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# A NEW APPROACH TO ASSESSMENT OF BIRD CARCASS REMOVAL (SCAVENGING) TIME ON WIND FARM IN EGYPT

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## ABSTRACT

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Wind farms developing rapidly in order to meet the high demand for energy from green sources. However, the impact of wind farm operation on the environment still needs to be established. The risk to wild birds is drawing the attention of stakeholders and bird conservation organizations. Carcass search is the main method used to assess the impact of wind farm operation on wild birds of various systematic groups and sizes. Assessment of the overall risk that wind farms pose to birds depends primarily on accurate calculation of carcass removal times and the detection ability of the searcher.

Most studies have assessed the carcass removal time using pet bird species, pigeons, or various local birds. In Egypt, all studies conducted in operating wind farms up to 2016 had used chickens to assess the carcass removal time and in this way to the estimate the total number of bird fatalities within wind farms.

The use of birds killed by a wind farm in carcass removal trials provides the actual time of carcass disappearance, in contrast with the use of other bird species. The removal times of carcasses of parakeets, quails, partridges and chickens were shorter than those of carcasses of White Stork, White Pelican, Honey Buzzard, Black Kites and eagles used in the current study and in another study in Australia.

The results of the present study indicate that carcasses of birds killed within the studied wind farm remain for two to three months, while the carcasses of other species in other localities remain no more than 1 to 15 days, which unquestionably influences the calculation of total fatalities and leads to overestimation of the overall risk that wind farms for birds.

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## INTRODUCTION

Carcass search is one of the main means of assessing the impact of wind farm development on migratory and resident birds, where the finding of bird carcasses is evidence of the risk that wind farms pose for birds. The mortality rate of birds killed by wind turbines is calculated based on the total carcasses found within the wind farm, while the total number is corrected using variable models with various parameters, such as the actual number of carcasses found, searcher efficiency (the ability of researchers to find carcasses, i.e. the researcher detection coefficient), and the removal time of found carcasses (the time of carcass disappearance or removal by various factors, i.e. the carcass disappearance coefficient). Therefore, the time when the carcasses found under the wind turbine disappeared is a critical parameter used in all models to estimate the total number of bird fatalities on a wind farm. Most studies have assessed the removal time of carcasses using pet bird species, pigeons, or various local birds. In Egypt, all studies conducted on operating wind farms up to 2016 used chickens to assess the removal time of carcasses and in this way to estimate the total number of bird fatalities within wind farms.

The data on the removal time of carcasses were used to calculate the corrected total bird mortality, which is one of the main parameters in various models, such as Erickson *et al.* 2004, Johnson *et al.* (2003), Kerns and Kerlinger (2004), Baerwald and Barclay (2009), Huso (2010), Korner-Nievergelt 2011 and Environment Canada, Canadian Wildlife Service and Ministry of Natural Resources (2014).

The purpose of this paper is to determine the removal time of carcasses of actual victims in the natural environment of a wind farm in Egypt. This can help to avoid the biases resulting from the use of different birds or pet bird species to assess the removal time. A biased determination of the time of carcass disappearance can substantially change estimations of the final mortality rate in wind farm projects

## SITE DESCRIPTION

The KfW 240 MW wind farm (Fig. 1) is about 38.5 km$^2$ in area, located west of the Ras Shukheir salt marsh (Sabkhet Ras Shukheir) along the coastal plain of the Red Sea. The wind farm site is bounded by slightly open flat areas to the west, to the Red Sea Mountains. The northern and eastern parts extend as far as the salt marshes located between the wind farm site and the Gulf of Suez. On the opposite coast of the Gulf is its eastern coastal plain, the Al-Tor area.

The wind farm has a total of 120 wind turbines arranged in seven rows with a northeast–southwest orientation. The rows of wind turbines vary in length from about 1.7 km (shortest row – no. 6) to about 5.2 km long (longest row – no. 2), and the distance between the rows is about 1.1 km. The wind farm is surrounded to the north and east by a 220 KV overhead high voltage transmission power line.

The total height of the G80-2.0 MW turbines is about 100 m, where the tower is 60 m high and the diameter of the rotor swept area is 80 m.

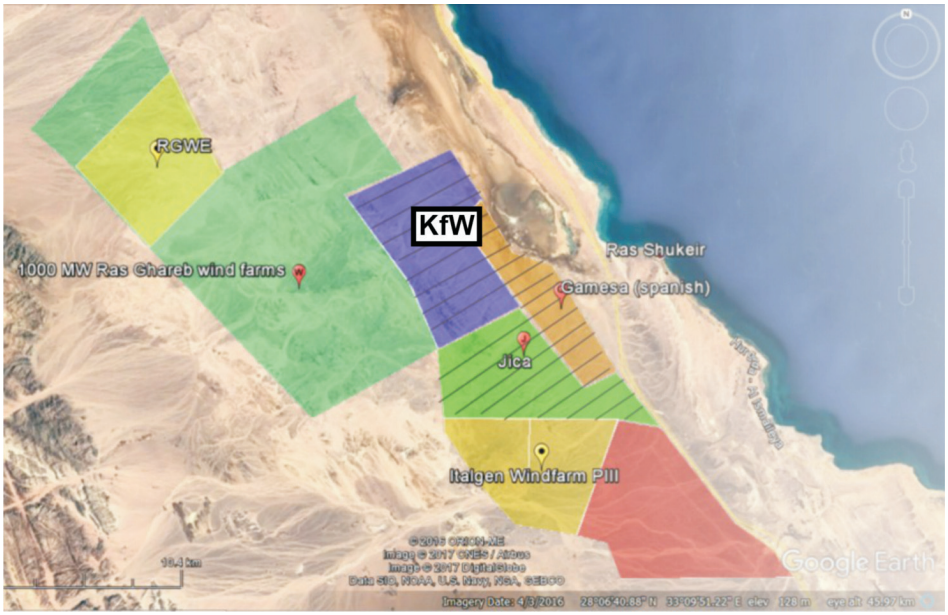


Fig. 1. Location of KFW wind farm within NREA area

## MATERIALS AND METHODS

The disappearance time (removal time) of bird carcasses was assessed based on the number of carcasses found in and around KfW 200 MW (100 turbines) during the spring and autumn from 2014 to 2016. Systematic assessment of removal times for 8 carcasses of different bird species was carried out in autumn of 2016 (6 carcasses) and 2017 (2 carcasses). The exact locations were detected using GPS and a small marked stone placed north of the carcass position to aid in its relocation without drawing direct attention to the carcass. The carcasses were checked daily to detect removal by scavengers or disappearance by decay under the influence of heat and dry conditions. The presence/absence of the carcasses, condition of the carcass (using standard categories: intact, scavenged and feather spot – Erickson *et al.* 2004; Brown and Hamilton 2006), and any additional comments or observations were recorded by the observer. As part of the standard work method, if a carcass was not present during a subsequent visit, the observer searched the surrounding area within at least a 20 m radius for carcasses that may have been blown away or been moved by scavengers.

**Data collected:** date and time of discovery, GPS coordinates of carcass, species name, carcass condition, evidence of predation, photo documentation of carcass condition.

**Data collection and routine:** removal times of carcasses were assessed as a percentage based on removed parts of the body or changes in its condition at its discovery time. The removal time of a carcass is the number of days that have passed when the carcass has disappeared and cannot easily be found by the searcher. During the

study period only intact carcasses (the whole body of a bird was considered intact whether or not it was fresh) were used to assess the removal time. For old carcasses, the day of collision is estimated according to the condition of the carcass when it is found, according to standard guidelines based on daily observations of fresh carcasses at the same site.

The data collection period was 43 days in 2016, from 25 September to 6 November, and 79 days in 2017, from 15 August to 1 November. In autumn 2016 the carcasses were visited daily from the time they were found, whereas in autumn 2017 visits were once a week. The visits were made to document the changes in carcass condition and other observations.

## RESULTS

The carcass removal time in 2016 was assessed using three carcasses found on the wind farm. Two of these were White Storks and the third was a Black Kite.

The first White Stork carcass found on 26 September 2016 (estimated 3 days old), near wind turbine no. 29, remained intact and in good condition for about 10 days after discovery. Due to normal decomposition its condition began to deteriorate, and it

Fig. 2. Overview of the study area site and habitat

gradually lost feathers over more than 30 days. This meant that the carcass did not disappear and was still easy to find at the site for more than 34 days.

The second White Stork was found on 4 October 2016 (about 15 days old), close to wind turbine no. 79, in poor condition; its body was complete but quite loose and could easily be broken into parts. Although the carcass was not in good condition, it remained visible and easy to find at the site, with no evidence of predation or scavenging. Hence the removal time of this carcass can be estimated to be more than 33 days.

A similar result was obtained for the Black Kite carcass, which had been subjected to predation, and some parts of the carcass had already disappeared (probably eaten by a fox). Although only parts of the carcass were found on 13 October 2016, fresh, at some distance from wind turbine no. 34, it remained untouched by predators or scavengers and easy to find up to the end of the study (about 27 days), even after a very heavy rain (27 Oct.).

The results indicate a relatively low rate of removal, where the average time of carcass persistence is estimated to be about 30 days. The carcasses disappeared mainly due to heavy rain and floods at the site.

In autumn 2017, the carcass removal time was assessed using the two carcasses found on the wind farm and along the power line. The two carcasses were visited on a weekly basis after they were found, and changes in the carcass condition and the effect of scavengers and/or predation were documented according to standard carcass condition categories (Fig. 3).

The first White Stork carcass, found close to the power line on 18 August (about 3 days old), remained intact and in good condition for about 15 days, after which due to normal decomposition it began to dry out and underwent a deterioration of condition, gradually losing feathers until the end of the season (more than 60 days). This meant that the carcass did not disappear and was still easy to find at the site where it had fallen for more than 60 days.

The second White Stork was found on 24 September 2017 (about 15 days old), close to wind turbine no. 23, intact and slightly dry. The carcass was in good condition and remained visible and easy to find at the site, with no evidence of predation or scavenging, until the end of the season. Thus the removal time of this carcass can be estimated to be more than 60 days.

The results of the carcass removal monitoring indicate a relatively low rate of removal, where the average rate of carcass persistence was estimated to be more than 60 days.

In addition, similar cases are known for spring 2015, with one White Stork carcass, one carcass of Honey Buzzard, and 17 carcasses of Great White Pelican killed by the power line (personal observations).

## DISCUSSION

The carcass removal time at the study site was tested using carcasses found during a carcass search, in contrast with most studies conducted to assess carcass removal times worldwide (Higgins *et al*. 1995, Lizarraga 2003, Anderson *et al*. 2004,

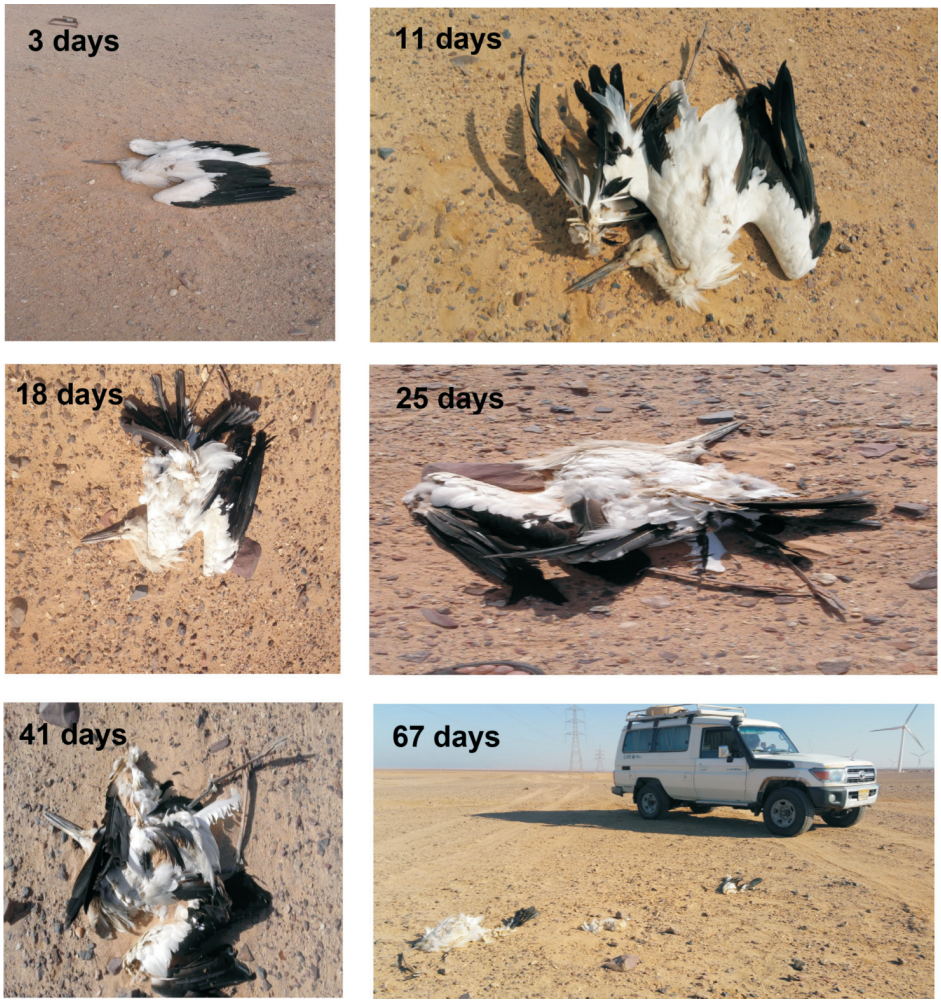


Fig. 3. Example history of a White Stork carcass between 18 Aug. and 21 Oct. 2017
3 days after collision with a power line. Body complete and fresh, with broken left wing.

11 days. Body complete, dry, with partially exposed chest and wing bones and loose primary feathers on left wing.

18 days. Body complete, dry, with more exposed chest and wing bones, loose primary feathers and lost parts of left wing.

25 days. Compact, complete body, very dry, with more exposed chest and wing bones. Lost primary feathers of right wing and lost parts of left wing.

41 days. Compact, incomplete body, very dry and broken into parts, especially wings, with most body feathers lost.

67 days. Incomplete body, very dry and broken into parts, most body feathers lost, with remains of wings still present.

Saraiva 2005, Bio3 2007c, and Silva *et al*. 2007). Some of these studies have used parakeets (*Melopsittacus undulates*), quails (*Coturnix coturnix*) and partridges (*Alectoris rufa*). Bernardino *et al*. (*2011*) and others have used chickens and ducks, and in

Egypt the carcass removal time has been assessed using chickens (EEAA, 2016, 2017, unpublished). In this study the carcass removal trial was similar to a study conducted at the Bluff Point and Studland Bay wind farms in Tasmania, Australia (Hull *et al*. 2015), where the removal time of carcasses of two eagle species (Wedge-tailed Eagle, *Aquila audax fleayi*, and White-bellied Sea-eagle, *Haliaeetus leucogaster*) were assessed using the carcasses of eagles actually killed by the wind turbines at the Bluff Point and Studland Bay wind farms.

In this study, conducted in autumn 2016 and 2017, the carcasses took a long time to be removed from the field. They were removed only due to natural decomposition under the influence of environmental conditions, with no evidence of scavenging observed except for the Black Kite carcass, which was found partially eaten by a carnivore (possibly a fox) on the first day (probably the night before the day of discovery). The remaining part of the carcass persisted during the entire study period in autumn 2016. Therefore the carcasses of various species of soaring birds killed by operating wind turbines last for at least 30 days (in the case of heavy rain) to about three months (in normal weather conditions). The results of the current study are confirmed by the findings and field observations of Hull *et al*. (2015) for a Honey Buzzard carcass, as well as our own observations of 17 Great White Pelican carcasses in spring 2015 within and around the same wind farm (personal observation), which lasted for three months. Assessment of removal times using carcasses of different species rather than species killed within the wind farm has given shorter removal times, ranging from 1 day to a maximum of two weeks (Pain 1991, Strickland *et al*. 2000, Anderson *et al*. 2004, Korner-Nievergelt *et al*. 2011, Bernardino *et al*. 2011), which leads to overestimation of the total number of carcasses and thus the mortality rate of birds within the operating wind farm.

## CONCLUSION

Assessment of carcass removal times based on killed carcasses is more accurate and realistic and avoids underestimating the time of persistence of carcasses, as when different species are used. Such underestimation apparently increased the values of the total numbers of birds killed within the wind farm and in consequence the overall risk that wind farm development poses for wild birds. No difference was found between autumn and spring in removal times of carcasses of soaring birds found in and around the operating wind farm in Egypt. The removal time of carcasses of various soaring birds found in and around the operating wind farm ranged from one month to three months, and their disappearance was due to decomposition and decay, with no evidence of scavengers by predators known to be present in the desert-type area under study. This was documented during the period of the study and in field observations in both autumn and spring.

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