VESS
VANUATU ENVIRONMENTAL SCIENCE SOCIETY

Report on seagrass conservation activities under the project “Strengthening Monitoring, Community Management, and Policies for Dugong Conservation in Vanuatu”

February 2022

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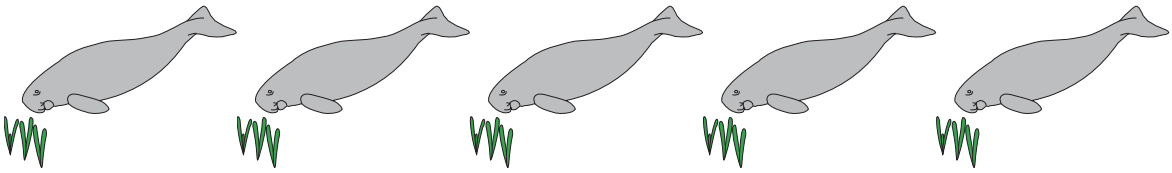
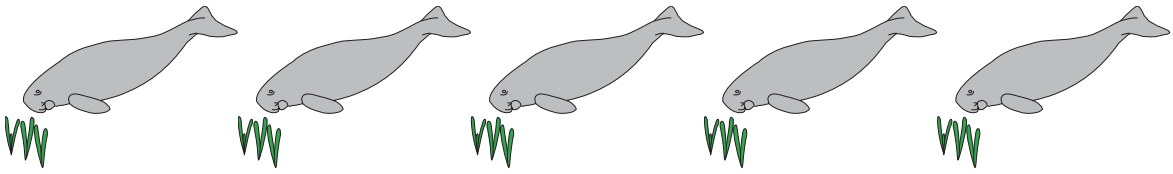


Summary

Dugongs, as well as green turtles, are dependent on seagrass for their survival. Therefore, protection of seagrass meadows is an important component of dugong conservation efforts. Assessing and monitoring important seagrass meadows over the long term will reveal trends in seagrass health and interventions can be implemented at an early stage to ensure dugongs in the area have enough food and habitat for their survival. This project has established long-term monitoring sites for seagrasses in Vanuatu within dugong hotspots. Four sites have been established and twenty-six monitoring events have taken place during the project. This has created a baseline for continued monitoring. From the initial data the seagrass meadows appear to be stable. Nine Ni-Vanuatu scientists have experienced an ecosystem monitoring programme with six achieving certification in Seagrass Watch monitoring. In addition, four fisheries officers also gained experience in the methodology.

Data from the seagrass monitoring has been reported back to the communities to guide management of their coastal area. The data has also been used in 3 published scientific papers.

154 seagrass specimens were collected representing 6 species of seagrass from 4 sites. 70 specimens have been deposited at the National Herbarium of Vanuatu at the Department of Forests. The remaining specimens are held at the VESS office. Prior to this collection there were only 4 seagrass specimens within the collection at the National Herbarium.



Seagrass Monitoring

Monitoring seagrass meadows over time allows natural resource managers to see trends in the health of the seagrass ecosystem. This can provide and early warning system of coastal ecological decline and allow earlier interventions to reduce the damage to seagrass meadows and the species that depend on them, such as dugongs and green turtles. This project introduced the Seagrass Watch programme to Vanuatu and established 4 long-term monitoring sites within important dugong hotspots. Seagrass Watch programme, overseen by James Cook University, Australia, uses globally standardised seagrass assessment and monitoring protocols and a rigorous quality control and quality assurance procedure.

Training

To ensure that the information generated within the Seagrass Watch programme is of good quality and maintains the high standard, only teams trained by Grass Watch headquarters staff can contribute their data to the global database. This means that the data can be used and trusted by local communities, resource managers and government as well as scientists.

Figure 1: Len McKenzie delivering the Workshop

Figure 2: participants during the theory portion of the course

Len McKenzie and Rudi Yoshida from James Cook University were the technical advisors for the seagrass elements of this project. They delivered a three-day workshop on seagrass monitoring using the Seagrass Watch methodology between the 7th and 9th of August 2017 in Port Vila. The training comprised classroom theory as well as practical training in the seagrass meadow of Erakor lagoon. The training built capacity in the sixteen Pacific Island scientists who took part. Eight (6 female and 2 male) of the scientists were from VESS, six of whom were new science graduates. Eight participants travelled from the Solomon Islands (funded by the GEF dugong and Seagrass Conservation Project). Four additional people from the Vanuatu Government and SPREP attended the first day of the workshop as observers. The training workshop covered the current knowledge on seagrasses in Vanuatu, species identification, seagrass conservation including threats and management, seagrass monitoring methodology, how to make herbarium specimens and seagrass mapping methodology.

Six of the VESS scientists achieved the basic level training certificates from Seagrass Watch Headquarters for successfully completing the training course and participating in 3 monitoring events after the course within a year. Len McKenzie and Rudi Yoshida produced a proceedings manual for the course which is now used as a manual for VESS's seagrass monitoring events. VESS has elaborated on this to develop our own protocols for monitoring event preparation and planning, monitoring event data management, seagrass specimen labelling and database management.

Figure 3: Workshop attendees identifying species of seagrass.

Figure 4: VESS scientists, Christina Shaw, Samantha Leo, Priscilla Amkori, Martika Tahi and Douglas Koran, receiving certificates from Seagrass Watch for achieving basic level training with the Deputy Director of Fisheries and the British High Commissioner.

When the project was conceived it was though that the communities would be able to monitor the seagrass meadows themselves. However, the methodology, although designed for citizen scientists, requires a reasonable understanding of scientific methodology and it was decided that monitoring by the communities themselves unaided would not yield usable results, nor would the data be robust enough to contribute to the global database. Therefore, it was decided that the capacity would be built in Ni-Vanuatu scientist who could then monitor the seagrass meadows with the assistance of the communities during the monitoring events.

Figure 5: Len and Rudy demonstrating the seagrass monitoring techniques at Erakor lagoon

Site Selection

A questionnaire survey was conducted throughout Vanuatu in 2016 and 2017 using the CMS Standardised Dugong catch / By-Catch Questionnaire as part of the GEF-funded Dugong and Seagrass Conservation Project. It was undertaken to update the knowledge about the distribution of dugongs in Vanuatu and the treats they face to enable concentration of conservation efforts to where they are most needed. Dugong hotspots are areas with high dugong sightings that overlap with areas where gillnet fishing, a key threat to dugongs, occurs. Twenty hotspots were identified within Vanuatu. These hotspots were then assigned a priority for conservation measures of high, medium or low as a result of the discussion with local experts about other threats that are likely to be present. Six were considered of high priority, nine medium priority and five of low priority. The long-term seagrass monitoring sites under this project are all located in high priority dugong hotspots.

Within the hotspot the VESS team spoke to local communities to identify large areas of seagrass meadows and made a visual inspection of the seagrass areas for seagrass coverage. The VESS team consulted with local communities to understand which were motivated to conserve seagrass meadows and dugongs and were willing to work with the VESS team on this project. The specific areas for long-term monitoring sites were decided by the characteristics of the seagrass meadows and discussions with the communities. The sites are (with site name in brackets):

- **Erakor Lagoon (EF1&2), South Efate dugong hotspot** - The site at Erakor is on the eastern shore of a lagoon located close to the capital city, Port Vila not far from Erakor village which is one of the largest peri-urban villages in Vanuatu.
- **Poanganisu (EF3&4), North Efate dugong hotspot** - The seagrass meadow close to Poanganisu is located on the northern coast of Efate where there are several close off-shore islands.
- **Lamap (ML1&2), Southeast Malekula, dugong hotspot** – At the Lamap site the seagrass meadow is located at the south-eastern corner of Malekula island (the second largest island in Vanuatu) opposite the off-shore islands of the Maskelyns. The inter-tidal seagrass meadow is close to Gaspard Bay, a site known for dugong sightings.
- **Lamen Bay (EP1&2), Northwest Epi dugong hotspot –** Dugong and green turtles are seen feeding on the seagrass in Lamen Bay which is dominated by *Haemophilia ovalis* seagrass. However, as this part of the bay is not inter-tidal and too deep to monitor without scuba, and therefore the monitoring site is located just to the north of this area, off a beach close to the airstrip. This is on the northeast corner of Epi Island.

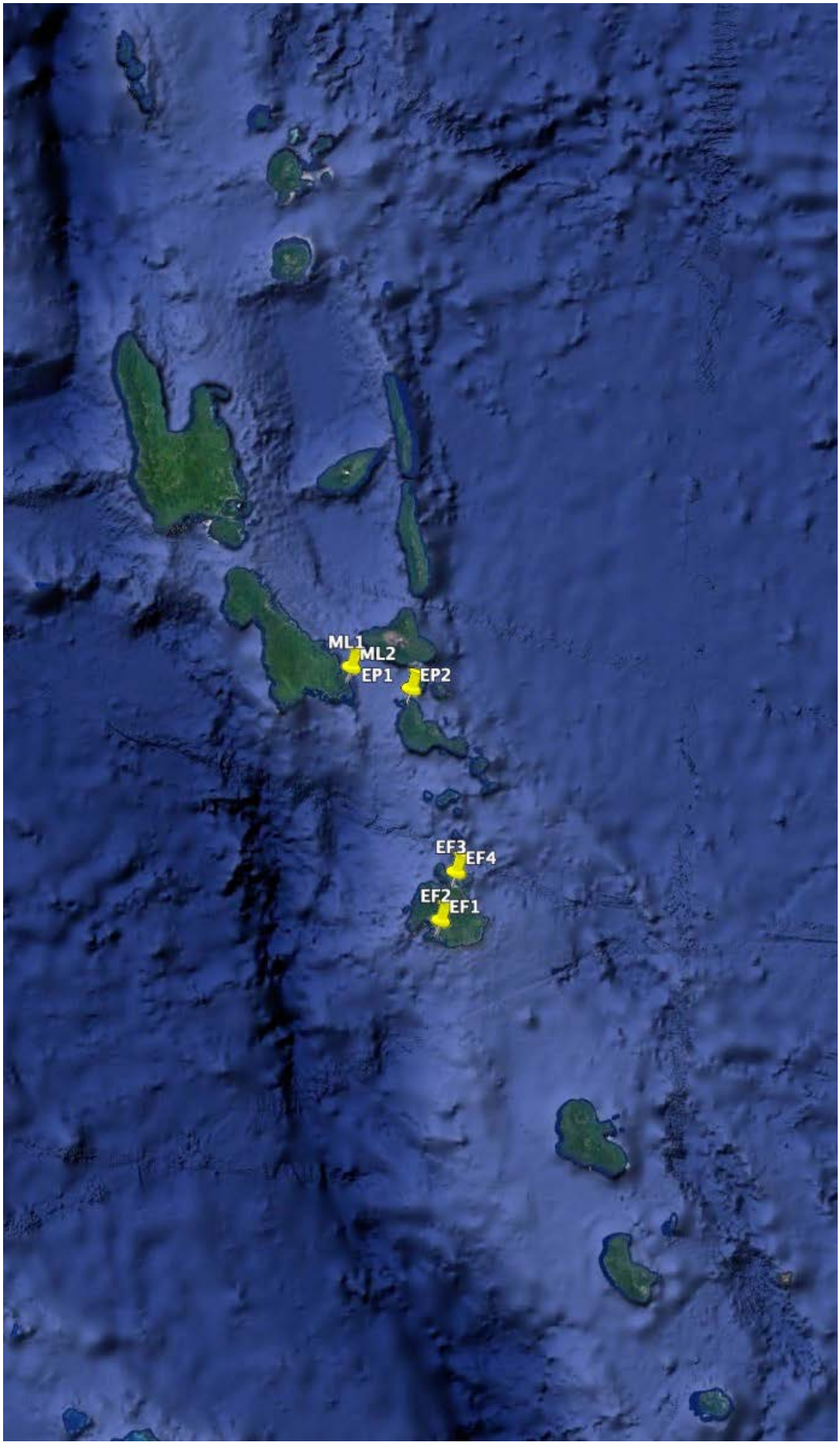


Figure 6: Google Earth image of Vanuatu with seagrass monitoring sites marked.

Figure 7: Lamen Bay monitoring site

Figure 8: Erakor lagoon monitoring site

Figure 9: Lamap monitoring site

Figure 10: Poanganisu monitoring site

Monitoring Events

For each monitoring event the Seagrass Watch protocols were used. At each site the location was recorded on the first visit using and hand-held GPS and at all subsequent visits the VESS team returned to the same location. Each monitoring location is a 50 meter x 50 meter square. The monitoring protocol uses three transects 25 meters apart perpendicular to the shore in the inter-tidal zone. A 50cm x 50cm quadrat is placed along the transect at 5-meter intervals. The seagrass within each quadrat is examined and the data recorded on datasheets. There is a total of 33 quadrats for each monitoring event at each site. The process is repeated at a second location close by within the same dugong hotspot.

Figure 11: Transect laid out in Erakor lagoon monitoring site

Figures 12: Photograph of quadrats laid on transect with photo-labeller identifying the site and quadrat

For each quadrat, we record the following:

- Percentage of seagrass cover;
- Average height of grass leaves;
- Seagrass species composition;
- Percentage of epiphyte cover on the seagrass leaves;
- Percentage of macroalgae cover withing the quadrat (Macroalgae is not attached to seagrass leaves);
- Sediment type;
- Anything other observations such as invertebrates or dugong feeding trails;

Photographs are taken of each quadrat using a photo-labeller to identify each quadrat. This is to allow for quality control and assurance both in-house and at Seagrass Watch headquarters. The data and photos are sent to Seagrass-Watch and are added to the international dataset once they have successfully gone through Seagrass Watch's quality control and quality assurance process.

Twenty-six monitoring events have taken place in the four long-term monitoring sites that have been established. The table below shows where and when these monitoring event took place.

Site name	EF1&EF2	EF3&4	ML1&2	EP1&2
Site location	Erakor	Poanganisu	Lamap	Lamen Bay
Sep-17				
Oct-17				
Nov-17				
Dec-17				
Jan-18				
Feb-18				
Mar-18				
Apr-18				
May-18				
Jun-18				
Jul-18				
Aug-18				
Sep-18				
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Mar-21				
Apr-21				
May-21				
Jun-21				
Jul-21				
Aug-21				
Sep-21				

Table 1: Seagrass monitoring event locations and dates

Results

Six species of seagrass were identified during monitoring of these site. The greatest number of species were found in Poanganisu and Lamap, where all 6 species were found. In Erakor four were found and in Lamen Bay 5 were identified. The tables below show which species have been found and in which location. Thalassia hemprichii and Cymodicea rotundata dominated the seagrass meadows within the monitoring sites. Halodole uninervis was also abundant. Enhalus acoroides was found at every monitoring event in several quadrats. Syringodium isoetifolium and Halophila ovalis, when present, were only found in a few quadrats.

Enhalus acoroides Significantly bigger than other species in Erakor with strong roots. 	*Thalassia hemprichii* Wide curved leaf with rounded end. 	*Cymodocea rotundata* Narrower leaf with rounded leaf tips.
Halodule uninervis Three tips on the leaf tip and one vein down the middle of the leaf. 	*Halophila ovalis* Small round leaves. 	*Syringodium isoetifolium* Narrow leaves like noodles with a point at the end.

Figure 13: Sea grass species identified during monitoring events. Image source: http://www.seagrasswatch.org/id_seagrass.html

Site name	EF1&EF2	EF3&4	ML1&2	EP1&2
Site location	Erakor	Poanganisu	Lamap	Lamen Bay
Thalassia hemprichii	Yes	Yes	Yes	Yes
Cymodocea rotundata	Yes	Yes	Yes	Yes
Halodule uninervis	Yes	Yes	Yes	Yes
Enhalus acoroides	Yes	Yes	Yes	Yes
Syringodium isoetifolium		Yes	Yes	Yes
Halophila ovalis		Yes	Yes	

Table 2: Species distribution at the monitoring sites

The monitoring data provides a baseline for the four sites. As monitoring continues over time any trend in the measured parameters will become apparent. During the short period of the project, the seagrass meadows appeared to be stable. There was no discernible change in seagrass cover and canopy height other than seasonal variation during the timeframe of the monitoring. Algae and epiphyte cover also appeared stable.

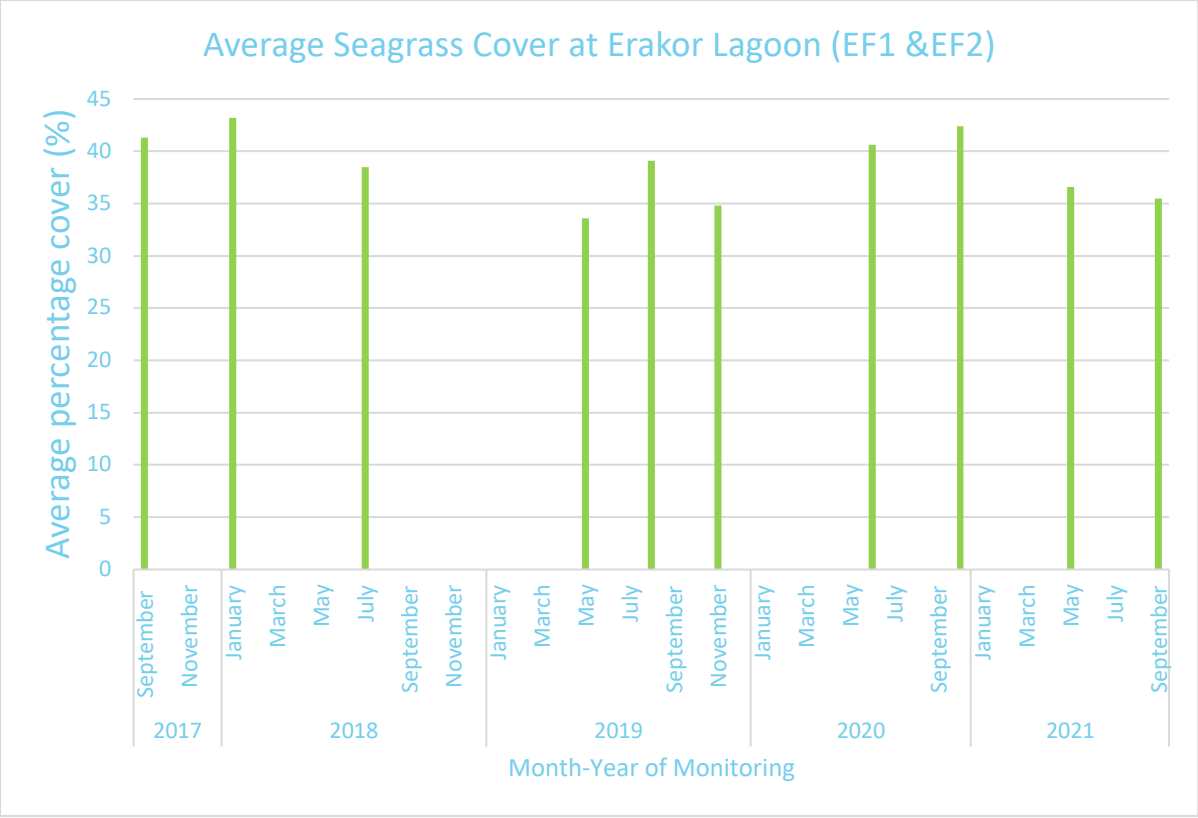


Figure 14: Seagrass cover over time at Erakor Lagoon, as an example, remained stable

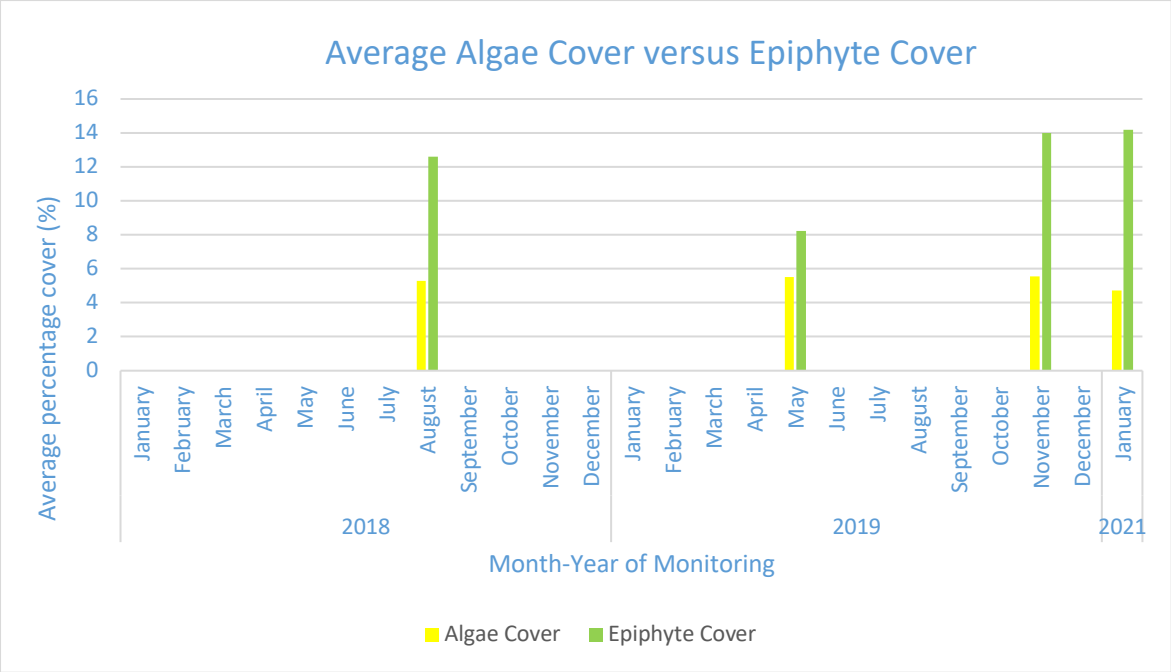


Figure 15: Epiphyte and algae cover over time at Lamap, as an example, remained stable

A number of invertebrates were found during the monitoring events including, coral, sponges, sea cucumbers, brittle stars, starfish, sea urchins, cowries, hermit and other crabs, bivalves, and snails. A number of small fish were also recorded.

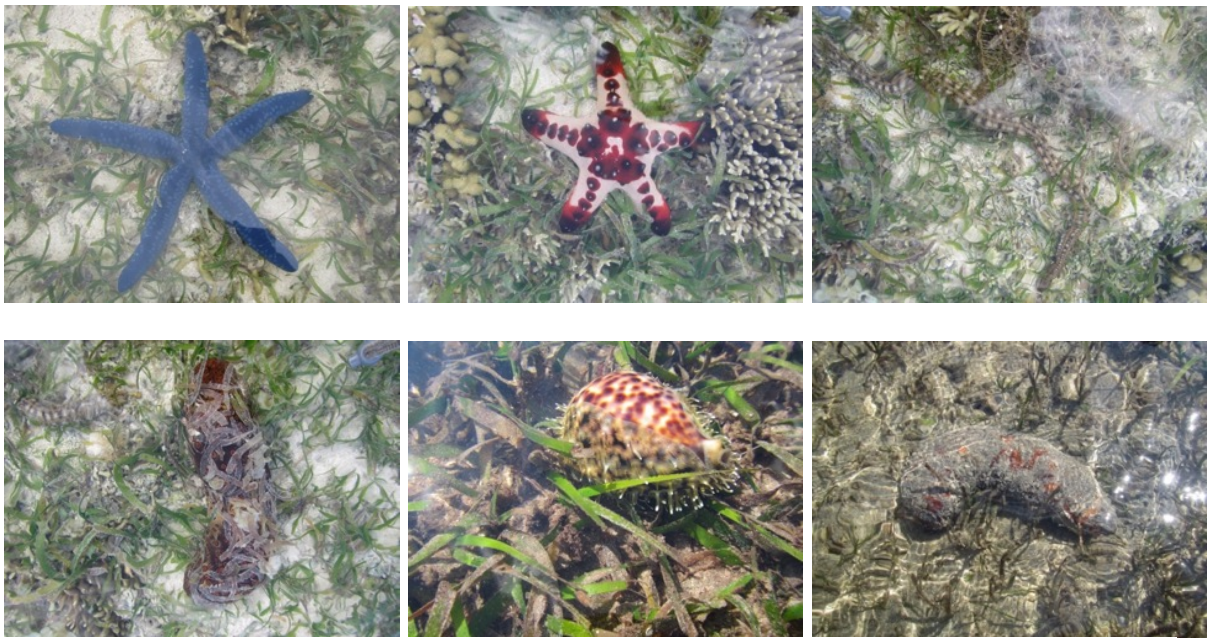


Figure 15: Some invertebrates found during the seagrass monitoring

During the project nine Ni-Vanuatu science graduates, working or volunteering with VESS, had the opportunity to gain practical experience of monitoring an ecosystem. In addition, four junior officers from the Vanuatu Fisheries Department accompanied

the VESS team for our monitoring events in June 2020 to gain experience in the protocols and methodology.

Figure 16: Martika Tahi, a science graduate working on the project for VESS, during a monitoring event

Figure 17: VESS and Fisheries officers assessing seagrass within a quadrat

Use of the data generated from the monitoring

The results for each site were written into a report that was presented to the communities at each of the sites. The reports have been updated after each monitoring event and given to the community leaders. The reports to the communities contain graphic representation of the data. The communities were counselled on how they can use the information in the reports to assist with the management of their coastal areas. During this project a baseline for the seagrass meadows in these areas has been established. The monitoring will need to continue over time in order to show any trend. Currently it appears the seagrass meadows are stable. An example of the community report can be found in Appendix A.

Figure 18: community members receiving the written report of seagrass monitoring in their area

All data from the monitoring events has been submitted to Seagrass Watch headquarters at James Cook university for quality control and quality assurance and incorporation into the global database for seagrasses. The data can be found via this link: https://www.seagrasswatch.org/vanuatu

The data generated from the monitoring under this project has been used in three scientific papers of which Christina Shaw from VESS is a co-author. The papers and the links to where they can be found online follows:

1. "Assessing intertidal seagrass beds relative to water quality in Vanuatu, South Pacific" published in the February 2021 issue of Marine Pollution Bulletin. This was collaboration with CEFAS from UK.

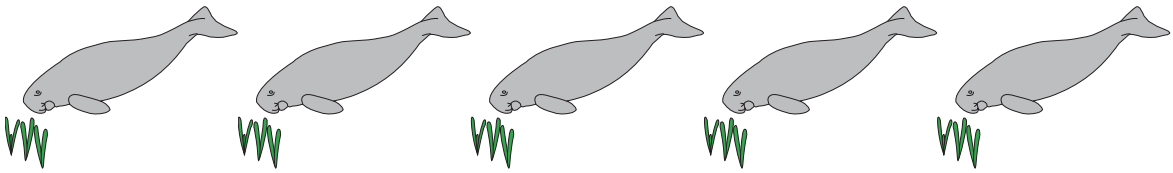
https://www.sciencedirect.com/science/article/pii/S0025326X20310559.

2. "Seagrass ecosystem contributions to people's quality of life in the Pacific Island Countries and Territories" published in the June 2021 issue of Marine Pollution Bulletin. This lead author of this paper is Len McKenzie from Seagrass Watch at James Cook University

https://doi.org/10.1016/j.marpolbul.2021.112307

3. Seagrass ecosystems of the Pacific Island Countries and Territories: A global bright spot" published in the June 2021 issue of Marine Pollution Bulletin. This lead author of this paper is also Len McKenzie from Seagrass Watch at James Cook University

https://doi.org/10.1016/j.marpolbul.2021.112308



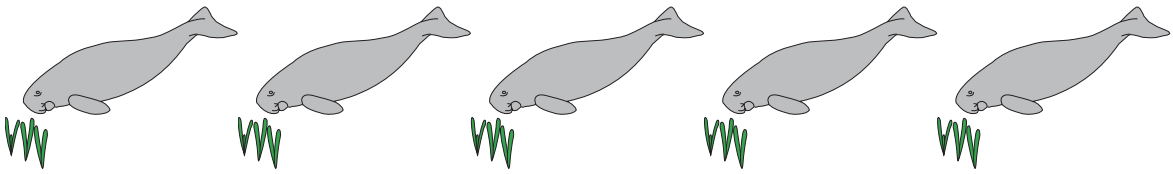
Seagrass Specimen Collection

During the initial seagrass monitoring events, voucher specimens were collected by the VESS scientists of the seagrass species within each monitoring site. In total 154 specimens were collected representing 6 species of seagrass from 4 sites. The specimens were washed and pressed in herbarium presses for several weeks until dried. They were then mounted on herbarium paper and labelled. 70 specimens have been deposited at the National Herbarium of Vanuatu at the Department of Forests. The remaining specimens are held at the VESS office. The data with the details of the specimens has been uploaded to the Global Biodiversity Information Facility (GBIF) and can be viewed here: https://www.gbif.org/dataset/0c77bfef-bbbc-43f9-9583-98bd4b9d5b77 .

Figure 19: Examples of pressed seagrass specimens, mounted and labelled for herbarium collections. Clockwise from top left: Cymodocea rotundata; Enhalus acoroides; Halodule uninervis; Syringodium isoetifolium; Thalassia hemprichii; Halophila ovalis.

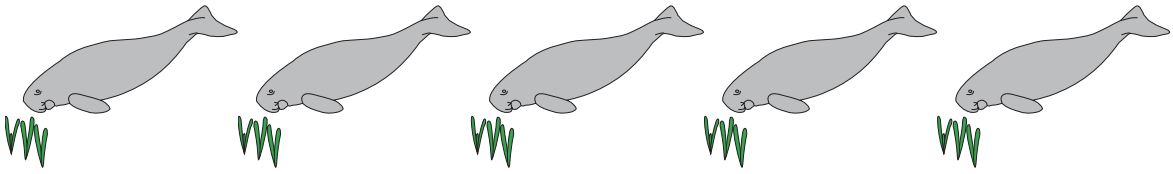
On the 13th of July 2020, the VESS team held an event to deposit 70 seagrass specimens at the Vanuatu National Herbarium located at the Department of Forestry. 23 people attended the event, included the British High Commissioner, deputy Director of Vanuatu Fisheries Department the Director of Environmental Protection and Conservation and Department of Forest staff. Christina Shaw gave a presentation on the seagrass specimens and the Seagrass Watch monitoring that had been undertaken by the VESS Ni-Vanuatu scientists and communities in the dugong hotspot areas. Five seagrass monitors, including VESS staff and assistants were awarded a seagrass-watch certificate of achievement during the event. There was also a display of seagrass voucher specimens for the attendees to look at before they were deposited into the herbarium.

Prior to this deposition of voucher specimens, the Vanuatu National Herbarium only had 4 specimens of seagrass, collected in 1971. Therefore, this addition to the collection represents a significant resource for scientists, both from Vanuatu and overseas and serves as a permanent record of the species that exist in Vanuatu today.



Awareness Raising

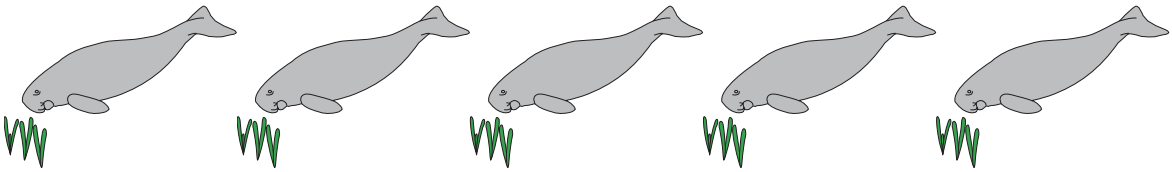
Over the timeframe of the project the 1,891 people attended workshops conducted by VESS. We organised and delivered sixty-one workshops in just over 2 years between August 2018 and December 2020. Two workshops were designed and conducted in the dugong hotspots. The first was general awareness raising on the lifecycle and ecology of dugongs, the importance of seagrass, the threats dugongs and seagrasses face, and practical conservation measures communities could take to help conserve the species in Vanuatu. This workshop's target audience was the communities living close to the 5 dugong hotspots which were selected as sites for this project (north and south Efate, Malekula, South Santo and Epi). The second workshop was to explain the Guidelines for Interacting with Dugongs and the accompanying Code of Conduct to Tourism. Of the attendees to the workshops 1084 were male and 807 were female. 758 were children of which 342 were boys and 416 were girls. More information on the awareness raising aspects of this project, including attendance at events and meetings, can be found in “Strengthening monitoring, community management, and policies for Dugong Conservation in Vanuatu Project Report on Awareness Raising Activities”. This report and the awareness-raising materials can be found on the VESS website www.vanuatuconservation.org.



Next steps

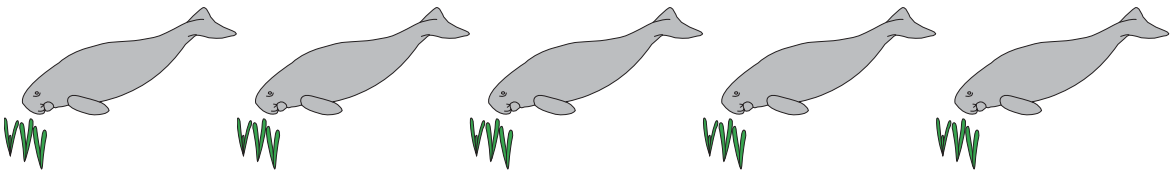
Under this project long term monitoring sites were established for seagrass monitoring. Baseline data has been collected over the last four years. To establish any long-term trends the monitoring needs to continue, ideally annually, at these sites. Funding is required to enable the VESS scientists to do this with the collaboration of the local communities living close to the dugong hotspot areas. If no funding is available or if there are gaps in funding in certain years, VESS would be able to monitor the sites on Efate but would need some funding, at least for travel to the sites, on Epi and Malekula. Should further funding be available VESS would like to establish more long-term monitoring sites within the dugong hotspots in Vanuatu. The priority would be the other two high priority hotspots of southwest Santo and Emae.

VESS has significantly increased the number of herbarium specimens held in Vanuatu over the course of this project. However, the collection we have made does not represent all the species that have been identified in Vanuatu. Therefore, we would like to undertake further field trips to locate the other 6 species and take voucher specimens to preserve for the herbarium collections. This will be a valuable resource for future scientist, both Ni-Vanuatu and from overseas.



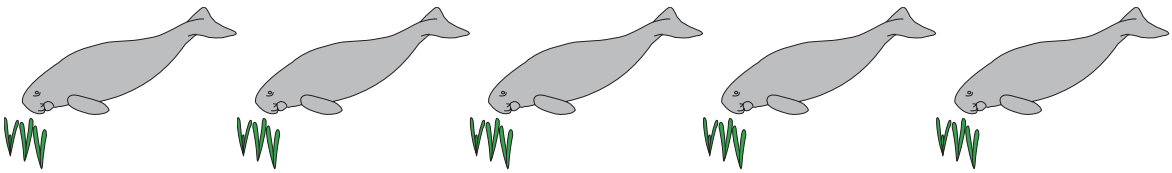
Funding

The "Strengthening monitoring, community management, and policies for Dugong Conservation in Vanuatu" project was funded by the Critical Ecosystem partnership Fund (CEPF). "The Critical Ecosystem Partnership Fund is a joint initiative of l'Agence Française de Développement, Conservation International, the European Union, the Global Environment Facility, the Government of Japan and the World Bank. A fundamental goal is to ensure civil society is engaged in biodiversity conservation." The project was implemented between July 2017 and December 2021.
Additional equipment including an herbarium press, herbarium mounting paper and folders and two bathyscopes were donated by the UK Commonwealth Marine Economies (CME) programme.



Acknowledgements

We would like to thank Len McKenzie and Rudy Yoshida from Seagrass Watch for their assistance and guidance throughout the project. We would also like to thank our funder CEPF to give us the opportunity to do this work as the CEFAS team working under the CME project for the equipment and collaboration on seagrass work in Vanuatu.
Dugong image credit: Diana Kleine, Marine Botany UQ (ian.umces.edu/media-library)



This report was compiled by Dr. Christina Shaw, VESS

Appendix A

Seagrass Monitoring Erakor Lagoon

The Vanuatu Environmental Science Society (VESS) has continued with the Seagrass Monitoring Program in important coastal areas for dugongs around Vanuatu. This program is in partnership with the Vanuatu Department of Fisheries and the Department of Environmental Protection and Conservation. VESS continues to build on its baseline data which investigates the condition of seagrass and measures, over time, any changes in the health of seagrass meadows. This baseline can be use for comparison in future years. The aim of this report is to inform communities of the findings of these surveys, which can be used to inform the management and protection seagrass in these local areas.

Erakor lagoon was chosen as a monitoring site as it has a large seagrass meadow with many animals that rely on it for food and shelter, including dugongs, green turtles, juvenile fish, and many other small animals. VESS has chosen the two sites, EF1 and EF2 within the lagoon (Figure 1), and we have monitored the condition of the seagrass multiple times a year for the last four years, and we will continue to monitor annually. Over time, we can detect changes in the health of seagrass. Variations are expected within the year due to different growing seasons, but we are looking for changes over time, from year to year.

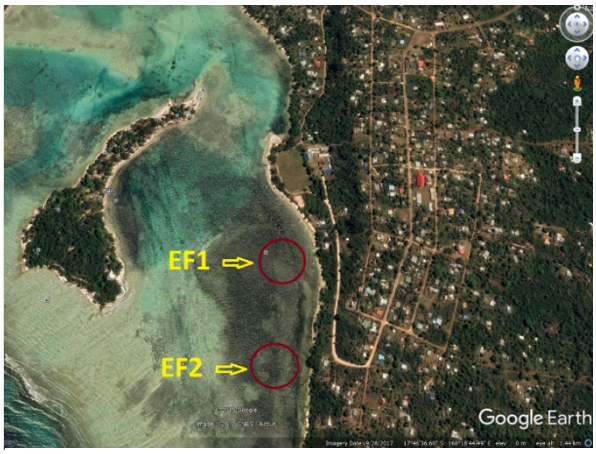


Figure 1: The Erakor sites named EF1 and EF2 shown on a Google image of Erakor Lagoon.

Method

At each site we go to the same location using a GPS to find it. Then we set up three 50m measuring tapes in parallel, 25m apart. These lines are called transects (Figure 2). Every 5m along the transects, we put a 50cm x 50cm square (quadrat) and look at the seagrass inside the square. There is a total of 33 quadrats for each monitoring event at each site.

We combine the information from all the quadrats together to get an average of the health of the seagrass across the whole site.

For each quadrat, we record the following:

- Percentage of seagrass cover;
- Average height of grass leaves;
- Different species of seagrass;
- Percentage of epiphyte cover (algae living on the seagrass leaves);
- Percentage of algae cover (algae not living on seagrass leaves);
- Sediment type e.g., sand, mud, shells;
- Anything else we find of interest such as how many snails are inside the area, or if there are feeding trails from dugongs; and
- Photos are taken at each quadrat as a back-up record and for quality assurance.

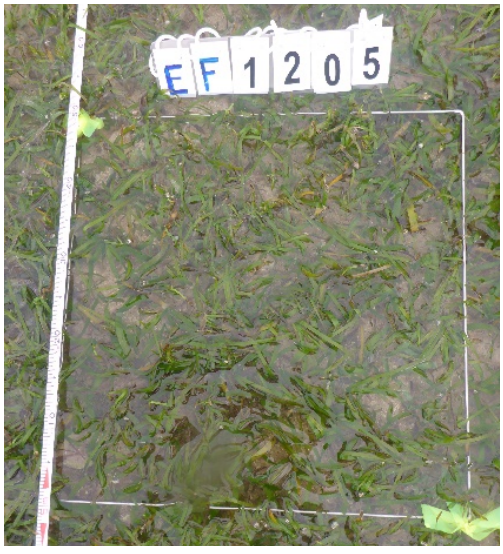


Figure 2: A quadrat next to the transect line. We collect data from inside the quadrat every 5m.

The data and photos are sent to Seagrass-Watch Head Quarters and is added to the international dataset after going through quality control and quality assurance process.

Results

VESS has identified four different species of seagrass in the Erakor lagoon sites (Figure 3). All four of these species have thin, strap-like leaves but they can be differentiated by their features. *Thalassia hemprichii* and *Cymodocea rotundata* are found the most throughout EF1 and EF2 at Erakor lagoon (Figure 4). *Halodule uninervis* was found in some of the quadrats and *Enhalus acoroides* was only found in a small number of our sample sites (which makes it hard to show in the graphs below). However, in the small bay where the boats come in, which is outside of our sample area, there is a large area of seagrass meadow dominated by *Enhalus acoroides*.

Enhalus acoroides	*Thalassia hemprichii*	*Cymodocea rotundata*	*Halodule uninervis*
Significantly bigger than other species in Erakor with strong roots.	Wide curved leaf with rounded end.	Narrower leaf with rounded leaf tips.	Three tips on the leaf tip and one vein down the middle of the leaf.

Figure 3: Four different seagrass species have been recorded in Erakor lagoon (source of images: http://www.seagrasswatch.org/id_seagrass.html

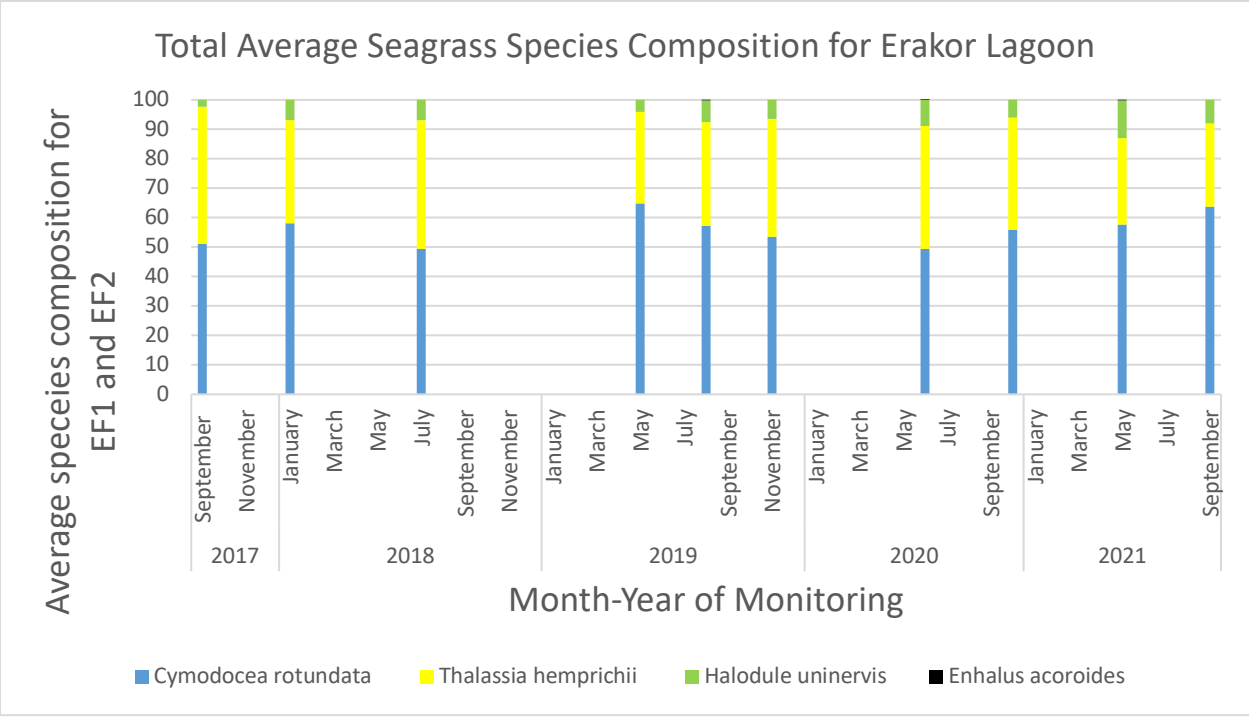


Figure 4: Total average of the seagrass species recorded at Erakor lagoon across years 2017-2021.

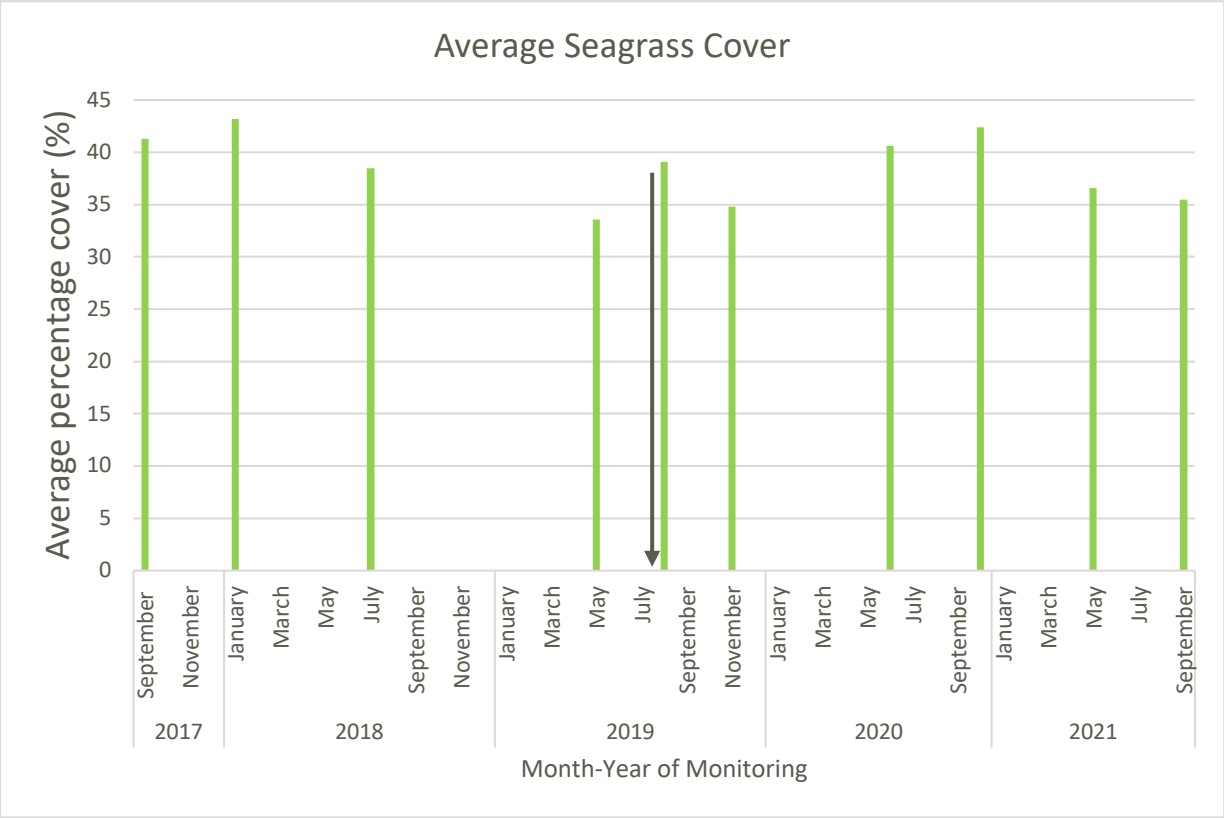


Figure 5: Average seagrass cover at Erakor lagoon over the years 2017-2021 shows seasonal variations but no major changes. Taboo started (⟶ August 2019).

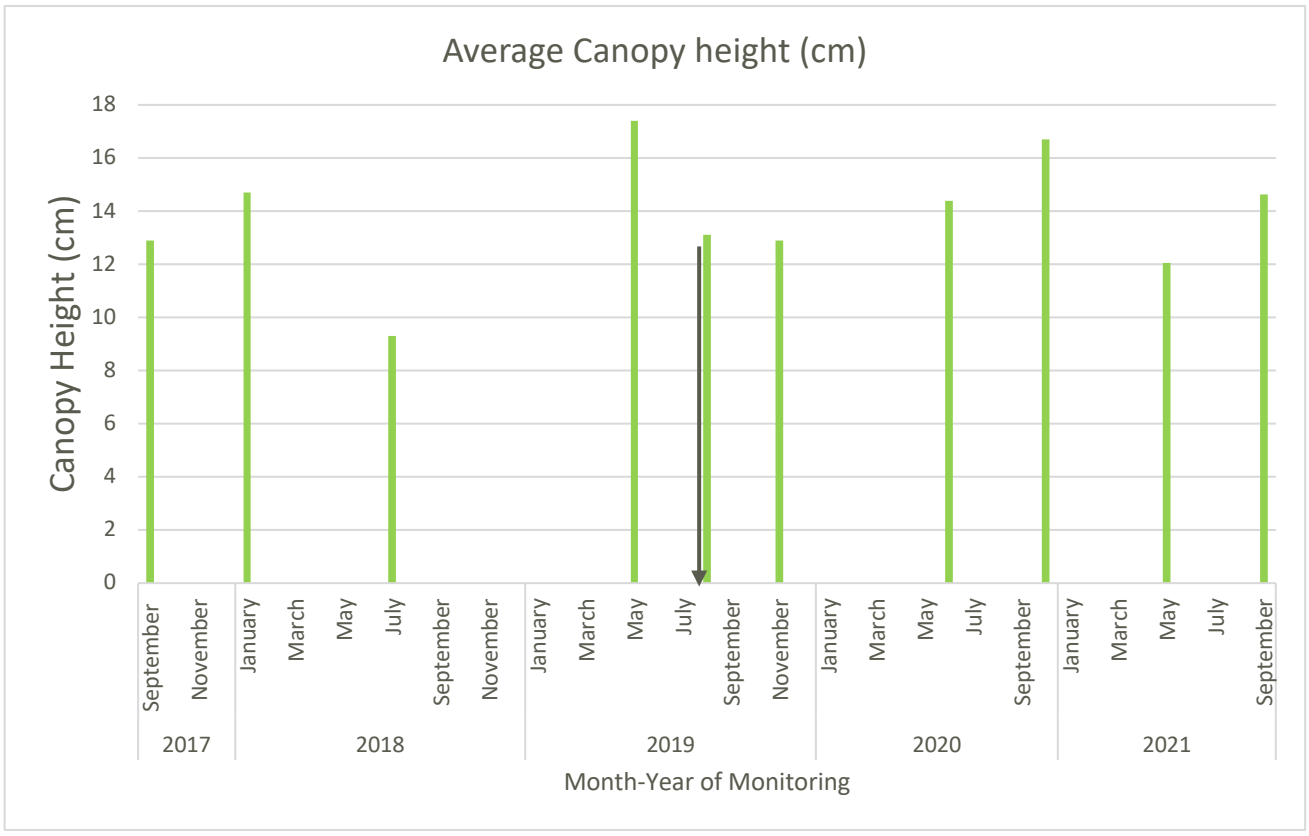


Figure 6: Average canopy height at Erakor lagoon over the years 2017-2021 shows seasonal variations but no significant changes to the canopy height. Taboo started (⟶ **August 2019).**

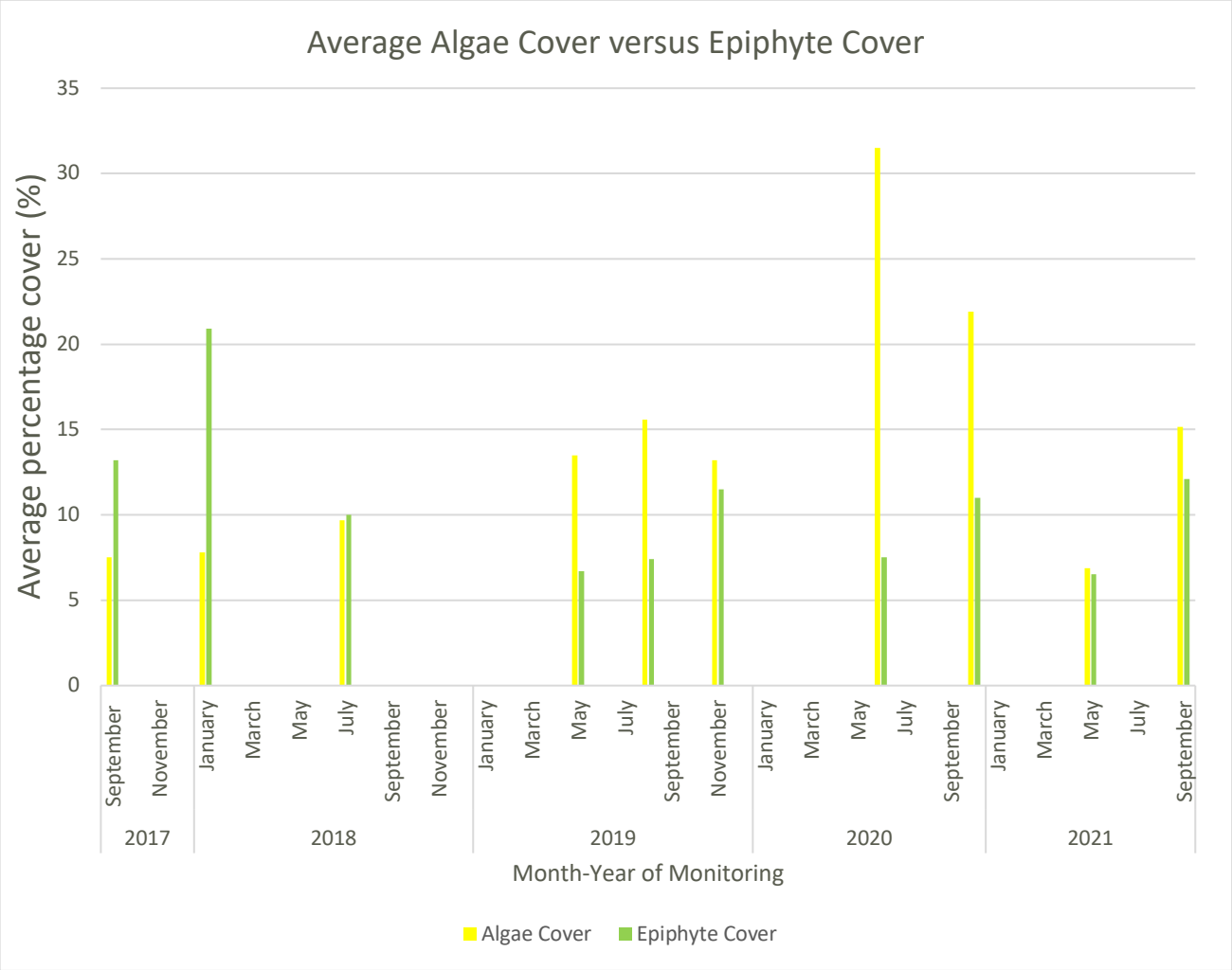


Figure 7: Average algae cover (algae not living on seagrass leaves) and epiphyte cover (algae living on seagrass leaves) at Erakor lagoon over the years 2017-2021. Generally, results are fairly stable apart from one monitoring event in June 2020, when the algae cover was higher. One result does not indicate a general trend so VESS will continue to monitor to see if a trend develops. Taboo started (⟶ August 2019).

There are natural changes in the seagrass meadows during the year, as the weather changes. Seagrass height and cover tends to be higher in the warmer months with longer sunshine hours. Algae, (both attached to the leaves and living separate to the seagrass), tends to be greater when there is more nutrient in the water as well as when the water is warmer. But the algae levels can be affected by the number of snails or other animals that feed on the algae too.

VESS started monitoring seagrass in the Erakor lagoon in 2017, and since then we have survey data for ten monitoring events (September 2017 to September 2021). The results are shown in the graphs (Figure 5,

Figure 6 and Figure 7). We can see that there are some variations with the different times of the year, as expected. However, the seagrass meadows appear to be stable when we look at the data across the years. It is important to continue monitoring so we can see if there are any changes over a longer period of time.

VESS will continue to update the community on the results of our monitoring to help with management of coastal areas and conservation actions that may be needed. We thank the Erakor community for allowing VESS to continue with the monitoring program and hope to continue working together to monitor this important ecosystem and protect the marine life that depends on it.