

The natural history of a monogamous coral-reef fish, *Valenciennea strigata* (Gobiidae): 1. abundance, growth, survival and predation

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Synopsis

The population dynamics of a monogamous coral-reef fish were examined to test hypotheses of recruitment limitation, predation, and postrecruitment processes, and to determine their affects on the mating system. *Valenciennea strigata* are monogamous gobies that live in sand and rubble zones throughout the Indo-Pacific. Seasonal abundance was recorded in the summer and winter over 2.5 years. A subset of this population was tagged ($n = 256$) and followed to determine mortality and mobility. *Valenciennea strigata* were more abundant in summer than in winter, suggesting that a pulse of recruitment in the spring set the maximum population density. Growth rates derived from tagged fish support the hypothesis that recruitment peaked in the spring. Tagged fish experienced 88% mortality within six months; the annual mortality rate approached 100%. Evidence of predation, antipredatory behavior and strong site fidelity implicate predation as the primary source of mortality. Competition for space was not observed between adults, but may affect settlement and recruitment. Despite the lack of adult competition for space, both sexes guarded their mates and courted individuals of the opposite sex. Thus, although population size appears to be determined by nonequilibrium processes, the mating system is affected by competition for mates. Successful mate guarding by both sexes enforced monogamy.

Introduction

Elton's (1927) model of community ecology suggests that most communities are structured by equilibrium processes. Although this model has dominated ecological theory, recent evidence supports a nonequilibrium view of the natural world (reviewed by Reice 1994). Studies of coral-reef fishes have been instrumental in this change of perspective (e.g. the lottery hypothesis, Sale 1978; the

recruitment-limitation hypothesis, Doherty 1983). These and other studies suggested that populations of coral-reef fishes are determined primarily by oceanic processes that affect recruitment, while equilibrium processes have little effect (Doherty 1991, Victor 1991). Similarly, predation can maintain populations at levels that minimize competition (Hixon 1991).

Although the emerging paradigm suggests that coral-reef fish populations are limited by nonequi-

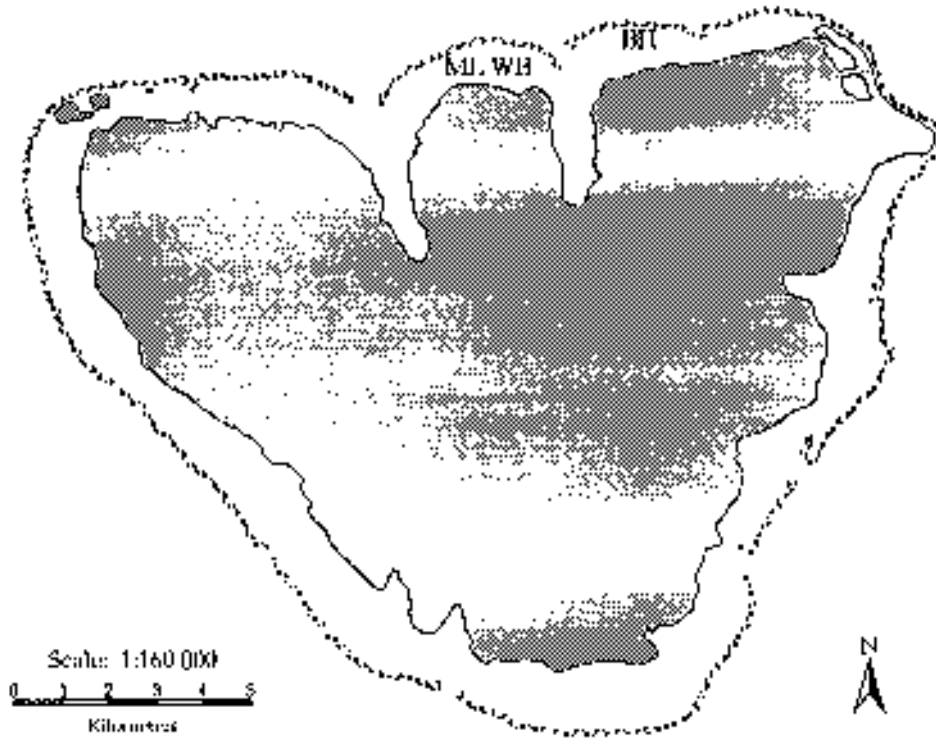


Figure 1. Study sites on Moorea Island.

librium factors, equilibrium processes may still affect these fishes (Jones 1991). In particular, competition for mates can occur even at low densities, especially if resources are clumped, affecting both reproductive output and the mating system (Emlen & Oring 1977). Thus, studying the mating systems of coral-reef fishes should provide evidence useful in distinguishing postrecruitment processes. For example, monogamy in coral-reef fishes has been explained by both equilibrium and nonequilibrium models (reviewed by Barlow 1984, Barlow 1986). Butterflyfishes appear to be monogamous because the competition for coral prevents males from sequestering multiple mates (Hourigan 1987). Conversely, a tilefish in the Red Sea exists at such low densities that mates remain together because encounters with potential mates are rare (Clark & Pohle 1992).

Valenciennea strigata (Broussonet) is one of the fish whose behavior was reviewed by Barlow. Little

additional information had been published on *V. strigata* or their relatives until the recent review of the genus by Hoese & Larson (1994). They described 15 species, ecologically similar in their use of sand and rubble habitats. Monogamy appears common to the genus; conspecifics are typically observed in pairs sharing a burrow that they construct themselves (e.g. Barlow 1984, Hoese & Larson 1994).

Here I examine the population dynamics of *V. strigata* to determine whether their population is influenced primarily by equilibrium or nonequilibrium factors. My companion paper (Reavis 1997) addresses the behavior and mating system of the same population. Together, these data suggest that the population is limited by nonequilibrium processes, and that the low population density allows both sexes to successfully guard a monogamous mate.