The nest matters: reproductive state influences decision-making and behavioural consistency to conflicting stimuli in male Siamese fighting fish, *Betta splendens*

Teresa L. Dzieweczynski1), Courtney E. Gill & Meghan M. Walsh

(Department of Psychology, University of New England, 11 Hills Beach Road, Biddeford, ME 04005, USA)

(Accepted: 9 February 2010)

Summary

Before the heritable basis or fitness consequences of differences in decision-making can be explored, consistent variation in decision-making among individuals must be established. The presentation of conflicting stimuli in the form of a female and a male provides a unique situation that has not been widely explored in terms of consistent individual variation. To assess consistency and plasticity in decision-making, male Siamese fighting fish were presented with a single female, single male and paired male and female presented simultaneously both when they did and did not have nests. Having a nest had a marked effect on male response, but only towards the female. Males differed from one another in the strategies they used when faced with conflicting stimuli; some males focused on the male, others on the female, and still others divided their response between the two. Most importantly, males behaved consistently yet differed from one another when context and reproductive state were constant. Finally, some males exhibited consistent plasticity as a result of social environment and/or reproductive state, the first finding of this kind. This study demonstrates the presence of consistent individual variation in decision-making, providing the groundwork for further studies into the evolution of this trait.

**Keywords**: individual differences, behavioural trade-offs, decision-making, repeatability, Siamese fighting fish.

1) Corresponding author’s e-mail address: tdzieweczynski@une.edu
Introduction

Consistent individual differences in terms of personality traits means that an individual will behave in a predictable manner in a given situation yet differ in its response from other members of the same population. Individual differences have been found for a number of behaviours including mate choice (e.g., Widemo & Saether, 1999; Wong & Jennions, 2003), foraging efficacy (e.g., Noakes, 1986; Blanckenhorn & Perner, 1994), and boldness (van Oers et al., 2003; Frost et al., 2007). Differences among individuals could result from behaviourally plastic responses to the environment (Sih & Watters, 2005), life history tradeoffs (Wolf et al., 2007), hormonal differences (Ketterson & Nolan, 1999) and/or genetic differences (Drent et al., 2003). Individuals that are more consistent in their responses will behave similarly each time they are faced with a given stimulus or situation whereas individuals that are more plastic in their responses will show different responses across time and/or contexts. Because the existence of consistent individual differences implies that individuals vary non-randomly from one another, these differences may have important ecological and evolutionary consequences and may influence how populations respond to selection (Dall et al., 2004). Therefore, measuring the degree of individual variation within a population is a logical starting point for any evolutionary study.

Environmental complexity and complex selective regimes drive individuals to adopt varying strategies to effectively cope with the often conflicting demands of acquiring resources, finding mates, and avoiding predators. Individual decision-making — defined as the process by which an individual selects a behaviour after weighing the costs and benefits of performing alternative behaviours — is a dynamic process that is influenced by a variety of factors (Lima & Dill, 1990). The need for plasticity in decision-making across contexts may seem in opposition to the idea of behavioural consistency because consistency in response must exist in order for selection to operate most effectively and evolution to occur (Brodie III & Russell, 1999; Wolf et al., 2007). However, individuals may vary in the degree of consistency they express across contexts as well as the degree of plasticity they express within a given context. These processes are not an either/or phenomenon and behaviour should reflect a combination of behavioural optimization within a context (i.e., plasticity) and general expression of personality across contexts (i.e., consistency) (Johnson & Sih, 2007). Individuals may