Issue 35 • December 2008

Seagrass-Watch

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

Reef Rescue

Great Barrier Reef Water Quality Marine Monitoring Program

Local eyes Global wise

In this issue:

From the editor

As 2008 comes to a close, it is an opportunity to look back and reflect on the achievements for the year. The most significant was Seagrass-Watch turning 10. Also was the completion of the fourth year of sampling for the Marine Monitoring Program. Seagrass-Watch plays a key role in helping to provide sound advice for the management of water quality on the Great Barrier Reef, and in this issue we present some of the key findings.

Also in this issue you'll find articles on recent efforts in Indonesia and the Comoros to map seagrass and establish monitoring. Read about the Restore-A-Scar program rescuing seagrass in the Florida Keys and groups in the Philippines rescuing seagrass by measuring its economic value.

Catch up with the Dhimurru Sea Rangers as they establish NT's first Seagrass-Watch monitoring site. You'll also find our regular updates from groups in Queensland and an Oscar style windup for the year with TeamSeagrass in Singapore. Included are also articles on education activities with schools in Torres Strait and you can even learn about rays.

Have a happy New Year and safe holiday season.

COVER:
Coral and seagrass.
Photographer Len McKenzie

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

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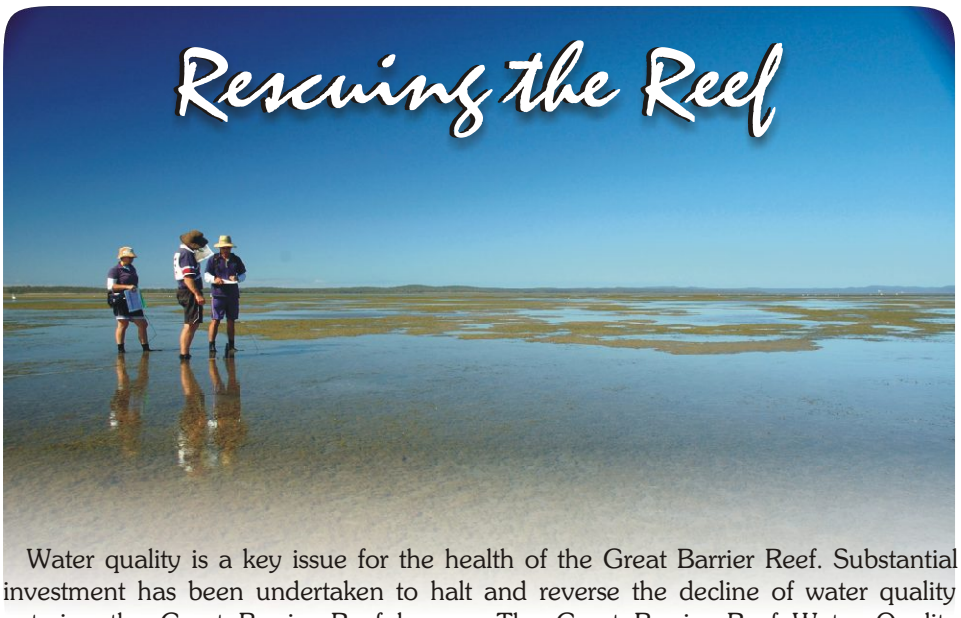
This newsletter can be downloaded as a pdf from www.seagrasswatch.org/newsletter.htm

NEXT ISSUE OUT MARCH 2009



Rescuing the Reef

Water quality is a key issue for the health of the Great Barrier Reef. Substantial investment has been undertaken to halt and reverse the decline of water quality entering the Great Barrier Reef lagoon. The Great Barrier Reef Water Quality Protection Plan Marine Monitoring Program (MMP) assesses the health of key marine ecosystems (inshore coral reefs and intertidal seagrasses) and the condition of water quality in the inshore GBR lagoon. The program is critical for the assessment of long-term improvement in water quality and marine ecosystem health with the adoption of land management practices in the Great Barrier Reef catchments.

Seagrass-Watch plays a key role in the collection of data on the condition of intertidal seagrass in partnership through the Great Barrier Reef Marine Park Authority, the Reef and Rainforest Research Centre (RRRC), James Cook University and the Queensland Department of Primary Industries & Fisheries. Apart for the standard Seagrass-Watch parameters, additional parameters are measured including the key water quality pollutants of concern (nutrients and herbicides). Sampling is focussed on the tropical Dry and Wet (monsoon) seasons.

During the early months of 2008, there was heavy rainfall throughout most of the major river catchments, creating heavy flooding in North and South East Queensland. The heavy and prolonged rainfall was associated with a number of low pressure systems moving across the Coral Sea over the Queensland coast. The wet season produced the 3rd largest flow discharge for the Burdekin River on record and the highest flood event of the Fitzroy River since 1991 (identified as a one in 25 year event).

Many Seagrass-Watch participants have played an important role in the collection of data which supports the Reef Water Quality Protection Plan MMP, so it is timely to provide feedback on the program findings.

Results from the 2007/2008 monitoring period show that seagrasses were in a good to fair condition on a GBR wide scale. Only two locations showed a declining trend, but both have the ability to recover in the near future because they have large seed reserves and increased reproductive effort. The region with the greatest seed banks and reproductive effort was Townsville, followed by the Cairns and Whitsundays respectively. The distribution of the seagrass meadows has changed little since monitoring was established, with no overall trend.

Trends in epiphyte cover were similar to trends in seagrass abundance and macro-algal abundance was generally low; with some variability in coastal/reef meadows and increasing slightly in estuary meadows.

Seagrass sediment nutrient concentrations suggest a general decline in Phosphate since 2005. Examination of seagrass tissues nutrients indicates that seagrass in estuary and coastal habitats were growing in low light and nutrient rich environments. However seagrass at reef habitats indicate moderate light and nutrient poor environments. The findings also suggest that water quality at only three locations (Townsville, Pioneer Bay and Great Keppel Island) was of concern: data indicates low light, nutrient rich environments, which were high in Nitrogen. Two of these locations also had the herbicide diuron present. All concentrations were below levels reported to inhibit seagrass growth.

A more detailed examination of the MMP results are presented throughout this issue of the newsletter according to the Natural Resource Management (NRM) regions identified in the GBR. Results for the 2007/2008 monitoring period cover the period from 1 July 2007 to 30 June 2008. Long-term patterns cover from April 2005 or earlier.

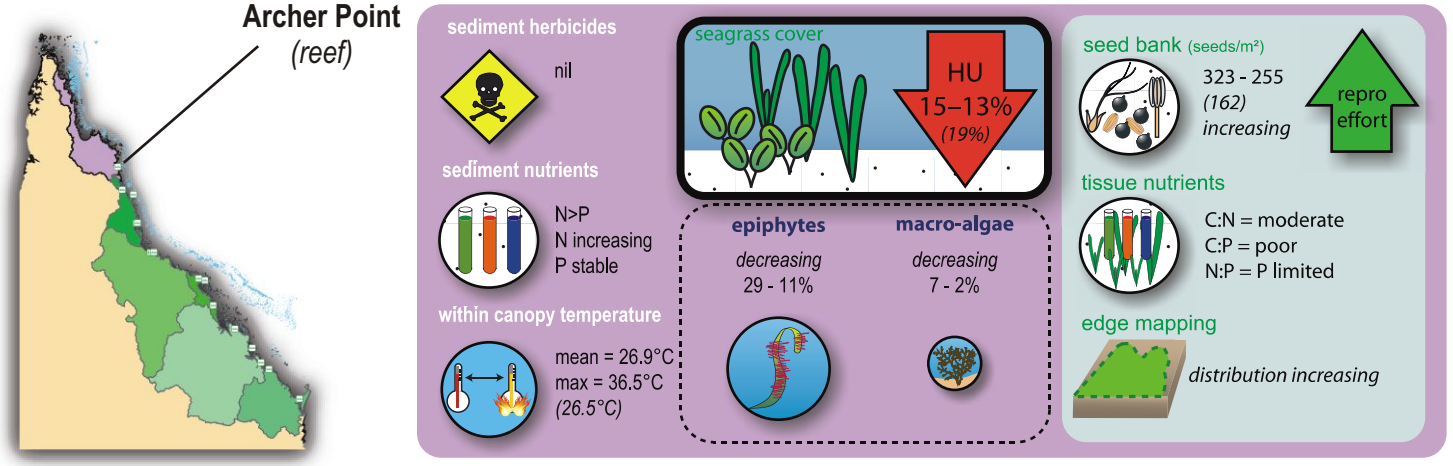
For information about the Marine Monitoring Program visit
http://www.gbrmpa.gov.au/corp_site/key_issues/water_quality/marine_monitoring

Intertidal seagrass meadows within the Cape York NRM region are monitored on a fringing reef platform in a protected section of the bay adjacent to Archer Point. The sites were dominated by *Halodule uninervis* (HU) and species composition has remained relatively stable over the past 12 months. The overall meadow distribution however, has increased.

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

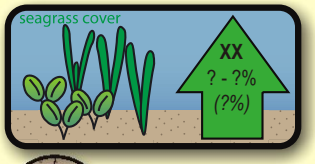
Nutrients in this coastal fringing reef habitat have increasing Nitrogen in the sediments while Phosphate has been declining. Plant tissues indicate a habitat with improving light quality, a relatively small nutrient pool with Phosphate limitation. This is not surprising as the higher calcium carbonate sediments on a reef adsorb the Phosphate making it unavailable to plants for growth.

No herbicides were detectable in the sediments at Archer Point in early 2008 and within canopy temperatures over the 2007/2008 sampling period were similar to the long term average.



Understanding the diagrams and icons

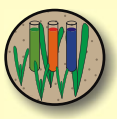
Sampling is focused on two periods each year: the late Dry season (September-October) and the late Monsoon (March-April). Results are summarised from the report *"McKenzie, L.J., Mellors, J.E. and Waycott, M. (2008). Great Barrier Reef Water Quality Protection Plan (Reef Rescue) Marine Monitoring Program, Intertidal Seagrass for the sampling period 1st September 2007 - 31st May 2008. Final Report to the Reef and Rainforest Research Centre. 127pp."* The Great Barrier Reef Marine Park Authorities (GBRMPA's) Reef Water Quality Protection Plan Marine Monitoring Program is funded by the Australian Governments Natural Heritage Trust. In 2007/08 the intertidal seagrass monitoring components were undertaken by the Department of Primary Industries & Fisheries and James Cook University; managed by the Reef and Rainforest Research Centre.



Seagrass cover: dominant species code, mean percent cover late Dry 2007 - late Monsoon 2008, long term mean italicised in parenthesis. Arrow indicates direction of trend or box indicates stable.

Seed banks: mean number of *Halodule uninervis* and *Zostera capricorni* seeds per square metre of sediment surface in late Dry 2007 - late Monsoon 2008, long term mean in parenthesis and trend *italicised.*

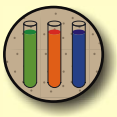
Reproductive effort: average number of reproductive structures (flowers, fruits, spathes) per node (leaf cluster emerging from the rhizome). Arrow indicates direction of trend, box indicates stable and circle shows lack of reproductive structures.



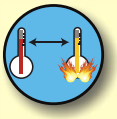
Plant tissue nutrients:
C:N is a surrogate for light, where moderate = adequate light available for growth (C:N>20:1), low = less than average light available than required for growth (C:N<20:1)
C:P is a surrogate for nutrient status of the habitat, where rich = relatively large P pool (C:P <500:1),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

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

Sediment herbicides: maximum concentration (µg/kg Dry Weight of sediment) of each of the 13 herbicides found in the sediments at the monitoring location. Diuron ~10 µg kg^{-1} inhibit seagrass photosynthesis, aquatic half life ~120 days.



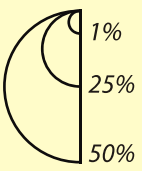
Sediment nutrients: concentration of adsorbed sediment nutrient pool
N:P ratios indicated a nutrient pool that is greater in adsorbed NH_4^+ than PO_4^{3-}
N is long term trend in Nitrogen concentration (in the form of Ammonium NH_4^+)
P is long term trend in Phosphate concentration (in the form of Orthophosphate PO_4^{3-})



Within canopy temperature: Mean and maximum within canopy temperatures for 2007/2008 monitoring period. Long-term mean temperature

Epiphyte cover: percentage of leaf area covered by epiphytic algae, long term trend italicized, mean cover late Dry 2007 late Monsoon 2008. Size of icon represents long-term average.

Macro-algal cover: percentage cover of macro-algae, long term trend italicized, mean cover late Dry 2007 late Monsoon 2008. Size of icon represents long-term average.



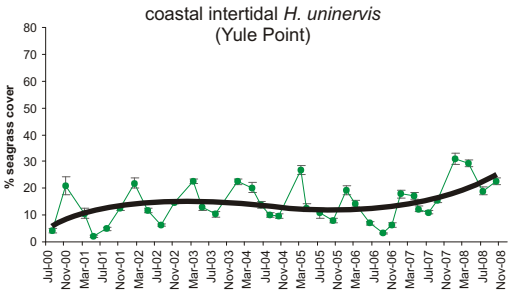
Wet Tropics

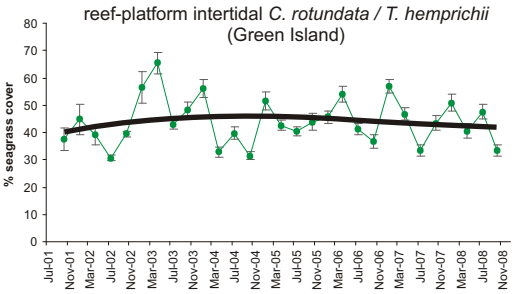
Monitoring occurs at two coastal and two reef seagrass habitat locations. The longest running monitoring sites are at Yule Point and Green Island. Yule Point meadows are dominated by *Halodule uninervis* and located on naturally dynamic intertidal sand banks. The Green Island meadow is dominated by *Cymodocea rotundata* (CR) with *Thalassia hemprichii* and is located on the large intertidal reef-platform south west of the cay.

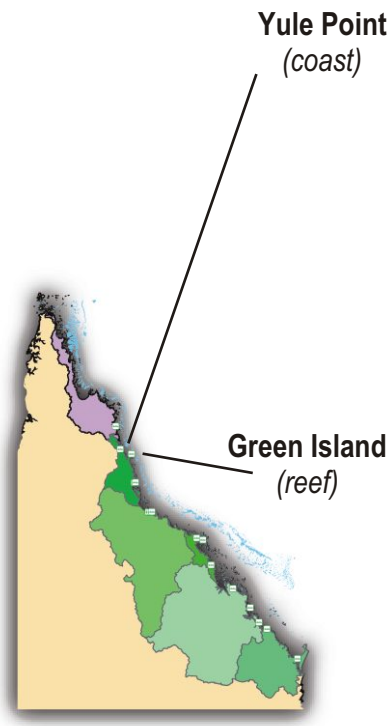
Yule Point and Green Island meadows appear to have changed relatively little since monitoring began in 2000, however 2008 abundances were some of the highest recorded. Seagrass cover is seasonal with higher abundances in the early months of the year. Overall distribution is stable at Green Island, but appears to be increasing at Yule Point. Seed reserves and reproductive effort were considerably higher at Yule Point compared to other locations. Epiphyte cover appears to be increasing, however macro-algal cover has remained low.

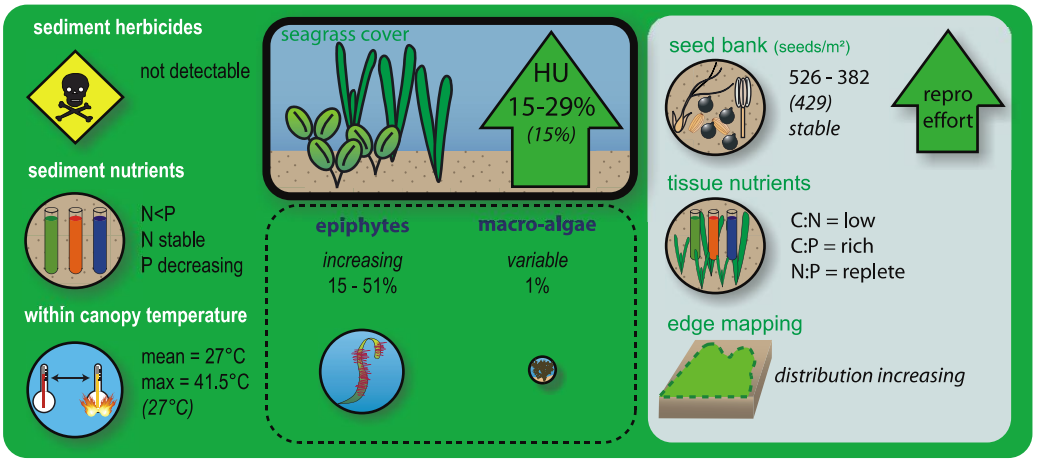
Within this NRM there is a distinction in nutrient state between low light, nutrient rich (coastal habitats, Yule Point) and moderate light, nutrient poor (reef habitats, Green Island) in relation to plant tissue C:N and C:P ratios. Within habitats, a decline across years in C:N and C:P ratios coupled with an increase in plant tissue N:P was noted. This is suggestive of a moderate decline in water quality, despite declines recorded in levels of adsorbed sediment nutrients for this region. The tissue nutrient content of seagrass plants was indicative of being replete (satiated or full).

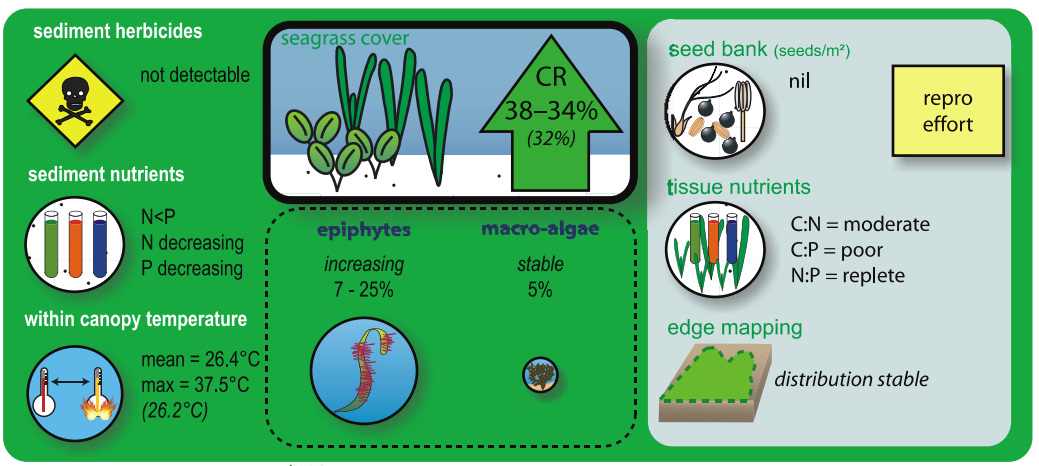
No herbicides were detectable in the sediments at these locations in early 2008, although diuron was detected at Green Island in 2006. Within canopy temperatures over the 2007/2008 sampling period were similar to the long term average. Extreme temperatures (>40°C) were recorded at Yule Point in February 2008.



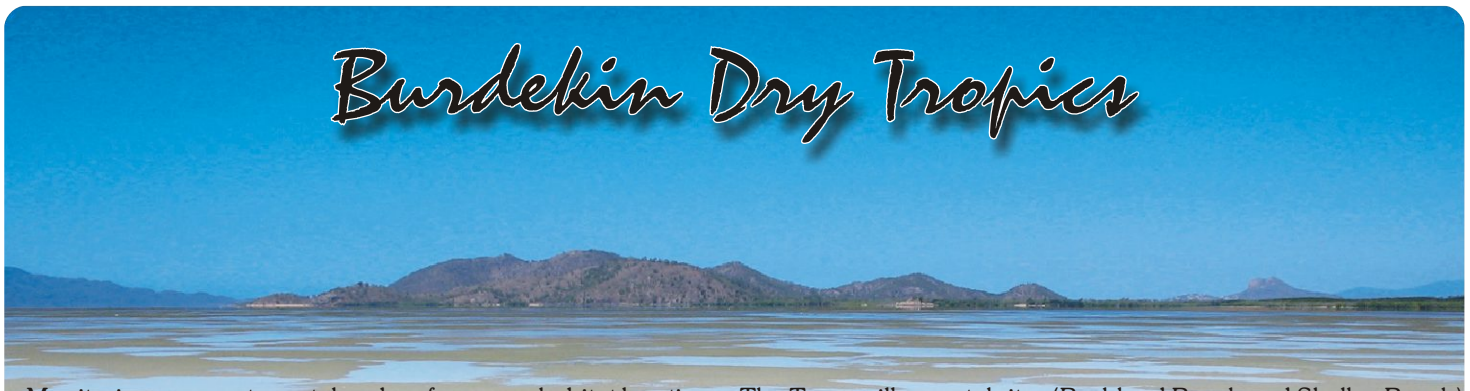








Burdekin Dry Tropics



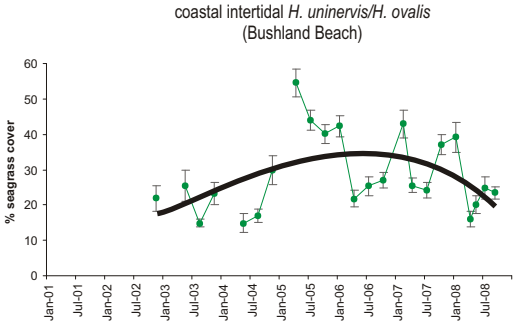
Monitoring occurs at coastal and reef seagrass habitat locations. The Townsville coastal sites (Bushland Beach and Shelley Beach) are located on naturally dynamic intertidal sand flats and dominated *by Halodule uninervis* (HU). Although seagrass cover increased at Bushland Beach during the late Dry 2007, overall cover and distribution for Townsville coastal sites has continued to decline, possibly a consequence of sand waves and erosion blowouts moving through the meadows. Fringing reef habitats on Magnetic Island were dominated by *Halodule uninervis* or *Cymodocea serrulata* (CS), where cover appears to have increased since monitoring was established in 2005. All intertidal seagrass sites would have been within the 2008 Burdekin River flood plume.

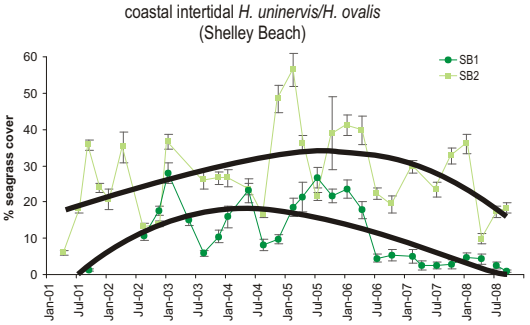
Seagrass abundance at both coastal and reef habitats appears to follow a seasonal pattern and distribution has remained stable. Seed reserves and reproductive effort is among the highest of all regions. This may be because the seagrass are well adapted to the high disturbance experienced in this region. Epiphytes and macro-algae cover is low and decreasing in the coastal meadows, however high and stable at reef meadows.

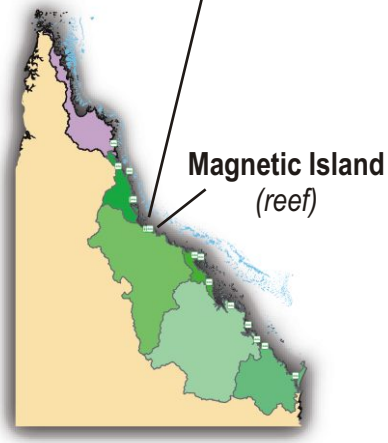
Reef and coastal seagrass habitats differ in sediment nutrients where Nitrogen is higher at Townsville and adsorbed Phosphate is higher at Magnetic Island. Plant tissue nutrients indicate reef habitats were higher in light and lower in nutrients.

Diuron was detected in the sediments at all coastal and reef sites and locations in early 2008, however concentrations were well below levels reported to inhibit seagrass photosynthesis (~10 $\mu g\ kg^{-1}$).

Within canopy temperatures over the 2007/2008 sampling period were slightly higher than the long term average, however no extreme temperatures were recorded.







Townsville
(coast)

Magnetic Island
(reef)

sediment herbicides
diuron
0.12 µg/kg

sediment nutrients
N>P
N increasing
P decreasing

within canopy temperature
mean = 25.3°C
max = 37.5°C
(26.2°C)

seagrass cover
HU
24-14%
(19%)

epiphytes
decreasing
7 - 25%

macro-algae
decreasing
6 - 1%

seed bank (seeds/m²)
4 793 - 7388
(3227)
i ncreasing

repro effort

tissue nutrients
C:N = low
C:P = rich
N:P = P limited

edge mapping
distribution decreasing

sediment herbicides
diuron
0.08 µg/kg

sediment nutrients
N<P
N decreasing
P decreasing

within canopy temperature
mean = 26.1°C
max = 37.5°C
(26.6°C)

seagrass cover
HU/CS
43-56%
(35%)

epiphytes
stable
51 - 54%

macro-algae
stable
21 - 6%

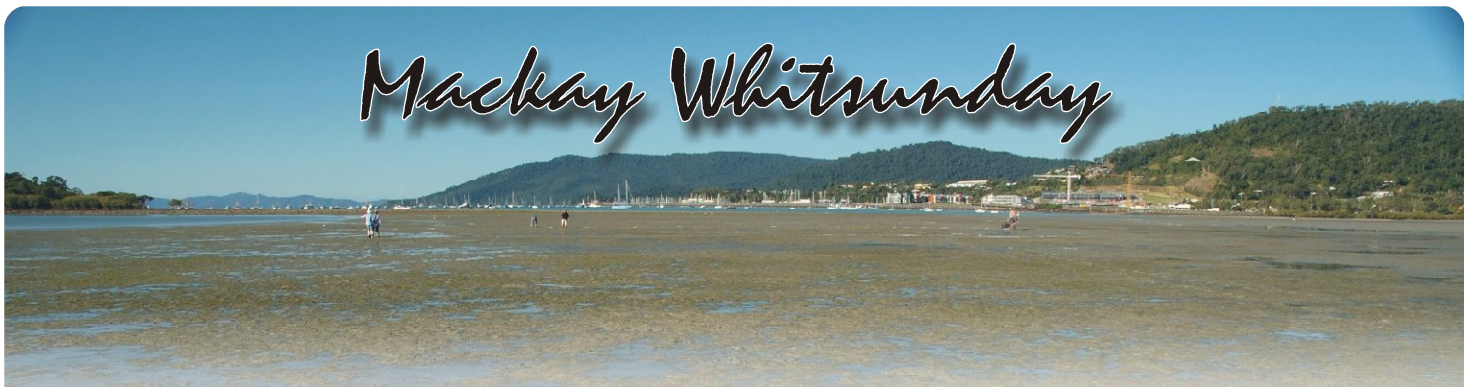
seed bank (seeds/m²)
4 - 8
(34)
increasing

repro effort

tissue nutrients
C:N = moderate
C:P = poor
N:P = N limited

edge mapping
distribution stable

Mackay Whitsunday



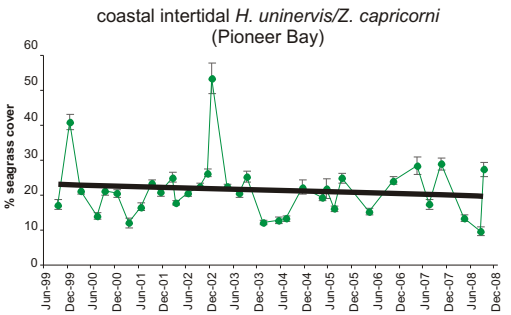
Monitoring occurs on estuarine, coastal and reef seagrass habitats in this NRM, however the reef location has only recently been established. Coastal seagrass habitats were dominated by *Halodule uninervis* (HU) and *Zostera capricorni* (ZC) and located on intertidal sand/mud flats adjacent to Cannonvale in southern Pioneer Bay. Seagrass cover was seasonal and although fluctuations are apparent between years (indicating disturbance regimes) it has generally remained stable over time.

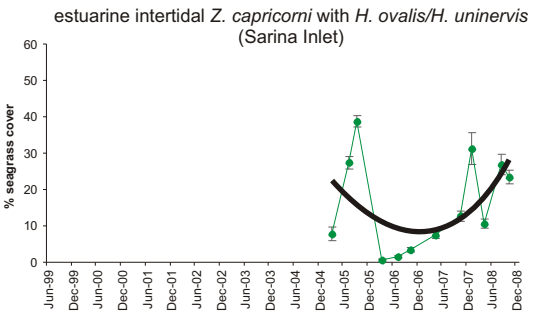
Estuarine habitats was dominated by *Zostera capricorni* and located on an intertidal sand/mud bank in Sarina Inlet south of Mackay. Overall the meadow appears to still be recovering from the losses experienced in 2006 and no seasonal patterns are apparent.

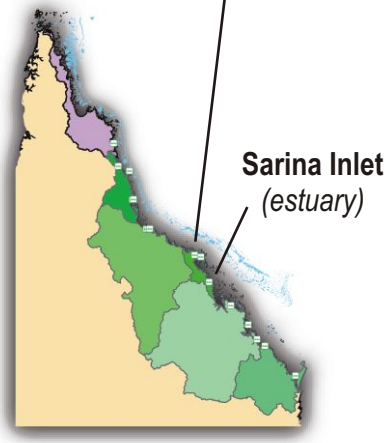
Reproductive effort appears to be increasing at both locations, however significant seed reserves are only present at Pioneer Bay. Similarly, meadow distribution continues to increase at both locations, but is more variable at Sarina Inlet. Epiphytes and macro-algae are generally low and although variable appear to be decreasing at Pioneer Bay.

On a GBR wide basis, ammonium levels at Pioneer Bay were at the high end of the continuum, as were levels of Phosphate, however there has been an overall decline in sediment Phosphate within this NRM. This is reflected in increasing values of sediment N:P as the sediment Phosphate pool declines. In general, tissue nutrient ratios did not separate plants or species into different habitat types. Ratios for these species typically characterized all habitats as environments low in light, and rich in nutrients. Interpretation of plant N:P ratios indicated that for the dominant species the plants were P limited or replete.

The highest GBR wide concentrations of diuron were detected in the sediments at both locations in early 2008. Within canopy temperatures over the 2007/2008 sampling period were similar to the long term average.







Pioneer Bay
(coast)

Sarina Inlet
(estuary)

Pioneer Bay (coast)

sediment herbicides: diuron 0.48 µg/kg

sediment nutrients: N<P, N increasing, P decreasing

within canopy temperature: mean = 25.4°C, max = 36.5°C, (25.2°C)

seagrass cover: HU/ZC 33-15% (20%)

epiphytes: decreasing 22 - 13%

macro-algae: stable 10 - 2%

seed bank (seeds/m²): 166 - 225 (279) increasing

repro effort

tissue nutrients: C:N = low, C:P = rich, N:P = P limited

edge mapping: distribution increasing

Sarina Inlet (estuary)

sediment herbicides: diuron 0.32 µg/kg

sediment nutrients: N<P, N increasing, P decreasing

within canopy temperature: mean = 24.8°C, max = 38°C, (24.1°C)

seagrass cover: ZC 13-11% (14%) recovering

epiphytes: variable 31 - 2%

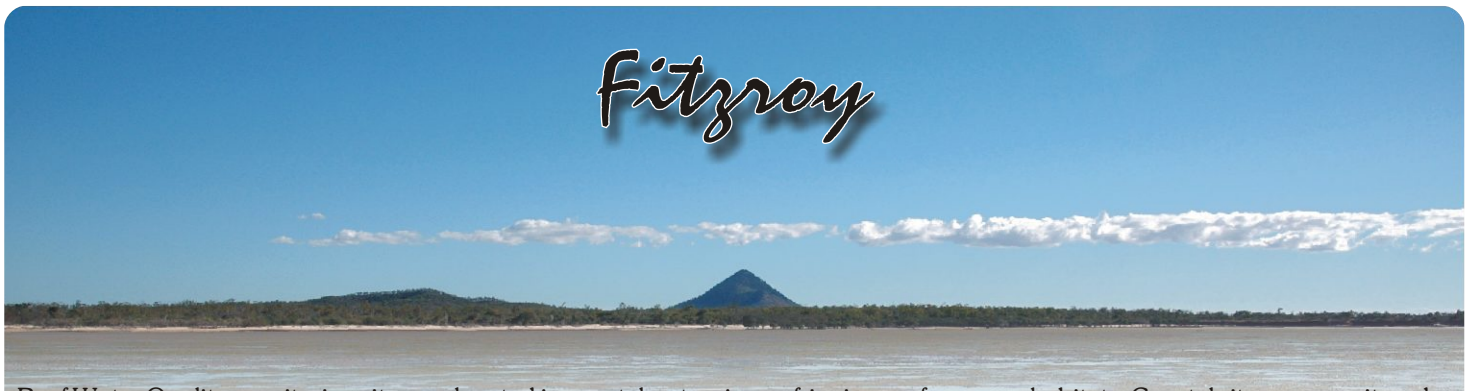
macro-algae: variable 2 - 1%

seed bank (seeds/m²): nil (66) variable

repro effort

tissue nutrients: C:N = low, C:P = rich, N:P = replete

edge mapping: distribution variable



Reef Water Quality monitoring sites are located in coastal, estuarine or fringing-reef seagrass habitats. 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) represents a near pristine environment, removed form anthropogenic influence. In contrast, the estuarine sites are located on the large sand/mud banks within Gladstone Harbour: a heavily industrialized port. Offshore reef sites were only recently established at Monkey Beach, Great Keppel Island.

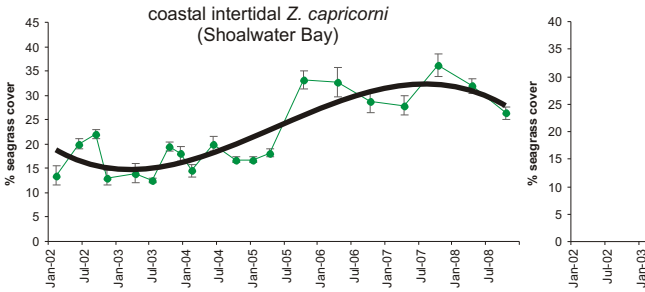
Coastal and estuarine locations were dominated by *Zostera capricorni* (ZC). Percent cover has continued to increase, driven by a large increase in cover in late 2005. Data over the past monitoring period still shows seagrass cover to be higher than when monitoring first commenced in early 2002. Seagrass distribution has remained stable in Shoalwater Bay and has continued to increase in Gladstone Harbour after the near total loss in early 2006.

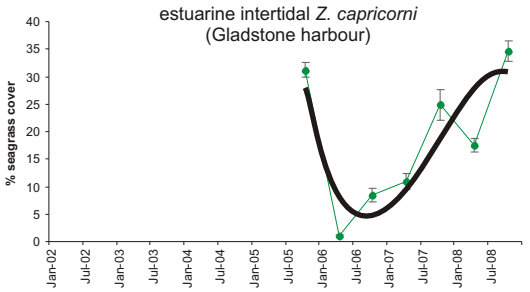
Although there were no seed reserves observed, evidence of reproductive effort was found to be increasing at both coastal and estuarine locations. The increased reproductive effort at Gladstone Harbour demonstrates resilience to disturbance at this location.

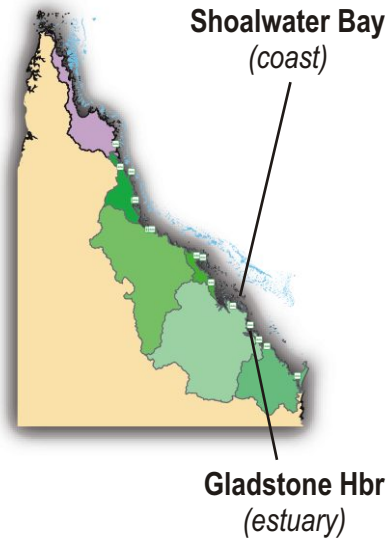
Epiphyte and macro-algal cover is higher at the estuarine than coastal location. Both epiphytes and macroalgae appear to be decreasing at Shoalwater Bay.

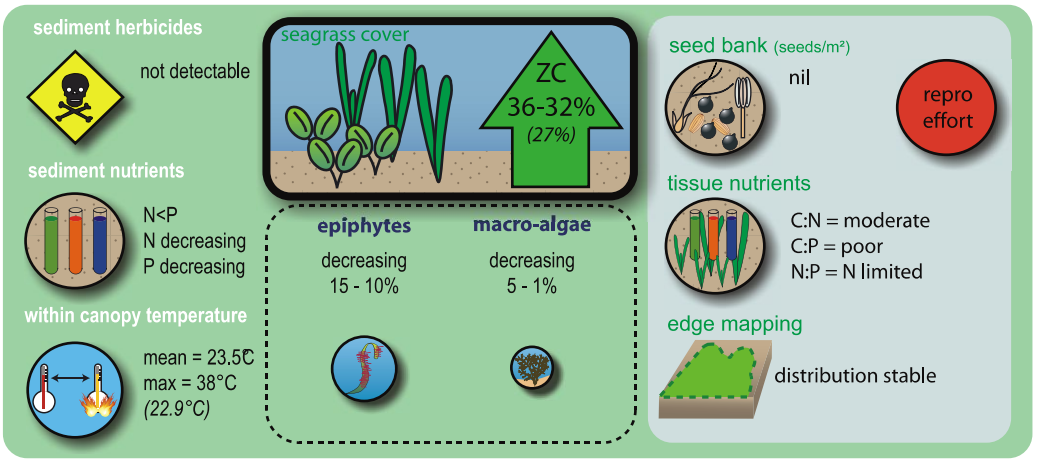
There has been a significant decline in the levels of sediment Phosphate at both Shoalwater Bay and Gladstone Harbour since monitoring commenced. Plant tissue nutrients indicate estuarine habitats were lower in light, with a much larger Phosphate pool. Both habitats appear Nitrogen limited.

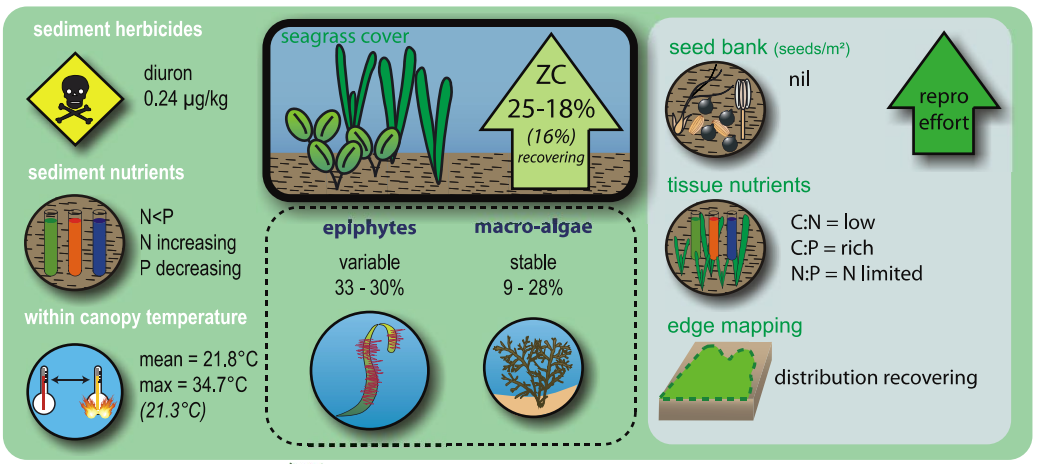
No herbicides were detected in the sediments at Shoalwater Bay, supporting its near pristine condition. Low diuron concentrations were detected in Gladstone Harbour. Within canopy temperatures over the 2007/2008 sampling period were similar to the long term average









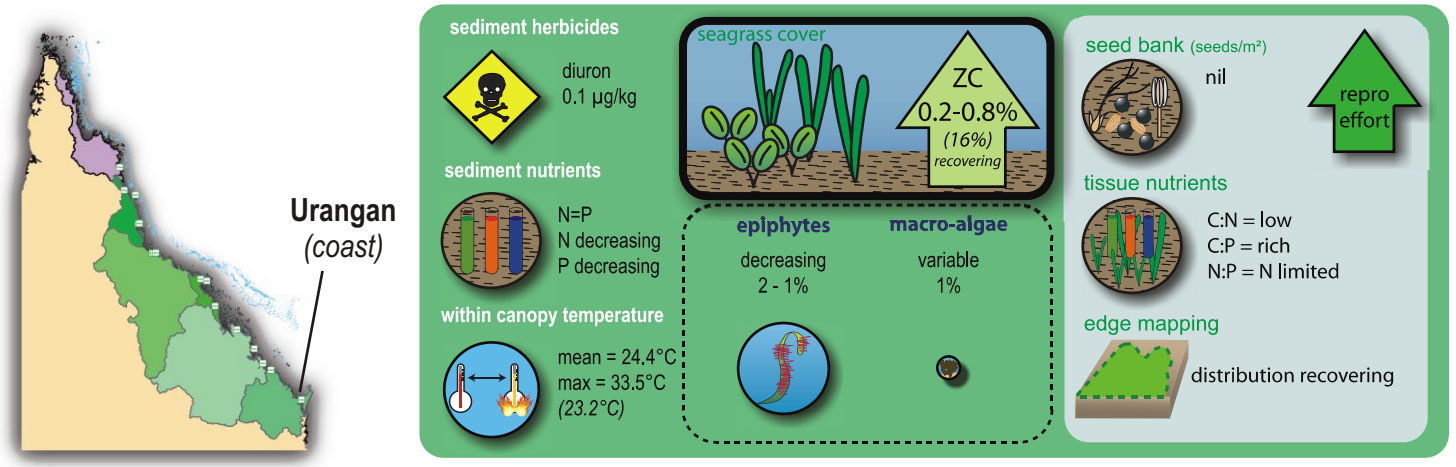


Only estuarine seagrass habitats are monitored in this NRM region. Urangan (Hervey Bay) has been monitored since 1999, however Rodds Bay was only recently established. Urangan is on a large intertidal mud/sand bank adjacent to the Urangan marina and in close proximity to the Mary River. Seagrass was lost from this location in 2006 and only began recovering in late 2007.

Seagrasses at Urangan were observed to produce significant numbers of reproductive structures, and the high reproductive effort is positive evidence of resilience in this location. Epiphyte and macroalgae cover is generally low and appears to be decreasing.

On a GBR wide basis, the estuarine habitat at Urangan had sediment nutrients below the median value with the exception of the extraordinarily high values recorded during 2005. The decline in Phosphate levels in 2007 was significant. Plant tissue nutrients suggest that Urangan meadows are in low light, nutrient rich environment with plants that are Nitrogen limited.

Low diuron concentrations were detected at Urangan and within canopy temperatures over the 2007/2008 sampling period were slightly warmer than the long term average.



Great Sandy Strait Fauna & Flora Watch

Gordon Cottle reports

Boonooroo

In mid September, Hanne and Gordon attempted to monitor BN1, but were unable due to the South Easterly gale holding the water over the site. Gordon returned two weeks later to find extensive sediment erosion revealing coffee rock and oyster beds over the whole area, and remarkably an artificial tyre reef. Also revealed by the erosion was ankle deep soft black mud.

When Hanne and Robyn returned to BN1 on mid October, they reported the black mud was still present. Seagrass cover was well up on March, when the area was covered in silt, and similar to June.

Tinnanbar

Hanne and Gordon visited TN1 in November in atrocious conditions: a 30 knot gale and squalls. Although water up to 60cm deep covered the site, they we are able to report the average cover was 25 - 30%, mainly *Zostera capricorni* and some *Halophila ovalis*. There were considerable patches of *Caulerpa sertularioides* (a fern like macroalgae), far more than first observed twelve months ago.

Robyn, Hanne and Gordon monitored the remaining sites (TN2 and TN3) the following day in similar conditions, wasting valuable time looking for pegs. Monitoring of TN2 was achieved with water still on the site. Transects 1 and 3 were comparable to March and July recordings , but transect 2 was down from an average cover of 25% in March to 5%.

At TN3, seagrass cover on transects 1 and 2 remained consistent with an average 5% cover, however there was an extensive patch of *Zostera capricorni* for much of the seaward portion of transect 3. Robyn and Paul returned to Tinnanbar the following week, and repegged both sites.

Tin Can Bay

In early December, Hanne, Gordon and Pat caught up with Len McKenzie (Seagrass-watch HQ) during a quick visit to the region. The meadows at Norman Point have changed relatively little over the years. The meadow is generally low cover (<5%) and scattered across an intertidal sand bank heavily scoured by tidal movement. This was the last monitoring event for 2008.

Hanne and Pat monitor TB1, December 2008

Seed Banks

Above: Michelle Waycott (left) and Margaret Parr (Whitsunday local coordinator 1999/2007). Below: Michelle talks to volunteers on seed collecting

In August 1999, Dr. Michelle Waycott and her team from James Cook University (JCU) visited Airlie Beach to examine the reproductive health of seagrasses in the region. During that visit they met up with scientists from Seagrass-Watch HQ and the Whitsunday Volunteers, who had recently established Seagrass-Watch monitoring in Pioneer Bay (see Issue 4). During the visit the seagrass meadow was in full bloom and Michelle pointed out the difference between *Halodule uninervis* male and female flowers, of great interest to everyone.

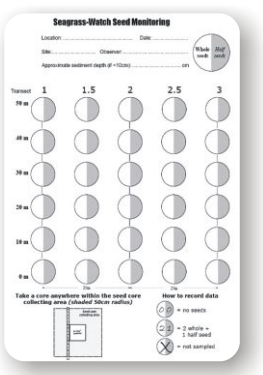
It was after Michelle's visit that the idea to incorporate seed monitoring as a component of Seagrass-Watch was conceived. Over the next 6-12 months, Len McKenzie, with Michelle's guidance, developed a standardised method for monitoring seed banks at the Seagrass-Watch sites. The idea was to determine the size of seed reserves in a seagrass meadow and to document changes in abundance through time as an indicator of meadow resilience (the meadows capacity to recover after loss).

Recovery of seagrasses from impacts such as cyclones/hurricanes and floods can take several years and principally from germination of local seed reserves. The greater the seed reserve, the more capable the meadow is of regaining its original status after impacts. The focus of the Seagrass-Watch monitoring was on *Halodule* seeds as they are easily collected and identified. Seeds of other seagrasses such as *Zostera, Cymodocea* and *Enhalus* are also possible to monitor, however *Halophila* seeds are very small (<1mm diameter) making them difficult to collect.

Germinating Halodule uninervis seeds

Halodule spp. are common throughout the Indo-Asia Pacific and produce single seeded, spherical fruits (approximately 2mm diameter) that are released below the surface of the marine sediments. The fruit is essentially the seed in *Halodule*. The fruits have a stony pericarp, are negatively buoyant and are capable of prolonged dormancy (>3 years).

Seed collection/monitoring is very easy. The seed corers are the standard used by JCU scientists, enabling comparison with previous research. The collection protocol and datasheet are designed to give the observer an idea of the spatial distribution (pattern) of seeds within the site. Often this pattern can provide information on the "dispersal shadow", ie., the distribution of seeds at increasing distances away from the parent plant. Although this can be difficult in clonal populations, since it is difficult to identify the maternal source with any great certainty, observers may note a pattern arising due to the clumping of seeds.

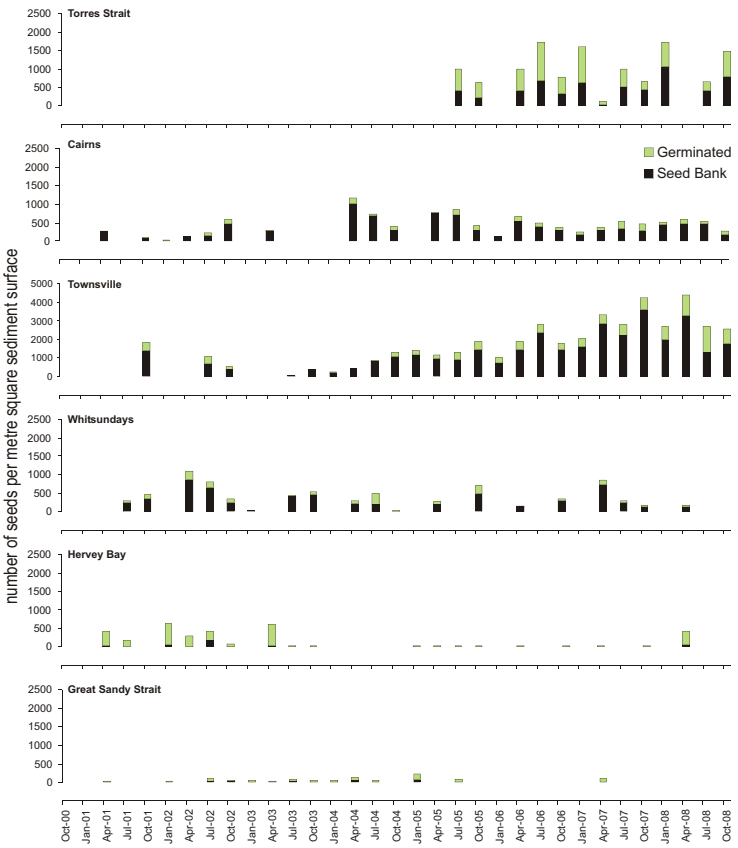


In dense *Halodule uninervis* meadows in north Queensland, overall mean densities ranged from between 14 ±1.6 and 19 ±1.9 seeds/fruits per core (approximately 7,000 - 10,000 seeds/fruits per m^2) (G Inglis, JCU, Pers. Comm.). Previous research indicates that temporal effects may not be significant unless the site has been heavily disturbed due to wave action.

Main photo: seed collecting
Insert: 3 seeds/fruits

Results from Seagrass-Watch seed monitoring along the east coast of Queensland Australia, demonstrates a great difference from the very northern regions (eg Torres Strait) to the very southern (eg Great Sandy Strait). In general, seed reserves are significantly higher in the wet and dry tropics (Cairns, Townsville and Whitsundays). The region with the greatest seed banks is Townsville and the highest number of seeds in an individual core was 109 (Oct07). These findings suggest that these meadows are adapted to episodic impacts such as monsoon rains and disturbance (eg cyclones). Meadows in Hervey Bay and Great Sandy Strait however, have a poor capacity to recover from such impacts.

continued page 24



Queensland

Townsville monitoring

Rebecca Bowie reports

Picnic Bay (MI1)

Monitoring in late September reported seagrass cover had increased by about 25% since July. *Halodule uninervis* was still the most dominant species present and the total cover ranged from 10%-95% across the site. Seed reserves were similar to July and these was less macroalgae cover. Unfortunately there were less animals observed but heaps of burrows and crab holes was a good indication that animals are still present within the site. A huge THANK YOU to Locky and Mandy for giving up their time and helping out.

Shelley Beach

Not much has changed with SB1 over the past year. The highest seagrass cover recorded was 7% at the seaward edge. The site is still dominated by *H. uninervis* but *Halophila ovalis* was more common toward the seaward edge. The site was still heavily impacted by "blow outs" which tend to move around depending on the time of year. Animals present (hermit crabs, fish, prawns and gastropods) were fair considering that there was little seagrass cover. Seeds were also monitored and a whooper of 95 wholes and 49 half's were recorded.

SB2 was dominated *H. uninervis* and was lush and dense compared to SB1. Macroalgae and epiphyte cover was lower than observed in August. There were many animals present (mainly hermit crabs) and luckily "Whitey" the crocodile kept away.

Bushland Beach (BB1)

The site at Bushland has always been lush and has improved greatly since January, which was monitored during the wet season. Being so close to the Bohle River our site in January had a "silk" like layer of mud. *H. uninervis* remains dominant with *H. ovalis* and *Zostera capricorni* present to varying degrees. Macroalgae and epi-cover were really low which explains why canopy height measurements were up to 16cm. Heaps of animals were present, which you would expect with the seagrass being so dense. A huge thank you to Shenade for helping out.

Naomi hammers a permanent peg into place. Light loggers are attached to the pegs. The loggers have a sensor which measures quantum Photosynthetically Active Radiation (PAR) light every 30 minutes. An automatic wiper cleans the sensor every 15 minutes. The light is recorded to determine how much light is available and what the minimum light requirements are for seagrass growth.

Cockle Bay, Magnetic Island

Dr Don Kinsey reports

Because of the unworkable tides forecast for October, the spring monitoring of the Cockle Bay site by our U3A Earth and Sea class was carried out on 26th September 2008.

Seagrass cover in July was the lowest we had seen since monitoring of our site began. It was encouraging, therefore, to find that cover in late September was approximately double that found in July and had returned to a more "normal" level. This new seagrass growth was in very good condition and consisted exclusively of *Cymodocea serrulata* and *Halodule uninervis*. The extensive large *Halimeda* mounds present in recent months were almost totally absent in the transect area. However, cryptic small *Halimeda* sp. clumps occurred commonly below the seagrass canopy on all transects and in nearly all quadrats.

There were now large aggregations of the alga *Hydroclathrus* sp. in the general area and also smaller occurrences of this species within some quadrats. There also was some occurrence of small foliose red algae and filming cyanobacteria, principally on our somewhat more elevated transect 3.

Some new green sponges were noted but were not common on this occasion. Epi-cover was reasonably extensive and almost entirely diatomaceous mud.

Seed occurrence was consistent with our usual pattern of scarcity, only two half seeds being found. Our dedicated seed person, Elena Timms, was accompanied by various grandchildren who were of enormous encouragement in her vain attempts to find the elusive seeds.

The high ground between the transect area and the adjacent mangroves exhibited some new growth of *Halophila ovalis*. There were also scattered small patches of the fine form of *Halodule uninervis*. This new growth was restricted to the pools and absent elsewhere. No *Zostera capricorni* was seen.

Seagrass-Watch and RWQPP MMP

Naomi Smith reports

Gladstone Harbour

In mid October we monitoried the two Seagrass-Watch sites within Gladstone Harbour for the MMP. We were able to borrow a boat from Gladstone QBFP and Bec navigated the 30 minute trip to our site. Compared to the September/October sampling last year the meadow has noticeably changed. There has been a decrease in algae cover, the percent of seagrass cover has increased and while *Zostera capricorni* is still the dominant species at these meadows there has been an increase in *Halophila ovalis*. As usual there were no seeds to be found at either site. Thank you to QBFP for lending us the boat.

Great Keppel Island

Thanks to Geoff from our Great Keppel Accommodation, we were ferried to our two Seagrass-Watch sites at Monkey Beach to conduct MMP monitoring. The first thing that we noticed was that there were denser patches of seagrass compared to the April sampling. The seagrass species present at these two sites are *Halodule uninervis, Halophila ovalis* and *Zostera capricorni*. We have noticed, while collecting the reproduction samples, that these sites always have numerous worms living within the sandy sediment. Jane spotted a very interesting patch of seeding *Zostera capricorni*. Each shoot had at least one spathe which looked almost transparent showing the seeds within.

Zostera capricorni spathe with seeds

Sarina Inlet

Dugong feeding trails, Sarina Inlet

It was an early start in mid October to monitor the two Sarina Seagrass-Watch sites. The dominant seagrass species for this meadow is *Zostera capricorni* with *Halophila ovalis* also present. When compared to past monitoring at these sites the meadow has changed quite significantly with the percent of seagrass cover decreasing and the species *Halodule uninervis* disappearing. The animal life has stayed the same with numerous burrows, crabs and gastropods being observed and recorded.

Left to right: Naomi, Rebecca and Jane complete MMP intertidal seagrass monitoring for 2008.

Whitsunday: Midge Point Seagrass

Paul & Jennifer Wenzler report

It was nice to be back in the field or should I say "on" the field again. It never amazes me but every time we go out there is always something different that confronts us. This time was no different.

The seagrass meadows looked very healthy. We noticed an unusual large amount of moon snail (*Polinicies*) egg sacks (see details below). At one of the first quadrats surveyed, we were amazed at the amount of tiny sea snails/gastropods (I counted over thirty in that quadrat, each measuring about 2 mm in length)…possibly one of those egg sacks hatched in the area.

It is also interesting to note that *Halophila ovalis*, which is present in the area, is on the decline, as it seems to be a seasonal thing, with less quadrats having any present.

We got a bit of a soaking on the day. After finishing our first transect, there was a sudden downpour, which soaked us to the bone. We saw it coming, but had nowhere to seek refuge.

Along the second transect, there has been a sizeable part eroded. It seems a naturally occurring event, as there have always been these eroded patches.

Also noted were a large number of largish (3cm diameter) flat bivalves (oysters?). Their shell looks like the silvery ones that are made into lampshades. We have never seen them before in the area. We also came across our first sea cucumber on the site as well.

"Sausage blubbers"

The horseshoe-shaped "sausage blubbers" that are often scattered on the sand or seagrass meadows are eggs of the Moon Snail *Polinices sordidus* (Family Naticidae).

Moon snails are predators that hunt other snails and bivalves. They attack and kill their prey by drilling a hole through the shell. Live moon snails are found just below the surface of the sand and they leave a distinctive meandering trail. They are more active at night. They breed in summer and produce large crescent moon shaped egg masses up to three or four times bigger than themselves.

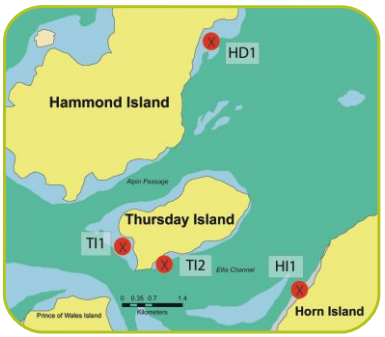
Eggs of *P. sordidus* are laid in fluid-filled capsules that are surrounded by a gelatinous matrix, covered by a tough transparent membrane. Eggs are fertilized internally from sperm stored within the female reproductive tract. When first laid, the jelly matrix rapidly absorbs water and swells, stretching the outer membrane, and the egg mass takes on a characteristic horseshoe 'sausage blubber' shape. The average diameter of these sausages is ~20mm. The jelly matrix is ~96% water and although embryos are distributed throughout, most are concentrated near the outside surface. An average-sized egg mass (100g) contains approximately 38,000 eggs.

Embryo development begins soon after laying. They start hatching after about 4 days and continue to hatch from the outer surface until day 16–17 of incubation, by which time the entire jelly matrix has disintegrated.

Source: Booth, D.T. (1995) J. Exp. Biol. 198: 241-247

Regional Roundup

Jane Mellors reports



Seagrass-Watch will continue in Torres Strait in 2009 thanks to the patronage of TSRA and Tagai College. Hopefully Seagrass-Watch will be expanded to include two new communities, working more closely with Rangers and Dugong & Turtle Project Officers, while continuing our close partnership with Tagai College. The two communities that have expressed formal interest through the TSRA Land and Sea Management Unit in monitoring seagrass habitat are Mer and Mabiaug Islands. A study into the feasibility of monitoring at these islands is underway (*see page 22*).

Besides the Seagrass-Watch activities, the Torres Strait Seagrass Monitoring Project will continue the mapping of marine habitats in the Torres Strait that are at greatest risk from shipping accidents and oil spills. This survey will build on the work that was undertaken earlier this year (*see issue 32*) and will include the Warrior Reefs, Darnley Island (and surrounding reefs) and the intertidal reefs from Kircaldie Reef to Zaigai Island.

Another aspect of the project is to conduct a baseline survey of subtidal seagrasses that are of value as dugong feeding areas. The baseline survey will be used to determine a suitable subtidal monitoring site. Seagrass-Watch subtidal monitoring methodology utilizing underwater cameras will be evaluated at this site. This exercise will then be assessed for its practicality in maintaining a long-term subtidal Seagrass-Watch site.

The established Seagrass-Watch sites around Thursday Island were monitored in late October. All four sites were monitored in the early hours of the morning - nothing like getting up before the sun to build character!!

Monitoring kicked off at Front Beach (TI2). The tide was already on its way in so monitoring had to start at the seaward end. Seagrass % cover was higher than that recorded in August with transect 3 showing a massive increase in cover by *Halodule uninervis* at the landward edge. Similarly, seed counts were higher than those recorded in August with the largest counts still occurring in that one spot around the middle of transect 2.

Front Beach completed for the year

Next up was Back Beach (Battery Point, TI1), where we were welcomed as the early morning feast by the sandflies and mosquitoes. With the bats chattering away in the back ground, we trudged out to the site. Seagrass cover was markedly higher than that recorded during the previous monitoring in August. Forams were again a striking feature of the meadow, being recorded in every quadrat. *Halodule uninervis* was the dominant species found in most quadrats, followed closely by *Thalassia hemprichii* and *Cymodocea rotundata*.

Back Beach: Jake and team monitor a transect

At Horn Island (HI1) it was great to see Pearson Wigness waiting for our arrival, kit in tow. We quickly set up the site and started monitoring. Seagrass cover was high toward the seaward end of the transects and relatively low at the landward edge. It looks like the landward edge of the meadow is regressing seaward. This requires some further study as it may be coincidental but there has been some construction work occurring on the foreshore in relation to a sewage pipe being laid. *Zostera capricorni* is also starting to appear regularly in transect 3 and was also noted in transect 1 this trip. Seed counts while not high where found in most cores.

Horn Island

Hammond Island: the Tagai Team

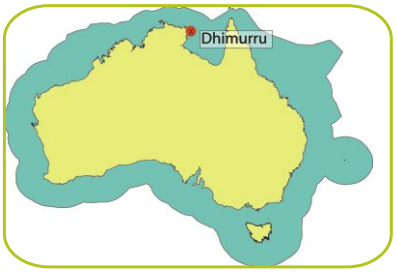
Hammond Island (HD1) was monitored through the commitment of the Tagai College's Marine Studies department to transport students and equipment. On Hammond, they were met by student residents of the island, keen to monitor at Corner Beach. This was a first for the school group who hope to continue monitoring this site in the future. Seagrass and epi-cover were relatively high compared to the other Torres Strait sites monitored for the month. Once again a distinct cross meadow zonation in species composition was evident. Transect 1 was dominated by *Thalassia hemprichii*, transect 2 was a mixture of *Thalassia hemprichii* and *Cymodocea rotundata* and transect 3 was predominantly *Cymodocea rotundata*. Monitoring this site has made the students appreciate the diversity of seagrass meadows around their islands.

Well that wraps up monitoring in the Torres Strait for 2008. At this point Seagrass-Watch HQ would like to thank Stacee Ketchell, Kantesha Takai and Tristan Yusia as they embark on a new phase of their lives "Life after High School" - good luck and thanks for the hours spent monitoring.

We look forward to welcoming the new guard of Seagrass-Watchers in 2009, monitoring kicking off with a workshop in early March.

Dhimurru Sea Rangers establish NT's first Seagrass-Watch monitoring site.

Neil Smit reports



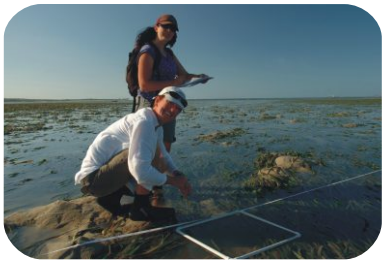
In October, a successful Seagrass-Watch training workshop was held in Nhulunbuy (NE Arnhem Land, Northern Territory, Australia) for Sea Rangers in the NE Arnhem Land region. During this workshop, the first Seagrass-Watch site for the Northern Territory was established at the Giddies River (GR1), just across Melville Bay from Nhulunbuy.

The three-day workshop was led by Len McKenzie from Seagrass-Watch HQ with assistance of local coordinators Vanessa Walsh (Dhimurru Aboriginal Corporation) and Neil Smit (Marine Biodiversity Group, Parks). Also joining the workshop were Paul Younger and Helen Clark from Batchelor Institute of Indigenous Tertiary Education to see how Seagrass-Watch activities could be incorporated into the Certificate II, Conservation and Land Management course that the Dhimurru rangers are currently enrolled in. .

There were five of us at the workshop. In the mornings we were introduced to the do's and don'ts in seagrass management, seagrass taxonomy, monitoring and mapping techniques. Our first hands-on classroom task was identifying seagrass species from the area, such as *Enhalus acoroides*, *Halophila ovalis* and *Halodule uninervis*. Some of these specimens were even good enough to make it into the press and are now housed at the NT Herbarium in Darwin.

In the afternoons we put the theory to test and went out to establish our monitoring site. Fieldwork is always challenging here in Nhulunbuy; natural hazards and distractions such crocodiles and sting rays are never far away. Then we also have to deal with the fact that our good spring low-tides are always leaning towards sunset, narrowing the time window in which we can do our monitoring.

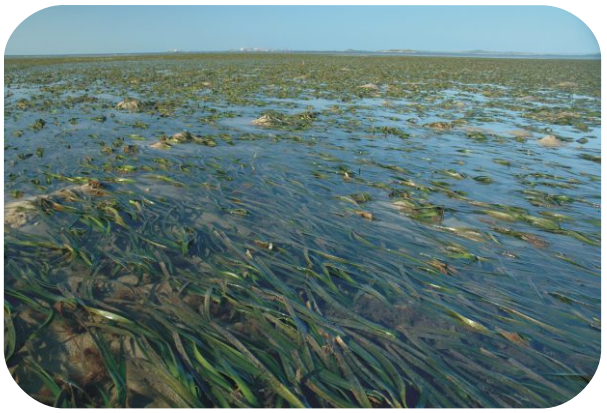
Nevertheless we managed to get our site established, completed its first assessment and partially mapped the seagrass meadow in which the site is located. Our site is dominated by extensive meadows of *E. acoroides* with the occasional *Halophila* and *Halodule* species. During our days out on the site we also found signs of *Enhalus* having recently flowered.



Although the species' found at the site is nothing unique for northern Australia, Len commented that, "... from what we know about northern Australia, the type of meadow/community is unique and is more comparable with *Enahlus* meadows seen in Indonesia and PNG".

After our first experience with seagrass monitoring we are keen to continue with monitoring of our unique meadows in the harbour and we will back in December to reinforce Seagrass-Watch's training.

Further, we like to thank Len McKenzie for gently guiding us into world of seagrasses, Paul Younger and Helen Clarke (Batchelor Institute of Indigenous Tertiary Education) for using their facilities during the workshop; Marine Biodiversity Group (Parks) for providing the funds to run the workshop and last but not least Vanessa Walsh for the organisation of the workshop.



Dhimurru is an incorporated Aboriginal organisation established by Yolngu land-owners in Northeast Arnhem Land, Australia. The office is located in Nhulunbuy.

Yolngu (Aboriginal people of Northeast Arnhem Land) are the traditional owners of lands consisting of approximately 101,000ha. The Aboriginal Land Rights (Northern Territory) Act of 1976 recognises Yolngu as the owners of this land under Australian law. Dhimurru has jurisdiction over approximately 8,500km^2 of this land.

Since time immemorial Yolngu have managed the natural and cultural resources and have achieved a balance that ensured long term, sustainable resource use for the economic and social well-being of the landowners.

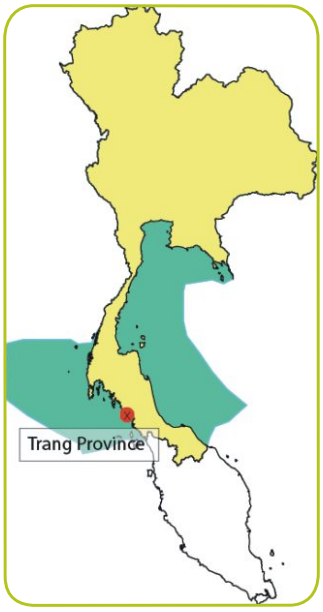
The permanent presence of a large non-Yolngu population in recent times required a new response. On April 8, 1992, after extensive consultations Dhimurru Land Management Aboriginal Corporation was formally incorporated under the Aboriginal Councils and Associations Act 1976 on September 8, 1992.

On the Dhimurru logo, the black cockatoo represents the Dhuwa moiety and the white cockatoo the Yirritja moiety. They are encircled by a stem of a coastal ground creeping plant known as rowu (Goats Foot, Morning Glory or Purple Beach Convolvulus: Ipomoea pes-caprae). This plant represents the unity of the clan groups working together.

Source : http://www.dhimurru.com.au/about.html

Dugongs : Constructor or destroyer of a seagrass ecosystem ?

Chittima Arytuhaka (Kasetsart University, Thailand) and Kanjana Adulyanukosol (Phuket Marine Biological Center, Thailand) report



The dugong (*Dugong dugon*) is a large marine mammal which is the only living representative of the once diverse family Dugongidae, belonging to the order Sirenia. At the present, it is listed as vulnerable internationally by the IUCN Red list and the trade of derived products is banned by the Convention on International Trade in Endangered Species (CITES).

In Thailand, dugong populations have been found along the coastlines of both the Gulf of Thailand and Andaman Sea. Over the last few decades, dugongs have received more attention in research and conservation. So, it seems that in Thai waters, populations of dugong have increased from about 150 to 250 individuals over these decades. However, it is not clear whether the increase in populations is due to the success of coastal management and conservation or just more frequent population surveys by researchers in collaboration of NGOs and fishermen.

To achieve an aim of dugong conservation, it is essential to have knowledge of the seagrass meadows, which are the dugongs main feeding ground. Dugongs feed predominantly on seagrass and the stomach content of dugong samples from Trang waters contained nine seagrass species with the most common two genera *Halodule* and *Halophila*.

Map of Talibong wildlife reserve area, Trang Province, Thailand Insert has map of seagrass meadows overlaid.

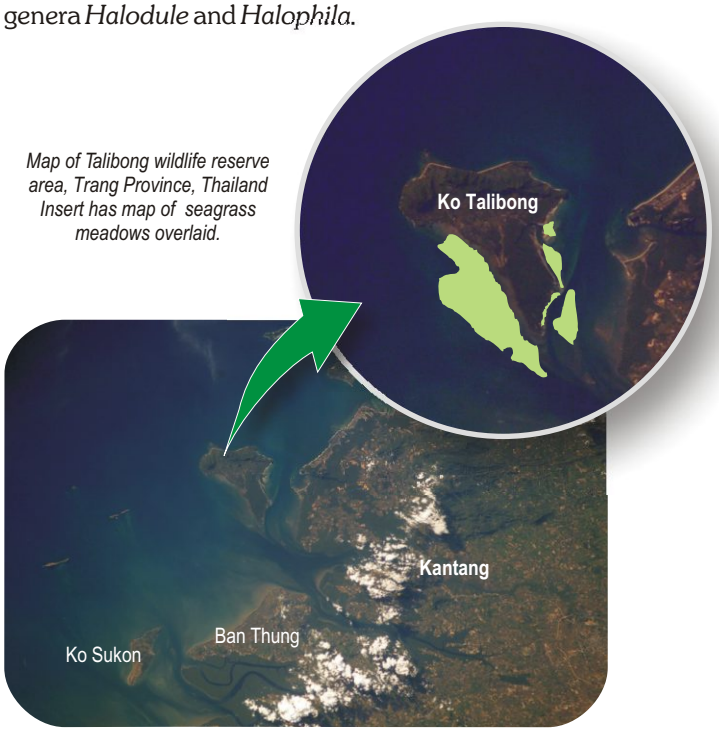
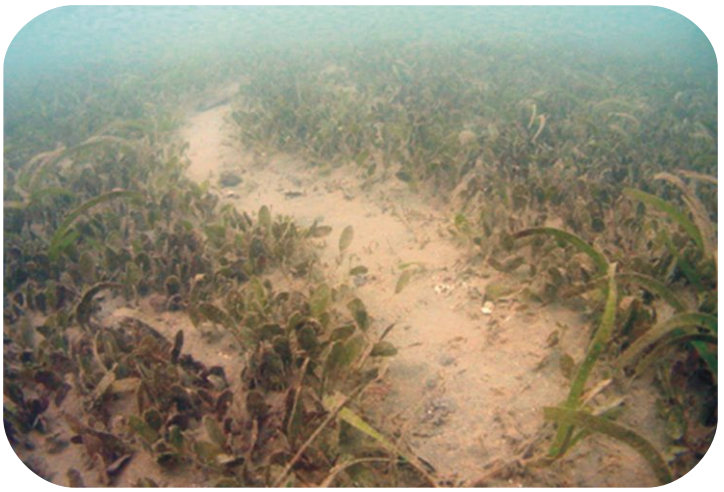


Image courtesy of the Image Science & Analysis Laboratory, NASA Johnson Space Center. Image ISS006-E-33386, http://eol.jsc.nasa.gov

These seagrass species are distributed widely in the seagrass meadows along the Andaman Sea coast. It has been widely reported in the literature from dugong surveys in Thai waters that the largest group inhabits around Talibong-Muk Islands, Trang Province (see map). This area has been announced as a wildlife reserve area and covers one of the largest and diverse seagrass meadows in Thailand.

As seagrass meadows serve as feeding grounds for dugongs, dugongs are therefore an important component of the seagrass ecosystem. Through my research, I am quite interested to find out whether the dugong's role is either a constructor or destroyer of seagrass meadows. To understand that, I collaborated with the second author (who has great experience on biology of dugongs in Thailand), to examine the impact of dugong feeding activity on an area of 8.9 km^2 of the Talibong seagrass meadow, from December 2006 to April 2007.



Feeding trail at high tide in predominant Halophila ovalis meadow Talibong, Trang Province, Thailand

Feeding trail just after seagrass grazing by dugong in Talibong wildlife reserve area, Trang Province, Thailand

It has been estimated that dugongs in the region consume approximately 14 kg wet weight of seagrass per day (*slightly lower than reported in the literature*). Preliminary results of our study on stable isotope analysis of dugong samples showed that carbon (C^{13}) in dugong meat is related to *Enhalus acoroides* rather than *Halophila ovalis*.

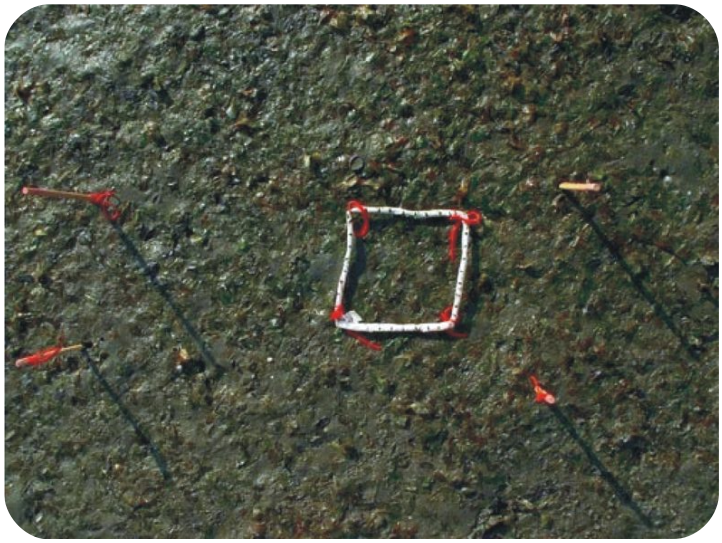
To examine the impact of grazing on the seagrass ecosystem, we first selected an area dominated by *Halophila ovalis* (because

Herd of dugongs in Talibong seagrass bed, Trang Province, Thailand. Photo taken by Adulyanukosol (co- author) during her survey of dugong population.

dugongs naturally fed in the area) and then examined 30 newly grazed dugong feeding trails (the sample size was sufficient for statistical analysis). On six occasions over a two month period we examined the feeding trails, taking photographs for description of temporal changes throughout the study period. During each visit we also randomly selected four trails from which we sampled the seagrass and collected sediment for analyses of meiobenthos, macrobenthos, grain size and organic matter content.

From the experiments, seagrass in feeding trails gradually recovered by extension of remaining rhizomes in the trails and possibly from the surrounding meadow. The feeding trails fully recovered to the same density and biomass as the surrounding seagrass within two months (56 days).

The study results indicate that dugongs cause a decrease of seagrass meadows with a scale of disturbance for a few months.



Feeding trail filled with seagrass expansion after 60 -days grazing by dugong in Talibong wildlife reserve area, Trang Province, Thailand. Photo taken by Cherdsukjai (2007).

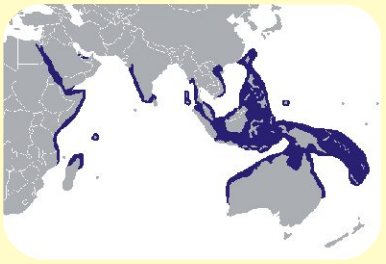
However, their feeding activity also mobilised sediments which had settled on the seagrasses, allowing more light to reach the plants. The feeding activity also aided benthic communities in the area. More discussion on actual roles of dugongs will be achieved after further analyses of meio- and macro-benthic samples. We expect to continue reporting on the findings of our research in future Seagrass-Watch Newsletters.

Dugong near Marsa Alam (Egypt). Photo courtesy of Julien Willem. Copyright 2008

About the Dugong

The word "dugong" derives from the Tagalog term dugong which was in turn adopted from the Malay duyung, both meaning "lady of the sea". Dugongs (*Dugong dugon*) are marine mammals in the Order Sirenia which are commonly called sea cows. Sea cows are more closely related to elephants than they are to other marine mammals such as whales or dolphins. The closest relative of the dugong was the Steller's Sea Cow (*Hydrodamalis gigas*), which was hunted to extinction in the 18th century.

Dugongs live in the shallow waters of at least 37 countries and territories around the world. Throughout their range which runs from east Africa to Vanuatu, dugongs are threatened by rising pollution from the land, coastal development, boat traffic, entanglement in fishing nets, and hunting and poaching for their meat and trophies. Dugongs have already disappeared from some places including the waters off Mauritius, Taiwan, western Sri Lanka, the Maldives, Japan's Sakishima Shoto Islands, Hong Kong's Pearl River estuary, several islands in the Philippines and parts of Cambodia and Vietnam.



Map showing dugong distribution

Dugongs feed mainly on seagrass, but can supplement their vegetarian diet with invertebrate animals such as polychaete worms, sea squirts and shellfish. Its snout is sharply down turned, an adaptation for grazing and uprooting benthic seagrasses. Dugongs feed mostly on small, delicate seagrasses, especially *Halophila* and *Halodule*, which are low in fibre, high in nitrogen and easily digestible. Dugongs can dig up whole seagrass plants including the roots. They do not favour lush seagrass meadows. Often very little of their preferred food can be seen on the seabed.

Dugong rolling. Image courtesy of Alberto Scarani. Copyright 2007

The largest dugong populations typically occurring in wide, shallow, protected areas such as bays, mangrove channels and the lee sides of large inshore islands where seagrass meadows are abundant. Groups of 10,000 or more are present on the Great Barrier Reef, at Shark Bay in Western Australia, and in Torres Strait.

Dugongs generally surface to breathe after only a few minutes. Dugongs can dive to at least 39 metres but spend most of their time in shallow water, less than 10 metres deep. Their paired nostrils are on the top of the head and have valves to stop water entering when they dive. Dugongs have flippers and tails that resemble those of dolphins, but they lack a dorsal fin. Their ears (which have no flaps or lobes) and eyes are on the side of the head. Dugongs do not see very well but are believed to have acute hearing within narrow sound thresholds. They have sensitive bristles covering their upper lip which they use to find and grasp seagrass. Dugongs grow to three metres long, can weigh up to 400 kg and live for 70 years or longer.

Dugong have a slow rate of reproduction. Groups of male dugongs follow a female when she is in oestrous ('in heat') and many mate with her, inflicting scars on the female's back, and on each other. Females have their first calf when they are between six and 17 years old and then produce calves only once every 2.55 years. As a result, females give birth only a few times during their life, and invest considerable parental care in their young.

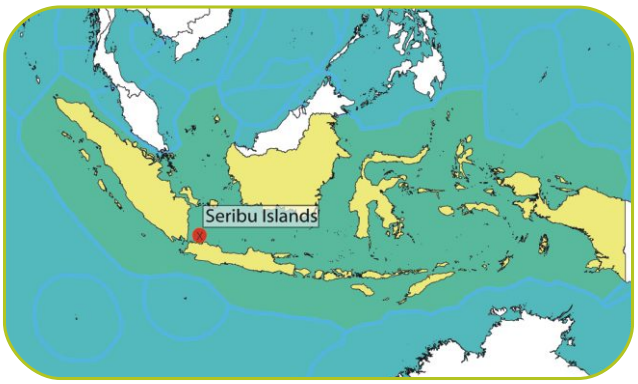
Mother and calf, East Timor. Photo courtesy of Nick Hobgood. Copyright 2005

Dugongs can move large distances, travelling alone or with their calves in search of food. They appear to have a good memory of place because satellite tracking shows that they return hundreds of kilometres to specific locations.

Source: Lawler, I., Marsh, H., McDonald, B. and Stokes, T. (2002) and http://en.wikipedia.org/wiki/Dugong

Seagrass meadows in the Pari Islands, Bay of Jakarta

Ichwan Makmur Nasution (Agency for Marine and Fisheries Research
Ministry of Marine Affairs and Fisheries of Indonesia)

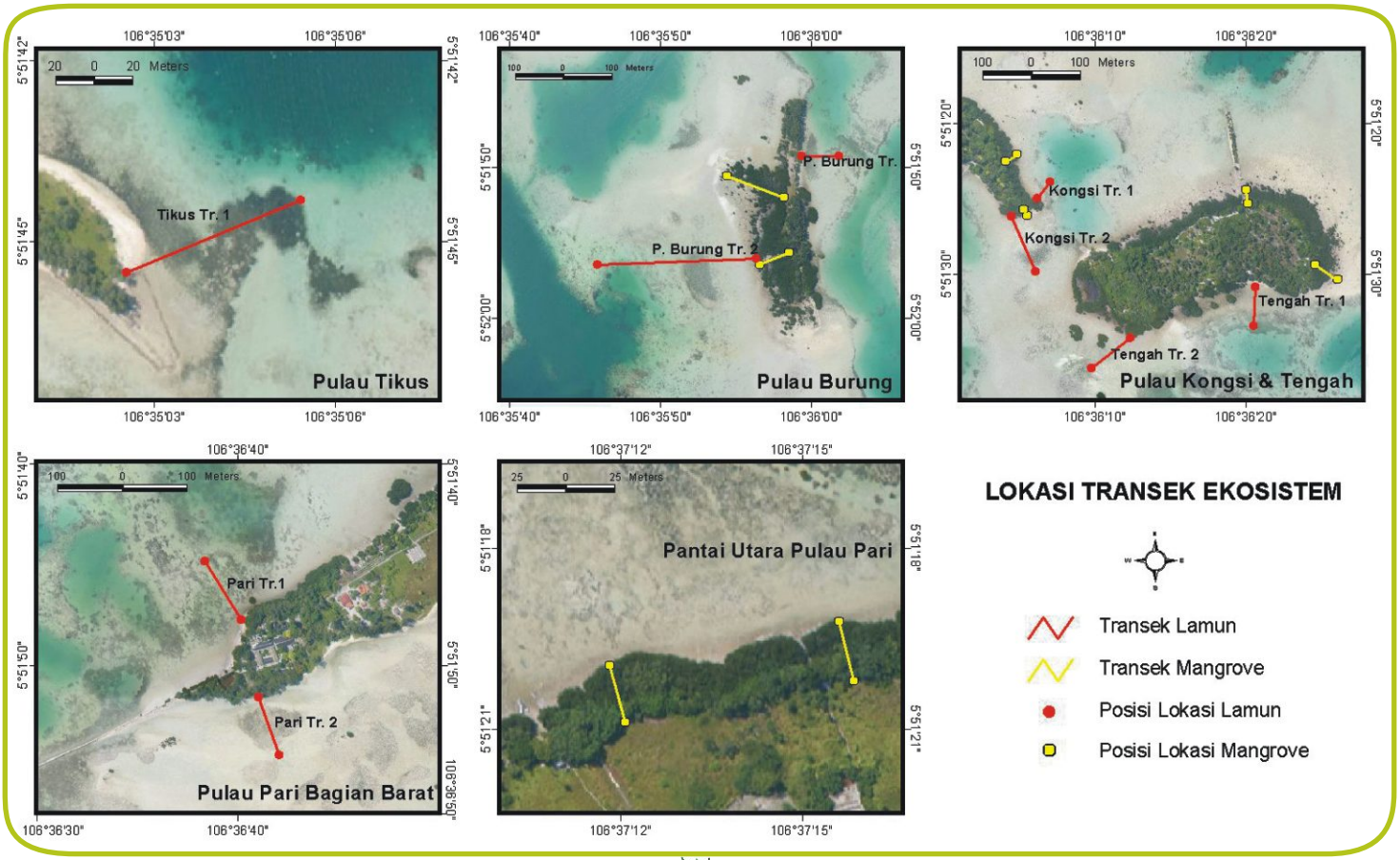


Seribu Islands is an archipelago near Jakarta, the Capital of Indonesia. Part of this group includes the Pari Islands, which consist Burung, Tengah, Kongsi, Pari, and Tikus. The Pari Islands are coral cays with shallow and low coasts. Water salinity in this area varies from 27 to 32.75 ‰ and is influenced by tides with daily average of highest tide 1.2m (lowest tide = 0.18m). The islands can be reached from Jakarta in 1-2 hours by boat. Seagrass in these islands has been studied from the 1970s, when Indonesian scientists started to conduct seagrass research.

The current survey was conducted in June 2007, at 9 stations on the five major islands. The stations were chosen based on aerial photography. Using Seagrass-Watch methods, we collected data about seagrass distribution, total cover, species composition, shoot density, and total biomass. Seven species of seagrass were identified, including *Enhalus acoroides*, *Thalassia hemprichii, Halodule uninervis, Halophila ovalis, Syringodium isoetifolium, Cymodocea rotundata*, and *Cymodocea serrulata*. Burung Island and Tikus Islands had the highest number of seagrass species (5) and Kongsi island and Tengah island has the lowest (2 species). *E. acoroides* and *T. hemprichii* were the species with the widest distribution in the Pari Islands as they were found at 8 of the 9 stations surveyed. Density of each species varied between stations. *H. pinifolia* has the highest density in the islands (1060 shoots/m^2 in Tikus island) and *C. rotundata* has the lowest (8 shoots/m^2 in Pari island). Average of total percent cover of seagrass in the islands varied from 13.5% in Burung islands to 71% in Tikus island. Total seagrass biomass varied from 225.04 in Pari Island to 1126.27 g DWm^{-2} in Tikus island.

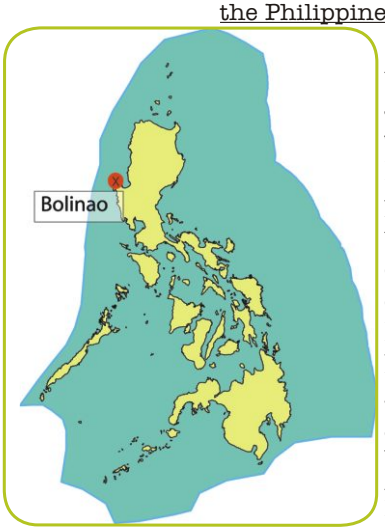
There are a lot of factors which impacted the condition of seagrass meadows in this area. A lot of pollution occurs in the Bay of Jakarta and by the influence of current and waves, sometimes will carry the pollutants to this area. In the last 10 years, there has been an expansion of extensive seaweed farms in the Pari Islands. These farms are located in the areas where seagrass grow.

Top: Kongsi Is.
Middle: Running out a transect.
Bottom: Enhalus and H. uninervis (Tikus Is)

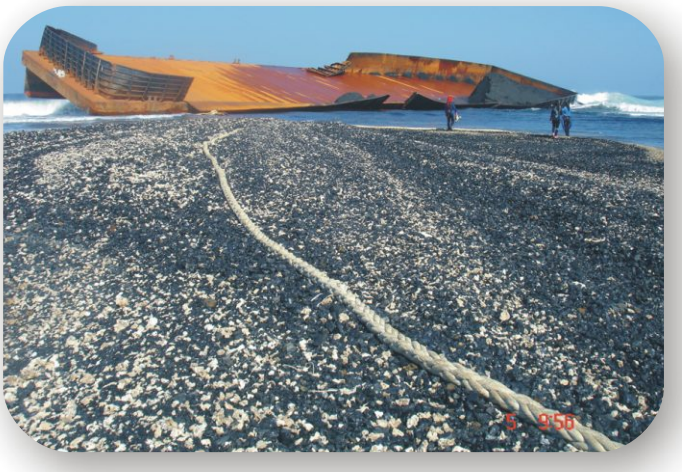


Do we have to wait for a catastrophe to realize the economic value of seagrass?

Miguel D. Fortes (Marine Science Institute CS University of the Philippines) reports



On the 27 November 2007, the Indonesian barge, APOL 3003 (92 x 25 m dimension), while being towed from Indonesia to a coal-fired power plant, was hit by typhoon 'Mina' in the vicinity of western Bolinao, Province of Pangasinan, Philippines. Due to strong winds (70-100 km/hr) and big waves (about 5-7 m high), the barge anchor and towing rope broke. The barge was hurled to the reef fronting the shoreline of Barangay Ilog Malino, where the impact destroyed her metal flat sheet railing cargo fence, spilling 95% of its 8,373 metric tons of its coal cargo. It was estimated the coal spill affected 33 hectares of seagrass in the immediate vicinity.



Indonesian barge, APOL 3003, with it's spilled coal cargo (Barangay Ilog Malino)

Our immediate response to the incident was to utilize the learning from the seagrass subcomponent of the UNEP/GEF SCS Project. That gave us a chance to immediately mobilize the Seagrass-Watch volunteers to intensify the monitoring of seagrass permanent sites. Using a combined transect, Seagrass-Watch and photographic protocols, the assessment teams recorded considerable damage to the seagrass ecosystem, ranging from complete burial of healthy meadows to death of fish and benthic invertebrates. Fishers and gleaners livelihoods were negatively affected. The results of the economic valuation of the goods and services coming from the affected area gives the total economic value of the damage at US$ 80,226.85.

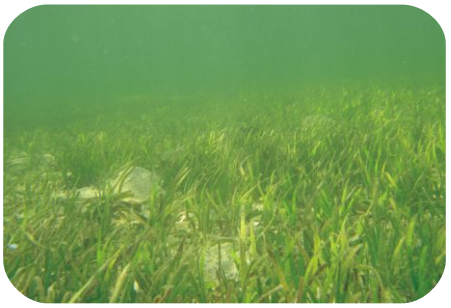
The grounding of the barge affecting such a sizable area of seagrass presents a fortuitous, first-hand direct challenge to the usefulness of the Demonstration Site in Bolinao in particular and of the UNEP/GEF SCS Project in general. On one hand, it brought to surface the elements in the true valuation of the goods and services of local seagrasses, which were lacking. This hindered considerable efforts on the part of both the local government and the Marine Science Institute to reach a reasonable and realistic total economic value of the resource. In addition, it also brought to fore the glaring inadequacy of the local government to handle such a case. This 'invited' outside vested interests, which complicated the legal settlement process.

On the other hand, the incident is perhaps the most persuasive factor, which for a very short period, convinced the people from all walks of life in Bolinao to truly realize the importance of the 'lowly' seagrass: that this importance can be converted directly to money, big money. With the current agreement of all parties concerned to give the amount due the municipality, more support on the part of the communities and the LGU have been pouring into the implementation of the projected activities of BSDS. This galvanized their voiced commitment to extend the life of the project beyond 2008.

While we all were happily challenged by the incident, it is opening up some old 'wounds' especially among the old politicos in the area. The legal tussle that resulted invited other interest groups to meddle in what should be a purely local affair. The other sectors of government jumped in, but in the long run, not contributing substantially to the resolution of the case.

Unfortunately the incident is likely to happen again. This is because of the increasing intensity and number of typhoons that are known to pass the northern part of the country, hand-in-hand with a similar increase in coal and oil tanker traffic in the western and northwestern part of Bolinao attendant to the enhanced economic partnership between China and the Philippines.

Fortunately, the coal spill gave us the opportunity to further refine our advocacy on seagrass protection and sustainable use. The incident demonstrated the true nature of the integrated approach to seagrass management and protection.



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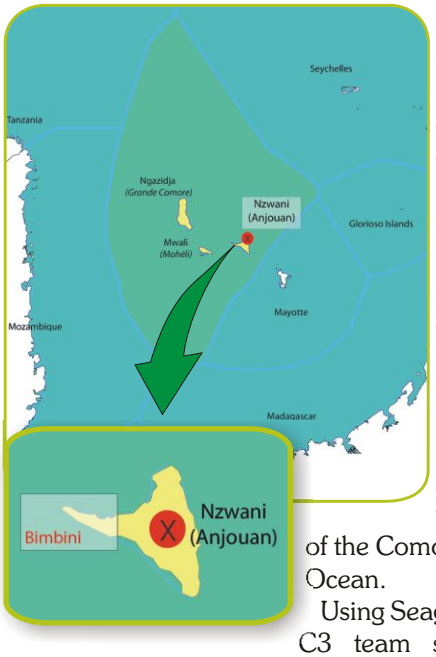
Fortes, M.D. K. Sour, H. Xiaoping, T.E. Kuriandewa, N. V. Tien, O. Vibol, N.E. Montano, T Almonte, S. Satumanatpan. 2007. "The UNEP/GEF Seagrass Demonstration Sites in South China Sea: Milestones in Seagrass Research and Biodiversity Management in East Asia". Kyoto University.

PREDICT (Prediction of the Recovery and Resilience of Disturbed Coastal Ecosystems in the Tropics). 2000. INCO-DC: International Cooperation with Developing Countries (1994-1998) Contract number: ERBIC18CT980292. FINAL REPORT

Mapping seagrass meadows on the remote Bimbini peninsula of Anjouan Island

Soizic Le Courtois and Daniella Blake report



Exploring the seagrass meadows around a remote peninsula of an island recovering from political turmoil was just part of a challenging expedition conducted by Community Centred Conservation (C3) and local partners in September 2008. This latest expedition was part of C3's ongoing project to map the previously unstudied extensive seagrass meadows on the three islands of the Union of the Comoros in the western Indian Ocean.

Using Seagrass-Watch methods, the C3 team scrambled, waded and climbed along the Bimbini peninsula on the north-west coast of the island of Anjouan through knee-deep mud and fields of sea-urchins. A huge expanse of seagrass, 15 km long and up to a kilometre wide was mapped around the peninsula. Nine species were found: *Thalassia hemprichii* was by far the most common. *Thalassodendron ciliatum*, *Halodule wrightii* and *Halodule uninervis*, *Cymodocea rotundata, Cymodocea serrulata* and *Enhalus acoroides* were also regularly observed, but *Halophila ovalis* and *Syringodium isoetifolium* were less common.

This expedition also offered the opportunity to train three members of a local environmental NGO, HTC (Halieutiques-Tourisme-Conservation) in Seagrass-Watch methods. A day was spent out on the peninsula with the three Comorians learning to identify the different species of seagrass and how to conduct surveys using Seagrass-Watch methods. The three students: Anlimouddine Moutouraffi, Andhumaty Omar and Naima Abdallah enjoyed their first experience learning about seagrass.

Local Fishers gathering octopus and shellfish among seagrass at Bimbini. Copyright Community Centred Conservation C3

Unfortunately this biodiversity-rich area, containing nine out of the twelve species of seagrass present in the Indian Ocean, is at threat from pressing environmental problems which include deforestation, clearing of mangroves, daily trampling by seashell and octopus gleaners, coral reef degradation and pollution from household waste dumped into the sea. According to local communities, the knee-deep mud is a recent phenomenon and is probably due to the extensive deforestation occurring on the island (Anjouan has lost 73% of its original forest cover).

Researchers find evidence of Green turtle poaching. Copyright Community Centred Conservation C3

The Union of the Comoros is situated at the northern end of the Mozambique Channel, equidistant from continental Africa and Madagascar. It comprises three volcanic islands: Grande Comore, Anjouan and Mohéli. The islands host a number of ecologically important and vulnerable coastal habitats including coral reefs, mangroves and seagrass which support high marine biodiversity. The seagrass meadows of the other two islands of the Union of the Comoros: Grande Comore and Mohéli, have already been mapped by C3 in 2006 and 2007 and the new information from Anjouan will be incorporated into GIS seagrass maps currently being produced by C3 for the whole Union of the Comoros.

Red knobbed Starfish (Protoreaster linckii). Copyright Community Centred Conservation C3

This work has been generously funded by the Rufford Small Grants Foundation, SeaWorld & Busch Gardens Conservation Fund and the PADI Foundation.

Anjouan

Anjouan (also known as Ndzuwani or Nzwani), population 277,500 (2006) is an autonomous island of the Union of Comoros, located in the Mozambique Channel. The total area of the island is 424 sq. kilometres.

African mainlanders, Creoles, Arabs, Malay-Polynesians, Antalotes and Shirazi Persians make up the population of Anjouan.

The economy of the island is dependent on agriculture and related industries. These industries employ over 80% of the work force. The island's main food staple is rice, most of which must be imported. Anjouan is the world's primary exporter of ylang-ylang oil, an ingredient in almost all perfumes.

Source: http://en.wikipedia.org/wiki/Anjouan image courtesy of Google maps

Seagrass restoration underway in the Florida Keys

Seagrass-Recovery reports

In early October, the Restore-A-Scar program launched its first restoration effort at Knight's Key Bank in the NOAA Florida Keys National Marine Sanctuary. The launch began the restoration process of over 4,000 square feet of damaged seagrass to be restored. The ongoing project at this site is taking place as a result of a significant contribution made to The Ocean Foundation's capital fund raising campaign by ABSOLUT® Vodka. As part of an innovative solution to combat climate change, ABSOLUT® Vodka and The Ocean Foundation have teamed up to restore seagrass meadows in coastal areas around major metropolitan areas.

Seagrass recovery at work, Seven Mile Bridge, Florida Keys
Photo courtesy of Kenny Wright (Seagrass Recovery)

Laying sediment tubes
Photo courtesy of Kenny Wright (Seagrass Recovery)

Launched August 1, 2008, the Restore-A-Scar program is a collaborative effort by The Ocean Foundation and Seagrass Recovery aimed at restoring seagrass scars found off the coasts of Florida, New York, California and Washington.

The first restoration project is taking place near the famous Seven Mile Bridge in the Florida Keys. On hand were Mark Spalding of The Ocean Foundation, Jeff Beggins and Kenny Wright with Seagrass Recovery, Dave Score and Bill Precht from NOAA, representatives from the Florida Department of Environmental Protection and Florida Fish and Wildlife Commission, local elected officials, as well as several members of the media.

The Restore-A-Scar program, www.restoreascar.org, uses individual and corporate donations to proactively restore damaged seagrass meadows. To restore the seagrass scars, biodegradable sediment tubes will be placed inside the seagrass scar to halt expansion of the scar and allow seagrass to re-colonize over the injury.

Donations are now being made to support another restoration on Pigeon Key in the Florida Keys National Marine Sanctuary. Please, join the effort today and support seagrass restoration today.

Turbid waters surround southern Florida and the Florida Keys in this true-color Moderate Resolution Imaging Spectroradiometer (MODIS) image taken by the Aqua satellite on December 2, 2003. Clouds of milky blue, green, and tan sediments and microscopic marine organisms (like phytoplankton and algae) discolour the water in the Gulf of Mexico north of the Keys, but end abruptly in the deeper water of the Straits of Florida. The water north of the Keys is relatively shallow, so sediments are a likely cause of the discolorationrough waters can churn up the mud from the sea floor, which then clouds the water. But in the deeper water south of the Keys, sediment on the sea floor is much harder to disturb, which keeps the water clearer.

Image courtesy of
http://visibleearth.nasa.gov/view_rec.php?id=6108

Florida Keys

The Florida Keys (pop. 79,535, 2000 census) are an archipelago of about 1700 islands in the southeast United States. They're made mostly of limestone and coral, and are known for their variety of wildlife, subtropical vegetation, and spectacular diving. The Keys begin at the southeastern tip of the Florida peninsula, about 24 km south of Miami, and extend in a gentle arc south-southwest and then westward to Key West, the westernmost of the inhabited islands, and on to the uninhabited Dry Tortugas. At the nearest point, the southern tip of Key West is just 151 km from Cuba.

Most of the islands are connected to the mainland via the Overseas Highway, making this a popular and easily-accessible destination.

However, popularity can be a double-edged sword. On the one hand, tourism is one of the economic mainstays of the region, and helps increase public awareness of how fragile this ecosystem is. But on the other hand, those same tourists and their activities can hurt the ecosystem by introducing pollutants and causing physical damage to fragile reefs and seagrass.

Florida Keys National Marine Sanctuary (FKNMS)

USA Congress established the FKNMS in November 1990 to protect the region's valuable and unique resources. The sanctuary comprises approximately 9,844 km2 of water and submerged lands, including more than 1700 islands of the Florida Keys archipelago. Unique marine environments including the largest contiguous seagrass community in the northern hemisphere and the nation's only coral reef tract that lies adjacent to the continent are present in the FKNMS.

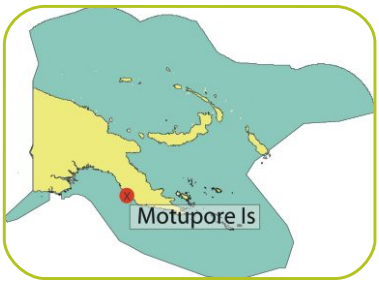
Recognizing the critical role of water quality in maintaining Sanctuary resources, Congress further directed the U.S. Environmental Protection Agency (EPA) and the state of Florida, to develop a Water Quality Protection Program (WQPMP) for the Sanctuary. This is the first such program ever developed for a marine sanctuary. A Seagrass Monitoring Project (SGMP) is a key component of the Program,

The general objective of seagrass monitoring in the FKNMS is to provide high-quality, quantitative data on seagrass status and trends including: distribution, primary production, tissue nutrient availability and water quality relationships. These data are being collected at three different types of sites within the FKNMS.

For more information and results on the monitoring, visit http://ocean.floridamarine.org/fknms_wqpp/

Source: http://en.wikipedia.org/wiki/Florida_Keys, http://visibleearth.nasa.gov/, http://floridakeys.noaa.gov/

Marine conservation and management training



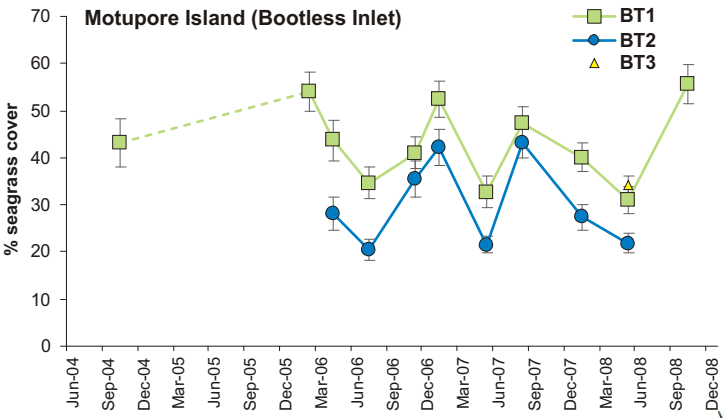
In late October 2008, Len McKenzie (Seagrass-Watch HQ) visited Motupore Island, near Port Moresby (Papua New Guinea) to conduct a Seagrass-Watch training exercise as one of the components of the resurrected University of Papua New Guinea (UPNG) marine conservation and management training course (*see also issue 25*).

Thirty participants from throughout Papua New Guinea attended, including 3rd and 4th year UPNG students and representatives from various non government organisations. Representatives from the local Motuan community also attended as they were keen to learn about the ecosystems and resources of Bootless Inlet (Bay) to develop a management plan.

The training was held at the Motupore Island Research Centre and facilitated by Ursula Kolkolo and Rickson Lis, with financial support from the David and Lucile Packard Foundation.

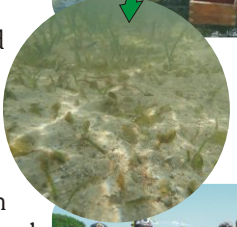
As part of the training, participants learnt seagrass identification, seagrass biology, why seagrasses are important and how they are threatened globally, how to monitor and map seagrass meadows, and how to manage the threats that continue to impact seagrass and marine ecosystems.

Although the training got off to a bit of a rocky start with the station generators breaking down, Len was able to quickly adapt and participants spent a busy afternoon collecting and identifying seagrass and making fresh press specimens. Although some participants at first confused a few macro-algae with seagrass, they soon could successfully identify the five species found around the island which were added to the MIRC seagrass herbarium.



With the generators still out of operation on day 2, seagrass biology lectures where quickly moved to the MIRC workshop at Tahira on the mainland. In the afternoon students, learnt about Global Positioning Systems and then after breaking into teams they practised their skills by competing in a "treasure" hunt.

With the power restored on day 3, it was an exhausting morning of presentations and then an afternoon monitoring BT1, one of the long-term monitoring sites established in Bootless Inlet. That evening after entering the data the students compared their findings with previous years.

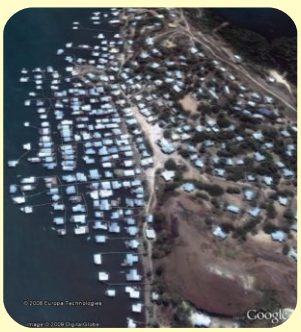


Sampling Motupore Island, Bootless Inlet

All participants enjoyed the 3 day course and many commented that they did not realize the importance of seagrass meadows; vowing that on returning to their local regions, they would endeavour to impart their knowledge to the local communities to help support seagrass and marine conservation. You can read their feedback comments on the Seagrass-Watch website at www.seagrasswatch.org .

MIRC has received 2 years of funding from the David and Lucile Packard Foundation to help run the courses in 2008/09. The 2009 course will hopefully include a longer seagrass component which will include seagrass productivity experiments and a few other exciting initiatives.

The Motuans



The Motuans are native inhabitants of Papua New Guinea, living along the southern coastal area of the country. The Motu were seagoing people and their impressive boats, called lakatois and up to 15m long, were capable of carrying a large cargo and crew. Their indigenous language is known as Motu, and they are believed to be the descendants of Polynesian immigrants who intermarried with the native Melanesians of the area.

Most Motuans live in houses built on stilts over the sea. They are the original inhabitants and owners of the land on which Port Morseby - the national capital city of Papua New Guinea - stands. Motupore Island is a protected archaeological site and believed to be the location of the original Motuan village.

Team SeaGrass

The Year that Was....

Siti Maryam Yaakub reports

It's that time of year again, when we take stock of the year that has been and make plans for the year to come. Here at TeamSeagrass, the plans for next year's monitoring are all ready and laid out, and if the past two years are anything to go by, 2009 will be just as awesome if not more so.

A lot has transpired in the two years we've been monitoring, and we've decided that there's no better way to remember those quirky and fun moments than to do it Oscar-style. Roll out the red carpet and drumroll please!

Chek Jawa, a treasure trove that supports a rich variety of life on it's shores

Fastest Site to Monitor Award:

Chek Jawa Site 2

Yes, it's a bit of a walk from our entry point, but because the dominant species is *Halophila ovalis*, you can't really go wrong with this one. Great site to break in the newbies with, one volunteer commented that he can do it blindfolded - we haven't actually tried this, but CJ2 is great because it leaves plenty of time for us to explore when the work is done.

"Siti sinks" She somehow found the one big hole in the middle of the meadow and sank up to her waist while the rest of the team are still high and dry. Photo courtesy of Marcus Ng

The Site Nobody wants to be Assigned to Award:

Pulau Semakau Site 2

Ahhh what can we say, Pulau Semakau is challenging enough as it is, but throw in knee deep water, soft substrates and *Thalassia* and *Cymodocea* that insist on looking like each other and you get a recipe for disaster. There's a running joke that we only assign the taller volunteers to PS2, because at least some part of them will still be visible if they sink into the mud. But it's not a discriminatory thing, we swear!

Nor Aishah toughs it out after a stingray injury

Toughest Seagrasser Award:

Nor Aishah and the hole in her foot

You have to be tough as nails to go through the rigours of being a TeamSeagrass volunteer (OK not really) but every once in awhile, mother nature throws you a curve ball. Our tough as nails award goes to Nor Aishah, who after being stung by a stingray on Pulau Semakau, decided she was fine enough to wait for us to complete our session and even put off going to the emergency room in favour of getting some dinner!

Best Boatman Award:

Melvin his crew of merry (and now probably weary) men

Melvin and his 'can do' boat, " No Problem"

Here at TeamSeagrass, we've been turned down a couple of times by different boat companies who want to keep their boat propellers intact (and justly so I guess). That is until we met Melvin and his crew who seem game for anything. And the best thing is, he has acquired a new boat and it's name says it all....

The "We woke up early for this?!" Award:

Semakau August 2008

We met at 4:30 AM only to wait in the dark because we couldn't locate our site. Yes, daylight is your best friend!

The intrepid TeamSeagrass monitor Semakau in the early hours of the morning.

The Wonky Tides Award:

Sentosa

Every year, we at TeamSeagrass purchase our oracle, the repository of all knowledge, the tide tables for the year. We sit around in feverish anticipation and pore over the entire book to plan our trips for the entire year; so that it is cast in stone and written in the blood of sacrificial sheep. But as some wise old guy once said, even the best laid plans go awry. These words never wrung so true in the case of Sentosa when we waited... and waited... and waited but the tides never went below the predicted level. But hey, even Oracles have off days right?

Most priceless TeamSeagrass Moment Award:

Mud Crawl at Chek Jawa, House 1

Words can't describe it, there's a video somewhere of a bunch of us crawling on hands and knees through some really really soft mud that just kept sinking. There was a lot of yelling and needless to say expletives. We ended up looking like Swamp Thing, but we were just happy to be alive :)

Funniest Gullible Moment Award:

Jerald and the Jumping Crab

I told Jerald that the crab was a jumping one and he believed me. 'Nuff said!

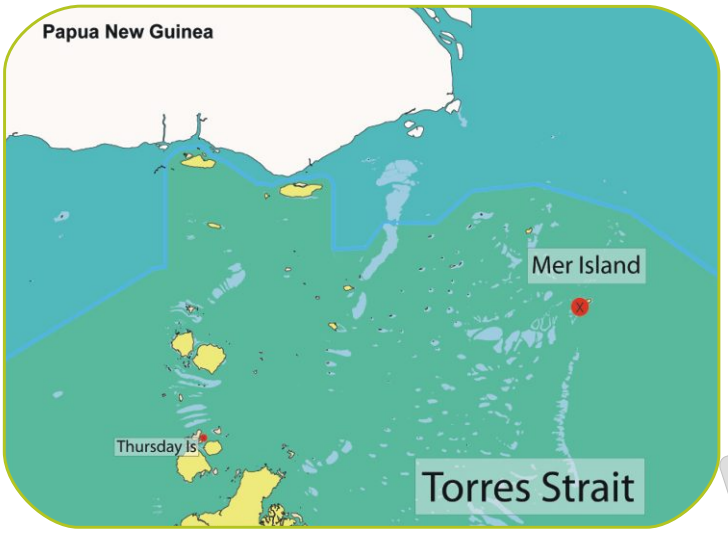
So those are the moments that stick out in our minds, but there are many more that we haven't shared. We're sure that 2009 will be a blast, make sure you read our blog (teamseagrass.blogspot.com) to see what we're up to! Happy Holidays everybody! TeamSeagrass, signing out!

Images courtesy of Ria Tan

WILD SINGAPORE
www.wildsingapore.com

Mer Island Seagrass-Watch

Jane Mellors reports



As part of the feasibility study for monitoring seagrass habitats on Mer and Mabiaug Islands, Seagrass-Watch HQ, Frank Loban (TSRA) and several members of the Tagai College Secondary Campus Seagrass-Watch team visited Mer Island (the most eastern populated island of the Torres Straits). The team met with the island councillor Mr Day, and discussed the intent of Seagrass-Watch and gave presentations at the State School and the community Hall.

Presentations at the school, on seagrass biology, ecology and monitoring, were followed by badge making and magic tricks by Mr Magic himself Andrew Denzin. The presentation to the community was received well with lots of questions relating to Climate Change and seagrass communities. Moses Walu, the Dugong & Turtle Project Officer, has even located a site that he feels should be monitored. Unfortunately due to neap tides and front, we didn't venture into the water to check out the seagrass. All in all, it was a successful trip, with teachers and community members expressing interest in joining the program. The logistics of monitoring at this remote location due to a the lack of commuter flights within the Torres Strait need to assessed.

Community talk

Any Questions ?

Mer Island is a small island of volcanic origin, populated by the Melanesian Meriam people (pop. 450) and situated in the eastern section of Torres Strait, near the Great Barrier Reef.

The island rises to a plateau 80m above sea level. The highest point of the island is the 230 metre Gelam Paser, the western end of the volcano crater.

The people of Mer speak Torres Strait Creole and Meriam. English is a second language.

Mer Island's most famous resident was trade unionist Eddie Mabo, whose decision to sue the Queensland government in order to secure ownership of his land, which had been removed from his ancestors by the English colonial powers using the *terra nullius* legal concept, ultimately led to the High Court of Australia, on appeal from the Supreme Court of the State of Queensland, issue the "Mabo decision" to finally recognise Mabo's rights on his land on 3 June 1992. Mabo himself died a few months before the decision.

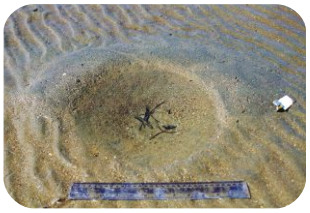
http://en.wikipedia.org/wiki/Mer_Island

Rays

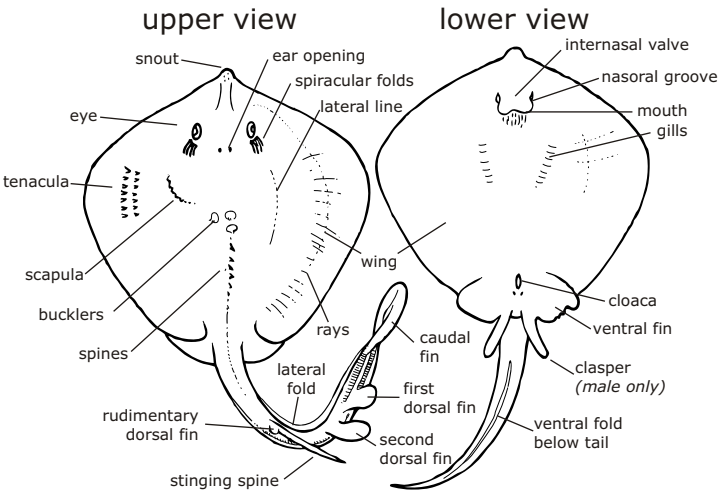
by Helen Taylor & Len McKenzie

Have you ever wondered what causes the pits/excavations on sandbanks and sometimes within the seagrass meadows? Well, some of these pits are caused by rays feeding.

Sting ray feeding pits at low tide



Rays are a type of flattened fish and are closely related to sharks. Rays belong to the group of fishes called Elasmobranchii, which also includes the sharks, skates, and ratfish. Rays are thought to have evolved from sharks. Unlike other fish, the Elasmobranchii are all fish that have no bones; their skeleton is made of cartilage, which is a tough, fibrous substance, not nearly as hard as bone.



Blue bottled ray (Taeniura lymma) Great Barrier Reef, Cairns, Australia.
Photo courtesy of Leonard Low

Rays have a flattened body shape and an elongated tail. Even the ray's skull is flattened. The eyes and spiracles are located on top of the head. The pectoral fins are large and connected to the body to form the ray's "disc." The shape of the disc differs from species to species and may be circular, oval, wedge-shaped or triangular. Some body shapes are adapted for living on the sea bed; others are adapted for almost constant swimming. Rays can range in size from about 10cm to nearly 7m across. The biggest ray is the manta ray.

There are about 500 different living species of rays and skates world-wide, which are divided into 19 families. These different families of rays are very different in the way they look, live, and hunt. They have different shapes, sizes, colour, fins, teeth, habitat, diet, method of reproduction, and other attributes. Rays occupy a range of marine and freshwater habitats, but are predominantly reported over soft-sediment environments including mudflats, sandflats and seagrass meadows.

Rays swim very differently than other fish. They are propelled through the water with their powerful, wing-like pectoral fins which ripple and flap. Their large pectoral fins also let them glide trough the water. Some rays can even jump above the water. Many species of rays are coated with a slimy mucous which reduces the surface tension and drag of the water and increases swimming speed.

Like sharks, rays lack a swim bladder and use their oily liver to maintain buoyancy (other fish use an air-filled bladder to help them float). When a ray stops swimming, it sinks down to the sea bed.

Some rays are oviparous (laying eggs) while others reproduce via aplacental viviparity (giving birth to live young that develop in the womb without a placenta). Fertilisation of eggs is accomplished by a pair of claspers of the male, which are modifications of the pelvic fin used for transferring sperm to the female. Rays and skates have a long gestation period and produce relatively few young (compared to other fish). The growth of ray populations, therefore, is slow.

Rays are extremely efficient predators, using a combination of sophisticated sensory systems to locate hidden prey. At close range, rays use a combination of vision and touch (mechanoreception) as well as electroreception to detect the small electric fields emanating from their prey. Their lateral line system, which is sensitive to vibrations and pressure changes, is used mainly for detecting prey over small distances. The sense of smell in rays is not quite as good as their shark cousins, however can still be used as a useful tool to detect prey over larger distances.

Rays mostly hunt on or near the bottom of the ocean. Some rays are active hunters. Rays do not have the typical pointy teeth seen in sharks, instead they have grinding, molariform teeth which form plates inside their mouths. Rays vary in their diets, but they are all carnivores. They feed primarily on small benthic infauna, typically molluscs, polychaetes, crustaceans, echinoderms and teleosts, often excavating the sediment to reach their target, leaving behind distinctive 'ray pits'.

Above: Sting ray feeding
Below: Ray feeding pits

Rays form pits by flapping their wings and jetting water through the modified gill opening (the spiracle) behind their eye and out through its gills on the under-surface of its body. This hydraulically mines the sediment, uncovers the prey and leaves a round or elliptical shaped pit that is characterised by a low sand ridge formed at the rear end of the animal. Depending on environmental conditions, ray pits can be seen in the intertidal sediment for many days after feeding. In Spain, what was originally thought to be dinosaur tracks have actually been identified as rays pits from the Upper Cretaceous.

The impacts of stingray foraging in seagrass meadows if generally minor, however sometimes they can be significant. In early 2007 it was reported that foraging from cownose rays was destroying seagrass meadows along the east coast of the United States of America. The rays were digging up the seagrass looking for scallops and other shellfish.

Continued over

Seagrass News

RAYS.. continued from page 23...

Cownose rays are reported to have increased 20-fold since 1970 as a direct consequence of overfishing of large sharks (the rays main predator).

However, some scientists have considered that foraging by rays may increase seagrass seedling recruitment because seeds may accumulate in the ray pits. A study in the intertidal seagrass meadows at Shelley Beach (Townsville) in July 1997 found that foraging by stingrays had negligible impacts on *H. uninervis* seed abundance. In that study, they reported there was around one stingray pit every 7m^2.

A group or collection of rays in commonly referred to as a "fever" of rays!

Rays have a high ratio of brain weight to body weight; they are probably very intelligent, even smarter than sharks. They are known to be very curious animals, often approaching a diver and simply observing the intruder.

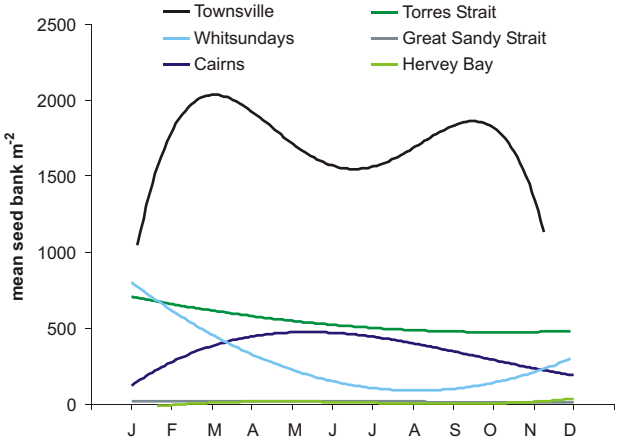
Rays defend themselves from predators in many ways. Some use a whip-like tail to lacerate an enemy, electrical rays give electrical shocks (up to 200 volts), and some have series of hard, bony spines on their body that puncture their victims. Camouflage on the sea bed is probably among their best defences.

Some rays can cause minor injuries to humans, but these are rarely serious. Many have a barbed, venomous stinging spine on the tail which rays use as a defence mechanism against predators. Despite media hype after the much publicised tragic death of Steve Irwin, rays are not naturally aggressive animals. When startled or threatened, rays can use their long stinging spines to inflict deep wounds. The toxin of all rays is a large, water-soluble protein that is destroyed by heat. In the event of an injury the wound site should be immersed in hot water (as hot as can be withstood) to alleviate the pain and medical treatment should be sort to ensure that the wound is flushed of the toxin.

So next time you're out monitoring and walking across the sand banks, keep and eye out for the ray pits and be ever vigilant of these fascinating fish.

SEEDS.. continued from page 9..

Along the east coast of Queensland, *Halodule uninervis* seed banks are generally more prevalent early in the year (post Monsoon) and germination (half seeds) more abundant in spring/late Dry (Sep-Nov) (all years pooled). However, in Townsville, the seed banks appear bi-modal with peaks in March and October. Why this pattern occurs is uncertain, and research currently underway at James Cook University will hopefully help to provide an answer.



Seed monitoring occurs at many locations outside the east coast of Queensland. In the Gulf of Carpentaria (western Queensland), seed banks are slightly smaller at Napranum (Munding) and Ganthaawu (Mornington Island) (approximately 126 and 19 seeds/fruits per m^2 respectively).

Germinating seed, courtesy M. Waycott.

But large seed banks are not restricted to Queensland. Large seeds banks have also been reported from Seagrass-Watch sites in Fiji, in particular Cawaci and Tagaqe (approximately 526 and 238 seeds/fruits per m^2 respectively). This suggests that *Halodule* meadows throughout the western Pacific are to some extent resilient to disturbance.

Seagrass-Watch training workshops

Cape York (Qld, Australia)
9 - 10 March 2009

Whitsundays (Qld, Australia)
4 - 5 April 2009

Singapore
2 - 3 May 2009

Bali (Indonesia)
9 - 10 May 2009

Register at http://www.seagrasswatch.org/training.html or contact hq@seagrasswatch.org

Related to the seed monitoring are investigations on the role dugongs might have dispersing seagrass seeds, helping to ensure meadows recover and genetic exchange. In 2002 (Issue 15) Michelle updated participants on the research her JCU team was conducting by examining dugong "poo" collected by Seagrass-Watch participants.

They found that seeds in dugong poo related to the meadows the dugongs grazed and the time of year. For example, *Zostera* seeds were dominant among the poo samples in November and *Halodule* seeds were found in June.

The research confirmed that seeds eaten by dugongs make it through the gut. Microscopic examination of the seeds from poo samples revealed that 43% of seeds were intact and the embryo inside the seed coat appeared healthy. However, whether the seeds would germinate is another project which Michelle is still keen to investigate.