The following supplement accompanies the article

Green sea urchins structure invertebrate and macroalgal communities in the Magellan Strait, southern Chile

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Supplement. Detailed experimental data and analyses

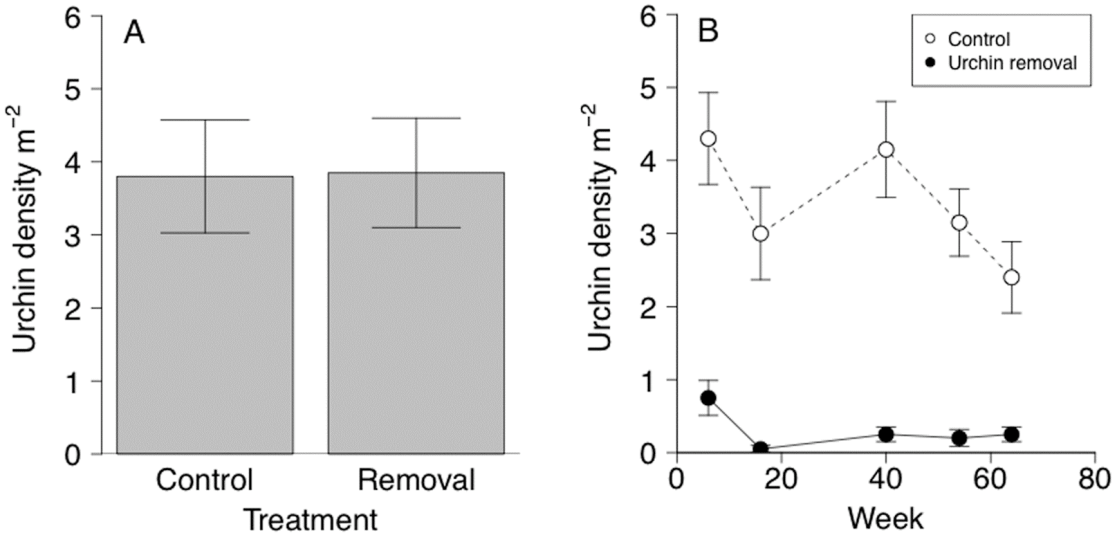

Fig. S1. (A) Mean density (± 1 SE) of the urchin *Arbacia dufresnii* on the western and eastern walls prior to urchin removal. Density is averaged across ten 1 m^2 quadrats. We conducted an analysis of variance (ANOVA) to test for differences in urchin density between the 2 walls. Analysis was performed on untransformed data because there was no evidence of heteroscedasticity (Levene's test, p = 0.593) or non-normality (Shapiro-Wilk's test, p = 0.068). Urchin density did not significantly differ between the 2 walls ($F_{1,38}$ = 0.004, p = 0.948). (B) Mean density (± 1 SE) of *A. dufresnii* on control and urchin removal walls through time following urchin removal. At each time step, density is averaged across ten 1 m^2 quadrats. We conducted a repeated-measures ANOVA to test for changes in urchin density between the 2 treatments and through time. We used likelihood ratio tests to determine the significance of including the interaction between treatment and time in the model. The interaction did not significantly contribute to the model (p = 0.213); we therefore concentrated on the main effects of treatment and time. The density of urchins was significantly different between treatments (t_{188} = –11.498, p < 0.001), and changes in the density of urchins were marginally significant through time (t_{188} = –2.035, p < 0.043)

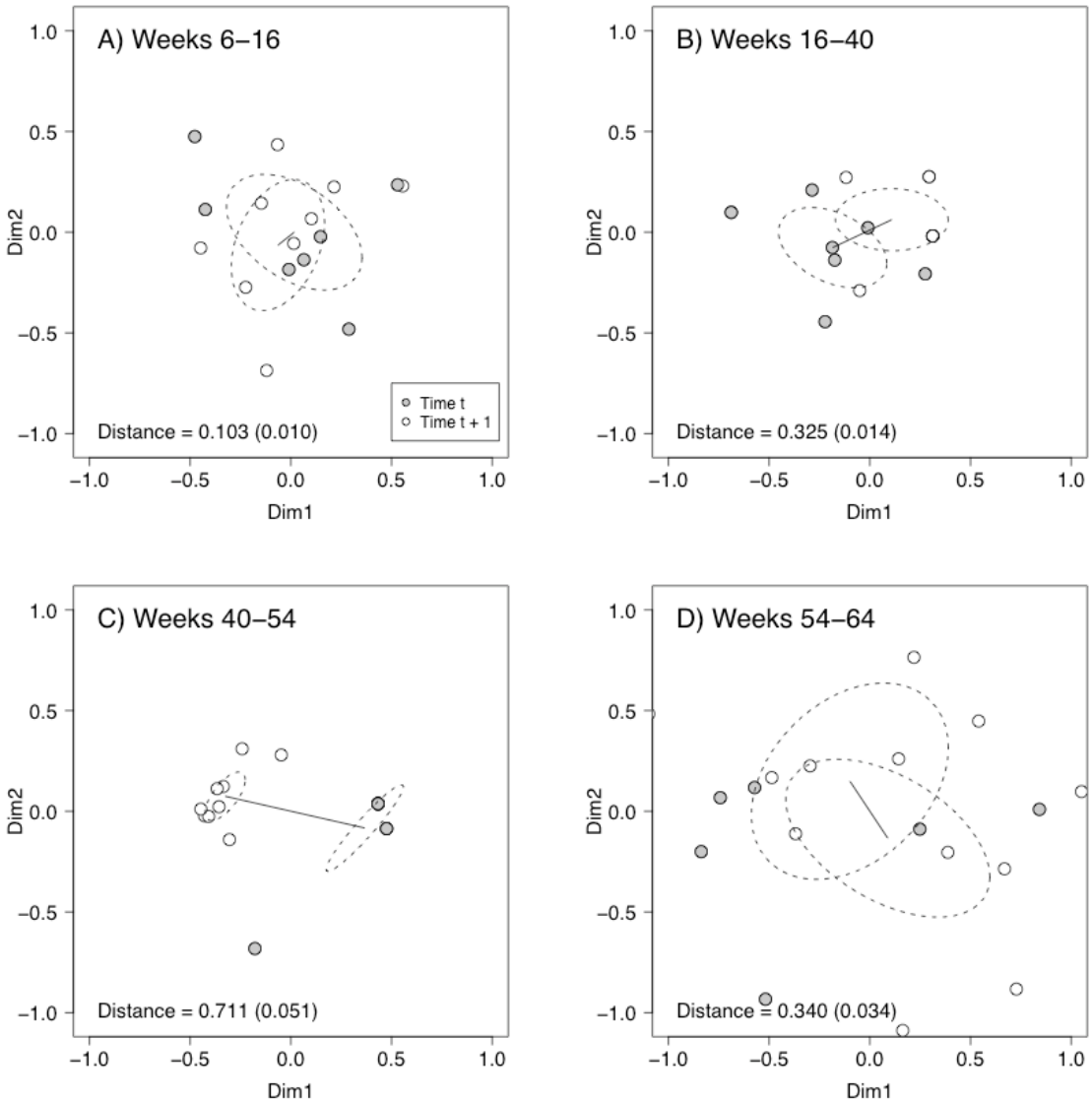

Fig. S2. Non-metric multidimensional scaling (nMDS) to examine the rate of change in macroalgal communities. For each zone (shallow or deep) on each wall (control or urchin removal), macroalgal communities were surveyed with 10 randomly placed 50 × 50 cm quadrats on each of 6 sampling dates. We used Bray-Curtis distances to calculate dissimilarities in the composition of macroalgal communities in the 20 quadrats taken in consecutive sampling periods. We then used nMDS to graphically display, in 2 dimensions, relationships between consecutive dates and to plot 95% confidence limits (black ovals) around the centroids for (1) 10 quadrats from sampling date *t* and (2) 10 quadrats from sampling date *t* + 1. We then calculated the Euclidean distance between the 2 centroids (heavy line). Large Euclidean distances indicate that the structure of macroalgal communities is undergoing rapid change between sampling dates, whereas smaller distances indicate slower rates of change. Illustrated here is the rate of change in macroalgal community structure on urchin removal treatments in the deep zone for sampling periods (A) 6–16 wk, (B) 16–40 wk, (C) 40–54 wk and (D) 54–64 wk. For each panel, the raw (and per week) Euclidean distance is indicated

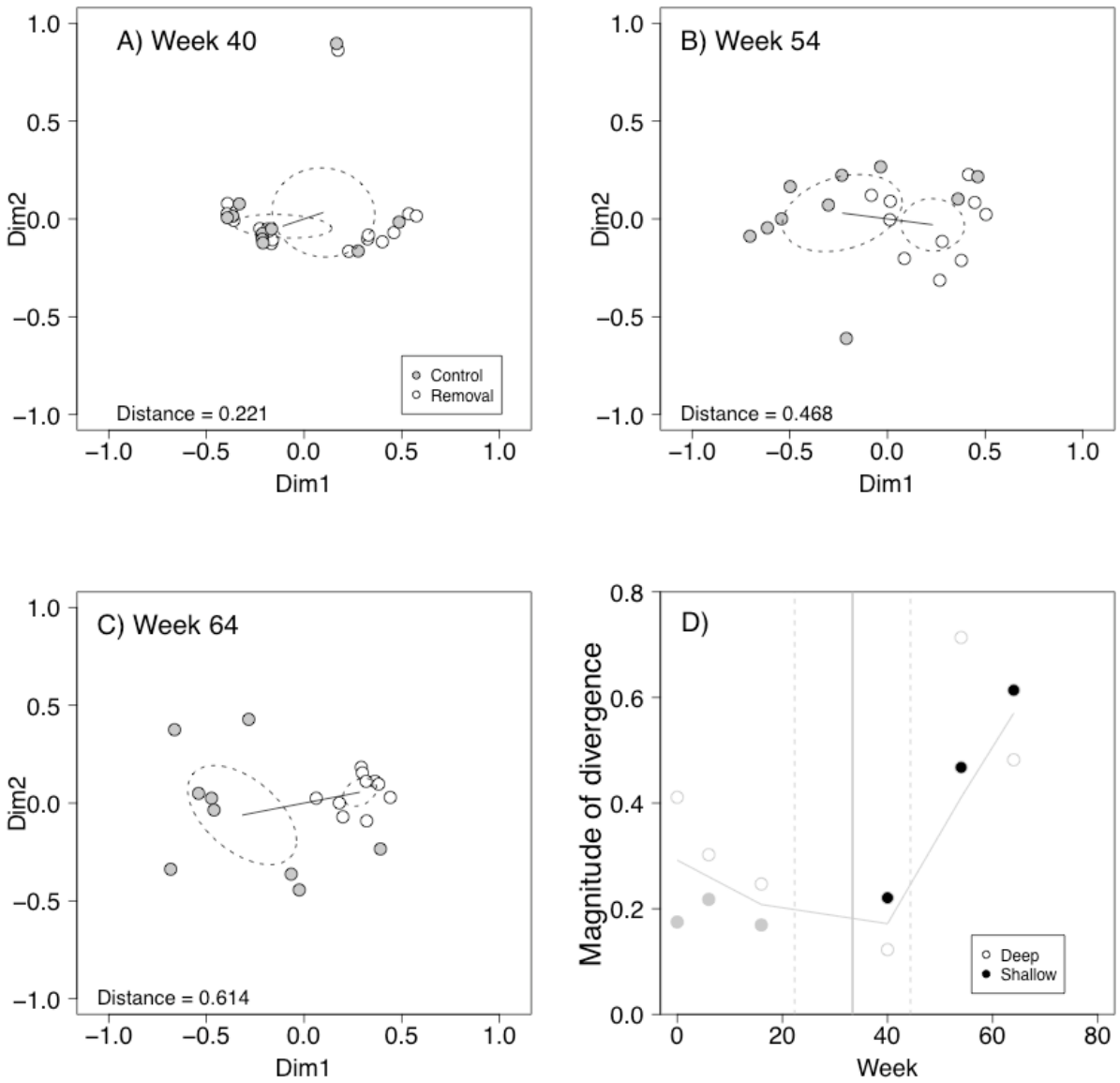

Fig. S3. Non-metric multidimensional scaling (nMDS) to examine the divergence of macroalgal communities on control and urchin removal walls. For each sampling date, we used Bray-Curtis distances to calculate dissimilarities in the composition of macroalgal communities in 20 quadrats on control walls (10 in the shallow zone and 10 in the deep zone) and 20 quadrats on urchin removal walls (10 in the shallow zone and 10 in the deep zone). For each zone (deep or shallow), we then used nMDS to graphically display, in 2 dimensions, relationships between the 20 quadrats taken on that sampling date and to plot 95% confidence limits (black ovals) around the centroids for (1) the 10 quadrats on the control wall and (2) the 10 quadrats on the urchins removal wall. We then calculated the Euclidean distance between the 2 centroids (heavy line). Large Euclidean distances indicate that the structures of macroalgal communities on control and urchin removal walls are highly dissimilar, whereas smaller distances indicate more similar macroalgal communities on control and urchin removal walls. Calculation of Euclidean distances in the shallow zone for Weeks (A) 40, (B) 54 and (C) 64. (D) Relationship between these 3 distances as presented in Fig. 3b of the article