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Author(s): Maurizio Sarà, Salvatore Grenci, Massimiliano Di Vittorio
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STATUS OF EGYPTIAN VULTURE (*NEOPHRON PERCNOPTERUS*) IN SICILY

MAURIZIO SARÀ[1]
Department of Animal Biology, University of Palermo, Via Archirafi 18, 93100 Palermo, Italy

SALVATORE GRENCI
Via Sturzo 67, 92100 Agrigento, Italy

MASSIMILIANO DI VITTORIO
Department of Animal Biology, University of Palermo, Via Archirafi 18, 93100 Palermo, Italy

The Egyptian Vulture (*Neophron percnopterus*) has been recently classified as endangered on the IUCN Red List (BirdLife International 2008) due to the dramatic decline of many Asian and Indian populations, a decrease that duplicated that in European countries at the end of the twentieth century (Donázar 1994; Levy 1996; Gallardo and Penteriani 1999). The critically endangered Italian population (Bulgarini et al. 1998) currently inhabits southern Apennines and Sicily (Liberatori and Massa 1992; Liberatori and Penteriani 2001). The Sicilian population, which lives exclusively in the central and western part of the island (elevation 400–1000 m a.s.l.), was estimated at 30 pairs between 1970 and 1980 (Iapichino and Massa 1989). However, in approximately ten years (1990–2000), there was an intensification of agriculture in inland Sicily (ISTAT 2000), with an increase in irrigated croplands and concomitant decrease in traditional livestock management.

The goals of our study were to: (1) evaluate the recent status of the Sicilian breeding population; (2) describe breeding performance in the last 18 yr (1990–2007); and (3) investigate possible causes and conservation measures to prevent extirpation of the population.

METHODS

Territory Occupancy and Reproductive Rates. From 1990 to 2007, we checked 23 breeding territories of the Egyptian Vulture in Sicily from a safe distance using binoculars and spotting scopes, three or more times in March–May (territory occupancy and egg-laying), June–July (late incubation and early nestling phase) and August–September (fledging) periods. Using field observations of breeding behavior at nests during those periods, we defined territorial pairs as those occupying breeding sites, breeding pairs as those laying eggs (Steenhof 1987), and a breeding attempt as a nest in which a pair have laid eggs in one year. Successful pairs were defined as those that fledged at least one young (Steenhof 1987). Failures included pairs that held a territory early in the nesting season, but disappeared (usually in May–early June), and pairs that laid eggs but were unsuccessful in fledging young.

It was not possible to monitor all the breeding territories every year, but the availability of several years of data allowed us to calculate the proportion (p_i) of sites occupied every year by pairs and single birds, and to calculate the mean p_i; later, the number of sites of known status was multiplied by the mean p_i to estimate the local population size. Annual productivity was expressed as the number of fledglings divided by the number of breeding pairs, whereas fledging rate was defined as the number of fledglings divided by the number of successful pairs.

Supplemental Feeding. In ten breeding attempts of three pairs (pair 1: 1998 and 2002–2006; pair 2: 2006; pair 3: 1998 and 2002–2003), we tested the effect of supplemental feeding. Once every 7–10 d, from April to August, we provided 10–15 kg of chicken ribs and beef chops at fixed points close to the nests (200–500 m).

Statistical Analyses. The Mann-Whitney *U*-test, with *P* adjusted for small-sized samples, was used to test for significant differences in annual productivity and fledging rate in the periods 1990–1999 vs. 2000–2007, which corresponds to periods before and after the significant agricultural habitat change in Sicily. We also used the Mann-Whitney *U*-test, with adjusted *P*, to evaluate the effect of food supplementation on the three breeding pairs by comparing the number of fledglings in years with and without food provisioning.

RESULTS

From 1990–2007, we checked territories a total of 168 times. We documented 131 breeding attempts, and 37 single adults at breeding sites. The mean *pi* of occupied sites was 0.32 ± 0.11 for pairs and 0.09 ± 0.08 for singles, corresponding to an estimated population size of 7 ± 2 pairs and 2 ± 1 singles. We monitored 122 of 131 breeding attempts to measure reproductive performance, and found 75% of them successful (Fig. 1), corresponding to an average annual number of successful pairs of 5.11 ± 1.71 ($N = 92$). The average number of young fledged per breeding

[1] Email address: mausar@unipa.it

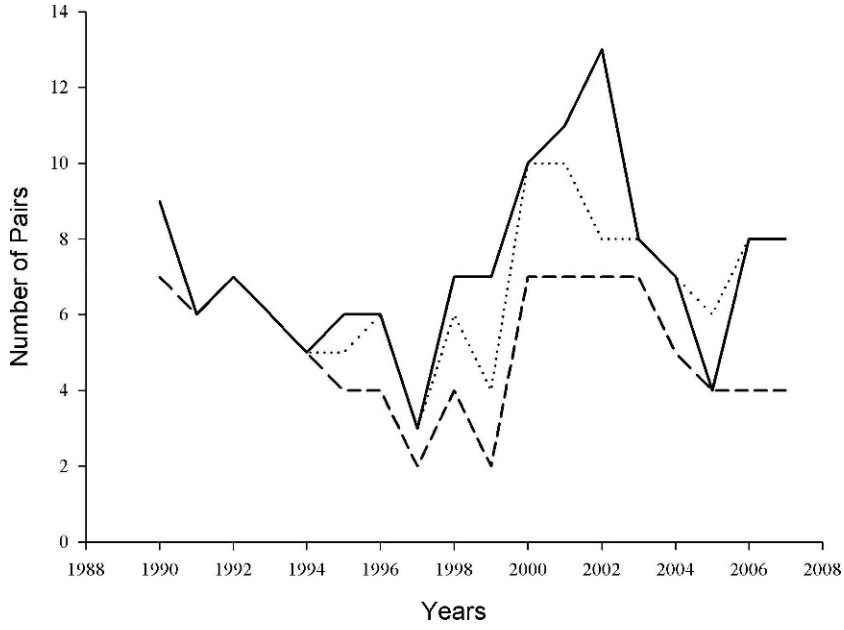

Figure 1. Estimated population trend of the Egyptian Vulture (*Neophron percnopterus*) in Sicily. Solid line = number of territorial pairs; dotted line = number of breeding pairs; dashed line = number of successful pairs per year.

pair was 0.92 ± 0.29 (N = 122), and 22.7% of those successful fledged two young vultures. We assessed causes of breeding failures and nest desertions in nine of 30 cases; eight of nine were of anthropogenic origin (five nest site disturbances, one killing, one poisoning, and one theft of young). Breeding failures and nest desertions were recorded at least once at most territories (20 of 23), and averaged 1.0 ± 0.94 during the 1990–1999 decade and significantly more (2.5 ± 1.19; U = 14; P = 0.02) during 2000–2007. Annual productivity (U = 38.50; P = 0.90) and fledging rate (U = 33.00; P = 0.57) did not differ between the two study periods.

Three pairs provided with food supplementation raised more young (1.4 ± 0.70; N = 10 breeding attempts) in years with food supplements than they did in years without (1.1 ± 0.58; N = 18 breeding attempts; U = 53; P = 0.046).

DISCUSSION

In Sicily, the number of nesting pairs has decreased since 1980, with considerable fluctuation, possibly because of the small sample size (Fig. 1). The distribution of Egyptian Vultures on Sicily is correlated to natural Mediterranean vegetation and arid uplands, and, within these landscapes, livestock density is the best factor predicting the presence of nesting birds (Sarà and Di Vittorio 2003). In Sicily, the fifth census of agriculture (ISTAT 2000) demonstrated, from 1990 to 2000, an increase (+12.6%) in irrigated cropland, which corresponded to a decrease (−11.1%) in traditional dry cereal farming. Livestock and husbandry also decreased dramatically (−45% sheep, −38% goats, −40% domestic fowl, −58% pigs), and 15 of the 17 garbage dumps active in the Egyptian Vulture core-area were closed between 1986 and 2003.

We found that reproductive rate (number of young per breeding pair and number of young per successful pair) did not vary significantly during our study, and were similar to those recorded in other European areas (Garzón 1973; Bergier and Cheylan 1980; Donázar and Ceballos 1988; Liberatori and Massa 1992). Thus, the pairs that bred were able to produce typical numbers of young.

Food availability (Levy and Segev 1996) and human disturbance near the nesting sites (Zuberogoitia et al. 2008) were the most common causes of nest site desertion and of variability in breeding success. These may be related, and it is difficult to separate their effects, as both habitat loss and livestock reduction often result from intensification of dry and traditional agricultural systems (Donald et al. 2001, Brotons et al. 2004), causing both a loss of food and increased human disturbance around nesting sites. In this respect the Egyptian Vulture is particularly exposed to anthropogenic disturbances and mortality, because it prefers nesting on low cliffs (Sarà and Di Vittorio 2003).

Current biodiversity policy in the European Union is focused on halting the loss of biodiversity (European Commission 2006), and, under the premises of the Nature 2000 Network, every country has significant responsibilities for the species listed in the 79/409/CEE Annex 1. Therefore, the two small Italian populations, i.e., the 16 ± 5 birds

here reported for Sicily plus the 2–5 known in Calabria (G. Cortone and M. Di Vittorio unpubl. data) must be protected to avoid regional loss of biodiversity and the extirpation of the species in Italy. Furthermore, the removal or reduction of the causes of population declines, even in such small populations, may improve the status of the European population, because the Egyptian Vulture is a regular migrant species all around the Mediterranean Sea (Agostini et al. 2004). We recommend that conservation actions be directed toward maintaining or ameliorating the quality of the species' potential habitat along the migration routes in this region. Additionally, because the reduction in traditional agro-grazing farming has resulted in a diminished number of livestock carcasses, we recommend that a permanent array of artificial feeding stations be established. This remedy is frequently adopted in Europe (Terrasse 1985; Gallardo et al. 1987; Liberatori and Cortone 1991, Gomez et al. 2001) and the Middle East (Levy 1991). However, care is needed to avoid unintentional poisoning due to the ingestion of veterinary drugs and other negative effects (Carrete et al. 2006, Blanco et al. 2007, Lemus et al. 2008).

The Egyptian Vulture is one of the most threatened raptors in Europe (Burfield 2008) and the threats and conservation remedies are similar throughout the species' distribution. We also recommend the development and implementation of a Species Action Plan, a comprehensive solution that appears to be successful in other locations (Burfield 2008).

ESTATUS DEL BUITRE *NEOPHRON PERCNOPTERUS* EN SICILIA

RESUMEN.—La población del buitre *Neophron percnopterus* en Sicilia se encuentra restringida a los sectores central y oeste de la isla. La población alcanzó cerca de 30 parejas durante el periodo entre 1970 y 1980, auque durante nuestro periodo de estudio (1990–2007), la población tuvo un tamaño promedio de sólo 7 ± 2 parejas más 2 ± 1 individuos no emparejados, con fluctuaciones considerables en los números. Las tasas reproductivas durante nuestro periodo de estudio (juvenil por pareja reproductiva y juvenil por nido exitoso) fueron típicas para una población europea, aunque la tasa de éxito de los nidos disminuyó y el abandono de nidos durante el período 2000–2007 fue el doble del registrado durante el período 1990—1999. La reducción en la cantidad de ganado muerto y en la disponibilidad de alimento, como también el aumento de la perturbación humana cerca de los sitios de anidación, probablemente alteraron la cualidad de los territorios de cría, y son probablemente la causa de la disminución del éxito de anidación. *Neophron percnopterus* es una de las aves rapaces más amenazadas de Europa, por lo que recomendamos el desarrollo rápido y la implementación del Plan de Acción de Especies.

[Traducción del equipo editorial]

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