



Abundance and size-structure of the Sea Urchin *Diadema antillarum* in 10 Sites of Puerto Rico after 25 years of Mass Mortality

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Introduction

In the early 1980s *D. antillarum* (Fig. 1) suffered a mass mortality. The die-off resulted in a drastic decline of coral cover. Natural recovery of *Diadema antillarum* has been limited and practically absent in many localities in the Caribbean with the exception of localized recovery in Jamaica and Dominica. In Puerto Rico recovery patterns have never been adequately documented with the exception of the La Parguera reef system in 2001.

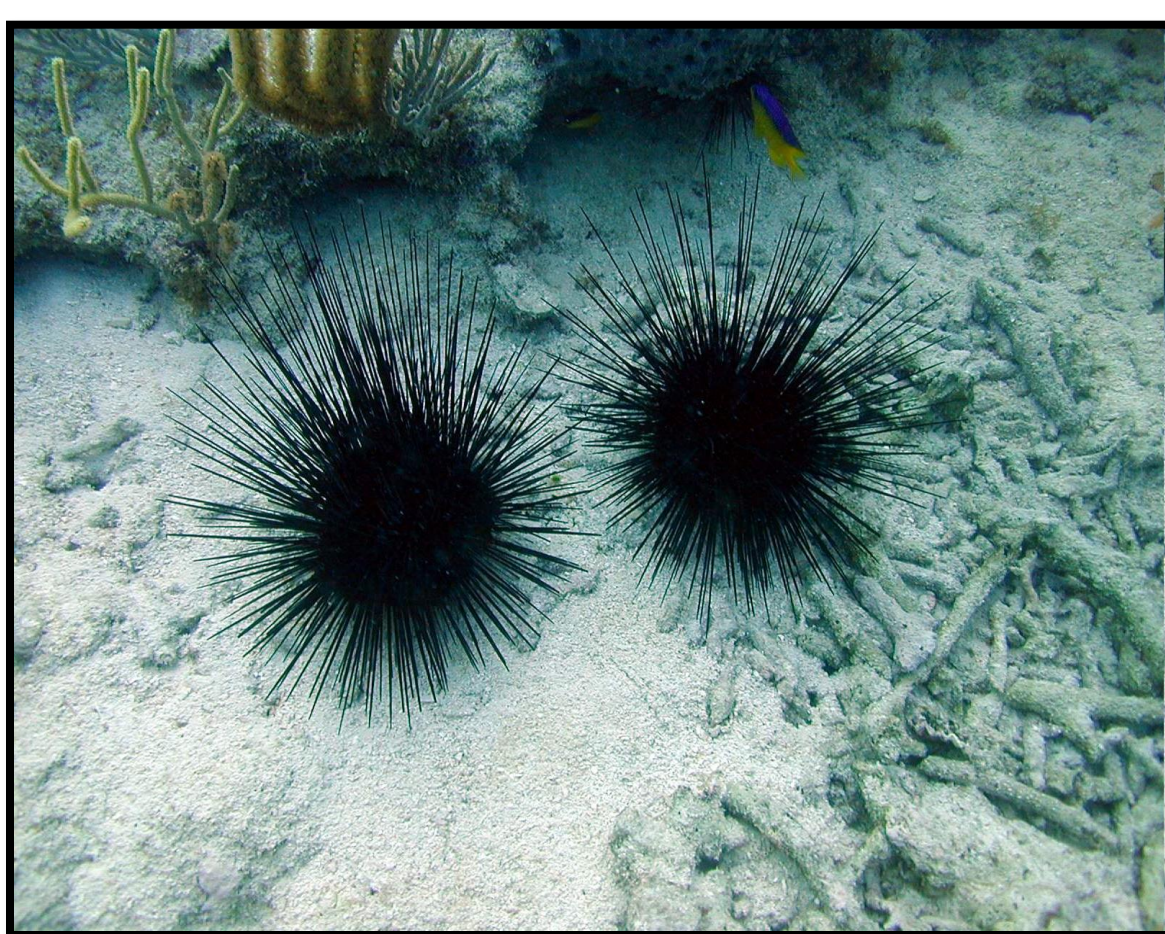


Figure 1. *Diadema antillarum*

This represents an important gap in the general knowledge of Puerto Rico coral reef ecosystems given the importance of *D. antillarum* as a structuring force and their influence in the dynamics of coral reef communities. The main objective of this study was to assess the current population status and size frequency distribution with respect to densities, at ten sites where *D. antillarum* used to be common.

Methods

This study was carried out at 10 sites around the island of Puerto Rico and Culebra. Sites were selected based on anecdotal and personal observation of previous presence of *D. antillarum* and because depth intervals at all sites include the 0-5 m depth zone where urchins tend to be more common (Weil et. al 2005).



Figure 2. Study sites

Abundances/densities:

At each site five 20 m² belt transects were randomly established parallel to the coast at 3-5 m in depth. Densities of *D. antillarum* were assessed by counting all individuals within transects.

Size frequency distribution:

The test diameters of the first 75 *Diadema* within transects were measured to the nearest 0.5 mm using a ruler.

Kruskal-Wallis One-way ANOVA was used to compare median size as well as compared abundances/densities among sites after data transformation procedures were unsuccessful in fulfilling the assumptions of normality and homoscedasticity of parametric ANOVA.

Results

Size frequency distribution: Median test diameter differs significantly among sites (Kruskal-Wallis One-Way ANOVA $P = 0.001$). The largest sea urchins were found at Luquillo and the smaller ones at Tamarindo. Juveniles were rare. The site with the highest proportion of juvenile was Punta Soldado where 22.6% of the individuals were < 40 mm followed by Tamarindo with 17%. Percentage of individual that were smaller than 40 mm were similar at Escambron and Aguadilla, 14.0% and 15.6% respectively. At Vega Baja only 2.1% of the observed sea urchins than measure > 4 cm meanwhile at Isla Verde no juveniles were found.

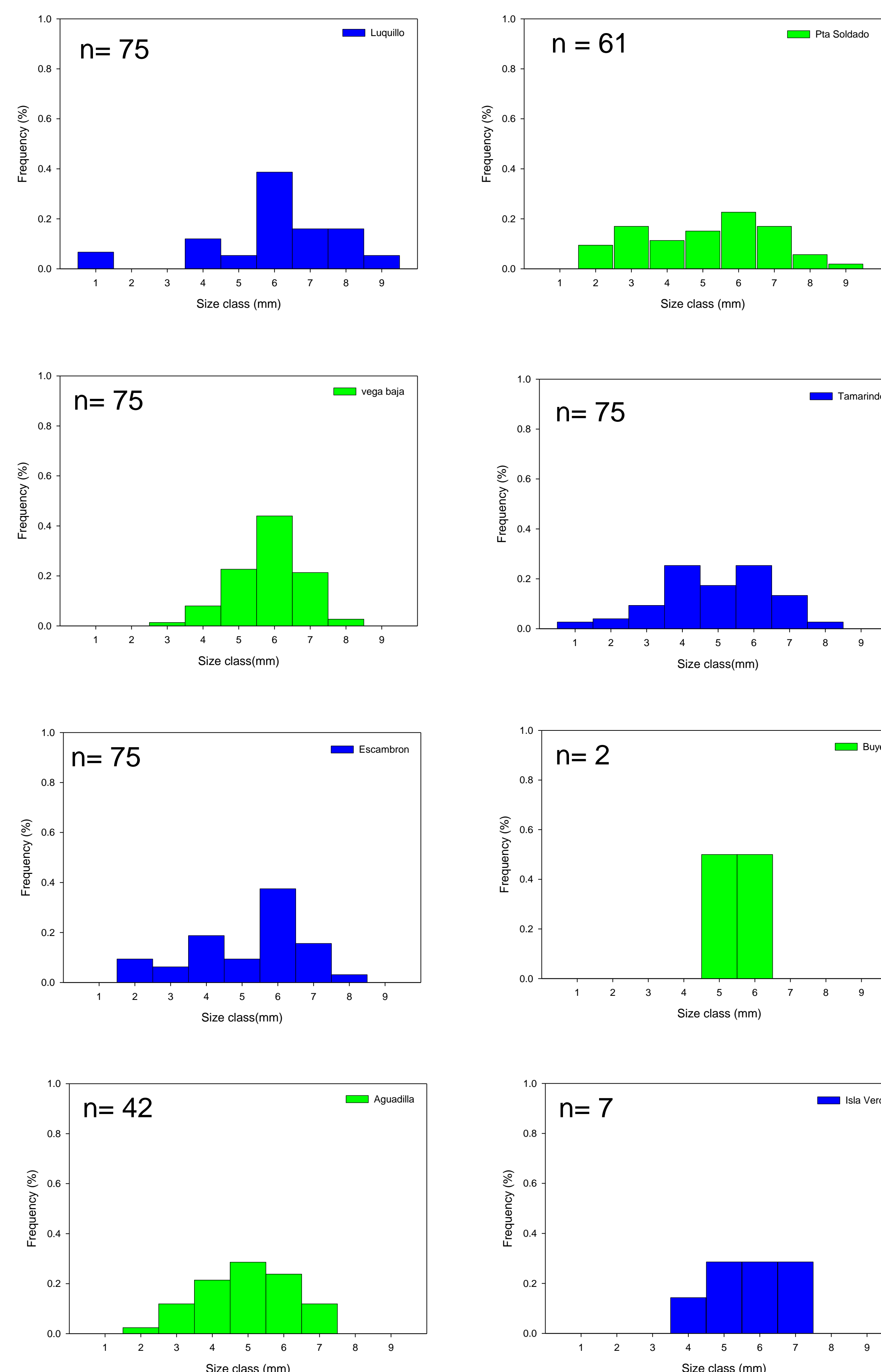


Figure 3. Histogram showing size frequency distribution of *D. antillarum* among study sites.

Abundances/densities: Median densities of *D. antillarum* differed significantly among sites (Kruskal-Wallis One-Way ANOVA $p < 0.001$) (Figure 1) Median densities of *D. antillarum* differed significantly among sites (Kruskal-Wallis One-Way ANOVA $p < 0.001$) (Figure 4). The site with the highest densities was Luquillo with a median density of 58 individuals/20 m² followed by Tamarindo and Vega Baja with 33 and 25 individuals/20 m² respectively. Conversely, densities recorded at Bahía Ballena and Rincón were 0 individuals/20 m². When standardized densities to a 1m², overall densities varied between 0.00 individuals/m² (Bahía Ballena and Rincón) and 2.90 individuals/m² (Luquillo).

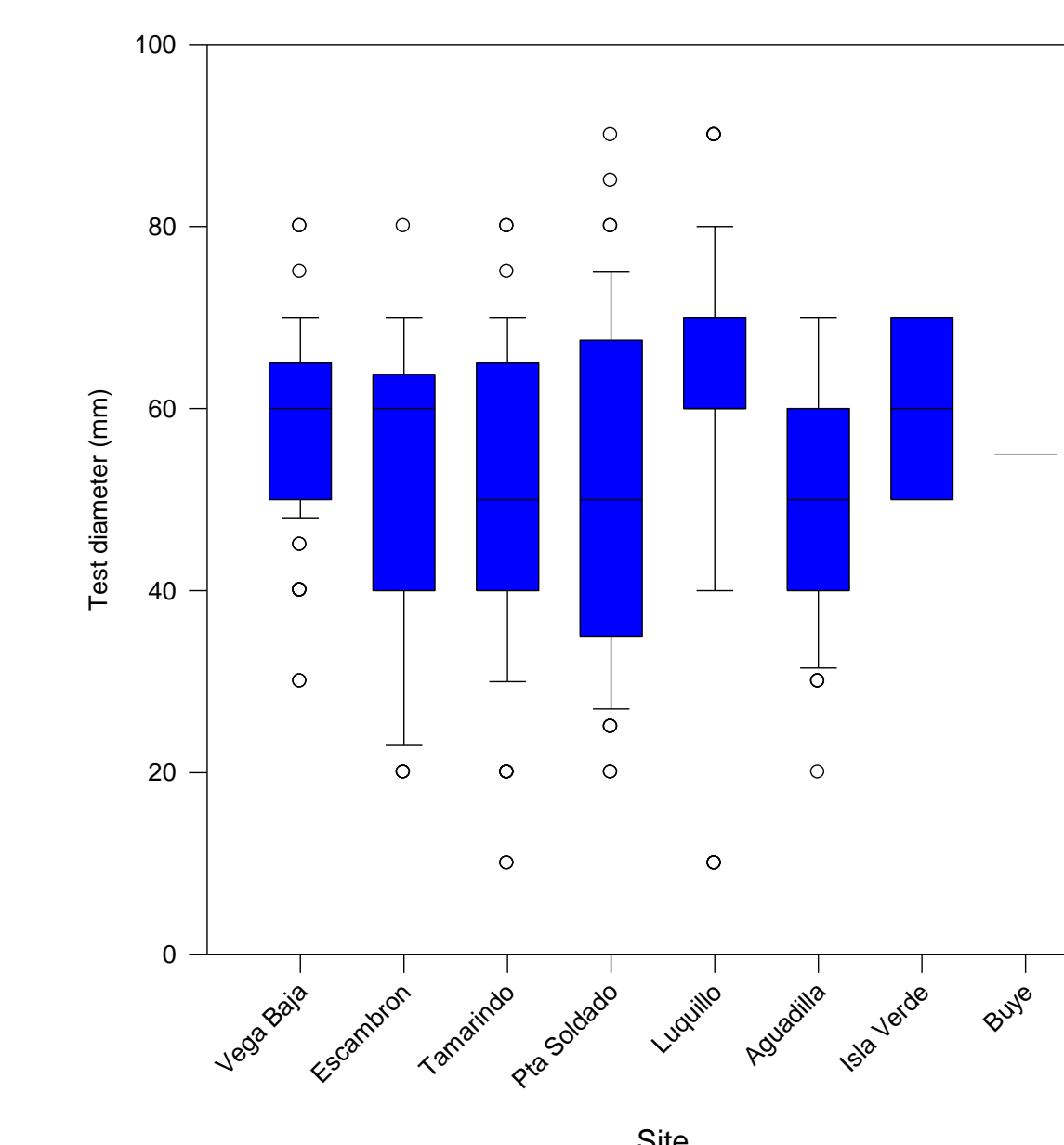


Figure 4 Box-plot graph showing median test diameter (mm) of *D. antillarum* at studies sites.

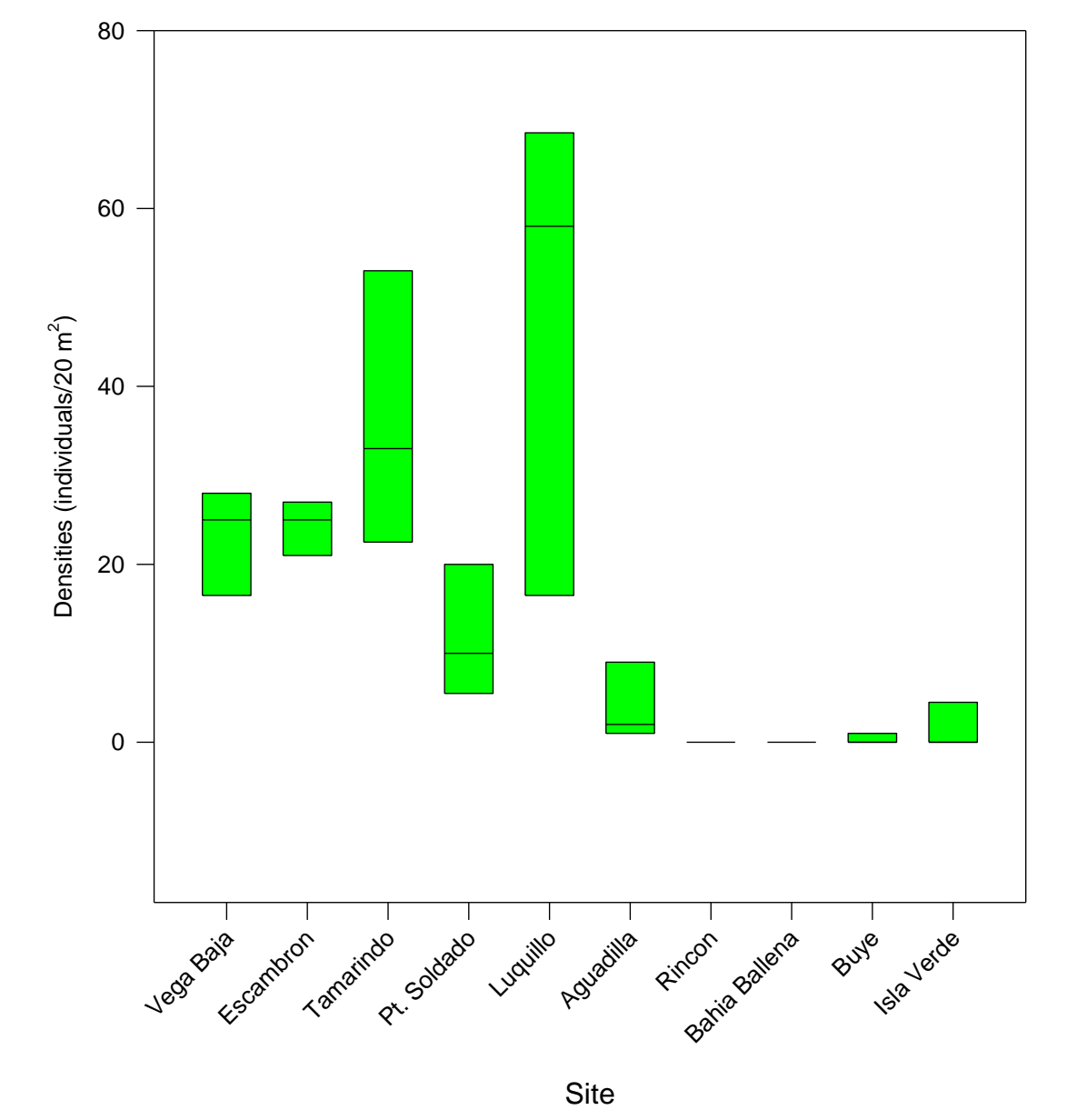


Figure 5. Box-plot graph showing median densities (individuals/ 20m²) of *D. antillarum* at studies sites.

Discussion:

Results of this study indicate that abundance of *D. antillarum* is still low compare to pre-mass mortality abundances. This contrasts with previous work indicating a recovery of *D. antillarum* in Jamaica (Idjadi et al., 2010) and Dominica (Steiner and Williams, 2006). Why densities of *D. antillarum* are still low compared to other region in the Caribbean is uncertain. However, low number of juveniles suggest that low densities of *D. antillarum* may be related to low reproductive and/or settlement success (pre and post settlement process). More studies in this area are encouraged.

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