*Bird Study* (2009) **56,** 268–271

SHORT REPORT

# Overlap between wind power plants and Griffon Vultures *Gyps fulvus* in Spain

JOSÉ LUIS TELLERÍA*
*Departamento de Zoología, Facultad de Ciencias Biológicas, Universidad Complutense, 28040 Madrid, Spain*

**Capsule** The huge expansion of wind power plants has already occupied a significant part of the breeding range of the Spanish population of Griffon Vultures.



The number of wind power plants has increased dramatically in Spain (European Wind Energy Association (EWEA) 2008). At the end of 2004 the Spanish wind power industry produced 8000 MW but, according to the 5-year Spanish Plan of Renewable Energy, the aim is to reach 20,000 MW in 2010 and 40,000 MW at the end of the process (Ministerio de Industria, Turismo y Comercio 2005). As a result, the country is being rapidly occupied by wind power plants, many of which are located in key wildlife conservation areas. In this context, the effects of wind power plants on birds are a matter of conservation concern because birds run the risk of colliding with turbines (De Lucas *et al.* 2007).

Although local impact assessments are routine in Spain, no large-scale evaluations of the potential effects of this industry on individual species across the country have been carried out (but see Tellería in press). This is an important issue because, according to EU directives (85/337/EEC, 97/11/EC, 2001/42/EC), all potential construction sites must be evaluated within the context of large-scale integral assessment frameworks (e.g. Fielding *et al.* 2006). This note explores the overlap between wind power plants with breeding sites of Griffon Vulture *Gyps fulvus*. Despite vultures being vulnerable to wind turbines (Barrios & Rodríguez 2004), there are no evaluations of the potential impact of this expanding industry on the Spanish population of this raptor (more than 20 000 breeding pairs; Martí & Del Moral 2003).

*Email: telleria@bio.ucm.es

Distribution of wind power plants (as determined by Universal Transverse Mercator (UTM) coordinates) was recorded from the official web of the Spanish Wind Energy Association (www.aeeolica.org) in September 2007. Information on vulture distribution was provided by the National Biodiversity Databank of the Spanish Ministry of the Environment (http://www.mma.es). This provides the results of a study of the Spanish Ornithological Society (SEO–Bird Life) carried out to elaborate the national atlas of breeding birds (Martí & Del Moral 2003). In this atlas, the presence or absence of vulture colonies was reported in the central point of 10 × 10 km UTM squares. These data were managed by ARCGIS-ARCMAP® 9.1 to assess the proximity of wind power plants to breeding sites. Proximity is used here to assess the collision risk with turbines. This index was evaluated by counting the number of squares occupied by vulture colonies that were located inside buffer areas delimited at increasing distances (5, 10, 20 and 30 km) from power plants. The number of turbines and installed power, an indicator of the potential incidence of wind plants on birds, was also calculated in the buffer areas occupied by colonies. It is important to point out that the proximity and number of wind farms near colonies is just a crude index of the actual risk of bird collision because this is also affected by particular features of individual wind farms (e.g. location, number and type of turbines; Morrison *et al.* 2007).

The main breeding range of Griffon Vultures is located in the northern half of Spain, an area occupied by many wind power plants (Fig. 1). Half of the UTM squares occupied by vulture colonies were located

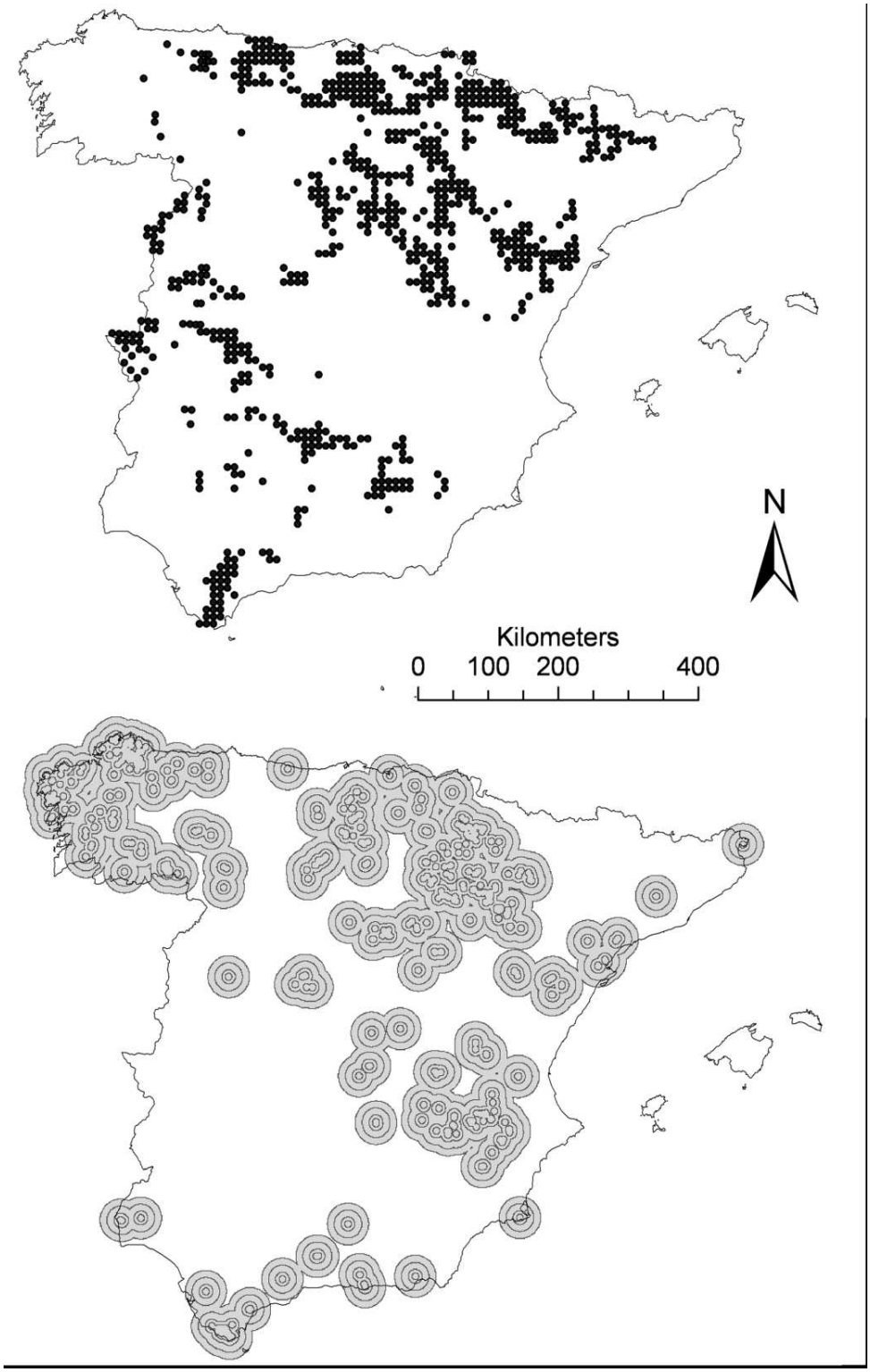


**Figure 1.** Distribution of 10 × 10 km UTM squares with breeding colonies of Griffon Vultures in Spain (top) and of 5, 10, 20 and 30 km buffer areas around wind plants (bottom).

**Table 1.** Number of UTM squares occupied by Griffon Vulture colonies in Spain and in the four buffer areas delimited around wind power plants. The number of turbines and installed power (September 2007) is also shown. The percentage of these scores with regard to the whole of Spain is displayed in parentheses.

| | | Buffer areas | | | |
|---|---|---|---|---|---|
| | Spain | 5 km | 10 km | 20 km | 30 km |
| UTM squares | 751 | 42 (5.59%) | 108 (14.38%) | 249 (33.16%) | 381 (50.73%) |
| Turbines | 13044 | 1855 (14.22%) | 3938 (30.19%) | 5504 (42.20%) | 6804 (52.16%) |
| Power (MW) | 10886 | 1606 (14.75%) | 3371 (30.93%) | 4804 (44.13%) | 5880 (54.01%) |

inside the largest buffer area (30 km) around wind power plants, where they were under the potential effect of 6800 turbines (Table 1). Since Griffon Vultures may move 50–70 km from nesting areas in search of food (Donázar 1993), it may be concluded that a significant proportion of the Spanish population of this species is under collision risk.

The construction of wind plants in areas in which vulnerable species are present (e.g. mountain areas in Spain) is a matter of conservation concern, despite the assumed low significance of turbine-related mortality compared to mortality attributed to more widespread infrastructures such as roads and buildings (National Wind Coordinating Committee 2002). Some assessments (Lekuona 2001, Everaert 2003) have calculated mean annual losses of 20.6 birds per turbine ($n$ = 11 plants, range 1.34–64) for wind plants in Europe (21.2 birds per turbine in the subset of the six Northern Spanish plants; range 4–64). Despite the variability of these estimates, it is possible to presume losses of several thousand small and large birds killed by turbines annually (Table 1). No data are available on the total number of vultures killed each year by wind power plants in Spain, but the numbers may be high since these raptors patrol across mountain ridges and highlands usually selected by wind power industry. Lekuona (2001) estimated at least eight Griffon Vultures killed per turbine per year in the area occupied by the Salajones wind plant (Navarre, northern Spain) and Lekuona & Ursúa (2007) reported that Griffon Vultures were the main species found dead at the wind plants of Navarre, representing 63.1% of all bird fatalities. These losses may be particularly damaging to vultures and other animals with low reproductive rates and long life spans which are unable to replace an accumulative loss of individuals.

There are no data on recent population trends of Eurasian Griffon Vultures in Spain. The population experienced a spectacular increase between 1990 and 2000 as a result of rising food availability (Parra & Tellería 2003). However, the enforcement of legislation to remove carrion after the bovine spongiform encephalopathy crisis, and the expansion of the wind farm industry may now lead to a decline of the Spanish population. The time to prevent these problems is now because we are still in the first stages of addressing a new conservation issue that will affect many species and countries (e.g. the EU aims to increase wind power production from 56 000 MW in 2007 to 300 000 MW in 2030; EWEA 2008). To approach this, it seems important to launch, according to EU directives, strategic environmental assessments to evaluate the potential effects of wind plants in sensitive areas.

## ACKNOWLEDGEMENTS

Alma Román prepared the data on wind plant distribution. J. Everaert and P. Whitfield considerably improved a first version of this note.

## REFERENCES

**Barrios, L. & Rodríguez, A.** 2004. Behavioural and environmental correlates of soaring bird mortality at on shore wind turbines. *J. App. Ecol.* **41:** 72–81.

**De Lucas, M., Janss, G.F.E. & Ferrer, M.** 2007. *Birds and Wind Farms. Risk Assessment and Mitigation.* Quercus, Madrid.

**Donázar, J.A**. 1993. *Los buitres ibéricos. Biología y conservación*, Reyero, J.M. (ed.). Quercus, Madrid.

**Everaert, J.** 2003. Wind turbines and birds in Flanders: preliminary study results and recommendations. *Natuur Oriolus* **69:** 145–155.

**European Wind Energy Association 2008**. *Pure Power. Wind Energy Scenarios up to 2030*. EWEA, Brussels.

**Fielding, A.H., Whitfield, D.P. & McLeod, D.R.A**. 2006. Spatial association as an indicator of the potential for future interactions between wind energy developments and Golden Eagles *Aquila chrysaetos* in Scotland. *Biol. Con.* **131:** 359–369.

**Lekuona, J.M.** 2001. *Uso del espacio por la avifauna y control de la mortalidad de aves en los parques eólicos de Navarra*. Gobierno de Navarra, Pamplona.

**Lekuona, J.M. & Ursúa, C.** 2007. Avian mortality in wind power plants of Navarra (Northern Spain). In De Lucas, M., Janss, G.F.E. &

Ferrer, M (eds) *Birds and Wind Farms. Risk Assessment and Mitigation*: 177–192. Quercus, Madrid.

**Martí, R. & Del Moral, J.C.**. 2003. *Atlas de las aves reproductoras de España*. Dirección General de Conservación de la Naturaleza – SEO/BirdLife, Madrid.

**Ministerio de Industria, Turismo y Comercio** 2005. *Plan de Energías Renovables en España 2005–2010*. Ministerio de Industria, Turismo y Comercio & Instituto para la diversificación y ahorro de la Energía, Madrid.

**Morrison, M.L., Sinclair, K.C. & Thelander, C.G.** 2007. A sampling framework for conducting studies of the influence of wind energy developments on birds and other animals. In De Lucas, M., Janss, G.F.E. & Ferrer, M (eds) *Birds and Wind Farms. Risk Assessment and Mitigation*: 101–115. Quercus, Madrid.

**National Wind Coordinating Committee** 2002. *Wind Turbine Interactions with Birds and Bats: a Summary of Research Results and Remaining Questions*. National Wind Coordinating Committee, Washington.

**Parra, J. & Tellería, J.L. 2004**. The increase in the Spanish population of Griffon Vulture *Gyps fulvus* during 1989–1999: effects of food and nest site availability. *Bird Con. Int.* **14:** 33–41.

**Tellería, J.L.** In press. Potential impacts of wind farms on migratory birds crossing Spain. *Bird Con. Int.* DOI: 10.1017/S0959270908008137.

(MS received 4 June 2008; revised MS accepted 6 November 2008)