Table S1. Concentrations of dissolved inorganic nitrogen (DIN) and phosphate (DIP) before and at the end of incubations at different nutrient conditions, and particulate organic nitrogen (PON) concentration at the end of incubations.

		DIN (μmol L^{-1})	DIP (μmol L^{-1})	PON (μmol L^{-1})
HNHP	Before	101 ± 1.1	10.5 ± 0.2	
	End	92.8 ± 1.6	9.7 ± 0.2	8.7 ± 2.7
	Molar drawdown	8.6 ± 1.7	0.6 ± 0.2	
LN	Before	8.8 ± 0.1		
	End	1.0 ± 0.4		9.3 ± 2.9
	Molar drawdown	7.8 ± 0.4		
LP	Before		0.4 ± 0.1	
	End		< 0.04	7.8 ± 2.7
	Molar drawdown		0.4 ± 0.1	

PON concentration was calculated based on PON quota and cell number at the end of incubation.

Table S2. Carbonate chemistry parameters of the media before and at the end of incubations at different nutrient conditions and pCO_2 levels.

			pCO_2 (µatm)	pH (total scale)	TA (µmol L^{-1})	DIC (µmol L^{-1})	HCO_3^- (µmol L^{-1})	CO_3^{2-} (µmol L^{-1})	CO_2 (µmol L^{-1})	Ω calcite
HNHP	LC	Before	510 ± 17^a	8.04 ± 0.01^a	2228 ± 17^a	2004 ± 20^a	1829 ± 21^a	159 ± 2^a	16 ± 1^a	3.8 ± 0.1^a
		End	428 ± 57^b	8.11 ± 0.05^b	2225 ± 24^a	1967 ± 22^b	1773 ± 34^b	180 ± 18^a	14 ± 2^b	4.3 ± 0.5^a
	HC	Before	1210 ± 53^a	7.71 ± 0.02^a	2219 ± 19^a	2131 ± 22^a	2010 ± 22^a	81 ± 2^a	39 ± 2^a	1.9 ± 0.1^a
		End	935 ± 139^b	7.81 ± 0.06^b	2225 ± 24^a	2098 ± 12^b	1966 ± 17^b	102 ± 14^b	30 ± 4^b	2.4 ± 0.3^b
LN	LC	Before	483 ± 23^a	8.06 ± 0.02^a	2204 ± 10^a	1973 ± 10^a	1796 ± 13^a	162 ± 6^a	16 ± 1^a	3.9 ± 0.1^a
		End	391 ± 39^b	8.12 ± 0.03^b	2123 ± 38^b	1866 ± 45^b	1679 ± 48^b	175 ± 9^b	13 ± 1^b	4.2 ± 0.2^b
	HC	Before	1126 ± 66^a	7.73 ± 0.02^a	2201 ± 3^a	2105 ± 7^a	1983 ± 9^a	85 ± 4^a	36 ± 2^a	2.02 ± 0.1^a
		End	888 ± 114^b	7.82 ± 0.05^b	2142 ± 38^b	2016 ± 47^b	1890 ± 49^b	98 ± 8^b	29 ± 4^b	2.4 ± 0.2^b
LP	LC	Before	397 ± 16^a	8.14 ± 0.02^a	2248 ± 30^a	1982 ± 22^a	1777 ± 17^a	192 ± 8^a	13 ± 1^a	4.6 ± 0.2^a
		End	365 ± 24^b	8.16 ± 0.02^a	2219 ± 20^b	1942 ± 22^b	1731 ± 25^b	199 ± 8^a	12 ± 1^b	4.8 ± 0.2^a
	HC	Before	1140 ± 110^a	7.73 ± 0.04^a	2215 ± 41^a	2128 ± 46^a	2005 ± 46^a	86 ± 7^a	37 ± 4^a	2.1 ± 0.2^a
		End	780 ± 43^b	7.88 ± 0.02^b	2228 ± 14^a	2084 ± 11^b	1941 ± 12^b	117 ± 6^b	25 ± 1^b	2.8 ± 0.1^b

Different letters represent statistically differences between before and end of the experiments (Tukey Post hoc, $p < 0.05$). For more detail information, see Table 1.

Table S3. Results of three-way ANOVAs for comparison of apparent light use efficiency (α) between growth, POC and PIC production rates at different CO_2 levels and nutrient conditions.

	Factor	*F* value	*p* value	Factor	*F* value	*p* value
α	N	4.2	=0.048	P	46.1	<0.001
	Para	172.8	<0.001	Para	292.3	<0.001
	C	<0.1	=0.988	C	14.9	<0.001
	N ×Para	16.2	<0.001	P ×Para	7.5	=0.002
	N ×C	1.1	=0.306	P ×C	8.6	=0.006
	Para ×C	0.2	=0.842	Para ×C	7.7	=0.002
	N ×Para ×C	0.6	=0.540	P ×Para ×C	3.2	=0.054

α, slop of fitted curves for growth, POC and PIC production rates; N, dissolved inorganic nitrogen (DIN, μmol L^{-1}); P, dissolved inorganic phosphate (DIP, μmol L^{-1}); C, pCO_2 (μatm); Para, growth rate (d^{-1}), POC and PIC production rates (pg C $cell^{-1}$ d^{-1}).

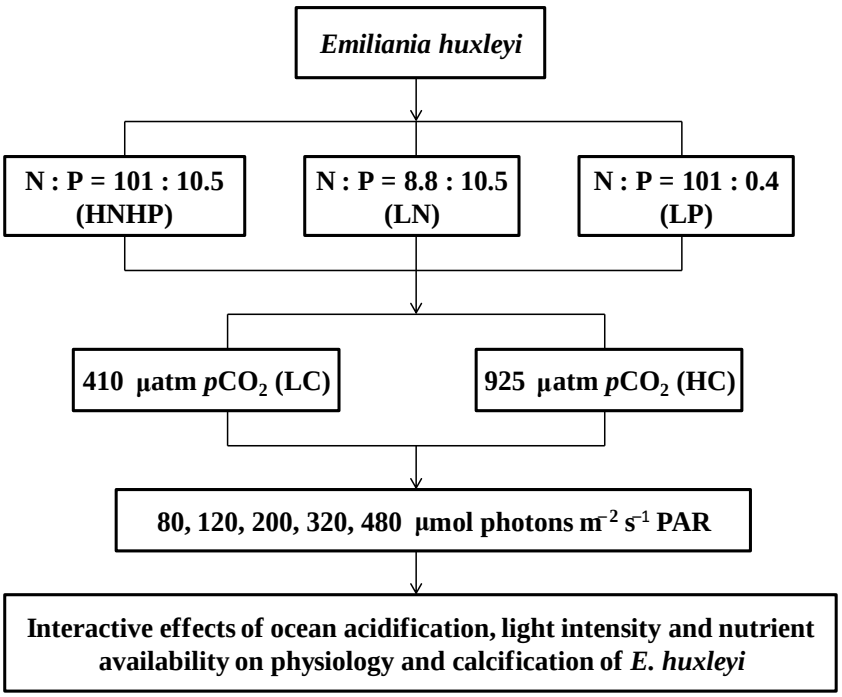

Figure S1. A flow chart for the experimental treatments. PAR represents photosynthetically active radiation.

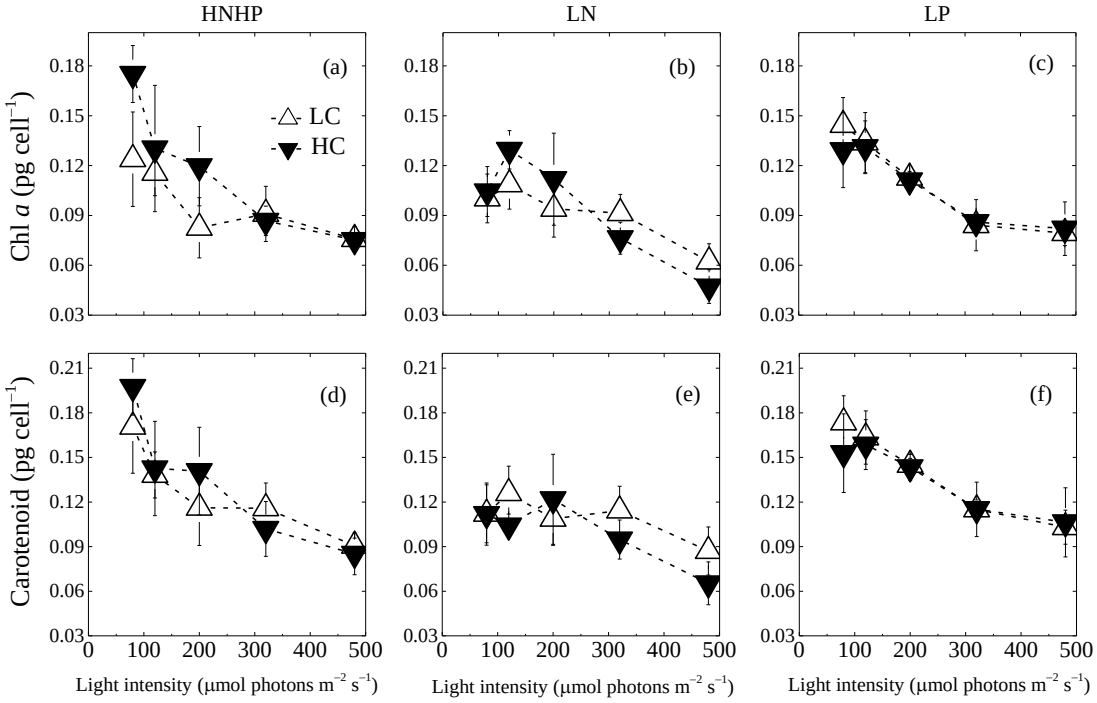

Figure S2. At both LC and HC, light responses of Chl *a* contents at HNHP (**a**), LN (**b**) and LP (**c**) conditions. At both LC and HC, light responses of carotenoid contents at HNHP (**d**), LN (**e**) and LP (**f**) conditions. The values represent the mean ± standard deviation for four replicates.

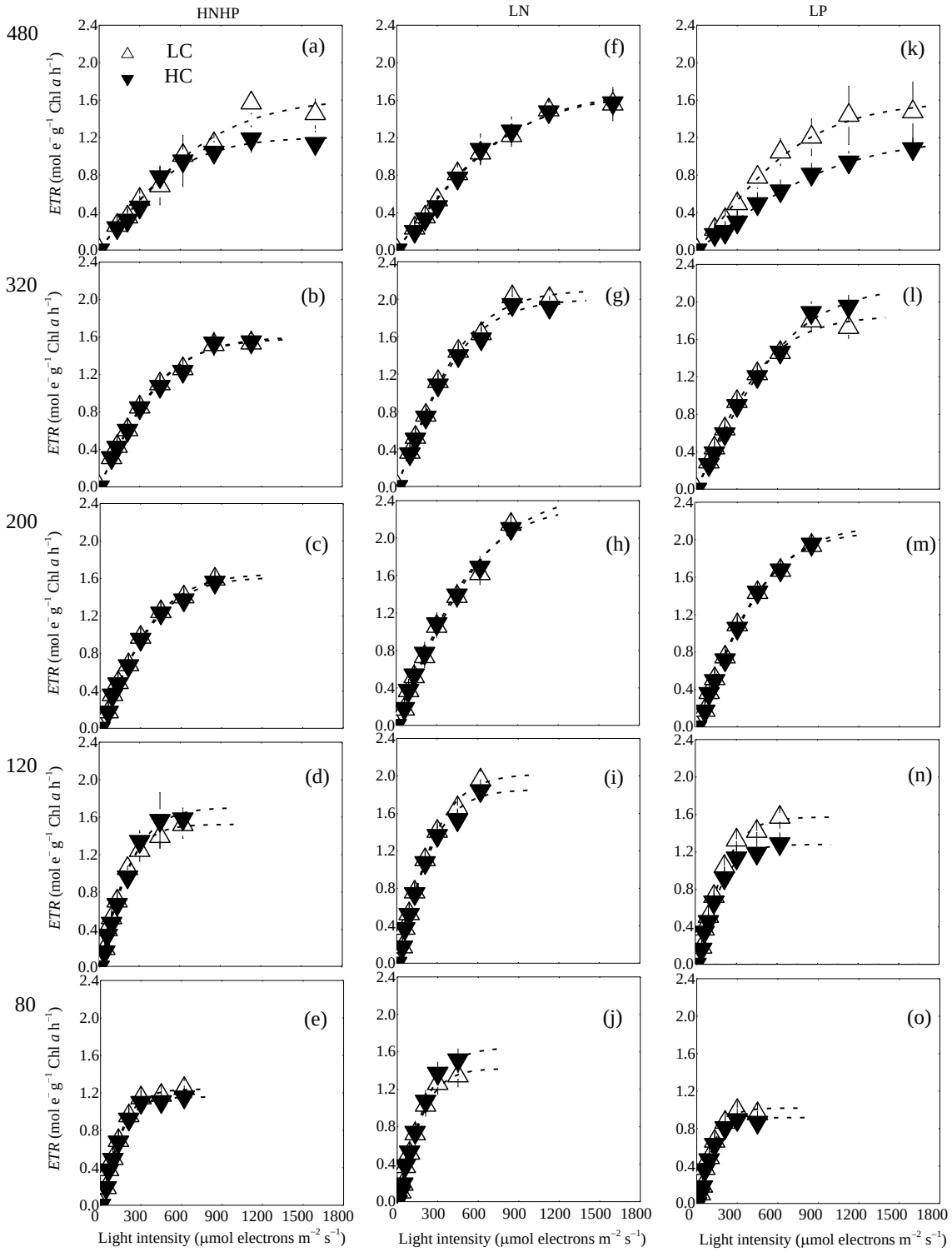

Figure S3. Electron transport rate (*ETR*) of *E. huxleyi* as a function of instant light intensities, and fitted response curves of *ETR* to instant light intensities (P-I curves, dashed lines) emitted by the XE-PAM. Under HNHP, at both LC and HC, *ETR* as a

function of instant light intensities and the fitted P-I curves when *E. huxleyi* were incubated at 480 (**a**), 320 (**b**), 200 (**c**), 120 (**d**), 80 (**e**) μmol photons m^{-2} s^{-1}. Under LN, at both LC and HC, *ETR* as a function of instant light intensities and the fitted P-I curves when *E. huxleyi* were incubated at 480 (**f**), 320 (**g**), 200 (**h**), 120 (**i**), 80 (**j**) μmol photons m^{-2} s^{-1}. Under LP, at both LC and HC, *ETR* as a function of instant light intensities and the fitted P-I curves when *E. huxleyi* were incubated at 480 (**k**), 320 (**l**), 200 (**m**), 120 (**n**), 80 (**o**) μmol photons m^{-2} s^{-1}. Dashed lines were fitted according to Jasby and Platt (1976). The values represent the mean ± standard deviation for four replicates.

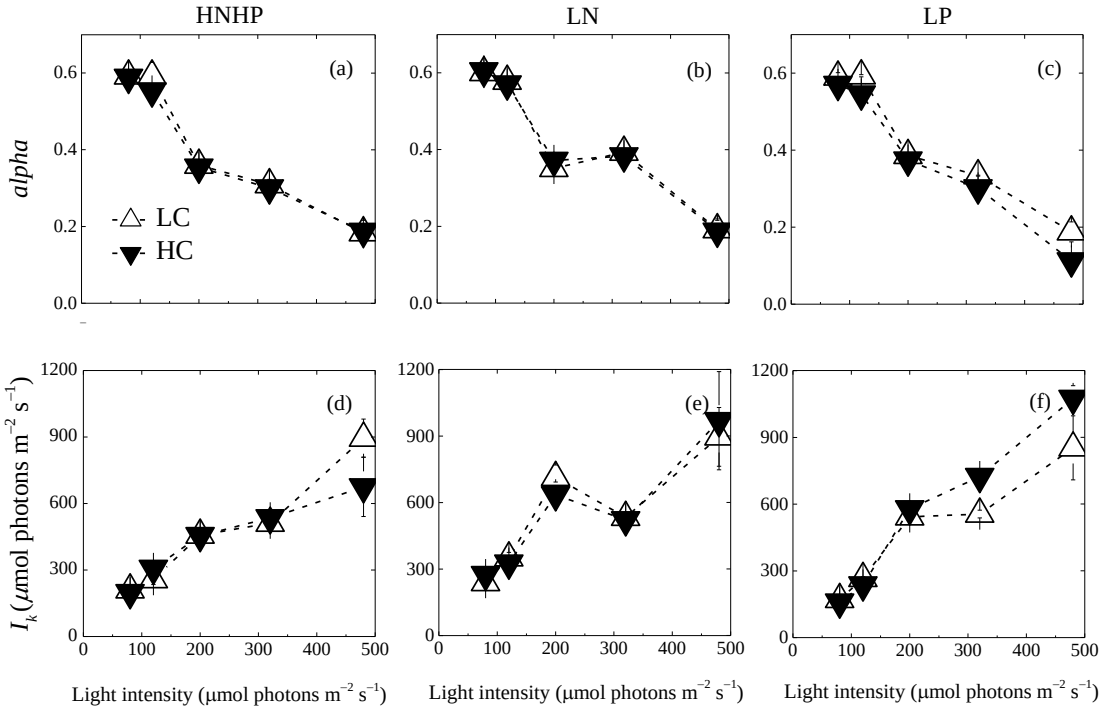

Figure S4. At both LC and HC, the slop (*alpha*) of fitted P-I curves of *E. huxleyi* as a function of incubation light intensities at HNHP (**a**), LN (**b**) and LP (**c**) conditions. At both LC and HC, fitted saturation light intensity (I_k) of *E. huxleyi* as a function of incubation light intensities at HNHP (**d**), LN (**e**) and LP (**f**) conditions. The values represent the mean ± standard deviation for four replicates.

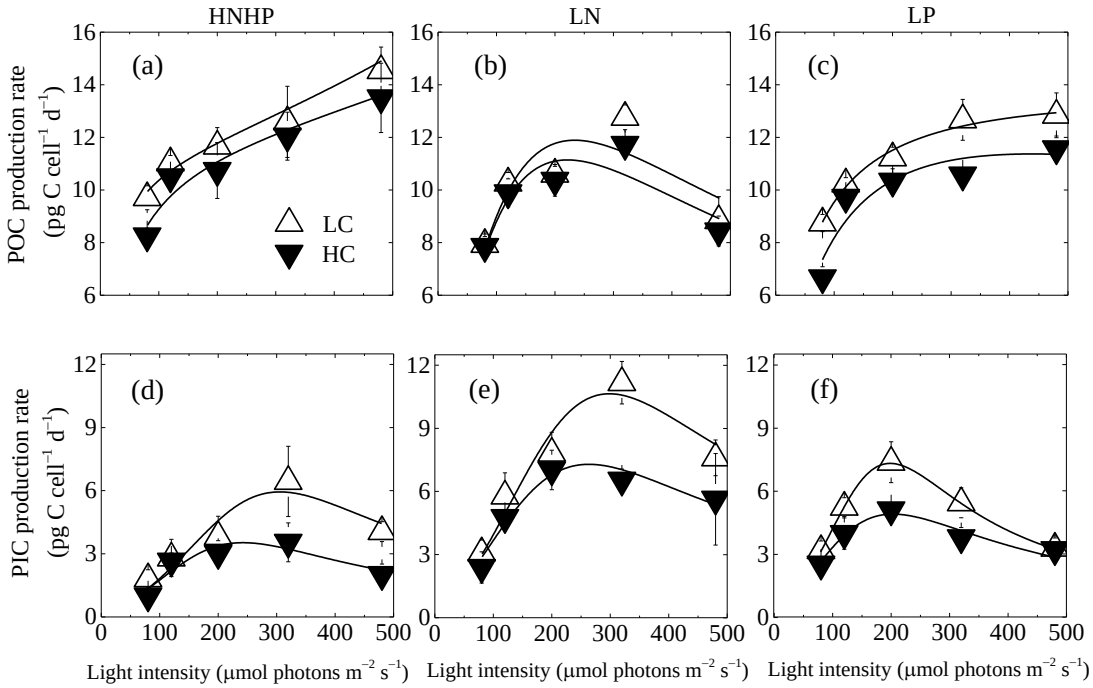

Figure S5. At both LC and HC, POC production rates of *E. huixleyi* as a function of light intensities at HNHP (**a**), LN (**b**) and LP (**c**) conditions. At both LC and HC, PIC production rates of *E. huixleyi* as a function of light intensities at HNHP (**d**), LN (**e**) and LP (**f**) conditions. The solid lines in each panel were fitted using the model provided by Eilers and Peeters (1988). The values represent the mean ± standard deviation for four replicates.

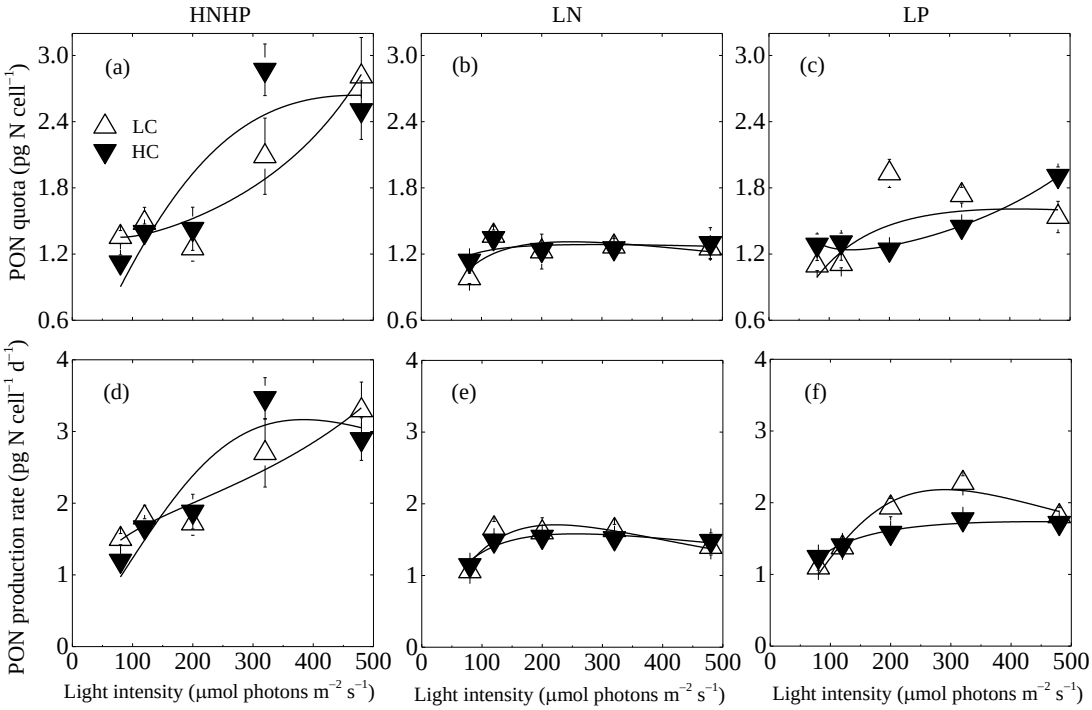

Figure S6. At both LC and HC, PON quota of *E. huixleyi* as a function of light intensities at HNHP (**a**), LN (**b**) and LP (**c**) conditions. At both LC and HC, PON production rates of *E. huixleyi* as a function of light intensities at HNHP (**d**), LN (**e**) and LP (**f**) conditions. The solid lines in each panel were fitted using the model provided by Eilers and Peeters (1988). The values represent the mean ± standard deviation for four replicates.