

1 **Supplementary material for:**

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3 **Proximate effects of temperature versus evolved intrinsic constraints for embryonic**
4 **development times among temperate and tropical songbirds.**

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8 Table S1. Average incubation temperatures are shown for treatment and control nests of each
 9 species as measured by our artificial egg.
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Site	Common Name	Scientific Name	Control Temperature C	Treatment Temperature C
Malaysia	Bornean Stubtail	<i>Urosphena whiteadi</i>	31.54	33.57
Malaysia	Mountain Wren- babbler	<i>Napothera crassa</i>	29.58	31.96
Malaysia	Chestnut-crested Yuhina	<i>Yuhina everetti</i>	34.57	36.23
Arizona	Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	35.96	37.19
Arizona	Grey-headed Junco	<i>Junco hyemalis</i>	35.88	36.97
Arizona	House Wren	<i>Troglodytes aedon</i>	35.04	36.38
Arizona	Mountain Chickadee	<i>Poecile gambeli</i>	35.14	36.06
Arizona	Red-faced Warbler	<i>Cardellina rubifrons</i>	35.08	36.2
Arizona	Western Bluebird	<i>Sialia mexicana</i>	35.42	36.43

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13 Table S2. Summary output of individual tropical (blue) and north temperate (red) species tested
 14 for differences between treatment and control nests in egg mass loss (g) and mass-specific
 15 metabolic rate (mL O₂ h⁻¹) using ANOVA with a random factor of year. Significant and
 16 marginally significant differences are denoted with (*) and (') respectively
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Species	Dependent variable	F value	P value
Bornean Stubtail	Egg mass	0.612	0.515
	Mass-specific metabolic rate	0.910	0.440
Mountain Wren-babbler	Egg mass	2.393	0.261
	Mass-specific metabolic rate	4.26	0.090'
Chestnut-crested Yuhina	Egg mass	0.0005	0.983
	Mass-specific metabolic rate	0.676	0.471
Cordilleran Flycatcher	Egg mass	0.730	0.440
	Mass-specific metabolic rate	9.102	0.037*
Grey-headed Junco	Egg mass	0.520	0.545
	Mass-specific metabolic rate	0.929	0.407
House Wren	Egg mass	7.458	0.034*
	Mass-specific metabolic rate	1.016	0.352
Mountain Chickadee	Egg mass	0.023	0.888
	Mass-specific metabolic rate	79.65	0.012 *
Red-faced Warbler	Egg mass	4.666	0.083'
	Mass-specific metabolic rate	0.362	0.568
Western Bluebird	Egg mass	6.340	0.032*
	Mass-specific metabolic rate	1.444	0.26

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20 Table S3. Common and scientific names for 9 bird species breeding at our tropical (Malaysia) and
 21 a north temperate (Arizona) field sites. Total number of paired treatment and control nests (*n*) are
 22 shown for our heating and swap experiments.
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Site	Common Name	Scientific Name	Heating	Swap
			Experiment	Experiment
			<i>n</i>	<i>n</i>
Malaysia	Bornean Stubtail	<i>Urosphena whiteadi</i>	3	4
Malaysia	Mountain Wren-babbler	<i>Napothera crassa</i>	3	---
Malaysia	Chestnut-crested Yuhina	<i>Yuhina everetti</i>	4	4
Arizona	Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	5	---
Arizona	Grey-headed Junco	<i>Junco hyemalis</i>	4	---
Arizona	House Wren	<i>Troglodytes aedon</i>	5	---
Arizona	Mountain Chickadee	<i>Poecile gambeli</i>	3	---
Arizona	Red-faced Warbler	<i>Cardellina rubifrons</i>	7	---
Arizona	Western Bluebird	<i>Sialia mexicana</i>	8	---
Totals			42	8

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Table S4. Comparison of fit between linear mixed models testing the effect of incubation period differences on embryonic period changes between treatment and control nests for nine species of breeding songbirds at two latitudes (see methods). Models were tested (a) with intercept values free to vary and (b) forcing all intercepts through zero.

	Model with free varying intercepts	Model with intercepts forced through 0
AIC	154.61	153.67
BIC	161.57	158.88
r²	0.91	0.88
SE	0.23	0.16
F-statistic	20.10	60.75

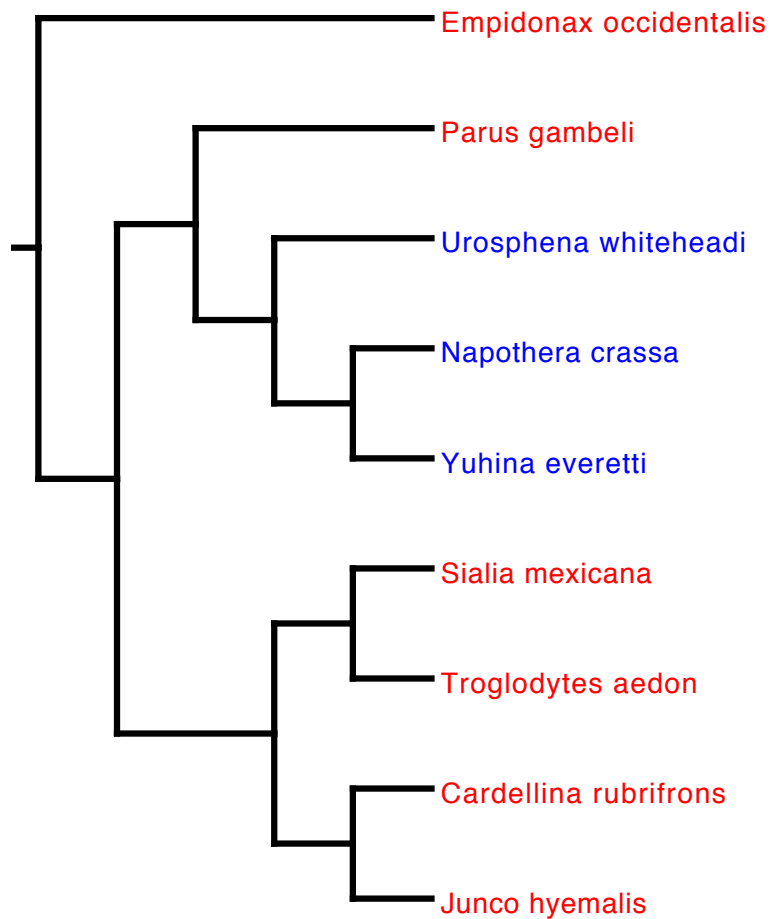
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47 Figure S1. Picture of the set up needed for the heating experiment here uncovered from
48 camouflaging materials for showing purposes. The heating device (solid red arrow)
49 around the nest cup where a fake egg connected to a probe (red star) records temperature
50 experienced by the embryos during incubation. A thermostat connected to the circuit (dashed red
51 arrow) regulates the energy input from the battery to the heating device. Notice the iron mesh
52 surrounding the nest to reduce sample loss due to predation.
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69 Figure S2. Phylogenetic relationships among north temperate (red) and tropical (blue) bird
70 species used in the present study. The majority rule consensus tree was computed in program
71 Mesquite using 1,000 trees obtained from BirdTree.org.
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