*The following supplement accompanies the article*

# Capturing the dynamics in benthic structures: environmental effects on morphology in the macroalgae *Halimeda* and *Dictyota*

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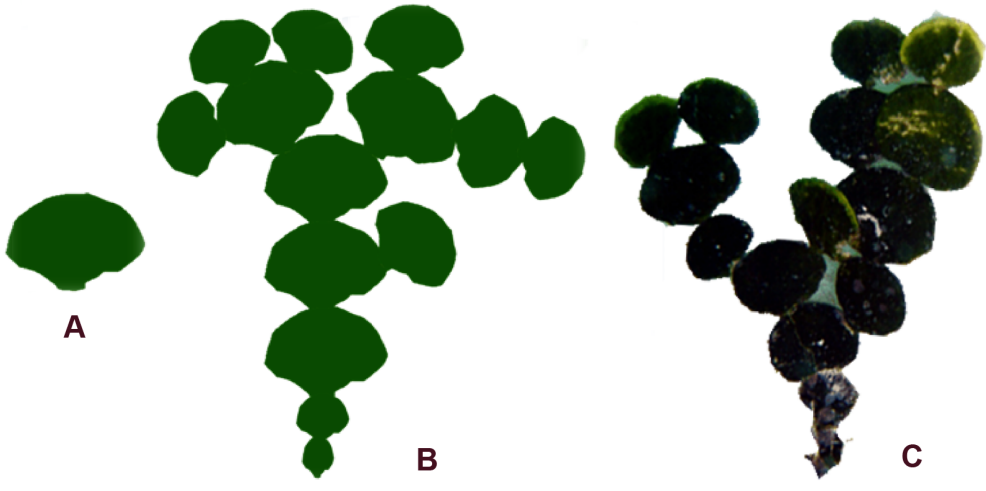
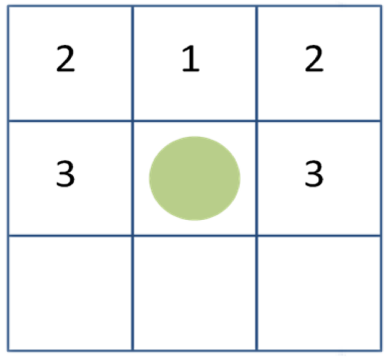
## Supplement 1

### *SPREAD Branching rules for each species*

Figures S1, S2 and S3 illustrate the branching rules for *H. tuna, H. opuntia,* and a species of *Dictyota* in terms of preferences for the location of a new module.

**Figure S1.** ***Halimeda tuna*** **form and branching rules.** One module is illustrated in A and its general form is illustrated in B, while an actual photo is seen in C. The box diagram in D is a two-dimensional front view perspective of where new modules are produced. The module that will produce another module is represented by the olive circle. The numbers represent preference for where the new module will be placed. Thus, if it is available and the growth probability as influenced by light, temperature and nutrients allows for it, a new module will preferably be produced directly on top of the mother module. The next preferences are the two cells above and to the sides, and the last are the ones immediately to the sides. Figure taken from Yñiguez et al. (2008)




D

**Figure S2. *Halimeda opuntia* form and branching rules.** One module is illustrated in A and its general form is illustrated in B while an actual photo from top view is seen in C. The box diagrams (D and E) are two-dimensional top view perspectives of where new modules can be produced. The module that will produce another module is represented by the olive circle. The numbers represent preference for where the new module will be placed. The plane or cross-section directly above the mother module is shown in D. Thus, if it is available and the growth probability as influenced by light, temperature and nutrients allows for it, a new module will preferably be produced directly on top of the mother module (number 1). The next preferences are the two cells above and to the sides (number 2), then the cells above and back (number 3 middle first), followed by the cells above and front (number 5 middle first). The last preference are the ones immediately to the sides (E)

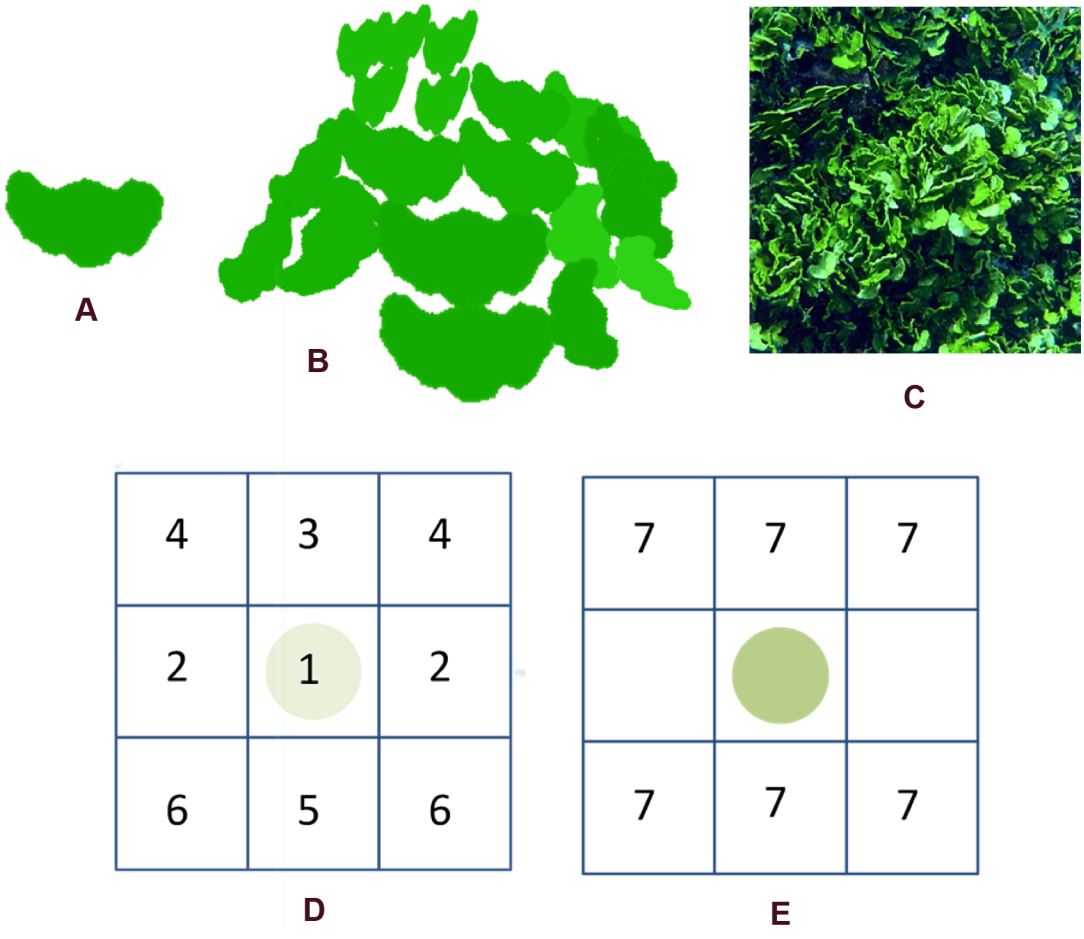
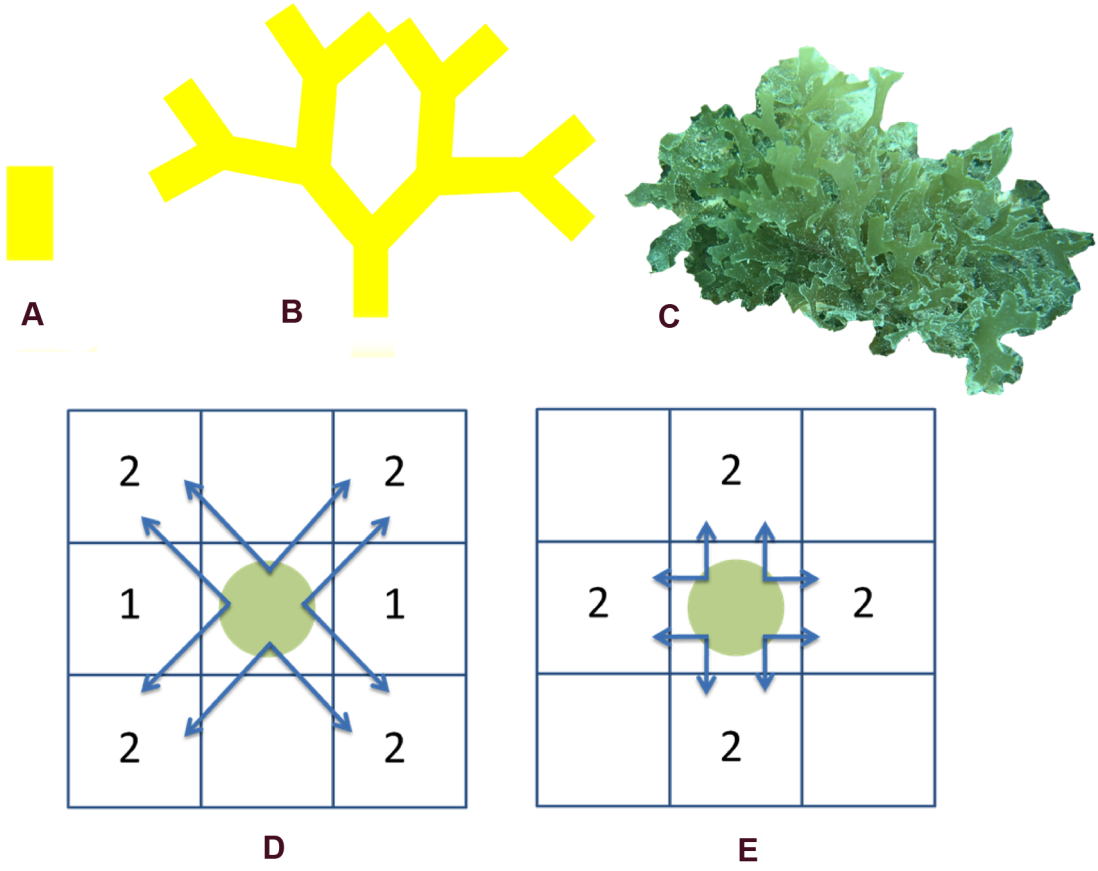


**Figure S3.** ***Dictyota menstrualis*** **form and branching rules.** One module is illustrated in A and its general form is illustrated in B while an actual photo is seen in C. The box diagrams (D and E) are two-dimensional top view perspectives of where new modules can be produced. Two new modules will always be produced by the "mother" module (represented by the olive circle). The numbers represent preference for where the two new modules will be placed. Cells labeled "1" in D are located above mother module and are the preferred locations. If the cells directly above and to the sides are not available and/or the growth probability does not allow for it, then the location of the two new modules are randomly chosen between the options (all numbered 2) pointed out by the arrows. In D, the corner locations are shown while in E the non-corner right-angle options are illustrated. These cross-sections represent both the planes where the mother module belongs and the one directly above it

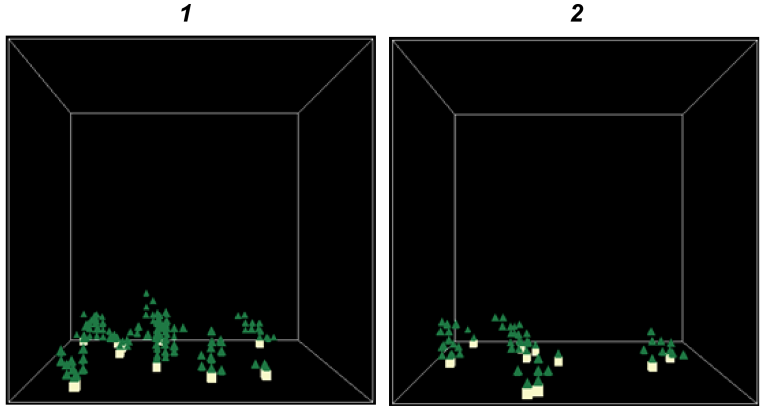


***Visualization of the morphological clusters of Halimeda opuntia and Dictyota derived from SPREAD***

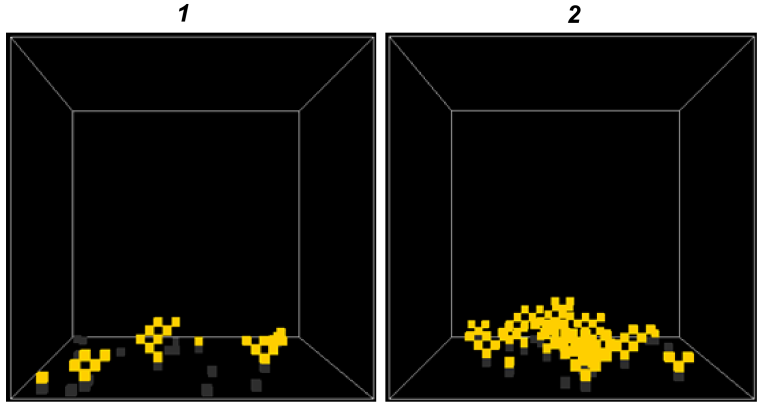
The six *Halimeda tuna* clusters were illustrated within the article. The visual representation of the other two macroalgae are shown here. *H. opuntia* had two clusters, while only the two (out of three) main clusters of *Dictyota* sp. are shown here since the third cluster was very rare. Table 3 details the characteristics of the clusters.

**Figure S4. Model-derived morphological clusters of *Halimeda opuntia and Dictyota* sp.**

*Halimeda opuntia* morphological clusters:




*Dictyota* morphological clusters:



***Details on the results of the PCA and MANOVA of the morphometrics obtained on the three macroalgae from the study sites***

The morphometrics measured from *Halimeda tuna*, *Halimeda opuntia*, and *Dictyota* spp. in the study sites were analyzed (separately for each species) using PCA to condense the information into components best describing the variations in form. The 1st and 2nd Principal Components for all accounted for a large part of the variations and represented metrics describing size and/or shape. PC1 and PC2 were then run as dependent variables in a MANOVA while site was the independent variable, in order to determine differences between the study sites. There were significant differences as seen in Table S1. Table S2 illustrates the specific differences between the four sites based on the results of Tukey's B post-hoc tests.

Table S1. Summary of the results from MANOVA of Principal Components 1 and 2 with site as treatment factor. An asterisk on the probability denotes a p-value < 0.01

| **Species** | **Principal Component** | **F-ratio** | **Probability** |
|---|---|---|---|
| ***Halimeda tuna*** | PC 1 (size) | 18.899 | 0.00000* |
| | PC2 (shape) | 9.931 | 0.00000* |
| ***Halimeda opuntia*** | PC 1 (shape) | 6.462 | 0.00029* |
| | PC2 (size) | 23.142 | 0.00000* |
| ***Dictyota menstrualis*** | PC 1 (shape) | 19.596 | 0.00000 |
| | PC2 (size) | 5.200 | 0.00157* |

* An asterisk on the probability denotes a p-value < 0.01.

Table S2. Summary of the results from Tukey's B post-hoc tests between sites for Principal Components 1 and 2 after being run through a MANOVA

| | ***Halimeda tuna*** | | ***Halimeda opuntia*** | | ***Dictyota menstrualis*** | |
|---|---|---|---|---|---|---|
| | PC1 | PC2 | PC1 | PC2 | PC1 | PC2 |
| **Little Grecian** | A | A | AB | A | A | A |
| **French Reef** | A | A | A | A | A | AB |
| **Coral Gardens** | B | B | B | B | B | AB |
| **Cheeca Patch** | B | B | B | B | B | B |

Note: Sites with the same letter for a Principal Component (within a column) are considered similar.