SEAGRASSES OF CAPE YORK PENINSULA: REVIEW OF CURRENT KNOWLEDGE

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INTRODUCTION

Cape York Peninsula (CYP) is the northernmost extremity of Australia, projecting into the Torres Strait between the Gulf of Carpentaria (west) and the Coral Sea (east). From its tip at Cape York it extends southward in Queensland for about 800 km, widening to its base, which spans 650 km from Cairns (east) to the Gilbert River (west). The larger rivers, all emptying into the gulf, are the Wenlock, Archer, Holroyd, Mitchell, Staaten, and Gilbert. Princess Charlotte Bay, in the northeast, is the deepest coastal indentation. The region has a monsoonal climate with distinct wet and dry seasons with mean annual rainfall ranging from 1715 mm (Starke region) to 2159 mm (Lockhart River airport). Most rain falls between December and April. Mean daily temperatures in the area range from 19.2 – 32.1°C. The prevailing winds are from the SE and persist throughout the year (EarthTech 2005). The
peninsula is sparsely populated, although there are Aboriginal reserves on both coasts. The raising of beef cattle is the chief occupation, but the rich bauxite deposits at Weipa are the main resource of the peninsula. Reached in 1606 by Willem Jansz, the peninsula was called Carpentaria Land by Abel Tasman, who charted the west coast in 1644. It was renamed by Captain James Cook in 1770 (Cape York Peninsula 2009).

Cape York Peninsula is considered an area of exceptional conservation value and supports an adventure tourist industry and commercial and non commercial fisheries. The marine coast has social value as sea country to Aboriginal people, and fish turtle and dugong are staple foods (Cape York Peninsula NRM 2005).

Although no area on earth is unaffected by human influence, Cape York Peninsula is located in one of the least impacted regions globally (Halpern et al. 2008). Northern Australia is part of the global centre for marine biodiversity. The drivers of anthropogenic change are much less in northern Australia than in the remainder of the Indo-Pacific. Australia as the only developed country in the region has a global responsibility for the conservation of marine biodiversity.

Extensive seagrass meadows are present in the waters surrounding Cape York Peninsula. The Queensland Department of Primary Industries & Fisheries (DPI&F) has mapped and sampled seagrasses along the entire Queensland coast (Coles et al. 1985, 1987, 1996, 2000, 2001a, 2001b, 2003, 2004; Lee Long et al. 1993). The last broad-scale mapping of the east coast of Cape York occurred in 1984 and the west coast in 1986. More recently, broad scale surveys of intertidal seagrasses in the Gulf of Carpentaria was conducted as part of a larger survey from Kakadu (Northern Territory) to Thursday Island (Torres Strait) (Roelofs et al. 2005). There has also been issued focussed fine scale mapping and monitoring is several locations, eg Weipa, Shelburne, Margaret, Bathurst Bay and Cape Flattery. Mapping across the CYCP has a number of limitations, due to the seasonality (extent of seagrass varies with season), depth of survey extent and difficulties of accurate mapping and precise positioning in marine environments (McKenzie et al. 2001). Initial mapping results from the CYP were first published in 1985. This data was re entered and validated in 2001 and is available in GIS formats (Coles et al. 2001a, 2001b)

Approximately 1,568 km² of seagrass meadows have been mapped in CYP in coastal waters down to 10m bMSL (calculated from composite dataset of all seagrass mapping layers available to DPI&F, December 2008). Seagrass meadows have been found from intertidal regions to depths of 60m near Lizard Islands (Coles et al. 2000). These meadows were characterized by high diversity and relatively small total biomass (Lee Long et al. 1993).

The Cape York Peninsula’s seagrass communities are amongst the richest in the world and are identified as having conservation significance (EarthTech, 2005). Fifteen seagrass species have been identified in the CYP region: Enhalus acoroides, Halodule pinifolia, Halodule uninervis, Halophila capricorni, Halophila decipiens, Halophila minor, Halophila ovalis, Halophila spinulosa, Halophila tricostata, Cymodocea rotundata, Cymodocea serrulata, Syringodium isoetifolium, Thalassia hemprichii, Thalassodendron ciliatum and Zostera muelleri ssp. capricorni (hereafter referred to as Zostera capricorni). Areas notable as species rich include Barrow Point to Murdoch Point (12 species), Flinders Island and
Princess Charlotte Bay (9 species), Weymouth Bay, Cape Direction, Murdoch Point - Lookout Point and Bedford Bay - Cape Tribulation (8 species) and Escape River Margaret Bay, Bathurst Bay, Ninian River and Cape Flattery (7 species).

*Halodule uninervis* and *Halophila ovalis* are the most common species in coastal intertidal areas. *Cymodocea serrulata* and *Syringodium isoetifolium* are found in shallow subtidal areas that are sheltered from the south-east winds in a variety of habitats including estuaries and muddy bays and reef tops (Coles *et al.* 1987, Lee Long *et al.* 1993). Subtidal meadows of *Halophila ovalis* and *Halophila spinulosa* are also quite extensive (Lee Long *et al.* 1993). Species common on coral reef platforms include *Cymodocea rotundata* and *Thalassia hemprichii*, generally around islands and on vegetated cays (Coles *et al.* 2007). *Enhalus acoroides* is generally found as small isolated patches in sheltered embayments (Womersley 1981; Coles *et al.* 2003). Sites that have been revisited since the broadscale surveys in the mid 1980s show that seagrasses generally occurred in similar areas but when surveyed at a finer scale were more extensive (Coles *et al.* 2007). As the majority of information for Cape York Peninsula comes from broadscale surveys, the area of recorded coastal seagrass for the region is likely to be an underestimate.

Most seagrass meadows are within coastal habitats in the CYP region. The majority of these meadows are in the shallow subtidal waters of large bays sheltered from the prevailing trade winds. In the CYP region there is little land-based influence with few major rivers. These seagrass meadows are also highly productive and provide important nursery grounds for fisheries (Coles *et al.* 1985). The meadows are also of important to the large dugong population within the region (Marsh and Lawler 2002). A dominant influence on coastal habitats although small, is terrigenous runoff from seasonal rains, similar to the adjacent estuary habitats (Carruthers *et al.* 2002). Episodic terrigenous runoff events result in pulses of increased turbidity, nutrients and a zone of reduced salinity in nearshore waters. The inter-tidal upper reaches of the meadows are limited by elevated temperatures and desiccation.

Reef-platform habitats are both subtidal and intertidal and support diverse seagrass assemblages. Approximately 3% of all mapped seagrass meadows in the eastern Cape York region are located on fringing-reefs (Coles *et al.* 2007). Meadows are known to be found on mid shelf sand reefs (e.g., Corbett Reef (DPI&F Unpublished Data)) and smaller vegetated cays (e.g., Turtle Island Group), however no detailed mapping has been conducted. On fringing-reefs, physical disturbance from waves and swell and associated sediment movement primarily control seagrass growing in these habitats. Shallow unstable sediment, fluctuating temperature, and variable salinity in intertidal regions characterize these habitats. Sediment movement due to bioturbation and prevalent wave exposure creates an unstable environment where it is difficult for seagrass seedlings to establish or persist.

Seagrasses in deep water (>15m) have been sampled twice, once between 1994 and 1999 (Coles *et al.* 2001; Coles *et al.* In Press) and again between 2003 and 2006 (Pitcher *et al.* 2007). The modelled distribution of seagrass species for both time periods shows spatial discontinuities in deep water seagrass meadows along the north-south axis with a low probability of seagrass being present north of Princess Charlotte Bay and extensive seagrass areas in the south of the region extending out from the coast in the Lizard Island region (De’ath *et al.* 2007; Coles *et al.* In Press). *Halophila ovalis, Halophila spinulosa, Halophila*
tricostata, Halophila decipiens and Halophila capricorni dominated the meadows in both surveys. The deep water comparisons are not true monitoring as they compare modelled distribution rather than actual meadow locations with the potential for unestimated error at small spatial scales. The comparisons for deep water are summarised and discussed in a separate report (De’ath et al. 2007).

The distribution of deepwater seagrasses appears to be mainly influenced by water clarity and a combination of propagule dispersal, nutrient supply, and current stress. Deepwater seagrasses are uncommon north of Princess Charlotte Bay which may be result of the East Australian Current diverging at Princess Charlotte Bay and the far northern section may not receive propagules for colonisation from southern meadows (Coles et al. In Press). Much of this coast is also silica sand and low in rainfall and stream run-off, and it is possible that limited availability of nutrients restricts seagrass growth (Coles et al., 2000).

Based on the mapped seagrass areas, 49% of coastal seagrass meadows on the eastern Cape York region are protected within declared Fish Habitat Areas (Coles et al. 2007). Also on the east coast, approximately 33% of seagrass meadows (excluding deepwater) are covered by the highest levels of protection zones of the GBRWHA (Coles et al. 2007).

A more detailed review of seagrass resources in CYP is presented below heading north from Cedar Bay on the east coast to Cape York and then south to Nassau River on the west coast.

**CEDAR BAY – COOKTOWN**

There are two major rivers within the region: the Endeavour and the Annan River. Both rivers support commercial, recreational and indigenous fisheries. The Endeavour River is the larger of the two river systems and has a catchment area of approximately 992 km². The Annan River is located approximately 5 km south of Cooktown and extends inland from Walker Bay. The Annan River catchment area is approximately 850 km² (Hortle and Pearson 1990). The Kuku Yalanji bama are the traditional people connected to country between Mowbray River (Port Douglas) and the Annan River.

Broad-scale mapping of the seagrass meadows in the region was conducted between 2-5 February 1985 as the final component of the Cape York to Cairns survey (Coles et al. 1985).

In 2004- 2005, coastal seagrass meadows were remapped from Walsh Bay, south of Archer Point, to Lookout Point, north of Cape Flattery, as part of an EnviroFund project (C. Howley Pers. Comm. see http://www.cymag.com.au).

Recently seagrasses on reef platforms in close proximity to river mouths (eg Annan River) and the shipping channel have been examined. Preliminary findings from Egret, Cowlishaw and Dawson reefs indicate that substantial seagrass meadows are present, particularly in areas where siltation is not heavy. For example, seagrass meadows dominated by Halodule uninervis and Halophila ovalis were reported from the NE side of Egret Reef in 2006 (1 - 8m depth). The sediments were fine silt over sand and the average seagrass percent cover was 1-2 % up to 15% (C. Howley, Pers. Comm.).
Archer Point

Intertidal seagrass meadows are located on a fringing reef platform in a protected section of the bay adjacent to Archer Point. Archer Point is monitored as part of the intertidal seagrass component of the Reef Rescue Marine Monitoring Program. The sites are dominated by *Halodule uninervis* and species composition has remained relatively stable over the past 12 months. The overall meadow distribution however, has increased (www.seagrasswatch.org).

Although seagrass cover has followed a seasonal trend over the last couple of years (higher abundance in late spring/early summer), overall the meadow has generally declined in abundance since monitoring was established in 2003. Fortunately, reproductive effort increased in 2007/2008, indicating the potential for the meadow to recover. Epiphyte and macro-algal cover were generally variable but appear to be declining over time (McKenzie *et al.* 2008).

Nutrient analysis in this coastal fringing reef habitat indicate increasing Nitrogen in the sediments while Phosphate has been declining. Plant tissues indicate a habitat with improving light quality, a relatively small nutrient pool with Phosphate limitation. This is not surprising as the higher calcium carbonate sediments on a reef adsorb the Phosphate making it unavailable to plants for growth. No herbicides were detectable in the sediments at Archer Point in early 2008 (McKenzie *et al.* 2008).

Walker Bay

Walker Bay is a relatively shallow bay protected from the SE swells by the rocky, mangrove covered, Grave Point and adjacent Draper Patch reef. The Annan River discharges into Walker Bay and is undoubtedly a major influence to the coastal environments and water quality. The predominant land use activities in the Annan River catchment are cattle grazing, timber extraction, aquaculture and agriculture. Although these land uses and practises have changed the nature of the Annan River catchment and tributaries, the system supports diverse habitats and provides an important corridor for the movement of a variety of fish species (Sheppard and Helmke 1999). The tidal areas of the catchment support extensive marine plant communities including many species of mangrove, saltcouch and seagrasses.

CYMAG conduct ongoing monitoring in the Annan River and latest findings (June 2008) indicate that river water quality is “good” (Anon 2008).

Walker Bay contains a largest subtidal (2-4m deep) meadow which in February 1985 was dominated by *S. isoetifolium* with *C. serrulata/H. uninervis* (wide) (heavily epiphytised) (seagrass cover 80-100%) (Coles *et al.* 1985; Coles *et al.* 2001b).

In November-December 2004, the meadows were remapped in greater detail (http://www.cymag.com.au). The meadow was more extensive (approximately 3.5 km²), with more species present (incl *Halophila spinulosa*) but similar in abundance. More recently (2007), it appears these meadows experienced a slight shift in species composition, from being dominated in areas by *Syringodium isoetifolium* to *Cymodocea serrulata*. As
Syringodium is a species well adapted to disturbed environments (eg sediment movement), the species shift may represent a stabilisation of the seabed (http://www.cymag.com.au).

**Quarantine Bay to Endeavour River**

Between December 2004 – May 2005, coastal seagrass meadows were remapped in Quarantine bay to the mouth of the Endeavour River (http://www.cymag.com.au). Extensive Halodule uninervis and Halophila ovalis meadows were mapped inshore and extending offshore. A smaller but dense meadow of Syringodium isoetifolium / Halodule uninervis was also found offshore.

**Cooktown and Endeavour River**

Cooktown is situated on the Endeavour River and is a 330 km drive north from Cairns. It has numerous natural, cultural and historical attractions for visitors to explore (http://www.cypda.com.au/cooktown). CYMAG conduct ongoing water quality monitoring in the Endeavour River and latest findings (June 2008) indicate that river water quality is “good” (Anon 2008). Results indicate elevated metals and hydrocarbons in sediment adjacent to town stormwater drain and boat slipway site with low levels of herbicides (diuron, simazine, and atrazine) in estuary during 2007 - 2008 wet season. Nutrient levels below the sewerage treatment plant do not appear elevated (Anon 2008).

Shallow medium density (30-60% cover) *H. ovalis* meadows were mapped on the southern banks near the mouth of the Endeavour River between Racecourse and Chinaman Creeks in February 1985 (Coles et al. 1985; Coles et al. 2001b).

Between 9 November 2004 and 5 May 2005, seagrass meadows were mapped in the lower reaches and mouth of Endeavour River as part of the CYMAG mapping project in the region (C. Howley, Pers. Comm. http://www.cymag.com.au). Isolated patches of sparse *Halophila ovalis* were present at the mouth of Chinaman Creek. A large meadow covered much of the northern intertidal bank of the river (Leprosy Creek, west of Point Saunders) with dense (50-75% cover) *Zostera capricorni* on the exposed banks and fringed by *Halophila ovalis* meadow (25-50% cover) along the river edge. At the mouth of the Endeavour River are extensive sandbanks. Adjacent to Sach’s Spit was a narrow intertidal meadow of *Zostera capricorni / Halodule uninervis* fringed by *Halophila ovalis*. A large intertidal meadow of predominately *Halodule uninervis* with some *H. ovalis* was present on the northern portion of Sach’s Spit (http://www.cymag.com.au).

![Sach’s Spit (Endeavour River) seagrass meadow, 2005](http://www.cymag.com.au)
A major dieback of several meadows located near the mouth of the Endeavour river was reported in July 2007. This included the loss of the extensive *H. uninervis* mixed meadow from the sands near Sach’s Spit, and a significant loss of density and leaf length at the *Zostera capricorni* meadow near Leprosy Creek (http://www.cymag.com.au). The cause of this dieback is unknown, however the herbicide clopyralid (0.28 mg/kg) was detected in sediments at Leprosy Creek in December 2007 (http://www.cymag.com.au).

**COOKTOWN TO CAPE FLATTERY**

In this region the coastline includes large bays exposed to SE swells where the seabed is mainly mobile sands. Behind protected headlands the sediment is mudier and more stable. Prevailing wind patterns are typical for this section of the Queensland coast with strong south to south-easterly winds dominating the dry-season months and generally lighter northerly winds prevalent during the wet-season. The only significant coastal meadows are between Cape Bedford and Cape Flattery adjacent to Hopevale.

Broad-scale mapping of the seagrass meadows in the region was conducted on the 2 November 21984 and 2 February 1985 (Coles *et al.* 1985). No seagrass meadows were found between the Endeavour River mouth and Cape Bedford.


**Hope Vale**

Hope Vale was established as a Lutheran Mission in 1949. The community covers an area of 110,000 hectares and is a Deed of Grant in Trust (DOGIT) land. Today's population is estimated at 856 (www.atsip.qld.gov.au), includes 13 clan groups with approximately 94% of the total population being of Aboriginal or Torres Strait Islander origin from various clans including the Dhuppi, Nukgal, Binthi, Thitharr, Dhararpa, Ngayumbarr-Ngayumbarr, Dingaal, Ngurrumungu, Thaanil, Gamaay, Ngaatha, Burunga. In addition to these clans, the community is made up of the Kuku Yimidhirr speaking peoples, the Yiidhuwarra (traditional owners of Barrow Point, Flinders Island, and the South Annan), the Bagaarrmugu, Muunthiwarra, Juunjuwaara and Muli peoples plus the Gan Gaarr and Bulgoon peoples to the south, the Kings Plain’s Thukuun Warra and the Sunset Yulanji peoples in the Maytown area (http://www.cypda.com.au/hopevale).

North west of Cape Bedford is Elim Beach which is renowned for its coloured sands and as the original Cape Bedford Mission by the Lutheran Church in 1886 which later became the HopeVale community.

Seagrass meadows between Cape Bedford and Cape Flattery were first surveyed in November 1984. The seagrass meadows in this region are adjacent and slightly north of Morgan River. The meadows are very low cover (<1%) and patchy *H. decipiens* (sand) or *H. decipiens/H. ovalis* (mud/sand) (Coles *et al.* 1985; Coles *et al.* 2001b).

In July/August 2007 the region was remapped and extensive seagrass (wupan) meadows of *Halodule uninervis* and *Halophila ovalis* were found across much of the
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Shallow/intertidal sand banks at Elim Beach (http://www.cymag.com.au). These meadows were not reported in 1984 as the banks were not accessible due to the low tides. The meadows north of the Morgan River were also mapped in July 2007, however these were shallower than the 1984 surveys and dominated by *Halodule uninervis* and *Halophila ovalis* (http://www.cymag.com.au).

**Cape Flattery Region (Cape Flattery to Lookout Point)**

Cape Flattery is a port which encloses an area of approximately 150 km² of marine habitat and include over 35 km of coastline. The area has two main creeks, Crystal Creek and Blackwater Creek, in a catchment area of approximately 114 km² (Ports Corporation Queensland 1995). The regions’ climate is tropical and characterised by hot (wet) summers and warm (dry) winters. Prevailing wind patterns are typical for this section of the Queensland coast with strong south to south-easterly winds dominating the dry-season months and generally lighter northerly winds prevalent during the wet-season.

In 2004/05, the Port of Cape Flattery handled 29 ships carrying 1,300,672 tonnes of silica sand (www.pcq.com.au). Silica sand, extracted from the nearby Cape Bedford - Cape Flattery dune-field, is the ports’ only export at present. The mine is owned and operated by Cape Flattery Silica Mines Pty Ltd. The silica sand mine is an open cut mine. Mined sand is transported to a processing mill and ultimately to the main export jetty on Cape Flattery via conveyor.

1111 ±200 ha of productive seagrass habitats have been identified between Cape Flattery and Lookout Point (Ayling et al. 1997). Eight species of seagrasses, and three types of seagrass meadow have been identified;

- a predominantly *Halodule/Thalassia* meadow in the sandy intertidal area bordered by the shoreline and fringing coral reef.
- a small isolated high biomass *Cymodocea/Thalassia* meadow at the mouth of Crystal Creek in sand/mud sediment.
- a large *Halodule/Halophila* meadow in muddy sediment offshore from the fringing reef in deeper water.

*Halophila ovalis* was the most widely distributed species followed by *Halodule uninervis* (wide-leaf) and *Halodule uninervis* (narrow-leaf). *Syringodium isoetifolium* was found only in small isolated patches (Ayling et al. 1997). No seagrass was found deeper than 7.5 m below Mean Sea Level (MSL). *Cymodocea* spp and *Thalassia hemprichii* were only found in shallow areas (<1.6 m below MSL) (Ayling et al. 1997).

Evidence from dugong feeding trails indicates these seagrass meadows are also important feeding habitat for dugong.

**Starcke River Region (Lookout Point to Barrow Point)**

This is an area recognised for its sizeable dugong populations and associated seagrasses. Seagrasses have been reported along almost the entire coast of this region and from inter-reef waters in the vicinity of the Lizard Island group during a deep-water surveys of seagrasses (Coles et al. 1985, 1996, 2001b; Lee Long et al. 1989).
Coastal seagrass habitats between Lookout Point and Barrow Point were first surveyed in October and November 1984 as part of a study from Cairns to Cape York (Coles et al. 1985; Coles et al. 2001b; Coles et al. 1987). Key seagrass areas along the same coastal region were re-surveyed in the following winter (July 1985). Between 17 - 22 September 1989, seagrass meadows in the area were once again surveyed along the coast and out to 28 m deep as results of dugong aerial surveys suggested the dugong population of the region was large and required an area of seagrass for feeding much larger than that estimated in 1984 (Lee Long et al. 1989; Marsh 1989).

In 1989, seagrass formed a near continuous seagrass meadow covering approximately 1,500km² extending from the coast between Lookout Point to Murdoch Point to depths of 28m (Lee Long et al. 1989). Seagrass cover ranged from dense in shallow water to a patchy and light cover of Halophila species in deeper water. Seagrass was also found on every reef platform examined. Deepwater surveys between Cape Weymouth and Cape Tribulation in 1995 confirmed that seagrass meadows were still relatively continuous across the region (Coles et al. 1996).

Eleven species of seagrass have been identified in the region. Seagrass cover is generally greatest, reaching 100%, in sheltered, shallow areas of the nearshore. At depths greater than 10 m in the mid-shelf seagrass cover is generally less than 50%.

From the lee (west) side of Lookout Point, a large H. ovalis and H. spinulosa meadow was reported extending along the sandy shore, becoming a wide, near-shore meadow of H. spinulosa, (80-100% cover) as the seabed becomes more muddy. This seagrass meadow continues three to four nautical miles south-east of the Starcke River (Lee Long et al. 1989). Between the Starcke River and Murdoch Point seagrass is sparse, however between Murdoch Point and Red Point a dense (>50% cover) H. spinulosa meadow extends out to the Cole Islets, possibly a consequence of the improved water clarity (Lee Long et al. 1989). Between the Cole Islets and Cape Bowen the seagrass meadows are mostly patchy and composed of H. ovalis and H. uninervis (10 to 50% cover). Seagrass cover is denser in sheltered shallow waters close to shore. North of Cape Bowen to Barrow Point the meadows are light (<1% cover) and predominately H. ovalis and H. decipiens on fine mud.

In the deeper waters (10 to 20 m) seagrasses are dominated by H. ovalis and H. spinulosa. At depths between 15 and 28 m, H. ovalis is more common than H. spinulosa and bottom cover generally less than 20% (Lee Long et al. 1989).

The reef platforms of Jewell, Parke, Martin, Linnett and Ribbon Reef No 10 were examined in December 1994 as part of a survey of 18 reef-tops between Cape Weymouth and Cape Tribulation. Meadows of Halophila ovalis (<2% cover) and Thalassia hemprichii (<1% cover) were reported from the reef-platforms of Parke and Martin Reefs respectively (DPI&F Unpublished data).
Lizard Island

The Lizard Island group is adjacent to the Starke River region. Price et al. (1976) first reported only two species of seagrass (Cymodocea rotundata and Halophila minor) from the Lizard Island group in their checklist of marine benthic plants. The only other previously reported species for the group was Thalassia hemprichii (Nichols and Johns, 1985; Boon, 1986).

In October 1995 McKenzie et al. (1997) mapped 292 ±78ha of intertidal and sub-tidal seagrass in the waters surrounding the Lizard Island Group. Seven seagrass species (1 previously undescribed) were identified in the survey area. Thalassia hemprichii was the most commonly encountered species, although it was restricted to the shallow reef-tops. Halophila ovalis was the second most commonly encountered species and was found in both intertidal and subtidal areas. Other species found in the survey area included Halodule uninervis, Halophila spinulosa, Syringodium isoetifolium, Cymodocea serrulata and Halophila sp. H. ovalis had the widest depth distribution and occurred at both the shallowest (0.4 m below MSL) and the deepest (4.4 m below MSL) sites where seagrass was found. Mean depths of occurrence for individuals species were mostly <15 m below mean sea level (McKenzie et al. 1997).

A previously undescribed seagrass species, Halophila sp., was found in the survey area near Watson’s Bay in depths >10 m below MSL. This species was similar to Halophila capricorni although several differences were noted. Significant anchor damage (scars) was observed in the seagrass meadows of Watson’s Bay. Shallow-water (<10 m) scars showed evidence of recolonisation/recovery, however deep-water (>10 m) scars appeared recent, as there was little evidence of seagrass recovery.

Turtle Group

In November 1992 Derbyshire et al. (1995) conducted a preliminary seagrass survey of reef-top, inshore and deepwater areas between the Turtle Island group and Mid Reef. They reported that seagrass meadows on deepwater and inshore areas were relatively dense, while reef-tops were only sparsely vegetated. Deepwater meadows were predominately Halophila spinulosa and Halophila ovalis. Thalassia hemprichii and Halophila ovalis sparsely covered the Mid Reef platform. Nearshore areas were mainly Cymodocea serrulata and Halodule uninervis.

Derbyshire et al. (1995) established that seagrass meadows in the Turtle Islands group were habitat for commercial prawn species, although deepwater seagrass, despite its vast area, were not as productive as inshore seagrass meadows for commercial prawns. They found that inshore seagrass meadows had juvenile prawn densities several thousand times greater than those from deep water meadows. Their results found that in respect to juvenile prawn habitats, the value of seagrasses was inshore>reef-top>deepwater. The importance also differed for species of prawn, eg. reef-tops were more important for red spot king prawns, deepwater more important for blue endeavour prawns and inshore more important

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1 Halophila minor was originally reported as H. ovata, but taxonomists now regard H ovata in the Indo-western Pacific as only present in the South China Sea and Micronesia (Kuo 2000).
for tiger prawns (the most valuable and sought after species in the fishery) (Derbyshire et al. 1995).

Although the deepwater meadows may not be important juvenile commercial prawn nursery habitat, they are very important feedings areas for the large dugong and turtle populations of the region.

**Miscellaneous reef platforms**

Most information on reef platforms of this region are either from the September 1989 surveys (Lee Long et al. 1989) or December 1994 where reef platforms were examined as an addition to deepwater surveys which were being conducted between Cape Weymouth and Cape Tribulation at the time (DPI&F Unpublished data).

Mid Reef platform has an extensive meadow of *H. ovalis*, with large patches of *T. hemprichii* and *C. rotundata*; Combe Reef platform is covered by light patches of *T. hemprichii*, *C. rotundata* and *H. ovalis*; Snake Reef has a light cover (<10%) of *T. hemprichii*; the two un-named reefs north of Combe Reef had mostly bare sand and coral rubble platforms but small patches of *H. ovalis* (10% cover) were found on soft, coarse sand on the back reef areas; Martin Reef had very light cover of *T. hemprichii* on sandy patches amongst coral rubble and algae; and Eyrie Reef, has a small area of *H. ovalis* (light cover) in the lee of Eagle Island (Lee Long et al. 1989).

No seagrass was found on the reef-platforms of Davies Reef, Tydeman Reef or an un-named reef (GBRMPA # 14-034) in December 1994 (DPI&F Unpublished data). However, dense (40-100% cover) seagrass meadows (including *Thalassia hemprichii*, *Zostera capricorni*, *Halophila ovalis* and *Cymodocea rotundata*) were reported from the reef flat and back reef of Pipon Reef. Meadows of moderate cover (10-30%) *Halophila spinulosa* and *Halophila ovalis* were also reported in the shallow subtidal areas surrounding the bommies of Pipon Reef (DPI&F Unpublished data).

**Barrow Point to Cape Melville**

The only seagrass survey conducted in this region was 4th November 1984, when only 22 ground truth sites were examined (Coles et al. 1985; Coles et al. 2001b).

Extensive seagrass meadows were reported within Ninian Bay, which is protected from the SE trades by Barrow Point. The meadow are reported to be predominately *Halophila ovalis/Halophila decipiens/H. uninervis* (narrow) with *C. serrulata* and *S. isoetifolium* (50-80% cover) on coarse sand (Coles et al. 1985; Coles et al. 2001b).

A small but dense (80% cover) meadow dominated by *H. decipiens* with *C. serrulata/H. uninervis* (wide) and *S. isoetifolium* was reportably present on the fringing reef north of North Bay Point (Coles et al. 1985; Coles et al. 2001b). Immediately seaward was a large extensive meadow of *C. serrulata* (20% cover) which extended north to Hales Island on the rocky rubble bottom protected from the SE trades by the shallow bank off North Bay Point.
Similar to the region from Cape Melville and Lookout Point, this region has been recognised as an area of importance to the dugong populations of the Great Barrier Reef. As such, dugong sanctuaries have been in place in both Bathurst and Princess Charlotte Bays since the mid 1980’s. This zoning protects animals from extractive activities, especially fishing impacts including incidental capture in commercial gill nets and habitat damage from trawling. Other significant impacts on the seagrasses in the region are from the adjacent land. The Normanby and North Kennedy Rivers flow into Princess Charlotte Bay (PCB), but no major catchment in Bathurst Bay.

This region was first surveyed during a broadscale survey between 5-7 November 1984 (Coles et al. 1985; Coles et al. 2001b). In May and November 1997 a detailed survey was conducted between Cape Rock (Bathurst Bay) and Port Stewart (PCB) to assess seagrass status in the senescent and growing seasons in response to possible changes in commercial gill netting in the region (Short 1999). 34,984 hectares of seagrass was mapped in May and 37,345 hectares in November 1997. Most seagrass was within Bathurst Bay and the eastern and northern (surrounding the Cliff Islands) sections of PCB. From May to November there appeared to be a shift of seagrass away from the western side towards the eastern side of PCB. Approximately 75-80% of seagrass meadow area was subtidal, and this changed little between surveys (Short 1999).

Eleven seagrass species were identified in the region (*Cymodocea serrulata*, *Cymodocea rotundata*, *Halodule pinifolia*, *Halodule uninervis* (thin and wide forms), *Halophila ovalis*, *Halophila tricostata*, *Halophila spinulosa*, *Halophila decipiens*, *Thalassia hemprichii* and *Syringodium isoetifolium*), however *Cymodocea rotundata* was absent in May 2007. In May the meadows of Bathurst Bay were dominated by either *Halophila decipiens*, *Cymodocea serrulata*, *Halophila ovalis*, *Halodule uninervis* (wide) or *Halophila spinulosa*. In November however there was a shift away from *Halophila decipiens* (Short 1999).

Overall, seagrass distribution was greater in November than May (approximately 2361 ha) and the proportion of meadows with abundance >25% cover was higher (only 4% of the seagrass meadow area had seagrass cover greater than 25% in May compared to 36% in November) (Short 1999).
Nine seagrass species were found around the Flinders Group of islands, the largest number from a single sampling area reported in the CYP (Coles et al. 1987). Not reported in the 1997 survey was *Halophila tricostata*, which was reported from the shallow waters (4m) of the Flinders Group of islands during the broadscale survey in 1984 (Coles et al. 1987).

Seagrasses were examined at Corbett Reef during a reconnaissance survey in October 1994. Significant seagrass meadows of *Halophila ovalis* and *Thalassia hemprichii* were scattered over the shallow/intertidal sand platform (10-20% cover). Meadows of *Halophila ovalis* occurred along the back edge (<10% cover) and sparse (<1%) meadows of *Thalassia hemprichii* and *Halophila ovalis* were found in the back reef area. In the channels *Halophila spinulosa* and *Halophila ovalis* (10% cover) were also reported (DPI&F Unpublished data). No detailed mapping has been conducted of any reef-tops in this region.

**Claremont Point to Olive River**

This is a large region on the east coast of CYP and includes the narrowest section of the Great Barrier Reef where the outer edge is at its closest point to mainland Queensland. The region contains two large bays (Lloyd Bay and Temple Bay). The most significant settlements in this region include Lockhart River and Portland Roads.

Lockhart River was originally a Mission south of Cape Direction, opened in July 1924 by the Church of England under the Torres Strait Anglican Mission. When the Second World War broke out the Europeans left and the Aboriginal people were told to go back to the bush and fend for themselves. In 1947 the mission was re-established on Quintell Beach in Lloyd Bay, with drastic changes inflicted on how the people should live and behave. In particular, tribal groups were forced to combine into a single community. Administration of Lockhart River mission was transferred to the Queensland Government in May 1967. The government then tried to relocate the people to Bamaga. Refusing to go but in 1971, the people were forced to move away from the traditional area of the coast. No consideration was given to traditional owners of the land and this move resulted in much discontent and friction. On the 29 October 1987, pursuant to section 334 of the Land Act 1962, land was assigned to the Council under the Deed of Grant in Trust (DOGIT) (www.apunipima.org.au).

Coastal seagrass meadows in this region have only been mapped during the broadscale Cape York to Cairns survey in November 1984 (Coles et al. 1985; Coles et al. 2001b). A dense (30-80% cover) and extensive *Halophila spinulosa* with *Halophila ovalis/Halodule* spp. meadow and isolated patches *Cymodocea serrulata* were mapped in the shallow waters adjacent to the coast. Smaller and patchy *Halophila* spp./*Halodule uninervis* meadows were scattered along the sandy shallow areas of the coast north to Cape Direction. These meadows were generally low cover (<10%) (Coles et al. 1985; Coles et al. 2001b).

Seagrass in Lloyd Bay was associated with patch reefs or on the lee side of islands and headlands. The meadows were subtidal (3-10m), low cover (<10%) and generally dominated by *Halophila ovalis/H. decipiens/H. uninervis* with *H. spinulosa* (Coles et al. 1985; Coles et al. 2001b).
Immediately north of Lloyd Bay is Cape Weymouth and Restoration Island (significant as the first landfall of Captain William Bligh after he and his companions were forced into the long boat during the mutiny of the "Bounty" near Tahiti). A few kilometres further north is Portland Roads which until the 1980's used to have a large timber wharf used by the allies during World War 2 as a jump off point for the New Guinea campaign. The wharf was more recently blown up by the Navy because of its dilapidated condition. Portland Roads is a safe anchorage used by the fishing fleet and the motherships which supply them with fuel, water and stores, and unload their catch which is returned to Cairns for export.

North of Cape Weymouth the meadows in Weymouth Bay are dense isolated patches, found south of the Pascoe River. In 1984 these meadows were either *H. ovalis*/*H. uninervis* (wide) with *C. serrulata* or *H. uninervis* (wide)/*S. isoetifolium/H. ovalis* with *H. spinulosa* on mud substrates (Coles *et al.* 1985; Coles *et al.* 2001b). den Hartog (1970) reported *Thalassodendron ciliatum* in the vicinity of Weymouth Bay, however it was not reported in 1984.

Large meadow of light seagrass cover (<10%) occurred in the southern regions of Temple Bay. These meadows were subtidal and dominated by *H. spinulosa* with *H. ovalis/Halodule* spp. Isolated patches of *H. ovalis/H. pinifolia* with *H. spinulosa* occur further north (Coles *et al.* 1985; Coles *et al.* 2001b). Seagrass meadows have also been reported from some of the reef platforms in the region. During a survey in November 1994, seagrass was common on the mid shelf reefs examined. *Thalassia hemprichii* (<5% cover) was present in the lagoon between the isles and on reef flat of Sherrand Reef. On Blanchard Reef, *Thalassia hemprichii* (5% cover) was reported on the sandy reef platform and *Halophila decipiens* (<1%) in 1-10m off back of reef. On the un-named reef south of Ogilvie Reef (GBRMPA #13-077) *Thalassia hemprichii* (<5% cover) was present on the sandy reef platform (DPI&F Unpublished data).

Seagrass was generally absent from outer barrier reefs (including Tijou Reef, Sand Bank No 7, and the unnamed reefs 12-137 and 13-116), with the exception of Sand Bank No 8 where *Thalassia hemprichii* (10% cover) was reported on the back reef and on the reef flat near the cay (DPI&F Unpublished data).

**MARGARET BAY REGION (OLIVE RIVER AND DOUBLE [ETATAPUMA] POINT)**

The Margaret Bay region has been described as an area of conservation significance and high wilderness value (Schneiders 1999). This area contains two large bays, Margaret Bay and Shelburne Bay, as well as two main rivers, a large creek and a number of other unnamed smaller creeks and tributaries. Margaret Bay is north-west of Cape Grenville and approximately 10 km south-east of Shelburne Bay. Large intertidal flats stretch across both bays. The coastal wetland communities within this region are near pristine, and their associated catchments are virtually untouched by human development. The region has critical cultural significance to the Wuthathi people (Sheppard *et al.* 2002).

Extensive seagrass meadows, which vary from dense (>50% cover) to sparse (<10% cover) occur across Margaret Bay. A large dense seagrass meadow was first identified by
In August 2001, the fisheries resources of the Margaret Bay region were further investigated as part of the ongoing commitment by DPI&F to extend the network of declared Fish Habitat Areas (FHAs) in Queensland (Sheppard et al. 2002). The survey area extended from Indian Bay (south of Cape Grenville) to Double Point in Shelburne Bay and included the Home Islands and Sunday Island. The fisheries resource assessment of the Margaret Bay region included investigations of marine plants (including seagrass), riparian vegetation and fisheries habitats.

5,623.0 ±843.4 ha of seagrass meadows were mapped in the region in August 2001, which comprised seagrass meadows in Margaret Bay (including Indian Bay) (2441.1 ± 374.2 ha), Shelburne Bay (3069.5 ± 405.9 ha), and the Home Islands (112.4 ± 63.3 ha) sections of the survey. Eight seagrass species were identified: *Cymodocea serrulata*, *Halodule uninervis*, *Syringodium isoetifolium*, *Enhalus acoroides*, *Halophila decipiens*, *Halophila ovalis*, *Halophila spinulosa* and *Thalassia hemprichii* (Sheppard et al. 2002). Seagrass resources in the Margaret Bay region are important in providing nursery habitats to juveniles of commercially important penaeid prawn species and regarded as highly important dugong habitats.

In August 2001 seagrass was found in all sections of the Margaret Bay region, mostly in the sheltered areas of the bays and on reef flats. Seagrass was identified on intertidal sand banks in Shelburne, Margaret and Indian bays, on intertidal reef flats in the Home Islands, and on sand/mud substrates in subtidal areas of western Shelburne Bay, Indian Bay and Margaret Bay. The most extensive cover of seagrass was in Margaret Bay, where seagrass was found in the majority of the subtidal habitat of the bay (Sheppard et al. 2002). Seagrass extended from the upper intertidal zone to 11.7m dbMSL in Margaret Bay, and to 9.0m dbMSL in Shelburne Bay. The seagrass species occurring at greatest depth in the Margaret Bay region were *Halophila spinulosa* and *Halophila decipiens*.

The majority of seagrass meadows (84% of total seagrass area) in the Margaret Bay region were low in seagrass cover (<10% cover) (Sheppard et al. 2002). Medium coverage seagrass meadows (10–50% cover) were found only in Margaret Bay and in the Home Islands, and no high coverage meadows (>50% cover) were identified (Sheppard et al. 2002).

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The distribution of seagrass meadows in Margaret Bay in 1984 and in 2001 were remarkably similar, suggesting long-term stability in distribution and abundance for these meadows. Most of the differences in total meadow area between 1984 and 2001 may be attributed to different survey methodologies and additional seagrass meadows identified on the intertidal sand flats in Shelburne Bay in August 2001. These meadows were very sparse in above-ground biomass, were dominated by very narrow and small leaved seagrass species (*Halodule uninervis* (narrow leaf form) and *Halophila ovalis*), and were characterised by isolated patches of seagrass interspersed with large areas of unvegetated substrate (Sheppard et al. 2002). Also, *Enhalus acoroides* was identified at locations in Margaret Bay, at Cape
Grenville and in the Home Islands but was not found in the region in 1984 (Sheppard et al. 2002).

DOUBLE POINT TO MOUNT ADOLPHUS ISLAND (CAPE YORK)

The main feature of this region includes the Escape River and Newcastle Bay to the north and the scattered islands and reefs in the very north of the Great Barrier Reef World Heritage Area.

Coastal seagrass meadows in this region have only been mapped during the broadscale Cape York to Cairns survey in November 1984 (Coles et al. 1985; Coles et al. 2001b). Only a few patchy and isolated meadows were found along the sandy coast. They were generally Halophila (including H. decipiens, H. ovalis, H. spinulosa) and Halodule uninervis dominated. Several moderate but patchy meadows were found in the estuary of the Escape River, however very little seagrass was present in Newcastle Bay. In the Escape River mouth the meadows were mainly H. ovalis or H. spinulosa with H. uninervis (wide)/C. serrulata on the sand substrate, and H. ovalis with Thalassia/H. uninervis (wide) on the mud substrates. There were isolated patches of Enhalus acoroides on the mud banks.

Deepwater seagrasses were examined across the region in (Coles et al. 2000, In Press; De’ath et al. 2007). Deepwater seagrasses are generally sparse north of Princess Charlotte Bay and H. decipiens and H. spinulosa were reported scattered in the nearshore deepwaters, and in the lee of mid and outer reefs (Coles et al. 2000, In Press; De’ath et al. 2007).

ALBANY ISLAND TO PUNSAND BAY

Coastal seagrass meadows in this region were first mapped during the broadscale Cape York to Tarrant Point survey in October 1986 (Coles et al. 2001a). Intertidal seagrass meadows between Albany Island and Peak Point (Punsand Bay) were also examined in early April 2005 as part of an atlas on the Prince of Wales and Adolphus shipping channels in the Torres Strait (Rasheed et al. 2006).

Dense (85-100%) meadows of S. isoetifolium/ H. uninervis (wide)/ C. serrulata/ H. spinulosa with H. minor/ H. uninervis (narrow)/ H. ovalis were mapped on the shallow sand/shell substrates between Bishop Point and Evans Point (including Shallow/Muddy Bay) in Oct06 (Coles et al. 2001a). Significant intertidal Zostera meadows were located in Somerset Bay in Albany Passage and in Shallow Bay west of Ida Island. An Enhalus acoroides meadow dominated the intertidal banks of Stover Bay in Albany Passage (Rasheed et al. 2006).

In Punsand Bay a subtidal meadow dominated by Halophila decipens with H. minor was mapped on the sand substrate in 5-6m at the western edge in October 1986 (Coles et al. 2001a). Inshore, a dense (>50% cover) meadow of Cymodocea serrulata/ Halophila ovalis/Halodule uninervis/Halophila spinulosa and Syringodium isoetifolium was reported in November 1998 (www.seagrasswatch.org/herbarium.html).
NORTHEASTERN GULF OF CARPENTARIA (BAMAGA TO NASSAU RIVER)

The Gulf of Carpentaria is a large, shallow, muddy marine bay shared between the Northern Territory and Queensland. The area has marked seasonality in temperature, rainfall, salinity and wind regimes. The dominant weather feature is a seasonal summer monsoon with associated northerly winds and rain (November through to March) and a very dry winter period with south-east trade winds (April to September). Seasonal temperatures range from 10 °C in winter (Poiner et al. 1989) to the high 30’s in summer. Tidal ranges vary from 2.4 m at Aurukun to 3.6 m at Crab Island in the north (Qld Transport Official Tide Tables and Boating Safety Guide 2002). Temperature, salinity, wind and rainfall show marked seasonality in this region. From June to September (Winter - Spring) winds are predominantly south-easterly, and from November through to April (Summer - Autumn), winds are generally north-westerly. It is during these months that the most rain falls associated with the monsoon trough.

The region is sparsely populated with the only major indigenous and non-indigenous populations located at Bamaga, Mapoon, Weipa, Napranum, Aurukun, Pormpuraaw, and Kowanyama (Cape York Regional Advisory Group 1997). The only island in the region is Crab Island in the north (all other islands in the north are within the Torres Strait NRM).

The terrestrial areas of the Northern Gulf region are comprised of extensive areas of woodland (dominated by Eucalyptus, some Acacia, Casuarina and Melaleuca), with smaller areas of shrubland and open heath. Major rivers in the Northern Gulf region catchment include the Wenlock R., Jardine R., Archer R., Coen R. and Mitchell. The rivers are typically long and meandering and open on to a flat, dry coastline often with wide tidal wetlands of mangroves and salt-pans. Extensive freshwater wetlands occur along much of the coastline. Large, shallow saline lakes can be found at the Kirke and Love Rivers.

The Northern Gulf coastline is mostly low and open with very few bays. There are three large mangrove lined and protected estuaries at Aurukun, Weipa and Port Musgrave. Coral reefs occur patchily along much of the coastline and there are numerous offshore reefs and shoals. Intertidal sand and mud banks often extend 1-2 km from the coast. Relatively clear water can be found along much of this section of the coastline, especially from Weipa north. The open coastline to the south of Weipa tends to be heavily influenced by wind driven turbidity and wave energy.

The coastline of the eastern gulf is extremely shallow and regularly disturbed by prevailing winds. Sediments throughout the gulf are predominately fine muds, and these are easily resuspended due to the shallow bathymetry resulting in increased turbidity, which restricts seagrass distribution and growth (Coles et al. 2004). Twelve species of seagrass have been found in the eastern Gulf of Carpentaria: Cymodocea rotundata, Cymodocea serrulata, Halodule uninervis (wide- & narrow-leaf), Halodule pinifolia, Syringodium isoetifolium, Enhalus acoroides, Halophila decipiens, Halophila minor, Halophila ovalis, Halophila spinulosa, Halophila triostata and Thalassia hemprichii.

The intertidal seagrasses of the Gulf of Carpentaria were first surveyed by aerial reconnaissance in October 1982 (Crab Island to Karumba) by CSIRO Division of Fisheries (Poiner et al. 1987). Following aerial surveys, areas identified as seagrass or unknown were
ground truthed using divers. They estimated 18.7 km$^2$ of seagrass between Crab Island and Tarrant Point. They reported 10 species of seagrass in the eastern Gulf of Carpentaria and seagrass was confined to Crab Island, Port Musgrave, Albatross Bay and Archer Bay.

A more extensive survey of seagrass distribution and abundance in the inlets and bays of the eastern Gulf of Carpentaria occurred during a broadscale survey between Albany Island and Tarrant Point from 21 October to 7 November, 1986. Approximately 185 km$^2$ of seagrass was present in 1986 (Coles et al. 2001a).

Roelofs et al. (2005) mapped approximately 93.26 km$^2$ of intertidal meadows along the mainland coast from 19-20 November 2004 using helicopter. Most meadows across the region were aggregated patches, with relatively few continuous meadows. Fringing reef areas, open sandy beaches and less turbid water was reported found north of Aurukun. Extensive intertidal seagrass meadows were found at Aurukun and Weipa.

The extensive intertidal banks along the Gulf of Carpentaria coast have seagrass meadows that are a mixture of *Halodule* and *Halophila* species. *Syringodium isoetifolium* and *Cymodocea serrulata* are common subtidally and *Halophila ovalis* and *Halophila spinulosa* further offshore (Poiner et al. 1989, Coles et al. 2001a). Along the exposed eastern coast of the gulf, seagrasses are generally sparse and restricted to the lee side of islands, protected reef flats, estuaries and protected bays (Coles et al. 2004). Seagrass species dominating meadows adjacent to the mainland coast are often considered to be pioneering or early colonists (*Halophila* and *Halodule* species). Little is know of the seagrass communities in waters greater than 10m depth. Species which are more common in deeper waters (10 metres and deeper) such as *Halophila decipiens* are however present throughout the gulf.

The 2004 intertidal survey (Roelofs et al. 2005) and long-term studies of change in population density and structure which have been carried out associated with port activities in Weipa, Karumba and Kirke River suggest that the distribution of seagrass has remained similar to 1986 but is highly seasonal and declines are associated with flooding during the wet season (Roelofs et al. 2001, 2006). These studies suggest considerable interannual variability occurs (Rasheed et al. 2001). Seagrass biomass is generally higher in the wet season than in the dry season. This difference in biomass is opposite to changes measured for seagrasses from the tropical east coast of Queensland (McKenzie et al. 1998, Mellors et al. 1993, McKenzie 1994, Rasheed 1999), but similar to seagrass seasonality measured at Karumba in the southern Gulf of Carpentaria (Rasheed et al. 2001).

The following is a detailed review of information about seagrasses in specific regions between Bamaga and the Nassau River.

**Bamaga & Jardine River**

Seagrass meadows are found scattered along eh coast and on the reef flat of Crab Island. Reef flat communities in this region are dominated by *Thalassia*. Meadows in estuaries and sheltered bays are mostly of the genera *Halodule*, with *Cymodocea* and *Enhalus acoroides* (Coles et al. 2001a).
Skardon

Skardon River was declared a port in February 2002 to service the Skardon River kaolin mine. The port facilities are located upstream on the shallow Skardon River. The Skardon River area includes a diverse range of ecologically important marine habitats such as mangroves, salt pans, rock bars, and marine swamps which are likely to support significant fisheries, estuarine crocodiles and green turtles (Roelofs et al. 2002, 2004).

Wet season (April 2002) and Dry season (September 2003) baseline marine habitat resources surveys have been conducted in the Port of Skardon River. An isolated Halodule uninervis (narrow form) meadow located approximately 2.4 km north of the port facilities on a sand/mud bank was reported during both surveys, however three sparse subtidal Halophila decipiens meadows area within 500 metres of the port facility were only reported during the Dry season (Roelofs et al. 2002, 2004).

In December 2006, the marine habitat resources were resurveyed as apart on an ongoing (every 3 years) monitoring program for the Port. Seagrass distribution in December 2006 (9.1ha) (Rasheed 2007) was more than double that recorded in September 2003 (4.4ha) (Roelofs et al. 2004). Two moderate Halophila decipiens and a light Halodule uninervis (narrow) meadows were reported adjacent to the eastern bank of the river and a moderate Halophila decipiens meadow was reported adjacent to the western bank (south of the barge landing) (Rasheed 2007). This was the first time that Halodule uninervis was found in the vicinity of the barge landing area. Previously H. uninervis had only been found in a nearby branch of the Skardon River (Roelofs et al. 2004)

Port Musgrave

Port Musgrave is a shallow, almost enclosed, estuary, forming a bay on the western coast of the Cape York Peninsula. Two major rivers, the Wenlock and the Ducie, to the north and south respectively, discharge into it. The surrounding area is rich in freshwater swamps, while the estuary itself has tidal flats and mangroves. The small Aboriginal community of Mapoon lies on the southern shore of the bay.

Mapoon was declared a Deed of Grant in Trust (DOGIT) in 1998 and is held by a group of nominated trustees. An August 2001 Census stated that 197 persons gave their address of usual residence as Marpuna Community, with about 92 per cent of the total population being of Aboriginal or Torres Strait Islander origin (http://www.cypda.com.au/old_mapoon).

Previous studies have identified significant areas of seagrass on the intertidal banks and subtidal waters at Port Musgrave (Coles et al. 2001a). Of particular note, isolated patches of Halophila tricostata, a deepwater species and endemic to northern Australia, was found in 3-7m depth off the coast immediately north of Port Musgrave (Coles et al. 2001a).

Meadows of Halodule uninervis/Halodule pinifolia and Halophila ovalis occur on the intertidal banks. Enhalus acoroides occurs in the shallow waters on the seaward edge of the banks, and Halophila decipiens is found in the deeper waters. The site is frequented by dugongs as lots of grazing trails have been observed (Christina Howley, Pers. Comm).
Mixed *Halodule uninervis* and *Halophila ovalis* meadow, Port Musgrave August 2008.  
*Photos: Christina Howley*

**Weipa**

Located on the north-west coast of Cape York Peninsula, the Port of Weipa is principally involved in the export of bauxite. In 2004/05, the port handled 374 ships carrying 15,519,910 tonnes of bauxite, 64,701 tonnes of fuel and 22,052 tonnes of general cargo (www.pcq.com.au). The port is located within Albatross Bay, a large shallow bay fed by four rivers (Pine, Mission, Embley, and Hey). The rivers form an extensive estuarine system with a variety of habitats-including mud flats, seagrass beds, and mangroves- that support significant fisheries resources and populations of seabirds, dugongs, turtles and crocodiles.

Seagrass distribution and species composition was originally documented for Weipa during surveys by CSIRO in 1982 and 1989, during a broadscale survey by QDPI&F in 1986 (Coles *et al.* 2001a, 2004), and by WBM (1991) and Fisheries Research Consultants (1994) (Dames & Moore 1995). Collectively, the surveys found up to six seagrass species in meadows located in the Embley, Hey and Mission Rivers and in an area south of Pine River Bay. No seagrasses were mapped in Pine River Bay.

In September 2000, a detailed survey of seagrass meadows in the region mapped 4688 \(\pm 418\) ha, an area of seagrass larger than in previous surveys of the Port of Weipa; 680 ha in October 1982; 2225 hectares (ha) in October 1986 to 4653 (\(\pm 422\)) ha in September 2000 (Poiner *et al.* 1987, Coles *et al.* 2001a, Roelofs *et al.* 2001). One additional seagrass species, *Syringodium isoetifolium*, was found during the September 2000 survey that was
not found previous. *Halophila minor* was not found in the 2000 survey, however Waycott *et al.* (2004) consider *H. minor* to be part of the *H. ovalis* complex of closely related entities whose leaves are highly plastic especially in relation to blade size, shape, colour, and texture (Waycott *et al.* 2002).

Since the baseline survey in 2000, DPI&F has conducted annual monitoring as a joint initiative with the Ports Corporation of Queensland (PCQ) to ensure port activities have a minimal impact on the marine environment with special emphasis on sensitive fisheries habitat, particularly seagrass meadows. Due to the large area of the port, long term monitoring focuses on seagrass meadows located near port and shipping infrastructure and activities (*the Intensive Monitoring Area or IMA*). In August / September each year all seagrass meadows within the IMA are mapped. A selection of “core monitoring meadows” representing the range of seagrass meadow communities in the region are assessed for biomass and species composition. At the time of the IMA survey, an aerial reconnaissance of seagrasses in the greater port limits is conducted with re-mapping of the entire port limits occurring every 3 years (i.e. 2002, 2005 and 2008).

The most recent survey results of the September 2008 indicate that total seagrass meadow area (3289 ±52 ha) and landscape cover for the greater port limits has remained at similar levels to the 2005 survey, however significantly lower than the 2001 and 2002 baselines (Chartrand and Rasheed 2009). The most significant change within the greater port limits was a change in species diversity in many for the meadows from mixed-species to mono-specific seagrass in 2008.

Nevertheless, monitoring indicates that seagrass habitat in the Port of Weipa were in a moderate condition (Chartrand and Rasheed 2009). There have been declines in density for a number of meadows compared with the previous eight years of monitoring, particularly for intertidal *Enhalus acoroides* meadows. The observed changes appeared to be partly a response to regional and local climate conditions, however other drivers including anthropogenic factors cannot be discounted. Meadows dominated by *Halodule uninervis* (narrow) had some declines in abundance, however these were generally within the ranges of previous years (Chartrand and Rasheed 2009).

A survey at the southern reaches of Albatross Bay from the northern end of Boyd Bay to Pera Head in September 2007 reported seagrass occurring as a single continuous meadow of dense *Halodule uninervis* (narrow) with *Halophila decipiens* in a coastal strip adjacent to the beach in Boyd Bay (Marine Ecology Consulting 2007).

**Kirke/Love**

The Kirke and Love Rivers are located south of the Aboriginal Community of Aurukun. Both rivers have large saline lakes and extensive associated seasonal wetlands. Terrain surrounding the rivers is typically flat, allowing saline tidal influence to extend several kilometres upstream, especially in the dry-season.

Seagrasses in the Love and Kirke rivers were first mapped in October 1986 as part of the broadscale seagrass survey of the Gulf of Carpentaria (Coles *et al.* 2001a). They recorded the presence of seagrass in the saline lakes of both rivers and identified two species: *Halodule pinifolia* and *Halophila ovalis*. 
In August 1999 the seagrasses of the Kirke and Love Rivers were mapped using a helicopter as part of an investigation by the DPI&F on the suitability of the area as a Fish Habitat Area (Rasheed 2000). No seagrass was found in the Kirke River. Seagrass was confined to six small *Halodule pinifolia* meadows along the edges of shallow intertidal banks in the Love River lake with a total area of $7.614 \pm 1.48$ hectares (Rasheed 2000; Sheppard *et al.* 2000). Rasheed (2000) however, suggested that the absence of seagrass in August 1999 was due to a prolonged period of freshwater inundation from floods in 1999 and that seagrass are likely to grow in the region when habitat conditions are more optimal for seagrass growth.

A resurvey of the Kirke River region was undertaken during April and September 2001 to examine the presence or absence of seagrass in both wet season and dry season conditions. Seagrass was absent in the Kirke River in April 2001, however two *Halodule pinifolia* meadows with a total area of $22.5 \pm 1.9$ hectares were mapped along the edges of the shallow intertidal banks in the Kirke River lake in September 2001 (Sheppard *et al.* 2000, Appendix 2).

**Cape Keerweer to the Nassau River**

No seagrass has been recorded in the coastal area between Cape Keerweer and the Nassau River mouth in the south.

**Threats**

The CYP region is an area rich in flora and fauna species. It is highly regarded by the Australian and the international community as one of the least impacted regions globally and deserves the highest amount of environmental protection available. The significance of the region to the cultural and natural heritage of Cape York’s indigenous communities cannot be understated. The wilderness areas of the region are crucial to their health, well-being and traditional knowledge. Management of this region will need to be mindful of the traditional habitants.

Mining, agriculture, shipping tourism and commercial and recreational fishing are the major economic activities in CYP. All have potential to expand in this region, however, overall threat level to CYP seagrass habitats is currently low. The low level of urban, agricultural and industrial development means threats are localised to port areas where a greater number of potential harmful activities can occur. Threats at these urban and industrial locations include the potential for increased nutrient runoff, port access dredging operations and port infrastructure development along the foreshore. Most threats to seagrass meadows in this region would be largely climate related, eg cyclones. There is potential for sea level rise, thermal damage to seagrasses, and algae blooms smothering meadows if global climate change predictions become real (Coles *et al.* 2007).

Nevertheless, the CYP community perceive the greatest threats to their seagrass meadows to be from the passage of large ships during low tides resuspending sediment plumes in their wakes, sediment erosion associated with dirt roads (and improper road construction), erosion in river catchments, disturbance from trawling and oil or chemical spills (EarthTech, 2005; Howley, 2006). Of potential concern would be unchecked increased
levels of extractive mining and the development of pastoral areas for horticulture within the region. These activities can greatly increase the amount of sediment/turbidity and pollutants associated with runoff produced after the monsoon rains. Oil spillage from large vessels possibly represents the single biggest point source pollution threat to the Great Barrier Reef in this region (Haynes et al. 2001).

**Monitoring & Seagrass-Watch**

By monitoring the health of seagrass meadows, we can understand the status and condition (quality) of environmental assets, characterise emerging problems and help evaluate performance/compliance of programs such as Reef Rescue and legislation (eg Fisheries Act 1994).

Most seagrass monitoring in the CYP region is concentrated around Ports and shipping activities. At present only three Seagrass-Watch sites are currently monitored in the CYP: one at Naprunum (with the Nanum-Wungthim Land & Sea Centre) and two sites at Archer Point (monitored by CYMAG, Howley Consulting and Cooktown State High) (see www.seagrasswatch.org). The two sites at Archer Point have the largest data set of continuous data for this region.

**Archer Point Status (Dec08):**

- Seagrass cover long-term average was between 16% in winter and 19% in late Dry season.
- Seagrass cover significantly improved in 2007 compared to 2006, however it was lower in the late Monsoon 2008 than the previous year.
- Overall, the meadow appears to have generally declined in abundance since monitored was established in 2003.
- Seagrass cover at AP1 has generally followed a seasonal trend with higher abundance in late spring/early summer. However, no seasonal trend is apparent at AP2.
- The sites were dominated by *Halodule uninervis* and *Halophila ovalis*.
- Although sites are only 50m apart, AP2 has slightly more *Cymodocea* and *Thalassia* present.
- Species composition remained relatively stable over the past 12 months.
Information from these sites is providing crucial information on seasonal changes in seagrass communities and their environments. An expansion of Seagrass-Watch in CYP is desirable as will provide greater information (improved resolution) and it is a means of actively involving local stakeholders, including indigenous communities, in the collection of natural marine resource information. Recent expressions of interest to establish monitoring at in Elim Beach (HopeVale) and Port Musgrave are encouraging.

For more information, visit [www.seagrasswatch.org](http://www.seagrasswatch.org)

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