Critical Marine Habitats Adjacent to the Prince of Wales and Adolphus Shipping Channels in the Torres Strait, Far North Queensland, Australia

QDPI&F Information Series QI06063
2006 ATLAS

RISK ASSESSMENT

RISK MANAGEMENT

HABITAT MANAGEMENT

HABITAT MANAGEMENT

Queensland Government
Department of Primary Industries and Fisheries

MARINE ECOLOGY GROUP

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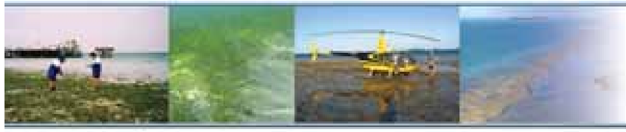

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The Queensland Department of Primary Industries and Fisheries has taken all reasonable steps to ensure the information contained in this publication is accurate at the time of the surveys. Seagrass, algae and other benthic habitat distribution and abundance can change seasonally and between years, and readers should ensure they make appropriate enquiries to determine whether new information is available.

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Introduction

The ports and shipping industry is an essential component of Australia's trade and underpins the viability of many of Australia's export and import industries. Designated shipping lanes have been developed in many areas of Queensland to provide a means for large vessels to access ports. Many of these shipping lanes pass through economically and ecologically important natural habitats and are often in areas that contain significant navigation hazards. In these areas there is a heightened risk of shipping accidents including collisions and groundings of vessels that may result in oil, fuel and chemical spills. Many marine habitats such as seagrasses, algae, mangroves and coral reefs are vulnerable to oil and fuel spills, particularly when they occur in intertidal areas. In many instances there is a lack of detailed information on the marine habitats that occur adjacent to these shipping lanes (Rasheed *et al*., 2005).

Queensland Transport and the Great Barrier Reef Marine Park Authority completed an oil spill and shipping accident risk assessment for coastal waters of Queensland and the Great Barrier Reef Marine Park in 2000 (Queensland Transport and the Great Barrier Reef Marine Park Authority, 2000). The risk assessment identified six marine environment high-risk areas (MEHRA's) for Queensland's shipping lanes and ports where there was a heightened risk of accidents as well as heightened consequences. The six MEHRA's identified in the risk assessment were:

1. Prince of Wales channel (Torres Strait)
2. Great North East channel (Torres Strait)
3. Inner Shipping Route between Cape Flattery and Torres Strait
4. Whitsunday Islands and Passages
5. Hydrographers Passage
6. Moreton Bay

The Queensland Department of Primary Industries and Fisheries' (QDPI&F) Marine Ecology Group with support from the CRC Reef and CRC Torres Strait has developed a program to examine areas of these MEHRA's where there is a lack of detailed information on key marine habitats. The group has already published two atlases in the series, one focusing on the inner shipping route (Rasheed *et al*. 2005a), and the other the Hydrographers Passage Shipping Channel (Rasheed *et al*. 2006a).

The focus of this atlas is on the Prince of Wales (PoW) and Adolphus shipping channels in the Torres Strait. Many ecologically and economically valuable intertidal marine habitats that occur in this area may be vulnerable to oil, fuel or chemical spills from a shipping accident. This atlas provides fine-scale maps of these vulnerable marine habitats. The detailed information collected on the location and nature of habitat types presented in this atlas will be included in the Geographic Information System (GIS) database for the Oil Spill Response Atlas (OSRA), an important resource aiding decision-making and emergency response to shipping accidents and oil spills. Data presented in this atlas was obtained from surveys conducted in March 2004, 2005 and 2006 and also incorporates earlier data obtained in March 2002 from seagrass and benthic habitat surveys of the region (Rasheed *et al*., 2003a).

Intertidal habitats around the Torres Strait survey area viewed from helicopter

Why survey the Torres Strait region?

The Prince of Wales (PoW) and Adolphus Shipping Channels were selected for investigation for a number of reasons including:

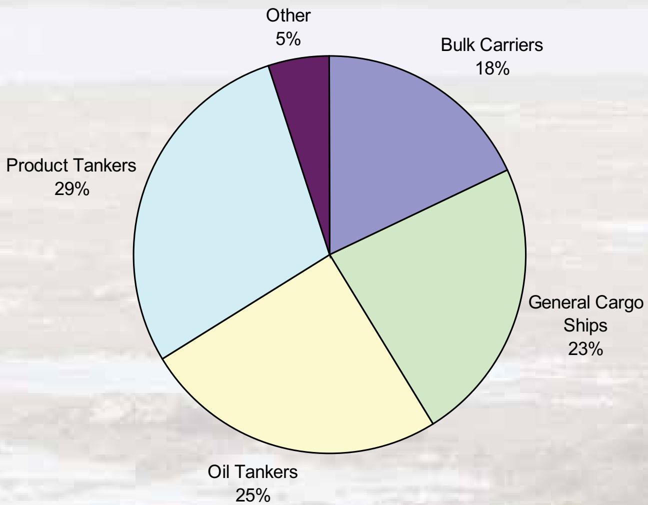
- They are one of the six identified MEHRA's for Queensland
- They contain a high diversity of intertidal habitats (including seagrass and coral reefs) in close proximity to the shipping channels
- The channels are very complicated to navigate, with complex tidal streams and currents, have limited water depth and are in close proximity to islands and reefs
- There was a lack of fine-scale information on intertidal habitats in the area
- Torres Strait Islanders have a high reliance on fisheries that depend on these habitats

The selection process included an examination of existing habitat information and consultation with shipping management agencies in Queensland (Maritime Safety Queensland and the Torres Strait Regional Authority). The PoW Channel is a major channel for Australia linking the Coral Sea in the east with the Arafura Sea in the west. The Adolphus Channel runs between the PoW Channel, past Cape York to the top of the Great Barrier Reef (GBR), and marks the start of the Inner Shipping Route (Map 1). The channels are narrow in a number of sections, being only 800 metres wide at its narrowest, and are bordered by important marine habitats including seagrass beds, coral reefs and extensive dugong habitat.

Shipping lanes in close proximity to reefs and islands

In 2005 / 2006, almost 3300 voyages were undertaken by shipping vessels through the PoW channel, making it the most used passage in Queensland (Neil Trainor, Australian Maritime Safety Authority, Pers. comm., 2006). In addition to this, a further 2100 ships utilised the Adolphus channel to enter the Inner Shipping Route to the GBR. Of these ships passing through the Torres Strait, the majority were oil and product tankers, and general cargo ships (Figure 1; Tracey Jiggins, Australian Maritime Safety Authority, 2006). The Torres Strait region has a high rate of shipping incidents compared to other shipping passages. There are at least 19 separate accidents recorded back to 1970, seventeen of which were ship groundings on reefs, with the remaining two being discharge accidents while docked at the Port of Thursday Island (Queensland Transport and the Great Barrier Reef Marine Park Authority, 2000). Of these 19 accidents, four caused large quantities of oil and fuel to be spilt into the sea (John Wright, Maritime Safety Queensland, 2006).

Figure 1 The vessel types using the Prince of Wales and Adolphus Channels



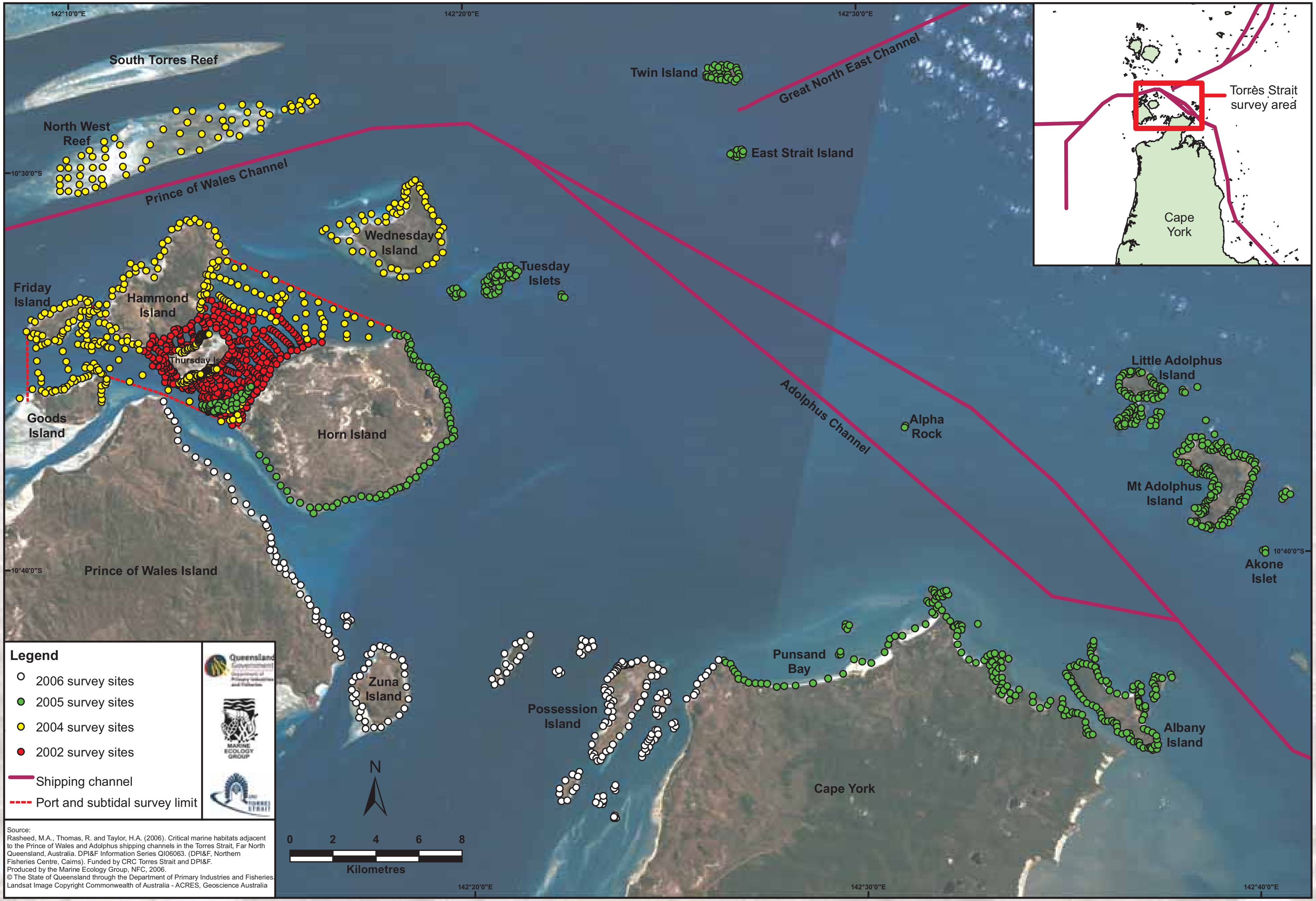
Shipping accidents in Torres Strait also pose a serious risk to commercial and Indigenous fishing. There are a large number of commercial fisheries operating in the region including the northern prawn, tropical rock lobster, trochus, and beche-de-mer fisheries. The northern prawn fishery alone generated in excess of $74 million dollars in 2003 / 2004 (Australian Fisheries Management Authority, 2006). The extensive seagrass habitats located around the PoW and Adolphus shipping channels provide vital nursery ground habitats for juvenile prawns associated with the fishery.

Traditionally, Torres Strait Islanders spiritual and cultural heritage is linked with the land and the sea and many Islanders rely on a wide range of marine species for subsistence and cultural uses. Torres Strait Islanders fish for a large range of species including the well known dugong and turtle. Past surveys have indicated that Torres Strait Islanders mainly target dugong, turtle, fish and crayfish, collecting an average of over 2000 kilograms worth of these species in a typical fishing day (Harris *et al*. 1995). As traditional inhabitants of the Torres Strait, the people are able to fish for both commercial and non-commercial fish species. The tropical rock lobster fishery is the second most valuable commercial fishery in the Torres Strait ($14 million pa.), and 92% of recorded catch by Islanders is sold as commercial catch (Caton & McLoughlin, 2004).

The high fisheries, indigenous and ecological values of the habitats that surround the Prince of Wales and Adolphus shipping channels, combined with the high incidence of accidents and increasing shipping use, make the Torres Strait region an area of particular interest.

Dugong grazing on seagrass

Map 1. Torres Strait survey area and sites around the Prince of Wales, Adolphus and Great North East shipping channels, 2002 - 2006



Survey Methodology

Methods used in these surveys were based on those developed by QDPI&F for similar surveys in other Queensland locations (e.g. Rasheed *et al*. 2005; 2004; 2003b). Three main mapping and survey techniques were used to collect marine habitat data for the maps presented in this atlas:

1. Helicopter Aerial Surveys

Intertidal habitat boundaries, characteristics and species composition were determined using a helicopter around spring low tides when habitats were exposed. Observers in a helicopter hovered directly over the habitat at a height of <100m and the position was fixed using a differential Global Positioning System (dGPS), accurate to ± 5 m. Habitat characterisation sites were scattered randomly within the mapped habitat boundaries with a greater intensity of sites in areas with high habitat complexity.

2. Boat-based Diver / Real Time CCTV Surveys

While most of the survey was confined to intertidal areas, subtidal habitats were mapped within the Thursday Island port limits. Subtidal habitats were mapped from a boat using divers or a remote camera system in areas deemed unsafe for diving operations. For camera sites a real time underwater CCTV unit mounted to a 0.25 m^2 quadrat provided live images that were viewed and assessed from a colour 38 cm monitor aboard the research vessel. Sediment grabs were used at each site to establish sediment type, confirm species seen on video and to check for the presence of some taxa that may have been missed when viewing the video screen. Depths below mean sea level (MSL) data were recorded and survey sites fixed using dGPS.

3. Aerial Photography and Satellite Imagery

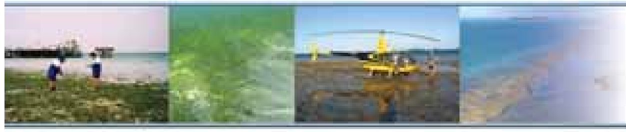
Existing aerial photography of the survey area (Beach Protection Authority, 1992, 1:50000), aerial photographs taken during the helicopter surveys and available satellite imagery (LANDSAT 7 ETM+, Commonwealth of Australia) were used to aid in mapping and determination of habitat boundaries for intertidal communities.

Helicopter aerial surveys

Aerial photography of Thursday Island in Torres Strait (Beach Protection Authority)

Boat-based diver surveys

Boat-based CCTV surveys



Habitat Characterisation

Habitat characterisation was based on survey sites that encompassed a circular area of the substratum of approximately 10 m^2. The position of each site was recorded using dGPS. While methods of observing habitat characterisation sites varied (i.e. helicopter/diver/camera), the information collected for seagrass, algae and benthic macro-invertebrate (BMI) habitat at each site was consistent:

1. Seagrass

At sites where seagrass was present the seagrass species composition, seagrass above ground biomass, percent cover, depth below mean sea level (MSL) (for subtidal sites), sediment type and time were recorded. Seagrass above ground biomass was determined using a modified "visual estimates of biomass" technique described by Mellors (1991). This technique involves an observer ranking seagrass biomass in the field in three random placements of a 0.25 m^2 quadrat at each site. Ranks were made in reference to a series of quadrat photographs of similar seagrass habitat for which the above ground biomass has previously been measured. This method was utilised for both the subtidal and intertidal survey areas. Two separate biomass ranges were used, low-biomass and high-biomass. The relative proportion of the above ground biomass (percentage) of each seagrass species within each survey quadrat was also recorded. Field biomass ranks were then converted into above ground biomass estimates in grams dry weight per square metre (g DW m^{-2}). At the completion of sampling each observer ranked a series of calibration quadrats that represented the range of seagrass biomass in the survey. After ranking, seagrass in these quadrats was harvested and the actual biomass determined in the laboratory. A separate regression of ranks and biomass from these calibration quadrats was generated for each observer and applied to the field survey data to determine above ground biomass estimates.

The presence or absence of seagrass at each site was defined by the above ground biomass. Where above ground biomass was absent, the presence of rhizome/root and seed bank material was not reported. Survey sites with no seagrass can be found within meadows because seagrass cover within meadows is not always uniform and may be patchy and contain bare gaps or scars.

Seagrass quadrat for "visual estimate of above ground biomass"

In addition, a visual estimate was made of the overall percent cover of seagrass at each site. All sites within a seagrass region were grouped to provide a mean percent cover of seagrass for that region. This percent cover was presented as a range in three categories:

- Low (<10%)
- Moderate (10-50%)
- High (>50%)

Low percent cover
(0 - 10%)

Moderate percent cover
(10 - 50%)

High percent cover
(50 - 100%)

Habitat Characterisation continued...

2. Algae

For this atlas, algae habitat occurring in the intertidal zone was mapped. At sites where algae were present, they were identified into the following five functional groups:

- Erect macrophytes - Macrophytic algae with an erect growth form and high level of cellular differentiation e.g. *Sargassum*, *Caulerpa* and *Galaxaura* species
- Erect calcareous - Algae with erect growth form and high level of cellular differentiation containing calcified segments e.g. *Halimeda* species
- Filamentous - Thin thread-like algae with little cellular differentiation
- Encrusting - Algae growing in sheet like form attached to substrate or benthos e.g. coralline algae
- Turf Mat - Algae that forms a dense mat or "turf" on the substrate

At each site, a visual estimate was made of the overall percent cover of algae as well as the relative proportion of the total cover made up of each of the five algal functional groups. All sites within an algae region were grouped to provide a mean percent cover of algae for that region. This percent cover was presented as a range in three categories:

- Low (<10%)
- Moderate (10-50%)
- High (>50%)

3. Benthic macro-invertebrates (BMI)

For this atlas benthic macro-invertebrate (BMI) habitat occurring in the intertidal zone was mapped. At sites where BMI were present, they were identified into the following four broad taxonomic groups:

- Hard coral - All massive, branching, tabular, digitate and mushroom scleractinian corals
- Soft coral - All alcyonarian corals i.e. corals lacking a hard limestone skeleton
- Sponges - All sponge species were grouped together
- Other BMI - Any other BMI identified e.g. ascidians, bivalves, gastropods, holothurians

At each site, a visual estimate was made of the overall percent cover of each of the BMI broad taxonomic groups. All sites within a BMI region were grouped and a mean percent cover of the dominant BMI group for that region was calculated. This percent cover was presented as a range in three categories:

- Low (<10%)
- Moderate (10-50%)
- High (>50%)


Erect Macrophytes with Seagrass


Erect Calcareous Algae


Encrusting and Turf Algae on Coral Rubble


Filamentous Algae


Hard Coral


Soft Coral


Sponges

Geographic Information System (GIS)

All data were entered into a Geographic Information System (GIS) developed for Torres Strait. Rectified colour aerial and satellite imagery of the region (Beach Protection Authority and Commonwealth of Australia), combined with aerial photography and videotape footage taken from the helicopter during surveys assisted with mapping. Other information including depth below MSL, substrate type, the shape of existing geographical features such as reefs and channels, and evidence of strong wave energy or tidal currents was also interpreted and used in determining habitat boundaries.

The precision of determining seagrass, algae and benthic macro-invertebrate (BMI) region boundaries depended on the range of mapping information and methods available for each region. Intertidal region boundaries followed with dGPS had the highest precision. Large subtidal areas where seagrass meadow boundaries could not be seen from the surface had the lowest mapping precision. For these seagrass meadows, boundaries were based on the mid-point between the last site where seagrass was present and the next non-seagrass site.

Each habitat region was assigned a mapping precision estimate (in metres) based on mapping methodology utilised for that region (Table 1). Mapping precision ranged from ± 5 m for isolated intertidal seagrass, algae and BMI regions to ± 75 m for large subtidal seagrass meadows (Table 1). The mapping precision estimate was used to calculate a range of area for each region and was expressed as a reliability estimate (R) in hectares. Additional sources of mapping error associated with digitising and rectifying aerial photographs onto base maps and with dGPS fixes for survey sites were assumed to be embedded within the reliability estimates.

Seagrass community types were determined according to overall species composition. A standard nomenclature system was used to name each of the seagrass meadows in the survey area. This system was based on the percent composition of biomass contributed by each species within the meadow (Table 2). This nomenclature also included a measure of meadow density that was determined by the mean above ground biomass of the dominant species within the community (Table 3).

Mapping intertidal habitat boundaries by helicopter

Table 1 Mapping precision and methodology for seagrass, algae and benthic macro-invertebrate regions in the Torres Strait survey area, 2002 - 2006

Mapping precision	Mapping methodology
< 5 m	Seagrass meadow boundaries mapped in detail by dGPS from helicopter All regions intertidal and exposed or visible at low tide Relatively high density of mapping and survey sites Recent aerial and satellite imagery aided in mapping
10 m	Region boundaries determined from helicopter and diver/camera surveys Inshore seagrass boundaries mapped from helicopter Offshore seagrass boundaries interpreted from survey sites and aerial photography Algae/BMI regions all intertidal Relatively high density of mapping and survey sites Recent aerial and satellite imagery aided in mapping
20 m	Seagrass meadow boundary interpreted from diver/camera surveys Algae/BMI region boundaries based on distance between survey sites All seagrass meadows subtidal Algae/BMI regions all intertidal Relatively high density of survey sites Recent aerial and satellite imagery aided in mapping
50 m	Seagrass meadow boundaries interpreted from diver/camera surveys Algae/BMI region boundaries based on distance between survey sites All seagrass meadows subtidal Algae/BMI regions all intertidal Relatively low density of survey sites Recent aerial and satellite imagery aided in mapping
75 m	Seagrass meadow boundaries interpreted from diver/camera surveys Applied to subtidal seagrass meadows only Relatively low density of survey sites Recent aerial and satellite imagery aided in mapping

Table 2 Nomenclature for seagrass community types in the Torres Strait survey area, 2002 - 2006

Community type	Species composition
Species A	Species A is 90-100% of composition
Species A with Species B	Species A is 60-90% of composition
Species A with Species B/Species C	Species A is 50-60% of composition
Species A/Species B	Species A is 40-60% of composition

Confirming species identifications on intertidal habitat at Wednesday Island

Table 3 Density (biomass) categories and mean above ground biomass ranges for each species used in determining seagrass community density in the Torres Strait survey area, 2002 - 2006

Density (biomass) category	Dominant seagrass species in meadow (g DW m^{-2})									
	Halophila decipiens/ ovalis	*Halodule uninervis* (thin)	*Syringodium isoetifolium*	*Halodule uninervis* (wide)	*Cymodocea rotundata/ serrulata*	*Thalassia hemprichii*	*Halophila spinulosa*	*Zostera capricorni*	*Thalassodendron ciliatum*	*Enhalus acoroides*
Light	< 0.5	< 1	< 5	< 5	< 5	< 5	< 15	< 20	< 40	< 40
Moderate	0.5-5	1-4	5-25	5-25	5-25	5-25	15-35	20-60	40-100	40-100
Dense	> 5	> 4	> 25	> 25	> 25	> 25	> 35	> 60	> 100	> 100

Critical Marine Habitats of Torres Strait

A total of 1,963 habitat assessment sites were surveyed in intertidal and subtidal regions adjacent to the Prince of Wales and Adolphus shipping channels over four years, from March 2002 to March 2006 (Map 1):

Survey year	Number of sites surveyed
2002	511
2004	546
2005	673
2006	233
TOTAL	1963

The survey assessed a total of 14,379 ha of benthic habitat. In general, seagrass was the dominant habitat type in the survey area (Table 4; Map 2), although there were also areas dominated by algae and Benthic Macro-invertebrates (BMI). Seagrass, algae and BMI often occurred together within the same habitat characterisation sites and hence had overlapping distributions. In terms of percent cover of the bottom seagrasses and algae combined made up an average of more than 50% of the sites surveyed (Figure 2). Hard corals, soft corals and other BMI formed a relatively small component of the overall benthic habitat within the survey area (Figure 2).

Seagrasses

Extensive intertidal and subtidal seagrass habitat occurred throughout the Torres Strait survey area. Seagrass was the dominant habitat type identified in the survey area with a total of 7,283 ± 601 ha mapped (Table 4; Map 2). Of this total, shallow subtidal (< 10 m) seagrass comprised a large component of the subtidal areas surveyed and covered an area of 1,812 ± 344 ha. As the subtidal survey area was confined to the limits of the Port of Thursday Island, it is highly likely that subtidal seagrass covers a much larger area than reported here. Intertidal seagrass habitat comprised the remainder of total seagrass area and covered 5,471 ± 257 ha.

Percent cover for the subtidal seagrass meadows was generally low (< 10%) or moderate (10-50%), while percent cover for the majority of intertidal seagrass habitat was either moderate (10-50%) or high (> 50%) (Map 2). Eleven seagrass species were identified in 28 distinct community types and 109 meadows (Figure 3; Table 4; Maps 3, 4, 5 and 6).

Seagrass communities dominated by *Enhalus acoroides* were the most common community type identified (Table 4). This species dominated intertidal areas around the Thursday Island Group (Thursday, Horn, Hammond, Goods, Friday, and Prince of Wales Islands) and the Possession Island area. Subtidal areas in these regions were dominated by *Cymodocea serrulata* (Maps 3 & 4). The Adolphus Island area (Mt Adolphus, Little Adolphus and Lacey Islands), North West Reef and Wednesday Island were all dominated by *Thalassia hemprichii* (Map 6). The remainder of the area around Cape York Peninsula was dominated by a mix of species, including *Zostera capricorni*, *Enhalus acoroides* and *Thalassodendron ciliatum* (Map 5).

Figure 2 Mean percent cover of the major benthos types in the Torres Strait survey area

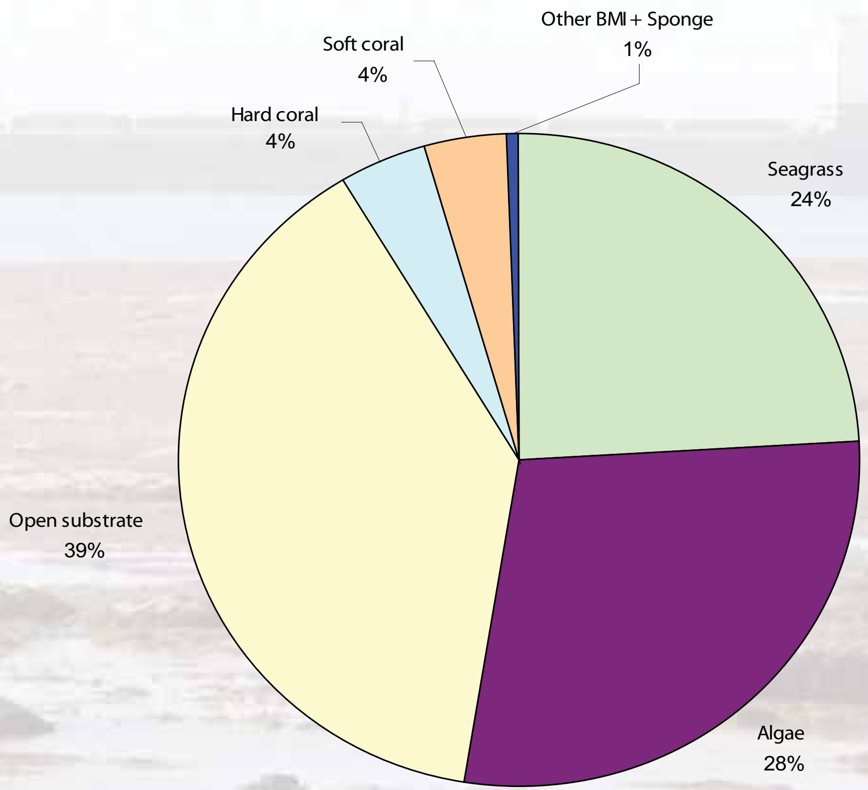


Table 4 Seagrass community types and area (ha) around the Torres Strait survey area, 2002 - 2006 (subtidal and intertidal areas combined) (n/a* meadow boundary was mapped but no biomass sites were sampled for this meadow in March 2004)

Dominant seagrass	Seagrass community type	No. of meadows	Area ± R (ha)
Cymodocea serrulata	*C. serrulata*	1	5.5 ± 0.9
	C. serrulata with *H. ovalis*	1	0.3 ± 0.2
	C. serrulata with mixed species	11	1707.8 ± 331.5
Enhalus acoroides	*E. acoroides*	7	16.2 ± 2.6
	E. acoroides with mixed species	22	1113.1 ± 63.8
	E. acoroides/T. hemprichii	6	1207.3 ± 34.1
	E. acoroides/T. hemprichii with mixed species	2	548.5 ± 22.7
	E. acoroides/T. hemprichii/H. ovalis	2	6.0 ± 1.1
	E. acoroides/T. ciliatum with mixed species	2	151.1 ± 11.2
	E. acoroides/T. hemprichii/H. uninervis (wide)	1	6.6 ± 0.9
	E. acoroides/H. uninervis (thin)	1	9.6 ± 1.1
	n/a*	1	7.1 ± 0.6
Halophila ovalis	*H. ovalis/H. uninervis* (thin)	1	0.4 ± 0.2
	H. ovalis/H. uninervis (wide)	1	1.2 ± 0.4
	H. ovalis with *H. spinulosa*	1	0.6 ± 0.5
Halophila spinulosa	*H. spinulosa*	1	19.8 ± 14.5
***Halodule uninervis* (thin)**	*H. uninervis* (thin) with mixed species	1	10.4 ± 2.1
	H. uninervis (thin)/*H. ovalis*	5	6.7 ± 2.4
Syringodium isoetifolium	*S. isoetifolium* with mixed species	1	0.8 ± 0.2
Thalassodendron ciliatum	*T. ciliatum*	3	2.4 ± 0.9
	T. ciliatum with *E. acoroides*	1	3.0 ± 0.4
	T. ciliatum with mixed species	6	367.6 ± 22.3
Thalassia hemprichii	*T. hemprichii*	19	389.8 ± 24.6
	T. hemprichii/T. ciliatum with mixed species	1	8.2 ± 0.8
	T. hemprichii with mixed species	7	1516.0 ± 51.6
	T. hemprichii with *E. acoroides*	1	13.9 ± 1.0
Zostera capricorni	*Z. capricorni*	1	5.7 ± 0.7
	Z. capricorni with mixed species	2	166.5 ± 7.2
TOTALS	**28 Seagrass community types**	**109 meadows**	**7282.6 ± 600.7 ha**

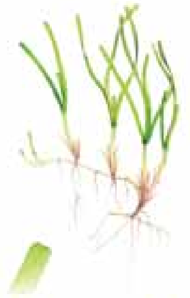
Halodule uninervis (thin)/*Halophila ovalis*

Thalassia hemprichii with mixed species

Enhalus acoroides with mixed species

Figure 3 Eleven seagrass species (from three families) identified around the Torres Strait survey area, 2002 - 2006

Family CYMODOCEACEAE Taylor:
Cymodocea rotundata
Ehrenb. et Hempr. ex Aschers



Cymodocea serrulata
(R. Br.) Aschers. and Magnus

Syringodium isoetifolium
(Aschers.) Dandy

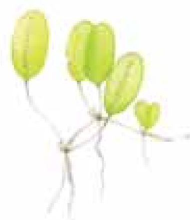
Thalassodendron ciliatum
(Forsk.) den Hartog

Family CYMODOCEACEAE Taylor:
Halodule uninervis
(wide and narrow leaf morphology) (Forsk.)
Aschers. in Boissier

Family HYDROCHARITACEAE Jussieu:
Enhalus acoroides
(L.F.) Royle

Halophila decipiens
Ostenfeld

Halophila ovalis
(R. Br.) Hook. F.

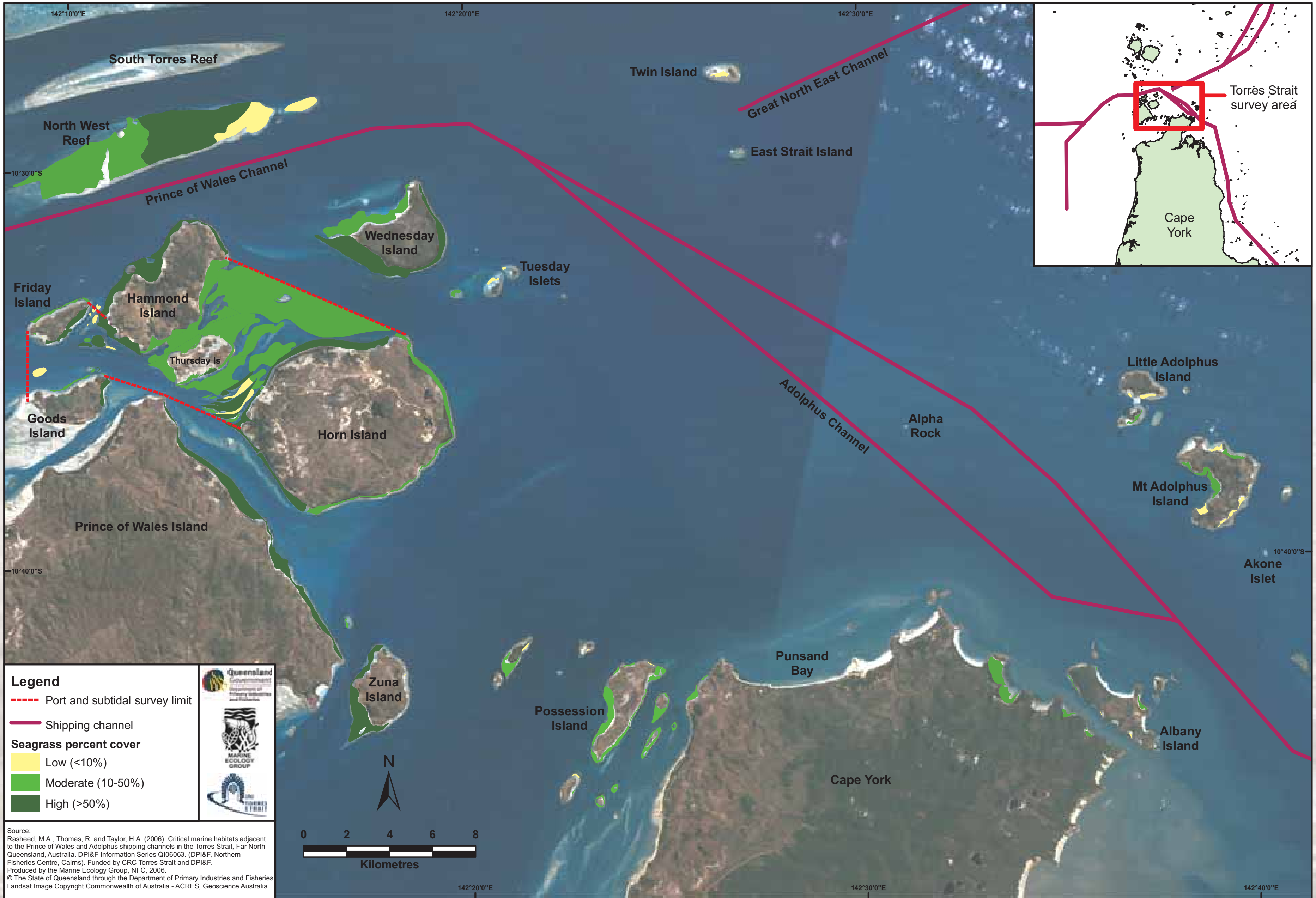


Family HYDROCHARITACEAE Jussieu:
Halophila spinulosa
(R. Br.) Aschers. In Neumayer

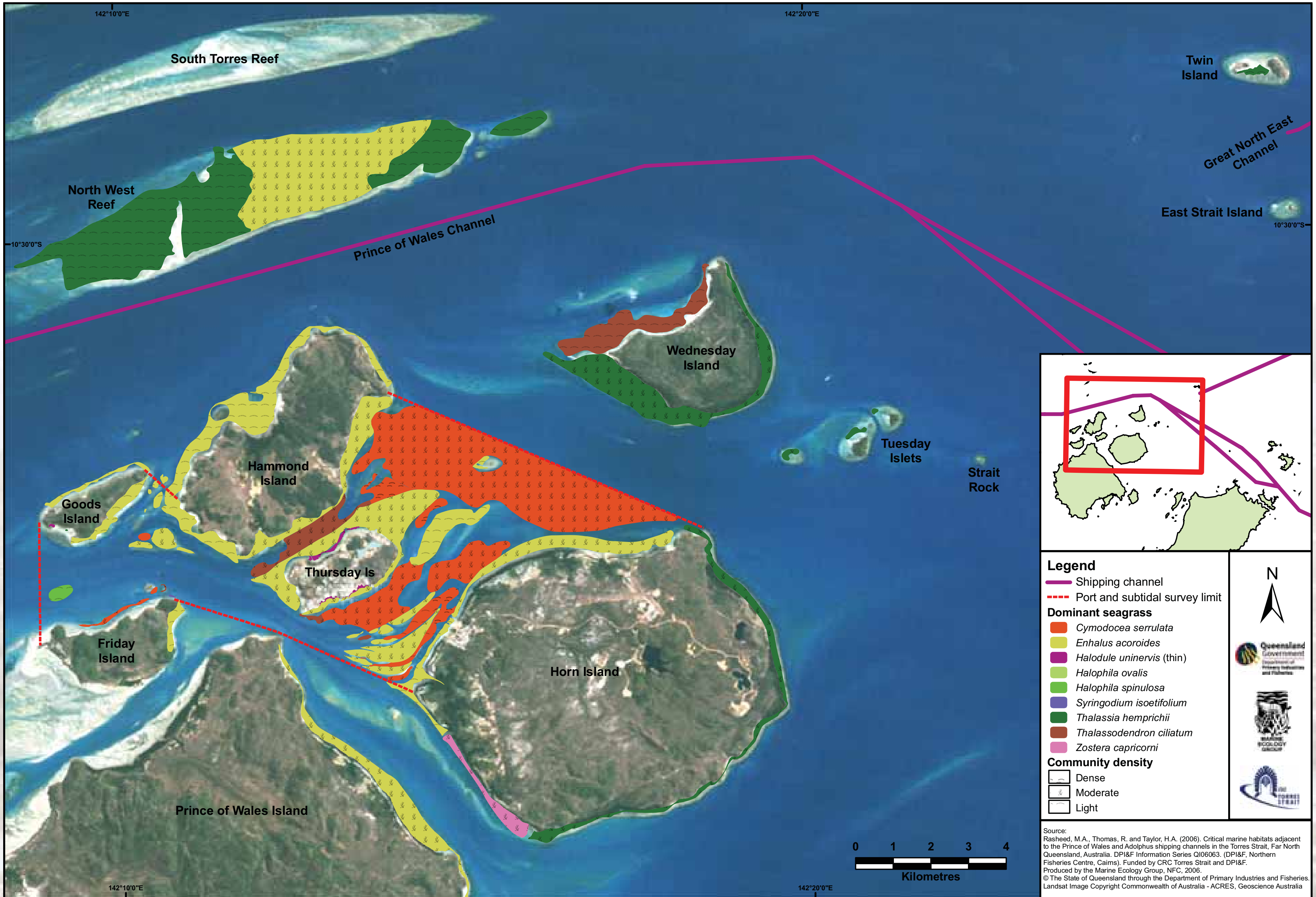
Thalassia hemprichii
(Ehrenb.) Aschers. in Petermann

Family ZOSTERACEAE Drummortier:
Zostera capricorni
Aschers.

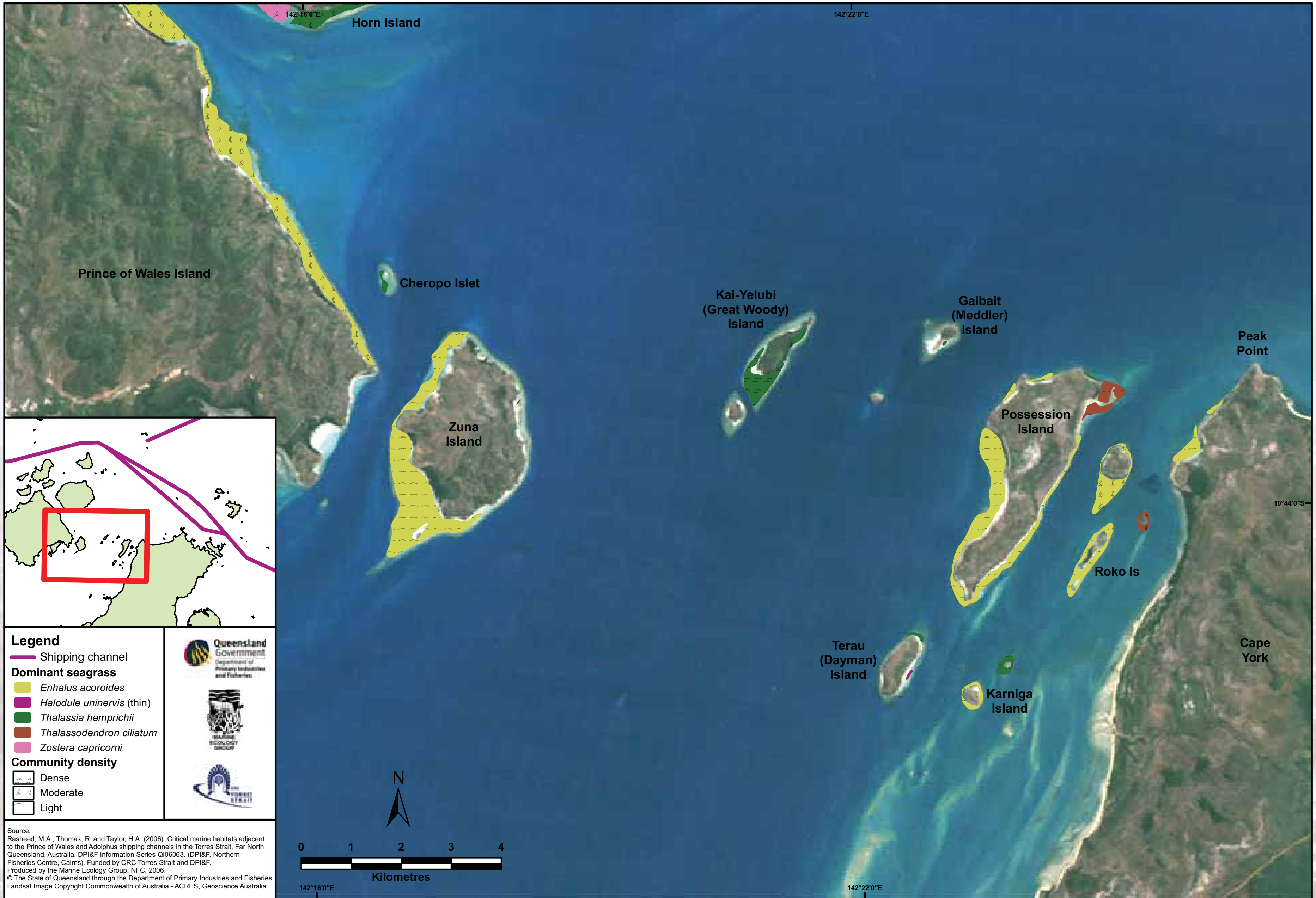
Map 2. Seagrass distribution and percent cover in the Torres Strait survey area, 2002 - 2006



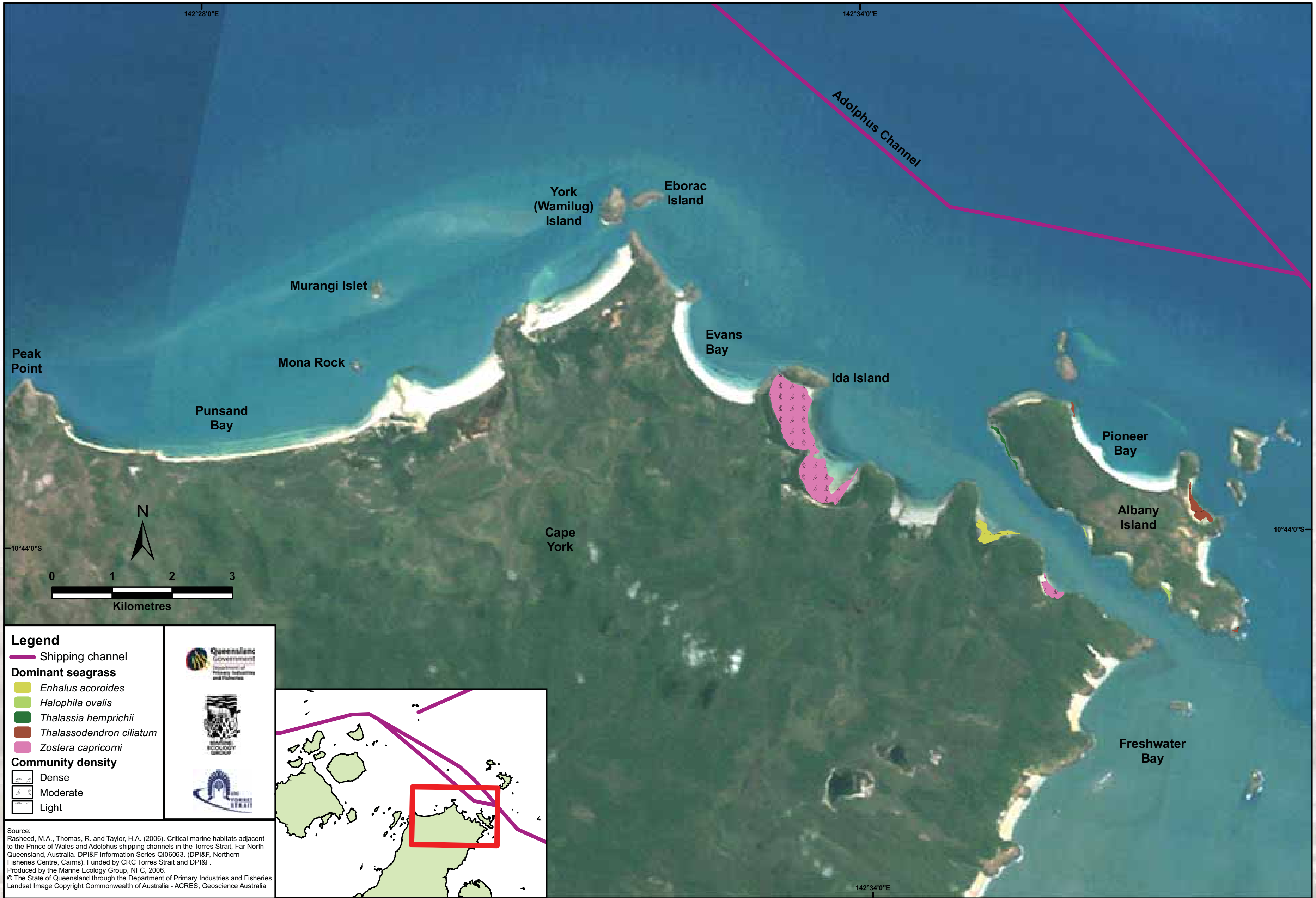
Map 3. Seagrass community types and density around Thursday Island and the Prince of Wales channel, Torres Strait, 2002 - 2006



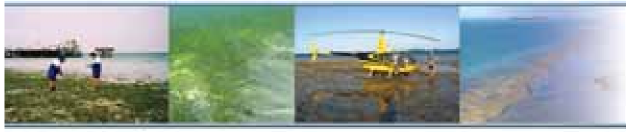
Map 4. Intertidal seagrass community types and density around Prince of Wales Island and Cape York, Torres Strait, 2002 - 2006



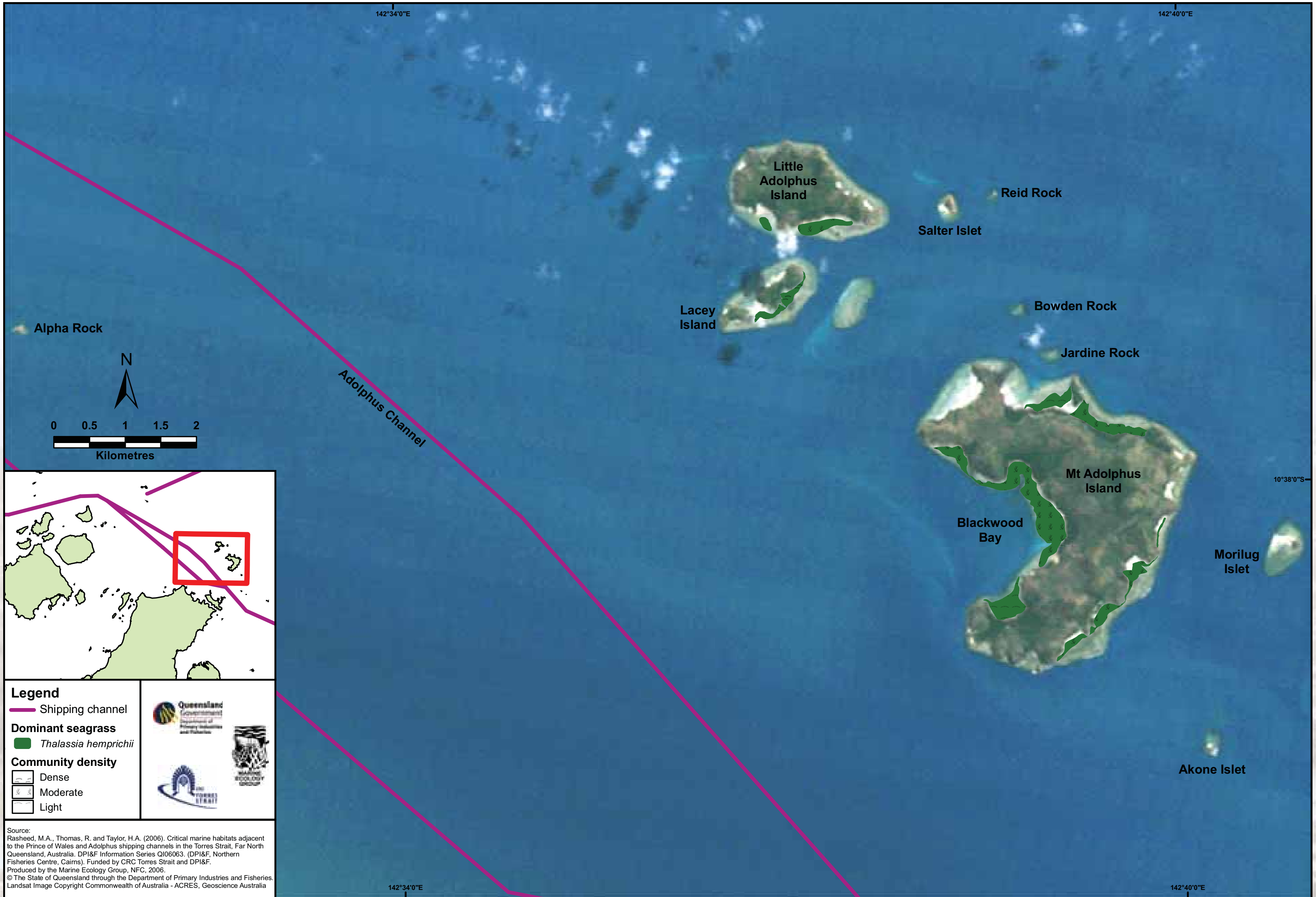
Map 5. Intertidal seagrass community types and density around Punsand Bay, Albany Island and Adolphus channel, Torres Strait, 2002 - 2006



Source:
Rasheed, M.A., Thomas, R. and Taylor, H.A. (2006). Critical marine habitats adjacent to the Prince of Wales and Adolphus shipping channels in the Torres Strait, Far North Queensland, Australia. DPI&F Information Series QI06063. (DPI&F, Northern Fisheries Centre, Cairns). Funded by CRC Torres Strait and DPI&F.
Produced by the Marine Ecology Group, NFC, 2006.



Map 6. Intertidal seagrass community types and density around Mt Adolphus Island and Adolphus channel, Torres Strait, 2002 - 2006



Algae

Extensive areas of intertidal algae habitat were identified throughout the survey region with a total of 5074 ± 817 ha mapped (Table 5). Algae made up a large percentage of benthic life at survey sites, with only open substrate higher (Figure 1). There were five dominant algal groups recorded, however most communities were comprised of a mixture of other species. In total, 19 different algal communities were identified which covered over 200 different communities (Table 5).

The majority of algae habitat had moderate (10-50%) cover and was dominated by algal turf mat species. Algal turf mats formed extensive communities on many of the exposed reef flats and often occurred in conjunction with both seagrass meadows and reef communities. The intertidal areas around most of the islands surveyed and also the Cape York area were particularly dominated by these turf mat communities (Maps 7, 8, 9 and 10).

In addition to the turf mat dominated communities, there were extensive areas of erect macrophytes located on the reefs and islands surrounding Thursday, Friday, Goods and Hammond Islands, and covering the majority of North West Reef (Map 7). These communities were mostly moderate percent cover (10-50%) and included genera such as *Sargassum* and *Caulerpa*. While erect macrophytes generally dominated these northern reefs, most of these communities also included mixed species from each of the algal functional groups.

Erect Macrophytic algae dominated habitat on Hammond Island

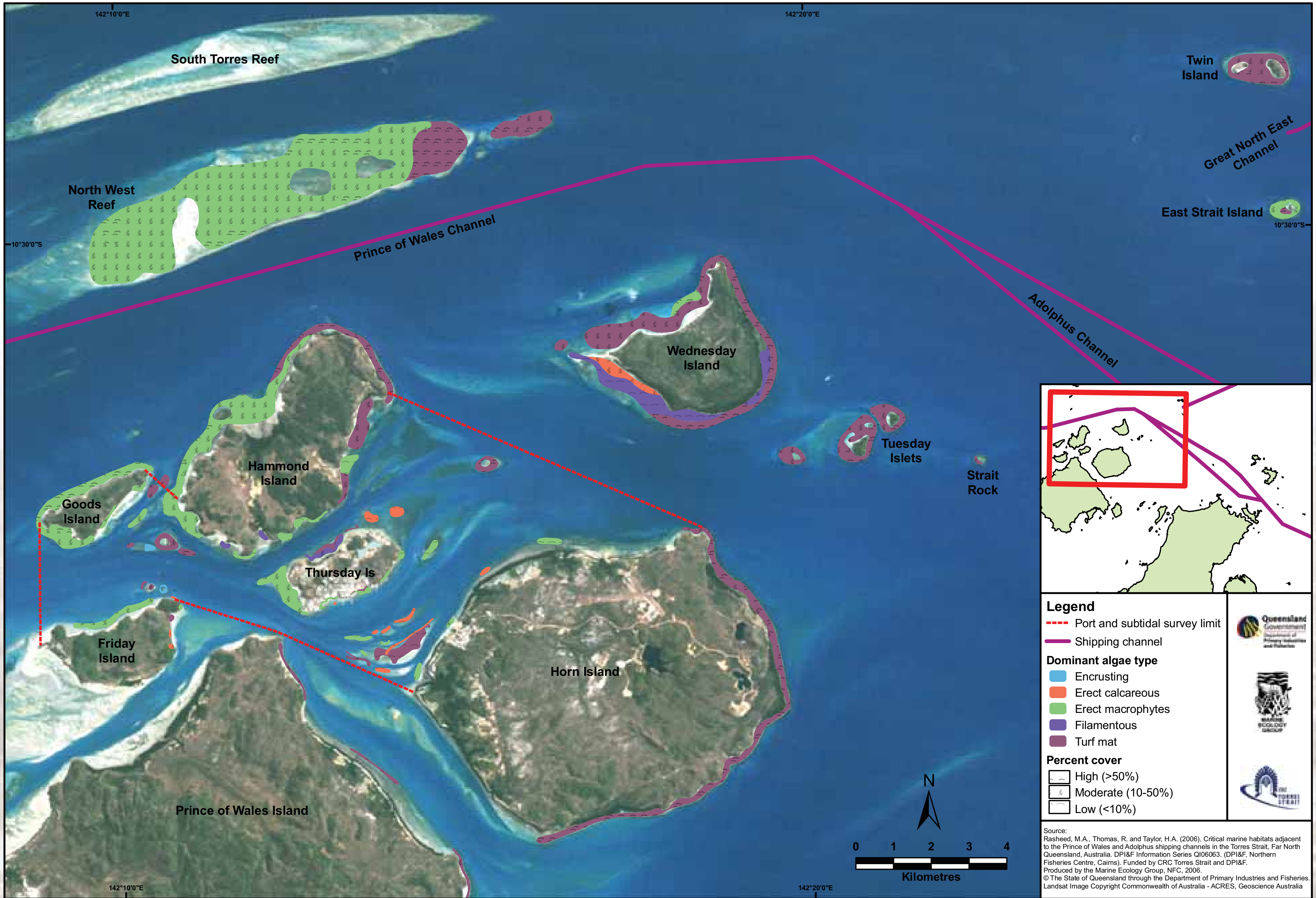
Table 5 Algae community types and area (ha) around the Torres Strait survey area, 2002 - 2006 (subtidal and intertidal areas combined)

Dominant algae group	Algae community type	No. of communities	Area ± R (ha)
Encrusting	Encrusting	2	2.5 ± 0.9
	Encrusting with mixed species	2	7.8 ± 2.0
Erect macrophytes	Erect macrophytes	4	18.4 ± 2.5
	Erect macrophytes with mixed species	48	2141.6 ± 336.9
	Erect macrophytes/Encrusting	1	1.2 ± 0.2
	Erect macrophytes/Filamentous	1	3.6 ± 0.8
	Erect macrophytes/Erect calcareous	1	0.8 ± 0.6
Filamentous	Filamentous	2	32.9 ± 4.9
	Filamentous with mixed species	5	205.2 ± 30.5
	Filamentous/Turf mat	1	3.7 ± 0.8
Turf mat	Turf mat	16	37.4 ± 11.5
	Turf mat with mixed species	87	2487.3 ± 395.7
	Turf mat/Encrusting	2	2.7 ± 1.1
	Turf mat/Erect macrophytes	6	16.2 ± 4.5
	Turf mat/Erect calcareous	1	10.4 ± 3.3
Erect calcareous	Erect calcareous	8	29.6 ± 5.2
	Erect calcareous with mixed species	7	28.5 ± 7.3
	Erect calcareous/Filamentous	1	36.3 ± 4.5
	Erect calcareous/Erect macrophytes	1	8.2 ± 3.3
TOTALS	**19 Algal community types**	**206 communities**	**5073.9 ± 816.7 ha**


Erect macrophytes/Erect calcareous community

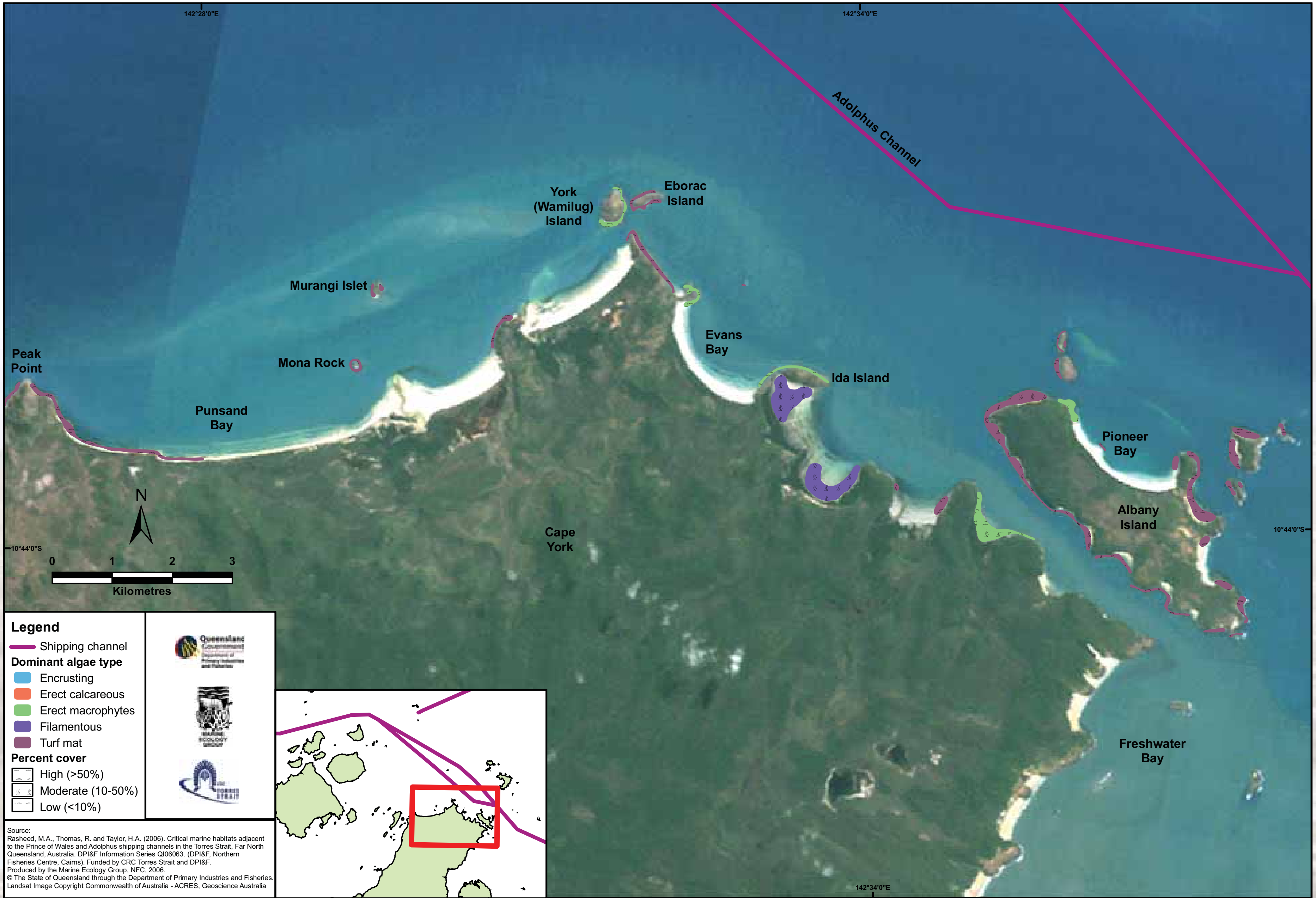

Erect macrophytes with mixed species including holothurians

Map 7. Intertidal algae community types and percent cover around Thursday Island and the Prince of Wales channel, Torres Strait, 2002 - 2006



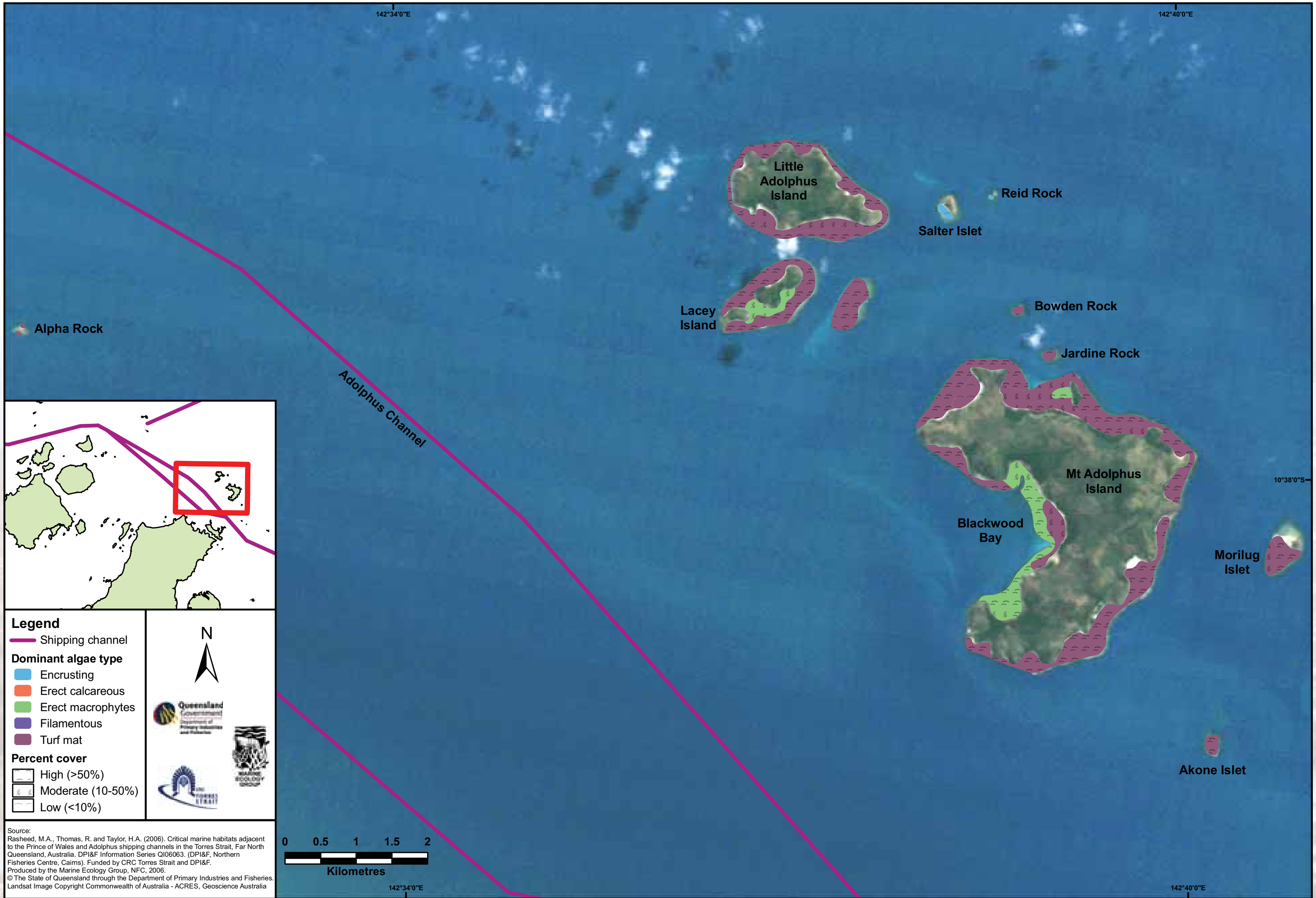
Map 8. Intertidal algae community types and percent cover around Prince of Wales Island and Cape York, Torres Strait, 2002 - 2006

Map 9. Intertidal algae community types and percent cover around Punsand Bay, Albany Island and Adolphus channel, Torres Strait, 2002 - 2006



Source:
Rasheed, M.A., Thomas, R. and Taylor, H.A. (2006). Critical marine habitats adjacent to the Prince of Wales and Adolphus shipping channels in the Torres Strait, Far North Queensland, Australia. DPI&F Information Series QI06063. (DPI&F, Northern Fisheries Centre, Cairns). Funded by CRC Torres Strait and DPI&F.
Produced by the Marine Ecology Group, NFC, 2006.

Map 10. Intertidal algae community types and percent cover around Mt Adolphus Island and Adolphus channel, Torres Strait, 2002 - 2006



Benthic macro-invertebrates (BMI)

Sessile intertidal benthic macro-invertebrates (BMI) also formed a significant component of the benthic habitat in the survey area with 2,022 ± 370 ha mapped (Table 6). Reef communities dominated by soft and hard corals formed the majority of BMI habitat (Maps 11, 12, 13 and 14). Although sponges were present in a much lower abundances than corals, where they did occur they were generally the dominant BMI group and formed significant communities together with hard corals on North West Reef and around the Adolphus Islands (Table 6; Maps 11 and 14). BMI formed a total of 157 discrete communities which were grouped into seven major community types (Table 6). Percent cover for all BMI communities was generally low (< 10 %) although some significant areas of high cover (> 50 %) hard and soft coral reef communities did occur. In general, hard and soft coral communities were found on the outer edges of intertidal banks, and extended into the subtidal region (see photo right).

Large intertidal reefs fringed many of the islands in the survey area

The Prince of Wales channel in close proximity to reefs at Hammond Is

A crocodile on exposed reef at Mt Adolphus Island

Holothurians were abundant on many of the intertidal reefs

Reef at Alpha Rock was dominated by hard/soft coral and turf mat algae

Table 6 Benthic macro-invertebrate (BMI) community types and area (ha) around the Torres Strait survey area, 2002 - 2006 (intertidal areas only)

Dominant BMI group	BMI community type	No. of communities	Area ± R (ha)
Hard coral	Hard coral	10	33.7 ± 7.3
	Hard coral/sponge	8	401.6 ± 51.8
	Hard/soft coral	61	671.9 ± 126.0
Soft coral	Soft coral	5	12.7 ± 3.4
	Soft/hard coral	68	670.7 ± 161.7
Sponge	Sponge	4	17.5 ± 3.5
	Sponge/soft coral	1	213.8 ± 16.2
TOTALS	**7 BMI community types**	**157**	**2071.9 ± 369.8**

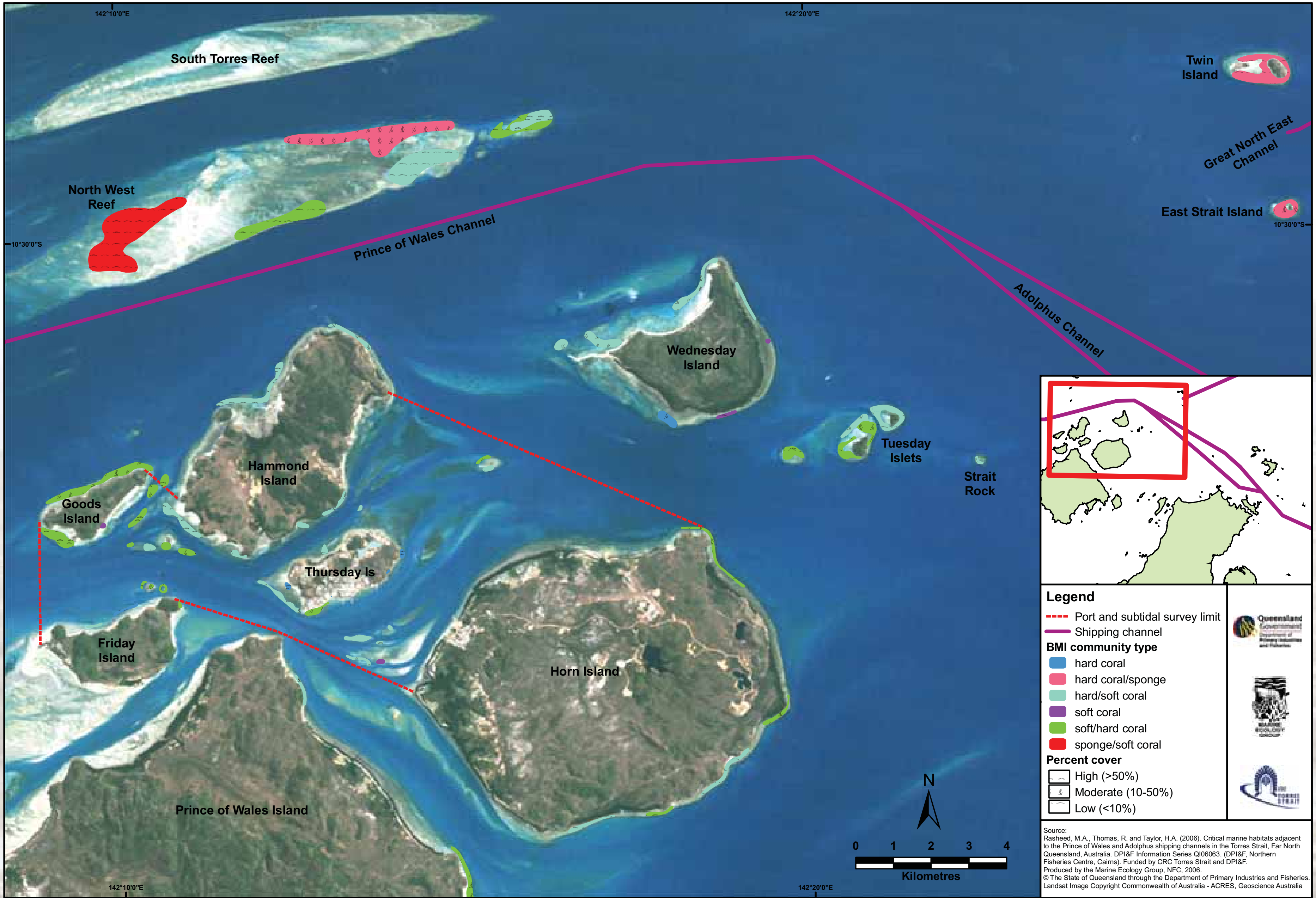

Mixed hard/soft coral dominated reef community

Hard coral dominated reef community

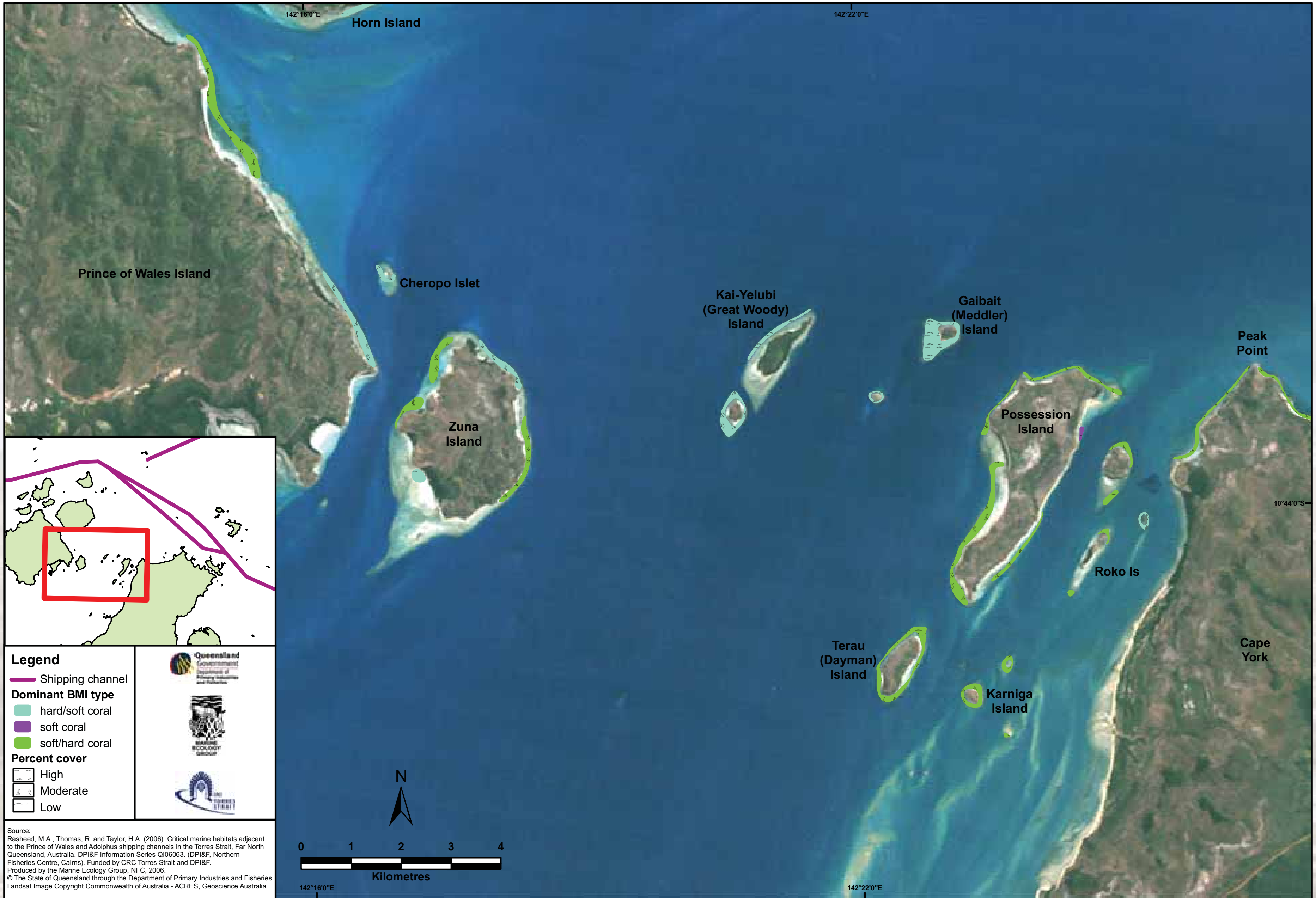


Soft coral dominated reef community

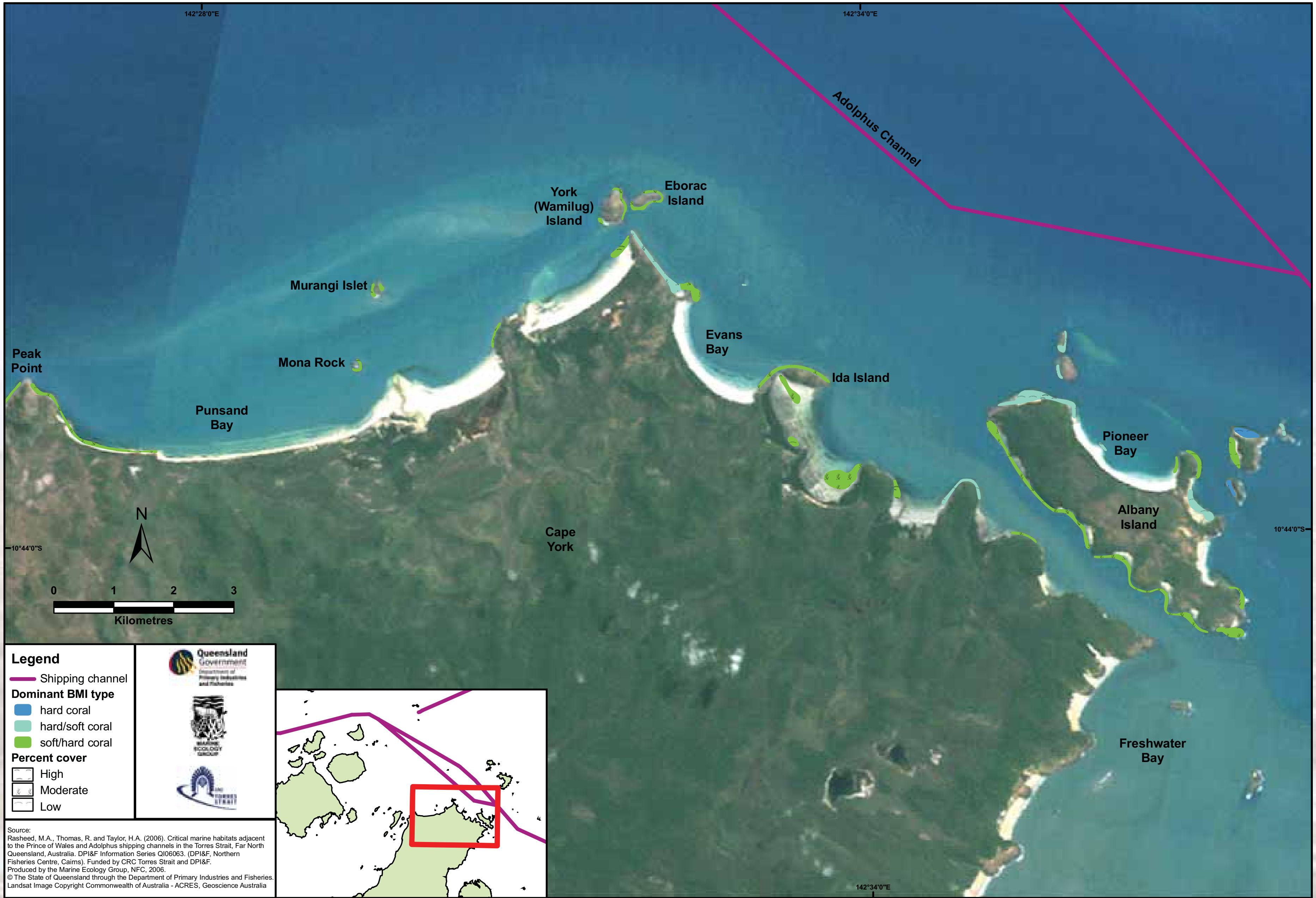
Map 11. Intertidal benthic macro-invertebrate community types and percent cover around Thursday Island and the Prince of Wales channel, Torres Strait, 2002 - 2006



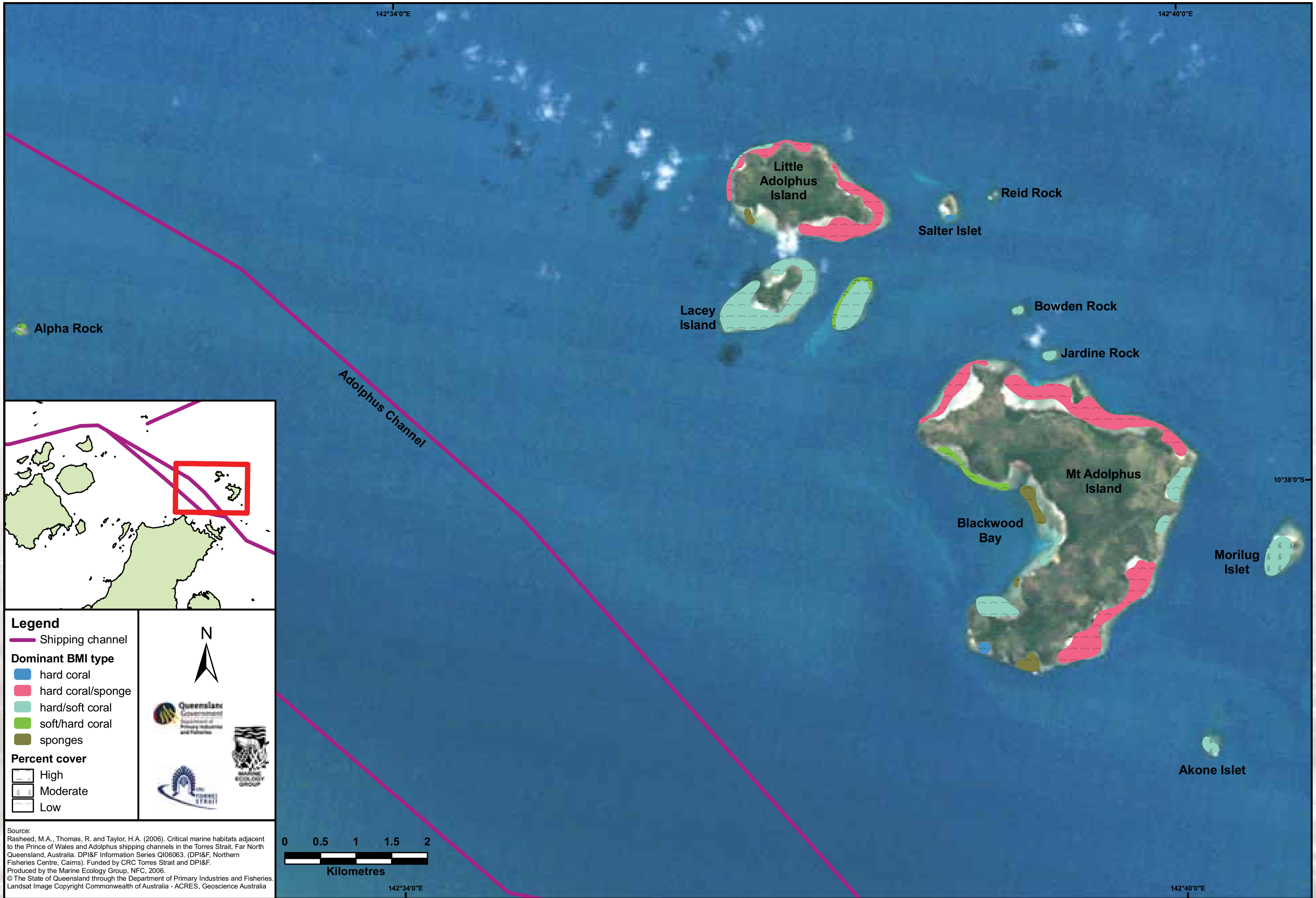
Map 12. Intertidal benthic macro-invertebrate community types and percent cover around Prince of Wales Island and Cape York, Torres Strait, 2002 - 2006



Map 13. Intertidal benthic macro-invertebrate community types and percent cover around Punsand Bay, Albany Island and Adolphus channel, Torres Strait, 2002 - 2006



Map 14. Intertidal benthic macro-invertebrate community types and percent cover around Mt Adolphus Island and Adolphus channel, Torres Strait, 2002 - 2006



Conclusions and Risk Assessment

This atlas documents results from a series of four surveys conducted from 2002 - 2006 that map ecologically and economically valuable intertidal marine habitats occurring adjacent to the Prince of Wales and Adolphus shipping channels in the Torres Strait. In these surveys, extensive areas of seagrass, algae and benthic macro-invertebrate (BMI) habitats were identified in proximity to the shipping channels. These habitats were likely to be highly sensitive to shipping accidents and oil spills.

Seagrass was the dominant feature of the survey area. Together with macrophytic algae, seagrass habitat covered the majority of intertidal areas on both reef tops and the shallow banks surrounding islands. Corals and other habitat forming benthic macro-invertebrates made up a smaller proportion of the survey area, generally being restricted to the deeper outer edges of reefs. Given their relatively high density, the seagrass communities described in this atlas were likely to have significant ecosystem roles in the region as well as supporting a diversity of commercial, recreational and traditional fisheries species.

The extensive seagrass cover throughout the Thursday Island port limits has implications for future port and coastal developments. The establishment of new wharves, boat ramps and navigation channels would likely have direct impacts on seagrasses and would require careful design to minimise impacts.

In order to assist in priority setting for accident response we have combined the habitats mapped in this survey into three distinct categories of impact risk from shipping accidents. The categories were based on habitats biological susceptibility to oils and habitat quality (Table 7; Map 15). While all of the intertidal area was considered at risk, some ability to discriminate between areas was considered important when there may be limited resources available to deal with an oil spill or shipping accident.

Although all seagrass, coral and macro-algae types found within the survey area are susceptible to damage from oil and also to some of the dispersants commonly used in oil spill management (e.g. Baca *et al.* 1996; Knap *et al.* 1983; O'Brien & Dixon 1976) they can vary substantially in their growth rates and ability to recover from damage. Small, fast growing seagrass species such as *Halophila* have the capacity for rapid recolonisation and recovery from disturbance when compared with larger slower growing species (eg. Rasheed 1999; 2004). Similarly, different macro-algae types vary in their growth rates and ability to recolonise. Filamentous turf algae are rapid colonisers and are quick to recover from damage compared to the more structurally complex erect macrophyte and erect calcareous growth forms (e.g. Diaz-Pulido & McCook 2002; Littler & Littler 1980; McClanahan 1997).

Benthic habitats were assigned into seven different groups for determination of risk by applying the known information on recovery rates and susceptibility to oil damage (Table 7). From this, a risk matrix that also accounted for density of habitat types was applied and regions were assigned into habitat risk categories: low risk, moderate risk and high risk (Table 7).

The application of the risk matrix resulted in a majority of the intertidal areas in the survey area being at high risk due to the near universal cover of seagrass (Map 15). The area surrounding the Adolphus Islands was the only intertidal region with substantantial areas at lower risk of impact from an oil spill. While the subtidal areas surveyed also contained extensive areas of seagrass, oil and fuel are less likely to come in direct contact with these deeper meadows. As such, subtidal seagrasses were assessed as being at moderate risk.

Care should be taken when interpreting the maps in this atlas as only exposed intertidal areas were examined in areas outside the Thursday Island port limits. Hard and soft coral habitats tended to occur more commonly in the shallow subtidal areas off the edges of banks and reefs and therefore were not fully represented on the maps in this atlas. The risk assessment catagories used in this atlas are relative and even areas classified as "low risk" contained habitats that would be susceptible to damage from oil spills and shipping accidents. Many of the habitats described may also vary in distribution, density, seasonality and between years. Attempts at ground truthing the extent of these habitats as part of any response to an accident/oil spill is recommended.

Information in this atlas will be incorporated into National Oil Spill Response Atlas (OSRA) to assist with priority setting for shipping accident response, with a goal to protect the most valuable and vulnerable habitats.

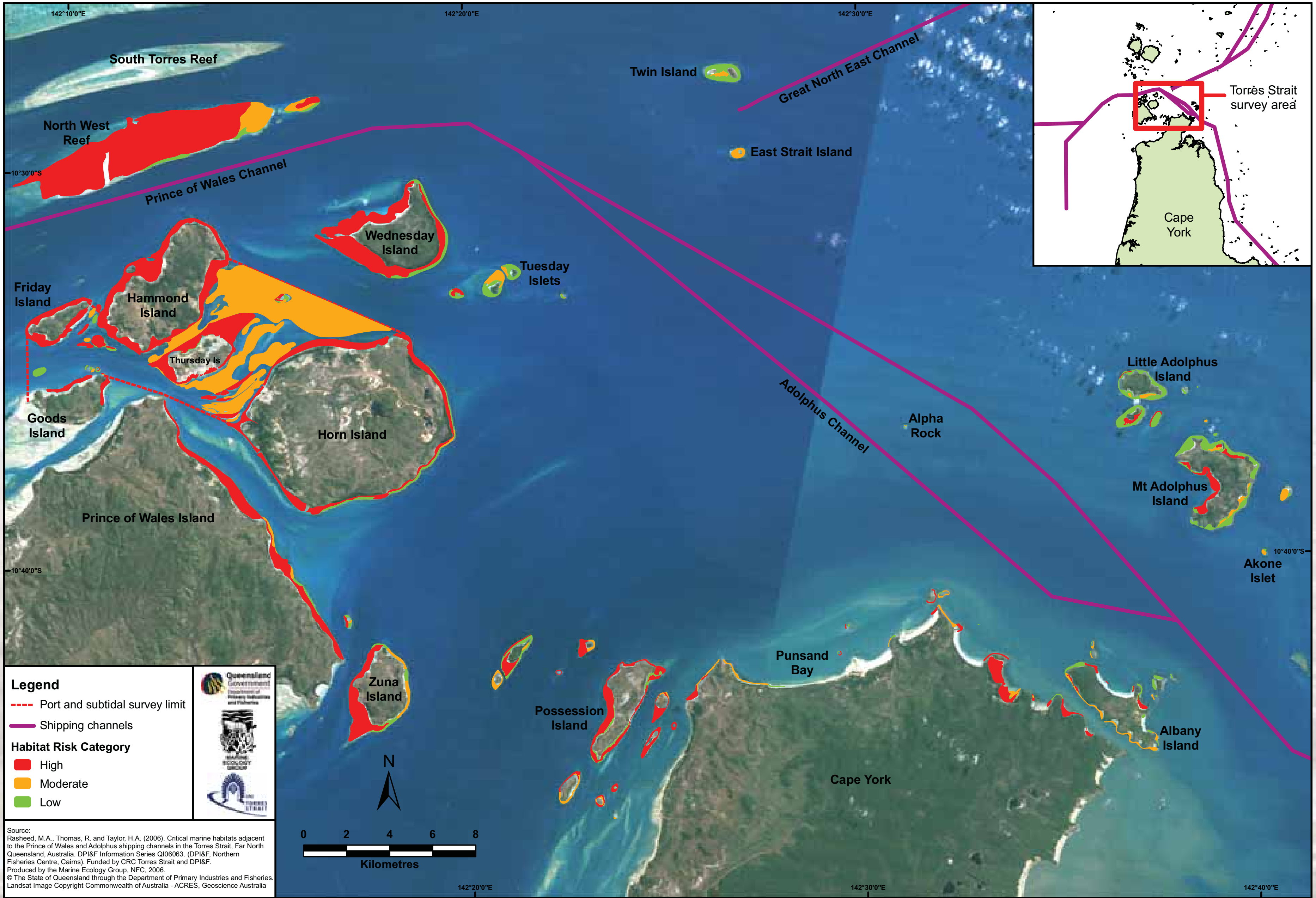
Table 7 Risk matrix for major habitat types for the Prince of Wales and Adolphus Shipping Channels.

Habitat Type		Percent cover of habitat: Low (0 – 10)	Moderate (10 – 50)	High (50 – 100)
Seagrass	Slow growing, long recovery time (TC, EA, TH, CR, CS, ZC)*	M	H	H
	Fast growing, short recovery time (HO, HD, HUN, SI)*	M	M	H
Algae	Turf / Filamentous	L	L	L
	Encrusting	L	M	H
	Erect Macrophytes / Erect calcareous	M	H	H
BMI	Hard & Soft Coral	L	M	H
	Sponges	L	M	H

* TC - *T. ciliatum*; EA - *E. acoroides*; TH - *T. hemprichii*; CR - *C. rotundata*; CS - *C. serrulata*; ZC - *Z. capricorni* HO - *H. ovalis*; HD - *H. decipiens*; HUN - *H. uninervis* (thin); SI - *S. isoetifolium*

Seagrass habitat in close proximity to port infrastructure on Thursday Is

Map 15. Habitat risk assessment categories for oil spills and other shipping accidents in the Torres Strait survey area, 2002 - 2006



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