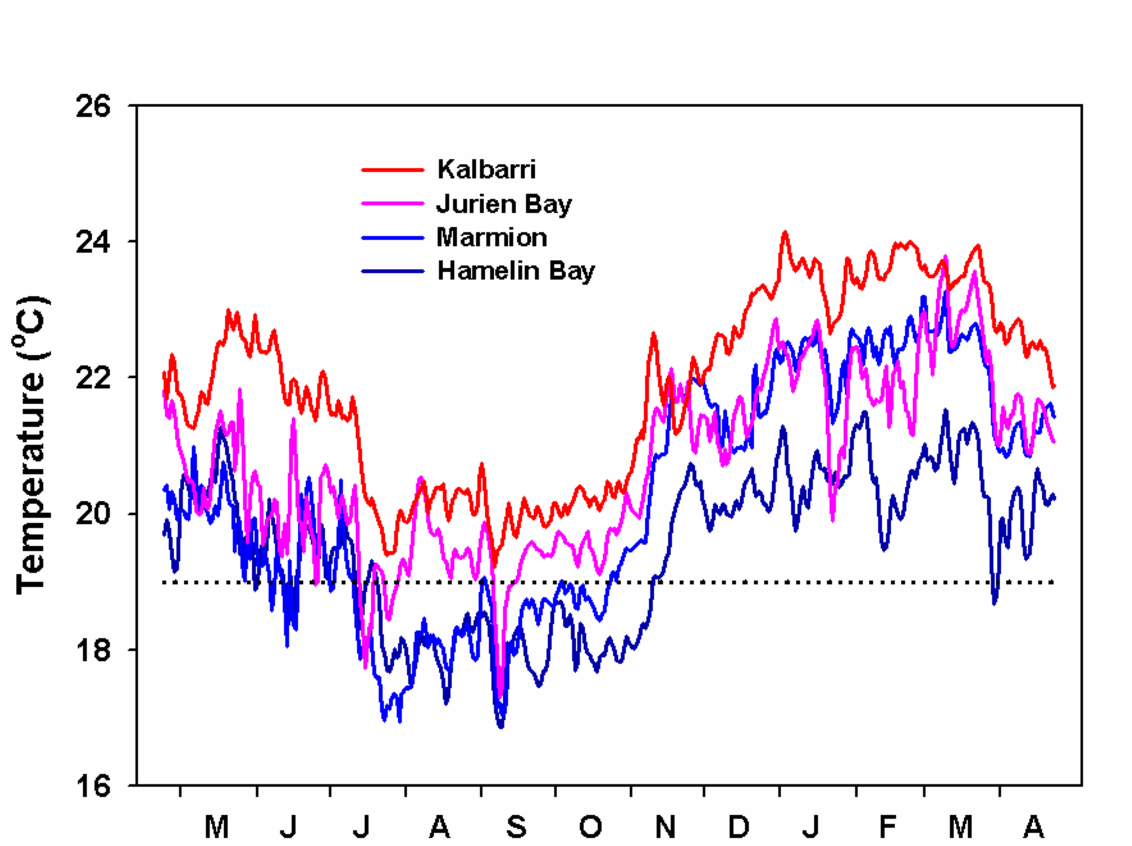
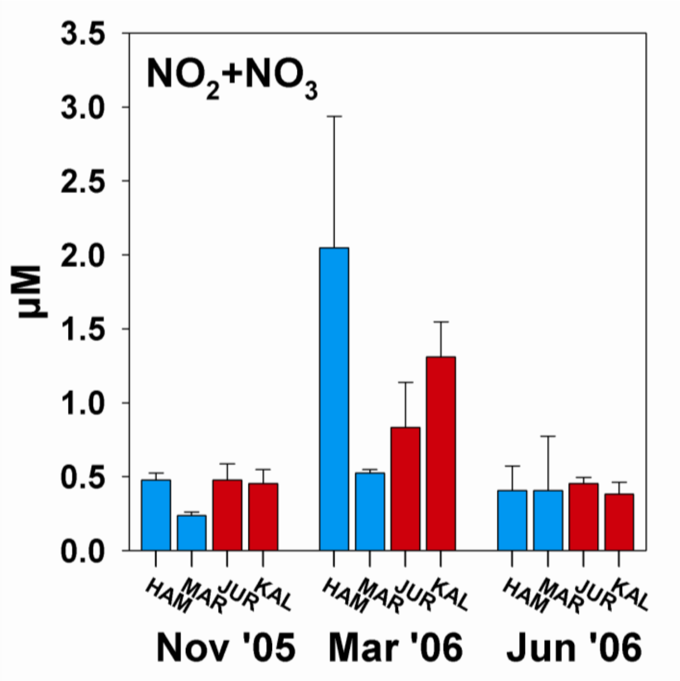
Appendix S1 – Supplementary figures

Fig. S1



Water temperature measured every 15 minutes (Onset tidbit loggers) ~5 cm above the reef from 23 April 2006 to 22 April 2007 [*mean*, *n* = 3 reefs; CV (not shown) between reefs within a region mostly < 1%, maximum ~5%]. In addition to the annual mean and maximum water temperature, we report in Table 1 the number of days exceeding 19 °C (dotted line), a threshold previously found to negatively influence growth and productivity of *E. radiata* [Kirkman, 1984. Standing Stock and Production of *Ecklonia radiata* (C.Ag.) J. Agardh. J Exp Mar Biol Ecol, 76, 119-130].

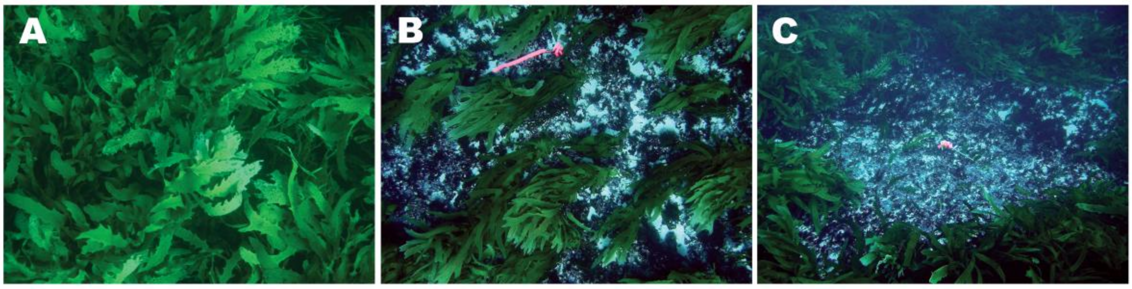
Fig. S2



Concentration of inorganic nitrogen (*mean* + *s.e.m.*, *n* = 3 reefs) immediately above the kelp canopy in each region at 3 times of the year. Blue = cool ocean climate, red = warm ocean climate (cf. Fig. 1). Water samples were collected in a clean syringe, filtered (0.45 µm) and stored frozen (-20 ^{o}C) until analysis by a commercial laboratory. ANOVA tested differences among regions and sampling times (Table S2).

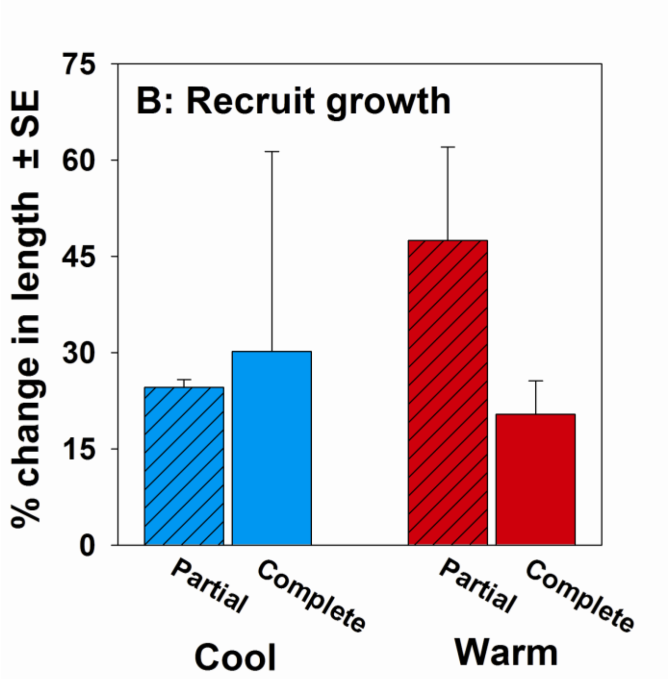
Previous studies have found similarly low values of NOx at multiple coastal sites along the southwest coast of Australia, and that NOx accounts for the largest component of biologically available nitrogen, with concentrations of NH_3/NH_4^+ <0.5 µM at all sites at all times (Hanson et al., 2005. Seasonal production regimes off south-western Australia: influence of the Capes and Leeuwin Currents on phytoplankton dynamics. Mar Freshw Res, 56, 1011-1026; Keesing et al., 2006. Strategic Research Fund for the Marine Environment Final Report, volume 2, CSIRO, Australia, pp. 274).

Fig. S3



Photographs of intact kelp canopy (A), and experimental plots of partial (B) and complete (C) canopy removal. Six plots of each disturbance intensity were established on 3 reefs within each region. Algae larger than ~20 cm were removed from circular plots of ≥2 m diameter, from 8.6 kelps m^{-2} ± 0.9 *s.e.m.* (*n* = 4 regions) in intact plots to 3.4 kelps m^{-2} ± 0.1 *s.e.m.* (*n* = 4 regions) in partial removal plots (moderate disturbance) and 0 kelps in complete removal plots (severe disturbance).

Fig. S4



Growth of kelp recruits in response to different intensities of experimental disturbance (hashed bars: partial canopy removal, open bars: complete canopy removal) in cool (blue) and warm (red) ocean climate (cf. Fig. 1, S3). This figure includes damaged recruits from Marmion (apical ends eaten). Testing using the same design as for net recruitment (Table S5) showed that in the warm climate, recruit growth was significantly lower (P = 0.042) in plots of complete canopy removal than in plots of partial canopy removal.

Appendix S2 – Statistical tables and procedures

Regressions were performed using the linear regression tool in *Sigmaplot v. 10* for windows, and ANOVA's were carried out in GMAV5 for windows. For ANOVA, 'Ocean Climate' was considered a fixed factor and 'Region(Ocean Climate)' a random factor. In the analysis of [NOx], 'Time' was considered a random factor. 'Disturbance Intensity' was a fixed factor.

Table S1

ANOVA testing for differences in ocean temperature between ocean climate and regions within ocean climate, for the initial 80-day duration of the disturbance experiment.

Source of variation	***Df***	***MS***	***F***	***P***
Ocean climate	1	9.5490	144.45	0.0069
Region (OC)	2	0.0661	6.02	0.0254
Residual	8			

Transformation: None; Cochran's C-test: $C = 0.6498$, $P > 0.05$.

Table S2

ANOVA testing for differences in the concentration of $NO_2 + NO_3$ between regions and sampling times. *Post hoc* SNK tests ($P < 0.05$) indicated that there were no differences between regions, but in some regions, there were sometimes an effect of time.

Source of variation	***df***	***MS***	***F***	***P***
Region	3	0.8908	1.60	0.2843
Time	2	3.4124	25.45	<0.0001
R x T	6	0.5550	4.14	0.0054
Residual	24	0.1341		

Transformation: Ln(x); Cochran's C-test: $C = 0.3498$, $P > 0.05$.

Table S3

ANOVA testing for differences in kelp canopy cover and canopy biomass among regions.

Source of variation	***df***	***MS***	***F***	***P***	***MS***	***F***	***P***
		Canopy cover*			**Canopy biomass#**		
Region	3	0.0253	1.93	0.1574	33589	0.54	0.6573
Residual	20	0.0131			61657		

*Transformation: Ln(x+1); Cochran's C-test: $C = 0.3282$, $P > 0.05$.

#Transformation: None; Cochran's C-test: $C = 0.3662$, $P > 0.05$.

Table S4

ANOVA testing for differences in quantum efficiency (Φ) and maximum electron transfer rate (ETR_{max}) between ocean climate, disturbance intensity and region within ocean climate.

Source of variation	***Df***	***MS***	***F***	***P***	***MS***	***F***	***P***
		Φ*			**ETR_{max}#**		
Ocean climate	1	0.7570	12.12	0.0735	0.1007	0.35	0.6130
Disturbance intensity	1	0.3346	128.59	0.0077	0.2057	98.86	0.0100
OC x DI	1	0.0513	19.70	0.0472	0.0471	22.65	0.0414
Region(OC)	2	0.0624	5.95	0.0117	0.2859	4.92	0.0217
DI x Region(OC)	2	0.0026	0.25	0.7835	0.0021	0.04	0.9649
Residual	16	0.0105			0.0582		

*Transformation: Ln(x); Cochrans's C-test: $C = 0.4378$, $P > 0.05$.

#Transformation: Ln(x); Cochrans's C-test: $C = 0.2507$, $P > 0.05$

Table S5

ANOVA testing for differences in net recruitment of kelp between ocean climate, disturbance intensity and region within ocean climate.

Source of variation	***Df***	***MS***	***F***	***P***
Ocean climate	1	0.4016	0.67	0.4998
Disturbance intensity	1	0.0476	1.25	0.3805
OC x DI	1	0.9401	24.61	0.0383
Region(OC)	2	0.6016	2.47	0.1162
DI x Region(OC)	2	0.0382	0.16	0.8562
Residual	16	0.2436		

Transformation: Ln(x); Cochrans's C-test: $C = 0.3508$, $P > 0.05$.

Table S6

ANOVA testing for differences in growth of transplanted recruits between the two extreme regions (Hamelin Bay and Kalbarri – cf methods) and disturbance intensity.

Source of variation	***df***	***MS***	***F***	***P***
Ocean Climate	1	0.0179	0.04	0.8420
Disturbance intensity	1	0.0020	0.00	0.9810
OC x DI	1	2.2960	5.44	0.0480
Residual	8	0.4221		

Transformation: Ln(x); Cochran's C-test: $C = 0.3126$, $P > 0.05$.

Table S7

ANOVA testing for differences in recovery of adult canopy between ocean climate, disturbance intensity and regions within ocean climate. DI x Region(OC) was highly non-significant (*P* = 0.690) and this random term was therefore pooled with the residual to increase the power of the test for effects of main effects (Winer BJ, Brown DR, Michels KM, 1991. Statistical Principles in Experimental Design. McGraw-Hill Inc.).

Source of variation	***df***	***MS***	***F***	***P***
Ocean climate	1	0.2981	1.06	0.411
Region(OC)	2	0.2802	1.21	0.322
Disturbance intensity	1	0.0499	0.22	0.648
OC x DI	1	1.0559	4.55	0.047
*DI x Region(OC)	2	0.0946		
*Residual	16	0.2491		
Pooled (*)	18	0.2320		

Transformation: Ln(x); Cochran's C-test: *C* = 0.4437, *P* > 0.05.