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Population dynamics and demographic processes in a reintroduced population of the Mauritius Kestrel *Falco punctatus*

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The Mauritius Kestrel *Falco punctatus* is a small falcon found endemic to the Indian Ocean island of Mauritius. Mauritius Kestrels are territorial cavity nesters, typically forming monogamous pairs breeding in the southern hemisphere summer and feed predominantly on *Phelsuma* spp. geckos. By 1974, this formerly ubiquitous forest raptor was restricted to the remote Black River gorges in the southwest of Mauritius and reached a population low of just four known wild individuals due to widespread habitat loss and pesticide application (Nicoll *et al.* 2004). As part of a successful species recovery programme a population was reintroduced into the Bambous mountain range on the east coast of Mauritius (57°42'E, 20°20'S) in 1987. The 163-km² Bambous mountains rise from sea level to 626 m and consist of a habitat mosaic of grassland, dense stands of the introduced Travellers' Palm *Ravenala madagascariensis*, invaded secondary forest and isolated pockets of remnant native forest. It is entirely surrounded by agricultural land (sugar cane), and this coupled with the relatively poor dispersal ability (Nevoux *et al.* 2013) ensures that at present this is a closed Kestrel population. Rainfall follows a seasonal pattern with annual rainfall ranging from 1619 to 4439 mm and up to 75% falling in the cyclone season (December–April).

Since the initial reintroduction the population has been intensively monitored and individual-based demographic data collected (Nicoll *et al.* 2003, 2004). This 20+ year data set has documented the dynamics of the population in detail, enabling us to (1) describe detailed patterns in key demographic parameters (Nicoll *et al.* 2003; Burgess *et al.* 2008, 2011; Senapathi *et al.* 2011; Nevoux *et al.* 2013), (2) explore the processes that might be driving these patterns (Burgess *et al.* 2008, 2011; Cartwright 2011; Nevoux *et al.* 2011), (3) examine the relative importance of these processes in the population's regulation (Nevoux *et al.* 2011), (4) examine the effectiveness of the reintroduction programme (Nicoll *et al.* 2004; Butler *et al.* 2009) and (5) guide management aimed at ensuring the long-term viability of this population. Here we briefly describe the reintroduction and establishment of the



population, then summarize our understanding of the demographic processes (survival, breeding success and dispersal) operating in this closed population and the implications for future management.

Between 1987 and 1996, 123 Kestrels were released and a network of over 60 nestboxes was established. The population developed rapidly, stabilizing at around 45 pairs by 2002 (Figure 1). Each breeding season breeding pairs were located, individuals identified and breeding success monitored and this has been accompanied by the development of a digitized habitat map of the study area (Burgess *et al.* 2009) and the collation of daily rainfall data.

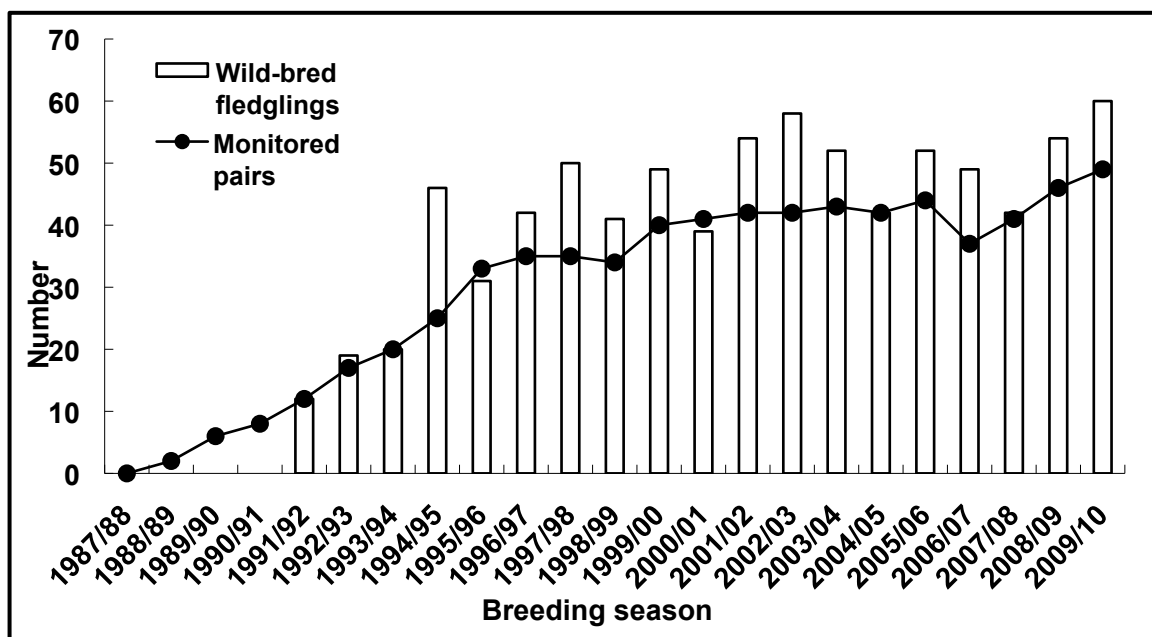


Figure 1 The number of wild-bred fledglings and monitored pairs each breeding season in the reintroduced Bambous mountain Mauritius Kestrel population. Seasons are referred to by the two calendar years they span.

Mauritius Kestrel ecology is strongly influenced by both habitat composition and seasonal rainfall conditions, breeding occurs later in wetter springs (Senapathi *et al.* 2011) and at higher altitudes (Burgess *et al.* 2011), agricultural encroachment reduces breeding success (Burgess *et al.* 2011, Cartwright 2011) and wetter austral summers reduce first-year survival (Nicoll *et al.* 2003). This negative impact of agriculture on breeding success may in part be due to the lower availability of native prey in agriculture versus forest habitats (Cartwright 2011). Most Kestrels breed within 2 km of their natal site, but on average females disperse further than males and disperse further when the availability of local breeding sites is limited (Nevoux *et al.* 2013). As a consequence female fitness is lower when they disperse longer distances compared with settling close to home (Nevoux *et al.* 2013). This Kestrel population appears to be strongly regulated, primarily through density-dependent juvenile survival via interference competition with juveniles congregating in the limited areas of high-quality native forest (Burgess *et al.* 2009) and secondarily through density-dependent reproductive



success via spatial heterogeneity (Nevoux *et al.* 2011). We suggest that the maintenance of a network of strategically located artificial nest-sites and the restoration of native forest areas, particularly at agriculture/forest boundaries, are considered when planning future conservation strategies in Mauritius.

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