

## Water relations and photosystem II efficiency of the intertidal macroalga *Fucus virsoides*

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### Supplementary Material

**Figure S1.** Sampling site of Marina Julia (NE Adriatic Sea) during a typical prolonged emersion period on February 21<sup>st</sup> 2024, when sampling for *in situ* water potential was performed.

**Table S1.** Trials for sample rehydration for PV curve analysis.

**Figure S2.** Median values and 25<sup>th</sup> and 75<sup>th</sup> percentiles of osmotic potential at full turgor ( $\pi_0$ , a), water potential at turgor loss point ( $\Psi_{tlp}$ , b), modulus of elasticity of cell walls ( $\epsilon$ , c), water content at turgor loss point ( $RWC_{tlp}$ , d) and capacitance ( $C$ , e) as extrapolated of *Fucus virsoides* individuals according to sampling dates. Different letters indicate statistically significant differences among sampling dates (Two-way ANOVA,  $p$ ).

**Table S2.** Results of statistical analyses of the water relation parameters.

**Table S3.** Mean  $\pm$  SD of osmotic potential at full turgor ( $\pi_0$ ), water potential at turgor loss point ( $\Psi_{tlp}$ ), modulus of elasticity of cell walls ( $\epsilon$ ), water content at turgor loss point ( $RWC_{tlp}$ ) and capacitance ( $C$ ) obtained through the elaboration of PV-curves measured in individuals of *Fucus virsoides* according to sampling dates ( $p < 0.05$ ).

**Table S4.** Results of Tuckey's HSD post hoc tests.

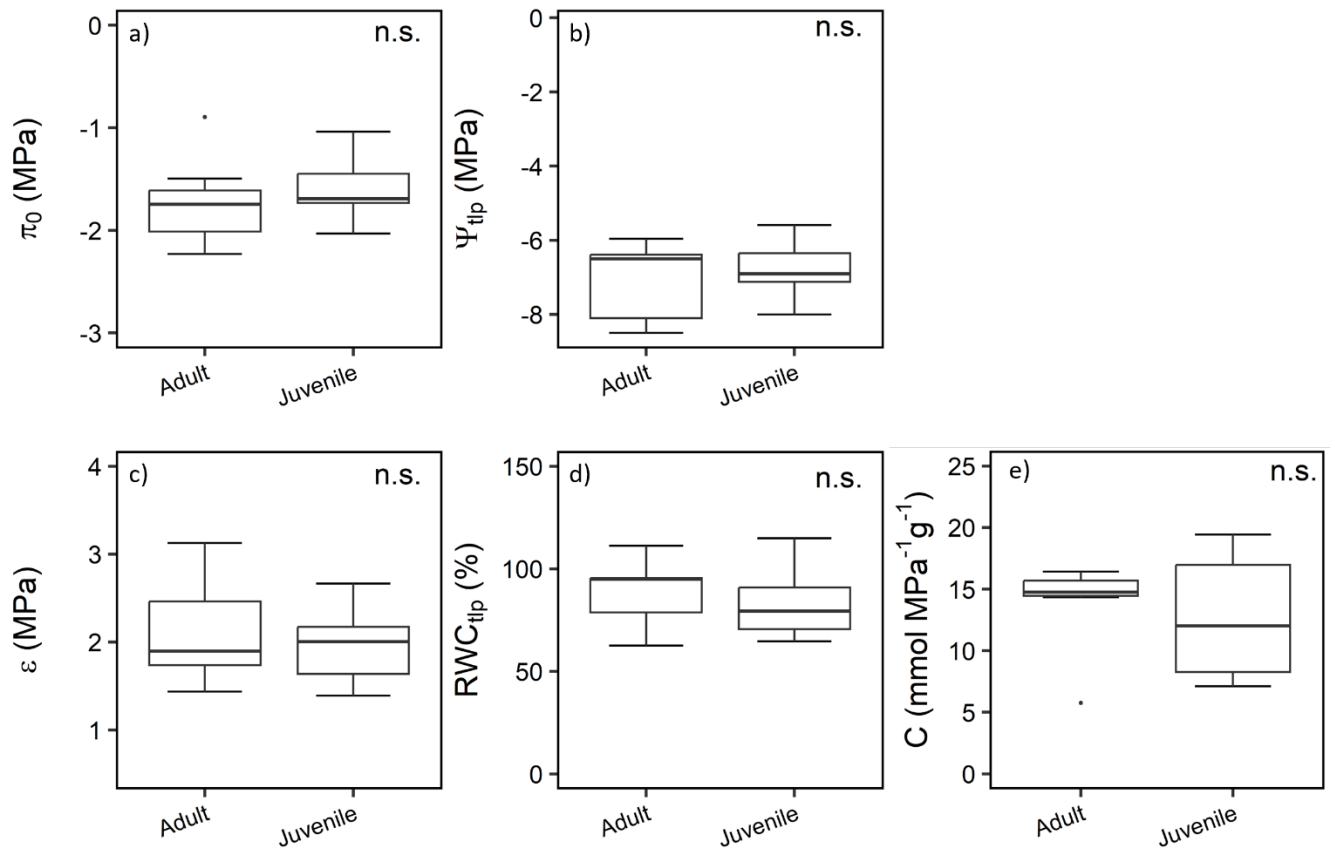
**Table S5.** Results of statistical analyses of the relationship of  $F_v/F_m$ , between life stages.



**Figure S1.** Sampling site of Marina Julia (NE Adriatic Sea) during a typical prolonged emersion period on February 21<sup>st</sup> 2024, when sampling for *in situ* water potential was performed.

**Table S1.** Trials for sample rehydration for P-V curve analysis.

Method	Storage duration, hours	$\Psi$ , – MPa	Fv/Fm
Sample suspended on a grid in a falcon tube filled with de-ionized water	1	1.76	
	2	1.57	
	24	1.97	
Sample in a falcon tube containing tissue paper soaked with de-ionized water	2	$1.11 \pm 0.37$	
	3	1.65	
	4	1.3	
	12	1.57	
	13	1.33	
	18	1.06	0.76
	24	$1.08 \pm 0.44$	0.77
	36	$0.29 \pm 0.18$	$0.75 \pm 0.03$
Sample kept in seawater in fridge for 24 hours, then put in a falcon tube containing tissue paper soaked with de-ionized water	1	1.03	
	2	0.74	
	3	0.73	
Sample kept in seawater in fridge for 10 days, then put in a falcon tube containing tissue paper soaked with de-ionized water	36	0.52	0.77



**Figure S2.** Median values and 25<sup>th</sup> and 75<sup>th</sup> percentiles of osmotic potential at full turgor ( $\pi_0$ , a), water potential at turgor loss point ( $\Psi_{tlp}$ , b), modulus of elasticity of cell walls ( $\epsilon$ , c), relative water content at turgor loss point ( $RWC_{tlp}$ , d) and capacitance at full turgor ( $C$ , e) as extrapolated of *Fucus virsoides* individuals according to sampling dates. Different letters indicate statistically significant differences among sampling dates (Two-way ANOVA,  $p$ ).

**Table S2.** Results of statistical analyses of the water relation parameters.

Response variable	Statistics	Tested factor			
	Wilcoxon signed-rank test	Life stages		W	p-values
$\pi_0$				16.0	0.32
$\Psi_{tlp}$				20.5	0.65
$\varepsilon$				27.0	0.81
$RWC_{tlp}$				28.0	0.71
C				27.0	0.81
	Two-way ANOVA	Sampling dates	SS	F	p-values
$\pi_0$			0.46	1.84	0.20
$\Psi_{tlp}$			5.05	4.78	p < 0.05
$\varepsilon$			2.15	7.39	p < 0.01
$RWC_{tlp}$			2435.4	13.01	p < 0.01
C			158.32	10.30	p < 0.01

Tuckey's HSD post hoc test: Water relation parameters \* Sampling dates

**Table S3.** Mean  $\pm$  SD of osmotic potential at full turgor ( $\pi_0$ ), water potential at turgor loss point ( $\Psi_{tlp}$ ), modulus of elasticity of cell walls ( $\epsilon$ ), relative water content at turgor loss point ( $RWC_{tlp}$ ) and capacitance ( $C$ ) obtained through the elaboration of PV-curves measured in individuals of *Fucus virsoides* according to sampling dates ( $p < 0.05$ ).

	n	$\pi_0$ , MPa	$\Psi_{tlp}$ , MPa	$\epsilon$ , MPa	$RWC_{tlp}$ , %	$C$ , mmol MPa <sup>-1</sup> g <sup>-1</sup>
1 <sup>st</sup> sampling: 13.03.2023	4	-1.87 $\pm$ 0.17	-7.41 $\pm$ 0.86	1.79 $\pm$ 0.35	84.10 $\pm$ 22.04	14.12 $\pm$ 1.49
2 <sup>nd</sup> sampling: 20.03.2023	5	-1.43 $\pm$ 0.47	-6.15 $\pm$ 0.37	1.72 $\pm$ 0.26	77.52 $\pm$ 12.96	16.91 $\pm$ 1.97
3 <sup>rd</sup> sampling: 13.04.2023	5	-1.72 $\pm$ 0.32	-7.40 $\pm$ 0.87	2.56 $\pm$ 0.49	95.06 $\pm$ 11.76	9.05 $\pm$ 3.95

**Table S4.** Results of Tuckey's HSD post hoc tests.

Water relation parameters	Contrast	Estimate	Std. Error	t-ratio	p-value
$\Psi_{tlp}$	1 <sup>st</sup> vs. 2 <sup>nd</sup> sampling	-1.26	0.49	-2.58	0.06
$\Psi_{tlp}$	1 <sup>st</sup> vs. 3 <sup>rd</sup> sampling	-0.01	0.49	-0.02	0.10
$\Psi_{tlp}$	2 <sup>nd</sup> vs. 3 <sup>rd</sup> sampling	-1.25	0.46	-2.72	P < 0.05
$\varepsilon$	1 <sup>st</sup> vs. 2 <sup>nd</sup> sampling	0.07	0.26	0.28	0.96
$\varepsilon$	1 <sup>st</sup> vs. 3 <sup>rd</sup> sampling	-0.78	0.26	-3.03	P < 0.05
$\varepsilon$	2 <sup>nd</sup> vs. 3 <sup>rd</sup> sampling	0.85	0.24	3.51	P < 0.05
$RWC_{tlp}$	1 <sup>st</sup> vs. 2 <sup>nd</sup> sampling	-13.9	6.49	-2.14	0.13
$RWC_{tlp}$	1 <sup>st</sup> vs. 3 <sup>rd</sup> sampling	17.3	6.49	2.65	0.05
$RWC_{tlp}$	2 <sup>nd</sup> vs. 3 <sup>rd</sup> sampling	-31.2	6.12	-5.09	P < 0.001
$C$	1 <sup>st</sup> vs. 2 <sup>nd</sup> sampling	-2.79	1.86	-1.498	0.33
$C$	1 <sup>st</sup> vs. 3 <sup>rd</sup> sampling	5.08	1.86	2.730	P < 0.05
$C$	2 <sup>nd</sup> vs. 3 <sup>rd</sup> sampling	-7.86	1.75	-4.484	P < 0.01

**Table S5.** Results of statistical analyses of the relationship of  $F_v/F_m$  between life stages

Parameters	Adult	Juvenile	Comparison of parameter	Total
	Estimate $\pm$ std. error	Estimate $\pm$ std. error	p-value	Estimate $\pm$ std. error
Relationship between $F_v/F_m$ and $\Psi$ ; non-linear exponential decay model				
Asymptote	$0.81 \pm 0.02$	$0.80 \pm 0.02$	0.60	$0.81 \pm 0.01$
Rate Constant (k)	$-0.05 \pm 0.01$	$-0.04 \pm 0.01$	0.09	$-0.04 \pm 0.01$
Relationship between $F_v/F_m$ and WL; three-parameter log-logistic model				
e: ED50	$66.67 \pm 1.82$	$62.50 \pm 1.31$	0.055	$64.99 \pm 1.21$
d: Upper Limit	$0.77 \pm 0.03$	$0.75 \pm 0.02$	0.55	$0.76 \pm 0.02$
b: Steepness of the curve	$5.17 \pm 0.85$	$7.88 \pm 1.58$	0.19	$5.82 \pm 0.76$