

Counts of Egyptian Vultures *Neophron percnopterus* and other avian scavengers at Muscat's municipal landfill, Oman, November 2013–March 2015

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Oman is important to migrant and resident scavenging raptors, including the globally endangered Egyptian Vulture *Neophron percnopterus*. We counted birds scavenging at Muscat's main (Al Multaqa) municipal landfill, November 2013–March 2015. A maximum of 458 Egyptian Vultures was observed during monthly counts. On average 216.3 ± 149.5 Egyptian Vultures were observed during winter months (October–March), and 72.4 ± 7.6 during summer months (April–September). Adults were typically the most common age class, on average 67% of the Egyptian Vultures seen. Although limited, these data confirm Oman's importance for Egyptian Vultures, and highlight the potential that waste disposal sites in the country have for monitoring local and migrant population fluctuations. Opportunities exist to use waste disposal sites and Egyptian Vultures to promote public education and citizen science that might benefit scavenging birds and other wildlife. Upgrades in solid waste disposal in Oman need not have a negative impact on scavenging birds, and governments and waste management companies can play a significant role in conserving these species while realizing the human health benefits of improved waste disposal.

INTRODUCTION

Amongst the avian raptor species that will scavenge, Oman is used by some of conservation concern, including the globally endangered Egyptian Vulture *Neophron percnopterus*, Lappet-faced Vulture *Torgos tracheliotos* and Steppe Eagle *Aquila nipalensis* and the vulnerable Eastern Imperial Eagle *Aquila heliaca* and Greater-spotted Eagle *Clanga clanga* (BirdLife International 2015, Eriksen & Victor 2013). Egyptian Vultures are partial migrants; birds that breed in northern areas move south for the non-breeding season. Also, juvenile Egyptian Vultures that migrate from northern areas probably dwell in southern areas like Oman for at least some years before returning to their natal areas (Oppel *et al* 2015), and these birds are to some unknown extent nomadic (<http://egyptianvultureoman.blogspot.co.at/>). Populations of Egyptian Vultures are in decline across their wide range (Birdlife International 2015), although Socotra (Porter & Suleiman 2012) and Masirah (Angelov *et al* 2013) islands are exceptions in Arabia. Egyptian Vultures face a great variety of threats on breeding and non-breeding grounds and on migration that include targeted and inadvertent poisoning, habitat loss, decline of food availability, persecution, use of body parts for traditional 'medicine', and interactions with electrical power infrastructure (BirdLife International 2015). Declines in eastern Europe may be the most obvious (Velevski *et al* 2015). Assumed declines in southern areas may be masked by the arrival of migrants during the non-breeding season and the lack of good survey data. Oman supports a resident population of Egyptian Vultures, and is host to non-breeding season visitors. Migrant Egyptian Vultures are in Oman mostly October–March; the largest recorded count at a rubbish dump in Oman is 1000 birds at Al Buraymi November 2005 (Eriksen & Victor 2013). Breeding by Egyptian Vultures in Oman occurs mostly in the northern mountains (eastern and western Hajar mountains including the Jebel Al Akhdar range), and Masirah island (Angelov *et al* 2013, Eriksen & Victor 2013). Records of birds at other places maybe mostly of non-resident or non-breeding birds, although single pairs and pockets of pairs breed where nesting habitat exists, especially in the northern half of the country. Past estimates of Oman holding c100 breeding pairs (Jennings 2010) are most likely too low (Al Bulushi *et al* 2013), as the population on Masirah alone is estimated to

be 65–80 breeding pairs (Angelov *et al* 2013). The number of migrant Egyptian Vultures that visit Oman is unknown, but the use of waste disposal sites by scavenging birds is common, and they have been identified as good places to watch eagles and vultures particularly October–March (Sargeant *et al* 2008).

Despite the apparent importance of Oman to scavenging birds of conservation concern (Environment Society of Oman 2012), very little published information is available on the numbers that occur in the country throughout the year or the locations that are most important. This lack of information may undermine conservation efforts in this rapidly developing country, both for resident populations and populations that migrate to Oman. We counted scavenging birds at the main municipal landfill for Muscat, Al Multaqa (aka 'New Al Amerat'), to better understand the species composition and numbers of avian scavengers using the dump, and how those varied throughout the year. These data provide a first glimpse at the likely importance of Al Multaqa for scavenging birds, and provides baseline data on numbers and monthly variation at the site.

STUDY AREA AND METHODS

The Muscat municipal landfill at Al Multaqa is located c15 km south of the built up areas of the city at c23.34° N 58.46° E, and is well-known amongst birdwatchers for the Egyptian Vultures, Lappet-faced Vultures and migrant *Aquila/Clanga* eagles that scavenge there (Plate 1). It is located to the north and at the base of the eastern Hajar mountains, where Egyptian Vultures are known to nest (Eriksen & Victor 2013), and where abundant nesting habitat exists.

We counted and aged (when possible) the raptors scavenging at the landfill on or around the third weekend of most (15 of 17) months November 2013–March 2015. Counts were made around noon using 10×42 binoculars and 25–60×65 telescopes from



Plate 1. View of the Al Multaqa landfill, which serves municipal Muscat, Oman, showing numerous Egyptian Vultures *Neophron percnopterus* flying around while workers cover rubbish (mostly household waste) with soil, 19 November 2014. © W Al Fazari

three vantage points (23.34171° N 58.45410° E, 23.33795° N 58.45923° E and 23.34695° N 58.45939° E), which together gave us a view of the entire site. All vantage points were 200–500 m from the main dumping area, where many birds congregated, though the actual distance varied throughout the study period, and birds could be more distant (or closer) as they soared and perched away from the dump itself or as the precise dumping location at the site changed. We attempted to count all scavenging birds observed from the vantage points, even those that were very distant. The numbers we report are an index of the scavenging birds using the site, as it was impossible to rule out some low level of double counting or that some birds were not counted.

At the site there were sometimes many birds perched, walking through the rubbish and flying at different distances from the observer. To improve count accuracy, multiple (typically 2–3) counts were made at each vantage point until consistency in count values was achieved. The duration of observation bouts at individual vantage points was \approx 10 minutes, but varied depending upon the number of birds. This meant that it took about 1–1.5 h to complete the count, including travel time between vantage points. The great majority of birds at the landfill were Egyptian Vultures, which can be aged by their plumage up to the age of five (Clark & Schmitt 1998, Plate 2). We recorded the age of Egyptian Vultures as: < 1 year (juveniles), 1–4 years (subadults) and > 4 years (adults).

We recorded the total number of birds observed per age class, and classified the months of October–February as ‘non-breeding’ or ‘winter’, and March–September as ‘breeding’ or ‘summer’ (no counts were made in April). From limited data from Masirah island it seems that most breeding by Egyptian Vultures occurs in the spring, and that many start incubating in February (Angelov & Yotsova 2012). A *t*-test was used to determine significance of differences between summer and winter counts.

RESULTS

Fifteen counts were made November 2013–March 2015. Egyptian Vultures were by far the most common scavenging raptor to use the site, and comprised 90% of the avian scavengers



Plate 2. Egyptian Vultures *Neophron percnopterus* of various ages roosting near the Al Multaqa landfill, Muscat, Oman, 13 January 2015. © M McGrady

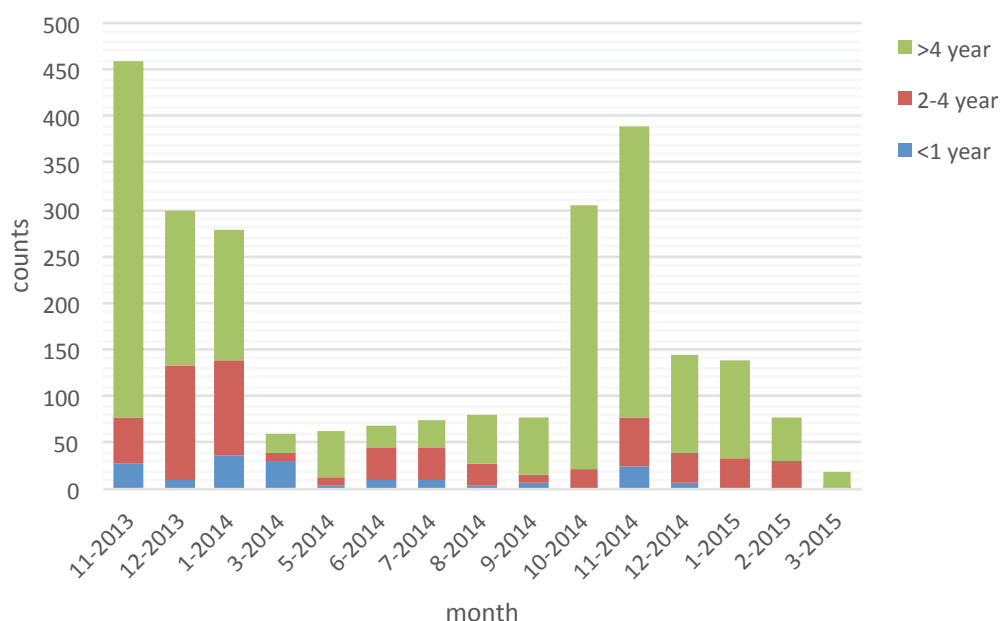


Figure 1. Counts of Egyptian Vultures November 2013–March 2015 at Al Multaqa landfill, Oman.

there. Counts of Egyptian Vultures are plotted in Figure 1. The highest count of Egyptian Vultures (458) occurred in November 2013, the lowest (19) in March 2015. Mean number of Egyptian Vultures during winter months (October–March) was 216.3 ± 149.5 (SD); during summer months (May–September) it was 72.4 ± 7.6 (Table 1).

In 11 of 15 months adults were the most common age class amongst Egyptian Vultures. On average adults comprised 67% (32.4–94.7) of the Egyptian Vultures seen at the landfill, subadults 24% (6.5–36.7), and juveniles 9% (0–51.7). No juvenile Egyptian Vultures were observed at the site January–March 2015. Significantly more Egyptian Vultures were counted at the site during the winter, and there were more subadults and adults counted in winter than in summer (Table 1). Other scavenging raptor species were recorded, but in very low numbers and only during the winter months. Over the study period, we observed Lappet-faced Vultures five times, Steppe Eagles (all juveniles) 27 times, Greater-spotted Eagles seven times and Eastern Imperial Eagles (Plate 3) 10 times.

DISCUSSION

Because migrant Egyptian Vultures leave Oman every spring, the numbers of vultures seen during summer at Al Multaqa should be an index of the ‘local’ population plus the number of immature birds from the north that remain in Oman. The number of adults in summer should be linked to the number of local breeding birds, and the number of individuals in late summer to the number of chicks being produced locally. Any link between the number of subadults and the status of the local population is less clear

Table 1. Mean counts (SD) of Egyptian Vultures at the Al Multaqa landfill near Muscat, Oman, during November 2013–March 2015.

Age (years)	Summer	Winter	P
< 1	9.5 (9.6)	13.2 (13.9)	0.369
1–4	26.4 (14.5)	55.1 (37.2)	0.017
>4	36.4 (18.9)	192.4 (117.9)	0.003
all ages	62.7 (20.9)	260.7 (131.6)	0.001



Plate 3. Globally endangered Egyptian Vulture *Neophron percnopterus* and globally vulnerable Eastern Imperial Eagle *Aquila heliaca* flying over the landfill at Al Multaqa, Oman, 19 November 2014. © W Al Fazari

because some subadults will be from elsewhere, mostly farther north (Oppel *et al* 2015), the precise character of this species' nomadism is not understood, and some sub-adult birds return to breeding areas in the north (www.lifeneophron.eu/en/Tagging.html).

During May–August 2014, when migrant adult birds are not present Oman, an average of 38.7 ± 16.2 adult and 7.2 ± 2.6 juvenile Egyptian Vultures were seen at Al Multaqa. These numbers might suggest that the local breeding population was 15–25 pairs, and that they produced 5–10 chicks in 2014. There also might have been some non-territorial floating birds amongst those in adult plumage. Although these may seem like plausible estimates, factors such as age-specific rates of use of disposal sites (Turrin *et al* 2015) might affect these. We must emphasize that the main feature of the breeding Egyptian Vulture population in northern Oman is that it is poorly known. More research is needed to better understand the likely relationship between the counts at the landfill and the size and productivity of the local population, and to identify the areas from which birds using the site come.

Similarly, the number and ages of Egyptian Vulture migrants arriving every autumn is related to the number of breeding birds farther north and their productivity, but this relationship is less clear because little is known about the provenance of migrant vultures wintering in Oman, and the amount of nomadism that occurs during the non-breeding season. Data from radiotracking of two 2–3 year old vultures show that they range over large areas and don't always frequent the large rubbish disposal sites (International Avian Research unpublished data, <http://egyptianvultureoman.blogspot.co.at/>). The lack of a significant increase in the number of juveniles during the non-breeding season could result from low productivity from northern areas or migration of juveniles to places other than Al Multaqa.

Oman has developed rapidly, particularly in the last 45 years. During that time the human population has grown from c723 000 to 4.3 million (Oman National Center for Statistics and Information 2015), and there has been a societal shift from village to large towns and cities; about 1/3 of the population now lives in Greater Muscat. What this has meant for the availability of food for vultures is unclear because while fewer Omanis are engaged in extensive livestock husbandry now, increased wealth and a strong tradition of extensive livestock rearing (mostly goats and camels), means that more animals are kept (2 327 071 in 2004, 3 235 777 in 2013, Oman Ministry of Agriculture and Fisheries 2013) and mortality is lower, and throughout the country there is more waste of all types. Ingestion of toxic and indigestible matter are known to harm avian scavengers (Henry *et al* 2011, Houston *et al* 2007, Mee *et al* 2007). Since c2009, waste disposal in Oman has been changing as part of a national strategy (www.ecomena.org/tag/waste-management-strategy/) that aims to reduce the number of waste disposal sites from over 300 to 12 (Be'ah company pers comm). The large number of avian scavengers that use Al Multaqa and the landfill at Tahwa, south of Sur (unpubl data: Environment Society of Oman, M McGrady) two of the most modern disposal sites in Oman, suggests that scavengers may still feed at improved sites, and benefit from the separation and improved handling of toxic material. Also, a modernized waste management effort in Oman may harness the scavengers' ecosystem service value (Markandya *et al* 2008) as part of a comprehensive strategy to reduce waste and cost, and promote human health, while providing access to safe food for scavenging birds (Dupont *et al* 2012). Further, the ability of all vultures to adapt to changing food availability by foraging over large areas (López-López *et al* 2014) supports the idea that waste management solutions can be employed that both meet public health objectives and are not detrimental to vultures. Best practice guidance (BirdLife International *et al* 2015) for waste management is available, and could form a substantial basis for developing the best approach to take in Oman.

Much needs to be done before the potential for monitoring population trends through rubbish disposal site counts can be realized. Surveys for local breeding populations and improved surveys at rubbish disposal sites used by large numbers of Egyptian Vultures appear to be good first steps, but tracking (<http://egyptianvultureoman.blogspot.co.at/>) and marking of individuals are also important tools that can be used to better understand this globally endangered species. Indeed, the limited work done so far (unpublished data: M McGrady, Environment Society of Oman) points to factors such as dump location, topography, time of year and waste type affecting the numbers and species composition of scavenging birds that uses any particular waste disposal site. More immediate, durable conservation benefit may be found by promoting birdwatching and public education at the waste disposal sites where scavengers congregate. The Egyptian Vulture is relatively well known by the public in Oman, albeit negatively, but even that presents an opportunity for changing public opinion. The rubbish disposal sites themselves are regularly visited by local and foreign birdwatchers and are good stages for educating the public about scavenging birds and wider issues about waste production and management, the important ecological services provided by wildlife, and migration.

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