Supplementary material for

**Maternal investment and early thermal environment interact to affect antipredator responses in two Australian lizard species**

**Supplementary results**

**Table S1.** Repeatability of the three performance and antipredatory behaviour measures.

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. delicata*** |  |  |  |
|  | R | l | U |
| Time hiding | 0.2807 | 0.0222 | 0.5025 |
| Time to active | 0.0724 | 0.0001 | 0.2431 |
| Distance moved | 0.2644 | 0.0406 | 0.4859 |
| Running velocity 1m | 0.4580 | 0.3128 | 0.5893 |
| Running velocity 25cm | 0.3440 | 0.2055 | 0.4812 |

**Table S2.** Estimates from full (with the two-way interaction between temperature and maternal egg investment) Bayesian multivariate models for morphology in *Lampropholis delicata and L. guichenoti*.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***L. delicata*** |  |  |  |  |  |  |  |
| *Full models with interactions* |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (SVL) | 23.24 | 0.26 | 22.72 | 23.77 | 1 | 6670 | 8694 |
| Intercept (Weight) | 0.31 | 0.01 | 0.29 | 0.32 | 1 | 7304 | 9396 |
| Intercept (Tail length) | 33.11 | 0.56 | 31.99 | 34.2 | 1 | 6588 | 8430 |
| SVL\_temperature (hot) | 1.15 | 0.32 | 0.52 | 1.77 | 1 | 6487 | 7911 |
| SVL\_Maternal (control) | 0.63 | 0.26 | 0.11 | 1.15 | 1 | 11982 | 9578 |
| SVL\_Age (scaled) | 0.85 | 0.14 | 0.59 | 1.13 | 1 | 6835 | 8496 |
| **SVL\_Temperature (hot) \* Maternal (control)** | **-0.85** | **0.35** | **-1.55** | **-0.16** | **1** | **11233** | **9890** |
| Weight\_Temperature (hot) | 0 | 0.01 | -0.02 | 0.02 | 1 | 7496 | 9343 |
| Weight\_Maternal (control) | 0.01 | 0.01 | -0.01 | 0.03 | 1 | 12789 | 9945 |
| Weight\_Age (scaled) | 0.05 | 0 | 0.04 | 0.06 | 1 | 7615 | 8652 |
| Weight\_Temperature (hot) \* Maternal (control) | 0 | 0.01 | -0.02 | 0.02 | 1 | 11798 | 10438 |
| Tail length\_Temperature (hot) | 5.24 | 0.69 | 3.88 | 6.59 | 1 | 7477 | 9009 |
| Tail\_length\_ Maternal (control) | 1.31 | 0.54 | 0.26 | 2.36 | 1 | 11637 | 9785 |
| Tail\_Age (scaled) | 1.39 | 0.3 | 0.81 | 1.99 | 1 | 7393 | 8832 |
| **Tail\_Temperature (hot) \* Maternal (control)** | **-4.21** | **0.82** | **-5.82** | **-2.62** | **1** | **9681** | **9641** |
|  |  |  |  |  |  |  |  |
| *Within-individual correlations in morphological traits* | |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| **rescor(SVL, Weigth)** | **0.77** | **0.03** | **0.69** | **0.83** | **1** | **6757** | **8161** |
| **rescor(SVL, Tail length)** | **0.55** | **0.07** | **0.4** | **0.68** | **1** | **6397** | **8788** |
| **rescor(Weight, Tail length)** | **0.56** | **0.06** | **0.42** | **0.68** | **1** | **7585** | **9700** |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| ***L. guichenoti*** |  |  |  |  |  |  |  |
| *Full models with interactions* |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (SVL) | 25.2 | 0.28 | 24.64 | 25.74 | 1 | 4758 | 6682 |
| Intercept (Weight) | 0.36 | 0.01 | 0.34 | 0.38 | 1 | 4445 | 6372 |
| Intercept (Tail length) | 35.66 | 0.61 | 34.44 | 36.85 | 1 | 2917 | 5190 |
| SVL\_temperature (hot) | 1.65 | 0.29 | 1.07 | 2.22 | 1 | 7430 | 9165 |
| SVL\_Maternal (control) | -0.57 | 0.24 | -1.04 | -0.08 | 1 | 8121 | 9053 |
| SVL\_Age (scaled) | 0.35 | 0.12 | 0.12 | 0.58 | 1 | 7543 | 9699 |
| **SVL\_Temperature (hot) \* Maternal (control)** | **1.18** | **0.35** | **0.49** | **1.87** | **1** | **8009** | **8993** |
| Weight\_Temperature (hot) | 0.06 | 0.01 | 0.04 | 0.08 | 1 | 5912 | 8387 |
| Weight\_Maternal (control) | 0 | 0.01 | -0.02 | 0.01 | 1 | 7505 | 8649 |
| Weight\_Age (scaled) | 0.04 | 0 | 0.03 | 0.05 | 1 | 7991 | 9438 |
| Weight\_Temperature (hot) \* Maternal (control) | 0 | 0.01 | -0.03 | 0.03 | 1 | 6580 | 8932 |
| Tail length\_Temperature (hot) | 5.79 | 0.47 | 4.86 | 6.7 | 1 | 6476 | 8613 |
| Tail\_length\_ Maternal (control) | 0.56 | 0.37 | -0.15 | 1.29 | 1 | 8101 | 9248 |
| Tail\_Age (scaled) | 1.37 | 0.19 | 1 | 1.75 | 1 | 8457 | 9343 |
| **Tail\_Temperature (hot) \* Maternal (control)** | **-1.33** | **0.54** | **-2.38** | **-0.28** | **1** | **6971** | **8683** |
|  |  |  |  |  |  |  |  |
| *Within-individual correlations in morphological traits* | |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| **rescor(SVL, Weigth)** | **0.64** | **0.05** | **0.54** | **0.72** | **1** | **6722** | **9429** |
| **rescor(SVL, Tail length)** | **0.56** | **0.05** | **0.45** | **0.66** | **1** | **7610** | **9116** |
| **rescor(Weight, Tail length)** | **0.82** | **0.03** | **0.75** | **0.87** | **1** | **6173** | **7667** |

**Table S3.** Estimates from full (with the two-way interaction between temperature and maternal egg investment) and simplified (main effects only) Bayesian multivariate models for performance and antipredatory behaviour in *Lampropholis delicata*.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***L. delicata*** |  |  |  |  |  |  |  |
| Full models with interactions |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (time to active) | 2691.18 | 245.68 | 2221.59 | 3180.19 | 1 | 4690 | 5977 |
| Intercept (time hiding) | 1665.48 | 224.08 | 1235.13 | 2112.36 | 1 | 5533 | 8143 |
| Intercept (distance travelled) | 733.24 | 60.22 | 616.27 | 852.17 | 1 | 6846 | 8462 |
| Intercept (running velocity, 1m) | 1.61 | 0.1 | 1.42 | 1.8 | 1 | 5235 | 7740 |
| Intercept (running velocity, 25 cm) | -0.33 | 0.1 | -0.52 | -0.13 | 1 | 5561 | 8281 |
| Time to active\_Temperature (hot) | 971.47 | 377.71 | 234.38 | 1719.32 | 1 | 4058 | 5913 |
| Time to active\_Maternal (c0ntrol) | 620.45 | 331.04 | -27.38 | 1274.15 | 1 | 4859 | 7084 |
| Time to active\_SVL (scaled) | 282.9 | 144.41 | 5.46 | 572.34 | 1 | 4433 | 7017 |
| **Time to active\_Temperature (hot) \* Maternal (control)** | **-1008.81** | **503.67** | **-2023.9** | **-22.82** | **1** | **4075** | **5944** |
| Time hiding\_Temperature (hot) | 872.73 | 349.48 | 188.7 | 1554.96 | 1 | 4360 | 6100 |
| Time hiding\_Maternal (control) | 505.93 | 307.47 | -104.11 | 1107.32 | 1 | 5298 | 7039 |
| Time hiding\_SVL (scaled) | 14.72 | 129.94 | -238.11 | 271.11 | 1 | 5864 | 7396 |
| Time hiding\_Temperature (hot) \* Maternal (control) | -896.71 | 467.14 | -1817.42 | 31.42 | 1 | 4410 | 6009 |
| Distance moved\_Temperature (hot) | -85.71 | 85.83 | -255.34 | 82.77 | 1 | 5712 | 7494 |
| Distance moved\_Maternal (control) | -63.03 | 81.03 | -223.62 | 95.14 | 1 | 5872 | 8124 |
| Distance moved\_SVL (scaled) | 21.43 | 31.85 | -40.8 | 84.26 | 1 | 7552 | 8414 |
| Distance moved\_Temperature (hot) \* Maternal (control) | 57.66 | 117.71 | -170.65 | 293.99 | 1 | 3570 | 6531 |
| Running velocity (1m)\_Temperature (hot) | -0.1 | 0.14 | -0.37 | 0.18 | 1 | 4558 | 6641 |
| Running velocity (1m)\_Maternal (control) | -0.42 | 0.13 | -0.68 | -0.16 | 1 | 4578 | 6688 |
| Running velocity (1m)\_SVL (scaled) | -0.05 | 0.05 | -0.15 | 0.05 | 1 | 6325 | 8102 |
| Running velocity (1m)\_Temperature (hot) \* Maternal (control) | 0.31 | 0.19 | -0.07 | 0.67 | 1 | 4133 | 6362 |
| Running velocity (25cm)\_Temperature (hot) | 0.04 | 0.15 | -0.25 | 0.33 | 1 | 4996 | 7188 |
| Running velocity (25cm)\_Maternal (control) | -0.19 | 0.14 | -0.46 | 0.09 | 1 | 4632 | 7044 |
| Running velocity (25cm)\_SVL (scaled) | -0.1 | 0.05 | -0.2 | 0 | 1 | 7187 | 8763 |
| Running velocity (25cm)\_Temperature (hot) \* Maternal (control) | 0.18 | 0.2 | -0.22 | 0.56 | 1 | 4140 | 6375 |
|  |  |  |  |  |  |  |  |
| *Reduced-main effect models* |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (time to active) | 2910.88 | 219.52 | 2481.73 | 3352.73 | 1 | 5878 | 8565 |
| Intercept (time hiding) | 1862.39 | 193.51 | 1484.1 | 2243.48 | 1 | 8183 | 9137 |
| Intercept (distance travelled) | 719.81 | 54.1 | 614.51 | 826.19 | 1 | 6660 | 8311 |
| Intercept (running velocity, 1m) | 1.53 | 0.09 | 1.37 | 1.7 | 1 | 6435 | 8426 |
| Intercept (running velocity, 25 cm) | -0.37 | 0.09 | -0.54 | -0.2 | 1 | 6566 | 8894 |
| Time to active\_Temperature (hot) | 432.23 | 267.31 | -81.43 | 958.83 | 1 | 5469 | 6074 |
| Time to active\_Maternal (control) | 202.18 | 257.5 | -301.43 | 701.06 | 1 | 5395 | 7371 |
| Time to active\_SVL (scaled) | 329.3 | 142.13 | 50.11 | 602.38 | 1 | 4853 | 6501 |
| Time hiding\_Temperature (hot) | 396.5 | 248.27 | -82.47 | 887.48 | 1 | 5698 | 7358 |
| Time hiding\_Maternal (control) | 124.64 | 229.15 | -324.47 | 583.19 | 1 | 6794 | 8237 |
| Time hiding\_SVL (scaled) | 55.59 | 128.33 | -197.55 | 303.07 | 1 | 5847 | 7835 |
| Distance moved\_Temperature (hot) | -55.83 | 60.62 | -174.19 | 64.26 | 1 | 6573 | 8357 |
| Distance moved\_Maternal (control) | -36.21 | 58.59 | -149.5 | 81.92 | 1 | 6553 | 8219 |
| Distance moved\_SVL (scaled) | 19.82 | 30.26 | -38.98 | 79.28 | 1 | 7571 | 8625 |
| Running velocity (1m)\_Temperature (hot) | 0.06 | 0.1 | -0.14 | 0.26 | 1 | 5633 | 7564 |
| Running velocity (1m)\_Maternal (control) | **-0.27** | **0.1** | **-0.46** | **-0.08** | 1 | 6581 | 8595 |
| Running velocity (1m)\_SVL (scaled) | -0.06 | 0.05 | -0.16 | 0.04 | 1 | 6075 | 8129 |
| Running velocity (25cm)\_Temperature (hot) | 0.13 | 0.1 | -0.07 | 0.34 | 1 | 6295 | 8545 |
| Running velocity (25cm)\_Maternal (control) | -0.1 | 0.1 | -0.29 | 0.1 | 1 | 6965 | 8651 |
| Running velocity (25cm)\_SVL (scaled) | -0.11 | 0.05 | -0.21 | -0.01 | 1 | 6306 | 8651 |
|  |  |  |  |  |  |  |  |
| *Within-individual correlations in performance and antipredatory traits* | | |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| rescor(Time to active, Time hiding) | 0.83 | 0.04 | 0.75 | 0.89 | 1 | 2747 | 4768 |
| **rescor(Time to active, Distance travelled)** | **-0.2** | **0.09** | **-0.37** | **-0.01** | **1** | **5299** | **9180** |
| rescor(Time hiding, Distance travelled) | -0.09 | 0.09 | -0.26 | 0.08 | 1 | 5925 | 8246 |
| rescor(Time to active, Running velocity 1m) | 0.07 | 0.1 | -0.12 | 0.25 | 1 | 4237 | 7504 |
| rescor(Time hiding, Running velocity 1m) | 0.01 | 0.09 | -0.17 | 0.19 | 1 | 4650 | 8250 |
| rescor(Distance travelled, Running velocity 1m) | 0.03 | 0.08 | -0.12 | 0.19 | 1 | 9798 | 9290 |
| rescor(Time to active, Running velocity 25cm) | 0.05 | 0.11 | -0.16 | 0.26 | 1 | 3397 | 6204 |
| rescor(Time hiding, Running velocity 25cm) | -0.03 | 0.11 | -0.23 | 0.18 | 1 | 3245 | 6258 |
| rescor(Distance travelled, Running velocity 25cm) | 0.03 | 0.08 | -0.11 | 0.18 | 1 | 11400 | 10383 |
| **rescor(Running velocity 1m,**  **Running velocity 25cm)** | **0.42** | **0.06** | **0.29** | **0.54** | **1** | **9081** | **9329** |

**Table S4**. Estimates from full (with the two-way interaction between temperature and maternal egg investment) and simplified (main effects only) Bayesian multivariate models for performance and antipredatory behaviour in *Lampropholis guichenoti*.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***L. guichenoti*** |  |  |  |  |  |  |  |
| Full models with interactions |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (time to active) | 7.19 | 0.19 | 6.82 | 7.57 | 1 | 7155 | 8263 |
| Intercept (time hiding) | 6.07 | 0.27 | 5.53 | 6.61 | 1 | 7601 | 8971 |
| Intercept (distance travelled) | 884.35 | 94.43 | 697.44 | 1068.52 | 1 | 8082 | 8793 |
| Intercept (running velocity, 1m) | 1.53 | 0.11 | 1.31 | 1.75 | 1 | 6164 | 7717 |
| Intercept (running velocity, 25 cm) | -0.39 | 0.12 | -0.62 | -0.17 | 1 | 6177 | 7787 |
| Time to active\_Temperature (hot) | -0.06 | 0.25 | -0.55 | 0.45 | 1 | 6386 | 8210 |
| Time to active\_Maternal (c0ntrol) | 0.05 | 0.25 | -0.42 | 0.54 | 1 | 6275 | 8398 |
| Time to active\_SVL (scaled) | 0.15 | 0.1 | -0.05 | 0.36 | 1 | 9841 | 9710 |
| Time to active\_Temperature (hot) \* Maternal (control) | -0.06 | 0.34 | -0.73 | 0.61 | 1 | 5765 | 7757 |
| Time hiding\_Temperature (hot) | 0.13 | 0.36 | -0.58 | 0.85 | 1 | 6759 | 8418 |
| Time hiding\_Maternal (control) | -0.11 | 0.35 | -0.78 | 0.59 | 1 | 6910 | 8615 |
| Time hiding\_SVL (scaled) | -0.02 | 0.15 | -0.31 | 0.28 | 1 | 10369 | 9985 |
| Time hiding\_Temperature (hot) \* Maternal (control) | 0.14 | 0.48 | -0.81 | 1.09 | 1 | 6817 | 8446 |
| Distance moved\_Temperature (hot) | -76.05 | 131.63 | -334.39 | 180.69 | 1 | 7236 | 8435 |
| Distance moved\_Maternal (control) | -118.55 | 121.23 | -356.69 | 120.27 | 1 | 7631 | 8796 |
| Distance moved\_SVL (scaled) | -22.84 | 52.89 | -125.4 | 81.73 | 1 | 9143 | 8908 |
| Distance moved\_Temperature (hot) \* Maternal (control) | 130.65 | 169.61 | -198.97 | 464.88 | 1 | 7189 | 8101 |
| Running velocity (1m)\_Temperature (hot) | 0.04 | 0.15 | -0.26 | 0.34 | 1 | 5351 | 7124 |
| Running velocity (1m)\_Maternal (control) | 0.06 | 0.14 | -0.22 | 0.34 | 1 | 5742 | 7354 |
| Running velocity (1m)\_SVL (scaled) | -0.12 | 0.06 | -0.24 | 0.01 | 1 | 7643 | 8757 |
| Running velocity (1m)\_Temperature (hot) \* Maternal (control) | -0.13 | 0.2 | -0.54 | 0.26 | 1 | 5323 | 7554 |
| Running velocity (25cm)\_Temperature (hot) | 0.22 | 0.16 | -0.1 | 0.53 | 1 | 5388 | 6922 |
| Running velocity (25cm)\_Maternal (control) | 0.21 | 0.15 | -0.08 | 0.51 | 1 | 5734 | 7465 |
| Running velocity (25cm)\_SVL (scaled) | -0.15 | 0.06 | -0.27 | -0.02 | 1 | 7737 | 8528 |
| **Running velocity (25cm)\_Temperature (hot) \* Maternal (control)** | **-0.41** | **0.2** | **-0.81** | **-0.01** | **1** | **5247** | **7090** |
|  |  |  |  |  |  |  |  |
| *Reduced-main effect models* |  |  |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| Intercept (time to active) | 1907.52 | 295.38 | 1328.59 | 2494.43 | 1 | 6228 | 8332 |
| Intercept (time hiding) | 933.21 | 216.46 | 509.97 | 1351.52 | 1 | 6415 | 8291 |
| Intercept (distance travelled) | 851.26 | 83.7 | 689.93 | 1016.8 | 1 | 8421 | 9060 |
| Intercept (running velocity, 1m) | 1.56 | 0.1 | 1.36 | 1.76 | 1 | 6896 | 8127 |
| Intercept (running velocity, 25 cm) | -0.29 | 0.1 | -0.5 | -0.08 | 1 | 6699 | 7892 |
| Time to active\_Temperature (hot) | -39.8 | 359.53 | -757.68 | 662.1 | 1 | 4901 | 6995 |
| Time to active\_Maternal (control) | 96.92 | 307.25 | -508.55 | 715.45 | 1 | 6770 | 8242 |
| Time to active\_SVL (scaled) | 176.91 | 177.12 | -168.02 | 524.89 | 1 | 5786 | 8405 |
| Time hiding\_Temperature (hot) | 56.79 | 263.33 | -470.82 | 565.7 | 1 | 5759 | 8371 |
| Time hiding\_Maternal (control) | 44.99 | 223.21 | -396.81 | 490.06 | 1 | 7254 | 8455 |
| Time hiding\_SVL (scaled) | 12.08 | 130.74 | -244.53 | 269.05 | 1 | 6770 | 8182 |
| Distance moved\_Temperature (hot) | -11.08 | 103.43 | -217.17 | 189.6 | 1 | 7395 | 8024 |
| Distance moved\_Maternal (control) | -52.37 | 85.48 | -219.94 | 114.91 | 1 | 9282 | 9446 |
| Distance moved\_SVL (scaled) | -20.48 | 51.92 | -122.11 | 83.31 | 1 | 8654 | 7787 |
| Running velocity (1m)\_Temperature (hot) | -0.02 | 0.12 | -0.26 | 0.21 | 1 | 5985 | 7933 |
| Running velocity (1m)\_Maternal (control) | -0.01 | 0.1 | -0.21 | 0.19 | 1 | 7875 | 8687 |
| Running velocity (1m)\_SVL (scaled) | -0.12 | 0.06 | -0.24 | 0 | 1 | 6432 | 7455 |
| Running velocity (25cm)\_Temperature (hot) | 0.02 | 0.13 | -0.22 | 0.27 | 1 | 5935 | 7481 |
| Running velocity (25cm)\_Maternal (control) | 0 | 0.11 | -0.2 | 0.21 | 1 | 7693 | 8738 |
| Running velocity (25cm)\_SVL (scaled) | -0.16 | 0.06 | -0.29 | -0.03 | 1 | 6434 | 7470 |
|  |  |  |  |  |  |  |  |
| *Within-individual correlations in performance and antipredatory traits* | | |  |  |  |  |  |
|  | **Estimate** | **SE** | **l-95% CI** | **U-95% CI** | **Rhat** | **Bulk\_ESS** | **Tail\_ESS** |
| rescor(Time to active, Time hiding) | 0.64 | 0.05 | 0.53 | 0.74 | 1 | 4119 | 5964 |
| rescor(Time to active, Distance travelled) | -0.13 | 0.08 | -0.29 | 0.03 | 1 | 9560 | 9631 |
| rescor(Time hiding, Distance travelled) | -0.01 | 0.08 | -0.17 | 0.15 | 1 | 8900 | 8679 |
| rescor(Time to active, Running velocity 1m) | -0.05 | 0.08 | -0.21 | 0.11 | 1 | 9061 | 9672 |
| rescor(Time hiding, Running velocity 1m) | -0.03 | 0.08 | -0.19 | 0.12 | 1 | 9797 | 8797 |
| rescor(Distance travelled, Running velocity 1m) | -0.04 | 0.08 | -0.19 | 0.11 | 1 | 12208 | 10143 |
| rescor(Time to active, Running velocity 25cm) | -0.09 | 0.09 | -0.25 | 0.08 | 1 | 7950 | 9565 |
| rescor(Time hiding, Running velocity 25cm) | -0.04 | 0.08 | -0.2 | 0.12 | 1 | 10752 | 9473 |
| rescor(Distance travelled, Running velocity 25cm) | 0.04 | 0.08 | -0.11 | 0.19 | 1 | 11246 | 9491 |
| **rescor(Running velocity 1m, Running velocity 25cm)** | **0.51** | **0.06** | **0.4** | **0.62** | **1** | **10729** | **10347** |