

How Similar are Reef Substrate Analysis Methods: Comparative Assessment of Traditional and Modern Approaches

W.K.M Perera*, C. Sooriyabandara, N. Perera
Blue Resources Trust, Colombo, Sri Lanka
[*malshan@blueresources.org](mailto:malshan@blueresources.org)

Proper substrate assessment is essential for understanding coral reef health and informing conservation management. Methods for monitoring benthic communities are diverse, ranging from traditional field-based transects to image-based and machine-learning platforms; however, comparisons of efficiency and effectiveness between systems are limited. This study compared four coral reef substrate monitoring methods: Point Intercept Transect (PIT), Line Intercept Transect (LIT), Coral Point Count with Excel Extensions (CPCe), and ReefCloud, across five reef sites in Sri Lanka. A total of 20 transects were assessed simultaneously across all methods to ensure comparability. Benthic data were recorded using underwater video for PIT and LIT analyses, and photo quadrats for CPCe and ReefCloud. Coral cover and the Shannon Diversity Index (H') were derived from all four methods following benthic classifications. Coral cover was comparable across methods ($p > 0.05$), with PIT recording the highest mean ($46.45\% \pm 6.53\%$) and ReefCloud the lowest ($38.24\% \pm 4.60\%$). The increased PIT estimates can indicate fixed-interval locations of the points, which can overlap more with coral colonies compared to the randomisation of distribution in image-based approaches. There was a significant difference in benthic diversity ($H' = 1.1147 \pm 0.0406$; $p < 0.05$), with ReefCloud recording the highest value. All methods quantified coral cover and benthic diversity, each with distinct trade-offs. PIT and LIT are labor-intensive; CPCe requires extensive manual image annotation for detailed analysis; and ReefCloud, while enabling rapid semi-automated classification, demands AI model training and additional processing for biodiversity metrics. No single method proved universally superior, and selection should be guided by monitoring objectives, available resources, and data resolution requirements. A hybrid approach combining field-based transects and image-based methods is recommended for Sri Lankan reefs, balancing scientific rigor with practical feasibility in resource-limited settings.

Keywords: *Coral reef monitoring, Point Intercept Transect, Line Intercept Transect, CPCe, ReefCloud, Machine Learning.*