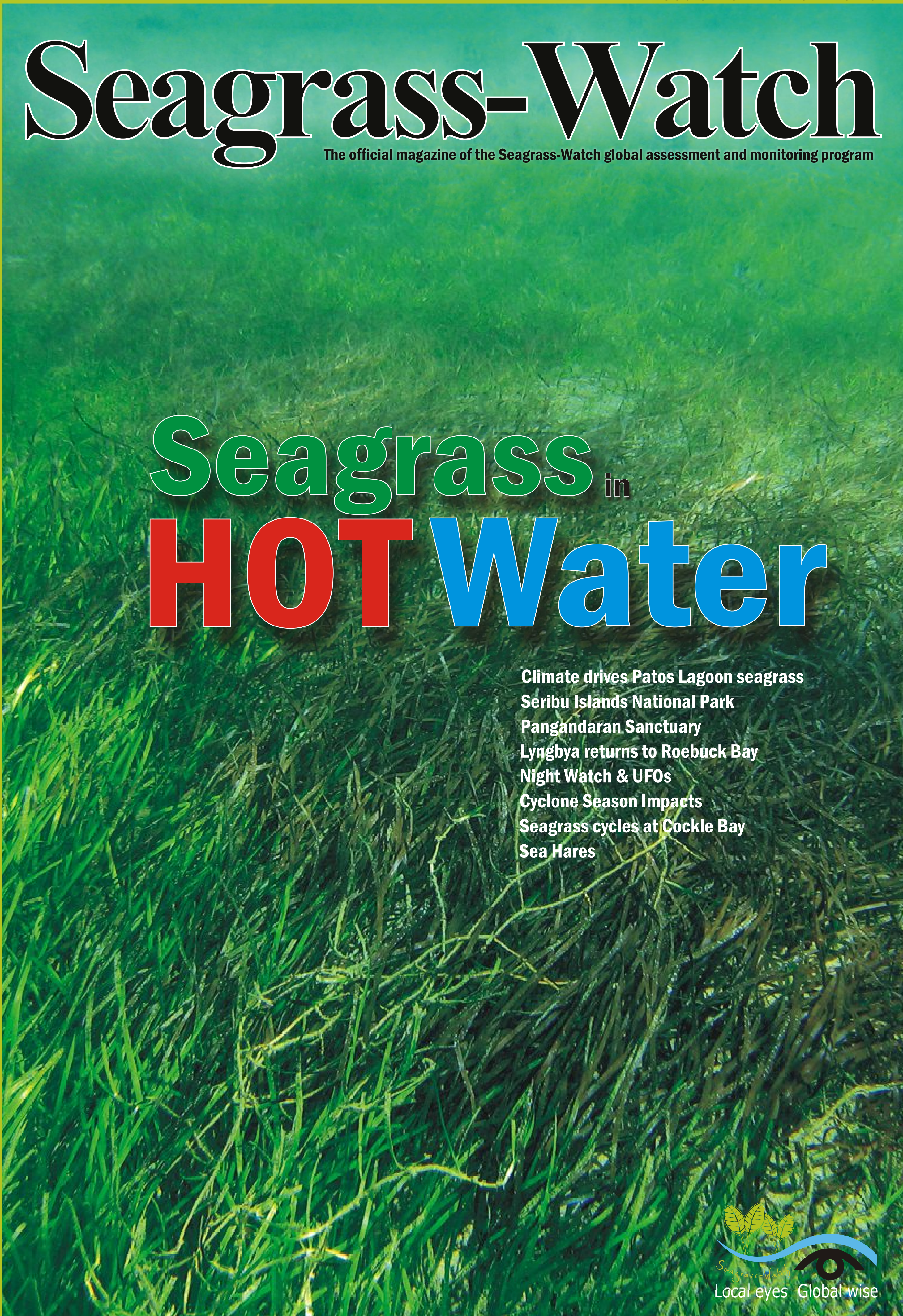
Issue 40 • March 2010

Seagrass-Watch

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



Seagrass in HOT Water

- Climate drives Patos Lagoon seagrass
- Seribu Islands National Park
- Pangandaran Sanctuary
- Lyngbya returns to Roebuck Bay
- Night Watch & UFOs
- Cyclone Season Impacts
- Seagrass cycles at Cockle Bay
- Sea Hares

Local eyes Global wise

In this issue:

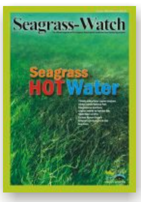
From the editors

Since seagrasses evolved back into the sea approximately 100 million years ago, they have adapted to a wide range of tolerances, including climate extremes. However, over the last century, seagrasses have had to cope with a changing climate occurring at an unprecedented rate. In this issue we present the latest findings from the Seagrass-Watch temperature monitoring and findings from seagrass monitoring where climate appears to be the most significant driver of change.

Read about the impacts of Cyclone Ului on the intertidal seagrasses of the Mackay Whitsunday region in Australia, and how climate influences the seagrass and drift algae of Patos Lagoon in southern Brazil. You can also read how over the last 40 years, climate driven cycles have influenced tropical seagrass succession at Cockle Bay.

In this issue you'll find articles on the return of *Lyngbya* to Roebuck Bay (Western Australia), a survey of seagrasses in Pangandaran Sanctuary (Indonesia), and a reassessment of seagrass in the Seribu Islands National Park (Indonesia).

You can also read about how some dedicated volunteers monitored their seagrasses at night, observing UFOs among other things. You can even learn about Sea Hares.



COVER: Burnt seagrass, Tagaqe, Fiji. Photographer Len McKenzie

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Editing & additional text: Len McKenzie, Rudi Yoshida & Richard Unsworth
Layout & graphic design: Rudi Yoshida & Len McKenzie

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

Seagrass-Watch HQ,
Northern Fisheries Centre
PO Box 5396, Cairns. Qld. 4870 AUSTRALIA
email: hq@seagrasswatch.org

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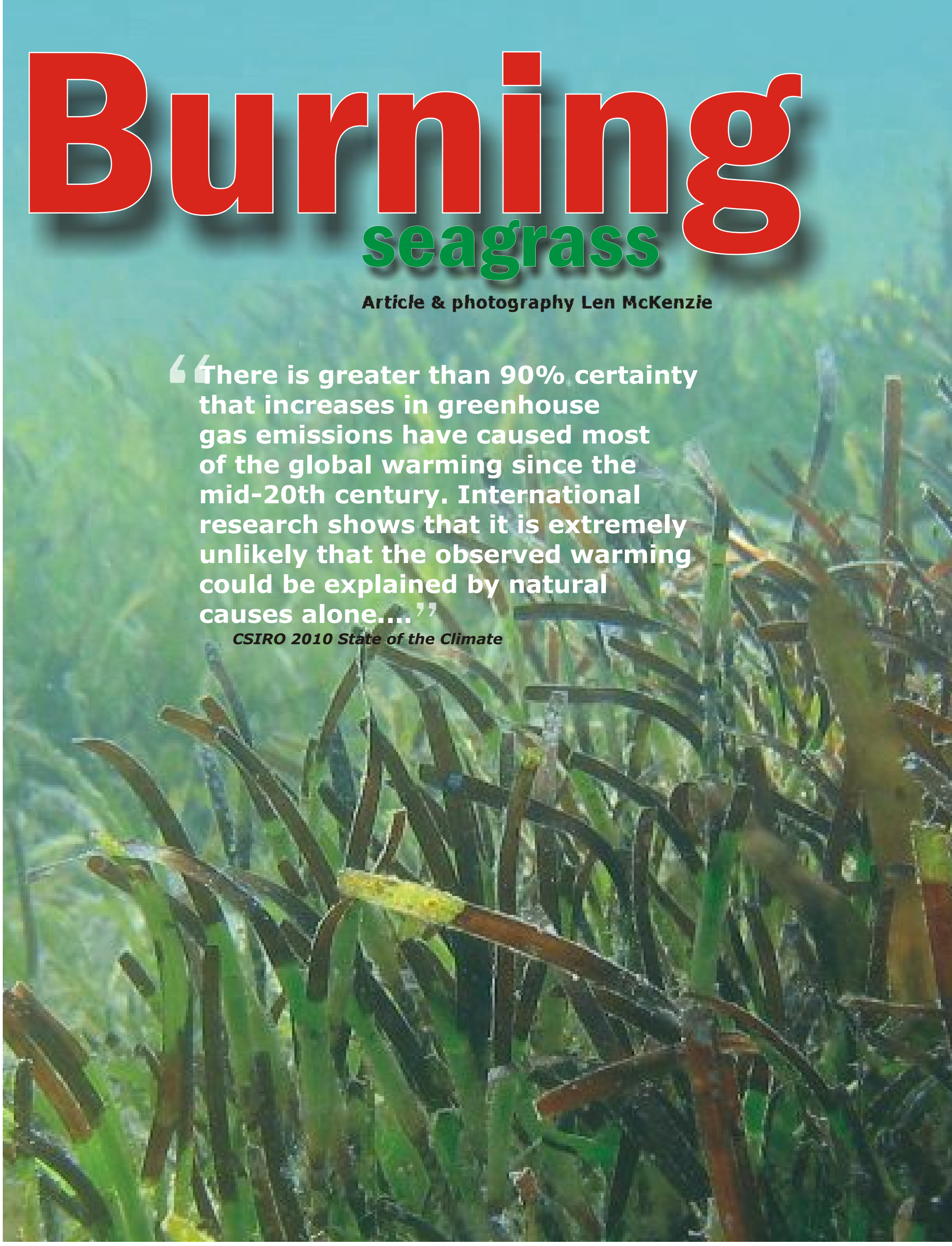
NEXT ISSUE OUT JUNE 2010

Burning seagrass

Article & photography Len McKenzie



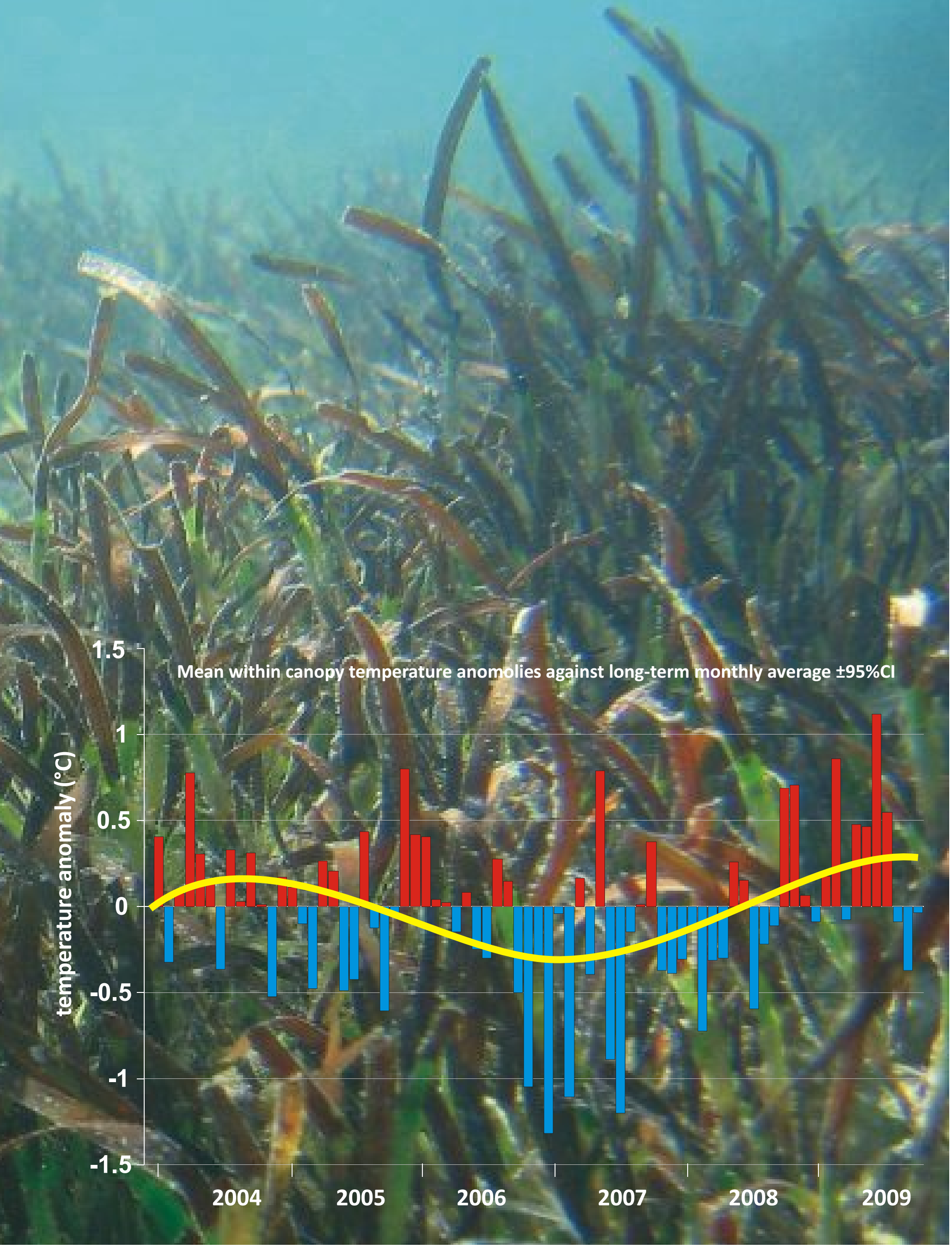
"There is greater than 90% certainty that increases in greenhouse gas emissions have caused most of the global warming since the mid-20th century. International research shows that it is extremely unlikely that the observed warming could be explained by natural causes alone...."

CSIRO 2010 State of the Climate

2009 ends the world's warmest decade on record. 2009 was also Australia's second warmest year on record since high-quality records began in 1910, and possibly the globe's 5th warmest year on record (about 0.44°C above the 1961-90 average). The Southern Hemisphere set a record in 2009 as the warmest year for that half of the world.

Although there is a high degree of interannual (year-to-year) and decadal variability in both global and hemispheric temperatures, underlying this variability is a long-term warming trend that has become strong and persistent over the past three decades. Sea surface temperatures around Australia have increased by about 0.4°C in the past 50 years and current sea surface temperatures are warmer than they have been over at least the past 250 years. Climate change scenarios suggest elevated temperature extreme ranges are projected to rise between 1.2°C and 4.1°C by 2100. Within this framework the impacts of increasing temperatures on seagrasses will be particularly significant for coastal intertidal and shallow subtidal seagrasses.

Intertidal seagrasses (both coastal and reef) are adapted to high air and water temperatures and desiccation through direct exposure to air. Experimental studies on tropical seagrasses demonstrate that the sensitivity is species specific as *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule uninervis* and *Thalassia hemprichii* are more tolerant to short term (1 to 4 hr) exposures of thermal stress (35 to 45°C) than *Halophila ovalis*, *Zostera capricorni* and *Syringodium isoetifolium*. The experiments also suggest that photosynthetic condition of all seagrass species are likely to suffer irreparable effects from short-term or episodic changes in seawater temperatures as high as 40 - 45°C. Ultimately, increased exposure to high temperature and/or desiccation can both



"The phenomenon known as "burning" of intertidal seagrasses is most likely a response to exposure and/or thermal stress associated with climate conditions..."

lead to the condition known as "burning".

Over the years the Seagrass-Watch program has reported many instances when intertidal seagrasses have been observed to be "burnt". Although generally restricted to tropical and sub-tropical regions, it is not an isolated phenomenon, and has been observed across several countries, species and intertidal seagrass habitats. In response to a lot of reports of burning in 2002, which coincided with coral bleaching events on the Great Barrier Reef (GBR) and throughout the Indo-Pacific, Seagrass-Watch implemented *in situ* (within canopy) temperature logging in September 2003 across Queensland.

Extreme temperature (40 - 42°C) events have been recorded on many occasions since monitoring was initiated. These events occurred during spring tides when meadows were either exposed to air or submerged up to 1.5m. Coastal locations such as Yule Point in the Far North reported 1-3 days in most years when extreme temperatures occurred (with the exception of 2009). Extreme temperatures have also been reported from other seagrass habitats, including fringing reef (e.g. Picnic Bay in 2009) and estuary (e.g. Sarina in 2006). The most southern location to report extreme temperature events was Rodds Bay in the Southern GBR in 2008.

In general, seagrass "burning" was observed when temperatures of up to 10°C above the seasonal average occurred, especially during low spring tides and midday solar exposure. During these events seagrasses may be exposed to elevated seawater temperatures for periods of 3 to 4 hours.

Results from the *in situ* temperature monitoring have also shown that the warmest year of monitoring was 2009, with the greatest monthly mean temperature anomaly of +1.12°C (above the 2003-2009 average) in August. The coldest year of monitoring was 2006 followed closely by 2007.

Seawater temperature directly affects seagrass metabolism, productivity and reproduction. This in turn can influence the seasonal and geographic patterns of species abundance and distribution. Increasing seawater temperature would result in the distribution of species more prevalent in tropical and equatorial waters expanding to higher latitudes. If mean sea surface temperature increases up to 2°C above ambient, we can also expect there to be a significant impact on species of seagrass that survive at the upper limit of their thermal tolerance.

Should such an increase in seawater temperature occur, we could also expect an increase in the frequency of burning events and possibly a decrease in seagrass abundance. Acute stress responses of seagrasses to elevated seawater temperatures are consistent with observed reductions in above-ground biomass in a number of locations worldwide with one episode of seagrass loss linked to an El Niño event. Such an impact would also be expected to favour a species composition dominated by *Halodule*/*Halophila* due to their faster recovery times and smaller stature limiting their exposure during low tide.

Some may argue that a small increase in water temperature may be beneficial to seagrass as metabolic rates increase with elevated temperatures. However, research has shown that this does not necessarily translate into an increase in shoot density and shoot size (denser meadows) because other factors, such as available light, may be limiting.

So what can we do? Mitigation of climate change is a key strategy, however as some climate change is inevitable, it is essential to protect and enhance seagrass resilience to climate change impacts. So by managing impacts that reduce resilience (eg water quality and light availability), and continued monitoring to evaluate the success of management performance, we can ensure our seagrasses survival.

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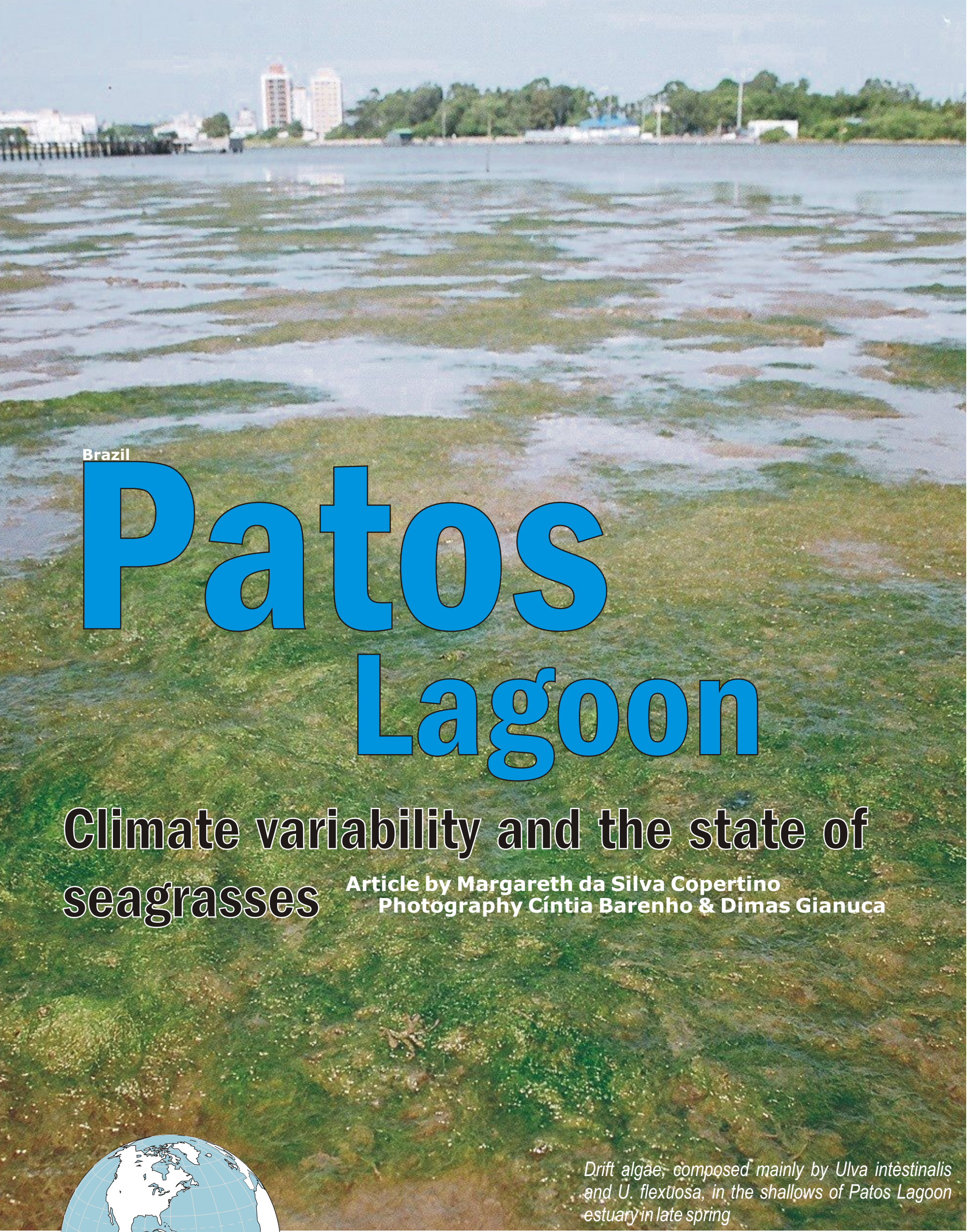
Brazil

Patos Lagoon

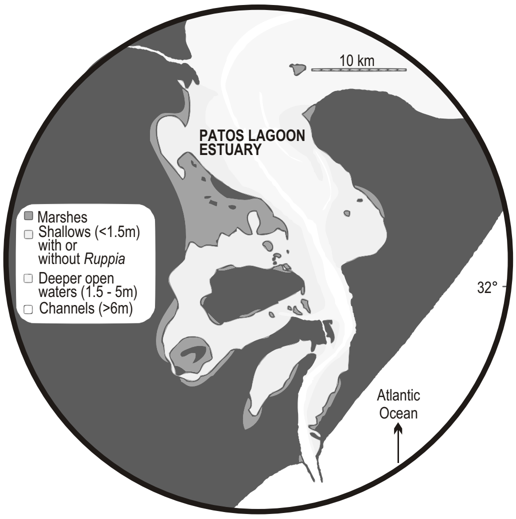
Climate variability and the state of seagrasses

Article by Margareth da Silva Copertino
Photography Cíntia Barenho & Dimas Gianuca



Drift algae, composed mainly by Ulva intestinalis and U. flextuosa, in the shallows of Patos Lagoon estuary in late spring

The "Lagoa dos Patos", in the Brazilian state of Rio Grande do Sul, is the largest lagoon in Brazil and the second largest in South America. The lagoon is 290 km long and up to 64 km wide, with an area of more than 10,100 square km. Photo courtesy of NASA



Seagrasses located on the southern coast of Brazil are subjected to extreme and variable environmental conditions. This is thought to maintain their low diversity and latitudinal distribution limit at the southeast Atlantic Coast. With a coast line dominated by exposed sandy beaches, seagrass meadows in the region are limited to very shallow areas of enclosed estuaries and coastal lagoons. Some of the most important of these meadows are located in Patos Lagoon, the largest choked lagoon in the world. This lagoon sustains an important fishery as well as economically important port activities. Fluvial discharge and winds are considered to be the main driving forces behind Patos Lagoon hydrology[1]. The lagoon has low annual average salinity (10-15 ppt) which is variable between and within years (0-35ppt). The most tolerant and eurihaline of seagrass species *Ruppia maritima* covers the shallow areas (<2.0m) forming both temporary and permanent meadows. These meadows also contain drift macroalgal species (mainly *Ulva* spp, *Cladophora* spp, *Rhizoclonium riparium*) and more oligohaline plants (e.g. *Zanichellia palustris*) may also be present at the high estuary. These shallow habitats are nurseries for important marine and estuarine fishing resources such as pink shrimp (*Farfantepenaeus paulensis*), blue crab (*Callinectes sapidus*) mullet (*Mugil platensis*), silver side (*Odonthestes argentinensis*), catfish (*Netuma* spp) and whitemouth croaker (*Micropogonias furnieri*). Such fisheries sustain an economy involving more than 3500 artisanal and 3000 industrial fishers[2].

Several studies have been conducted since the 1970's by the University of Rio Grande (Brazil) on the population ecology and physiology of *Ruppia maritima*, relative to a range of biotic and abiotic factors[3]. In addition, an ecological model of biomass production as a function of water depth and transparency was developed[4]. A long-term monitoring program was set up in 2000 to record the changes in spatial coverage and density of seagrass in the lagoon. By integrating monitoring results with previous studies and data, and analysing them relative to climate and hydrological parameters, an historical analysis of submerged aquatic vegetation (seagrass and macroalgae) has been performed for the last 30 years.

The variability of seagrass meadows in Patos Lagoon and their balance relative to algal populations is thought to be dependent mainly on hydrodynamics. Once water and sediment movements are moderated (usually in late spring and throughout summer), other factors such as water level, transparency, temperature and salinity, affect growth rates, biomass allocation and flower production. Due to these interacting effects, seagrass growth is concentrated in spring and summer, with meadows decaying or disappearing in winter. Although high spatial and temporal variability is intrinsic to the Patos Lagoon seagrasses, drastic reductions in abundance (4 to10 times lower biomass compared to values found in the 1980´s and 1990´s) and distribution (more than 50% reduction) could be observed between the end of the 1990´s end and the beginning of the 2000´s (Figure *a*). This has resulted in changes in seagrass community structure and meadows becoming increasingly fragmented.

These changes (including disappearances at more exposed areas) were strongly correlated to precipitation anomalies and extreme events (storms and wind generated waves), some of which were thought to be associated to ENSO episodes[5]. Within these ENSO periods (e.g. 1997/1998, 2001 to 2003), precipitation anomalies occurred in South Brazil, which was reflected by increases in Patos Lagoon fluvial discharge[1] (Figure *b*). The higher discharge and anomalous flows increased the estuarine average water level and turbidity, resulting in reduced salinity and enhanced sediment movement in the shallow areas. A single extreme event (October 2001), driven by a synergistic effect of high fluvial discharge and prevailing strong winds, quickly raised the estuarine water level, dislodging salt marsh areas and several seagrass meadows. The responses of *R.maritima* population to the unfavorable conditions were relatively fast, but the complete recover was a slow process (~10 years in some areas).

A reduction in the size of the seagrass seed bank and the low germination rates of *R. maritima* were considered likely to reduce the chances of meadow recovery. As a result of habitat fragmentation, remaining shoots and seedlings were considered highly vulnerable to even reduced levels of water and sediment movement, inhibiting meadow recovery. After the long El Niño phase, a strong La Niña brought a dry period with low fluvial discharge, resulting in low average water level and elevated salinity and transparency. Recovery of these habitats was dominated by fast growing drift macroalgae (*Cladophora* spp, *Ulva* spp) rather than seagrass and was related to the very high temperatures and salinity.

Dense meadows reappeared only in the summers of 2008 and 2009. High germination rates observed in spring 2007 were likely the result of extreme cold temperatures in winter coinciding with low salinities. As discharge and water quality conditions were highly favourable, fast growth and sexual reproduction was enhanced, with biomasses comparable to observations in the past. However, during the spring of 2009 and summer 2010, another El Niño marked its presence in South America by bringing high humidity and anomalous precipitation over the region. With a raised estuarine water level, low transparency and salinity, seagrasses suffered a new decline, and meadows have been found only in the very shallow and protected bays.

The observed changes in the abundance and structure of these estuarine plant communities are likely to have reduced the amount of available habitat for benthic invertebrates. Due to the importance of the seagrasses to local fisheries, observed changes are of concern. The results of seagrass monitoring in Patos Lagoon have important implications for understanding the impacts of regional climate variability and future long-term changes in climate on coastal ecosystems.

Figure A: Changes in the structure of submerged aquatic vegetation across periods from 1980 to 2009: R.maritima and drift algae biomass (left axis); R.maritima population parameters (right axis) expressed as a relative index standardized to the maximum value found during the period.

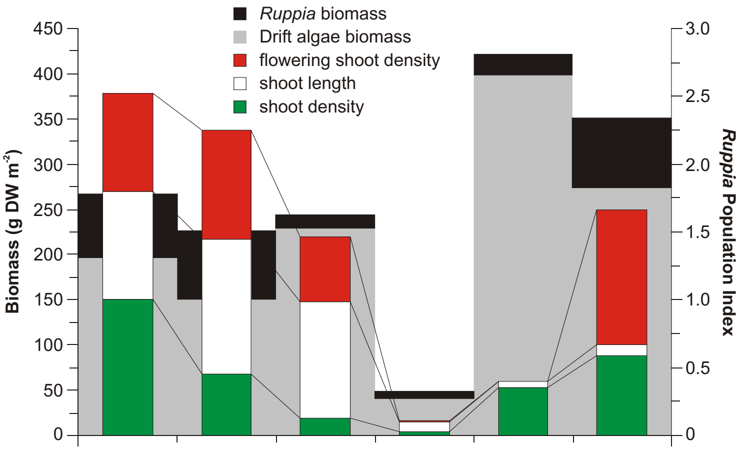
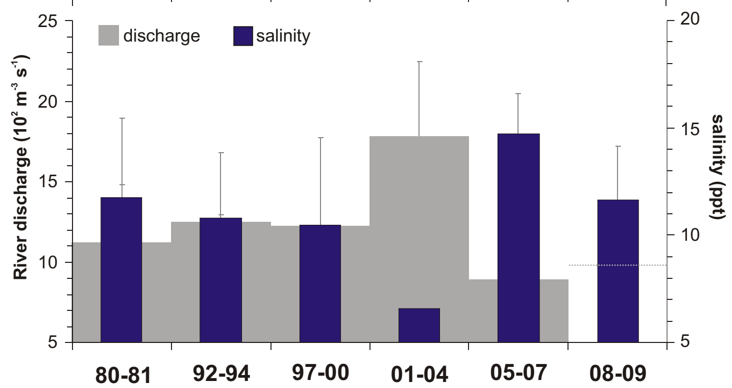


Figure B: Average fluvial discharge and salinity for each period.



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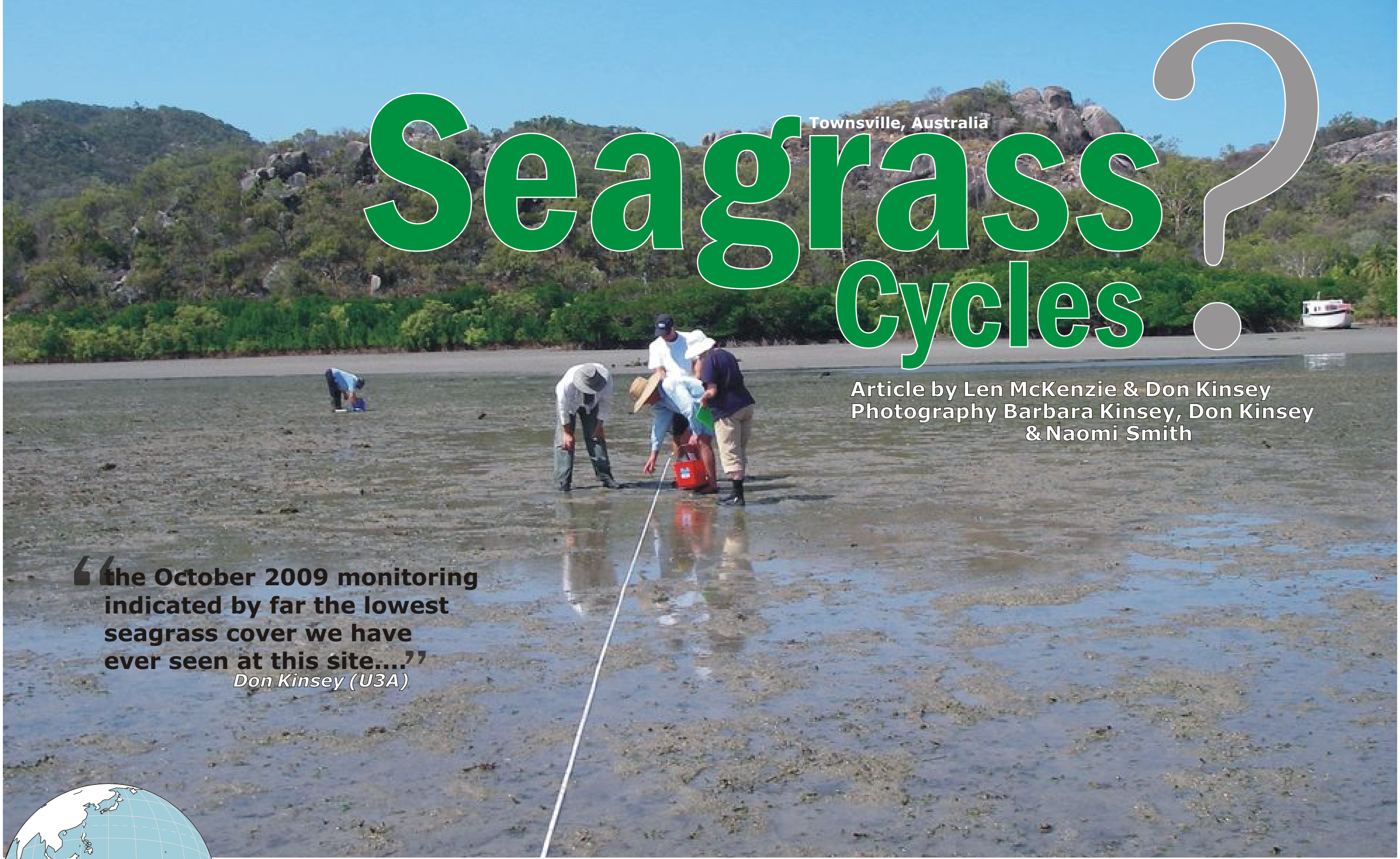
5. Odebrecht et al. (2010). In: Paerl and Kennish. (Org.). Coastal Lagoons: Human and Natural Impacts. In press.

Fishing fixed nets, called "redes de saquinho" (little bag nets) or "redes de aviãozinho" (little plane nets), used to catch shrimp at shallow waters (up to 2m). The nets are usually located outside seagrass meadows.

Insert: Pink-shrimp, Farfantepenaeus paulensis, an important Patos Lagoon fishing resource.



Townsville, Australia

Seagrass Cycles?

Article by Len McKenzie & Don Kinsey
Photography Barbara Kinsey, Don Kinsey & Naomi Smith

> **"the October 2009 monitoring indicated by far the lowest seagrass cover we have ever seen at this site...."**
> *Don Kinsey (U3A)*

Cockle Bay is on the south western shores of Magnetic Island, 7km offshore from the City of Townsville, northern Queensland. Located in the dry tropics, the bay experiences a summer wet season and a winter dry season with mean daily temperatures ranging from a minimum in July of 25.0°C to a maximum of 31.4°C in December/January.

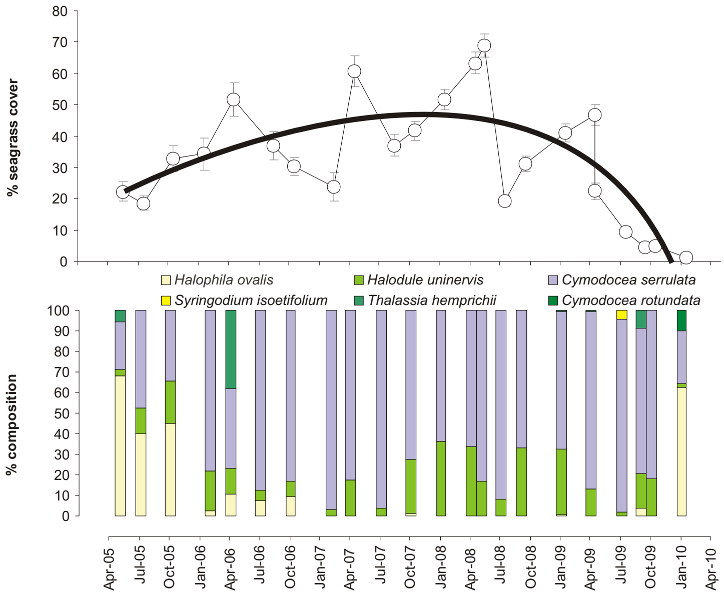
Seagrasses are a prominent and important feature of Magnetic Island's marine environment. Twelve species and approximately 1,500 hectares of seagrass surround the Island. The seagrass was first mapped during a broadscale survey in 1987 and again in 1996. In 2007/2008 more detailed mapping of seagrass meadows was conducted along the southern bays of Magnetic Island (within the Townsville Port Limits). While detailed historical comparisons are not appropriate (due to different sampling techniques), overall distributions of coastal seagrass meadows over the 2 decades were similar. Since then however, annual monitoring by Fisheries Queensland (in partnership with the Port of Townsville) of a representative set of intertidal and subtidal seagrass meadows indicates some declines.

Cockle Bay has a long history in seagrass research and monitoring. Cockle Bay was the site of one of the seminal research studies on seagrass succession. In 1984, Birch and Birch[1] published their paper which concluded that recolonisation is directional and follows a deterministic pattern based on a seagrass species' resistance to disturbance, tolerance of emersion and tolerance to low salinity. The late William Birch first started observing seagrasses in Cockle Bay in 1968, but on 24 December 1971, Tropical Cyclone Althea almost completely denuded the bay of its seagrasses. This provided Birch with an opportunity to track the seagrass recovery over the next decade (one of the first long-term studies of its kind).

Cockle Bay, April 2006

Birch reported that nine months after the 1971 cyclone, the previously vegetated bay could only produce isolated seagrass plants of *Halophila* and *Thalassia* (separated by about 10m from each other). By monitoring the seagrass along two 270m transects in June/August of each year, they were able to show the progression of meadows dominated by pioneering to climax species. Ten years after disturbance, *Halophila* reached a steady state, unlike *Halodule uninervis* whose frequency was still increasing. *Cymodocea serrulata* slowly recolonised the thicker sediments before being outcompeted by the calcareous alga *Halimeda*. Although *Thalassia hemprichii* survived the cyclone better than other species, it was never, and it never became, an important component of the meadows. The seagrasses were classified into pioneer, competitor or tolerator classes, and a largely deterministic model of their patterns and processes was suggested.

What Birch and Birch[1] found was that the meadows first progressed from *Halophila*/*Thalassia* dominated to *Halodule*/*Halophila*/*Thalassia*-dominated. If the sediments were shallow, then the meadows climaxed to *Halodule*-dominated communities (with *Cymodocea*/*Halophila*) or *Syringodium* in some cases. But if the sediments were deeper, then the potential climax meadow was dominated by *Cymodocea* (with *Halodule*/*Halophila*). This successional pattern is still commonly accepted today.



Interestingly, William Birch reported a small patch (a female plant) of *Enhalus acoroides* in Cockle Bay, which he observed over 12 years, and reported it remained stable and intact. Cockle Bay is possibly the southern geographical limit of *Enhalus acoroides* distribution in Queensland. Recent searches of the bay however have failed to find any *Enhalus* plants.

Twenty years after Birch and Birch's publication, seagrass monitoring began again in Cockle Bay. This time it was motivated by the University of the Third Age (U3A) and the desire to participate in local environmental monitoring. In 2005 the seagrass meadow at Cockle Bay was extensive and abundant. Anecdotal reports indicated that the seagrass meadow at Cockle Bay had been impacted by Cyclone Tessi and associated flooding in 2000. In 2005 this impact was no longer apparent.

A Seagrass-Watch site was established and it was reported to be predominantly a mixed *Halophila ovalis*/ *Cymodocea serrulata*/ *Halodule uninervis* meadow. Over the next five years however, the meadow developed to a *Cymodocea serrulata*/*Halodule uninervis*/*Halophila ovalis* meadow (similar to Birch and Birch predictions) with considerable additional cover by *Halimeda* in large, frequently discrete mounds. By 2008, *Halophila ovalis* was almost absent from the site though occurred sparsely in the higher intertidal adjacent to the mangroves. Before the meadow could climax into a coralline algae bed, flooding across the region in early 2009 had a severe impact on the meadow. Throughout 2009 the seagrass cover declined significantly. Seagrass mapping in October 2009 by Fisheries Queensland[2] reported that although the extent of the meadow had changed little since 2007, the seagrass biomass had declined by nearly 80%. The extensive *Halimeda* mounds had also largely disappeared, however this seems to have begun just before the early 2009 wet season floods; somewhat inconsistent with the hypothesis of a coralline algae bed being the climax community. By early 2010, the meadow has shown little sign of recovering. With low seed reserves and low reproductive effort (see issue 39), it may be some time before the meadow fully recovers.

References:

1. Birch, WR & Birch, M. (1984). Aquatic Botany. 19: 343--367

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Cockle Bay, September 2009

Cyclone Season

Article by Len McKenzie
Photography Len McKenzie & Rudi Yoshida
Cyclone image courtesy of NASA

The 2009-10 Australian region cyclone season officially started on 1 November 2009 and ends on 30 April 2010. Severe Tropical Cyclone Ului was the third tropical cyclone in Queensland for the 2009/10 season and was one of the fastest intensifying tropical cyclones on record; strengthening from a tropical storm to a category 5 cyclone within 24 hours.

Originally identified as a tropical low in the Pacific Ocean to the north of Vanuatu, it was upgraded to Tropical Cyclone Ului on 12 March. Over the next 24 hrs Ului strengthened to category 5, making it a severe tropical cyclone. Fortunately, over the next few days, TC Ului weakened to category 2 as it slowly moved on a south to southwesterly track across the Coral Sea toward the central Queensland coast. At approximately 1.30am on 21st March (local time) TC Ului, with winds of up to 200 kilometres an hour, crossed the outlying Whitsunday Islands and made landfall near Airlie Beach.

The region had escaped catastrophic damage, but significant wind damage was reported around the Central Coast and Whitsundays district, mainly between Airlie Beach and Mackay. Reports of damage included widespread tree damage, large areas of sugarcane destroyed and localised structural damage. Many boats were also damaged or destroyed due to large seas and swell created by Ului, particularly around Shute Harbour and Airlie Beach. Most of the major damage occurred at Proserpine and the areas to the south. Some locations reported over 200mm of rain in 24 hours. TC Ului hit the coast nearly four years to the day when the more destructive category 4 Cyclone Larry crossed the coast fur ther north near Innisfail on March 20, 2006 (see issue 26).

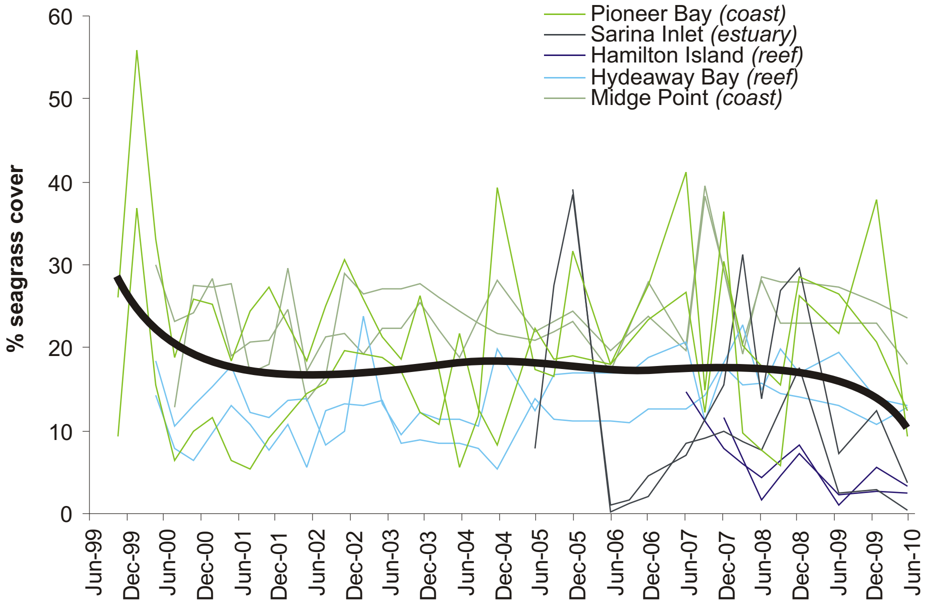
Within days of the cyclone crossing the coast, Seagrass-Watch HQ (Fisheries Queensland) was on the ground to examine the impacts, if any, to the intertidal seagrass meadows.

All types of intertidal seagrass habitats in the region were examined, including: fringing reef (island and mainland), coastal and estuarine. This included 5 monitoring locations from Hydeaway Bay in the north to Sarina Inlet in the south.

Significant impacts were observed at both coastal locations examined (Pioneer Bay (Airlie Beach) and Midge Point). The most obvious impacts were severe erosion at the landward margin and the occurrence of blowouts across the intertidal banks. Blowouts are grass-free depressions within seagrass meadows which are characteristic of moderate to strong wave action where the seagrass mat is disrupted and rhizomes are exposed. Blowouts alter successional development of seagrass meadows and may result in changes to seagrass species composition.

Seagrass abundance in the week following TC Ului was low compared to the long-term regional average, however not all locations had declined below their expected seasonal abundances. Greatest declines were reported for Pioneer Bay, Hamilton Island and Sarina Inlet.

Sarina Inlet meadows had been recovering since they were lost in 2006 possibly a consequence of flooding associated with TC Larry and the Monsoon. Recovery had been slow as reproductive effort was low. The most significant impact on the intertidal banks after Ului was sediment movement and deposition. A large creek had developed adjacent to the meadow and sedimentation from the runoff had smothered much of the meadow.



The meadow at Hydeaway Bay was relatively unimpacted, with no visible signs of disturbance. The location was possibly sheltered from the destructive winds by the hills on the adjacent coast and the reef crest seaward.

The long-term prognosis of the seagrass meadows in the impacted region is unknown. Meadows impacted in the late Monsoon generally continue to decline for the next 6 to 9 months as their energy reserves are lower than accustomed approaching the senescent season. The low reproductive effort also suggests lower resilience to these acute impacts. Full recovery may take 2-3 years or more. During this recovery phase, it is important that the meadows are not further impacted as this will reduce the plants ability to grow and restore. Continued monitoring will track the success of the recovery.

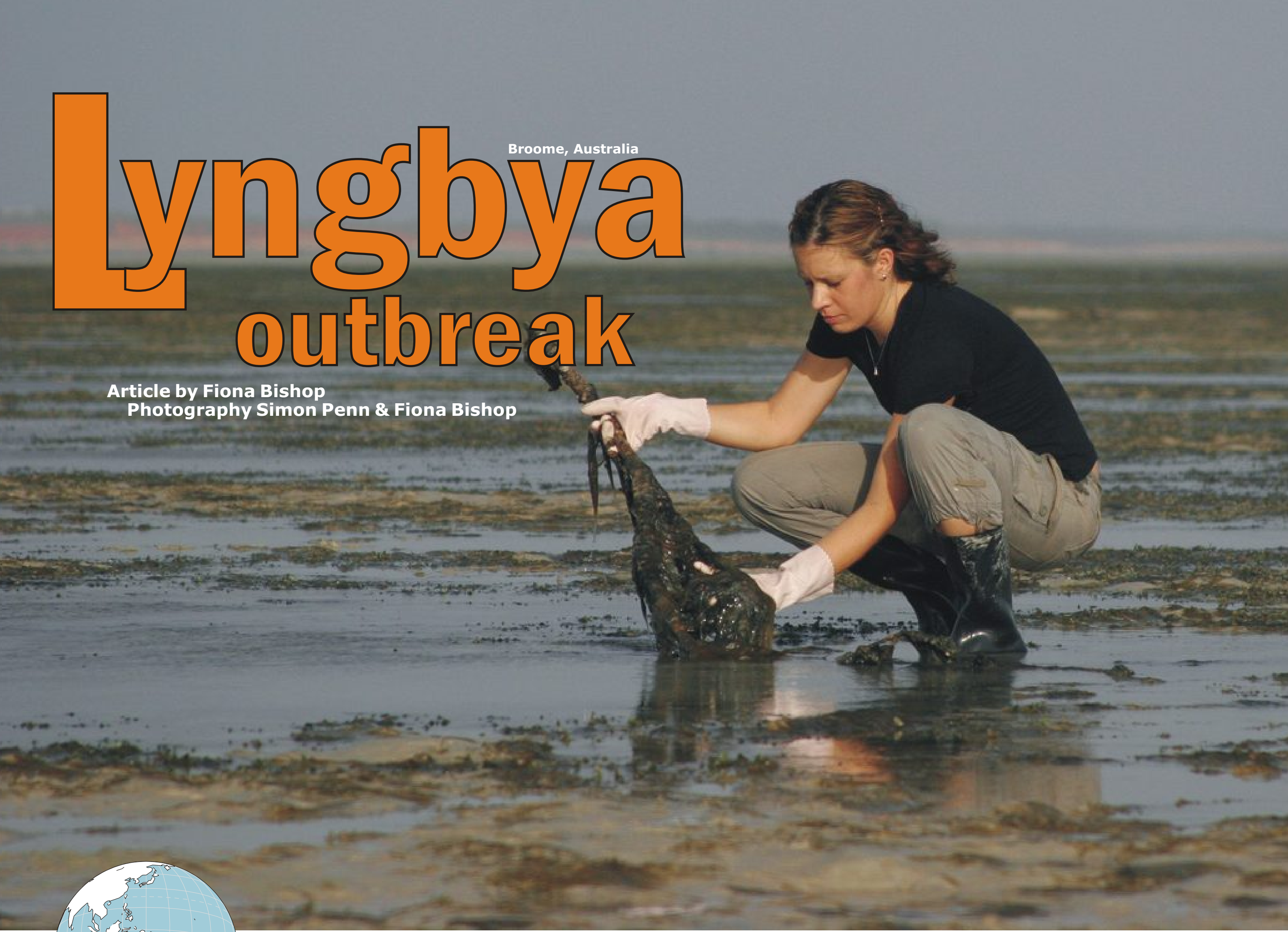
14 October 2009

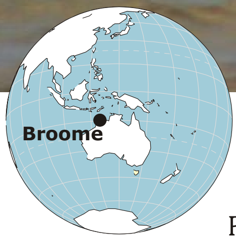
Pioneer Bay: Blow outs caused by wave action from Cyclone Ului, 28 March 2010

Lyngbya outbreak

Broome, Australia

Article by Fiona Bishop
Photography Simon Penn & Fiona Bishop





The lush green seagrass meadows of Broome's Roebuck Bay have become smothered by the blue-green cyanobacterium *Lyngbya majuscula*, causing concern amongst Broome Community Seagrass Monitoring Project Volunteers, and the wider community of Broome.

There has been an increasing number of severe *Lyngbya* outbreaks in Roebuck Bay observed in recent years, with dark slimy globs usually appearing after the first rains of the wet season, and the murky-coloured and foul-smelling mass then rapidly spreading so that it is visible from horizon to horizon, choking the formerly vibrant green seagrass meadows.

The *Lyngbya* outbreaks are of particular concern in light of Roebuck Bay's extraordinary ecological values. The bay is a world-renowned biodiversity hotspot. Roebuck Bay is listed under the global Ramsar Convention treaty as an internationally significant wetland and its rich intertidal mud flats are a Threatened Ecological Community under WA State Environmental Law. Roebuck Bay is also one of the most important migratory shorebird sites in Australia, with the birds flocking there from across the globe to feast on the abundant invertebrates and fish.

Roebuck Bay's seagrass meadows, which are being suffocated by the *Lyngbya,* are fundamental to the health of the wider marine and coastal ecosystem. As well as migratory shorebirds, threatened species including dugongs and turtles depend on the seagrass as a source of food. The seagrass provides habitat for thousands of smaller marine animals such as crabs, starfish, worms, snails, shells and anemone. As a nursery for fish and prawns and as one of the foundations of the marine food chain, seagrass is vital for sustaining commercial and recreational fisheries. Every year that the *Lyngbya* chokes the seagrass ecosystem, the whole of Roebuck Bay and the surrounding coastal area suffers.

As well as this, *Lyngbya* is a human health risk, becoming toxic at certain stages in its development. The toxins in *Lyngbya* can become airborne and may be inhaled when the *Lyngbya* dries, causing asthma and respiratory problems. The toxins in the *Lyngbya* cyanobacteria are water soluble, and can cause eye and skin irritations such as dermatitis, as well as nausea and vomiting, in those who come into contact with it. The Broome community has been advised by coastal managers to avoid the *Lyngbya.* Some community members needing to visit the bay for work have been advised that waterproof clothing, gloves and protective glasses are necessary.

Dugong Feeding trail in healthy meadow, prior to Lyngbya outbreak (Roebuck Bay)

Healthy meadow before the wet season

Lyngbya smothering seagrass

The exact causes of the *Lyngbya* bloom in Roebuck Bay are not clear, but community members are concerned about nutrients and sediment entering the Bay from land use activities. There have been calls from the community for a cross-agency commitment to identify the cause of the *Lyngbya* and to implement a management plan once findings and recommendations are made.

With scientists from around the world flocking to Roebuck Bay to study its remarkable ecosystem and biodiversity, concern over the *Lyngbya* bloom has extended beyond our region, into the wider global scientific community. To locals, who know Roebuck Bay as a place of great economic, cultural, and recreational value, the issue is worrying on a more personal level. Everyone hopes a solution can be found to stop the assault of the *Lyngbya* before it does any more damage.

The Broome Community Seagrass Monitoring Project is funded by Coastwest and the Port of Broome, co-managed by Environs Kimberley and Department of Environment and Conservation.

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Accidental exposure to *Lyngbya*

Exposure to *Lyngbya* can cause severe irritation including:

- skin and eye irritation
- respiratory irritation and exacerbation of preexisting respiratory conditions such as asthma following inhalation of dried *Lyngbya*
- gastrointestinal irritation following ingestion of dried *Lyngbya.*

The main aim of first aid treatment is to wash (with soap and water) areas of the body that have come into contact with *Lyngbya* as soon as possible after exposure has occurred to remove any residual material. If *Lyngbya* is possibly trapped in clothing (eg swim wear) the clothing should be removed.

Cool compresses may provide some relief from skin irritation. If eye contact has occurred flush the eyes thoroughly with clean water or saline.

Medical attention should be sought if:

- the eyes are affected
- the extent and severity of irritation is causing concern
- the person complains of respiratory discomfort after swimming in affected water or breathing in dried *Lyngbya* material, particularly if they have an existing respiratory condition such as asthma.

For more information:
http://www.deir.qld.gov.au/workplace/resources/pdfs/factsheet_lyngbya.pdf

Lyngbya majuscula (Lyngbya), also known as mermaid's hair or fireweed, is a naturally occurring, toxic, blue-green algae that can occur in bloom proportions in some coastal waters in Australia. Exposure to Lyngbya can cause severe irritation

Indonesia

Seribu seagrasses thriving

Article by Edy Setyawan and Aar Mardesyawati
Photography TERANGI

Seribu Islands National Park (TNKS) is located in the mid to northern region of the Seribu Islands. TNKS continues to support interesting coastal ecosystems which consist of seagrass, mangrove, and coral reefs. Among them, seagrass has received less attention from researchers and government compared to the other ecosystems. Thus, limited data is available on the status of seagrass in TNKS or even the Seribu Islands overall. In 2009, TERANGI conducted a seagrass assessment in TNKS management zones to compare with the last assessment in 2007. The purpose of this assessment was to provide a current status of seagrass resources in TNKS by determining seagrass extent and species diversity.

The assessment was conducted in November 2009. Thirty-six locations were examined, representing core zones (4 locations), protection zones (3 locations), residential zones (9 locations), and utilization of tourism zones (12 locations). Observations were done using five 0.5x0.5m^2 quadrats in each transect. In each station, two or three transects were laid down 25 m apart, parallel to each other and perpendicular to shore.

From 480 quadrats examined, the seagrass cover varied from 0 to 42.6%, with an average of 12.1%. The highest seagrass cover was found at Kelapa Island, a location in a residential zone. Eight of 36 locations observed had no seagrass. Seagrass was absent mostly from small islands (e.g. Kuburan Cina Island) or narrow cays (e.g. Sulaiman Cay) which either had a narrow or absent reef flats.

Overall, 10 species of seagrass were found in TNKS: *Enhalus acoroides, Thalassia hemprichii, Cymodocea rotundata, Cymodocea serrulata, Halophila ovalis, Halophila minor, Halophila decipiens, Syringodium isoetifolium, Halodule uninervis*, and *Halodule pinifolia*. The assessment in 2007 reported only eight species of seagrass. The two species which were not found in 2007 were *Halophila decipiens* and *Halodule pinifolia*.

The highest number of seagrass species found in a location was 6 species at Panggang Island. In residential zones, there were 3 or 4 species of seagrass, while in other zones only 1 or 2 species. Among all the seagrass species, *Thalassia hemprichii* dominated more than a half of the total seagrass coverage (53.1%). *T.hemprichii* can tolerate a wide range of limiting factors so it can live in many habitats. *Halophila ovalis* had the lowest coverage (0.03%).

Spatially, seagrass coverage in each zone of TNKS varied from 0.2 to 23.9%. Core zones had the lowest seagrass coverage with only 0.2%. The highest seagrass coverage was found in residential zones (23.9%), followed by utilization of tourism zones (10.1%), and protection zones (5.8%). Seagrass located near inhabited islands and on wide reef flats, like in residential zones, tended to have a higher coverage and species richness. It seems that sheltered locations between small islands, nutrients in runoff from inhabited islands, and lack of direct utilization of seagrass by the local community have supported the growth of seagrass.

Pangandaran seagrasses

Article by Budi Irawan, Ichwan Nasution & Syarif Hidayatullahi
Photography Indonesia Seagrass Monitoring Program
Seagrass image courtesy Seagrass-Watch HQ

Pangandaran is a small peninsula in the southern part of Java, facing the Indian Ocean. The peninsula, has two bays, Pangandaran Bay (east) and Parigi Bay (west) and is divided into a Terrestrial Nature Reserve, Marine Nature Reserve and a Nature Recreation Park. It is also a major tourist destination.

In July 2006, a tsunami hit the area, when an undersea earthquake measuring 7.7 triggered a three metre wave that caused extensive damage and killed hundreds of people.

Pangandaran consists of various types of ecosystems such as lowland tropical forest, coastal forest, coral reefs and seagrass meadows. Compared to other ecosystems, little was known about the presence and condition of seagrass meadows in this area.

In May 2009, a rapid survey of seagrass condition was conducted at Pangandaran, which included species occurrence and total coverage.

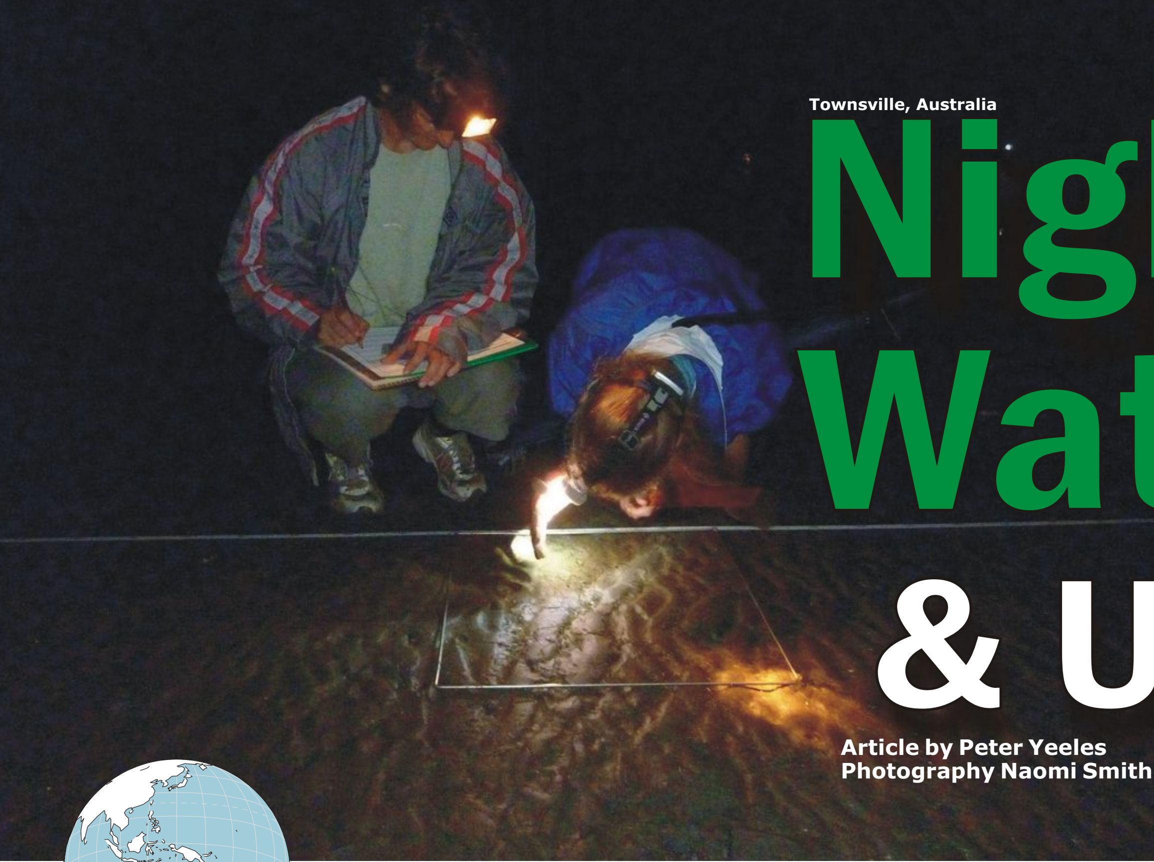
Based on our rapid survey, seagrasses were found in two locations: east coast (Pangandaran Bay) and west coast (Parigi Bay).

Seagrass meadows on the east coast of Pangandaran were heterogeneous, consisting of at least 3 species: *Cymodocea rotundata*, *Thalassia hemprichii* and *Halodule pinifolia*. We found seagrasses in two sites, Rengganis and Batu Layar, with total cover of seagrass at 86.7% and the dominant species was *H. pinifolia*. Substrate type in this location was sand with mud, and from visual observations, sedimentation was occurring in the area.

Seagrass meadows on the west coast of Pangandaran were monospecific, containing only *Thalassia hemprichii*. In this area, we found seagrasses along Pasir Putih Bay with low total cover (7.4%). Substrate type at this location was white sand with coral rubble.

Nowadays, there are some disturbances to the seagrasses in Pangandaran. The major impacts are caused by local tourists. This is because the sanctuary is a major tourist area. Additional impacts may also arise form the use of the area as a major fishing port.

Left to Right: West and East coasts of Pangandaran



Townsville, Australia

Night Watch & UFOs.

Article by Peter Yeeles
Photography Naomi Smith

It was a little unusual donning my dive boots to head out for a seagrass survey in the middle of the night, but it turned out to be a great experience. Mosquito repellent replaced sun block, head-torches replaced wide-brimmed hats and as is the norm for this time of year, rain jackets were a pre-requisite. It had been raining hard all day, but luckily by midnight the rain was light and stopped completely by the time we arrived at the site. I arrived at around half past midnight to find a small group of fellow seagrass watchers waiting to open the gate.

The mosquitoes were out in force, their numbers buoyed by the recent rains. Under the lights of the car park it was a case of keep moving or be eaten alive, as no amount of repellent seemed to deter them! Luckily their numbers thinned as we walked out to the site, and with a light sea breeze they didn't cause too much discomfort.

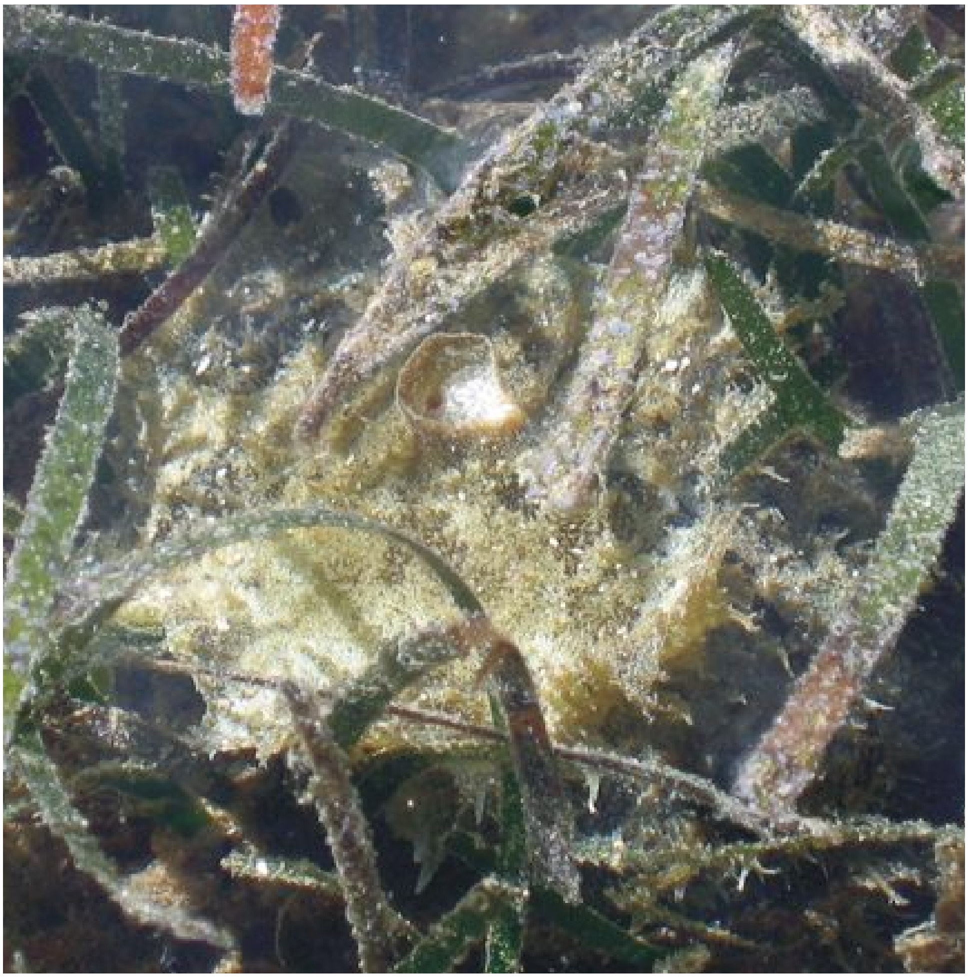

Small bivalves attached to seagrass leaves

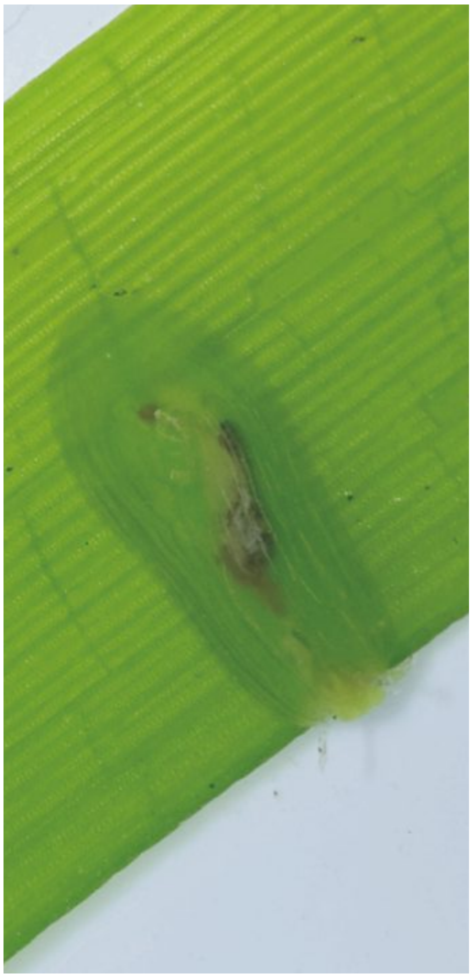
The groups initial consensus at the site was that there had been an increase in seagrass abundance, and upon reviewing the data collected this view was confirmed. Two seagrass species were found at SB1 with narrow-leafed seagrass *Halodule uninervis*, being the most abundant and in greater densities than in the previous survey last September. Small amounts of *Halophila ovalis* were found in transects 1 and 3. Seed counts yielded a similar number to the previous survey. Interestingly, the majority of seagrass leaves were covered in what was initially thought to be algae. Upon closer inspection it was determined that it was a covering of small bivalves, covering anywhere between 30% and 80% of a large proportion of leaves. The usual fauna of small gastropods and hermit crabs were noted in various quadrats across the site.

One of the exciting things about getting out onto the flats and monitoring seagrass, is the variety of marine life that can be found. Being more of a terrestrial biology student, the weird and wonderful things that marine ecosystems produce never ceases to amaze. One of the more unusual creatures which the Townsville seagrass team have come across lately were bright green polyps found clinging to a bit of driftwood. These were found during the night survey, and the green rings lit up beautifully under torchlight.


Unidentified animals attached to driftwood

A couple of days later, on the way to survey SB2 some fellow beachcombers showed us an Unusual Floating Object (UFO!), which was so strange that no one in the group had any idea of its origins. A photograph was duly taken as a record, and it was later identified as a porcupine fish swim bladder. With no sign of it's owner on the beach you do have to wonder how it got there on its own!





SEA HARES..continued from page 16...

other sea hares as the back of the body is a sloping disc-like shield, with papillae around the edge and one large exhalant siphon in the middle. *Dolabella* is well camouflaged with mottled shades of green and brown.

Sea hares are herbivores, eating blue-green algae (cyanobacteria) and epiphytes on seagrass blades. Often when blooms of cyanobacteria occur over seagrass meadows, sea hares can appear in large numbers. Sea hares scrape the material from the seagrass leaves, without damaging them. Epiphyte herbivores can benefit seagrass by removing material which can limit light reaching the leaves. These relationships can be important to the survival and productivity of seagrasses.

Some sea hares are mobile during the day and others at night. During early morning, some can be found in immobile aggregations. Three to four hours after sunrise, these groups disperse and the animals spend the day as mobile individuals or pairs feeding. Late in the afternoon and during the two to three hours following sunset, the animals reassemble. It's thought that the animals feed during the day and engage in reproductive behaviour during the night. However, *Dolabella* lies buried in the sand during the day with only their siphons exposed, but from late afternoon to early morning they feed and move about

Dolabella auricularia is a delicacy for indigenous Fijians and women fishers are well known for gleaning shallow seagrass meadows for the animals. *D. Auricularia,* known as veata, is collected both for subsistence and sale in the local markets. The heart, the upperside and egg masses (kavere) of *D. auricularia* are a good cheap source of protein and income in many parts of the Pacific including Fiji, Philippines, Samoa and Kiribati. In the Fiji Islands, the egg masses and the animal are eaten either raw or half-cooked and are usually marinated with lemon juice.

In general, sea hares are quite harmless. While not usually considered poisonous, there have been a few accounts of *Dolabella auricularia* causing food poisoning, but it is suspected that it is the result of some poisonous algae in the internal organs. In Western Australian, the species *Aplysia gigantea* has also been accused of poisoning dogs.

So next time you're in the seagrass, keep an eye out for sea hares and mind your step!

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Above: A tiny translucent sea hare (Phyllaplysia sp.) grazing epiphytic algae from Enhalus acoroides blades in Singapore.
Above left: Dolabella auriculaira (image :Len McKenzie)
Below: Bursatella leachi (about 5cm long) mottled brown and beige with two rows of blue spots along the back, and covered in long protuberances (papillae) that give them a 'shaggy dog' appearance.

Many sea hare species emit a purple ink-like fluid when distressed....

Animal facts

Sea Hares

Article by Len McKenzie
Photography Wildsingapore.com

Have you ever noticed a purple stain in your footprints when walking across a seagrass meadow? If so, it's most likely you've just disturbed a concealed sea hare. Many sea hare species emit a purple ink-like fluid when distressed, and sometimes individuals are so abundant they are difficult to avoid.

Sea hares are slug-like molluscs of the family Aplysiidae and are found all around the world in temperate and tropical waters. The sea hares consist of 9 genera and range in size from less than 2 cm to over 70 cm in length. They usually have a head bearing a pair of enrolled tentacles (rhinophores, which look like elongate ears) just behind the eyes, and large flattened, enrolled oral tentacles on each side of the mouth. Sea hares get their name from their supposed similarity in shape to an alert European Hare, with ears pricked.

Studies on sea hares suggest that the rhinophores and oral tentacles function as organs of touch and smell; sensing dissolved molecules in the water. Their eyes are poorly developed and only able to sense light and shade. This allows them to sense the shadows of potential predators and detect day and night.

Most sea hares, like most sea slugs, have evolved and gradually lost their shell. In some species the shell is a flattened lightly calcified plate, partially or fully enclosed in the mantle skin, and forms a weak protective layer over the internal organs. In species where the shell is completely absent, to protect the gill and other organs they have evolved large flaps of skin from the edge of their foot which are called parapodia which fold up over the mantle. In some sea hares, the parapodia fuse together to form a secondary parapodial chamber. The only way into and out of this chamber is through a pair of siphons which allow fresh sea water to be pumped in over the gills, and deoxygenated water and waste products to be pumped out.

All sea hares are hermaphrodites, which mean they are fully functional males and females. Their penis is located in a sac on the right side of their head. To get sperm to the penis from the reproductive opening in the mantle cavity, there is a sperm groove which runs from just in front of the gill along the body just below the right rhinophore to the opening of the penis sac alongside the right oral tentacle.

Sea hares commonly encountered in seagrass meadows of the tropical Indo-Pacific include the ragged sea hare *Bursatella leachi*, the smaller *Stylocheilus striatus*, and the larger wedge sea hare *Dolabella auricularia*. *Bursatella leachi* is about 5cm long, mottled brown and beige with two rows of blue spots along the back, and covered in long protuberances (papillae) that give them a 'shaggy dog' appearance. *Stylocheilus striatus* is more elongate in appearance, usually has dark longitudinal lines, and has smaller and more numerous blue or purplish spots scattered over the body. *Dolabella auricularia* differs in shape to

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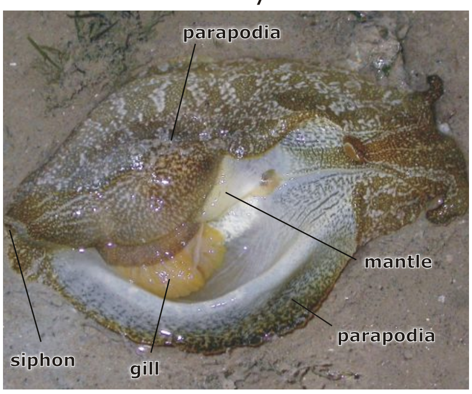
head

body



Geographic sea hare (*Syphonota geographica*) laying eggs