

ABSTRACT

Changes in Coastal Ecosystem Health over 70 Years Using Benthic Foraminiferal Assemblages and Implications for Regulating Industrial Development in a Tropical Island Context

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A detailed study of benthic foraminiferal assemblages was conducted in the nearshore Gulf of Paria on Trinidad's west coast to understand its post-industrialization ecological health status and develop an indicator-based model for more strategic environmental monitoring. Forty-five sites across nine locations were sampled seasonally and 73 species in total, representing 41 genera, were identified and compared with assemblages from a 1947-1950 pre-industrial natural baseline inventory. The highest species diversities and population densities were recorded at Mosquito Creek, Small Boats, Brighton and Pointe-a-Pierre with all other locations under severe ecological stress with significant deviations from the natural baseline. Stress indicators such as low species diversity, stunting, imbalanced test type ratios, and high deformity percentages correlated with high TPH and specific heavy metal concentrations. Studies in the Gulf have assessed the impact of pollutants on benthic macrofauna at specific locations, with very few including foraminifera, but no contiguous study across the nearshore Gulf has been conducted using any benthic bioindicator to date. The resulting cumulative impact on nearshore biota is therefore not well understood. In addition, globally there is still a gap in understanding the specific benthic foraminiferal bioindicators in tropical island nearshore environments impacted by industrial pollution. A Coastal Ecological Health Status (CEHS) model is proposed to monitor nearshore ecological health status using foraminiferal population stress criteria. This model can support more extensive use of these organisms as bioindicators to increase the understanding of cumulative impacts in tropical nearshore ecosystems. Ultimately it can be used by regulators and research institutions globally to continuously evaluate the impact of multiple effluent sources on the tropical coastal environment. Locally it can stimulate a review of the present point source industrial effluent discharge standards under the Trinidad's Water Pollution Rules which should take into account the ecological sensitivity of the receiving environment.

Keywords: foraminifera; benthic diversity; pollution indicators; bioindicator; Gulf of Paria; baseline; ecosystem health; coastal nearshore.