

EFFECTS ON AGGRESSION AND THE CORTISOL RESPONSE FOLLOWING ACUTE STRESS IN THE AFRICAN CATFISH: DIFFERENCES BETWEEN DAY AND NIGHT

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Introduction

Among farmers it is common practice to house fish species under artificial photoperiods to optimise growth, delay maturation or reduce aggression. In the Netherlands African catfish (*Clarias gariepinus*) are commonly kept under continuous dim light. Hereby, an important *Zeitgeber* (i.e. the day-night cycle) is removed (Roenneberg and Mellow 2005). This may alter the activity of the stress axis (Nader et al. 2010), expressed as increased aggression lower coping capacity to challenges (Weibel et al. 2002, Kassi and Chrousos 2013). Providing a natural day-night cycle may therefore be beneficial to the biology, physiology and welfare of African catfish. Here, African catfish were housed under continuous dim light or 12hr light-dark cycles and the number of skin lesions and plasma cortisol levels both under basal conditions and following a stressor were assessed. In a follow-up experiment we assessed if differences in the stress response relate to the time of day the stressor was given (i.e. dark *versus* light phase) or if housing without a light-dark cycle had affected stress coping. Animals were again housed under 12hrs light:12hrs dark (12L:12D) and 24hrs dark (0L:24D) photoperiods, but this time the stressor was applied in either the dark/active phase (12L:12D and 0L:24D groups) or the light/resting phase (12L:12D).

Material and Methods

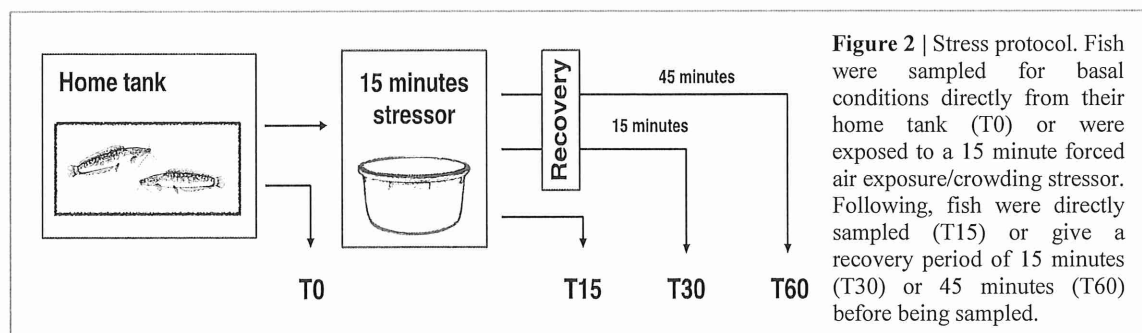
Experimental setup

Experiment I: African catfish were housed under a 12hrs light:12hrs dark photoperiod (**12L:12D**; 07.00h-19.00h lights on) and the second under a constant photoperiod of 0hrs light:24hrs dim light (**0L:24D**; 0.00h-24.00h low light). Fish given a fixed amount of food three times daily (07.00h – 15.00h – 23.00h) via an automatic feeder. Fish were stressed at 09.00h.

Experiment II: African catfish were housed under different photoperiods: 12hrs light:12hrs dark (**12L:12D**; 07.00h-19.00h lights on), 12hrs dark:12hrs light (**12D:12L**; 12.00h-24.00h lights on) and 0hrs light:24hrs dim light (**0L:24D**; 0.00h-24.00h low light). Fish given a fixed amount of food three times daily (**L:D** and **D:D** at 07.00h – 15.00h – 23.00h; **D:L** at 04.00h - 12.00h – 20.00h) via an automatic feeder. To correct for feeding times between groups, fish were stressed at 11.00h (12L:12D and 0L:24D) or 08.00h (12D:12L).

Stress protocol

Catfish were placed into a dry mortar tub (65 cm diameter x 37 cm height) for 15 minutes to evoke a stress response (forced air exposure and crowding stress). To assess the stress response, from each group 7-10 fish were sampled as shown in the schematic overview in **Figure 2**. Assessment of the stress response was done by measuring plasma cortisol and counting the number of skin lesions on fish.



Results

Experiment I

Our data show that there was no difference in the basal level of plasma cortisol between the 12L:12D and 0L:24D photoperiods, but there was a significantly higher number of skin lesions for fish housed under 0L:24D. Following the stressor, the cortisol response was weaker for fish housed under 0L:24D, but the number of stressor-induced skin lesions was greater, compared to fish from a 12L:12D photoperiod.

Experiment II

Our result show no differences in basal plasma cortisol between fish from the three photoperiods, but the number of skin lesions following housing was significantly higher for 12D:12L and 0L:24D when compared to the natural 12L:12D group. Following the stressor, we observed that fish stressed during the dark phase (12D:12L and 0L:24D) had a lower cortisol response and a greater number of stressor-induced skin lesions compared to fish stressed during the light phase (natural 12L:12D).

Discussion and conclusion

Based on our data, housing African catfish under a normal day-night cycle (12L:12D) and handling or sorting done during the light phase would offer the best conditions for the fish. Although stress-induced peak levels of plasma cortisol are higher under such conditions, they rapidly decline to basal levels. Moreover, the number of skin lesions during normal housing (basal) and the level of aggressive acts (number of skin lesions inflicted onto others) following a stressor was lower.

However some remarks regarding the implementation of these findings may be made. Firstly, conclusions reported here are based on experiments performed on a small scale and can therefore not be directly translated to an aquaculture setting. An increase in stocking density for example may negatively affect the welfare of African catfish as competition for resting space may increase (Boerrigter et al. 2015). Secondly, data of a recent study in zebrafish (Manuel et al. 2014) suggested that repeated exposure to unpredictable acute stressors imposes a greater stress load when given during the resting phase compared to the active phase. The imposed stress load associated with aquaculture practices on the African catfish, and whether it differs between the resting and active phase, is currently not known, but warrants further research

References

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