Centre for Tropical Water and Aquatic Ecosystem Research

Indigenous community capacity building to assess dugong and sea turtle seagrass habitats for sea country management.

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Report No. 14/58

December 2014

This report should be cited as:
McKenzie, L., Johns, L., Yoshida, R., Smith, N. and Langlois, L. 2014. *Indigenous community capacity building to assess dugong and sea turtle seagrass habitats for sea country management*. A report to the Threatened Species Division, Queensland Department of Environment & Heritage Protection (EHP). Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) report 14/58. James Cook University, Cairns, Australia. 53 pp.

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This publication has been compiled by the Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER), James Cook University.

Cover image: dugong grazing trails in *Halodule uninervis/Halophila ovalis* meadow being assessed by Indigenous workshop participants at Archer Point (25 July 2014, photo by Len McKenzie)

Acknowledgments:
This project was funded by the Threatened Species Division, Queensland Department of Environment & Heritage Protection (EHP), as part of the Indigenous sea country management project. We thank Christine Howley (Howley Consulting) for assistance with the Cooktown and Hopevale workshops and Geoffrey Carlin (CSIRO Land and Water) for advice on subtidal camera assembly. We also thank Chris Kinnaird, Belinda Norris and Melissa Douthat (EHP) for their support throughout the project. We acknowledge the traditional custodians of the lands on which we conducted this project. We pay our respects to ancestors and elders, past, present and future.

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Acronyms & Abbreviations Used In This Report

App .... Application software
CSIRO.............. Commonwealth Scientific and Industrial Research Organisation
EHP .... Queensland Department of Environment & Heritage Protection
GBR.................. Great Barrier Reef
GBRMPA.......... Great Barrier Reef Marine Park Authority
GPS .... Global Positioning System
HQ .... Head Quarters
JCU .... James Cook University
km .... kilometre
KPI .... Key Performance Indicators
kts.................... knots
m .... metre
MDD .... Minimum Detectable Difference
MERI .... monitoring, evaluation, reporting and improvement framework
NPA .... Northern Peninsula Area
s.e .... Standard Error
TropWATER ..... Centre for Tropical Water & Aquatic Ecosystem Research
TUMRA .... Traditional Resource Use Management Agreements
WiFi .... Wireless Fidelity

EXECUTIVE SUMMARY

Background:

Indigenous groups throughout Queensland have expressed interest in assessing seagrass habitats, particularly in relation to critical habitat for dugong and sea turtle.

Project aims and approach:

The aim of this project was to build the capacity of a number of Indigenous groups throughout Queensland to assess critical dugong and marine turtle seagrass habitats using the Seagrass-Watch program as the foundation. This was to be achieved through a progression of capacity building activities:

1. informal/casual communications (to build relationships and cultural understanding),
2. awareness raising activities (e.g. Introductory workshops) - provide an understanding of dugong and sea turtle seagrass habitats) and
3. skills training (e.g. Level 1 training workshops) - to build skills and abilities, and provide experience assessing dugong and sea turtle seagrass habitats,

The approach would empower indigenous communities to participate in formal data collection and sea country planning.

Results & key findings:

118 individuals received training (either introductory, Level 1, or both) throughout the project.

16 introductory workshops were conducted between April and October 2014, from Cape York to Hervey Bay (covering approximately 2300km of Queensland coastline), and attended by 94 participants from 17 Indigenous communities.

4 Seagrass-Watch level 1 training courses were delivered in far north Queensland, and 36 participants attended.

A low cost, robust, and user friendly camera assembly using high-performance (high resolution) live capture digital imagery was designed to assess subtidal dugong and sea turtle seagrass habitats. Two subtidal assessment trials were conducted: Upstart Bay and Missionary Bay.

There appears to be a genuine interest in assessment and monitoring of dugong and sea turtle seagrass habitats from the Indigenous communities and individuals who contributed to this project. The strong link with Traditional Owners and their sea country encourages this interest.

A number of Indigenous groups expressed a strong interest to immediately implement assessment and long-term monitoring of the dugong and sea turtle seagrass habitats in their sea country. Communities will require financial support to purchase field sampling equipment and to procure the services of Seagrass-Watch HQ for data QAQC and data management. Maintaining capacity will also require annual or biennial refresher workshops on methodologies and possibly higher training by Seagrass-Watch HQ. A scientist or level 1 qualified participant will need be on site at each monitoring event to oversee activities and provide quality assurance, to ensure time and resources are not wasted.

Identification of suitable seagrass meadows where monitoring sites can be established and the incorporation of dugong and sea turtle seagrass habitat assessment into work plans for rangers would ensure continuity of monitoring. Also, the identification of a local "*champion*" within each indigenous community to oversee and manage activities to assess and monitor dugong and sea turtle seagrass habitats will help maintain capacity and motivation.

A number of Indigenous groups have expressed strong interest to implement assessment and monitoring of subtidal dugong and sea turtle seagrass habitats using drop-cameras, including: Girringun Aboriginal Corporation in Missionary Bay and northern Hinchinbrook Island region; Gudjuda Land & Sea Rangers in Upstart Bay; Lama Lama Rangers in Princess Charlotte Bay. Detailed assessments/surveys of subtidal dugong and sea turtle seagrass habitats will need to be conducted to ensure sites are appropriately placed and meet the criteria for long-term monitoring. Financial and scientific support will be required to conduct the surveys.

A key finding from the capacity building in Queensland was that there was more interest in dugong and sea turtle seagrass habitats from Traditional Owner groups in the far north of the state; but this may be a consequence of a greater focus on sea country management within northern groups and more specific ranger groups being established with TUMRAs and funding to undertake sea country work. This would suggest that a priority for financial and scientific support should focus initially on the northern Great Barrier Reef, as this would provide greater uptake and application of capacity building activities to sea country planning and management. With the support of Indigenous groups, it is hoped that a long-term comprehensive seagrass monitoring program be established for the northern GBR with particular emphasis on the seagrass habitats that support significant densities of dugongs.

The structured capacity building approach, where trainees progress through a series of increased learnings, enables a better understanding of the background knowledge and application of skills. Mandatory attendance of introductory workshops prior to attending higher levels of training also ensures higher trainee success rates. This capacity building approach empowers Indigenous communities to:

- more effectively communicate to public and youth
- collect scientific and sea country data with confidence
- contribute to sea country planning & management with certainty.

OBJECTIVES:

1. To build capacity of Indigenous groups to assess critical dugong and marine turtle seagrass habitats and collect data using standardised scientific methodologies
2. To conduct 15 introductory Seagrass-Watch courses at indentified locations
3. To conduct 3 Seagrass-Watch level 1 courses at indentified locations
4. To trial and conduct subtidal assessment of seagrass at two locations.

INTRODUCTION & BACKGROUND

For the Indigenous peoples of coastal Queensland, dugongs and marine turtles have great cultural, social, spiritual and dietary significance[1-3]. For many, dugong and marine turtle are integral to the customary way of life and looking after them and their habitats is a cultural responsibility.

Dugongs and marine turtles are important to Aboriginal and Torres Strait Islander peoples because these animals belong to sea country, and hence, are part of the complex cultural relationship between saltwater peoples and their coastal land and sea estates[4]. Management of dugongs, marine turtles and their habitats occurs as part of Indigenous peoples' role in sea country management. Although Indigenous cultures differ from region to region, Indigenous groups have developed a variety of initiatives to continue or regain their involvement in marine resource and environmental management in ways that give contemporary expression to their inherited rights and obligations to sea country[5]. Management (Indigenous or non Indigenous) of sea country and critical habitats may include, for example: go slow zones to reduce boat strike in known dugong and/or turtle feeding areas; setting aside sanctuaries where dugong and/or turtle cannot be hunted; restricting commercial net fishing in locations where dugong and/or turtle are known to occur. These initiatives often occur in partnership with government agencies, research institutions and others (e.g. Traditional Use of Marine Resources Agreements (TUMRA) describe how Great Barrier Reef Traditional Owner groups work in partnership with the Australian and Queensland governments to manage traditional use activities on their sea country).

Dugong and green turtle populations around the world have been subject to population declines, and animals are now absent from large areas of their former distribution range in some parts of the world. These declines are the result of overharvesting, entanglement in fishing lines and nets, boats and boat noise displacing animals from feeding and breeding areas, boat strike and destruction of seagrass habitats. These combined impacts can affect local population sizes. Evidence from current long-term monitoring studies is showing that with good management, such as by protecting habitat, reducing deaths in fisheries and ensuring that harvests are sustainable, dugong and turtle populations can be maintained or recover. Research and monitoring is essential for effective management of sea country and dugong and turtle populations.

Seagrass are critical food for dugong *(Dugong dugon)* and green turtle *(Chelonia mydas)* which are listed as threatened or vulnerable to extinction in the IUCN Red List (www.iucnredlist.org). An adult green turtle eats about two kilograms of seagrass a day, while an adult dugong eats about 28 to 40 kilograms a day. Queensland has some of the most extensive seagrass meadows in the world with approximately 18,374 km^2 in the coastal waters (shallower than 15 metres) and 39,757 km^2 in offshore waters deeper than 15 metres[6]. Overall, this represents between 10 - 20% globally[7-9] making Queensland's seagrass resources globally significant. Therefore, it is no coincidence that Queensland seagrasses support some of the worlds largest populations of dugong and green turtle.

The Northern Great Barrier Reef and Torres Strait continue to support globally significant populations of dugongs[10]. In November 2013, the dugong population size in the Northern Great Barrier Reef was estimated to be 6,558 ±1,141 animals[10]. Regions of very high dugong relative density in the Northern Great Barrier Reef were between Cape Flattery and Cape Bowen (Starke River region); Bathurst Bay; the eastern section of Princess Charlotte Bay; between Princess Charlotte Bay and around Friendly Point; as well as Lloyd, Temple and Shelburne Bay[10]. Indigenous communities whose sea country includes these high dugong densities, are keen to participate in development of related plans and activities to manage critical dugong and turtle habitats effectively.

Although seagrass are recognised as one of the most productive of the Earth's ecosystems, widespread and accelerating losses currently place seagrass ecosystems among the most threatened[11]. Seagrass are most abundant in coastal regions where available nutrients, light and suitable habitable substrate meet growth requirements. It is also these coastal areas where seagrass globally are exposed to the impacts from the billion or more people who live within 50 km of them[12]. These impacts have all led to a rapid loss of seagrass ecosystems, at a rate of around 1.5% of seagrass area per year globally[11]. Queensland is not immune to these threats and losses[13, 14]. As a consequence of extreme and broad scale climate related impacts in Queensland over the last 3-5 years, significant losses of seagrass have been reported[15]. The scale of losses are believed to have impacted on food resource availability for dugong and green turtles resulting in further losses of both.

Information on seagrass distribution and condition is a necessary prerequisite to managing dugong and sea turtle. To make informed decisions, sea country and coastal managers need information on the characteristics of seagrass resources, such as where species of seagrasses occur and in what proportions and quantities, and whether damaged meadows can be repaired or rehabilitated. Additionally, sea country and coastal managers may also need to know where seagrasses might have occurred for the purposes of recovery, restoration and to allow for natural spatial dynamics. Knowledge of the extent of natural changes in seagrass meadows is also important so that human impacts can be separated from normal background variation[16].

The need for developing institutional arrangements that empower Indigenous peoples to strengthen their participation in natural resource management, and ensure that their use of resources is ecologically sustainable is recognised by the United Nations[17]. The Seagrass-Watch program (www.seagrasswatch.org) encompasses many of these visions. Seagrass-Watch protocols combine a series of education and training exercises to develop knowledge and skills in field-based seagrass monitoring. The methods do not require special abilities, such as swimming or diving, are logistically simple, relatively safe and inexpensive. Quality assurance and quality control procedures assure that the data collected is scientifically rigorous and that time and resources are not wasted[18].

Using the Seagrass-Watch program as a foundation, this project undertook the following major tasks in consultation with EHP:

1. conduct a series of introductory workshop, at identified communities, which address identification and importance of seagrass, threats and techniques for monitoring critical sea country habitats. Ensure Introductory course presentations and associated handouts are culturally sensitive/relevant and focus on sea country assessment and management outcomes. Conducted a questionnaire after each workshop to assess/gauge participant satisfaction and provide feedback;
2. conduct higher level formal training (Seagrass-Watch Level 1) courses at 3 identified communities, to build the capacity of Indigenous rangers and community members to collect data using standardised scientific methodologies to assess critical dugong and marine turtle seagrass habitats, and;
3. develop and trial an inexpensive, durable, user-friendly, real-time underwater closed circuit drop camera to conduct assessment of subtidal seagrass habitats at 2 locations with identified communities.

The capacity building will assist Traditional Owners and decision makers in managing sea country habitats and also increase community confidence in management.

METHODOLOGY

Engagement & awareness raising

A component of the Seagrass-Watch program is engaging with coastal Indigenous groups and Traditional Owners to raise awareness of the importance of seagrass to sea country. One of the most effective communication tools is face-to-face interaction, enabling participants to experience seagrass ecosystems via field tours. To share experiences, learn about seagrasses / seagrass ecosystems and how a site is monitored, is one of the most powerful ways to raise awareness.

For groups or individuals with access to new technologies, Seagrass-Watch employing platforms such as Twitter and Facebook to communicate the latest seagrass news from around the word, provides program up-dates and facilitates the sharing of knowledge between users. One of the most effective communication tools the Seagrass-Watch program uses is its active and informative website. The website is content rich, and populated with high-quality photographs of seagrass and associated organisms. The website has become a first stop for many online users searching for seagrass information with between 500-600 unique visitors a day. The website provides an easily accessible portal to explore and learn what seagrasses are, why they are important, how they are threatened and includes reports on the state of seagrass where participants are actively monitoring.

Capacity building and training

The collection of data by Indigenous and community groups necessitates a high level of training to ensure that the data is of a standard that can be used for management purposes. Technical issues concerning quality control of data are important especially when the collection of data is by people not previously educated in scientific methodologies.

The Seagrass-Watch program has a tiered level of training for participants 18 years of age and over (www.seagrasswatch.org/training.html) (Table 1). The introductory level has no requirements before attending, however due to the higher academic focus of the higher levels of training, there are requirements before participants can attend a course, and a level of achievement to be completed to pass a training course. Presentations in Level 1 are targeted at participants with an education level of year 12 to first year university.

Table 1. *Seagrass -Watch training levels.*

Introductory	(Beginner) *Duration:* 1hr classroom, 2 hours field. Course covers introduction to seagrass identification, the importance of seagrass, how seagrass can be damaged and Seagrass-Watch monitoring techniques. The course consists of a classroom presentation and undertaking field monitoring demonstration. *no requirements to attend and no formal assessment*.
Level 1	(Basic) *Duration:* 8hrs classroom, 2-3 hours field. Participants will study seagrass biology, learn seagrass taxonomy, discuss present knowledge of seagrass ecology (including importance and threats), gain knowledge of monitoring, learn about the Seagrass-Watch program and techniques for monitoring seagrass resources and become skilled at conducting a field monitoring event. Participants are trained to identify local seagrass species, undertake rapid visual assessment methods (% cover), accurately record data, preserve seagrass herbarium samples, photograph quadrats and identify presence of dugong feeding trails or other impacts. *Requirements = participants must have some Seagrass-Watch monitoring experience and have participated in at least one field monitoring event prior to attending.* *Achievement = demonstrated competency in 5 core units. Attendance of classroom, laboratory and field session; achieve 80% of formal assessment (multiple choice, open book) and demonstrated competency in the field (successfully complete 3 monitoring events/periods within 12 months).*

Formal training is conducted by Seagrass-Watch HQ and includes formal lectures and on-site assessments with a tiered level of certification for competency. After 6–9 hours of training, participants should have the skills and abilities be able to produce reliable data. After trainees have demonstrated experience with the field techniques (via 3 monitoring events post training) and competency, they are certified to supervise on-site monitoring and demonstrate monitoring methods. Informal / introductory training is also conducted by local coordinators and/or scientists. Ideally, at least one formally trained volunteer is present at each monitoring event. Evidence of competency is securely filed at Seagrass-Watch HQ.

Subtidal seagrass monitoring

Two regions were chosen in collaboration with EHP to assess subtidal seagrass habitats in their sea country; based on interest, capacity of local Indigenous groups and access to suitable vessels. The regions were: north Hinchinbrook Island, with Girringun Traditional Owners; and Upstart Bay, with Gudjada Traditional Owners. Potential subtidal monitoring sites (3 - 10m water depth) were identified within each region based on available mapping/monitoring information and in consultation with Traditional Owners.

A site was defined as the area within a 50m radius of a GPS waypoint. At each site, a drop camera was deployed to visually assess the seabed and record the footage for post-field analysis. In conjunction with the visual assessment at each site, a van Veen grab was used to confirm the seagrass species and sediment characterisation inferred from the camera.

Based on the assessment of deepwater *Halophila* meadows[19], replication at each site requires at least 10 drops of the camera (assuming within-site variance is reduced by at least 50% with 10 replicates). Each drop of the camera requires a steady and clear image of the seabed within the $0.25m^2$ frame (field of view). Camera drops were separated by 5-10m, which was accomplished by drifting around the GPS waypoint.

Post-field, the footage of each vertical drop of the camera from each site was assessed by a trained and experienced scientist/staff member at Seagrass-Watch HQ. The percentage cover of seagrass within the $0.25m^2$ quadrat (field of view) was be estimated. Data followed standard Seagrass-Watch QAQC and data management protocols[18, 20, 21] (see also www.seagrasswatch.org).

Measuring success

This project contributes to a number of outcomes to be delivered by a number of Queensland Indigenous groups as part of their sea country strategic policies (e.g. indigenousseacountry.org.au) and EHP, as part of the Dugong Indigenous Management Project: A partnership in sustainable management of dugong and turtle. The outcomes include:

- providing on-ground Indigenous ranger support to complement existing community ranger operations and support and capacity building services provided to Indigenous rangers;
- data and monitoring activities extended state-wide to Indigenous communities and training conducted and/or enhanced;
- critical gaps in knowledge of seagrass status, distribution, threat and conservation through rapid assessment methodologies (e.g. standardized surveys) identified;
- data and awareness raising programmes developed to assist Indigenous ranger engagement with communities to influence hunting and management practices and to participate in development of related plans and activities;
- a coordinated approach to working with communities developed and undertaken;
- capacity of Cape York traditional owners to manage critical dugong and turtle habitats effectively in sea country enhanced

To ensure that the project outcomes and activities were delivered, a MERI Plan was implemented to help monitor progress and ensure accountability of achievements. A number of Key Performance Indicators were established in consultation with EHP to measure project success (Table 2).

Table 2. *Key Performance indicators and targets for successful delivery of project.*

KPI	target
1. 13 introductory courses successfully delivered in selected locations	satisfactory feedback from 80% of attendees
2. three level 1 training courses delivered in selected locations	trainees need a 75% mark to pass this training
3. contacts recorded	all participants names recorded and provided to EHP
4. further monitoring activities carried out	30% of Indigenous groups trainees express interest in carrying out further studies on their own country
5. data management	all data collected as part of training courses is made available to EHP in report form
6. reporting	written monthly reporting delivered to EHP upon agreed date

RESULTS & DISCUSSION

Introductory workshops

KPI-1: 13 introductory courses successfully delivered in selected locations *(satisfactory feedback from 80% of attendees)*	16 introductory courses successfully delivered, with 91% of attendees rating the training as good or excellent

Introductory workshops on seagrass habitats for dugong and sea turtle were conducted for Indigenous rangers and traditional owners at 16 locations across Queensland between 25 April and 08 October 2014 (Figure 1, Table 2). A total of 94 participants attended the workshops from 17 Indigenous groups (Table 2, Appendix 1). Due to the constraints of access to intertidal banks during daylight hours, introductory workshops were unable to be conducted in the coastal communities of the southern Gulf of Carpentaria.

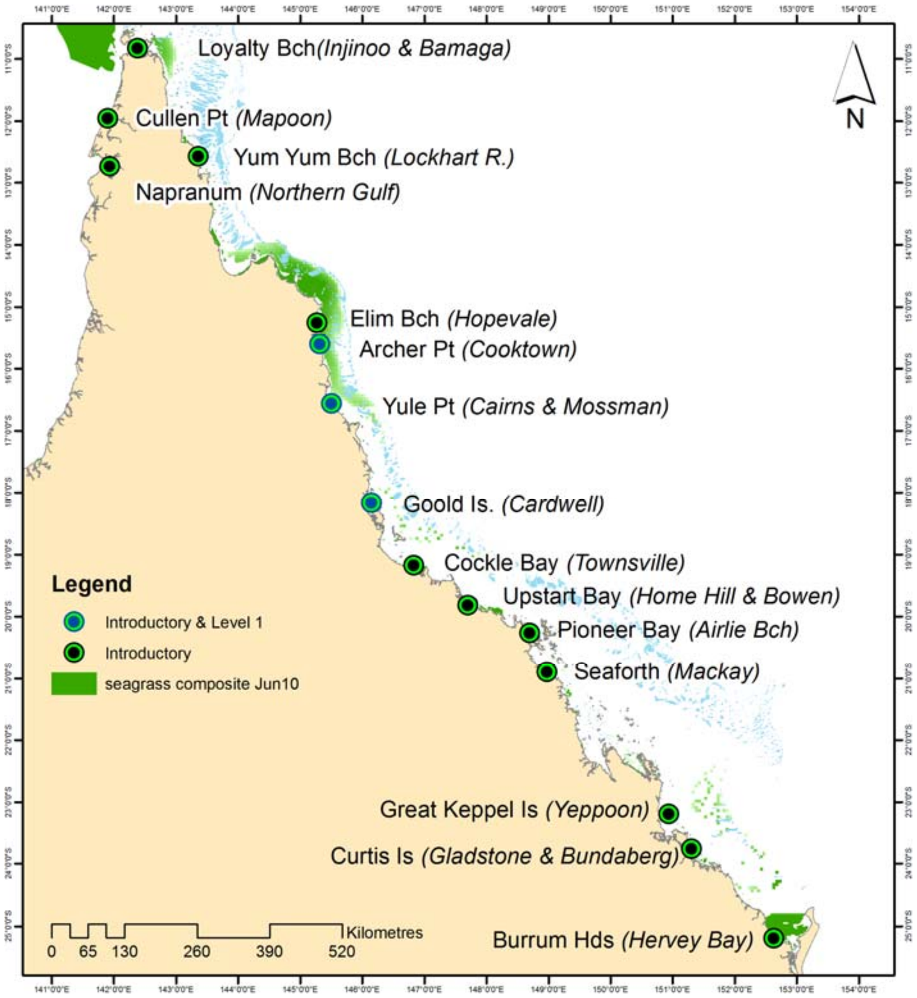

Figure 1. *Location of Introductory and Level 1 training workshops. Seagrass composite represents the maximal habitable area that seagrass has been mapped November 1984 to June 2010*[22].

Prior to each Introductory workshop, a flyer was prepared in consultation with EHP and distributed through all appropriate networks via acceptable mechanisms for maximum uptake (e.g. email, bulletins, post, handout, face to face contact in communities) (Appendix 2).

Table 3. *Location, data and Indigenous groups which participated in introductory workshops 29Apr-08Oct14.*

Location (NRM)	Date	Ranger group / community	Instructor
Cooktown *(Cape York)*	29 April 2014	Yuku Baja Muliku	Christina Howley
Airlie Beach *(Mackay Whitsunday)*	13 May 2014	Ngaro	Len McKenzie
Seaforth/Mackay *(Mackay Whitsunday)*	14 May 2014	Koinmerburra	Len McKenzie
Cardwell *(Wet Tropics)*	14 May 2014	Girringun & Gudjuda	Louise Johns
Bowen/Cape Upstart *(Burdekin)*	14 May 2014	Gudjuda	Naomi Smith
Cairns *(Wet Tropics)*	15 May 2014	Yirrganydji, Gimuy, Yidinji, Mandingalbay Yidinji	Louise Johns
Mossman *(Wet Tropics)*	16 May 2014	Kuku Yalanji	Louise Johns
Mapoon *(Cape York)*	19 May 2014	Mapoon	Louise Johns
Napranum *(Cape York)*	20 May 2014	Nanum Wungthim	Louise Johns
Hopevale *(Cape York)*	23 May 2014	Guugu Yimithirr	Christina Howley
Gladstone *(Fitzroy)*	26 May 2014	Gidarjil	Len McKenzie
Great Keppel Island *(Fitzroy)*	28 May 2014	Woppaburra & Darumbal	Len McKenzie
Magnetic Island/Townsville *(Burdekin)*	13 June 2014	Palm Island, Magnetic Island rangers	Louise Johns
Bamaga & Injinoo *(Cape York)*	19 June 2014	NPA rangers	Louise Johns
Burrum Heads/Hervey Bay *(Burnett Mary)*	24 June 2014	Butchulla	Len McKenzie
Lockhart River *(Cape York)*	08 October 2014	Kuku Ya'u Wuthuthi, Kanthanumpu	Louise Johns

The aim of the Introductory workshops was to provide some background knowledge to increase the capacity of Indigenous Ranger groups and communities to better manage their sea country, particularly in relation to the conservation and sustainable management of sea turtles and dugongs. Workshops included a short classroom/laboratory session and a field visit. The classroom included two presentations of approximately 30 minutes each. The first presentation covered topics such as: what seagrass are, where you find seagrass, how they differ from algae (seaweeds), why seagrass are important and threats to seagrass. During the second presentation, participants learnt about seagrass identification, monitoring protocols, the status of local seagrass and relevance to sea country management. After the presentations the participants examined a variety of seagrass species from their area (4-6 species) and learnt how to get involved in Seagrass-Watch should they be interested (Figure 2). The overall format of the Introductory workshops was a more relaxed format with plenty of interaction and feedback from the participants (e.g. Figure 3)

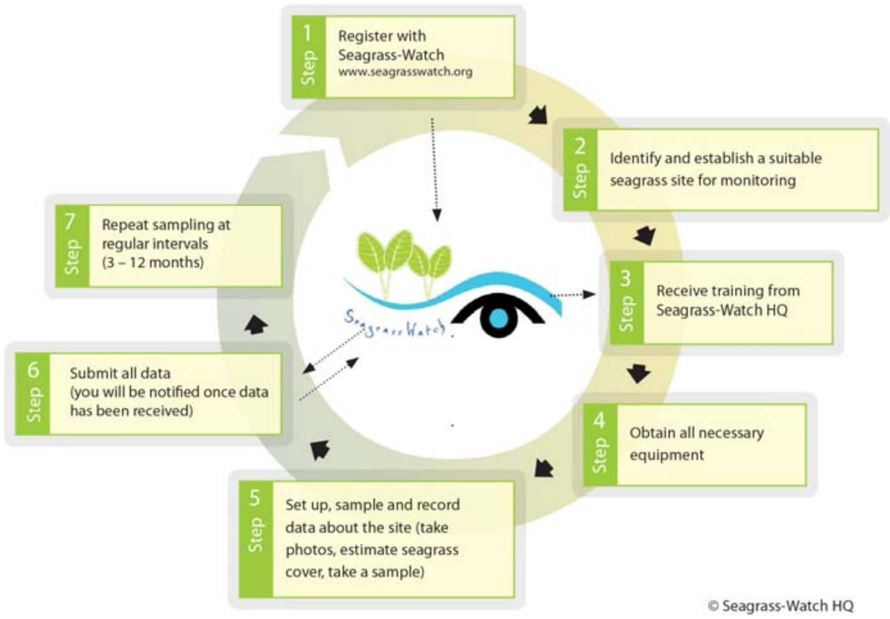

Figure 2. *Seven step cycle to be involved in Seagrass-Watch long-term monitoring.*

The final component of the Introductory workshop was a field demonstration of the globally standardised Seagrass-Watch monitoring protocols. Field demonstrations only occurred during low tide on intertidal seagrass meadows due to accessibility and cost effectiveness (limiting use of vessels and divers) and Work Place Health & Safety due to dangerous marine animals (e.g., crocodiles, box jellyfish and irukandji).

Most field locations had at least 2 species of seagrass present. The field location with the greatest species diversity was Loyalty Beach (near Bamaga, Cape York) with at least 5 species (*Enhalus acoroides, Thalassia hemprichii, Syringodium isoetifolium, Halophila ovalis, Cymodocea serrulata* and *Halodule uninervis*) on the site. Majority of southern locations included fewer seagrass species; mainly *Zostera muelleri, Halodule uninervis* and *Halophila ovalis*. All species are of importance to dugong and sea turtle. 94% of participant said with further training, they felt they could confidently identify seagrass species. Many field demonstration sites were also meadows frequented by grazing dugongs, which enabled the participants to learn how to recognise grazing trails and not confuse with shovel nose ray feeding scars and propeller scars from boats.

The majority of introductory workshop participants had no previous experience on seagrass habitats (i.e. assessment and monitoring); however, over 90% of respondents said they would be interested in attending level 1 training. All participants responded that the workshop had been of benefit, that they now had a better understanding of seagrasses and that they would be able to apply the knowledge learnt as part of the sea country planning.

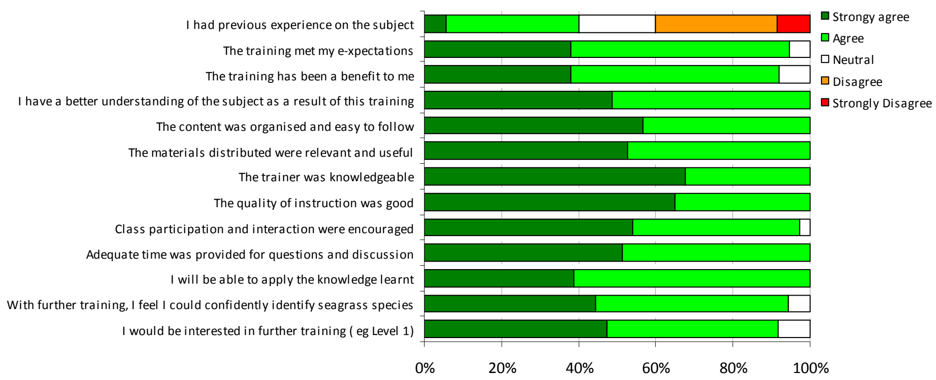

Figure 3. *Feedback from Introductory workshop participants on the quality of the workshop, whether it met their expectations and if they would be interested in further training is provided.*

KPI-4: further monitoring activities carried out *(30% of Indigenous groups trainees express interest in carrying out further studies on their own country)*	92% of Indigenous trainees expressed interest in further training (level 1) so that they could conduct seagrass assessments on their own country

92% of Indigenous trainees said the training overall was good or excellent (Figure 4) and that they would also be interested in further training (e.g. Seagrass-Watch Level 1).

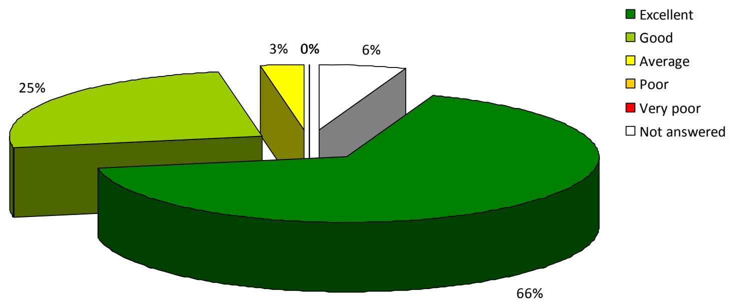

Figure 4. *How participants rated the Introductory workshop overall.*

Figure 5. *Participants from Yirrganydji, Gimuy, and Mandingalbay Yidinji learning and trialling seagrass assessment protocols under guidance at Yule Point, 15 May 2014.*

Figure 6. *Participants from Gidarjil learning seagrass assessment protocols under guidance at Pelican Banks, Curtis Island (Gladstone Harbour), 15 May 2014.*

a. b. c.

Figure 7. *Woppaburra, Darumbal and Fitzroy Basin Elders Committee participants at Great Keppel Island, 15 May 2014: trialling assessment of percentage seagrass cover at Monkey Beach (a); learning seagrass species identification (b); and recording details on sediment and macrofaunal abundance (c).*

Figure 8. *Participants from Hopevale (Guugu Yimithirr) and Queensland Parks and Wildlife assessing the seagrass meadows at Elim Beach (Cape Bedford in background).*

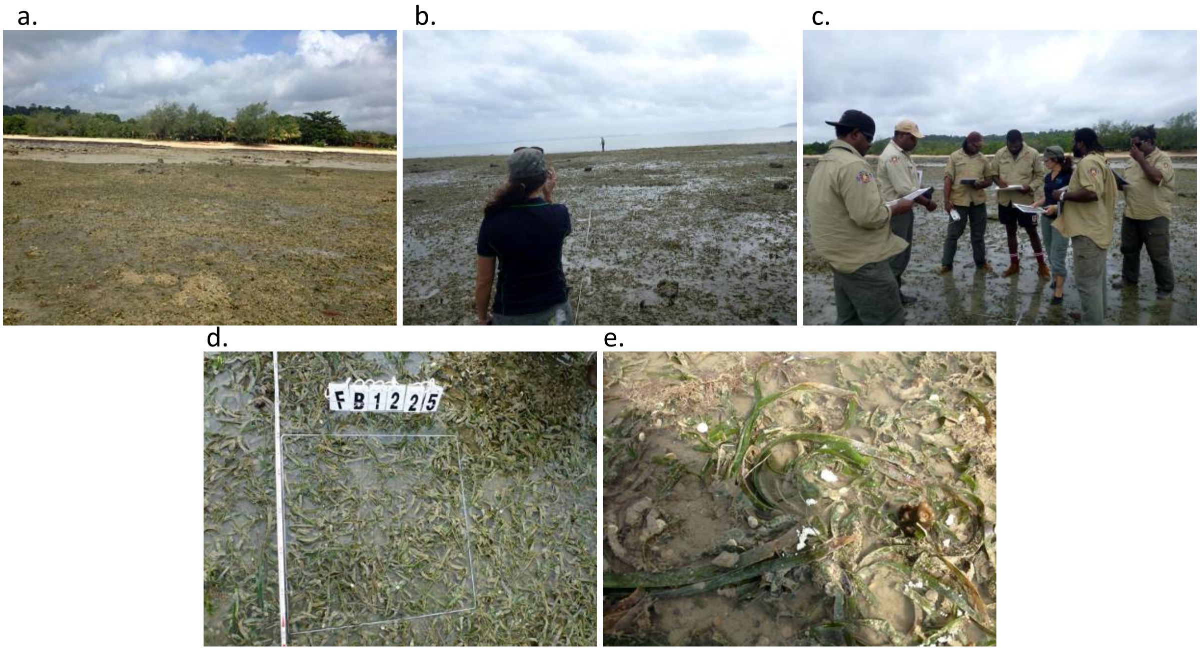

Figure 9. *NPA rangers trialling seagrass assessment protocols under supervision: Mixed seagrass meadow (Enhalus acoroides, Thalassia hemprichii, Syringodium isoetifolium, Halophila ovalis, Cymodocea serrulata and Halodule uninervis) at Loyalty Beach (a); laying out a standard monitoring site (b); estimating seagrass cover (c); quadrat showing high seagrass cover (d); male Enhalus acoroides plant with flowers (e).*

Figure 10. *Palm Island and Magnetic Island rangers trailing seagrass assessment techniques at Cockle Bay.*

Figure 11. *Introductory workshop with Mapoon rangers: first, some background information in the classroom (left); laying out a field monitoring site at Cullen Point (centre); assessing seagrass in the field (right).*

Figure 12. *Kuka Yalanjii rangers (Mossman) trailing seagrass assessment techniques at Yule Point: assessing macrofauna and sediment in a quadrat (left); standard quadrat photograph (centre); assessing seagrass in the field (right).*

Figure 13. *Introductory workshop with Napranum rangers: learning the background information of how to estimate seagrass cover using standard guides (a,c); measuring seagrass canopy height on strap-leaved seagrass in the field (b); tape measures laid in correct position on a monitoring site (d).*

Figure 14. Seaforth: *classroom lectures (left); learning how to set up a standard seagrass monitoring site by laying out the 50m tapes in the correct positions (centre); assessing seagrass in the field (right).*

Level 1

KPI-2: three level 1 training courses delivered in selected locations *(trainees need 75% mark to pass this training)*	*Four level 1 training courses were delivered at locations agreed with EHP, and 31% of trainees passed (NB: still to complete 3 monitoring events over next 12 months to receive Certificate of Achievement)*

Four Level 1 training courses were conducted (Table 3), which were attended by 36 trainees in total. 78% of trainees successfully passed the classroom assessments, demonstrating they have a basic understanding of seagrass ecology and the ability to identify seagrass species. Eight trainees, however, were unable to demonstrate competency in seagrass identification. 31% of trainees also passed the field component, demonstrating they have the skills to apply the field methods and were eligible to continue with 3 monitoring events to qualify for a *Certificate of Achievement*. Unfortunately, 31% of trainees have yet to complete the field component of their course due to bad weather and H&S issues at the time.

Table 4. *Details of Level 1 training workshops conducted.*

Location	Date	Ranger group / community	Field
Archer Point (Cooktown)	24-25 July 2014	Yuku Baja Muliku & Lama Lama Rangers	completed
Cardwell	7-8 August 2014	Wulgurukaba, Gudjuda & Girringun	not completed*
Cairns	11-12 August 2014	Djunbunji, Guru Gulu, Gunggandji, Mandingalbay Yidinji & Yirrganydji	completed
Cairns	2-3 December 2014	Dawul Wuru & Gunggandji	completed

**trainees invited to attend field component of Cairns workshops*

The importance of the Introductory workshops cannot be underestimated. 33% of trainees had attended Introductory workshops prior to attending a Level 1 course. All trainees who attended Introductory workshops passed the classroom component, and 75% passed the field component; demonstrating they have the understanding, skills and ability to assess dugong and sea turtle seagrass habitats for sea country management *(NB: to receive Certificate of Achievement, trainees still need to complete 3 monitoring events over next 12 months to demonstrate experience with the methods)*. Of those who did not attend Introductory workshops, only 67% passed the classroom, and 29% passed the field components. This demonstrates that attending an Introductory workshop is necessary prior to embarking on more advanced training. Building the capacity of Indigenous communities to assess dugong and sea turtle seagrass habitats for sea country management is best done in a gradual approach.

Feedback provided by the trainees on the Level 1 workshops was very favorable, and all trainees were happy with the quality of instruction, the materials provided and the content (Figure 15).

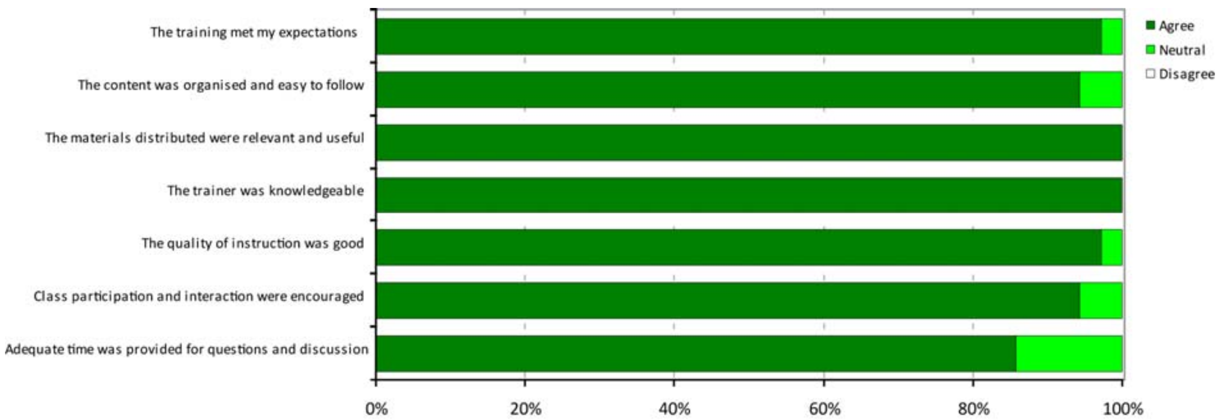

Figure 15. *Seagrass-Watch Level 1 trainee feedback.*

The capacity building outcomes from the Level 1 training workshop can be classified in three broad categories:

1. Knowledge

Thorough understanding of:

- what seagrasses are
- why they are important
- factors required for healthy seagrass growth
- threats to seagrasses
- approaches to mapping and monitoring of seagrass resources
- how monitoring data is used for sea country management

2. Skills

Proficiency in:

- how to identify seagrass species
- how to make a herbarium press specimen
- how to monitor seagrass resources

3. Abilities

Capacity to confidently:

- Educate others on seagrass resources
- Demonstrate monitoring techniques/protocols
- To provide advice on appropriate management and mitigation of threats to seagrass resources

77% of trainees rated the training overall as excellent (Figure 16), and .

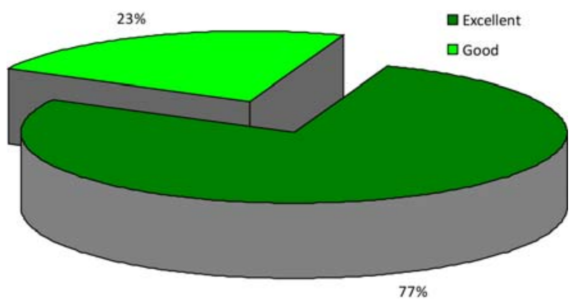

Figure 16. *How the Level 1 trainees rated the training overall.*

Figure 17. *Archer Point, 24-25 July 2014: classroom group activities (a); assessing seagrass cover (b); participants being assessed for competency in field protocols (c); workshop participants (d).*

Figure 18. *Cardwell, 7-8 August 2014: classroom assessments (left); learning seagrass identification (centre); workshop participants and trainers (right).*

Figure 19. *Cairns, 11-12 August 2014: classroom assessments (left); learning seagrass identification (centre); field assessment (right).*

Figure 20. *Cairns, 2-3 December 2014: classroom lectures(a); seagrass identification (b); field exercise (c); estimating seagrass cover (d); photographing a quadrat (e).*

Subtidal seagrass monitoring

Subtidal seagrass assessments in the past have required relatively expensive ($5k - $30k) and specialised camera assemblies to provide live CCTV images to a surface vessel. A key objective of this project was to design a low cost assembly using high-performance (high resolution) live capture digital imagery. After much trialing in collaboration with CSIRO Land and Water, a camera assembly meeting the project requirements was designed.

Subtidal seagrass was assessed using a real-time underwater closed circuit drop camera assembly which included a GoPro® HERO®3+ Silver camera mounted to a frame with a 0.25 m^2 quadrat in the field of view. The live image from the GoPro® was transmitted via WiFi underwater using a high quality coaxial cable (cam-do.com, Figure 16) back to a surface Android™ (mobile operating system) tablet (Samsung Galaxy Tab 2 7.0) for live viewing and recording. The HERO®3+ Silver captured professional-quality 1080p60 video and the built-in Wi-Fi enabled the use the GoPro App (Android™) to provide real time video monitoring and complete control over the camera settings. Images were recorded to the Samsung Galaxy Tablet SD card.

Figure 21. *WiFi Extension Cable from cam-do.com, which extends the use of WiFi and Bluetooth control of GoPro® Hero3, cameras underwater. At the dry end, the WiFi extension interfaces wirelessly with any Android phone or tablet or iPhone or iPad. The interface can be attached to the back of the phone (in this image a Sony Experia Active) using velcro or 3M double sided removable mounting squares.*

Trials to assess the new camera assembly and subtidal seagrass was conducted at two locations: Upstart Bay, with Gudjuda rangers, and; Missionary Bay, Hinchinbrook Island with Girringun rangers. The subtidal seagrass assessment consisted of:

- establishing a site (GPS waypoint) based on all available data;
- the study area (site) was defined as within 50 metres radius of the GPS waypoint;
- deploying a real time camera assembly to visually assess the seabed and recording the footage for post field analysis;
- using a grab (van Veen) in conjunction with the visual assessment to confirm seagrass taxonomy and sediment type;
- conducting a sufficient number of camera drops (with a 0.25m^2 field of view) to estimate percentage cover of substrate by seagrass within a site.

Location/trial 1: Upstart Bay 19Nov14
Gudjuda rangers *(2 attended)*

Weather and sea state were not favorable (15-20kts, lots of swell), and as a consequence a ranger and a JCU staff member were incapacitated (i.e. sea sickness). The site was in 5-10m water depth at a position (S19.813 E147.749) where good cover of seagrass (*Halodule uninervis and Halophila ovalis*) had been assessed previously (October 1999[23]).

The poor sea state made the operation of the camera assembly and van Veen grab difficult from the side of the boat. The water visibility was poor and the image from the camera was degraded (a result of a low quality coaxial cable being used to transmit the WiFi signal from the GoPro® underwater). A number of benthic grab samples were successfully collected, although no seagrass was located. Both rangers expressed an interest and willingness to conduct another trial when conditions improve.

Figure 22. *Gudjuda rangers (left) and GoPro with low quality coaxial cable (right)*

After the Upstart Bay trial, the JCU team conducted pool trials and further testing of the equipment in Ross River (i.e. lower visibility). The camera signal worked to about 2m depth, beyond which the signal deteriorated.

After consultation with CSIRO, the team procured a cable assembly just released from cam-do.com to improve the quality of the image for the second trial in Missionary Bay, Hinchinbrook Channel.

Location/trial 2: Cardwell 25Nov14
Girringun rangers *(2 rangers + 2 Girringun volunteers)*

Weather was favourable (10-15kts, calm seas) and the vessel was larger than the one used in trial 1. Three sites were assessed using standard subtidal protocols. The first site examined was in Missionary Bay (S18.22220 E146.10123). A herd of dugongs were observed near the site, indicating the possible presence of seagrass. The location was shallow (~3-4m), which enabled easy camera deployment for the rangers to become familiar with the assembly. The rangers were very happy with the simplicity of the assembly and were able to conduct a series of 10 drops successfully. The live preview worked flawlessly (Figure 23), but for optimal viewing on the tablet it was best for the observer to shelter out of sunlight (e.g. under a towel) (Figure 24).

Figure 23. *Drop camera assembly (left) and field deployment (right). Note GoPro® fixed at correct height to ensure 0.25m^2 quadrat is within field of view and focus, and Samsung Galaxy Tablet with App to control GoPro, view and record footage.*

Figure 24. *Deployment of drop camera, with one operator controlling in-water frame assembly and the other operator checking images live from GoPro (note: screen operator requiring to shelter under towel to reduce screen glare).*

A number of collections were conducted using the van Veen grab to determine the sediment grain description (which was mud/fine sand) and verify the seagrass species (narrow leaved *Halodule uninervis* and *Halophila ovalis*) (Figure 25).

a. b. c. d.

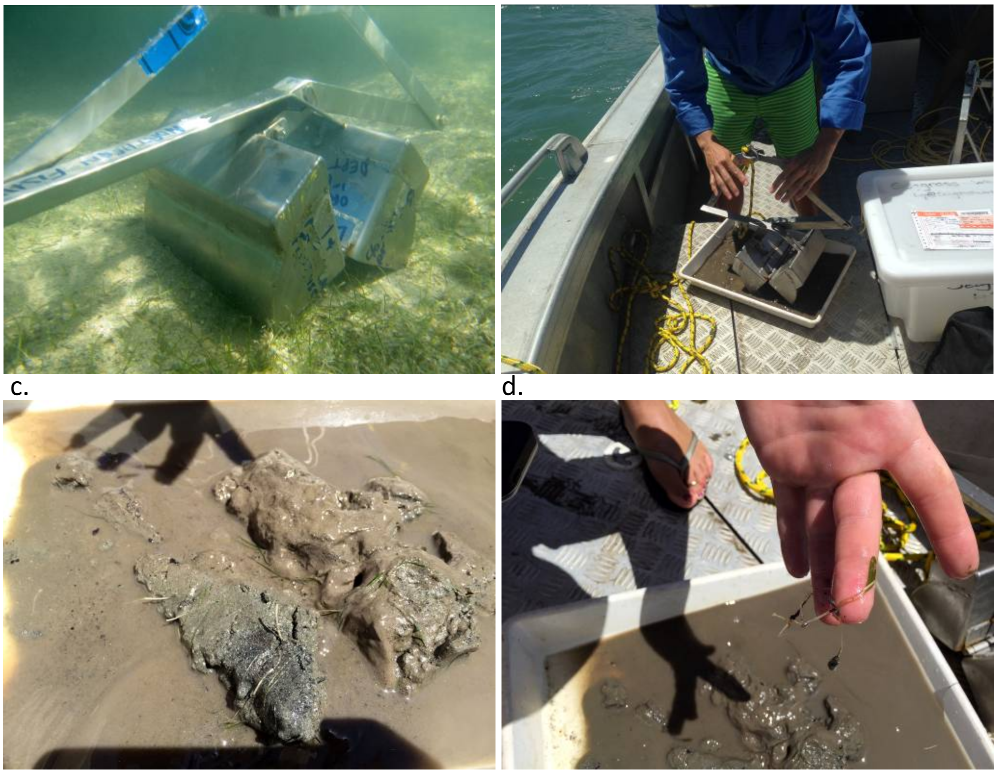

Figure 25. *Van Veen grab, required to check sediment grain size and verify seagrass species: van Veen grab deployed (stock image) (a); sample released from grab (b); grab sample showing grain size (c); checking seagrass species (d).*

At request of the rangers, a deeper site was assessed in Hinchinbrook channel. In the middle of the channel the water depth was approximately 10m; however, due to the very turbid waters, the image was almost lost (i.e. totally dark) deeper than 5m. The next site assessed was closer to the edge of the channel (~5m depth, position S18.28900 E146.09663), and although the image was barely visible, there was no seagrass found on the site.

In conclusion, the rangers were pleased with the camera assembly and motivated to implement future monitoring. Girringun expressed that they would be able to conduct subtidal monitoring at least 4 times a year (*combining this with their dolphin surveys*).

Post-survey, the digital video footage was examined at Seagrass-Watch HQ (JCU). Due to the turbid/low light conditions in the field, some post-processing was necessary to enhance image features and improve assessments.

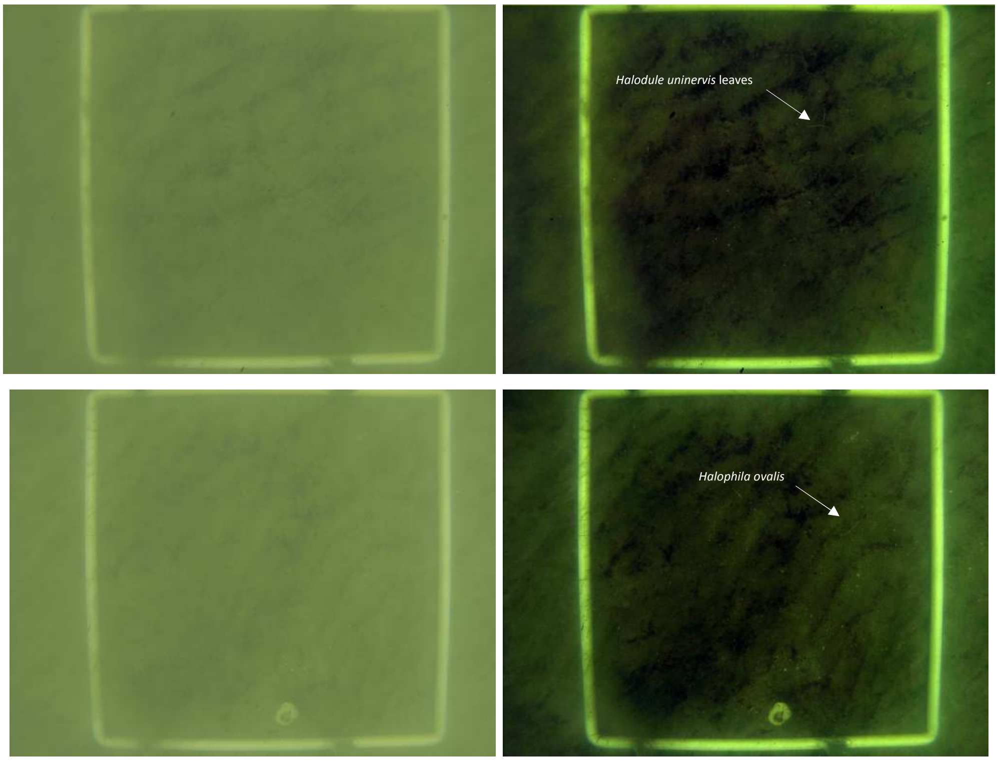

Figure 26. *Example of image captured from Missionary Bay site pre- and post-processing.*

Of the 3 sites assessed using standard subtidal protocols, seagrass was only found at one site; Missionary Bay. Seagrass abundance (% cover of the substrate) averaged 0.28 ±0.09% (median=0.15%) and was dominated by narrow leaved *Halodule uninervis* with *Halophila ovalis* (Figure 27). The abundance of the meadow on 25 November 2014 was significantly lower than when last assessed on 13 October 1996 (18.27g DW m^{-2}, >50% cover) during a baseline survey of the region[24]. The meadow species composition and sediment type, however, were similar to that reported in 1996.

A criteria to determine the suitability of a site for monitoring is that the Minimum Detectable Difference (MDD) be less than 20% (at the 5% level of significance with 80% power). The MDD is the minimum difference between the largest and smallest means, and is based upon differences in precision of the mean Standard Error for each sample number. Using the degrees of freedom at a particular sample number, critical t-values were selected from t-value tables for both 0.05 (α set at 5%) and 0.20 (β set at 80% power), using 2-tailed tests[25]. These t-values were entered into the following formula (eq. 1) in order to determine the minimum detectable difference:

$$MDD = \sqrt{2}\; S_{\bar{Y}}\; (t_{(0.05),\nu} + t_{(0.2),\nu}) \qquad \textbf{(equation 1)}$$

where $S_{\bar{Y}}$ = SE for sample size, ν = 2 (number of replicates -1) and all t-values are 2-tailed.

The MDD for the site (calculated using eq. 1) was 75.6%, which does not support the site's suitability for monitoring. It is recommended that a more thorough survey or the region be conducted to identify suitable sites for monitoring.

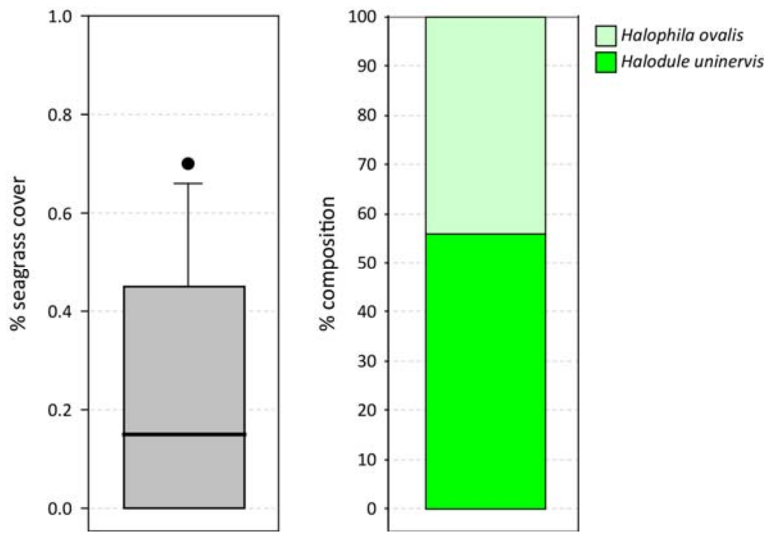

Figure 27. *Percentage cover (species pooled) and composition of seagrass at the subtidal site in Missionary Bay (Hinchinbrook Island), 25 November 2014. The box represents the interquartile range of values, where the boundary of the box closest to zero indicates the 25th percentile, a line within the box marks the median, and the boundary of the box farthest from zero indicates the 75th percentile. Whiskers (error bars) above and below the box indicate the 90th and 10th percentiles, and the black dots represent outlying points.*

Seagrass in the overall Wet Tropics have been in a poor state since 2009 and remain in a vulnerable condition, with weaker resistance and a lower capacity to recover from major disturbances[26]. The greatest threat to seagrass meadows in the northern Hinchinbrook region is runoff from adjacent modified catchments. The catchment which poses the greatest risk for seagrass from poor water quality, with regards to agricultural runoff, is the Tully-Murray[27, 28]. Current indications are that inshore water quality, largely driven by fluctuations in total suspended sediment, and seagrass state across the Wet Tropics are in a poor to very poor state[29]. A recent survey of a number of locations in the region found little recovery[30]. Conducting a detailed survey of seagrass meadows in the region (Dunk Island to Lucinda) would provide insight on the recovery of seagrass in the area and identify suitable subtidal monitoring sites. Establishing long-term monitoring of subtidal seagrass sites will provide critical information on seagrass recovery and assist with managing sea country.

CONCLUSIONS

Building the capacity of Indigenous groups to assess critical dugong and marine turtle seagrass habitats can be successfully achieved through a gradual progression of capacity building activities:

1. informal/casual communications - to build relationships and cultural understanding to ensure further training is focused, targeted and language appropriate;
2. awareness raising activities (e.g. Introductory workshops) - to progress attitudes and awareness by providing an understanding of dugong and sea turtle seagrass habitats, the functions they perform in nature, and the services these functions provide to Indigenous culture;
3. skills training (e.g. Level 1 training workshops) - to build the skills and abilities of trainees, and provide experience assessing dugong and sea turtle seagrass habitats.

The structured approach where trainees progress through a series of increased learnings enables a better understanding of the background knowledge and application of skills. Mandatory attendance of introductory workshops prior to attending higher levels of training also ensures higher trainee success rates. If successful, this capacity building approach empowers Indigenous communities to:

- more effectively communicate to public & youth
- collect scientific and sea country data with confidence
- contribute to sea country planning & management with certainty.

There appears to be a genuine interest in dugong and sea turtle seagrass habitats, and participating in their assessment and monitoring, from the Indigenous communities and individuals who contributed to this project. The strong link with traditional owners and their sea country encourages this interest. Overall, project participants found the capacity building approach excellent and enjoyable. Although the majority who progressed to higher level 1 training (after attending an introductory workshop) found the experience challenging, they were keen to apply the skills learnt on their sea country. There are, however, several hurdles to overcome before this can be successfully achieved.

Indigenous communities who expressed a strong interest to implement immediate assessment and long-term monitoring of the dugong and sea turtle seagrass habitats in their sea country (e.g. Dawul Wuru Aboriginal Corporation to establish a long-term monitoring site at Ellie Point, Cairns Harbour) will require significant scientific and financial support. Communities will require financial support to purchase field sampling equipment and to procure the services of Seagrass-Watch HQ for data QAQC and data management. Maintaining capacity will also require annual or biennial refresher workshops on methodologies and possibly higher training by Seagrass-Watch HQ.

Identification of suitable dugong and sea turtle seagrass habitats where sites can be established, which can be accessed safely and at minimal cost, doesn't require boats or long travel, will increase the likely success of ongoing monitoring. Also, incorporation of dugong and sea turtle seagrass habitat assessment into work plans for rangers would ensure ongoing monitoring takes place but only if the rangers and Traditional Owners see it as being a useful tool.

The biggest hurdle with long-term assessment of dugong and sea turtle seagrass habitats in coastal communities, however, is maintaining capacity and motivation. This could be achieved by identifying local "*champions*". Champions are local community members who understand the value that monitoring and assessment brings to improved management of sea country, and they can take visible and tangible action to support the engagement of others within the community. Champions appreciate the commitment and involvement required to maximize the investment of Indigenous engagement. Champions also engage themselves in providing essential key leadership to manage and organise the community and organise the monitoring events. A "champion" should also have the appropriate technical or scientific credentials (i.e. a level 1 Certificate of Achievement) as well as the social skills needed to drive and maintain momentum. However, until a local Champion can be identified, the communities may require a scientist to be on site at each monitoring event to oversee activities and provide quality assurance.

A key finding from the project was a high interest in assessment and monitoring of subtidal seagrass habitats. The inclusion of new technologies was embraced by Indigenous rangers who currently have the infrastructure (e.g. vessels), and they were of the opinion that if they had the drop-camera assembly, they would be able to easily incorporate subtidal assessments within their existing work plans.

Through this project, a low cost camera assembly using high-performance (high resolution) live capture digital imagery was designed and successfully tested. From the trials, it was estimated that it should take approximately 30min to assess a site, i.e. minimum of 10 good camera drops and grabs while drifting within 50m radius of a waypoint. However, before long-term monitoring of subtidal dugong and sea turtle seagrass habitats can be established, detailed assessments/surveys of possible locations need to be conducted. Much of the existing information on subtidal seagrass habitats in Queensland is between 15 and 30 years of age, particularly in the Northern GBR. The drop-camera assembly could be used to survey an area (location) to assess the current state (distribution and abundance) of the seagrass habitats, from which key long-term monitoring sites can be identified. Financial and scientific support will be required to conduct the surveys. The low and highly variable seagrass at sites examined in this project also suggests a greater number of drops (i.e.>10) may be required at each site to adequately capture the within-site variance necessary for long-term monitoring. This would need to be determined from the results of the survey during the implementation of long-term monitoring. Several Indigenous groups are keen to progress subtidal assessments, including: Girringun Aboriginal Corporation in Missionary Bay and northern Hinchinbrook Island region; Gudjuda Land & Sea Rangers in Upstart Bay; Lama Lama Rangers in Princess Charlotte Bay. Should the groups implement subtidal assessment, the following requirements for conducting camera drops and grabs are recommended:

- vessel of sufficient size (6 people) to accommodate personnel and operate gear safely;
- minimum of 4 people to conduct assessment (1 boat driver, 1 handling camera frame, 1 watching video output & providing feedback to camera frame operator, 1 operating the grab);
- rangers would need training from Seagrass-Watch HQ on use, deployment, and maintenance of equipment;
- specific guidelines/manual prepared by Seagrass-Watch HQ to help refresh personnel of procedures each assessment;
- at least 2 hours to assess a location (assuming 3 sites per location).

A key finding from the capacity building was that there was more interest in dugong and sea turtle seagrass habitats from Traditional Owner groups in the far north of the state; but this may be a consequence of a greater focus on sea country management within northern groups and more specific ranger groups being established with TUMRAs and funding to undertake sea country work. This would suggest that a priority for financial and scientific support should focus initially on the northern Great Barrier Reef, as this would provide greater uptake and application of capacity building activities to sea country planning and management. With the support of Indigenous groups, it is hoped that a long-term comprehensive seagrass monitoring program be established for the northern GBR with particular emphasis on the seagrass habitats that support significant densities of dugongs.

RECOMMENDATIONS

- if supported by Indigenous rangers and Traditional Owners, dugong and sea turtle seagrass habitat monitoring (using standard Seagrass-Watch methods) should be incorporated into ranger work plans to ensure monitoring is implemented, provide continuity as a useful tool for sea country management.
- that a local "champion" or coordinator position be encouraged within Indigenous communities to oversee and manage activities to assess and monitor dugong and sea turtle seagrass habitats. To ensure time and resources are not wasted, the champion is also recommended to have passed a level 1 training course.
- that annual refresher of methodologies and further training from Seagrass-Watch HQ be supported for Indigenous groups undertaking dugong and sea turtle seagrass habitat monitoring
- that attendance of Introductory workshops be mandatory prior to attending higher levels of training (e.g. level 1) in dugong and sea turtle seagrass habitat monitoring
- that funding to undertake sea country work initially target northern Traditional Owner groups focused on sea country management or ranger groups with established TUMRAs
- scientific and financial support be provided for Indigenous group from which participants have successfully completed a level 1 training course and expressed a strong interest to implement immediate assessment and long-term monitoring of the dugong and sea turtle seagrass habitats in their sea country (e.g. Dawul Wuru Aboriginal Corporation to establish a long-term monitoring site at Ellie Point, Cairns Harbour)
- that a scientist or level 1 qualified participant (who has completed the required 3 post workshop monitoring events) be on-site at each monitoring event to oversee activities and provide quality assurance
- scientific and financial support be provided to implement assessment and monitoring of subtidal dugong and sea turtle seagrass habitats using drop-cameras in locations where Indigenous groups have expressed strong interest, including: Girringun Aboriginal Corporation in Missionary Bay and northern Hinchinbrook Island region; Gudjuda Land & Sea Rangers in Upstart Bay; Lama Lama Rangers in Princess Charlotte Bay.
- that detailed assessments/surveys of subtidal dugong and sea turtle seagrass habitats in locations (e.g. bays) proposed for monitoring be conducted (in partnership with scientists) to ensure sites are appropriately placed and meet the criteria for long-term monitoring. Financial and scientific support will be required to conduct the surveys.
- that a long-term comprehensive seagrass monitoring program be established for the northern GBR with particular emphasis on the seagrass habitats that support significant densities of dugongs.

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APPENDIX 1

KPI-3: contacts recorded *(all participants names recorded and provided to EHP)*	names of all workshop participants and their community recorded

Table 5. *Participants of each Introductory workshop*

Location: Archer Point	
Date:29th April 2014	
Field work: Archer Point *(field intro only – no classroom)*	
Coral Hale	*Yuku Baja Muliku Rangers*
L. Bowyer	*Yuku Baja Muliku Rangers*
Irene Bowyer	*Yuku Baja Muliku Rangers*
Joyce Henderson	*Yuku Baja Muliku Rangers*
Clive Henderson	*Yuku Baja Muliku Rangers*
Wayne (Anthony Sycamore)?	*Yuku Baja Muliku Rangers*
Zeila?	*Yuku Baja Muliku Rangers*
Location: Airlie Beach (Whitsunday)	
Date:c13th May 2014	
Field work: NA	
NIL ATTENDEES	
Location: Cardwell	
Date: 14th May 2014	
Field work: not completed due to bad weather *(*field component with Naomi at Molongle Creek, 7 July 2014)*	
Tracey Lampton*	*Gudjada rangers*
Dianne Smallwood*	*Gudjada rangers*
Joseph Tallis*	*Gudjada rangers*
Ben Devow*	*Gudjada rangers*
Penny Ivey	*Girringun rangers*
Cindy Togo	*Girringun rangers*
Karman Lippit (IPA coordinator)	*Girringun rangers*
Sean Walsh (ranger coordinator)	*Girringun rangers*
Location: Seaforth (Mackay)	
Date: 14th May 2014	
Field work: Seaforth	
Samarla DeShong	
Claire Barton	*non Indigenous - Reef Catchments*
Kerri Woodcock	*non Indigenous – Reef Catchments Coastal Sys co-ord*
Keresia McCallie	*non Indigenous - Reef Catchments Coastal officer*
Location: Cairns	
Date: 15th May 2014	
Field work: Yule Point *(*did not attend)*	
Gavin Singleton	*Yirrganydji*
Kevin Singleton	*Yirrganydji*
Warren Singleton (elder)*	*Yirrganydji*
William Mundraby	*Djunbunji rangers*
Laurissa Mundraby	*Djunbunji rangers*
Brandon Mundraby	*Djunbunji rangers*
Isaac Mundraby	*Djunbunji rangers*
Jimmy Richards(ranger coordinator)	*Djunbunji rangers*
Danton Noble	*Gimuy*
David Jahveh Kyle*	*Yidinji*
Michael Grogan	*Yidinji*
Rebecca Fourmile Bhatti*	*Yidinji*
Johanna Karam*	*CYP NRM*
Kate Maltby*	*EHP Indigenous program*
Skeen West*	*EHP wildlife unit*

Location: Mossman	
Date: 16th May 2014	
Field work: Yule Point *(*did not attend)*	
Russell Bowen	*Kuku Yalanji rangers*
Colin Doughboy	*Kuku Yalanji rangers*
Phillip Minniccon	*Kuku Yalanji rangers*
Jenny Carson	*Kuku Yalanji rangers*
Danila Beveen Reisener	*Kuku Yalanji rangers*
Bradley Creek	*Kuku Yalanji rangers*
Cameron Hooker	*Kuku Yalanji rangers*
Shaun Creek*	*Kuku Yalanji rangers*
Ruby Winkle	*Kuku Yalanji rangers*
Sue Garrett (ranger coordinator)	*Kuku Yalanji rangers*
Location: Mapoon	
Date: 19th May 2014	
Field work: Cullen Point	
Cecil Woodley (previous Level 1 trained)	*Mapoon rangers*
Stanley Budby (previous Level 1 trained)	*Mapoon rangers*
Edwin Ling	*Mapoon rangers*
Clarissa Wells	*Mapoon rangers*
Nathan Nearly	*Mapoon rangers*
Lawry Booth	*Mapoon rangers*
Judy Saggigi	*Mapoon rangers*
Louise Stone (ranger coordinator)	*Mapoon rangers*
Location: Napranum	
Date: 20th May 2014	
Field work: Napranum *(*did not attend)*	
Teddy Barkley	*Napranum rangers*
Philip Mango*	*Napranum rangers*
Herbert Jerry	*Napranum rangers*
Matt Gillis (ranger coordinator)	*Napranum rangers*
Location: Gladstone	
Date: 26th May 2014	
Field work: Curtis Island	
Malachi Johnson (Ranger)	*Gidarjil rangers*
Saranne Giudice	*non Indigenous – BMRG Biodiversity Project officer*
Run Blair (Ranger)	*Gidarjil rangers*
Desmond Purcell (Ranger)	*Gidarjil rangers*
Location: Great Keppel Island	
Date:28th May 2014	
Field work: Great Keppel Island	
Mary-Joan Dorante	*Fitzroy Basin Elders Committee – Admin*
Kevin Gibson	*Fitzroy Basin Elders Committee – volunteer*
Louise Willie-Muggeridge	*Fitzroy Basin Elders Committee – Project officer*
Dean Edmund	*Darumbal elder*
Robert Muir	*Woppabura*
Location: Hopevale	
Date: 23rd May 2014	
Field work: Elim Beach (29th May 2014)	
Angela Michael	
Dustin Costello	
Neville Bowen	
Reynold Woibo	
Charmaine Bowen	
Jarret Voren	
Anthony Bowen	

Chris Roberts	
Pete Kilshaw	
Location: Magnetic Island	
Date: 13th June 2014	
Field work: Cockle Bay, Magnetic Island	
William Blackman	*Palm Island*
Isiah Blackman	*Palm Island*
Lyle Johnson	*Magnetic Island rangers*
Alex Johnson	*Magnetic Island rangers*
Oscar Curran	*non Indigenous*
Ben Mills	*non Indigenous*
Location: Bamaga	
Date: 19th June 2014	
Field work: Loyalty Beach	
Christo Lifu	*NPA rangers*
Tolowa Noma	*NPA rangers*
William Ingui	*NPA rangers*
Francis Salee	*NPA rangers*
Poi Baira	*NPA rangers*
Richard Woosup	*NPA rangers*
Erra Bond	*NPA rangers*
Location: Burrum Heads (Hervey Bay)	
Date: 24th June 2014	
Field work: NA	
Barbara Hayes	*non Indigenous*
Location: Lockhard River	
Date: 8 October 2014	
Field work: Yum Yum Beach	
Loddy Chippendale	*Wuthuthi*
Paddy Don Creek	*Kanthanumpu*
Beverly Pascoe	*Kuku Y'au*
Roderick J Doctor	*Kuku Y'au*
Shaun Warradoo	*Wuthuthi*
Wayne Warradoo	*Wuthuthi*

Table 6. *List of Level 1 participants*

Location: Cooktown	
Date: 24-25 July 2014	
Field work: Archer Point	
Gauai Wallace	*Yuku Baja Muliku Rangers*
Wayne Anthony Sycamore	*Yuku Baja Muliku Rangers*
Ernie Baird	*Yuku Baja Muliku Rangers*
Joyce Henderson	*Yuku Baja Muliku Rangers*
Irene Bowyer	*Yuku Baja Muliku Rangers*
Stephen Doughboy	*Yuku Baja Muliku Rangers*
Mrs Coral Hale	*Yuku Baja Muliku Rangers*
Gavin Bassani	*Lama Lama Rangers*
Lachlan Bassani	*Lama Lama Rangers*
Lindsay John Bassani	*Lama Lama Rangers*
brandon liddy	*Lama Lama Rangers*
Elaine Liddy	*Lama Lama Rangers*
Chris Witana	*Lama Lama Rangers*
Kate Maltby	*Senior Project Officer, Queensland Indigenous Land and Sea Ranger Program*

Location: Cardwell	
Date: 07-08 August 2014	
Field work: Not completed - due to weather conditions.	*Rescheduled 2015*
Mr Alec Johnson	*Wulgurukaba Community Ranger*
Ms Tracey Lampton	*Gudjuda Land & Sea Ranger*
Joseph Tallis	*Gudjuda Land & Sea Ranger*
Diane Smallwood	*Gudjuda Land & Sea Ranger*
Mr Ben Devow	*Gudjuda Land & Sea Ranger*
Cindy -Lou Togo	*Girringun Aboriginal Corporation*
Penelope Ivey	*Girringun Aboriginal Corporation*
Neil Leo	*Girringun Aboriginal Corporation*
Albert Reese	*Girringun Aboriginal Corporation*
Simon Smallwood	*Girringun Aboriginal Corporation*
Evelyn Ivey	*Girringun Aboriginal Corporation*
Christopher Muriata	*Girringun Aboriginal Corporation*
Location: Cairns	
Date: 11-12 August 2014	
Field work: Yule Point	
Miss Laurissa Mundraby	*Djunbunji Land & Sea*
Mr Cecil Leftwich	*Guru Gulu, Kunggandji*
William Mundraby	*Mandingalbay Yidinji*
Tarquin Singleton	*Yirrganydji*
Bernie Singleton	*Yirrganydji*
Location: Cairns	
Date: 02-03 Dec 2014	
Field work: Yule Point	
Gavin Jacob Singleton	*Dawul Wuru Aboriginal Corporation*
Bronwyn Singleton	*Dawul Wuru Aboriginal Corporation*
Justin Neal	*Gunggandji Land and Sea Program*
Paul Sexton	*Gunggandji Land and Sea Program*
Harrison Smith	*Gunggandji Land and Sea Program*
Lucas Langlois	*SW HQ*

APPENDIX 2

Figure 28. *Example of a flyers used to advertise Introductory (left) and Seagrass-Watch Level 1 (right) workshops*

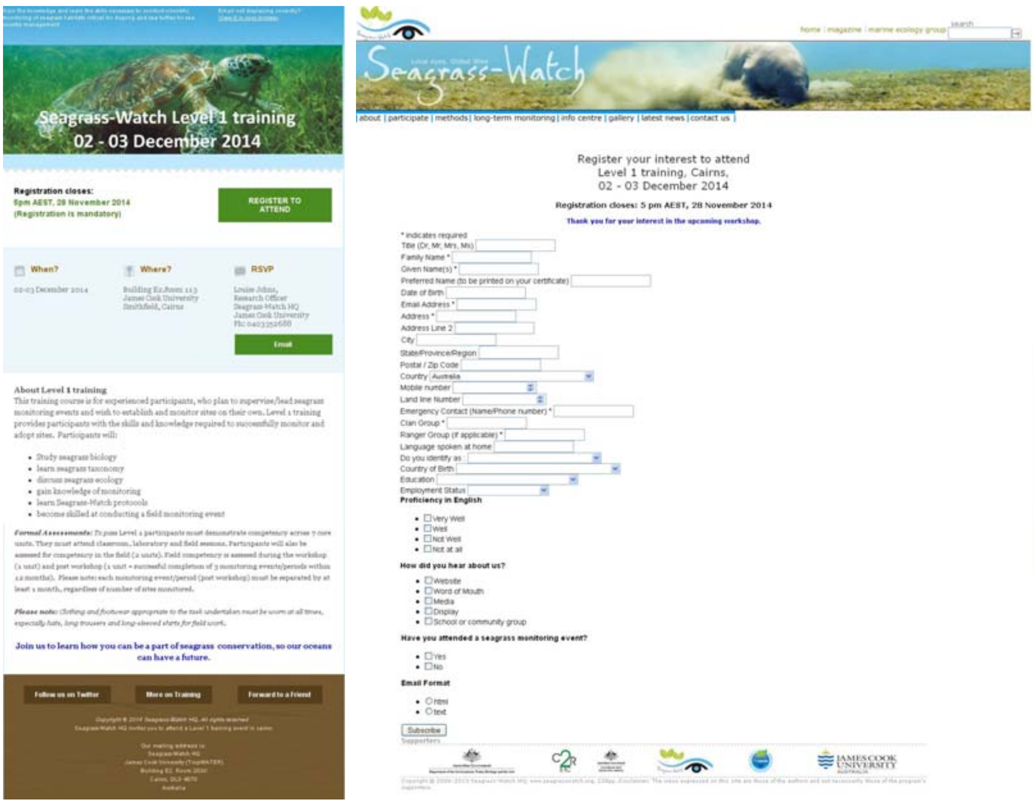
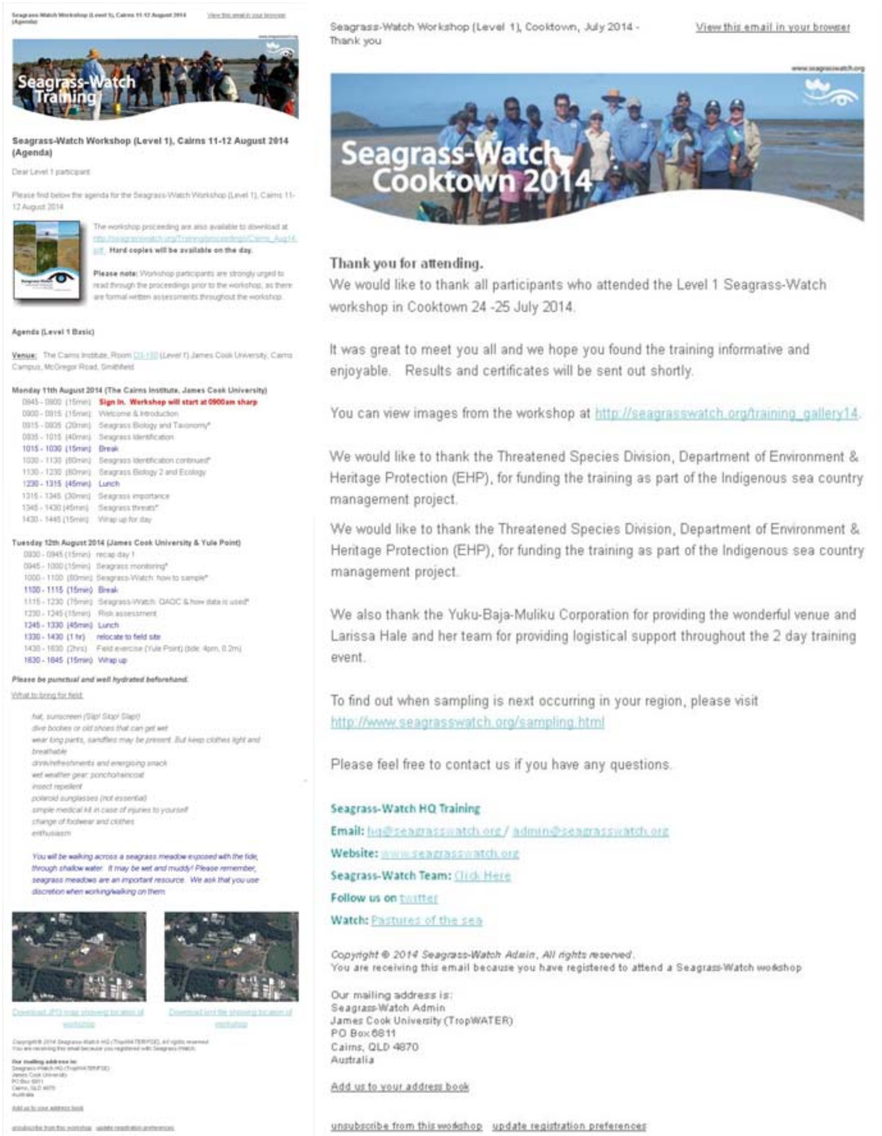


Figure 29. *Example of invite and registration forms required for Level 1 training.*


Seagrass-Watch Workshop (Level 1), Cairns 11-12 August 2014 (Agenda)

Seagrass-Watch Workshop (Level 1), Cooktown, July 2014 - Thank you

View this email in your browser

Seagrass-Watch Cooktown 2014

Thank you for attending.
We would like to thank all participants who attended the Level 1 Seagrass-Watch workshop in Cooktown 24 -25 July 2014.

It was great to meet you all and we hope you found the training informative and enjoyable. Results and certificates will be sent out shortly.

You can view images from the workshop at http://seagrasswatch.org/training_gallery14.

We would like to thank the Threatened Species Division, Department of Environment & Heritage Protection (EHP), for funding the training as part of the Indigenous sea country management project.

We would like to thank the Threatened Species Division, Department of Environment & Heritage Protection (EHP), for funding the training as part of the Indigenous sea country management project.

We also thank the Yuku-Baja-Muliku Corporation for providing the wonderful venue and Larissa Hale and her team for providing logistical support throughout the 2 day training event.

To find out when sampling is next occurring in your region, please visit http://www.seagrasswatch.org/sampling.html

Please feel free to contact us if you have any questions.

Seagrass-Watch HQ Training
Email: hq@seagrasswatch.org / admin@seagrasswatch.org
Website: www.seagrasswatch.org
Seagrass-Watch Team: Click Here
Follow us on twitter
Watch: Pastures of the sea

Copyright © 2014 Seagrass-Watch Admin, All rights reserved.
You are receiving this email because you have registered to attend a Seagrass-Watch workshop

Our mailing address is:
Seagrass-Watch Admin
James Cook University (TropWATER)
PO Box 6811
Cairns, QLD 4870
Australia

Add us to your address book

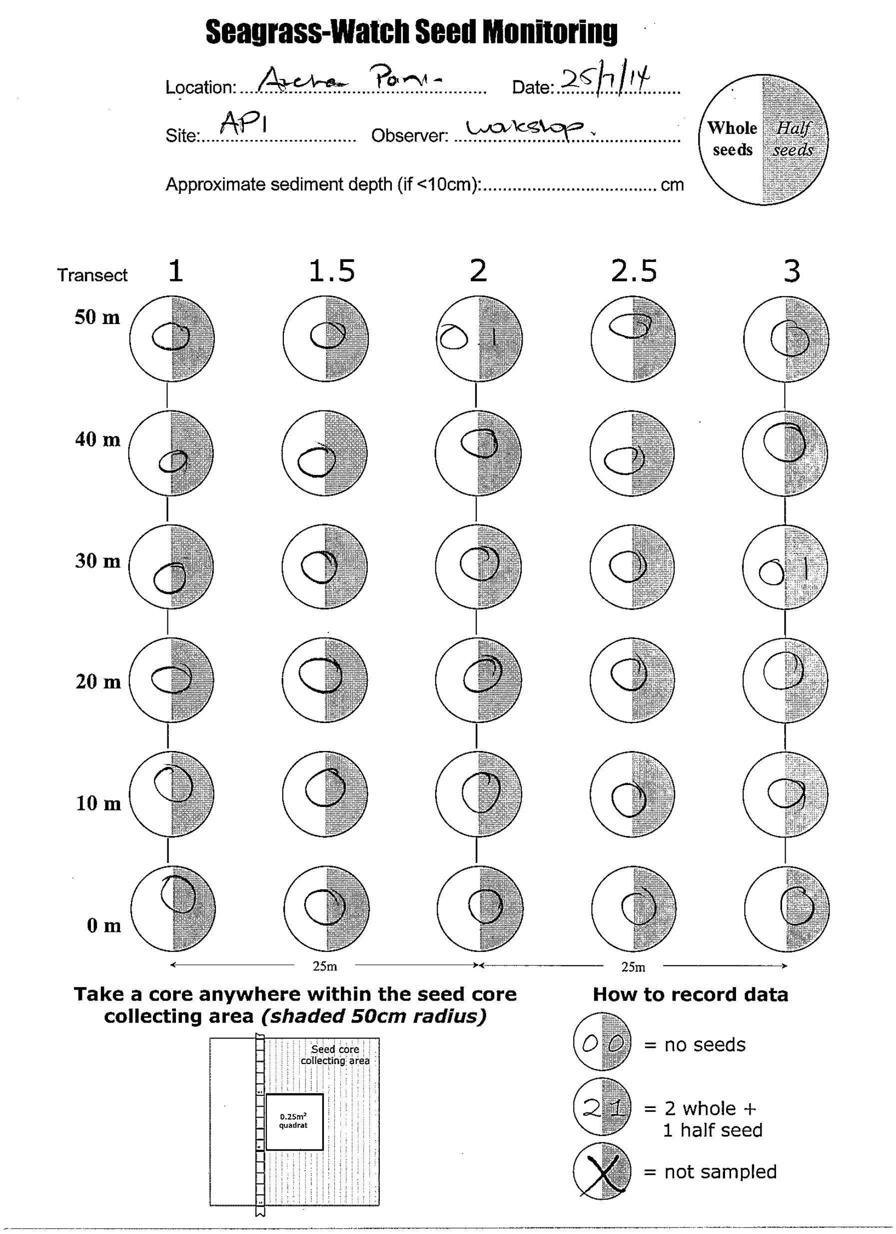
unsubscribe from this workshop update registration preferences

Figure 30. *Example of a level 1 agenda notice for registered participants and feedback post attendance.*

APPENDIX 3

KPI-5: data management *(all data collected as part of training courses is made available to EHP in report form)*	Field datasheets attached, feedback data reported in main text

Field datasheets from Level 1 training workshop, Archer Point, 24-25 July 2014



Seagrass-Watch Seed Monitoring

Location: Archer Point Date: 25/7/14

Site: AP1 Observer: Workshop

Approximate sediment depth (if <10cm):.................................... cm

Whole seeds | Half seeds

Transect	1	1.5	2	2.5	3
50 m	0	0	0 1	0	0
40 m	0	0	0	0	0
30 m	0	0	0	0	0 1
20 m	0	0	0	0	0
10 m	0	0	0	0	0
0 m	0	0	0	0	0

25m 25m

Take a core anywhere within the seed core collecting area *(shaded 50cm radius)*

Seed core collecting area

0.25m² quadrat

How to record data

0 0 = no seeds

2 1 = 2 whole + 1 half seed

X = not sampled

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

ELAINE LIDDY, Ernie BAIRD JOYCE HENDERSON
OBSERVER: GAbai Wallace Coral Hale DATE: 25 / 7 / 14
LOCATION: ARCHER POINT
SITE code: AP1 TRANSECT no.: 1
START TIME: 1.15pm END TIME:

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: Hu	HO	SI		WATER	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	fine SAND / Broken SHELL	Small fish ×5, Ripples, No holes for crabs		3	100				11	4,3,3.8	0	2
2 (5m)	fine Sand / Broken Shell	Sea cucumber, 1 Crab Hole, Rippled	☐	5%	100				5	3,3,3	0	90
3 (10m)	fine Sand / Broken shell	3 worm piles, 8 crab Holes, 1 Shell with crab, Ripples	✓	6%	85	15			0	2,1.5,2	0	15
4 (15m)	fine Sand / Broken Shell	7 crab Hole, 1 worm pile, Rippled		5%	100				0	4.6,2.5,1.5	0	90
5 (20m)	Fine Sand / Broken shell	(with crabs) 2 Shells, Rippled		2%	100				1cm	2,2,2	0	10
6 (25m)	fine Sand / Broken shell	Small Holes, Empty Shell, Rippled	☐	·1%	100				·5cm	sunburnt 2,	0	0
7 (30m)	fine Sand / Broken shell	small crab Holes, 1 Rock, Rippled, small shells	✓	0%	100				·5cm		0	0
8 (35m)	fine Sand / mud / Broken SHELL	Rippled, 1 crab Hole		3%	100				0	2,2,1.5	0	30
9 (40m)	fine Sand / Broken shell	Rippled, Small crab holes, Small Crab		0%	0				1.5cm	0	0	0
10 (45m)	fine Sand / Broken Shell	Rippled, Small crab holes, live Shell	☐	3%	90%	10%			4.5cm	2cm, 1cm, 2cm	0	100%
11 (50m)	fine Sand / Broken Shell	small crab Holes, rippled, 1 crab with shell		0					2.4	—	0	—

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

SG = SAND GRAVEL
SS = SHELL SAND

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

IRENE, KATE, CHRIS, WAYNE, LINDSEY
OBSERVER: GROUP B DATE: 25 / 7 / 14
LOCATION: ARCHER POINT
SITE code: AP1 TRANSECT no.: 2
START TIME: 1.15 pm END TIME:

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: H.U	H.O			WATER	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	F.S	WORM MOUND x 2	✓	15%	50%	50%			0	2. cm, 0.6cm, 2.1cm	5%	0
2 (5m)	FS	CRAB x1, WORM TRACK x1, RIPPLES, WATER	✓	0.7%	100%	0			1 cm	2.0cm, 1.6cm, 0.8cm	0%	35%
3 (10m)	FS	RIPPLES, WATER, NO SEAGRASS, WORM MOUND x1	N.R	0	0	0			12.cm	0	0	0
4 (15m)	SG FS	WATER FAST FLOWING, RIPPLES NO GRASS	N.R	0	0	0			15.cm	0	0	0
5 (20m)	SS, GS, FS,	WATER, RIPPLES, WORM MOUNDS x3	N.R	20	~~20~~ 0.2	~~80~~ 98.8			4cm	3cm, 2.5cm, 1.6cm	0	90%
6 (25m)	MUD, SAND FS	CRAB x1, HOLE x39, PARTIAL WATER 20%	✓	5	100					4cm, 3.5, 4.4	0	3%
7 (30m)	FS, GS, MUD	CRABS x3, WATER		17%	90	10			2cm	2cm, 3cm, 3cm	0	25%
8 (35m)	FS, GS,	CRAB x1, CRAB HOLE x1, RIPPLES, WATER. D.F.T x1		15	90	10			5cm	3cm, 3cm, 4cm	0	38%
9 (40m)	GS, FS,	DFT x1, WATER, SHELLS x2 RIPPLES		20	100	0			6cm	3cm, 3cm, 2cm	0	45%
10 (45m)	GS, FS	WATER, RIPPLES	✓	20	50	50			13cm	4.1cm, 4.2cm, 4.8cm	0	16%
11 (50m)	MUD, GS, FS	HALF SEED, DFT	✓	25	80	20			0	3.6cm, 3.4cm, 4.3cm	0	0

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: Lachlan, Gavin, Brandon, Steven DATE: 25 / 07 / 14
LOCATION: Archer Point
SITE code: AP1 TRANSECT no.: 3
START TIME: 1:20 pm END TIME:

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: HU	HO	CS		Water	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	CS	Ripples, shell grit	✓	4%	100%	0			0	1.5,2,2	0%	0%
2 (5m)	FS, Gr	Creek with current	☐	1%	100%	0			13cm	2,2,4	0.4%	-1
3 (10m)	CS, Gr	Shell grit, dugong feeding trails		19%	60%	40%			8cm	2,3,3	0%	0%
4 (15m)	CS, Gr	Worm mound, dugong trail	✓	13%	30%	70%			8cm	3.5,2,3	0%	5%
5 (20m)	FS, CS	Ripples, under water		25%	85%	15%			5cm	3,3,2	0%	40%
6 (25m)	Gr	under water,	☐	32%	80%	20%			7cm	4,2,2	0.5%	30%
7 (30m)	FS	~~Crustacean x1~~ Half seed		10%	85%	15%			0	1,2,2	0	0
8 (35m)	FS, CS	Crustacean x 3		25%	90%	10%			1cm	3,2,3	0	20%
9 (40m)	FS	crustacean trail 1x1		35%	10%	90%			2cm	4,3,2	0	70%
10 (45m)	FS	partly under water, 1x hermit crab	☐	7%	100%				1cm	2,3,1	0	10%
11 (50m)	FS, CS	under water		15%	82%	5%	13%		4.5cm	3,3,3.5	0	0

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Field datasheets from Level 1 training workshop, Cairns, 11-12 August 2014

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: Tarquin / Laurissa / BERNARD. DATE: 12 / 8 / 14
LOCATION: Yule Point
SITE code: YP1 TRANSECT no.: 1
START TIME: 14 35 END TIME: 15 15

START of transect (GPS reading)
Latitude: 16 ° 56912 ' S Longitude: 145 ° 51231 ' E

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: HU	HO			Water	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	Fine Sand	ripples x hole	✓	1%	100				0	3,3.5,2	0	0
2 (5m)	FS	ripples 4 worm holes	✓	5%	95	5			0	2,2,3.5	0	0
3 (10m)	FS	ripples x worm holes	✓	7 %	100				0	3,3,5	0	0
4 (15m)	FS	ripples worm hole	✓	1%	100				0	3,3,2	0	0
5 (20m)	FS	ripples 4 x worm holes	✓	3%	30	70			0	2,1.5,1	0	0
6 (25m)	FS	ripples Snail	✓	0	0	0			0	0	0	0
7 (30m)	FINE SAND	Ripples 2x WORM HOLES	✓	3 %	100	0			0	3,2 2	0	0
8 (35m)	FS	RIPPLES	✓	1	100%	0			0	6 3 2	0	0.1
9 (40m)	FS	Ripple 3x W HOLES	✓	3%	100%	0			0	2,1.5 2	0	0
10 (45m)	FS	Ripple. 3 x Worm	✓	0.3%	100%	0			0	2, 3, 1.5cm	0	0
11 (50m)	FS	Ripples 3 x Worm Hole 1x worm	✓	0.2	100%	0			0	3, 1, 1.5cm	0	0

END of transect (GPS reading)
Latitude: 16 ° 56889 ' S Longitude: 145 ° 51263 ' E

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: WILLIAM MUNDRABY / CECIL LEFTWICH DATE: 12/08/2014
LOCATION: YULE POINT
SITE code: YP 1 TRANSECT no.: ~~YP1100~~ 2
START TIME: 14:20 PM END TIME: 15:12 P

START of transect (GPS reading)
Latitude: 16°56931° ' Longitude: 145°51245 '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: HU					Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	FS	WORM HOLE X2, WORM X1 RIPPLES	✓	5	100					2,1.5,1.5	0	0
2 (5m)	FS	WORM HOLE X 1 RIPPLES	✓	0	0					0	0	0
3 (10m)	FS	Worm hole x 1 Ripples		3	100					4.5 cm 1.5 cm 2 cm		1%
4 (15m)	FS	5 Starfish 1 Crab Ripples		0	0					0	0	0
5 (20m)	FS	2 WORM Holes 2 Starfish Ripples		0	0					0	0	0
6 (25m)	FS	2 WORM HOLES RIPPLES	✓	8	100					4 cm 4.6 cm 7 cm	0	1%
7 (30m)	FS	2 worm holes		3	100					4 cm 3 cm 4 cm	0	0
8 (35m)	FS	1 X Worm hole Ripples		1	100					4 cm 1.5 cm 1.5 cm	0	0
9 (40m)	FS	Worm Holes x 1 Ripples		1	100					2 cm 1.5 cm 1.5 cm	0	0
10 (45m)	FS	Worm Holes x 1 Worms x2 Ripples		0.7	100					1.5 cm 1.5 cm 2 cm	0	0
11 (50m)	FS	Worm Holes x 1 Crab Hole x 1 Ripples		0	0					0	0	0

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

FS = FINE SAND.

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: R. YOSHIDA DATE: 12 / 8 / 14
LOCATION: Yule Pt
SITE code: YP1 TRANSECT no.: 3
START TIME: 1450 END TIME: 1500

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	📷 (✓)	% Seagrass coverage	% Seagrass species composition: HU	HO			Water	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	FS	Ripples Detritus	✓	7	100%				0	4,2,4	0	0
2 (5m)	FS	Ripples.	✓	13	95	5			0	5,3,4	0	0
3 (10m)	"	" worm tube (1)	✓	9	100				0	5,4,6	0	0
4 (15m)	"	"	✓	4	100				0	5,5,4	0	0
5 (20m)	"	"	✓	3	1	99			0	4,3,3	0	10
6 (25m)	"	Ripples	✓	0					0	–	–	–
7 (30m)	"	"	✓	0.3	100				0	4,3,3	0.8	0
8 (35m)	"	"	✓	4	99.5	0.5			0	4,5,4	0	0
9 (40m)	"	Ripples.	✓	4	100				0	4,3,4	0	0
10 (45m)	" / mud	" Sea Star (1) HC (3) GAS (1)	✓	0.5	99	1			2	2,3,2	0	0
11 (50m)	" / mud		✓	0					3	–	–	–

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Seagrass-Watch Seed Monitoring

Location: Yule Point Date: 12/8/14

Site: YP1 Observer: Workshop Participants

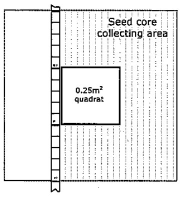
Approximate sediment depth (if <10cm): .... cm

(Whole seeds | *Half seeds*)

Transect	1	1.5	2	2.5	3
50 m	0	0	0	0	0
40 m	0	0	0	0	0
30 m	0	0	0	0	0
20 m	0	0	0	0 | 1	0
10 m	0	0	0	0	0
0 m	0	0	0	0	0

← 25m → ← 25m →

Take a core anywhere within the seed core collecting area *(shaded 50cm radius)*



How to record data

0 | 0 = no seeds

2 | 1 = 2 whole + 1 half seed

X = not sampled

Field datasheets from Level 1 training workshop, Cairns, 02-03 December 2014

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: LUCAS / GAVIN DATE: 3/12/14
LOCATION: YULE POINT
SITE code: YP1 TRANSECT no.: 1
START TIME: 12:50 END TIME: 13:43

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition: HU	Ho			Water	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	FS	TW=x1, ripples	✓	0						0	0	0
2 (5m)	FS	TW=x1, Burrows x2, ripples	✓	0.3	100					3cm 3cm 2cm	0	0
3 (10m)	FS	TW=x1, ripples	✓	0						0	0.1	0
4 (15m)	FS	TW=x2, Burrow x1, ripples, starfish x1	✓	1.3	100					8, 7, 5	0	0
5 (20m)	FS	Snail=x3,	✓	21	50	50				7, 6, 6	0	19
6 (25m)	FS / Mud	1x sea star	✓	5	90	10			5cm	7, 6, 2	0	95
7 (30m)	FS / Mud	1 x sea star	✓	12	30	70				6, 8, 8	0	19
8 (35m)	FS/Mud	3x sea star	✓	12	30	70			5.5	8, 10, 8	0	95
9 (40m)	FS/Mud	hermit crab x1	✓	10		100			5		0	95
10 (45m)	FS / Mud	hermit crab x1	✓	0					7	–	0	–
11 (50m)	FS/Mud	–	✓	0 9		100			14	–	0	95

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

FS = Fine sand
TW = Tube worm

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: JUSTIN / PAUL DATE: 3/11/14
LOCATION: YULE POINT
SITE code: YP1 TRANSECT no.: 2
START TIME: 12-36 END TIME: 1.46 pm

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition: HU	~~[illegible]~~	HO		W	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	FINE SAND	TW x2 RIPPLES	✓	12%	~~100~~	~~100~~			0	4.5 cm 6.5 3.5 cm	0	0
2 (5m)	FS	RIPPLES	✓	0%	0	0	0	0	0	–	0	–
3 (10m)	FS	RIPPLES TW	✓	0.69	100				0	5.5 8.5 6.5	0	0
4 (15m)	FS	RIPPLES TW AW x1	✓	0	0	0	0	0	0	–	0	–
5 (20m)	FS	WORM HOLE x 3	✓	0.7	100				0	5, 6, 5	0	0
6 (25m)	FS	WORM HOLE x 3	✓	15	0	0	0	0	0	7.5 2.5 7.0	2	2
7 (30m)	FS	RIPPLES WATER	✓	15	99		1		0	5.0 4.6 2.1	0	35
8 (35m)	FS	WATER RIPPLE SNAIL x1 STARFISH x1	✓	7	60		40		3	5.5 6 3.5	0	95
9 (40m)	FS/MUD		✓	22	70		30		4	8.5 8.0 9.5	2	64
10 (45m)	FS/MUD	STARFISH x1 HERMIT CRAB x1	✓	2.5			100		10	~~0~~	0	100
11 (50m)	FS/MUD		✓	0	–		–		13	–	0	0

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

FS – FINE SANDS
TW – TUBE WORMS
AW = ACORN WORM

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

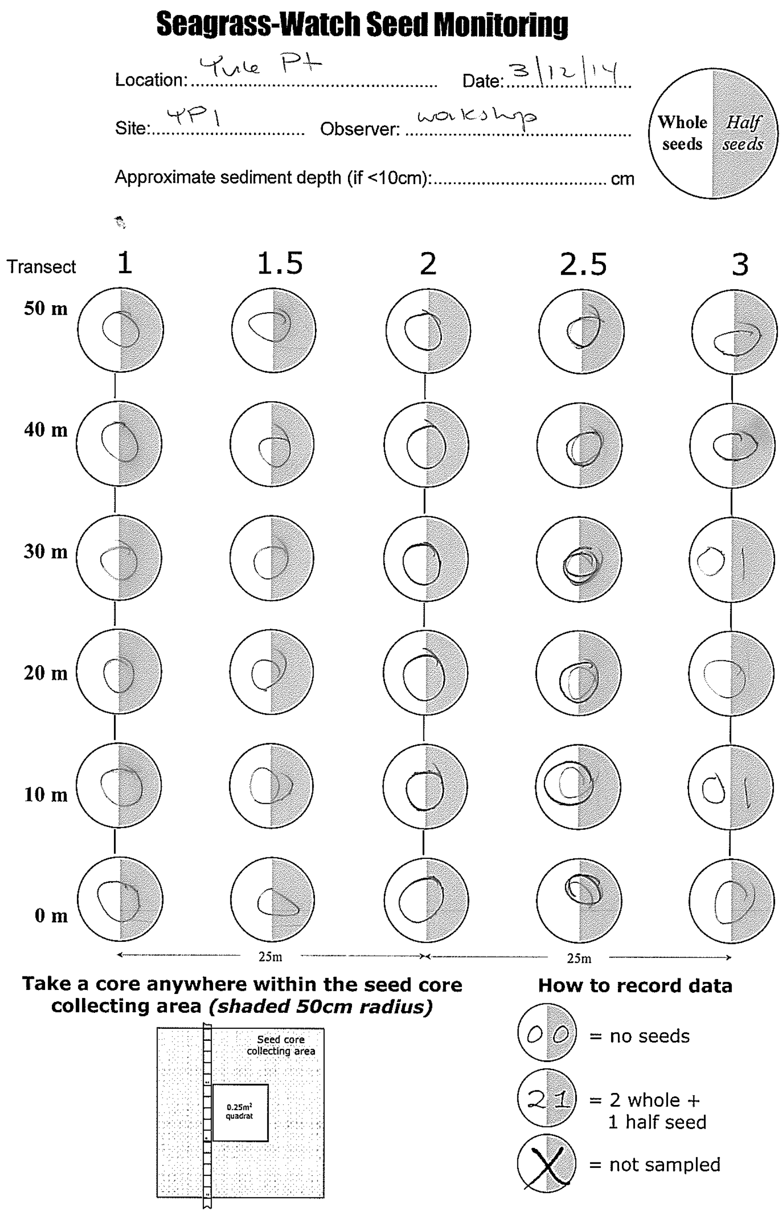
OBSERVER: Bronwyn / Harrison DATE: 03/12/14
LOCATION: YULE POINT
SITE code: YP1 TRANSECT no.: 3
START TIME: END TIME:

START of transect (GPS reading)
Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (eg, mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition: HU	HO			Water	Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	F/S	N/A		23	100%				0	4 4 6	0 N/A	-1
2 (5m)	F/S	N/A		27	99.9%	0.1			0	10 6 6	0 N/A	0
3 (10m)	Fine Sand MUD	N/A		10	100%				0	8.5 8.5 4.5	0 N/A	0
4 (15m)	FINE SAND MUD	WT x2 N/A		2	100%				0	7.5 4 3	0 N/A	0
5 (20m)	F/S MUD	1x GAS		0					0	0	0	0
6 (25m)	F/S MUD	N/A		0					2cm	0	0	0
7 (30m)	F/S MUD	N/A		1.8	100%				2.	2 4 6	0	4.5 ~~90~~
8 (35m)	MUD	1x GAS		12	60	40.5			3.	8 6 4 4.5	100	60
9 (40m)	MUD	N/A		3	100	1			8	12 3 4	100	0
10 (45m)	MUD	N/A		28		100			8.	2 2 2	100	0
11 (50m)	MUD	N/A		35		100			11.5	2 3 2	100	0

END of transect (GPS reading)
Latitude: ° ' Longitude: ° '

F/S = Fine Sand
WT = WORM TUBE
GAS = GASTROPOD



Seagrass-Watch Seed Monitoring

Location: Yule Pt Date: 3/12/14

Site: YP1 Observer: workshop

Approximate sediment depth (if <10cm): .... cm

Whole seeds | *Half seeds*

Transect	1	1.5	2	2.5	3
50 m	0	0	0	0	0
40 m	0	0	0	0	0
30 m	0	0	0	0	0 1
20 m	0	0	0	0	0
10 m	0	0	0	0	0 1
0 m	0	0	0	0	0

25m 25m

Take a core anywhere within the seed core collecting area *(shaded 50cm radius)*

Seed core collecting area

0.25m² quadrat

How to record data

0 0 = no seeds

2 1 = 2 whole + 1 half seed

X = not sampled

Field datasheets from subtidal assessment, northern Hinchinbrook Island, 25 November 2014

SEAGRASS MAPPING

Recorder: L. LANGLOIS GPS#/Vessel: GIRRINGUN Date: 25/11/14

	% cover	Species / % composition of cover
Point#: 1 Location: MISSIONARY BAY Lat 18 ° 22220 S Long 146 ° 10123 E Time 1007 hrs Depth: 4 m Observer: LL Sediment: M/FS Algae (%) 5 Algae (spp./comp) GREEN FIL Comments: HERD OF DUGONG (8) MISS		HU THIN HO 10 DROPS
Point#: 2 Location: HINCH CHANNEL Lat 18 ° 26734 S Long 146 ° 06995 E Time 1031 hrs Depth: 10 m Observer: CINDY Sediment: M Algae (%) <1% Algae (spp./comp) GREEN FIL Comments: TURBID – NO VIS		NO SEAGRASS 10 DROPS
Point#: 3 Location: SCRAGGY PT Lat 18 ° 28900 S Long 146 ° 09663 E Time 1047 hrs Depth: 5 m Observer: CINDY Sediment: M/FS Algae (%) <1% Algae (spp./comp) Comments: TURBID = LIMITED VIS		NO SEAGRASS 10 DROPS
Point#: Location: Lat ° S Long ° E Time hrs Depth: m Observer: Sediment: Algae (%) Algae (spp./comp) Comments:		
Point#: Location: Lat ° S Long ° E Time hrs Depth: m Observer: Sediment: Algae (%) Algae (spp./comp) Comments:		
Point#: Location: Lat ° S Long ° E Time hrs Depth: m Observer: Sediment: Algae (%) Algae (spp./comp) Comments:		

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: L. McKENZIE DATE: 25 / 11 / 14
LOCATION: MISSIONARY BAY
SITE code: DROP CAMERA TRANSECT no.: 1
Start TIME: ______ End TIME: ______

START of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

Quadrat (metres from transect origin)	Sediment (eg. mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition: HU	HO				Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	M/FS	detritus	✓	0.6	100					–	0	–
2 (5m)	"	"	✓	0						–	0	–
3 (10m)	"	"	✓	0.5		100				–	0	–
4 (15m)	"	" drift algae	✓	0						–	1	–
5 (20m)	"	" green fil	✓	0						–	3	–
6 (25m)	"	" "	✓	0.4	25	75				–	3	–
7 (30m)	"	" "	✓	0						–	2	–
8 (35m)	"	" "	✓	0.3		100				–	3	–
9 (40m)	"	"	✓	0.7	100					–	0	–
10 (45m)	"	"	✓	0						–	0	–
11 (50m)												

END of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: L. McKENZIE DATE: 25 / 11 / 14
LOCATION: HINCHINBROOK CHANNEL
SITE code: DROP CAMERA TRANSECT no.: 2
Start TIME: ______ End TIME: ______

START of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

Quadrat (metres from transect origin)	Sediment (eg. mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition					Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	M	very low vis	✓	0						–		–
2 (5m)	"	no vis	✓	0						–		–
3 (10m)	"		✓	0						–		–
4 (15m)	"		✓	0						–		–
5 (20m)	"		✓	0						–		–
6 (25m)	"		✓	0						–		–
7 (30m)	"		✓	0						–		–
8 (35m)	"		✓	0						–		–
9 (40m)	"		✓	0						–		–
10 (45m)	"		✓	0						–		–
11 (50m)												

END of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: L. McKENZIE DATE: 25 / 11 / 14
LOCATION: SCRAGGY PT (HINCHINBROOK IS)
SITE code: DROP CAMERA TRANSECT no.: 3
Start TIME: ______ End TIME: ______

START of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

Quadrat (metres from transect origin)	Sediment (eg. mud/sand/shell)	Comments (eg 10x gastropods, 4x crab holes, dugong feeding trails, herbarium specimen taken)	(✓)	% Seagrass coverage	% Seagrass species composition					Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)	M/FS		✓	0						–	0	–
2 (5m)	M		✓	0						–	0	–
3 (10m)	"	CH×1 sea pen	✓	0						–	0	–
4 (15m)	"	CH×1	✓	0						–	0	–
5 (20m)	"		✓	0						–	2	–
6 (25m)	"		✓	0						–	0	–
7 (30m)	"		✓	0						–	0	–
8 (35m)	"		✓	0						–	0	–
9 (40m)	"		✓	0						–	0	–
10 (45m)	"		✓	0						–	0	–
11 (50m)												

END of transect (GPS reading)
Latitude: ....°.......' .... Longitude: ....°.......' ....

CH = crab hole

APPENDIX 4

KPI-6: reporting *(written monthly reporting delivered to EHP upon agreed date)*	EHP received regular reports on the delivery of the project and participated in planning.

Reporting

Immediately following each training event, Project officers updated EHP on the attendance and results via email or phone.

Meetings

Throughout the planning and implementation of the project, face to face meetings were also held with EHP representatives on an *ad hoc* or needs basis.

Table 7. *Meetings conducted during the planning and delivery of the project*

Date	Location	Present
18 February 2014	JCU Cairns Campus	Chris Kinnaird, Len McKenzie, Louise Johns, Melissa Douthat, Belinda Norris
17 March 2014	Northern Fisheries Centre	Chris Kinnaird, Len McKenzie, Louise Johns, Kate Maltby & Brenda Floey
5 May 2014	EHP Cairns	Chris Kinnaird, Louise Johns
11 July 2014	EHP Cairns	Chris Kinnaird, Louise Johns
19 August 2014	EHP Cairns	Chris Kinnaird, Len McKenzie, Louise Johns & Brenda Foley
30 September 2014	JCU Cairns Campus	Chris Kinnaird, Len McKenzie, & Louise Johns
30 October 2014	JCU Cairns Campus	Chris Kinnaird, Len McKenzie, & Louise Johns

web postings

Images and information from all Introductory and Level 1 workshops can be viewed at

http://seagrasswatch.org/training_gallery14

Media

11 June 2014, Western Cape Bulletin, Weipa QLD (by Fiona Croft)

General News, page 4 (regional circulation 1,350)

Watching the Sea Grass grow

By Fiona Croft
Photos Matt Gillis

THE Nanum Wungthim Rangers have just completed further training on sea grass monitoring with Louise Johns from James Cook University's Sea Grass Watch, (SGW) team.

Ranger Coordinator, Matt Gillis said the Rangers and Sea Grass Watch have been monitoring sea grass at a permanent monitoring site within the Embley River on the northern side of the river in Napranum for the past ten years.

The rangers have found changes in data over the past 12 months.

"The sea grass in the Embley River has impacts from port development and land runoff," Mr Gillis said.

"This area is surrounded by mining that alters the sediment, nutrient and fresh water running off into the sea grass meadows. The monitoring site tends to have more fine mud rather then sediment and shell, which is more suitable for sea grass meadows."

The rangers gain skills at the workshops in sea grass identification, the importance of sea grass, animals that use the sea grass, and the distribution of sea grass around the world.

These skills are used when monitoring sea grass and include learning about percentage cover, sediment composition and data collection.

"Sea grass is essential for the survival of the dugong and species of sea turtle that graze on it," Mr Gillis said.

This extensive sea grass community provides habitat for juvenile fish and prawn species that are important to commercial, recreational and the local community.

There is evidence showing the trails that dugong leave behind on the Embley River.

"Dugong tend to pull the sea grass completely out as the rhizomes growing below the surface are the most nutrient rich part of the plant.

The sea grass varies in growth throughout the year and has greater growth in the wet season when possibly there is more fresh water seeping from the land into the meadows.

There are four species of sea grass at the monitoring site: Halophila ovalis; Halodule uninervis, Thalassia hemprichii and Enhalus acoroides.

Sea grass varies from algae, and is more related to plants that grow on the land as they have roots and set seed as do other angiosperms.

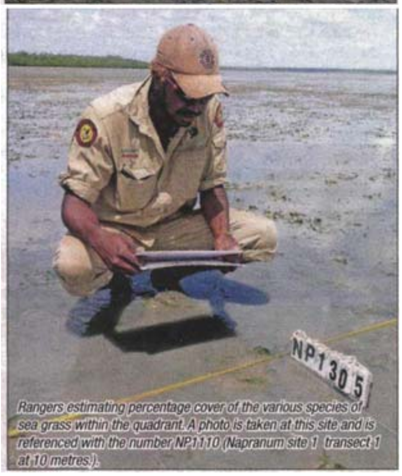
All data collected by the rangers is sent to the Sea Grass watch team and added to the Sea Grass watch data base which can be viewed at *www.seagrasswatch.org.* It is found that the sea grass changes over time and even within a year the rangers have seen increases in sea grass cover and changes in species of sea grasses.

People of the community that are interested in participating and have an interest in sea grass are welcomed to join the rangers in future sea grass monitoring days.

The rangers will continue to monitor the sea grass four times a year when the tides are below 0.9 of a metre. This allows for the sea grass to be exposed and data collected. Depending on the tides and current predictions, it is usually in June or July, September, December or January and April.

Ranger Godfrey Wigness monitoring sea grass on the shores of the Embley River.

Rangers standing beside a boat trail caused by boats motoring through the sea grass. Boats can disturb and destroy sea grass while turtle and dugong suffer from propeller strike.



Rangers estimating percentage cover of the various species of sea grass within the quadrant. A photo is taken at this site and is referenced with the number NP1110 (Napranum site 1 transect 1 at 10 metres.).

APPENDIX 5

As part of the feedback from Level 1 participants, they were asked to provide their thoughts in response to the following:

What aspects of the training could be improved?

nothing
1 day in class, 1 day field work (cut back classroom to 1 day)
more group activities
nothing, pretty straight forward
not much
would be great to have more time for the assessments/practical's, if possible. More local info
not much I can say, but it was good and I enjoyed it
more course
it was good. Don't have change anything
tell people more about seagrass
more field events

What I enjoyed most about the training was……

good to learn about our seagrass on country
practical training
straight forward and easy to follow
field trip
small group
bonus questions
very well presented
looking at pictured sheets during the assessments
I enjoyed seeing the international sites
group activities
learning about seagrass
very good
learning the skills to monitor, identify and maintain seagrass
everything. Learning about how seagrass was interesting
working with other rangers
theory and field trip. Putting our skills to use
Practical components, "hands on" training – Great job Len!
learning more skills to work
down at the beach, doing Seagrass-Watch
what seagrass are there
mixing in and enjoying it
the explanations, comparisons to enable us to better understand why we do Seagrass-Watch
Learnt new things
information
very clear and a good opportunity to be outdoors on the second day
every good
practical side of the training. I enjoyed the theory side, most informative
everything especially the field event

I did not realise that.....

seagrass was so important to our sea country
the state of the seagrass in decline
how important the role of seagrass played in the environment. I only saw as a food source for turtles and dugong
seagrass seeds could be collected
seagrass was so important
the area I work in, hasn't been survey in our area
seagrass had seeds
there are over 60 different species of seagrass
there are 60 species of seagrass, possibly 72
there were so many types of seagrass
I now have a better understanding of the whole process
what living in on seagrass
was more to what we have been doing
all the data was collected at James Cook Uni
how many seagrass species were their
there are more seagrass
number of seagrass there were

Now I understand that.....

we must protect our seagrass
accurate monitoring is so important to what is happening in the environment
it's important to monitor seagrass as it varies during season
seagrass plays a significant role in the marine environment
seagrass, there are many types
seagrass is an important factor for a healthy eco-system
marine wildlife needs it
seagrass are the filters of the ocean and are susceptible to pollution
the methodology used, background
seagrass is a good monitor of ocean
There's different types of seagrass in the area
a little more on seagrass ID and monitoring
it shows how healthy the area is that it grows . How vital it is food fish habitat
there are a lot of threats to seagrass

When I go back to my area, I will.....

try to encourage uncles and nephews to do any future courses
identify if our country have seagrass
spread the word and make more people aware
learn more about seagrass
identify and gain knowledge of the species located there
seek out and maintain seagrass beds in an initial baseline data gathering
seek to coordinate/implement consistency e.g. methodologies, data collection etc
read handbook
more training
be vigilant in my Seagrass-Watch
inform the community or anyone about the seagrass, we might have in our area
participate in more field trips and to gain a better understanding and more experience in monitoring seagrass
talk about to other members of public and family friends. See if we can get a seagrass program in an area not in use
share my knowledge with others

Other comments

I enjoy knowing the different species and the names of each of them

people who go out on the seas in the Cairns area, need to be aware of the fragility of seagrasses and the important part they play in the ecosystem

Thank you. Very informative and easy to understand

nice venue

this is more then what had been doing

Big thanks to both trainers done a great job explaining and encouraging us all