The *Bungala 2000* Project

Marine Component

Report prepared for the
Inman Valley and Torrens Vale Landcare Group
by James Brook

The Bungala 2000 Project. Marine Component

Prepared January 2007

Cover illustrations

Mouth of the Bungala River at Normanville Beach: Alistair Christie.

Underwater photos: Alison Eaton

(Seagrass *Amphibolis* sp. and brown algae S*caberia agardhii* and *Caulocystis cephalornithos*; green lobed algae *Dictyosphaeria sericea,* brown lobed algae *Lobophora variegata* and the red ascidian *Herdmania momus*)

1. Introduction

Bungala 2000 was a community project supported with Government funding, which commenced in 1997. It aimed to establish baseline data on the physical, economic, chemical and biological condition of the Bungala River, its catchments and immediate marine environment (see cover illustration and Figure 1). This data would be used to produce a long term plan which presented options for better total catchment management. The project would inform the land owners and the broader community of catchment management issues, and provide encouragement and support to those who wished to improve existing management practices.

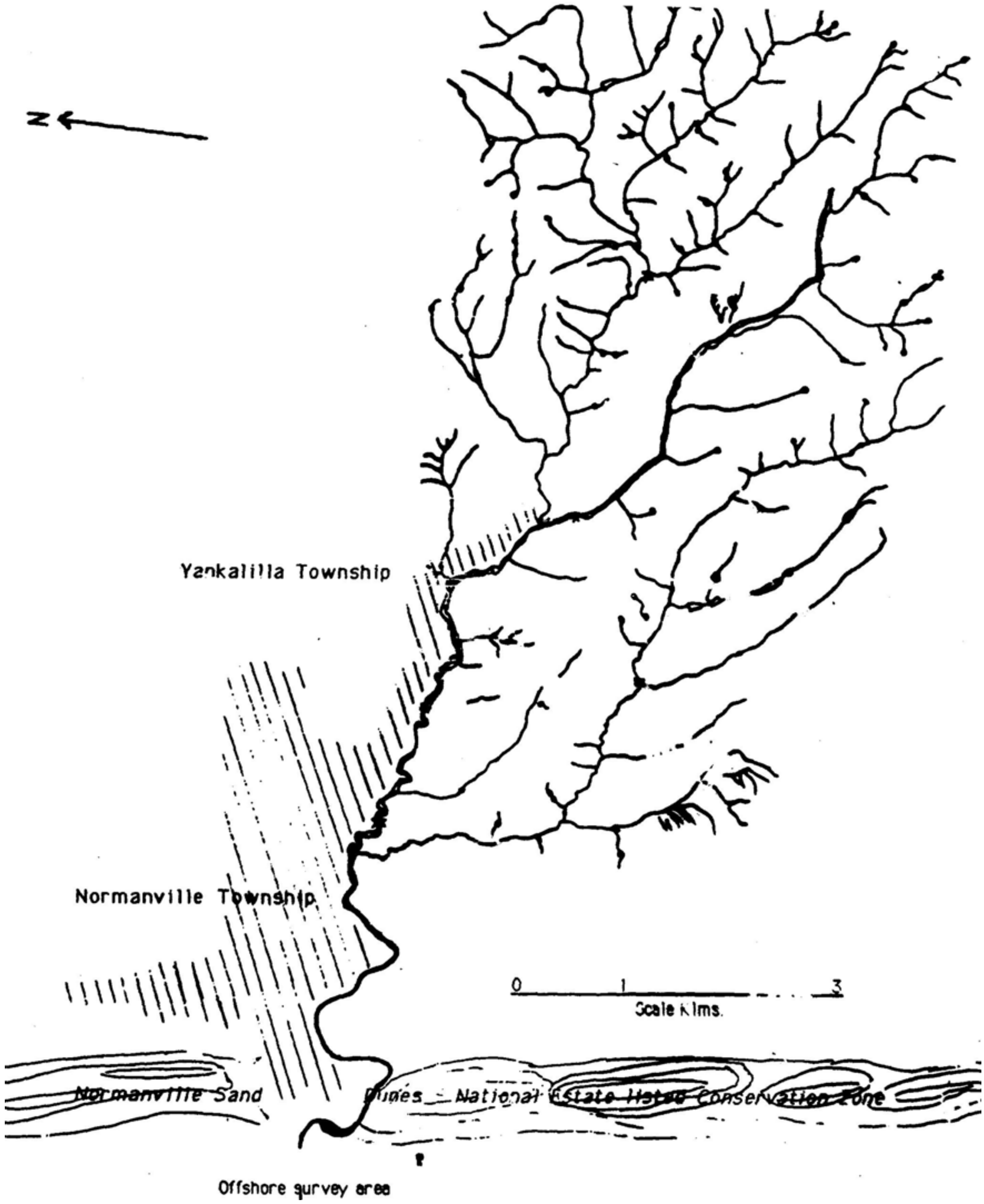

Figure 1: The Bungala River Catchment

Ultimately, the terrestrial part of the project did not have adequate community support to see it through to completion, therefore funding was not sought for the third year, the management plan was not completed, and the project was wound up. The project was reviewed (Pedler *et al.* 1999) and eventually a final report was written (Druce & Belford 2005).

These reports acknowledged that the group of community divers maintained interest despite project discontinuity caused partly by the intermittent nature of funding. This group established monitoring points and collected data at these points. With the support of the then newly formed Normanville Underwater Divers and Explorers Club (NUDE), Dolphin Dive, the Yankalilla SES and the Second Valley to Cape Jervis Land Management Group (also newly formed), three additional rivers were included in the monitoring program with no additional financial cost to the project. Although only a few participants had some limited knowledge of marine biology, the group collectively brought a range of skills to the marine component of the project, and thus contributed to its success.

The final report indicated that there were some limited funds remaining from the first two years of the project. It was decided that this money should be allocated to writing up the marine component of the project, and therefore this report was commissioned. The remaining sections describe the methods, results and discussion of the collection of physical and biological data for the marine component of the *Bungala 2000* project (B2KMC) and some additional data collected during the preparation of this report.

2. Methods.

The data collection methods used for the Bungala 2000 marine component (B2KMC) were not formally recorded at the time of the surveys. Much of the story has been pieced together from a number of sources, including inspection of the data, photographs taken during the surveys, and personal communications with the divers, the project officer and the scientist advising the project. However, some uncertainty remains about aspects of the methods.

2.1 Site location

GPS was not used for this project to record site locations or for relocating the sites. Instead, one of the participants used land based trigonomentry to relocate marks but precise notes on these locations were not recorded. Relocation of the star droppers placed at each of the sites generally relied on good visibility from the surface and knowledge of the approximate depth and off-shore distance. all sites were located in at least 3 metres of water at low tide, with boat safety being a key consideration. The available information about the site locations is summarised in Table 1 and approximate locations are shown in Figure 2.

Table 1: Location of marine monitoring sites

Locality	River/creek	Location
Normanville	Bungala	Slightly north of the river mouth.
Carrickalinga	Carrickalinga	In the sand to the north of and immediately adjacent to the main mixed reef/seagrass area directly offshore from the creek outflow.
Carrickalinga	Control site	At the southern side of the Haycock Point. This site was never relocated.
Rapid Bay	Yattagolinga	Approximately 10-15 metres to the north of the creek outflow.
Second Valley	Parananacooka	Directly offshore from the beach. In 1997, was located at the boundary between sand and seagrass. The star dropper was still in place several months ago (pers. comm., Greg Perry, participant)

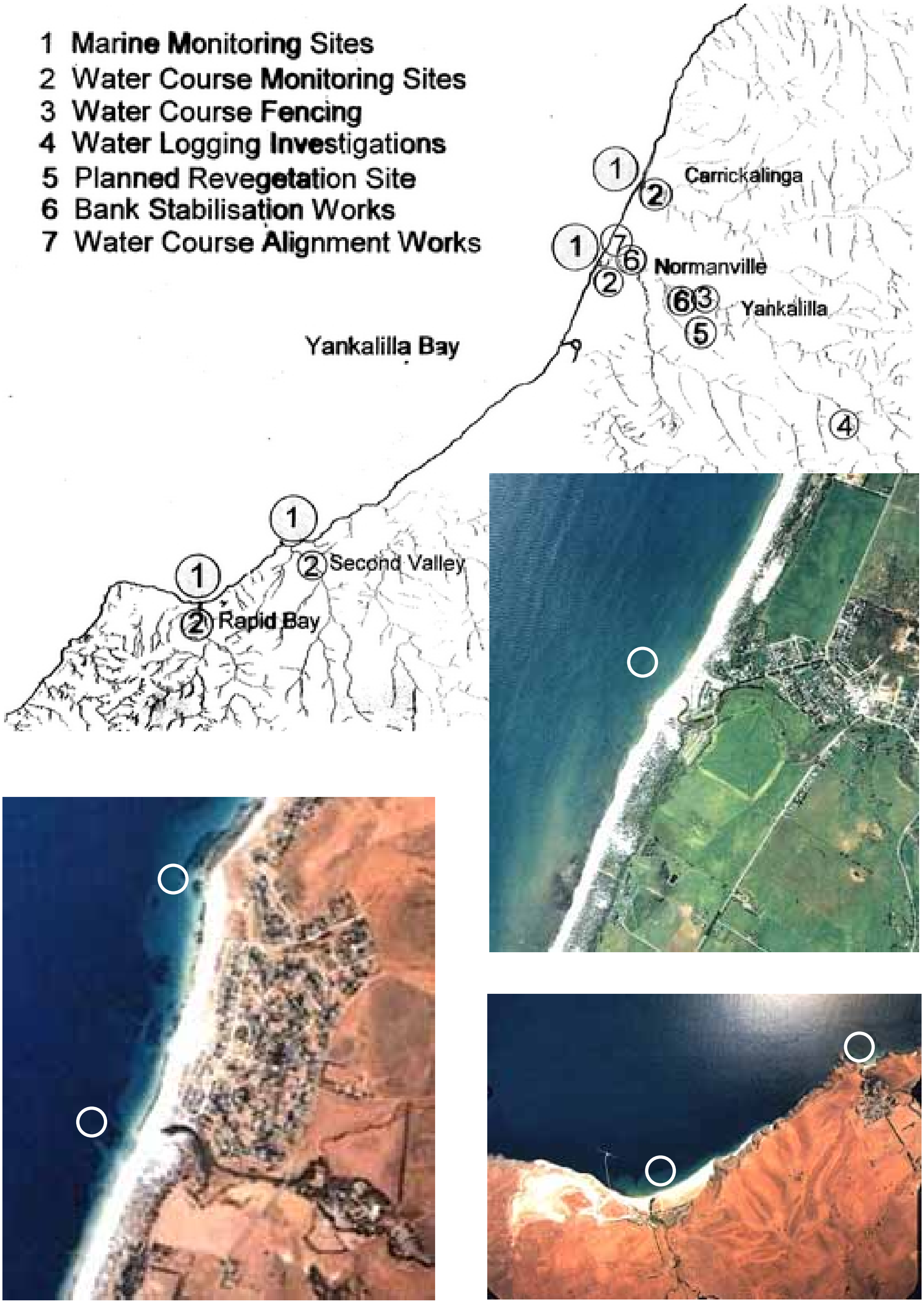

Figure 2: Approximate locations of the marine monitoring sites, with overall map showing the four sites (top left); Bungala River at Normanville (top right); Carrickalinga creek and control site further north at Haycock point; and Yattagolinga River (Rapid Bay) and Parananacooka River (Second Valley). Aerial photos courtesy of former Department of Lands, map courtesy of Inman Valley and Torrens Vale Landcare Group.

2.2 Sediment traps

The vessels used to catch sediment/silt were made from 1850mm lengths of 375mm (1.5 inch) diameter polypipe closed at the bottom end and open at the top. Cross hairs of plastic were placed in the top of the sediment trap to counteract vortex effect and consequent loss of sediment. The traps were wired to star droppers which had been hammered into sand, such that the vessels were approximately one metre above the sea floor. Three traps were located at each site and separated by approximately five metres in a triangular formation.

The traps were deployed for approximately two months, after which the contents were sent for laboratory analysis to determine the mineral composition of the sediment (using X-ray defraction), and the size composition of the sediments based on the size categories listed in Table 2.

Figure 3: Sediment traps (encrusted with algae and bryozoans). Photo: Alistair Christie.

Table 2: Sediment sites categories.

Descriptor	Size (mm)
Coarse	>2
Very coarse sand	2-1
Coarse sand	1-0.5
Medium sand	0.5-0.25
Fine sand	0.25-0.125
Very fine sand	0.125-0.0625
Mud	<0.0625

2.3 Flora and Fauna surveys

2.3.1 Identification

Although some voucher specimens were taken, the surveys were essentially non-destructive and relied on field identification of the various organisms recorded. Divers received some training in identification from Dr Karen Edyvane and Andrew Dalgetty from SA Research & Development Institute, Aquatic Sciences Division (see Figure 4). Underwater photos taken with a disposable camera were also used to assist identification, and were the source of the unattributed photos included in this report. Although much better photos can be taken by experienced underwater photographers using more recent equipment (compare Figure 10, Figure 12 and Figure 14 with the the cover illustrations), these photos served their purpose and many have been included in this report (those with photographer unattributed).

Figure 4: Identification training with the experts.
Photo: Alistair Christie.

In some cases, particular species could be determined, but in other cases species were grouped into higher level categories. In many cases, further groupings were made when analysing the data. The various species and groups of attached organisms used when recording and analysing the data are shown in Table 3 which contains references to illustrations and the corresponding Reef Watch codes. A number of fish and mobile invertebrates were also recorded at each site. Sea stars were recorded for a number of surveys. Although identification of particular sea stars was not made, one was photographed (see Figure 5).

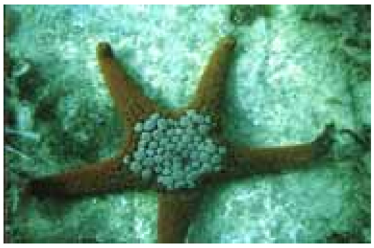

Figure 5: The sea star *Nectria* (probably *N. ocellata*).

Table 3: Species and Groups recorded and analysed during marine surveys

Species/Group	Notes	Illustrations/ examples	Reef Watch code
Wire weed (*Amphibolis*)	Two species, *Amphibolis antarctica* and *A. griffithii* were recorded but combined for analysis.	Illustrated in Figure 6	GRASS
Tape week (*Posidonia*) sinuosa	The species *Posidonia sinuosa* was recorded. See for illustration. Reef Watch code GRASS.	Illustrated in Figure 7	GRASS
Epiphytes	This group comprised species that grow on seagrass or brown canopy forming algae, and included red and brown algae, e.g. *Metagonolithion* sp. or *Cladosiphon* sp. respectively.	Illustrated in Figure 7	(none)
Kelp (*Ecklonia radiata*)	A common, large brown canopy forming species of algae. Algae have a similar structure to terrestrial forests with canopy forming species providing shelter for understorey species.	Illustrated in Figure 8	BKELP
Other canopy forming brown algae	A number of species, including *Cystophora monilifera*, *Caulocystis cephalornithos* and *Scaberia agardhii*, and the genus *Sargassum*, were recorded during surveys but were grouped together for analysis and labelled using the Reef Watch code for large canopy forming algae.	Examples in Figure 9	BBIG
Small brown algae	The main species recorded in this group were the lobed species *Lobophora variegata* and the membranous, sac like species *Colpomenia* sp.	*Lobophora* illustrated in Figure 10	BSMALL
Red algae	This group included species listed on the data sheets as “red algae” or the equivalent scientific name “Rhodophyta”. Although some sketched illustrations on the data sheets suggest that the latter referred to coralline algae, diver recollection is that these were used interchangably, both referring to coralline algae, foliose or membranous red algae growing dircetly on substrate (i.e. not the epiphytes described above). Irrespectively, the single combined group was used for analysis.	Example in Figure 11	RSMALL
Green Algae	This group included the lobed species *Dictyosphaeria sericea* as well as foliose species.	Illustration in Figure 12	GSMALL
Ascidians	Ascidians were recorded according to their colour (red, yellow) but grouped together for analysis.	Example in Figure 14	ATTAN
Sponges	A variety of sponges were observed and recorded as a single group.	Examples in Figure 13	ATTAN
Worm tubes	Likely to be the species *Galeolaria caespitosa*.		ATTAN

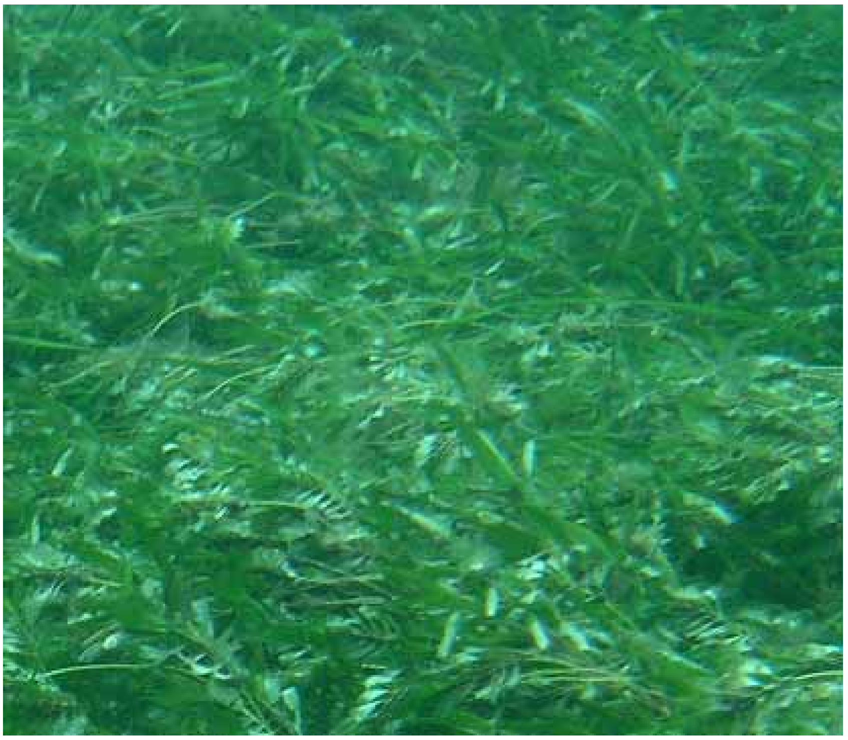

Figure 6: Wire weed (seagrass *Amphibolis spp.*). Photo: James Brook.

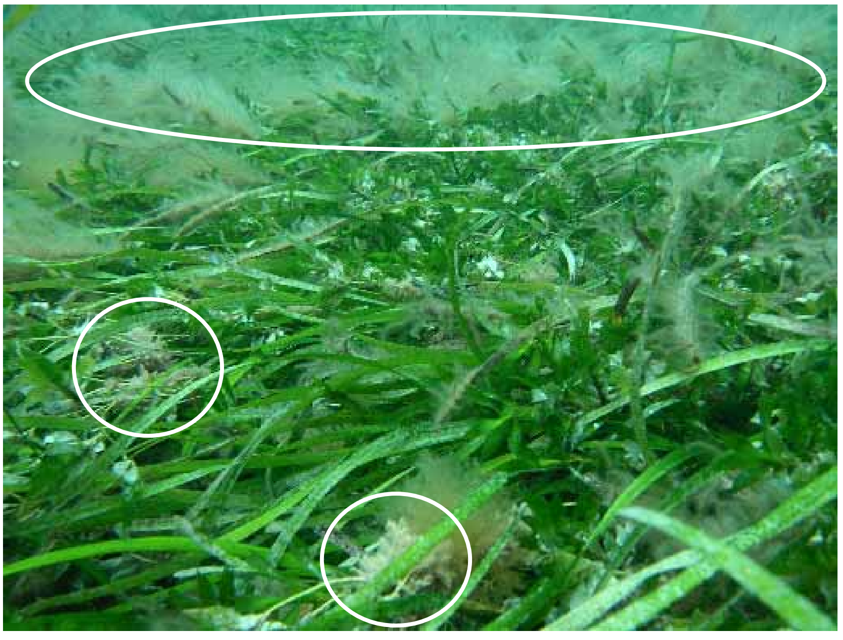

Figure 7: Tape weed (seagrass *Posidonia sinuosa*) with brown filamentous epiphytes (top oval) and red coralline epiphytes (circles). Photo: James Brook.

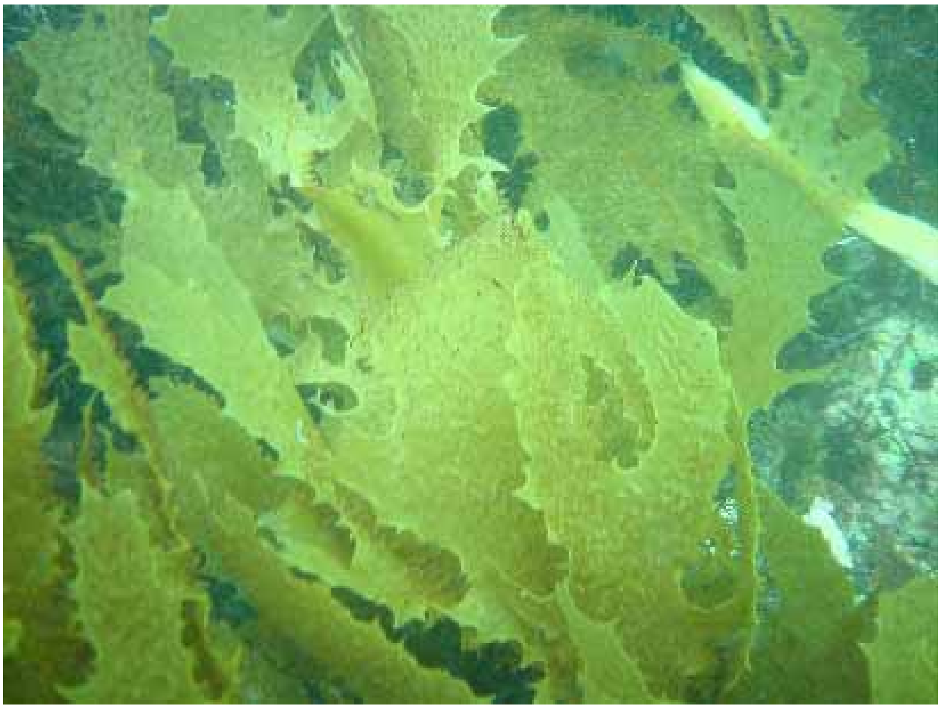

Figure 8: The Kelp *Ecklonia radiata* (Reef Watch code BKELP). Photo: James Brook

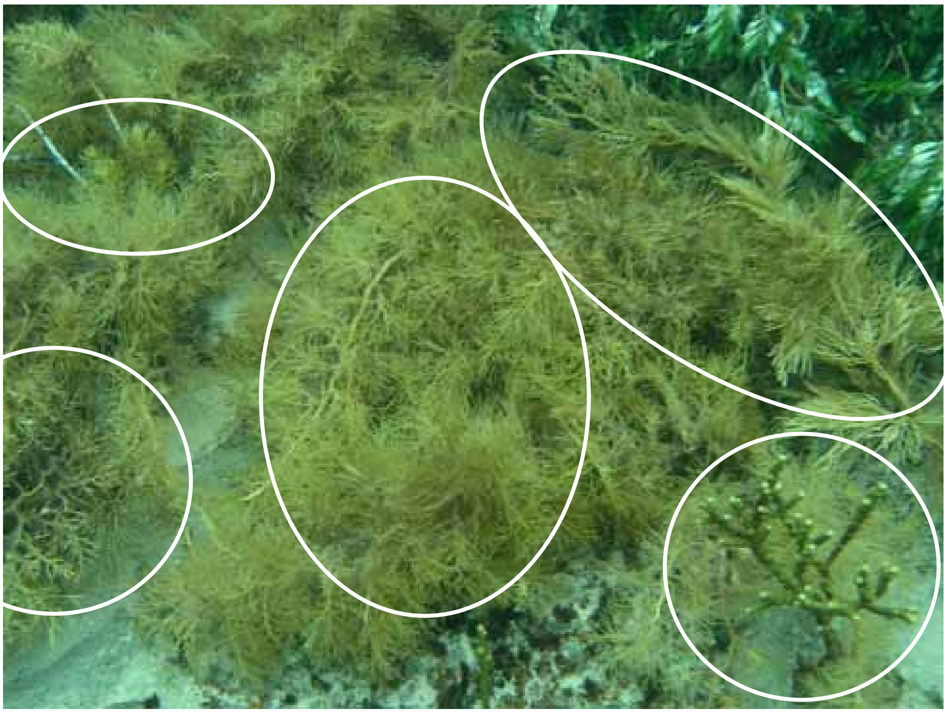

Figure 9: Various large canopy forming brown algae (Reef Watch code BBIG), including probably identifications: *Caulocystis cephalornithos* (top left), *Cystophora monilifera* (bottom left), *Cystophora subfarcinata* (centre), *Cystophora siliquosa* (top right) and *Scaberia agardhii* (bottom right). Photo: James Brook.

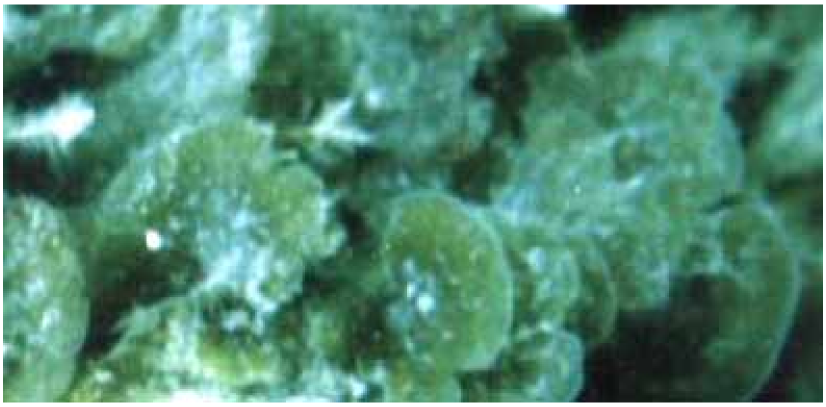

Figure 10: Example of small brown algae, the lobed species *Lobophora variegata*.

Figure 11: Red algae (circled) growing amongst seagrass covered with the brown filamentous epiphyte *Cladosiphon* sp. Photo: James Brook.

Figure 12: Green lobed algae (*Dictyosphaeria sericea*)

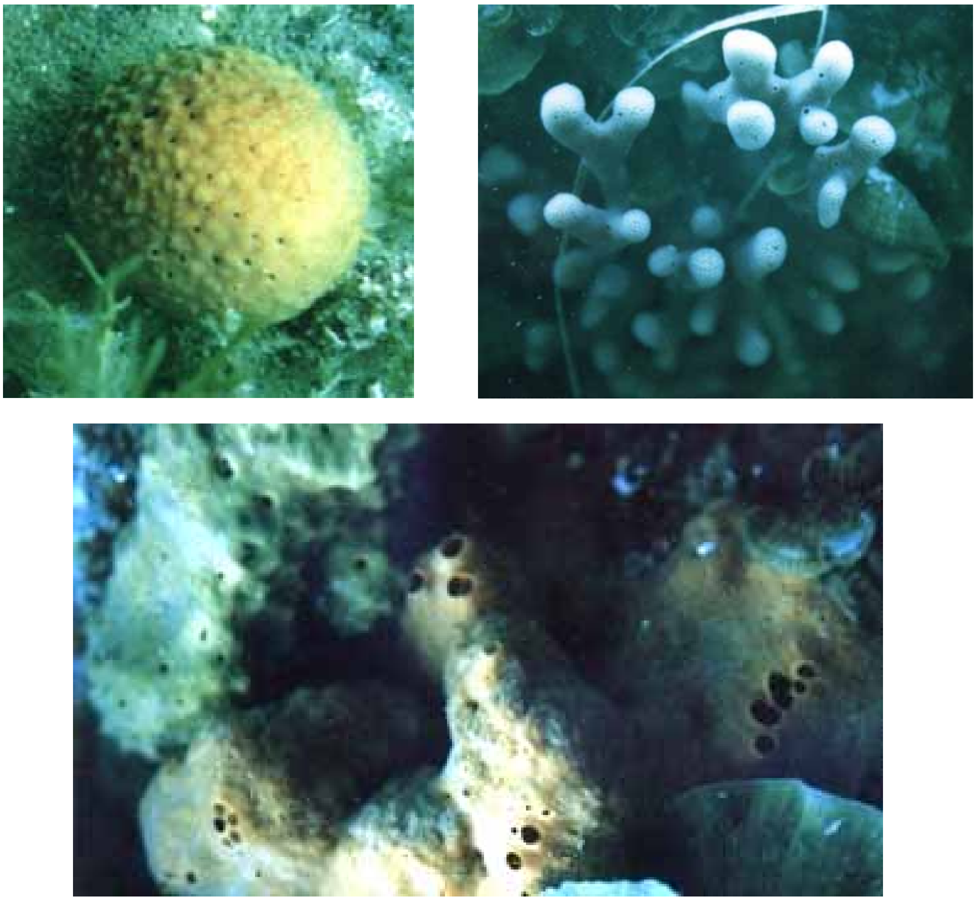

Figure 13: Various sponges.

Figure 14: The red-throated ascidian *Herdmania momus*.

Three substrate types were also recorded (rock, sand and gravel), but this was not done in a consistent manner. Sometimes all substrate was recorded, even if vegetated, and sometimes only bare patches.

Three methods (two in 1997 and one in 2005) were used to sample the benthic (bottom-dwelling) flora and fauna, namely a belt transect, quadrat and a line intercept transect (LIT).

2.3.2 Belt transect

The transect involved the establishment of a 50m tape measure running perpendicular to the shoreline, anchored at the most seaward star dropper and heading directly offshore (using a compass if necessary). The transect was subdivided into blocks of 5m length, and 1m width (to one side of the transect line). At three of the sites (Normanville, Second Valley and Rapid Bay), the survey was repeated on the other side of the line (see Figure 15).

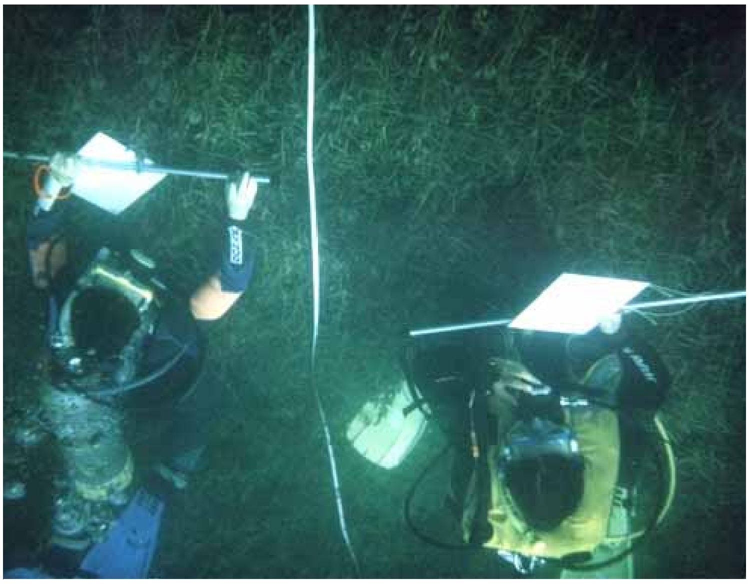

Figure 15: Divers undertaking belt transect survey.
Photo: Alistair Christie.

The limited resources of the project precluded any opportunity for trial surveys or calibration of divers. In hindsight, this was the reason for some inconsistencies in the data collected. Divers recorded either the presence/absence or percentage cover of different organisms or groups of organisms within each of the blocks. The choice to record presence/absence or percentage cover was not made consistently within transects at a site, nor between the sites, nor between the two divers who undertook the surveys. Furthermore, total percentage cover at a site varied between 55% to 265%. Inspection of the data suggests the lack of a consistent approach to sampling the different benthic layers (substrate, dominant flora, epiphytes/mobile animals). As mentioned above, part of this was due on occasions to a total of 100% of substrate being recorded in addition to whatever cover of flora and fauna was present. Similarly, seagrass was sometimes recorded as having 100% percentage cover but epiphytes growing on that seagrass were also given a percentage cover. However, even if the substrate data and epiphytes were omitted, there were clearly other inconsistencies in the way that percentage cover was recorded.

Because of these inconsistencies, the data were reduced to presence/absence (a one or a zero) for each block within a transect, and then summed for the ten such blocks in the 50m transect.

The belt transect described here is a repeatable method that may have some use for ongoing monitoring of the benthic environment adjacent to river outflows. However, because the composition of benthic communities can vary a lot even at the scale of a few metres, the lack of an exact starting point may make it difficult to detect change from the baseline collected in 1997.

2.3.3 Quadrat

The quadrat method involved placing a 1m by 1m metal frame (see Figure 16) in the vicinity of the sediment traps, and estimating the percentage cover of those organisms visible from directly above (total 100%), and recording the presence of understorey species.

Figure 16: Quadrat (1m x 1m) placed on sea floor.

The particular location was chosen haphazardly, i.e. in a semi-random manner without regard to the particular organisms that would lie within the quadrat. Only two quadrats at each of the Normanville and Carrickalinga sites, and a single quadrat at the Second Valley and Rapid Bay sites, were undertaken. Unfortunately, without a higher number of replicate quadrats, one can only draw conclusions about the area within those quadrats, rather than the site as a whole. Given that we do not know the precise location of most of the sites, let alone the particular quadrat, the quadrat data collected is therefore of little practical use as percentage area baseline data for the site.

2.3.4 Line intercept transect (LIT)

It was decided to collect additional baseline data that could be expressed as a percentage cover, for the Bungala and Carrickalinga sites. This will provide a new baseline for sites with known (marked) locations and allow greater flexibility for the collection of future data, for example using Reef Watch benthic survey methods (Reef Watch 2007a, Reef Watch 2007b). Furthermore, for reef sections within the transects, a number of percentage cover based indicators of reef condition or health developed for South Australian reefs can be applied (Gaylard 2003; Turner *et al*. 2007). Such indicators include the percentage cover of:

- canopy forming brown algae (positive); and
- bare rock,
- turfing algae, or
- encrusting mussels (all negative if present in excessive quantities, i.e. > 20, 25 or 15% respectively).

A number of methods are available for calculating percentage cover, including quadrats and the line intercept transect (Reef Watch 2007;Turner *et al*. 2007). However, for this work it was decided to use a variant of the line intercept transect (LIT) that had been applied by the Department for Environment and Heritage in 2003 in the proposed Encounter Marine Park (pers. comm., Bryan McDonald, MPA Scientific Officer). This method enabled the rapid survey of longer transects (100-200m) within the similar dive time to that normally required to collect 20m of data using the standard Reef Watch LIT. Note that the term “VLIT” throughout the remainder of this document will refer to this variation of the standard Reef Watch LIT.

These longer transects were aligned perpendicular to the shore, with a transect line marked with individual metres was laid from a starting point in 3m of water. Each metre along the transect line was considered separately. Within each metre the dominant lifeforms lying directly under one edge of the transect tape were recorded, and their percentage overlap with the tape estimated to the nearest tenth of a metre (see Figure 17).

The Normanville transect can be relocated through land-based trigonometry by lining up the pole on hill lines up with pole to right of the house at the right of the river mouth, and the northern outer corner of jetty with the bottom of NSLSC fence to the left of the river mouth (Figure 18).

Similarly, the Carrickalinga transect can be relocated by lining up the left hand side of the brown house by the river with the right hand side of the house further halfway up the hill, and to the right, the pine tree lines up with middle of a dark wedge on the distant hill to the left of three towers (Figure 19).

3.

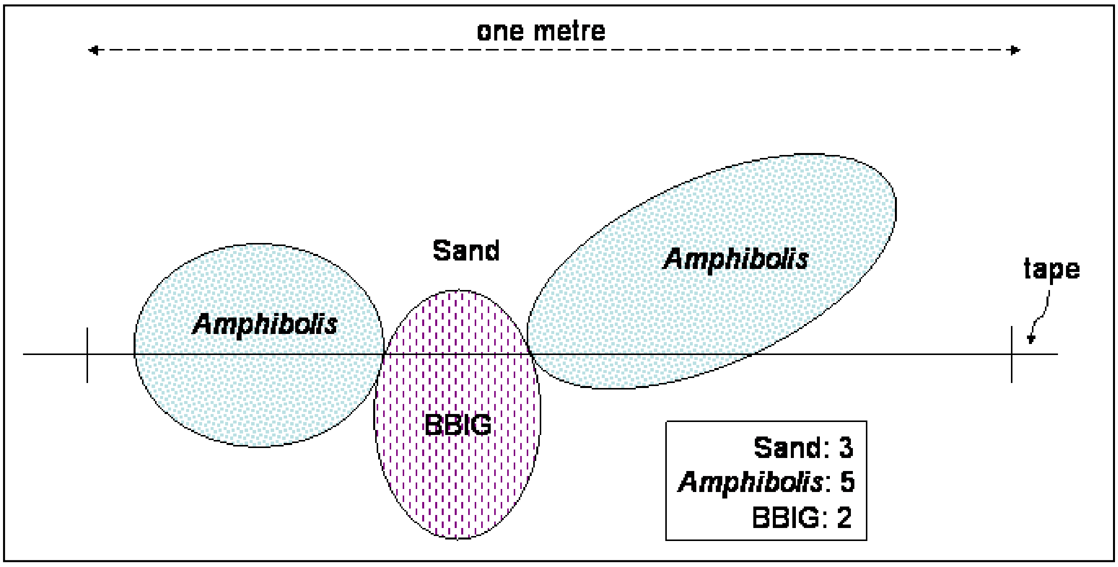

Figure 17: Line Intercept Transect method used in 2005

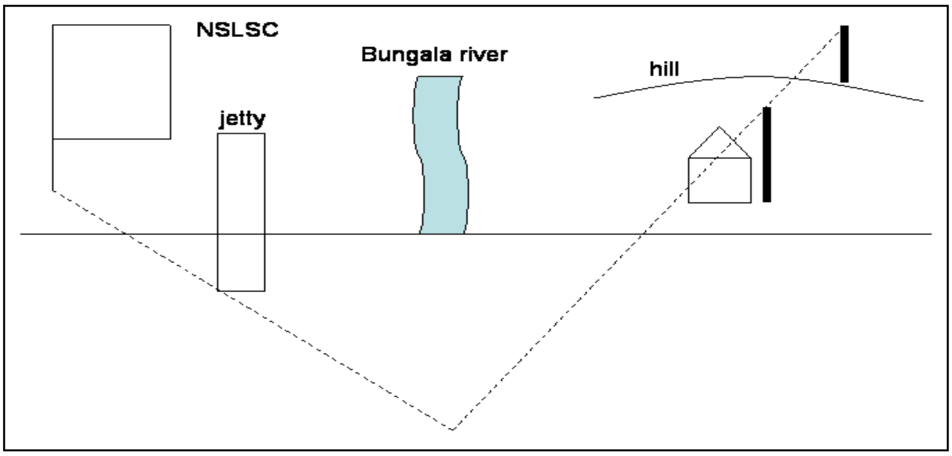

Figure 18: Marks for relocating Normanville LIT

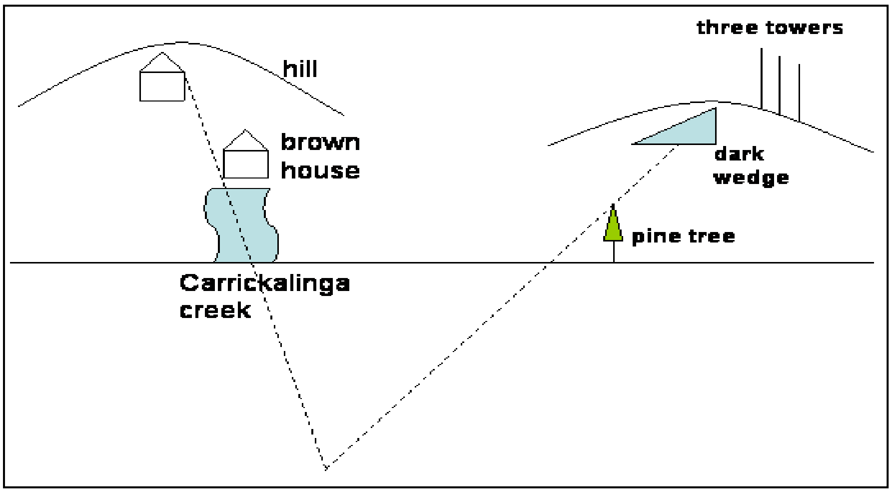

Figure 19: Marks for relocating Carrickalinga LIT

Results

3.1 *Sediment*

Two silt traps were retrieved from the Normanville and Carrickalinga sites, one from Rapid Bay, and none from Second Valley (as poor visibility prevented the retrieval of these traps). Fouling organisms covered 20-50% of the traps. The laboratory results for the sediment retrieved from these traps are presented below.

3.1.1 Sediment composition

X-ray diffraction of the sediment retrieved from the sediment traps in July 1997 showed little clay, but relatively high quantities of quartz, low magnesium calcite and high magnesium calcite.

The quartz content of the Bungala river samples was similar to the median value of the three sediment traps retrieved from Normanville, and the Carrickalinga samples, but was much lower for the Rapid Bay site. Conversely, the Rapid Bay site was high in low magnesium calcite compared with the other offshore sites, with the lowest calcite levels being found in the Bungala River.

A graph showing selected results of the X-ray diffraction process is shown in Figure 21.

3.1.2 Sediment size

The three marine sites had different sediment size compositions. The sediment at Normanville had a high content of the finest particles (mud); Carrickalinga also had mud content but a more even distribution of different coarsities of sand, with the “coarse sand” category having the highest fraction. There was no mud at Rapid Bay, but most of the sediments were fine or very fine sand. The results are illustrated graphically in Figure 20.

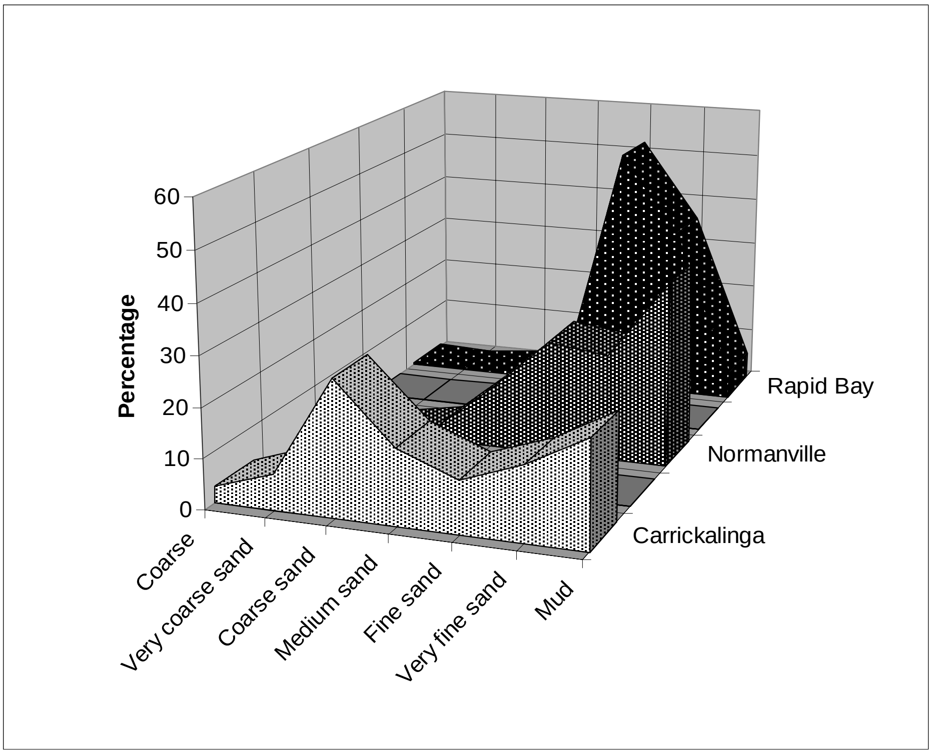

Figure 20: Composition of sediments sampled using silt traps.

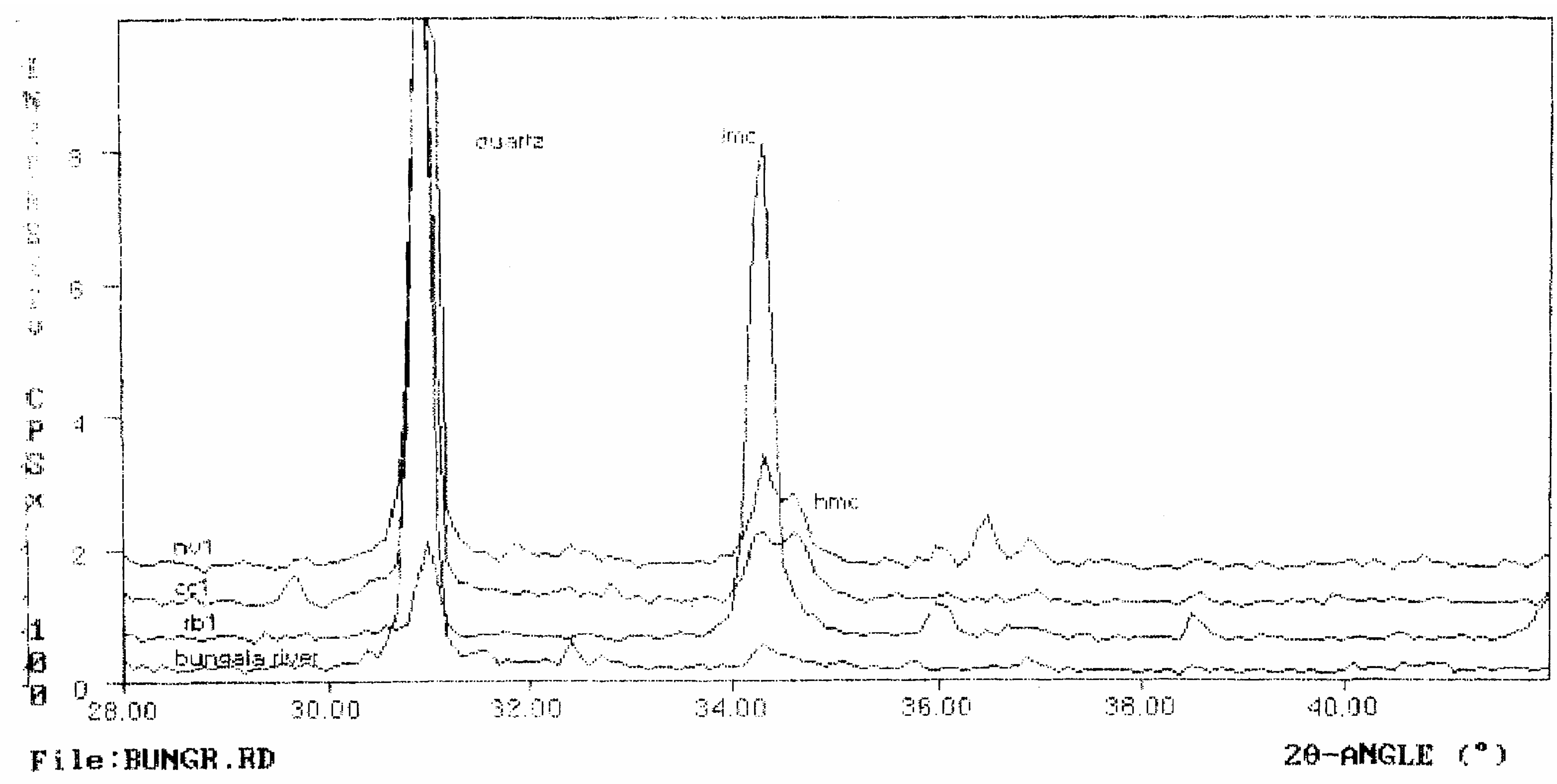

Figure 21: Selected results from the X-ray diffraction of sediment from the Bungala River and Normanville, Carrickalinga and Rapid Bay marine sites.

3.2 Normanville (Bungala River)

3.2.1 Belt transect results

Belt transects were conducted twice at Normanville (April and October 1997), with both sides of the transect tape surveyed on each occasion. The composition of the dominant species of algae and seagrass, averaged over the two sides of the transect, was similar for both surveys. The number of 5m x 1m blocks with epiphytes recorded increased from zero in April to seven out of ten in October. It was noted on one data sheet from April that there was possibly algae or a parasite growing on most of the *Posidonia*, but this might have referred to very fine epiphytes rather than the more robust coralline species or brown species *Cladosiphon* sp. There was also an increase from zero to three blocks for ascidians between these surveys. The results are illustrated in Figure 22.

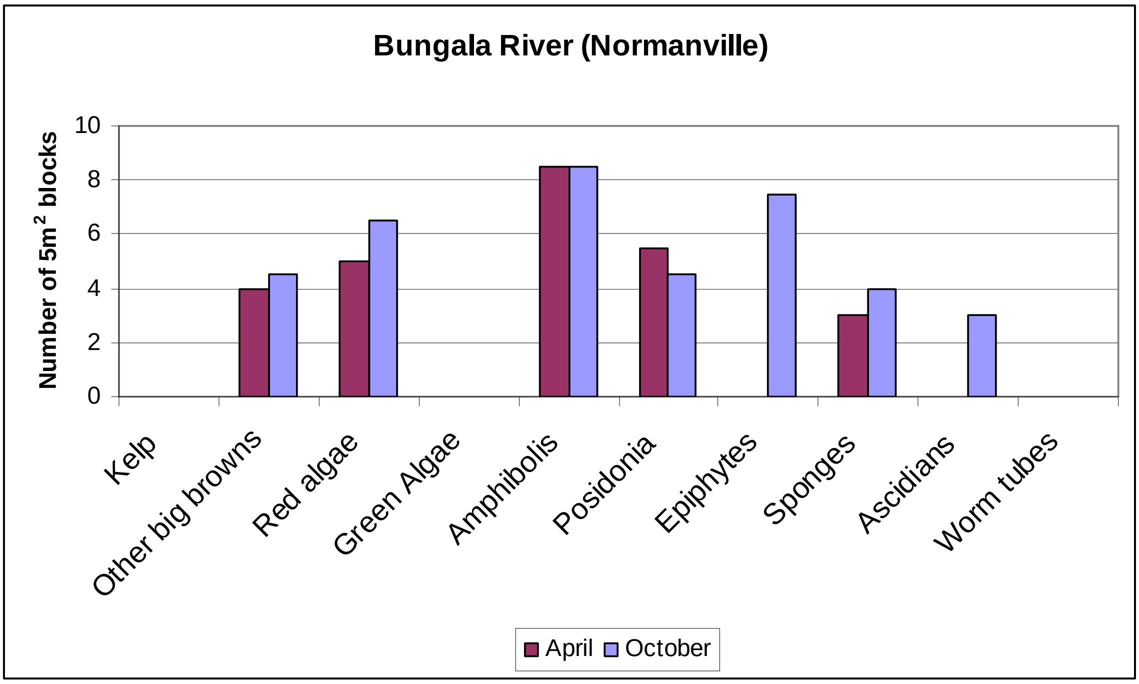

Figure 22: Benthic organisms from Normanville transects, in April and October 1997 (averaged data for left and right side of transect line).

The mobile species were also recorded during the surveys are summarised in Table 4.

Table 4: Mobile species recorded at Normanville

Survey	Fish	Invertebrates
April	Leatherjacket Silverbelly (*Parequula melbournensis)* Slender weed whiting (*Siphonognathus attenuatus*) Wood's siphon fish (*Siphaemia cephalotes*)[1]	Abalone Other gastropods Scallops (20) Sea star
October	Unidentified species of small fish	Abalone Other gastropods Sea star Crabs (decorator and hermit)

[1] Identified from illustration on data sheet

3.2.2 Quadrat results

Despite the limitations in the usefulness of the quadrat data, the results of the two quadrats undertaken in April 1997 are presented in Table 5. These results illustrated that there can be high variability between areas only a few metres apart.

Table 5: Quadrat results for Normanville

Genus/species	Quadrat 1 (%)	Quadrat 2 (%)
Amphibolis	40	
Cystophora monilifera		70
Sargassum	60	20
Scaberia agardhii		10

Understorey species included (for both quadrats):

- *Colpomenia* sp.
- *Lobophora variegata*

3.2.3 VLIT results

The results of the VLIT transect show that the transect was dominated by seagrass communities, with almost three quarters cover of seagrass plus an additional nine percent cover of the epiphytic genus *Cladosiphon*. The remaining area was split between bare sand and reef (either bare or covered in algae). The results are summarised in Figure 23.

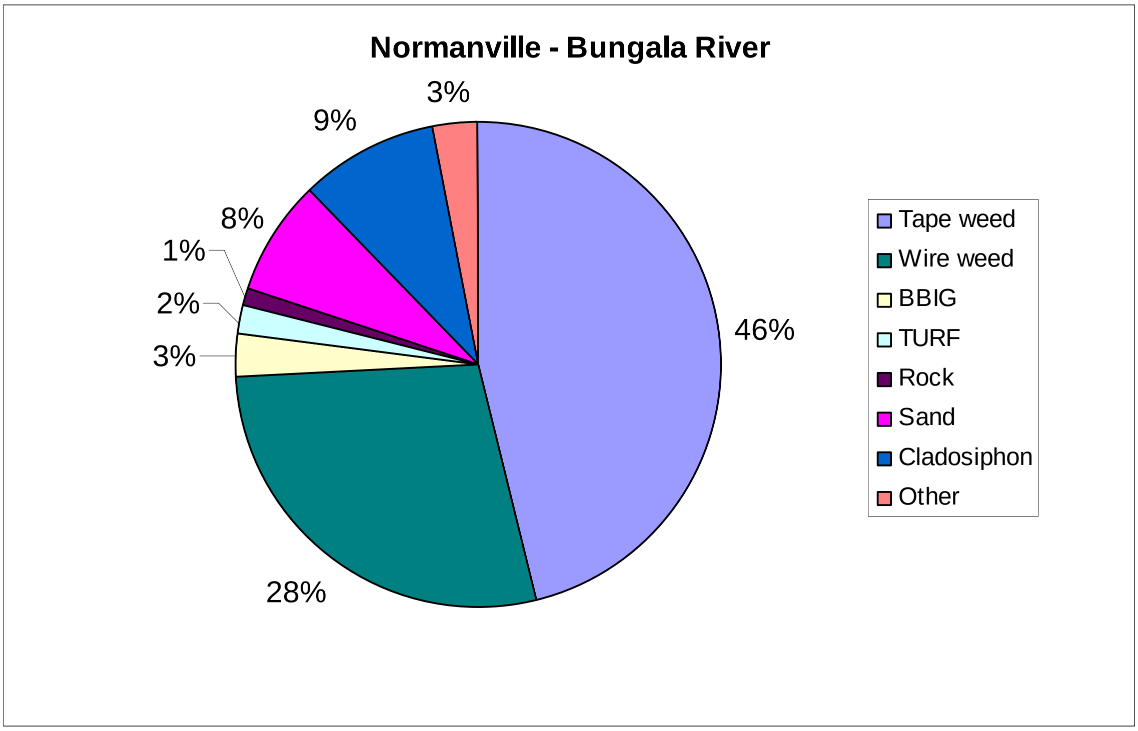

Figure 23: Percentage cover of dominant organisms on Normanville Line Intercept Transect, November 2005

3.3 Carrickalinga Creek

3.3.1 Belt transect results

A belt transect was conducted one at Normanville (April and October 1997), using one side of the transect tape. As for Normanville, seagrass was dominant, but canopy forming brown algae were also dominant. As for the April survey at Normanville, no epiphytes or ascidians were recorded. The results are illustrated in Figure 26.

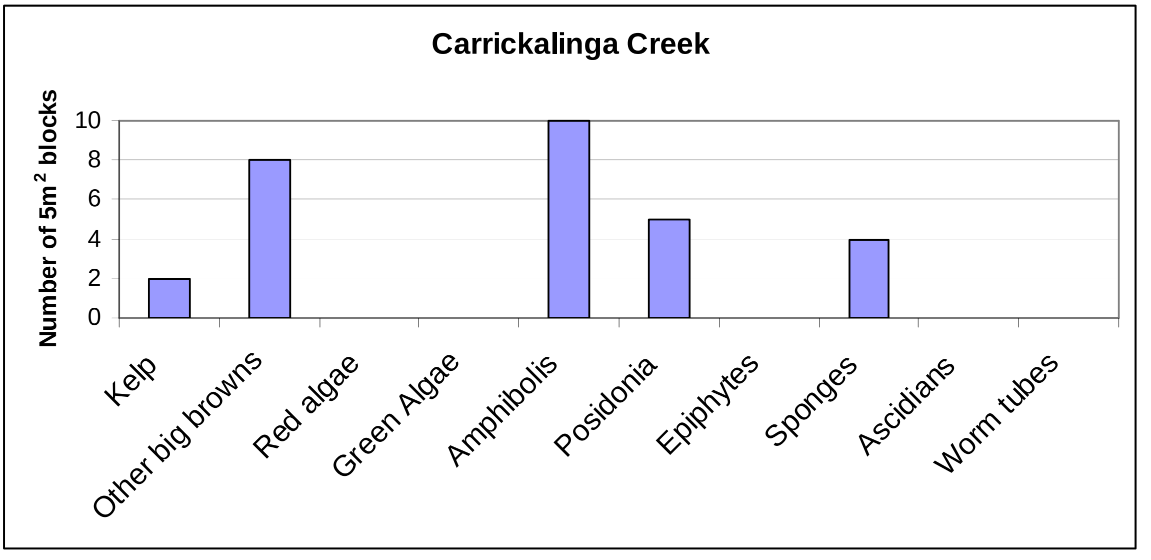

Figure 24: Benthic organisms from Carrickalinga transects, in April 1997.

The mobile species recorded during the survey are summarised in Table 6.

Table 6: Mobile species recorded at Carrickalinga

Fish	Invertebrates
Sand skippers (undifferentiated) – see Figure 25. Silverbelly (*Parequula melbournensis)* Goat fish (*Upeneichthys vlamingii*)[2] Unidentified long thin fish with black upper half and grey/brown lower half	Gastropods

Figure 25: “Sand skipper”

[2] Identified from description on data sheet

3.3.2 Quadrat results

Despite the limitations in the usefulness of the quadrat data, the results of the two quadrats undertaken in April 1997 are presented in Table 7. Unlike the Normanville quadrats, there was not much variability between the quadrats.

Table 7: Quadrat results for Carrickalinga

Genus/species	Quadrat 1 (%)	Quadrat 2 (%)
Amphibolis	20	20
Posidonia		10
Sargassum	80	70

Understorey species included:

- *Colpomenia* sp.
- "soft pink coral"
- Sponge – "orange fingers" (quadrat 1)
- Yellow ascidians – probably *Polycarpa viridis* (quadrat 2)

3.3.3 VLIT results

The results of the VLIT transect show that the cover along the transect was approximately equally proportioned between sandy bottom dominated by seagrass and reef dominated by algae (see Figure 26).

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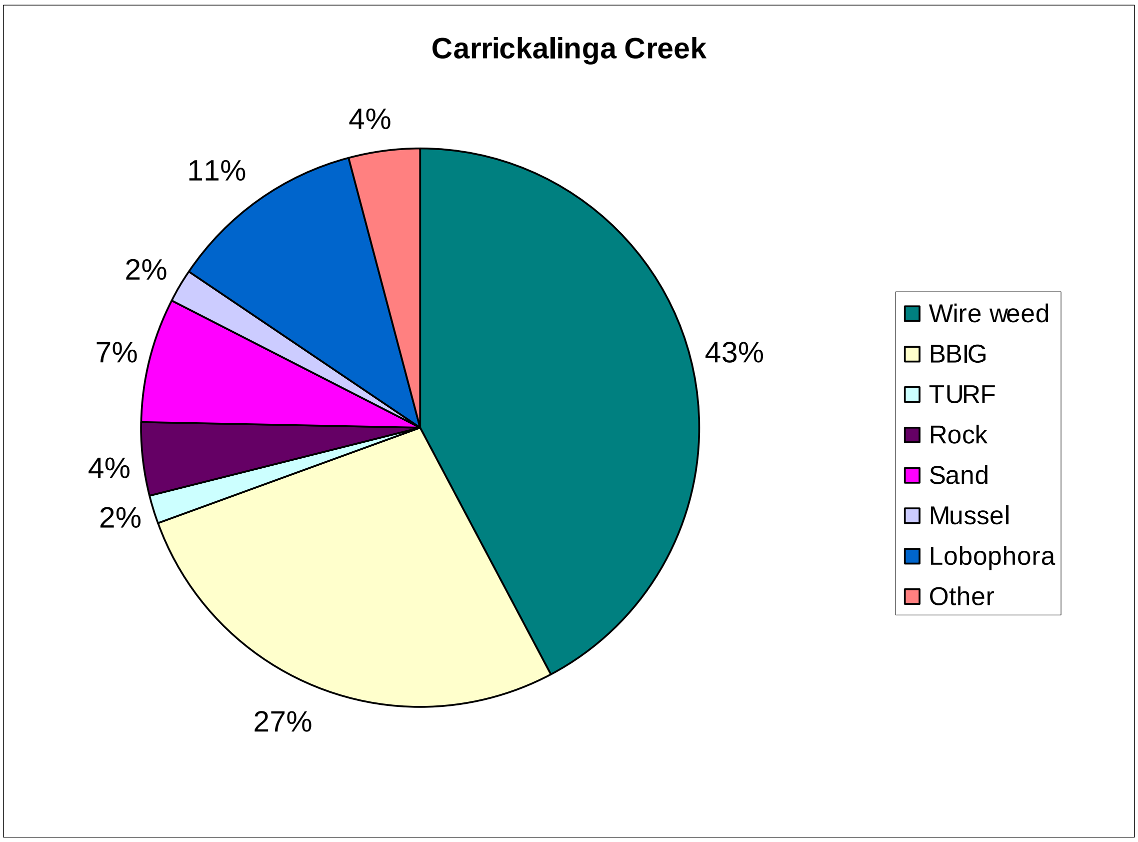

Figure 26: Percentage cover of dominant organisms on Carrickalinga Line Intercept Transect, November 2005

A closer examination was made of the reefy portion of the transect. This showed that just over half of the cover was by canopy forming species (54%), with the brown lobed understorey species *Lobophora variegata* occupying almost half of the remaining area (22%). Bare rock, turfing algae and encrusting mussels accounted for 9%, 3% and 4% of the cover respectively.

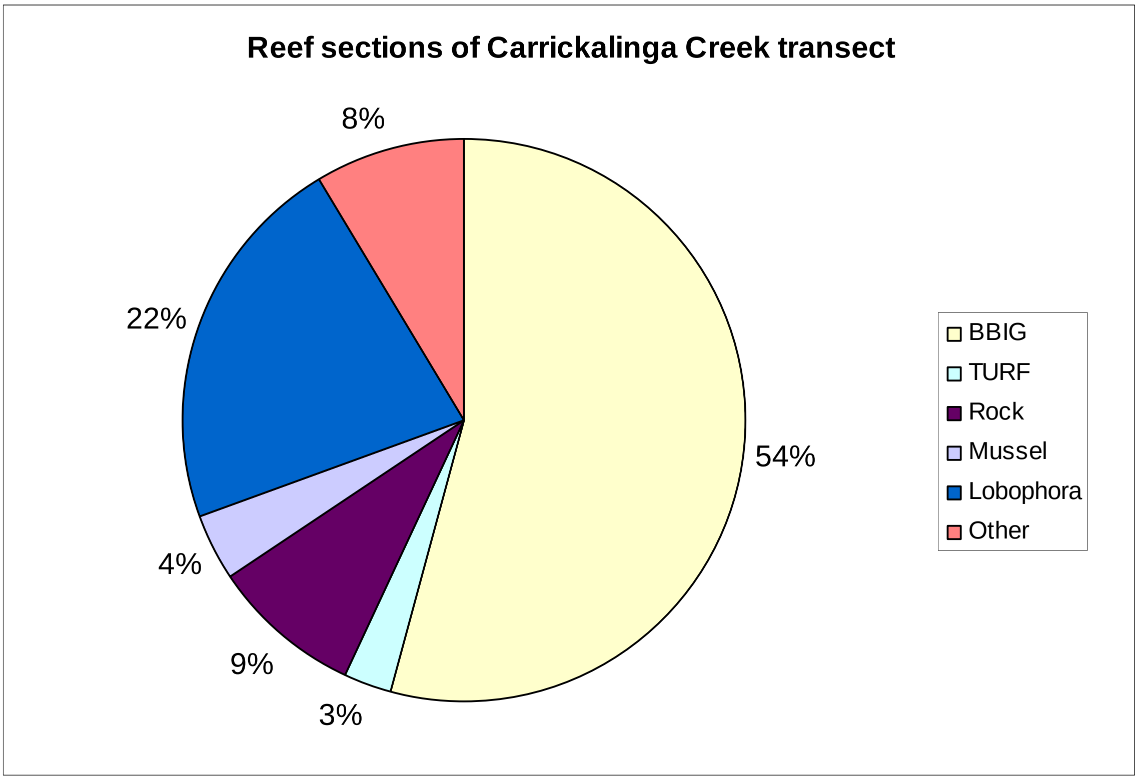

Figure 27: Percentage cover of dominant organisms on reefy sections of the Carrickalinga Line Intercept Transect, November 2005

3.4 *Second Valley (Paranaacooka River)*

3.4.1 Belt transect results

Belt transects were conducted twice at Second Valley (April and October 1997), with both sides of the transect tape surveyed on each occasion. However, the method had not been refined to use 5mx1m blocks in April, therefore only the results from October were analysed, averaged across the two sides of the tape. As for Carrickalinga and Normanville, seagrass and was dominant. As for Carrickalinga, canopy forming brown algae were also present, but unlike the other sites, red algae were more frequently recorded. The results are illustrated in Figure 28.

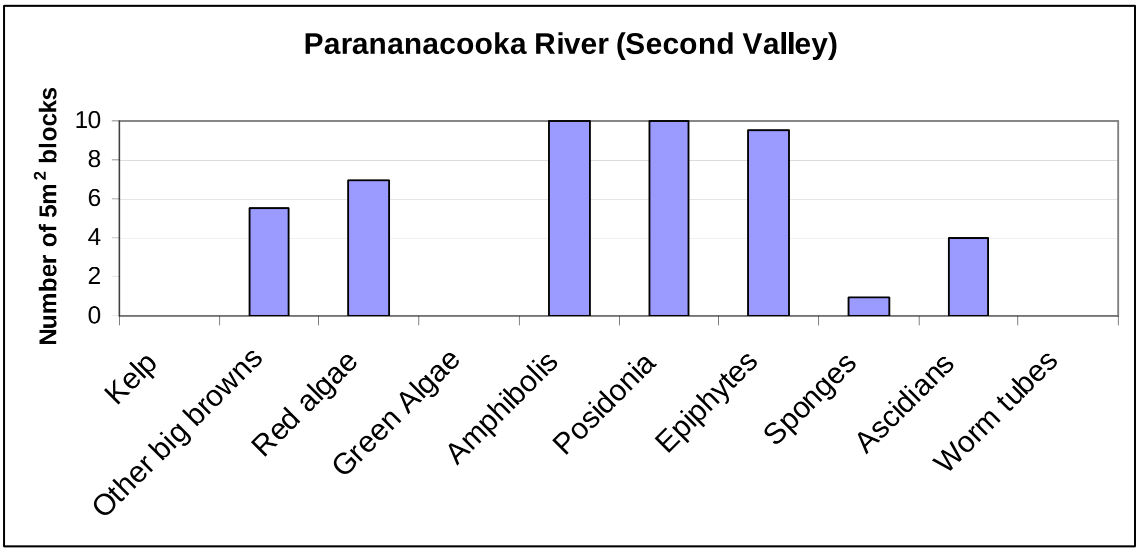

Figure 28: Benthic organisms from Second Valley transects, in October 1997.

The mobile species were also recorded during the surveys are summarised in Table 8 :

Table 8: Mobile species recorded at Second Valley

Survey	Fish	Invertebrates
April	Leatherjackets Silverbelly (*Parequula melbournensis)*	Abalone Other gastropods Squid (*Sepioteuthis australis*)
October		Abalone Other gastropods Sea star

3.4.2 Quadrat results

Despite the limitations in the usefulness of the quadrat data, the results of the quadrat undertaken in April 1997 is presented in Table 9. No understorey species were reported.

Table 9: Quadrat results for Second Valley

Genus/species	Quadrat cover (%)
Amphibolis	30
Sand	10
Sargassum	50
Scaberia agardhii	10

3.5 *Rapid Bay (Yattagolinga River)*

3.5.1 Belt transect results

Belt transects were conducted twice at Second Valley (April and October 1997), with both sides of the transect tape surveyed on each occasion. However, the method had not been refined to use 5mx1m blocks in April, therefore only the results from October were analysed, averaged across the two sides of the tape. The cover was almost exclusively sand, with small areas of gravel (total 5%). Some seagrass was recorded, but notes on the data sheet indicate that there were only isolated specimens with one or two stalks from a single rhizome. The ascidians were growing on *Amphibolis.* The results are illustrated in Figure 29

The mobile species were also recorded during the surveys are summarised in Table 10.

Table 10: Mobile species recorded at Rapid Bay

Survey	Fish	Invertebrates
April	Leatherjackets (two species) Silverbelly (*Parequula melbournensis)* Unidentified pipehorse	Gastropods (on seagrass blades) Crabs Squid (*Sepioteuthis australis*)
October	None recorded	

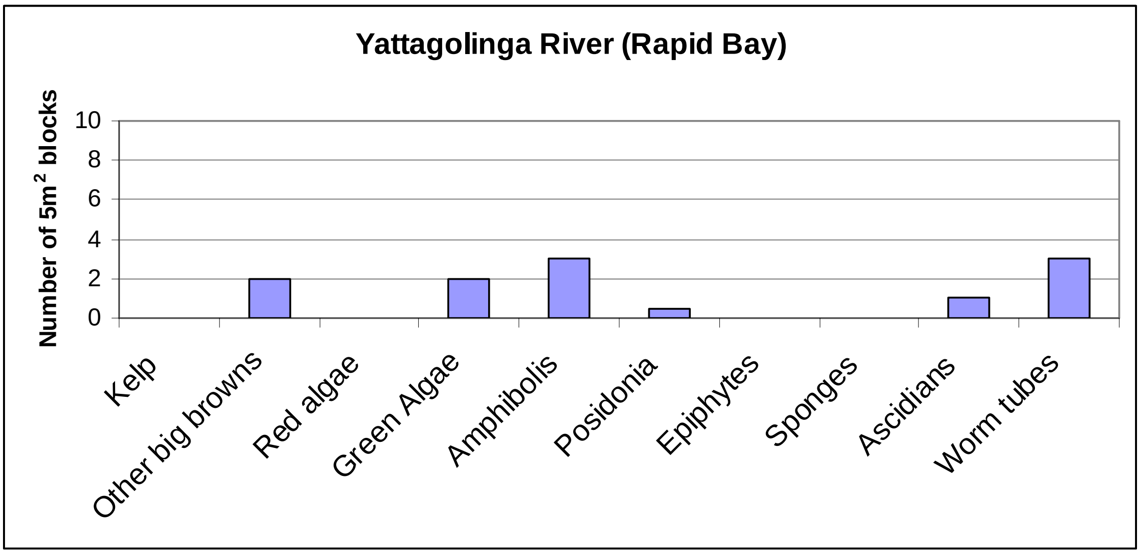

Figure 29: Benthic organisms from Rapid Bay transects, in October 1997.

3.5.2 Quadrat results

Despite the limitations in the usefulness of the quadrat data, the results of the quadrat undertaken in April 1997 is presented in Table 11. Small traces of "lettuce type weed", probably *Ulva*, were also reported.

Table 11: Quadrat results for Rapid Bay

Genus/species	Quadrat cover (%)
Amphibolis	5
Sand	84
Gravel	10
Sargassum	1

4. Discussion

4.1 Usefulness of the data

The belt transects have provided a repeatable method for which the data presented here can form a baseline for future monitoring, at those sites where star dropper marking the start of the transect can be relocated.

At the site with repeated data (Normanville), the dominant species composition was generally similar between surveys. The most marked difference was the presence of epiphytes in most parts of the transect in October, compared with April when none were recorded. This is most likely to reflect seasonal changes, with epiphyte growth perhaps promoted by nutrient inputs from the Bungala River during winter flows. Future monitoring should continue to include epiphytes as a target group of species, so that any loss in seagrass can be correlated with increase in epiphytes. Smaller changes in other organisms may be also be due to seasonal or other natural temporal fluctuations or could be the result of small-scale spatial variation arising from the transect line being laid in a slightly different direction between surveys and hence not covering exactly the same area.

The quadrat data can not be used as a quantitative baseline for percentage cover data of the sites. However, it does provide some useful factual information:

- The sea lettuce (*Ulva*), a species generally associated with high nutrient levels, was present in small quantities.
- Seagrass was established at the low tide 3m depth contour at all sites except Rapid Bay, where only small traces were found. The results at this site are not unexpected given that the inshore environments up to 300 metres offshore have been smothered by quarry taillings (Bourman 1988).
- Large canopy forming brown algae were present on reefy areas at the same locations.

The LIT method used to obtain 2005 data provides percentage area data that is generally compatible with the LIT data collected by Reef Watch (Reef Watch 2007b) and government agencies in SA (Turner *et al.* 2007). It is particularly useful for the reefy areas near the mouth of Carrickalinga Creek, as it allows the calculation of indices of the "health" of the reef. The current results suggest that reef at this site is healthy, but in comparison with other reefs in South Australia, a number of the parameters measured (cover of brown canopy forming algae, bare rock, turfing algae and mussels) are relatively close to thresholds delimiting reefs in poor health. The level of sedimentation on reefs is also considered to be an important index of reef health. Although the Bungala 2000 project involved sampling of suspended sediment, it was not done in such a way as to quantify the level of sedimentation. This could be done by having a standard period for deployment. A period of one month (half of the period used for the Bungala 2000 project) should allow sufficient sediment to be collected but ensure that the opening of the trap does not become partially or fully blocked by fouling organisms.

The review of the program (Pedler *et al.* 1999) suggested that the data collected for the Bungala 2000 project had already contributed to aquaculture zoning plans within the area, and could contribute to the possibility of the Yankalilla Bay being proclaimed a marine protected area. The sites are included within the Encounter Marine Park proposal, but it is unlikely that the data can make any contribution at this stage of the process. However, the data collected in 2005 in conjunction with this report is in the same form as the data collected across the park which contributed to the design of the draft zoning plan.

4.2 Other benefits of the program

The achievements of the marine component of the Bungala 2000 project (B2KMC) are best viewed from the perspective of its contribution to and importance in the historical development of community marine monitoring projects. In particular, a number of the participants in the B2KMC have since played a vital part during the ensuing decade in the ongoing development of the Reef Watch program (www.reefwatch.asn.au), serving in a variety of roles including scientific advisor, project officer, steering committee member, and as regular participants in monitoring dives. As such, this report will be published on the Reef Watch website and acknowledged for its part in the history of the development of that program.

The lessons from the Bungala 2000 project appear to have been taken aboard for the Reef Watch program. Confusion over methods has been avoided with its clearly documented, standardised methods, and training (including in-water training) is resourced. The essential requirement for project officer support has been recognised, and after some funding gaps in the initial years, there is now indicative funding over several years. Support for the project officer role has been underpinned through the establishment of steering and scientific committees. (Turner *et al*. 2006).

4.3 Recommendations

The following recommendations are made:

- That the Reef Watch program be approached to extend its activities at Carrickalinga to include the Carrickalinga Creek site, and that funding be sought to assist them in this expanded role
- That the Reef Watch program give consideration to the ability of community divers to apply a broader range of skills to the task of acquiring data on physical processes such as sedimentation and water movement at its monitoring sites.
- That local community groups give consideration to participating in repeat surveys in April 2007, in conjunction with the Leafy Seadragon Festival, and that funding and in-kind support be sought to facilitate such involvement.

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- Greg Perry
- Alison Eaton
- Alison Prider
- James Brook
- George & Cilla Adler
- Mike Gerner (2005)

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