14.3.3. Following Restoration With Scientific Evidence

Introduction

Marine habitat restoration requires more than the installation of artificial structures or the planting of mangrove seedlings. Scientific follow-up is essential to understand whether organisms are becoming established, which interventions need further care, and what information local institutions require before making new conservation decisions. In coastal environments, recurring observations are particularly important because ecological responses can vary with site conditions and over time.

During Academic Year 2024–2025, Davao Oriental State University (DOrSU), through its Regional Integrated Coastal Resource Management Center XI (RIC-XI) and institutional partners, contributed to restoration monitoring and the development of marine biodiversity evidence. In Pujada Bay, the university supported an artificial clay reef initiative whose early ecological results were reported in 2025. Partner documentation also described follow-up monitoring of mangrove seedlings planted before the reporting year. Separately, DOrSU formalized a partnership with the Municipality of Governor Generoso to undertake a baseline marine biodiversity assessment in Barangay Tagabebe.

These activities are complemented by an earlier peer-reviewed study on seafloor habitat mapping in Pujada Bay. Together, the following accounts demonstrate the value of ecological monitoring, science-based partnerships, and reproducible habitat information for coastal conservation. The evidence supports early observations, a documented partnership, and established research methods—not a claim that a natural reef has fully recovered or that proposed management actions have already been completed.

A Developing Reef Provides Evidence of Early Colonization

In February 2024, rrreefs and its partners installed an artificial clay reef system in Pujada Bay, City of Mati, using approximately 820 three-dimensional terracotta elements across a 100-square-meter structure. Although the initial deployment predates Academic Year 2024–2025, the structure provided a continuing site for monitoring during the reporting period. DOrSU, through RIC-XI, worked with the restoration partners to support technical coordination and follow-up assessments (rrreefs, 2025).

The project's first-year impact report, covering February 2024 to February 2025, estimated approximately 4,000 coral recruits on the reef structure. Coral recruit density was reported to have increased from 13 to 34 recruits per square meter between the monitored observations, while the proportion of surveyed clay elements bearing at least one recruit increased. The report also described changes in fish communities around the installation. These figures are early project-site observations; they do not establish that restoration alone caused every observed change or that the surrounding natural reef has fully recovered (rrreefs, 2025).

A central feature of the initiative is its use of repeated observations. Recording coral settlement and changes in associated organisms over time provides a stronger basis for evaluating the developing habitat than the number of installed modules alone. Such information can help researchers determine monitoring priorities, identify questions about coral survival and growth, and assess whether additional management support is warranted.

On July 23, 2025, rrreefs co-founder Hanna Kuhfuss presented monitoring findings at the Pujada Bay Protected Landscape and Seascape Special Protected Area Management Board meeting hosted by DOrSU. Communicating results directly to protected-area managers connected the technical monitoring effort

with a forum responsible for discussing conservation priorities and proposed restoration directions (DOrSU PIO, 2025; Oblianda, 2025).



Figure 1. Hanna Kuhfuss discusses the Pujada Bay artificial reef monitoring results during the PBPLS Special PAMB meeting at DOrSU, July 23, 2025. Actual event photograph documenting the reporting of monitoring findings; it is not an underwater monitoring photograph. Photo credit: DOrSU–Public Information Office.

Technical continuity also depends on local participation. DOrSU, rrreefs, the Coastal Conservation and Education Foundation, and other partners joined reef-building learning activities in Pujada Bay in 2024. Such engagement supports familiarity with artificial reef components and restoration practices. The photograph below documents a workshop associated with the restoration partnership, rather than the ecological measurements reported in 2025.



Figure 2. Participants in the Pujada Bay Artificial Clay Reef Building Workshop, October 19, 2024. Actual training photograph included as evidence of partner engagement in the restoration initiative, not as direct proof of coral recruitment. Photo credit: rrreefs / DOrSU project partners; workshop date corroborated by CCEF (2025).

References

rrreefs. (2025, June). Reef impact report: February 2024–February 2025, Pujada Bay, Philippines. https://www.rrreefs.com/wp-content/uploads/2025/06/2025_PUJ_impact_report.pdf

Davao Oriental State University, Public Information Office. (2025, July 23). Marine life booms in Pujada Bay after artificial reef installation. https://dorsu.edu.ph/marine-life-booms-in-pujada-bay-after-artificial-reef-installation/

Oblianda, A. S. (2025, July 29). The promise of eco-engineered reefs in coral restorations. Philippine Information Agency. https://pia.gov.ph/features/the-promise-of-eco-engineered-reefs-in-coral-restorations/

Coastal Conservation and Education Foundation. (2025). 2024 annual report (p. 33). https://www.coast.ph/wp-content/uploads/2025/03/CCEF_Annual_Report_2024_web.pdf

Counting Surviving Mangroves, Beyond Counting Plantings

Restoration outcomes cannot be assessed reliably through planting totals alone. Seedlings must survive, establish roots, and continue growing under local conditions before a planting initiative can be considered on a path toward durable mangrove habitat. For this reason, follow-up observations are an important complement to coastal tree-planting campaigns.

In its June 2025 impact report, rrreefs documented follow-up of a defined cohort of 3,000 mangrove seedlings planted in Pujada Bay in April 2024, before the reporting period. The project record identified 1,887 surviving seedlings, equivalent to approximately 63% of the monitored cohort. The report also described the tracking of seedling condition through observations of species, height, and leaves. The broader Pujada Bay partnership referred to approximately 9,000 seedlings planted across activities, but the 63% figure pertains to the specified 3,000-seedling group; it should not be generalized to every planting in the bay (rrreefs, 2025).

Documenting survival alongside losses gives restoration partners information that a planting count cannot provide. Changes in height or leaf development can support later comparison, while survival differences may help identify where to examine substrate, exposure, flooding, disturbance, or follow-up care. These relationships require site-specific investigation and should not be inferred from a single percentage.

For DOrSU and its partners, the reported follow-up is an example of the practical value of post-planting assessment in an interconnected coastal landscape. By retaining information on a defined cohort, the project establishes a more useful baseline for future mangrove stewardship. The available source documents monitoring and survival; it does not establish long-term forest development, ecosystem-wide rehabilitation, or that all seedling losses have been explained.

Evidence note: The primary source is rrreefs' 2025 Pujada Bay impact report, which documents the monitored cohort and survival results. The supplied institutional photo archive did not include a verified photograph of the mangrove survival survey; no unrelated image has been represented as direct monitoring evidence.

References

rrreefs. (2025, June). Reef impact report: February 2024–February 2025, Pujada Bay, Philippines. https://www.rrreefs.com/wp-content/uploads/2025/06/2025_PUJ_impact_report.pdf

Helping a Coastal Municipality Establish Its Starting Point

Conservation planning depends on knowing the habitats and species present before new interventions are introduced. For a proposed local conservation area, a baseline biodiversity assessment can provide an initial description of the resources requiring protection and a reference point against which subsequent surveys may be compared.

On September 11, 2024, DOrSU and the Local Government Unit of Governor Generoso signed a Memorandum of Agreement at the Municipal Conference Hall in Sigaboy for a baseline marine biodiversity assessment in Barangay Tagabebe. The university project, led by Amy G. Ponce and funded by

the municipal government, was designed to collect information on fishes, corals, and seagrasses within a proposed Local Conservation Area (DOrSU PIO, 2024).

The agreement is significant because it connects municipal conservation priorities with university research capability. Fish, coral, and seagrass assessments address distinct but related parts of coastal habitat condition. Establishing information on their occurrence and composition can support discussion of management boundaries, habitat pressures, monitoring needs, and future conservation priorities.

The signed agreement is a verifiable institutional milestone during Academic Year 2024–2025. However, the signing itself should not be described as completion of fieldwork, confirmation of biodiversity results, or adoption of a management plan. Those later outputs would need separate survey reports or formal management documents.



Figure 3. DOrSU and the Municipality of Governor Generoso formalize the marine biodiversity assessment partnership for Barangay Tagabebe, September 11, 2024. Actual memorandum-of-agreement signing photograph. Photo credit: DOrSU–Public Information Office.

References

Davao Oriental State University, Public Information Office. (2024, September 11). DOrSU, LGU Governor Generoso partner for marine biodiversity assessment in Barangay Tagabebe. https://dorsu.edu.ph/dorsu-lgu-governor-generoso-partner-for-marine-biodiversity-assessment-in-barangay-tagabebe/

Research Context for Following Habitat Change

Consistent monitoring of marine environments benefits from methods that can describe habitat extent and condition at appropriate spatial scales. Earlier collaborative research involving Pujada Bay developed and tested a portable seafloor imaging system that provides methodological context for this wider task.

Terayama and colleagues (2022) presented a portable speedy sea scanner using a five-camera imaging platform and a deep-learning segmentation approach. In a sea trial conducted in Pujada Bay on

December 7, 2019, the team produced detailed seafloor orthophotographs and analyzed imagery to distinguish corals, seagrasses, sea urchins, and other seabed features. The published study reported approximately 3-mm-per-pixel mapping resolution and an estimated survey efficiency of 12,900 square meters per hour (Terayama et al., 2022).

The publication demonstrates how repeatable spatial observations can support marine habitat assessment by showing where habitats occur and how features are distributed. Such methods can complement biological surveys, which investigate changes in colonization, abundance, condition, and survival through time. Taken together, spatial mapping and field monitoring can provide a fuller foundation for evaluating coastal habitats.

This is an earlier peer-reviewed research contribution and should not be counted as a new 2024–2025 survey. The available sources also do not establish that the portable scanner or its segmentation model was used to produce the 2025 artificial reef monitoring figures. Its relevance is methodological: the study offers a documented example of innovative, high-resolution marine habitat assessment conducted in Pujada Bay.

References

Terayama, K., Mizuno, K., Tabeta, S., Sakamoto, S., Sugimoto, Y., Sugimoto, K., Fukami, H., Sakagami, M., & Jimenez, L. A. (2022). Cost-effective seafloor habitat mapping using a portable speedy sea scanner and deep-learning-based segmentation: A sea trial at Pujada Bay, Philippines. Methods in Ecology and Evolution, 13(2), 339–345. https://doi.org/10.1111/2041-210X.13744

Scopus publication record (supplied citation register): https://www.scopus.com/pages/publications/85118377252?origin=resultslist

Conclusion

DOrSU's activities under Indicator 14.3.3 demonstrate the importance of following restoration work with scientific evidence and building partnerships that can support future coastal conservation decisions. The artificial clay reef initiative in Pujada Bay generated early observations of coral colonization and associated marine life, while the partner report's mangrove survival assessment moved beyond the number of seedlings planted to document the condition of a defined restoration cohort.

The September 2024 agreement with the Municipality of Governor Generoso extended the university's role in providing marine biodiversity expertise to a proposed local conservation area. An earlier Pujada Bay seafloor mapping study offers scientific context for the value of consistent, high-resolution habitat information. Across these accounts, the university contributes through monitoring partnerships, interpretation of restoration observations, and institutional arrangements for obtaining baseline evidence.

The available records establish early ecological indicators, documented follow-up, and a formal assessment partnership. They do not yet prove long-term reef or mangrove recovery, completed biodiversity survey results for Tagabebe, or adoption of new management measures. Continued measurement, accessible reporting, and collaboration among researchers, government agencies, and communities remain essential to translate these foundations into durable ecosystem protection.