INDONESIA DISSERTATION/THESIS PROJECT

Monitoring Seagrass Ecosystems in Wakatobi: Spatial Patterns, Indicators of Health and Protocol Evaluation

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Seagrass meadows are among the most productive marine ecosystems, playing a vital role in maintaining coastal biodiversity and supporting small-scale fisheries, particularly in the Indo-Pacific region. These ecosystems serve as nursery grounds for juvenile fish, contribute to carbon sequestration, stabilise sediments and help maintain water quality. Despite their ecological and economic value, seagrass habitats are increasingly under threat from coastal development, nutrient loading, sedimentation and climate-driven stressors.

In 2024, a seagrass monitoring project was initiated at Hoga Island, Wakatobi, Indonesia, using adapted Seagrass-Watch protocols. The survey methodology involved the use of quadrats and transects across three tidal zones (high shore, mid shore and near-reef flat) at two locations (Hoga 01 and Hoga 02). Within each quadrat, observers recorded percentage cover of seagrass, algae and epiphytes, sediment type and canopy height. Seagrass was categorised based on morphological traits rather than species-level identification.

Preliminary results indicate notable differences in seagrass health and composition across zones. Higher percentage cover was found in high and mid-shore areas, while canopy height tended to increase with proximity to deeper zones. Algae and epiphyte cover also varied, with higher levels of epiphytes generally occurring in shallower, more established meadows. Morphologically, bladed seagrasses dominated all areas, while oval and fern-like types appeared sporadically.

These baseline data highlight both spatial variability and methodological challenges in monitoring tropical seagrass ecosystems. The dataset provides a valuable opportunity for projects that explore ecological patterns, evaluate monitoring protocols and identify early indicators of meadow health or degradation. Proposed projects outlined below offer a focus within the broader seagrass monitoring effort, investigating key ecological relationships that can inform future management and restoration practices:

1: Zonation patterns and seagrass structure across the tidal gradient

This project could explore how seagrass cover, canopy height and morphological composition vary along the shore-to-reef gradient at Hoga. Using transect data, the study will compare ecological indicators across three zones (high shore, mid shore, reef flat) and between two sites (Hoga 01 and 02). The aim is to assess how environmental gradients (e.g., exposure, depth, substrate) influence seagrass distribution and form. The findings could inform refinement of sampling protocols and habitat classification used in future monitoring efforts.

2: Epiphytes and algae as indicators of seagrass meadow condition

This project could analyse patterns of algae and epiphyte coverage on seagrass blades to evaluate their potential as indicators of meadow health, maturity or stress. It will investigate how these components vary across shore zones and locations and how they correlate with seagrass cover and canopy height. High epiphyte load may signal mature, slower-flow environments, while excessive

algae could suggest nutrient enrichment or competitive pressure. By assessing these patterns statistically, the project aims to contribute to the understanding of secondary communities in seagrass systems and their use as proxies for environmental condition.

3: Evaluating morphological classification in seagrass monitoring protocols

Due to limitations in taxonomic expertise during the 2024 survey, seagrasses were grouped into broad morphological categories (bladed, oval, fern, syringe). This project will evaluate the effectiveness of these groupings for ecological analysis and explore whether they provide sufficient resolution to detect meaningful spatial or environmental trends. It will assess the distribution of morphotypes across transects and explore their relationships with sediment type, zone and other environmental variables. The findings will contribute to improving citizen science protocols by proposing clearer guidelines or visual tools for morphological classification in future surveys.

The data collected for these projects would require snorkelling instead of SCUBA diving techniques.

Recommended reading:

Bachtiar, R., Madduppa, H. H., & Bell, J. J. (2022). Contrasting drivers of sponge and seagrass assemblage composition in an Indo-Pacific seagrass meadow. Journal of the Marine Biological Association of the United Kingdom.

Chamberlain, J. (2024). Wakatobi Field Report. Operation Wallacea.

McKenzie, L., Campbell, S., & Roder, C. (2003). Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources (2nd Edition). QFS, NFC, Cairns.

Rappe, R. A. (2020). Seagrass meadows for fisheries in Indonesia: a preliminary study. IOP Conference Series Earth and Environmental Science, 564(1):012017.