Opercular frequency ventilation reflects the activity and personality of Mozambique tilapia males

(Oreochromis mossambicus, Peters 1852)

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INTRODUCTION

In teleosts, the occurrence of patterns or behavioural changes can be studied in a context of continuum boldness-shyness (1).

The degree of boldness influences the decision to take in an unpredictable environment, reflecting a balance between gains and risks (1; 2).

The test with a new object, can be used to assess the personality of the individual, simulating a potential danger and so, inducing a stress response (3).

The Ventilatory Frequency (VF), measured by non-invasive methods, can be used as a behavioural indicator to determine a stress response, as it is in conformity with cortisol measurements in plasma (4).

OBJECTIVES

1. To assess personality (within the shy-bold continuum) among Mozambique tilapia males (*Oreochromis mossambicus)* from a population breed in a captivity for several generations.

2. To investigate a possible relationship between personality and opercular ventilator frequency.

METHODS

1. Social isolation of the male (7 days)

2. Acclimatization to the experimental tank (24h before experiment)

3. **Experiment:**
   a) Ventilatory frequency was assessed using bioelectric potentials generated by the fish opercular and mouth movements (Fig. 1A)
   b) A novel object test was used to determine the personality of the subjects by measuring latency to approach each of the three zones of the object as follow: Bold ⩽ 3 min to enter the "Zone 5"; Intermediate > 3 min to enter the "Zone 5" or "Zone 10"; Shy, not enter "Zone 20" (Fig 1B).

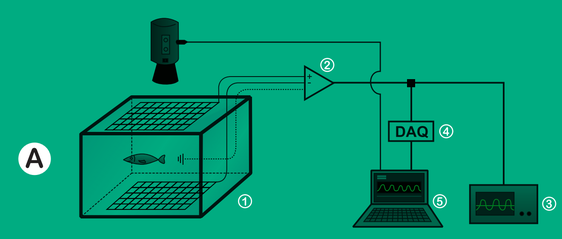

Fig. 1: (A) Experimental diagram: 1 – Experimental tank with two grids in stainless steel placed in the water column ; 2 - Amplifier; 3 - Oscilloscope; 4 - Analogue to digital converter (DAQ); 5 - Computer; 6 – Video Camera

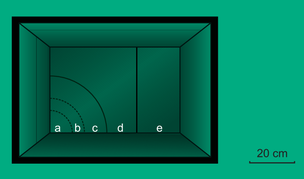

Fig. 1: (B) View from the top of the tank (scaled): a – Zone 5 cm distant from the object; b- Zone 10 cm distant; c- Zone 20 cm distant; d- Neutral zone; e- Avoidance Zone (furthest zone from the object)

RESULTS

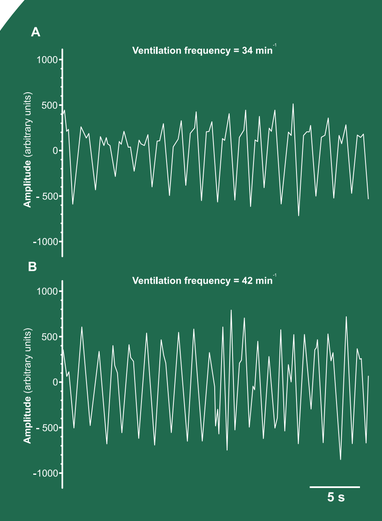

Fig. 2 – Example of opercular ventilation movements recorded for two males with Shy (A) and Bold (B) personality, respectively, for 30 s in the absence of new object in the aquarium (time scale of 5 s indicated by horizontal bar).

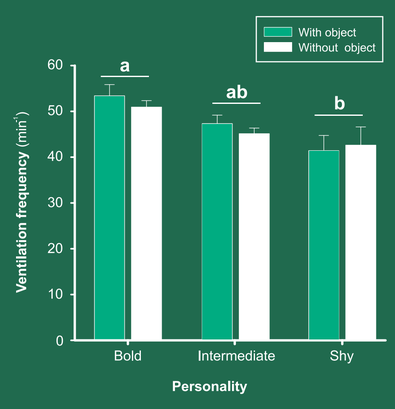

Fig. 3 – Opercular ventilation frequency (min^{-1}) of a male ,depending on his personality before the introduction of a new object in the aquarium (10 min, black bars) and during the presence of the object (10 min, gray bars). Bold, N = 12, Intermediate, N = 17; Shy, N = 9. The different letters on the vertical bars indicate statistically significant differences among the three personality types (HSD test, P <0.05).

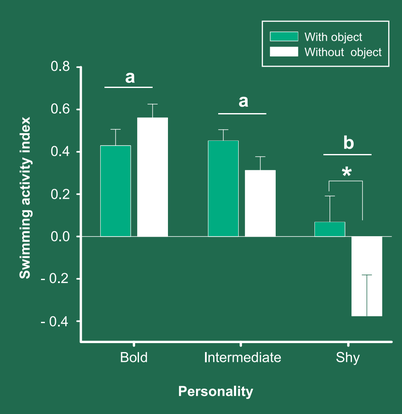

Fig. 4 – Swimming activity index of the males in function to his personality beore the introduction of a new object in the aquarium (10 min, black bars) and during the presence object (10 min, gray bars). Bold, N = 12, Intermediate, N = 17; Shy, N = 9. The different letters on the vertical bars indicate statistically significant differences among the three personality types (HSD test, P <0.05).

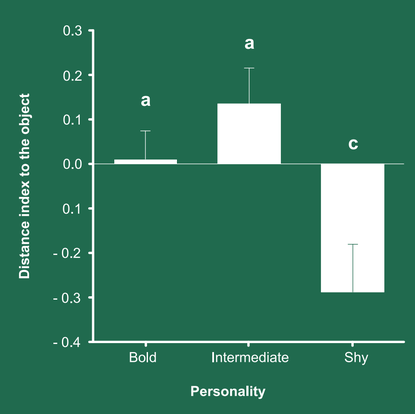

Fig. 5 – Distance index to the object (during 10 min) for each type of personality. Bold, N = 12, Intermediate, N = 17; Shy, N = 9 . The different letters on the vertical bars indicate statistically significant differences among the three personality types (HSD test, P <0.05). Asterisk indicates significant differences (HSD test, P <0.05)

CONCLUSIONS

- **Personality and opercular VF showed significant relationship in male *O. mossambicus* (Fig.3).**
- **Activity level and VF evidence a positive link in each type of personality, with bold and intermediate males more active, therefore with higher VFs, compared to shy males (Fig. 4).**
- **Individual's exploratory capacity and personality showed a relationship, with bold and intermediate males exploring significantly more than shy males (Fig. 5).**
- **Bold and intermediate personality types are only separated due to the classification criteria used in this study.**
- **Possible bold selection, due to the alteration of the selection pressures in captivity.**

References:
(1) Coleman, K. & Wilson, D.S. 1998. Shyness and boldness in pumpkinseed sunfish: individual differences are context-specific. *Animal Behaviour*, **56**: 927-936. **(2)** Wilson, D.S., Clark, A.B., Coleman, K. & Dearstyne, T. 1994. Shyness and boldness in humans and other animals. *Trends in Ecology & Evolution*, **9**: 442-446. **(3)** Burns, J.G. 2008. The validity of three tests of temperament in Guppies (*Poecilia reticulata*). *Journal of Comparative Psychology*, **122**: 344-356. **(4)** Barreto, R.E. & Volpato, G.L. 2004. Caution for using ventilatory indicator of stress in fish. *Behavioural Processes*, **66**: 43-51.

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