

# Four's a crowd? Social preferences in golden mantella (*Mantella aurantiaca*) tadpoles

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## Introduction

- **Social groups can aid survival** through increased predator protection and increased foraging opportunities (1,2,3). However, **large group sizes** can also be associated with **higher intragroup competition**(4).
- Individuals need to be able to **discriminate between group size** in order to **analyse the costs and benefits** of joining a group (5).
- The **object tracking system** is one method for which species can **assess numerosity for small precise quantities**, usually up to the value of four (6).
- Some **amphibian species** have been shown to **exhibit this object tracking system**. Such as: *Dendrobates auratus*, *Hyla intermedia* and *Bombina bombina* (7,8,9).
- The ability to assess numerosity is so far **unstudied within the mantellidae family**.

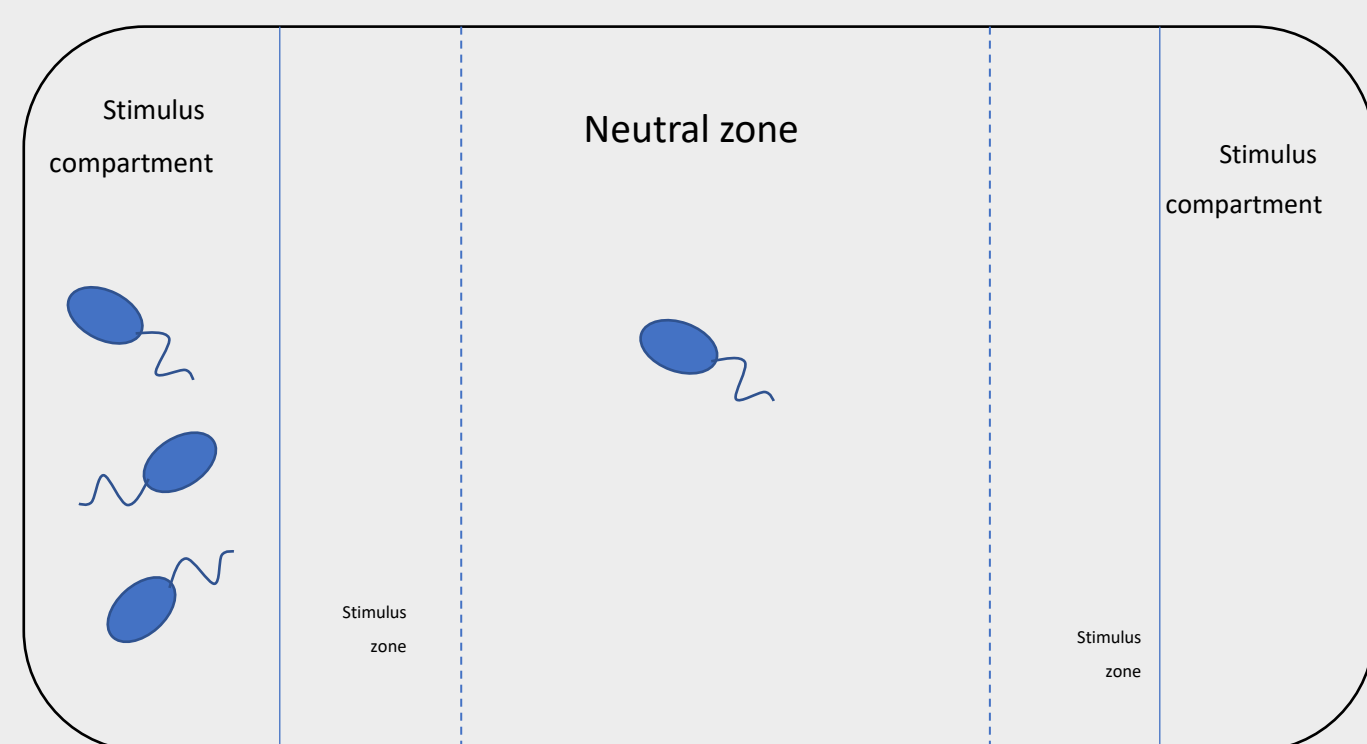
## Methods:

**Study population:** Two unrelated *M.aurantiaca* clutches (n=42, n=56 respectively) housed individually. Experiments lasted from week two after hatching to week eight, once metamorphosis began

### Experimental Procedure

- Focal tadpole first placed in 35mm plastic vial for 5 minutes acclimation time
- 20 minutes recorded via remote camera
- Time spent within each zone measured and preference index created
- Preference index =  $t(\text{large shoal}) / (t(\text{large shoal}) + t(\text{small shoal}))$

### Experimental Setup



### Experiments

- 16 trials for each experiment per week across both clutches
- Experiment 1: 3 vs 0 tadpoles in stimulus compartments
- Experiment 2: 2 vs 1 tadpoles in stimulus compartments
- Experiment 3: 4 vs 2 tadpoles in stimulus compartments



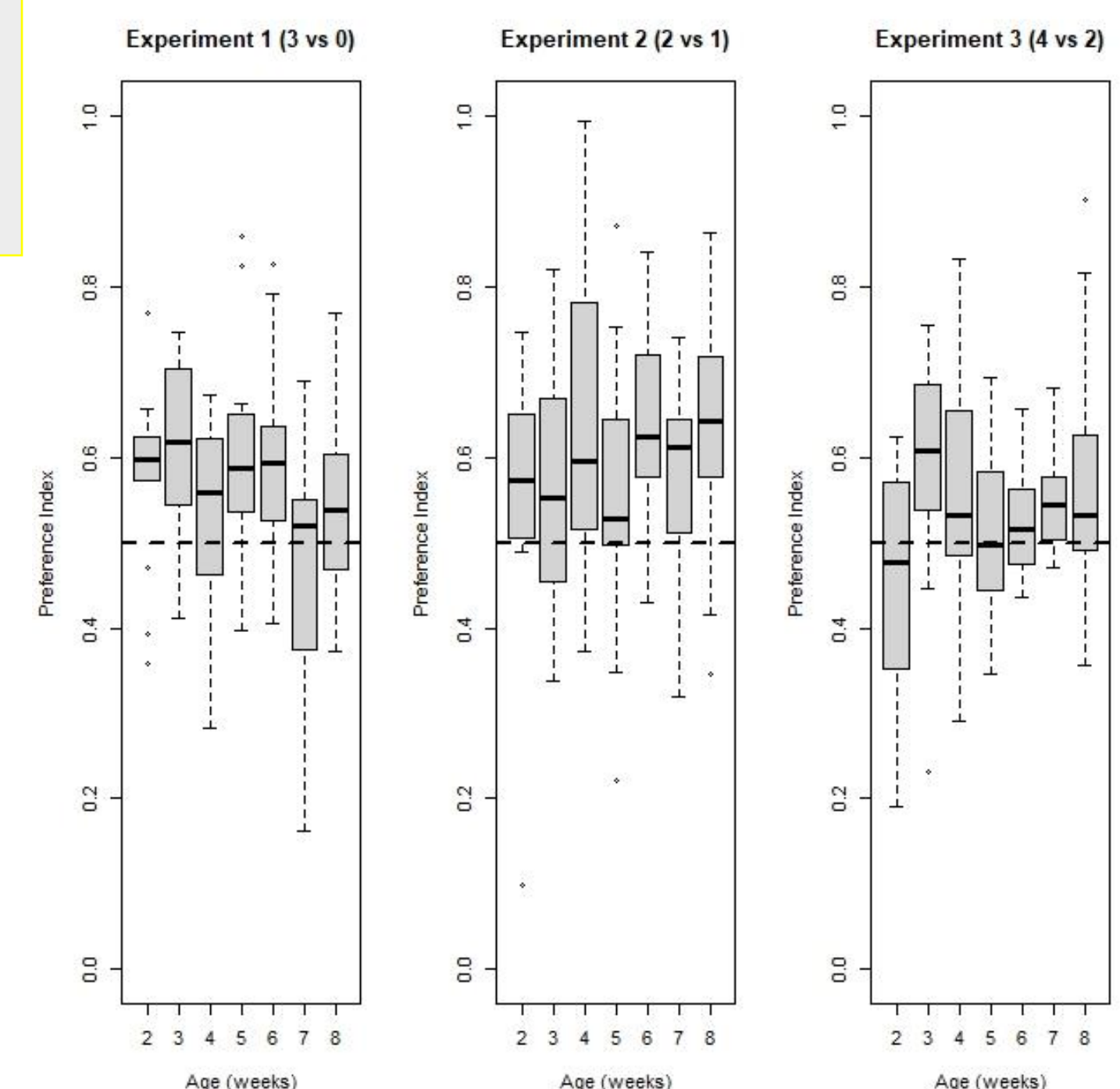
Figure 1: Across all three experiments a significance was found in preference index for the larger shoal ratio ( $P < 0.001$ ). The dotted line in the figure highlights 0.5 which was the preference index threshold indicating a larger shoal preference.

GLMM performed to establish a preference in shoal size between experiments two and three, with experiment as a fixed effect, age in weeks as a random effect and preference index as the independent variable.

As this GLMM revealed a difference in preference depending on group sizes, all three experiments were then tested separately.

## Results:

- In **experiment one** tadpoles showed a **significant preference to be with the group** (3 vs 0:  $t=47.43$ ,  $df=111$ ,  $P < 0.001$ ). The strength of this preference declined with age ( $t=2.069$ ,  $df=111$ ,  $P=0.04$ ).
- A **significant difference between preference indices of experiment two and three** ( $\text{Chisq}=10.78$ ,  $df=1$ ,  $P=0.001$ ), with tadpoles in **experiment two showing stronger preferences for the larger group than in experiment three** (mean  $\pm$  S.D. = 2 vs 1:  $0.6 \pm 0.14$ ; 4 vs 2:  $0.54 \pm 0.12$ ).
- Both experiments age at testing had no significant effect on preferences: Experiment 2 (2 vs 1): ( $t=1.33$ ,  $df=107$ ,  $P=0.19$ ), 3; Experiment 3: (4 vs 2) ( $t=1.09$ ,  $df=107$ ,  $P=0.28$ ) (Figure 1).



## Conclusions:

- There appears to be **no difference in social preference based on age**.
- *M. aurantiaca* tadpoles **prefer to aggregate when given the choice** between a social aggregation and being solitary.
- *M.aurantiaca* tadpoles **prefer larger shoals over smaller shoals** when given a choice.
- A **lower preference index** in the 4 vs 2 experiment compared to the 2 vs 1 experiment **indicates some ability to discriminate numerosity** using the object tracking system
- This difference **suggests the proximate number system**, which is useful for higher numerosity [], **may not be present in *M.aurantiaca*** and more research is needed to further investigate this.

## References

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