**TITLE:** Influence of warming temperatures on coregonine embryogenesis within and among species

**JOURNAL:** Hydrobiologia

**AUTHOR INFORMATION:**

Taylor R. Stewart1,2\*, Mikko Mäkinen3, Chloé Goulon4,5, Jean Guillard4,5, Timo J. Marjomäki3, Emilien Lasne4,6, Juha Karjalainen3, and Jason D. Stockwell2

1Department of Biology, University of Vermont, Burlington, VT, USA

2Rubenstein Ecosystem Science Laboratory, University of Vermont, Burlington, VT, USA

3University of Jyväskylä, Jyväskylä, Finland

4University Savoie Mont Blanc, INRAE, CARRTEL, Thonon-les-Bains, France

5Pôle ECLA (ECosystèmes LAcustres) (OFB – INRAE – USMB), Thonon-Les-Bains, France

6ESE, Ecology and Ecosystem Health, Agrocampus-Ouest, INRAE, Rennes, France

\*Corresponding Author: Taylor R. Stewart, Department of Biology, Rubenstein Ecosystem Science Laboratory, University of Vermont, 3 College St, Burlington, VT 05401, USA.

Email: [taylor.stewart@uvm.edu](mailto:taylor.stewart@uvm.edu)

**ESM 2** Phenotypic variance component analysis for length-at-hatch (mm) and yolk-sac volume (mm3) from Lake Southern Konnevesi vendace (LK-Vendace (*Coregonus albula*)), Lake Superior cisco (LS-Cisco (*C. artedi*)), and Lake Ontario cisco (LO-Cisco) across each incubation temperature treatment (°C).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trait | Study Group | T°C | Female | | |  | Male | | |  | Female:Male | | |  | Error | |
| σ2 | *P* | % |  | σ2 | *P* | % |  | σ2 | *P* | % |  | σ2 | % |
| Length-at-Hatch | LK-Vendace | 2.2 | 0.06 | <0.001 | 37.01 |  | 0.02 | 0.011 | 11.06 |  | 0.0 | 1.0 | 0.0 |  | 0.08 | 51.93 |
|  | 4.0 | 0.07 | <0.001 | 41.39 |  | 0.02 | 0.007 | 9.74 |  | 0.0 | 1.0 | 0.0 |  | 0.09 | 48.87 |
|  | 6.9 | 0.08 | <0.001 | 49.84 |  | 0.0 | 1.0 | 0.0 |  | 0.01 | 0.227 | 3.82 |  | 0.08 | 46.34 |
|  | 8.0 | 0.05 | <0.001 | 34.13 |  | 0.01 | 0.239 | 6.14 |  | 0.02 | 0.033 | 9.92 |  | 0.08 | 49.81 |
|  | LS-Cisco | 2.0 | 0.49 | <0.001 | 61.71 |  | 0.01 | 0.490 | 1.55 |  | 0.01 | 0.783 | 0.86 |  | 0.28 | 35.87 |
|  |  | 4.4 | 0.20 | <0.001 | 30.63 |  | <0.01 | 0.999 | <0.01 |  | <0.01 | 0.910 | 0.56 |  | 0.44 | 68.81 |
|  |  | 6.9 | 0.18 | 0.006 | 31.62 |  | 0.0 | 1.0 | 0.0 |  | 0.11 | 0.007 | 18.89 |  | 0.28 | 49.48 |
|  |  | 8.9 | 0.10 | 0.001 | 29.00 |  | 0.01 | 0.465 | 3.17 |  | 0.0 | 1.0 | 0.0 |  | 0.23 | 67.83 |
|  | LO-Cisco | 2.0 | 0.12 | <0.001 | 29.51 |  | <0.01 | 0.908 | 0.23 |  | 0.0 | 1.0 | 0.0 |  | 0.28 | 70.26 |
|  |  | 4.4 | 0.07 | <0.001 | 13.63 |  | <0.01 | 0.999 | <0.01 |  | 0.0 | 1.0 | 0.0 |  | 0.42 | 86.37 |
|  |  | 6.9 | 0.04 | 0.001 | 16.36 |  | 0.01 | 0.208 | 4.66 |  | 0.84 | 0.840 | 1.02 |  | 0.19 | 77.96 |
|  |  | 8.9 | 0.02 | 0.078 | 8.95 |  | 0.0 | 1.0 | 0.0 |  | 0.05 | 0.050 | 12.60 |  | 0.21 | 78.44 |
| Yolk-sac Volume | LK-Vendace | 2.2 | <0.01 | 0.007 | 14.06 |  | 0.0 | 1.0 | 0.0 |  | <0.01 | 0.830 | 1.12 |  | <0.01 | 84.82 |
|  | 4.0 | <0.01 | 0.005 | 20.51 |  | <0.01 | 0.179 | 6.71 |  | <0.01 | 0.373 | 4.69 |  | <0.01 | 66.38 |
|  | 6.9 | <0.01 | 0.007 | 28.09 |  | <0.01 | 0.991 | 0.07 |  | <0.01 | <0.001 | 23.51 |  | <0.01 | 43.19 |
|  | 8.0 | <0.01 | <0.001 | 32.74 |  | <0.01 | 0.697 | 1.39 |  | <0.01 | 0.008 | 9.53 |  | <0.01 | 35.93 |
|  | LS-Cisco | 2.0 | 0.02 | 0.030 | 25.48 |  | 0.0 | 1.0 | 0.0 |  | 0.01 | 0.001 | 20.11 |  | 0.04 | 54.42 |
|  |  | 4.4 | 0.01 | 0.008 | 33.64 |  | <0.01 | 0.784 | 1.78 |  | 0.01 | 0.050 | 13.49 |  | 0.02 | 51.10 |
|  |  | 6.9 | <0.01 | 0.151 | 14.07 |  | <0.01 | 0.846 | 1.81 |  | 0.01 | 0.058 | 17.15 |  | 0.04 | 66.98 |
|  |  | 8.9 | 0.02 | 0.230 | 8.87 |  | 0.01 | 0.487 | 4.93 |  | 0.02 | 0.192 | 10.90 |  | 0.13 | 75.31 |
|  | LO-Cisco | 2.0 | 0.02 | <0.001 | 39.32 |  | <0.01 | 0.816 | 0.39 |  | 0.0 | 1.0 | 0.0 |  | 0.03 | 57.63 |
|  |  | 4.4 | 0.02 | <0.001 | 56.43 |  | <0.01 | 0.468 | 1.57 |  | 0.01 | 0.293 | 2.89 |  | 0.01 | 39.11 |
|  |  | 6.9 | 0.04 | <0.001 | 41.84 |  | <0.01 | 0.999 | <0.01 |  | <0.01 | 0.096 | 5.55 |  | 0.05 | 52.61 |
|  |  | 8.9 | 0.05 | <0.001 | 32.90 |  | <0.01 | 0.699 | 0.80 |  | 0.0 | 1.0 | 0.0 |  | 0.10 | 66.30 |