APPENDIX O1

Marine ecological surveys

O1 MARINE ECOLOGICAL SURVEYS

O1.1 INTRODUCTION

The proposed reverse osmosis desalination plant for the Olympic Dam expansion (with additional water required by the South Australian Government under a Memorandum of Understanding), would discharge a maximum of 370 ML/d of salt water brine to Upper Spencer Gulf near Point Lowly (Figure O1.1). Although the exact discharge location has not yet been determined, it is likely to be about 500 m to 1 km offshore from Point Lowly (Figure O1.2). Construction works would include the installation of intake and outfall pipelines which would be buried in the seafloor for some, if not all, of their length.

The proposed Olympic Dam expansion would also require a landing facility to extend about 200 m offshore on the western side of Upper Spencer Gulf, approximately 10 km south of Port Augusta (Figure O1.1).

This appendix supports the information on marine surveys provided in Chapter 16, Marine Environment of the Draft EIS.

O1.1.1 Study aims

The purpose of this appendix is to present the results of the marine surveys of the Point Lowly and landing facility areas. The surveys were designed to determine the composition and abundance of the benthic community (communities inhabiting the seafloor) in sufficient detail to enable potential impacts to be assessed in the areas proposed for disturbance. The surveys would inform the design of future baseline surveys and environmental monitoring conducted prior to construction, and during operation of the desalination plant, should it be approved. Formal surveys of the intertidal habitats were not conducted, as it was considered that previous surveys (SEA 1981) provided an adequate description of those habitats. Surveys of the Australian Giant Cuttlefish were conducted in June and July 2008 (during their spawning season), and are described in Appendix O5.

O1.1.2 Regional perspective

Spencer Gulf is a shallow marine embayment that extends 270 km inland from the Southern Ocean, progressively narrowing and becoming shallower as it extends towards Port Augusta (Figure O1.1). The warm to hot climate, low rainfall, minimal terrestrial run-off and high evaporation contribute to the northern reaches of the Gulf becoming progressively more saline than the mouth. Hypersaline conditions within the Gulf are enhanced by the input of brine from saltpans in the Pirie-Torrens Basin, which forms an extension of the Gulf into the arid north of South Australia (Bye and Harbison 1991). These phenomena result in the Gulf behaving as an 'inverse estuary'. The principal mechanisms for water exchange in the Gulf are thought to be tidal, wind driven and thermohaline (temperature and salinity driven) currents (Harbison and Wiltshire 1993). However, the higher salinity in the upper reaches of the Gulf indicates that circulation north of Point Lowly is limited to some degree.

The marine environment of Upper Spencer Gulf has developed in response to the relatively unusual physico-chemical conditions that prevail in the region compared with the majority of the coast of southern Australia, including:

- relatively high salinities (from 40 g/L at Point Lowly in winter up to 48.6 g/L at Port Augusta in summer)
- the wide water temperature ranges (from 13 °C in winter up to 29 °C in summer)
- the low levels of natural nutrient input into the system
- the relatively low wave energy that prevails in much (but not all) of the region (IMCRA Technical Group 1998).

The unusual combination of relatively warm water, high salinity and sheltered conditions prevailing in Upper Spencer Gulf supports a distinct assemblage of flora and fauna, including numerous relict species and communities that have tropical affinities. The far northern ecosystems of Spencer Gulf tolerate even more elevated salinities and temperature fluctuations (Shepherd 1983).

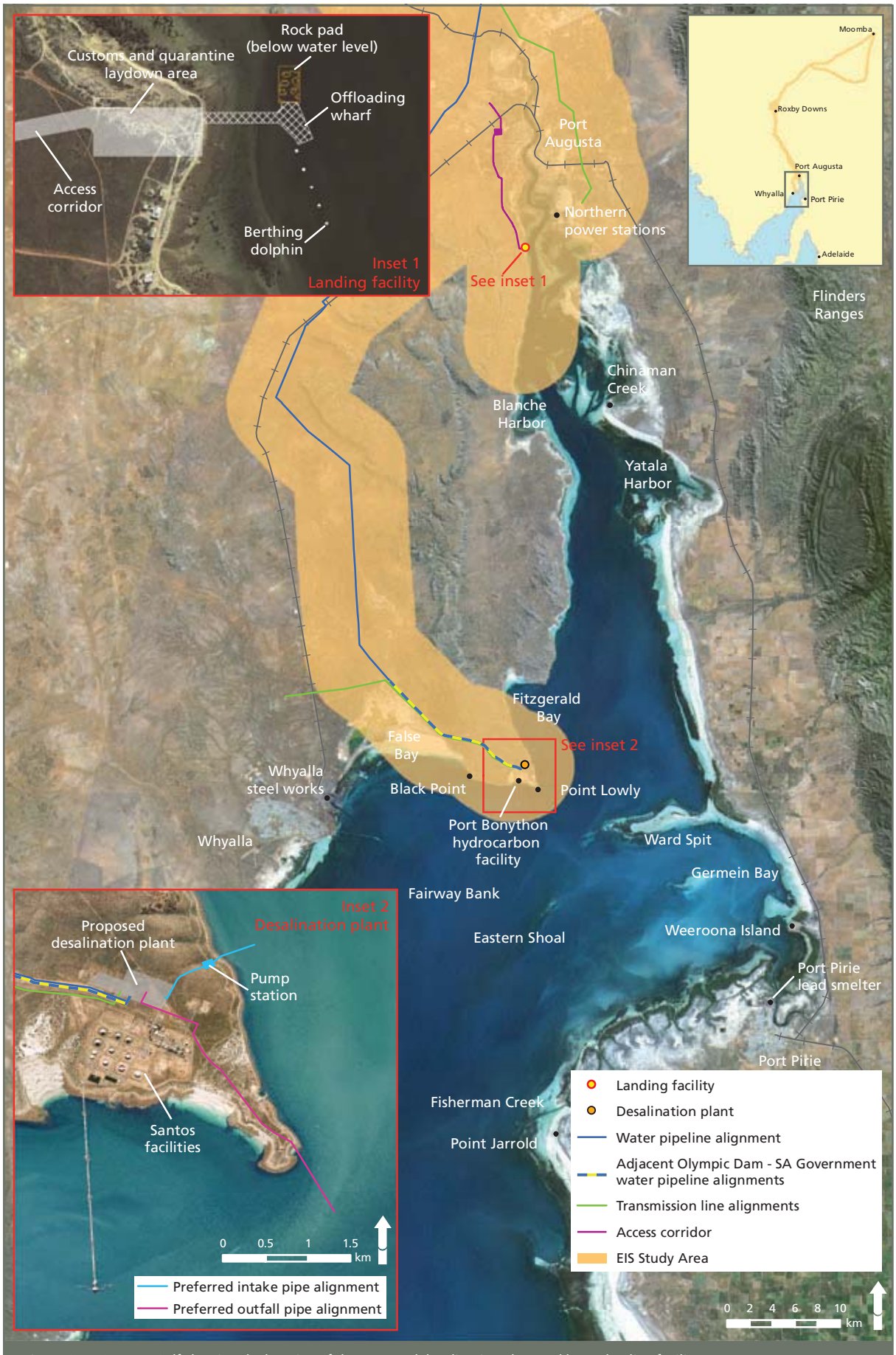


Figure O1.1 Spencer Gulf showing the location of the proposed desalination plant and barge landing facility

O1.2 POINT LOWLY ECOLOGICAL SURVEYS

O1.2.1 Methods

Survey methodology

Thirty-seven uniformly spaced sites throughout the study area were surveyed using scuba during 10-13 April, 15-16 May and 29-30 November 2006, to assess the distribution and composition of benthic assemblages and to collect sediment for contaminant and grain size analysis. The survey area extended 4.3 km west and 2 km north of Point Lowly and 2-3 km out to sea (Figure O1.2).

At each site, divers ran out a 30 m tape measure into the prevailing current. One diver recorded the numbers of animals on the seabed's surface and the percentage cover of algae and seagrass within 1 m of the tape. The diver also collected representative samples to confirm identification. Taxa were identified to the lowest feasible taxonomic level, typically genus or species, although two groups, polychaetes and sponges, were classed in terms of their morphology. The presence of polychaetes was inferred by the presence of tubes, which were classified according to whether they were calcified or not. Sponges were placed into six groups depending on shape and habit (erect, spheroidal, encrusting, cupulate (*Phyllospongia*), tubular or fan). The second diver video-recorded along the transect maintaining a height necessary to encompass approximately 1 m either side of the tape.

GPS location, depth, visibility, current speed and sediment characteristics were also recorded at each site. Although fish were recorded opportunistically, they were not quantitatively surveyed at each site. Fish were not therefore included in the analyses of benthic communities.

An additional survey of the pylons at the end of the Port Bonython jetty was completed to document the encrusting species and fish occupying this habitat.

Statistical analysis

Non-metric multi-dimensional scaling (nMDS) was used to establish differences between biological assemblages at each of the survey sites. This multivariate technique creates representations of multi-dimensional data (i.e. multiple sites and multiple taxa) in a reduced number of dimensions (typically two or three), based on differences in the abundance of each taxa recorded between all pairs of sites simultaneously (Clarke and Warwick 1994, McCune & Mefford 1999). A two dimensional plot was selected for ease of presentation, on the condition that it had an acceptably low stress value (less than 0.2) (Clarke and Warwick 1994).
Similarities between assemblages for each pair of sites were calculated using the Bray-Curtis measure, which is well suited to ecological datasets where many zero values are included (Clarke and Warwick 1994). Prior to these calculations, the data were standardised to create equivalency between counts of animals and measures of the percentage cover of algae. The data were transformed to the square root, as recommended by Clarke and Warwick (1994), to reduce the potentially disproportionate influence of more abundant species. Due to some mixed recording of abundance or percentage cover for some taxa, a presence/absence transformation was also applied for comparison.

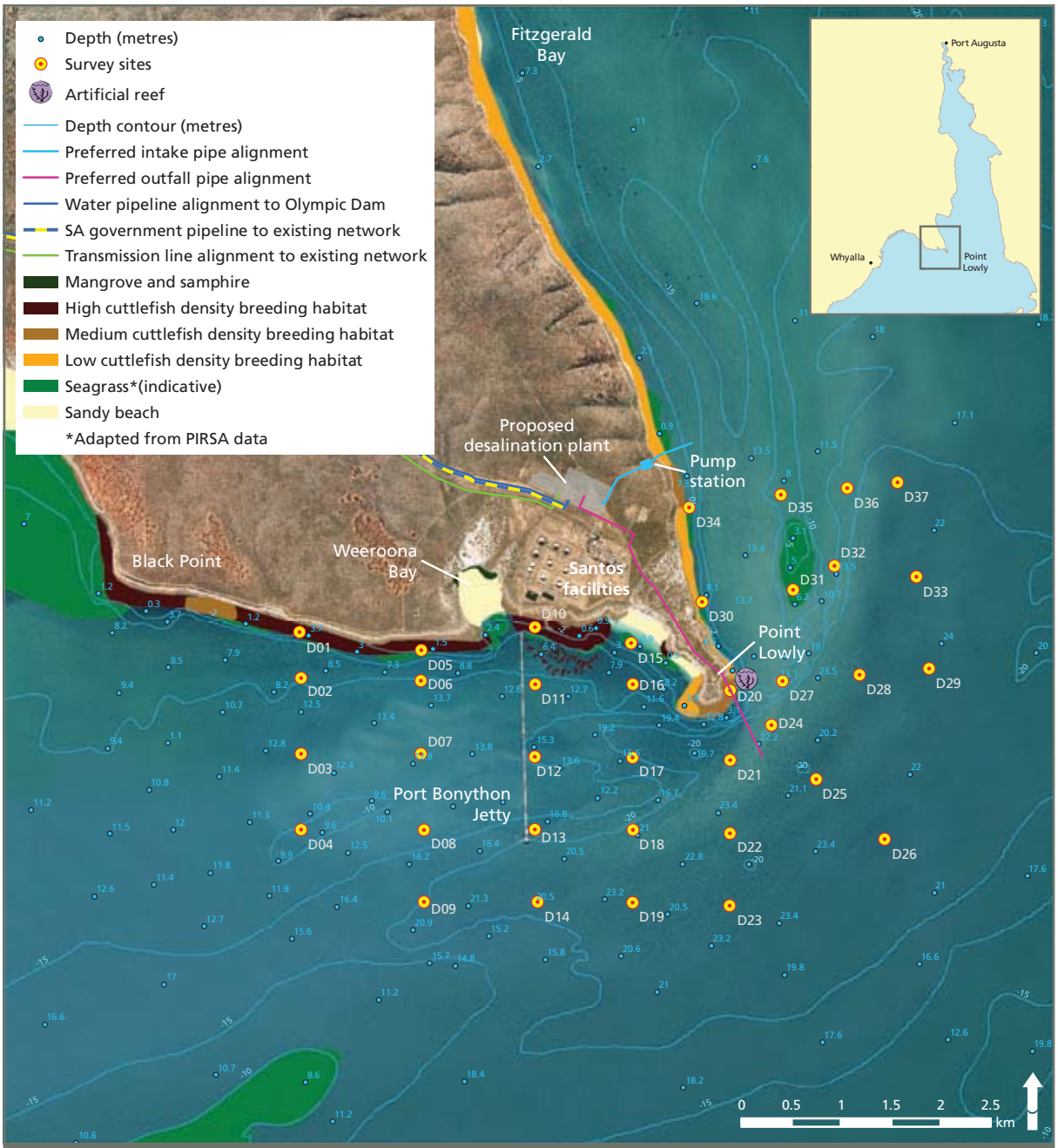


Figure O1.2 Marine benthic survey locations at Point Lowly

O1.2.2 Results and discussion

Habitat description

Depths ranged from 5 m to 29 m and sediment varied from muddy silt, generally in the west, to coarse sand and pebbles and broken reef along the northern shoreline.

Six distinct marine communities were identified in the vicinity of Point Lowly:

- a sandy intertidal community (SEA 1981)
- a rocky intertidal and subtidal reef community (SEA 1981)
- a sparse seagrass community
- a silt/sand community
- a dense sponge community
- a jetty pylon community.

The distribution and abundance of each marine community at Point Lowly are primarily influenced by the substrate type, water depth and the amount of water movement. Schematic profiles of the communities inhabiting the seafloor from the reef habitat near the shore to the deepwater channel habitat 2.8 km off-shore are shown in Figure O1.3 (reef and silt/sand communites), Figure O1.4 (sponge community), Figure O1.5 (key to icons), and Figure O1.6 (the jetty pylon community).

Intertidal community

A small stand of the Southern Mangrove *Avicennia marina* woodland and samphire *Tecticornia* spp. shrubland occurs in Weeroona Bay, which lies within the Santos safety exclusion zone. The nearest extensive mangrove and samphire communities occur 15 km south-west of Point Lowly in False Bay and 10 km north-west in Fitzgerald Bay.

The rocky intertidal community at Point Lowly comprises mostly gastropods (snails), barnacles and crustaceans. The species with the largest range is the Honeycomb Barnacle *Chamaesipho columna*, which inhabits all levels of the intertidal platform. The two most common gastropods are *Austrocochlea* sp. and *Bembicium* sp., with the latter dominant in the higher levels of the intertidal zone. In the mid to lower levels, the Flame Limpet *Chiazacmea flammea* and the calcareous tube-building worm *Galeolaria caespitosa* predominate. The 'worm-tube' gastropod, *Serpulorbis sipho*, occupies the lowest level of the intertidal zone and the upper subtidal zone.

Reef community

Rocky reef habitat lines most of the shore at Point Lowly and extends approximately 150 m out to sea to a depth of 5-7 m. The reef habitat supports a diverse community of flora and fauna that is dominated by a variety of brown and red macroalgae. The dominant canopy forming brown algae are *Cystophora polycystidea*, *Sargassum spinuligerum*, *Caulocystis* spp. and Corkweed *Scaberia agardhii* (dominant where the substrate changes from reef to sand at a depth of 5-6 m). The understory consists of the brown lobed alga *Zonaria* sp. and the red algae *Gigartina brachiata*, *Asparagopsis taxiformis* and *Laurencia* spp.

In-shore, a cloudy envelope of the filamentous brown alga *Hincksia sordida* covered many of the large, canopy-forming, brown algae. Its annual appearance in autumn in Spencer Gulf appears to be related to increased nutrient concentrations and calm conditions. The *H. sordida* bloom is dissipated by winter storms.

The rocky substrate supports numerous encrusting species, including sponges, cnidarians, molluscs and echinoderms. The small mussel, *Mytilus* sp., is the most abundant mollusc in the shallower water, whereas the Hammer Oyster *Malleus meridianus* is more abundant in the deeper sections of the reef. Other common fauna include a variety of sponges, the Spiny Sea Urchin *Heliocidaris erythrogramma*, the Bagpipe Ascidian (Sea Squirt) *Polycarpa viridis* and Razorfish *Pinna bicolor*. A number of reef fish including the Sea Sweep *Scorpis aequipinnis*, the Zebra Fish *Girella zebra* and the Dusky Morwong *Dactylophora nigricans* are also relatively common (see Appendix O2 for a list of fish records in Upper Spencer Gulf).

The reef also provides important breeding habitat for the Australian Giant Cuttlefish *Sepia apama* from May to September (see Appendix O5).

Seagrass community

About 150 m offshore the reef habitat merges with sandy substrate that supports small patches of seagrass, which become slightly larger in the more sheltered water near the end of Point Lowly. The sparse seagrass community consists mainly of the Tapeweeds *Posidonia sinuosa* and *P. australis*. The density of the seagrass is greatest at 3-5 m depth and then gradually declines as water depth increases. Bands of Corkweed *Scaberia agardhii* (an alga) and Eelgrass *Zostera tasmanica* often occur in association with the *Posidonia* community.

In general, currents are too strong and the water too turbid in the vicinity of Point Lowly to support extensive seagrass meadows. The nearest extensive seagrass meadows occur 2-3 km north-east of Point Lowly on Point Lowly Shoal, 5-8 km south-west on Fairway Bank, and 5 km west in False Bay (see Figure O1.2).

The dominant fauna in this zone is the Razorfish *Pinna bicolor*, which gradually increases in density with greater depth, probably in response to the stronger currents offshore. Razorfish act as important substrates for the attachment of a variety of encrusting organisms (see below).

Silt/Sand community

The soft bottom substrate, consisting of silt, sand and shellgrit, is by far the most extensive habitat off Point Lowly, beginning in about 6-10 m of water and extending seaward to the limit of the study area, at a depth of about 29 m. The soft-bottom habitat is dominated by very strong currents and relatively turbid water. In the deep channels where the currents are strongest, sand and shellgrit ripples are an occasional feature of the bottom.

The most common organisms are the Bagpipe Ascidian *Polycarpa viridis* and the Razorfish *Pinna bicolor*, which are uniformly distributed over the benthos and reach densities of $8/m^2$ and $5/m^2$ respectively. Razorfish are a vital component of the benthic community as they provide substrate for a variety of flora and fauna, including (among others) the soft coral *Carijoa multiflora*, numerous sponges, the Hammer Oyster *Malleus meridianus*, the occasional Pencil Urchin *Goniocidaris tubaria impressa* and numerous species of mainly red algae including *Asparagopsis taxiformis*, *Gelinaria ulvoidea* and *Pollexfenia pedicellata*.

Other less common organisms include the Queen Scallop *Equichlamys bifrons*, the Spotted Ascidian *Phallusia obesa* and the Stalked Ascidian *Pyura gibbosa gibbosa*. The occasional Western King Prawn *Melicertus latisulcatus* and Blue Swimmer Crab *Portunus pelagicus* was also observed.

The presence of numerous holes in the substrate indicates that the community of infauna (fauna living in the sediment) is probably diverse and abundant.

Sponge community

One deep water site 600m off Point Lowly (D24, 28 m: Figure O1.2) was dominated by erect, spheroidal, encrusting, cupulate, tubular and fan-shaped sponges, collectively covering more than 70% of the substrate. Although the substrate was similar to the silt/sand bottom community described above, the current regime was stronger.

Hammer Oysters, bryozoans, brittle stars and hydroids were also present, with high abundances relative to the silt/sand bottom community.

Jetty pylon community

The Port Bonython jetty pylons provide significant artificial reef habitat in the Point Lowly region. The pylons support a diverse community of flora and fauna, the structure of which varies according to depth. Shallow sections of pylons (0-5 m depth) are dominated by filamentous green algae, the red alga *Asparagopsis* sp. and mussels. Intermediate depths (5-10 m) support Hammer Oysters *Malleus meridianus*, feathery hydroids *Halocordyle* sp., encrusting sponges, the colonial ascidian *Clavelina* sp. and the soft coral *Carijoa multiflora*. The deepest sections (>10 m) of the pylons support mainly amorphous sponges, the Hammer Oyster and the soft coral.

The jetty pylons also provide habitat for a variety of reef fish. At the time of the survey the most commonly observed fish was Sea Sweep *Scorpis aequipinnis* followed by Moonlighter *Tilodon sexfasciatus*. Other fish observed were the Long-snouted Boarfish *Pentaceropsis recurvisostris*, Magpie Perch *Cheilodactylus nigripes*, Western Talma *Chelmonops curiosus* and Globe Fish *Diodon nicthemerus*.

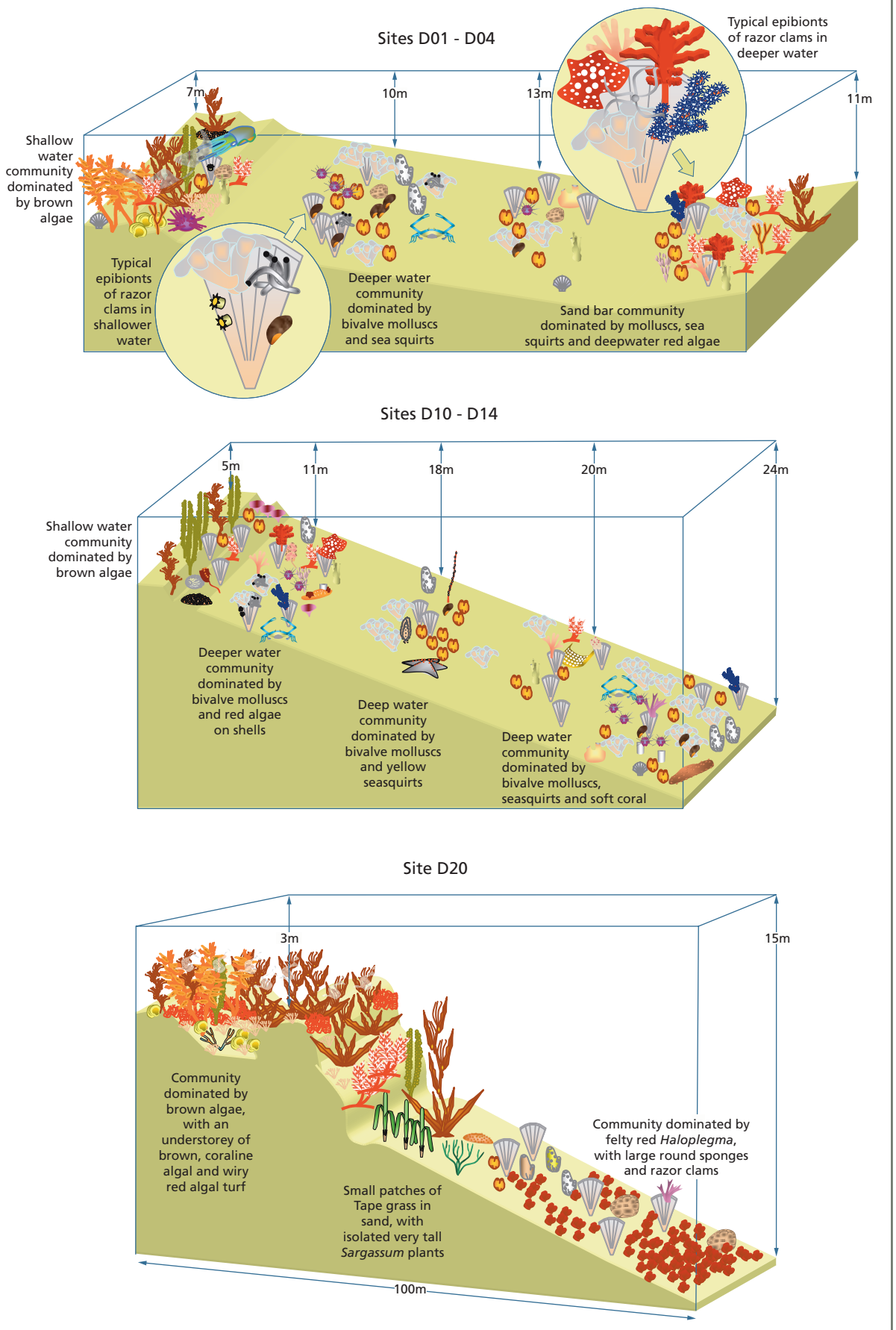


Figure 01.3 Schematic profiles of the reef and silt/sand communities

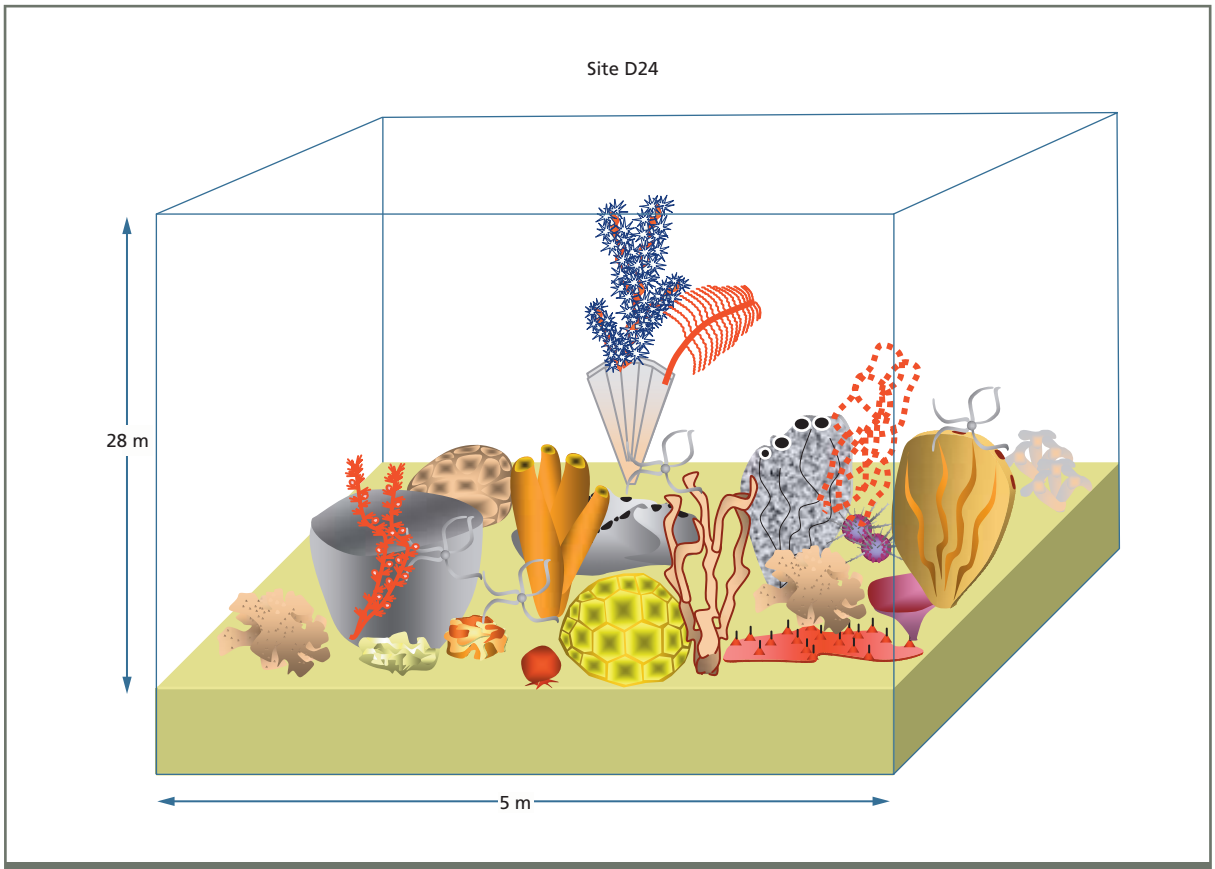
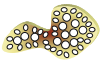
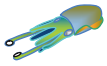
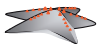


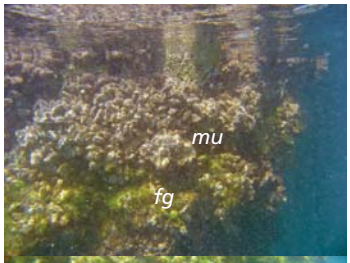
Figure O1.4 Schematic profile of the sponge community

Icon	Common name	Size
ANIMALS		
Filter feeders		
	sea whip	20 cm
	fragile holey bryozoan	10 cm
	lace bryozoan	3 cm
	polychaete worms	2 cm
	queen scallop king scallop	10 cm
	hammer oyster	20 cm
	razor clam	30 cm
	hairy mussel	8 cm
	sac sea squirt	10 cm
	spotted sea squirt	20 cm
	yellow sea squirt	6 cm
	stalked sea squirt	20 cm
	cup-sponge	5 cm
	sponge, large, cup-shaped	10 cm
	sponge, erect, pipe-like	5 cm
	sponge, spheroidal, massive	5 cm
	sponge, erect, finger-like	20 cm
	sponge, erect-planar	10 cm
	sabellid in calcareous tubes	1 cm

Icon	Common name	Size
ANIMALS		
Epizooites		
	stony coral cup	5 mm
	soft coral	40 cm
Algal grazers		
	gastropod molluscs (abalone)	10 cm
	spiny sea urchin	10 cm
Bottom feeders		
	Crustacea – crab (blue swimmer crab)	30 cm
	grubfish	10 cm
	sea cucumbers	20 cm
Sponge grazers		
	Nudibranch molluscs	2 cm
	serpent stars	3 cm
	sea urchins (thorny urchin)	4 cm
Predator		
	Cephalopod mollusc (giant cuttlefish)	40 cm
Bivalve predator		
	Echinoderms sea stars	20 cm
PLANTS		
Canopy plants		
	brown algae (stem-bladder weed)	50 cm
	Cystophora	1.2 m
	Sargassum	1.3 m
	corkweed	1 m

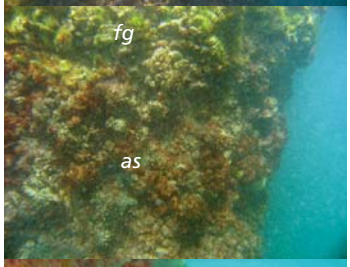
Icon	Common name	Size
PLANTS		
Understorey plants		
	small rabbit ears	15 cm
	brown fanweed	10 cm
	red algae (fluffy red weed)	15 cm
	red tangle weed	20 cm
Soft substrate plant		
	tape grass	40 cm
Turf plant		
	pink, articulated coralline alga	5 cm
Epiphytes		
	snotty weed	diffuse
	red holey membrane weed	20 cm
Deep water epiphytes		
	red filmy weed	10 cm
	red flat-forked weed	4 cm
Deep water plants		
	Green algae (green velvet weed)	40 cm
	red-cups	20 cm
	red beadplant	10 cm
	red gristle weed	30 cm
	red felt weed	10 cm

Figure O1.5 Key to schematic profile icons



+1.0 to -0.25 m

- Mussels (*mu)*
- Filamentous green algae *(fg)*

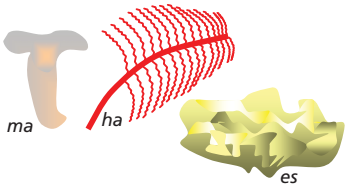


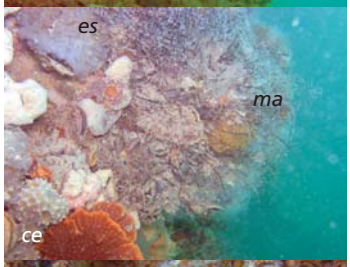
-0.25 to -0.50 m

- Filamentous green algae *(fg)*
- Fluffy red algae (*Asparagopsis, as)*

-0.50 to -2.0 m

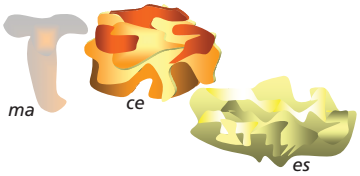
- Hammer oysters (*Malleus, ma)*
- Feathery hydroids (*Halocordyle, ha)*
- Encrusting sponge *(es)*

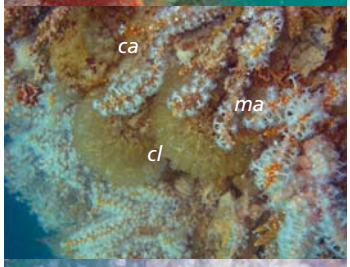




-2.0 to -5.0 m

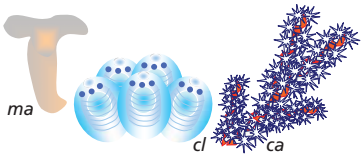
- Hammer oysters (*Malleus, ma)*
- Stony bryozoans (*Celleporaria* spp, *ce)*
- Encrusting sponge *(es)*

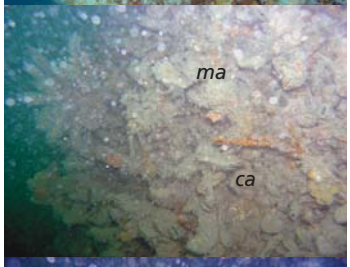




-5.0 to -10.0 m

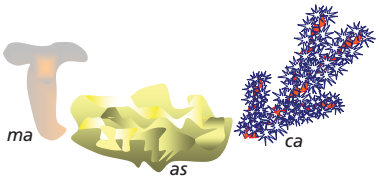
- Hammer oysters *(Malleus, ma)*
- Colonial seasquirts (*Clavelina, cl)*
- Soft coral (*Carijoa, ca)*

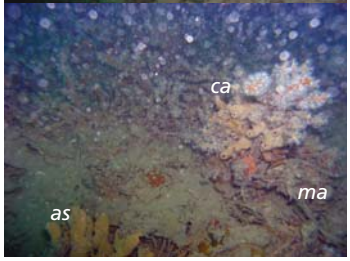




-10.0 to -15.0 m

- Mainly Hammer oysters (Malleus*, ma)*
- Amorphous sponges (*as)*
- Soft coral (*Carijoa, ca)*





-15.0 to -22.0 m

- Mainly Hammer oysters (Malleus*, ma)*
- Amorphous sponges (*as)*
- Soft coral (*Carijoa, ca)*

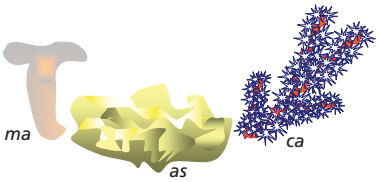


Figure O1.6 Schematic profile of the jetty pylon community

Abundance and diversity

A total of 167 marine taxa were identified in the study area (see Appendix O2), of which 117 were recorded on transects. The number of taxa identified on any particular transect ranged from eight at D28 to 28 at Site D35. In total, 9,639 animals and 275 linear metres of plant cover were recorded along 1,100 m of transects. In total, eight fish species were recorded, six of which were recorded only from the pylon survey (12 species were recorded incidently on shallow reef habitat during surveys of the Australian Giant Cuttlefish described in Appendix O5.5).

Diversity was similar across the three depth ranges sampled, but the proportion of flora and fauna differed substantially according to depth (Figure O1.7 (A and B)). Highest diversity of algal and seagrass taxa was found in shallow waters but the opposite was true for animals, which were most diverse at deep sites. Overall, mean diversity of animals was almost twice that of flora.

Patterns of abundance were similar to those of diversity across the three depth ranges but were more pronounced (Figure O1.7 (C and D)). The average plant and algal cover was more than 13 times greater for sites <10 m in depth than for sites between 21–30 m. Conversely, the mean number of animals at deep sites was almost three times greater than at shallow sites.

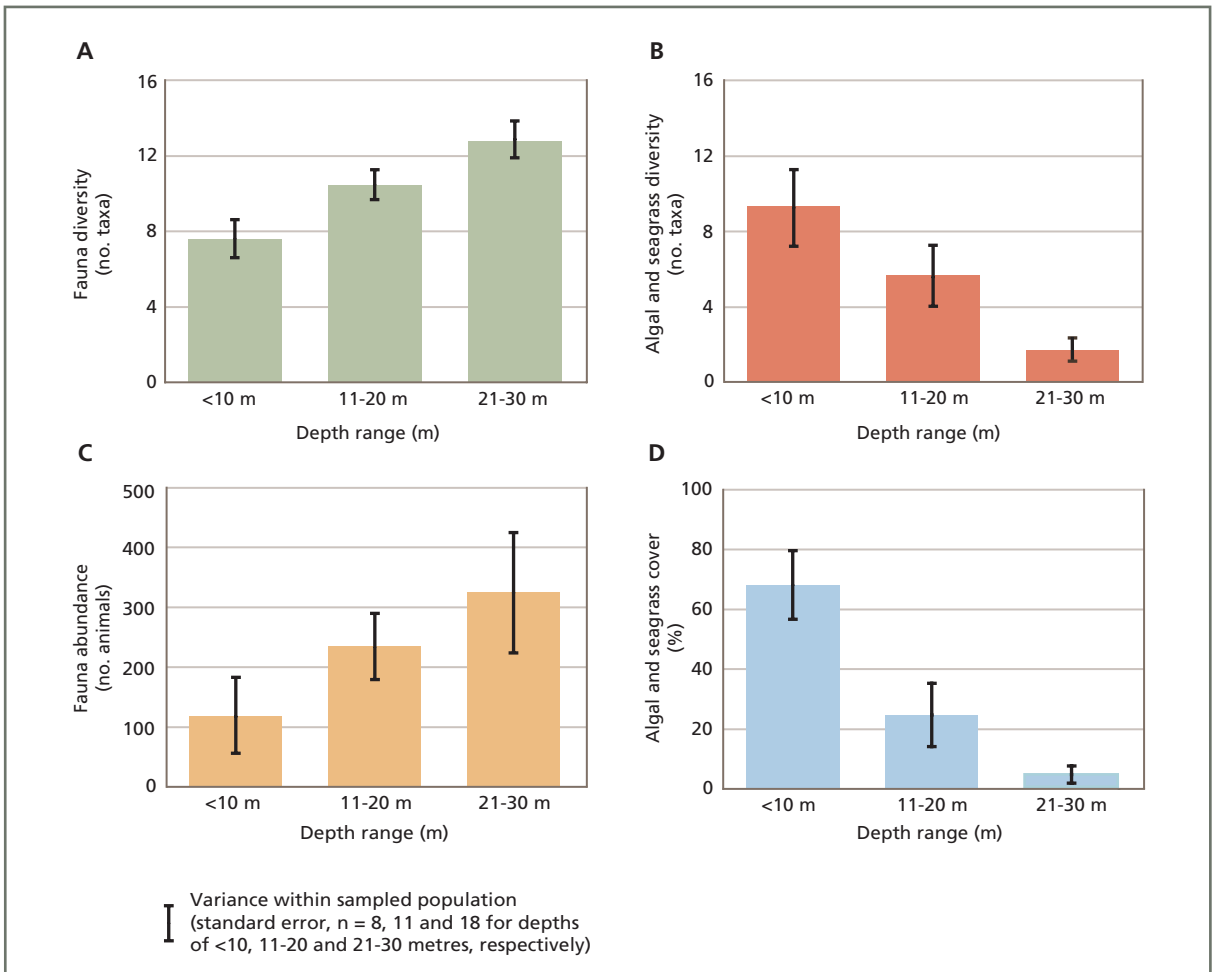


Figure O1.7 Mean diversity of fauna (a) and of algae/seagrass (b), and abundance of fauna (except sponges) (c) and % cover of algae/seagrass (d), by depth range

Biological assemblages

Clear differences in the assemblages at sites in different depth categories were evident from the non-metric multi-dimensional scaling (nMDS) plots on presence/absence (Figure O1.8) and square root transformed data. The depth gradient was strongly correlated with the horizontal ordination axis (Pearson correlation, $r^2 = 0.78$).

Shallow sites along the shoreline (<10 m deep) were the most distinct group and differed more from each other than sites between 11–20 m and 21–30 m. Of the shallow sites, the deepest (D02, 10 m: Figure O1.2) had a silty bottom and a similar assemblage to sites between 11 20 m. The next deepest site (D31, 9 m), had a mixture of silty bottom and seagrass, and a similar assemblage to the 11–20 m sites. Ordination using a less severe transformation than presence/absence (square root) plotted this site nearest to, and in a distinct quadrant with the other seagrass site (D30). Communities at intermediate depth were more similar to each other than communities at shallow and deep sites. The deepest of the intermediate depth sites (D13, 20 m at the end of the jetty), however, had a similar community to those of the deep group. Ordination using a less severe transformation than presence/absence (square root) showed the sponge community site (D24) to be different from all other sites.

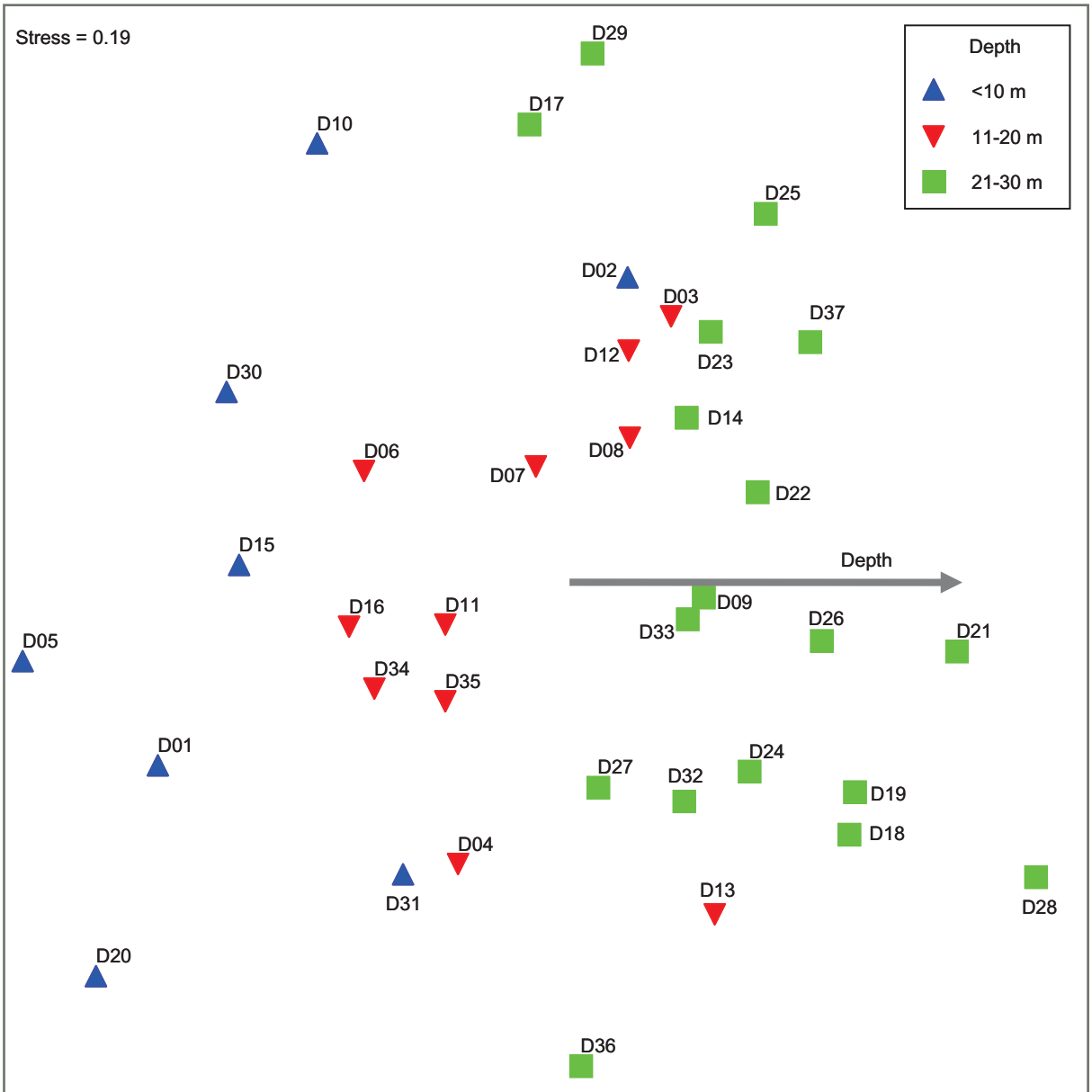


Figure O1.8 Two-dimensional nMDS plot of community composition of all sites based on presence/absence data (i.e. the closer two sites are on the plot, the more similar are their communities)

O1.3 LANDING FACILITY SURVEYS

O1.3.1 Methods

The survey method used at Point Lowly was also used at the landing facility during surveys on 3-5 August 2007. Surveys were performed along three 200-300 m long primary transects, located perpendicular to the shore and ranging in depth from about 2 m to 10 m (Figure O1.9). Benthic communities were surveyed along 30 m secondary transects at three locations along each of the main transects (labelled L1-9 in Figure O1.9). Sediment samples were also taken at each site. A single transect covering the entire depth range was video-recorded.

O1.3.2 Results

Habitat description

Depths (adjusted for tide) ranged from intertidal (0 m) to 9 m. Sediment varied from sand to muddy substrate.
Three distinct marine communities primarily influenced by the substrate type and water depth were identified across secondary transects:

- an intertidal/upper subtidal community
- a shallow, dense seagrass community
- a mid-depth (6-12 m), muddy sediment community.

Intertidal/upper subtidal community

The intertidal/upper subtidal community at L7 was characterised by adjacent mangroves and a number of species of brown macroalgae and invertebrates typical of intertidal areas, including barnacles. There were also elements typical of other communities, including bivalve mounds comprising the Hammer Oyster *Malleus meridianus* and the introduced Pearl Oyster *Pinctada albina sugillata* (see mid-depth community), and high numbers of individual Pearl Oysters (see dense seagrass community).

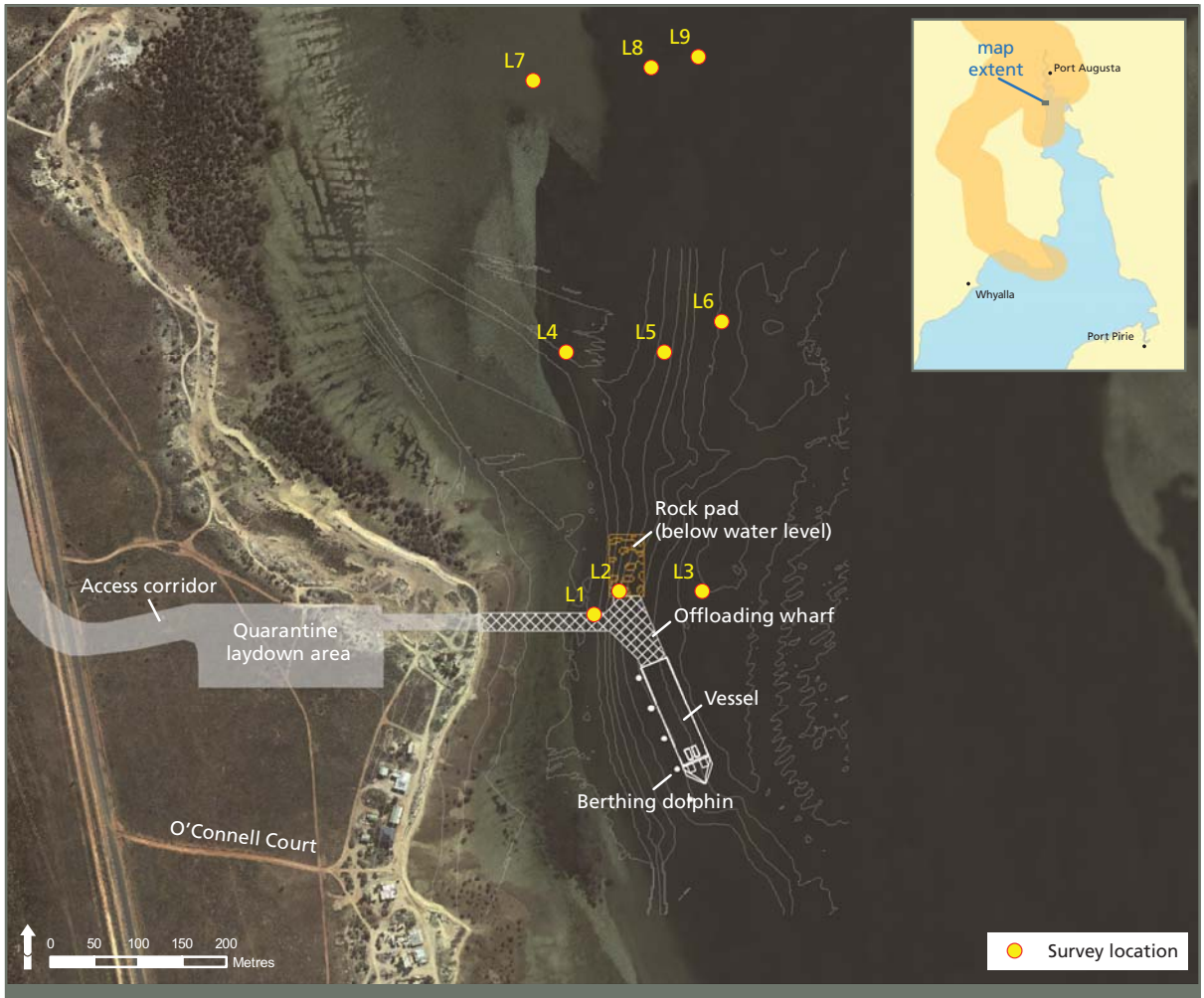


Figure O1.9 Marine benthic survey locations at the proposed landing facility

Dense seagrass community

Seagrass communities were found on transects L1, L4, L5 (a mixed community – see below), and L8. There was 100% cover of *Posidonia australis* on all transects except L5, where bivalve mounds covered 40% of the area but *P. australis* fully covered the areas between them. Transects L5 and L8 had 90–100% cover of the epiphytic filamentous brown algae *Hincksia sordida*[1], and transect L1 also had a sparse cover (10%). There was no *Hincksia* recorded on transect L4. Instead, there was a dense cover (80%) of *Asperococcus bullosus*, a species found only in traces on other transects. Traces of red algae (particularly *Hirsutithallia angustata* and *Spongiclonium*[2] sp.) were found on several transects along with *Warrenia comosa*, *Asparagopsis taxiformis*, *Dasya* spp., *Polysiphonia* sp. and a species from the Ceramiaceae family.

On all seagrass transects, Razorfish were recorded in small numbers (0–10) and the Pearl Oyster was present, sometimes in large numbers (30 at L1 and 200 at L8; in mounds covering 40% of L5). Three species of encrusting ascidian were collected from *Posidonia* blades, and various other invertebrates were recorded (see Table O1.1).

Mid-depth, muddy sediment community

This community was found on transects L2, L3, L5 (a mixed community – see above), L6 and L9. At L2, the green filamentous turfing alga *Derbesia* sp. covered 90–100% of the seafloor, and was mixed with traces of a brown turfing alga *Hincksia* sp. and the red alga *Centoceros clavulatum*. Smaller areas of *Derbesia* were found at L9 (5%). Traces of a number of other red algae were present on one or more of these transects, particularly *Dasya* spp. (most transects) and *Chondria succulenta* (four transects) (see also Table O1.1).

Bivalve mounds formed significant habitat. Mounds of bivalves comprising mainly Hammer Oysters and Pearl Oysters covered up to 60% of the area, and up to 35 Razorfish were also found on some transects. A number of ascidians were attached to these bivalve substrates, including *Ascidia*[2] *thompsoni*, *Halocynthia*[2] *dumosa*, *Phallusia obesa*, and compound ascidians from the genus *Botrylloides*. The stalked compound ascidian *Sycozoa pulchra*[1] was generally present, attached directly to the sediment, and was present in very high numbers (>10/m^2) on transect L3. Encrusting and spheroidal sponges, cnidarians including the soft coral *Carijoa multiflora*, the bryozoan *Triphyllozoon* sp. and the nudibranch *Doriopsilla carneola* were also found on a number of transects.

Species lists

The list of species recorded is included in Appendix O2. The species found on individual secondary transects are listed in Table O1.1.

[1] Species uncertain (genus certain)
[2] Genus uncertain

Table O1.1 Taxa recorded on secondary transects

Quantities are recorded in the form of counts (integers), percentage cover (%)[1], number of mounds (m), or presence only (Y).

Species	Transect									Description
	L1	L2	L3	L4	L5	L6	L7	L8	L9	
Green algae										
Derbesia sp.		90%							5%	Bright-green flaccid filamentous turf on mud
Brown algae										
Asperococcus bullosus	Y			80%				Y		Hollow tubular sausage-shaped brown alga on *Posidonia* leaves
Austronereia[2] *australis*									Y	Yellowish branched thread-like alga with minute terminal hair tufts to 350 mm (possibly also a *Sporochnus*)
Caulocystis spp.	Y						12			Alga to 200 mm tall with denuded brown axes with small peg-like stumps and spindle-shaped fertile branches
Hincksia sp.	Y	Y		Y						Tangled turf weed-branched thread-like greenish-brown turf alga
Hincksia sordida[3]	10%				100%		17%	90%	30%	Snot-weed – slimy tangled grey-brown minute threads in 100 mm clumps, easily detached and floating
Hormophysa cuneiformis							1			Robust alga with three-cornered branched flattened and serrated fronds to 400 mm tall
Hormosira banksii							1			Neptune's Necklace
Red algae										
Asparagopsis taxiformis		Y				Y		Y		Fluffy erect branches to 20 mm tall
Ceramiaceae				Y						Pink thread-like alga with alternate branching
Centroceros clavulatum		Y								Thread-like red alga mixed with *Derbesia* turf
Chondria succulenta			Y						Y	Dark-red finely-branched with 1 mm basal disc to 300 mm tall
Coelarthrum opuntia									Y	Branched chain weed – greenish-pink jointed to 100 mm tall segments with internal gel
Dasya crescens									Y	Red-brown delicate, finely-branched to 200 mm tall
Dasya extensa						Y				Red-yarn Weed – deep-red to 250 mm tall with fluffy branches
Dasya hookeri			Y							Thread-like red alga with small fan-shaped side and terminal branches
Dasya villosa									Y	Red-yarn Weed – deep-red to 250 mm tall with fluffy branches
Dasya sp.					Y					
Hirsutithallia angustata	Y		Y	Y				Y		Thread-like alga deteriorating to a pink colour
Hypnea[2] sp.	Y						Y		Y	Yellowish gristly alga with short pointed branches at right angles to main axes
Polysiphonia sp.								Y		Dark-red creeping alga, short upright branches, on *Posidonia*
Rhabdonia coccinea									Y	Soft red alga with short pointed branches
Spongoclonium[2] sp.		Y		Y						Red thread-like alga with main stalks thickened and coated with debris
Warrenia comosa				Y						Thread-like red alga with furry texture
Seagrass										
Posidonia australis	100%	2%		100%	60%		7%	100%		Tapeweed

Table O1.1 Taxa recorded on secondary transects (cont'd)

Species	Transect									Description
	L1	L2	L3	L4	L5	L6	L7	L8	L9	
Sponges										
Encrusting		4 spp.	1 spp.							Several species on shells
Spheroidal			Y		4	6				
Cnidarians										
Carijoa multiflora						Y				Soft coral with orange branched stalks to 150 mm tall with many flower-like polyps
Plumularia procumbens			Y							Wispy brown stalks with wispy side branches bearing microscopic polyps
Sarcoptilus grandis						1				Orange sea-pen to 100 mm tall with 26+ leaves and smooth axis with swollen base
Unidentified anemone							Y			
Bryozoans										
Celleporaria sp.			Y							Stony bryozoan folded colony with tiny zooid openings bearing a single tooth ventrally
Triphyllozoon sp.						Y			Y	
Polychaetes										
Serpulid worms		Y					Y			In contorted calcareous tube 5 mm across 50 mm long on *Malleus*
Fan worm							1			
Crustacea										
Philyra laevis	Y									Pebble Crab
Barnacles							Y			
Isopods							Y	Y		
Portunus pelagicus									1	Blue Swimmer Crab
Chitons/ Gastropods										
Ischnochiton cariosus				Y						Chiton with brown fan-shaped rows of granulated stripes on each shell
Serpulorbis sipho	Y						16 m		1	False worm shell – worm-like snail in a contorted limey tube to 100 mm long
Doriopsilla carneola		1				1			1	Yellow nudibranch
Bivalves										
Pinna bicolor	3		1	1	6	35	1	10	9	Razorfish
Brachidontes rostratus	Y									Black angular small mussel to 10 mm long with fine ribs. Fossil attached to *Pinctada* shells
Chama ruderalis				Y					1	Bivalve to 30 mm across lower valve flat and attached to *Malleus* or *Pinctada*
Trichomya hirsutus							Y			
Katelysia scalarina							2			
Limaria orientalis		Y								White asymmetric bivalve to 35 mm tall with 20 toothed ribs
Malleus meridianus		10 m	1 m		40%m	60%m	16 m		70 m	Hammer Oyster
**Pinctada albina sugillata*	30	10 m	1 m	Y	40%m	60%m	16 m	200	70 m	Pearl Oyster – 100 mm across with slightly unequal basal wings and delicate spines fracturing to scales
Echinoderms										
Tosia australis	1									Small Biscuit Star – 12 mm across
Ascidians										
Ascidia[2] *thompsoni*		Y	Y		Y		Y		Y	Translucent
Halocynthia[2] *dumosa*		Y				Y			Y	Purple-orange stripes in siphon

Table O1.1 Taxa recorded on secondary transects (cont'd)

Species	Transect									Description
	L1	L2	L3	L4	L5	L6	L7	L8	L9	
Sycozoa pulchra[3]		10	300						Y	Stalked compound ascidian – swollen cylinder of furrowed rows of individuals on a thin stalk 100 mm tall
Phallusia obesa						Y				Spotted ascidian
Botrylloides spp.			Y		Y	Y			Y	
Unidentified compound ascidian						Y				Sand covered mass 50 mm across with thread-like individuals internally
Unidentified Didemnid sp. 2.	Y									Thin grey sheet puncture with small holes on *Posidonia* leaves
Unidentified Didemnid sp. 3.								Y		Buff-coloured sheet with tiny bladders on dead *Posidonia* leaves
Unidentified Didemnid sp. 4.								Y		Grey net-like sheet punctured with openings on *Posidonia*
Unidentified Didemnid sp. 5.									Y	Orange
Fish										
Parapercis haackei						1				Wavy Grubfish

* Introduced species.
[1] Percentage cover total can be greater than 100% due to multiple layers, e.g. epiphytic algae
[2] Genus uncertain.
[3] Species uncertain (genus certain).

O1.4 REFERENCES

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