



Maintenance of species boundaries within social aggregations of ecologically similar goby sister species

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Abstract

The maintenance of species boundaries when opportunities for admixture are abundant, is a poorly understood phenomenon for many taxa. While many mechanisms for maintaining species boundaries have been described their relative importance depends largely on the particulars of the system in question. Aggregating social behavior can be a means to keep sympatric sister species distinct if it leads to segregation during reproduction. The widespread Caribbean reef gobies *Coryphopterus personatus* and *C. hyalinus* are sympatric sister species with nearly identical morphology that spend their entire adult lives in shoals in which reproduction occurs. To date no studies have investigated whether shoals are species-specific, which would be expected if aggregating behavior helps to maintain species boundaries. To address this, the species of individual fishes collected from 16 shoals were identified using morphology, mitochondrial sequence data, and microsatellite allele frequencies. Levels of admixture between the species were also assessed. Shoals were generally composed of both species in similar proportions to their relative abundances on the reef, where the shoals were found, indicating that the species are not behaviorally segregating. For most specimens, morphological, mitochondrial, and nuclear data were congruent with a single species, but 18 individuals showed disagreements with microsatellite genotypes of 16 suggesting some level of historic/contemporary admixture. Of these, two were identified as likely first- or second-generation hybrids or backcrosses. Despite co-occurrence and evidence of some gene flow, the two species show little admixture overall suggesting that microscale differences in breeding site selection, allochrony, and/or cryptic mate choice may play an important role in the maintenance of species boundaries despite cooccurrence well within the range typically thought of as sympatry.

Keywords Social aggregations · Hybridization · Species boundaries · Sympatry · Isolating mechanisms

Introduction

Understanding processes that maintain species boundaries in sympatry is a major focus of evolutionary ecology. Many ecological and evolutionary mechanisms have been identified in the maintenance of species boundaries, with their relative importance depending on the specifics of the study system (Harrison et al. 2017). This is particularly true amongst closely related species living in sympatry, which can lead to frequent opportunities for hybridization. Research has found that allochronic, ecological, and behavioral isolation,

as well as gametic incompatibility, are frequently important (Coyne and Orr 2004; Harrison et al. 2017). Allochronic isolation occurs when gamete release and production are offset in time, leading to a reduced opportunity for interaction between gametes of sympatrically distributed species (Levitan et al. 2011; Bouwmeester et al. 2021) and can occur on scales from hours to years (Knowlton et al. 1997; Rosser 2015; Tarpey et al. 2017). Ecological isolation occurs when species utilize different ecological niches which subsequently minimizes opportunities for mating interactions (Bovbjerg 1970). Behavioral isolation occurs when differences in behavior develop that impact the likelihood of heterospecific mating and can include differences in mating behavior (Parchman et al. 2013) and/or formation of spatially segregated social groups (Gerhardt 1974; Diabaté et al. 2009). Gametic incompatibility occurs when a viable zygote is not formed during fertilization (Rawson et al. 2003).

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