

Seagrass-Watch

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

A decade of seagrass monitoring

Connectivity: should we really care?

Seagrasses of northern Palk Bay

Strength to strength in WA

Seribu Islands' seagrasses

U3A keeps watch

Lion Village monitors first site

Converting the masses

Jellyfish



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From the editor

Seagrass meadows are among the most threatened ecosystems on earth. Information on their status is solely dependent on monitoring efforts and this is how Seagrass-Watch plays a globally important role. With over ten years of monitoring data now available, there is now a better understanding of not only how seagrass meadows change within and between years, but also between habitats and regions. Unfortunately, some regions are less well monitored than others and this needs to be addressed.

Rising to this challenge is the increase of participants across the Indo-Pacific, including Thailand, Indonesia, Fiji and Western Australia. Read about their efforts and those of Team Singapore on how to raise public consciousness about the importance of our beloved marine flora.

You can also read about the importance of connectivity and why marine managers should take a more holistic approach to MPAs. Read how the monsoon is a major driver of seagrass in Palk Bay (India) and the significance of Seribu Islands' seagrass.

In this issue are also articles on monitoring efforts by U3A in Townsville and educational efforts in Torres Strait and Suva. You can even learn about jellyfish.

COVER:

Green Island seagrass meadow (Qld, Australia).
Photographer Len McKenzie

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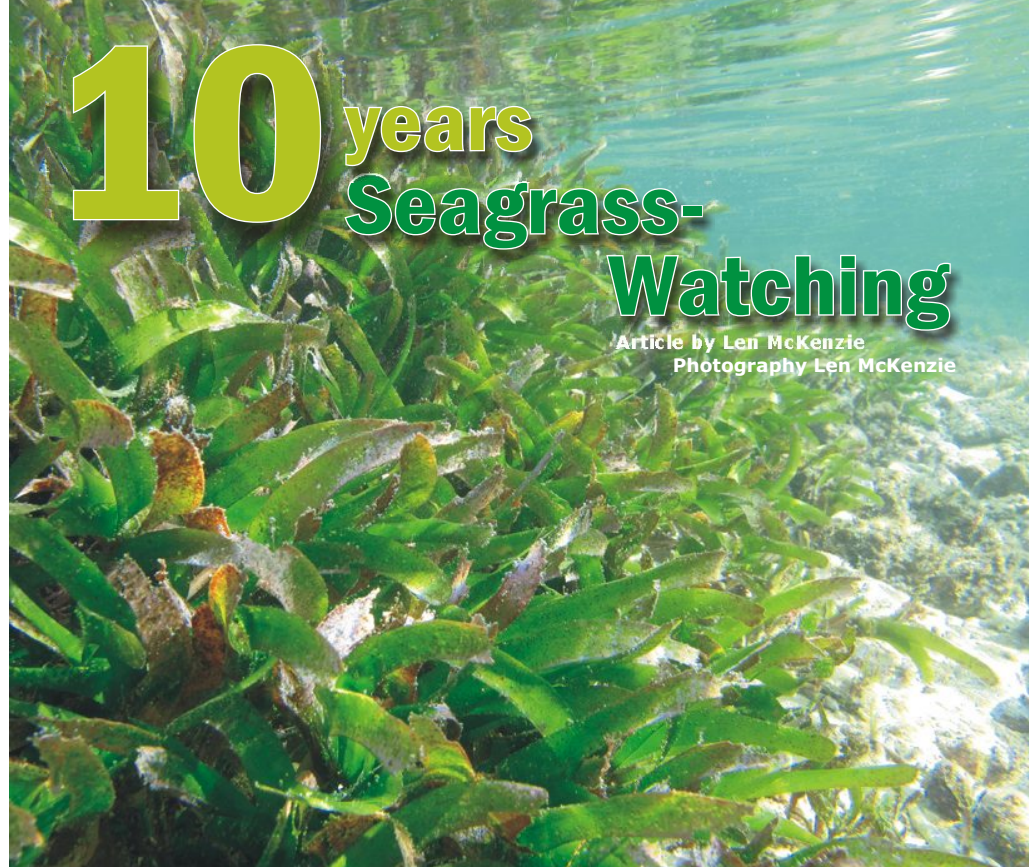
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Seagrass-Watch acknowledges the Traditional Owners on whose sea country we monitor

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Article by Len McKenzie
Photography Len McKenzie

August 2009 marked a decade of Seagrass-Watch monitoring. This makes Seagrass-Watch one of the most comprehensive seagrass monitoring programs globally.

Since 1990, seagrasses globally have been declining at a rate of 7% per year. Furthermore, a recent study published in Proceedings of the National Academy of Science (PNAS 106(30): 12377–12381) found that 29% of the known seagrass areal extent has disappeared since seagrass areas were initially recorded in 1879 and that seagrasses have been disappearing at a rate of 110 km² yr⁻¹ since 1980. That is equivalent to two football (soccer) fields per hour. Understandably, these figures are disturbing and place seagrass meadows among the most threatened ecosystems on earth.

As most Seagrass-Watch participants are aware, seagrass meadows provide important ecosystem services, including an estimated \$1.9 trillion per year in the form of nutrient cycling; sediment stabilization; sequestration of carbon; habitat for fish, bird, and invertebrate species; food for dugong and endangered green turtles; and commercial and subsistence fisheries. Seagrass also support important linkages between mangrove and coral reef habitats (see article page 8).

Multiple stressors are the cause of this decline, in particular the negative impacts accruing from the billion or more people who live within 50km of a seagrass meadow.

Information on the status of seagrass resources both locally and globally is solely dependent on monitoring efforts. The recent PNAS article recognises that the largest data gap exists in the tropical Indo-Pacific region (from East Africa to Hawaii), where seagrasses are widespread and abundant. Given the rapid population growth and development pressures in the Indo-Pacific, there is a pressing need to acquire more data in this important region to aid in evaluating the status of seagrasses. Perhaps this is an important role Seagrass-Watch monitoring efforts can play?

As the Seagrass-Watch program has been collecting data on a number of seagrass ecosystem measures for over a decade at some locations, it is timely to use these measures to assist with the development of more appropriate guidelines. What Seagrass-Watch participants recognise is that seagrass percentage cover in some habitats will naturally differ from others. For example, a coastal meadow dominated by *Halodule* may only ever be around 20% cover, but an estuarine meadow of *Zostera* may be 60% or more most of the time. This does not imply that the *Halodule* meadow is in poor condition compared to the *Zostera* meadow, it only shows that they differ.

Currently, assessment of seagrass habitat condition (i.e. poor, fair, good) is more often than not subjective. Although based on qualitative measures, the interpretation of the data relies heavily on expert knowledge/opinion. The goal is to develop more transparent and impartial guidelines. By using the Seagrass-Watch long-term dataset, we are now deriving seagrass abundance indicators for regional habitat guidelines.

Abundance data collected from reference sites can be used to estimate percentile values, which in turn could be used to derive guidelines. This is the approach recommended for water quality guidelines. To be confident in such guidelines we need to be sure they are based on percentile estimates that reflect the true population values.

Like most statistical measures, errors in percentile estimates reduce with increasing sample size. Examination of the Seagrass-Watch dataset has shown that for the percentile values tested, error values tend to level off at around 15 to 20 samples, suggesting this number of samples is sufficient to provide a reasonable estimate of the true percentile value. Therefore, based on these analyses it is recommended that seagrass abundance guidelines can be based on a minimum of 18 samples (monitoring events) collected over at least 3 years.

Using this approach, it is planned to develop realistic seagrass abundance guidelines at regional and subregional levels where possible. These guidelines would contribute to an assessment toolbox which can be used to report on ecosystem health and work towards a global report card on seagrass.

Seagrass-Watch participants have

examined 83,131 quadrats | spent 639,287 hours monitoring | taken 16,901 quadrat photos | undertaken 2,469 monitoring events | taken on average, 2min 36sec to assess a quadrat | run 354.5 km of transects |

The first Seagrass-Watch sites established in August 1999 were in the Great Sandy Strait (Boonooroo, Pelican Bay, Poona) and Hervey Bay (Burrum Heads and Toogoom) regions of Queensland (Australia). These sites are still monitored today, although the observers have changed. For example, Gordon Cottle and his team of Great Sandy Strait Fauna & Flora Watch volunteers have been monitoring their region since August 2001.

Their numbers were recently boosted by an influx of new members in the Cooloola Coast area. Monitoring of the inaugural Seagrass-Watch site (BN1) by Gordon and his team on the 20th August 2009 reported a meadow similar to what was examined in 1999. Over time the meadow has fluctuated in seagrass abundance, and species have come and gone. Unfortunately the amount of epiphyte cover has gradually increased suggesting persistent elevated water column nutrients in the environment. Results from their monitoring efforts are important in building a clearer picture on seagrass status and human pressures.



“Seagrass-Watch participants have observed 200 dugong feeding trails” in their quadrats...

Seagrass-Watch HQ

Dugong feeding trails at Yule Point, Australia



Townsville, Australia U3A monitoring

Article by Don Kinsey
Photography Jane Mellors
& Barbara Kinsey



The July monitoring in Cockle Bay was somewhat similar to that of July 2008, but the normally low winter seagrass cover was even lower this year (around 12% overall compared with 20% in 2008). This is in marked contrast to April 2009 at around 55%. The seagrass was very short. The thin coating of mud over most of the reef-flat noted in April and resulting from the extreme wet-season was still persistent and rather “anchored” by fine filamentous algae. There was high epi cover made up of mud (perhaps including some diatoms) held in place by the very fine filamentous algae.

Macro-algae were not much in evidence with only small patches of foliose reds and very small but frequent cryptic patches of *Halimeda*. As usual, *Cymodocea serrulata* dominated the seagrass cover, with similar or somewhat lower levels than usual of *Halodule uninervis*. There was no *Halophila ovalis* or *Thalassia hemprichii* found on the transects.

The reef-flat had conspicuous numbers of whelks and very numerous burrows, probably predominantly snapping shrimps judging by the very large amount of audible clicking.

Only 5 germinated seeds were found over the total of the sampling site, though this low level is rather normal in Cockle Bay throughout the year.

The high ground between the site and the adjacent mangroves exhibited the same fine mud cover as elsewhere. Very infrequent patches of the fine form of *Halodule uninervis* were seen.

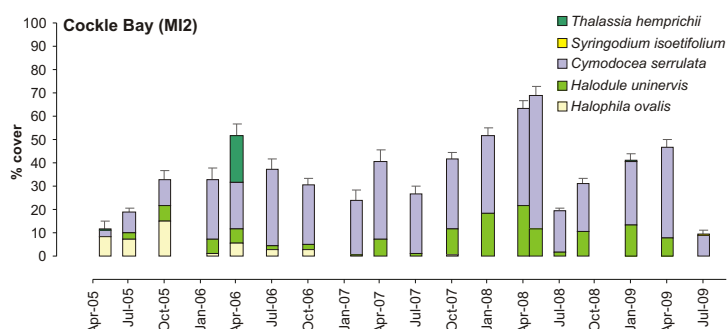
Virtually no *Halophila ovalis* and no *Zostera capricorni* were found.

An unscheduled examination of the site in August indicated that the seagrass cover had declined even further and there was no significant algal cover, though the numerous whelks still seemed to be able to eke out a living. Some of the wet-season mud had washed away and the whole site looked very desolate. The higher ground near the mangroves actually had a lower profile indicating substantial mud wash-out and there was no evidence of seagrasses at all in this area.

The University of the Third Age (U3A) is an international organisation, embodying the principles of life-long education and the pursuit of knowledge for its own sake, in an atmosphere of mutual learning and teaching. Each U3A is a learning community, organized by and for people who can best be described as being active in retirement - the so-called Third Age of their lives.

Developed in Toulouse in 1972, to bring older citizens into contact with academic programmes at the University. U3A was established in Melbourne in 1985. There are now more than 100 U3A Australia-wide with a total national membership exceeding 40,000.

<http://www.u3a.org.au/>



“Seagrass-Watch participants have counted 14,849 whole *Halodule* seeds and 5,998 germinated *Halodule* seeds...”

Seagrass-Watch HQ

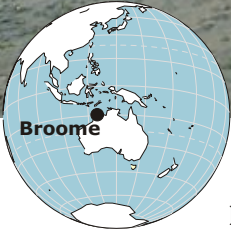


Broome, Australia

Strength to strength

Article by Fiona Bishop
Photography Len McKenzie & Rudi Yoshida

Monitoring Town Beach, Broome



Seagrass monitoring in Broome really does have a lot going for it: the rejuvenating stroll in the fresh ocean air across the luminous, sparkling tidal flats; the gorgeous soft pink-orange sunrises; the sense of wonder at the bizarre and beautiful fauna seen in our quadrats; and the delight at seeing the first patches of seagrass. There is also a great sense of satisfaction in learning the methodology, and in knowing that our efforts have made an important contribution to protecting our seagrass through a scientifically robust monitoring project.

Perhaps the joy of monitoring is why the Broome Community Seagrass Monitoring Project saw record numbers of enthusiastic participants signing up for our recent Seagrass-Watch workshop, designed to build the capacity of participants to monitor this precious resource. We had a fun and fascinating time learning about seagrass biology & identification, conducting laboratory exercises, identifying seagrass and practising preparing press specimens. We also learned about seagrass ecology and threats, and were given a comprehensive presentation about Seagrass-Watch methodology. From 6am on the second day, after a lovely breakfast of freshly baked muffins & coffee to wake us up (fast becoming a Broome Seagrass Project tradition), we walked out to the Town Beach monitoring site at Roebuck Bay for

fieldwork practice, where our regional television journalist also turned up to film the event for a positive community interest story on the nightly news.

I would like to extend a special thank-you to the two ranger groups from the Dampier Peninsula who made the effort of travelling hundreds of kilometres to Broome to attend the training; the KLC Bardi Jawi Rangers and the KRCI Djarindjin Rangers. I'm also grateful to Department of Environment and Conservation's Sharon Ferguson who helped organise the event, and to Seagrass-Watch HQ (Len McKenzie and Rudi Yoshida) who ran a highly professional and impressive workshop for us.

The Broome Community Seagrass Monitoring project has been growing from strength to strength, with increasing numbers of participants attending monitoring sessions; what's more, we

have embarked on intertidal, subtidal and aerial photography mapping. The project has benefited from working closely with Indigenous Traditional Owners in the region, while community education has also been a priority. The project was recently granted another year's funding from Coastwest; we received additional funding from the Port of Broome, which recognizes that our seagrass is an excellent indicator of the health of Broome's Roebuck Bay, Ramsar-listed as a

Wetland of International Significance. While the state of seagrass globally is dire, it's heartening to know that, with monitoring projects like ours supported by funders and community participants alike, this precious resource has a better chance of being protected and continuing to flourish.

Broome Community Seagrass Monitoring Project is co-managed by Environs Kimberley and DEC, with funding from Envirofund and the Port of Broome.

Seagrass-Watch HQ has formally trained 639 participants worldwide...
Seagrass-Watch HQ





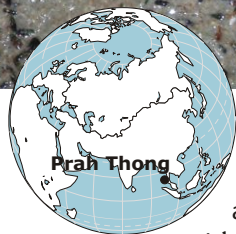
Phra Thong Island, Thailand

Lion Village and monitoring

Article by Barry Bendell

Photography Piyapat Nakornchai
& Barry Bendell

Sea star Archaster and Halophila beccarii



The first seagrass monitoring at Phra Thong Island, Thailand, took place on 24 June 2009. Seagrass occurs in a band around the sheltered eastern side of the island, offshore of mangrove. The western side is exposed to the Andaman Sea, and has broad beaches that have been important nesting sites for marine turtles.

There are 11 species of seagrass recognised from the Thai Andaman coast, and all of those are known in the local district. Near our monitoring site we have seen 5 species. *Halophila ovalis* is dominant in upper intertidal areas, but *Halophila beccarii* is also abundant. *Enhalus acoroides* is dominant in lower intertidal and upper subtidal areas, where there is also some *Halodule uninervis* and *Halodule pinifolia*. The site is near Lion Village, which was built to replace another village completely destroyed by the tsunami of 26 December 2004, when 75 local people died. Construction of the new village was funded by Lions Club International, hence its name. Villagers report that seagrass cover was reduced by the tsunami, but has since recovered.

On the day of monitoring, participants met at the local school to learn about seagrass monitoring. In the late afternoon, as the tide

was beginning to recede, our group of 11 proceeded out to the meadow. The monitoring technique was quickly grasped, and we proceeded easily along the transects. Only two seagrass species were encountered in the quadrats, *Halophila ovalis* and *Halophila beccarii*. Once our task was finished, the participants fanned out across the tidal flats, equipped with buckets and string bags, to exploit the open storehouse that is a seagrass meadow on a receding tide.

People in coastal Thailand know well the value of their seagrass meadows. It is a rich source of molluscs, crab, shrimp, and fish, especially rabbitfish and groupers. Among molluscs, the most commonly collected is *Strombus canarium* (dog conch). The sea cucumber *Holothuria scabra* (sandfish) is also collected. It fetches

the highest price of any sea cucumber in export markets, and has been severely reduced in abundance by over-harvesting in many parts of Asia. The most conspicuous animal around the meadow is the sea star *Archaster*. It is often seen in aggregations of 100s of animals, and is so abundant that children have collected buckets of them for use as fertilizer in the school garden.



A bucket of *Holothuria scabra*

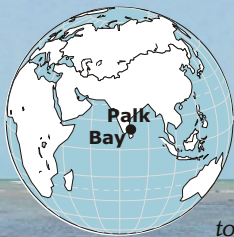


A collection of conches, *Strombus* spp



The people of Lion Village are concerned about conserving their marine resources, and are interested in protecting the seagrass meadow, possibly by establishing restricted fishing zones.

It is hoped that monitoring will be just the beginning of more conservation efforts. Since 1996, the NGO Naucrates (www.naucrates.org) had been working to document and conserve the island's nesting sea turtle populations. It has been working with another NGO, Mangrove Action Project (MAP) (www.mangroveactionproject.org), to promote community-based management of coastal resources. Work on seagrass has been supported by funding to MAP from the Ecumenical Coalition on Tourism (ECOT).



Palk Bay is a 64-137 km wide strait that lies between India's Tamil Nadu state and the island nation of Sri Lanka. This shallow area of approximately 600 km² connects the Bay of Bengal to the northeast with the Gulf of Mannar to the south.

On the southern end of Palk Bay there is a group of small low islands and reef shoals connecting Dhanushkodi on Rameswaram Island in Tamil Nadu and Talaimannar on the Mannar Island in Sri Lanka. According to Hindu mythology, this natural bridge is called Rama's Bridge or Adam's Bridge. The Island of Rameswaram is linked to the Indian mainland by the Pamban Bridge.

In 2006, I examined seagrass diversity, biomass, density and percentage cover to assess the relationship with environmental parameters during post-monsoon, summer, pre-monsoon and monsoon seasons at three locations in northern Palk Bay. Palk Bay is in the dry tropics and significantly influenced by seasonal rivers and shrimp farm discharges. Coastal areas receive 60% of their annual rainfall (464.6 mm) during the northeast Monsoon season (October to December).

First we mapped the seagrass meadow extent along the northern Palk Bay coastal villages. From the maps, three monitoring sites were chosen: on the northern and southern sides of Agni estuary (Keezhathottam and Velivayal villages respectively), and on the sandy shore at the mouth of a small estuary adjacent to Manora village. Seasonal and spatial variation in seagrass cover, species composition, canopy height, shoot density and biomass was examined at each site.

Halodule pinifolia was the most common seagrass species, generally found in the upper intertidal zone at all sites. *Halodule pinifolia* dominated Keezhathottam and Velivayal, however Manora was mainly dominated by *Cymodocea serrulata*. *Syringodium isoetifolium* was also recorded at Velivayal and Manora.

Seagrasses of Northern Palk Bay

Article and photography V. Balaji

Keezhathottam Village, Site 1

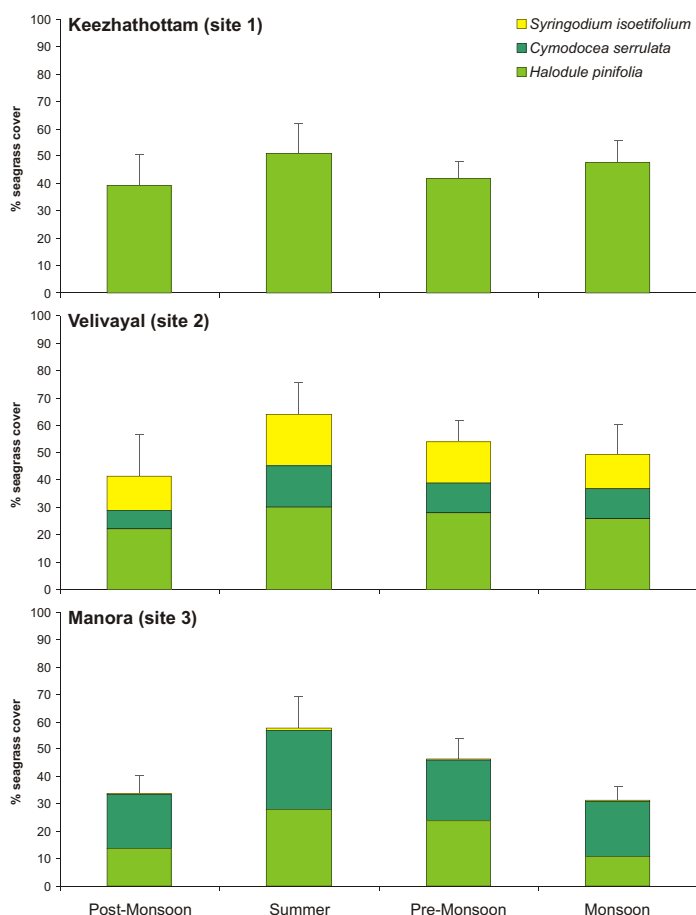
Percent cover was highest at Keezhathottam and appeared to change seasonally, with higher abundances in summer ($51 \pm 11\%$) declining during the monsoon and reaching minimal abundances in the post monsoon ($39.5 \pm 11\%$). A similar pattern of abundances was recorded across all sites. All the three seagrass species performed better and increased in biomass as well shoot density and canopy height during the same time of the year.

Higher seagrass productivity, above ground biomass, below ground biomass, shoot density, canopy height and percentage cover occurred in summer, when salinity and temperature were at their peak (Keezhathottam = 30°C , 32‰ ; Velivayal = 28°C ; 33‰ ; Manora = 28°C , 32‰). Lower seagrass productivity occurred during the monsoon, when salinity and temperature were at their dip level (Keezhathottam = 25°C , 6‰ ; Velivayal = 24°C , 5‰ ; Manora = 23°C , 4‰).

Levels of ammonia peaked ($0.098 \mu\text{mol/l}$) during the pre monsoon at Keezhathottam and during the summer at Velivayal and Manora ($0.097 \mu\text{mol/l}$ and $0.206 \mu\text{mol/l}$ respectively). This was possibly a consequence of the lack of freshwater flow and slower currents that also favourable for the productivity.

By examining a range of environmental factors (eg climate and water quality), this study revealed that temperature and salinity were a major forcing factors for seagrass biomass, shoot length and density. *Halodule pinifolia* above ground biomass was found to increase with elevated air temperature and inorganic phosphate. *Cymodocea serrulata* total biomass increased with increasing salinity, shoot density was positively correlated with total nitrogen, while below ground biomass was positively correlated with total phosphate. Percent cover of *Syringodium isoetifolium* was correlated with pH.

This study found that the distribution and abundance of three species of seagrass community in northern Palk Bay is probably dependent on erratic influx of seasonal freshwater flow that controls the stenohaline competitors (*Cymodocea serrulata* and *Syringodium isoetifolium*).





Connectivity

should we really care about it?

Article by Richard K.F. Unsworth
Photography Len McKenzie

Although it's simple to appreciate the role that seagrass meadows play in supporting charismatic species such as seahorse, dugong and turtle, what are some of the other key conservation values of seagrass meadows that matter from a wider ecosystem perspective? Would it really matter if we lost some seagrass in a harbour? Researchers describing some of the high conservation values of seagrass often use the term 'connectivity', but what is connectivity in the marine environment and why should we really care about it.

The Indo-Pacific bio-region, where the majority of Seagrass-Watch currently takes place contains one of the highest marine biodiversities anywhere in the world. This great diversity of marine life utilises fringing, barrier and atoll reefs, together with an array of additional marine habitats such as seagrass meadows, mangrove forests, mud flats and algal beds. Research throughout this region has shown that many of these habitats are in fact not isolated pockets of marine life, but are instead linked as a result of faunal, detrital and nutrient movements (e.g. fish moving from reefs to seagrass to feed and vice-versa). It is these linkages that are commonly referred to as habitat connectivity.

Understanding habitat connectivity is important for the sustainable management of any marine systems, as the over-exploitation, damage and removal of one habitat may have detrimental impacts upon another. For example, research in Indonesia found that seagrass fish assemblages were significantly less diverse and abundant when either mangrove or coral reefs were missing. The removal of one habitat may also have physical impacts on another; this was demonstrated clearly in the Indonesian province of Aceh where removal of mangrove from coastal areas is thought to have increased the lethal action of the

2004 Tsunami on coastal terrestrial ecosystems, as mangroves previously acted as natural barriers.

Although seagrass does contain some resident fish species (e.g. species of pipefish, wrasse), these expansive meadows make lush regular feeding grounds for a range of abundant fish from adjacent habitats. This is principally due to the very high abundance of small crustaceans that reside in seagrass meadows and become active at night. Many species of fish will move from deeper water reef habitats with tidal or diel cycles into seagrass meadows to feed on these crustaceans. As a consequence, larger predatory fish (e.g. trevally) will follow this migration. These crustaceans can therefore be an important supply of energy to nearby habitats such as coral reefs.

Seagrass meadows are also connected to other habitats (such as coral reefs) due to the food and shelter they provide for juvenile fish (a nursery area). Although not all species of coral reef fish utilise seagrass meadows as nursery grounds, many species (e.g. some species of bream, snapper, and emperor) have been found to be exclusively dependent upon specific feeding resources of seagrass meadows and mangroves at certain stages of their juvenile life-cycle. This can even be as specific as utilising

different assemblages of crustaceans within the inter-tidal to sub-tidal zonation at different stages of their development. Such movements of fish between different habitats at different stages of their life-cycle are termed ontogenetic migrations and can represent critically important connections between habitats. The local loss of a seagrass meadow could therefore result in the decimation of the local population of a particular reef fish species. These dependences and ontogenetic migrations are not just limited to fish, as economically important crustacean species (e.g. endeavour, king and tiger prawns) also have dependence upon seagrass meadows at specific stages of their life-cycle.

Connectivity is also important in terms of nutrient and carbon cycling. Estuarine and coastal seagrass meadows play a vital role in filtering and cycling of an array of nutrients, toxins and sediments that commonly concentrate in river water from influences such as deforestation, agriculture, and urban development (see *Seagrass-Watch Issue 35*).

For example, it is probable that without the vast coastal seagrass meadows in Queensland Australia, water quality on the Great Barrier Reef may be much lower, and sedimentation rates higher.

A very important but poorly researched component of seagrass meadows is their production of organic carbon and its ultimate sink. Research work conducted in the Torres Strait (Northern Australia) has recently found reef lagoon seagrasses to be amongst the most productive habitats on earth, exceeding the production of many terrestrial plant communities, including tropical and temperate forests and grasslands. Ecological processes such as herbivory, as well as physical processes such as wind and wave action can cause the loss and export of large proportions of this organic carbon. Although some of this material may become sequestered directly into seagrass sediments (see *Seagrass-Watch Issue 36*), it is not always apparent where the majority of this carbon production ends up. It is highly likely though that flora and fauna within adjoining connected habitats utilise this primary productivity as a source of energy.



Fishing in a seagrass meadow, Solomon Is



Seagrass meadows undoubtedly have a number of key roles in supporting the production and diversity of adjacent habitats such as coral reef habitats. Processes of connectivity are therefore of critical importance in marine systems, this suggests that the ongoing global loss and fragmentation of marine habitats such as seagrass will have serious implications to the function and management of coastal ecosystems. In terms of understanding the conservation value of a local habitat relative to other local development priorities (e.g. coastal reclamation) it is therefore critical to not just consider habitat value on a direct basis. Conservation value needs to be considered in terms of the role that a habitat provides to a wider area and the consequences of the loss of that role.

Despite the enthusiasm for seagrass conservation and monitoring shown by Seagrass-Watch participants, seagrass meadows in many countries are not the conservation priorities that their importance deserves. This may often be due to a lack of appreciation for the wider role they play in a coastal ecosystem. Not considering the importance of seagrass may also have detrimental impacts upon current conservation goals. Marine reserves are commonly created to protect high value habitats such as coral reefs, but often fail to protect adjacent seagrass meadows. Such a management strategy in some locations could fail to completely protect coral reef fish stocks. This is because fishermen may exploit these fish when they nocturnally feed within adjacent seagrass meadows rather than on the reef.

Managing marine habitats to threats such as coastal development, deteriorating water quality, and fisheries overexploitation requires a more holistic approach that considers the relative contribution that all habitats (including seagrass) make to the wider ecosystem.

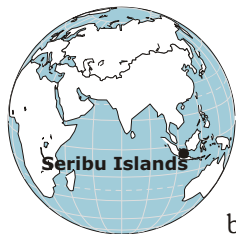


Seribu Islands

seagrass extent, condition and threats

Article by Edy Setyawan, Aar Mardesyawati and Estradivari.
Photography TERANGI

Seagrasses are the only flowering plants living submerged in the marine environment and known to be among the most productive areas of aquatic ecosystems. Seagrasses, as a community and an ecosystem, have a wide range of ecologically and economically important roles.



At Seribu Islands, north of Jakarta, Indonesia, seagrasses grow on the reef flats in between mangrove and coral reef ecosystems. Despite the many important ecosystem services seagrass can provide, this ecosystem has less attention for researchers compared to other resources, thus limited information is available on its status. In July 2007, TERANGI (Terumbu karang Indonesia), initiated a pilot seagrass project at Seribu Islands to determine the seagrass extent and species diversity. Forty locations were examined,

representing 35 islands and 5 cays from the southern to the northern Seribu Islands. Observations were conducted on only one side of the chosen island/cay; coinciding with TERANGI's coral reef monitoring sites. Five 1m² quadrats with 100 grids were placed randomly at each location. The observers collected information on seagrass abundance and species composition.

From 200 quadrats examined, the seagrass coverage varied from 0 to 67%, with an average of 25%. Of 40 observed locations, only 29 of them had seagrass. Although no seagrass was observed at the other 11 locations, this could be a consequence of climate.

The monsoon plays an important role in influencing the seagrass coverage in Seribu Islands, through sand transport, and changes in wind speed and rainfall.

Overall, there were 8 species of seagrass found in Seribu Islands: *Enhalus acoroides* (Ea), *Thalassia hemprichii* (Th), *Cymodocea serrulata* (Cs), *Cymodocea rotundata* (Cr), *Halophila ovalis* (Ho), *Halophila minor* (Hm), *Syringodium isoetifolium* (Si), and *Halodule uninervis* (Hu). The species richness ranged between 0 and 5 species per location. Panggang and Pramuka Islands had the highest number of seagrass species.

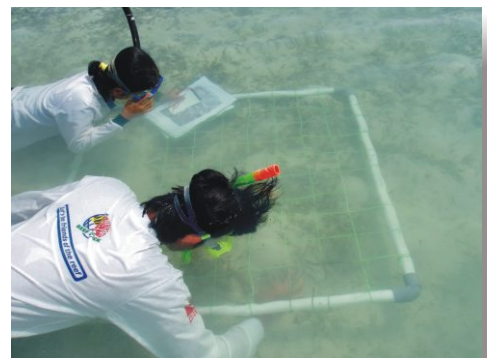
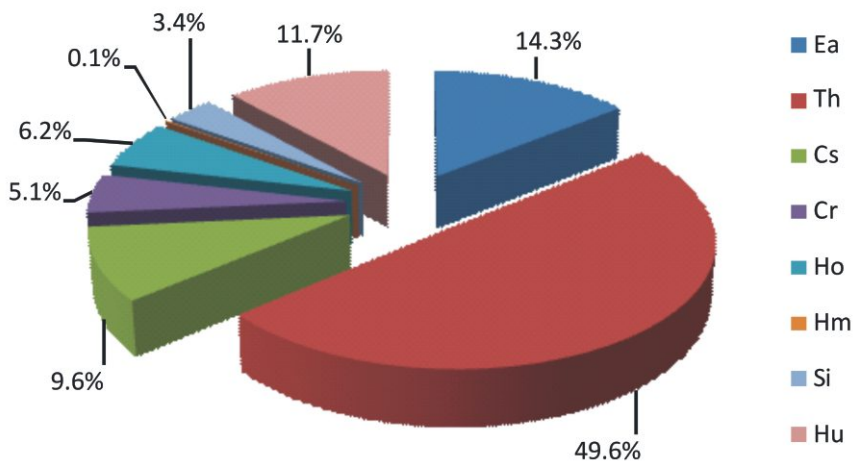
Thalassia hemprichii dominated half of the total seagrass coverage (49.6%),

followed by *Enhalus acoroides* (14.3%), *Halodule uninervis* (11.7%), and *Cymodocea serrulata* (9.6%) (see graph). The remaining four species only covered between 5.1% and 0.1% of seagrass. *Thalassia hemprichii* is one of most widely distributed seagrass species, not only at Seribu Islands, but also in the western Pacific. This species has a wide range of limiting factors thus it can live in many habitats.

Halophila minor had the lowest coverage and was only found at one location (Payung Besar Island). Morphologically, this species has small rounded leaves and is usually covered by sediments or sands, therefore it can be difficult to be observed underwater.

Spatially, the greatest seagrass extents were found in Bidadari and Onrust Islands, our two southernmost observed locations. These two islands were located in Jakarta Bay. This area is believed has been severely polluted by discharges from 13 rivers in Jakarta. Some researches also revealed that both the water and sediment have high concentration of metal and nutrient. Where few marine organisms could grow, especially corals, *Thalassia hemprichii* grew abundantly.

Although the overall coverage of seagrass at Seribu Islands is categorised as poor (25%) based on Decree of Ministry of Environment No. 200/2004, the seagrass itself does not have so many direct threats compared to mangrove and coral reefs. The local community does not utilize the seagrass thus the direct anthropogenic impacts to seagrass are low. The main threats are indirect and in the form of coastal runoff (water pollution). High nutrients from Jakarta Bay, although not good for coral health, in fact support the growth of some seagrass species. Under a careful and strict management consideration, seagrass ecosystem at Seribu Islands can be economically used, such as for fertilizers, food and medicine, etc, as well as can be protected as a nursery and feeding ground for some valuable marine organisms.



TERANGI (Terumbu karang Indonesia), The Indonesian Coral Reef Foundation, is a non profit organization. TERANGI was established in 1999 and is the first non-government organization in Indonesia to focus exclusively on conservation issues.



Converting the masses

Article by Siti Maryama Yaakub
Photography Ria Tan



Those of us who live and breathe seagrass are inclined to forget that our beloved marine flora doesn't feature very highly in the consciousness of those less enthused about this awesome (what else) habitat, much less the multitude of ecosystem services it provides. Some have attributed this lack of awareness and concern for the plight of seagrass ecosystems to the fact that they simply pale in comparison to other marine ecosystems that are more charismatic such as coral reefs, or more visible as in the case of mangroves.

Here in Singapore, TeamSeagrass volunteers have been involved in several public awareness and outreach activities, ranging from exhibitions at public fairs, to magazine and newspaper articles and being featured in nature documentaries. TeamSeagrass members who have volunteered at public fairs can attest that the majority of the populous either haven't a clue of what seagrasses are or that those the more enlightened ones lump seagrass together with seaweeds. Perhaps we have a bit more of an uphill battle, given that the majority Singaporeans are city-dwellers and that local biodiversity doesn't feature very strongly in the science syllabus. But after putting together several exhibition booths, we've amassed some insights into doing outreach and embedding seagrasses into the hearts and minds of the public. Here, We share four of our most helpful public outreach gems and welcome insights and any tips fellow

Seagrass-Watchers may have in preaching the gospel of seagrass to the public.

TeamSeagrass Outreach Gem #1: Keep it Simple.

No one likes being bombarded with scientific words and latin names on a weekend afternoon. The key to maintaining interest is to keep descriptions simple. Use words like 'flowering plants' instead of 'angiosperms', give the common name wherever possible and use visual aids to help explain processes.



TeamSeagrass Outreach Gem #2: Hitting two birds with one stone.

One method we've recently learnt is that of doubling awareness without doubling effort. First entice younger audiences with colourful visuals and fun activities (there are lots in the Activity Book by Seagrass-Watch HQ).





“Seagrass-Watch participants have examined 18 species of seagrass...”
Seagrass-Watch HQ

Next, while the young ones are busy figuring out a puzzle, entertain the adult with a seagrass anecdote. Singapore is a land of avid foodies and for the average Singaporean, a food reference of some sort gets the ball rolling. Start by telling them lots of seafood comes from seagrass and then slowly work the conservation message into it.

TeamSeagrass Outreach Gem #3: Decorate thy booth

Let's face it, first appearances matter. The booth that is attractive and colourful is a crowd magnet and a crowded booth then attracts more people, and before you know it, you're bombarded with questions about seagrass. Even having the quadrat and measuring tape out helps pique interest. What's an even bigger crowd

puller is a display tank with seagrass in it. This of course, involves getting actual specimens from the field, but in most cases, they end up as herbarium specimens and will not have died in vain. Kids love getting their hands wet and getting them to tell them apart makes for a great game.

TeamSeagrass Outreach Gem #4: Everybody loves a challenge (and prizes!)

Our TeamSeagrass Games and Quizzes can really get the crowd going especially when there are prizes involved. Our TeamSeagrass stickers and car decals are very popular with the crowd and the awareness potential continues long after the event is over.



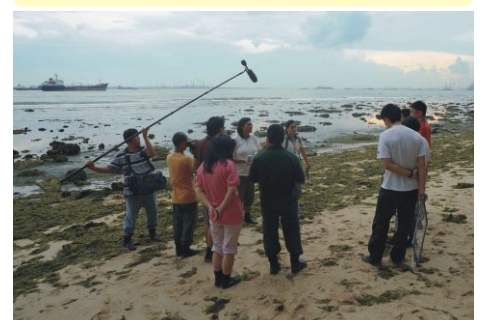
TeamSeagrass featured in Singapore's National Biodiversity Strategy and Action Plan (NBSAP).

TeamSeagrass' monitoring efforts are part of Singapore's action plan to safeguard its biodiversity. Under Strategy No. 5, the partnership between the National Parks Board, TeamSeagrass and its affiliates (Raffles Girls School and Schering-Plough) are heralded as an example of how to promote and engage an active citizenry in biodiversity issues and promote stewardship of the environment.

The NBSAP is a national document that is submitted to the Secretariat of the Convention on Biological Diversity (CBD) of which Singapore is a party to. One of the primary aims of the convention is to halt biodiversity loss by 2010. Habitat monitoring features strongly in the Convention's recommendation towards meeting this goal.

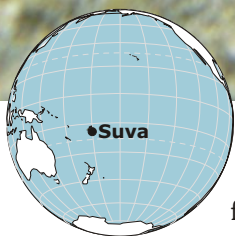
For more information, visit:
National Parks Board:
<http://www.nparks.gov.sg>

Convention on Biological Diversity:
<http://www.cbd.int/>



USP & International join forces

Article by Posa Skelton
Photography Robin South,
Gillianne Brodie & Rudi Yoshida



Halophila ovalis ssp. *bullosa*

Two seagrass sites were surveyed on Saturday, 12 September 2009, by students from the International School in Suva and post-graduates from University of the South Pacific (USP).

For the International School this was their second monitoring of their site, SV1, for the year, which was organised by their teachers, Ms Howard and Ms Tora.

Anticipating a hot-midday sun, the students and teachers were caught by the southerly cool breeze and the light drizzle that had many of us shivering.

For the second site (SV2), it was the first time it was surveyed for the year. Many thanks to Dr Gillianne Brodie and her post graduate students.

With the guidance from our GPS we were led to the two sites only to discover that our long-term monitoring markers acquired some legs and had gone walkabout. Fortunately, the sites were about 200 metres apart so our photographers (Fiu Manueli and Robin South) were able to cover both sites taking pictures of our hard-working students and also the many sea critters scurrying about.



International Secondary School complete SV1

From the schools



Above: Yellow sponges with
Halodule pinifolia
Below: USP students monitor SV2



Above: Lamp-shell or brachiopod (*Lingula anatina*), encountered during seed coring

The dedicated students divided themselves into three groups and got straight on to the tasks of estimating percentage cover, working out the seagrass species and measuring the canopy height.

While we were busy with the tasks at hand, a group of recent migrants from Alaska and Siberia eyed us closely; wondering what we were doing on their feeding grounds.

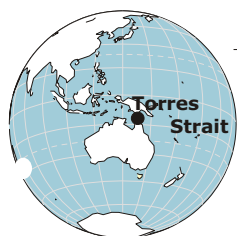
These vagrants are here from this month until April next year to avoid the cold months in the northern hemisphere. Keeping our coastal foreshore healthy ensures that these birds continue to visit us every year.

We were fortunate that one of our endemic seagrass species (*Halophila ovalis* ssp. *bullosa*) was flowering and seed pods were fairly common, although it did require close inspection.

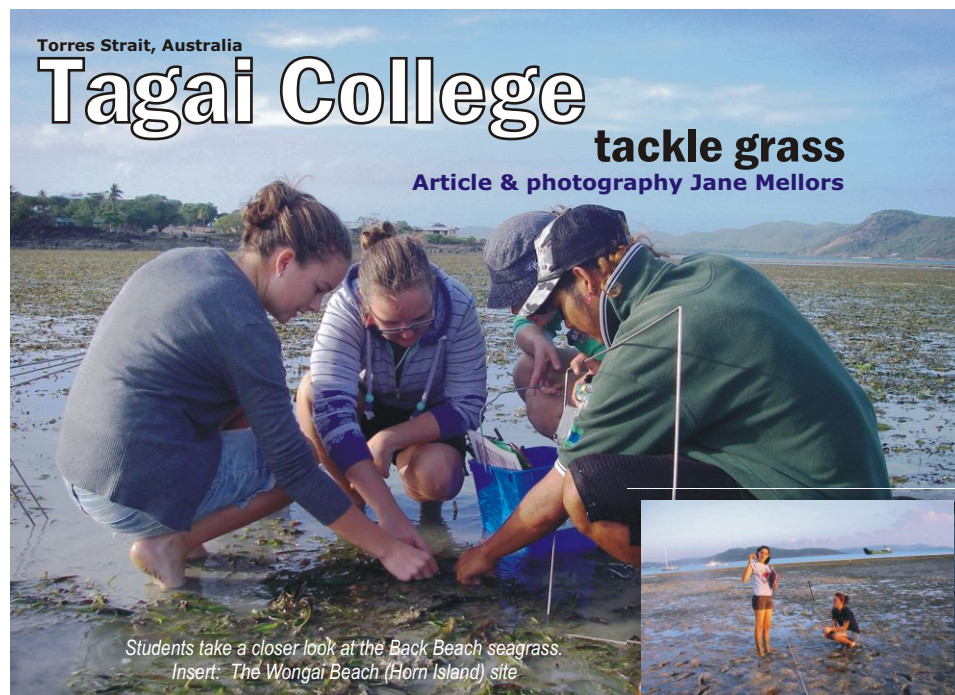
Finally, during our search for *Halodule* seeds we encountered quite a number of lamp-shells or brachiopod (*Lingula anatina*). This invertebrate looks like a mussel or bivalve, although they are distantly related. Most brachiopods are known from fossil records, with only about 300 living species. About 27 species are known from Fiji.



Dr Gillianne Brodie (holding red bucket) with USP students, SV2



Monitoring the Kaiwalagal sites occurred around sunrise, so not quite as daunting as monitoring in the dark. The monitoring period started off with TI1, Front Beach. Seagrass cover was marginally down, with epiphyte cover being noticeably lower than in late May. From TI2 a flat sandy beach to knee deep sediments at TI1. Seagrass cover at this site was marginally down while algae cover and epiphyte cover were distinctly lower. The next morning saw the Tagai team on its way to Hammond Island. This site is renowned for its crab population and one has to be careful where you put your feet, as these crabs would rather confront you than scurry away. As the tide dropped, the meadow goes quite dry except for where our site is located. So we are monitoring in knee deep water in this hollow in the middle of the meadow. At this site seagrass and algae cover were down, while epiphyte cover was higher than that recorded in late May. Our last site for monitoring was Horn Island. This site is characterized by thick mud which in recent times has started to smell a lot like rotten eggs. Algae cover was marginally



higher than in May while algae cover was noticeably lower and epiphyte cover markedly higher.

Tagai College students are now dutifully logging their activities and the time spent on each activity in the recently created Seagrass-Watch Logbook. This recording of their activities is one of the requirements the students have under a Community Based Learning Enrolment

Course that is being trialed in the Torres Strait for the Queensland Studies Authority. The students must undertake a series of activities besides regularly monitoring their sites. The most recent activity this group undertook was promoting Seagrass-Watch in the Torres Strait on the local radio at Thursday Island.

◀ JELLYFISH...continued from page 16...

world's oceans for jellyfish. A recent publication in Marine Pollution Bulletin reported that 37.2% of the nearly 400 turtle autopsies conducted since 1968 had ingested some form of plastic, mostly bags.

Humans also harvest Cannonball jellyfish for a growing southeast Asia market of dried product. Dried jellyfish are prepared by a Jellyfish Master and served shredded with a dressing of oil, soy sauce, vinegar and sugar, or as a salad with vegetables. In Japan, cured jellyfish are rinsed, cut into strips and served with vinegar as an appetizer. Jellyfish have also provided biotechnology products such as fluorescent protein markers used in medicine to determine gene expression and collagen for treatment of rheumatoid arthritis.

Jellyfish are often reported to bloom, usually seasonal, responding to the availability of prey, increasing with temperature and sunshine. Blooms may also be the result of water currents concentrating individuals. There is very little data about changes in global jellyfish populations over time, however the increasing frequency of jellyfish blooms globally has been attributed to humans impact on marine systems. Increased nutrients in the water, ascribed to agricultural runoff, have also been suggested as one cause. Some jellyfish populations increases are "invasive", newly arrived from other parts of the world.

A genus of scyphozoan jellyfish very commonly found in seagrass and coastal environments around the world is *Cassiopea*. *Cassiopea* is also called the "Upside Down Jellyfish", because it lies on its back, so that the bell touches the ground. In

this position it resembles a sea anemone. *Cassiopea* adults are about 100 mm in diameter, flattish, with four to six flat tentacles surrounding the mouth. Each of these tentacles contains symbiotic algae (zooxanthellae) which supply nutrients to the host. Accordingly, the adult lies inverted in shallow water, exposing the maximum number of algae to sunlight. Although considered harmless to humans, they have a mild sting from stinging cells excreted in a mucus. If stung, sensitive people develop a red rash-like skin irritation, notorious for being extraordinarily itchy.

The most infamous jellyfish are in the class Cubozoa (about 50 species) with their hollow box (cube) shaped bells. Possibly the most well known is *Chironex fleckeri*, the box jellyfish. Box jellies, also called sea wasps and marine stingers, live primarily in coastal waters off northern Australia and throughout the Indo-Pacific. Up to 15 tentacles grow from each corner of the bell and can reach 3 metres in length. Each tentacle has about 5,000 stinging cells, which are triggered not by touch but by the presence of a chemical on the outer layer of its prey. Their venom is considered to be among the most deadly in the world. Box jellies are more numerous after local rain, especially near river and creek outlets and are usually absent when seas are rough. Marine stingers are not usually found over coral, in deep water, or around extensive seagrass meadows. Nevertheless, you should always be safe.





Animal facts
Jellyfish
Article & photography
Len McKenzie

Some countries consider them delicacies, while others consider them dangerous. They have been around for more than 650 million years, but individuals live for only a few weeks to a year. Their body is made up of almost 90 to 94% water and they don't have any brain, heart, or bones. Although they may look like some alien from outerspace, they are found in every ocean in the world and commonly seen in seagrass meadows. They are of course, jellyfish.

Since jellyfish are not actually fish, the term "jellyfish" is a misnomer. The name jellyfish generally refers to two classes of free-swimming animals in the phylum Cnidaria: Scyphozoa (over 200 species) and Cubozoa (about 20 species), which have a basic body structure that resembles an umbrella. The class name comes from the Greek name 'skyphos',

which means a kind of drinking cup and alluding to the cup shape of the organism (medusae).

This body structure of the medusa (adult) is called the bell and tentacles hang from the border of the bell. Their bodies are made up of two cellular layers, the ectoderm and the endoderm, between which lies the mesoglea, a layer of connective tissue composed of a transparent gelatinous substance. Jellyfish swim by contracting and expanding their bell shaped bodies in a rhythm. Jellyfish have small sensory organs around their bell known as rhopalia, which they use to identify light and odour.

In most cases, to reproduce, both males and females (medusa) release sperm and eggs into the surrounding water, where the eggs are fertilized. Jellyfish spawn

daily if there is enough food. In most jellyfish species, spawning is controlled by light, often at either dusk or dawn. In a few species, the sperm swim into the mouth of the female, allowing the fertilization of the ova within the female's body. After fertilization, a cilia covered larval form, called the planula, develops from the egg. It settles onto a firm surface and develops into a scyphistoma (polyp). The scyphistoma is cup-shaped with tentacles surrounding a single orifice, resembling a tiny sea anemone. The scyphistoma reproduces asexually by budding and is called a segmenting polyp or a strobila. The budding produces new, immature jellies called ephyrae. Tiny jellyfish (usually only a millimetre or two across) pull away from the strobila by swimming, and then feed in the plankton and grow to adult medusae.

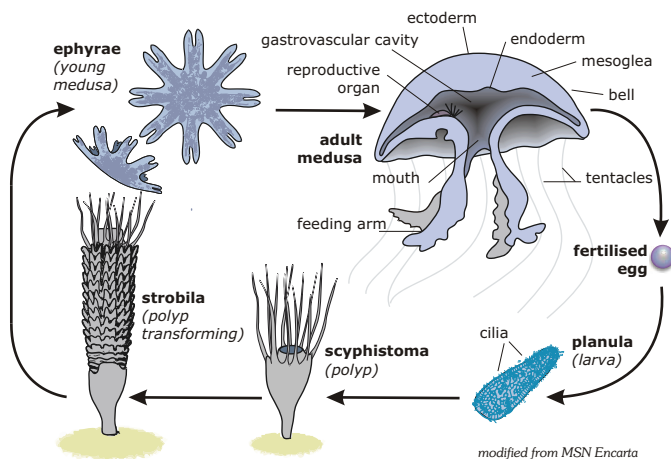
Jellyfish catch prey, typically plankton and small fish, using stinger cells (nematocysts) which cover their oral arms or tentacles. These nematocysts are paired with a capsule which contains a coiled filament that stings. The filament unwinds and launches into the target, thereby injecting toxins upon contact. The tentacles transport the prey to the mouth. They digest using the gastrodermal lining of the gastrovascular cavity, where nutrients are absorbed.

A group of jellyfish is called a "fluther" or "smack"

Jellyfish also use their stinger cells as a defence mechanism. Jellyfish predators include other

species of jellyfish, tuna, shark, swordfish, and at least one species of Pacific salmon, as well as the endangered leatherback turtles. Tragically, leatherbacks, the biggest member of the turtle family is prone to mistaking discarded plastic bags that litter the

continued page 15 ▶



First Aid

For stings from **non-tropical jellyfish** the application of ice may reduce the degree of localized pain.

Stings from **bluebottle jellyfish** should be immersed in hot water (as hot as casualty can comfortably tolerate)

For stings from **tropical jellyfish (including box jellies)**, domestic vinegar should be poured liberally over the tentacles to inactivate stinging cells as soon as possible. The tentacles may then be removed. Artificial respiration and cardiac massage may be required. Where antivenin is unavailable, pressure-immobilisation may be used on limbs after inactivation of stinging cells, while the patient is being transported to the nearest medical centre.



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