Temperament traits and microhabitat use in bullhead, *Cottus perifretum*: fish associated with complex habitats are less aggressive

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Summary

Temperament traits have been linked to fitness-related functional contexts such as dispersal or mating attractiveness, but few studies have linked inter-individual differences in habitat use to temperament traits. Therefore, we conducted a three-month field study with weekly tracking to define the individual microhabitat use of bullhead (*Cottus perifretum*). The species is known for its dependence on structured habitats. At the end of the field-survey, bullhead were recaptured and tested in the laboratory for five temperament traits: boldness, interest in novel food, novel environment activity, aggressiveness and activity. Repeated trait tests (activity, \(r = 0.439\); novel environment activity, \(r = 0.422\)) and habitat complexity use (\(r = 0.568\)) indicated behavioural consistency. Overall, bullhead significantly preferred complex habitats, such as branch jams, while avoiding open water. Individual frequency in the use of complex habitats could not be attributed to size or sex differences, but was significantly negatively correlated to the level of aggressiveness. We hypothesize that this relationship was caused by a higher level of aggressive defence of less structured territories. Other temperament traits were not significantly linked to individual habitat use. To our knowledge, this study is the first to show a relationship between aggressiveness measured under laboratory conditions and the use of complex habitats *in situ*.

**Keywords**: daytime shelter, habitat selection, personality, temperament traits, habitat structure.

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1. Introduction

One of the most important methods of reducing competition between species is niche partitioning by habitat use (Schoener, 1974). This has also been shown to exist within single populations of one species (Bolnick et al., 2003). Some individuals of a population expand to unused or underused habitats when competition passes a threshold (Mayr, 1926; Svanbäck et al., 2008). For instance, many lentic fish species prefer the near-shore littoral habitat; when faced with tighter competition, some individuals of a population use the less preferred open water habitat (e.g., Svanbäck et al., 2008). Such diversity in microhabitat use may occur in the absence of differences in sex, size or age, but could be related to other behavioural characteristics (Bolnick et al., 2003). However, little is known about the relation between the diversity in habitat use and other behavioural traits. Animal temperament (Réale et al., 2007) comprises a range of behavioural traits that might help to increase understanding of heterogeneous microhabitat use.

Temperament traits are increasingly used to highlight consistent differences in individual behaviour between and within animal populations (Réale et al., 2007). Populations have been subdivided into temperament types such as either bold and shy (Wilson et al., 1994; Réale et al., 2000; Sinn et al., 2008), fast and slow explorative (Verbeek et al., 1994) and responsive versus unresponsive (Wolf et al., 2008). Between-individual differences in temperament traits have been linked to fitness-related functional contexts (reviewed by Schuett et al., 2010) such as behaviour of bird singing (Garamszegi et al., 2008), brood care helping (Bergmüller & Taborsky, 2007), mating attractiveness (Godin & Dugatkin, 1996) and mating success (Reaney & Backwell, 2007), dispersal or movement range (reviewed by Clobert et al., 2009) and growth (Millot et al., 2009). Surprisingly, relationships between individual microhabitat use in nature and temperament traits have hardly been studied (but see Boon et al., 2008).

An important question that arises is whether there is relation between temperament traits and individual use of structured habitats. The individual difference in environmental choice may cause a diversification of temperament traits. For example, individuals in the less structured habitat may be exposed to a higher predation risk and show riskier and bolder behaviour (Magnhagen & Borcherding, 2008). The level of boldness is then positively adapted to the level of predation risk (Brown et al., 2007). The other causal