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Diel activity and variability in habitat use of white sea bream in a temperate marine protected area

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ABSTRACT

Fish populations are often comprised of individuals that use habitats and associated resources in different ways. We placed sonic transmitters in, and tracked movements of, white sea bream (*Diplodus sargus sargus*) in the no-take zone of a Mediterranean marine protected area: the Torre Guaceto marine protected area, (Adriatic Sea, Italy). Tagged fish displayed three types of diel activity patterns in three different habitats: sand, rocky reefs and "matte" of the seagrass *Posidonia oceanica*. Individuals were more active during the day than at night. Overall, white sea bream displayed a remarkable behavioural plasticity in habitat use. Our results indicate that the observed behavioural plasticity in the marine protected area could be the result of multiple ecological and environmental drivers such as size, sex and increased intra-specific competition. Our findings support the view that habitat diversity helps support high densities of fishes.

1. Introduction

The distributions and movements of marine fishes are strongly influenced by density dependent processes and by the availability of shelter, food and spawning grounds (Dickson et al., 2005; Kuefler and Haddad, 2006). In turn, the mobility of a fish species can influence the degree of connectivity among habitats types (Kaunda-Arara and Rose, 2004; Dorenbosch et al., 2007; Vega Fernández et al., 2008). Thus, connectivity among habitats is affected by overfishing and severe habitat degradation (Palumbi, 2004; Worm et al., 2006), which can greatly drive down populations (Starr et al., 2007).

An understanding of habitat uses and daily activities of adult fish is crucial for conserving fish populations (Holland et al., 1996). Habitat uses and diel activity patterns vary greatly among species (Chapman and Kramer, 2000), and also at a population level within a species. Intra-specific variation in habitat use of fish has been attributed mostly to ontogenetic shifts (Nagelkerken et al., 2000; Huijbers et al., 2008; Afonso and Hazin, 2015). Some studies have shown that movements of individuals can vary within a population (Egli and Babcock, 2004; Hammerschlag-Peyer and Layman, 2010) and that spatial partitioning can occur, within groups of individuals using different habitats (Morbey et al., 2006; Kobler et al., 2009; Koeck et al., 2013). Also, some studies have reported the existence of substantial plasticity in fish movements with respect to habitat use and daily activity (Roughgarden, 1972; Reebs, 2002; Hammerschlag-Peyer and Layman, 2010; Bolnick et al., 2003; Koeck et al., 2013), supporting the hypothesis that some species described as generalists could actually be composed of a heterogeneous array of specialists (West, 1988; Bolnick et al., 2002; Loury et al., 2015). As a consequence, the identification of habitat relationships among groups of individuals can help support spatial

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