Mabuiag Island Seagrass Baseline Survey

March/April 2009

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On 26 March 2009, the Department of Primary Industries and Fisheries was amalgamated with other government departments to form the Department of Employment, Economic Development and Innovation.

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Background

Local island communities in the Torres Strait are deeply connected to their sea country through their culture, economy, spirituality and social way of life. The health of their marine resources has been, and continues to be, vital to Torres Strait Islanders from a subsistence and cultural point of view. The Torres Strait Regional Authority Land and Sea Management Unit (TSRA LSMU) is focused on addressing environmental priorities through the establishment of an Indigenous Land and Sea Ranger Program. The program aims to engage rangers in delivering land and sea management initiatives in their region. The ranger program plans to be established in seven Torres Strait communities with Mabuiag Island participating as a pilot community in the program.

Very little information is known on the distribution and abundance of important subtidal seagrass habitat around Mabuiag Island, despite the nearby Orman Reefs being identified as one of the most important areas of seagrass habitat in the Torres Strait and Queensland for dugong (Rasheed *et al*. 2006). An extensive coverage of seagrass was identified on and around the Orman Reefs in 2004 (Rasheed *et al*. 2006). The above ground productivity of Orman Reef seagrass meadows was high compared with other tropical seagrass communities, indicating that the habitat is of key importance to fisheries, dugong and turtle and carbon cycling in the central Torres Strait.

The Mabuiag Island Rangers and the TSRA LSMU has recognised the importance of seagrasses and have made establishing long term subtidal seagrass monitoring a key priority of the local ranger program. To establish the program locally, strong baseline information on the subtidal seagrass habitat around the island was required. A baseline survey provides important information on overall habitat diversity, areas considered high environmental value and areas best suited for long term monitoring by rangers.

The Queensland Department of Employment, Economic Development and Innovation (DEEDI; formerly Department of Primary Industries & Fisheries) Marine Ecology Group in collaboration with the TSRA launched a program to deliver the baseline information on the marine habitat around Mabuiag Island with a focus on subtidal seagrass communities. Seagrasses are important in supporting local dugong and turtle populations in addition to being habitat and nursery grounds for a number of locally fished prawn and lobster species. Little information is known on subtidal habitats around Mabuiag Island and as a result our assessments were focused on describing these more extensive and under-described areas.

The specific objectives of the present study are to:

1. Conduct a baseline survey of subtidal seagrass distribution and abundance around Mabuiag Island; and

2. Identify a suitable area in which to establish a long term community monitoring site

Methods

The baseline survey was conducted between the 13th – 15th March and 28th – 30th April 2009. Sampling at this time of year captures information just after the peak abundance of tropical seagrasses.

Sampling methods applied were based on existing knowledge of seagrass distribution by local rangers and Traditional Owners and physical characteristics of the area such as depth, visibility, logistical and safety constraints. Two sampling techniques were used:

1. Subtidal diver habitat characterisation
2. Subtidal underwater camera habitat characterisation

1. Subtidal diver habitat characterisation

In shallow areas (<7m), sites were examined by free diving observers swimming to the bottom. Seagrass habitat characteristics were determined at sites located approximately every 500m on transects. Transects were spaced from 1 to 3 km apart with a higher density of transects in areas of high habitat complexity. Additional sites were sampled between transects to check for seagrass habitat continuity.

2. Subtidal underwater camera habitat characterisation

In subtidal areas where water was too deep for effective sampling by free-divers (>7m) an underwater CCTV camera system was used to assess seagrass habitat characteristics. The camera was deployed to the seabed and provided real-time footage to an observer on the boat. A Van Veen grab (grab area 0.0625 m^2) was used at sites to confirm seagrass species and sediment characteristics. Seagrass habitat characterisation sites were located on transects and between transects in the same manner as the shallow subtidal diver sites.

Habitat Characterisation Sites

Seagrass habitat characterisation sites encompassed a circular area of the substratum of approximately $10m^2$. The position of each site was recorded using a Global Positioning System (GPS) accurate to ± 5 m. While methods of observing habitat characterisation sites varied (diver/camera), information collected at each site was consistent. This included seagrass species composition, seagrass above ground biomass, depth below mean sea level (MSL) and sediment type. Additional information on other habitat forming benthos was also recorded at all sites (algae cover, hard coral, soft coral, sponge and other benthic macro-invertebrates).

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 $0.5m^2$ quadrat at each site. Ranks were made in reference to a series of quadrat photographs of similar seagrass habitats for which the above ground biomass has previously been measured. Three separate biomass ranges were used: low biomass, high biomass and an *Enhalus* range for sites dominated by the two largest species, *Enhalus acoroides* and *Thalassodendron ciliatum*. 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 for each of the three biomass ranges. 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.

Seagrass Habitat Mapping and Geographic Information System

All survey data were entered into a Geographic Information System (GIS) for presentation of seagrass distribution and abundance. Rectified Quickbird images of Mabuiag Island assisted with mapping. Other information including depth below mean sea level (dbMSL), substrate type, and the shape of existing geographical features such as reefs and channels was also interpreted and used in determining habitat boundaries.

Three types of GIS layers were created in ArcGIS® to describe Mabuiag Island seagrasses:

- **Habitat characterisation sites** - point data containing seagrass percent cover and above ground biomass (for each species), algae and benthic macro-invertebrate percent cover and proportion of functional groups, dbMSL, time, sediment type, latitude and longitude from GPS fixes, sampling method and any comments;

- **Seagrass meadow area** – area data for seagrass meadows;

- **Seagrass biomass and density** – seagrass percent cover for each seagrass meadow and biomass of individual species within seagrass meadows;

Each seagrass meadow was assigned a mapping precision estimate (±m) based on the mid-point between the last site where seagrass was present and the next non-seagrass site, as well as topographical changes in seafloor structure (i.e. reef tops versus deepwater channels).

Seagrass percent cover and species biomass layers were generated from an ArcGIS® spatial analyst tool in which habitat survey sites are interpolated. Interpolating is a method of calculating a new point between two or more existing points (i.e. two habitat survey sites). A type of interpolation called Inverse Distance Weighted (IDW) was applied to seagrass meadows generated (as described above). This then estimates new values among habitat survey sites by taking a weighted average of seagrass cover or biomass from surrounding habitat survey sites (i.e. in the neighbourhood). The weighted average calculated for each new point diminishes as the distance from the new point to the habitat survey sites increases. This tool provides an indication of the likely spread of seagrass (percent cover or species biomass) across a meadow based on the coverage of habitat survey sites and the relationship of the values among sites.

Results

A total of 332 subtidal habitat characterisation sites were surveyed in March/April 2009 (Map 1). Seagrass was found at 56% of sites surveyed with most seagrass found on shallow reef tops (Map 1). A combined area of 19,517 ± 4286 ha of seagrass habitat was mapped as a result of the baseline survey (Map 2). Meadow area ranged from 10.2 ha to 10,568 ha, with the largest meadow located across the extensive reef top to the north of the island (Map 2).

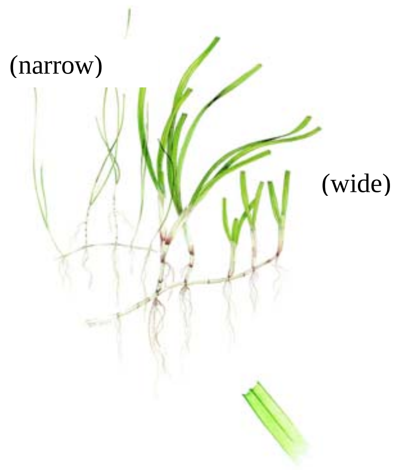
The greatest density of seagrass was located to the northwest of Mabuiag Island with the highest recorded seagrass cover of 60% in a nearshore meadow on the eastern side of the island (Map 2). Other dense regions of seagrass were found to the north, northeast and southwest of the island on the large reef flats (Map 2). Seagrass cover in the deepwater channels surrounding the island had low overall seagrass cover. The greatest area of deeper seagrass (>5m) was located in the inshore deep channel running from the north side of the island near the water treatment plant around to the east of the island and down to the most southern point of Mabuiag (Map 2). Seagrass was also present in deeper areas further offshore (ca. 3.5km) to the east of the island.

Ten seagrass species (from 2 families) were identified in the survey area in March/April 2009:

Family CYMODOCEACEAE Taylor:

Cymodocea rotundata
Ehrenb. Et Hempr. Ex Aschers

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



Halodule uninervis
(Forsk.) Aschers. in Boissier

Syringodium isoetifolium
(Aschers.) Dandy

Thalassodendron ciliatum
(Forsk.) den Hartog

Family HYDROCHARITACEAE Jussieu:

Thalassia hemprichii
(Ehrenb.) Aschers. in Petermann

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

Halophila spinulosa
(R. Br.) Aschers. In Neumayer

Halophila decipiens
Ostenfeld

Enhalus acoroides
(L.F.) Royle

The most abundant species (i.e. greatest biomass) throughout the survey area was *Thalassia hemprichii* followed by *Cymodocea serrulata*, *Halophila spinulosa*, *Syringodium isoetifolium* and *Halophila ovalis* (Map 3). Other species found in the survey area were found at a limited number of sites and did not account for the overall makeup of seagrass meadow composition.[1] *Thalassia hemprichii* was found throughout the two largest reef top meadows to the north and south of Mabuiag Island (Map 3). The greatest abundance of *Thalassia* was found in the central portion of the large northern meadow while the southern reef top meadow contained more uniform cover of this species but still dominated the meadow composition (Map 3).

[1] Less abundant species are not represented in attached maps. Refer to metadata layers for the full species distribution layers.

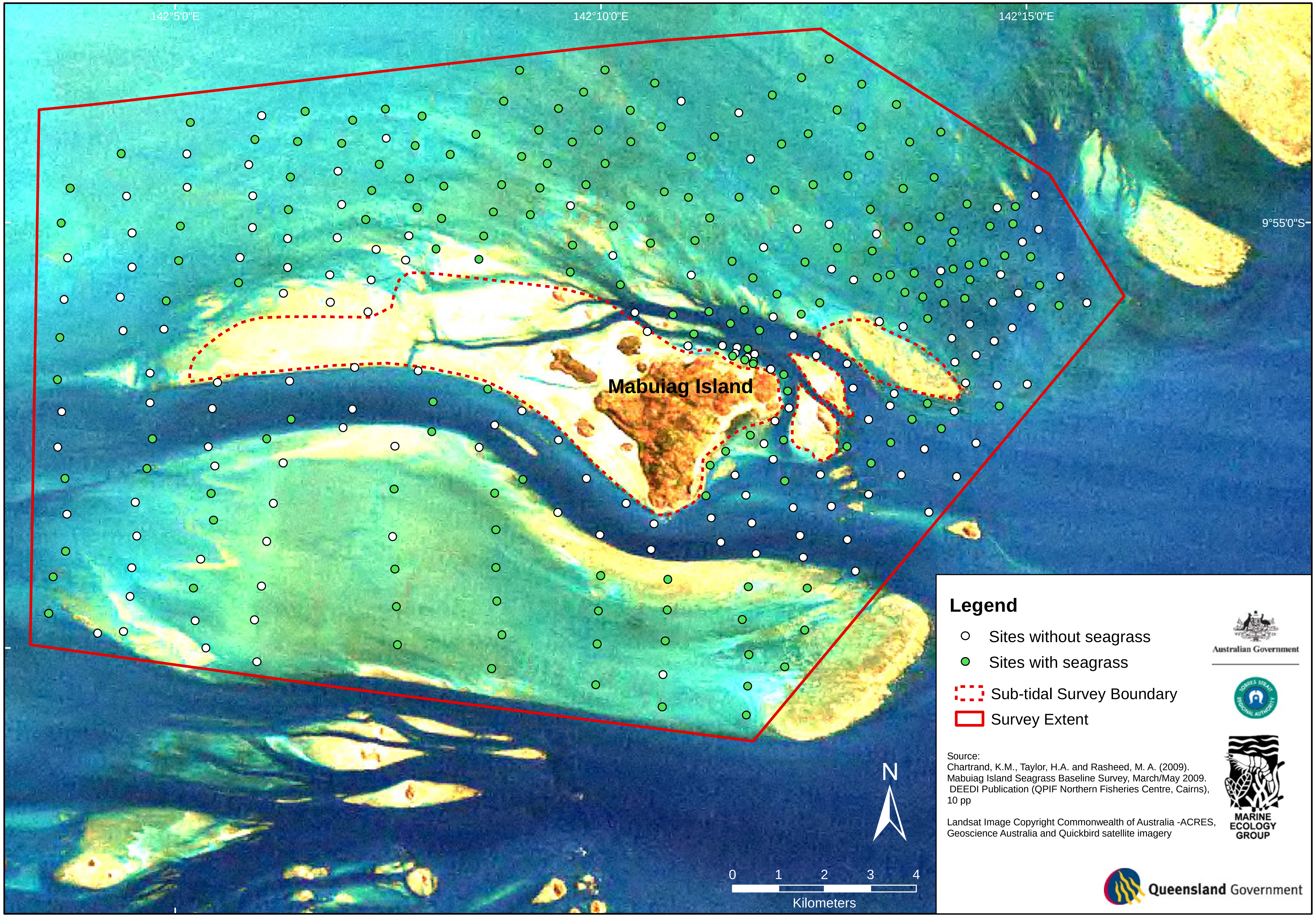
The northern reef top was also largely composed of a wide distribution of *Cymodocea serrulata, Halophila spinulosa* and *Syringodium isoetifolium* (Map 3).

In addition to seagrass, other benthic taxa formed significant areas of habitat around Mabuiag Island despite a large proportion of the substrate being open. Four structural distinct types of algae (erect macrophytes, erect calcareous, filamentous, turf mat and encrusting), hard coral, soft coral, and sponge formed areas of benthic habitat both on the reef top and in the deeper channel areas.

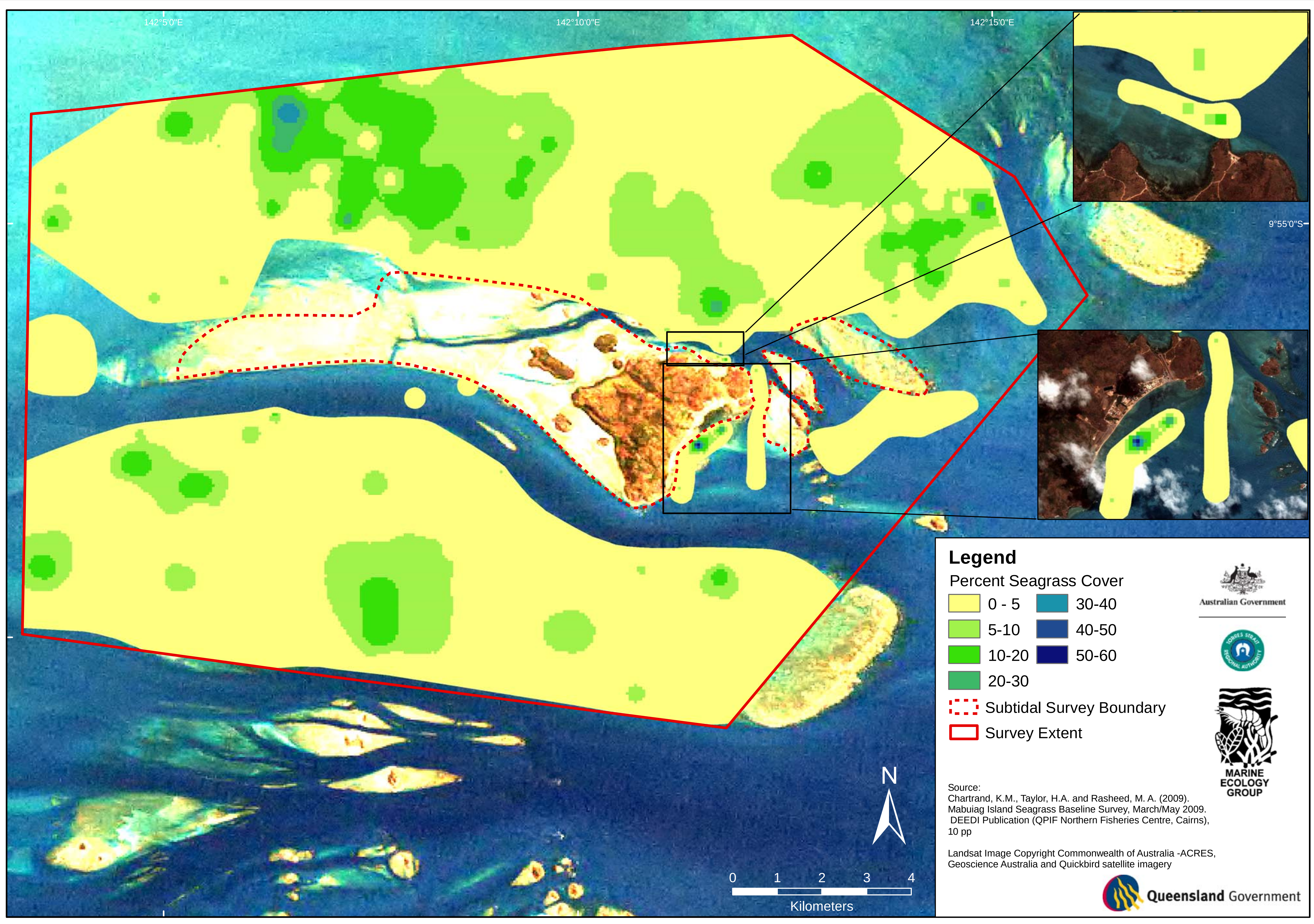
A few distinct trends in these other benthic taxa were evident in distribution between reef tops and deeper channel environments. Erect macrophytic algae was most prevalent on the reef tops while red encrusting algae dominated the deep channels. Strong currents created from large tidal movement through these deep channels likely inhibit larger structural taxa. An exception is hard corals which also formed a large proportion of the deeper channel benthos. Reef top habitat throughout the survey extent was comprised of a more diverse mix of taxa including hard corals, soft corals, sponge and other benthic macro-invertebrates.

The most ideal location for a long term seagrass monitoring site is one that would have a good, consistent cover of seagrass year round, and that comprises the range of species that are found within the region. With this in mind, there are a few areas on the north side of the island that are appropriate, such as to the north west (near the survey boundary limit), directly to the north of the airport, or towards the Orman Reefs (Maps 2 & 3). The most suitable of these is to the north west of the island where seagrass cover is at its highest and biomass of the key species is dense. However, it should be noted that sampling at this site is likely to be more constrained by logistics and adverse weather conditions than other sites in the lee of the island.

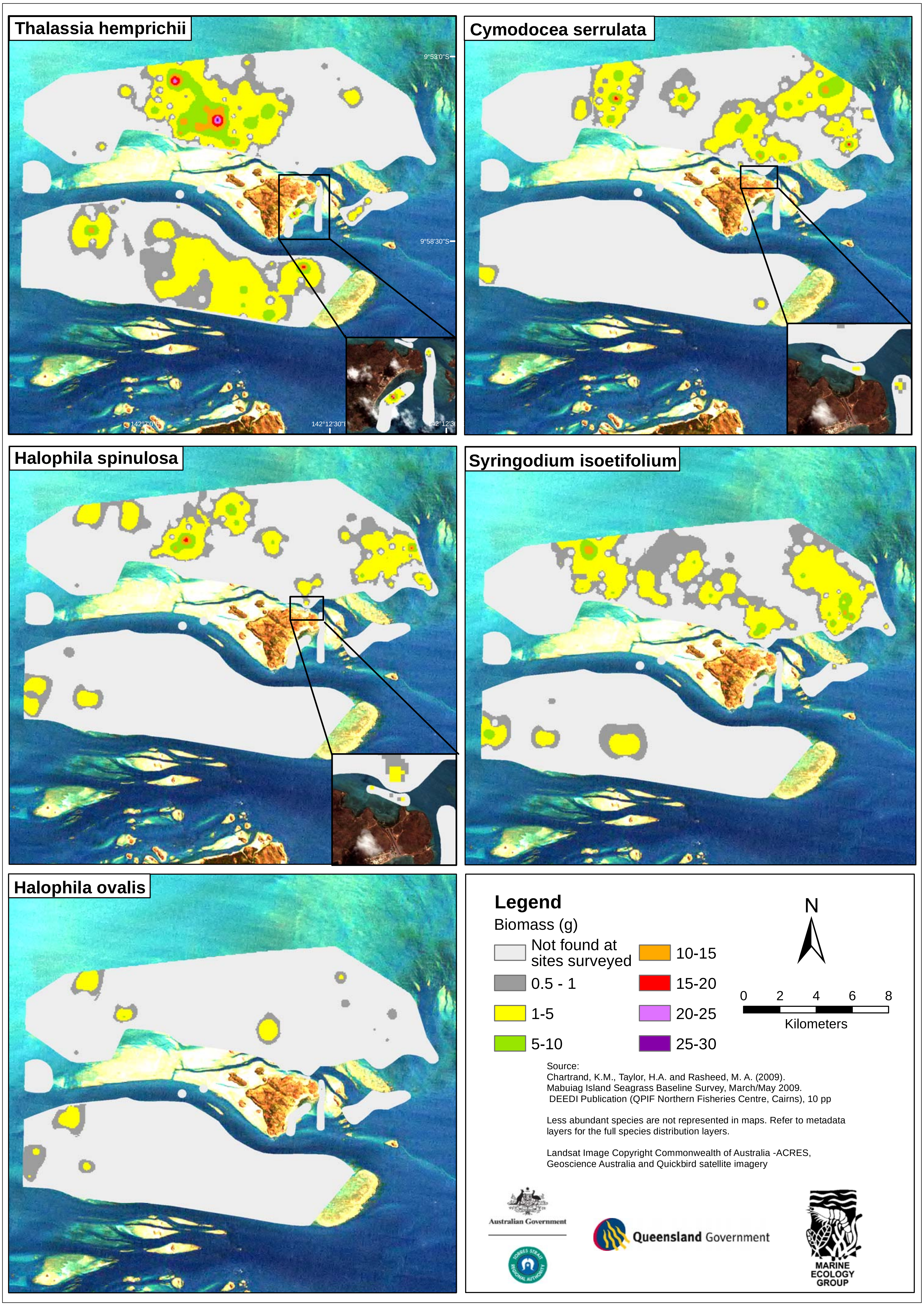
Map 1. Habitat assessment sites surveyed around Mabuiag Island March/April 2009



Map 2. Percent cover of seagrass within meadows mapped around Mabuiag Island March/April 2009



Map 3. Seagrass abundance by species within meadows mapped around Mabuiag Island March/April 2009



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