

## 10. Subtidal Reef

### 10.1 Plant-covered Reefs



Figure 10.1: A: Reef at Edithburgh, eastern Yorke Peninsula. B: Reef at Chinamans Hat Island, Southern Yorke Peninsula. C: Shipwreck off Wardang Island, which forms a reef environment for seaweeds. Photo C by S. Saville, OzDiverDown

Asset	Plant-dominated Reefs
Description	Reefs of various rock types and structural forms, which are covered by seaweeds (macroalgae). In many areas, reef cover comprises larger, structurally-dominant brown seaweeds in the canopy, and an understory of smaller brown, red and green seaweeds.
Main Species	<p><b>Plants</b></p> <ul style="list-style-type: none"> <li>• Common Kelp <i>Ecklonia radiata</i></li> <li>• numerous species of <i>Sargassum</i></li> <li>• numerous species of Zig-zag Weed <i>Cystophora</i></li> <li>• <i>Scytothalia dorycarpa</i> and <i>Seirococcus axillaris</i></li> <li>• Tangleweed <i>Acrocarpia paniculata</i></li> <li>• Grapeweed <i>Caulocystis</i> species</li> <li>• Corkweed <i>Scaberia agardhii</i></li> <li>• species of brown seaweed in the understory, as Peacockweed <i>Lobophora variegata</i>, and Fanweed <i>Zonaria</i> species</li> <li>• Green seaweeds such as species of <i>Caulerpa</i> and <i>Codium</i> species, and flat encrusting species such as <i>Dictyosphaeria sericia</i></li> <li>• Red seaweeds such as <i>Plocamium</i> (several species) and serrated red seaweed <i>Phacelocarpus</i>, Twisted Red Strapweed <i>Osmundaria prolifera</i>, Agarweed <i>Pterocladia lucida</i>, forkweeds such as <i>Rhodymenia</i>, <i>Rhodophyllis</i> and <i>Delisea</i> species, Red Seafan <i>Sonderopelta coriacea</i> and many others</li> <li>• coralline red seaweeds such as <i>Haliptilon roseum</i> and <i>Amphiroa anceps</i>, and several others</li> </ul> <p><b>Fishes</b></p> <ul style="list-style-type: none"> <li>• various Leatherjacket species, Magpie Perch, Dusky Morwong, Sea Sweep, Silver Drummer, Long-snouted Boarfish, Old Wife, Zebra Fish, Six-banded Coralfish, Western Talma, Wrasses (e.g. Blue-throated, Senator Castelnau's, Western Blue Groper), Victorian Scalyfin, Herring Cale, Rainbow Cale, bullseye species, Pencil Weed Whiting, Rock Flathead, weedfishes (various species in <i>Heteroclinus</i> and <i>Cristiceps</i>), Leafy Seadragon and Weedy Seadragon</li> </ul> <p><b>Sharks and Rays</b></p> <ul style="list-style-type: none"> <li>• Wobbegongs, Port Jackson Shark, Smooth Stingray, Black Stingray, Southern Eagle Ray, Southern Fiddler Ray and several other ray species</li> </ul>

	<p><b><i>Invertebrates</i></b></p> <ul style="list-style-type: none"> <li>• Shells, such as Abalone, Turbo Shells, Australian Tulip Shell Cartrut shell, Pheasant Shell / Painted Lady, small gastropod shells (snails), such as Conical Top Shell, kelp shells and mitre shells</li> <li>• Giant Cuttlefish</li> <li>• Nudibranchs and other sea slugs (many species)</li> <li>• Anemones (many species)</li> <li>• colonial ascidians (many species) and solitary ascidians / sea squirts</li> <li>• sea stars</li> <li>• Purple Sea Urchin and Egg Urchin</li> <li>• Orange Feather Star and other featherstar species</li> <li>• sponges</li> <li>• sea spiders</li> <li>• amphipods and Isopods, and other small crustaceans</li> <li>• polychaete worms, ribbon worms, and other worm groups</li> </ul>
<p><i>Main Locations</i></p>	<ul style="list-style-type: none"> <li>• Point Riley</li> <li>• Wardang Island</li> <li>• Point Souttar</li> <li>• “toes” of Yorke Peninsula (e.g. Daly Head to Penguin Point, and locations such as Roysten Head, Shell Beach, Formby Bay and Gleasons Landing)</li> <li>• southern end of Innes National Park (e.g. Cape Spencer; Cable Hut Bay</li> <li>• various locations around Chinamans Hat Island, and Groper Bay / Pondalowie</li> <li>• Part of Althorpe Islands group (see chapter on <b>Rock Islands</b>)</li> <li>• south-eastern YP (e.g. Troubridge Hill, Troubridge Point, Marion Reef)</li> <li>• Black Hill West and Kemp Bay</li> <li>• parts of Investigator Strait, and deeper waters of south-eastern Yorke Peninsula</li> </ul>

***Description***

The seaweeds (correctly called “macroalgae”) which grow on the hard surfaces of reefs, collectively form one of the major marine habitats in the NY NRM region, especially in the southern part. **Figure 10.1** shows examples of plant-dominated reefs within the NY NRM region, and some locations where such reefs exist are shown in **Map 10.1**, based on mapping by DEWNR during the past decade. Plant-covered reefs have a distinct structure, comprising larger, structurally-dominant seaweeds in the canopy, and an understory of smaller brown, red and green seaweeds.

Off southern Yorke Peninsula, there are abundant seaweed forests in shallow waters less than 20m (J. Baker, pers. obs. 2002 - 2014). There are both exposed and concealed rock surfaces, some upward-facing, and others under overhangs, on rock walls, in crevasses, and indentations. These surfaces are covered with a large canopy of brown seaweeds. There are usually three main layers (see Edyvane and Baker 1998; James and Bone 2011, and Baker et al. 2014):

- a flat surface of crustose coralline seaweed, or a short turf of branched coralline seaweed (e.g. *Haliptilon*), and short brown seaweeds (e.g. *Lobophora* and *Zonaria* species) and red seaweeds that are grazed by snails;
- a middle layer (5–20 cm high) of multi-branched green seaweeds (such as *Caulerpa*) and red seaweeds (such as *Plocamium*). In some areas, there are short plants of canopy seaweeds such as *Sargassum*
- a 20–100+ cm high canopy of large brown seaweeds such as Common Kelp *Ecklonia radiata*, and species of *Cystophora* and *Sargassum*.

These seaweed layers form a very rich habitat for many invertebrate species, some of which are discussed in this chapter. The rock type and plant cover on reefs off southern Yorke Peninsula and other areas of NY NRM Region are summarised in **Table 10.1.1**.

### **Ecological Significance of Plant-covered Reefs**

Seaweed-dominated reefs have important physical, chemical, biological and ecological functions. They have been called keystone habitats because they provide many micro-habitats for a rich fauna, and removal of the plant cover causes major changes in the ecology of the entire reef system. The ecological services of seaweed-dominated reefs habitats include the following (from Baker 2000; et al. 2014):

- providing oxygen to marine waters through photosynthesis (Robertson and Hansen 1982);
- stabilising sea floor surfaces, and helping to prevent coastal erosion (by absorption and deflection of wave energy);
- trapping sediments and absorbing nutrients for growth, thus acting as a “biofilter”;
- sand production (e.g. crustose corallines such as *Lithophyllum* and *Sporolithon*, branched coralline algae *Metagoniolithon*, *Amphiroa*, and *Halimnion* are sources of calcium carbonate, as are bryozoans such as *Membranipora membranacea*, foraminifers (tiny shelled organisms), and calcareous-tubed worms such as spirorbids. These animals, along with snail shells, small bivalve shells, calcareous spicules in sponges, echinoids (sea urchins), and solitary and colonial corals, all contribute to coastal sediment production - James and Bone 2011);
- providing micro-habitats for a wide variety of fishes and invertebrates, through layering of the vegetation, often comprising an understory and a canopy (Hirst 2003). Furthermore, different life stages of the same fish species can require specific types of seaweed as habitat during their development;
- food sources and feeding areas for fishes and invertebrates, both directly on the plant blades (by herbivorous juvenile and adult fish, molluscs and other fauna), and indirectly on the small animals (epifauna) which live attached to the seaweed (Shepherd 1973; Shepherd and Cannon 1988; Jones 1988; Jones and Andrew 1990; Holbrook et al. 1990; Shepherd and Baker 2008). A number of reef-dwelling animals rely upon marine plants for their food sources, feeding on the small crustaceans, hydroids, molluscs and worms which live on, under or around seaweed. Some fish species eat the amphipods and other small crustaceans which cling to multi-branched red seaweeds such as species of *Gelidium* (Holbrook et al. 1990), *Plocamium* and *Asparagopsis*, or the blades and holdfasts of kelps and other large canopy seaweeds (e.g. *Sargassum* and *Cystophora* species). Small crustaceans such as amphipods, copepods, and isopods living in stands of seaweed and on coralline seaweed “turf” are the primary food source for juveniles of many reef species, such as goatfish, southern wrasses, kelpfish and leatherjackets (Choat and Ayling 1987). By attenuating currents and creating physical barriers to particle transport, seaweed can also trap mobile food sources (including larvae) for animals living there; they may also assist in localised recruitment of larvae and prevent some species of benthic larvae from being transported away from suitable habitat (Eckman et al. 1989). Hence, seaweed beds have a nursery function, as important as seagrass beds, for providing larval and juvenile fish habitat (Jenkins et al. 1996). Lower down the food chain, shrimps, micro-crustaceans and small marine snails often feed on the mixture of diatoms, encrusting microalgae and coralline algae, bryozoans, bacteria and fungi growing on fronds of seaweed;
- providing habitat for reproduction of fishes and invertebrates. For some near-shore species, stands of seaweed are the centres for courtship behaviours, mating and egg laying and development. Different marine plant associations attract different species, highlighting the importance of maintaining seaweed diversity on coastal reefs (e.g. Jones and Andrew 1990; Andrew and Jones 1990; Kuitert 1996). Marine plants also provide shelter and means of camouflage from predators.

When seaweed breaks off reef surfaces from currents and wave action, especially during winter storms, the pieces which are dislodged (known as drift algae) have important ecological functions in coastal marine systems as they break down:

- the piles of dislodged algae which accumulate on the sea floor provide a refuge from predators, and in some cases a source of food for invertebrates which are eaten by post-larval and juvenile fishes, and small benthic fishes (such as pipefishes and weedfishes and snakeblennies);
- crustaceans which live in the broken down seaweed also form a large part of the diet of near-shore fish species, such as Yellow-eye Mullet, *Aldrichetta forsteri*, School Whiting, *Sillago bassensis*, Australian Herring, *Arripis georgiana*, and estuary catfish / cobbler, *Cnidogobius* sp. (Robertson & Hansen 1982);
- some juvenile reef fish, such as trumpeters, wrasses, leatherjackets, drummers and syngnathids (seahorses and pipefishes) use drift seaweed in the water column as transport and shelter prior to settling on reefs (Kuitert 1996, and J. Baker, pers. obs);

Baker, J. L. (2015) *Marine Assets of Yorke Peninsula*. Volume 2 of report for Natural Resources - Northern and Yorke, South Australia

- the breakdown of seaweed recycles carbon, dissolved nutrients, phosphates, and silicates through marine ecosystems, and crustaceans living and feeding on decomposing seaweed (detritus) which washes up on beaches helps in the breakdown and recycling of organic material (Robertson and Hansen 1982);
- bacteria also break down the beachwrack, and the plant detritus which is formed provides a major food source for mysids, shrimp species, polychaete worms and crabs, which are in turn eaten by near-shore fishes, seabirds and wading birds;
- the seaweed which washes up on the beach or on rock platforms (beachwrack) provides micro-habitats and food for invertebrate species, such as tiny crustaceans, worms and insects;
- the beachwrack-dwelling fauna assists in maintaining other levels of biodiversity, through their role as food sources for other coastal species, such as wading birds, sea birds and crabs.

### ***Distribution of Plant-dominated Reef in NY NRM Region***

Some examples of seaweed-dominated reefs within the NY NRM region are shown in **Table 10.1.1** below, with details of the main plant species which form part of the reef cover.

**Table 10.1.1: Examples of plant-covered reef areas in NY NRM region, and details of main species cover. From Edyvane and Baker 1996 and 1998; SARDI S.A. Benthic Survey data 1993, 1995, unpublished; J. Baker, pers. obs. 2002, 2008, 2013, 2014; Shepherd and Brook 2002; Baker 2004; Baker et al. 2009, 2013, 2014).**

<b>Site</b>	<b>Substrate &amp; Relief</b>	<b>Main cover / algal canopy species</b>
<b>south-eastern Yorke Peninsula (e.g. Edithburgh area)</b>	aeolianite reef, low relief in shallow subtidal (1-2m), higher relief off shore	<i>Ecklonia radiata</i> kelp, grapeweed <i>Caulocystis</i> , and mixed <i>Sargassum</i> species; various multi-branched red seaweeds in understorey. In the shallows, some of the red seaweeds on sand-covered rock surfaces include <i>Chondria</i> , <i>Gelidium Mychodea</i> and <i>Laurencia</i> .
<b>south-eastern "heel" YP (e.g. Troubridge Hill, Troubridge Point, Marion Reef)</b>	aeolianite reefs, 5-10+m deep	Mixed <i>Cystophora</i> species and kelp <i>Ecklonia radiata</i> dominate reefs, with lesser cover of <i>Sargassum</i> species and the large red <i>Osmundaria prolifera</i> as sub-dominants. The understorey includes mixed calcareous / coralline red algae and a diversity of other red seaweeds (e.g. species of <i>Erythroclonium</i> , <i>Rhabdonia</i> , <i>Areschougia</i> , <i>Webervanbossaea</i> , <i>Dasya</i> , <i>Laurencia</i> , <i>Champia</i> , <i>Euptilota</i> , <i>Ptilocladia</i> , and <i>Asparagopsis armata</i> , among others); green seaweeds (e.g. species in <i>Caulerpa</i> and <i>Codium</i> ; <i>Dictyosphaeria sericea</i> ), and small browns (e.g. <i>Lobophora variegata</i> ). Species of multi-branched red seaweeds such as <i>Erythroclonium</i> , <i>Plocamium</i> , <i>Cliftonaea</i> , <i>Cladurus</i> and <i>Areschougia</i> , as well <i>Osmundaria prolifera</i> , are locally abundant in the understorey of <i>Cystophora</i> -dominated reefs in the Troubridge Hill and Marion Reef areas.
<b>Black Hill West</b>	Sand-covered reef patches and seagrass on sand, at the edge of reef platform; relief 0.5 to 1m	<i>Amphibolis</i> seagrass with abundant calcareous red macroalgal epiphytes; reef patches with <i>Ecklonia</i> , and species of <i>Cystophora</i> (e.g. <i>C. moniliformis</i> ) and <i>Sargassum</i> , with turfing brown and calcareous red macroalgae understorey; sponges and ascidians under low ledges.
<b>Kemp Bay (west)</b>	Heavily dissected calcareous platform reef, with sand and rubble	Sparse cover of low <i>Ecklonia</i> and <i>Cystophora moniliformis</i> over reef patches densely covered with mixed calcareous macroalgae, multi-branched red macroalgae and turfing brown macroalgae; higher relief reef platform edges with sponges, ascidians, and cnidarians on underside.

Table 10.1.1 (cont.):

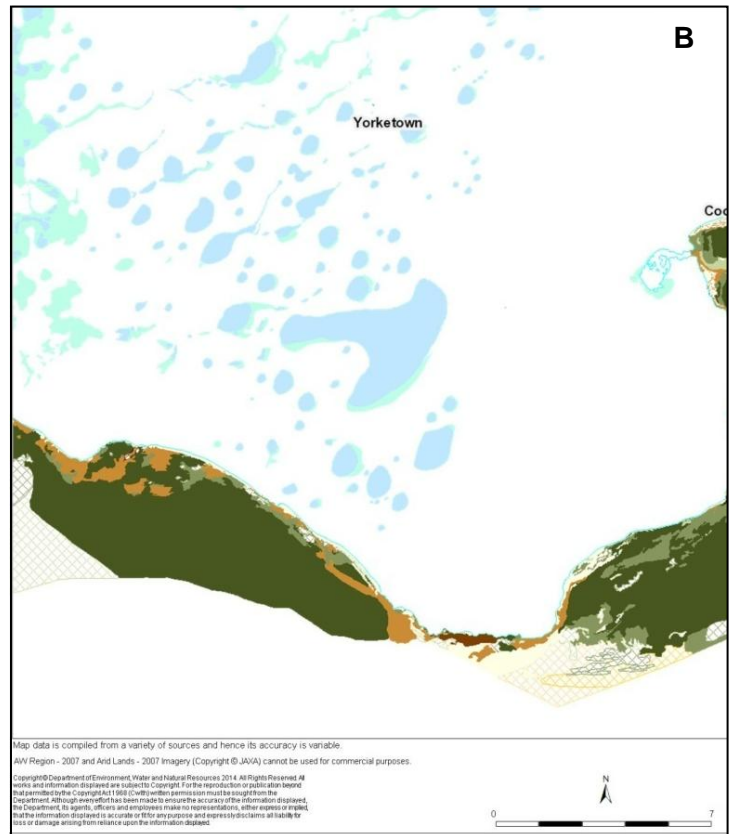
Site	Substrate & Relief	Main cover / algal canopy species
parts of Investigator Strait, and deeper waters of south-eastern Yorke Peninsula	Aeolianite reef, 5-10m relief	Canopy dominated by common kelp <i>Ecklonia radiata</i> .
Chinamans Hat Island lagoon	Calcarenite reef, 1-2m relief	Canopy cover approx. 70%. Main species include <i>Cystophora moniliformis</i> and <i>C. siliquosa</i> . Patches of <i>Amphibolis</i> seagrass.
Chinamans Hat Island (southern side, and centre of beach on eastern side, shallow)	Low reef	Canopy cover approx. 70% off beach, and 90% on southern side. Main species include <i>Cystophora moniliformis</i> and <i>C. siliquosa</i> . Patches of <i>Amphibolis</i> seagrass. Multi-branched and calcareous red macroalgae, and species of <i>Caulerpa</i> and zoanthids in understory.
Chinamans (reef on southern side, 10-15m)	Calcarenite? reef, 1-2m relief	Canopy cover approx. 90%. Main species include <i>Cystophora siliquosa</i> and other <i>Cystophora</i> species; lesser cover of <i>Ecklonia</i> , <i>Scytothalia dorycarpa</i> and other brown canopy species; large red macroalgae such as <i>Plocamium</i> and <i>Phacelocarpus</i> species and patches of green <i>Caulerpa</i> species. Understorey of articulated coralline red algae and turfing brown algae.
southern end of Innes National Park (e.g. Cape Spencer; Cable Hut Bay)	Granite, with overlying calcarenite in shallows	On deeper, more wave-exposed reefs at 5m to 10m, plants which dominate the canopy include <i>Cystophora</i> species (e.g. <i>C. siliquosa</i> ), <i>Sargassum</i> species (e.g. <i>S. fallax</i> ), <i>Carpoglossum confluens</i> , <i>Acrocarpia paniculata</i> and <i>Ecklonia radiata</i> , with understory plants including a dense cover of green seaweeds (e.g. particularly <i>Caulerpa</i> species on reefs around 10m), mixed red seaweeds such as species of <i>Plocamium</i> , <i>Areschougia</i> , and <i>Phacelocarpus</i> , and a dense and abundant cover of encrusting and articulated coralline red algae.
Groper Bay / south Pandalowie	Calcarenite reef, 1.5m relief	Canopy cover approx. 90% in places. "Neptunes Necklace" plant <i>Hormosira banksii</i> and various green seaweeds are common closer to shore (e.g. 0+m – 2m). <i>Cystophora moniliformis</i> is one of the dominant seaweeds in the shallow reef area (e.g. 1m) on the western side of Pandalowie Bay. In the shallow subtidal (about 2m), <i>Ecklonia</i> kelp and species of <i>Cystophora</i> (e.g. <i>C. moniliformis</i> , <i>C. retorta</i> ) are common, with green <i>Caulerpa</i> species in the understory. In deeper waters, mixed <i>Cystophora</i> species (including <i>C. siliquosa</i> , <i>C. moniliformis</i> , <i>C. monilifera</i> and <i>C. retorta</i> ) occur, with "corkweed" <i>Scaberia agardhii</i> . Abundant articulated coralline algae (several species) in understory; also species of <i>Caulerpa</i> abundant (e.g. <i>C. racemosa</i> , <i>C. brownii</i> , <i>C. cactoides</i> , amongst others) and <i>Zonaria spiralis</i> . (NB Patches of <i>Amphibolis</i> seagrass also present).
headland north of Groper Bay	Calcarenite reef, 2 - 3m relief	Between 2m and 10m deep, mainly <i>Ecklonia</i> , with lesser cover of mixed <i>Cystophora</i> species (e.g. <i>C. siliquosa</i> , <i>C. moniliformis</i> , <i>C. racemosa</i> , <i>C. retorta</i> ), and green <i>Caulerpa</i> species in the understory.

Table 10.1.1 (cont.):

Site	Substrate & Relief	Main cover / algal canopy species
<b>Althorpe Islands</b>		see separate chapter on <b>Rock Islands</b>
<b>Royston Head</b>		Shallow reefs (e.g. 5m) are dominated by a large number of species of brown seaweeds, including <i>Seirococcus axillaris</i> , <i>Scytothalia dorycarpa</i> , <i>Cystophora</i> and <i>Sargassum</i> species, and <i>Ecklonia radiata</i> . Mixed green seaweeds (e.g. species of <i>Caulerpa</i> ) and coralline red algae dominate the understory. The reef at Royston Head at 10m has dominant cover that is similar to that on the coastal and island reefs of southern Eyre Peninsula, dominated by several <i>Sargassum</i> species and <i>Myriodesma integrifolium</i> , with a dense and diverse understory of mixed red seaweeds, such as species of <i>Micropeuce</i> , <i>Areschougia</i> , <i>Polysiphonia</i> and many others.
<b>Shell Beach (southern end of Browns Beach)</b>	granite reef (southern end of Browns Beach)	South of Browns Beach, part of the Shell Beach area comprises sand habitat and smooth granite blocks up to 2m high, with a mixed community of brown seaweeds between around 1m and 10m in the reef areas, comprising <i>Ecklonia</i> , mixed species of <i>Cystophora</i> including <i>C. racemosa</i> and <i>C. retorta</i> , <i>Carpoglossum confluens</i> , <i>Acrocarpia paniculata</i> , <i>Sargassum fallax</i> and <i>S. linearifolium</i> , and other species.
<b>Formby Bay and Gleesons Landing</b>	Calcarenite reef and granite boulders, 0.7 - 1m relief (Gleesons) calcarenite reef and granite reef	At Gleeson's, canopy cover approx. 50 - 60%. Main species include dense, low cover of <i>Cystophora</i> and <i>Caulocystis</i> spp.; minor cover of <i>Scaberia</i> , with articulated coralline and brown turf understory, plus sessile invertebrates (zooanthids etc). Macroalgae interspersed with patches of <i>Amphibolis</i> and <i>Posidonia</i> seagrass. Reef at Formby Bay is dominated by various species of <i>Cystophora</i> , and kelp <i>Ecklonia radiata</i> . The granitic shore reef in the Gleesons Landing area has "corkweed" <i>Scaberia agardhii</i> , species of <i>Cystophora</i> , and <i>Ecklonia</i> as dominant reef cover between 2m – 6m.
<b>submerged reef and islet off Daly Head</b>	granite reef	Brown seaweeds which thrive in wave-exposed conditions, such as <i>Carpoglossum confluens</i> , <i>Ecklonia radiata</i> and <i>Acrocarpia paniculata</i> have been recorded in the canopy, with lesser cover of <i>Cystophora grevillei</i> and <i>C. platylobium</i> , and red seaweeds in the understory, such as species of <i>Callophyllis</i> , <i>Callophycus</i> and <i>Cladurus elatus</i> ; articulated coralline algae such as <i>Haliptilon roseum</i> and species of <i>Amphiroa</i> , <i>Metagoniolithon</i> , and <i>Cheilosporum</i> ; turfing brown seaweeds such as <i>Homoeostrichus sinclairii</i> , and a dense cover of crustose coralline algae on the reef surfaces.
<b>Point Souttar</b>	Low, silt-covered reef; 0.2 - 0.5m relief; sand	Low <i>Sargassum</i> plants and sparse <i>Ecklonia</i> ; abundant fine, filamentous brown macroalgae covering reef and canopy plants. Turfing red and brown filamentous seaweeds on reef surfaces.

**Table 10.1.1 (cont.):**

Site	Substrate & Relief	Main cover / algal canopy species
<b>Wardang Island, western side</b>	Calcareous reef	Patch reefs in the area are dominated by mixed species of brown and red seaweeds, and invertebrates. At the time of a 1995 survey, calcareous reef at 10m on the W side was dominated by species of <i>Cystophora</i> (such as <i>C. expansa</i> , <i>C. monilifera</i> , <i>C. moniliformis</i> ), with lesser cover of <i>C. brownii</i> and <i>Sargassum</i> species such as <i>S. sonderi</i> and <i>S. spinuligerum</i> ; the large red "leathery" seaweed <i>Osmundaria prolifera</i> , with the turfing brown <i>Lobophora variegata</i> common in the understory, with various invertebrates (e.g. ascidians). "Bare" calcareous rock was also recorded in some areas at 10m.
<b>Wardang Island, southern side</b>	Calcareous reef	On the SW side of the island is a small bay, with patchy reef offshore. Towards the south and east, on shallower reef (5m), dominant species recorded during a 1995 survey included brown seaweeds such as <i>Sargassum heteromorphum</i> , <i>S. linearifolium</i> and <i>Cystophora expansa</i> , with "corkweed" <i>Scaberia agardhii</i> and the red <i>Osmundaria prolifera</i> in patches. Few understory species were recorded, other than crustose coralline algae on the reef, and the multi-branched red <i>Cladurus elatus</i> , with minor cover of the turfing brown <i>Cladostephus spongiosus</i> .
<b>Point Riley</b>	Boulders of various sizes. 1 – 2m relief. Many crevices and undercuts.	Canopy cover approx. 90%. Dense cover of mixed <i>Sargassum</i> species, interspersed with patches of filamentous red macroalgae, and the green <i>Caulerpa brownii</i> . <i>Sargassum</i> heavily covered with opportunistic bloom of brown <i>Hincksia sordida</i> .



**Map 10.2.1: Major areas of plant-covered reef in NY NRM Region. (A) south-western Yorke Peninsula; (B) south-eastern Yorke Peninsula; (C and D) eastern Yorke Peninsula.**



### Seaweed Species on Plant-covered Reefs

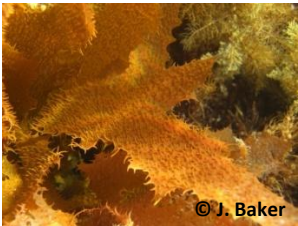
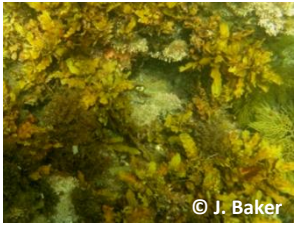




Some of the most commonly occurring canopy-forming brown seaweeds which are found on reefs in the southern part of the NY NRM region include those in **Table 10.1.2** below. Plant-dominated reefs occur throughout the region. Species of the large brown canopy seaweeds *Cystophora* and *Sargassum* dominate many of the plant-covered reefs in the NY NRM region, along with the common kelp *Ecklonia*, particularly in areas of moderate wave exposure, and “corkweed” *Scabera agardhii* in more sheltered reef areas, such as those in eastern Spencer Gulf.





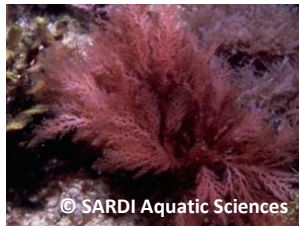







In many of the reef areas along the southern “foot” of the Peninsula, broken calcareous reef is dominated by “corkweed” *Scabera agardhii*, several species of the brown seaweeds *Cystophora* and *Sargassum*, the brown *Caulocystis*, the small red “bubble weed” *Botryocladia sonderi*, the large leathery red *Osmundaria prolifera*, green seaweeds such as *Caulerpa* (e.g. *C. flexilis*) and *Dictyosphaeria sericea*, and turfing brown seaweeds on rock surfaces (e.g. *Lobophora variegata* and other species) (Edyvane and Baker, 1998 and SARDI S.A. Benthic Survey data, unpublished). The kelp *Ecklonia*, and various species of *Cystophora* are common in deeper waters, to at least 10m (Edyvane and Baker 1998; Shepherd and Brook 2002).





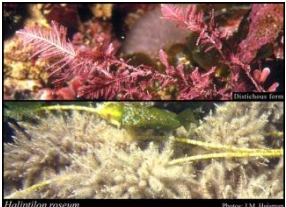





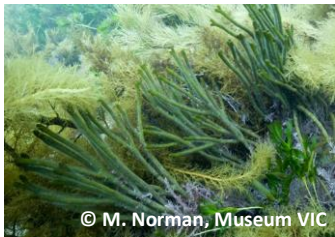

In some of the more wave-exposed areas off the southern “foot” of Yorke Peninsula, robust canopy species such as *Acrocarpia paniculata*, *Scytothalia dorycarpa*, *Seirococcus axillaris*, and *Carpoglossum confluens* also occur (Edyvane and Baker 1998; Baker et al. 2014).

In parts of southern Yorke Peninsula and Investigator Strait, calcareous red seaweeds are common on reef surfaces under the canopy (Edyvane and Baker 1998), and on south-eastern Yorke, in high current areas, the understory plants under the canopy include the large leathery red seaweed *Osmundaria prolifera*; a diversity of multi-branched red seaweeds, in the genera *Erythroclonium*, *Plocamium*, *Rhabdonia*, *Areschougia*, *Webervanbossaea*, *Laurencia*, *Champia*, *Cliftonaea*, *Cladurus*, *Euptilota*, and *Ptilocladia* (amongst others), as well as the “fluffy” reds *Asparagopsis armata*, and species in *Dasya* and *Wrangelia* (Edyvane and Baker 1998).

**Table 10.1.2: Examples of plant species which are common on reefs in NY NRM region.**

BROWN SEAWEEDS			
Species Name	Representative Image	Species Name	Representative Image
<i>Ecklonia radiata</i> (kelp)	 © J. Baker	<i>Sargassum</i> species (e.g. <i>S. fallax</i> and <i>S. linearifolium</i> , <i>S. spinuligerum</i> , <i>S. sonderi</i> ) and <i>Sargassopsis</i> species (e.g. <i>S. heteromorphum</i> )	 © J. Baker
<i>Acrocarpia paniculata</i>	 © University of New Brunswick	<i>Cystophora</i> species (e.g. <i>C. moniliformis</i> , <i>C. monilifera</i> , <i>C. siliquosa</i> , <i>C. retorta</i> )	 © M. Norman, Museum VIC
<i>Scytothalia dorycarpa</i>	 © H. Crawford	<i>Scabera agardhii</i> (corkweed)	 © K. Smith

<b>BROWN SEaweEDS</b>			
<i>Seirococcus axillaris</i>	 © M. Norman, Museum VIC	<i>Caulocystis</i> species	 © J. Baker
<i>Lobophora variegata</i>	 © Smithsonian Institution	<i>Zonaria</i> species (e.g. <i>Z. spiralis</i> and <i>Z. angustata</i> ) and <i>Homoeostrichus sinclairii</i>	 © J. Finn, Museum Victoria
<b>RED SEaweEDS</b>			
<b>Species Name</b>	<b>Representative Image</b>	<b>Species Name</b>	<b>Representative Image</b>
<i>Plocamium</i> (several species)	 © SARDI Aquatic Sciences	<i>Osmundaria prolifera</i>	 © J. Baker
<i>Phacelocarpus peperocarpus</i>	 © Royal Botanic Gardens & Domain Trust. Photo by J. Taylor	<i>Pterocladia lucida</i>	 © G. Saunders, UNB
<i>Rhodymenia foliifera</i> (= <i>R. australis</i> )	 © R. Baldock, State Herbarium of SA	<i>Sonderopelta coriacea</i>	 © J. Finn, Museum Victoria
<i>Gelidium australe</i>	 © R. Baldock, State Herbarium of SA	<i>Callophycus oppositifolius</i>	 Photo by J. Huisman. © WA Herbarium, DPW ( <a href="http://florabase.dpaw.wa.gov.au">http://florabase.dpaw.wa.gov.au</a> )

RED SEAWEEDS (continued)			
Species Name	Representative Image	Species Name	Representative Image
<i>Ballia callitricha</i>	 © Royal Botanic Gardens & Domain Trust. Photo by J. Taylor	<i>Melanthalia abscissa</i>	 © R. Baldock, State Herbarium of SA
<i>Delisea</i> species	 © University of New Brunswick	<i>Rhodophyllis</i> species	 © University of New Brunswick
<i>Halptilon roseum</i>	 Photo by J. Huisman. © WA Herbarium, DPW ( <a href="http://florabase.dpaw.wa.gov.au">http://florabase.dpaw.wa.gov.au</a> )	<i>Amphiroa anceps</i>	 Photo by J. Huisman. © WA Herbarium, DPW ( <a href="http://florabase.dpaw.wa.gov.au">http://florabase.dpaw.wa.gov.au</a> )
<i>Metagoniolithon</i> species (e.g. <i>M. radiatum</i> )	 © J. Baker	<i>Cheilosporum sagittatum</i>	 Photo from <a href="http://www.4shared.com">www.4shared.com</a>
GREEN SEAWEEDS			
Species Name	Representative Image	Species Name	Representative Image
<i>Caulerpa flexilis</i>	 © J. Finn, Museum Victoria	<i>Caulerpa brownii</i> and other <i>Caulerpa</i> species	 © C. Hall
<i>Codium</i> species (e.g. <i>C. australicum</i> , <i>C. galeatum</i> , <i>C. pomoides</i> and others)	 © M. Norman, Museum VIC	<i>Dictyosphaeria sericea</i>	 © J. Baker

**Fishes in Plant-covered Reef Habitats**

Along the southwestern “foot” of Yorke Peninsula, many of the fishes which live on reefs which are dominated by seaweeds include those species shown in **Table 10.1.3** (from Savarton et al. 1987; Baker 2004; Shepherd and Baker 2008; Baker et al. 2008, 2009; Shepherd and Baker, unpubl. data; J. Baker, pers. obs.). Reef fishes which live in the vicinity of seaweed-dominated reefs include the following groups (from Shepherd and Baker 2008, and J. Baker pers. obs.):

- mid-water schooling species that range widely, and often school above reef habitats (examples include Sea Sweep, Barber Perch);
- reef-dwelling species that live near the sea floor, and swim within 1–2 m of the reef surface (e.g. Dusky Morwong, Silver Drummer; Magpie Perch; Blue-throated Wrasse and some of Leatherjacket species);
- reef-dwelling species that live below the seaweed canopy, and these species often have small home ranges or territories (Senator Wrasse; Victorian Scalyfin; Herring Cale); and
- cryptic species, active mainly at night (e.g. Southern Velvetfish; Red Velvetfish;) and cave-dwelling species (e.g. Yellow-headed Hulafish; Cardinalfishes; White-barred Boxfish).





Less commonly seen species include strongly site-associated long lived fishes of conservation concern, such as Western Blue Groper (see chapter on **Blue Groper**) and Long-snouted Boarfish.

Seaweed-covered reefs are a major habitat for reef fishes in NY NRM region, because such areas provide important habitat for feeding, breeding, shelter from storms, and escape from predators. Feeding opportunities on seaweed-covered reefs include:













- larger, more mobile fishes preying on smaller fishes which live in the reef habitat;
- “picker” fishes, such as Magpie Perch, Moonlighter, Western Talma and many of the leatherjacket species, eating small invertebrates found on reef surfaces, and under the seaweed canopy, or invertebrates which are attached to the seaweed stems and blades;
- small fishes, such as weedfishes and tripefins, live on the sea floor or amongst seaweed, and feed on small crustaceans such as amphipods; and
- fishes directly eating the seaweed itself. Examples of herbivorous fishes which eat seaweed include Herring Cale, Rainbow Cale, Victorian Scalyfin, Silver Drummer, and Southern Sea Carp / Marblefish.

(Shepherd and Baker 2008a, 2008b; Shepherd 2014, and see **Ecological Significance of Plant-covered Reefs**).




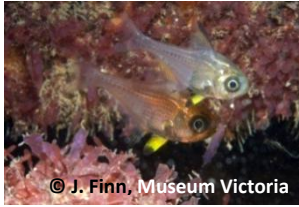




**Table 10.1.3: Examples of fishes associated with reefs which are dominated by seaweeds, in the NY NRM region.**

Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
<i>Acanthaluteres brownii</i> Spiny-tailed Leatherjacket	 © R. Stuart-Smith, Reef Life Survey	<i>Meuschenia hippocrepis</i> horseshoe LJ	 © A. Brown
<i>Meuschenia flavolineata</i> yellow-striped leatherjacket	 © M. Norman, Museum VIC	<i>Cheilodactylus nigripes</i> Magpie Perch	 © J. Lewis

**Table 10.1.3 (continued):** Examples of fishes associated with reefs which are dominated by seaweeds, in the NY NRM region.

Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
<p><i>Dactylophora nigricans</i> Dusky Morwong</p>	 <p>© J. Lewis</p>	<p><i>Kyphosus sydneyanus</i> Silver Drummer</p>	 <p>© R. Ling, Flickr, CC Licence</p>
<p>Western Blue Groper <i>Achoerodus gouldii</i></p>	 <p>© A. Brown</p>	<p>Long-snouted Boarfish <i>Pentaceropsis recurvirostris</i></p>	 <p>© R. Stuart-Smith, Reef Life Survey</p>
<p><i>Enoplosus armatus</i> Old Wife</p>	 <p>© J. Lewis</p>	<p><i>Girella zebra</i> Zebra Fish</p>	 <p>© Reef Life Survey</p>
<p><i>Notolabrus tetricus</i> Blue-throated Wrasse</p>	 <p>© H. Crawford</p>	<p><i>Pictilabrus laticlavus</i> Senator Wrasse</p>	 <p>© J. Baker</p>
<p><i>Dotalabrus aurantiacus</i> Castelnaus Wrasse</p>	 <p>© R. Stuart-Smith, RLS</p>	<p><i>Scorpis aequipinnis</i> Sea Sweep</p>	 <p>© R. Stuart-Smith, RLS</p>
<p><i>Scorpis georgiana</i> Banded Sweep</p>	 <p>© D. Muirhead</p>	<p><i>Parma victoriae</i> Victorian Scalyfin</p>	 <p>© J. Finn, Museum VIC</p>

**Table 10.1.3 (continued):** Examples of fishes associated with reefs which are dominated by seaweeds, in the NY NRM region.







Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
Rainbow Cale <i>Heteroscarus</i> (previously <i>Odax</i> ) <i>acroptilus</i>	 © G. Short, CC Licence	<i>Tilodon sexfasciatus</i> six-banded coral fish	 © J. Finn, Museum Victoria
<i>Odax cyanomelas</i> herring cale	 © R. Stuart-Smith, RLS	<i>Pempheris multiradiata</i> bigscale bullseye, and other bullseye species	 © J. Finn, Museum Victoria
<i>Chelmonops curiosus</i> western talma	 © R. Stuart-Smith, RLS	<i>Siphonognathus beddomei</i> pencil weed whiting	 © A. Green, RLS
Rock Flathead <i>Platycephalus laevigatus</i>	 © S. Speight, Flickr - CC Licence	weedfishes (various species in <i>Heteroclinus</i> and <i>Cristiceps</i> )	 © J. Lewis

### ***Sharks and Rays in Plant-covered Reef Habitats***

Compared with other habitats in the region, there are few shark and rays species which reside in plant-dominated reef habitats. Some examples include Port Jackson Shark, Eastern Shovelnose Stingaree, Southern Fiddler Ray, Eagle Ray, Smooth Stingray and Black Stingray and the Gulf Catshark. All of these species live in a variety of habitats in the NY NRM region, and their presence in the vicinity of plant-covered reefs is not exclusive. Some examples are shown in **Table 10.1.4** below.

Highly mobile, migratory shark species such as White Shark (White Pointer, Great White Shark) and Bronze Whaler often feed at the edges of reef structures which drop into deeper waters.

**Table 10.1.4: Examples of some shark and ray species associated with reefs which are dominated by seaweeds, in the NY NRM region.**

Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
Wobbegongs <i>Orectolobus maculatus</i> and <i>O. halei</i> , and <i>Sutorectus tentaculatus</i>	 © R. Ling, Flickr. CC Licence	Port Jackson Shark <i>Heterodontus portusjacksoni</i>	 © M. Norman, Museum Victoria
Gulf Catshark <i>Asymbolus vincenti</i>	 © J. Lewis	Southern Eagle Ray <i>Myliobatis australis</i>	 © J. Bennett, CC Licence
Smooth Stingray <i>Dasyatis brevicaudata</i> and Black Stingray <i>D. thetidis</i>	 © S. Speight, Flickr. CC Licence	Southern Fiddler Ray <i>Trygonorrhina dumerilii</i>	 © J. Finn, Museum Victoria. CC Licence

### ***Invertebrates of Plant-covered Reefs***

Many of the plant-dominated reefs in the NY NRM region support reef invertebrates which live on or under the plants, or in caves, crevices, or under ledges that form part of the reef substrate. Some of these invertebrates live on the blades of seaweed and graze on them; others which live on seaweeds suck fluids from those plants as a food source; some live on or under the holdfasts which attach the marine plants to the reef substrate, and some of the larger invertebrates eat the smaller plants or animals which live on seaweed.









Examples of common species include Purple Sea Urchin (a seaweed grazer); turbo shells, tulip shells, pheasant shells and other gastropod molluscs (marine snails); abalone; various species of sea star such as Biscuit Star and Velvet Star; sponges; anemones; bryozoans; ascidians (including large solitary ascidians such as Sea Tulips), brittlestars, crinoids, reef crabs, sea cucumbers, and various worms which live on reefs, such as fan worms, scaleworms, flatworms and ribbon worms (J. Baker, pers. obs. 2002-2014). Some examples of the many different types of marine invertebrates which utilise plant-covered reefs in the NY NRM Region are shown in **Table 10.1.5** below.

**Table 10.1.5: Examples of some marine invertebrates associated with reefs which are dominated by seaweeds, in the NY NRM region.**

Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
Abalone - e.g. Blacklip Abalone <i>Haliotis ruber</i> , Greenlip Abalone <i>H. laevigatus</i> , and Staircase Abalone (Ridged Ear Shell) <i>H. scalaris</i>	 <p>© H. Crawford</p>	Turbo Shells <i>Turbo torquatus</i> and <i>T. undulatus</i>	 <p>© R. Velzeboer</p>
Australian Tulip Shell <i>Pleuroploca australasia</i>	 <p>© T. Alexander, ausmarinverts.net</p>	Cartrut shell <i>Dicathais orbita</i>	 <p>© P. Southwood, CC Licence</p>
Pheasant Shell / Painted Lady <i>Phasianella australis</i> and <i>P. ventricosa</i>	 <p>© M. Norman, Museum Victoria</p>	Kelp shell <i>Phasianotrochus eximius</i>	 <p>Fig. 3 © D. Beechey, seashellsofnsw.org</p>
small gastropod shells, such as Conical Top Shell <i>Thalotia conica</i> , and mitre shells (e.g. <i>Mitra glabra</i> )	 <p>© R. Huet, AnimalBase, CC Licence</p>	Giant Cuttlefish <i>Sepia apama</i>	 <p>© H. Crawford</p>
Nudibranchs and other sea slugs (many species)	 <p>© H. Crawford</p>	Anemones (many species)	 <p>© H. Crawford</p>
colonial ascidians (numerous species)	 <p>© H. Crawford</p>	solitary ascidians such as <i>Pyura gibbosa</i>	 <p>© J. Baker</p>



**Table 10.1.5: Examples of some marine invertebrates associated with reefs which are dominated by seaweeds, in the NY NRM region.**

Latin Name and Common Name	Representative Image	Latin Name and Common Name	Representative Image
Biscuit Star <i>Tosia australis</i>		sea stars (e.g. <i>Nectria wilsoni</i> , <i>Plecaster decanus</i> , <i>Pentagonaster dubeni</i> , and numerous others)	
Purple Sea Urchin <i>Heliocidaris erythrogramma</i>		Egg Urchin <i>Amblypneustes</i> species, including <i>A. ovum</i>	
Orange Feather Star <i>Cenolia trichoptera</i> and other feather star species		Sponges (many species)	
Amphipods and Isopods, and other small crustaceans		Sea Spiders	
Polychaete worms and many other worm groups		Ribbon Worms	