A Globally-Important Stronghold in Oman for a Resident Population of the Endangered Egyptian Vulture Neophron percnopterus

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A globally-important stronghold in Oman for a resident population of the endangered Egyptian Vulture *Neophron percnopterus*

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The Egyptian Vulture is a partial migrant that is globally endangered. Recent satellite tracking in Oman suggests that the resident population of Egyptian Vultures is larger than previously estimated. We used information from tracked vultures as a framework for searches for Egyptian Vulture territories in northern Oman. We found 61 occupied territories, and identified 19 additional presumed territories for which occupancy was unconfirmed. The sum of those and the territories recently discovered on Masirah Island exceeds the published national estimate of 100 pairs. An initial conservative estimate suggests a breeding density of 0.26 pairs/km^2 in our study area, indicating that it holds around 225 pairs. Although the nesting density in suitable habitat across Oman appears to be variable, the number of pairs of Egyptian Vultures is certainly multiple times greater than estimated. This is encouraging news for this endangered species, and suggests that under certain conditions Egyptian Vultures can thrive, even in places where anthropogenic development is rapidly increasing, as in Oman. Because Oman is developing, threats to Egyptian Vultures and other large soaring birds (e.g. due to electrocution and poisoning) may be reduced or partially avoided by planning and regulation that includes installation of safe electricity infrastructure, ensuring that food consumed at dump sites is safe for scavenging birds, and raising public and government awareness.

Key words: Arabia, conservation, electrocution, GPS tracking, raptors, scavenging birds, waste management

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The Egyptian Vulture *Neophron percnopterus* is classified as globally endangered (Botha *et al.* 2017, BirdLife International 2019), and large range contractions have occurred (e.g. Ogada *et al.* 2015, Velevski *et al.* 2015). In the Middle East, the population is thought to be in steep decline (Jennings 2010), but there are healthy and dense resident populations on the islands of Socotra (Yemen) and Masirah (Oman; Porter & Suleiman 2012, Angelov *et al.* 2013b). On mainland Arabia the species is resident in Oman (Meyburg *et al.* 2019), Yemen and south-westernmost Saudi Arabia, while migratory Egyptian Vultures occur northwards from central Saudi Arabia (BirdLife International 2019).

In Oman, Egyptian Vultures breed primarily in the Hajar Mountains in the north (Eriksen & Victor 2013), and the national population had been estimated at 100 pairs (Jennings 2010). However, research has revealed

a large number of breeding Egyptian Vultures on Masirah Island alone (65–80 pairs; Angelov *et al.* 2013b), calling into question that estimate, especially since large congregations (up to 600) occur at some dumpsites, particularly during the winter months (Al Fazari & McGrady 2016, Al Farsi *et al.* 2019). It was thought that most of the Egyptian Vultures in Oman in winter were migrants from farther north. However, recent data from satellite tracking suggests that most are residents (Meyburg *et al.* 2019) and this provided the impetus for the work reported in this paper. A large population in Oman would differ from the situation in almost all other parts of their range.

In light of potential changes in the size of the Egyptian Vulture population in Oman, we conducted ground surveys of Egyptian Vultures that aimed to (1) confirm the occupancy of presumed territories used by vultures tracked with transmitters (see Methods), (2) search for other territorial vultures in areas near the presumed territories of tracked vultures and (3) collect information, if possible, on the breeding status and nest site characteristics.

METHODS

Study area

Our study area was in the northern part of the arid Eastern Hajar Mountains (160–200 mm annual rainfall), which are located at the easternmost tip of the Arabian Peninsula. The region is characterized by a great abundance of cliffs, with wadis and mountain slopes, sparsely vegetated with trees. Animal husbandry is primarily of Goats and Sheep, while feral Donkeys are widespread. In January 2018 we deployed GPS-Argos satellite and GPS/GSM-transmitters on 12 adult Egyptian Vultures in Oman, trapped at Al Multaqa (23.34°N, 58.46°E), the main municipal landfill of Muscat, and tracked them (Meyburg *et al.* 2019). The tracking data in 2018 were used to locate potential territories of tracked vultures, which provided an initial framework for ground searches in 2019 for other vulture territories. In some cases, tracking data enabled the identification of likely nest sites. We were able to reliably locate nests based mostly on the accumulation of locations within very small areas at particular cliffs for prolonged periods of time during the suspected incubation and early nestling period (February–April).

The study area encompassed the location of presumed territories of tracked birds, adjacent areas of suitable nesting habitat, and potential nesting habitat along the roads and tracks that gave access to the main searched areas. Overall it covered c. 2900 km^2, 1730 km^2 of which was considered suitable nesting habitat (i.e. medium and large cliffs with many potential nesting niches away from human disturbance). The main Muscat landfill was located about 15 km west of the centre of the study area (Figure 1). The study area could be roughly divided into three sub-areas. The southern third was the most rugged and least accessible and had the lowest human population. The northern third was mostly flat, had few suitable cliffs for nesting and the highest level of human activity. It contained the main Muscat landfill, the towns of Al Hajar (23.39°N, 58.52°E) and Al Amerat (23.52°N, 58.50°E), a major highway and a number of smaller villages. The eastern third contained relatively lower mountains, bordered the Arabian Sea to the east and was divided by two major wadis with vertical cliffs: Wadi Aday (23.429°N, 58.548°E) and Wadi Majlas (23.263°N, 58.827°E).

Survey protocol

We conducted surveys for territorial and breeding vultures from 17 February to 9 March 2019, which at its end is supposed to coincide with the peak period for onset of incubation (Jennings 2010). Egyptian Vulture territories are most effectively located in the 10–15 days prior to egg laying (pers. obs.). Logistical constraints and the desire to cover as much area as possible meant that on many days we sought to collect data from both tracked and untagged vultures, but for eight full days searches were conducted solely for territories of untagged birds.

Surveys, in suitable vulture breeding habitat, were conducted by driving on asphalt and dirt roads using a 4×4 vehicle occupied by a driver and two observers. Parts of some routes were covered multiple times on different days as we transited to other areas, or on the same day when we returned to our base in Muscat. The absence of tracks and roads in some parts precluded surveying large parts of the study area and sometimes meant that observations were made of suitable nesting habitat and possible territories that were as much as 3.5 km away. Despite these sometimes large distances, adult birds and faecal accumulations (i.e. 'whitewash'; see Figure 2B) were often conspicuous and facilitated our observations. In the case of birds with transmitters, we also walked (0.5–1.5 h) to presumed territories that were inaccessible by car to make observations.

In areas of suitable habitat, and whenever Egyptian Vultures were seen, we stopped and made observations using binoculars (10×50) and telescopes (20–60×60). We recorded the location (using GPS) and time of those observations and any signs of occupancy and breeding

(e.g. whitewash, possible nest sites, territorial and breeding behaviours, including displays, copulation, chasing of intruders, etc.), including the presence of possible mates. We made digital photographs of possible breeding cliffs, nesting niches and whitewash (i.e. perches and potential nests; Figure 2). Confirmed and presumed nests were then located, and plotted on satellite images (Figure 1; from Google Earth in 2018, CNES/Airbus 2019, Maxar Technologies 2019) from which the elevation of the nest was determined. We also recorded characteristics of actual and presumed nest sites, including the orientation of the nest and nest site type (i.e. ledge, when there was no defined cavity where the nest was positioned, or niche). While monitoring the nests we recorded, if possible, whether eggs had been laid. The location of other observations (e.g. behaviours, perch sites, roost sites, etc.) were also recorded and plotted in Google Earth (Google Earth v. 7.3.2).

Observations of territories held by tracked birds were made from locations offering good visibility of the presumed breeding location at a distance of 500–1300 m, and were made twice during the field work (mean: 3.28 h/territory), between 17–20 February and then between 1–7 March.

Territories were classed as occupied, probably occupied or apparently unoccupied (Steenhof *et al.* 2017) and a territory centre was estimated, based on nest locations and the locations at which vultures displayed territorial behaviours. It is important to note that we could not be completely sure that apparently unoccupied territories were actually unoccupied. An initial estimate of minimum nearest neighbour distance was made within landscapes that offered good vulture nesting possibilities from mapped territory centres. We then used this value as a filter to aid in our searches, taking into account the possibility that territories could have multiple nest sites.

Estimating total number of territories

We made an initial, rough estimate of the number of Egyptian Vulture territories in our study area by mapping areas of suitable nesting habitat and plotting the centres of the occupied and unoccupied/vacant

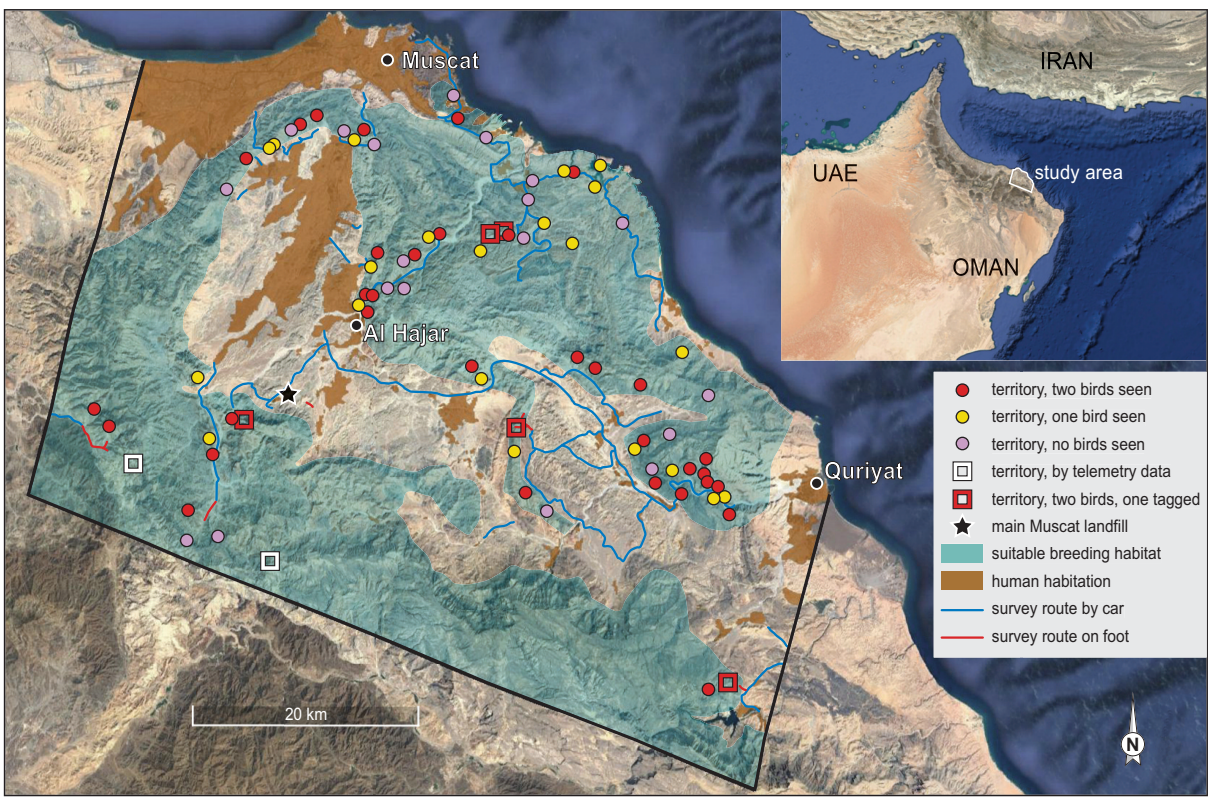

Figure 1. Map of the study area, including locations of the main Muscat landfill at al Multaqa and breeding territories of Egyptian Vultures found during this study. Map produced using Google Earth Pro 2018, Images 2019 CNES/Airbus, 2019 Maxar Technologies.

territories that we found. Then, using the average nearest neighbour distance from our data (1.06 km; see results section below) we plotted the presumed territory boundaries as being half way between territory centres when the distance between them was <1.06 km or along the arc of a circle with a radius of 1.06 km, if the nearest neighbour distance was >1.06 km. We counted the number of resulting territories, then reduced that by 50% in areas of suitable habitat that we did not survey, thereby making allowance for possible lower densities in those areas.

RESULTS

Occupancy of presumed territories

We visited five of the seven areas used by vultures suspected from telemetry to be territorial; time/accessibility constraints meant we were unable to visit the other two. Direct observations at all five areas confirmed them to be occupied and vultures exhibiting territorial, breeding or nesting behaviours were observed in all. As expected, because our visits preceded laying, we confirmed that no eggs had been laid yet in any of the five territories.

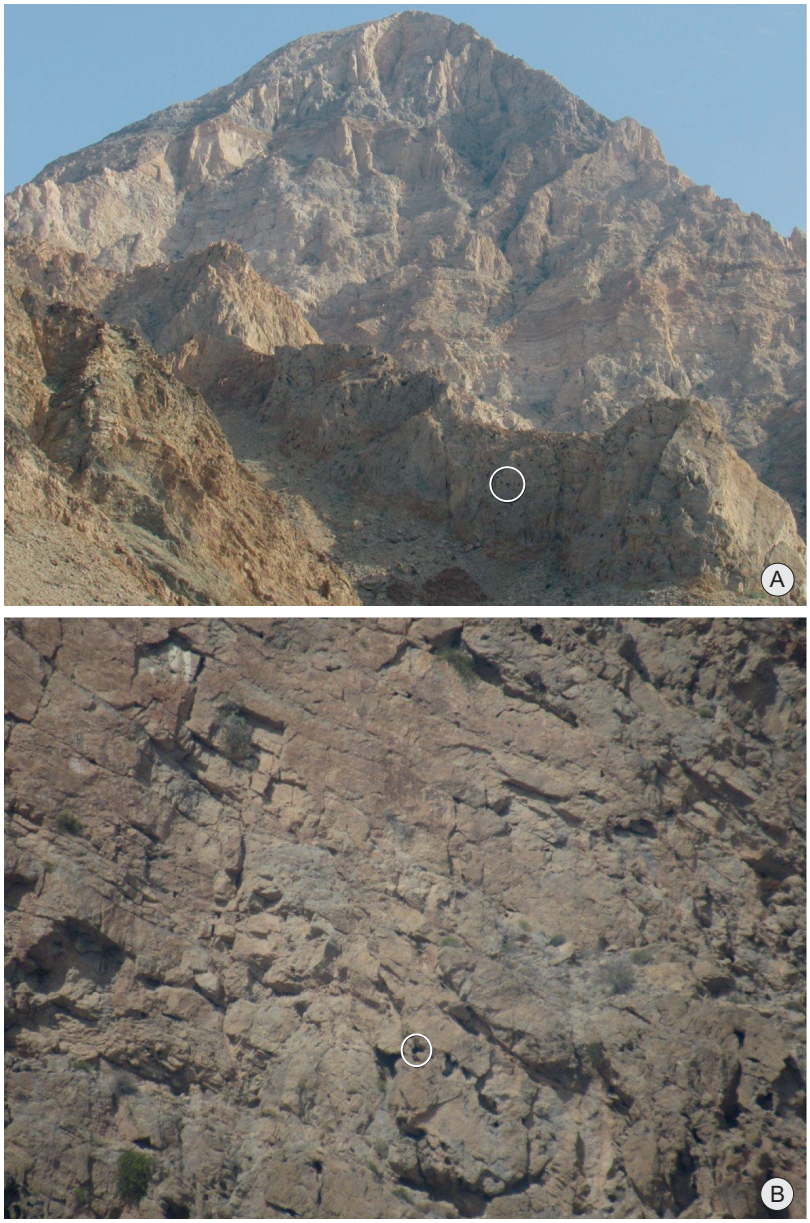

Figure 2. Example of Egyptian Vulture nesting sites in our study area. (A) Landscape view and (B) view at nesting site scale, with faecal accumulation (whitewash) at a frequently used roost near the top left. White circle indicates the nest niche (photos I. Angelov).

Number and densities of territories

Including visits to the territories of tracked birds, 296 km of surveys in suitable breeding habitat were conducted by car and 24 km on foot; 80 'territories' were found. Thirty-eight were occupied by a pair, in 21 only single birds behaving territorially were observed and we identified 19 locations as likely territories that were apparently unoccupied in 2019 (Figure 1). Two territories were identified solely from tracking data, but were not visited (see section above).

Nearest neighbour distances ranged from 0.46 to 1.8 km (mean: 1.06 km, $n = 15$). Across the study area, territories clustered in areas with good nesting possibilities, i.e. rugged terrain away from high levels of human activity. The highest densities were found along the two large wadis in the eastern part of the study area, Wadi Aday and Wadi Majlas, with 14 and 15 territories along 8 and 10 km, respectively. High densities were also located in the area southeast of Yiti (14 territories), within 15 km southwest of the landfill (10 territories), along the mountain chain north of Al Amerat (11 territories) and on a prominent north-south oriented ridge c. 20 km southeast of Al Hajar (4 territories). Together these high-density areas contained 68 territories distributed over 260 km^2, accounting for 85% of all territories we found, though they were found within an area that held <15% of the suitable breeding habitat in the whole study area.

Overall, based on our observations following the method specified above, we estimate that our 2900 km^2 study area contained 225 territories of Egyptian Vultures, which constitutes a density of 0.26 pairs/km^2.

Nest site characteristics

Details of nest sites were collected from 40 territories. Mean elevation of nests was 451 ± 309 m (range: 40–1330); orientation of nests was variable (Figure 3). Thirty-eight nests were in niches; three were on ledges, which were all large and well sheltered. At 39 nests we were able to determine whether eggs had been laid or not; by the end of the study period only four of them had eggs.

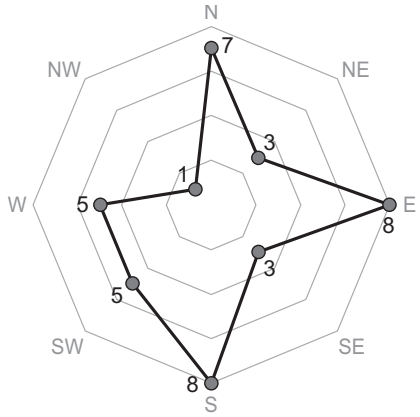

Figure 3. Orientation of Egyptian Vulture nest niches ($n = 40$) in the study area.

DISCUSSION

Oman as a stronghold for Egyptian Vultures?

We found many more Egyptian Vulture territories in our study area in northern Oman than expected based on published population estimates of 100 pairs for the whole of the country (Jennings 2010, Eriksen & Victor 2013). In a relatively small survey area, we found 61 occupied territories and 19 other likely territories for which we could not confirm occupancy. Based on our observations we made a rough estimate of 225 pairs within our 2900 km^2 study area. We note that this estimate should be treated with some caution. It may not be accurate because for only 15 nests we were fully confident that we had identified the nearest neighbour and the variability of territory density across the whole of the study area, especially the southeast corner, was not known and could obviously affect the estimate (see García-Heras *et al.* 2013). Indeed, results of surveys on Masirah Island suggest that territory density might vary with distance from a reliable food source, a dumpsite (Angelov *et al.* 2013b). Nevertheless, even when only considering the number of territories actually found by us, our results confirm the supposition of Meyburg *et al.* (2019) that Oman's resident Egyptian Vulture population must be significantly larger than expected. Taken together with other data from Masirah Island (65 pairs; Angelov *et al.* 2013b), more occupied Egyptian Vulture territories have now been found in small areas of Oman than were estimated to exist for the whole country (Jennings 2010). Thus, it is almost certain that the current number of territorial Egyptian Vulture pairs is multiple times greater than that estimate. This conclusion is further supported by observations of large numbers of vultures at anthropogenic dump sites within the study area (Eriksen & Victor 2013, Al Bulushi *et al.* 2013, Al Fazari & McGrady 2016, Al Farsi *et al.* 2019), tracking data (McGrady *et al.* 2019), as well as our own data from *ad hoc* surveys near Rustaq (23.44°N, 57.43°E, 8 territories) and Wadi Tiwi (22.83°N, 59.23°E , 7 territories) in 2019, and information from Ras Ash Shajar Nature Reserve (22.93°N,

59.13°E), Fahud (22.29°N, 56.55°E), Tahwa Landfill (22.36°N, 59.35°E) and Jebel Kahwan (22.23°N, 59.37°E; M. McGrady unpubl. data). In hindsight, Jennings (pers. comm.) believes that the 2010 estimate was probably low, affected by the lack of field data from Oman, the assumption that migrants arrived in winter and influenced by his experiences over many years elsewhere in Arabia, where vulture sightings were declining. The underestimate in 2010 notwithstanding, these findings run counter to Egyptian Vultures population declines occurring in almost all other parts of their range (Botha *et al.* 2017) and may call into question other (conflicting) regional estimates of 2000 pairs for Arabia (Jennings 2010), including Socotra Island where 800 pairs were estimated (Porter & Suleiman 2012) and "perhaps 1000 pairs" for the Middle East (Birdlife International 2019).

Nesting characteristics

Egyptian Vulture nests in our study area were located in niches, crevices and on ledges that were well sheltered and were similar to descriptions of nests from elsewhere (Cramp & Simmons 1980, del Hoyo *et al.* 1994). Vultures did not appear to select nest sites based on their orientation (Figure 3), probably because in most or all territories there is an abundance of very deep nesting niches that provide sufficient shelter from harmful environmental conditions (e.g. sun or winds; see Ceballos & Donázar 1988) no matter their orientation.

In our study we could not determine the subsequent breeding success of the vultures observed. This was because our surveys occurred mostly before egg laying, we were unable to see into most nests and because of constraints of time and difficult terrain on accessing territories. Jennings (2010) states that the majority of Egyptian Vultures in north Oman lay eggs during February–March, though some lay in January and April, and this is consistent with what was suggested by the activity of tracked birds; the field surveys suggested laying occurred mostly after early March. Angelov *et al.* (2013b) found that Egyptian Vultures on Masirah Island (c. 280 km to the south) laid mostly during December–March. Given the difficulty of making observations at nests and the apparent resident nature of the vulture population, post-breeding season counts at rubbish dumps and landfills might be used to calculate an index of annual breeding success and perhaps gather information on juvenile and sub-adult mortality. More tracking of Egyptian Vultures is also needed to fully understand their movement ecology, reveal causes of death and enable estimations of age-specific mortality.

Potential causes of the apparent population increase in Oman

While our survey, which concentrated specifically on Egyptian Vultures and used modern technological aids (i.e. telemetry), might be expected to result in more territories being found, we believe that there has been an actual population increase of some unknown scale during recent decades. Supporting circumstantial evidence is that Egyptian Vultures are conspicuous, often gregarious and easy to identify, and therefore they would have been hard to miss. On Masirah Island levels of ornithological observation effort would have been fairly high, even some decades in the past. An airbase has been located on Masirah Island for many years and in earlier decades it was manned by expatriate military personnel, some of whom were keen bird watchers who organized birding trips (e.g. Jennings 1980, Pomeroy unpubl. data) and published bird lists (Griffiths & Rogers 1975, Rogers 1988). Given that, it seems likely that at least some of the nearly five-fold increase in the number of Egyptian Vulture territories on Masirah Island (Angelov *et al.* 2013b) is attributable to actual population increases, rather than improved methods and greater effort.

The apparent increase in vulture territories, at least in some parts of Oman (Angelov *et al.* 2013b), runs counter to the general global trend (Botha *et al.* 2017, Safford *et al.* 2019), but is not entirely surprising given the favourable conditions in Oman today and in recent decades. Oman is a large, ecologically diverse country, where abundant potential nesting opportunities exist for Egyptian Vultures, particularly in the north. Hunting of birds is officially illegal in Oman and is not practiced to any great extent (though some low-level poaching does occur; Brochet *et al.* 2019). Though Omanis have a traditional negative view of vultures ("Egyptian Vulture" is an insult in Oman, used to suggest someone is lazy), it does not result in notable levels of persecution. Perhaps the most important factor that has benefited Egyptian Vultures in Oman is the rapid development that has occurred since the early 1970s that has been characterized by rapid growth in the human population (Oman National Center for Statistics and Information 2015) and a concomitant increase in the amount of anthropogenic waste, to which Egyptian Vultures have access (Al Fazari & McGrady 2016). However, development has also brought about real and potential challenges to vultures in Oman.

Future challenges

Major changes are occurring in Oman in the food resources that vultures use. While anthropogenic waste

is increasing, it is highly likely that so too is the amount of toxic material that could poison vultures (Tauler-Ametiller *et al.* 2019). Although national-scale upgrades in waste management are presumably better controlling the amount and distribution of toxic materials that vultures might consume (De la Casa-Resino *et al.* 2014), they are also changing the distribution and availability of vulture food; the upgrades will result in the closure of over 300 small rubbish dumps and the establishment of 12 large, modern engineered landfills distributed across the country (Public Authority for Solid Waste Management pers. comm.). In addition, although numbers of livestock have increased (Oman Ministry of Agriculture and Fisheries 2013), husbandry has changed and probably fewer carcasses of dead animals are available to vultures and numbers of wild animals are decreasing (A. Spalton pers. comm.) for a variety of reasons. Although closure of anthropogenic waste disposal sites might not have a measurable effect on Egyptian Vultures in areas where other sources of food are available (Katzenberger *et al.* 2018), this may not be the case in Oman where wild and domestic food resources may be scarce or located away from areas where vultures breed (García-Heras *et al.* 2013) and forage.

Stray and feral dogs are often an issue where anthropogenic waste is disposed (Gompper 2014) and their numbers can have sometimes complex relationships with local human culture, scavenging bird numbers, spread of disease (Markandya *et al.* 2008) and animal control efforts (Botha *et al.* 2017). Lethal control of stray and feral dogs using poisons can cause high mortality among non-target species like vultures (Ogada 2014, Ntemiri *et al.* 2018) and eagles (Millsap *et al.* 2004, Meyburg *et al.* 2008, Meyburg unpubl. data), especially if undertaken at a rubbish dump frequented by them (Grubač *et al.* 2014, BirdLife International 2015). Egyptian Vulture populations on Masirah and Socotra islands may benefit from the dog populations being very small, and little human conflict with mammalian carnivores that may fuel the use of poisons (Porter & Suleiman 2012). This is in sharp contrast to other islands with resident vulture populations, like Cabo Verde and Canary Islands, Spain, where poisoning of dogs has been identified as a primary reason for vulture population declines (Donazar *et al.* 2002, Freitas *et al.* 2019). Feral dogs seem to be a fairly minor problem at the Muscat municipal landfill (i.e. in our study area; Public Authority for Solid Waste Management pers. comm.), but large numbers use the dumpsite near Salalah, where hundreds of migratory Steppe Eagles *Aquila nipalensis* have also wintered (Eriksen & Victor 2013). Additionally, Omanis have a rather ambivalent view of dogs (feral or domesticated). Feral dogs are generally feared and shepherding, guard and pet dogs are rather rare. We are aware of Omani government efforts to control dogs in northern Oman, but those efforts are, as far as we know, limited in scope and use shooting rather than poisoning.

In some places electrocution is a major cause of population instability in Egyptian Vulture (Donázar *et al.* 2002, Angelov *et al.* 2013a). As Oman has developed, so too has its electricity distribution network, and the risk to Egyptian Vultures of electrocution is probably increasing. We are aware of incidents of Egyptian Vultures (McGrady *et al.* 2019) and Steppe eagles (P. Ceccolini unpubl. data) being electrocuted in Oman, but the scale of this problem is not known. Thus, it would be useful to conduct electrocution/collision surveys and risk assessments, particularly in areas of high vulture densities and around dumpsites.

While it may seem from the above that development in Oman will lead eventually to vulture declines, it may also be that, within the context of a developing (rather than developed) country, Oman has opportunities to undertake proactive conservation that might also be cost effective. For example, as Oman's electricity network grows, installing vulture-safe electricity infrastructure from the outset could reduce electrocutions, reduce maintenance costs and improve customer service, yet cost about the same as unsafe infrastructure (Harness 2000). Also, within the framework of the waste management upgrade, the establishment of vulture restaurants could ensure safe food for vultures (Plaza & Lambertucci 2017), enhance birdwatching tourism opportunities and provide a portal for public education about scavenging birds and the wider issue of waste management in modern times. Importantly, even in situations where vultures appear to be enjoying a benefit from human presence in the form of anthropogenic food (e.g. at restaurants or dump sites), this does not mean the human-vulture relationship is positive in all respects. Decisions about electrical infrastructure, waste management and vulture conservation should be scientifically well-informed and taken with caution (García-Heras *et al.* 2013, Arkumarev *et al.* 2014).

Conclusions and scientific and conservation implications

The discovery of a large Egyptian Vulture population in Oman highlights just how little we know and points to the need for more research aimed at better understanding the status and ecology of Egyptian Vultures

and other scavenging birds in Oman. Given the need for good research that supports conservation of vultures in Oman and across their range, and the fact that the high densities of vultures in Oman might provide access to sufficiently large sample sizes, opportunities exist for research. Such research would provide a solid scientific basis for conservation activities and could additionally provide important information and training to the next generation of Omani conservation biologists. Important research could include regular monitoring of scavenging bird numbers at dumpsites, surveys of potentially dangerous power lines, breeding vulture surveys and direct behavioural observations at territories and feeding sites.

Although Oman's position as an apparent stronghold for Egyptian Vultures is rather special, conservation measures suggested for Oman could find useful application in neighbouring countries (McGrady *et al.* 2019). The countries of the Arabian Peninsula share many characteristics, including that they are consistently amongst the top per capita producers of anthropogenic waste worldwide (Ouda *et al.* 2017), electricity networks are expanding and vultures are generally viewed negatively. Conservation opportunities exist especially in the larger Arabian countries of Saudi Arabia, Oman and Yemen, where notable resident scavenging bird populations exist (Jennings 2010) and passage and wintering scavenging birds can occur in large numbers (McGrady 2018).

Current conditions in Oman, with abundant supply of food for vultures, abundant nesting opportunities and relatively few threats (McGrady *et al.* 2019, Meyburg *et al.* 2019), seem to allow Egyptian Vultures to thrive. Maintaining those conditions against the backdrop of rapid development will be the conservation challenge of the future in Oman, and learning about vultures in Oman may help management decisions in other countries where Egyptian Vultures are at risk, especially within the Middle East (McGrady *et al.* 2019).

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SAMENVATTING

Sommige populaties van de Aasgier *Neophron percnopterus* zijn standvogel (zoals die in Oman), andere trekvogel. De soort wordt wereldwijd bedreigd. Recent uitgevoerd onderzoek met satellietzenders in Oman doet veronderstellen dat de populatiegrootte van deze standvogelpopulatie groter is dan eerder werd geschat. We gebruikten informatie van gezenderde gieren om territoria van Aasgieren in het noorden van Oman op te sporen. We vonden 61 bezette territoria en stelden 19 extra gebieden vast waarvan het gebruik door Aasgieren niet bekend was. Het totaalaantal broedparen van deze gebieden en gebieden die onlangs op Masirah Eiland zijn ontdekt, overschrijdt de gepubliceerde schatting van 100 paren in Oman. Een eerste conservatieve schatting suggereerde een nestdichtheid van 0,26 paar/km^2 in ons studiegebied Dit betekent dat dit gebied ongeveer 225 paren bevat. Hoewel de nestdichtheid in geschikt habitat in Oman variabel lijkt, is het aantal paren Aasgieren hier zeker meerdere keren groter dan eerder werd geschat. Dit is bemoedigend nieuws voor deze bedreigde soort en suggereert dat onder bepaalde omstandigheden Aasgieren zeer goed kunnen gedijen, zelfs op plaatsen waar menselijke invloeden snel toenemen, zoals het geval is in Oman. Bedreigingen als elektrocutie en vergiftiging van Aasgieren en andere grote vogels die gebruikmaken van thermiek kunnen verminderd of misschien zelfs worden voorkomen door een goede planning en regulering bij de constructie van de elektriciteitsinfrastructuur in de wijde omgeving rond vuilnisbelten, zodat Aasgieren en andere aaseters daar veilig voedsel kunnen zoeken. Verder moet door een goede voorlichting het publiek en de overheid bewust worden gemaakt van dit probleem.

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