

Impact of environmental conditions on biomass yield, quality, and bio-mitigation capacity of *Saccharina latissima*

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Table S1. Pearson Correlation Coefficients of key environmental parameters in early spring (February to April) above the diagonal and late spring (April to June) below the diagonal in bold. Top number gives the relation, bottom number the probability. N = 24. Prob > |r| under H0: Rho=0.

	Light	Salinity	Temperature	Chl a	DIN	Ortho-P	NP_E
Light		-0.119	-0.676	-0.325	0.101	-0.637	0.356
Light	-	0.581	<0.001	0.122	0.637	<0.001	0.084
Salinity	-0.525		0.056	0.857	-0.969	0.122	-0.825
Salinity	0.008	-	0.797	<0.001	<0.001	0.571	<0.001
Temperature	-0.318	-0.027		0.506	-0.156	0.990	-0.560
Temperature	0.1304	0.900	-	0.012	0.457	<0.001	<0.001
Chl_a	-0.194	-0.511	0.768		-0.931	0.586	-0.998
Chl a	0.365	0.011	<0.001	-	<0.001	0.003	<0.001
DIN	0.630	-0.973	-0.047	0.353		-0.250	0.906
DIN	<0.001	<0.001	0.827	0.091	-	0.239	<0.001
orthoP	-0.38568	0.357	0.887	0.391	-0.356		-0.637
orthoP	0.0627	0.087	<0.001	0.059	0.088	-	<0.001
NP_E	0.64504	-0.968	-0.151	0.288	0.994	-0.46	
NP_E	<0.001	<0.001	0.480	0.172	<0.001	0.024	-

Light = incoming PAR ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$). Chl a = proxy for pelagic phytoplankton biomass ($\mu\text{g chl a l}^{-1}$). DIN = dissolved inorganic nitrogen. Ortho-P = bioavailable dissolved inorganic phosphorus. NP_E = molar ratio between dissolved inorganic N and P in the seawater.

Table S2. Results of statistical analyses, testing by General Linear Models the impact of abiotic environmental factors on the growth performance, biochemical composition and biofouling of *S. latissima* in the periods of early spring (early February to mid-April) and late spring (mid-April to early June). Model 1 included light, salinity and ortho-P concentrations. Model 2 included temperature, salinity and the ratio between inorganic dissolved N and P (NP_E). P-values < 0.05, indicating significant relation to the specific environmental parameter, are marked in bold. AIC: Akaike's information criteria, with a lower numeric value indicating a better fit of the model.

Dependant variable	Model	Predictor	F value	df	P-value	Estimate	AIC
Early spring							
Biomass yield (g m ⁻¹)	1	Light (μmol photons m ⁻² s ⁻¹)	17.22	18	0.001	1.994	21.3
		Salinity (psu)	1.06	18	0.317	7.670	
		Ortho-P (μM)	0.65	18	0.430	3.592	
	2	Temperature (°C)	0.15	18	0.702	-2.498	29.3
		Salinity (psu)	0.62	18	0.442	-8.426	
		NP_E	0.54	18	0.472	-2.235	
Fronde length (cm)	1	Light (μmol photons m ⁻² s ⁻¹)	35.88	18	<0.001	0.952	-23.8
		Salinity (psu)	4.73	18	0.043	6.986	
		Ortho-P (μM)	0.04	18	0.843	0.654	
	2	Temperature (°C)	0.02	18	0.897	-0.539	-8.5
		Salinity (psu)	0.48	18	0.498	-3.377	
		NP_E	0.10	18	0.751	-0.540	
Specific Growth Rate (% d ⁻¹)	1	Light (μmol photons m ⁻² s ⁻¹)	13.49	18	0.002	0.282	-51.2
		Salinity (psu)	0.24	18	0.634	0.359	
		Ortho-P (μM)	4.86	18	0.041	0.858	
	2	Temperature (°C)	0.05	18	0.822	-0.175	-45.2
		Salinity (psu)	0.96	18	0.341	-1.582	
		NP_E	1.02	18	0.325	-0.421	
Biofouling (g m ⁻¹)	1	Light (μmol photons m ⁻² s ⁻¹)	9.73	18	0.006	-1.272	15.1
		Salinity (psu)	1.10	18	0.309	-5.854	
		Ortho-P (μM)	2.68	18	0.119	-5.107	
	2	Temperature (°C)	0.06	18	0.813	-1.110	18.8
		Salinity (psu)	0.43	18	0.522	5.319	
		NP_E	0.78	18	0.389	1.990	
Dry Matter (% of FW)	1	Light (μmol photons m ⁻² s ⁻¹)	0.17	17	0.683	-0.043	-38.5
		Salinity (psu)	0.11	17	0.743	-0.403	
		Ortho-P (μM)	8.37	17	0.010	1.886	
	2	Temperature (°C)	5.77	17	0.028	2.398	-42.2
		Salinity (psu)	0.26	17	0.614	-0.872	
		NP_E	0.05	17	0.825	-0.107	
Carbon (% of DM)	1	Light (μmol photons m ⁻² s ⁻¹)	5.76	15	0.030	0.099	-67.7
		Salinity (psu)	2.39	15	0.143	1.248	
		Ortho-P (μM)	1.46	15	0.245	1.039	
	2	Temperature (°C)	1.61	15	0.224	1.393	-68.3
		Salinity (psu)	0.75	15	0.401	-0.931	
		NP_E	0.05	15	0.827	-0.095	
Nitrogen (% of DM)	1	Light (μmol photons m ⁻² s ⁻¹)	0.39	15	0.544	0.028	-64.2
		Salinity (psu)	3.42	15	0.084	1.099	
		Ortho-P (μM)	4.64	15	0.048	0.722	
	2	Temperature (°C)	7.65	15	0.014	1.02	-69
		Salinity (psu)	1.53	15	0.235	0.836	
		NP_E	0.10	15	0.762	0.057	
Phosphorus (% of DM)	1	Light (μmol photons m ⁻² s ⁻¹)	17.62	16	<0.001	-0.645	-24.7
		Salinity (psu)	0.82	16	0.377	0.637	
		Ortho-P (μM)	0.10	16	0.758	-0.143	
	2	Temperature (°C)	7.65	16	0.014	3.647	-19.4
		Salinity (psu)	3.80	16	0.069	6.138	
		NP_E	2.98	16	0.104	1.345	
Chlorophyll a (mg g DM ⁻¹)	1	Light (μmol photons m ⁻² s ⁻¹)	-5.03	16	<0.001	-0.511	-38.2
		Salinity (psu)	0.56	16	0.580	0.950	

Dependant variable	Model	Predictor	F value	df	P-value	Estimate	AIC
Early spring							
	2	Ortho-P (μM)	0.70	16	0.495	0.762	-28.1
		Temperature ($^{\circ}\text{C}$)	3.69	16	0.073	3.361	
		Salinity (psu)	3.65	16	0.074	4.771	
		NP_E	1.34	16	0.264	0.887	
Fucoxanthin (mg g DM ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	16.63	16	0.001	-0.298	-50.1
		Salinity (psu)	1.37	16	0.259	1.401	
		Ortho-P (μM)	0.41	16	0.531	0.490	
	2	Temperature ($^{\circ}\text{C}$)	3.65	16	0.074	2.211	-44.4
		Salinity (psu)	5.34	16	0.035	3.716	
		NP_E	1.60	16	0.225	0.633	
Violaxanthin (mg g DM ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	10.91	13	0.006	-4.166	-25.5
		Salinity (psu)	14.79	13	0.002	2.219	
		Ortho-P (μM)	0.34	13	0.570	-0.240	
	2	Temperature ($^{\circ}\text{C}$)	2.70	13	0.125	-23.378	-22.9
		Salinity (psu)	4.65	13	0.050	32.616	
		NP_E	0.01	13	0.906	1.445	
β -carotene (mg g DM ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	10.26	15	0.006	-0.480	-22.6
		Salinity (psu)	0.98	15	0.338	1.429	
		Ortho-P (μM)	0.02	15	0.887	-0.108	
	2	Temperature ($^{\circ}\text{C}$)	5.04	15	0.040	3.039	-21.4
		Salinity (psu)	4.39	15	0.054	6.491	
		NP_E	2.86	15	0.111	1.289	
Late spring							
Biomass yield (g m ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	1.76	18	0.201	-3.340	-4.1
		Salinity (psu)	0.82	18	0.378	1.410	
		Ortho-P (μM)	0.88	18	0.360	0.888	
	2	Temperature ($^{\circ}\text{C}$)	0.47	18	0.504	2.156	-6.5
		Salinity (psu)	0.01	18	0.931	-0.650	
		NP_E	0.26	18	0.617	-0.301	
Fronde length (cm)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	0.82	18	0.378	-0.467	23.2
		Salinity (psu)	0.24	18	0.627	-1.525	
		Ortho-P (μM)	0.89	18	0.357	1.770	
	2	Temperature ($^{\circ}\text{C}$)	0.93	18	0.349	5.993	20.6
		Salinity (psu)	0.06	18	0.803	3.699	
		NP_E	0.04	18	0.853	0.220	
Specific Growth Rate (% d ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	0.63	18	0.437	-0.338	16.0
		Salinity (psu)	2.42	18	0.138	4.351	
		Ortho-P (μM)	0.16	18	0.693	-0.690	
	2	Temperature ($^{\circ}\text{C}$)	0.00	18	0.961	-2.760	12.6
		Salinity (psu)	0.41	18	0.532	70.533	
		NP_E	0.31	18	0.584	5.020	
Biofouling (g m ⁻¹)	1	Light ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)	2.80	18	0.112	-0.848	23.3
		Salinity (psu)	4.01	18	0.061	-6.190	
		Ortho-P (μM)	6.21	18	0.023	4.672	
	2	Temperature ($^{\circ}\text{C}$)	4.67	18	0.044	14.030	22.3
		Salinity (psu)	0.02	18	0.893	2.070	
		NP_E	0.03	18	0.855	0.225	