Sociability and its link with boldness in collective behaviour in sticklebacks

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INTRODUCTION

Background

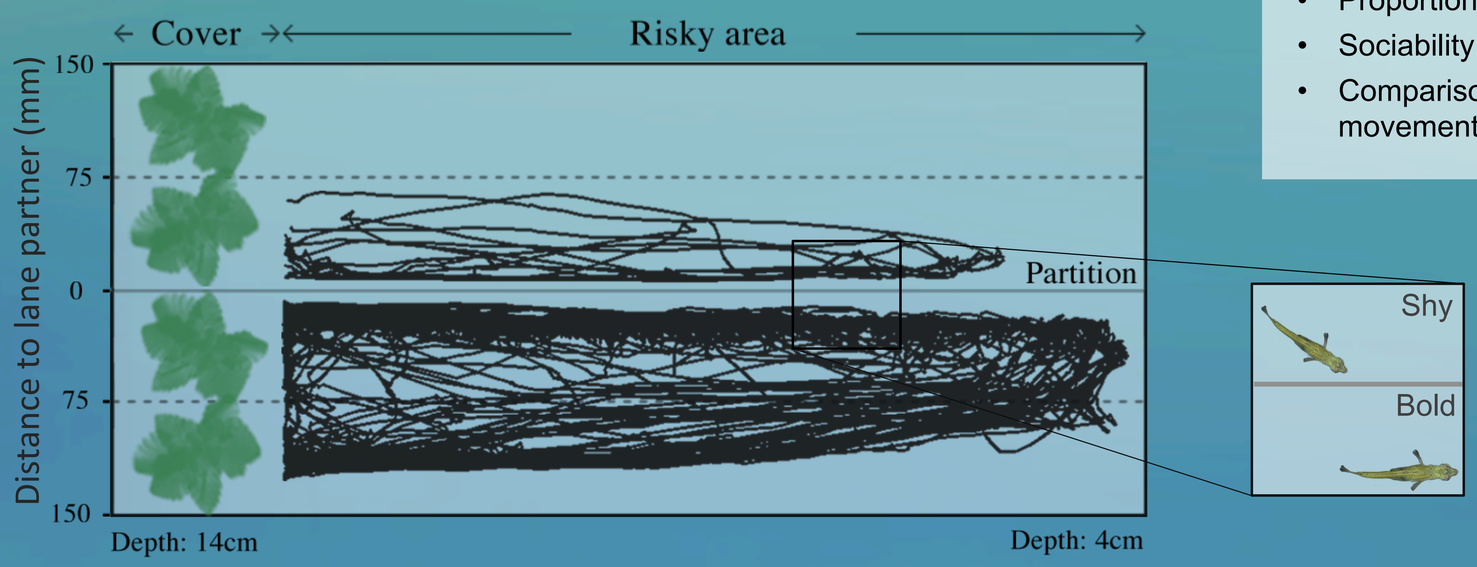
Social animals must coordinate their behaviour to ensure the benefits of grouping, resulting in collective movements and leadership. The mechanisms that govern such sociality are a key topic in contemporary science. Importantly, often consistent differences exist in the way individuals respond to conspecifics (sociability trait).

Problem

The sociability personality trait remains unexplored in a natural setting in which individuals can interact and hide under cover. Therefore its role in collective behaviour remains unclear.

Predictions

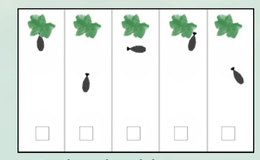
Individuals with higher sociability may be more risk-averse and motivated to respond to conspecifics. Therefore more sociable individuals may be less bold, more strongly affected by social interactions and the personality of their group mates, positively affect group cohesion, and lead group movements less.



METHODS

Subjects & housing

Wild-caught three-spined sticklebacks (*Gasterosteus aculeatus*) were housed in individual compartments in a temperature-controlled lab (T = 14°C ± 1°C) on a restricted feeding schedule. Fish were controlled for age and size.



Individual housing

Experimental design

Fish (*N* = 96) were subjected to experimental tanks that contained a safe area with cover leading to a shallow risky area on the other side:

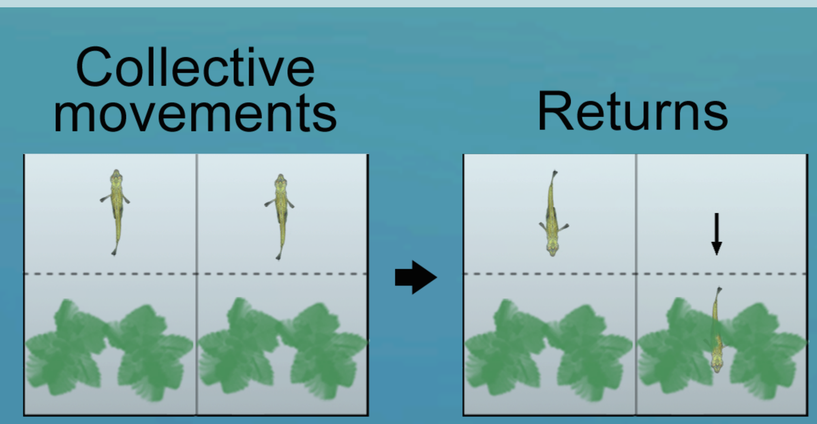
- Days 1 & 2: Isolation stage: individuals tested to quantify boldness (1h/day)
- Days 4 & 5: Pairing stage: individuals able to interact through a transparent partition (1h/day)

AnTracks

Quantification of behaviour

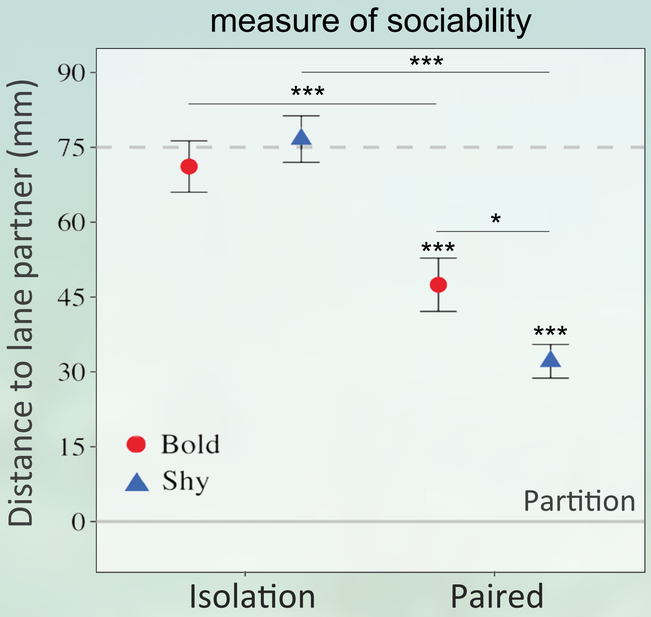
Exact positional coordinates of each fish were determined 10 times/sec using automatically tracking software, enabling the analysis of:

- Proportion of time out of cover (during isolation: boldness)
- Sociability: average distance from partner's lane
- Comparison between collective movements, the initiation and return of such movements, and solo trips

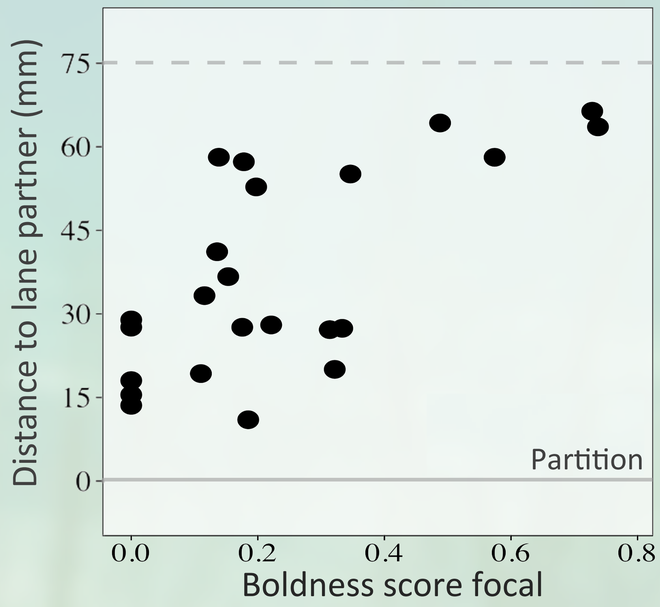


RESULTS

Distance to partner's lane as measure of sociability



Shyer fish are more sociable than bolder fish



Personality

Boldness: consistency in time out of cover during isolation (r_s = 0.65, p < 0.001)

Sociability: consistency in distance from partner during collective movements (r_s = 0.43, p < 0.05)

Leadership

Less sociable fish initiated more collective movements more trips (r_s = 0.475, p < 0.05)

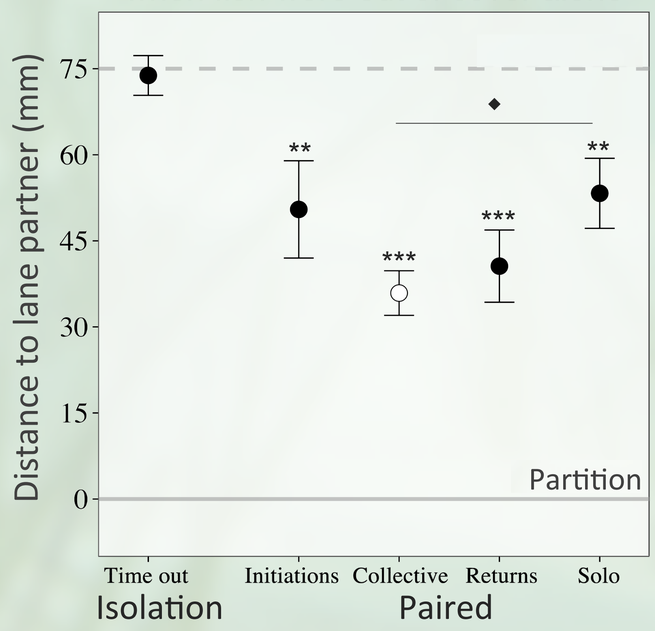
Effect of partner

Fish led ($F_{2,13}$ = 5.46, p < 0.05) and returned from collective movements ($F_{2,13}$ = 4.65, p < 0.05) closer to their partner's lane when it was shyer

No effect during collective movements ($F_{1,20}$ = 2.28, p = 0.15) and solo trips ($F_{2,15}$ = 0.63, p = 0.44)

Effects of focal and partner boldness on sociability were analysed using LMMs. Boldness and sociability scores were square-root transformed. Means are quoted ± SE. *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, ◆ $p < 0.10$

Sociability expression even persisted when fish were out of cover alone



CONCLUSION

Sticklebacks were consistent in **sociability** in a natural setting in which they could hide under cover and interact with conspecifics. Sociability was strongly linked to **boldness**, with shyer fish swimming closer to their partner, and even persisted when fish were out of cover alone**. Social interactions** had a mixed effect, with the boldness of a partner affected sociability when individuals led and returned from collective movements. Importantly, **leadership** was negatively related to sociability.

These results highlight a important role for sociability in **collective behaviour** and its fundamental link with boldness. This provides important insights into the **mechanisms** that govern the organization and dynamics of social groups and may help explain the maintenance and evolutionary history of **personality differences**.

Key message

By investigating sociability in a natural setting we show this personality trait is fundamentally linked to boldness and plays a crucial role in collective behaviour by affecting social cohesion, coordination and group leadership.

BBSRC

Selected literature: **Cote et al**. 2010, *Proc B* 277; **Couzin et al**. 2005, *Nature* 443; **Krause & Ruxton** 2002, *Living in groups*; **Reale et al.** 2010, *Phil Trans B* 365; **Sih et al.** 2012, *Ecol Lett* 15; **Webster & Ward** 2011, *Biol Rev* 86; **Wright & Krause** 2006, *Nat Prot* 1

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