



# Coral and algae cover with respect to abundances of the sea urchin

## *Diadema antillarum* in Puerto Rico.

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### Introduction:

*Diadema antillarum* has been recognized as a key species in coral reefs due in part to its eating habits of macroalgae. This selective behavior played an important role in controlling abundance, distribution of algae and promoting coral recruitment by keeping substrate free of algae and available for colonization. Therefore, an inverse relationship between alga cover and *D. antillarum* could be expected. Similarly it could be expected that coral cover may be enhanced by the presence of this sea urchin. The objective of the study is to relate densities of *D. antillarum* to coral and algae cover at nine sites around Puerto Rico.



Figure 1: *Diadema antillarum* surrounded by a *Porites porites*.

### Methods:

The study was carried out in 9 sites in Puerto Rico: Vega Baja (1), Escambrón (2), Isla Verde (3), Luquillo (4), Tamarindo (5), Punta Soldado (6), Buye (7), Rincón (8) and Aguadilla (9). At each site, five 20m<sup>2</sup> belts transects at similar depth (0 to 3 m) were placed randomly to provide true data. Within each transect five 1m<sup>2</sup> quadrat were placed (25 total) to assess coral and algae cover.

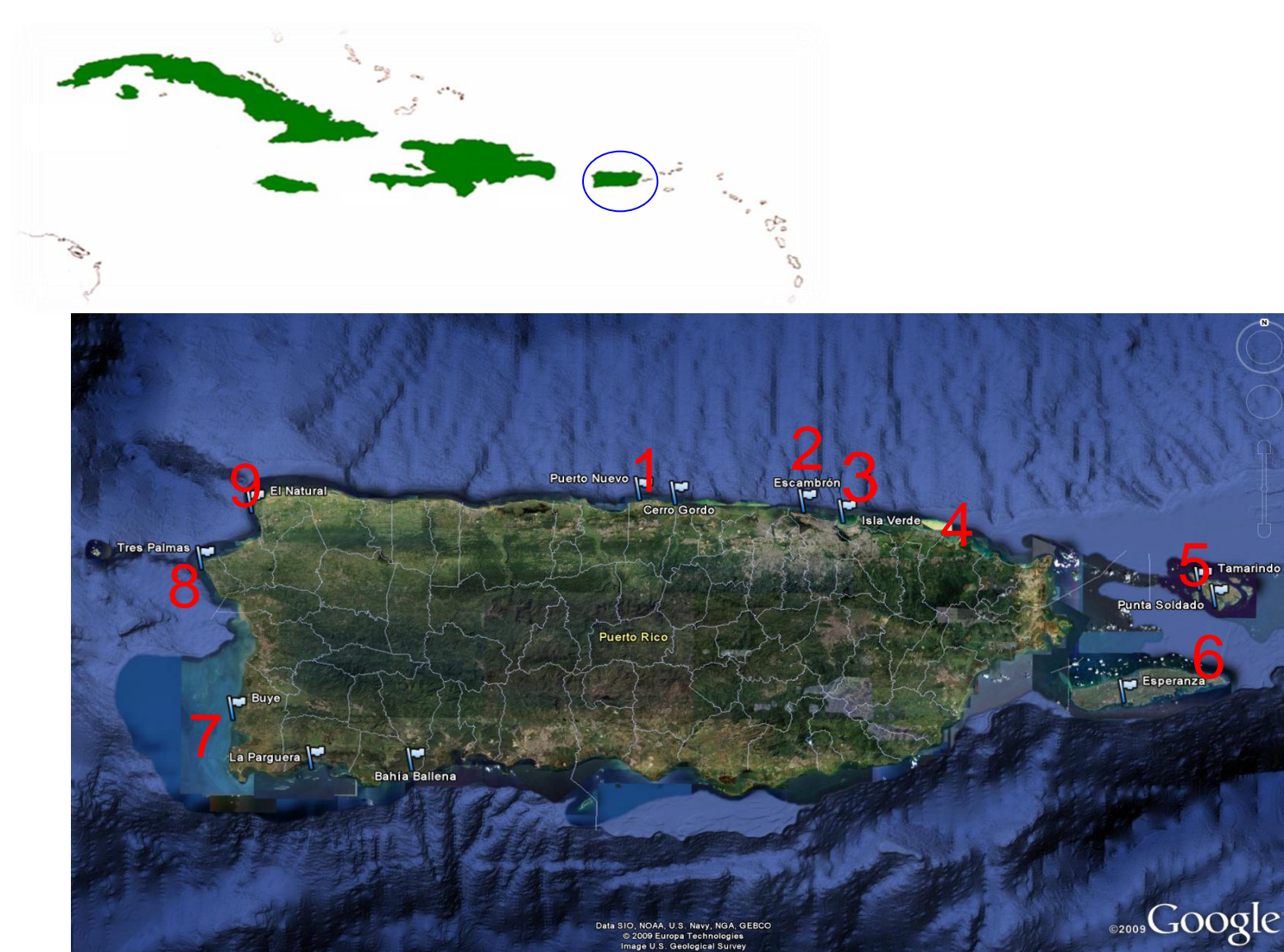


Figure 2: Study sites in Puerto Rico

### Statistical Methods:

Kruskal-Wallis One-way ANOVA was performed to test if densities of *D. antillarum* differed significantly among sites. Similarly this test was used to compare coral and algae cover among sites. This test was performed because the data did not show an equal variance and a normal distribution. In addition, a correlation analysis was performed to explore if there is a relationship between algae cover and coral cover.

### Results:

Median densities of *D. antillarum* differed significantly among sites (Kruskal-Wallis One-Way ANOVA  $p < 0.001$ ) (Figure 3). Interestingly, no sea urchins were found at Rincón. Coral cover differed significantly among sites (Kruskal-Wallis;  $P = < 0.001$ ) being significantly higher at Rincón and Tamarindo with 20.00% compared to other sites (Dunn's test). These two sites are located within a Marine Protected Area. Similarly alga cover differed significantly among sites (Kruskal-Wallis;  $P = < 0.001$ ). The site with the highest alga cover was Vega Baja (84.16%) followed by Escambrón (78.33%). With respect to the relationship between coral and alga cover results indicate that coral cover was inversely related to alga cover in only two of the 9 sites; Vega Baja ( $r = -0.973$ ,  $p = 0.00$ ) and Rincón ( $r = -0.936$ ,  $p = 0.00$ ). In overall, there was no significant relationship between sea urchin abundances and coral/algae cover.

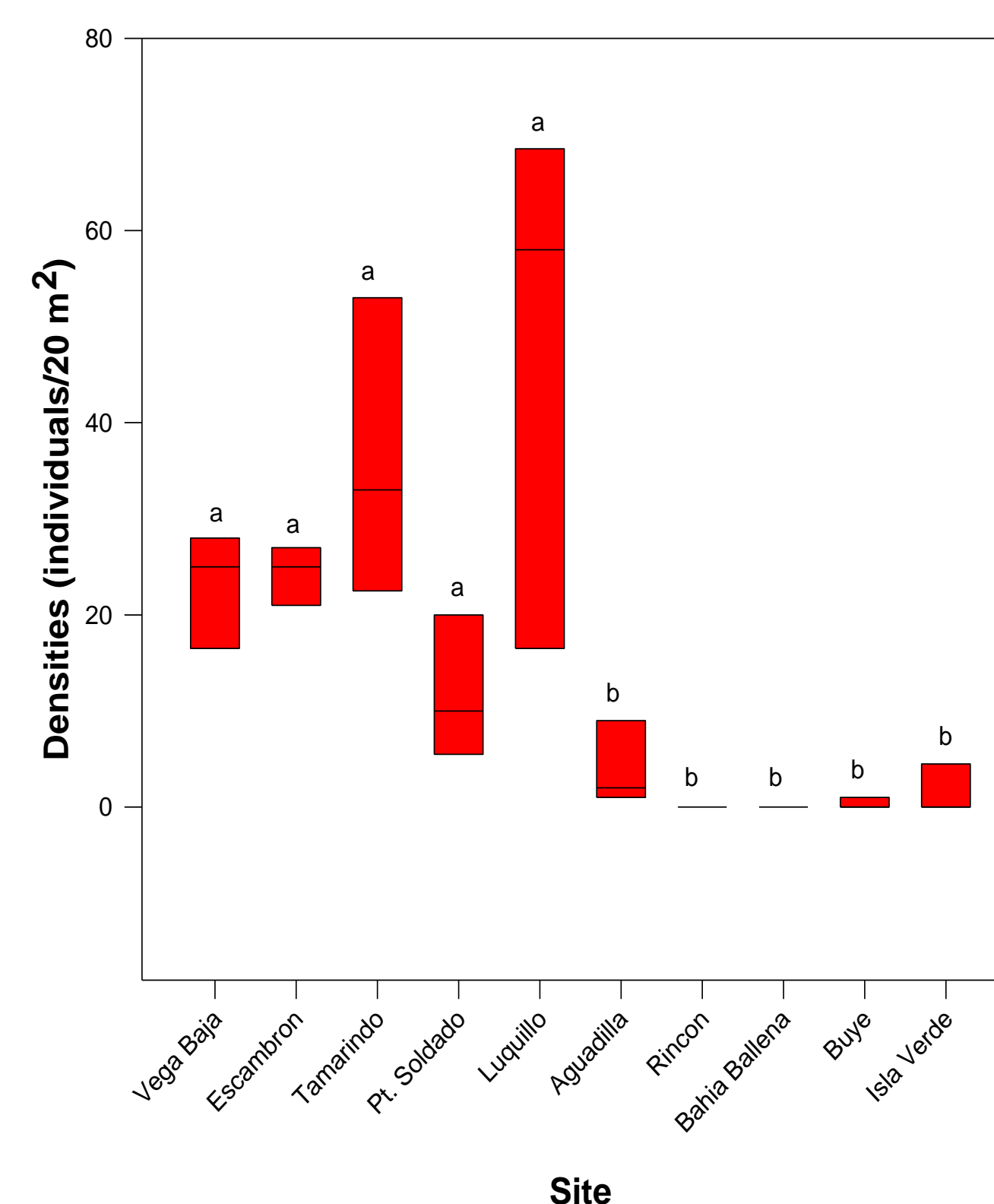


Figure 3: Box-plot graph showing median densities (individuals/ 20m<sup>2</sup>) of *D. antillarum* at studies sites

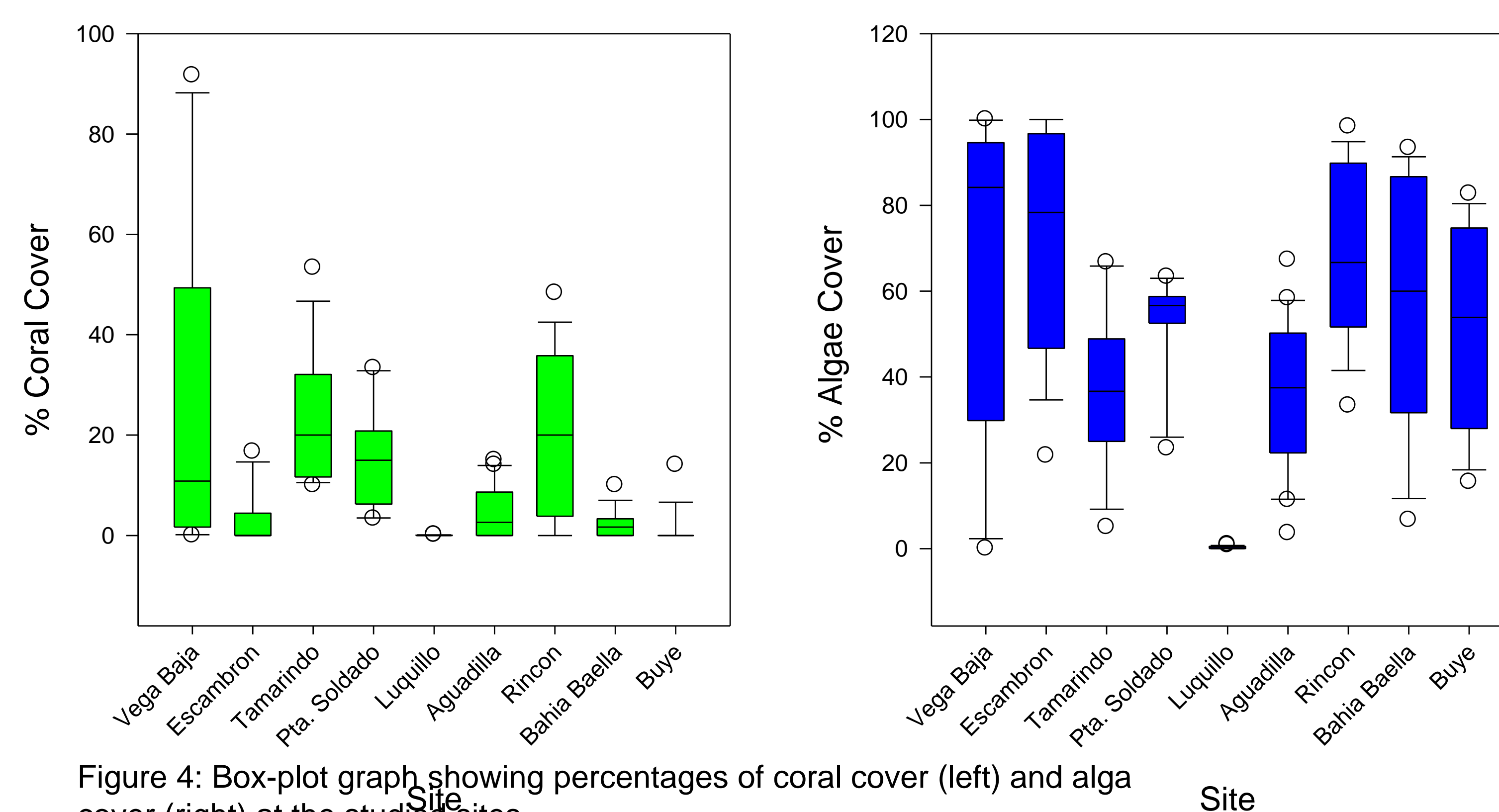


Figure 4: Box-plot graph showing percentages of coral cover (left) and alga cover (right) at the studied sites.

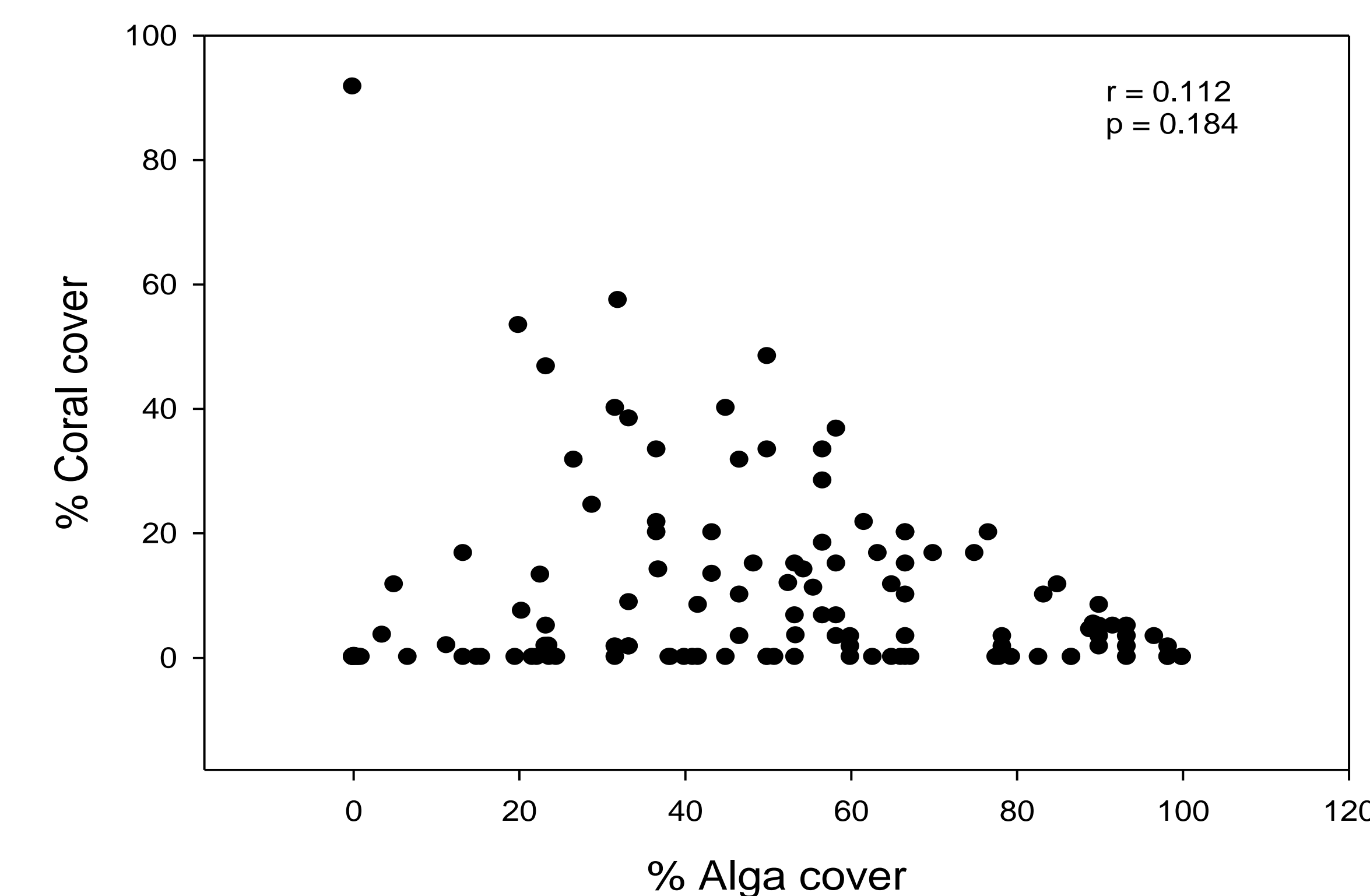


Figure 5: Correlation between coral and alga cover. Data of all sites pooled.

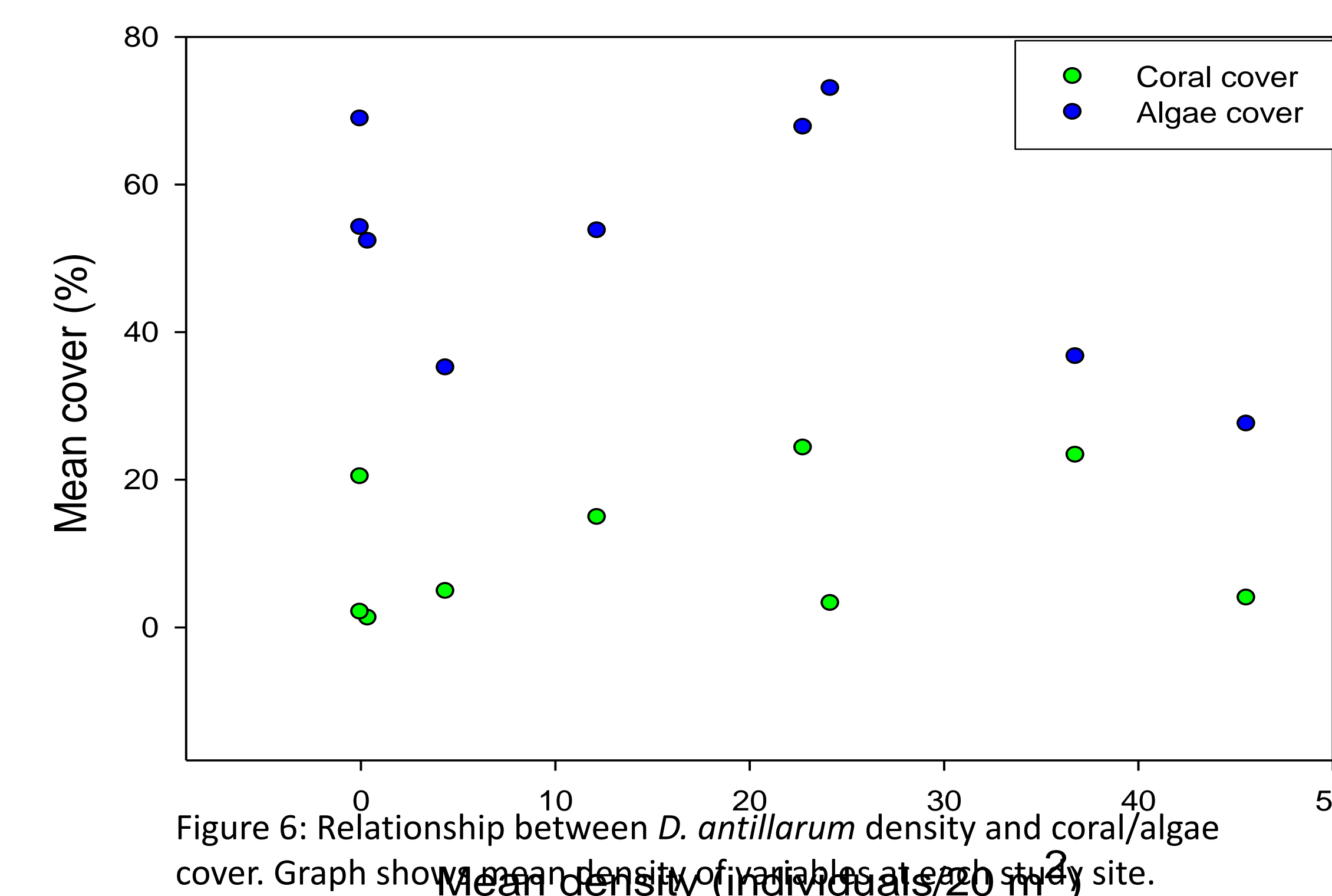


Figure 6: Relationship between *D. antillarum* density and coral/algae cover. Graph shows mean density of individuals/20m<sup>2</sup> site.

### Discussion:

Results of this study indicate that the relation between coral cover and algae cover is not as simple as an inversely proportional relation as suggested by other studies. In addition, results suggest that sea urchins did not play a significant role in increasing coral cover and reducing algae cover. This result challenges previous knowledge regarding such relationship. This indicates that other factors are contributing in the coral and algae cover. Therefore results may vary if spatial and temporal influences are taken in consideration.

