Supplementary material

**Looks can be deceiving: contrasting temperature characteristics of two morphologically similar kelp species co-occurring in the Arctic**

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Supplementary Table S1: Response variable measured over the course of the sporophyte experiment of *Laminaria digitata* and *Hedophyllum nigripes*.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Experimental phase** | | | | | **Recovery phase** |
| **Day** | **0** | **3** | **7** | **11** | **14** | **21** |
| Area | x | x | x | x | x | x |
| Freshweight | x |  |  |  | x | x |
| Dryweight | x |  |  |  | x | x |
| C:N-ratio | x |  |  |  | x | x |
| FV/FM | x | x | x | x | x | x |

**Supplementary Table S2:** Results of two-way ANOVA for standardized growth rates of *Laminaria digitata* and *Hedophyllum nigripes* sporophytes over two weeks in a temperature gradient. (n=5)

|  |  |  |  |
| --- | --- | --- | --- |
| **Effect** | **df** | ***F*** | **p-value** |
| Temperature | 4 | 39.3 | <0.0001 |
| Species | 1 | 1.2 | 0.3 |
| Temperature х Species | 4 | 27.3 | <0.0001 |

**Supplementary Table S3:** Results of multiple Kruskal-Wallis tests on optimal quantum yield over all temperatures in *Laminaria digitata* and *Hedophyllum nigripes* sporophytes. P-values were corrected after Bonferroni. (n=5).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Time (days)** | ***L. digitata*** | | | ***H. nigripes*** | | | | |
| **df** | ***H*** | **p-value** | **df** | ***H*** | | **p-value** | |
| 0 | 8 | 30 | 0.0005 | 6 | 17.7 | | 0.035 | |
| 3 | 8 | 31.5 | 0.0005 | 6 | 21.7 | | 0.005 | |
| 7 | 8 | 39.6 | 0.0005 | 6 | 24.1 | | 0.003 | |
| 11 | 8 | 34.8 | 0.0005 | 6 | | 28.4 | | 0.0005 |
| 14 | 8 | 28.5 | 0.002 | 6 | | 29.6 | | 0.0005 |

**Supplementary Table S4:** Results of Friedman test for optimal quantum yield over time (day 0-14) separated by temperatures for *Laminaria digitata* and *Hedophyllum nigripes* sporophytes. Significance level: 0.05. (n=5).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Temperature (°C)** | ***L. digitata*** | | | | ***H. nigripes*** | | | | |
| **df** | ***χ2*** | **p-value** | | **df** | ***χ2*** | | **p-value** | |
| 0 | 4 | 0.8 | 0.09 | | 4 | | 0.8 | | 0.94 |
| 5 | 4 | 9.6 | | 0.04 | 4 | | 11.4 | | 0.02 |
| 10 | 4 | 12.6 | | 0.01 | 4 | | 17.1 | | 0.002 |
| 15 | 4 | 12.6 | | 0.01 | 4 | | 16.5 | | 0.002 |
| 16 | - | | | | 4 | | 7.3 | | 0.12 |
| 17 |  | - | |  | 4 | | 15.3 | | 0.004 |
| 18 | 4 | 4.7 | | 0.3 | 4 | | 15.2 | | 0.004 |
| 19 | 4 | 6.7 | | 0.2 | *-* | | | | |
| 20 | 4 | 9.4 | | 0.05 | *-* | | | | |
| 21 | 4 | 17.3 | | 0.002 | *-* | | | | |
| 22 | 4 | 18.7 | | 0.001 | - | | | | |

Supplementary Table S5: Results of two separate RM ANOVAs on change of density of gametophytes over temperature and time (days 0, 7 and 14) in *Laminaria digitata* and *Hedophyllum nigripes.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Effect** | ***L. digitata*** | | | | | | | ***H. nigripes*** | | | | | | | | | |
| **df** | | ***F*** | | **p-value** | | | **df** | | | ***F*** | | | | **p-value** | | |
| Temperature | 6 | | 0.4 | | 0.9 | | 5 | | | 1.4 | | | | 0.3 | | |
| Time | 2 | 65.7 | | <0.0001 | | 2 | | | 35.7 | | | <0.0001 | | | |
| Temperature × Time | 12 | 2.6 | | 0.01 | | 10 | | | 1.0 | | | | 0.5 | | |

**Supplementary Table S6:** Results of RM ANOVA on sex ratio of gametophytes in *Hedophyllum nigripes* over temperature (0-19°C) and time (days 7 and 14). Significance level alpha = 0.05.

|  |  |  |  |
| --- | --- | --- | --- |
| **Effect** | **df** | ***F*** | **p-value** |
| Temperature | 5 | 7.4 | 0.0008 |
| Time | 1 | 268.7 | <0.0001 |
| Temperature × Time | 5 | 37.1 | <0.0001 |

**Supplementary Table S7:** Results of a two-way ANOVA for temperature effects (0-15°C) on sporophyte recruitment in *Laminaria digitata* and *Hedophyllum nigripes* gametophytes at day 14. Significance level alpha = 0.01.

|  |  |  |  |
| --- | --- | --- | --- |
| **Factor** | **df** | ***F*** | **p-value** |
| Temperature | 3 | 13.0 | 0.0001 |
| Species | 1 | 4.0 | 0.06 |
| Temperature x Species | 3 | 20.9 | <0.0001 |

Supplementary Figure S1: Acclimation scheme and temperature gradient established for *Laminaria digitata* (A) and *Hedophyllum nigripes* (B) sporophytes from Kongsfjorden, Spitsbergen.

**Supplementary Figure S2:** Acclimation scheme and temperature gradient established for *Laminaria digitata* (A) and *Hedophyllum nigripes* (B) gametophytes from Kongsfjorden, Spitsbergen.

**Supplementary Figure S3:** I-PAM images of *Laminaria digitata* and *Hedophyllum nigripes* sporophytes visualizing effective quantum yield over the whole thallus at day 14 (end of experiment 1) and day 21 (end of post-cultivation at 10°C). Images are not to scale.