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Behaviour of the Recently-described Rodrigues Damselfish, *Pomacentrus rodriguesensis*

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Abstract—This comprises the first study on the behaviour of a recently described species, *Pomacentrus rodriguesensis*, on the island of Rodrigues. *P. rodriguesensis* was observed to be solitary with a territorial preference for live coral. Individuals fed on a combination of food types, eating predominantly plankton, but also occasionally benthic algae. *P. rodriguesensis* was found to defend its territory against other individuals. Conspecifics elicited the majority of agonistic responses but *P. rodriguesensis* also acted aggressively towards benthic feeders such as *Pomacentrus pikei* and *Stegastes limbatus* and species of wrasse during summer. It is suggested that the pattern of territoriality observed in *P. rodriguesensis* prevents a reduction in the benthic algal component of its diet by competitors and protects its nests from egg predators. Its preferred habitat of live coral suggests that it may be vulnerable to declines in coral cover.

INTRODUCTION

A total of 493 coastal fish species have been recorded in the large, shallow lagoon of Rodrigues (Republic of Mauritius), including 32 species of Pomacentridae (Heemstra *et al*., 2004). The Rodrigues Damselfish, *Pomacentrus rodriguesensis*, was first observed in Rodrigues in 2001 (Allen & Wright, 2003; Heemstra *et al*., 2004) and is thought to be endemic to the Republic of Mauritius. *P. rodriguesensis* is found on reef slopes at depths ranging from 3–20 m and is particularly abundant in the north of Rodrigues, within the relatively sheltered region of Port Mathurin Bay (Fig. 1).

Pomacentrids are an ecologically diverse family of fish and many species have a major influence on the structure of benthic reef communities (Ceccarelli *et al*., 2001). They have also been shown to be vulnerable to habitat degradation and the abundance of some coral-dwelling damselfish species declines after coral mortality (Booth & Beretta, 2002; McClanahan *et al*., 2002). Port Mathurin Bay has been affected by coral bleaching in recent years (Hardman *et al*., 2007) and proposed new developments may impact the coral reef habitats and associated fish communities. Due

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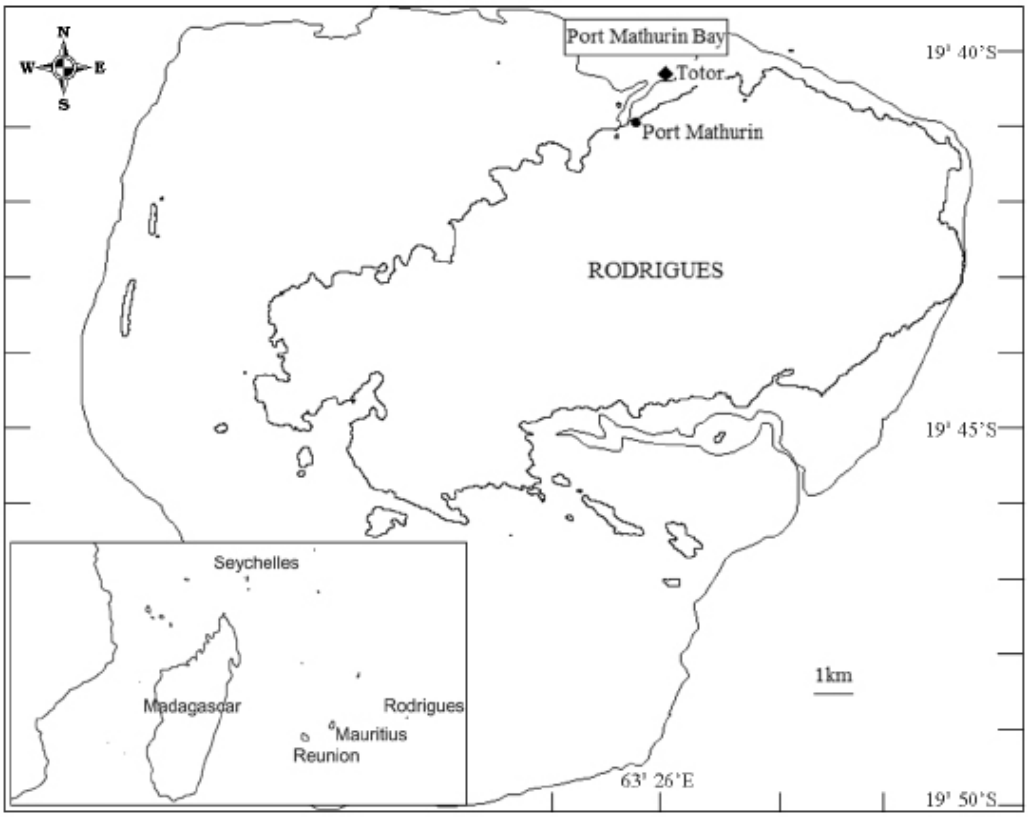

Figure 1. Location of the study site, Totor, within Port Mathurin Bay on the north coast of Rodrigues and the location of Rodrigues, 595 km to the east of Mauritius in the western Indian Ocean.

to its relatively recent discovery, nothing was known about *P. rodriguesensis*. This therefore constitutes the first study to document aspects of its behaviour, its ecological niche and its vulnerability to habitat change.

MATERIALS and METHODS

Estuary descriptions

Surveys were undertaken at a sheltered site, Totor (19°40'S; 63°26'E), where *P. rodriguesensis* is particularly abundant (Fig. 1). Totor is situated 1 km offshore within the region of Port Mathurin Bay. It is characterised by low visibility (3.7–6.4 m) and high sedimentation rates (>10 $mg.cm^{-2}.d^{-1}$) (Hardman, 2004) and consists of a gently sloping, fringing coral reef dropping to a silty seabed at 15 m depth. The study was undertaken at depths of 2–7 m using SCUBA during two periods of 1 month, viz. December 2007 (summer) and August/September 2009 (winter).

Observations of individual behaviours were made during focal animal observations (Lehner, 1979) in which each individual was observed for 5 minutes. Every 15 seconds, the individual's behaviour was noted as either: (i) feeding, (ii) resting, (iii) patrolling around its territory or (iv) interacting. Interactions with conspecifics and other species were noted. The distance each fish moved during the 5-minute observation period was also estimated. Observations were converted to percentages for each individual in terms of the four behavioural categories listed above. Data were found to have heterogeneous variance and comparisons were thus conducted using a non-parametric statistical test (Mann-Whitney U test; 95% confidence level)

RESULTS and DISCUSSION

Population structure

One hundred individuals of *P. rodriguesensis* were observed during each of the two study periods, with a total underwater observation period of 16 h 40 min. *P. rodriguesensis* was observed to be a solitary species with a preference for territory of mixed live coral dominated by *Acropora* and *Montipora* spp. Individuals appeared to have small territories and estimated distances moved during the observation periods ranged from 0.5-5 m, with individuals remaining 5-30 cm above the substratum. Their territory size was similar to that of *Pomacentrus albofasciatus*, but larger than that of *Pomacentrus lividus* in Guam (Belk, 1975).

Individuals were observed to spend the greatest proportion of their time patrolling their territory, with significantly more time spent patrolling during the summer (69.5 ± 2.0% of observations) than during the winter (45.3 ± 1.1% of observations; $Z = -8.603$, $p < 0.001$; Fig. 2). There was no significant difference in the amount of time spent resting during summer and winter ($Z = -0.161$, $p > 0.05$). On average, individual *P. rodriguesensis* spent significantly more time feeding during the winter (39.0 ± 1.1% of observations) than during the summer (12.8 ± 1.5% of observations; $Z = -9.791$, $p < 0.001$; Fig. 2). *P. rodriguesensis* was observed to feed on a variety of food types, but predominantly on plankton and occasionally on benthic algae. Pomacentridae have been reported to belong to three feeding guilds: pelagic feeders, benthic feeders and a third group which feeds on both pelagic and benthic biota (Frédérich *et al*., 2009). It appears that *P. rodriguesensis* falls into the third group, in which individuals feed on small planktonic prey, small vagile invertebrates and filamentous algae.

During the two study periods, 54 interactions were observed with 13 different species of fish from five families. Interactions between summer and winter were similar, and the majority of agonistic responses elicited by *P. rodriguesensis* were against con-specifics (26.9% in summer; 27.6% in winter). Of the inter-specific interactions, 62.5% of agonistic responses were against other pomacentrids, in particular *Pomacentrus pikei* and *Stegastes*

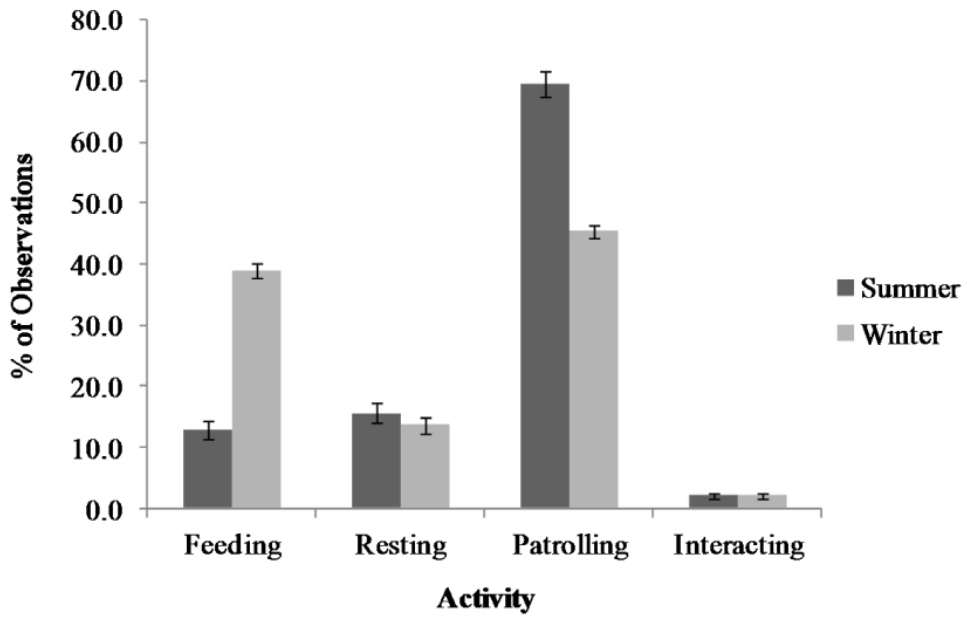

Figure 2. Mean percentage (±SE) of observations on 200 *Pomacentrus rodriguesensis* individuals feeding, resting, patrolling and interacting during summer and winter.

limbatus. During winter, 13.8% of interactions were with surgeonfish (*Acanthurus* spp.), while only one agonistic response was recorded during summer. Previous research has indicated that Pomacentridae defend their territory to protect their food resources (Low, 1971; Mahoney, 1981), their eggs (Fishelson, 1970; Myrberg & Thresher, 1974), or their shelter sites (Moran and Sale, 1977). Myrberg and Thresher (1974) demonstrated that, in *Eupomacentrus planifrons*, the level of agonism was inversely proportional to the taxonomic distance between the intruder and *E. planifrons*. A number of studies have also demonstrated significant correlations between diet overlap and agonism (Ebersole, 1977; Low, 1971; Mahoney, 1981; Thresher, 1976) suggesting that their territorial behaviour functions to defend an adequate food supply from competitors.

Territoriality to protect a food source is not usually observed in planktivorous damselfish. However, *P. rodriguesensis* was observed to feed on benthic algae. *P. pikei* and *S. limbatus* are both algal feeders (Allen, 1991; Allen & Emery, 1985) and some of the common species of surgeonfish (e.g. *Acanthurus nigrofuscus* and *Acanthurus blochii*) also feed on benthic algae (Fishelson *et al.*, 1987; Randall, 1985). Agonistic responses against surgeonfish were more frequent during winter when *P. rodriguesensis* spent more time feeding. This indicates that, despite observations suggesting that *P. rodriguesensis* feeds predominantly on plankton, benthic algae are in fact their most important food source. Their territorial behaviour suggests that, although they may not dramatically modify the benthic reef environment, they may promote the biomass of their preferred food algae (Jones *et al*., 2006).

During summer, 19.2% of interactions were with species of wrasse, whereas these only constituted 10.3% of interactions during winter. In Japan, P*omacentrus nagasakiensis* was found to spawn throughout summer, guarding their nests from potential enemies as wrasse have been shown to be frequent egg predators (Moyer, 1975). This suggests that *P. rodriguesensis* individuals may also guard their nests from predators during summer. Nests were not observed during the study and this aspect of their biology therefore requires further investigation.

Our results thus suggest that the pattern of territoriality observed in *P. rodriguesensis* has two functions, serving to prevent a reduction in the benthic algal component of its diet by competitors and protecting its nests from egg predators. Individuals were found to prefer live coral as habitat, suggesting that they may be vulnerable to future declines in coral cover. Although *P. rodriguesensis* is currently common within Port Mathurin Bay, this area has been affected by coral bleaching and associated coral mortality (Hardman *et al*., 2007). The region is also of commercial value and proposed port developments could impact on this species. A recently gazetted network of marine reserves does, however, encompass sites of high abundance, providing some protection for *P. rodriguesensis* from future developments.

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