RESILIENCE BASED MANAGEMENT CASE STUDY

Using citizen science to monitor ecosystem health

GREAT BARRIER REEF, AUSTRALIA

Integrating citizen science and education to fill knowledge gaps and enable better management

The Issue

The Great Barrier Reef World Heritage Area (GBRWHA) stretches along approximately 2000km of the Queensland coastline, extending from inshore mangrove forests and beaches to offshore reefs and islands. The Great Barrier Reef (GBR) is renowned for its coral reef habitat, but is composed of a mosaic of interconnected ecosystems including both seagrass meadows and mangrove forests that are a vital for the overall health of the Reef[1]. Degraded water quality from local catchment runoff, in addition to broadscale climate impacts including heat-waves and cyclones, threaten the health of the mosaic of GBR ecosystems.[1]

In 2019 the Great Barrier Reef Marine Park Authority launched the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP) recognising the logistical challenges of monitoring and managing such a large and diverse ecosystem as the GBR (348,000 km^2). It highlighted the need to expand spatial monitoring across the GBR's multiple habitats to provide managers with information that spanned the various ecosystems throughout the different regions (Figure 2).

Previous monitoring on the GBR focused on tracking temporal change at sentinel sites (approx. 1 site every 7,000 km^2). While this provides high resolution of temporal impacts at specific sites, many reefs and seagrass meadows

How the Program Addresses Resilience Based Management?

Figure 1: The citizen sciene monitoring program contributes to the community and governance components of resilience based management.

The data collected by the project provides the spatially diverse information required by managers to effectively implement adaptive management frameworks on the Great Barrier Reef. The rapid assessment method provides a spatial representation of coral and seagrass habitats that complements the intensive temporal monitoring of sentinel sites linking spatial and temporal responses. Utilising citizen scientists and students to collect this valuable data also supports ecosystem resilience through education and engagement. By working with schools, the project was able to engage with a broad cross section of the community, as students from households with different backgrounds, occupations, and opinions about how to care for the GBR participated. First Nations peoples were also involved in the monitoring, fostering relationships, and developing skills to facilitate collaborative management. By providing a pathway for 'young adults' to become personally acquainted with the GBR and the challenges it faces, the project helps build community embracement of the behavioural and management changes that will be required to protect the GBR into the future.

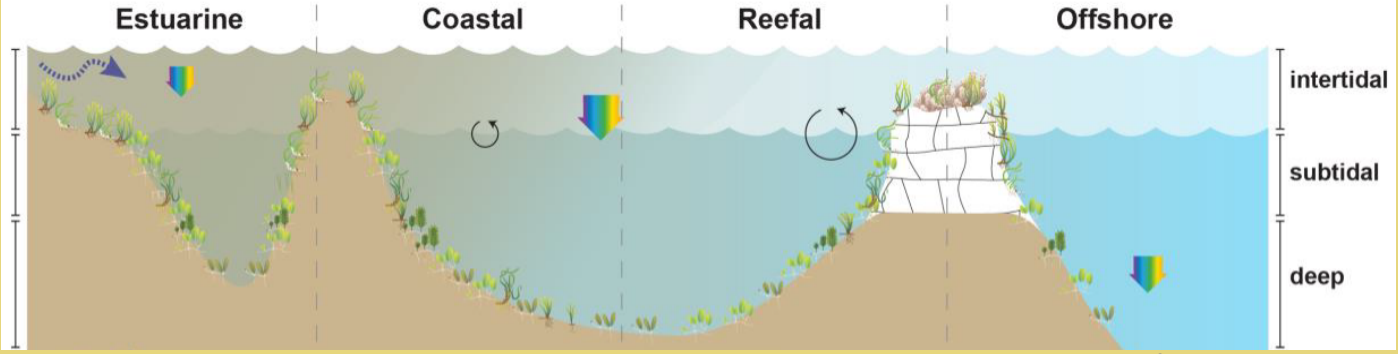


Figure 2. Range of different seagrass habitats in the Great Barrier Reef. Figure from Udy et al. 2019[2]

have little or no data on their condition or the species present. The limited spatial coverage of information on coral and seagrass condition, and relative impact of different stressors on these ecosystems, makes resilience-based management of these critical habitats across the GBRWHA challenging.

Citizen-science provides a means for the collection of large quantities of data across a wide geographic area. It also fosters conservation efforts through relationship building and hands-on engagement. The wellbeing of local communities and the GBR is inextricably linked. By involving communities in monitoring the health of the GBR's varied ecosystems, understanding and support for future management actions can be fostered and local and traditional knowledge held by the community can be integrated into the management of the Reef system.

Actions Taken

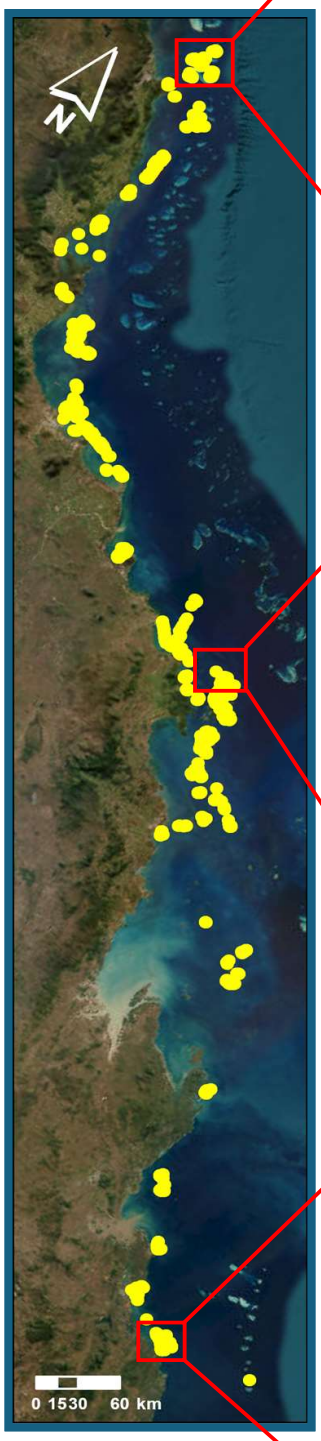
In 2019 a citizen science project was established to undertake rapid assessments of coral and seagrass communities throughout the Great Barrier Reef. This project had two objectives:

1) fill the knowledge gap identified by RIMReP, by establishing a cost-effective monitoring project capable of collecting information on the condition of seagrass and coral across many reefs and habitats within the GBRWHA.

2) build a stronger connection between the communities that live in GBRWHA catchments and their adjacent reef ecosystems.

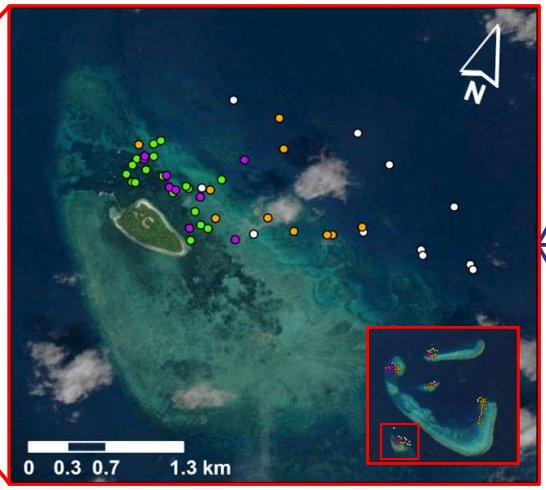
The Science Under Sail Australia (SUSA) citizen science project was designed to complement the existing Marine Monitoring Program that focuses on water quality, coral, and seagrass condition of inshore reefs (managed by the Great Barrier Reef Marine Park Authority). The MMP provides long term temporal sampling at 37 coral reefs and 47 seagrass meadows within the GBRWHA, focusing on near shore reefs and intertidal seagrass meadows. SUSA's project provided an opportunity to access and survey many additional locations (approx. 800 p.a.) using standard rapid assessment methods to classify habitats. These methods are designed to be easily learned by citizen scientists and undertaken from a small or large research vessel. The flexibility provided by a live aboard vessel has enabled more subtidal sites

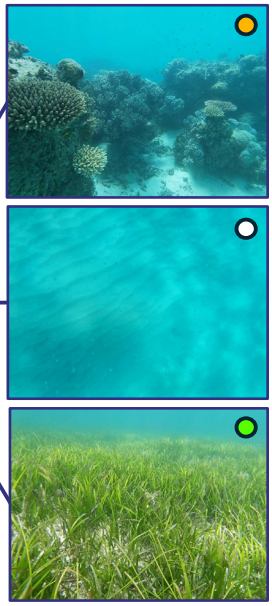

Figure 3. The project engaged students, First Nations people and citzen scientists in monitoring the health of seagrass and coral habitats throughout the Great Barrier Reef World Heritage Area.



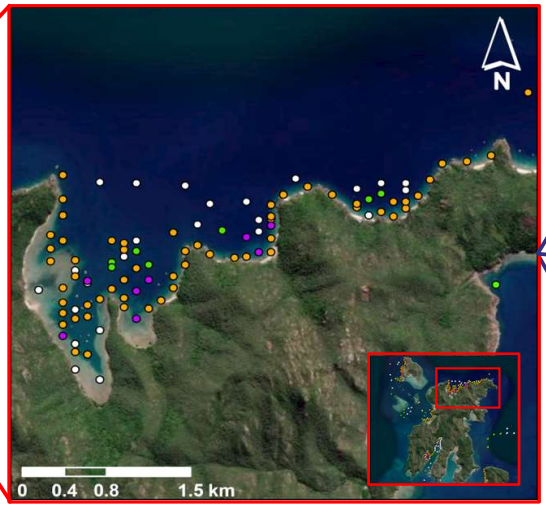
GBR Survey Sites

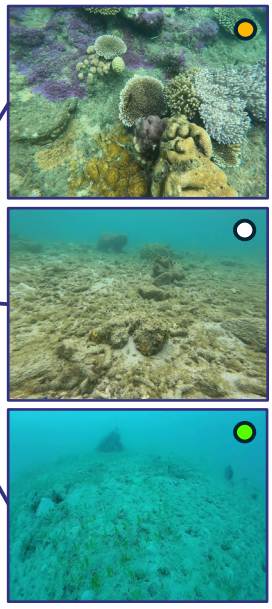
Green Island



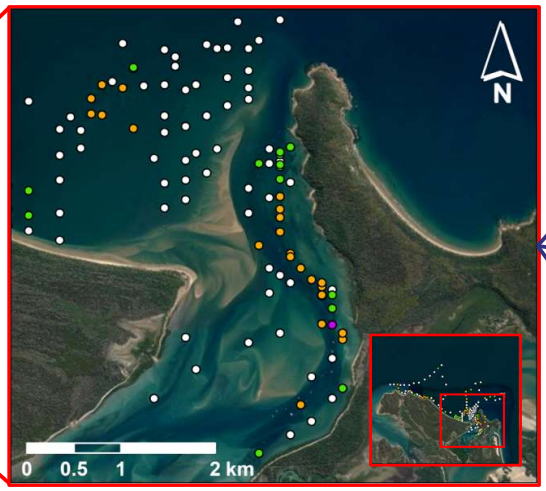


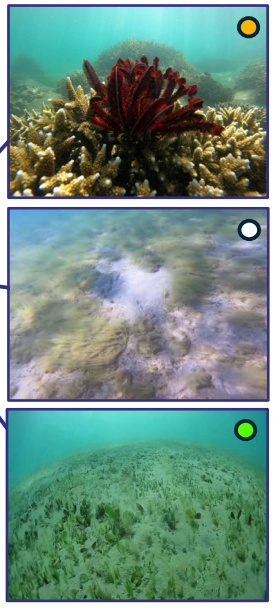
Butterfly Bay (Hook Is.)





Pancake Creek





Benthic Habitats of the GBR

- Seagrass/Coral
- Seagrass
- Coral
- Absence

NPSR, Esri, HERE, Garmin, USGS, NGA, Earthstar Geographics.
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Rebecca Penna

Figure 4. Map of survey sites and the habitat types observed. Zoom in examples to display spatial resolution in specific locations, with example photos of the habitat types observed.

to be surveyed and expanded the spatial extent of monitoring further from urban centres. Monitoring trips ranged in length from single-day school excursions to multi-day live aboard surveys. During the single-day school excursions all students participated in data collection and assessment of benthic habitats, experiencing the change in habitats at different locations and learning about the various pressures on GBR ecosystems. The multi-day trips allowed participants to become competent and confident research assistants, performing benthic surveys as well as data entry and management tasks. The varied length of field trips enabled surveys to be conducted across many areas of the GBR that had previously not been surveyed or had limited historical data.

This project also provided opportunities for First Nations people to connect with Sea Country through an indigenous boarding school excursion, community engagement days, and a survey methodology training day with Gidarjil rangers that equipped participants with the skills to carry on further monitoring when opportunities arise.

How Successful Has it Been?

The project demonstrated that a coordinated citizen science project working collaboratively with schools and First Nations peoples along the Queensland coast could fill the seagrass distribution knowledge gap identified in 2019 by the Seagrass Monitoring Expert Panel.[2] During the project, over 100 days of fieldwork were conducted (averaging 25 days p.a.), collecting habitat survey data from approx. 35 sites /day. The project has provided managers with seagrass abundance, coral health, and other habitat information from a spatially diverse range of sites between Cairns and the southern boundary of the GBRWHA (Figure 4). 453 participants engaged directly with the project, including senior high school and university students, First Nations people, teachers, and other community members. Through engaging local schools in experiential learning, the project was able to inspire local understanding and promote actions beneficial to their adjacent sections of the GBR. Participants often shared their experience and passion gained for the GBR during the SUSA program through social media, school newsletters/assemblies or other community networks (e.g. community environmental groups, church groups). This has helped to grow local capacity, as these participants become the next generation of community leaders, GBR managers, and advocates for the GBR.

The project trialled the use of video content, video conferencing and social media to engage a much wider audience than could participate in the field-work. Throughout this project SUSA:

1) Developed a virtual GBR excursion for high school students unable to visit the GBR.

2) Ran professional development days for teachers and developed course plans to help teachers incorporate this real-world data into the curriculum.

3) Had students video conference with their peers to explain what they were learning during the field trip.

4) Used social media posts to engage with a larger audience, reaching over 73,000 people with social media content in a single year (photos & videos).

Figure 5. The project provided hands on and virtual learning experiences

Lessons Learnt

Getting students out of the classroom and providing hands on learning opportunities has evoked student passion for the GBR and inspired participants to be part of the solution to protect it. The combination of a supervised citizen science activity working in collaboration with established educational organisations (Education Queensland or private schools) enriches students' learning experiences by fulfilling and building upon educational syllabi and providing a cost-effective way for managers to obtain new data on the condition of the GBR's critical habitats.

Parents and teachers of participants have regularly commented that involvement in a SUSA live aboard experience has led to students becoming more interested in environmental issues in their community and becoming more engaged in learning opportunities at school.

Successful delivery of this project was dependant on having teachers within schools that were passionate about providing students with a real-world experience of the GBR. This opportunity enabled students to link their classroom learnings with an understanding of how their own actions influence the long-term health of the GBR.

Lead Organisations

Science Under Sail Australia

Acknowledgments

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Australian Government | REEF TRUST | Great Barrier Reef Foundation | SCIENCE · UNDER · SAIL · AUSTRALIA

References

1 Waycott M, Collier C, McMahon K, Ralph P, McKenzie LJ, Udy J, Grech A (2007) Vulnerability of seagrasses in the Great Barrier Reef to climate change. In *Climate Change and the Great Barrier Reef: a vulnerability assessment*. Great Barrier Reef Marine Park Authority

2 Udy J, Waycott M, Carter A, Collier C, Kilminster K, Rasheed M, McKenzie L, McMahon K, Maxwell P, Lawrence E, Honchin C (2019) Monitoring seagrass within the Reef 2050 Integrated Monitoring and Reporting Program: Final Report of the Seagrass Expert Group, Great Barrier Reef Marine Park Authority, Townsville.