Online Resources 1 -Table 1: Results of three-way ANOVA analyzing the effect of depth, location and month on temperature (°C), GDD (°C day^{-1}) and accumulated PAR (mole)

	Effect	MS	$F_{(df)}$	P
Temperature	Depth	201.2	$1.916_{(1,3338)}$	0.201
	Location	767.5	$10.89_{(8,3338)}$	<0.001
	Month	6400	$47.66_{(6,3338)}$	<0.001
	Location x Month	51.88	$6.656_{(47,3338)}$	<0.001
	Location x Depth	28.57	$3.840_{(8,3338)}$	0.001
	Month x Depth	90.76	$11.79_{(6,3338)}$	<0.001
	Location x Month x Depth	7.795	$12.80_{(47,3338)}$	<0.001
	Error	0.609		
GDD	Depth	392353	$0.750_{(1,3338)}$	0.404
	Location	8311948	$11.61_{(8,3338)}$	<0.001
	Month	218530017	$257.2_{(6,3338)}$	<0.001
	Location x Month	532516	$28.17_{(47,3338)}$	<0.001
	Location x Depth	227999	$12.34_{(8,3338)}$	<0.001
	Month x Depth	342887	$18.25_{(6,3338)}$	<0.001
	Location x Month x Depth	18901	$1.807_{(47,3338)}$	0.001
	Error	10459		
Accumulated PAR	Depth	222495942	$8.510_{(1,3324)}$	0.024
	Location	2827422	$1.704_{(8,3324)}$	0.215
	Month	72998347	$2.720_{(6,3324)}$	0.123
	Location x Month	304419	$2.088_{(47,3324)}$	0.007
	Location x Depth	1508393	$10.870_{(8,3324)}$	<0.001
	Month x Depth	26685443	$185.5_{(6,3324)}$	<0.001
	Location x Month x Depth	145828	$35.11_{(47,3324)}$	<0.001
	Error	4154		

Online Resources 1- Table 2: Results of two-way ANOVA analyzing the effect of depth and sampling date on frond length and biomass yield for all nine locations

		Frond length (cm)			Biomass yield (kg m^{-1})		
Location	Effect	MS	$F_{(df)}$	P	MS	$F_{(df)}$	P
1-58°N	Depth	6843	$10.85_{(1,389)}$	0.046	11.76	$33.34_{(1,17)}$	0.027
	Sampling date	19978	$31.67_{(3,389)}$	0.009	1.020	$3.794_{(3,17)}$	0.209
	Depth x Sampling date	630.8	$4.529_{(3,389)}$	0.004	0.349	$0.195_{(2,17)}$	0.825
	Error	139.3			1.792		
2-60°N	Depth	10110	$70.28_{(1,392)}$	0.004	15.05	$4.860_{(1,12)}$	0.271
	Sampling date	968.7	$6.734_{(3,392)}$	0.076	4.494	$1.451_{(1,12)}$	0.441
	Depth x Sampling date	143.9	$1.391_{(3,392)}$	0.245	3.098	$19.18_{(1,12)}$	0.001
	Error	103.4			0.161		
3-60°N	Depth	37698	$25.84_{(1,686)}$	0.002	13.81	$6.872_{(1,24)}$	0.079
	Sampling date	3063	$2.100_{(6,686)}$	0.194	3.446	$1.715_{(3,24)}$	0.334
	Depth x Sampling date	1459	$12.91_{(6,686)}$	<0.001	2.009	$5.536_{(3,24)}$	0.005
	Error	113.0			0.363		
4-60°N	Depth	23163	$29.93_{(1,588)}$	0.003	0.036	$44.62_{(1,18)}$	0.022
	Sampling date	1114	$1.441_{(5,588)}$	0.349	0.005	$5.996_{(2,18)}$	0.143
	Depth x Sampling date	773.9	$21.63_{(5,588)}$	<0.001	0.001	$1.247_{(2,18)}$	0.311
	Error	35.79			0.001		
5-61°N	Depth	8832	$91.71_{(1,369)}$	0.002	5.382	$49.46_{(1,12)}$	0.090
	Sampling date	692.3	$7.224_{(3,369)}$	0.069	0.689	$6.326_{(1,12)}$	0.241
	Depth x Sampling date	95.83	$0.649_{(3,369)}$	0.584	0.109	$0.443_{(1,12)}$	0.518
	Error	147.8			0.246		
6-63°N	Depth	4139	$2.667_{(1,592)}$	0.151	165.2	$20.10_{(1,22)}$	0.020
	Sampling date	65058	$36.85_{(6,592)}$	<0.001	79.99	$9.629_{(3,22)}$	0.048
	Depth x Sampling date	1765	$6.775_{(6,592)}$	<0.001	8.307	$3.536_{(3,22)}$	0.031
	Error	260.6			2.349		
7-67°N	Depth	29.12	$0.004_{(1,676)}$	0.954	0.818	$2.786_{(1,28)}$	0.170
	Sampling date	9106	$1.138_{(6,676)}$	0.440	0.516	$1.745_{(4,28)}$	0.302
	Depth x Sampling date	8001	$111.6_{(6,676)}$	<0.001	0.296	$4.753_{(4,28)}$	0.005
	Error	71.69			0.062		
8-67°N	Depth	761.4	$5.431_{(1,490)}$	0.080	0.062	$13.73_{(1,18)}$	0.066
	Sampling date	441.4	$3.148_{(4,490)}$	0.146	0.099	$21.92_{(2,18)}$	0.044
	Depth x Sampling date	140.2	$5.111_{(4,490)}$	<0.001	0.005	$0.166_{(2,18)}$	0.848
	Error	27.43			0.027		
9-69°N	Depth	3228	$4.180_{(1,882)}$	0.075	77.24	$11.16_{(1,36)}$	0.015
	Sampling date	63442	$82.15_{(8,882)}$	<0.001	77.92	$10.82_{(6,36)}$	0.005
	Depth x Sampling date	772.3	$3.681_{(8,882)}$	<0.001	7.205	$3.899_{(6,36)}$	0.004
	Error	209.8			1.848		

Online Resources 1- Table 3: Results of two-way ANOVA analyzing the effect of depth and sampling date on dry weight (DW) and ash content for all nine locations

		DW (% of WW)			Ash (mg g^{-1} DW)		
Location	Effect	MS	$F_{(df)}$	P	MS	$F_{(df)}$	P
1-58°N	Depth	34.07	$8.764_{(1,18)}$	0.035	67627	$18.68_{(1,18)}$	0.010
	Sampling date	47.49	$12.23_{(4,18)}$	0.016	7219	$1.960_{(4,18)}$	0.265
	Depth x Sampling date	3.882	$0.980_{(4,18)}$	0.443	3683	$1.384_{(4,18)}$	0.279
	Error	3.963			2661		
2-60°N	Depth	36.03	$3.205_{(1,20)}$	0.147	19311	$1.415_{(1,20)}$	0.300
	Sampling date	18.28	$1.598_{(5,20)}$	0.337	7779	$0.556_{(5,20)}$	0.734
	Depth x Sampling date	11.31	$2.916_{(4,20)}$	0.047	13764	$10.99_{(4,20)}$	<0.001
	Error	3.879			1252		
3-60°N	Depth	24.54	$2.379_{(1,30)}$	0.165	36817	$6.580_{(1,30)}$	0.037
	Sampling date	31.06	$2.943_{(7,30)}$	0.089	3868	$0.662_{(7,30)}$	0.700
	Depth x Sampling date	10.55	$1.900_{(7,30)}$	0.105	5843	$8.958_{(7,30)}$	<0.001
	Error	5.555			652.2		
4-60°N	Depth	510.0	$12.80_{(1,24)}$	0.016	130441	$13.24_{(1,24)}$	0.015
	Sampling date	61.24	$1.537_{(5,24)}$	0.324	8980	$0.911_{(5,24)}$	0.539
	Depth x Sampling date	39.86	$7.058_{(5,24)}$	<0.001	9853	$13.69_{(5,24)}$	<0.001
	Error	5.647			719.6		
5-61°N	Depth	34.68	$650.3_{(1,8)}$	0.025	13940	$2.245_{(1,8)}$	0.375
	Sampling date	126.8	$2376_{(1,8)}$	0.013	57270	$9.221_{(1,8)}$	0.203
	Depth x Sampling date	0.053	$0.005_{(1,8)}$	0.944	6211	$2.735_{(1,8)}$	0.137
	Error	10.08			2271		
6-63°N	Depth	330.5	$11.69_{(1,28)}$	0.014	65491	$9.012_{(1,28)}$	0.024
	Sampling date	33.97	$1.201_{(6,28)}$	0.415	4401	$0.606_{(6,28)}$	0.721
	Depth x Sampling date	28.27	$2.782_{(6,28)}$	0.030	7267	$1.531_{(6,28)}$	0.205
	Error	10.16			4747		
7-67°N	Depth	408.0	$14.51_{(1,28)}$	0.009	156795	$12.92_{(1,28)}$	0.011
	Sampling date	51.65	$1.837_{(6,28)}$	0.239	21365	$1.761_{(6,28)}$	0.254
	Depth x Sampling date	28.12	$0.548_{(6,28)}$	0.767	12132	$2.541_{(6,28)}$	0.043
	Error	51.32			4775		
8-67°N	Depth	71.82	$2.654_{(1,10)}$	0.179	661.3	$0.266_{(1,10)}$	0.633
	Sampling date	44.78	$1.665_{(4,10)}$	0.319	9194	$3.703_{(4,10)}$	0.116
	Depth x Sampling date	27.06	$2.305_{(4,10)}$	0.130	2483	$1.597_{(4,10)}$	0.249
	Error	11.74			1555		
9-69°N	Depth	257.6	$8.821_{(1,32)}$	0.017	118606	$13.46_{(1,32)}$	0.006
	Sampling date	53.34	$1.800_{(8,32)}$	0.212	11229	$1.255_{(8,32)}$	0.378
	Depth x Sampling date	29.63	$2.298_{(8,32)}$	0.045	8947	$2.578_{(8,32)}$	0.027
	Error	12.90			3471		

Online Resources 1- Table 4: Results of two-way ANOVA analyzing the effect of depth and sampling date on intracellular nitrate (I-DIN) and tissue nitrogen (Q_N) for all nine locations

		I-DIN (mg NO_3^- g^{-1} DW)			Q_N (mg N g^{-1} DW)		
Location	Effect	MS	$F_{(df)}$	P	MS	$F_{(df)}$	P
1-58°N	Depth	0.001	$1.485_{(1,20)}$	0.290	29.77	$1.591_{(1,17)}$	0.265
	Sampling date	0.000	$0.594_{(4,20)}$	0.687	1282	$73.47_{(4,17)}$	0.001
	Depth x Sampling date	0.001	$1.223_{(4,20)}$	0.332	17.46	$0.225_{(4,17)}$	0.921
	Error	0.001			77.64		
2-60°N	Depth	0.005	$1.946_{(1,24)}$	0.222	166.7	$1.338_{(1,18)}$	0.331
	Sampling date	0.002	$0.647_{(5,24)}$	0.678	853.5	$6.848_{(4,18)}$	0.073
	Depth x Sampling date	0.003	$6.933_{(5,24)}$	<0.001	124.7	$6.23_{(3,18)}$	0.004
	Error	0.000			20.02		
3-60°N	Depth	0.003	$1.759_{(1,30)}$	0.226	17.97	$0.621_{(1,30)}$	0.448
	Sampling date	0.002	$1.343_{(7,30)}$	0.354	1714	$69.26_{(7,30)}$	<0.001
	Depth x Sampling date	0.002	$145.8_{(7,30)}$	<0.001	24.75	$0.219_{(7,30)}$	0.978
	Error	0.000			112.8		
4-60°N	Depth	0.033	$2.709_{(1,24)}$	0.161	4143	$29.55_{(1,36)}$	0.003
	Sampling date	0022	$1.842_{(5,24)}$	0.259	116.5	$0.831_{(5,36)}$	0.578
	Depth x Sampling date	0.012	$62.63_{(5,24)}$	<0.001	140.2	$8.097_{(5,36)}$	<0.001
	Error	0.000			17.31		
5-61°N	Depth	n.d	n.d	n.d	48.40	$1.385_{(1,8)}$	0.448
	Sampling date	n.d	n.d	n.d	496.4	$14.20_{1,8)}$	0.165
	Depth x Sampling date	n.d	n.d	n.d	34.95	$0.259_{(1,8)}$	0.625
	Error	n.d			135.1		
6-63°N	Depth	0.003	$0.086_{(1,28)}$	0.780	286.5	$3.469_{(1,24)}$	0.111
	Sampling date	0.051	$1.467_{(6,28)}$	0.327	378.5	$4.549_{(6,24)}$	0.044
	Depth x Sampling date	0.035	$2.182_{(6,28)}$	0.075	83.21	$1.647_{(6,24)}$	0.178
	Error	0.016			50.53		
7-67°N	Depth	0.836	$19.89_{(1,28)}$	0.004	3865	$276.1_{(1,27)}$	<0.001
	Sampling date	0.068	$1.618_{(6,28)}$	0.287	46.41	$3.312_{(6,27)}$	0.085
	Depth x Sampling date	0.042	$3.772_{(6,28)}$	0.007	14.01	$1.255_{(6,27)}$	0.310
	Error	0.011			11.16		
8-67°N	Depth	0.000	$1.592_{(1,19)}$	0.273	55.19	$0.310_{(1,20)}$	0.607
	Sampling date	0.000	$15.45_{(4,19)}$	0.011	369.2	$2.072(_{4,20)}$	0.249
	Depth x Sampling date	0.000	$0.335_{(4,19)}$	0.852	178.1	$47.81_{(4,20)}$	<0.001
	Error	0.000			3.726		
9-69°N	Depth	0.322	$11.34_{(1,33)}$	0.009	222.9	$9.371_{(1,36)}$	0.016
	Sampling date	0.236	$8.153_{(8,33)}$	0.004	229.5	$9.651_{(8,36)}$	0.002
	Depth x Sampling date	0.029	$1.604_{(8,33)}$	0.162	23.78	$1.501_{(8,36)}$	0.191
	Error	0.018			15.84		

Online Resources 1- Table 5: Results of two-way ANOVA analysing the effect of location and sampling date on the protein content (mg protein g^{-1} DW) of *Saccharina latissima* cultivated at 1-2 m and 8-9 m depth.

	Between-Subject effect	MS	$F_{(df)}$	P
1-2 m depth	Sampling date	1583	$16.32_{(6,35)}$	<0.001
	Location	402	$4.15_{(2,35)}$	0.024
	Sampling date x Location	5681	$58.57_{(11,35)}$	<0.001
	Error	97		
8-9 m depth	Sampling date	1654	$11.71_{(6,33)}$	<0.001
	Location	5431	$38.45_{(2,33)}$	<0.001
	Sampling date x Location	3475.9	$24.61_{(10,33)}$	<0.001
	Error	141		

Online Resources 1- Table 6: Results from the independent sample t-test for protein content between the cultivation depths (1-2 m and 8-9 m) for all experimental sites. Statistical significances ($p < 0.05$) are accentuated in **bold**.

Location	t-value	*df*	p-value
1-58°N	-0.42	3	0.705
2-60°N	-3.90	4	**0.017**
3-60°N	-1.49	3	0.231
4-60°N	-19.35	3	**< 0.001**
5-61°N	-15.00	3	**0.001**
6-63°N	-2.28	4	0.085
7-67°N	-36.12	4	**< 0.001**
8-67°N	0.55	4	0.613
9-69°N	-2.08	4	0.106

Online Resources 1- Table 7: Results of two-way ANOVA analyzing the effect of depth and sampling date on biofouling coverage (%) for all nine locations

		Biofouling coverage (%)		
Location	Effect	MS	$F_{(df)}$	P
1-58°N	Depth	19.85	$0.047_{(1,68)}$	0.838
	Sampling date	9178	$19.51_{(4,68)}$	0.007
	Depth x Sampling date	470.3	$4.042_{(4,68)}$	0.035
	Error	170.4		
2-60°N	Depth	3.740	$0.072_{(1,31)}$	0.805
	Sampling date	9970	$193.0_{(3,31)}$	0.001
	Depth x Sampling date	51.67	$1.036_{(3,31)}$	0.390
	Error	49.86		
3-60°N	Depth	50.25	$0.127_{(1,46)}$	0.736
	Sampling date	10042	$25.10_{(5,46)}$	0.001
	Depth x Sampling date	400.3	$6.434_{(5,46)}$	<0.001
	Error	62.20		
4-60°N	Depth	6132	$9.173_{(1,44)}$	0.039
	Sampling date	724.6	$1.084_{(5,44)}$	0.482
	Depth x Sampling date	668.5	$18.57_{(4,44)}$	<0.001
	Error	36.01		
5-61°N	Depth	338.0	$5.243_{(1,22)}$	0.149
	Sampling date	12314	$190.4_{(2,22)}$	0.005
	Depth x Sampling date	64.69	$3.336_{(2,22)}$	0.054
	Error	19.39		
6-63°N	Depth	3.295	$0.269_{(1,48)}$	0.626
	Sampling date	2120	$173.0_{(5,48)}$	<0.001
	Depth x Sampling date	12.25	$0.221_{(5,48)}$	0.952
	Error	55.42		
7-67°N	Depth	295.8	$1.187_{(1,56)}$	0.318
	Sampling date	404.3	$1.623_{(6,56)}$	0.286
	Depth x Sampling date	249.2	$18.11_{(6,56)}$	<0.001
	Error	13.76		
8-67°N	Depth	222.5	$1.059_{(1,32)}$	0.379
	Sampling date	1653	$7.861_{(3,32)}$	0.062
	Depth x Sampling date	210.2	$6.462_{(3,32)}$	0.002
	Error	32.53		
9-69°N	Depth	35.55	$0.085_{(1,79)}$	0.779
	Sampling date	2159	$4.972_{(7,79)}$	0.025
	Depth x Sampling date	434.2	$4.890_{(7.79)}$	<0.001
	Error	88.78		