

Publication

Variation of anal fin egg-spots along an environmental gradient in a haplochromine cichlid fish

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Male secondary sexual traits are targets of inter- and/or intrasexual selection, but can vary due to a correlation with life-history traits or as by-product of adaptation to distinct environments. Trade-offs contributing to this variation may comprise conspicuousness toward conspecifics versus inconspicuousness toward predators, or between allocating resources into coloration versus the immune system. Here, we examine variation in expression of a carotenoid-based visual signal, anal-fin egg-spots, along a replicate environmental gradient in the haplochromine cichlid fish *Astatotilapia burtoni*. We quantified egg-spot number, area, and coloration; applied visual models to estimate the trait's conspicuousness when perceived against the surrounding tissue under natural conditions; and used the lymphocyte ratio as a measure for immune activity. We find that (1) males possess larger and more conspicuous egg-spots than females, which is likely explained by their function in sexual selection; (2) riverine fish generally feature fewer but larger and/or more intensely colored egg-spots, which is probably to maintain signal efficiency in intraspecific interactions in long wavelength shifted riverine light conditions; and (3) egg-spot number and relative area correlate with immune defense, suggesting a trade-off in the allocation of carotenoids. Taken together, haplochromine egg-spots feature the potential to adapt to the respective underwater light environment, and are traded off with investment into the immune system.

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