. were also present in the 0 – 10 m depth range. Below 10 m depth the mixed turfing algae were the dominant group (including *Halopteris paniculata*, *Gracilaria secundata* and *Ptilonia* spp), with increasing amounts of *Caulerpa* sp. with increasing depth. Sponge abundance increased beyond 10 m depth on the video analysis. *Macrocystis angustifolia* was observed in the 0 – 5 m depth range off Frederick Head and Pardoe Beach in the vicinity of Horseshoe Reef.

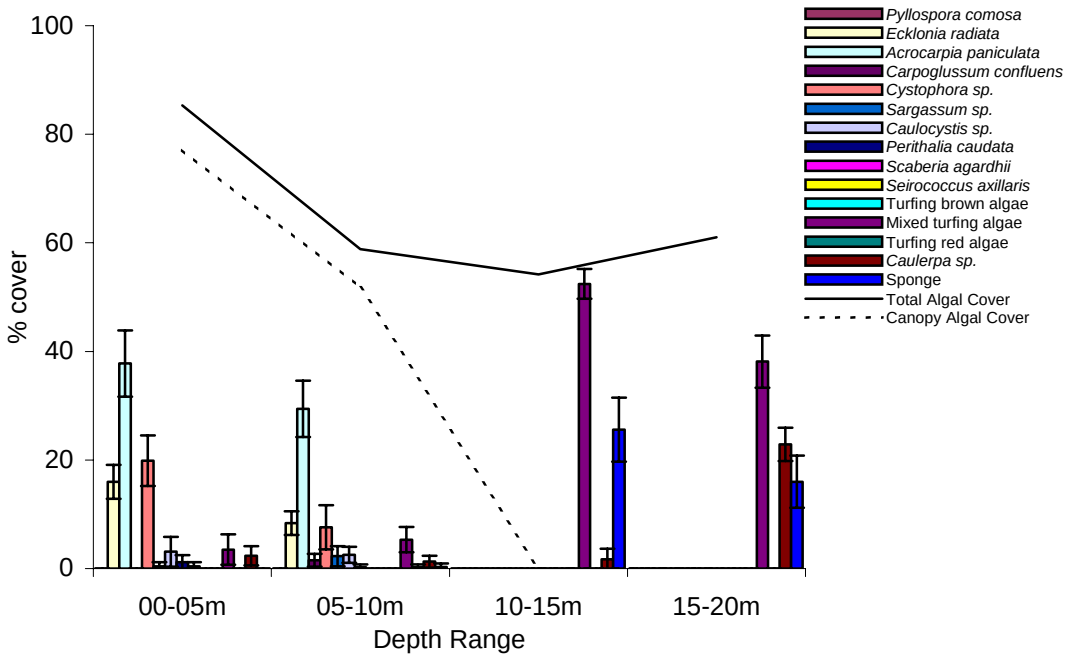


Figure 9. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Point Sorell and Lillico Beach (Section B)

The total algal cover associated with cobble habitat in this section was between 50 % and 60 % cover (Figure 10). In all depth ranges (0 - 20 m) mixed turfing algae were the dominant algae group (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*). Shallower than 5 m *Acrocarpia paniculata* and *Cystophora* sp. were present in small amounts (10 – 15%), but decreased to less than 5 % by 5 – 10m. Very small amounts of *Sargassum* sp., *Caulocystis* sp. and *Xiphophora chondrophylla* were also observed in less than 10 m depth. In the 15 – 20 m depth range *Caulerpa* sp. comprised 10% of the algal cover. Sponge cover increased from 5 – 20 m, however remained below 20 % at the deepest parts of the cobble.

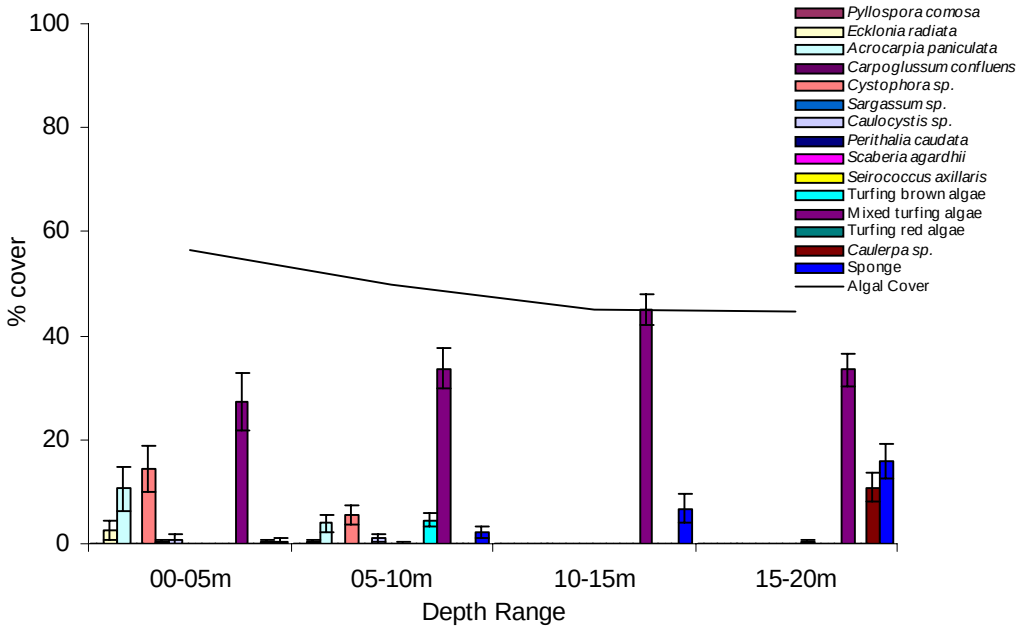


Figure 10. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Point Sorell and Lillico Beach (Section B)

3.3.3 Seagrass Distribution

Seagrass beds in section B consisted of two species, *Heterozostera tasmanica* and *Amphibolis antarctica*. *H. tasmanica* was present in low to medium densities (< 50 % cover) between the 10 and 20 m depth contours off Northdown Beach, while the *A. antarctica* was present in dense beds (> 80 % cover), often interspersed with reef and cobble, and generally in less than 10 m depth (Figure 11). The majority of the *A. antarctica* beds were located around Horseshoe Island and the western end of Northdown Beach.

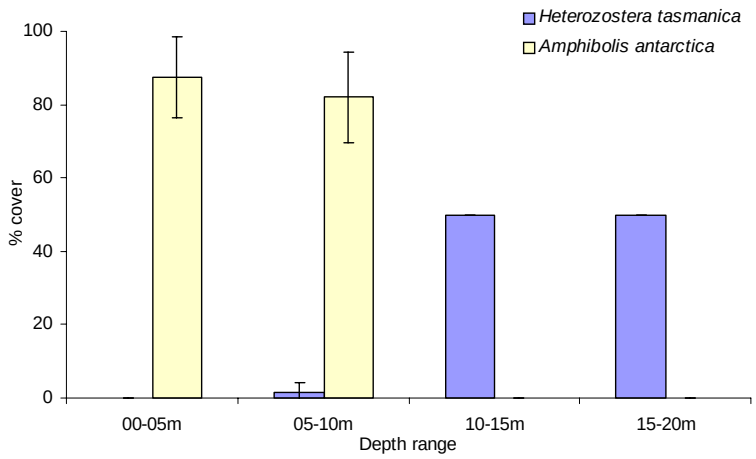


Figure 11. Mean percentage cover (±s.e.) for seagrass (*Heterozostera tasmanica* and *Amphibolis antarctica*) between Point Sorell and Lillico Beach section B.

3.4 Section C; Lillico Beach to Lodders Point

3.4.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section C is quantified by depth in Table 4. Small amounts of seagrass were present to 6 m. Reef habitat gradually increased from shore, 2 m to 10 m where it was replaced by sand habitat. Reef was completely replaced by cobble habitat at 20 m depth.

Depth (m)	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	0.3	107.8	253.5	1.7
2-4	9.2	131.8	113.6	4.9
4-6	24.3	136.4	104.8	1.5
6-8	104	200	62.9	
8-10	328.3	149.4	26.2	
10-12	273.4	75.2	28.9	
12-14	94.2	34.3	29.2	
14-16	121.5	19	18.6	
16-18	96.8	10.5	2.6	
18-20	58	6.3		
20-22	34			
22-24	16.2			
24-26	2.4			
26-28				
28-30				
30+				
Total	**1162.6**	**870.7**	**640.3**	**8.1**

Table 4. Distribution of habitat types in Section C by depth

3.4.2 Algal Distribution

The algal cover on reef habitat between Lillico Beach and Lodders Point (Section C) showed a gradual decrease in total cover from 85 % to 65 % (Figure 12). The cover of canopy forming algal species decreased with depth from around 75 % cover in less than 5 m depth , to around 20 % cover in the 5 – 10 m depth range and none below 10 m depth. The algal distribution on reef in this section showed a similar trend to that in section B (Figure 9), with *Ecklonia radiata*, *Acrocarpia paniculata* and *Cystophora* sp. dominant in the 0 – 5 m depth range. *Perithalia caudata*, *Scaberia agardhii*, *Dictyopteris mulleri*, *Caulerpa* sp. and mixed red and brown turfing algae were also present in this depth range. Below 5 m mixed turfing algae became the dominant group of algae (including *Halopteris paniculata*, *Gracilaria secundata* and *Ptilonia* spp), with small amounts *E. radiata*, and numerous species of fucoid algae. The amount of *Caulerpa* sp showed a slight increase with depth, but still remained under 10 % cover. Around 10 % sponge cover was observed in the 5 – 15 m depth range. *Macrocystis angustifolia* was observed off Buttons Beach, Picnic Point and Lodders Point in the 0 – 5 m depth range.

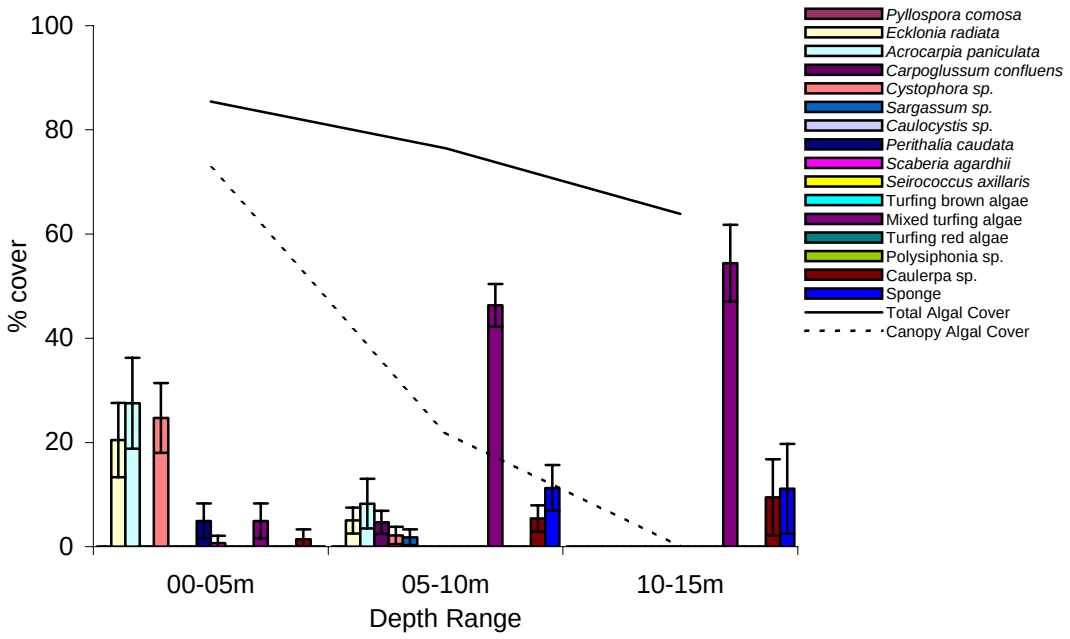


Figure 12. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Lillico Beach and Lodders Point (Section C)

The cover of algae on the cobble habitat, within section C, decreased from 80 % in the 0 – 5 m depth range to 25 % by 20 m depth (Figure 13). In all depth ranges mixed red and brown turfing algae were dominant (with *Echinothamnion hystrix* and *Thamnoclonium dichotomum* dominant below 10 meters). A small amount of *Caulerpa* sp. was observed between 0 and 15 m depth. The brown algae *Scaberia agardhii* was present in the 0 – 5 m depth range, while *Acrocarpia paniculata* comprised around 10 % of the algal cover in the 5 – 10 m depth range.

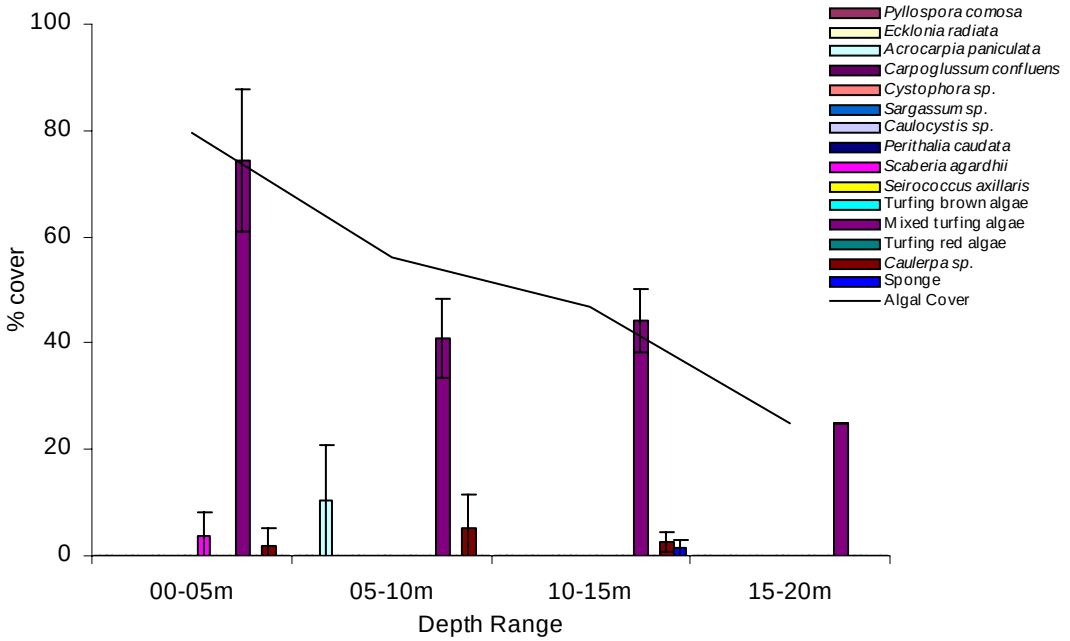


Figure 13. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Lillico Beach and Lodders Point (Section C)

3.4.3 Seagrass Distribution

The seagrass in section C consisted entirely of *Amphibolis antarctica*. The majority of this was present in a single bed offshore from 'The Fish Pond'. The seagrass cover was dense, with coverage of 80 and 100 % in this one bed (Figure 14).

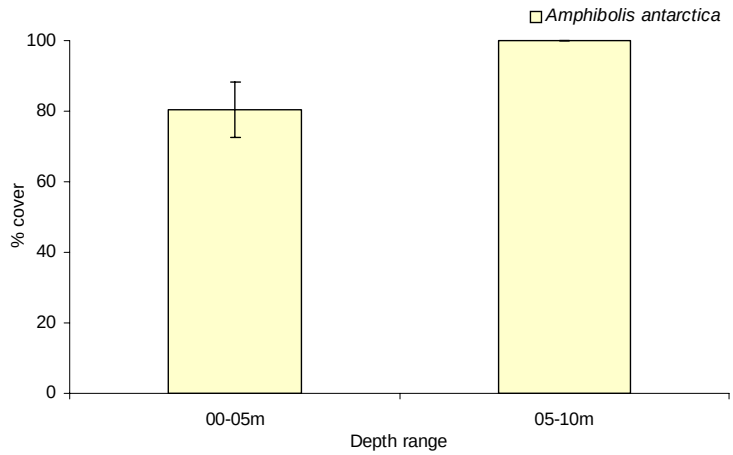


Figure 14. Mean percentage cover (±s.e.) for seagrass (*Amphibolis antarctica*) between Lillico Beach and Lodders Point section B

3.5 Section D; Lodders Point to Round Hill Point

3.5.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section D is quantified by depth in Table 5. Seagrass was present in the 6- 12 m depth range. Reef again decreased at 22 m and the outer boundary of the mapped area consisted of cobble habitat 1.5 kms from shore.

Depth (m)	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	0	186.1	42.6	0
2-4	0	145.6	34.8	0
4-6	0	156.2	38.6	0
6-8	3.3	158.7	38.6	0.4
8-10	12.8	189	29.7	0.2
10-12	36.3	185.2	28.4	1.1
12-14	64.2	222.8	13.2	
14-16	119.7	200	5.8	
16-18	188.2	114.6	2.6	
18-20	231.9	16.6	0	
20-22	137.7	6.2	2.2	
22-24	35.9			
24-26	3.7			
26-28				
28-30				
30+				
Total	**833.7**	**1581**	**236.5**	**1.7**

Table 5. Distribution of habitat types in Section D by depth

3.5.2 Algal Distribution

The algal cover between Lodders Point and Round Hill Point (Section D) was approx. 95 % in the 0 - 5 m depth range and gradually decreased to 75 % in the 10 - 15 m depth range (Figure 15). The canopy forming algal species were dominant in the 0 – 5 m depth range, making up the majority of the algal cover. Below 5 m the cover of the canopy forming species dropped rapidly, with none present below 10 m depth. In shallow water (0 – 5 m) the reef habitat in this section was dominated by *Acrocarpia paniculata* and *Cystophora* sp, with small amounts of *Caulocystis* sp., *Ecklonia radiata*, *Sargassum* sp., mixed red and brown turfing algae and *Caulerpa* sp were also observed. Below 5 m depth mixed red and brown turfing algae was the dominant assemblage (including *Halopteris paniculata*, *Gracilaria secundata*, *Hypnea ramentacea* and *Ptilonia* spp), with small amounts of the species observed in the shallower depth range also present. In the 10 – 15 m depth *Caulerpa* sp. was the only algae observed other than the mixed turfing algae. *Macrocystis angustifolia* was observed in the 0 – 5 m depth range off Penguin Point, Preservation Bay and Round Hill Point.

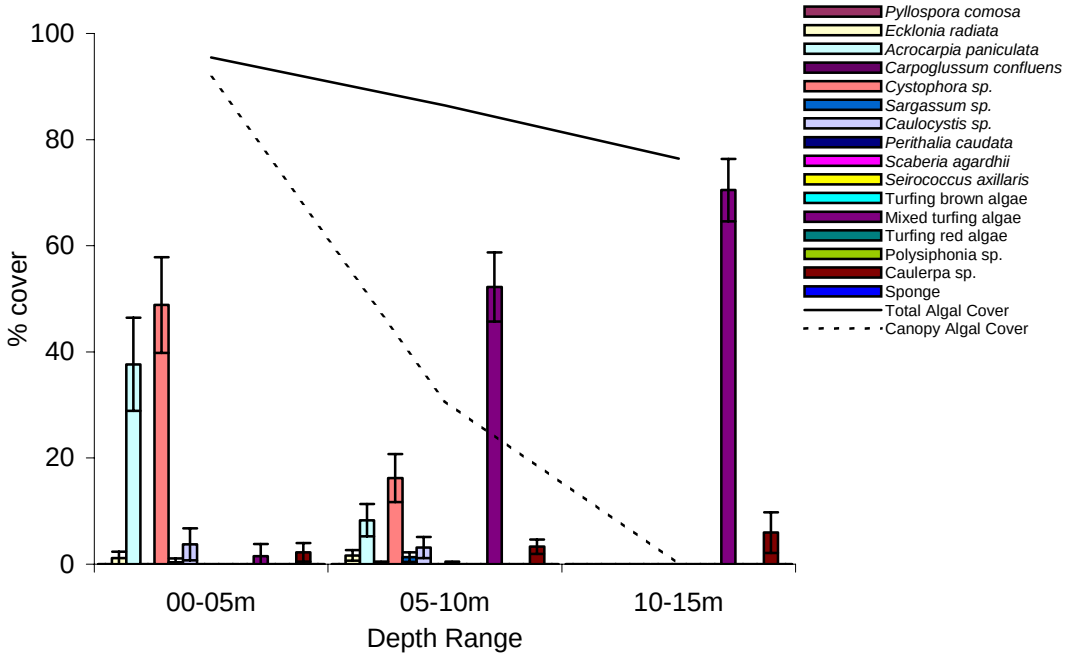


Figure 15. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Lodders Point and Round Hill Point (Section D)

Cobble habitat between Lodders Point and Round Hill Point showed between 50 and 65 % algal cover (Figure 16). In the 0 – 5 m depth range *Cystophora* spp. were the dominant algae species, with small amounts of *Acrocarpia paniculata*. Below 5 m mixed turfing algae were the dominant algal species. In the 5 – 10 m depth range, small amounts of *Cystophora* spp., *A. paniculata*, *Scaberia agardhii* and *Caulerpa* sp. were observed using the video. Below 10 m *Caulerpa* sp. was the only species apart from the mixed turfing algae (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*) regularly observed.

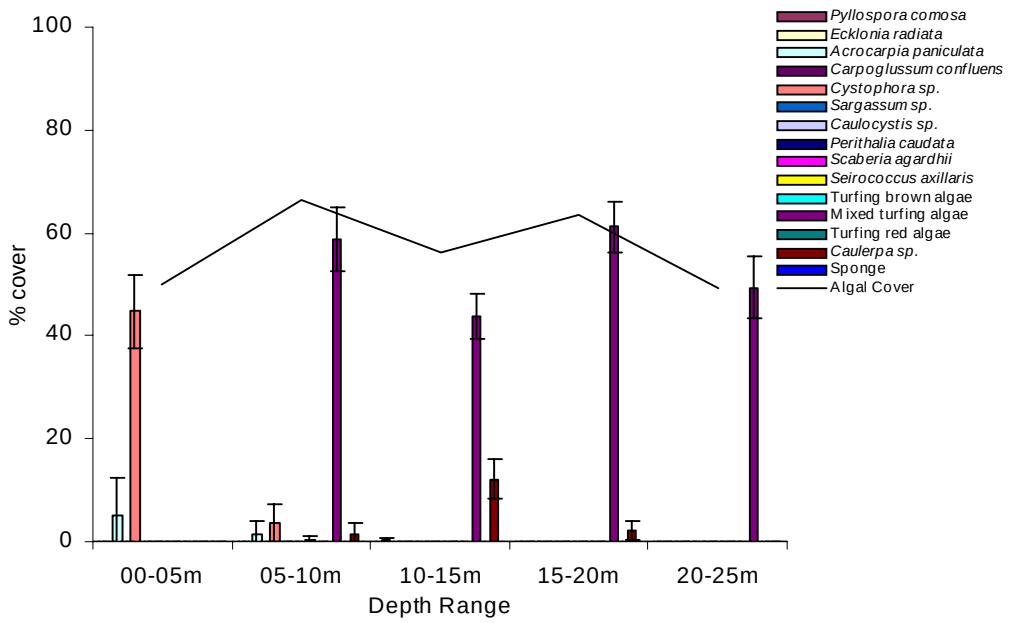


Figure 16. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Lodders Point and Round Hill Point (Section D)

3.5.3 Seagrass Distribution

There were no significant quantities of seagrass observed between Lodders Point and Round Hill Point. Occasional patches of *Amphibolis antarctica* were observed interspersed with the reef, however insufficient seagrass was observed using the video to perform a detailed analysis.

3.6 Section E; Round Hill Point to Table Cape

3.6.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section E is quantified by depth in Table 6. Seagrass was present in the 6-12 m depth range as in Section D. Sand habitat was recorded to 30 m depth with a band of reef following the shoreline.

Depth (m)	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	4.2	313.7	191.4	0
2-4	9.3	236.6	106.1	0
4-6	9.3	242.2	114.2	0
6-8	23.1	281.4	94	0.6
8-10	28.7	398	66.7	0.3
10-12	51.8	530.5	66.6	0.3
12-14	71.4	240.1	52.9	
14-16	104.4	161.2	60.7	
16-18	115.9	128.6	78.5	
18-20	108.9	121.6	69	
20-22	63	41.6	54.7	
22-24	11.8		46.5	
24-26	0.2		28.2	
26-28			17.2	
28-30			15	
30+			74	
Total	**602**	**2695.5**	**1135.7**	**1.2**

Table 6. Distribution of habitat types in Section E by depth

3.6.2 Algal Distribution

The observed algal cover between Round Hill Point and Table Cape showed over 80% cover in the 0 – 5 m depth range which gradually decreased with depth to around 50 % cover by the 15 – 20 m depth range (Figure 17). The cover of canopy forming algal species was greater than 75 % in less than 5 m, but rapidly dropped to less than 5 % by 10 m depth. The 0 – 5 m depth range was dominated by three main species, *Ecklonia radiata*, *Acrocarpia paniculata* and *Cystophora* sp.. Numerous other fucoid algal species, red and brown turfing algae and *Caulerpa* sp. were present in smaller quantities. In the 5 – 10 m depth range mixed red and brown turfing algae were the dominant group of algae (including *Halopteris paniculata*, *Gracilaria secundata*, *Hypnea ramentacea* and *Ptilonia* spp), with *A. paniculata* also present at around 20 % cover. There was a small amount of *E. radiata*, *Dictyopteris mulleri*, *Caulerpa* sp. and many of the fucoid algae seen in the shallower depth range. Below 10 m many of these species dropped out, with the turfing red and brown algae becoming the dominant grouping with around 50 % cover. Sponge cover increased with depth, with sponges making up around 35 % cover in the 15 – 20 m depth range. *Macrocystis angustifolia* was observed in the 0 – 5 m depth range off Round Hill Point, Wivenhoe Beach, South Burnie Beach, Blackman Reef, Cooee Point, East Wynyard Beach and

Fossil Cove.

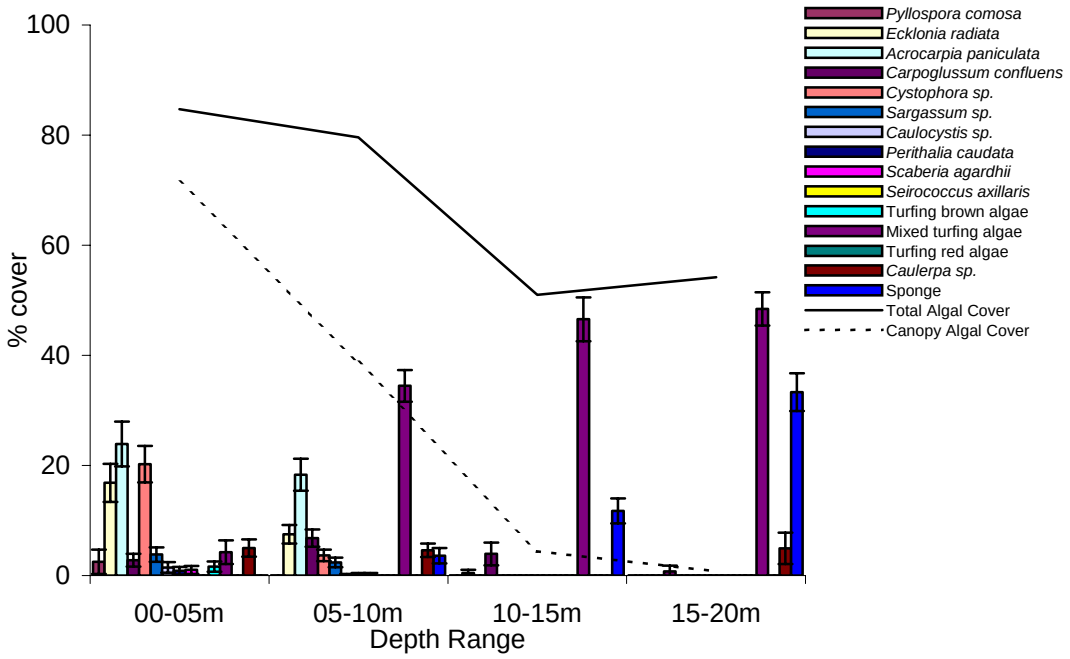


Figure 17. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Round Hill Point and Table Cape (Section E)

The cobble habitat in this section was not surveyed with the video in the 0 – 5 m depth range, however for the remainder of the cobble habitat the algal cover ranged from around 60 % in the 5 – 10 m depth range and decreased to around 30 % by the 15 – 20 m depth range (Figure 18). The algal cover was dominated by mixed red and brown turfing algae in all depths surveyed (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*), with small amounts of *Caulerpa* sp present in all depths. Small amounts of *Scaberia agardhii* in the 5 – 10 m depth range being the only other species with any significant contribution to the algal cover. Sponge cover increased from less than 10 % cover in the 10 – 15 m depth range to 25 % in the 15 – 20 m depth range.

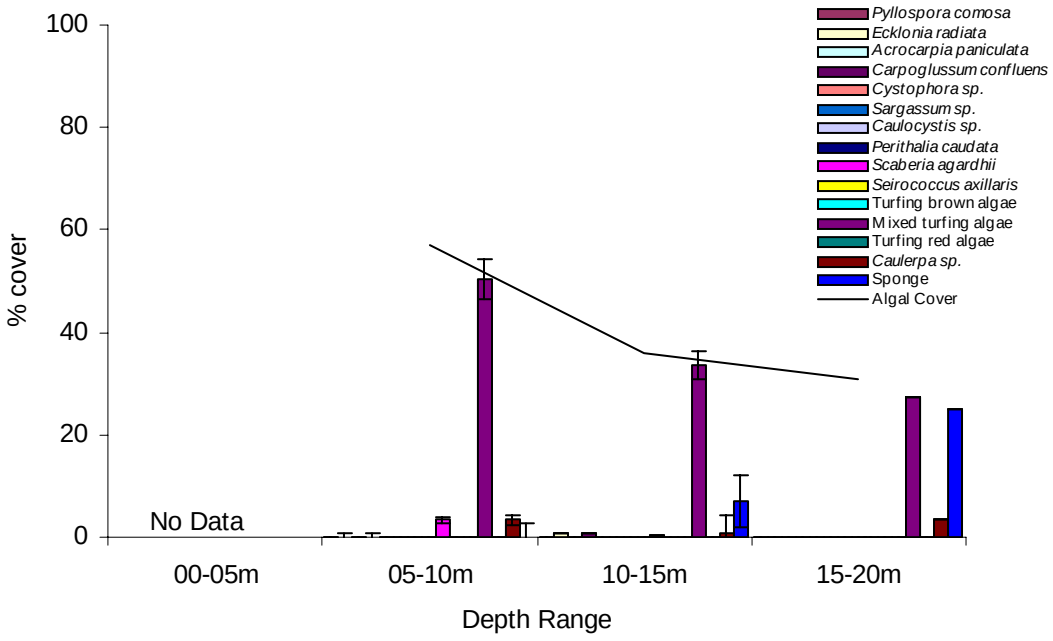


Figure 18. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Round Hill Point and Table Cape (Section E)

3.6.3 Seagrass Distribution

There were no significant quantities of seagrass were observed in section E. A small amount of the seagrass *Amphibolis antarctica* was surveyed using the video in the 0 – 5 m depth range off Fossil Bluff (Wynyard). This was associated with reef habitat, and occurred in dense patches amongst outcropping reef, but was impossible to map due to the shallow water depths.

3.7 Section F; Table cape to Rocky Cape

3.7.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section F is quantified by depth in Table 7. Seagrass was not acoustically mapped in Section F but was identified using the video. Reef habitat decreased from 4 m but was present in large amounts interspersed with sand habitat. Sand and cobble habitat was recorded to 30+ m.

	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2	0	193.1	45.1	
2-4	0	116.1	42.7	
4-6	0	90.9	43.8	
6-8	0.1	95	47.2	
8-10	0.4	95.3	51.1	
10-12	3.3	92.2	64.1	
12-14	11.7	94.3	85.9	
14-16	28.9	83.1	103.8	
16-18	45	79.9	141	
18-20	73.4	69.7	193	
20-22	84.9	48.2	202.6	
22-24	56.1	52.3	218.2	
24-26	78.4	45.9	231.4	
26-28	54.5	52	195.4	
28-30	32.4	39.6	245.5	
30+	32.5	16.1	897.1	
Total	**501.6**	**1263.7**	**2807.9**	**0**

Table 7. Distribution of habitat types in Section F by depth

3.7.2 Algal Distribution

The algal cover on reef habitat from Table Cape to Rocky Cape (Section F) in the 0 – 5 m depth range displayed over 90 % cover. There was a steady decline in cover to around 50 % in the 10 – 15 m depth range, before a slight increase to around 65 % in 15 - 25 m (Figure 19). The cover of the canopy forming species was greater than 75 % in less than 5 m depth, with a rapid decrease to less than 5 % by 10 – 15 m depth. A slight increase in the cover of the canopy forming species below 15 m depth represents the influence of the deeper *Ecklonia radiata* communities occurring off Rocky Cape. The 0 – 5 m depth range was dominated by the brown algae *Acrocarpia paniculata* and *Cystophora* sp. and the green algae *Caulerpa* sp. There were small amounts of *Ecklonia radiata* and several fucoid algae. In the 5 - 10 m depth range turfing red and brown algae were the dominant group, with *E. radiata*, *A. paniculata*, *Cystophora* sp., *Sargassum* sp and *Caulerpa* sp also present. Below the 10 m depth contour, mixed red and brown turfing algae (including *Halopteris paniculata*, and *Ptilonia* spp) cover increased to over 50 % cover by the 20 – 25 m depth range. *E. radiata* cover remained high in depths below 10 m, with close to 20 % cover in the 15 - 20 m depth range. This differs from the other sections and reflects the increase in

exposure around Rocky Cape causing a shift in the algal communities. *Caulerpa* sp. was the only other species consistently seen below 10 m depth, with around 10 % cover to 20 m depth. Sponge increased in abundance from 10 to 25 m depth, with abundances of 91% in the deeper depths. *Macrocystis angustifolia* was observed in the 0- 5 m depth range around Sisters Island.

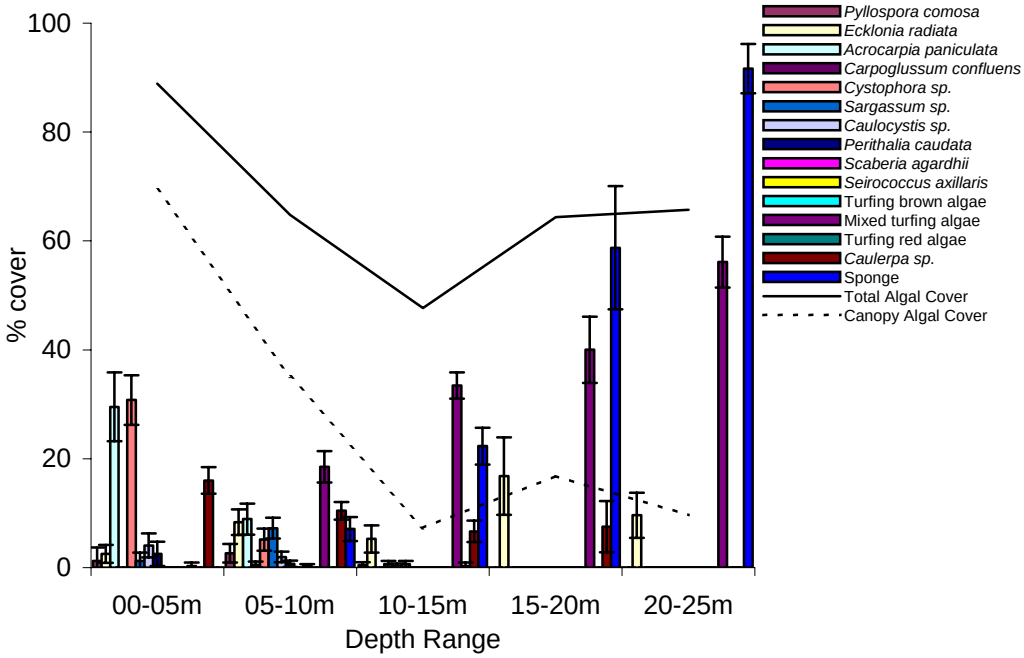


Figure 19. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Table Cape and Rocky Cape (Section F)

The algal cover on cobble habitat was 60 % to 10 meters depth and then reduced to 25 % below this depth (Figure 20). In the 0 – 5 m depth range *Sargassum* sp. was the dominant species (35 % cover) with 10 – 20 % cover of *Acrocarpia paniculata* and *Caulerpa* sp. *Sargassum* sp. remained the dominant species in the 5 – 10 m depth range, with 50 % cover. Small amounts of *Caulerpa* sp. and several fucoid algal species were also present in this depth range. Below 10 m mixed red and brown turfing algae comprised the majority of the algal cover (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*) small amounts of *Caulerpa* were present from 15 – 30 m, with a small amount of *Scaberia agardhii* also present below 25 m depth. Sponge was present between 10 and 20 m, with cover around 20 % between 10 and 15 m and decreasing below this. Sponges were not observed in the deeper water suggesting the cobble here is a less preferential habitat compared to reef in this section of coast.

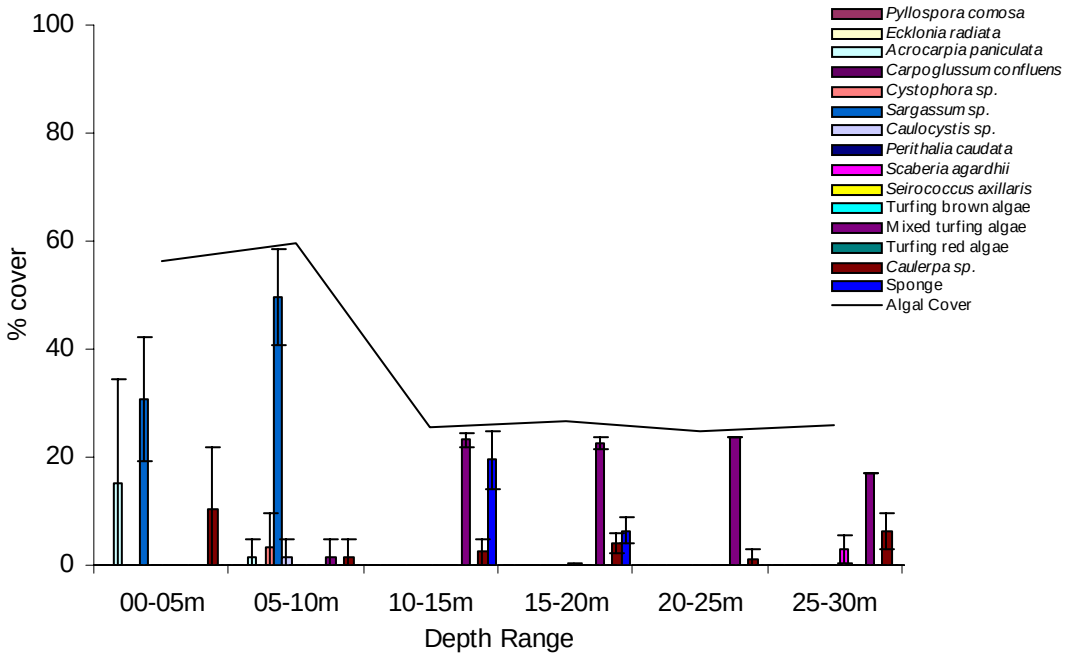


Figure 20. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Table Cape and Rocky Cape (Section F)

3.7.3 Seagrass Distribution

Seagrass beds were not directly mapped between Table Cape and Rocky Cape, as the seagrass generally occurred as either dense patches within reef habitat or as a very sparse bed on the deeper sand habitat (5 – 15 m). In both cases it was impossible to acoustically differentiate the seagrass from the other habitat, however the underwater video was used to provide information on the seagrass cover and distribution. West of Sisters Beach there was a considerable amount of *Amphibolis antarctica* associated with many of the shallow reefs. This occurred in dense patches, often interspersed with outcropping rocks. Between 5 and 15 m depth on sand habitat there was a light cover of *Heterozostera tasmanica*. This mainly occurred from Sisters Beach west to Rocky Cape. The results are shown in Figure 21.

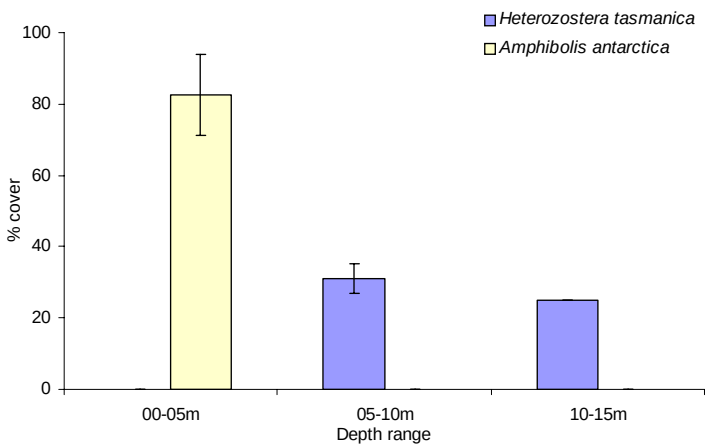


Figure 21. Mean percentage cover (±s.e.) for seagrass (*Heterozostera tasmanica* and *Amphibolis antarctica*) between Table Cape and Rocky Cape (Section F).

3.8 Section G; Rocky Cape to the Stanley Nut

3.8.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section G is quantified by depth in Table 8. Similar to Section F, seagrass was not acoustically mapped due to its sparse coverage. Reef habitat was present to 26 m where it was replaced by cobble.

Depth	Cobble (ha)	Reef (ha)	Sand(ha)	Seagrass (ha)
0-2	0	90.6	791.4	
2-4	0	57.9	484.4	
4-6	0	66.7	422.7	
6-8	1.3	56	369.3	
8-10	7.5	101.9	332.7	
10-12	20.5	160.5	300.7	
12-14	2.6	188.1	207.6	
14-16	0.3	224.6	140	
16-18	0.5	109	46.2	
18-20	0.7	13.3	19.8	
20-22	2.2	6.3	12.8	
22-24	4.5	3.7	13.4	
24-26	6.9	1.8	13.6	
26-28	25.7		7	
28-30	13.1			
30+				
Total	**85.8**	**1080.4**	**3161.6**	**0**

Table 8. Distribution of habitat types in Section G by depth

3.8.2 Algal Distribution

The algal cover between Rocky Cape and the Stanley Nut (section G) displayed 75 % cover in the 0 – 5 m depth range, which gradually decreased to 40 % in the 10 – 15 m depth range, before increasing to around 55 % in 20 – 25 m water depth (Figure 22). The cover of canopy forming species was around 70 % in the 0 – 5 m depth range and rapidly decreased to less than 2 % in the 10 – 15 m depth range. A slight increase in the canopy forming species in the 20 – 25 m depth range is due to the inclusion of a small amount of video from Rocky Cape in the analysis for this section. In the 0 – 5 m depth range fucoid algae dominated, with *Acrocarpia paniculata* and *Cystophora* sp. comprising around 50 % cover collectively. Smaller amounts of *Ecklonia radiata*, *Perithalia caudata*, and several fucoid algae including *Carpoglossum* sp., *Sargassum* sp. *Caulocystis* sp, *Seirococcus axillaris*, and the green algae *Caulerpa* sp. were also noted in this depth range. In the 5 – 10 m depth range a similar suite of species were observed, with *A. paniculata*, *Sargassum* sp., mixed red and brown turfing algae and *Caulerpa* sp. being dominant. Below 10 m mixed red and brown turfing algae became the dominant algal groups (including *Halopteris paniculata* and *Ptilonia* spp), with *Caulerpa* sp. present in the 10 – 15 m depth range. In the 20 – 25 m depth range

E. radiata and *Cystophora* sp. were also present. This is representative of the algal communities off Rocky Cape, which are structured due to the influence of high wave exposure when compared to the rest of the coastline in this section. Sponge habitat was present in the 5 – 10 m depth range and increased in cover to becoming the dominant biota in the 20 – 25 m depth range. *Macrocystis angustifolia* was observed in the 0 – 5 m depth range off Mary Ann Cove and Cowrie Point.

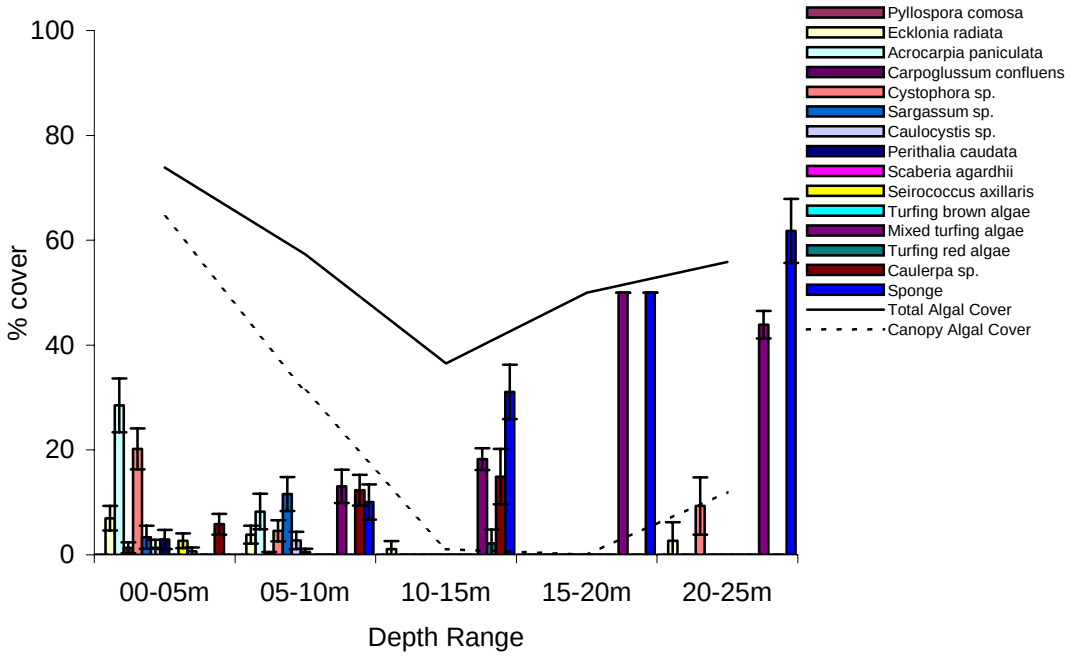


Figure 22. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between Rocky Cape and the Stanley Nut (Section G)

There was little cobble habitat between Rocky Cape and the Stanley Nut. Algal cover on the cobble that was present showed algaes to be around 40 % cover (Figure 23). Mixed turfing red and brown algae (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*) and *Caulerpa* sp. dominated this habitat between 5 and 15 m depth. In the 5 – 10 m depth range a small amount of *Cystophora* sp., *Sargassum* sp. and *Caulocystis* sp. were also present. A small amount of sponge habitat was observed on the cobble habitat between 5 and 15 m.

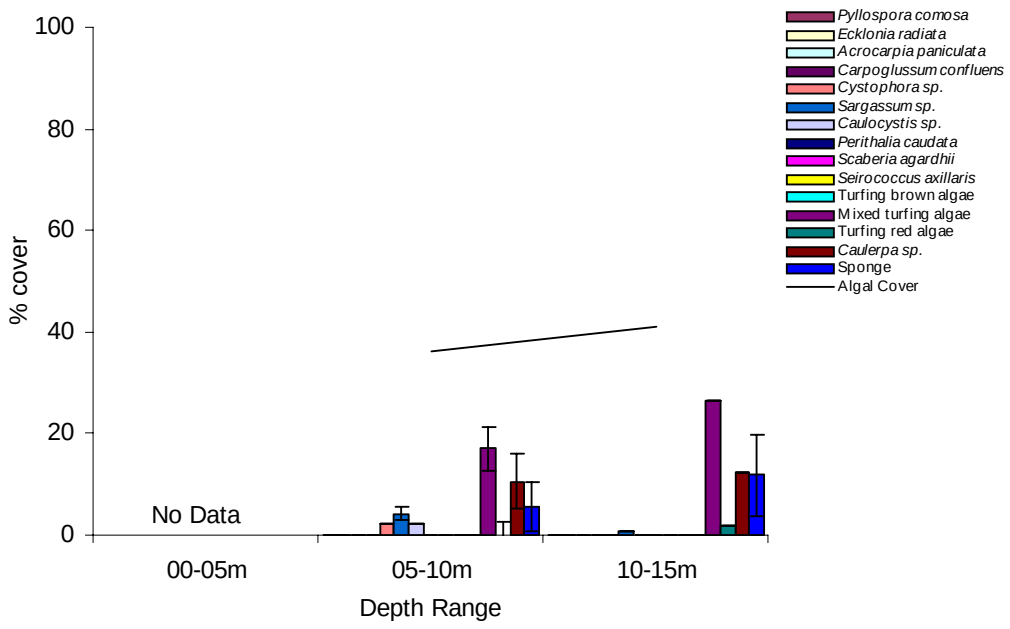


Figure 23. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between Rocky Cape and the Stanley Nut (Section G)

3.8.3 Seagrass Distribution

Significant seagrass beds were not identified between Rocky Cape and the Stanley Nut. However, on the western side of Rocky Cape and Cowrie Point the density of seagrass was high. To the west of Rocky Cape small amounts dense of *Amphibolis antarctica* were preset interspersed with reef in the 0 – 5 m depth range (Figure 24). Beyond this, sparse *Heterozostera tasmanica* was present on sand habitat to 10 m. Dense patches of *Amphibolis antarctica* were also present interspersed with reef in the 0 – 5 m depth range around Cowrie Point.

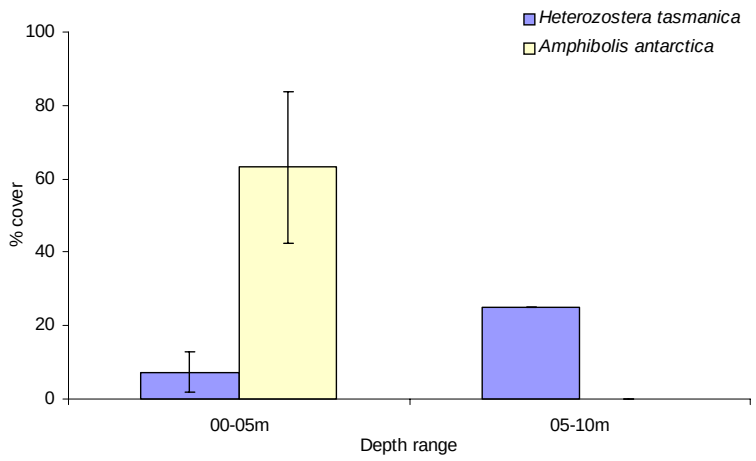


Figure 24. Mean percentage cover (±s.e.) for seagrass (*Heterozostera tasmanica* and *Amphibolis antarctica*) between and Rocky Cape and the Stanley Nut (Section G).

3.9 Section H; The Stanley Nut to Robbins Passage

3.9.1 Habitat Distribution

The distribution of dominant habitats; cobble, reef, sand and seagrass in Section H is quantified by depth in Table 9. The largest areas of seagrass in the mapping region were recorded to 12 m in Section H. Cobble habitat was not identified. Reef habitat was replaced by sand at 22 m.

Depth	Cobble (ha)	Reef (ha)	Sand (ha)	Seagrass (ha)
0-2		206.5	6496.5	353.5
2-4		99.1	1465.7	363.8
4-6		201.2	894.9	331.3
6-8		228.1	270.4	235.5
8-10		194.2	76.8	92.3
10-12		203.5	62.5	27
12-14		140	137.2	
14-16		70.2	290.9	
16-18		46.3	151.4	
18-20		25.8	69.5	
20-22		4	45.4	
22-24			6.3	
24-26				
26-28				
28-30				
30+				
Total	**0**	**1418.9**	**9967.5**	**1403.4**

Table 9. Distribution of habitat types in Section H by depth

3.9.2 Algal Distribution

The majority of reef between the Nut at Stanley and Robbins Passage was present off Highfield Point and North Point, with a small amount in Robbins Passage. The algal cover on this reef was high, ranging from 75 – 90 % cover between 0 and 15 m depth (Figure 25). The cover of canopy forming algal species closely resembles the total algal cover in this section. This is a reflection of the clearer waters in this region and the generally shallow distribution of the reef allowing these species to dominate the algal communities in all depth ranges. *Acrocarpia paniculata* and *Cystophora* sp. were dominant in the 0 – 5 m depth range, with small amounts of *Sargassum* sp., *Caulocystis* sp., *Perithalia caudata*, *Seirococcus axillaris*, *Xiphophora chondrophylla* and *Caulerpa* sp. On the more exposed points *Phyllospora comosa* and *Ecklonia radiata* were the dominant species in this depth range. Below 5 m depth *E. radiata* increased in cover to 20 - 25 % and was the dominant species in 10 – 15 m. Large amounts of *A. paniculata*, *Sargassum* sp. and *S. axillaris*, and smaller amounts of *Cystophora* sp., *Caulocystis* sp. and *Polysiphonia* sp. were also present in the 05 – 10 m depth range. Many of these species were also present in the 10 – 15 m depth range, along with mixed red and brown turfing algae (including *Halopteris paniculata* and *Ptilonia* spp) and *Caulerpa* sp. A small amount of sponge was present in the 10 – 15

m depth range. *Macrocystis angustifolia* was observed in the 0 – 5 m depth range off North Point.

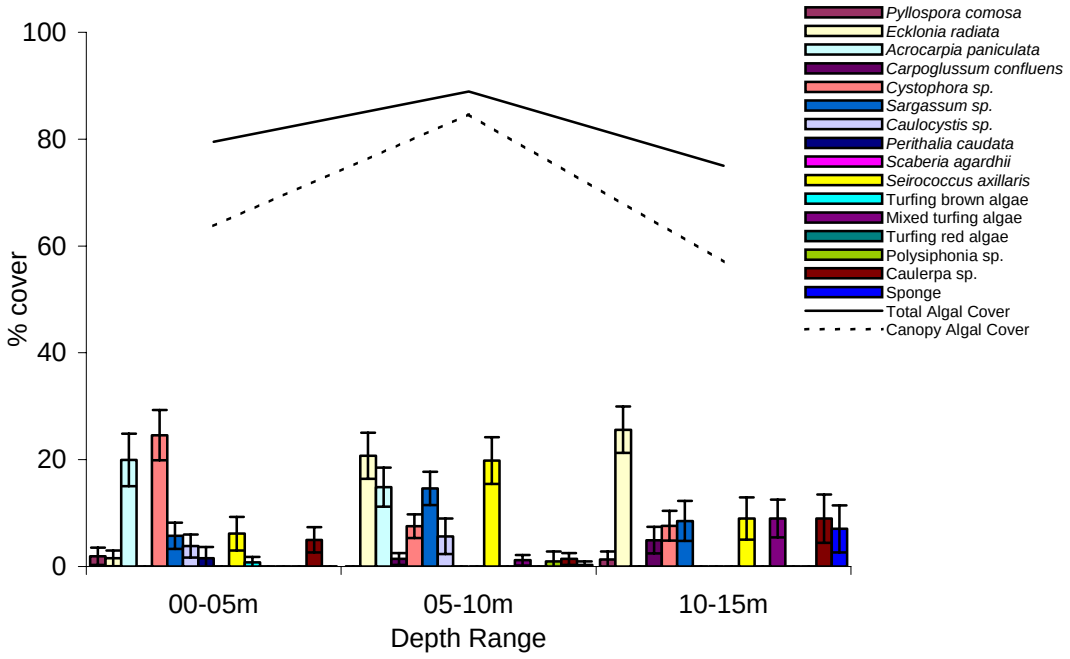


Figure 25. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with reef habitat in 5 metre depth strata between the Stanley Nut and Robbins Passage (Section H)

Large cobble patches were not identified between the Stanley Nut and Robbins Passage, however small patches of cobble were observed on the video and these supported a different algal community to those on reef habitat. The cover of algae on cobble was around 95 % in the 0 – 5 m depth range and decreased to less than 50 % by the 10 – 15 m depth range (Figure 26). In the 0 – 5 m depth range *Sargassum* sp. *Caulocystis* sp. and the red algae *Polysiphonia* sp. were the dominant algal types. Small amounts of *Acrocarpia paniculata* and *Cystophora* sp. were also present in this depth range. In the 5 – 10 m depth range the same five species were present, with small amounts of *Ecklonia radiata*, mixed turfing red and brown algae and *Caulerpa* sp. In the 10 – 15 m depth range mixed red and brown turfing algae (dominated by *Echinothamnion hystrix* and *Thamnoclonium dichotomum*) and *Caulerpa* sp were the most common algae, with lesser amounts of *E. radiata*, *Carpoglossum confluens* and *Sargassum* sp. Sponge habitat was also common in depths greater than 10 m.

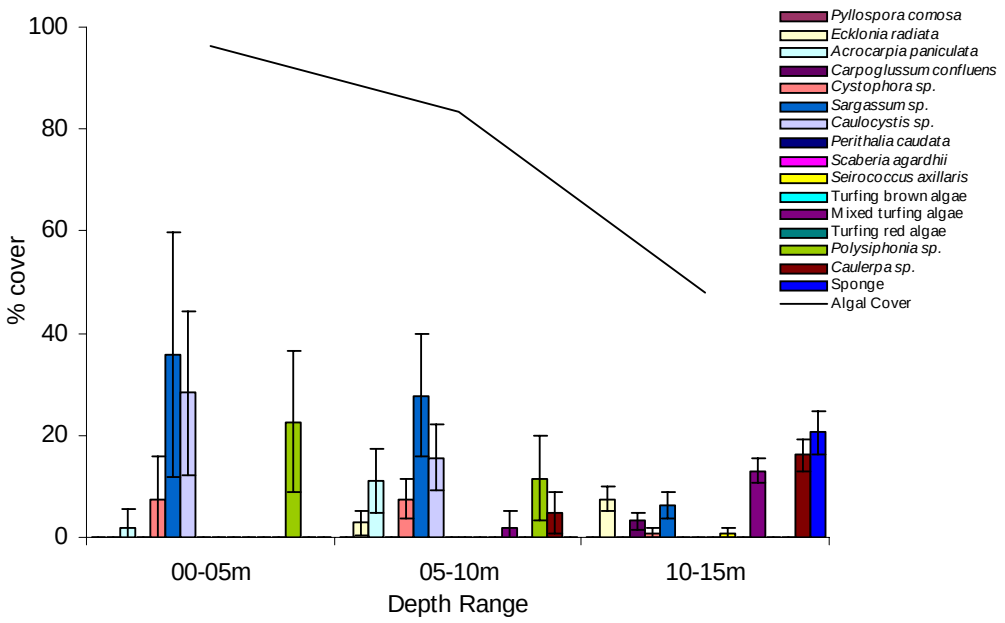


Figure 26. Mean percentage cover (±s.e.) for dominant canopy macroalgae and understorey algae associated with cobble habitat in 5 metre depth strata between the Stanley Nut and Robbins Passage (Section H).

3.9.3 Seagrass Distribution

The section from the Stanley Nut to Robbins Passage had the most extensive seagrass beds of any of the sections surveyed. Three seagrass species, *Heterozostera tasmanica*, *Amphibolis antarctica* and *Posidonia australis*, occurred in this section, with beds to the west of Cable Point and throughout Robbins Passage. *H. tasmanica* was predominantly found in sparse beds between 0 and 10 m depth on sandy substrate (Figure 27). *A. antarctica* was mainly confined to areas of reef or cobble habitat in the 0 – 5 m depth range, often occurring interspersed with a variety of algal species. *P. australis* was found in distinct beds and also mixed with the *H. tasmanica*. *P. australis* species often exhibited a dense growth pattern, especially to the west of Cable Point.

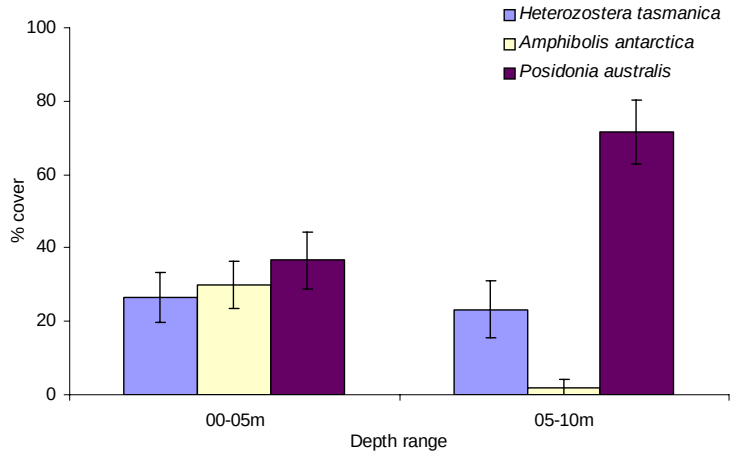


Figure 27. Mean percentage cover (±s.e.) for seagrass (*Heterozostera tasmanica, Amphibolis antarctica* and *Posidonia australis*) between and Rocky Cape and the Stanley Nut (Section G).

3.10 Section I; Robbins Passage to Hunter Island

Section I (Robbins Passage to Hunter Island) was not surveyed as planned within this project. Due to a combination of the logistics and weather conditions it was not possible to survey the area with the vessel employed for acoustic sampling. The tidal regimes within the bay and the strong currents made the area inaccessible. Review of the aerial photographs for this region, from the archives available at DPIW, did not contain any suitable photographs to be digitised into the GIS without acoustic ground truthing.

3.11 Section Analysis Results Summary

3.11.1 Habitat Distribution Summary

The distribution of dominant habitats; cobble, reef, sand and seagrass for the coastal sections A-H is quantified in Table 10 by section and by depth and section in Table 11.

From the entire study region of 39,529 Ha, 25% of the surveyed area was in the 0-2 m depth range, with only 2.7% outside of 30 m. The majority of cobble habitat occurred in the 10-20 metre depth range. Seagrasses were noted in the video analysis out to 12 meters with the greatest abundances in the 2-4 meter depth range and was most dominant in section H between Stanley Nut and Robbins Passage. The largest amount of reef was found in section E (2696 Ha) Round Hill Point to Table Cape.

SECTION	COBBLE (ha)	REEF (ha)	SAND ha)	SEAGRASS (ha)	TOTAL (ha)
A	0	843	3034	2	*3879*
B	1428	1286	1432	42	*4188*
C	1163	871	640	8	*2682*
D	834	1581	237	2	*2654*
E	602	2696	1136	1	*4435*
F	502	1264	2808	0	*4574*
G	86	1080	3161	0	*4327*
H	0	1419	9968	1403	*12790*
TOTAL	*4615*	*11040*	*22416*	*1458*	*39529*

Table 10. Distribution of habitat types by Section.

DEPTH RANGE	SUBSTRATE				TOTAL (ha) and % of all area surveyed	
	COBBLE (ha)	REEF (ha)	SAND (ha)	SEAGRASS (ha)		
0-2m	24	1312	8492	363	*10191*	25.8%
2-4m	127	1007	2820	395	*4349*	11.0%
4-6m	187	1092	2195	343	*3817*	9.7%
6-8m	258	1251	1396	237	*3142*	7.9%
8-10m	513	1397	1006	93	*3009*	7.6%
10-12m	584	1508	875	28	*2995*	7.6%
12-14m	475	1156	757	0	*2388*	6.0%
14-16m	528	912	847	0	*2287*	5.8%
16-18m	587	559	637	0	*1783*	4.5%
18-20m	592	300	528	0	*1420*	3.6%
20-22m	354	158	482	0	*994*	2.5%
22-24m	133	121	420	0	*674*	1.7%
24-26m	92	100	383	0	*575*	1.5%
26-28m	80	99	293	0	*472*	1.2%
28-30m	45	51	285	0	*381*	1.0%
30m +	33	16	1002	0	*1051*	2.7%
TOTAL	*4612*	*11013*	*22442*	*1459*	*39529*	

Table 11. Distribution of habitat types in all Sections by depth and % cover

3.11.2 Algal Distribution Summary

The total cover of algae was found to differ both between reef and cobble habitats and with depth (Figure 28). Reef consistently supported a greater cover of algae than cobble in the same depth range. The total algal cover for both reef and cobble decreased with depth over the first 15 m, for cobble habitat this decrease continued with depth, however for reef the cover increased slightly with a small peak in the 20 – 25 m depth range. This is an artefact of the majority of the reef in this depth range occurring off headlands, which generally have clearer waters more conducive to algal growth.

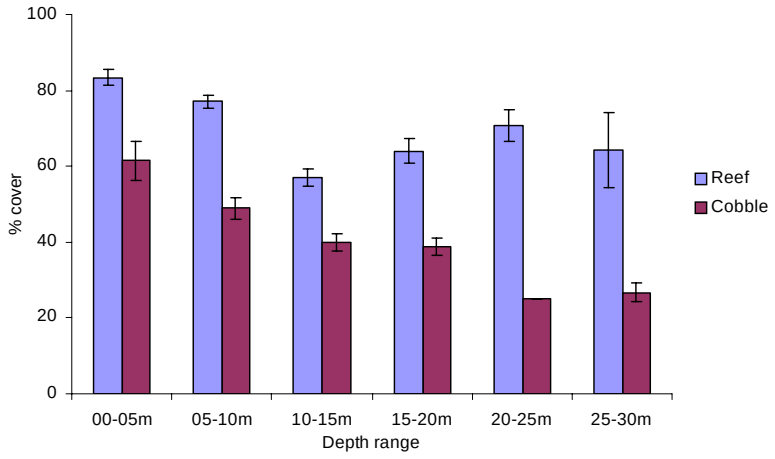


Figure 28. Average percent algal cover (± s.e.) across five metre depth bins for reef and cobble habitat along the north west coast of Tasmania between Robbins Passage and West Head.

Algal distribution by depth was influenced by differences in water clarity and exposure along the coastline from West Head to Robbins Island. Water clarity was generally lower in the central sections of this coast, between Devonport and Wynyard, than the eastern and western extremities. The exposure was similar along this coast, with the prominent headlands, such as West Head, Badger Head, Rocky Cape and North Point, experiencing higher exposure than the remainder of the coast. These differences in water clarity and exposure the generally resulted in a decrease in the maximum depth distribution or total absence of many of the larger brown algae from the central sections of this coastline.

In the 0 – 5 m depth range *Ecklonia radiata* comprised between 10 and 20 % of the algal cover from West Head to Ulverstone (Sections A – C) and around Wynyard (Section E) but was almost absent around Burnie (Section D) and generally less than 10 % West of Table Cape (Sections F-G) (Figure 29). Thallus brown algae (large fleshy brown algae such as *Phyllospora, Cystophora, Sargassum, Caulocystis and Carpoglussum*) made up over 50 % of the total algal cover in the 0 – 5 m depth range along the entire coast, but was especially high in the vicinity of Burnie (Section E), where it made up over 90% of all algae. Turfing algae in this depth range were more common in the central sections between Port Sorell and Table Cape (Sections B – E) than the remainder of the coast, but even in these sections they comprise less than 6 % of the total algal cover. *Caulerpa* spp. were more common in the western sections (E – H), with a peak in section F of 16 % cover. Sponge did not occur in this depth range.

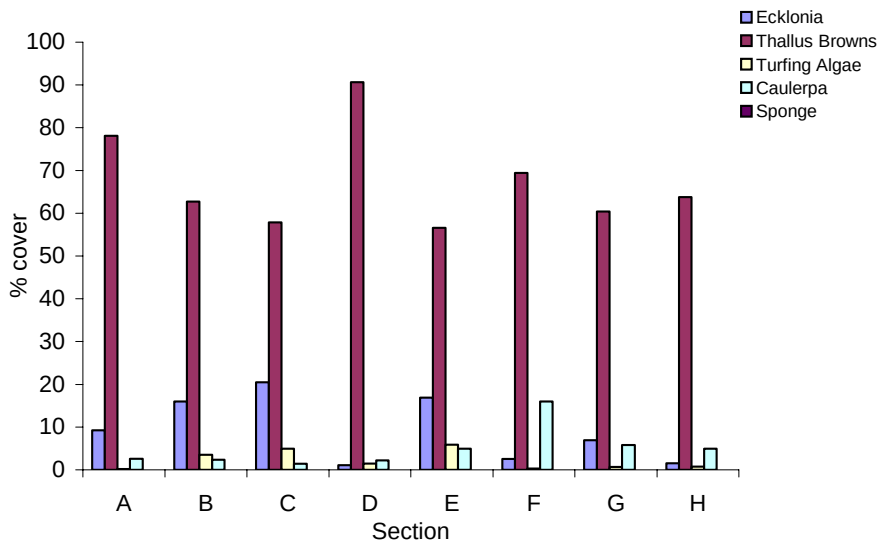


Figure 29. East to West trends in algal groupings between 0 and 5 m depth along the Cradle Coast NRM Region

The trends in the algal distribution became more apparent in the 5 – 10 m depth range. *Ecklonia radiata* cover was highest in the eastern and western sections and decreased in the central sections, especially around Burnie (Section D) where it was less than 2 % cover (Figure 30). Similarly thallus brown algae were more common in this depth range in the eastern and western sections, and lower in the central sections. The amount of turfing algae was conversely low in the eastern and western sections and much higher in the central section, especially from Devonport to Wynyard (sections C – E) where it comprised 35 - 52 % of total algal cover. *Caulerpa* spp. was less than 7 % cover in all sections except sections between Stanley and Table Cape (sections F and G) where it was between 10 and 13 % cover. Small amounts of sponge were present in this depth range, with larger amounts around Devonport (section C) between Burnie and Stanley (sections E - G).

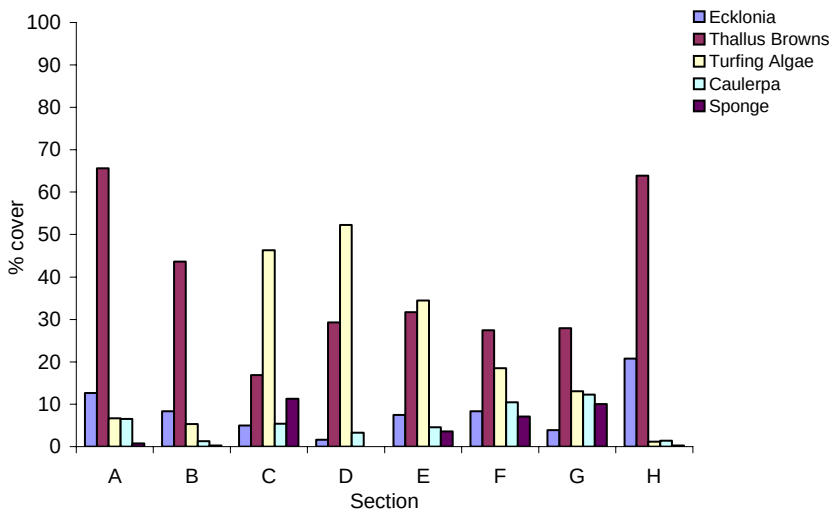


Figure 30. East to West trends in algal groupings between 5 and 10 m depth along the Cradle Coast NRM Region

Video and algal grab samples were used to identify some of the major components of turfing algae throughout the study region. *Halopteris paniculata* and *Ptilonia* spp. were common turfing algae in shallow water (< 5 m) and *Codium* spp. was noted along the entire surveyed region in small amounts in deeper waters (> 5m). Between Port Sorell and Burnie *Gracilaria secundata* was common, while *Champia* sp. and *Delisea hypneoides* were dominant around Port Sorell. *Hypnea ramentacea* was present in the video records around Burnie. On cobble substrate, below 10 m depth, species of *Echinothamnion hystrix* and *Thamnoclonium dichotomum* were the dominant component of the turfing algae.

3.12 Robbins Passage to West Head Map Series

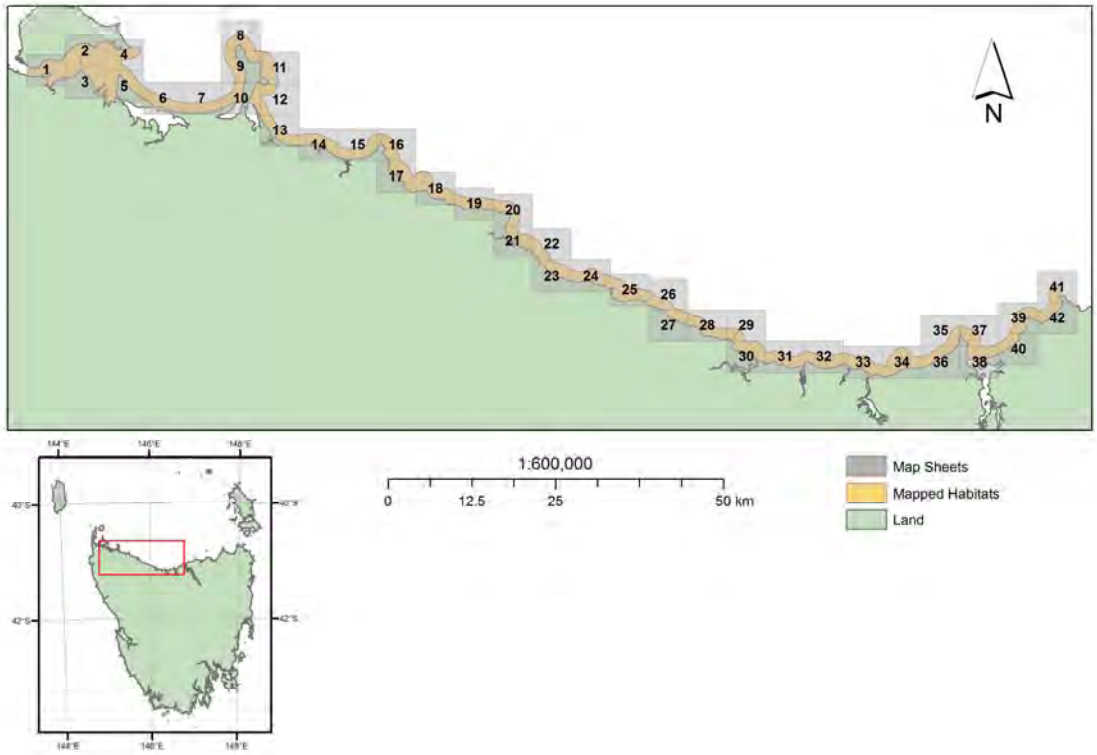
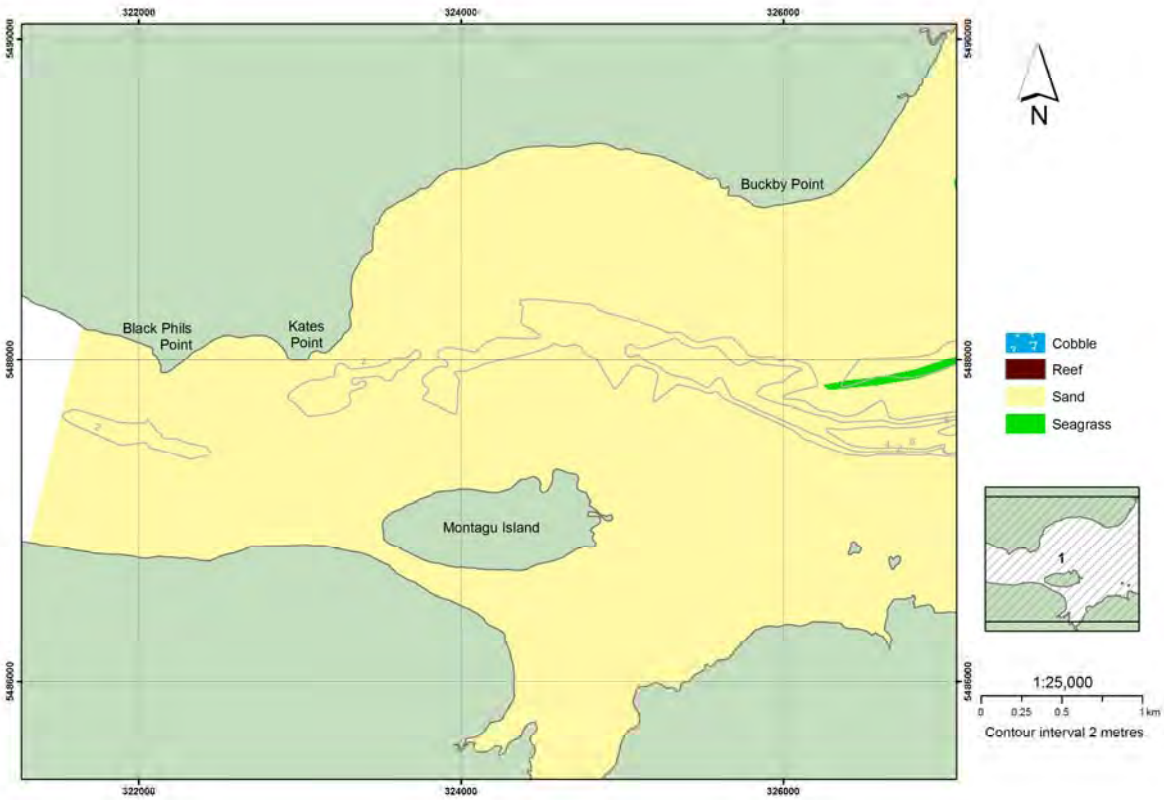


Figure 31. Map Index for the Cradle Coast region for the SeaMap 2006 survey.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5490000
5488000
5486000
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Black Phils Point
Kates Point
Montagu Island
Cobble
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Seagrass
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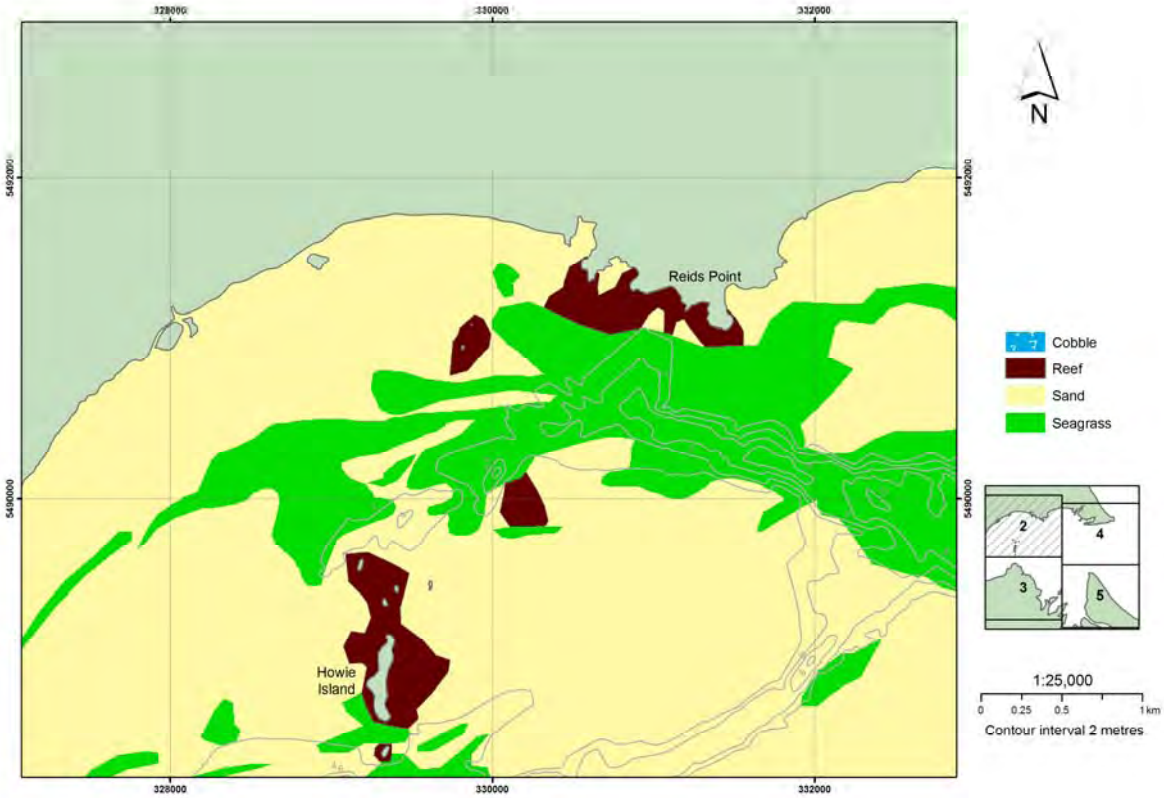
Contour interval 2 metres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Howie Island
Cobble
Reef
Sand
Seagrass
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3
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1:25,000
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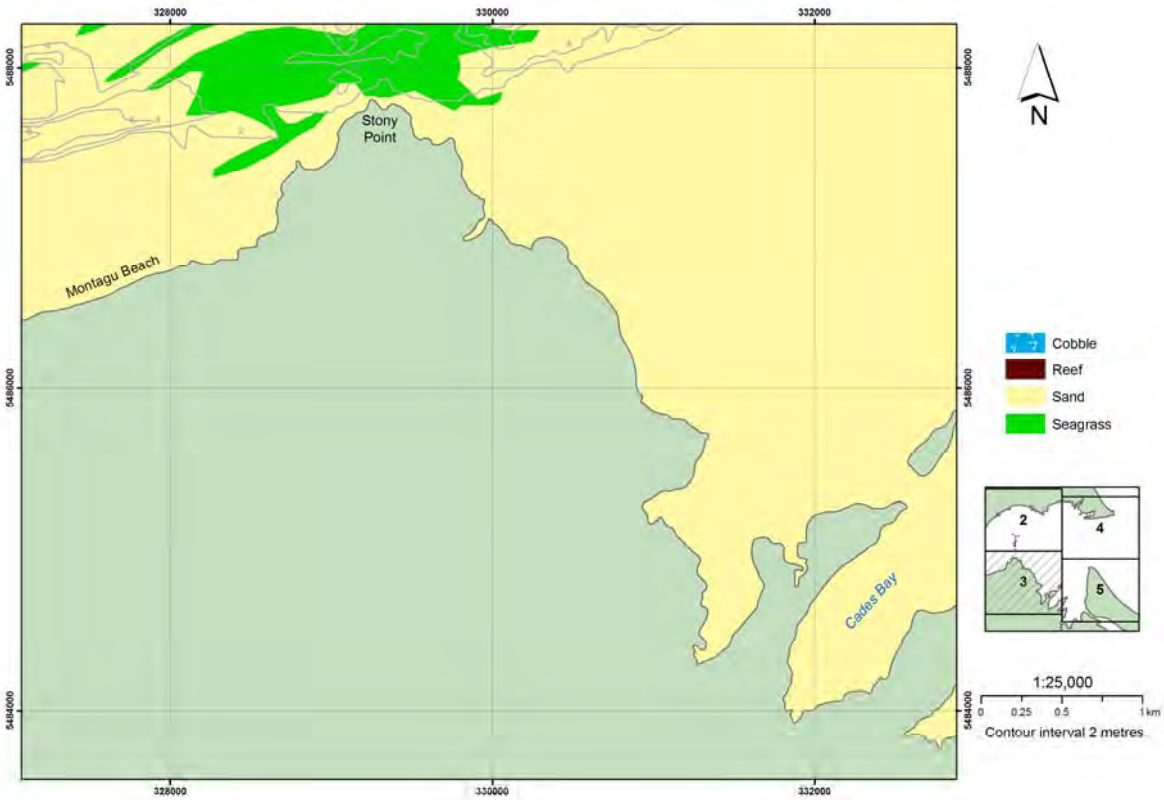
Contour interval 2 metres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Montagu Beach
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3
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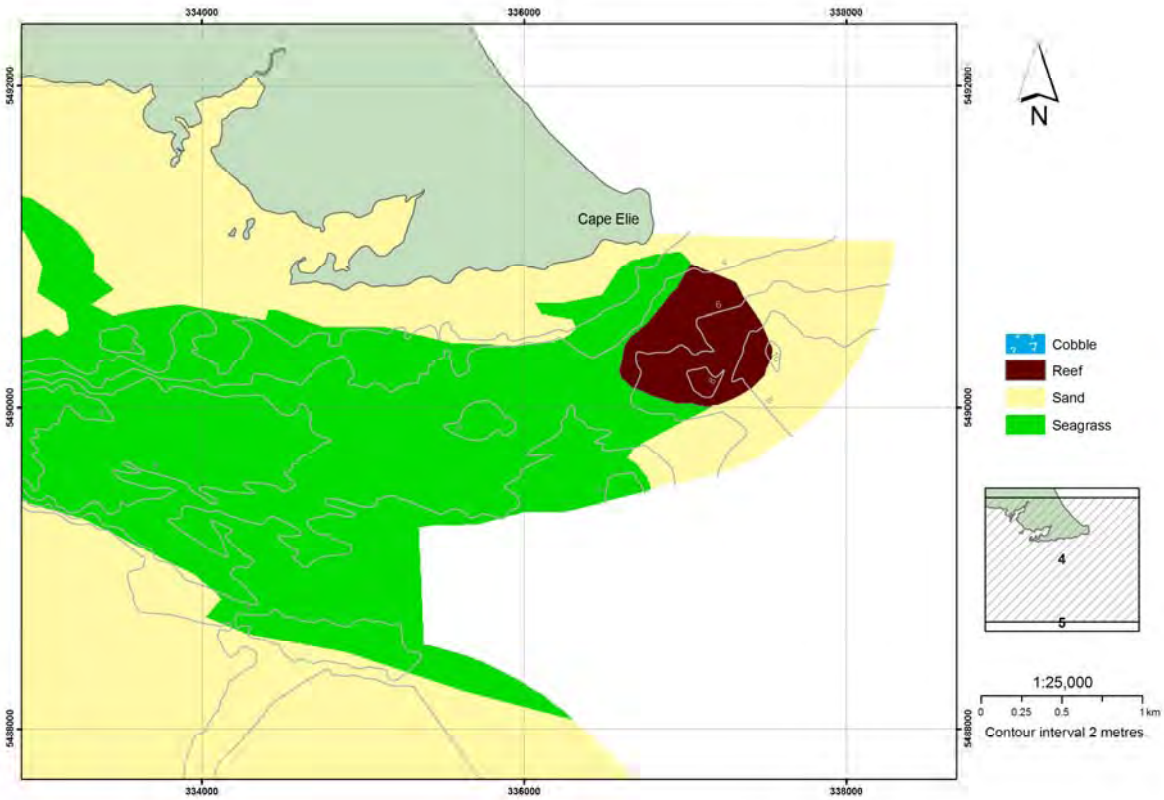
Contour interval 2 metres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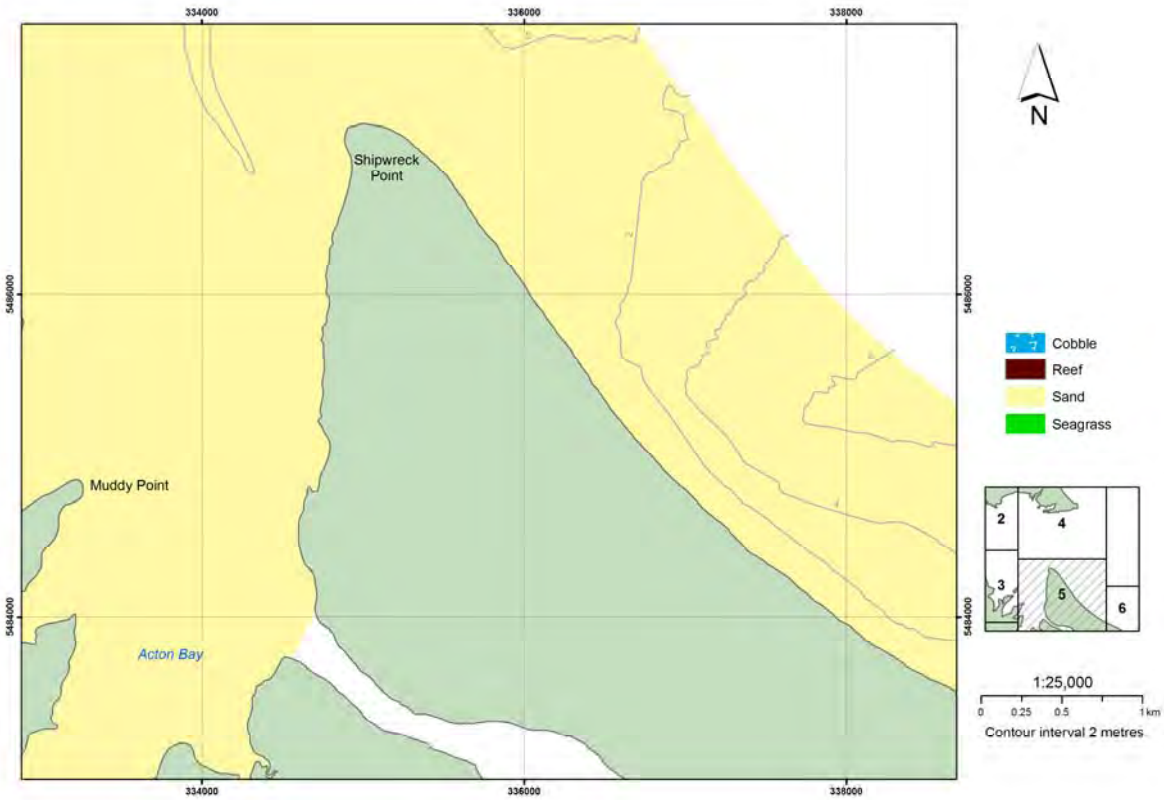
Contour interval 2 metres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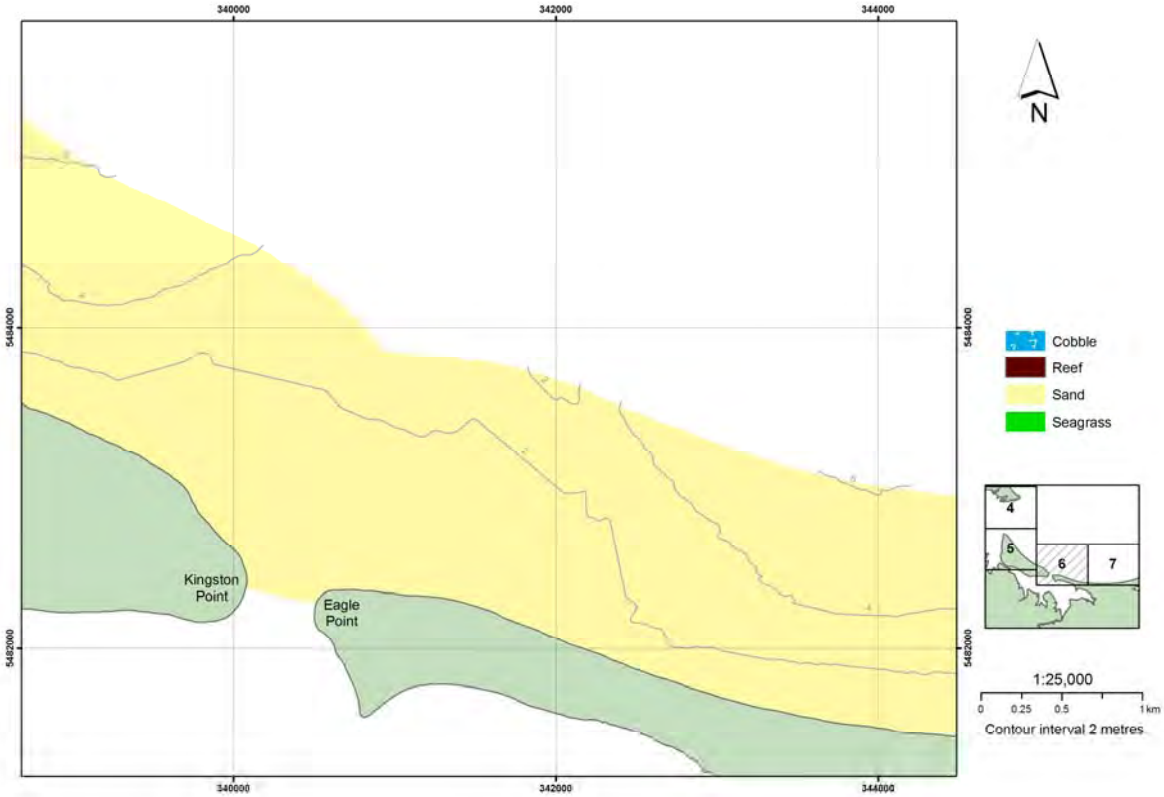
Contour interval 2 metres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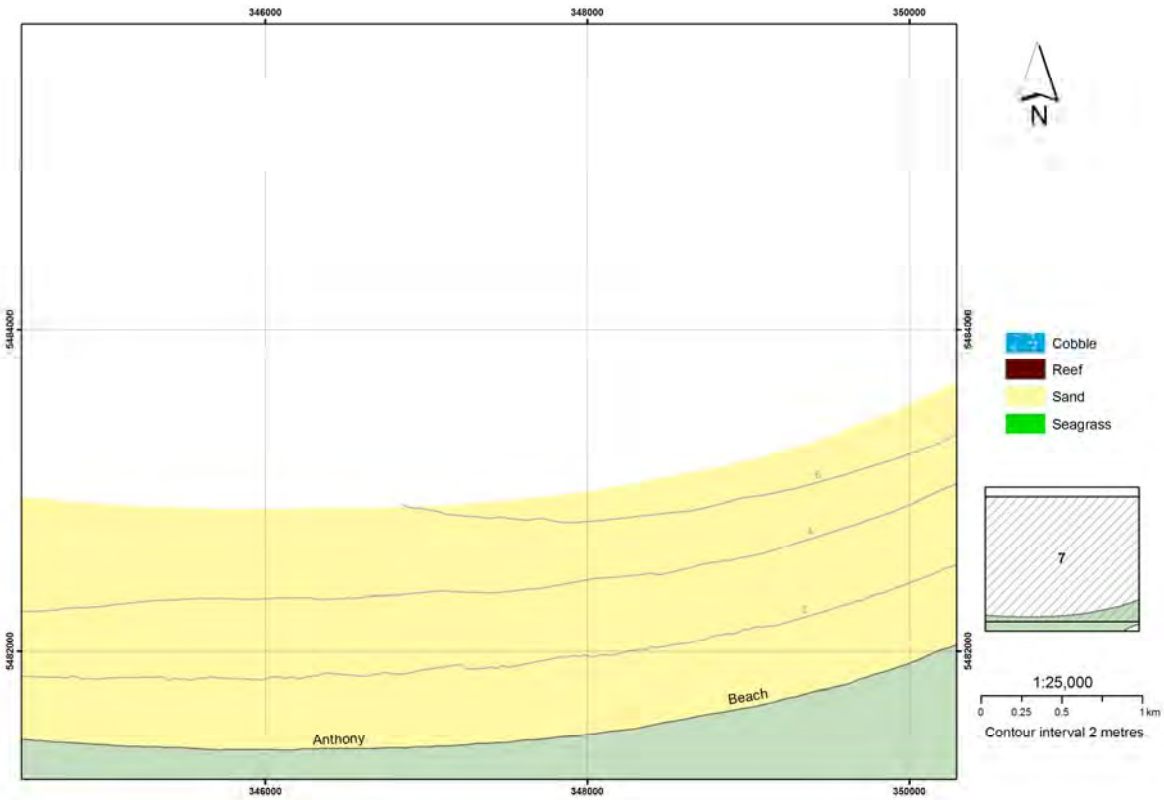
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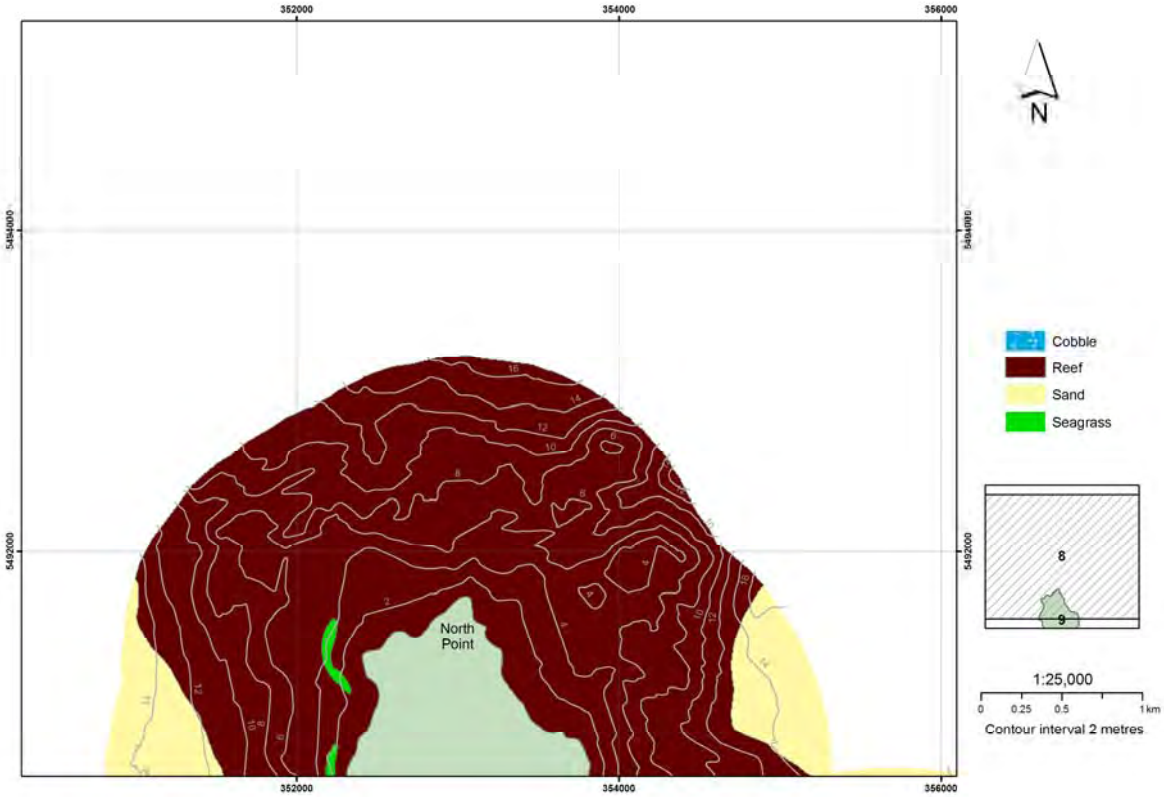
Beach
Anthony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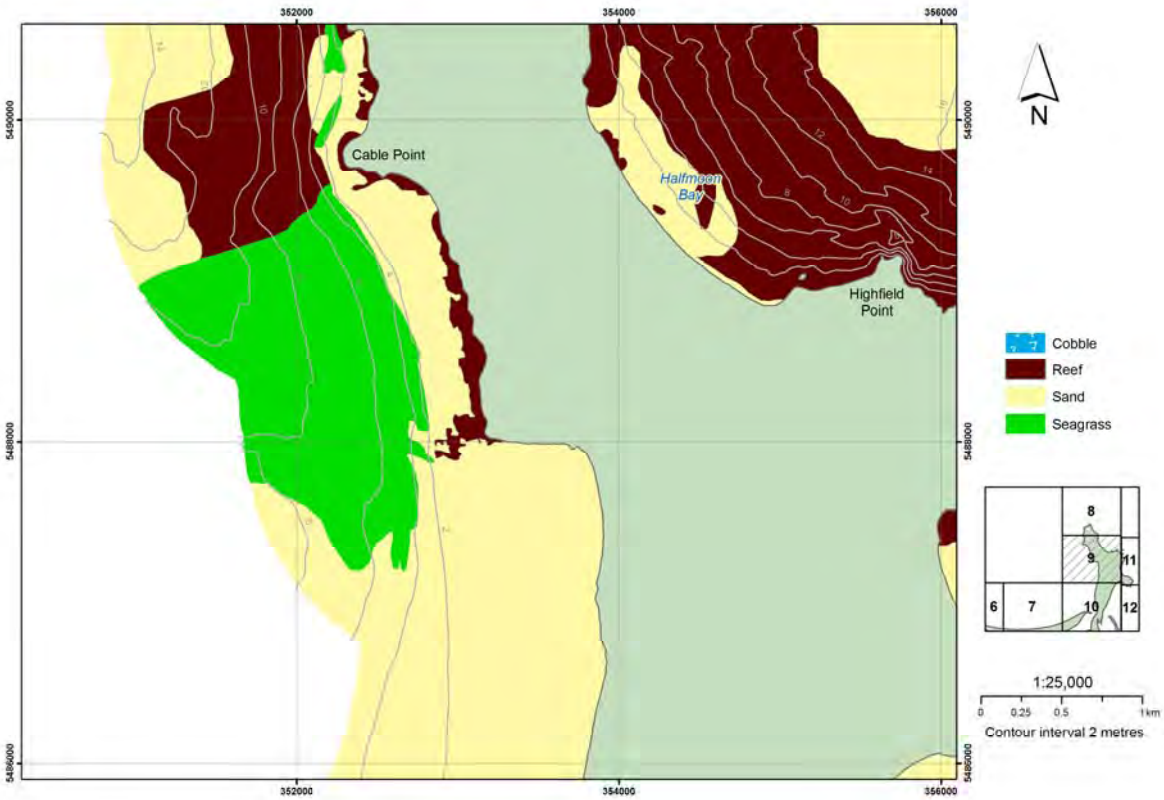
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Highfield Point
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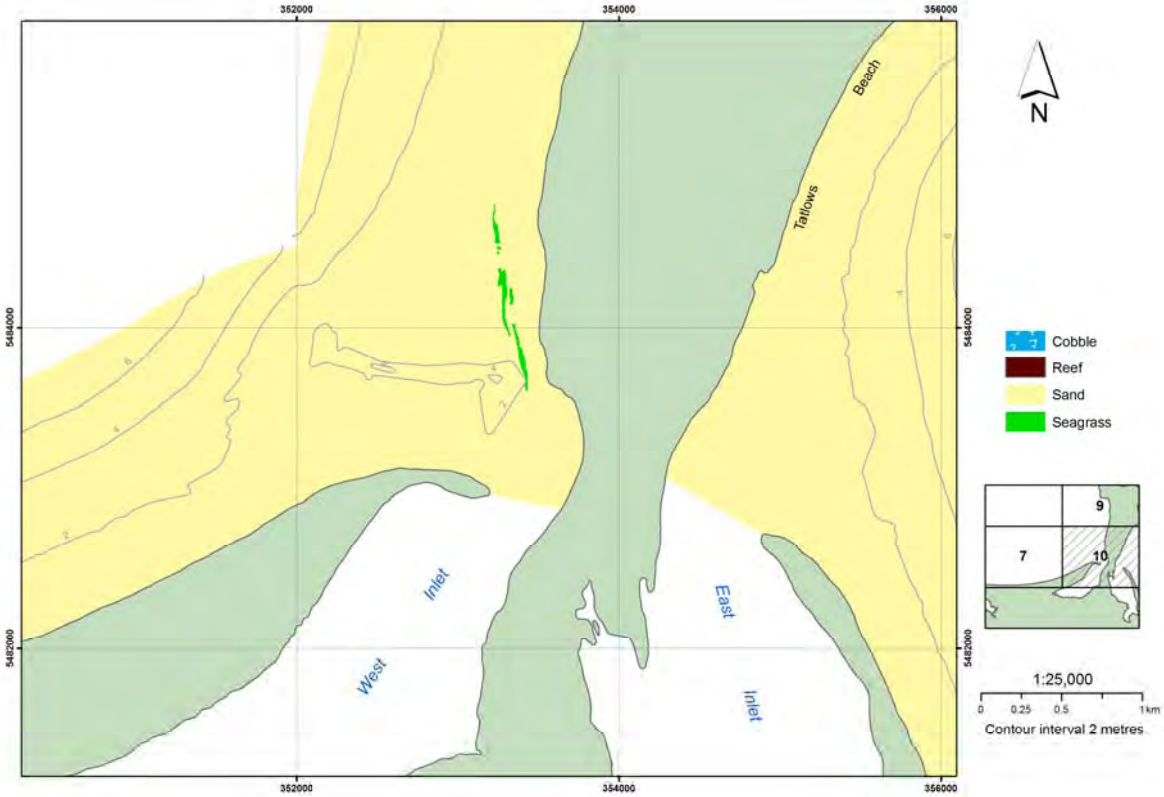
Contour interval 2 metres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West
Inlet
East
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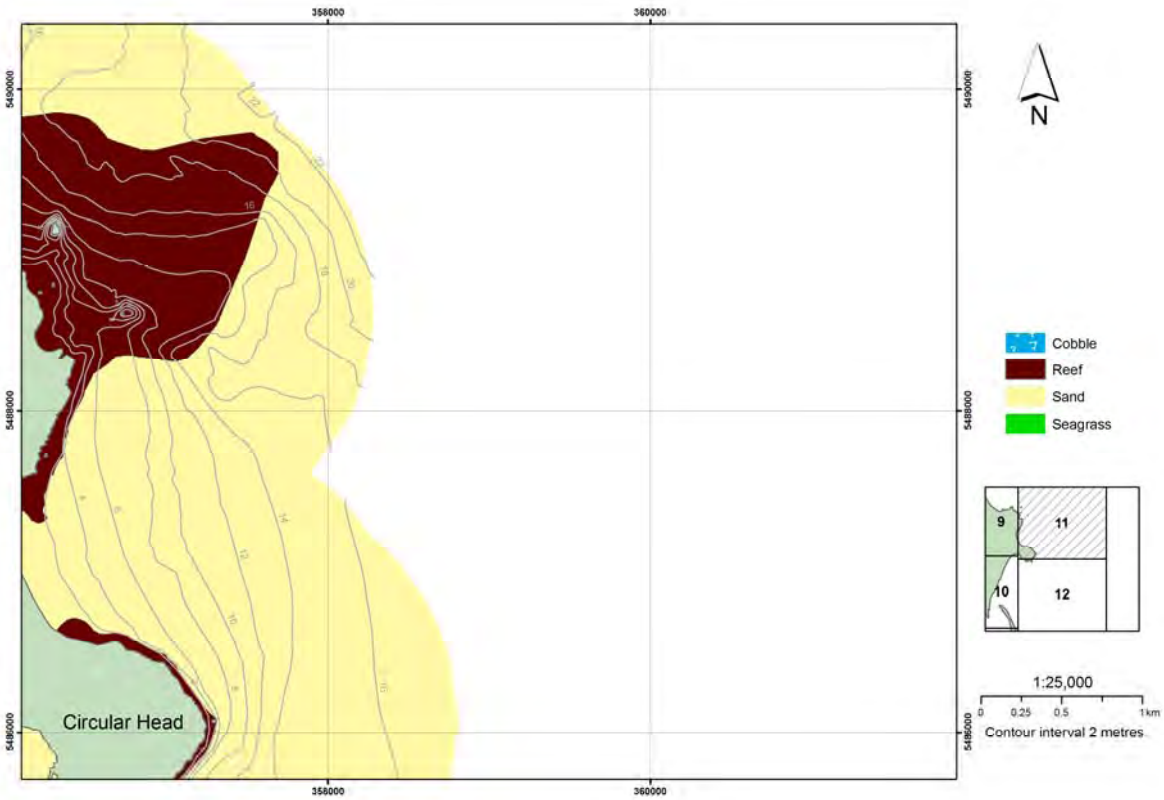
Contour interval 2 metres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Reef
Sand
Seagrass
9
11
10
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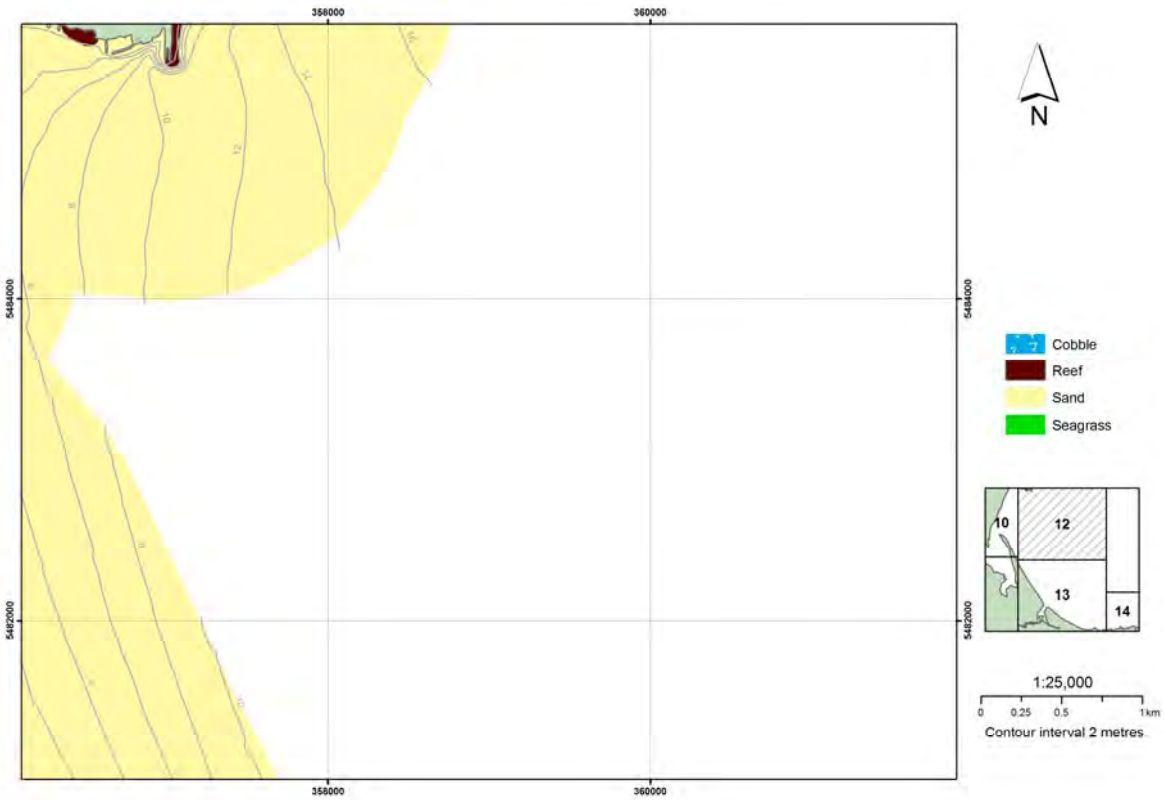
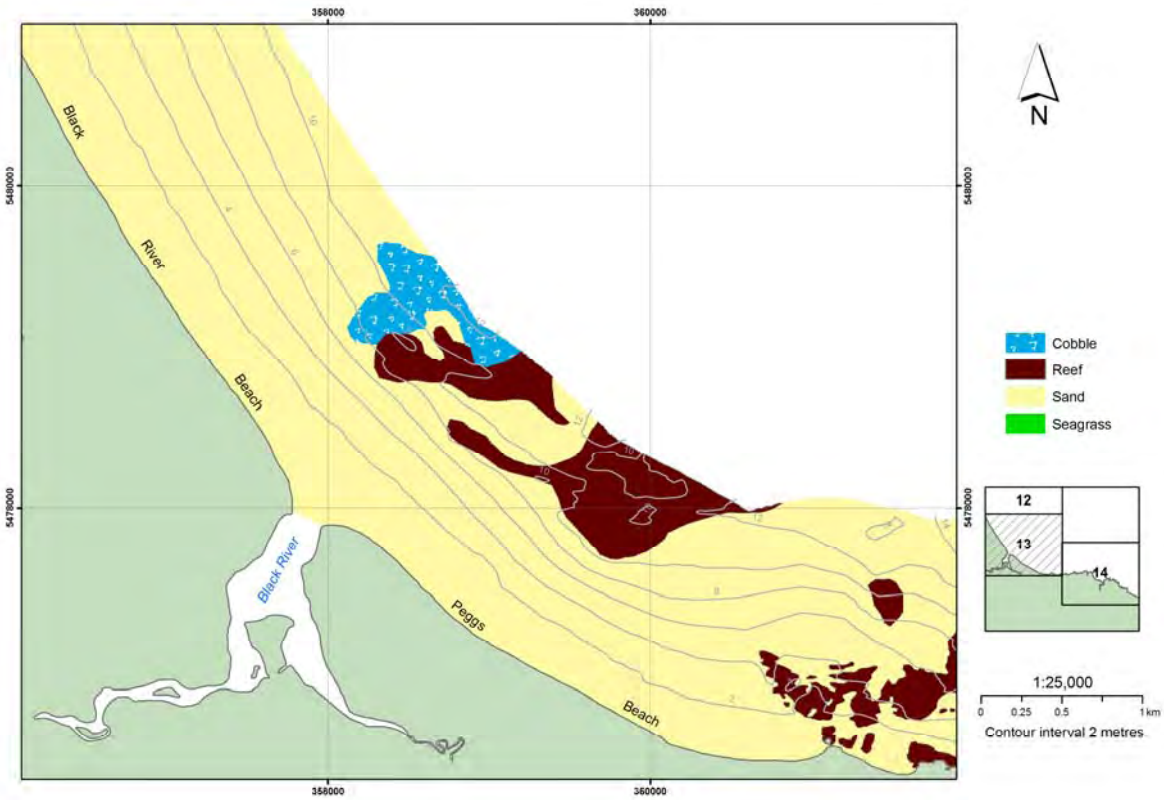
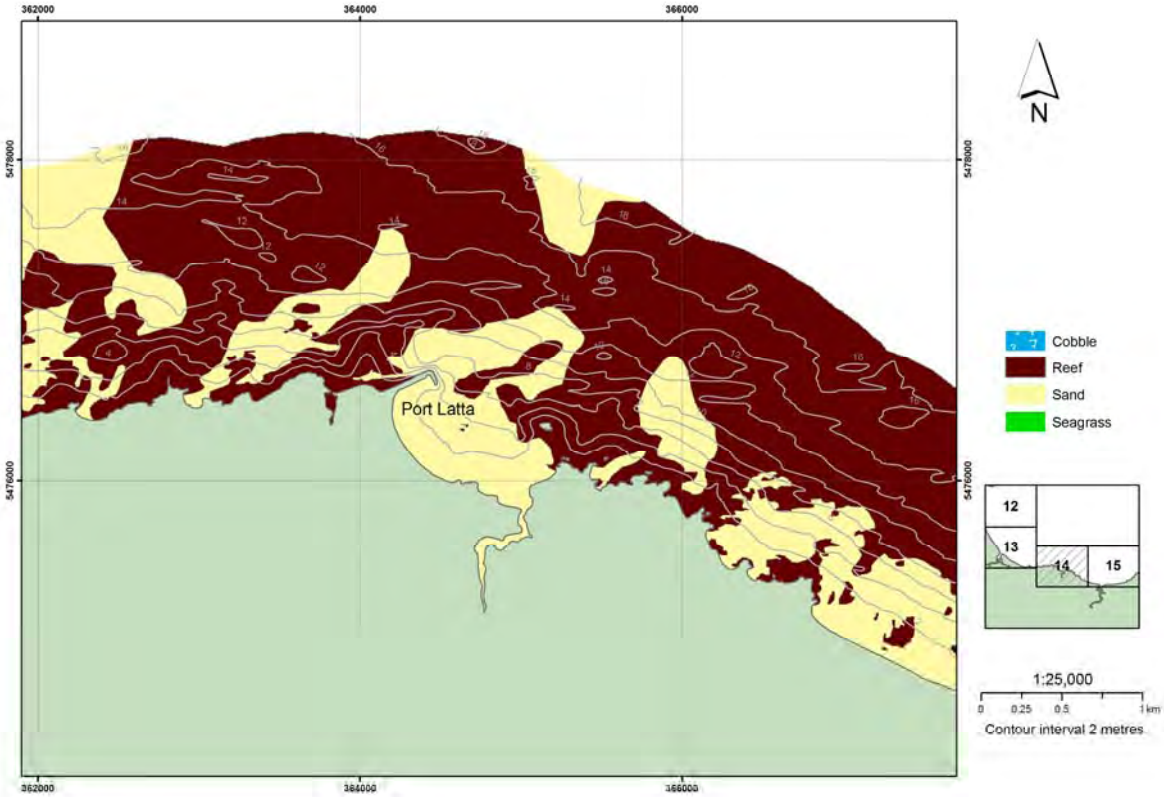
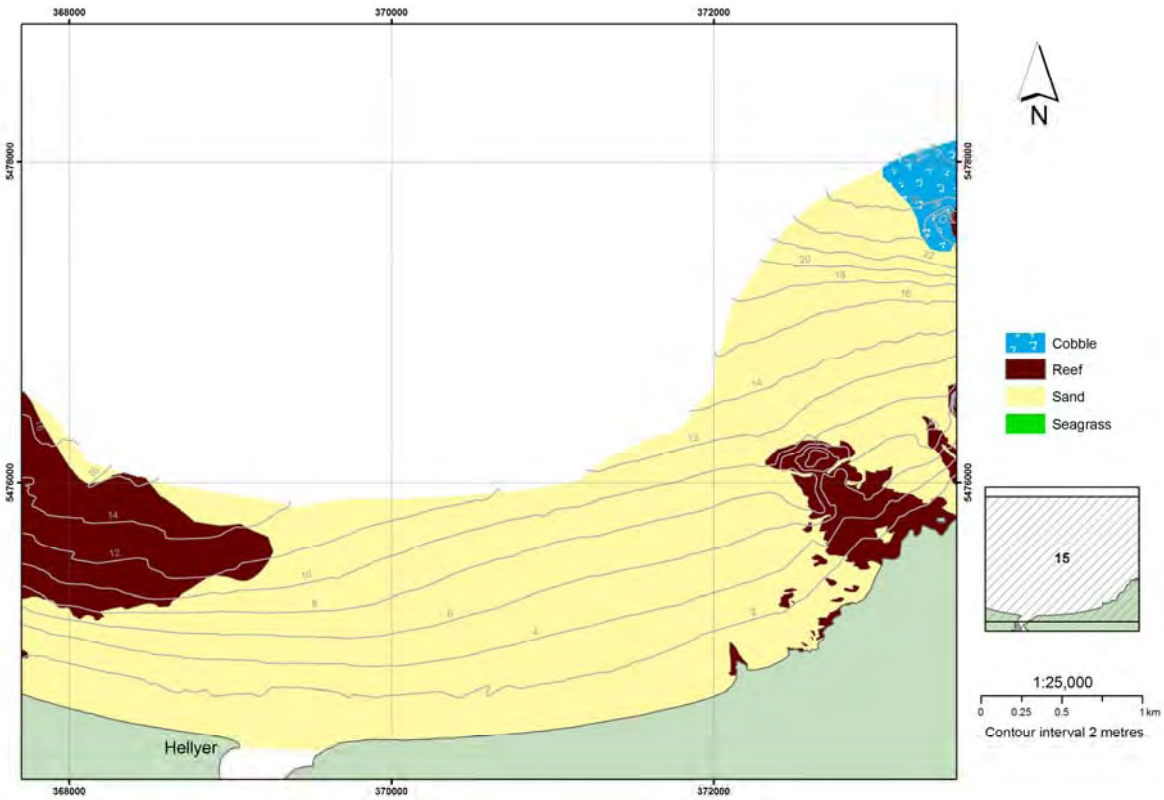
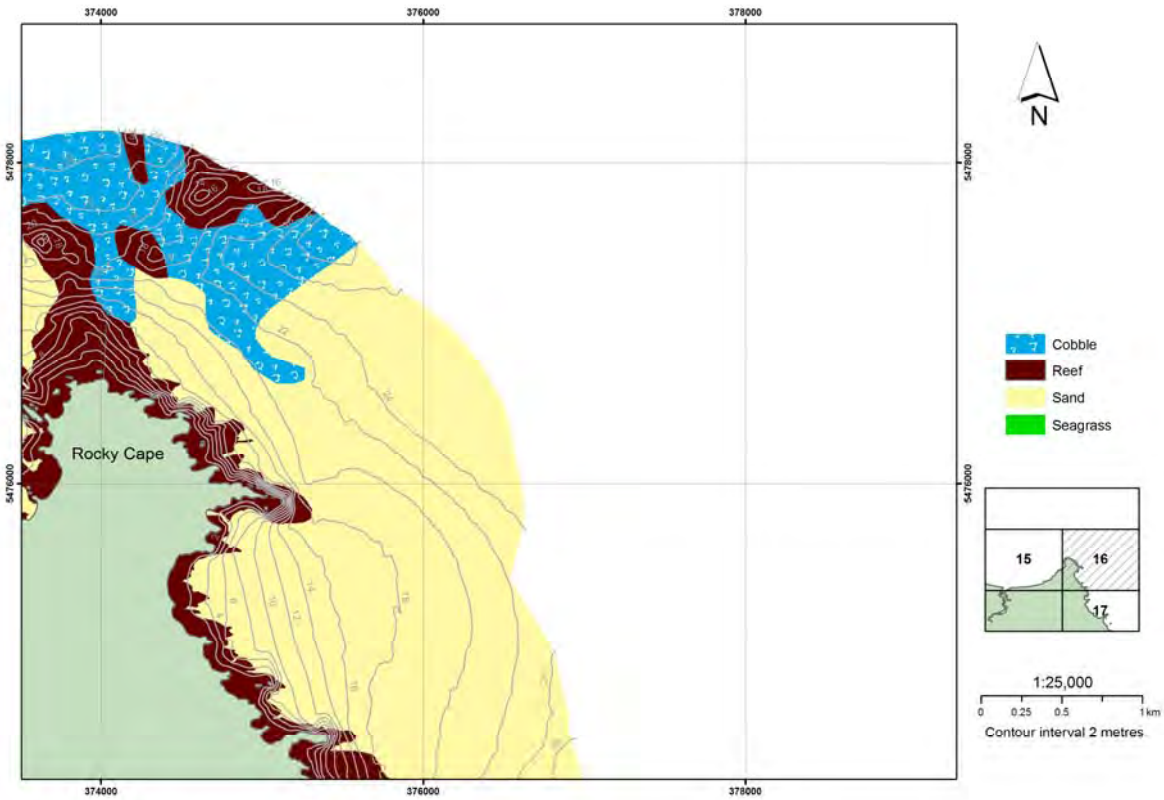
0 0.25 0.5 1km
Contour interval 2 metres

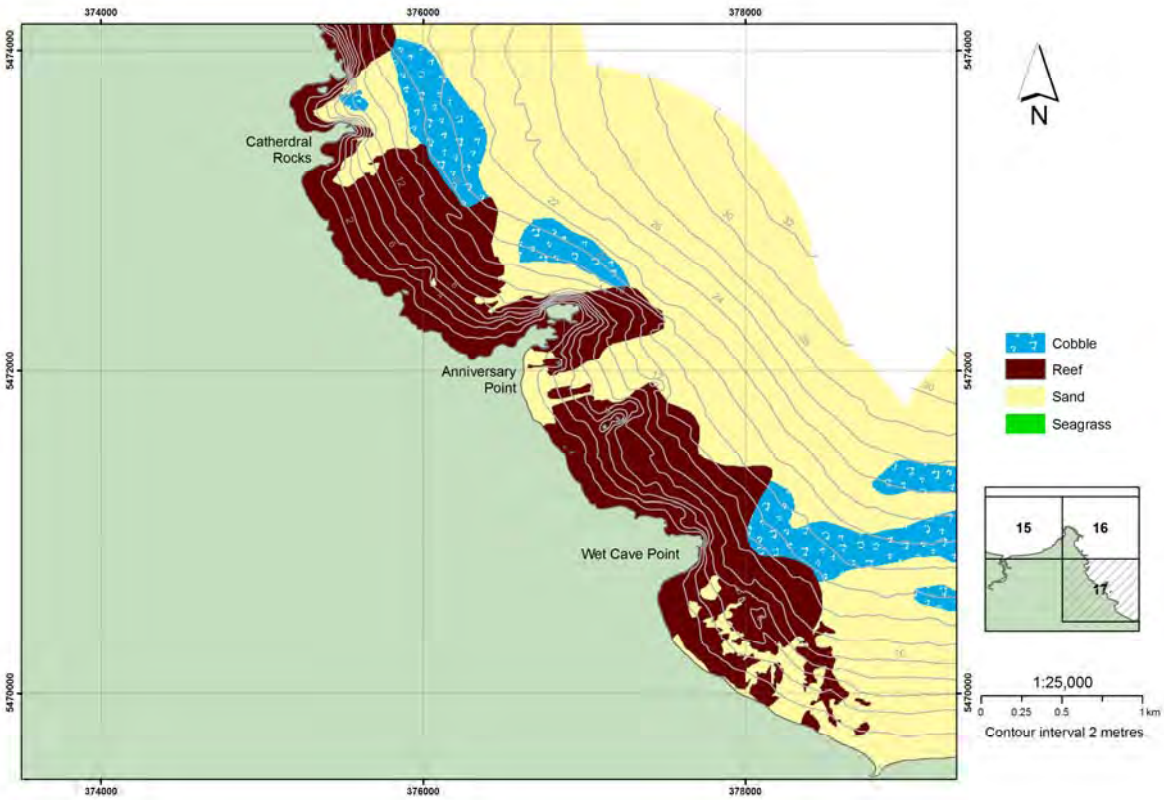

358000
360000
5484000
5482000
N
Cobble
Reef
Sand
Seagrass
10
12
13
14
1:25,000
0 0.25 0.5 1km
Contour interval 2 metres

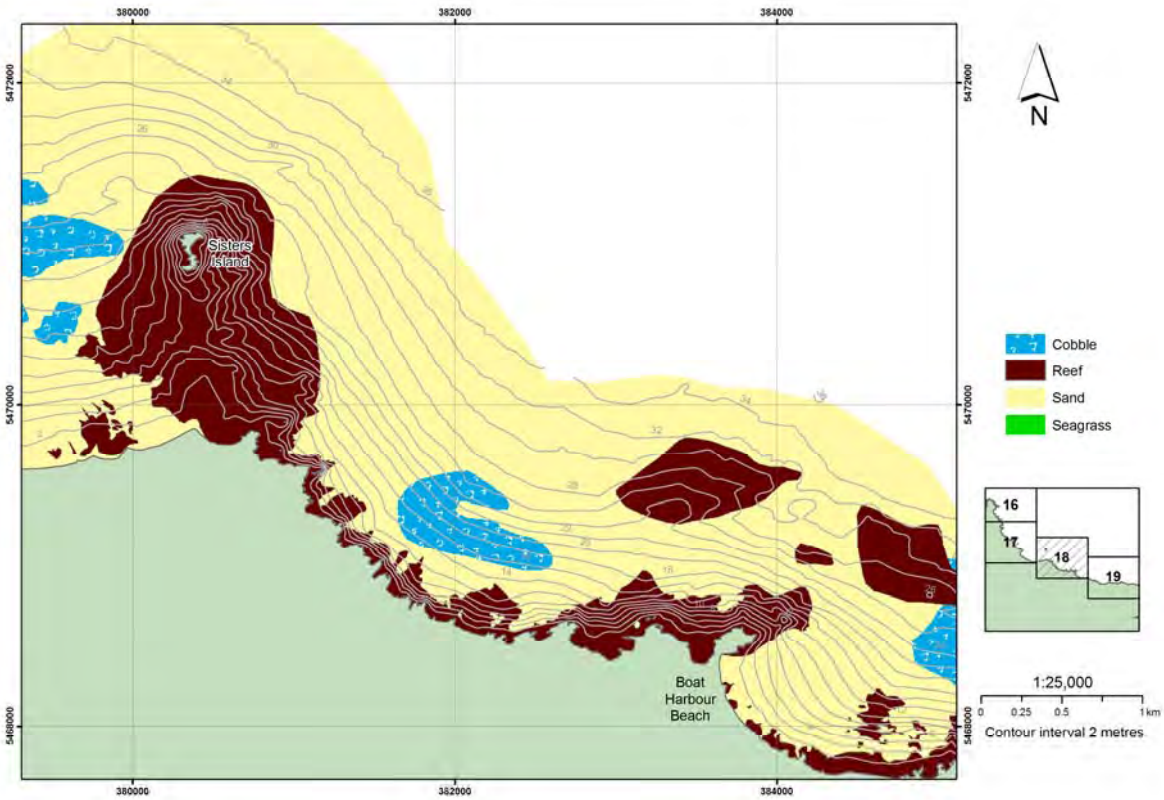

358000
360000
5480000
5478000
Black
River
Beach
Black River
Peggs
Beach
N
Cobble
Reef
Sand
Seagrass
12
13
14
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

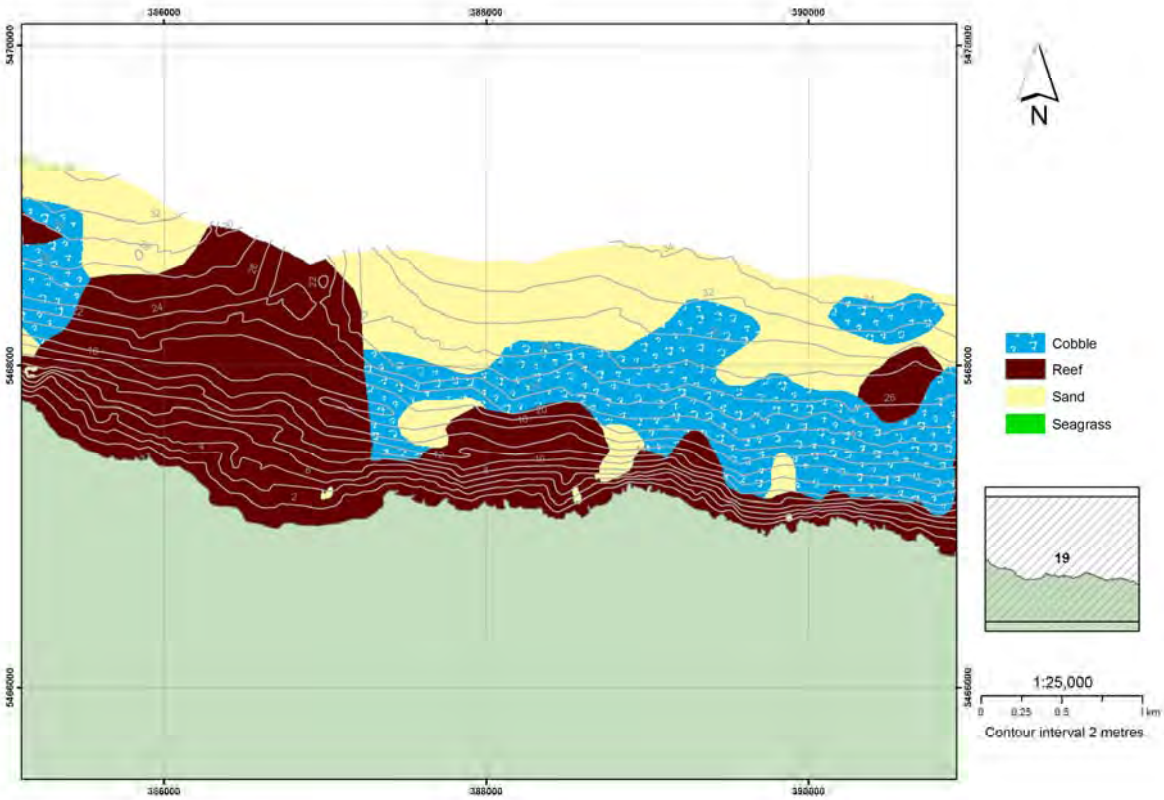

362000
364000
366000
5478000
5476000
Port Latta
N
Cobble
Reef
Sand
Seagrass
12
13
14
15
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

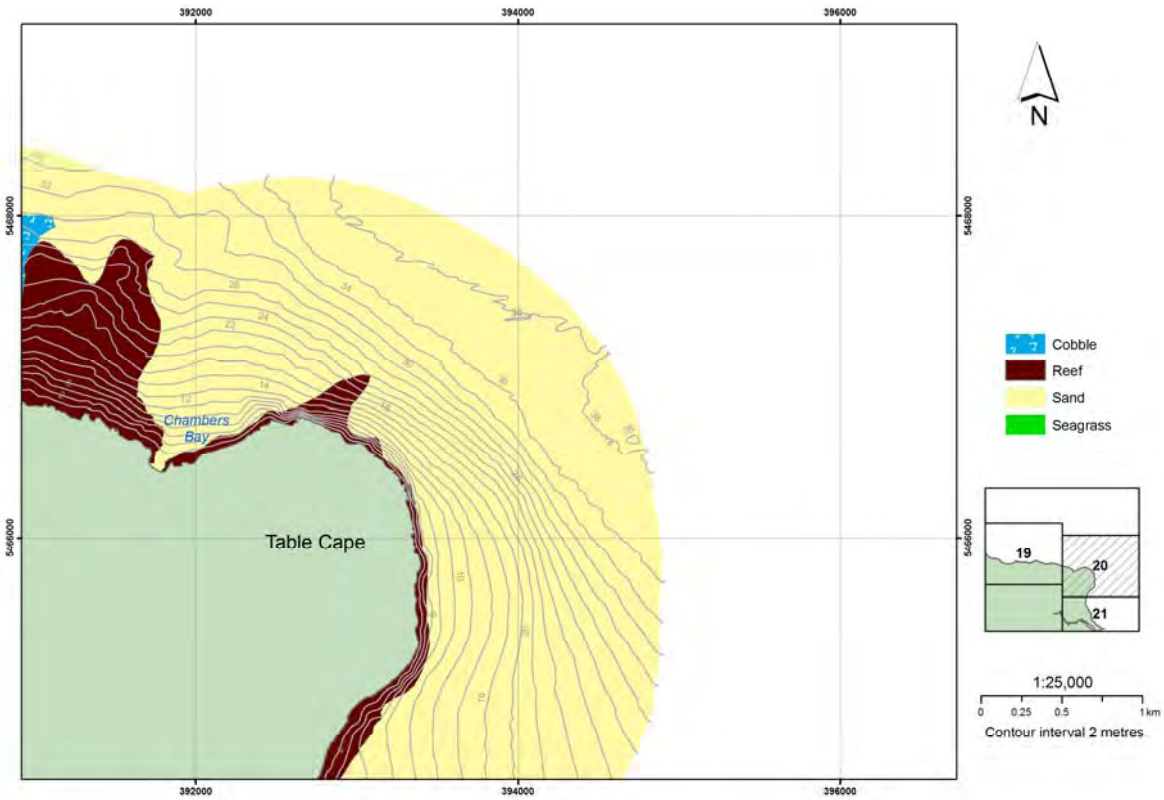

368000
370000
372000
5478000
5476000
N
Cobble
Reef
Sand
Seagrass
15
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres
Hellyer

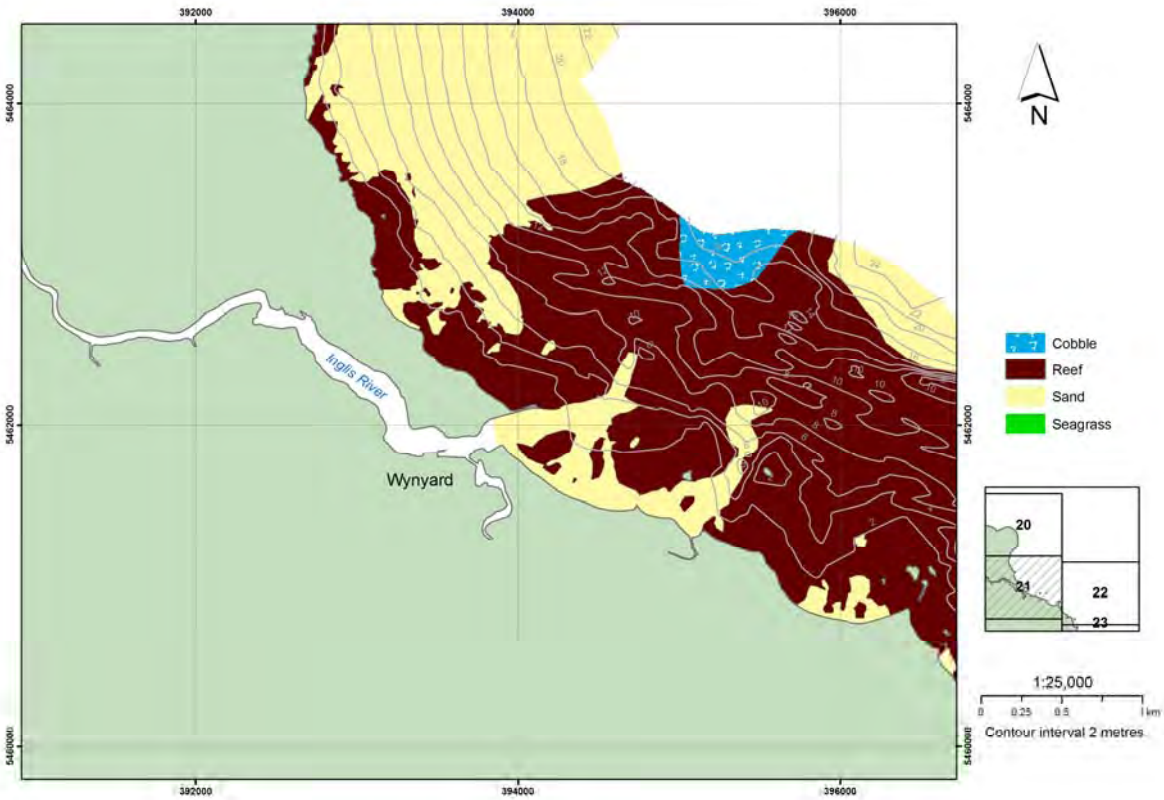

374000
376000
378000
5478000
5476000
N
Cobble
Reef
Sand
Seagrass
15
16
17
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres
Rocky Cape

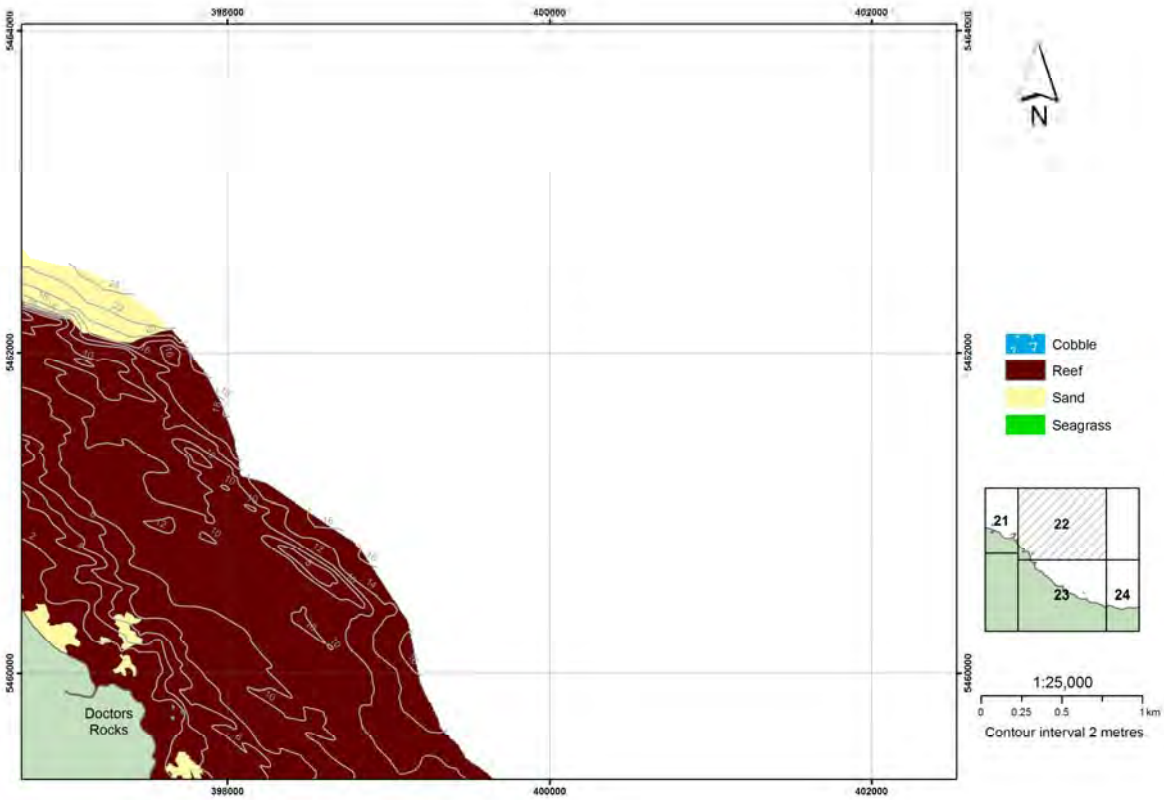

374000
376000
378000
5474000
5472000
5470000
Catherdral Rocks
Anniversary Point
Wet Cave Point
N
Cobble
Reef
Sand
Seagrass
15
16
17
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

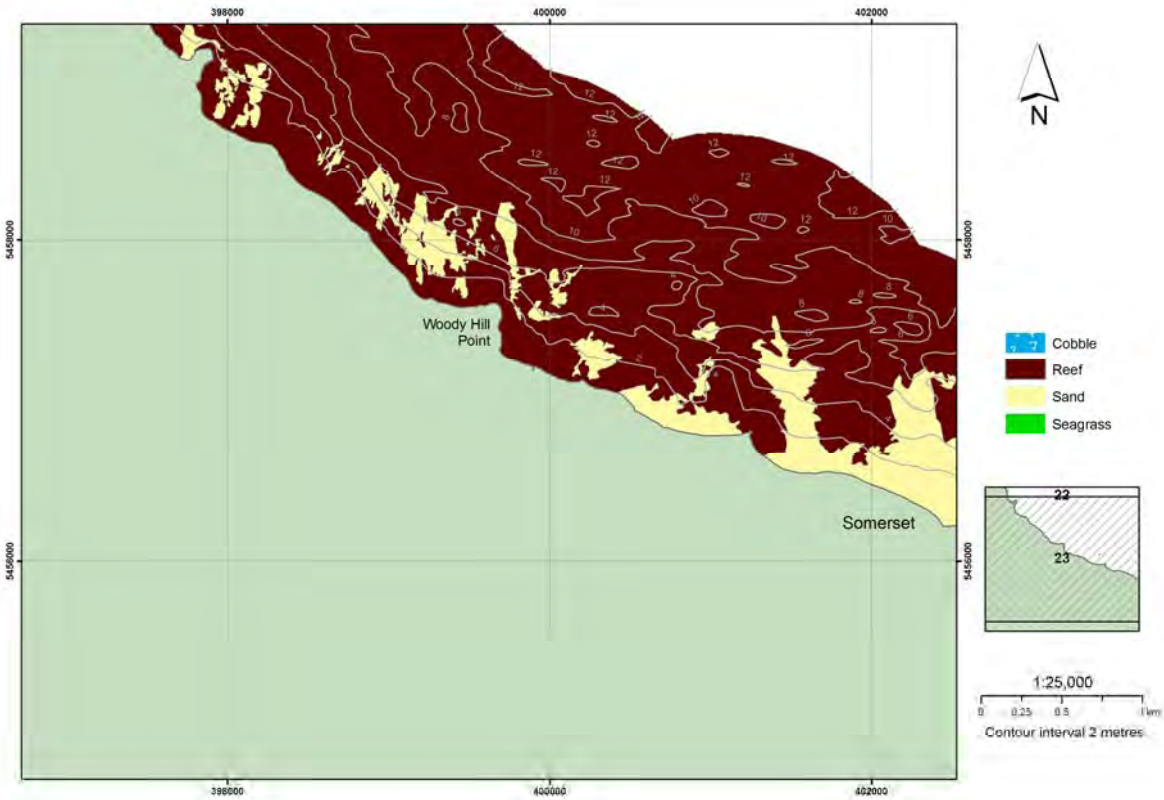

380000
382000
384000
5472000
5470000
5468000
Sisters Island
Boat Harbour Beach
N
Cobble
Reef
Sand
Seagrass
16
17
18
19
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

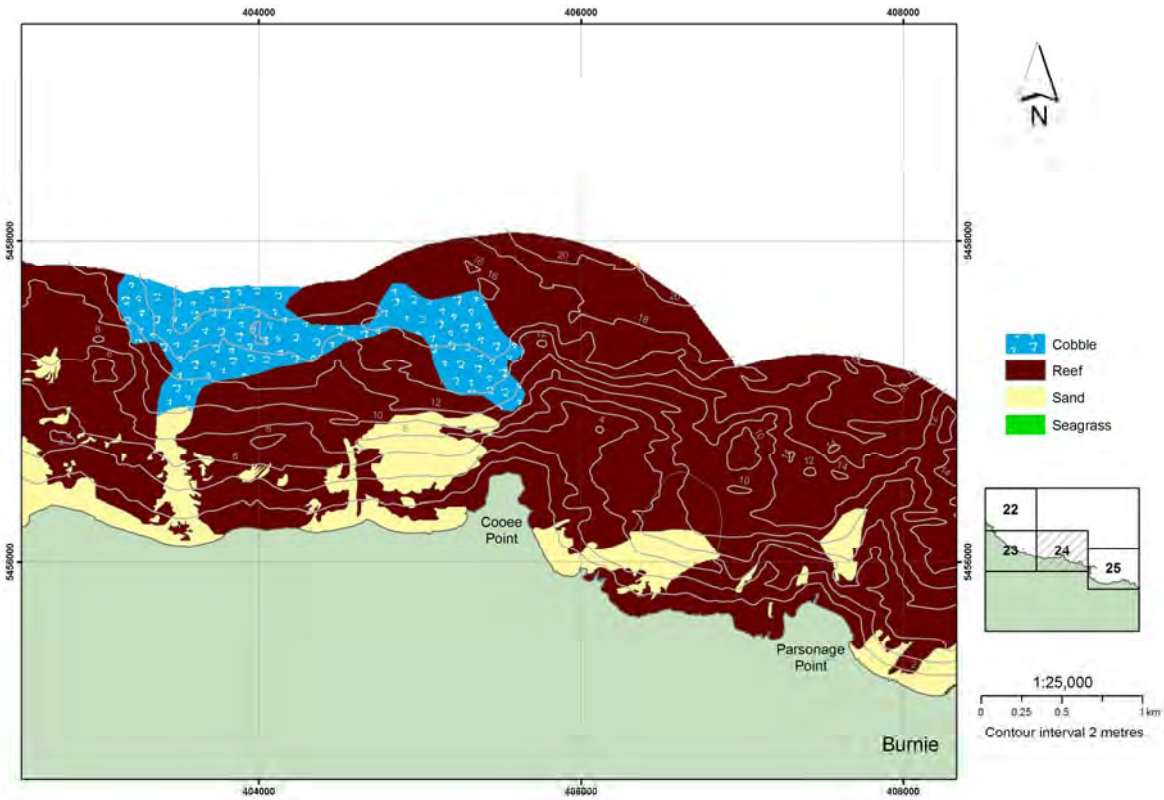

N
Cobble
Reef
Sand
Seagrass
19
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

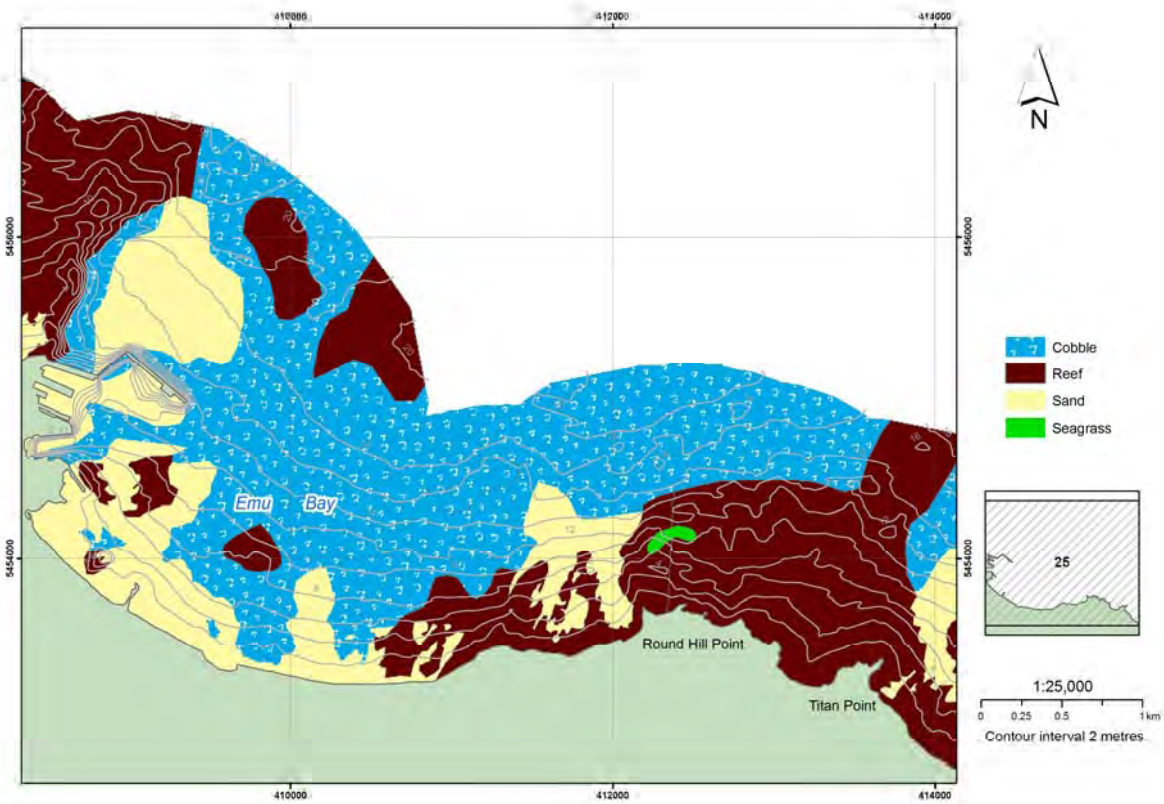

N
Cobble
Reef
Sand
Seagrass
Chambers Bay
Table Cape
19
20
21
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

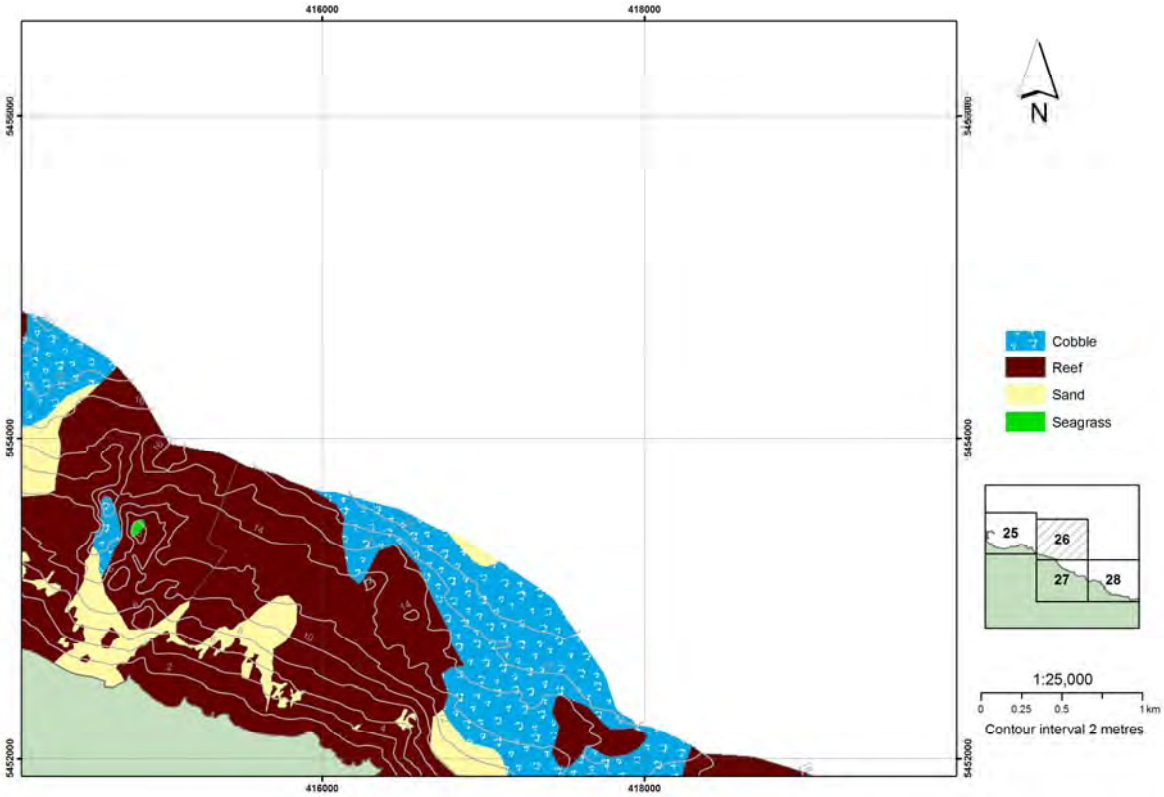

392000
394000
396000
5464000
5462000
5460000
N
Inglis River
Wynyard
Cobble
Reef
Sand
Seagrass
20
21
22
23
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

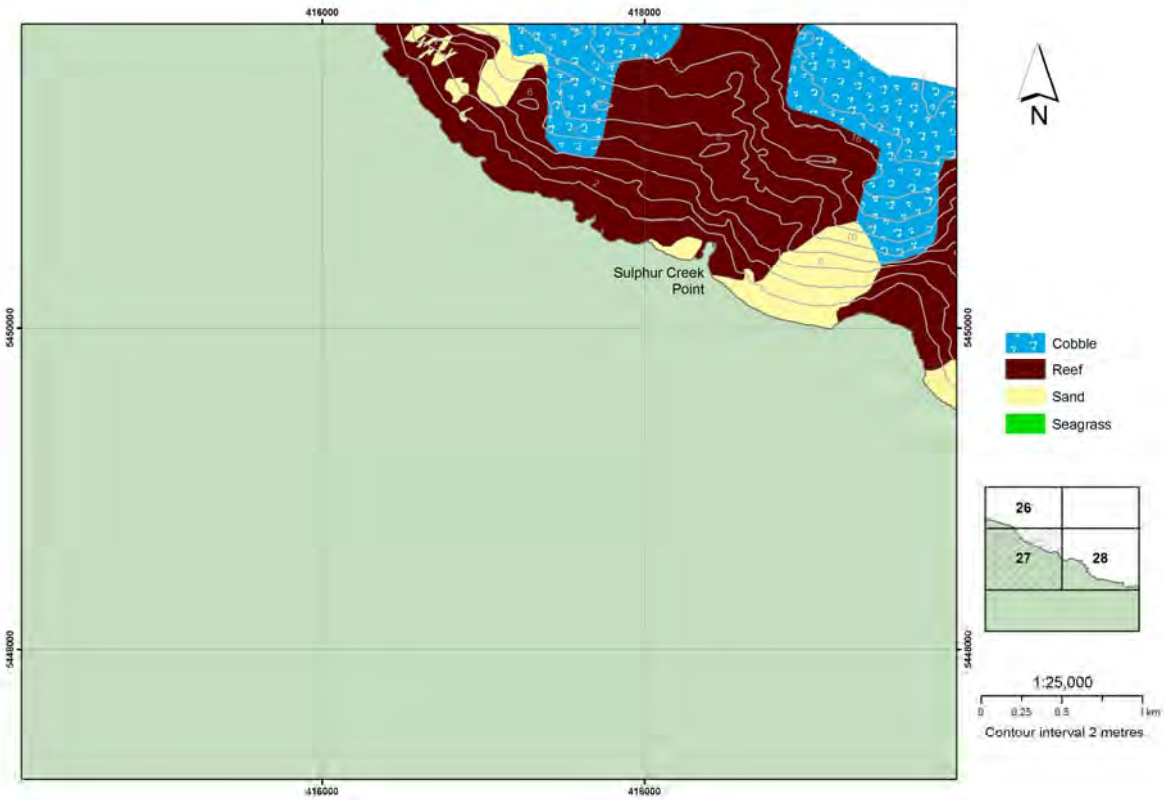

398000
400000
402000
5464000
5462000
5460000
N
Doctors Rocks
Cobble
Reef
Sand
Seagrass
21
22
23
24
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

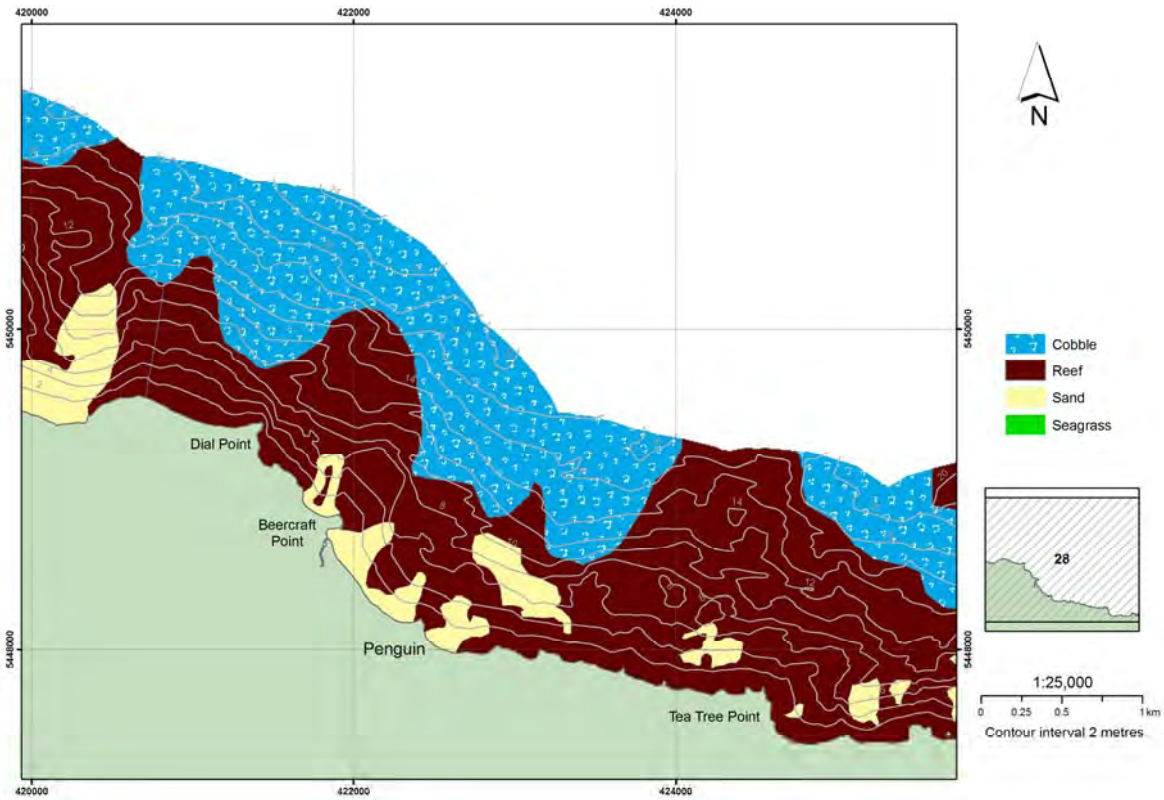

398000
400000
402000
5458000
5456000
Woody Hill Point
Somerset
N
Cobble
Reef
Sand
Seagrass
22
23
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

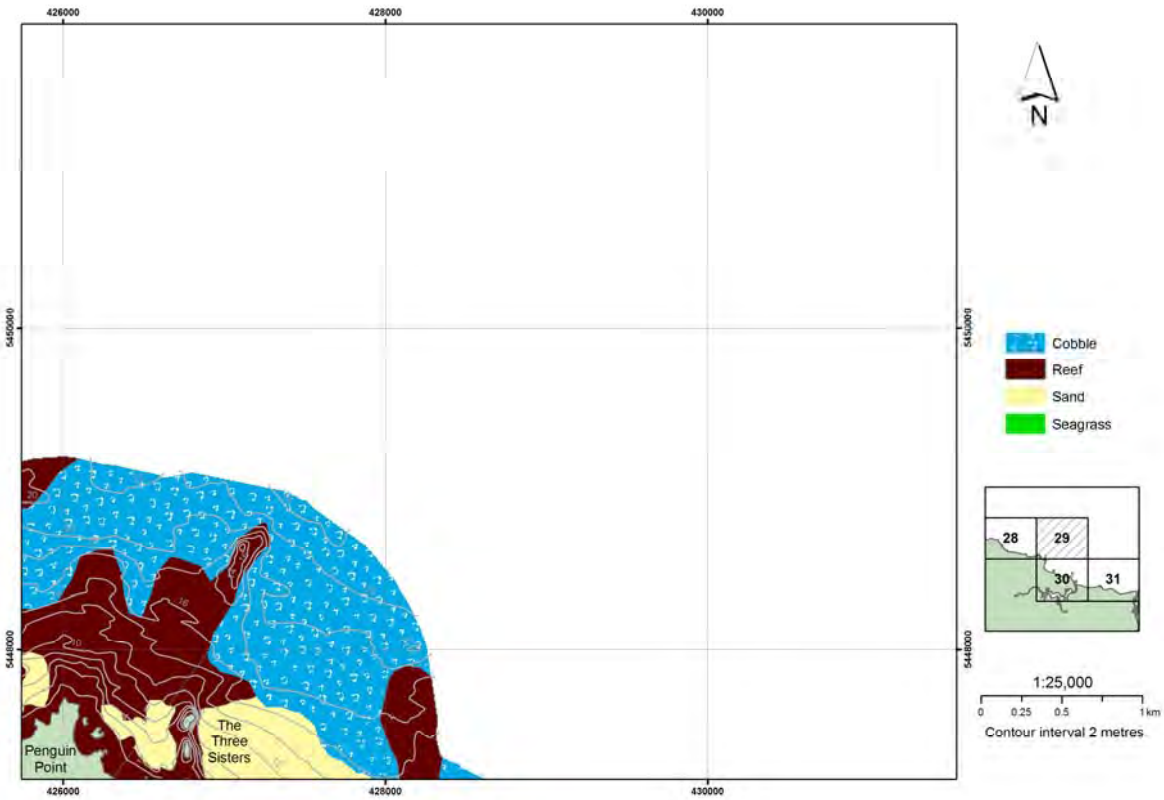

404000
406000
408000
5458000
5456000
Cooee Point
Parsonage Point
Burnie
N
Cobble
Reef
Sand
Seagrass
22
23
24
25
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

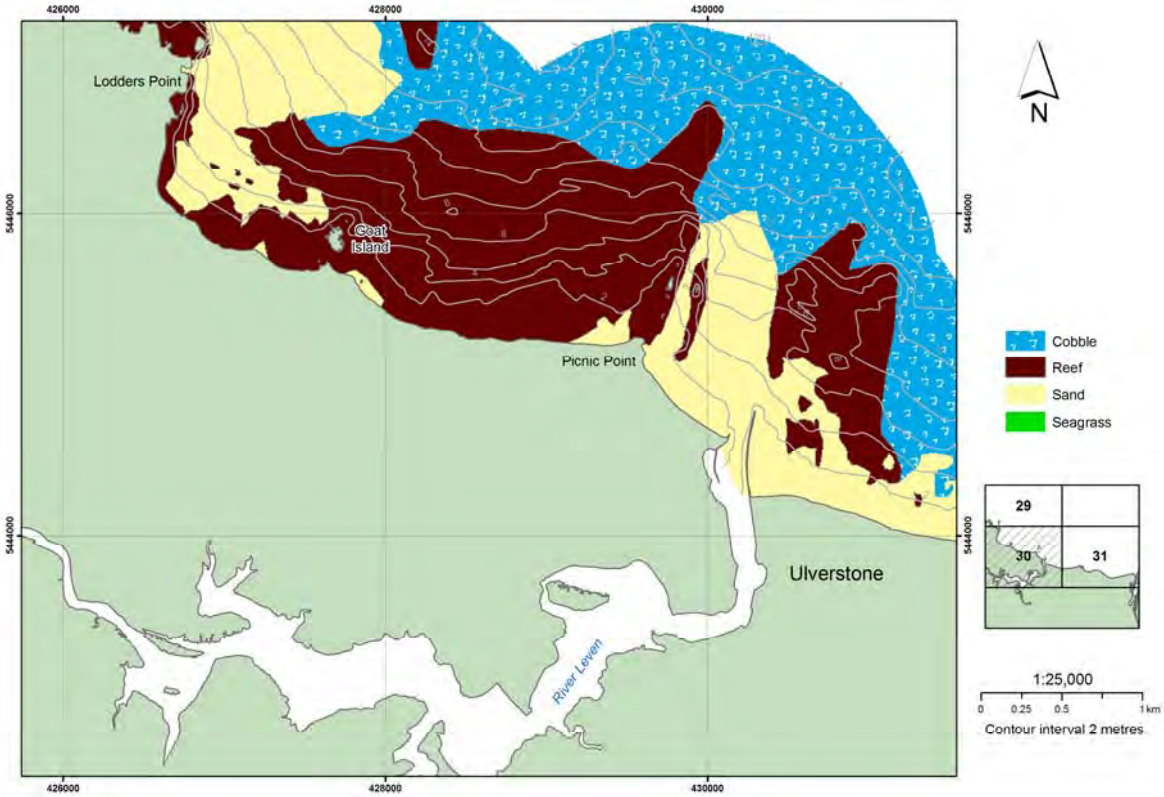

410000
412000
414000
5456000
5454000
N
Cobble
Reef
Sand
Seagrass
Emu Bay
Round Hill Point
Titan Point
25
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

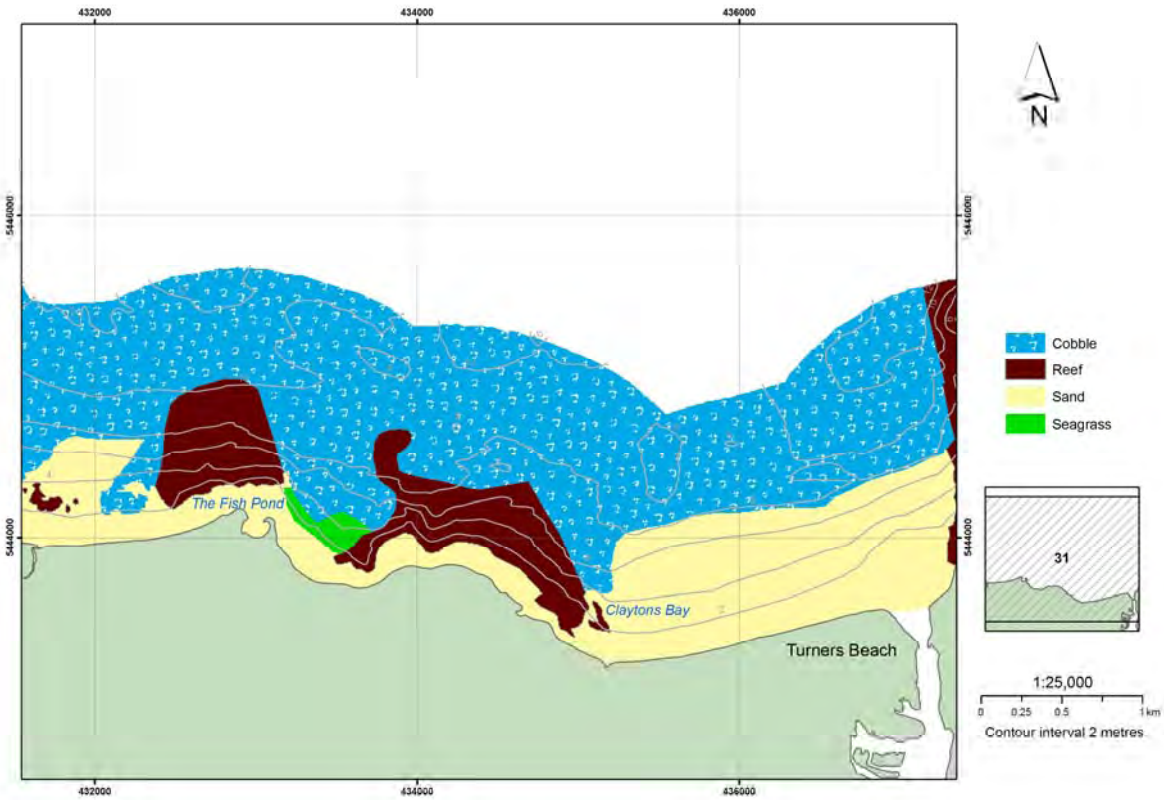

416000
418000
5456000
5454000
5452000
N
Cobble
Reef
Sand
Seagrass
25
26
27
28
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

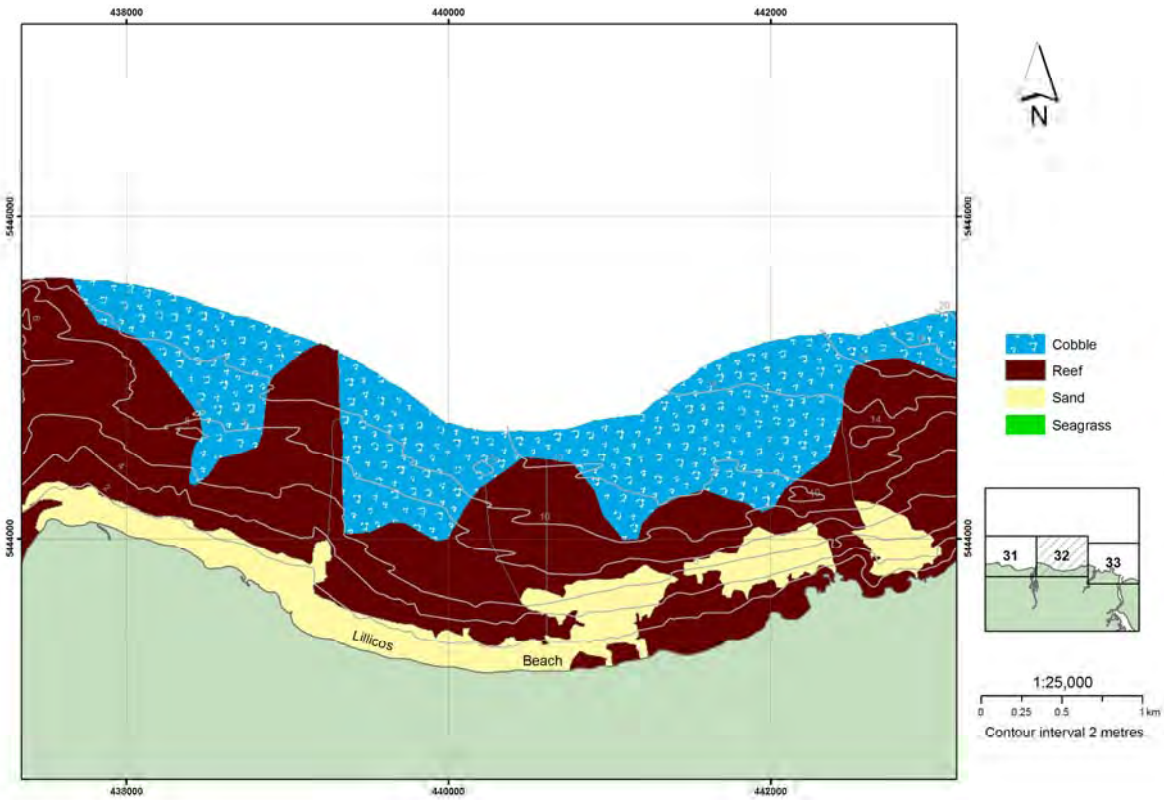

416000
418000
5450000
5448000
Sulphur Creek Point
N
Cobble
Reef
Sand
Seagrass
26
27
28
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

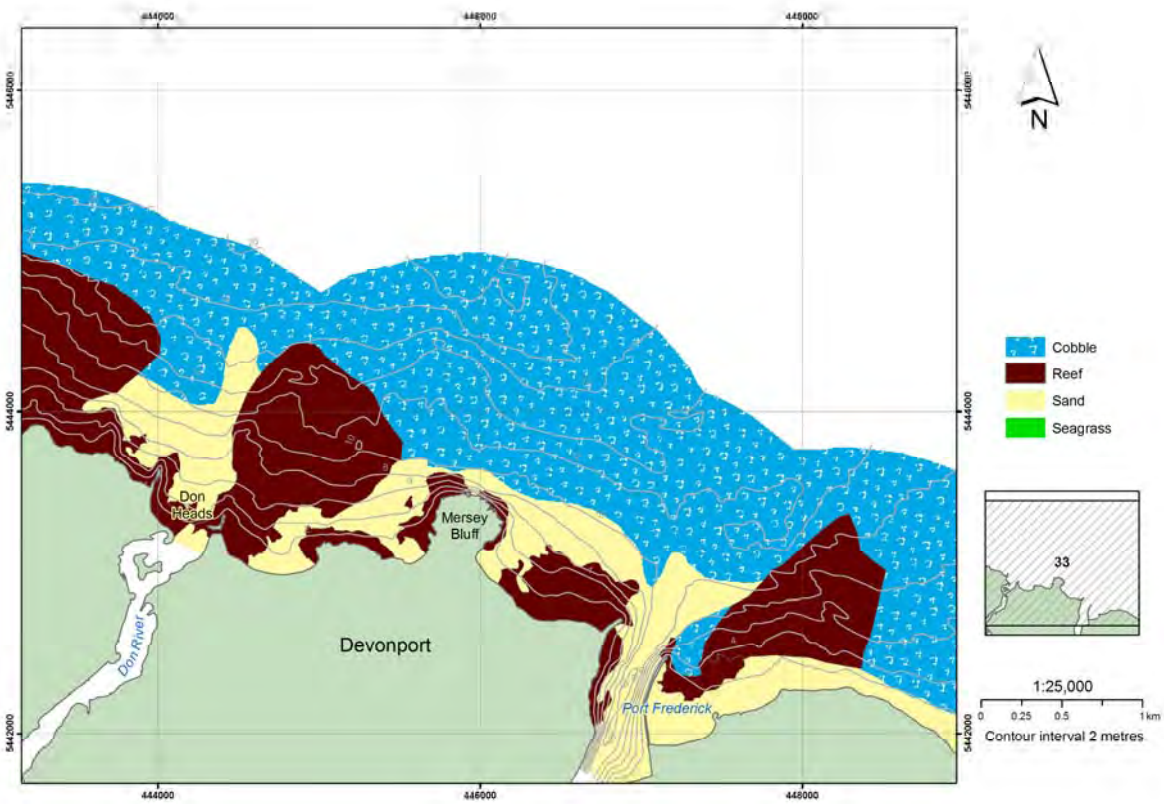

420000
422000
424000
5450000
5448000
Dial Point
Beercraft Point
Penguin
Tea Tree Point
N
Cobble
Reef
Sand
Seagrass
28
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

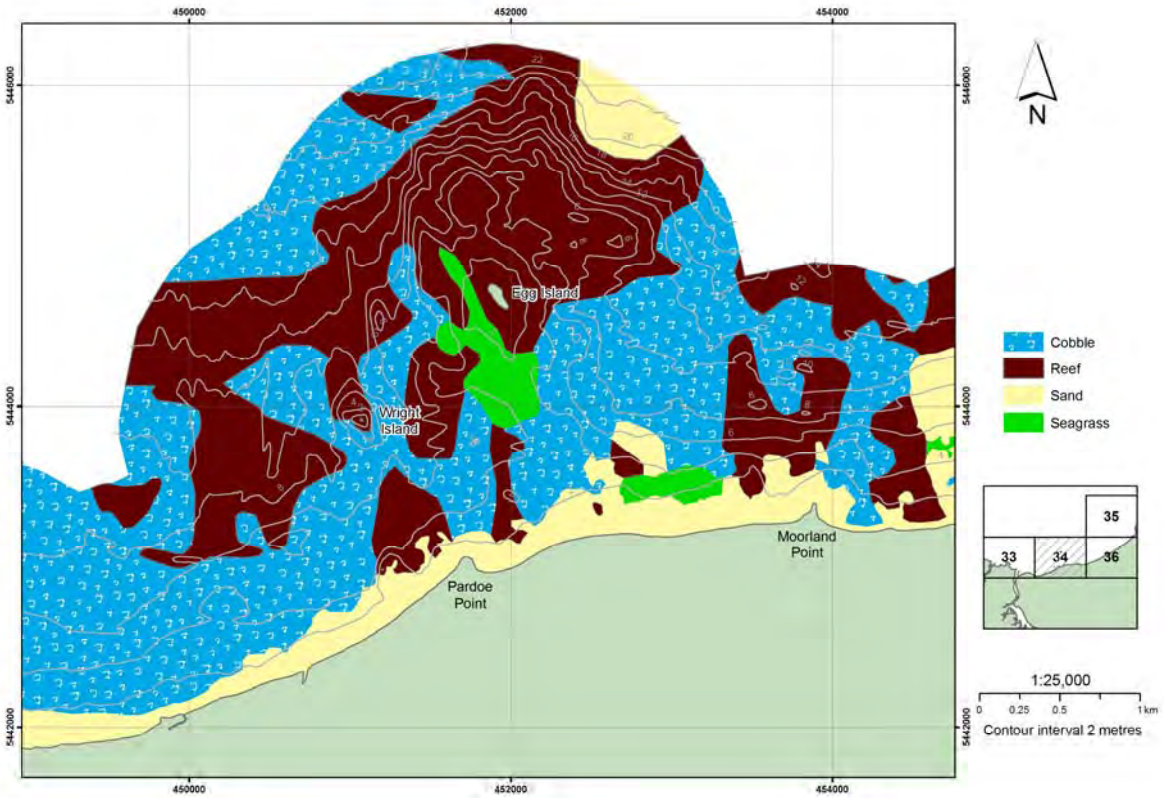

426000
428000
430000
5450000
5448000
N
Cobble
Reef
Sand
Seagrass
28
29
30
31
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres
The Three Sisters
Penguin Point

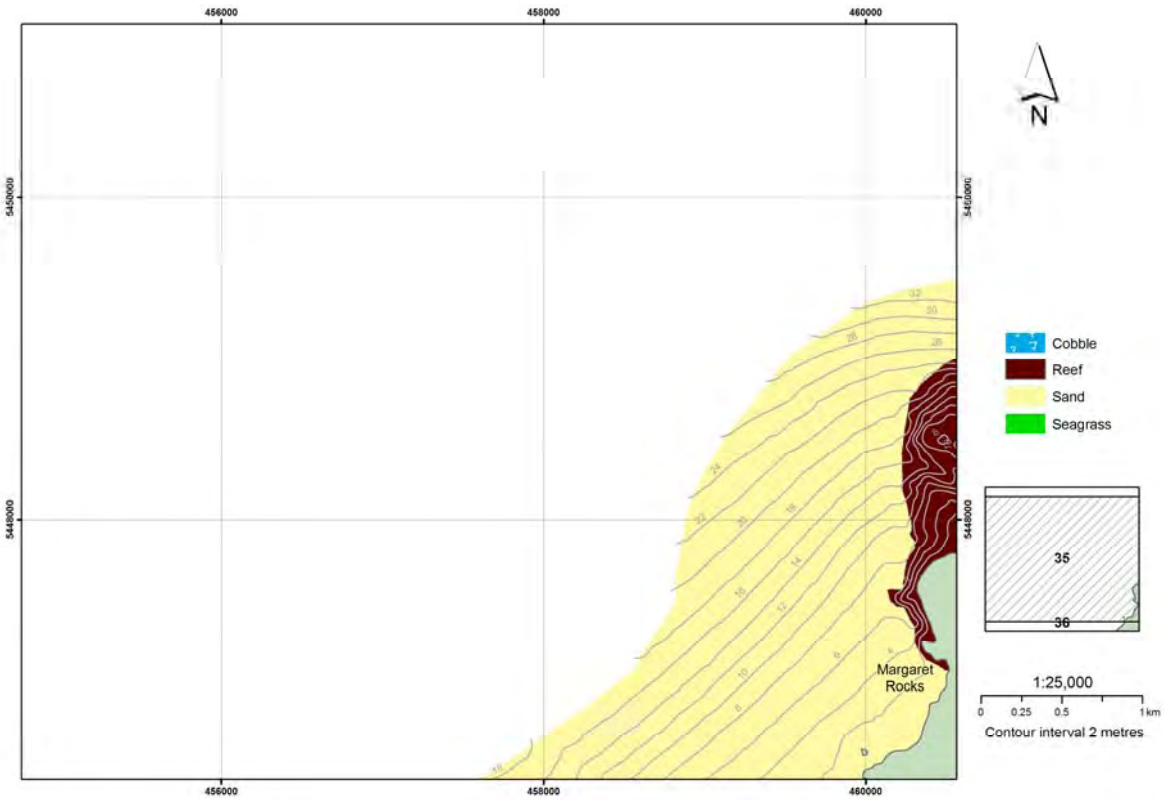

426000
428000
430000
5446000
5444000
N
Lodders Point
Goat Island
Picnic Point
Ulverstone
River Leven
Cobble
Reef
Sand
Seagrass
29
30
31
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

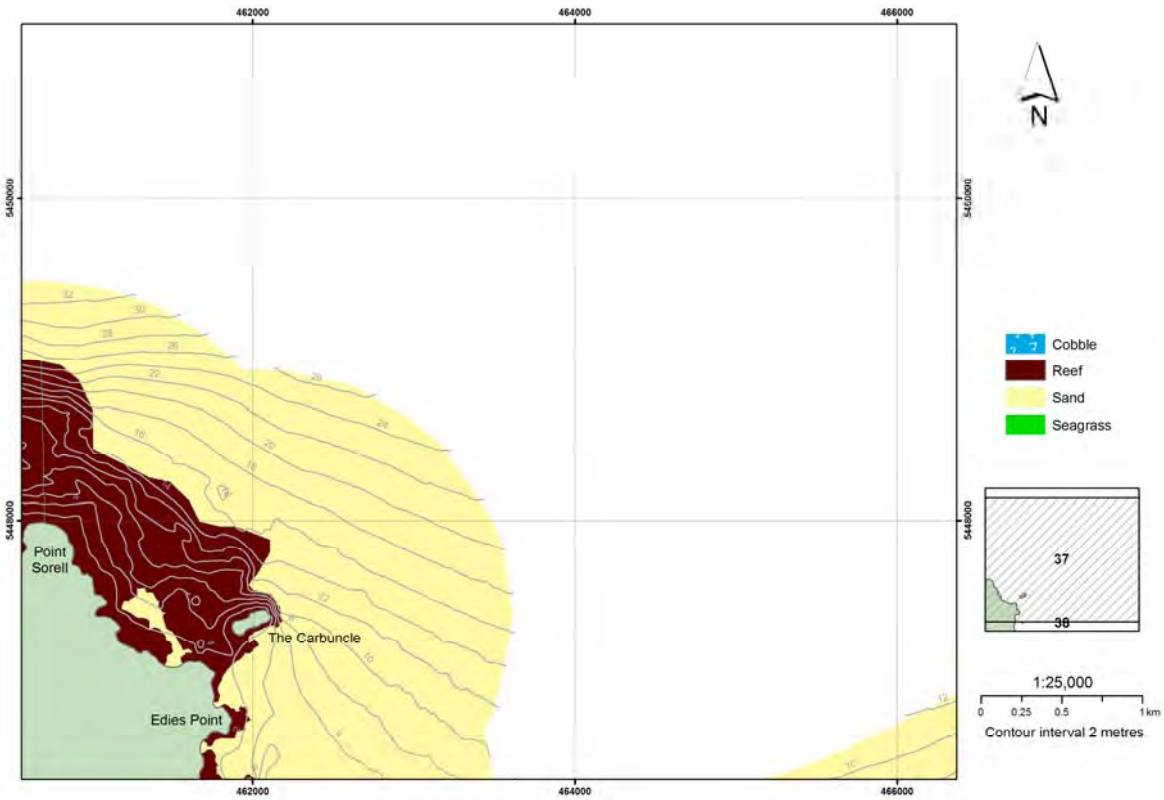

432000
434000
436000
5446000
5444000
N
Cobble
Reef
Sand
Seagrass
The Fish Pond
Claytons Bay
Turners Beach
31
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

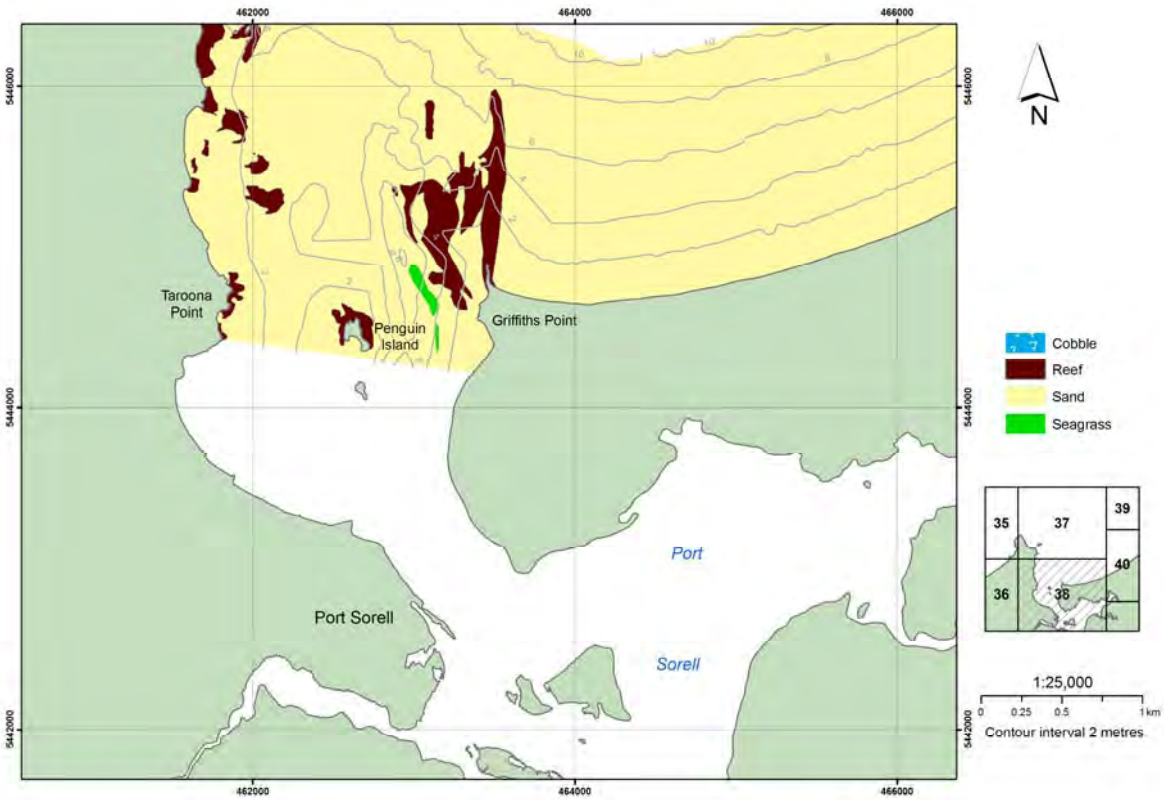

438000
440000
442000
5446000
5444000
N
Cobble
Reef
Sand
Seagrass
Lillicos
Beach
31
32
33
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

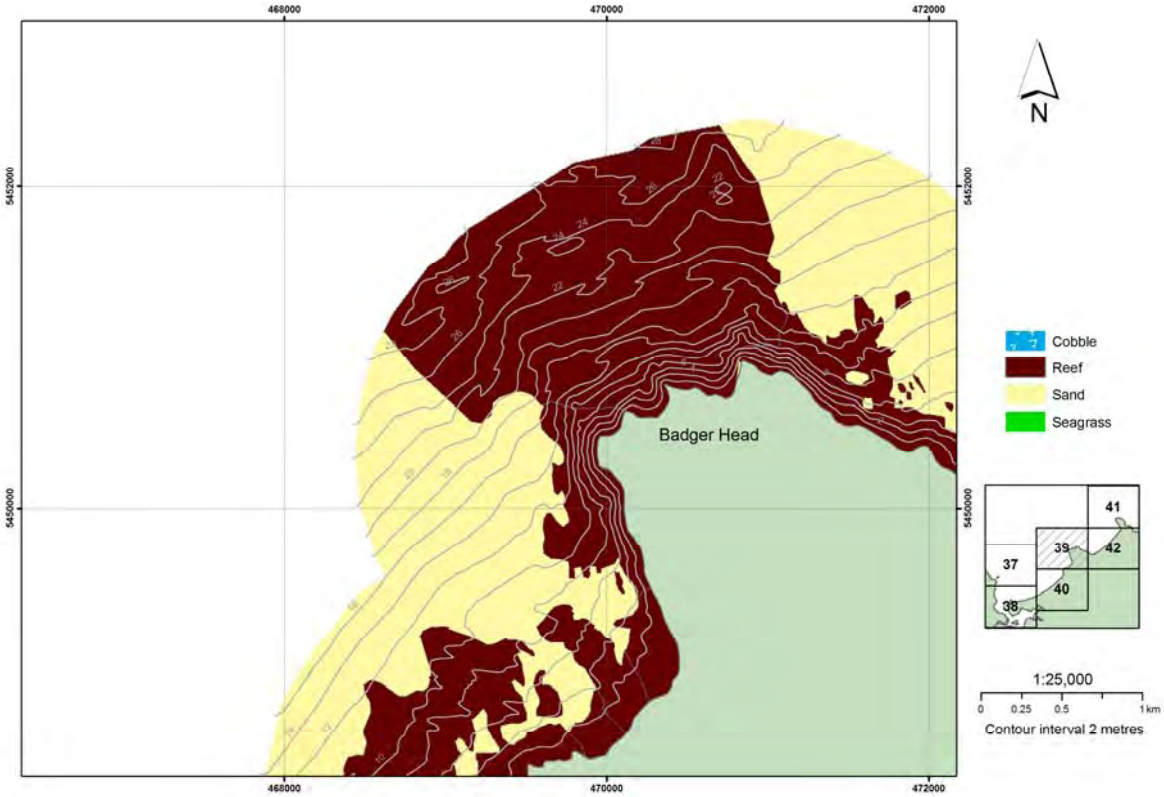

N
Cobble
Reef
Sand
Seagrass
Don Heads
Mersey Bluff
Don River
Devonport
Port Frederick
33
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

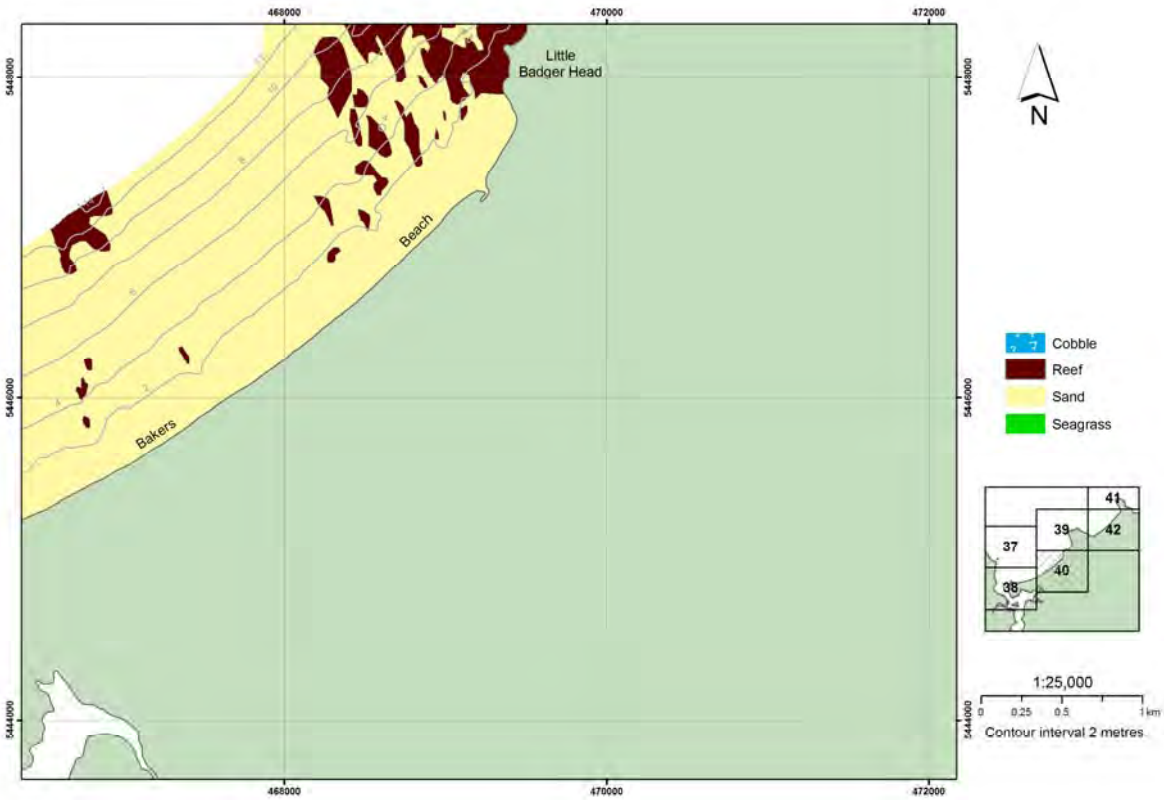

N
Cobble
Reef
Sand
Seagrass
Egg Island
Wright Island
Pardoe Point
Moorland Point
35
33
34
36
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

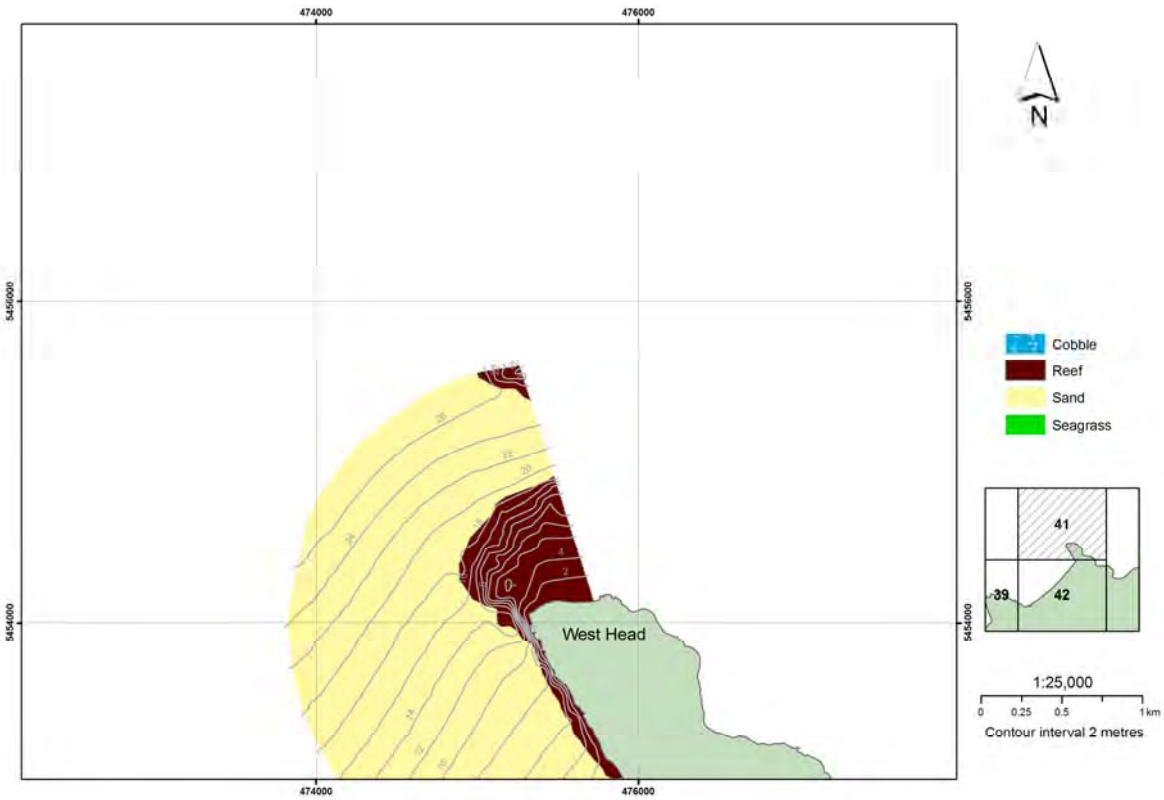

456000
458000
460000
5450000
5448000
N
Cobble
Reef
Sand
Seagrass
35
36
Margaret Rocks
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres

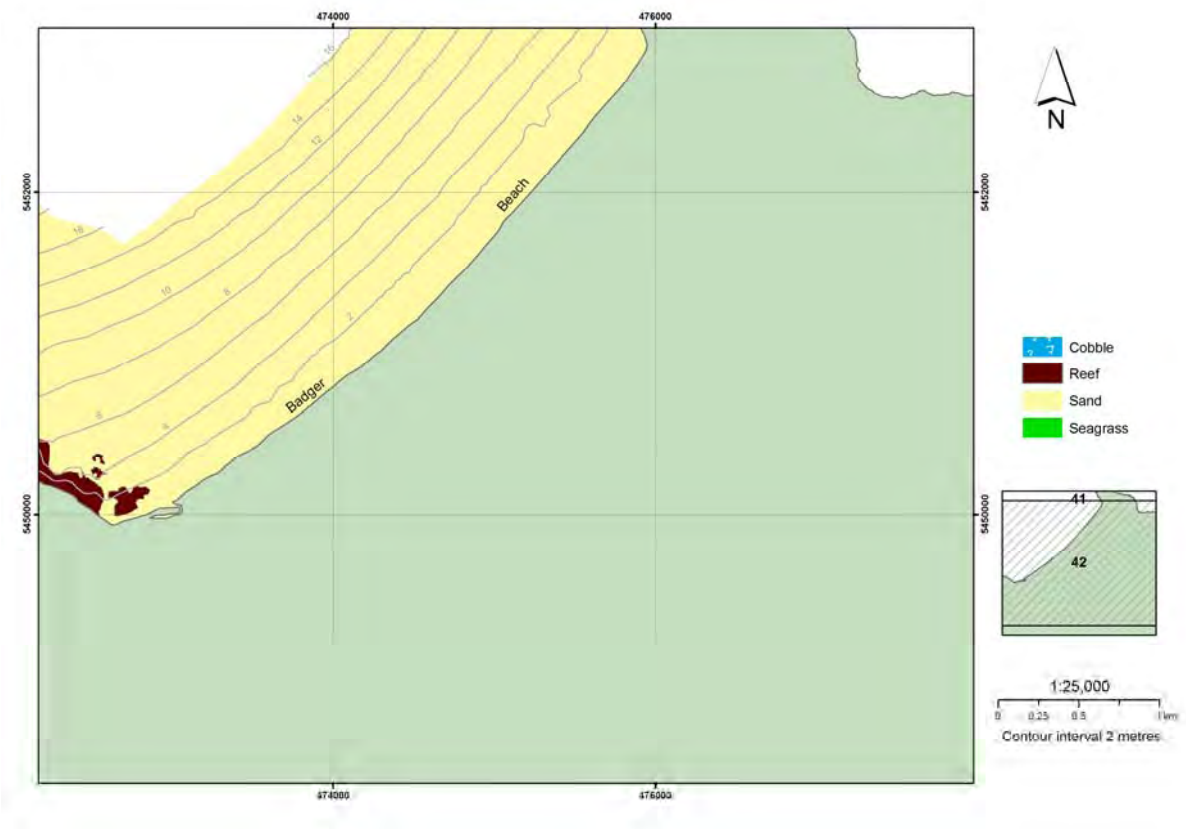

462000
464000
466000
5450000
5448000
N
Cobble
Reef
Sand
Seagrass
37
38
Point Sorell
The Carbuncle
Edies Point
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres


462000
464000
466000
5446000
5444000
5442000
N
Taroona Point
Penguin Island
Griffiths Point
Port Sorell
Port
Sorell
Cobble
Reef
Sand
Seagrass
35
37
39
40
36
38
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres


468000
470000
472000
5452000
5450000
N
Badger Head
Cobble
Reef
Sand
Seagrass
41
39
42
37
40
38
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres


468000
470000
472000
5448000
5446000
5444000
Little
Badger Head
Beach
Bakers
N
Cobble
Reef
Sand
Seagrass
41
39
42
37
40
38
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres


474000
476000
5456000
5454000
West Head
N
Cobble
Reef
Sand
Seagrass
41
39
42
1:25,000
0 0.25 0.5 1 km
Contour interval 2 metres



3.13 Selected estuaries on the North West Coast

The habitat distribution and area calculation for the selected estuaries, the Montagu, Duck Bay, Black River and the Detention River, are shown in Figure 32 and the results in Table 12. These habitats are not analysed by depth as some of these estuaries are very shallow (< 2m) and it was not possible to determine the bathymetry with acoustic methods.

The largest of these mapped estuaries was Duck Bay at 2385.4 ha. The Duck and the Montagu were the only estuaries of these four where seagrass was present. Low profile reef (< 2 m in vertical profile) was found in all four estuaries with the Duck having the only Medium profile reef (> 2 m in vertical profile). The majority of the unconsolidated sediment in all four estuaries was classified as sand with silty sand being present in but not dominant.

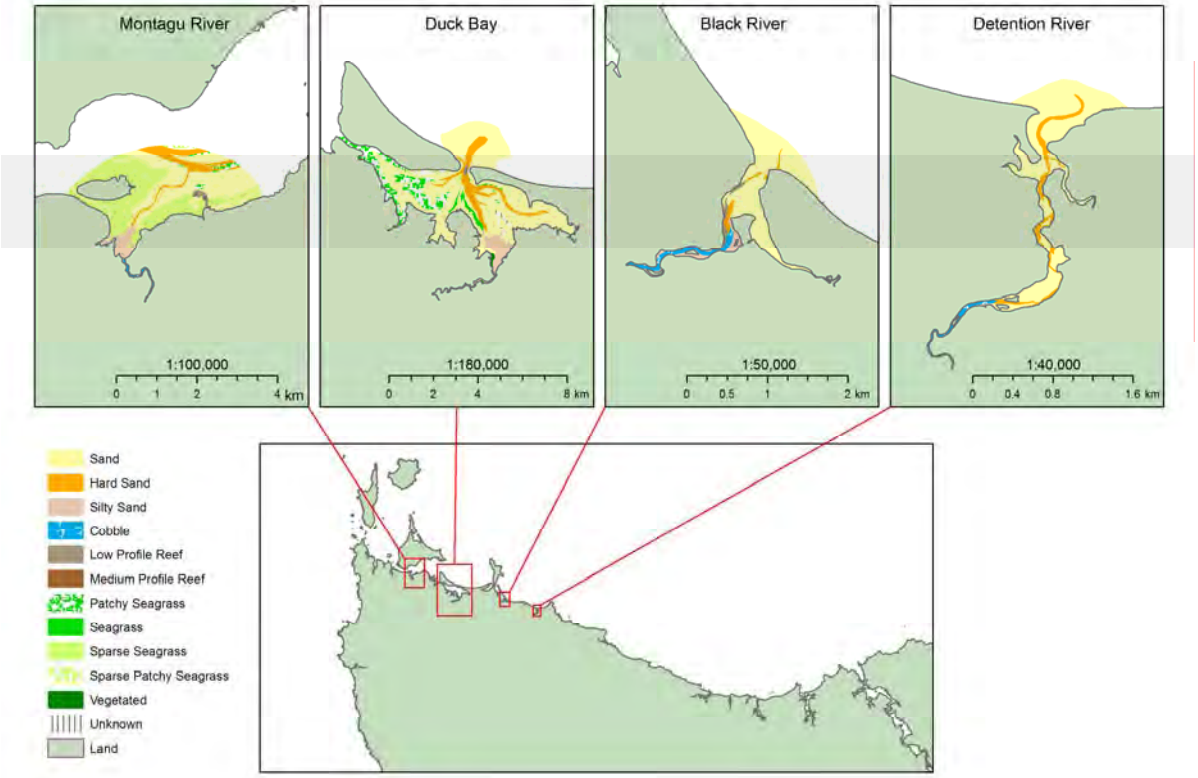


Figure 32. Selected estuaries within the Cradle Coast region, which form part of the SeaMap Tasmania series for the NW Coast, include the Montagu River, Duck Bay, Black River and the Detention River.

Habitat (Ha)	Montagu	Duck	Blac	Detentio
Sand	264.2	1598.4	72.2	61.8
Silty Sand	31.9	129.3	6.8	0.4
Hard Sand	65.6	220.5	4.0	10.6
Cobble	7.5	0.0	8.0	3.4
Low Profile Reef	6.8	6.3	3.2	1.0
Med Profile Reef	0.0	1.2	0.0	0.0
Seagrass	0.0	33.9	0.0	0.0
Patchy Seagrass	12.7	356.2	0.0	0.0
Sparse Seagrass	270.3	4.1	0.0	0.0
Sparse Patchy	6.6	35.4	0.0	0.0
Total	**665.6**	**2385.3**	**94.2**	**77.2**

Table12. Distribution of habitat types in the Montagu, Duck, Black and Detention estuaries on the NW coast.

3.14 Sediment particle size sampling.

Sixteen sediment core samples were taken and analysed between Badger Head and Robbins Passage (Figure 33). These samples were taken in a range of depths across the study area. Twelve of these samples were classified as fine sands, with a further

three classified as very fine sands according to the Wentworth scale (Figures 34a-l and 34n-p). Only one sample, sample 13 (Figure 34m), was classified as coarse sand. This sample was collected from amongst cobble habitat at 32 m depth in Emu Bay, and consisted of predominantly fine shell grit.

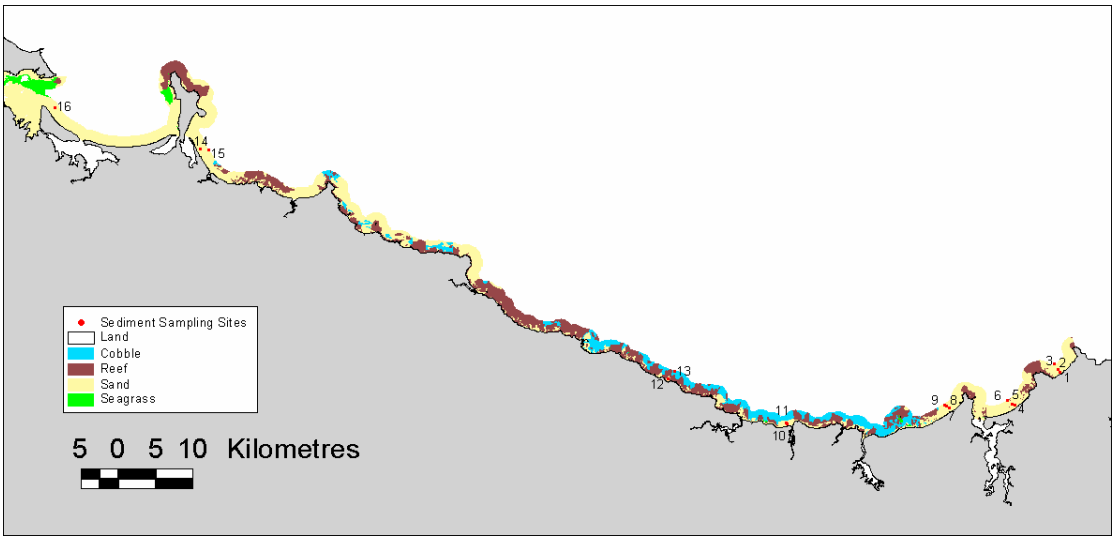
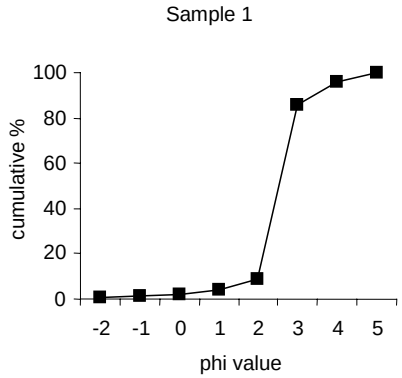
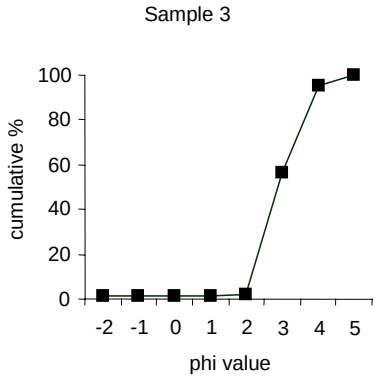


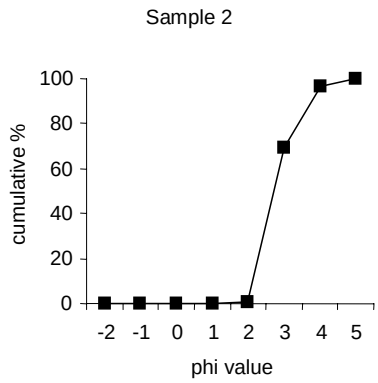
Figure 33. Location of Sediment sampling stations overlayed on habitats between West Head and Robbins Passage



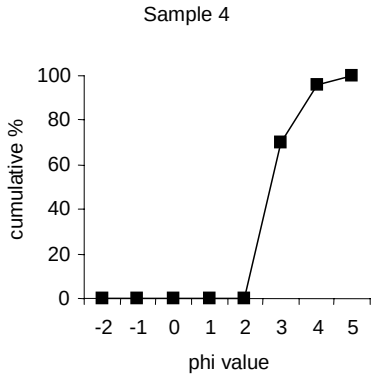
Sediment Sample 34a. Phi 50% = 2.4; Wentworth classification = fine sand



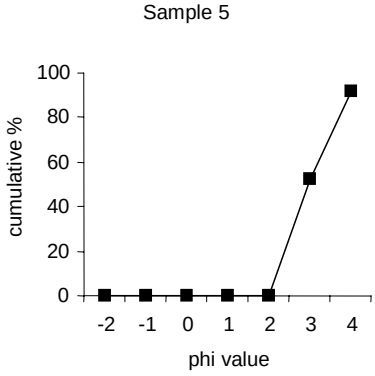
Sediment Sample 34c. Phi 50% = 2.8; Wentworth classification = fine sand



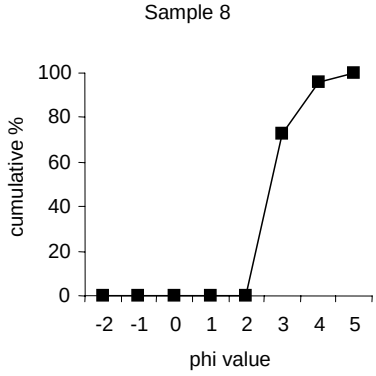
Sediment Sample 34b. Phi 50% = 2.6; Wentworth classification = fine sand



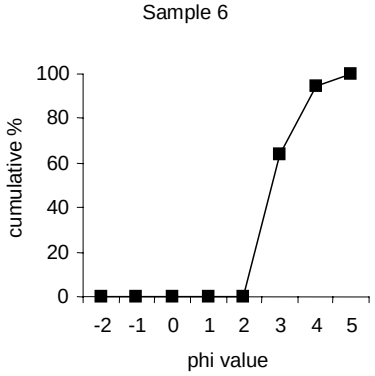
Sediment Sample 34d. Phi 50% = 2.8; Wentworth classification = fine sand



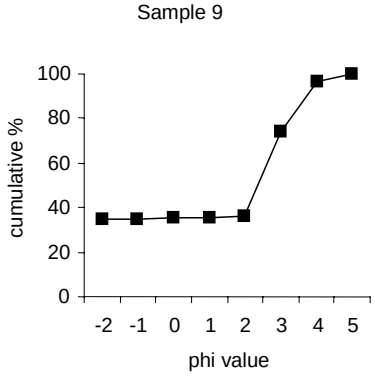
Sediment Sample 34e. Phi 50% = 3.0; Wentworth classification = very fine sand



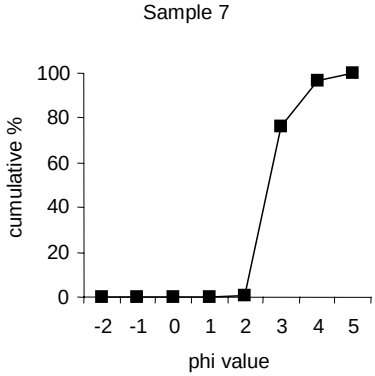
Sediment Sample 34h. Phi 50% = 2.6; Wentworth classification = fine sand



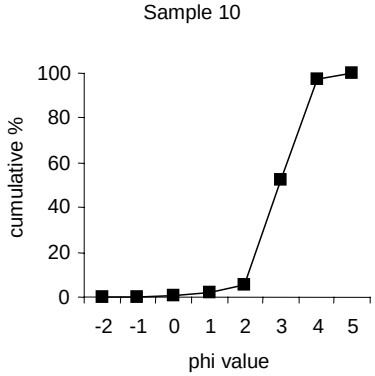
Sediment Sample 34f. Phi 50% = 2.8; Wentworth classification = fine sand



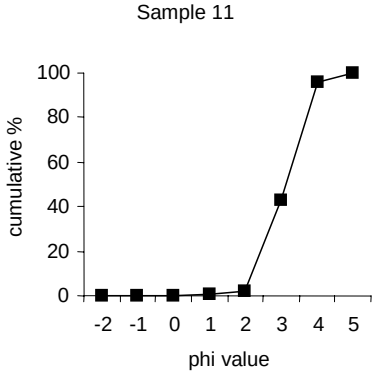
Sediment Sample 34i. Phi 50% = 2.4; Wentworth classification = fine sand



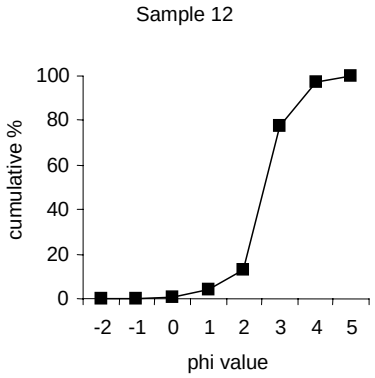
Sediment Sample 34g. Phi 50% = 2.6; Wentworth classification = fine sand



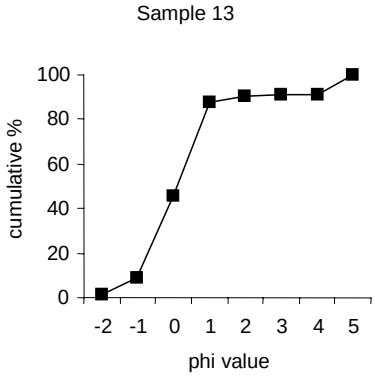
Sediment Sample 34j. Phi 50% = 3.0; Wentworth classification = very fine sand



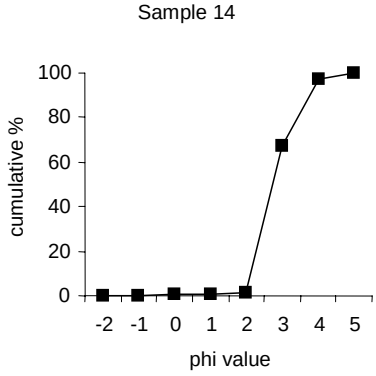
Sediment Sample 34k. Phi 50% = 3.0; Wentworth classification = very fine sand



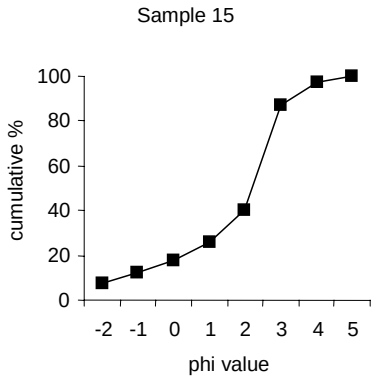
Sediment Sample 34l. Phi 50% = 2.5; Wentworth classification = fine sand



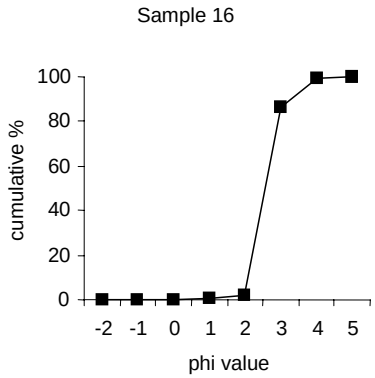
Sediment Sample 34m. Phi 50% = 0.1; Wentworth classification = coarse sand



Sediment Sample 34n. Phi 50% = 2.6; Wentworth classification = fine sand



Sediment Sample 34o. Phi 50% = 2.2; Wentworth classification = fine sand



Sediment Sample 34p. Phi 50% = 2.6; Wentworth classification = fine sand

4. Discussion

The structure of algae communities along the north coast of Tasmania showed differences between reef and cobble habitat, and also between areas of different exposure. Reef habitat was found to have consistently higher algal cover than cobble habitat for all sections of coast. The algal structure was also shown to differ between the gently sloping shallow areas, which dominated much of this coastline, and the more steeply sloping exposed headlands, such as West Head, Rocky Cape and North Point. The algal structure was similar to that identified by previous studies, with a mix of *Acrocarpia paniculata* and *Cystophora* spp. and numerous other fucoid algae in shallow water gradually being replaced by turfing red and brown algae below 10 m depth (Barrett, 2001). This type of algal structure is typical of that found in low to moderately exposed coastal waters. The exposed headlands had a greater proportion of *Phyllospora comosa* and *Ecklonia radiata*, especially around Badger Head, Rocky Cape and North Point.

A definite trend was noted in the distribution of algal species, from the video analysis, in an East – West direction. Independent of habitat substratum the algal distribution was most notably dominated by Thallus brown species in all sections surveyed in the Cradle Coast NW region. In sections A-F this was most closely followed by red algal species except in section H where *Caulerpa* was the next most dominant reef algal species. *Ecklonia* was noted from the video analysis to maintain a constant distribution between 8 and 15 % percentage cover except in sections D and H. In section D sponge was not noted in the video record on reef habitat, but this may have been a function of the distribution of video transects within this section.

The east to west trends in algal distribution were driven by differences in the exposure and light availability along the coastline. The central part of this coast, between Devonport and Wynyard is affected by lower water clarity, which resulted in the absence or reduced depth distribution of many of the large brown canopy forming algal species. On the prominent headlands, including West Head, Badger Head, Rocky Cape and North Point, where exposure and water clarity increased, these large brown canopy forming species had increased depth distributions, and in several locations the algae *Phyllospora comosa* was observed, which is indicative of increased wave exposure. Several of these headlands also supported extensive sponge communities, especially around Rocky cape, where the clear water and strong current flow provided an ideal environment for sponges in the deeper water.

String kelp, *Macrocystis angustifolia*, occurs along much of this coastline. Generally this species occurs to 3 m depth, but in more open exposed sites can occur down to 10 m depth (Barrett, 2001; Edgar, 1997). Vessel based video surveys were unable to consistently sample this species due to the risk of hitting submerged rocks in the shallow water. The distribution of this species constructed from a mix of vessel log observations and video observations showed it to have a patchy distribution between North Point and Horseshoe Reef, often forming narrow fringing beds around islands and along small sections of rocky coastline.

The Cradle Coast NRM region contained significant amounts of both reef and cobble habitat. The cobble habitat had low structural complexity with greater than 99.5 % classified as low profile. The reef also had a high proportion of low profile, with greater than 92 % of all reef being classified as low profile. Previous mapping of small sections of this coastline also identified the dominance of low profile cobble and reef off Lillico Beach and to a lesser extent off Goat Island (Barrett and Wilcox, 2001). Similar areas dominated by low profile reef have also been identified in some sheltered sections of the Bruny Bioregion (Frederick Henry Bay, Norfolk Bay and the D'Entrecasteaux Channel) (Barrett et al, 2001) and abalone reporting block 31B in the northeast of the state (Jordan et al, 2005). The low flat nature of cobble and reef in most of this region restricts the availability of shelter and refuges available to support sizeable populations of many species of invertebrates and fishes (Barrett and Wilcox, 2001). Several areas exhibited greater structural complexity, including Rocky Cape, Sisters Island and West Head. Rocky Cape has previously been identified as an area of high species richness along this coastline (Barrett and Wilcox, 2001; Barrett and Edgar, 1981; Edgar, 1984), which was attributed to the increased structural complexity in this area. The proportion of more complex reef (medium and high profile) in these areas was low compared to areas of the south and east coasts previously mapped (Jordan et al, 2005; Barrett et al, 2001). The reefs within this region are generally shallow when compared with the other bioregions, with very few locations where they extend to some depth. In section E Round Hill to Table Cape, sponge habitat was dominant on the deeper outer regions of the reef edges mapped (in the 15-20 m depth strata).

Three seagrass species were recorded within this study area. Primarily the seagrass beds occurred west of Rocky Cape, where there was extensive sheltered sand less than 15 m deep. The seagrass species *Heterozostera tasmanica* and *Posidonia australis* formed large single species and mixed beds between the intertidal zone and 15 m depth. *Amphibolis antarctica* formed less extensive beds, and was often associated with reef habitat, especially Black Reef at the eastern entrance to Robbins Passage. This species was also found associated with shallow reef along much of the survey area, especially around Sisters Beach and east of Ulverstone. It has previously been documented that *Amphibolis Antarctica* forms a minor component of reef biota in this region (Barrett, 2001). Sparse *Heterozostera tasmanica* was also identified on the video transects on sand between 5 and 20 m depth east of Port Sorell and in the vicinity of Sisters Beach (Barrett, 2001).

The composition of soft sediments within the region shows that most of the samples were fine sand or very fine sand. Fifteen of the sixteen sediment samples show that the unconsolidated habitats consisted of a fine or very fine sand, with only one sample of course sand at 32 m from Emu Bay, which was from a sand patch associated with cobble habitat and contained a large proportion of shell grit. This is unlike other more sheltered, shallow regions such as the D'Entrecasteaux Channel or Duck Bay where the sediments tend towards silts.

This study provides the necessary information required by planning agencies involved in the management of the marine environment in the Cradle Coast region. The results of this study contribute to the understanding of the distribution of marine habitats in Tasmanian state waters and greatly improve databases such as SeaMap Tasmania. This information will assist the Tasmanian community to better manage its marine resources.

5. Acknowledgements

The authors gratefully acknowledge the assistance of Dr Neville Barrett for his efforts in reviewing this report and Professor Colin Buxton for his continued support of the SeaMap Tasmania project.

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Appendix 1. Image Mapper (on DVD)

The habitat maps with linked video, images and statistical results of the individual reporting sections can be viewed on the attached DVD.

Appendix 2. Algal photos (on DVD)

ID photos of algae identified in this region can be viewed in the PDF on the attached DVD.

Appendix 3. Aerial Photograph Record.

Aerial photographs sourced for digitisation in this research.

PHOTO_ID	SCALE	FLY_DATE
1393-10	1:42000	2/03/2005
1393-8	1:42000	2/03/2005
1393-29	1:42000	2/03/2005
1393-30	1:42000	2/03/2005
1393-32	1:42000	2/03/2005
1393-34	1:42000	2/03/2005
1393-36	1:42000	2/03/2005
1393-38	1:42000	2/03/2005
1393-39	1:42000	2/03/2005
1393-41	1:42000	2/03/2005
1393-43	1:42000	2/03/2005
1382-2	1:24000	12/03/2004
1382-8	1:24000	12/03/2004
1382-9	1:24000	12/03/2004
1382-23	1:24000	12/03/2004
1382-27	1:24000	12/03/2004
1382-26	1:24000	12/03/2004
1382-37	1:24000	12/03/2004
1382-39	1:24000	12/03/2004
1335-99	1:24000	16/12/2000
1335-86	1:24000	16/12/2000
1335-85	1:24000	16/12/2000
1335-66	1:24000	16/12/2000
1335-70	1:24000	16/12/2000
1335-68	1:24000	16/12/2000
1335-55	1:24000	16/12/2000
1335-51	1:24000	16/12/2000
1335-59	1:24000	16/12/2000
1334-80	1:42000	29/11/2000
1335-44	1:24000	16/12/2000
1335-37	1:24000	16/12/2000
1335-36	1:24000	16/12/2000
1366-247	1:45000	7/01/2003
1340-261	1:42000	1/01/2001
1340-260	1:42000	1/01/2001
1340-258	1:42000	1/01/2001
1340-264	1:42000	1/01/2001
1340-263	1:42000	1/01/2001
1340-262	1:42000	1/01/2001
1340-252	1:42000	1/01/2001
1340-251	1:42000	1/01/2001
1340-250	1:42000	1/01/2001
1340-249	1:42000	1/01/2001
1340-245	1:42000	1/01/2001
1340-246	1:42000	1/01/2001
1340-248	1:42000	1/01/2001
1340-247	1:42000	1/01/2001