
Supplementary information

Vulnerability of amphibians to global warming

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Vulnerability of amphibians to global warming

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25 **Table of contents**

26

27 **Supplementary Tables.....3**

28 Table S1 3

29 Table S2 4

30 Table S3 5

31 Table S4 6

32 Table S5 7

33

34

35 **Supplementary tables**

36 **Table S1 | Statistical model estimates for thermal safety margins calculated for local species**
 37 **occurrences and assemblages** Model estimates for each microhabitat (terrestrial, arboreal, aquatic)
 38 and each climatic scenario (current, +2°C, or +4°C of global warming above pre-industrial levels) are
 39 depicted. No contrast structure was used in the presented models. mean: mean model estimate; CI.lb:
 40 lower bound of the 95% confidence interval; CI.ub: upper bound of the 95% confidence interval; p:
 41 p-value; k_{sp} : number of species; k_{obs} : number of observations; Var_{sp} : variance explained by differences
 42 between species; Var_{phy} : variance explained by shared evolutionary history; Var_{obs} : residual variance.

<i>Local species patterns in thermal safety margin</i>									
	mean	CI.lb	CI.ub	p	k_{sp}	k_{obs}	Var_{sp}	Var_{phy}	Var_{obs}
Terrestrial (current)	11.694	8.856	14.428	<0.001	5177	203853			
Terrestrial (+2°C)	10.914	8.025	13.594	<0.001	5177	203853			
Terrestrial (+4°C)	9.409	6.530	12.090	<0.001	5177	203853			
Arboreal (current)	12.235	9.402	14.960	<0.001	1771	56210			
Arboreal (+2°C)	11.517	8.660	14.236	<0.001	1771	56210	1.295	11.960	1.828
Arboreal (+4°C)	10.073	7.229	12.797	<0.001	1771	56210			
Aquatic (current)	13.598	10.708	16.276	<0.001	5203	204808			
Aquatic (+2°C)	12.827	8.796	14.361	<0.001	5203	204808			
Aquatic (+4°C)	11.682	8.796	14.361	<0.001	5203	204808			
<i>Assemblage-level patterns in thermal safety margin</i>									
	mean	CI.lb	CI.ub	p		k_{obs}			Var_{obs}
Terrestrial (current)	15.279	15.208	15.330	<0.001		14090			
Terrestrial (+2°C)	14.328	14.279	14.396	<0.001		14090			
Terrestrial (+4°C)	12.602	12.542	12.657	<0.001		14090			
Arboreal (current)	14.279	14.191	14.381	<0.001		6614			11.06
Arboreal (+2°C)	13.393	13.298	13.478	<0.001		6614			
Arboreal (+4°C)	11.746	11.666	11.830	<0.001		6614			
Aquatic (current)	17.408	17.352	17.471	<0.001		14091			
Aquatic (+2°C)	16.528	16.468	16.581	<0.001		14091			
Aquatic (+4°C)	15.287	15.225	15.346	<0.001		14091			

43

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Table S2 | Statistical model estimates for overheating risk and the number of overheating events.

Model estimates for each microhabitat (terrestrial, arboreal) and each climatic scenario (current, +2°C, or +4°C of global warming above pre-industrial levels) are depicted. The estimated number of overheating events in species predicted to experience at least one overheating event (i.e., overheating species) are also depicted. Model estimates for aquatic microhabitats are not displayed because no species was predicted to experience overheating events in this microhabitat. No contrast structure was used in the presented models. mean: mean model estimate; CI.lb: lower bound of the 95% confidence interval; CI.ub: upper bound of the 95% confidence interval; p: p-value; k_{sp} : number of genera; k_{sp} : number of species; k_{obs} : number of observations; Var_{genus} : variance explained by differences between genera; Var_{sp} : variance explained by differences between species; Var_{obs} : residual variance.

<i>Overheating risk</i>										
	mean	CI.lb	CI.ub	p	k_{genus}	k_{sp}	k_{obs}	Var_{genus}	Var_{sp}	
Terrestrial (current)	9.98×10^{-7}	5.60×10^{-7}	1.78×10^{-6}	<0.001	464	5177	203853			
Terrestrial (+2°C)	1.93×10^{-6}	1.09×10^{-6}	3.43×10^{-6}	<0.001	464	5177	203853			
Terrestrial (+4°C)	9.09×10^{-6}	5.13×10^{-6}	1.61×10^{-5}	<0.001	464	5177	203853			
Arboreal (current)	4.77×10^{-7}	2.58×10^{-7}	8.80×10^{-7}	<0.001	174	1771	56210	0.306	69.653	
Arboreal (+2°C)	9.78×10^{-7}	5.45×10^{-7}	1.75×10^{-6}	<0.001	174	1771	56210			
Arboreal (+4°C)	3.72×10^{-6}	2.08×10^{-6}	6.67×10^{-6}	<0.001	174	1771	56210			
<i>Number of overheating events (all species)</i>										
	mean	CI.lb	CI.ub	p	k_{genus}	k_{sp}	k_{obs}	Var_{genus}	Var_{sp}	
Terrestrial (current)	0.014	0.001	0.080	<0.001	464	5177	203853			
Terrestrial (+2°C)	0.025	0.002	0.127	<0.001	464	5177	203853			
Terrestrial (+4°C)	0.153	0.046	0.460	<0.001	464	5177	203853			
Arboreal (current)	0.008	0.001	0.043	<0.001	174	1771	56210	0.110	52.500	
Arboreal (+2°C)	0.015	0.001	0.083	<0.001	174	1771	56210			
Arboreal (+4°C)	0.076	0.012	0.230	<0.001	174	1771	56210			
<i>Number of overheating events (among overheating species)</i>										
	mean	CI.lb	CI.ub	p	k_{genus}	k_{sp}	k_{obs}	Var_{genus}	Var_{sp}	Var_{obs}
Terrestrial (current)	2.155	0.239	5.264	<0.001	38	104	836			
Terrestrial (+2°C)	2.576	0.410	5.857	<0.001	61	168	1424			
Terrestrial (+4°C)	6.747	3.136	11.385	<0.001	118	391	4248			
Arboreal (current)	1.621	0.026	4.429	<0.001	4	13	152	0.253	0.187	0.310
Arboreal (+2°C)	1.956	0.113	4.973	<0.001	5	16	283			
Arboreal (+4°C)	5.084	1.806	9.387	<0.001	17	56	748			

56

Table S3 | Statistical model estimates for the number of species predicted to experience overheating events. Model estimates for each microhabitat (terrestrial, arboreal) and each climatic scenario (current, +2°C, or +4°C of global warming above pre-industrial levels) are depicted. The estimated number of species overheating in assemblages containing at least one species predicted to experience at least one overheating event (i.e., overheating assemblages) are also depicted. Model estimates for aquatic microhabitats are not displayed because no species was predicted to experience overheating events in this microhabitat. No contrast structure was used in the presented models. mean: mean model estimate; CI.lb: lower bound of the 95% confidence interval; CI.ub: upper bound of the 95% confidence interval; p: p-value; k_{obs} : number of observations; Var_{obs} : residual variance.

	Number of species overheating (all assemblages)					
	mean	CI.lb	CI.ub	P	k _{obs}	Var _{obs}
Terrestrial (current)	0.056	0.016	0.118	<0.001	14090	55.47
Terrestrial (+2°C)	0.096	0.029	0.199	<0.001	14090	
Terrestrial (+4°C)	0.288	0.083	0.604	<0.001	14090	
Arboreal (current)	0.021	0.002	0.054	<0.001	6614	
Arboreal (+2°C)	0.040	0.006	0.094	<0.001	6614	
Arboreal (+4°C)	0.107	0.021	0.243	<0.001	6614	
	Number of species overheating (among overheating assemblages)					
	mean	CI.lb	CI.ub	P	k _{obs}	Var _{obs}
Terrestrial (current)	3.185	0.601	6.883	<0.001	253	0.601
Terrestrial (+2°C)	3.228	0.678	6.810	<0.001	426	
Terrestrial (+4°C)	3.084	0.617	6.557	<0.001	1328	
Arboreal (current)	1.930	0.054	5.054	<0.001	74	
Arboreal (+2°C)	2.445	0.189	5.649	<0.001	111	
Arboreal (+4°C)	2.509	0.312	5.692	<0.001	285	

Table S4 | Statistical model estimates for the proportion of species predicted to experience overheating events. Model estimates for each microhabitat (terrestrial, arboreal) and each climatic scenario (current, +2°C, or +4°C of global warming above pre-industrial levels) are depicted. The estimated proportion of species overheating in assemblages containing at least one species predicted to experience at least one overheating event (i.e., overheating assemblages) are also depicted. Model estimates for aquatic microhabitats are not displayed because no species was predicted to experience overheating events in this microhabitat. No contrast structure was used in the presented models. mean: mean model estimate; CI.lb: lower bound of the 95% confidence interval; CI.ub: upper bound of the 95% confidence interval; p: p-value; k_{obs} : number of observations; Var_{obs} : residual variance.

	<i>Proportion of species overheating (all assemblages)</i>					
	mean	CI.lb	CI.ub	P	k _{obs}	Var _{obs}
Terrestrial (current)	1.22 x 10 ⁻⁵	8.96 x 10 ⁻⁶	1.66 x 10 ⁻⁵	<0.001	14090	42.26
Terrestrial (+2°C)	2.09 x 10 ⁻⁵	1.60 x 10 ⁻⁵	2.72 x 10 ⁻⁵	<0.001	14090	
Terrestrial (+4°C)	8.13 x 10 ⁻⁵	6.60 x 10 ⁻⁵	1.00 x 10 ⁻⁴	<0.001	14090	
Arboreal (current)	1.19 x 10 ⁻⁵	7.07 x 10 ⁻⁶	2.02 x 10 ⁻⁵	<0.001	6614	
Arboreal (+2°C)	1.86 x 10 ⁻⁵	1.19 x 10 ⁻⁵	2.89 x 10 ⁻⁵	<0.001	6614	
Arboreal (+4°C)	4.99 x 10 ⁻⁵	3.62 x 10 ⁻⁵	6.87 x 10 ⁻⁵	<0.001	6614	
	<i>Proportion of species overheating (among overheating assemblages)</i>					
	mean	CI.lb	CI.ub	P	k _{obs}	Var _{obs}
Terrestrial (current)	0.053	0.046	0.061	<0.001	253	1.019
Terrestrial (+2°C)	0.058	0.052	0.065	<0.001	426	
Terrestrial (+4°C)	0.094	0.088	0.100	<0.001	1328	
Arboreal (current)	0.038	0.029	0.050	<0.001	74	
Arboreal (+2°C)	0.054	0.043	0.067	<0.001	111	
Arboreal (+4°C)	0.061	0.053	0.070	<0.001	285	

Table S5 | Statistical model estimates for the association between the number of overheating events and thermal safety margins. Model estimates for each microhabitat (terrestrial, arboreal) and each climatic scenario (current, +2°C, or +4°C of global warming above pre-industrial levels) are depicted. Model estimates for aquatic microhabitats are not displayed because no species was predicted to experience overheating events in this microhabitat. All model estimates are on the log scale. Separate models were fitted for each microhabitat and climatic scenario. mean: mean model estimate; se: standard error; p: p-value; k_{sp} : number of genera; k_{sp} : number of species; k_{obs} : number of observations; Var_{genus} : variance explained by differences between genera; Var_{sp} : variance explained by differences between species; Var_{obs} : residual variance.

	mean	se	p	k_{genus}	k_{sp}	k_{obs}	Var_{genus}	Var_{sp}	Var_{obs}
<i>Terrestrial (current)</i>									
Intercept	3.723	0.390	<0.001	464	5177	203853	5.850	3.346	0.116
Slope (TSM)	-1.201	0.031	<0.001						
<i>Terrestrial (+2°C)</i>									
Intercept	6.318	0.310	<0.001	464	5177	203853	5.272	2.380	0.078
Slope (TSM)	-1.452	0.027	<0.001						
<i>Terrestrial (+4°C)</i>									
Intercept	7.611	0.171	<0.001	464	5177	203853	2.954	1.025	0.248
Slope (TSM)	-1.616	0.015	<0.001						
<i>Arboreal (current)</i>									
Intercept	4.929	1.091	<0.001	174	1771	56210	0.001	15.190	0.001
Slope (TSM)	-1.511	0.094	<0.001						
<i>Arboreal (+2°C)</i>									
Intercept	7.836	0.836	<0.001	174	1771	56210	4.359	2.358	0.001
Slope (TSM)	-1.739	0.080	<0.001						
<i>Arboreal (+4°C)</i>									
Intercept	10.093	0.587	<0.001	174	1771	56210	8.789	0.917	0.001
Slope (TSM)	-2.085	0.039	<0.001						