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FORUM

Dispersal of Egyptian Vultures *Neophron percnopterus:* the first case of long-distance relocation of an individual from France to Sicily

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ABSTRACT
Knowledge of juvenile dispersal is important for understanding population dynamics and for effective conservation, particularly of geographically isolated raptor populations. Here, we report the first documented case of a long-distance movement of an Egyptian Vulture *Neophron percnopterus* from the French population to Sicily. This observation opens a new perspective for the conservation of the small and endangered Sicilian population of this species, providing evidence that persistence of the Italian population may be aided by new input from other countries.

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The extent of juvenile dispersal and recruitment into a breeding population as sexual maturity is reached is a critical aspect of evolutionary and conservation biology (Greenwood 1980, Paradis *et al* 1998). Dispersal, a behaviour typical of several raptor species (Newton 1979, Pearce 2007), has important implications for population genetic and demographic processes (Elorriaga *et al* 2009), including the capacity for recolonization, (meta)population persistence, and breeding success (*eg* Forero *et al* 2002, Woodroffe 2003, Pearce 2007). Hence, knowledge of juvenile dispersal is important for understanding population dynamics and for implementing effective conservation (Walter 2000, Gosling 2003, Hobson *et al* 2004, Carrete *et al* 2007, Soutullo *et al* 2008), especially for threatened and long-distance migratory species such as the Egyptian Vulture *Neophron percnopterus* (Donázar 1993).

The Egyptian Vulture, a long-lived, cliff-nesting raptor, has a breeding range extending over Eurasia and Africa (Cramp & Simmons 1980). The Italian population is critically endangered according to IUCN criteria (Rondinini *et al* 2013) and breeds in the central and southern Apennines and in Sicily (Sarà & Di Vittorio 2003). This species has declined sharply throughout its range and is endangered worldwide (BirdLife International 2016). In Sicily, the population has decreased since 1980 and there are currently only seven breeding pairs, the largest population in Italy (Andreotti & Leonardi 2009, Di Vittorio 2011, Di Vittorio *et al* 2016).

Anthropogenic factors such as poisoning, habitat degradation, reduction in food availability, and high mortality during migration (Oppel *et al* 2015) and in the African winter quarters, are possibly the main factors in the species' decline (Grande 2006, Grande *et al* 2008, Angelov *et al* 2013). Previous studies have underlined the link between philopatric behaviour and population dynamics (*eg* Grande 2006, Carrete *et al* 2007, Grande *et al* 2008), showing that natal dispersal distances are usually short, with dispersers recruiting in areas near their natal territories (Elorriaga *et al* 2009).

Movements of juveniles between France and Spain are well known (Donázar 1993, Elorriaga *et al* 2009), as demonstrated by the presence of French Egyptian Vultures in Spanish communal roosts (Donázar 2004), and the record of an individual banded in northern Spain and nesting in France (Elorriaga *et al* 2009). Moreover, the majority of the French population travels across the Iberian Peninsula annually during pre-breeding and post-breeding migration (Elorriaga *et al* 2009, García-Ripollés *et al* 2010), and reaches Africa through the Strait of Gibraltar, while others cross further east through the Levant (Ferguson-Lees &

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Figure 1. The Egyptian Vulture observed in Sicily. The ring code is zoomed upper left (photograph by G. Rannisi).

Christie 2001, Meyburg *et al* 2004). The common migration route of French and Spanish populations could facilitate the exchange of individuals between these areas (Meyburg *et al* 2004).

Individuals from distant geographic areas can play an important role in the population dynamics of small populations of raptors as a result of the 'rescue effect' (*ie* population recovery by immigration of new individuals), as recently evidenced for Bonelli's Eagle in France (Lieury *et al* 2016). From comparisons between population viability models and survival rates, Grande (2006) found that the Egyptian Vulture population in the Ebro Valley, northeastern Spain, was declining slower than expected and suggested that immigration of adults from different populations might be responsible for population maintenance. In contrast, other small populations in southern Spain are declining at similar or even higher rates than those projected by population viability models, despite being located along the migratory route to Africa through the Strait of Gibraltar (Sanz-Aguilar *et al* 2015).

Egyptian Vultures from other countries have occasionally been reported in northern Italy: an individual from département du Gard, France, was observed in Udine, northeast Italy in July 2013 at a Griffon Vulture *Gyps fulvus* feeding station (F. Genero, pers comm) and a bird from département du Vaucluse was observed in Novi Ligure, northwest Italy, in 2015. Here, we report the first documented long-distance resighting of an Egyptian Vulture from the French

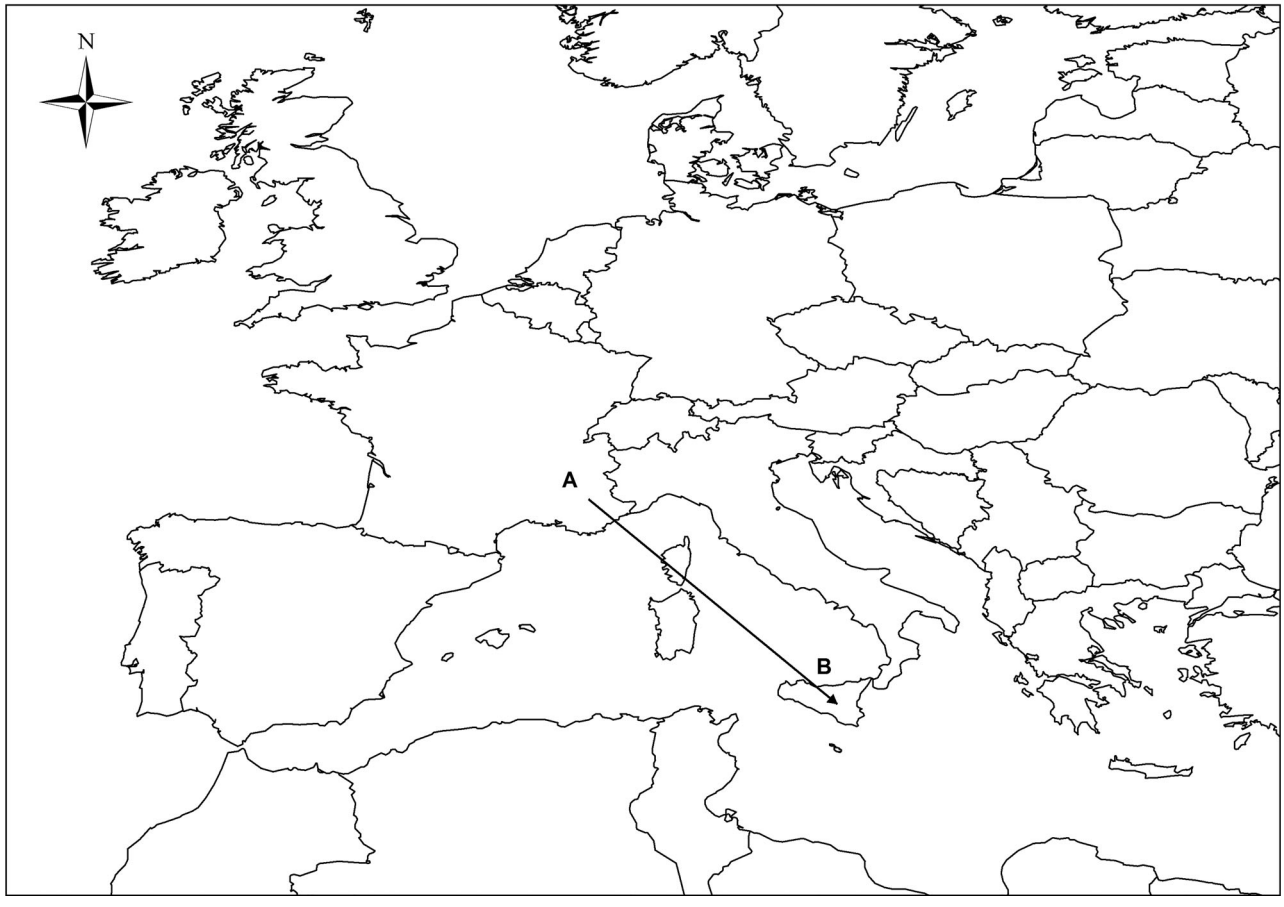

Figure 2. Natal site (Verdon Canyon, France: A) and the resighting site (Nebrodi Mountain, Sicily: B).

population. On 28 May 2016, we observed and photographed on the Nebrodi Mountain (northern Sicily) a fourth-calendar-year Egyptian Vulture marked with a white ring bearing the code 4M (Figure 1). This bird was observed together with another immature individual near a feeding station for Griffon Vultures. This bird was the first one ringed in the nest on 30 July 2013 in the Verdon Canyon, southeast France, where the Egyptian Vulture returned naturally on 1999 as a consequence of the reintroduction of the Griffon Vulture. To our knowledge, this is the first long-distance resighting of an Egyptian Vulture in Sicily (950 km; Figure 2). From a conservation perspective, exploratory movements of juveniles such as this, even if rare, may play an important role in the population dynamics of this endangered species. For example, long-distance dispersal could be underestimated (*eg* Koenig *et al* 1996, Woodroffe 2003, Saurola & Francis 2004, Grande *et al* 2008), as has been revealed by the results of several raptor-marking projects, together with wildlife telemetry and genetic studies (*eg* Arsenault *et al* 2005, Le Gouar *et al* 2006, Urios *et al* 2007, Cadahía *et al* 2009).

This observation is important because it introduces a new perspective for the conservation of the small and endangered Sicilian population of Egyptian Vultures, providing the first evidence that the Italian population could receive new input from other countries to facilitate its persistence. Moreover, the presence of this species near a feeding station highlights the importance of supplementary feeding interventions for the conservation of Egyptian Vultures (see *eg* Sarà *et al* 2009, López-López *et al* 2014, Arrondo *et al* 2015, Lieury *et al* 2015), which is particularly important at stopover sites during migration.

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