Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 1: Relative growth rate in area (RGR_{area}), relative growth rate in biomass ($RGR_{biomass}$), and maximum quantum yield of photosystem II (F_v/F_m) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 µmol photons m^{-2} s^{-1}) for 21 days. Values are presented as mean ± standard deviation (SD; n = 3).

Salinity	Irradiance	Mean RGR_{area} (% day^{-1})	Mean $RGR_{biomass}$ (% day^{-1})	F_v/F_m
SA12	LL	1.45 ± 0.28	3.95 ± 1.95	0.686 ± 0.011
	ML	3.52 ± 1.02	5.96 ± 1.44	0.519 ± 0.030
	HL	3.10 ± 0.23	4.56 ± 0.69	0.679 ± 0.028
SA21	LL	2.20 ± 0.73	4.30 ± 2.01	0.677 ± 0.052
	ML	5.35 ± 0.37	6.19 ± 0.57	0.576 ± 0.077
	HL	6.68 ± 0.64	6.81 ± 1.37	0.696 ± 0.019
SA30	LL	4.35 ± 0.33	4.51 ± 1.56	0.731 ± 0.024
	ML	7.72 ± 1.13	6.69 ± 0.82	0.661 ± 0.021
	HL	7.70 ± 0.74	8.95 ± 1.81	0.690 ± 0.006

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 2: Two-way ANOVA results and Tukey's post hoc comparisons for the area-based relative growth rate (RGR_{area}) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 μmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Condition	Effect / comparison	Estimated difference	df	*F*	*p*
ANOVA	N/A	Salinity (SA)	N/A	2	73.31	**< 0.001**
ANOVA	N/A	Irradiance (I)	N/A	2	58.75	**< 0.001**
ANOVA	N/A	SA × I	N/A	4	3.58	**0.0256**
ANOVA	N/A	Residuals	N/A	18	N/A	N/A
Tukey: irradiance effect within each salinity level	SA12	LL vs. ML	-2.07	N/A	N/A	**0.0043**
	SA12	LL vs. HL	-1.65	N/A	N/A	**0.0216**
	SA12	ML vs. HL	0.42	N/A	N/A	0.7342
	SA21	LL vs. ML	-3.16	N/A	N/A	**< 0.001**
	SA21	LL vs. HL	-4.48	N/A	N/A	**< 0.001**
	SA21	ML vs. HL	-1.33	N/A	N/A	0.0703
	SA30	LL vs. ML	-3.37	N/A	N/A	**< 0.001**
	SA30	LL vs. HL	-3.35	N/A	N/A	**< 0.001**
	SA30	ML vs. HL	0.02	N/A	N/A	0.9992
Tukey: salinity effect within each irradiance level	LL	SA12 vs. SA21	-0.75	N/A	N/A	0.3911
	LL	SA12 vs. SA30	-2.9	N/A	N/A	**< 0.001**
	LL	SA21 vs. SA30	-2.15	N/A	N/A	**0.0031**
	ML	SA12 vs. SA21	-1.83	N/A	N/A	**0.0110**
	ML	SA12 vs. SA30	-4.2	N/A	N/A	**< 0.001**
	ML	SA21 vs. SA30	-2.37	N/A	N/A	**< 0.001**
	HL	SA12 vs. SA21	-3.58	N/A	N/A	**< 0.001**
	HL	SA12 vs. SA30	-4.6	N/A	N/A	**< 0.001**
	HL	SA21 vs. SA30	-1.02	N/A	N/A	0.1895

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera (Phaeophyceae)*
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 3. Two-way ANOVA results and Tukey's post hoc comparisons for the biomass-based relative growth rate ($RGR_{biomass}$) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 μmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Condition	Effect / comparison	Estimated difference	df	*F*	*p*
ANOVA	N/A	Salinity (S)	N/A	2	3.82	**0.0413**
ANOVA	N/A	Irradiance (I)	N/A	2	7.63	**0.0040**
ANOVA	N/A	S × I	N/A	4	1.67	0.2004
ANOVA	N/A	Residuals	N/A	18	N/A	N/A
Tukey: salinity effect (main effect)	N/A	SA12 vs. SA21	-0.94	N/A	N/A	0.3739
	N/A	SA12 vs. SA30	-1.89	N/A	N/A	**0.0325**
	N/A	SA21 vs. SA30	-0.95	N/A	N/A	0.3668
Tukey: irradiance effect (main effect)	N/A	LL vs. ML	-2.03	N/A	N/A	**0.0215**
	N/A	LL vs. HL	-2.52	N/A	N/A	**0.0046**
	N/A	ML vs. HL	-0.49	N/A	N/A	0.7542
Tukey: irradiance effect within each salinity level	SA12	LL vs. ML	-2.02	N/A	N/A	0.2322
	SA12	LL vs. HL	-0.61	N/A	N/A	0.8636
	SA12	ML vs. HL	1.4	N/A	N/A	0.4784
	SA21	LL vs. ML	-1.9	N/A	N/A	0.2707
	SA21	LL vs. HL	-2.52	N/A	N/A	0.1132
	SA21	ML vs. HL	-0.62	N/A	N/A	0.8619
	SA30	LL vs. ML	-2.17	N/A	N/A	0.1873
	SA30	LL vs. HL	-4.44	N/A	N/A	**0.0040**
	SA30	ML vs. HL	-2.26	N/A	N/A	0.1645

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 4. Two-way ANOVA results and Tukey's post hoc comparisons for the maximum quantum yield of photosystem II (F_v/F_m) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 µmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Condition	Effect / comparison	Estimated difference	df	*F*	*p*
ANOVA	N/A	Salinity (SA)	N/A	2	7.73	**0.0038**
ANOVA	N/A	Irradiance (I)	N/A	2	26.60	**< 0.001**
ANOVA	N/A	SA × I	N/A	4	2.97	**0.0477**
ANOVA	N/A	Residuals	N/A	18	N/A	N/A
Tukey: irradiance effect within each salinity level	SA12	LL vs. ML	0.17	N/A	N/A	**< 0.001**
	SA12	LL vs. HL	0.01	N/A	N/A	0.9698
	SA12	ML vs. HL	-0.16	N/A	N/A	**< 0.001**
	SA21	LL vs. ML	0.10	N/A	N/A	**0.0082**
	SA21	LL vs. HL	-0.02	N/A	N/A	0.7997
	SA21	ML vs. HL	-0.12	N/A	N/A	**0.0020**
	SA30	LL vs. ML	0.07	N/A	N/A	0.0741
	SA30	LL vs. HL	0.04	N/A	N/A	0.3759
	SA30	ML vs. HL	-0.03	N/A	N/A	0.5994
Tukey: salinity effect within each irradiance level	LL	SA12 vs. SA21	0.01	N/A	N/A	0.9575
	LL	SA12 vs. SA30	-0.05	N/A	N/A	0.3062
	LL	SA21 vs. SA30	-0.05	N/A	N/A	0.1981
	ML	SA12 vs. SA21	-0.06	N/A	N/A	0.1610
	ML	SA12 vs. SA30	-0.14	N/A	N/A	**< 0.001**
	ML	SA21 vs. SA30	-0.09	N/A	N/A	**0.0264**
	HL	SA12 vs. SA21	-0.02	N/A	N/A	0.8240
	HL	SA12 vs. SA30	-0.01	N/A	N/A	0.9229
	HL	SA21 vs. SA30	0.01	N/A	N/A	0.9752

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 5: Two-way ANOVA results and Tukey's post hoc comparisons for the maximum relative electron transport rate ($rETR_{max}$) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 µmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Condition	Effect / comparison	Estimated difference	df	F	p
ANOVA	N/A	Salinity (SA)	N/A	2	2.76	0.0898
ANOVA	N/A	Irradiance (I)	N/A	2	14.31	**<0.001**
ANOVA	N/A	SA × I	N/A	4	3.85	**0.0198**
ANOVA	N/A	Residuals	N/A	18	N/A	N/A
Tukey: irradiance effect within each salinity level	SA12	LL vs. ML	17.49	N/A	N/A	**0.0048**
	SA12	LL vs. HL	2.27	N/A	N/A	0.9994
	SA12	ML vs. HL	-15.23	N/A	N/A	**0.0167**
	SA21	LL vs. ML	0.79	N/A	N/A	1.0000
	SA21	LL vs. HL	-12.49	N/A	N/A	0.0709
	SA21	ML vs. HL	-13.27	N/A	N/A	**0.0473**
	SA30	LL vs. ML	5.06	N/A	N/A	0.9038
	SA30	LL vs. HL	-0.49	N/A	N/A	1.0000
	SA30	ML vs. HL	-5.55	N/A	N/A	0.8521
Tukey: salinity effect within each irradiance level	LL	SA12 vs. SA21	14.17	N/A	N/A	**0.0294**
	LL	SA12 vs. SA30	3.86	N/A	N/A	0.9777
	LL	SA21 vs. SA30	-10.31	N/A	N/A	0.1997
	ML	SA12 vs. SA21	-2.53	N/A	N/A	0.9986
	ML	SA12 vs. SA30	-8.58	N/A	N/A	0.3997
	ML	SA21 vs. SA30	-6.05	N/A	N/A	0.7883
	HL	SA12 vs. SA21	-0.58	N/A	N/A	1.0000
	HL	SA12 vs. SA30	1.1	N/A	N/A	1.0000
	HL	SA21 vs. SA30	1.68	N/A	N/A	0.9999

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 6: Two-way ANOVA results and Tukey's post hoc comparisons for the initial slope of the rapid light curve (α) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 μmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Effect / comparison	Estimated difference	df	F	p
ANOVA	Salinity (SA)	N/A	2	0.72	0.4999
ANOVA	Irradiance (I)	N/A	2	19.74	**< 0.001**
ANOVA	SA × I	N/A	4	1.64	0.2078
ANOVA	Residuals	N/A	18	N/A	N/A
Tukey: salinity effect (main effect)	SA12 vs. SA21	0.01	N/A	N/A	0.9178
	SA12 vs. SA30	0.01	N/A	N/A	0.4801
	SA21 vs. SA30	0.01	N/A	N/A	0.7174
Tukey: irradiance effect (main effect)	LL vs. ML	0.05	N/A	N/A	**<0.001**
	LL vs. HL	-0.01	N/A	N/A	0.9818
	ML vs. HL	-0.06	N/A	N/A	**<0.001**

Journal: Journal of Applied Phycology
Article title: Early life stages for juvenile sporophytes of a sub-Antarctic giant kelp under glacier-retreat associated changes: interactive effects of salinity and irradiance in *Macrocystis pyrifera* (Phaeophyceae)
Authors: Camila Gómez-Mardones, Johanna Marambio, Juan Pablo Olivos, Francisco Bahamonde, Juan Pablo Rodríguez, Andrés Mansilla
Corresponding author: Juan Pablo Olivos (juolivos@umagallanes.cl)

Online Resource 7: Two-way ANOVA results and Tukey's post hoc comparisons for the light saturation point (E_k; µmol photons m^{-2} s^{-1}) of juvenile *M. pyrifera* sporophytes exposed to three salinity levels (SA12, SA21, and SA30, corresponding to 12, 21, and 30 g kg^{-1}, respectively) and three irradiance levels (LL = 5, ML = 10, and HL = 17 µmol photons m^{-2} s^{-1}). P-values for multiple comparisons were adjusted using Tukey's method. The estimated difference corresponds to the first level indicated in each comparison minus the second. Statistically significant differences ($p < 0.05$) are shown in bold. N/A = not applicable.

Analysis type	Condition	Effect / comparison	Estimated difference	df	F	p
ANOVA	N/A	Salinity (SA)	N/A	2	2.69	0.0950
ANOVA	N/A	Irradiance (I)	N/A	2	3.75	**0.0434**
ANOVA	N/A	SA × I	N/A	4	2.96	**0.0485**
ANOVA	N/A	Residuals	N/A	18	N/A	N/A
Tukey: irradiance effect within each salinity level	SA12	LL vs. ML	55.01	N/A	N/A	0.1725
	SA12	LL vs. HL	9.59	N/A	N/A	0.9999
	SA12	ML vs. HL	-45.42	N/A	N/A	0.3706
	SA21	LL vs. ML	-10.59	N/A	N/A	0.9997
	SA21	LL vs. HL	-55.29	N/A	N/A	0.1682
	SA21	ML vs. HL	-44.7	N/A	N/A	0.3899
	SA30	LL vs. ML	17.21	N/A	N/A	0.9910
	SA30	LL vs. HL	17.16	N/A	N/A	0.9912
	SA30	ML vs. HL	-0.05	N/A	N/A	1.0000
Tukey: salinity effect within each irradiance level	LL	SA12 vs. SA21	56.01	N/A	N/A	0.1578
	LL	SA12 vs. SA30	-3.41	N/A	N/A	1.0000
	LL	SA21 vs. SA30	-59.42	N/A	N/A	0.1157
	ML	SA12 vs. SA21	-9.59	N/A	N/A	0.9999
	ML	SA12 vs. SA30	-41.21	N/A	N/A	0.4897
	ML	SA21 vs. SA30	-31.62	N/A	N/A	0.7786
	HL	SA12 vs. SA21	-8.86	N/A	N/A	0.9999
	HL	SA12 vs. SA30	4.17	N/A	N/A	1.0000
	HL	SA21 vs. SA30	13.03	N/A	N/A	0.9986