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Seagrass-Watch

The official magazine of the Seagrass-Watch global assessment and monitoring program

Coastal Canaries

- Great Barrier Reef - Reef Rescue
- MangroveWatch
- Dugongs without borders
- Seaweed farms vs seagrass
- Samoan tsunami impacts
- Restoration & research in Portugal
- Seagrasses in India under threat
- Seagrass role inspires participation
- Marine rescuers working together
- Giant clams

Local eyes Global wise

In this issue:

From the editors

Seagrasses are often referred to as the coal mine canaries of coastal ecosystems. This is because they show measurable and timely responses to water quality and are effective barometers of marine environmental health. Seagrass-Watch plays a key role in providing sound advice for the management of water quality on the Great Barrier Reef, and in this issue we present the latest findings from the Reef Rescue Marine Monitoring Program.

In this issue you can also read about the impacts of seaweed farms in southern Indonesia, the Samoan tsunami and threats to seagrass in India. You'll find articles on recent efforts in Madagascar, and how the important role of seagrass is inspiring participants to monitor seagrass in Broome and restore degraded meadows in Portugal.

You can also read about Sea Rangers monitoring in Cape York and Torres Strait, and the pilot MangroveWatch program being developed. You can even learn about giant clams.

COVER:
Seagrass and mangrove, Archer Point (Qld, Australia).
Photographer Len McKenzie

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Seagrass-Watch acknowledges the Traditional Owners on whose sea country we monitor

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NEXT ISSUE OUT MARCH 2010

Like the canaries that were used to detect deadly gases in the coal mines, seagrass are our "coastal canaries" detecting environmental degradation in coastal and reef ecosystems.

Seagrass are sensitive to environmental changes. They have a high light requirement, among the highest of any plant in the world, and being sessile, they integrate water quality attributes, such as light and nutrient availability, which affects their ability to grow. Measurable changes in seagrass distribution, abundance and condition provides resource managers with advance signs of deteriorating ecological conditions caused by poor water quality and pollution. For this reason, seagrasses are considered biological sentinels.

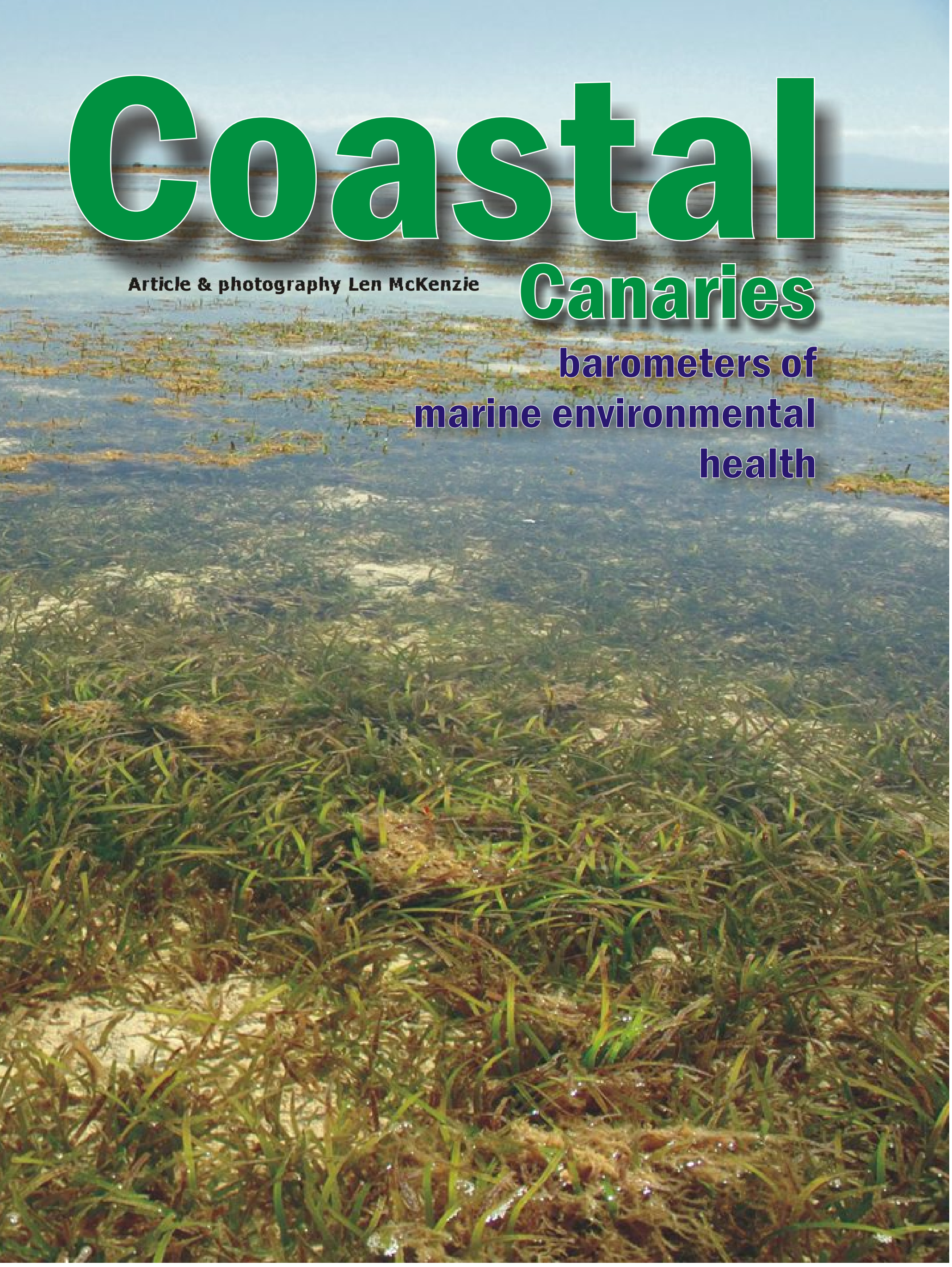
Seagrass often live in shallow, sheltered coastal waters, directly in the path of catchment (watershed) nutrient and sediment inputs. This makes them highly susceptible to these impacts. Also, their widespread distribution throughout tropical and temperate regions allows better assessment of larger-scale trends than do other comparable coastal habitats, such as mangrove, corals, or salt marsh plants. As seagrasses show measurable and timely responses to changes in ecosystem quality, they act as biological barometers for human induced pollution; their decline is a sign of coastal environmental stress.

It is for this reason that the Great Barrier Reef's (GBR) intertidal seagrasses are being monitored using Seagrass-Watch as part of the Reef Rescue Marine Monitoring Program (MMP). Established by the Great Barrier Reef Marine Park Authority and funded through The Australian Governments Caring for Our Country Program, the MMP tracks trends in the amount of sediment, nutrients and other pollutants entering GBR waters,

Coastal Canaries

barometers of marine environmental health

Article & photography Len McKenzie



and the condition of key biological communities (seagrass and inshore coral reefs) influenced by water quality.

The Reef Rescue MMP assesses the effectiveness of the Australian and Queensland Government's Reef Rescue Package and Reef Water Quality Protection Plan (Reef Plan). The goal of Reef Plan is to: halt and reverse the decline in water quality entering the Reef by 2013; and to ensure that by 2020 the quality of water entering the lagoon from adjacent catchments has no detrimental impact on the health and resilience of the Great Barrier Reef.

In September 2009, new quantitative targets for Reef Plan were established to reduce pesticides and fertilisers (nitrogen and phosphorus) found in Reef waters by 50% in four years and that by 2020 there will be at least a 20% reduction in sediment loads at the end of catchments.

To ensure these targets are achieved, from 1st January 2010, farmers and graziers in Tropical Queensland must comply with a number of new regulations, including: monitoring fertiliser application; restrictions and controls on herbicides; and high risk farms must implement Environmental Risk Management Plans. Failure to comply with the new regulations could incur a maximum penalty of $30,000.

The Reef Rescue MMP is critical for the assessment of long-term improvement in water quality and marine ecosystems health with the adoption of improved land management practices. It can also be used to evaluate performance/compliance of the new legislation, and this is where Seagrass-Watch can play a significant role.

Since 2005, intertidal seagrasses have been monitored across the six Natural Resource Management regions (NRMs) adjacent to the Great Barrier Reef World Heritage Area. Intertidal seagrasses are currently monitored sub-regionally at 30 sites using Seagrass-Watch as the basic monitoring strategy with additional parameters (e.g. reproductive health, tissue nutrients, sediment herbicides, sediment nutrients). Sampling is focussed on the tropical Dry and Wet (Monsoon) seasons.

Results from 2008/2009 show that seagrasses were in a fair state in terms of seagrass abundance and composition (rating as per Seagrass-Watch report card) on a Great Barrier Reef wide scale. Seagrass abundance was more than 20% lower than the previous monitoring period at two thirds of locations monitored; half those south of the Wet Tropics have declined since 2005. This appears primarily the result of natural physical disturbance (e.g. sediment movement). Seagrass condition at three coastal locations in the Wet and Dry Tropics had plants growing in low light environments, with a relatively large phosphorus (P) pool and an excessive nitrogen (N) pool.

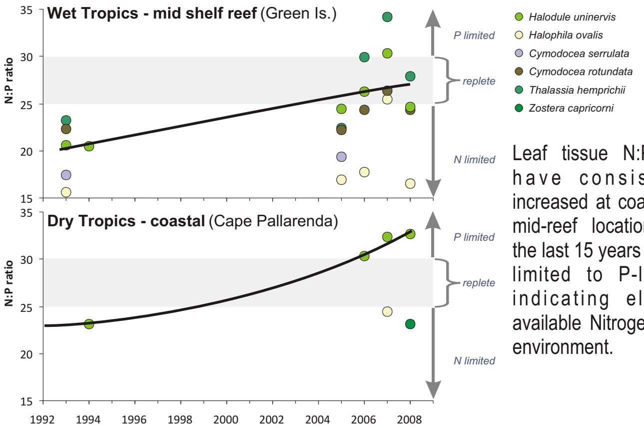
The seagrass meadows monitored in 2008/2009 were dominated by *Halodule uninervis, Halophila ovalis, Cymodocea rotundata, Thalassia hemprichii*, or *Zostera meulleri* ssp. *capricorni*. Reef habitats had more seagrass species than coastal or estuarine habitats. South of the Whitsundays, seagrass seed banks were low or non-existent, suggesting reduced ability (low resilience) to recover from disturbance. Although the extent of intertidal seagrass meadows declined in late-Monsoon 2009 compared to the previous monitoring period, the smallest extents were reported in 2006.

Epiphyte abundance was variable but increased slightly in coastal meadows. Macro-algae abundance remained low, but increased slightly in estuaries. Within canopy temperatures over the past 12 months were warmer at northern locations and cooler at southern locations compared to the previous monitoring period. The only location to experience maximum temperatures above 40°C during the past 12 months was Picnic Bay (Magnetic Island) in November 2008.

Seagrass sediment nutrient concentrations in coastal and estuary habitats became richer in phosphate (orthophosphate) while reef habitats were richer in nitrogen (ammonium). Examination of seagrass leaf tissue nutrients revealed decreasing carbon to nitrogen

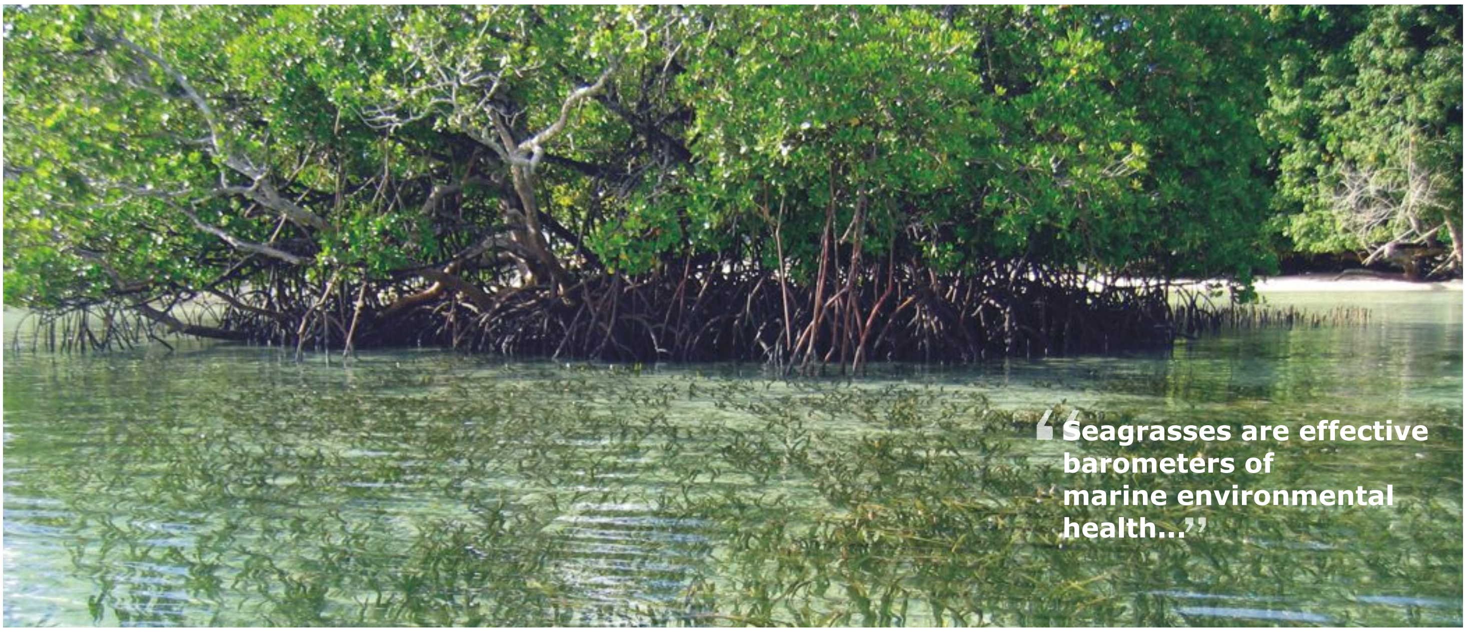
(C:N) content within all habitats since 2005, indicating reduced light availability. The leaf tissue carbon to phosphate ratios (C:P) indicated all habitats were nutrient rich, with estuarine and reef habitats becoming richer. Seagrass leaf nitrogen to phosphate ratios (N:P) indicated seagrass to be nutrient replete (potentially eutrophic) at 50% of locations examined.

Most notable was that leaf tissue N:P has increased within coastal habitats since 2005, indicating nitrogen enrichment. Such a trend is consistent with historical patterns of increasing nitrogen observed in the Wet and Dry Tropics. GBR-wide levels within reef and estuary habitats remained mostly unchanged from 2005 to 2008, however increases have occurred at coastal and mid-shelf reef habitats in the Wet and Dry Tropics over the last 15 years.



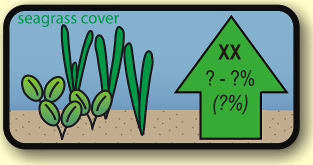
Leaf tissue N:P ratios have consistently increased at coastal and mid-reef locations over the last 15 years (from N-limited to P-limited); indicating elevated available Nitrogen in the environment.

A more detailed examination of the Reef Rescue MMP intertidal seagrass results are presented in this issue of the magazine according to the Natural Resource Management regions identified in the Great Barrier Reef. Results for the 2008/2009 monitoring period cover the period from 1 July 2008 to 30 June 2009. Long-term patterns cover from April 2005 or earlier.

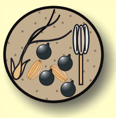


Understanding the diagrams and icons

Sampling is focussed on two periods each year: the late Dry season (September-October) and the late Monsoon (March-April). Results are summarised from the report *"McKenzie, L.J. and Unsworth, R.K.F. (2009) Great Barrier Reef Water Quality Protection Plan (Reef Rescue) – Marine Monitoring Program: Intertidal Seagrass, Final Report for the Sampling Period 1st September 2008 – 31st May 2009. Fisheries Queensland, Cairns (127pp)."* The Great Barrier Reef Marine Park Authorities (GBRMPA's) Reef Water Quality Protection Plan (Reef Rescue) Marine Monitoring Program is funded by the Australian Government's Caring for our Country initiative. In 2008/09 the intertidal seagrass monitoring components were undertaken by Fisheries Queensland, a service of the Department of Employment, Economic Development and Innovation; managed by the Reef and Rainforest Research Centre.



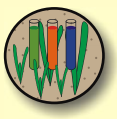
Seagrass cover: dominant species code, mean percent cover late Dry 2008 - late Monsoon 2009, long term mean italicised in parenthesis. Arrow indicates direction of trend, box indicates stable and diamond indicates variable.



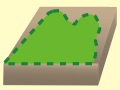
Seed banks: mean number of *Halodule uninervis* and *Zostera capricorni* seeds per square metre of sediment surface in late Dry 2008 - late Monsoon 2009, long term mean in parenthesis and trend *italicised.*

repro effort

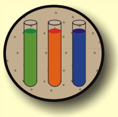
Reproductive effort: average number of reproductive structures (flowers, fruits, spathes) per node (leaf cluster emerging from the rhizome). Arrow indicates direction of trend, box indicates stable and circle shows lack of reproductive structures.



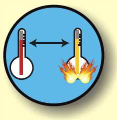
Plant tissue nutrients (C=carbon, P=phosphate, N=nitrogen):
C:N is a surrogate for light, where moderate = adequate light available for growth (C:N>20:1), low = less than average light available than required for growth (C:N<20:1)
C:P is a surrogate for nutrient status of the habitat, where rich = relatively large P pool (C:P <500:1), poor = relatively small P pool (C:P >500:1)
N:P is the overall nutrient availability to the plant, where N limited = N:P <25, replete N:P = 25-30; P limited = N:P >30



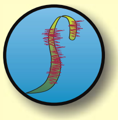
Edge mapping: long-term trend in distribution of seagrass meadow within 100m of monitoring site.



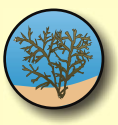
Sediment nutrients: concentration of adsorbed sediment nutrient pool
N:P ratios indicate adsorbed NH_4^+ relative to PO_4^{3-}
N is long term trend in nitrogen concentration (in the form of ammonium NH_4^+)
P is long term trend in phosphate concentration (in the form of orthophosphate PO_4^{3-})



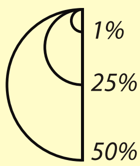
Within canopy temperature: Mean and maximum within canopy temperatures for 2008/2009 monitoring period. Long-term mean temperature in *italics.*



Epiphyte cover: percentage of leaf area covered by epiphytic algae, long term trend italicized, mean cover late Dry 2008 to late Monsoon 2009. Size of icon represents long-term average.



Macro-algal cover: percentage cover of macro-algae, long term trend italicized, mean cover late Dry 2008 to late Monsoon 2009. Size of icon represents long-term average.



Reef Rescue

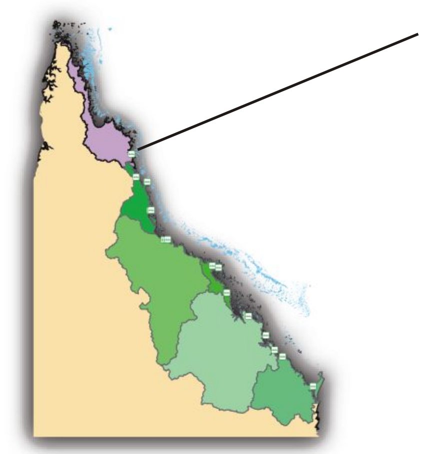
Cape York

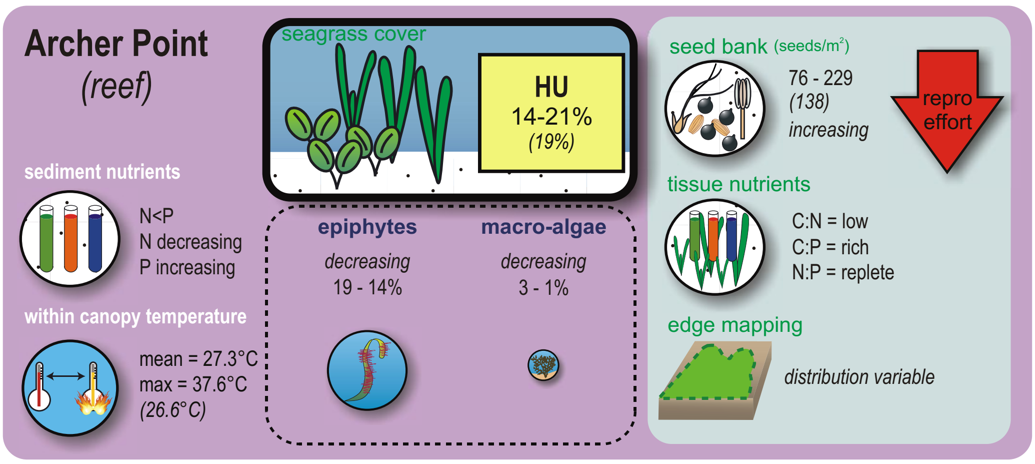
Cape York Peninsula is the northernmost extremity of mainland Australia. It is an area of exceptional conservation value and has cultural values of great significance to both Indigenous and non-Indigenous communities. The majority of the land is relatively undeveloped, therefore water entering the GBR lagoon is perceived to have minimal human influence. Intertidal seagrass meadows within this NRM region were only monitored on a fringing reef platform in a protected section of the bay adjacent to Archer Point. The sites were dominated by *Halodule uninervis* and *Cymodocea rotundata*. Although species composition has varied since 2003, it stabilised over the last 12 months. The overall meadow extent declined slightly in 2008/2009 and remains lower than 2005 baseline.

Although seagrass cover followed a seasonal trend (higher abundance in late spring/early summer), overall the meadow abundance has stabilised and appears to have recovered from previous declines. Reproductive effort decreased in 2008/2009, indicating low resilience. Epiphyte and macro-algal cover were generally variable but appear to be declining over time.

Nutrients in this coastal fringing reef habitat have decreasing nitrogen in the sediments while phosphorus has been increasing. Seagrass tissue elemental ratios suggest the habitat to have low light availability, nutrient poor and the plants possibly replete or N limited.

Within canopy temperatures were similar to previous years and the maximum recorded was 37.6°C in November 2008. The average maximum daily air temperature was 0.5°C hotter and mean annual rainfall was 16% lower than the 80 year average.

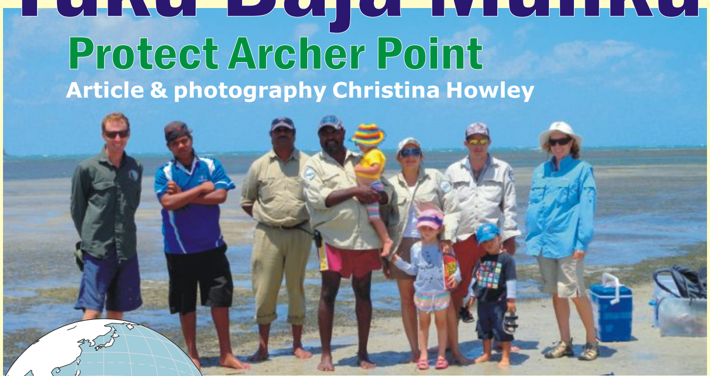


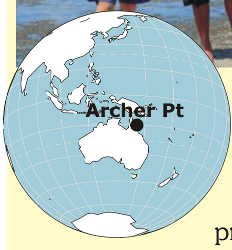


Yuku Baja Muliku

Protect Archer Point

Article & photography Christina Howley





The seagrass meadows at Archer Point are diverse and healthy, supporting lots of marine creatures which we come across while we are monitoring, such as crabs, prawns and stingrays. During the October monitoring we identified 4 species of seagrass within the survey area, bringing the total to 7 species found in this bay. We also saw dugong feeding trails and a turtle that seemed to be stranded in the seagrass waiting for the tides to come in. Since we started monitoring in 2002 we have seen changes in the seagrass species composition and the area of coverage. These changes have mostly resulted from shifting sands due to an adjacent creek. The surrounding catchment area is undeveloped National Park and Aboriginal Freehold Land and thus minimal human impacts to the seagrass.

The Archer Point coastal area is a Parrot Fish Storyplace for the Yuku Baja Muliku Traditional Owners. The land surrounding the monitoring site was officially handed back to the Traditional Owners in 2006. They have since appointed 2 indigenous rangers to manage the area and will have 4 rangers and a coordinator by January 2010. The Yuku Baja Muliku rangers have drawn up a Management Plan for the busy camping area and are working to implement proper waste management with an amenities block and rubbish collection. They are also developing a TUMRA with GBRMPA and would like to have an Indigenous Protected Area (IPA) declared. They want to see only sustainable numbers of fish such as coral trout taken from the area, as well as protecting dugong and turtles. Their goal is to see that all people enjoying the Archer Point area will respect the environment and look after it properly.

It is a pleasure for the Seagrass-Watch team to get to work with the Yuku Baja Muliku rangers on their country.

Reef Rescue

Wet Tropics

The Wet Tropics region is located in far northern Queensland and includes two significant World Heritage Areas (the GBR and the Wet Tropics rainforest). Changing land use practices (agriculture and coastal development) and declining water quality have been identified as significant issues in the region.

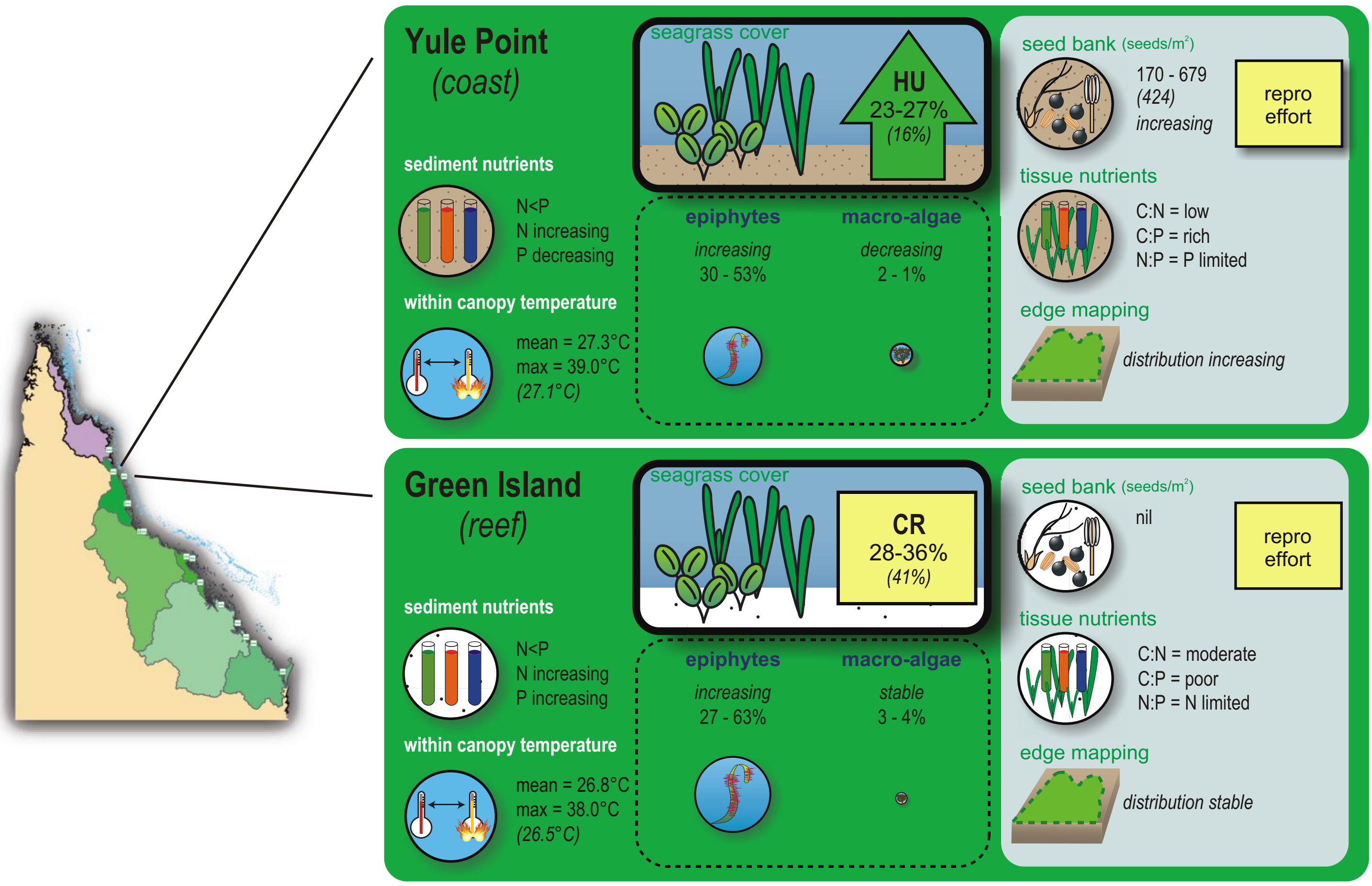
Monitoring occurs at two coastal and two reef seagrass habitat locations. Seagrass species composition is relatively stable and dominated by *Halodule uninervis* and *Halophila ovalis* meadows at coastal locations and *Cymodocea rotundata* and *Thalassia hemprichii* at offshore island locations. The longest running monitoring sites are at Yule Point and Green Island. Yule Point meadows are located on naturally dynamic intertidal sand banks and the Green Island meadow is located on the large intertidal reef-platform south west of the cay.

Yule Point and Green Island meadows appear to have changed relatively little since monitoring began in 2000, however 2008 abundances were some of the highest recorded at these sites. Seagrass percent cover although seasonal, has generally increased or stabilised over the past 12 months and was naturally lower at coastal compared to reef locations. Seagrass spatial extent was stable at reef locations and variable at coastal locations due to the dynamic nature of sandbanks. Seed reserves and reproductive effort were considerably higher at Yule Point compared to other locations in the region. Epiphyte fouling of seagrass increased at most locations, although macroalgae abundance was negligible.

Seagrass leaf tissues in reef environments had higher C:N ratios than those in coastal, indicating a potentially higher light environment in reef habitats. However decreasing C:N ratios at Green Island since 2006 indicate decreasing light availability at this location. Tissue C:P ratios indicate high levels of nutrients at coastal locations. N:P ratios have progressively increased over time at coastal and reef habitats since 2005indicating increased nitrogen availability.

Overall results suggest low light availability and elevated N (potentially eutrophic) at coastal locations. Reef locations had higher sediment phosphate and ammonium relative to coastal locations. Sediment nutrients were higher at Green Island than in previous years, but in coastal meadows, levels were mostly unchanged.

Within canopy temperatures were slightly warmer at coastal than reef locations. The maximum canopy temperature was 39°C. Temperature during the 2008/2009 monitoring period were similar to previous years. Mean maximum daily air temperature was 0.2°C hotter across the region and mean annual rainfall was 11% higher than the 100 year average. The within seagrass canopy light environment varied as a function of season, with higher light present within winter relative to summer (wind speed, daylight hours and tidal height). The coastal light environment was 39% lower than measured offshore.



Burdekin Dry Tropics

The Dry Tropics region includes several river catchments, the most significant being the Burdekin. Because of its geographical location, rainfall in the region is lower than other regions within tropical Queensland. Major threats to seagrass meadows in the region include: coastal development; changes to hydrology; downstream effects from agricultural (including sugarcane, horticultural, beef), industrial (including refineries) and urban centres

Monitoring occurs at coastal and reef seagrass habitat locations. The Townsville coastal sites (Bushland Beach and Shelley Beach) were located on naturally dynamic intertidal sand flats and reef sites were located offshore on the sheltered fringing reef flats of Magnetic Island (Picnic Bay and Cockle Bay).

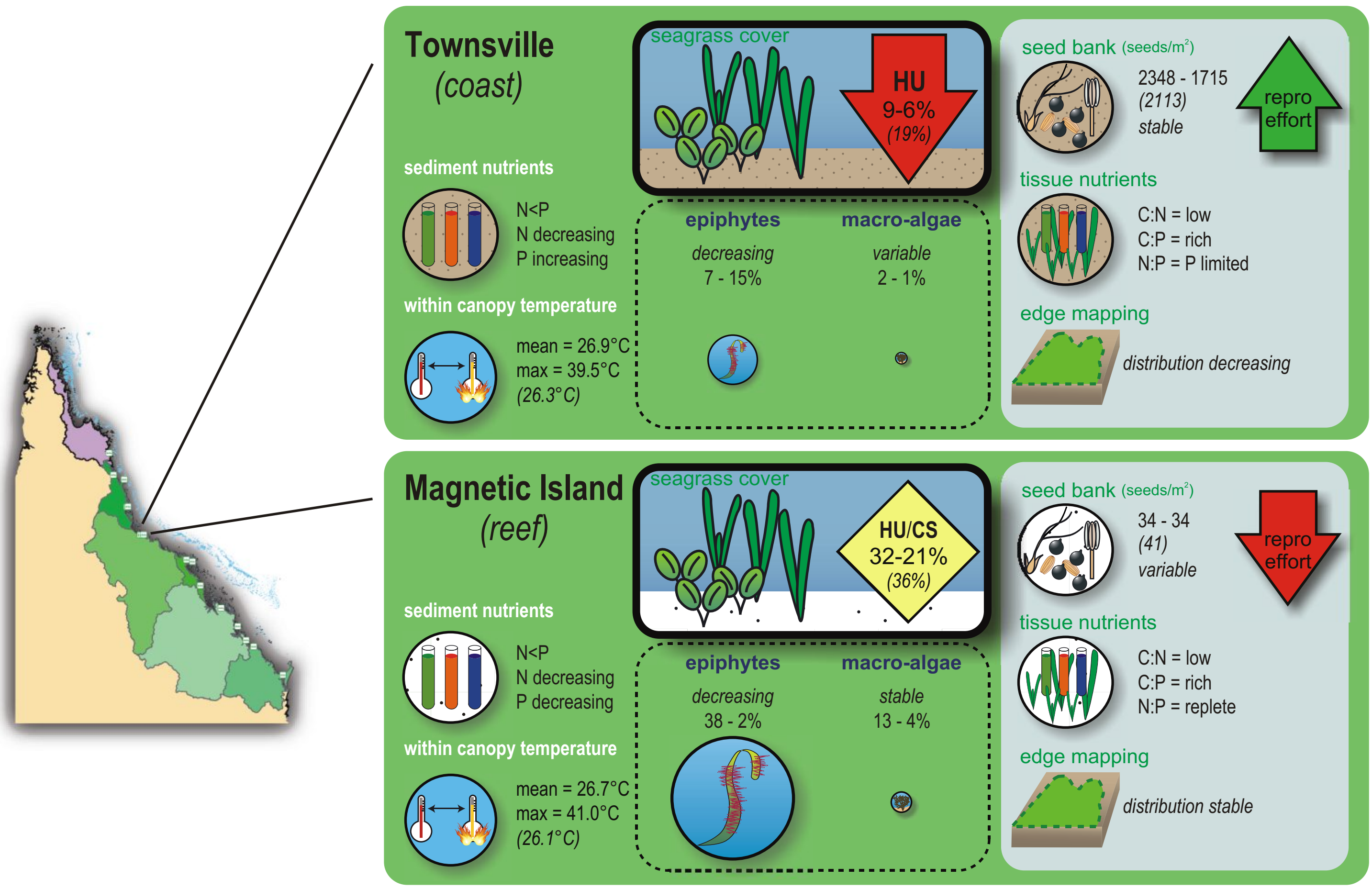
Although seagrass species composition has fluctuated over time, it remains dominated by *Halodule uninervis* and *Halophila ovalis* at coastal meadows and *Cymodocea rotundata* and *Halodule uninervis* at offshore island meadows. Overall, seagrass abundance declined at coastal locations and was variable at reef locations. Seagrass spatial extent declined at coastal sites, but remained relatively stable at reef sites. Epiphyte fouling of seagrass was highly variable at reef habitats and increased at coastal sites, but the long-term trend continues to decrease.

Seagrass leaf tissues in both coastal and reef habitats had low C:N ratios, indicating a potentially low light environment. Decreasing C:N ratios at coastal sites since 2006 indicate decreasing light availability. Tissue C:P ratios indicated both coastal and reef locations are nutrient rich. Leaf tissue N:P ratios indicated that all species at reef sites were replete or N limited, while seagrass at coastal sites were P limited with an increasing trend since 2006. Overall results suggest coastal sites had low light availability and elevated N (potentially eutrophic).

Levels of ammonium and phosphate in coastal sediments were the lowest and highest recorded at the Dry Tropics sites to date, respectively. Since 2005, both phosphate and ammonium concentrations have declined in reef sediments.

The maximum canopy temperature was 41°C (Magnetic Island) and the 2008/2009 monitoring period was 1°C hotter on average than the previous 2 years and the long-term average. Mean maximum daily air temperature was 0.1°C hotter and mean annual rainfall was 27% higher than the 70 year average.

The within seagrass canopy light environment varied as a function of season, with higher light present within winter relative to summer (daylight hours and tidal height). The coastal light environment was 79% lower than was measured offshore.



Reef Rescue
Mackay Whitsunday

The Mackay Whitsunday region encompasses the Proserpine, O'Connell, Pioneer and Plane Creek river systems. The region's climate is humid and tropical with hot wet summers and cool dry winters. The major industries in the Mackay Whitsunday region are agriculture, grazing, tourism, fishing and aquaculture.

Intertidal seagrass meadows in this region occur on the large sand/mud banks of sheltered estuaries and coastal fringes; they also occur on top of the offshore fringing reefs. Key environmental drivers include exposure, desiccation and variable flood runoff during the wet season. Monitoring occurs on estuarine, coastal and reef seagrass habitats, however the reef location has only been monitored since 2007.

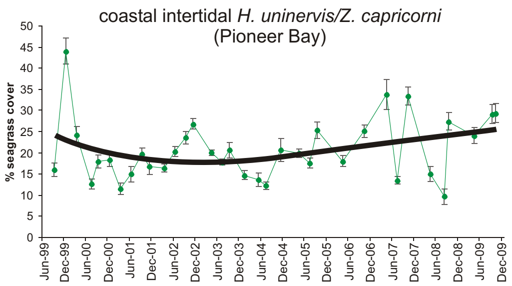
Coastal seagrass habitats were dominated by *Halodule uninervis* and *Zostera capricorni* and located on intertidal sand/mud flats adjacent to Cannonvale in southern Pioneer Bay. Estuarine habitats was dominated by *Zostera capricorni* and located on an intertidal sand/mud bank in Sarina Inlet south of Mackay.

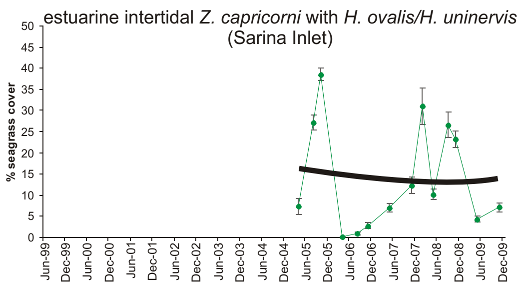
Coastal and estuarine seagrass abundance has varied over time, but has continued to decline at the reef site (since 2007). Estuarine and reef meadows remained highly variable in extent but increased within the coastal habitat. The ability of the estuarine meadows to recover from disturbance was limited, as no seeds were recorded in 2009 (large decline from previous years). Seed banks in Pioneer Bay remained variable, however reproductive effort has decreased. Epiphyte abundance was low and variable across all habitats, while macro-algae abundance was stable.

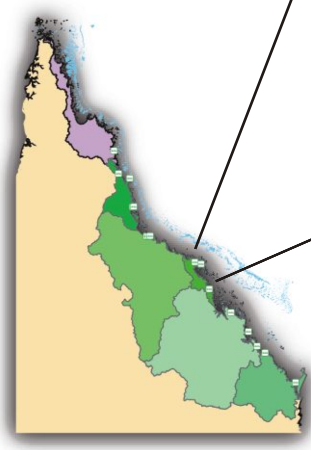
Seagrass tissue nutrient ratios indicated seagrasses were replete or marginally N limited. Ratios remain highly variable between years at all sites. Tissue ratios of C:N indicated all sites were low light environments and low C:P tissue ratios indicated all habitat types were nutrient rich.

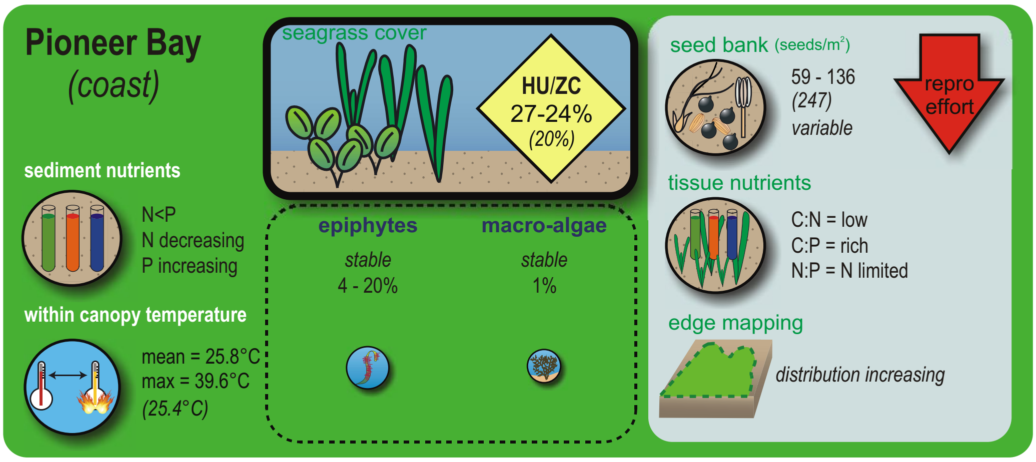
Sediment P levels at the reef and coastal sites (but not the estuarine sites) were among the highest recorded at any site within the MMP. Phosphorus remained variable at all sites, but N had decreased.

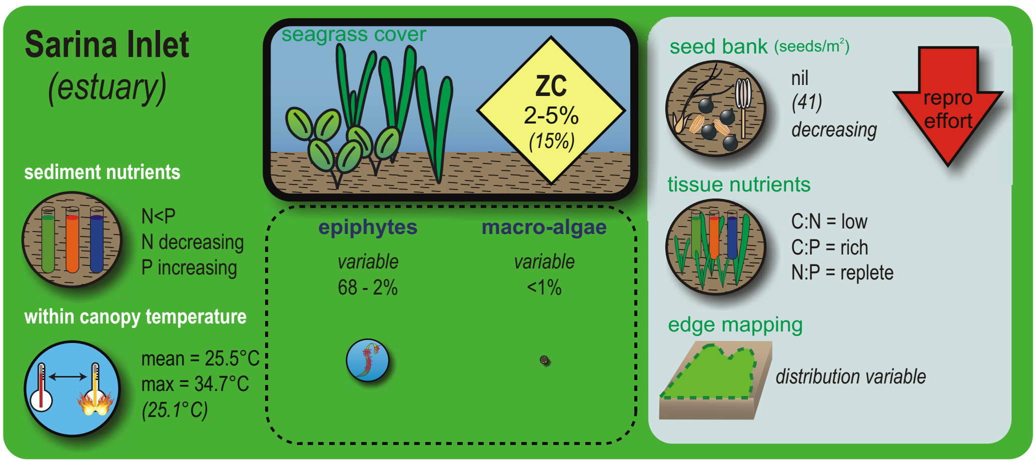
No extreme canopy temperatures (>40°C) were recorded over the last 12 months.











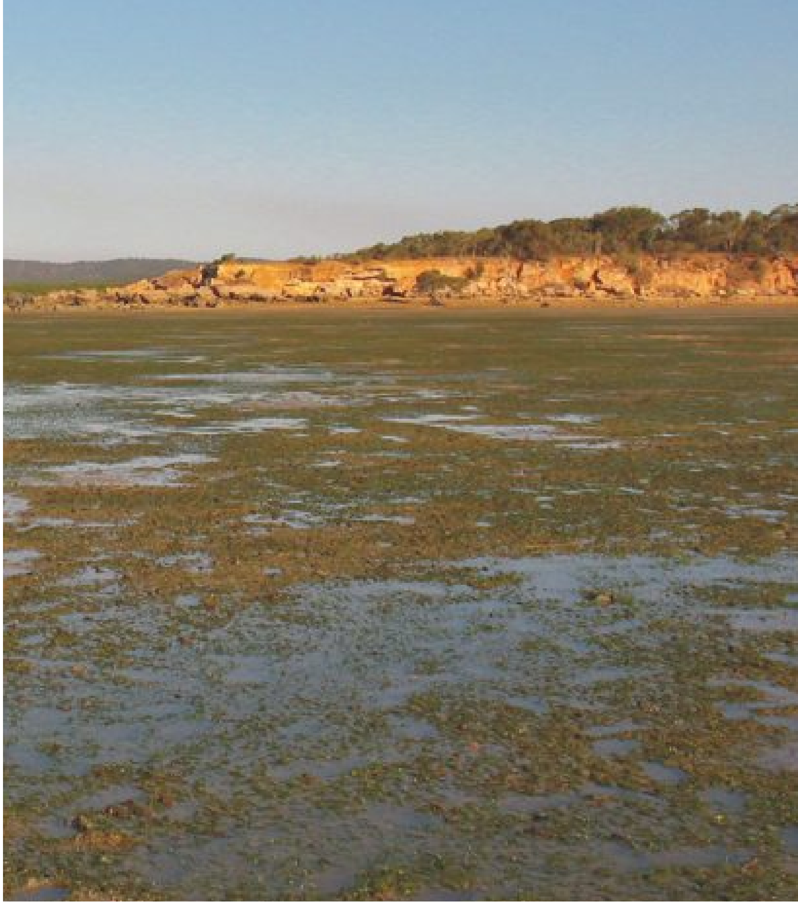
Fitzroy

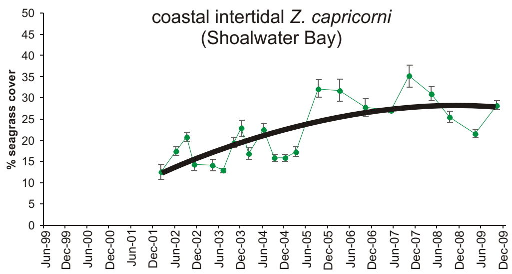
Reef Rescue MMP monitoring sites are located in coastal, estuarine and fringing-reef seagrass habitats in this region. Coastal sites are monitored on the large intertidal flats of the north western shores of Shoalwater Bay. The remoteness of this area (due to its zoning as a military exclusion zone) provides a near pristine environment. In contrast, the estuarine sites are located on the large sand/mud banks within Gladstone Harbour: an industrial port. Offshore reef sites at Monkey Beach, Great Keppel Island, have only been monitored since late 2007.

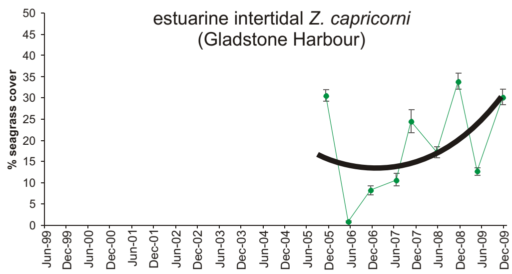
Estuarine and coastal meadows were dominated by *Zostera capricorni*, while reef habitats were dominated by *Halodule uninervis*. Coastal and estuarine seagrass abundance were highly variable over the last 12 months, but reef seagrasses at Great Keppel have declined in abundance since 2007. Meadow extents were stable at coastal habitats, but varied at estuarine and reef locations. Epiphyte cover did not change, however macro-algae abundance declined.

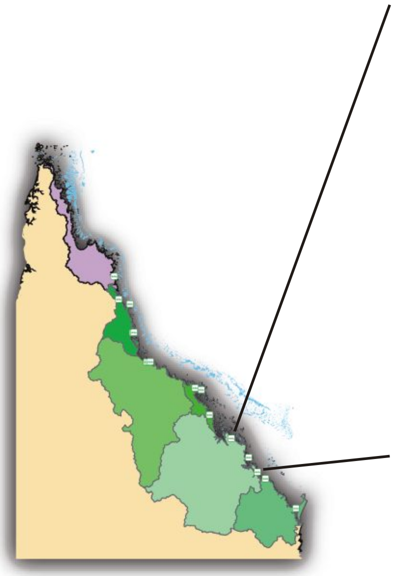
Seagrass leaf tissue elemental ratios of N:P indicated plants in all habitat types were nutrient replete. C:N tissue ratios indicated estuarine and reef habitats as low light environments, but coastal meadows at Shoalwater Bay had moderate light. C:P tissue ratios indicated reef and estuarine meadows were nutrient rich, and coastal meadows nutrient poor.

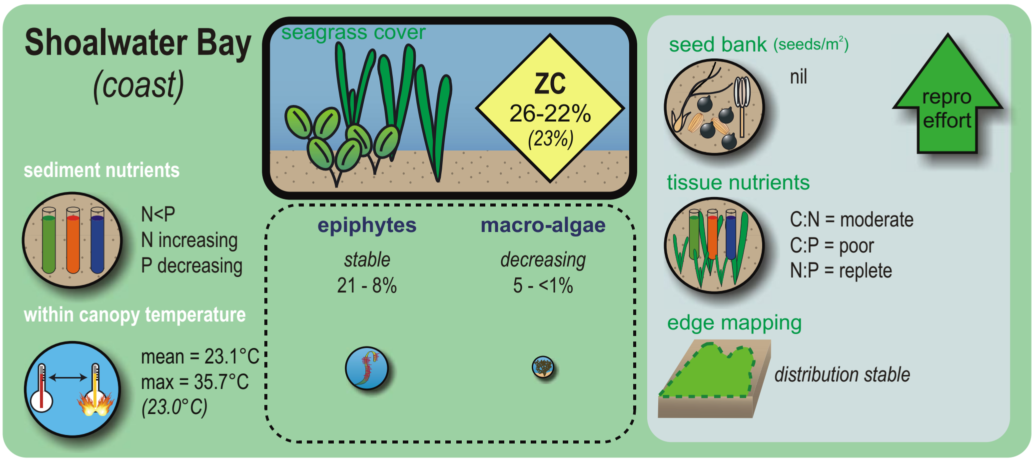
Seagrass sediment nutrients were highly variable between years and no trends were apparent. No extreme canopy temperatures (>40°C) were recorded over the last 12 months and all sites were subjected to elevated rainfall during both the 2008 and 2009 wet seasons.

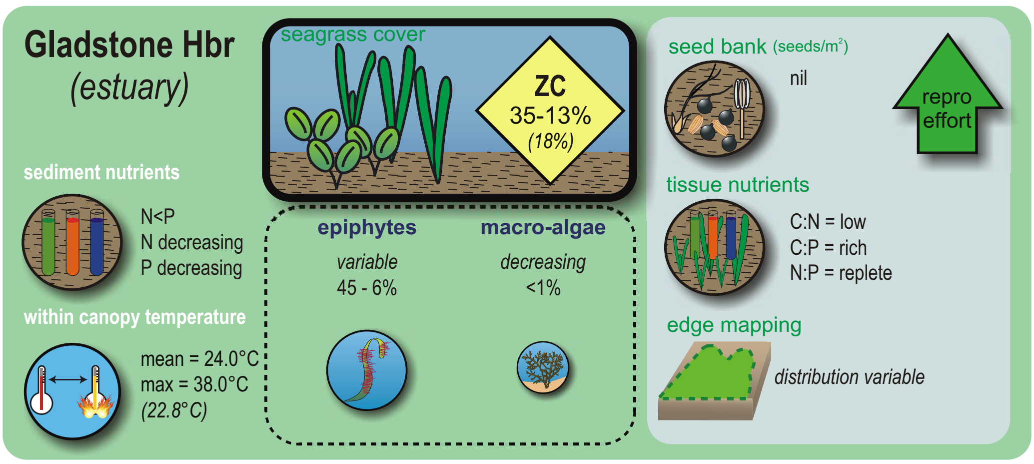












Reef Rescue

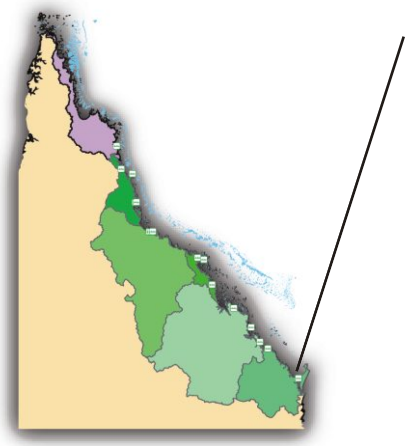
Burnett Mary

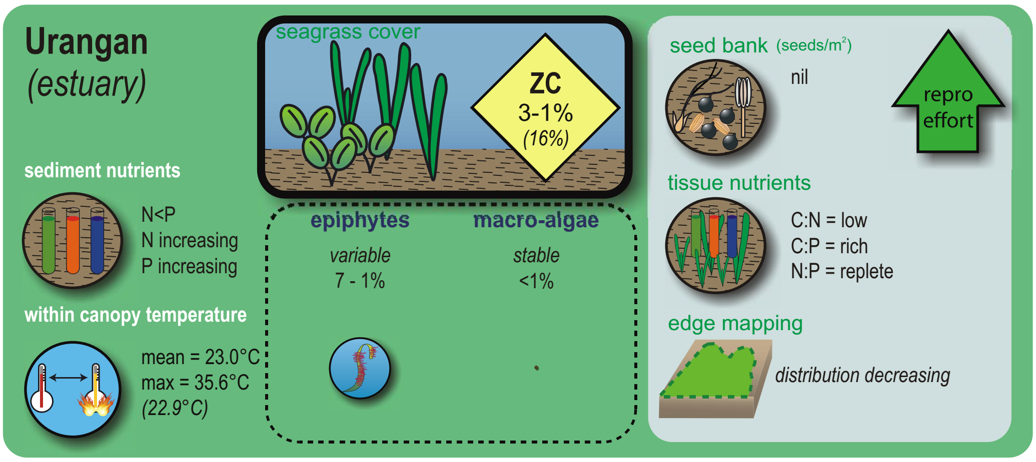
Only estuarine seagrass habitats dominated by *Zostera capricorni* are monitored in the north and south of this region. Urangan (Hervey Bay) in the south has been monitored since 1999, however Rodds Bay in the north was only established in 2007. Urangan is on a large intertidal mud/sand bank adjacent to the Urangan marina and in close proximity to the Mary River. The location is sheltered from the SE winds and associated wave action. Seagrass was lost from this location in 2006 and only began recovering in late 2007. Although no seed reserves were reported, seagrass reproductive effort has increased, indicating the meadow will continue to recover.

Seagrass at Urangan has undergone a long cycle of 'boom and bust' and is currently recovering from flood related loss in 2006. Unfortunately the meadow extent declined early in 2009, possibly a consequence of flooding in the region at the time. Although abundance of epiphytes has fluctuated over time, macro-algae abundance has remained low and stable.

Seagrass leaf tissue elemental ratios of N:P were unchanged from previous years and indicative of potential N limitation. C:N ratios indicated the seagrass to be in a low light environment and C:P ratios suggest the environment to be nutrient rich. Sediment nutrients have been highly variable between years and no trend is apparent.

No extreme canopy temperatures (>40°C) were recorded over the last 12 months. These estuarine meadows have been subjected to elevated rainfall during both the 2008 and 2009 wet seasons.

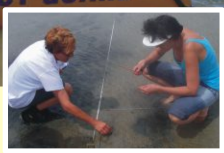




Marine Rescue

Volunteers working together

Article by Gordon Cottle
Photography GSSFFW



Not all monitoring in the Great Sandy Strait is conducted from the shore. Some sites can only be accessed from the water and we also conduct Boat Patrols: surveying dugongs, turtles, dolphins, sea snakes, waders, vessels, fishers and litter.

It was while returning from a "water based" site, the motor on Robyn Bailey's tinnie (aluminium boat) "packed up" in the Tuan Channel. As a condition of our WPH&S policy we carry VHF Marine radios, so Robyn called Volunteer Marine Rescue Flotilla21 (VMR21) for assistance (and got a mention in the local News). During the tow, Skipper Stuart Platt asked Robyn what they were doing, to which I'm sure Robyn gave him the full story of Seagrass-Watch!!!

Shortly afterwards I received a phone call from Vice-Commodore John Meredith enquiring about our activities. As VMR21 had vessels on the water most of the day for their training purposes, could they participate in our monitoring?

I then received an invitation to give a presentation on "*Seagrasses in the Great Sandy Strait*" to VMR21s monthly meeting, which was well received. Commodore Bill Towers endorsed a proposal that they supply their vessel the *Pride of Maryborough* (8.6m with two 150hp engines) and we mapped a course for regular Boat Patrols. GSSFFW agreed to pay a fixed rate from our then ENVIROFUND Round 10, now Caring for our Country funding.

The first patrol was conducted on 24th August 2008, and has been followed on a regular basis since. We have also used *Jupiter One*, their smaller vessel, to monitor sites at Reef Islands and Boonooroo. On the 19th September this year, I was invited to VMR21 to talk about Seagrass-Watch and a number of their members are now registered participants..

This is a prime example of how two diverse volunteer groups can work together to the mutual benefit of each, in cooperation with BMRG and Cooloola Coastcare Association Inc.

Mangrove Watch

A new monitoring program that partners mangrove scientists and community participants

Article by Norm Duke & Jock Mackenzie

Photography Norm Duke & Len McKenzie

"MangroveWatch", a program addressing both scientific and environmental management needs of tidal wetlands, is underway in the Burnett Mary region of Queensland. This new monitoring program targets estuarine and coastal systems where there are mangroves, saltmarsh and saltpans. Like Seagrass-Watch the program uses a partnership between stakeholders and scientists.

This program has been established to address the urgent need to preserve and protect threatened tidal wetland ecosystems. Mangroves and tidal saltmarshes are amongst the most endangered marine wetland habitats worldwide. This is despite a wealth of benefits, ranging from fish habitat supporting commercial and recreational fisheries, to shoreline defence protecting valuable coastal real estate. These wetlands also act as filters of coastal waters, but they are fast disappearing around the world at an alarming 2% per year on average. As a consequence, there has been a dramatic loss of ecosystem services with vast losses in area and function as remnant patches progressively deteriorate.

Australia's mangroves are considered some of the best in the world with the world's third, or arguably second largest, countrywide-area for this type of wetland. The area of Australia's mangroves is around 12,000 km^2, but the figure is easily twice that if the tidal wetland components of saltmarsh and saltpans as well as mangroves are included.

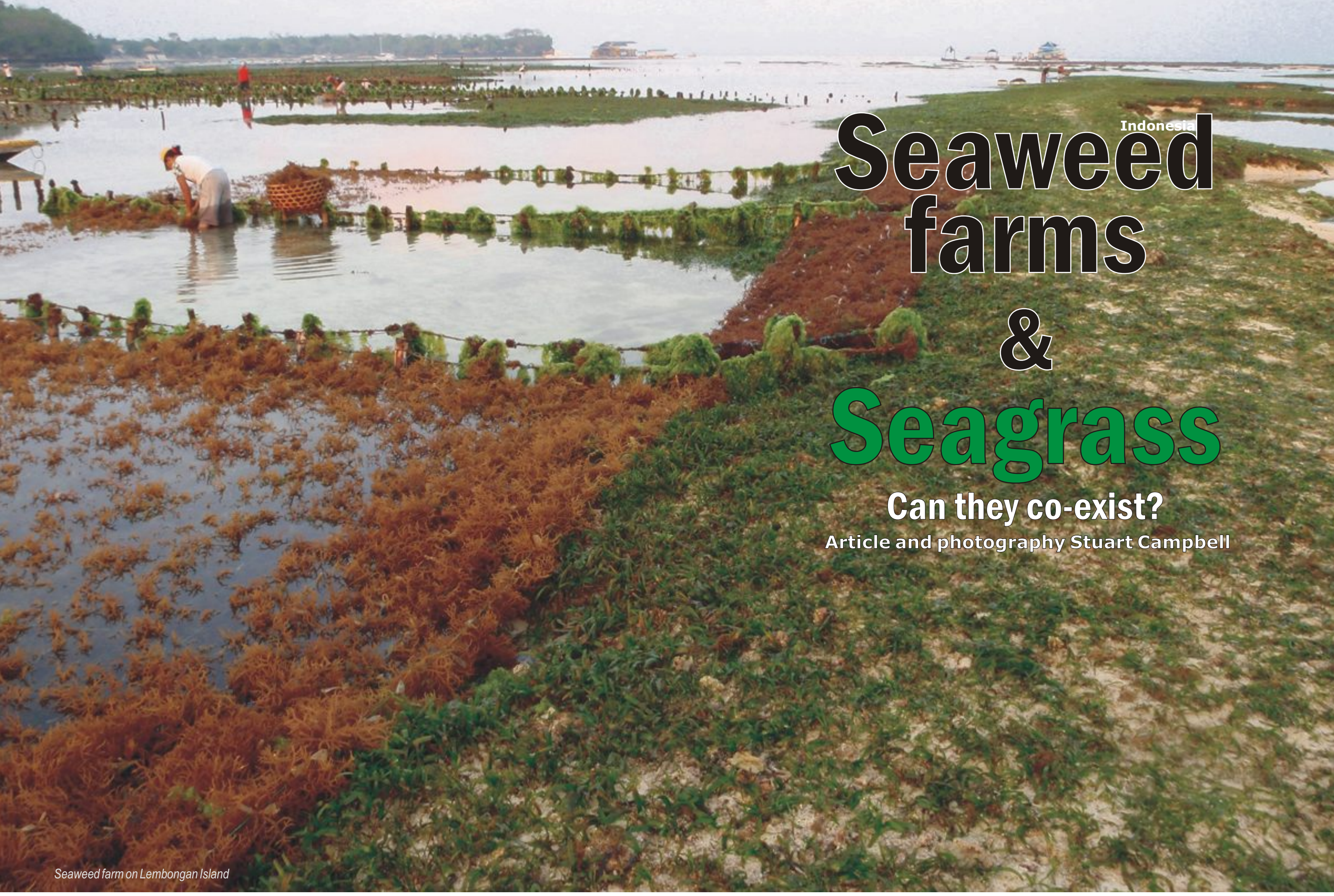
Protecting threatened areas within marine parks and reserves is only part of the solution. The number of "watch" programs demonstrates the enthusiasm of community volunteers for monitoring seagrass, corals, wetlands and coasts. Unfortunately this community enthusiasm has, until recently, been impeded for mangroves and saltmarsh by a lack of effective and practical monitoring methodologies.

The new MangroveWatch program is about rectifying this situation. Since its launch in May 2009, enthusiastic volunteers have embraced this new Community Coastcare initiative implemented in the Burnett Mary NRM region by the University of Queensland. The region extends from Eurimbula Creek in the north to Tin Can Bay in the south, including Hervey Bay, Fraser Island and the Great Sandy Strait. The program is a pilot while methods and strategies are tested and developed over the initial 12 months.

A key feature of MangroveWatch is its close partnership between community volunteers and scientists from the University of Queensland's Centre for Marine Studies. Together they are systematically recording basic data as video and still imagery for assessments of estuarine habitat health. Armed with expert support, training and advice, MangroveWatch volunteers in the Burnett Mary region are actively contributing to the monitoring of local estuaries. An important goal in this phase of the program is to produce a public document describing key issues affecting local estuaries and mangroves, and their overall health.

For more information, visit www.mangrovewatch.org.au

Images (left to right): Recording bank condition using video ; Rhizophora stylosa and Avicennia marina in Shoalwater Bay (Qld, Aust); and training workshops with community volunteers in Tin Can Bay (Qld, Aust)



Seaweed farm on Lembongan Island

Indonesia

Seaweed farms & Seagrass

Can they co-exist?

Article and photography Stuart Campbell

The islands of Nusa Lembongan, Nusa Ceningan and Nusa Penida are situated a few kilometres south-east of Bali, Indonesia. The Nature Conservancy and Conservation International have been working over the past few years to propose the Penida Marine Protected Area that encompasses all three islands.

The region has exceptional marine biodiversity with 247 species of corals and 562 species of fish recorded by surveys in 2008. With a population of 45,000 residents, growing tourism, fisheries and seaweed culture industries there is need to zone the area for a range of uses by communities, tourists and for the protection of important marine habitats. In addition to coral reefs the islands of Lembongan and Ceningan also have extensive mangrove and seagrass habitat.

Seaweed farms cover 308 ha, mangroves 231 ha and seagrass meadows 108 ha. But little is known of the types of seagrass meadows that occur, their functional relationship with other habitats and if they are being impacted by the expansion of seaweed farms.

Many of the seaweed farms are placed directly above seagrass and this can lead to seagrass die off in these areas. Surprisingly though, during our preliminary investigation, intertidal seagrass was surviving below seaweed cultured on ropes placed about 5cm from the sediment surface, despite the obvious shading. At other farms though there was no seagrass present underneath the seaweed cultures.

Right: Seagrass meadows of Cymodocea rotundata and Thalassia hemprichii at Nusa Ceningan

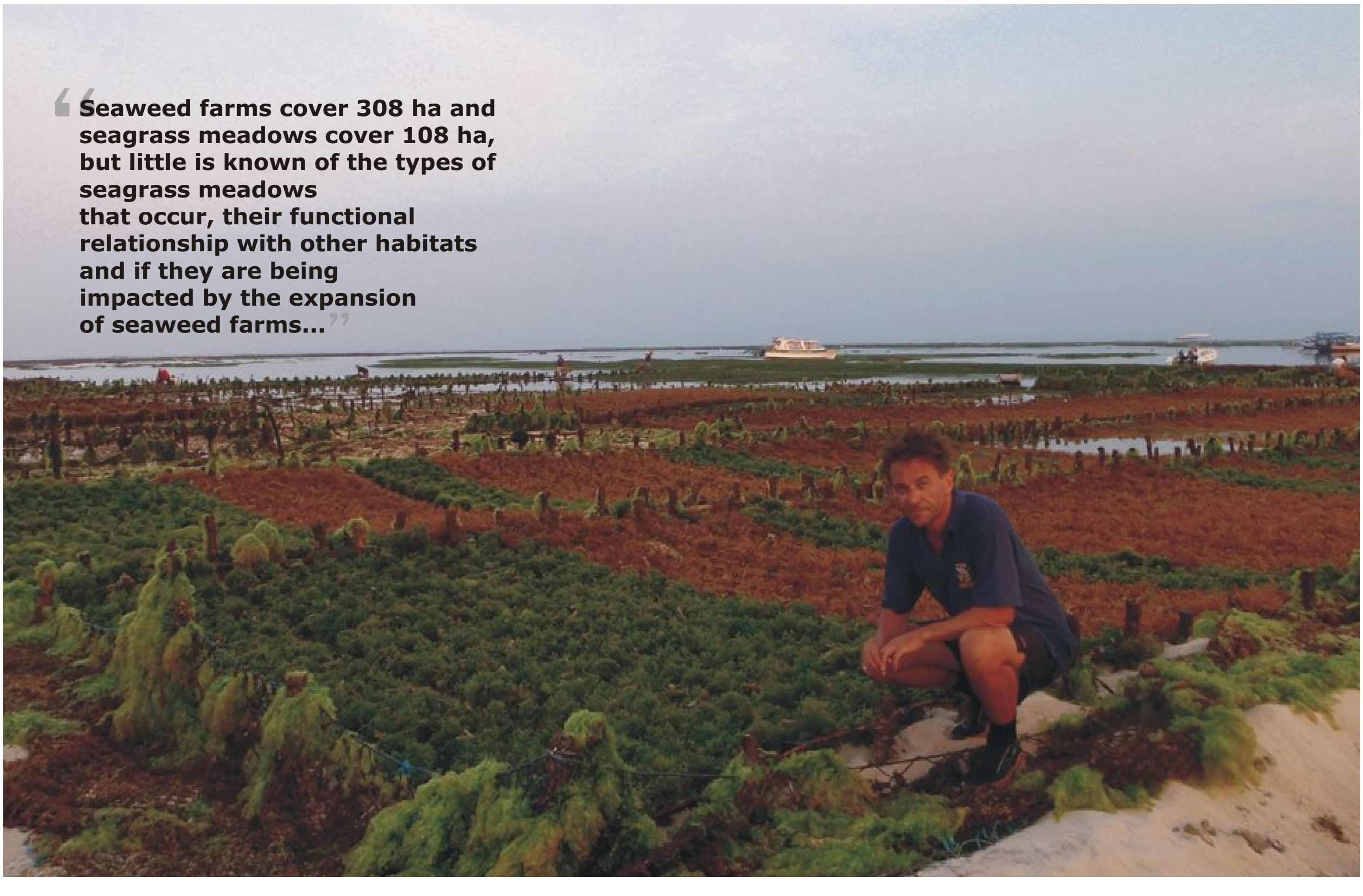
A clear management imperative is to identify existing important seagrass habitats for fisheries and resident turtle and dugong and protect these from future encroachment of seaweed farms.

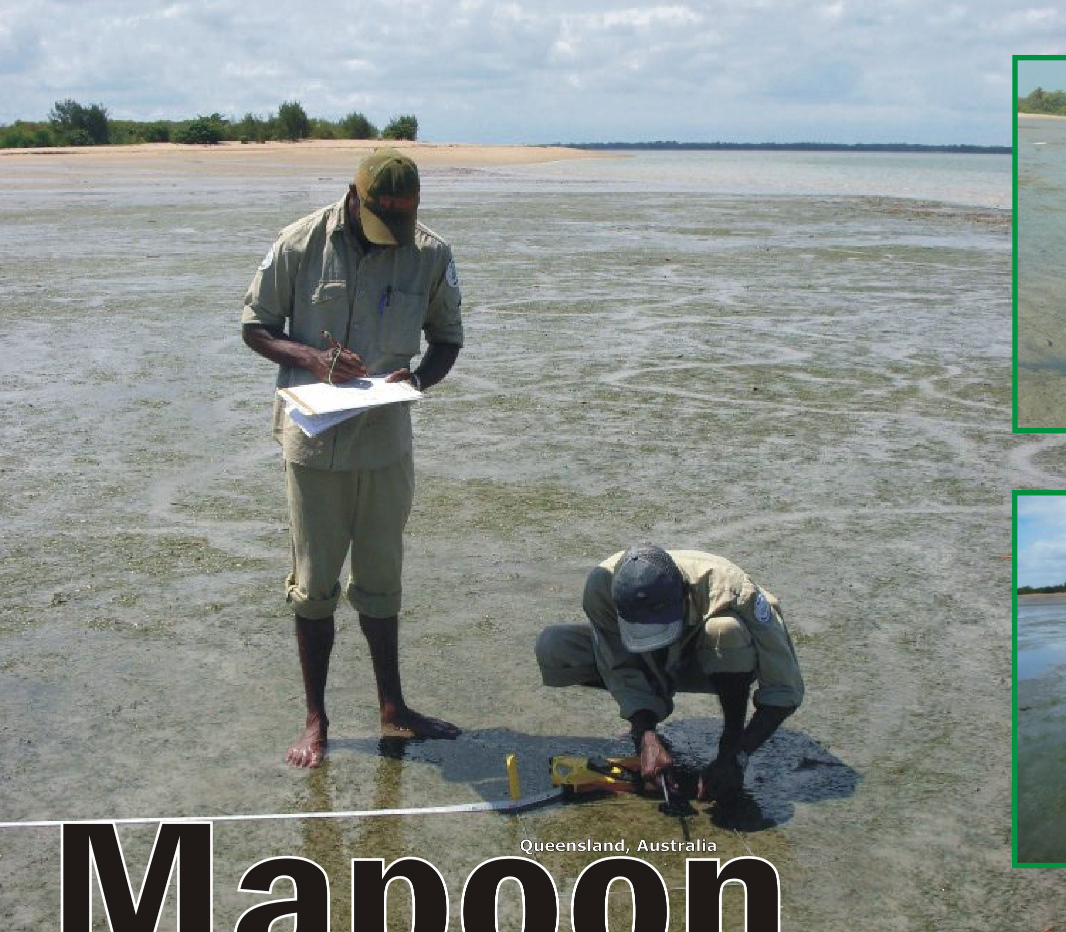
The proposed zoning plan for the Penida Marine Protected Area is a first step to ensuring sensitive marine habitats are protected from such impacts. Falls in market demand and an oversupply of seaweed has led to a 70% reduction in the price for seaweed over the past 5 or so years, and this may inadvertently help to protect those remaining seagrass meadows.

From 2nd-5th November 2009, Wildlife Conservation Society staff from the Indonesian Marine Program travelled to Lembongan and Ceningan Islands with the purpose of identifying what type of seagrass meadows exist and if meadows are suitable for monitoring by local schools and NGOs using Seagrass-Watch methods. Such a program would raise awareness of the importance of seagrass and also help understand if existing meadows remain healthy. Eight species of seagrass were found during the visit and number of different meadow types were identified including those dominated by *Ecklonia* and *Thalassia* and those comprised predominantly of *Cymodocea*, *Halodule* and *Thalassia*. Sites considered representative of the wider area and in proximity to schools were considered suitable for monitoring. Further discussions with NGO's working on the island and local schools will aim to establish a Seagrass-Watch program as part of a wider program for the Bali Lombok region.

Boats anchored over a patchwork of seaweed farms

(Lembongan Is)
Above: A farmer returns with a boat full of seaweed.
Below: Seagrass and seaweed compete for space.





Queensland, Australia

Mapoon

Rangers & Seagrass-Watch

Article by Richard Unsworth
Photography Mapoon Rangers & Richard Unsworth

Mapoon is a beautiful coastal town near the mouth of the Wenlock and Ducie Rivers in North West Cape York and is on the traditional lands of the Tjungundji People. The last couple of years have seen the local Aboriginal council develop a successful ranger program that undertakes a variety of environmental activities in the Cape. One of the environmental activities of the rangers has been to monitor their local seagrass meadows.

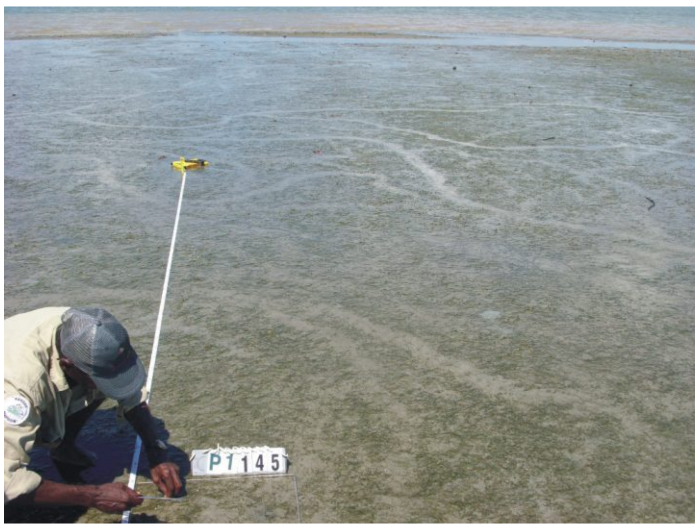
September saw members of the Seagrass-Watch HQ join with the Mapoon rangers to undertake their quarterly Seagrass-Watch sampling and set up an additional site at Cullen Point. The rangers completed Seagrass-Watch Level 1 training in Cairns earlier in 2009. As a community very much linked to the sea through fishing, seagrass meadows are an important habitat of great value. So developing capacity within the community to monitor and understand this significant resource is of great importance, especially in an era of climate change and increased industrial development.

Seagrass meadows at Cullen Point near Mapoon were found by the rangers to be dominated by *Halodule uninervis* and *Halophila ovalis*. Comparison of these assemblages with monitoring of seagrass in other areas of the Cape by Seagrass-Watch and Fisheries Queensland indicates that these meadows are in a reasonably healthy state. This is especially the case given the high rainfalls and flooding of early 2009. Seagrass at Cullen Point had a reasonable seed-bank present within the sediment indicating the meadow would have good resilience to periods of stress.

The species of seagrass at Cullen Point are of the type commonly use by dugong and turtle as a food source. Although the rangers didn't observe any dugong during the recent monitoring, their feeding trails were observed across the sites. This indicates the area is likely to be important for these globally endangered species.

It is also the value of seagrass as a fish nursery and fish feeding area that is particularly important to the Mapoon community. Continued monitoring and assessment of the seagrasses of Cullen Point can only help to conserve these important habitats.

The aim of Seagrass-Watch in Mapoon is to undertake quarterly monitoring. Unfortunately the lack of daytime tides early in 2010 mean that sampling wont be possible until the end of the Wet season in April. Fisheries Queensland, supported by Cape Alumina Ltd, will continue to assist with monitoring when it resumes.



Dugongs without borders

Article by Sahondra Parent & Chris Poonian

Photography Community Centred Conservation (C3)

Malagasy fishers preparing their nets

In recent years, dugong numbers have rapidly declined throughout the Western Indian Ocean region as a result of hunting, accidental capture in nets and habitat destruction. To address these issues, Community Centred Conservation (C3) and local partners initiated the project 'Dugongs without Borders' in Northern Madagascar in May 2009. The project aims to build national and regional capacity in Comoros and Madagascar for collaborative dugong research and conservation initiatives. One component of this project is the collation of information on seagrass habitat in the region, including baseline surveys and mapping, using the Seagrass-Watch protocol.

According to interview surveys that we conducted in July and August 2009 among fishers and retired dugong hunters in Northern Madagascar, it would appear that the region may still host a significant dugong population and interviewees were even able to identify past and present dugong feeding sites. We are now concentrating our seagrass mapping work at these sites in order to assess dugong habitat and consider options for its protection.

Following a training session in Seagrass-Watch methods with our partner organisations, we conducted preliminary seagrass mapping at Ramena, Antaravy, and Nosy Hara Marine Park (Ampasindava and Vohilava) from September to November 2009. Our work has revealed the presence of 8 species including: *Thalassia hemprichii*, *Cymodocea rotundata*, *C. serrulata*, *Halodule uninervis*, *Halodule wrightii*, *Syringodium isoetifolium*, *Halophila ovalis* and *Zostera capensis*. There was good news for dugongs because seagrass meadows generally appeared healthy and extensive.

Working in this remote region has proven to be quite a challenge with many sites only accessible by boat and located in remote areas where freshwater is scarce; fortunately the incredible hospitality of local communities has greatly aided our work. This is the first phase of a series of seagrass mapping work planned for the upcoming months. The information gathered on seagrass habitats in Northern Madagascar will provide us with a better idea of the importance of particular sites for dugongs and priorities for conservation with the help of local stakeholders.

For further information, please visit our website at
www.c-3.org.uk

image courtesy GBRMPA

C3-Madagascar is an official partnership between C3 and the University of Antsiranana and we are grateful to our other local collaborators: Madagascar National Parks and Centre National de Recherches Océanographiques. This work has been generously funded by the BP Conservation Leadership Programme and Convention on Migratory Species of Wild Animals (CMS).

Research Outreach Education

Article by Carla Sofia do Carmo Pereira Pacheco
Photography Biomares Project

Portugal, is a country in the southwest of Europe. It has an area of 92.4 km^2 and is the most western nation of the European continent. The southern and western boundaries of the main Portuguese territory is the Atlantic ocean; it has also two autonomous regions, the Azores and Madeira archipelagos. Only 3 species of seagrass occur in Portugal, *Zostera marina*, *Zostera noltii* and *Cymodocea nodosa* in areas easy to observe. The Luiz Saldanha Marine Park created in 1998 with 52 km^2 is part of Arrábida Natural Park, managed by Nature Conservation & Biodiversity Institute.

It is a remarkable area in what concerns the biodiversity not only at national but also at European level, indeed more than 1000 species of floral (e.g. anemones, starfishes, sea urchins, crustaceans, sea-horses) and fauna (e.g. seagrass meadows) has been identified. It should be emphasized that the preservation of these seagrass meadows is crucial.

This park is included in the national list of sites of the UE Natura 2000 Network Arrábida-Espichel. The LIFE Biomares project (LIFE is the EU's financial instrument supporting environmental and nature conservation projects throughout the EU), was developed because of the willingness to help preserve and restore

Top left: Spreading sediment over newly transplanted seagrass
Top: Fertilizing seagrass.
Above: Transporting racks with seagrass to be transplanted

the biodiversity of the Professor Luiz Saldanha Marine Park for the conservation of other species, as for instance the seahorses. The Life Biomares project includes several actions such as: restoring the seagrass meadows found in Portinho da Arrábida in order to restore the previously associated biodiversity. This action will be implemented by transplanting plants (*Zostera marina*, *Zostera noltii* and *Cymodocea nodosa*) collected from donor meadows (such as the Sado estuary and Ria Formosa). The donor populations will be subject to mapping and special monitoring to evaluate the impact of removal of plants. Experiments involving germination of seeds and plant growth from seeds to increase the genetic diversity of the transplanted population, will also be conducted in laboratory, under controlled environment; the installation of "eco-friendly" moorings that consists of fixed anchors with turnbuckle and swivel systems, with a surface buoy, so that mooring cables do not drag over the sea floor. Informing and raising awareness of the general public and more direct users about the marine biodiversity of the

Collecting flowers for germination

marine park with an itinerant exhibition at the Oceanographic Museum.

The project has several partners, including: Nature Conservation & Biodiversity Institute, ICNB, Algarve Sea Sciences Centre (CCMAR), Biological Resources National Institute, I.P. (IRNB / L-IPIMAR), Psychology Superior Institute (ISPA). Consejo Superior of Investigaciones Cientificas (CSIC) IMEDEA (investigation laboratory) and Spain Superior Council of Scientific Investigation (CSIC), Cement General Company, S.A. (SECIL) and National Oceanic and Atmospheric Administration (NOAA).

Due to the importance of seagrass ecosystems it is crucial to conduct systematic monitoring of biotic (e.g. fauna, flora) and abiotic factors (e.g. substrate, temperature). Estremoz Science Center in collaboration with Evoras´ Science and Technology University intends to implement monitoring activities in coastal areas with school communities and others. We also intend to inform and raise awareness for this ecosystem and write guides and activity books to be available on our website or in Estremoz Science Center.

This monitoring activity is part of the Seagrass-Watch global monitoring program. The project will be conducted in coastal areas with environmental groups, educational institutes and local participants.

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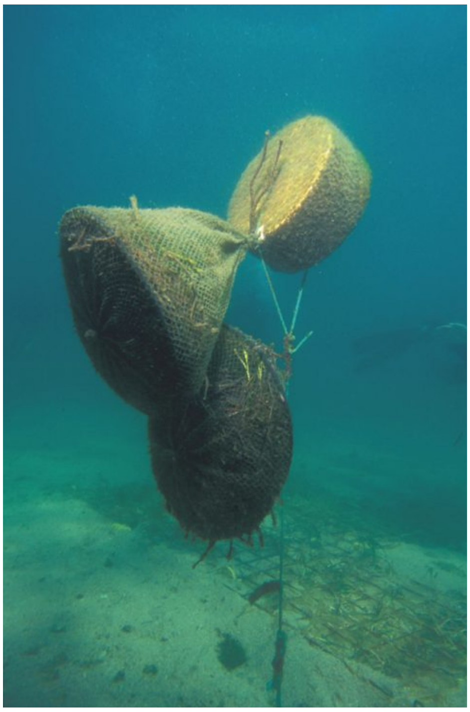
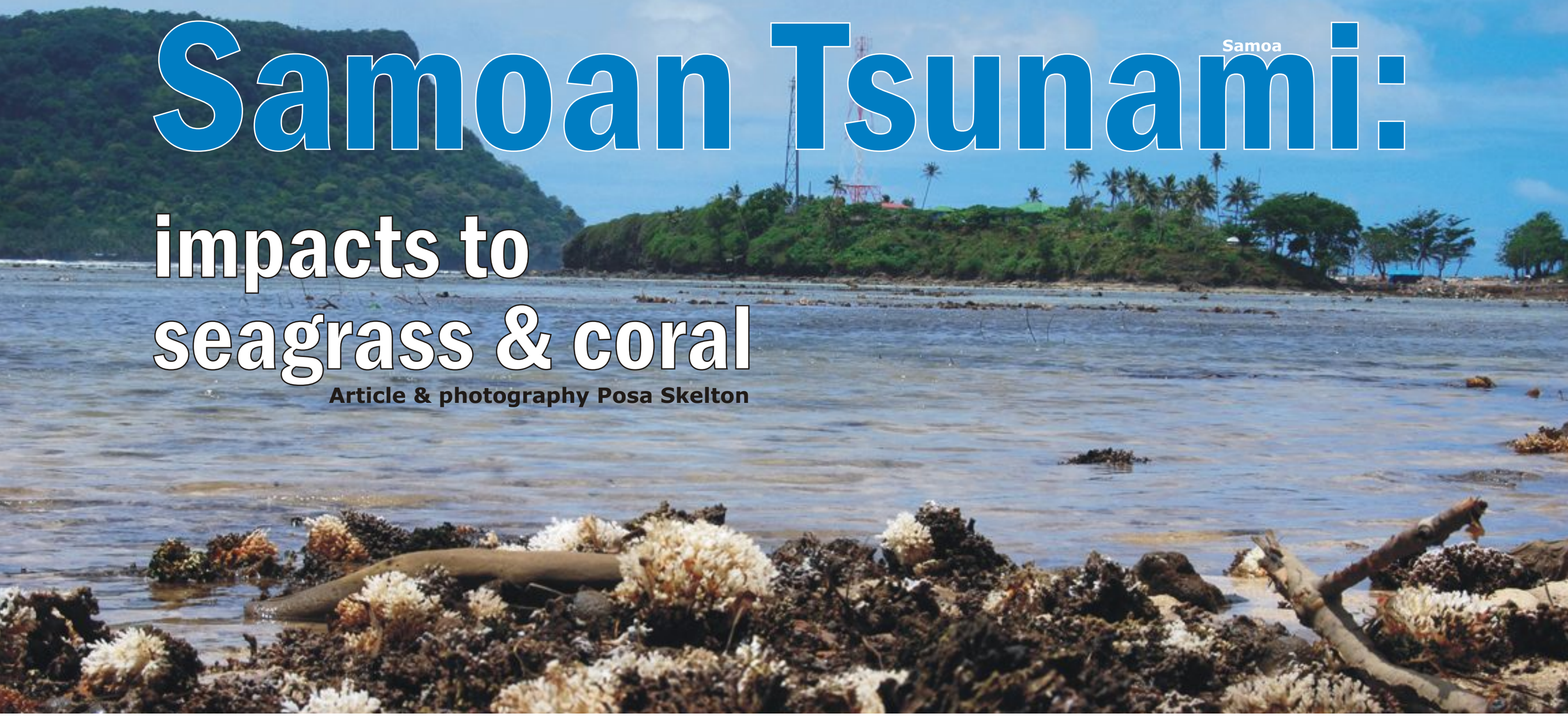
Experiments involving germination of seeds and plant growth from seeds to increase the genetic diversity of the transplanted population

Left: Diver collecting flowers for germination
Below: Seed bag ready to be deployed



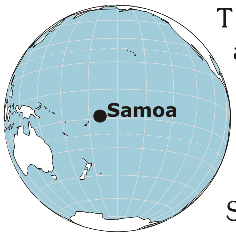
Left: Seed bags in place over a transplanted area of seagrass
Below: Outreach and education, on the importance of seagrass ecosystems and how fragile they are



Samoan Tsunami:
impacts to seagrass & coral

Article & photography Posa Skelton

On the 29th September 2009 at 6:48am Samoa time, an 8.3 magnitude quake struck approximately 195 km south of the Samoan archipelago. The ensuing tsunami killed over 150 people in American Samoa, Samoa and Tonga. Two-weeks after the tsunami a team of scientists assembled in Samoa to undertake impact assessments and provide recommendations to prevent future loss of life and infrastructure.



The marine assessment team (including Seagrass-Watch participants) undertook surveys from 14-17th September. The surveys focussed on assessing the extent of damage to the marine environment, identifying the main causes of the damage and assessing the state of marine resources in the affected areas. Sites were chosen because of their close proximity to the worst impacted villages, being part of community conservation areas, important nursery, foraging and nesting sites for turtles and important tourism areas. A range of methods were used (manta-tow, transects, photo-quadrats, sonar, timed-swim, under water visual census and rapid-assessment) to provide the widest geographic coverage as well as site-specific assessment.

The impact to reef habitats was found to be highly variable. This was attributed to many factors, such as the presence of offshore islands, the depths between the islands and the mainland fringing reefs, the width of the reefs, land topography and the presence of rubble and other loose debris in the water at the time of impact. Rubble on the reef-crest and back-reef became missiles and severed tips of many branch corals. Large boulders (2-4m wide) were toppled, or shifted a fair distant towards the shore, damaging corals on the way. Steep slopes close to the high water mark facilitated the mixing and swirling of the waves resulting in the severest impacts on coral communities. Debris from land also accentuated the damage. Only a few sites showed evidence of backwash. At deeper waters (30m), the reef was intact and minimal impact was noted. Evidence of seagrass meadows being impacted included the presence of clumps of *Halophila ovalis* ssp. *bullosa* found 100m inland. No *Syringodium isoetifolium* (the only other seagrass species in Samoa) was observed during the surveys. This species generally disintegrates faster than *Halophila.*

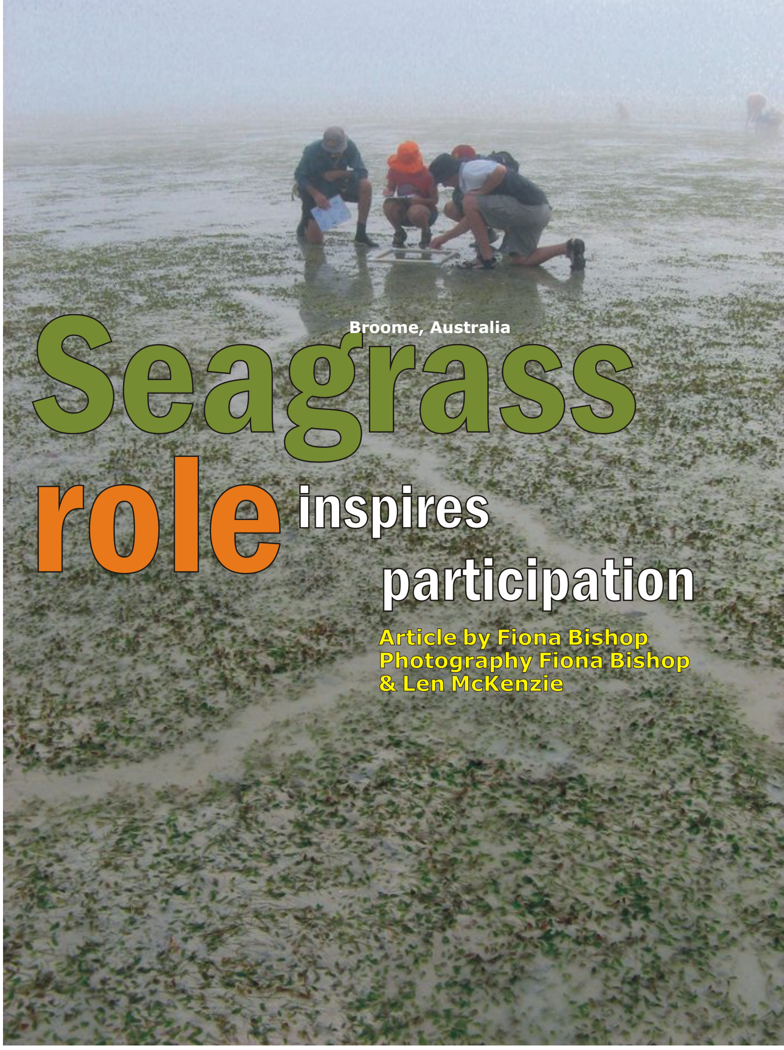
Marine animals were also affected. Turtles, sharks, holothurians and dolphins were stranded inland, resulting in the some deaths. Some were successfully released back into the sea by Government, SPREP and the community. The recovery of the reefs is already occurring with the high abundance of turf algae (cyanophytes, chlorophytes and rhodophytes). The good flushing of the inshore reefs by the swells and fine conditions should ensure things will be back to normal in a relatively short period of time. Some factors may conspire to slow the recovery process including Crown-Of-Thorns outbreak (20 counted in 100m transect), cyclones with associated heavy rain resulting in land run-off, damage caused by debris already in the water, and elevated sea surface temperatures. An immediate recommended action was to remove and dispose debris found in the water, as well as COTS. This should help coral fragments to stabilise and re-establish. Continuous monitoring as well as establishing long-term monitoring sites was also recommended.

Halimeda and Halophila ovalis found 100m inland

Broome, Australia

Seagrass role inspires participation

Article by Fiona Bishop
Photography Fiona Bishop & Len McKenzie



A recent report about the benefits of seagrass ecosystems to climate health has greatly excited one of the resource's fastest growing fan bases the dedicated participants of the Broome Community Seagrass Monitoring Project. We already knew the value of seagrass as a marine nursery, habitat, food, water purifier, fisheries sustainer, coastal stabilizer and marine health indicator. Now we have learned from the report entitled "Blue Carbon: the Role of Healthy Oceans in Binding Carbon", launched by international organisations including the United Nations Environment Programme and the Intergovernmental Oceanographic Commission of UNESCO, that seagrass is one of the most cost effective carbon capture and storage systems on the planet, Carbon (*see Seagrass-Watch Issue 36*). With other healthy marine ecosystems, it could help deliver up to 25% of the emissions reductions needed to avoid 'dangerous' climate change.

This finding was of particular interest to Broome residents, who have also recently learned that sea levels in Western Australia are rising at a rate double that of the world average with our Kimberley region experiencing even higher level rises than the WA average. Statistics from Australia's National Tidal Centre have shown that globally, sea levels have increased by just over 3mm, while in the Kimberley, levels rose by more than 8mm.

The knowledge that monitoring seagrass meadows through our community project may not only protect marine health, but help to reduce the impacts of climate change, such as these sea level rises, was very inspiring for our participants.

These participants came out in force for our October monitoring session in Roebuck Bay. The monitoring was characterised by unusual visual conditions, with a sublime sunset caused by smoke-filled skies casting eerie hues onto glistening meadows at the Demco site. Then, at the Town Beach site, a thick blanket of heavy mist rolled over the bay from Roebuck Plains, engulfing our site in a ghostly fog.

A special highlight of this season's monitoring was the number of newly trained participants attending each session. These participants recently completed a Seagrass-Watch Level 1 workshop, so were able to contribute a higher level of skill and knowledge to the monitoring process. During the October monitoring we found that most areas of seagrass had flourished, with thick green meadows of *Halophila ovalis* and *Halodule uninervis* containing all sorts of macrofauna. We also recommenced seed monitoring, which aids seagrass resilience calculations.

This season we launched into the new Coastwest funding period, which has been supplemented by a second grant from the Port of Broome. We have also seen the start of intertidal mapping and a new phase of community education, with presentations delivered to students from Broome primary schools and Notre Dame University.

The Environs Kimberley Seagrass Monitoring Project is co-managed by EK and DEC and supported by Coastwest, the Port of Broome and Seagrass-Watch HQ.

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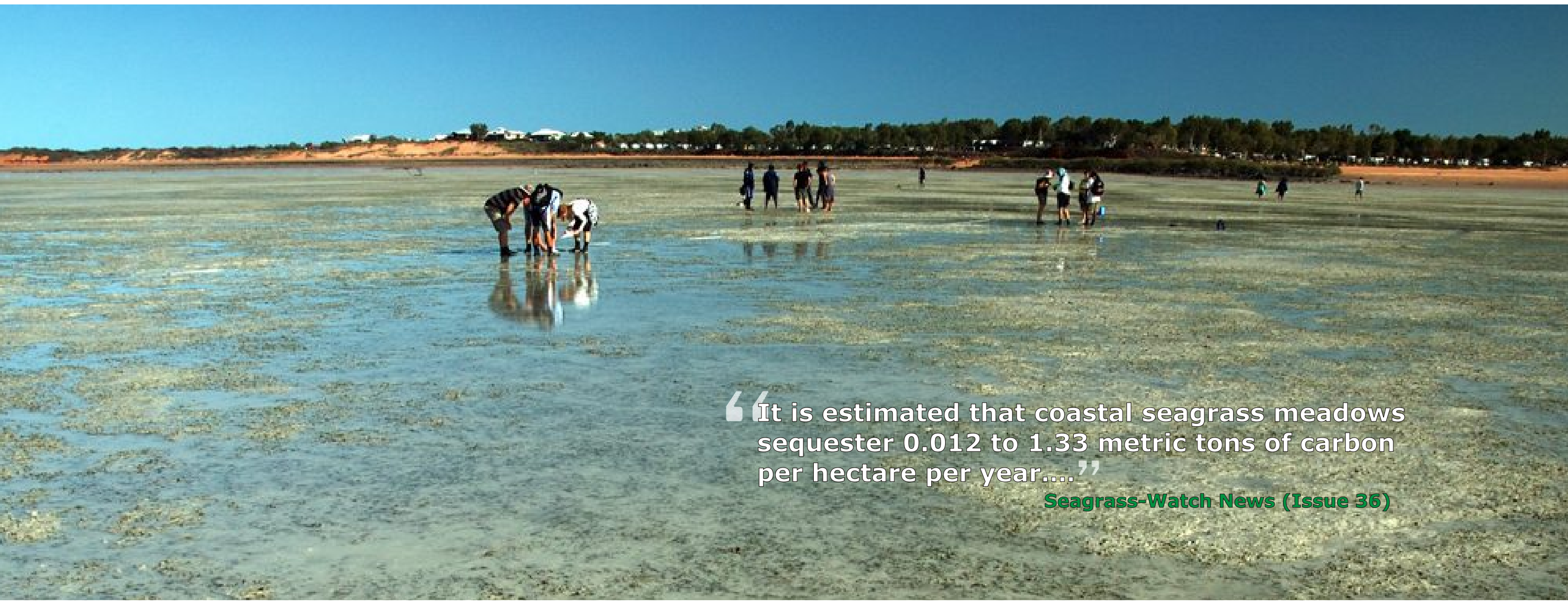
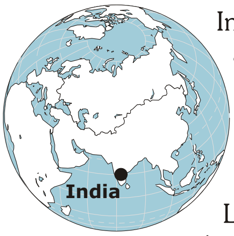


"It is estimated that coastal seagrass meadows sequester 0.012 to 1.33 metric tons of carbon per hectare per year...."
Seagrass-Watch News (Issue 36)



In India, seagrasses are spread along the east and west mainland coasts and also in the shallow lagoons of Lakshadweep and sheltered coasts of Andaman and Nicobar islands. Of the 14 seagrass species reported from India, Gulf of Mannar ranks highest with 13 species, followed by Palk Bay (11 species), Andaman and Nicobar islands (9 species) and the Lakshadweep islands (8 species). However, seagrasses in different parts of India are facing varied threats from human disturbances and natural phenomenon.

India

Seagrass under threat

Article by T. Thangaradjou, E.P. Nobi, E. Dilipan, K. Sivakumar & L. Kannan

Photography T. Thangaradjou, Dinesh, E.P. Nobi, K. Sivakumar

The mainland

Seagrasses on the east coast of India, especially in Palk Bay and Gulf of Mannar, suffer large scale losses due to southwest monsoonal winds and northeast monsoon cyclones which are prevalent in this part of the sea. Further, most of the key fish landing centres of this region are endowed with extensive seagrass meadows which face destruction due to fishing related activities, especially anchoring of boats. Every time one anchor is lifted, at least 1kg of seagrasses is uprooted. The quantity may look small, but when such destruction is caused by 100s of boats every day then the damage is severe and needs immediate attention. Seagrasses growing in the tidal pools and partially exposed during low tides are showing heat stroke like symptoms due to elevated surface water temperature. Increases in surface water temperature over 38°C for 5-6 days wilts the seagrass leaves by denaturing the chlorophylls and results in leaf death.

A striking feature leading to the denudation of seagrass meadows, noticed in the Pamban area of Gulf of Mannar, is the harvesting of milky white paper shells (*Tellina angulata*) having good market value in the ornamental shell industry. This has induced the local fisherwomen to dig out the seagrass meadows of this region (which are the habitats of this bivalve) on a large scale to collect shells. Harvesting the shells physically destroys the underground rhizomes and roots of the plants, affecting seagrass growth. It has been found that over 153 ha of dense of sparse seagrass meadows have been lost during 2002-2004 in this region. 80% of this loss was caused by shell harvesting.

Trawling and bottom set gill net operations are largely causing physical damage to the seagrasses by uprooting the plants and removing the healthy leaves. It

Digging in seagrass meadows for paper shells: Local women dig out large areas of seagrass meadows searching for Paper shells. This activity has resulted in up to 80% of seagrass loss in the Pamban area.

is estimated that approximately 20-25kg of seagrasses is removed by a trawler and about 30-40kg of seagrasses is being removed by the shore seine operations (the quantity varies depending on the seagrass density) on a single day in the Palk Bay and Gulf of Mannar region.

Nutrient enrichment due to varied factors is promoting the growth of seaweeds. The seaweeds are capable of growing rapidly and can smother entire seagrass meadows and reduce light availability. Also, when seaweeds decay, they release humic substances which cause deleterious effects to seagrasses.

The islands

Lakshadweep

Water quality is one of the important parameters that determines the health of the seagrass ecosystem. In Lakshadweep islands, though the water quality remains largely pristine, disposal of tuna and other fish wastes and untreated solid waste disposal have caused localised eutrophication. The enhanced nutrients have resulted in the proliferation of seaweeds and reduction of light availability, thus suppressing the seagrass growth. Tourism developments, mostly along the coastal areas, has also lead to the destruction of seagrasses.

Most interesting feature found in this part of the Arabian Sea is the increased number of green turtles (*Chelonia mydas*) which graze intensively on the seagrass meadows. Interaction with the local people of these islands has clearly indicated that there is a gradual increase in the turtle population over the last five years in many islands especially Agathi, Kavarathi *etc*.

Though some of the local fisherfolk insist on the seasonal hunting of green turtles, those in opposition have suggested translocating some of the turtle population to the other islands having good seagrass meadows.

Andaman and Nicobar

Dugongs (*Dugong dugon*) and green turtles have been regularly reported from Andaman and Nicobar islands (D'souza and Patankar, 2009). Seagrasses of these islands are also facing serious threats from intensive shipping, boating and tourism activities.

The Boxing Day tsunami of 2004 severely altered the coastal geomorphology of the Andaman and Nicobar islands and also devastated the seagrasses by uprooting the plants, lifting the land and dumping sediment on seagrass meadows. Our recent studies on the distribution of seagrasses of the Andaman and Nicobar islands have revealed the disappearance of seagrasses from the North Reef and Interview islands of North Andaman, where extensive seagrass meadows were reported earlier.

Similarly, remote sensing studies have confirmed the disappearance of seagrasses from many locations (Lakshman beach, Inhengloi) of the Great Nicobar island, from where dense seagrass meadows were previously reported. Seagrasses of the northern part of the Andaman islands have been largely destroyed because of low tide exposure due to lifting of land while the southern part of the Andaman islands and Nicobar group of islands have been deposited with huge amounts of sediments and coral debris. However, these seagrasses are now showing little recovery from the physical damages caused by the sheer power of tsunami waves. Adequate and immediate attention should be paid to the conservation of seagrass resources because losses reported from several parts of the country may also lead to the loss of associated biodiversity, fishery and other ecological functions and services in the coastal zone.

As seagrasses are widely recognized as key ecosystems in the coastal zone, they must be given due consideration for research, monitoring and conservation as compared to coral reefs and mangroves, by the resource managers and policy makers. Though several state and central government organisations have now started to pay good attention on seagrass research, it is time to develop a macro level plan on seagrass conservation for sustainability, future prosperity and posterity.

Reference: D'souza, E. and V. Patankar., 2009. First underwater sighting and preliminary behavioural observations of Dugongs (Dugong dugon) in the wild from Indian waters, Andaman islands. Journal of Threatened Taxa 1: 49-53.

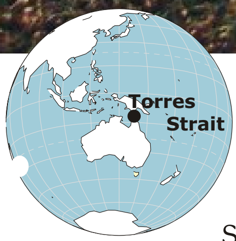
Algae smothering seagrass

Torres Strait, Australia

Monitoring sites increase

Article by Jane Mellors
Photography Moses Wailu, Jane Mellors, Karen Vidler & Tagai college

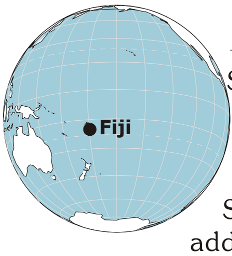
Mabuiag Island seagrass meadow



2009 saw the number of sites being monitored in the Torres Strait increase from the already established sites at Thursday Island, Horn Island and Hammond Island. The addition of new sites was due to the Torres Strait Regional Authority's Land and Sea Management Unit's focus on Torres Strait Island communities addressing key environmental priorities through the establishment of the Indigenous Land and Sea Ranger Program. One of the priorities of the Ranger Program is to implement the recommendations of the community formulated Dugong and Turtle Management Plans. In most plans better knowledge and skills for monitoring seagrass habitat are highlighted. Due to the staged rolling out of the Ranger Programs two new communities, Mabuyag and Mer started Seagrass-Watch. In September, a training workshop on Mer attracted an enthusiastic group. Two rangers (James and Frank) from Badu attended the workshop so that they could report back to their island community and gauge whether there was sufficient interest to initiate seagrass monitoring on Badu.

The established sites around the central island continued to be monitored by Tagai College students under the guidance of teachers Ann More and Andrew Denzin. This year however the Tagai College program stepped up a notch by being recognized by Queensland Studies Authority (a statutory body of the Queensland Government) as an enrichment course community based learning program. Students enrolled in 60 hours of extra curricula activities with milestones that were recorded in a log book before they were awarded their Certificate of Achievement Level 1. In addition to their certificate the students also gain a point towards their Queensland Certificate of Education (QCE) - Queensland's senior school qualification. The QCE is awarded to eligible students usually at the end of Year 12, but is still valid for a person to claim up to the age of 25. Congratulations to the six students (50% of the enrolment) who gained credit in this inaugural year.

From the top: Workshop participants in the field on Mer Island.
Students monitor Back Beach (Thursday Island)
Estimating percent cover at Mabuiag Island site
Students measuring canopy heights (Hammond Island)



Suva, Fiji

Nasese seagrass

Article by Lekima Copeland
Photography Gilianne Brodie & Posa Skelton

Seagrass-Watchers from the University of the South Pacific, International School Suva and several additional participants gathered to monitor the two sites on the mudflats adjacent to Corpus Christi on the 14th November 2009.

This monitoring event was relatively new to some participants and as such was a great way of diversifying their field experience. A minor hiccup was encountered by the University student group with regards to a lack of steel quadrats. However, under the guidance of group leader Dr Gilianne Brodie, the resourceful USP students were able to construct their own quadrats using nylon rope and driftwood found lying along the Nasese shore line.

A short briefing by Seagrass-Watch Fiji Local coordinator, Dr Posa Skelton, on the identification of seagrass, and with the aid of identification keys and self explanatory datasheets, the survey was made much easier for participants. During the monitoring event, participants identified and learnt about the three species of seagrass (*Halodule uninervis, Halophila ovalis* and *Halodule pinifolia*) that we can find on the Nasese foreshore. Besides recording seagrass plant parameters, sediment samples were also sieved to look for the Halodule *uninervis* seeds. International School students stated that there was a need to create awareness around Fiji on the importance of seagrass.

Bubble Shell (genus: Haminoea)

One unexpected find on the day was hundreds of small living bubble shells from the opisthobranch mollusc family Bullidae genus *Haminoea*. Dr Brodie commented that she thought their presence was probably reproduction related and that she remembered recording a mass occurrence of these animals just like this at the same location in March 1985.

GIANT CLAMS..continued from page 24...

Indo-Pacific is the Horse's Hoof or Bear Paw clam *Hippopus hippopus*.

This species reaches 50 cm shell length and can weigh up to 13 kg. The valves are an elongate triangular shape, thick, with 8-12 squarish extremities of the rib interstices. The byssal orifice is closed tightly in adults, and from the lower view the pattern of the rib interstices give the species its common name. The mantle is yellow-brown with green or gray lines and does not extend over the valve margin. It is widespread in SE Asia, Australia to Vanuatu and parts of Micronesia.

Giant clams are harvested by Pacific Islanders for food. However giant clam shells are sold on the black market as decorative accouterments, and the adductor muscle is prized as a delicacy (both in Japan and in France). There is concern among conservationists as the numbers in the wild have been greatly reduced by extensive overharvesting for food and the aquarium trade. The IUCN lists the giant clams as vulnerable.

Attention!
Clams are totally protected in Queensland, Australia

Under Section 78 of the Fisheries Act, a person must not unlawfully take, possess or sell a regulated Fish - clams are a regulated fish (Regs, Schedule 4 Division 6).

Max Penalty $75,000 (1000 penalty units)

Clams must not be taken from the foreshores or any other place. Queensland Boating and Fisheries Patrol officers regularly patrol these areas.
For more information on this or other fisheries issues visit FishWeb www.dpi.qld.gov.au/fishweb/ *or* contact your nearest Patrol Office

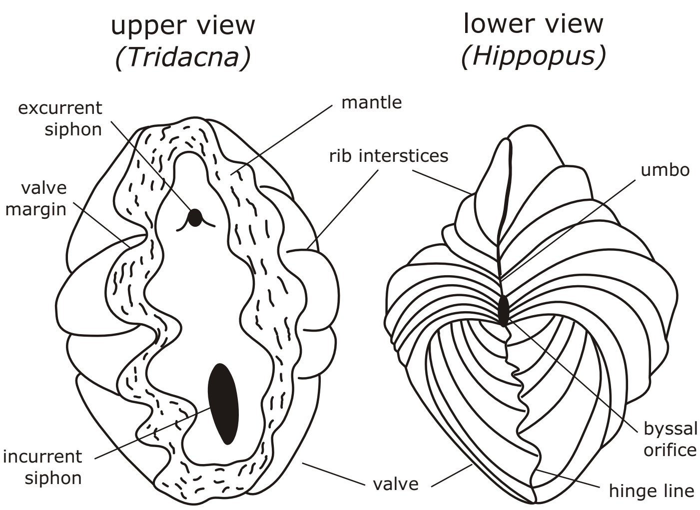
Animal facts

Giant clams

Article by Len McKenzie
Photography by
Len McKenzie
& Rudi Yoshida

When monitoring seagrass meadows on reef flats in the Indo-Pacific, it is not uncommon to come across one of the natural wonders of the marine realm; the giant clam.

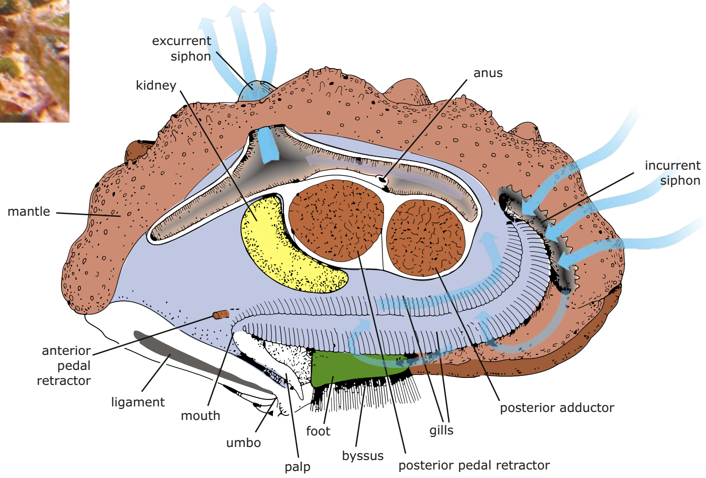
As is often the case with large sea creatures, the giant clam has been historically misunderstood. They were once thought of as the "killer" or "man-eating" clam. Popular South Pacific legends described divers being drowned when the clam closed its shell on the divers arm or leg. However, no account of a human death by giant clam has ever been substantiated. While a clam is certainly capable of holding one fast in its grip, in reality the shell's closing action is a defensive response, not an aggressive one, and the process of closing the shell valves is slow enough not to pose serious threat. Today the giant clam is considered neither aggressive nor particularly dangerous.



Giant clams are of the bivalve mollusc family Tridacnidae. They evolved over 65 million years ago in the Eocene, along with modern corals. Giant clams are the largest living bivalve molluscs. There are 7 species of giant clam, the largest is *Tridacna gigas*, which are native to the shallow (220 m) coral reefs of the South Pacific and Indian oceans. Individuals can weigh more than 250 kilograms, measure as much as 1.2 metres in length, and have an average lifespan of 100 years or more.

Being bivalves, giant clams have 2 shells (valves) which encase the animal. The valves are joined at the bottom, and the adductor muscles on each side hold the shell closed. If the adductor muscles are relaxed, the shell is pulled open by ligaments located on each side of the umbo.

Clams draw in and expel water for respiration and feeding through two siphons: the incurrent and excurrent. The water is moved by the beating of millions of cilia (hairlike structures) on the gills; other cilia strain food from the incurrent water and transport it, entangled in mucus, to the mouth.



modified from Yonge 1975, Sci. Am. 232: 96-105.

The clams mantle tissues also act as a habitat for the symbiotic single-celled algae (zooxanthellae) from which it gets its nutrition. Adult clams can obtain over 90% of their food requirements from the photosynthetic products of the zooxanthellae. Giant clams differ from other molluscs in that by day, the clam opens its shell and extends its mantle tissue so that the algae receive the sunlight they need to photosynthise.

Clams also act as natural biofilters as they take up dissolved ammonia and nitrate from the surrounding seawater to supply their symbiotic zooxanthellae with nitrogen for growth.

Giant clams are hermaphrodites; each clam produces both sperm and eggs. They reach sexual maturity at 56 years, and are broadcast spawners, probably triggered by water temperature. The fertilized eggs develop through several larval stages that swim briefly before settling permanently on the bottom. Although larval clams are planktonic, they become sessile in adulthood. Juveniles settle and attached to rock or substrate using byssus (threads) present along with narrow byssal orifice.

Most clams are found on coral reefs, partly embedded in sand or rubble, although one species (*Tridacna crocea*, the Boring Clam) burrows into coral pockets. The most commonly encountered giant clam in seagrass meadows of the tropical

continued page 23