

# Continuous light versus photoperiod: effects on eye size and deformities in larval and juvenile cod

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Our results show that larval rearing environment may have direct impacts on morphological development of larval fish. How these perturbations may affect larval function and quality remain unclear and require further investigation. The results indicate that care should be taken when an organism is propagated for aquaculture and subjected to an artificial environment.

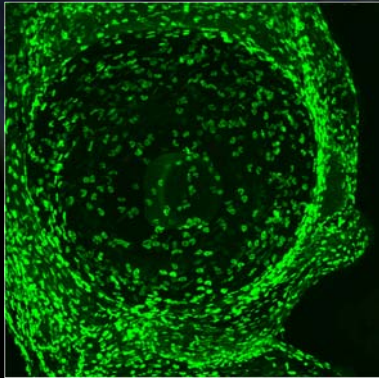


Figure 1. Newly divided cells in the head and eye region of an 11-day-old cod larva. Cell proliferation is visualized by immunocytochemical staining with BrdU.

## Experiment 1:

Cod larvae reared in two 2.5m<sup>3</sup>tanks (photoperiod versus continuous light) were investigated for cell proliferation rate. Cell division was determined on the eye disc surface which has thin cell layers where cells easily can be counted (Fig. 1).

The results showed that 11-day-old cod larvae with photoperiod had significantly lower cell division rate in the outer cell layers of the eye than cod larvae with continuous light (Fig. 2) (2-way ANOVA,  $p < 0.001$ ).

Compared to the continuous light larvae, photoperiod resulted in significantly smaller eyes at similar length on day 32 posthatch (Fig. 3) (ANCOVA,  $p < 0.001$ ).

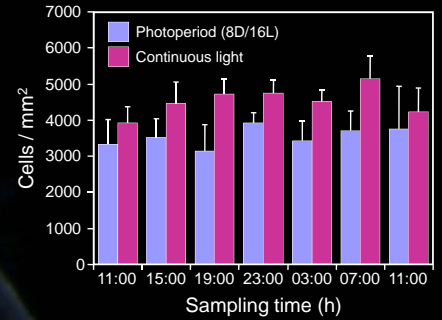


Figure 2. Cell proliferation on the eye disk of 11-day-old cod larvae.

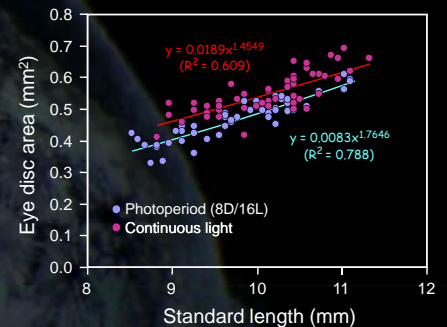


Figure 3. Larval size and eye size relationship at day 32.

## Experiment 2:

Cod larvae were reared in 400 liters tanks (photoperiod versus continuous light, triplicate treatments). The rearing was extended well into juvenile stages up to a size of about 10 g (day 134).

Only morphometrics were investigated in this experiment. Similar to the results of the first experiment, the relationship between eye size and fish length was significantly lower in the photoperiod treated larvae (Fig. 4). This effect extended into the juvenile stages.

50 juvenile cod from each of two tanks within the two light treatments were inspected for bone deformities by X-ray imaging. Deformed vertebrae and the bent neck deformity were found in cod from both treatments, while lordosis was only observed in the continuous light group (Fig. 5).

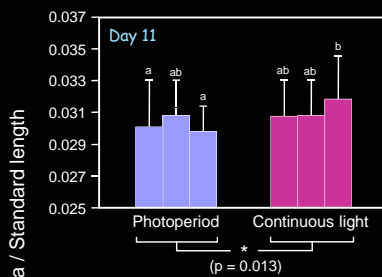


Figure 4. The eye area to fish length ratio for cod larvae and juveniles in relation to light regime.

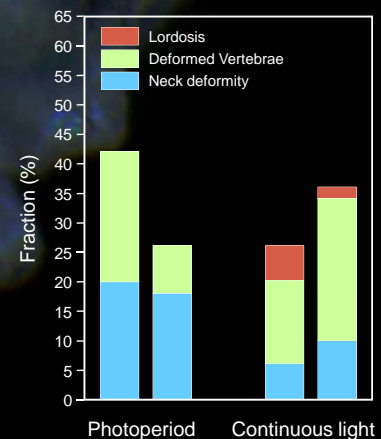
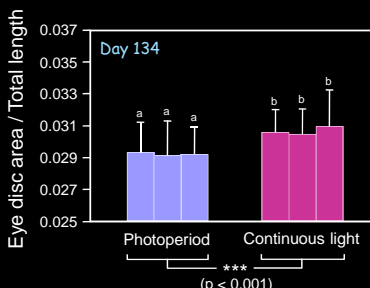
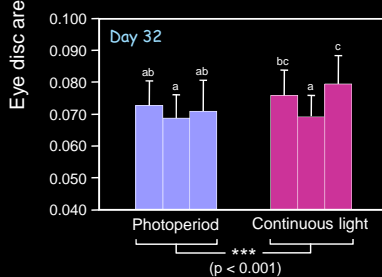


Figure 5. Bone deformities evaluated from radiographs at day 134 posthatch (ca 10 g wet weight)