# 14.5.2. Measuring Change in Aquatic Ecosystems

### Introduction

Assessing the condition of aquatic ecosystems requires several forms of evidence. Coral recruitment can describe early habitat colonization, biodiversity baselines can establish reference conditions, pollution studies can reveal exposure, and identification tools can help researchers make consistent comparisons of species across places and time.

During Academic Year 2024–2025, Davao Oriental State University (DOrSU) contributed to this broader evidence base through follow-up monitoring of artificial clay reefs in Pujada Bay, a municipal agreement for baseline marine biodiversity assessment in Tagabebe, research on microplastics in rabbitfish, and a published DNA barcode reference library for southern Mindanao marine fishes. An earlier Pujada Bay seafloor-scanning study provides a relevant example of repeatable habitat mapping methods.

These outputs represent different stages of environmental assessment rather than a single comprehensive ecosystem-health survey. The report therefore distinguishes initial reef observations, planned baseline work, published biological and pollution data, and historical methods, without attributing observed biodiversity entirely to restoration.

## A Developing Reef Provides Evidence of Recovery

The artificial clay reef installed in Pujada Bay in February 2024 continued to provide a site for scientific monitoring during AY 2024–2025. DOrSU, through RIC-XI, works with rrreefs and local partners to assess the developing habitat. The project's first-year report estimated about 4,000 coral recruits on the approximately 100-square-metre structure.

The observations give the partners a basis for judging early colonisation and planning further surveys. The Philippine Information Agency also reported these findings in July 2025, extending public access to the project's results.

A useful feature of the work is its emphasis on following the same developing habitat over time. Coral settlement is an early ecological response; it provides a starting point for examining survival and subsequent growth. For DOrSU and its partners, repeated observations can support decisions about maintenance, monitoring priorities, and suitability of further interventions. These early results should remain distinct from proof of a fully recovered natural reef (RIC-XI and project partners, 2025; rrreefs, 2025; Oblianda, 2025).




*Figure 1. Hanna Kuhfuss shares artificial reef monitoring findings with the PBPLS Special PAMB, July 23, 2025. This is a photograph of results being presented, not a field-monitoring image. Photo credit: DOrSU–Public Information Office.*

### References

Regional Integrated Coastal Resource & Management Center XI, Ponce, A., Polestico, R., Jimenez, L. A., Bation, L., Eballe, A., Bachelor of Science in Environmental Science Program, Ambasan, R. M., Camposo, M. K., Ponce, R., & rrreefs. (2025, April 7). Establishment and monitoring of the 3-D Artificial Clay Reef (ACR) in Pujada Bay, City of Mati, Davao Oriental [Project milestone]. Zenodo. Retrieved from https://doi.org/10.5281/zenodo.21756194

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

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

## Helping a Coastal Municipality Establish Its Starting Point

Before a conservation area can be managed well, its living resources must be understood. On September 11, 2024, DOrSU and the Municipality of Governor Generoso signed an agreement for a baseline marine biodiversity assessment in Barangay Tagabebe. Project Leader Amy G. Ponce leads the university contribution, with funding from the municipal government.

The planned assessment covers fish, corals, and seagrasses in a proposed Local Conservation Area. The agreement creates a concrete channel for local government to obtain scientific support for conservation and fisheries planning.

A baseline can help a municipality describe the resources it intends to protect and establish reference information for later comparisons. Covering fish, corals, and seagrasses recognises the different components of the proposed conservation area. The agreement assigns a role to university expertise within a locally funded initiative; completion of the survey, its findings, and adoption of management measures would require follow-up documentation (DOrSU PIO, 2024).




*Figure 2. Signing of the Tagabebe marine biodiversity assessment partnership between DOrSU and Governor Generoso, September 11, 2024. 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. Retrieved from https://dorsu.edu.ph/dorsu-lgu-governor-generoso-partner-for-marine-biodiversity-assessment-in-barangay-tagabebe/

## Documenting Plastic Contamination in Local Fisheries

Plastic pollution is also present in organisms that communities harvest for food. DOrSU researchers Lahoy and Antonio examined microplastic occurrence in the gastrointestinal tract of rabbitfish (Siganus canaliculatus) from Pujada Bay, with the study published in 2025.

Connected with the university's wider aquatic research and RIC-XI laboratory activities, the findings provide local evidence of plastic exposure in a commercially important fish. They strengthen the case for waste prevention and further monitoring.

Studying a locally harvested species connects marine pollution with an organism familiar to resource users. The research can help educators explain that plastic exposure is an ecological concern extending beyond visible shoreline litter. The finding concerns the gastrointestinal tract; it does not establish contamination levels in edible muscle or quantify human health risk. Its immediate contribution is evidence supporting prevention and further investigation (Lahoy & Antonio, 2025).

### References

Lahoy, N. M., & Antonio, E. S. (2025). Microplastic occurrence in the gastrointestinal tract of rabbitfish (Siganus canaliculatus) in Pujada Bay, Philippines. Davao Research Journal, 16(2), 49–61. https://doi.org/10.59120/drj.v16i2.377

## Making Marine Species Easier to Identify

Knowing which species occur in local waters strengthens the foundation for conservation. A 2025 collaborative study involving DOrSU researchers documented 771 marine fish species from southern Mindanao and developed a DNA barcode reference library for commercially important species.

The reference supports species identification and future monitoring. It contributes biodiversity knowledge that managers and researchers can use when comparing sites and assessing change; the publication does not itself demonstrate habitat restoration.

A reference library helps connect names assigned in field surveys with evidence that can support identification. For commercially important fishes, this can improve the consistency of biodiversity records used in research and conservation discussions. The work is a shared scientific resource for future assessment. Its regional species total should not be presented as a count confined to a single reef, municipality, or restoration site (Fortaleza et al., 2025).

### References

Fortaleza, M. A., Labrador, K. L., Lanutan, J. J., Bacus, M. G., Consuegra, J. M., del Fierro, J. E. L. F., Sobradil, R. B., Opina, R. L., Cabasan, J. P., Eballe, A. C., Gumanao, G. S., & Nañola, C. L., Jr. (2025). The marine fishes from southern Mindanao, Philippines, including a DNA barcode reference library of commercially important species. Bulletin of Marine Science, 101(1), 325–347. https://doi.org/10.5343/bms.2023.0116

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## Research Methods That Support Repeatable Habitat Assessment

The earlier Pujada Bay sea-scanner study adds a published mapping method to the scientific context for ecosystem-health assessment. Repeatable habitat information can help researchers define the places to be surveyed and support comparison of observations across space and time.

This is a methodological connection, not a claim of a new mapping survey during the academic year. The current reef, biodiversity, and pollution sources remain the evidence for the activities and knowledge outputs described elsewhere in this report (Terayama et al., 2022).

### 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 record in supplied export. Retrieved from https://www.scopus.com/pages/publications/85118377252?origin=resultslist

## Expert-Validated Threats Behind the Measurements

Monitoring gains meaning when its results connect to the threats that managers can act on. A 2025 study in The Philippine Journal of Fisheries, co-authored by DOrSU researchers, validated through an expert survey (N = 22) the exposure factors affecting small pelagic fisheries and milkfish aquaculture in the Philippines. For small pelagic fisheries, experts ranked coastal development, water quality, temperature changes, typhoons, and declining catch as the leading threats, and endorsed alternative livelihoods, marine protected areas, and financial access as the priority adaptations. For milkfish aquaculture, water quality, fry source, temperature change, typhoons, and salinity led the list, with hatchery development, feed research, and marketing support identified as the responses to prioritize.

This expert-validated threat framework gives the university's aquatic monitoring a clearer interpretation layer: measurements of water quality, catch, and ecosystem condition can be read against the factors that practitioners themselves rank as most consequential. The study documents expert consensus on priorities; it does not by itself establish that monitoring programs have been reoriented around them.

Macusi, E. D., Nallos, I. M., Santos, M. D., & Geronimo, R. C. (2025). Climate and non-climate related hazards in small pelagic fisheries and milkfish aquaculture: Expert opinion survey in the Philippines. The Philippine Journal of Fisheries, 32(1).

## Conclusion

DOrSU’s contributions under Indicator 14.5.2 expand the information available for observing aquatic ecosystem condition. Monitoring of the developing artificial reef provides early evidence of coral settlement, the Tagabebe agreement creates a route toward local biodiversity baselines, and the rabbitfish microplastic study helps identify a pollution concern affecting aquatic organisms.

The southern Mindanao marine fish reference library further supports consistent identification for future surveys, while the earlier Pujada Bay seafloor-scanner study illustrates a published technique for habitat

mapping. These forms of evidence are complementary, but they should not be combined into an unsupported claim of comprehensive recovery or a completed monitoring programme at every site.

Continued repeat surveys, appropriate field protocols, transparent data handling, and verified follow-up will help convert this knowledge base into stronger assessments of change. The documented reporting-period contribution is progress in observation, scientific reference information, and preparation for local conservation assessment.