

Boada, J., Farina, S., Arthur, R., Romero, J., Prado, P. and Alcoverro, T. 2018. Herbivore control in connected seascapes: habitat determines when population regulation occurs in the life history of a key herbivore. – Oikos doi: 10.1111/oik.05060

## Appendix 1

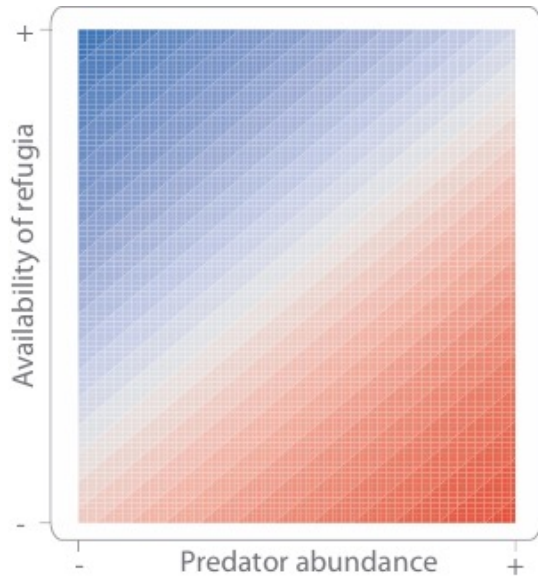
### Predator abundance and predation impact

The abundance of predators was measured at the locations where predation impact was assessed. We used fixed cameras to record 20 minute videos in each habitat. Four cameras were placed in each habitat (i.e. macroalgal rocky substrates and *P. oceanica* seagrass meadows). Abundance of predatory fish (i.e. *Diplodus* spp. and *Sparus aurata*, Sala 1997) was measured. Additionally, the available refugia were measured in each location (i.e. number of crevices in the rocks and the height of the unburied rhizome layer in seagrass habitats). Generalized linear models (GLMs) were used to test the effect of both predators and refugia on predation impact in each habitat. The results here show how predation impact is influenced by both the abundance of predators (i.e. *Diplodus* spp.) and the availability of refugia. The more predators present in a particular location the higher the predation impact found in both (A) macroalgal habitats and (B) seagrasses. Second, the more refugia available, the more protection against predators and lower the probability of being eaten. Results are drawn using the package ‘visreg’ in R from GLMs performed.

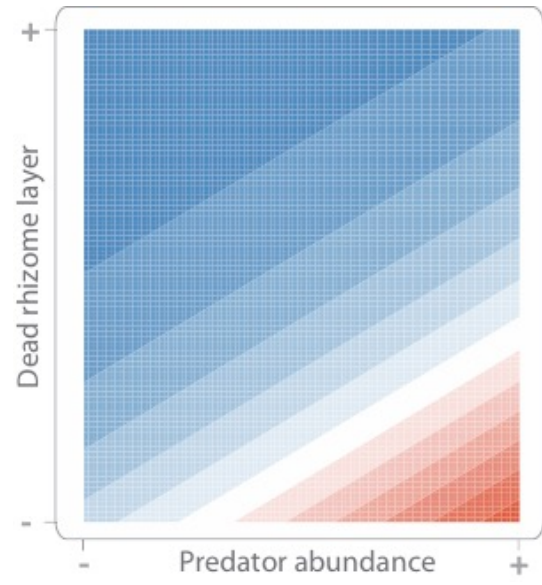
Further research confirmed the identity of *Diplodus sargus* as the main predator. Twenty-four urchins were marked in Medes Island marine reserve and predation events were recorded using GoPro Hero 2 cameras. *Diplodus sargus* was always responsible for first detecting the urchin and opening the carcass, while several other species including sea breams and wrasses appeared later on as scavengers.

This data was part of Boada et al. 2015a and has been re-analysed to support the findings of the present study.

(A)



(B)



alive  dead

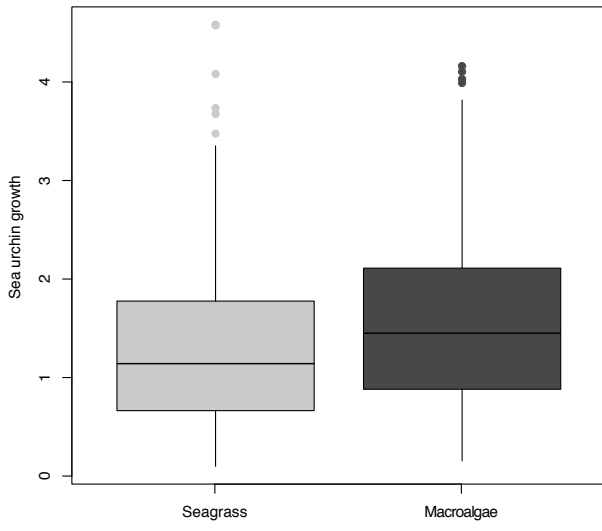
## Appendix 2

### Potential explanations for similar adult sea urchin numbers between habitats

Adult urchin densities were found to be similar between habitats despite the large differences in post-settlement survival (see results, Fig. 2). This suggests that the very few urchins that survive, are able to determine the adult population by accumulating in adult classes. However other potential explanations could also translate in similar results. First, if urchins grow faster in the seagrass habitats reaching the adult size class earlier that would compensate for differences found in early life stages. To test this, we compared urchin growth in the two studied habitats (i.e. seagrasses and macroalgae). Although we found significant differences in growth, the overall growth was very similar and, if anything, slightly higher in macroalgal habitats (A). Growth was measured yearly through growth marks in urchin tests from 40 and 54 individuals collected from seagrass and macroalgal habitats respectively. Urchins were collected from three different locations. GLMM was used to test the importance of habitat (explanatory variable) on urchin growth (response variable). Site and urchin size class were added as random factors in the GLMM. This is new previously unpublished data presented to support the conclusions of the present study.

Another potential explanation is that migration from rocky habitats to the seagrasses could also equalize adult urchin number in the two habitats. Measuring migration using methods robust enough to be confident of the results is highly complex in well-structured marine systems. Marking urchins is not feasible without compromising normal movement behaviour. However indirect measurements in the field can serve as indicative proxy. We assessed urchin densities within seagrass meadows in eleven sites where meadows were adjacent to rocky substrates. Urchin abundances at 1, 3 and 10 m from the edge of the meadow (rock-seagrass boundary) were measured. Urchins were individually measured and classified in three different size classes (i.e. juveniles <3 cm, young adults from 3 to 5cm and adults >5 cm) to calculate urchin densities. Mean values (+/- SE) are presented in (B). While juveniles and young adults were more present at the edge, adult urchins were homogeneously distributed across the meadow. These results strongly suggest that migration may be operating as a potential mechanism regulating urchin numbers between habitats. This is clearly something that needs further investigation.

(A)



(B)

