

---

# The evolution of individual diversification: can egg size variation facilitate the rapid evolution of resource polymorphism in fishes?

Samantha Victoria Beck<sup>\*†1,2</sup>, Bjarni Kristjánsson<sup>1</sup>, Katja Räsänen<sup>3</sup>, Zophonías Jónsson<sup>4</sup>, Skúli Skúlason<sup>5</sup>, and Camille Leblanc<sup>6</sup>

<sup>1</sup>Hólar University College – Iceland

<sup>2</sup>University of Iceland – Iceland

<sup>3</sup>Swiss Federal Institute of Aquatic Science and Technology, Dept. Aquatic Ecology (Eawag) – Überlandstrasse 133, CH-8600 Dübendorf, Switzerland

<sup>4</sup>Faculty of Life- and Environmental Sciences, University of Iceland – Sturlugata 7, 101 Reykjavik, Iceland

<sup>5</sup>Hólar University College – Iceland

<sup>6</sup>Hólar University College (HUC) – Department of Aquaculture and Fish Biology Háeyri 1, 550, Saudárkrókur Iceland, Iceland

## Abstract

Phenotypic diversity can be seen at multiple levels: among and within species, populations and siblings. However, understanding the determinants of phenotypic variation and its consequences for the performance of individuals and diversification of natural populations remains a challenge for evolutionary ecology and conservation. One putative, but rarely investigated, facilitator of adaptive diversification is maternally mediated developmental plasticity, such as when development is affected by egg size. Studies on polymorphic Arctic charr (*Salvelinus alpinus*) have shown that egg size mediated developmental plasticity can influence an individual's phenotype and performance. Here we tested the hypothesis that egg size variation in sympatric charr morphs may influence variation in the rate of development and the expression of genes related to growth and skeletal development. We studied seven wild Icelandic Arctic charr populations and measured egg size, estimated the rate of development, as well as measuring gene expression at different developmental stages. Our early findings indicate that expression levels of genes related to growth and skeletal development are higher in embryos originating from smaller eggs in comparison to their larger conspecifics at eye stage. Earlier expression of genes in smaller eggs could be indicative of not only compensatory growth, but also of developmental plasticity in craniofacial structures as these individuals will need to feed earlier. These results are the first to demonstrate a role for egg size in influencing individuals' developmental trajectories which is likely important for the rapid evolution of resource polymorphism in fish.

**Keywords:** Evolutionary diversification, egg size, plasticity, development

---

\*Speaker

†Corresponding author: beck@holar.is