Social Interactions of Pigmented and Albino Catfish

(experimental background and data description)

Introduction/Motivation

The experiment was conducted at the Czech University of Life Sciences in 2016 – 2017. The main idea of the experiment was to investigate and compare social/aggressive interactions of two groups of catfish (*Silurus glanis*, Linnaeus 1758) individuals while competing among each other for limited hideout sources.

A group of regular pigmented catfish (four pieces) or a group of albino catfish (again four pieces) was placed into an indoor aquarium with a hideout being placed roughly in the middle. The movements and mutual interactions between the four individuals in the aquarium were (partially) recorded with a camera for the follow-up period of 24 hours. After the experiment, the recording was viewed by experts while focusing at specific interaction types. In particular, the following activities were considered:

- a change of an individual in the hideout (denoted as `zdroj W_L`);
- an unsuccessful try to take over someone's place in the hideout (`Q_L_pokus`);
- aggressive interactions (biting `A_biting`, chasing `A_chasing`, lateral displacement `A_latdsipl`, and frontal displacement `A_frontdispl`);
- total movement activity (`total`);

Any occurrences of these types of activities were recorded into the underlying data file together with the corresponding time, the type of the group of catfish (regular pigmented vs. albino), and some additional group specific characteristics: average weight of the group (`W_prumer`), maximum weight (`W_max`), minimum weight (`W_min`), average length (`delk_pr`), maximum length (`delk_max`), minimum length (`delk_min`).

All together, there were 28 identical experiments conducted (identical in a sense, that the conditions of the indoor aquarium were always kept the same (at least as much as possible): temperature, visibility, artificial light to mimic day/night conditions, or other chemical/physical parameters) while in 14 experiment the regular pigmented individuals were placed into the aquarium and in 14 experiment albino individuals were placed in instead.

However, the mutual interactions occurring between the individuals when competing for the limited hideout sources are not about to be explained only with respect to the group type (regular pigmented group vs. albino group) but also with respect to various 'subject specific' physiological characteristics (such as stress enzyme levels, or blood sample analysis). For this purpose, analogical experiments (however, without camera recordings) took place aside in order to assess these characteristics (taken always post mortem). Four individuals (regular pigmented or albino ones) were again placed into an identical indoor aquarium assuring the same conditions as in the first aquarium but, after some specific time they were all taken out to take brain, gill, and liver samples together with blood tests. Another four individuals of the same type were placed into the aquarium instead until they were taken out after some specific time again in order to prepare another subject-specific and time-specific physiological characteristics.

Given some previous research in this area (see, for instance, Slavik et al., 2015), the whole 24 hour follow-up period can be effectively split into 4 disjoint fragments of a day (0:00 – 6:00, 6:00 – 12:00, 12:00 – 18:00, and, finally, 18:00 – 24:00). In this respect, the specific times for physiological samples were defined in a way that two samples are always taken within each fragment of a day (thus, 4 individuals and 2 sampling opportunities are given within each fragment for every group – regular pigmented or algino invididuals). Various parameters are assessed from the blood tests (such as the

cortisol level, lactate, glucose, etc.) and the concentration of different enzymes is also measured for the brain, gill, and liver samples (for instance, SOD, CAT, or TBARS).

Scientific Hypothesis
The main idea is to focus on differences between aggressiveness and social interactions of regular pigmented catfish and albino individuals. For instance, if there is a difference which is, moreover, related to some difference in cortisol, or glucose, than could may have something to do with higher levels of stress. Or, alternatively, if the difference is somehow related to the difference in lactose then it could be explained, for instance, by more effort needed in various encounters.

To be specific, the following scientific hypothesis are formulated:

1. The social interactions between individuals of the same type (regular pigmented or albino individuals) when competing for the limited hideout sources are different (albino individuals are, in general, assumed to be less active in the given environment).
2. Aggressive interactions and their occurrences depend on the 24 hour daily period (in general, it is assumed, that the catfish individuals are more active during a day).
3. The difference between the social interactions of regular pigmented catfish and albino catfish can be linked to different stress (in general, albino individuals are considered to be more stressful as they are assumed to be more threatened than regular pigmented individuals).
4. The difference between the social interactions of regular pigmented catfish and albino catfish can be explained by differences in the concentration of various chemicals in the blood.

Some limitations
An obvious difficulty of this experiment lies in the fact that the subject specific physiological characteristics (blood tests and gill, liver, and brain samples are always taken post-mortem) and the subject specific social interactions recorded on the camera are not measured with respect to the same individuals. Other technical limitations of the whole experiment made it impossible to collect more precise data. For instance, for the first experiment with the albino individuals, the camera device was not set properly and the corresponding recording could not be used to asses the aggressiveness and the social interactions. Moreover, the same four individuals were used for some experiments and there are only 11 experiments with unique groups of four albino individuals while there were 14 experiments with unique groups of 4 regular pigmented individuals (variable `č.vzorku` in the main data file).

Data files
All together, there are three (`xlsx`) data files available separately for the social interaction and aggressiveness, blood test results, and the stress enzyme samples. The files can be downloaded from the official course website in SIS (student's login required) together a detailed description of the whole experiment (in Czech).

- Data file form the video recordings: `social_interactions.xlsx`
- Blood test results: `blood_results.xlsx`
- Stress enzymes samples: `stress_enzymes.xlsx`

References
[1] Slavík, O., Horký, P., Maciak, M.(2015). **Ostracism of an Albino Individual by a Group of Pigmented Catfish**. *PLoS One*, 10(5):e0128279, 1 – 11.