www.ecoda.de

ecoda GbR
ENVIRONMENTAL
EXPERT OPINION
Ruinenstr. 33
44287 Dortmund
Germany

Fon +49 231 841697-10
Fax +49 231 589896-0
ecoda@ecoda.de
www.ecoda.de

# Expert Opinion on the Expected Impact on Birds

as Part of the Environmental Impact Assessment
for the Proposed "Čibuk 1" Wind Farm
located near the Villages Dolovo and Mramorak
in the Municipality of Kovin (Autonomous Province of Vojvodina, Republic of Serbia)

Reported to:

Continental Wind Serbia DOO
Đure Jakšića 6
11000 Beograd

Prepared by:

Dr. Michael Quest

Checked by:

Dr. Frank Bergen

Final Draft Report

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# 1 Introduction

## 1.1 Background of the investigation

With "Čibuk 1" a wind farm of 57 wind turbines is planned for construction near the villages of Dolovo and Mramorak in the Municipality of Kovin (Autonomous Province of Vojvodina, Republic of Serbia).

The construction and operation of wind power plants may have a negative impact on breeding and resting birds and can also affect migratory birds. The main effects on birds are (EUROPEAN COMMISSION 2010; INSTITUTE FOR NATURE CONSERVATION OF SERBIA 2010; see also Chapter 5):

- risk of collision
- disturbance and displacement
- barrier effects
- loss or degradation of habitats

### 1.1.1 International conventions, laws and standards with regards to birds

In order to assess the impact of constructing and operating of the planned wind farm on birds and to fulfil European standards this expert opinion conform to European conventions (Bern and Bonn Conventions) and directives (Birds Directive):

Bern Convention: Convention on the Conservation of European Wildlife and Natural Habitats (Serbia acceded 1 May 2008)

The Bern Convention is an internationally binding legal instrument covering most of the natural heritage of the European continent and extending to some African states. Its aims are to conserve wild flora and fauna and their natural habitats and to promote European co-operation within the area. The Convention particularly emphasizes the need to protect endangered natural habitats and endangered vulnerable species, including migratory species.

The rules relevant for the conservation of special species are listed in articles 6 and 10:

*"Article 6*

*Each Contracting Party shall take appropriate and necessary legislative and administrative measures to ensure the special protection of the wild fauna species specified in Appendix II. The following will in particular be prohibited for these species:*

*a all forms of deliberate capture and keeping and deliberate killing;*
*b the deliberate damage to or destruction of breeding or resting sites;*
*c the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention;*
*d the deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty;*
*e the possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof, where this would contribute to the effectiveness of the provisions of this article."*

*"Article 10*

1 *The Contracting Parties undertake, in addition to the measures specified in Articles 4, 6, 7 and 8, to co-ordinate their efforts for the protection of the migratory species specified in Appendices II and III whose range extends into their territories.*

2 *The Contracting Parties shall take measures to seek to ensure that the closed seasons and/or other procedures regulating the exploitation established under paragraph 3.a of article 7 are adequate and appropriately disposed to meet the requirements of the migratory species specified in Appendix III."*

Bonn Convention: Convention on the Conservation of Migratory Species of Wild Animals (CMS) (Serbia acceded 1 March 2008)

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. This intergovernmental treaty, negotiated under the aegis of the United Nations Environment Programme, is concerned with the conservation of wildlife and habitats on a global scale.

The relevant rules concerning migratory species are stated in article III:

*"Article III*

*Endangered Migratory Species: Appendix I*

4. *Parties that are Range States of a migratory species listed in Appendix I shall endeavour:*

a) *to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;*
b) *to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and*
c) *to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species.*

5. *Parties that are Range States of a migratory species listed in Appendix I shall prohibit the taking of animals belonging to such species. Exceptions may be made to this prohibition only if:*

a) *the taking is for scientific purposes;*
b) *the taking is for the purpose of enhancing the propagation or survival of the affected species;*
c) *the taking is to accommodate the needs of traditional subsistence users of such species; or*
d) *extraordinary circumstances so require; provided that such exceptions are precise as to content and limited in space and time. Such taking should not operate to the disadvantage of the species."*

Furthermore it is based on the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (in the following: Birds Directive).

Birds Directive: Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds

The aim of the Birds Directive is to provide long-term protection and conservation of all bird species including migratory species naturally living in the wild within the European territory of the Member States and to regulate the management and the use of birds.

The relevant rules concerning migratory species are listed in article 5:

*"Article 5*

*Without prejudice to Articles 7 and 9, Member States shall take the requisite measures to establish a general system of protection for all species of birds referred to in Article 1, prohibiting in particular:*

*(a) deliberate killing or capture by any method;*

*(b) deliberate destruction of, or damage to, their nests and eggs or removal of their nests;*

*(c) taking their eggs in the wild and keeping these eggs even if empty;*

*(d) deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive;*

*(e) keeping birds of species the hunting and capture of which is prohibited."*

### 1.1.2 General note on the implementation of legal requirements into practice

In practice problems exist because the restrictions of article 5 of the Birds Directive apply to all European bird species and thus to numerous and widespread species as well. Therefore it is common to reasonably select so-called target species or species of special interest (cf. Chapter 3.1). These are species that could be regarded as endangered or vulnerable to a certain degree (Species of European Conservation Concern, IUCN-Red-List species, species of the Appendix I or selected species of article 4 paragraph 2 of the Bird Directive, Species of the Appendix II of the Bern Convention) or / and that may be affected by wind turbines (cf. Chapter 5, EU-COMMISSION 2010).

A species-specific consideration of numerous and widespread species in practice is not feasible. Common species are generally in a favourable conservational status; thus possible effects of wind turbines are normally not supposed to lead to a deterioration of their abundance (cf. KIEL 2007).

In terms of a threshold of significance many authors only consider effects that result in the deterioration of populations, contrary to the Birds Directive (cf. KIEL 2005, LÜTTMANN 2007). LANA (2009) states that assessing a restriction on deliberate disturbances for certain European bird species is not based on individuals but on local populations. Accordingly, an impact would be rated as significant if effects harmed a number of individuals in a way that the chances of survival, rate and success of reproduction of the population as a whole would deteriorate.

In terms of applicable assessment criteria and significance thresholds, this expert opinion adheres to guidelines used in Germany and internationally as well (*e.g.* EUROPEAN COMMISSION 2007, EUROPEAN COMMISSION 2010, INSTITUTE FOR NATURE CONSERVATION OF SERBIA 2010, LANA 2009, MUNLV 2010).

## 1.2 Aim of the investigation

The main purpose of the investigation is to collect data on birds of high conservational importance and / or on birds that may be at high risks (collision, avoidance) regarding wind turbines (in particular target species) that will permit estimates on their spatial and temporal distribution in the study area.
As a result the aim of this expert opinion is to

- identify, predict and assess the likely effects of the proposed wind farm on breeding, resting and migratory birds;
- assess whether impacts of the proposed wind farm remain at an acceptable level, or whether additional measures are necessary to minimize or eliminate unacceptable impacts;
- recommend mitigation measures or measures for compensation in order to minimize possible conflicts.

Accordingly, Chapters 2 and 3 of this report describe the project and the methods used in the investigations. Intensive observations of breeding, resting and migrating birds, carried out from 2009 to 2011, form the basis for presenting the occurrence of species in the study area and for describing the importance of the area for bird species (Chapter 4). Proceeding from potential effects of wind turbines on birds (Chapter 5), the prediction and the assessment of likely effects (Chapter 6) as well as the opportunities for mitigation and compensation measures will be presented (Chapter 7).

## 1.3 Description of the study area and its wider surroundings

### 1.3.1 The area of the proposed wind farm

The proposed site for "Čibuk 1" wind farm is located in south Banat (Autonomous Province of Vojvodina) in the agricultural area west of the Deliblato Sands Special Nature Reserve." (PAUNOVIĆ & KARAPANDŽA 2011a and cf. Map 1.1). "The area is made up almost exclusively of intensively cultivated monoculture fields, mostly without hedgerows. The presence of non-cultivated land is negligible and there is no forest-steppe and forest vegetation. The bushy and ligneous vegetation is composed of individual trees, bushes and small intermittent and/or scarce lines of trees along dirt roads and around the depression of the Stankova valley in the vicinity of the village of Mramorak. This depression is in a state of late eutrophication, with water availability only in the wettest periods in the year.

The eastern border of the planned wind-farm "Čibuk 1" site stretches along the unused Vladimirovac-Bavanište railway track for a distance of 1 km. There is an electrical energy installation (*i.e.* an overhead power line) running through both of the sites. The entire study area contains a dense network of dirt roads used to access the fields (Image 5). Primary village dumps are sporadically present along certain parts of the roads, especially in the narrower area around the settlements." (cf. PAUNOVIĆ & KARAPANDŽA 2011a).

At the eastern border of the planned wind farm a 1 km buffer zone to Deliblato Sands Special Nature Reserve is established (cf. Map 2.1). This buffer zone aims to minimize potential adverse effects of the proposed wind farm on animals and habitats of the Deliblato Sands Special Nature Reserve. Deliblato Sands reaches IBA-criteria for nine species of passerines. Several studies show that likely adverse effects of wind turbines will have no significant impact on passerines and their habitats in that distance (STÜBING 2001, REICHENBACH *et al.* 2004, MÖCKEL & WIESNER 2007).

### 1.3.2 Deliblato Sands

PAUNOVIĆ & KARAPANDŽA (2011a) describe Deliblato Sands as follows: "On the east and north-east sides of the entire study area is the Deliblato Sands Special Nature Reserve, which stretches in a northwest-southeast direction. This reserve was placed [...] under protection as Europe's largest area of eolic sand residue with distinctive forms of dune relief, characteristic sand, steppe and forest ecosystems, a unique mosaic of biocoenosis and typical and specific specimen of flora and fauna [...]. Many of these species are rarities and very significant based upon international criteria" (Official Gazette of the Republic of Serbia, Nos. 43/02, 81/08). In addition, seven kilometres south-east of the southernmost point of the wind farm site, and west of the village of Deliblato, is the Kraljevac Pond Special Nature Reserve. Kraljevac Pond, along with Vašarište and Obzovik, used to have the status of a resource undergoing the protection procedure (Official Gazette of the Republic of Serbia, No. 112/03), and then in 2009, it was declared a special nature reserve (Official Gazette of the Republic of Serbia, No. 14/09)."

### 1.3.3 Other areas of special interest

PAUNOVIĆ & KARAPANDŽA (2011a) mention two other areas with high importance predominantly for birds:

Crna Bara:

"Approximately 12 kilometres south-east of the study area lies another marsh – Crna Bara [...], which does not enjoy a protected status. However, its characteristics contribute significantly to the preservation of biodiversity and provide a habitat for a large number of protected species, primarily birds (PUZOVIĆ *et al.* 1999, TUCAKOV *et al.* 2009)."

Danube River:

The Danube River is located about 25 km south of the study area in a straight line. The bed of the river in that zone is very wide and practically represents the beginning of the Đerdap Lake, created by the construction of the Đerdap 1 river dam. Long and wide shallow waters (*i.e.* flooded former coastal zones) (ĐONIĆ ET JEČINAC, 1991) are located in the flow section between km 1110th and 1088th of the Danube River (*i.e.* downstream of Smederevo island) until the settlements of Dubovac and Dubovački rit (Dubovac Marsh) ..., where the Deliblato Sands actually begins on the left bank and all along km 1077th of the river (*i.e.* the junction of the Danube-Tisa-Danube channel). This section is also a place of extremely rich biodiversity and is an especially significant habitat for big flocks of birds living in water habitats (about 100,000 individuals on average) that stay there throughout the winter for feeding and resting (PAUNOVIĆ *et al.* 1995).

**Expert Opinion on the Ornithological Investigation**

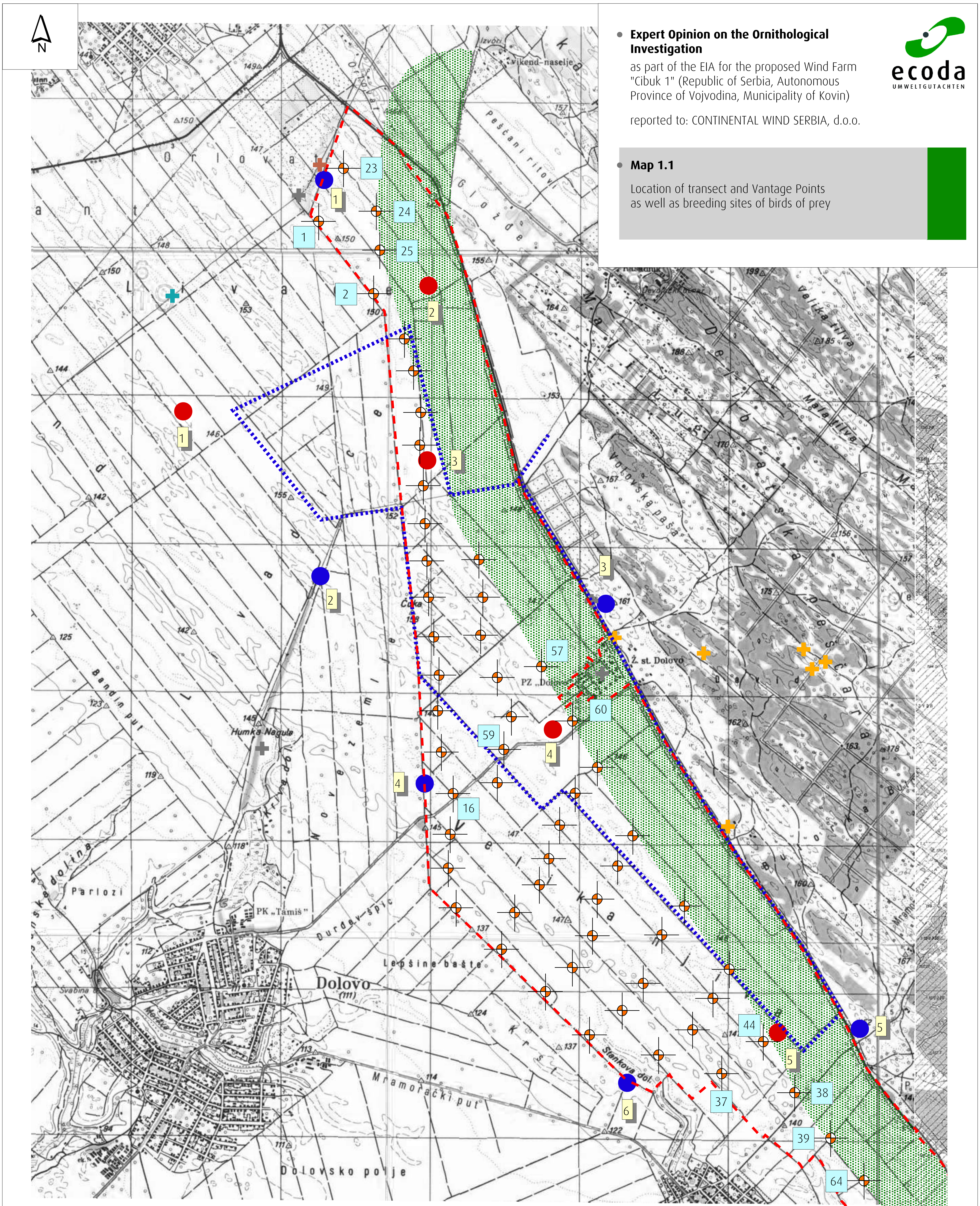
as part of the EIA for the proposed Wind Farm "Cibuk 1" (Republic of Serbia, Autonomous Province of Vojvodina, Municipality of Kovin)

reported to: CONTINENTAL WIND SERBIA, d.o.o.

ecoda UMWELTGUTACHTEN

**Map 1.1**

Location of transect and Vantage Points as well as breeding sites of birds of prey




Legend

| | | |
|---|---|---|
| Location of a planned Wind Power Plant (WPP) | Vantage Point of Team 1 | Breeding sites (cf. PAUNOVIC & KARAPANDZA 2011) |
| 23 Number of a particular WPP (only that WPP are marked, which are mentioned in the text) | Vantage Point of Team 2 | Eurasian Hobby |
| Border of the planned wind-fram | Transect route of Team 1 | Common Buzzard |
| 1 km-buffer zone to Deliblato Sands | | Saker Falcon |
| | | Common Kestrel |

Scale 1 : 50.000

0 500 2:500 m

# 2 Description of the proposed project

## 2.1 Wind turbines

"Čibuk 1" wind farm is planned to be equipped with 57 wind turbines like VESTAS V-112 IEC (class IIA, with a nominal power of 3 MW). The tower height of each turbine will be 120 m, the length of a turbine blade will be 57 m.

The poles of the turbines, spaced in accordance with the technical and technological concept, will be positioned on individual agricultural plots relatively close to existing local roads in the area covered by the plan. The installations of the wind turbines will comprise the following elements:

- a 25x25 m tower foundation (625 $m^2$ for each turbine);
- a 26x51 m service plateau in front of the tower on which the main construction crane will be positioned, surrounded by 1 m wide drainage ditches (1,326 $m^2$ for each turbine);
- auxiliary plateaus (on both sides of the service plateau) 50x12 m and 40x15 m, respectively, on which auxiliary cranes for erecting the main crane will be positioned, as well as installation equipment (tower components, blades, etc.);
- a 6 m wide wind turbine access road that will have a minimum horizontal curve radius of 42 m during the construction phase to enable access for special transport vehicles.

The tower foundation, service plateau and access road are permanent facilities (fixed elements) that will be used during the operation of the tower, whereas the auxiliary plateaus and the curve areas of the access road are temporary elements that will no longer be used once the wind turbine has been constructed (cf. DETAILED REGULATION PLAN of the Infrastructure System for the Čibuk wind farm at Mramorak 2009).

## 2.2 Access to wind power plants

Access to the wind turbine towers will be secured by constructing 5 m wide access roads leading from the nearest field road to the foundation of the tower. According to the draft development concept, these access roads are not considered construction land but will remain cultivated land serving the constructed wind towers.

The draft development plan does not propose the construction of any new municipal roads. The existing Dolovo-Deliblato Sands municipal road will retain its current category and regulation, notwithstanding possible adaptations in order to ensure optimal traffic conditions.

Existing field roads will retain their purpose as agricultural access roads while some roads that ensure the most convenient access to individual wind turbines in accordance with their adopted layout may be reconstructed within the limits of their current dimensions, covered by modern paving and furnished with appropriate traffic elements (cf. DETAILED REGULATION PLAN of the Infrastructure System for the Čibuk wind farm at Mramorak 2009).

## 2.3 Permanent habitat loss due to construction of wind turbines and further required facilities

A total of at least 111,207 $m^2$ (11.12 ha) of largely intensively cultivated land will be permanently lost. To very low extent of ruderal vegetation along dirt roads will be lost as well.

# 3 Methods

As a data base to predict the expected impact of the project, breeding, resting and wintering birds (incl. hunting / foraging birds) within the area of the proposed wind farm and its surroundings were recorded. The data on birds leading to this expert opinion were collected by two independent teams doing field studies from September 2009 to November 2010 (cf. Table 3.1 and 3.2: PAUNOVIĆ & KARAPANDŽA 2011 and RAŠAJSKI 2011).

The study area covered the area selected for the planned wind farm, predominantly the transect route and the vantage points. Especially for target species additional observations were made predominantly at Deliblato Sands but also in the wider area of the study area to gather data about breeding pairs of target species in the vicinity (cf. Map 3.1).

In total more than 220 days were spent in the field with birds being observed in about 1.279 hours (cf. Table 3.1 and 3.2).

Team 1 (Javor RAŠAJSKI)

Team 1 carried out two different field methods: minimum transect walks and vantage point census. The team observed the study area from September 2009 until the end of October 2010. In total 626 hours were spent in the study area. The numbers of observation days differ clearly between months (cf. Table 3.1) ranging from five (January 2010) to twelve days (September 2009, March, April, August and September, October 2010).

Vantage point censuses started in January 2010 and were conducted during transect walks. The time spent for each vantage point census was not reported in detail (cf. RAŠAJSKI 2011).

Table 3.1: Observation days per month carried out by Team 1

| Year | Month | Total Days | Hours |
|---|---|---|---|
| 2009 | September | 12 | 26.0 |
| | October | 10 | 20.5 |
| | November | 8 | 20.5 |
| | December | 6 | 32.5 |
| 2010 | Januar | 5 | 28.0 |
| | Februar | 7 | 42.0 |
| | March | 12 | 56.5 |
| | April | 12 | 75.5 |
| | May | 10 | 59.0 |
| | June | 10 | 40.0 |
| | July | 8 | 58.0 |
| | August | 12 | 62.0 |
| | September | 12 | 53.5 |
| | October | 12 | 52.0 |
| Total | | 136 | 626.0 |

Team 2 (Milan PAUNOVIĆ)

Team 2 conducted only vantage point counts. They observed the study area from March to the end of February 2011. In total 91 days were spent within the study area. The numbers of observation days differ clearly between months. Most observations were carried out in June 2010 when 13 days were spent within the study area. In March 2010 the effort was only two days while in the remaining months the effort lasted from five to nine days (cf. Table 3.2). On the whole 653 hours were spent for the bird observations (cf. PAUNOVIĆ & KARAPANDŽA 2011a, 2011b).

Table 3.2: Observation days carried out by Team 2

| Year | Month | Total Days | Hours |
|---|---|---|---|
| 2010 | March | 2 | 16.0 |
| | April | 8 | 48.0 |
| | May | 5 | 34.0 |
| | June | 13 | 75.0 |
| | July | 8 | 58.0 |
| | August | 9 | 61.5 |
| | September | 9 | 74.0 |
| | October | 8 | 61.0 |
| | November | 9 | 69.5 |
| | December | 7 | 69.0 |
| 2011 | January | 6 | 36.0 |
| | February | 7 | 51.0 |
| Total | | 91 | 653.0 |

## 3.1 Defining species of special interest and target species

Species of special interest

This group of species comprise all species fulfilling one of the following criteria:

- listed in Appendix I or II of Bonn Convention
- listed in Appendix I of the EU-Birds Directive
- listed as endangered, vulnerable or at least near threatened by IUCN-criteria
- considered as a "Species of European Conservation Concern" (SPEC-species) (cf. BIRDLIFE INTERNATIONAL 2004)"

Furthermore certain species of birds are considered as species of special interest, if recent studies found indications they might be vulnerable to specific effects of wind turbines (*e.g.* REICHENBACH *et al.* 2004, EU-COMMISSION 2010).

Information about status, abundance and spatial distribution of these species were gathered predominantly within transect walks and are presented species-wise but not as comprehensive as for target species..

Target species

As a subset of the species of special interest, target species are defined as species with a high conservational status, or as species that may significantly be affected by wind turbines. Wind turbines seem to have no significant impact, for example, on most passerine birds, neither in terms of collision risk nor in terms of habitat loss due to avoidance behaviour (REICHENBACH *et al.* 2004, MÖCKEL & WIESNER 2007, EU-COMMISSION 2010). Thus, target species comprise birds of prey (usually deemed vulnerable by many authors) and other large and long-living birds (*e.g.* Owls) as well as species that are common in the study area or its surroundings (especially Deliblato Sands) and for which a significant adverse impact caused by the proposed wind farm cannot be excluded.

PAUNOVIĆ & KARAPANDŽA (2011a, 2011b) and RAŠAJSKI (2011) defined 35 target species for the study area that are mostly considered as target species in this expert opinion as well. However, Black-headed Gull, Caspian Gull and Common Raven are not considered as target species in this expert opinion because these particular species are neither considered to be vulnerable or endangered nor to be potentially vulnerable to wind turbines. Consequently, 32 species are defined as target species in the expert opinion (marked grey in Table 4.1).

## 3.2 Collecting data

Two different methods for gathering data were used: the transect method (predominantly species of special interests not considered target species) and vantage point census (target species). A selective approach was chosen where the target species and species of special interest were observed in detail while the remaining species were only recorded qualitatively in most cases.

Detailed descriptions of materials and methodology used for the field study are shown in the reports on the Ornithofauna (*e.g.* PAUNOVIĆ & KARAPANDŽA 2011a, PAUNOVIĆ & KARAPANDŽA 2011b and RAŠAJSKI 2011). Thus, only the most important facts regarding methodology of the field study are presented here.

### 3.2.1 Transects

In 2009 and 2010 transect walks were undertaken from Team 1 (Javor RAŠAJSKI) to get an overview about species composition and density of breeding birds of the site and its surroundings - in particular of species of special interest, that were not defined as target species (cf. RAŠAJSKI 2011).

### 3.2.2 Vantage points

Data collection for target species took place during standardized observations from strategic vantage points (VPs) covering the area of the proposed turbine locations and its surroundings. VPs were chosen parsimoniously in order to achieve maximum visibility by a minimum number of points. From September 2009 until February 2010 five VPs were used. At the beginning of March 2010 the study was redesigned and in order to cover all proposed turbine locations six vantage points (VP1 to VP6) were selected (see also maps in RAŠAJSKI & PAUNOVIĆ 2010 and PAUNOVIĆ & KARAPANDŽA 2011a and 2011b, RAŠAJSKI 2011).

Observers acquainted themselves thoroughly with the survey area before conducting observations. This included familiarizing themselves with the distances of landmarks from VPs and ascertaining the height of landmarks in the survey area. Familiarity with the area is essential to record flight lines and flight heights with utmost accuracy once observations commence.

Observations were undertaken between dawn and dusk by a single observer under conditions of good ground visibility (>3 km). In general, each observation lasted three hours (with only few exceptions). Weather conditions were recorded at the beginning of each observation and as an average for each hour of the observation.

Data was recorded in two ways:

1. number of all species per field visit at certain vantage points;
2. number, time, height and other characteristics of target species. The area in view was scanned constantly until a target species (see Chapter 1.2) was detected in flight. Once detected, the bird was followed until it ceased flying or was lost from view. The route followed by the bird was plotted in the field onto 1:25 000 scale maps. The recorded data of target species included the date and time of observations by vantage point. The altitude of single individuals, aggregations or flocks of birds was particularly assessed, recorded and classified in 5 height ranges:

   <50 m, 50 –100 m, 100–150 m, 150–200 m, >200 m

   Minimum, maximum and average flight height was also assessed. Observation time, flight types and directions, flight distance from the vantage point and bird behaviour were recorded, too.

At the end of each watch, the locations of activity indicative of breeding by target species (*e.g.* selected raptors) were recorded on the map.

Additionally, standard observations also yielded hints on breeding sites. Supposed breeding sites were confirmed or rejected by further site visits.

### 3.2.3 Time effort per vantage point

<u>Team 1</u>

The vantage point census took place from January to October 2010. On the whole 289 observation units were carried out in the field. The number of observation units per month differs remarkably (see Table 3.1 and RAŠAJSKI 2011). The highest number of observation units was done during the migration periods of March to April and August to October (cf. Table 3.1).

The number of observation units per VP also differs remarkably. Most observation units were carried out at VP4 (92 units), the lowest number was done at VP1 (cf. Table 3.3).

Table 3.3: Number of observation units at the five VPs of Team 1

| VP | obs (n) |
|---|---|
| VP1 | 26 |
| VP2 | 56 |
| VP3 | 60 |
| VP4 | 92 |
| VP5 | 55 |
| total | 289 |

Team 2

The vantage point census took place from March 2010 to February 2011. Overall 71 days and 653 hours of observation were spent in the field. The time effort per month (Table 3.2) as well as per vantage point differ remarkably (cf. Table 3.4 and PAUNOVIĆ & KARAPANDŽA 2011a and 2011b). The highest observation time, in June, was six times higher than the time spent in March. With beginning of July the time effort per month and per VP became more constant (cf. Table 3.2).

Most of the time was spent at VP3 where observations in total lasted 123 h. The lowest observation time was conducted at VP6 (79.5 h)

Table 3.4: Number of observation units and of observation hours of Team 2 at the six VPs

| VP | obs (n) | hours |
|---|---|---|
| VP1 | 40 | 109.0 |
| VP2 | 37 | 102.5 |
| VP3 | 47 | 123.0 |
| VP4 | 42 | 111.0 |
| VP5 | 40 | 109.0 |
| VP6 | 36 | 98.5 |
| total | 242 | 653.0 |

## 3.3 Data recording

Data was recorded as follows and recorded on a 1:25 000 map copy. For each watch, the number of each observed flying bout was consecutively put down. The number of each bout was cross-referenced to the flight path plotted on the map. For each flying bout the following variables were recorded:

- time that the bird was first detected (to nearest minute)
- duration of each flying bout (to nearest minute)
- flight altitude minimum, maximum and average
- behaviour

- distance from VP and flight direction

The following variables were written down / marked on a separate field map for each VP:

- date, time and VP number
- location of the VP used
- flight paths of target species
- number of each flying bout (cross-referenced with Form 2)

## 3.4 Data analysis of vantage point census

Based on the raw data, for each species the following variables were calculated:

- $\text{days}_{\text{rec.}}$: number of days (=units) on which at least one recording was detected (for each VP).
  Recordings of a species can either be individually or as a flock (independent of the number of birds). The number of recordings is an important variable because it is not influenced by flock size. In contrast, a single but great flock has a large effect on the variable “number of birds”. Therefore, the number of recordings gives additional information about the activity and continuity as well as on bird behaviour.

- presence: portion of days (=units) on which at least one recording was detected (for each VP).
  Using these first two variables, frequency and continuity of occurrence can be described for each species in a rough but robust way (how frequently was the area used by a particular species?).

- $\text{ind.}_{\text{min. / max.}}$: minimum/maximum number of individuals in a simultaneous recording (for each VP)
  This variable allows a rough estimate on the number of different individuals using a particular area.

- $\text{rec.}_{\text{total}}$ / $\text{ind.}_{\text{total}}$: number of recordings / individuals detected during all observation hours (for all VPs and separated for each VP); note that multiple counts might occur, *i.e.* the total number of recordings / individuals probably refers to a smaller group of stationary individuals).
  This variable is one measure for the degree of activity of a species within an area. Note that a high activity can refer to single recordings of flocks or a large number of recordings of single individuals.

- $\text{duration}_{\text{rec.}}$: as the duration of each recordings was noted, it is possible to calculate the total duration of all recordings occurring within a particular area.
  This variable again is a measure for the level of activity of a species. Note that it is independent of the number of individuals in a recording.

- ratio of observed time$_{.}$: as the total duration of all recordings occurring within a particular area is calculated, it is possible to calculate the ratio of time with recordings of a particular area and the total observed time at this area. (Since detailed information of observed time at a particular VP was only provided by Team 2, this ratio can solely be calculated for data gathered by Team 2.)

- duration$_{rec.}$ at critical altitudes: duration of all recordings of birds staying within a particular area in critical altitudes.

- ratio of flights in critical altitudes: as the duration of all recordings is known, the ratio of observed time in critical altitudes and the total observed time of a certain species within a particular area can be calculated.

# 4 Results

## 4.1 General information about bird community

Investigations on the whole bird community in the surrounding of the proposed wind farm were done in 2009, 2010 and 2011 predominantly by transects. At least 119 bird species were recorded during transect walks and vantage point counts. Even though White-tailed Eagle and Common Crane are mentioned in the list of species, they were only observed outside the study area.

Based on the data - predominantly gathered by transect walks - RAŠAJSKI (2011) identified 92 species in the study area, among them 14 species that bred in the study area:

> Kestrel, Grey Partridge, Common Quail, Common Pheasant, Common Cuckoo, Crested Lark, Skylark, Black-headed Wagtail, Red-backed shrike, European Magpie, Hooded Crow, Whinchat, African Stonechat and Corn Bunting.

PAUNOVIĆ & KARAPANDŽA (2011a and 2011b) recorded 111 species during their surveys..

Since the results of these investigations have already been presented by RAŠAJSKI & PAUNOVIĆ (2010), PAUNOVIĆ & KARAPANDŽA (2011a and 2011b) and RAŠAJSKI (2011) they are not repeated in detail here.

## 4.2 Species of special interest and target species

A total of 64 species fulfil the criteria defined in Chapter 3.1 and are considered as species of special interest (cf. Table 4.1).

Of all these bird species, 32 were defined as target species. 20 of the target species used the study area during the breeding season as a breeding or (at least probably) foraging / hunting site, 17 target species used the observed area for resting / wintering, while 17 target species occurred as (at least probably) migrants in the study area. Two target species were recorded flying over the study area showing no relationship to the habitats of the site (cf. Table 4.1).

Table 4.1: Species of special interest and target species observed in the study area with annotations to status of protection and status in the study area.

| No. | Target species / species of special interest | Bern | Bonn | Birds directive | BirdLife International (2004) | IUCN | Status within the study site |
|---|---|---|---|---|---|---|---|
| 1 | *Phalacrocorax carbo* | III | | | | | flyover |
| 2 | *Phalacrocorax pygmaeus* | II | | I | SPEC 1 | | flyover, migrating |
| 3 | *Nycticorax nycticorac* | II | | I | SPEC 3 | | flyover |
| 4 | *Ardea purpurea* | II | | I | SPEC 3 | | probably foraging, migrating |
| 5 | *Ciconia ciconia* | II | II | I | SPEC 2 | | probably foraging, migration |
| 6 | *Anser fabilis* | II | | IIa | | | resting, predominantly migrating |
| 7 | *Anser albifrons* | II/III | | IIb, IIIb | | | resting, predominantly migrating |
| 8 | *Anser anser* | II/III | | IIa, IIIb | | | resting, predominantly migrating |
| 9 | *Pernis apivorus* | II | II | I | | | probably foraging, migrating |
| 10 | *Haliaeetus albicilla** | II | I | I | SPEC 1 | | not recorded |
| 11 | *Circus aeruginosus* | II | II | I | | | hunting |
| 12 | *Circus cyaneus* | II | II | I | SPEC 3 | | probably foraging, migrating |
| 13 | *Circus pygargus* | II | II | I | | | migrating, probably wintering |
| 14 | *Accipiter gentilis* | II | II | | | | hunting, migrating, resting |
| 15 | *Accipiter nisus* | II | II | | | | hunting, migrating, resting |
| 16 | *Buteo buteo* | II | II | | | | breeding, migrating, resting |
| 17 | *Buteo lagopus* | II | II | | | | wintering |
| 18 | *Aquila pennata* | II | II | I | SPEC 3 | | hunting |
| 19 | *Falco tinnunculus* | II | II | I | SPEC 3 | | breeding, migrating, resting |
| 20 | *Falco vespertinus* | II | II | I | SPEC 3 | NT | probably hunting |
| 21 | *Falco columbarius* | II | II | I | SPEC 3 | | migrating, wintering |
| 22 | *Falco subbuteo* | II | II | I | | | breeding, migrating, resting |
| 23 | *Falco cherrug* | II | II | I | SPEC 1 | VU | hunting |
| 24 | *Falco peregrinus* | II | II | I | | | migrating |
| 25 | *Perdix perdix* | III | | IIa IIIa | SPEC 3 | | breeding |
| 26 | *Coturnix coturnix* | III | II | IIb | SPEC 3 | | breeding, migrating, resting |
| 27 | *Grus grus* | II | II | I | SPEC 2 | | migrating |
| 28 | *Scolopax rusticola* | III | II | IIa IIIb | SPEC 3 | | probably foraging |
| 29 | *Childonias hybrida* | II | | I | SPEC 3 | | flyover |
| 30 | *Streptopelia turtur* | III | II | IIb | SPEC 3 | | breeding |
| 31 | *Cuculus canorus* | III | | | | | breeding |
| 32 | *Asio otus* | II | | | | | foraging |
| 33 | *Otus scops* | II | | | SPEC 2 | | foraging |
| 34 | *Athene noctua* | II | | | SPEC 3 | | probably breeding in buffer zone |

continuation of Table 4.1

| No. | Target species / species of special interest | Bern | Bonn | Birds directive | BirdLife International (2004) | IUCN | Status within the study site |
|---|---|---|---|---|---|---|---|
| 35 | *Tyto alba* | II | | | SPEC 3 | | probably breeding in buffer zone |
| 36 | *Strix aluco* | II | | | | | foraging |
| 37 | *Caprimulgus europaeus* | II | | I | SPEC 2 | | probably foraging |
| 38 | *Apus melba* | II | | | | | flyover |
| 39 | *Alcedo atthis* | II | | I | SPEC 3 | | ? |
| 39 | *Merops apiaster* | II | II | | SPEC 3 | | foraging |
| 41 | *Coracias garrulus* | II | II | I | SPEC 2 | NT | probably foraging |
| 42 | *Upupa epops* | II | | | SPEC 3 | | foraging |
| 43 | *Jynx torquilla* | II | | | SPEC 3 | | probably foraging |
| 44 | *Picus viridis* | II | | | SPEC 2 | | probably foraging |
| 45 | *Galerida cristata* | III | | | SPEC 3 | | breeding |
| 46 | *Lullula arborea* | III | | I | SPEC 2 | | probably foraging |
| 47 | *Alauda arvensis* | III | | IIb | SPEC 3 | | breeding, migrating |
| 48 | *Hirundo rustica* | II | | | SPEC 3 | | foraging |
| 49 | *Delichon urbicum* | II | | | SPEC 3 | | foraging |
| 50 | *Anthus campestris* | II | | I | SPEC 3 | | probably breeding, migrating |
| 51 | *Oenanthe oenanthe* | II | | | SPEC 3 | | probably breeding, migrating |
| 52 | *Sylvia nisoria* | II | | I | | | |
| 53 | *Muscicapa striata* | II | | | SPEC 3 | | |
| 54 | *Lanius collurio* | II | | I | SPEC 3 | | breeding, migrating |
| 55 | *Lanius minor* | II | | I | SPEC 2 | | porbably foraging |
| 56 | *Lanius excubitor* | II | | | SPEC 3 | | porbably foraging |
| 57 | *Sturnus vulgaris* | | | IIb | SPEC 3 | | breeding, migrating, resting |
| 58 | *Passer domesticus* | | | | SPEC 3 | | |
| 59 | *Passer montanus* | III | | | SPEC 3 | | |
| 60 | *Carduelis cannabina* | II | | | SPEC 2 | | |
| 61 | *Emberiza citrinella* | II | | | | | |
| 62 | *Emberiza hortulana* | II | | I | SPEC 2 | | |
| 63 | *Emberiza melanocephala* | II | | | SPEC 2 | | |
| 64 | *Emberiza calandra* | II | | | SPEC 2 | | |

Explanations for Table 4.1:

Grey marked: target species
Bern: Bern Convention on the Conservation of European Wildlife and Natural Habitats
II: strictly protected fauna species
III: protected fauna species
Bonn: Bonn Convention on the Conservation of Migratory Species of Wild Animals, CMS
I: Endangered migratory species
II: Migratory species conserved by agreements
Birds Directive: DIRECTIVE 2009/147/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 November 2009 on the conservation of wild birds
I: The species mentioned in Annex I shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution.
IIa: The species referred to in Annex II, Part A may be hunted in the geographical sea and land area where this Directive applies.
IIb: The species referred to in Annex II, Part B may be hunted only in the Member States in respect of which they are indicated.
IIIa:The activities referred to in paragraph 1 shall not be prohibited in respect of the species referred to in Annex III, Part A, provided that the birds have been legally killed or captured or otherwise legally acquired.
IIIb: Member States may, for the species listed in Annex III, Part B, allow within their territory the activities referred to in paragraph 1, making provision for certain restrictions, provided that the birds have been legally killed or captured or otherwise legally acquired.
BirdLife International (2004): (Bird) Species of European Conservation Concern:
SPEC 1: Species of global conservation concern, *i.e.* classified as globally threatened, near threatened or data deficient (BirdLife International 2004a).
SPEC 2: Concentrated in Europe and with an unfavourable conservational status.
SPEC 3: Not concentrated in Europe but with an unfavourable conservational status.
IUCN: European IUCN Red List Category:
VU: vulnerable
NT: near threatened
*species was not observed in the study area

In the following the occurrence of target species within the study area during the vantage point census are presented. The description of the occurrence of the remaining species of special interest follows in Chapter 4.4.

## 4.3 Vantage point census

### 4.3.1 Team 1

During standardized field observations from January to October 2010, a total of 2,206 individuals of target species were registered in 432 recordings (cf. Table 4.2 and 4.3). The most observed target species was the Greylag Goose with 834 individuals. More than one hundred individuals were recorded from the following four species: Common Buzzard (593 ind.), Bee-eater (283 ind.) and Common Kestrel (276 ind.). Approximately 90 % of all observed individuals of target species were of these species. All other targets species were registered with less than 50 individuals.

Four species were observed of more than 100 individuals at a certain VP: Greylag Goose (822 ind. at VP2), Buzzard (132 ind. at VP2, 256 ind. at VP4 and 104 ind. at VP5), Bee-eater (170 ind. at VP3) and Kestrel (170 ind. at VP4).

Most of the target species (16) were recorded at VP4: 13 at VP5, 12 at VP2 und VP3 each. The lowest number was recorded at VP1: 6 species. Most of the individuals were encountered at VP2 (1,059 ind.), whereof 822 individuals were Greylag Goose. The second-most number of individuals was recorded at VP4, thus displaying the highest number of records. The number of recorded individuals at VP1, VP3, and VP5 was between 68 and 312.

Four species (Common Buzzard, Bee-eater, Common Kestrel and Goshawk) were registered at every VP, three species (Sparrowhawk, Marsh Harrier, Hoopoe) were recorded at four VPs. Little Owl, Barn Owl, Scops Owl, Long-eared Owl and Montagu's Harrier were recorded at three VPs. The remaining six target species were observed at only one or two VPs.

A detailed description of spatial and temporal distribution as well as behaviour and status of target species in the study area is given in chapter 4.4.

Table 4.2: Number of individuals of each species at different VPs (VP1 to VP5) by Team 1.

| Species | VP1ind | VP2ind | VP3ind | VP4ind | VP5ind | total |
|---|---|---|---|---|---|---|
| obs. units | 26 | 56 | 60 | 92 | 55 | 289 |
| Greylag Goose | 12 | 822 | | | | 834 |
| Buzzard | 24 | 132 | 77 | 256 | 104 | 593 |
| Bee-eater | 6 | 38 | 170 | 61 | 8 | 283 |
| Kestrel | 24 | 43 | 38 | 120 | 51 | 276 |
| Goshawk | 1 | 1 | 4 | 21 | 16 | 43 |
| Crane | | | | 30 | | 30 |
| Little Owl | | 3 | | 11 | 11 | 25 |
| Hoopoe | | 6 | 8 | 8 | 1 | 23 |
| Sparrowhawk | | 3 | 3 | 13 | 2 | 21 |
| Barn Owl | | 6 | | 12 | 1 | 19 |
| Scops Owl | | | 1 | 8 | 8 | 17 |
| Long-eared Owl | | 3 | | 7 | 1 | 11 |
| Nightjar | | | 6 | | | 6 |
| Marsh Harrier | 1 | 1 | 2 | 2 | | 6 |
| Honey Buzzard | | | | 3 | 3 | 6 |
| Montagu's Harrier | | 1 | 2 | 2 | | 5 |
| Saker Falcon | | | | 3 | 1 | 4 |
| Hobby | | | | 1 | 2 | 3 |
| Roller | | | 1 | | | 1 |
| total species | 6 | 12 | 11 | 16 | 13 | 19 |
| total individuals | 68 | 1,059 | 312 | 558 | 209 | 2,206 |

Table 4.3: Number of recordings of each species at different VPs (VP1 to VP5) by Team 1.

| Species | VP1rec | VP2rec | VP3rec | VP4rec | VP5rec | total |
|---|---|---|---|---|---|---|
| obs. units | 26 | 56 | 60 | 92 | 55 | 289 |
| Kestrel | 9 | 15 | 16 | 40 | 20 | 100 |
| Buzzard | 5 | 16 | 11 | 47 | 17 | 96 |
| Goshawk | 1 | 1 | 4 | 18 | 14 | 38 |
| Bee-eater | 1 | 5 | 15 | 8 | 3 | 32 |
| Nightjar | | | 6 | | 24 | 30 |
| Little Owl | | 3 | | 11 | 11 | 25 |
| Hoopoe | | 5 | 7 | 7 | 1 | 20 |
| Sparrowhawk | | 2 | 3 | 11 | 2 | 18 |
| Barn Owl | | 4 | | 9 | 1 | 14 |
| Greylag Goose | 1 | 12 | | | | 13 |
| Scops Owl | | | 1 | 6 | 6 | 13 |
| Long-eared Owl | | 3 | | 6 | 1 | 10 |
| Marsh Harrier | 1 | 1 | 2 | 2 | | 6 |
| Honey Buzzard | | | | 3 | 2 | 5 |
| Saker Falcon | | | | 3 | 1 | 4 |
| Montagu's Harrier | | 1 | 1 | 1 | | 3 |
| Hobby | | | | 1 | 2 | 3 |
| Roller | | | 1 | | | 1 |
| Crane | | | | 1 | | 1 |
| total species | 6 | 12 | 11 | 16 | 14 | 19 |
| total recordings | 18 | 68 | 67 | 174 | 105 | 432 |

#### 4.3.1.1 Target species at site VP1

At VP1 Common Kestrel was the dominant species, occurring in 30.8 % of all observation units. Common Buzzards were present in 19.2 % of all observation units. All other target species could only be observed in one observation unit. Twelve Greylag Geese once flew at heights between 50 and 200 m at VP1. All other individuals were recorded at altitudes lower than 50 m. No target species was observed more than one hour in total (cf. Table 4.4).

Table 4.4: Observations of target species by Team 1 at site VP1 during 26 observation units (abbreviation of variables see Chapter 3.4).

| n= 26 obs units | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| Kestrel | 8 | 30.8 | 9 | 24 | 1 | 4 | 54 | 0 | 0.0 |
| Bee-eater | 1 | 3.8 | 1 | 6 | 6 | 6 | 20 | 0 | 0.0 |
| Buzzard | 5 | 19.2 | 5 | 24 | 2 | 9 | 19 | 0 | 0.0 |
| Greylag Goose | 1 | 3.8 | 1 | 12 | 12 | 12 | 10 | 10 | 100.0 |
| Goshawk | 1 | 3.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| Marsh Harrier | 1 | 3.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| total | | | 18 | 68 | | | 113 | 10 | 8.8 |

#### 4.3.1.2 Target species at site VP2

Greylag Goose, Common Buzzard and Common Kestrel were recorded in more than 10 % of all observation units. All other target species reach at most about 5 % of all observation units. Individuals most often observed were Greylag Geese, encountered with 822 individuals. Buzzards occurred with 132 individuals, Common Kestrel and Bee-eater with 43 and 38 individuals, respectively. All other target species amounted to less than 10 individuals (cf. Table 4.5).

About 70 % of all observed flights of Greylag Goose took place at heights between 80 and 200 m. All registered flights of the other target species were located below 50 m.

Table 4.5: Observations of target species by Team 1 at site VP2 during 56 observation units (abbreviation of variables see Chapter 3.4).

| n= 56 obs units | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| Greylag Goose | 12 | 21.4 | 12 | 822 | 14 | 200 | 115 | 80 | 69.6 |
| Buzzard | 16 | 28.6 | 16 | 132 | 2 | 17 | 71 | 0 | 0.0 |
| Kestrel | 15 | 26.8 | 15 | 43 | 1 | 5 | 53 | 0 | 0.0 |
| Little Owl | 3 | 5.4 | 3 | 3 | 1 | 1 | 23 | 0 | 0.0 |
| Barn Owl | 4 | 7.1 | 4 | 6 | 1 | 2 | 22 | 0 | 0.0 |
| Long-eared Owl | 3 | 5.4 | 3 | 3 | 1 | 1 | 20 | 0 | 0.0 |
| Bee-eater | 5 | 8.9 | 5 | 38 | 5 | 12 | 15 | 0 | 0.0 |
| Sparrowhawk | 2 | 3.6 | 2 | 3 | 2 | 1 | 15 | 0 | 0.0 |
| Hoopoe | 5 | 8.9 | 5 | 6 | 1 | 2 | 11 | 0 | 0.0 |
| Goshawk | 1 | 1.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| Marsh Harrier | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| Montagu's Harrier | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| total | | | 68 | 1,059 | | | 356 | 80 | 22.5 |

#### 4.3.1.3 Target species at site VP3

At VP3 Common Kestrel, Common Buzzard and Bee-eater were the target species observed most. They were present in about 25 % and 18 % of all observation units at this VP, respectively. Nightjars and Hoopoe could be recorded at about 10 % of the total observation units (cf. Table 4.6).

Regarding individuals, Bee-eaters were the most abundant species, constituting more than 50 % of all recorded individuals of target species. Second and third individual-rich species were Common Buzzard and Common Kestrel. In total these three species comprised more than 90 % of all recorded individuals of target species.

No individual was observed at heights above 50 m.

Table 4.6: Observations of target species by Team 1 at site VP3 during 60 observation units (abbreviation of variables see Chapter 3.4).

| n= 60 obs units | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| Buzzard | 11 | 18.3 | 11 | 77 | 2 | 12 | 89 | 0 | 0.0 |
| Kestrel | 16 | 26.7 | 16 | 38 | 1 | 6 | 65 | 0 | 0.0 |
| Bee-eater | 15 | 25.0 | 15 | 170 | 2 | 35 | 52 | 0 | 0.0 |
| Nightjar | 6 | 10.0 | 6 | 6 | 1 | 1 | 24 | 0 | 0.0 |
| Hoopoe | 7 | 11.7 | 7 | 8 | 1 | 2 | 18 | 0 | 0.0 |
| Goshawk | 4 | 6.7 | 4 | 4 | 1 | 1 | 9 | 0 | 0.0 |
| Sparrowhawk | 3 | 5.0 | 3 | 3 | 1 | 1 | 7 | 0 | 0.0 |
| Scops Owl | 1 | 1.7 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| Marsh Harrier | 2 | 3.3 | 2 | 2 | 1 | 1 | 3 | 0 | 0.0 |
| Roller | 1 | 1.7 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| Montagu's Harrier | 1 | 1.7 | 1 | 2 | 2 | 2 | 1 | 0 | 0.0 |
| total | | | 67 | 312 | | | 276 | 0 | 0.0 |

#### 4.3.1.4 Target species at site VP4

During the investigation Team 1 observed most species at VP4, detecting 15 target species. Common Crane, however, was only outside the study area. Common Buzzards and Common Kestrels were the most frequent species with a presence of 51.1 and 43.5 % of all observation units. Goshawk, Little Owl, Sparrowhawk were present between 12.0 and 19.6 % of all observation units, all other target species occurred in less than 10 % of all observation units (cf. Table 4.7).

More than 100 individuals of Common Kestrel and Common Buzzard were seen throughout all observation units. 61 individuals of Bee-eaters and 21 on Goshawks were observed, all other species were recorded with less than 20 individuals at this VP.

Only Cranes (flying outside the study area) were observed at heights above 50 m.

Table 4.7: Observations of target species by Team 1 at site VP4 during 92 observation units (abbreviation of variables see Chapter 3.4).

| n= 92 obs units | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | $duration_{rec}$ (min) | $duration_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| Kestrel | 40 | 43.5 | 40 | 120 | 1 | 6 | 129 | 0 | 0.0 |
| Buzzard | 47 | 51.1 | 47 | 256 | 2 | 12 | 89 | 0 | 0.0 |
| Goshawk | 18 | 19.6 | 18 | 21 | 1 | 2 | 46 | 0 | 0.0 |
| Barn Owl | 9 | 9.8 | 9 | 12 | 1 | 2 | 27 | 0 | 0.0 |
| Bee-eater | 8 | 8.7 | 8 | 61 | 2 | 22 | 24 | 0 | 0.0 |
| Sparrowhawk | 11 | 12.0 | 11 | 13 | 1 | 2 | 21 | 0 | 0.0 |
| Little Owl | 11 | 12.0 | 11 | 11 | 1 | 1 | 19 | 0 | 0.0 |
| Long-eared Owl | 6 | 6.5 | 6 | 7 | 1 | 2 | 16 | 0 | 0.0 |
| Scops Owl | 6 | 6.5 | 6 | 8 | 1 | 2 | 16 | 0 | 0.0 |
| Saker | 3 | 3.3 | 3 | 3 | 1 | 1 | 13 | 0 | 0.0 |
| Common Crane* | 1 | 1.1 | 1 | 30 | 30 | 30 | 10 | 10 | 100.0 |
| Hoopoe | 7 | 7.6 | 7 | 8 | 1 | 2 | 9 | 0 | 0.0 |
| Honey Buzzard | 3 | 3.3 | 3 | 3 | 1 | 1 | 8 | 0 | 0.0 |
| Hobby | 1 | 1.1 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| Marsh Harrier | 2 | 2.2 | 2 | 2 | 1 | 1 | 2 | 0 | 0.0 |
| Montagu's Harrier | 1 | 1.1 | 1 | 2 | 2 | 2 | 1 | 0 | 0.0 |
| total | | | 174 | 558 | | | 435 | 10 | 2.3 |

* Common Crane was recorded outside the study area

4.3.1.5 Target species at site VP5

As for VP4, Common Kestrel, Common Buzzard, Goshawk and Little Owl were the most frequent species in terms of fraction at observation units as well as observed individuals. Scops Owl was recorded six times, mostly with single individuals. All other target species were observed rarely (cf. Table 4.8).

More than 50 % of all recorded individuals of target species were Common Buzzards. The portion of Kestrels was about 25 %. All other species were recorded with less than 10 % of all individuals.

No individual was observed at heights above 50 m.

Table 4.8: Observations of target species by Team 1 at site VP5 during 55 observation units (abbreviation of variables see Chapter 3.4).

| n= 55 obs units | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| Kestrel | 20 | 36.4 | 20 | 51 | 1 | 4 | 53 | 0 | 0.0 |
| Buzzard | 17 | 30.9 | 17 | 104 | 2 | 11 | 52 | 0 | 0.0 |
| Goshawk | 14 | 25.5 | 14 | 16 | 1 | 2 | 47 | 0 | 0.0 |
| Little Owl | 11 | 20.0 | 11 | 11 | 1 | 1 | 19 | 0 | 0.0 |
| Scops Owl | 6 | 10.9 | 6 | 8 | 1 | 2 | 16 | 0 | 0.0 |
| Sparrowhawk | 2 | 3.6 | 2 | 2 | 1 | 1 | 7 | 0 | 0.0 |
| Hobby | 2 | 3.6 | 2 | 2 | 1 | 1 | 7 | 0 | 0.0 |
| Honey Buzzard | 2 | 3.6 | 2 | 3 | 1 | 2 | 7 | 0 | 0.0 |
| Bee-eater | 3 | 5.5 | 3 | 8 | 2 | 3 | 6 | 0 | 0.0 |
| Barn Owl | 1 | 1.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| Saker | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| Long-eared Owl | 1 | 1.8 | 1 | 1 | 1 | 1 | 2 | 0 | 0.0 |
| Hoopoe | 1 | 1.8 | 1 | 1 | 1 | 1 | 1 | 0 | 0.0 |
| total | | | 81 | 209 | | | 225 | 0 | 0.0 |

### 4.3.2 Team 2

During standardized field observations from March 2010 to February 2011, a total of 2,930 individuals of target species were registered within 640 recordings (cf. Table 4.9 and 4.10). White-fronted Goose was the dominant target species occurring at all VPs in relevant numbers. However, the number of recordings was rather low (cf. Table 4.10) indicating that this species occurred rarely but in larger flocks of predominantly ten to hundred individuals. Similarly, Cormorants (at VP1 to VP5) and Greylag Goose (at VP1, VP4 to VP6) were very rarely recorded but in notable numbers. In fact about 66 % recorded individuals derived from Geese (54 % of all recorded individuals) and Cormorants (13 % of all recorded individuals) which were observed in only 36 recordings (5.6 % of all recordings). By contrast, Common Buzzard and Common Kestrel occurred very frequently at all VPs (Common Buzzard: in about 50 % of all recordings, Common Kestrel in about 23 % of all recording) but in lower amount of individuals. As these species do not gather in flocks the total number of recorded Common Buzzards or Common Kestrels did not reach the numbers of recorded White-fronted geese (Common Buzzard: about 20 % of all individuals, Common Kestrel about 8 % of all individuals). In total these five species constitute about 90 % of all recorded birds (considering target species only) (cf. Figure 4.1 and 4.2).

Five species (White-fronted Goose, Common Buzzard, Common Kestrel, Marsh Harrier and Hen Harrier) were observed at each VP, whereas four species (Cormorant, Montagu's Harrier, Hobby and Saker Falcon) were recorded at five VPs and eleven species at only one or two VPs.
Harries could be observed all over study area showing an obviously preference to particular structures or areas of the study site whereas Hobbys were predominantly observed in the north of the study site, in particular at VP1 which was located near to a nest of the species. Saker Falcons were reported very rarely but at nearly all VP. Other target species were very rarely recorded and / or in very low numbers.
A detailed description of spatial and temporal distribution as well as behaviour and status of target species in the study area is given in chapter 4.4.

Species composition was generally comparable at all VPs. The number of recorded species mainly ranged between 11 and 13. At VP3 three species occurred which have not been recorded at any other VP, leading to the highest number of species. By contrast, at VP6 only 9 target species were observed.

The number of birds at each VP clearly differed (considering target species only): most individuals were recorded at VP3 and VP1. However, species occurring in larger flocks (*e.g.* Geese, Cormorant) have a strong effect on the data set. As Table 4.9 shows, the higher numbers at VP3 and VP1 mainly refers to White-fronted Goose and the higher number of birds at VP4 refers to Greylag Goose. As those species were rarely observed at VP6, the total number of birds at this VP was comparably low (cf. Figure 4.1 and 4.2).

Compared to all other VPs the total number of recordings was lower at VP6, too (cf. Table 4.10). So, the results indicating a lower activity of target species in this area. Due to the occurrence of Common Buzzards at VP3 the number of recordings was highest at this point. Apart from this, there are only slight differences in the activity of target species at the six vantage points.

Figure 4.1 shows the number of individuals standardized by observed time of all target species (Ind. per h.). One can see that the comparable high number of individuals at VP1 and VP3 mainly derived from few flocks of geese recorded in the winter 2010 / 2011. When deleting individuals of geese the number of recorded individuals of target species per hour at VP1 to VP5 varies only a little bit. VP6 shows the lowest number of recorded individuals per h (cf. Figure 4.2).

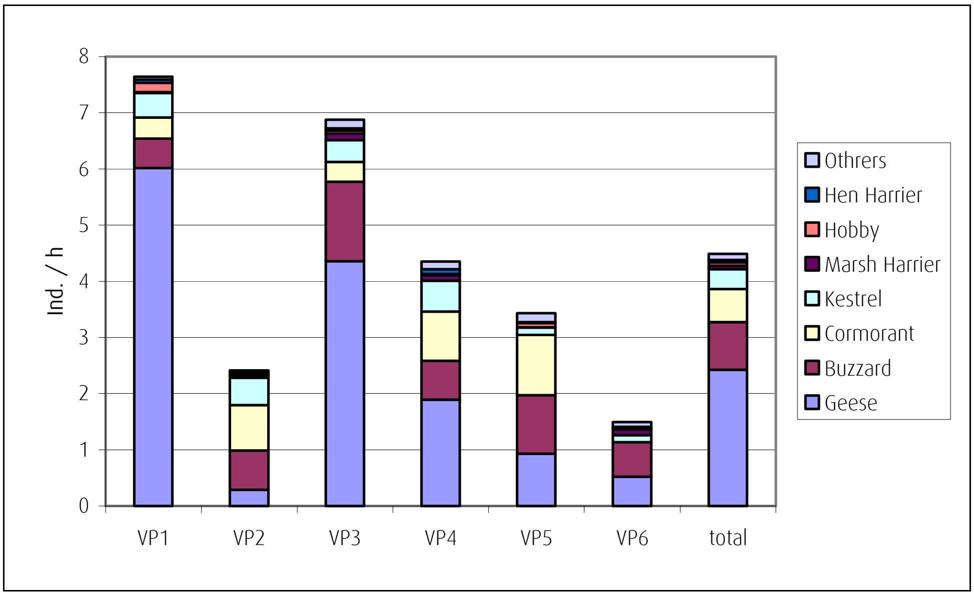



Figure 4.1: recorded Individuals / h of all target species at every VP

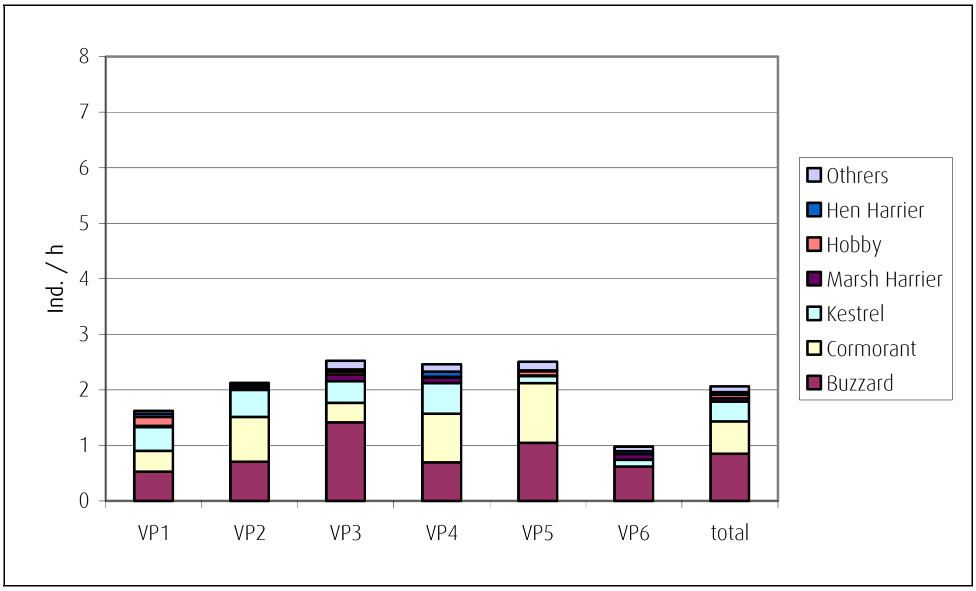



Figure 4.2: recorded Individuals / h of target species except Geese at every VP

Table 4.9: Number of individuals recorded by Team 2 of each species at different VPs (VP1 to VP6) during 653 hours of observation.

| species | VP1 | VP2 | VP3 | VP4 | VP5 | VP6 | total |
|---|---|---|---|---|---|---|---|
| obs. units | 40 | 37 | 47 | 42 | 40 | 36 | 242 |
| White-fronted Goose | 423 | 29 | 536 | 57 | 54 | 23 | 1,122 |
| Buzzard | 57 | 72 | 174 | 77 | 114 | 61 | 555 |
| Cormorant | 41 | 83 | 43 | 97 | 117 | | 381 |
| Kestrel | 47 | 50 | 48 | 61 | 14 | 12 | 232 |
| Greylag Goose | 183 | | | 153 | | 28 | 364 |
| Bean Goose | 50 | | | | 47 | | 97 |
| Marsh Harrier | 2 | 1 | 15 | 11 | 1 | 10 | 40 |
| Hobby | 18 | 4 | 6 | 2 | 8 | | 38 |
| Hen Harrier | 6 | 4 | 5 | 10 | 2 | 5 | 32 |
| Goshawk | 3 | | 5 | | 8 | | 16 |
| Sparrowhawk | 1 | 1 | 7 | | 6 | | 15 |
| Common Crane | | | | 10 | | | 10 |
| Montagu's Harrier | 1 | 1 | 1 | 3 | | 4 | 10 |
| Saker Falcon | 1 | | 1 | 1 | 1 | 1 | 5 |
| Booted eagle | | | | | 1 | 3 | 4 |
| Merlin | | | 1 | | 1 | | 2 |
| Red-footed Falcon | | | 2 | | | | 2 |
| Aquila spec. | | | 1 | | | | 1 |
| Rough-legged Buzzard | | 1 | | | | | 1 |
| White Stork | | 1 | | | | | 1 |
| Roller | | | | 1 | | | 1 |
| Peregrine Falcon | | | 1 | | | | 1 |
| total target species | 12 | 11 | 15 | 12 | 13 | 9 | 22 |
| total individuals | 833 | 247 | 846 | 483 | 374 | 147 | 2,930 |

Table 4.10: Number of recordings by Team 2 of each species at different VPs (VP1 to VP6) during 653 hours of observation.

| species | VP1rec | VP2rec | VP3rec | VP4rec | VP5rec | VP6rec | total |
|---|---|---|---|---|---|---|---|
| obs. units | 40 | 37 | 47 | 42 | 40 | 36 | 242 |
| White-fronted Goose | 5 | 2 | 7 | 2 | 3 | 1 | 20 |
| Buzzard | 37 | 41 | 85 | 41 | 66 | 34 | 304 |
| Cormorant | 1 | 2 | 1 | 2 | 2 | | 8 |
| Kestrel | 22 | 32 | 34 | 38 | 11 | 10 | 147 |
| Greylag Goose | 2 | | | 2 | | 1 | 5 |
| Bean Goose | 1 | | | | 2 | | 3 |
| Marsh Harrier | 2 | 1 | 14 | 9 | 2 | 10 | 38 |
| Hobby | 10 | 4 | 6 | 2 | 8 | | 30 |
| Hen Harrier | 6 | 4 | 5 | 9 | 2 | 5 | 31 |
| Sparrowhawk | 1 | 1 | 7 | | 6 | | 15 |
| Goshawk | 3 | | 3 | | 7 | | 13 |
| Common Crane | | | | 1 | | | 1 |
| Montagu's Harrier | 1 | 1 | 1 | 2 | | 4 | 9 |
| Saker Falcon | 1 | | 1 | 1 | 1 | 1 | 5 |
| Booted Eagle | | | | | 1 | 2 | 3 |
| Merlin | | | 1 | | 1 | | 2 |
| Aquila spec. | | | 1 | | | | 1 |
| Rough-legged Buzzard | | 1 | | | | | 1 |
| White Stork | | 1 | | | | | 1 |
| Roller | | | | 1 | | | 1 |
| Peregrine Falcon | | | 1 | | | | 1 |
| Red-footed Falcon | | | 1 | | | | 1 |
| total target species | 12 | 11 | 15 | 12 | 13 | 9 | 22 |
| total recordings | 92 | 90 | 168 | 110 | 112 | 68 | 640 |

#### 4.3.2.1 Target species at site VP1

At VP1 Buzzards and Kestrels were the most present species, being observed at 65 and 55 %, respectively, of all observation units. Hobbies were present at 25 % of the observation days. In contrast to this, Hobbies could be recorded for the longest time at VP1 (1,164 min), simply because at six observation units two Hobbies stayed the whole observation unit in their nest near the VP1 (cf. Table 4.11). A few flocks of White-fronted Goose, Greylag Goose, Bean Goose and Cormorant were observed migrating over this VP in the period from November 2010 to February 2011. The Geese were flying predominantly at heights between 150 and 200 m, while Cormorants migrated higher than 200 m.

All other species were rarely registered with single individuals and the total duration was quite low (less than 1 % of the whole observation time).

Most of all Buzzards were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. About 10 % of all recorded flights of Kestrels took place at heights between 50 and 200 m.

The ratio of Goshawks and Saker Falcon flying at heights between 50 and 200 m were comparatively high but derived from only a single individual.

Table 4.11: Observations of target species by Team 2 at site VP1 during 40 observation units with a total of 109 hours

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hobby | 10 | 25.0 | 10 | 18 | 1 | 3 | 1,164 | 17.8 | 20 | 1.7 |
| Buzzard | 26 | 65.0 | 37 | 57 | 1 | 6 | 624 | 9.5 | 507 | 81.3 |
| Kestrel | 22 | 55.0 | 34 | 47 | 1 | 4 | 532 | 8.1 | 49 | 9.2 |
| Hen Harrier | 6 | 15.0 | 6 | 6 | 1 | 1 | 67 | 1.0 | 27 | 40.3 |
| Montagu's Harrier | 1 | 2.5 | 1 | 1 | 1 | 1 | 30 | 0.5 | 0 | 0.0 |
| White-fronted Goose | 4 | 10.0 | 5 | 423 | 18 | 300 | 28 | 0.4 | 19 | 67.9 |
| Marsh Harrier | 2 | 5.0 | 2 | 2 | 1 | 1 | 14 | 0.2 | 0 | 0.0 |
| Greylag Goose | 2 | 5.0 | 2 | 183 | 83 | 100 | 10 | 0.2 | 7 | 70.0 |
| Goshawk | 3 | 7.5 | 3 | 3 | 1 | 1 | 10 | 0.2 | 5 | 50.0 |
| Cormorant | 1 | 2.5 | 1 | 41 | 41 | 41 | 10 | 0.2 | 0 | 0.0 |
| Saker Falcon | 1 | 2.5 | 1 | 1 | 1 | 1 | 5 | 0.1 | 5 | 100.0 |
| Bean Goose | 1 | 2.5 | 1 | 50 | 50 | 50 | 3 | 0.0 | 0 | 0.0 |
| Sparrowhawk | 1 | 2.5 | 1 | 1 | 1 | 1 | 2 | 0.0 | 0 | 0.0 |
| | | | 104 | 833 | | | 2,499 | 38.2 | 639 | 25.6 |

4.3.2.2 Target species at site VP2

As for VP1, Common Buzzards and Common Kestrels were the most present species at VP2, being observed at 70.3 and 54.1 %, respectively, of all observation units. Hen Harriers and Hobbies were present at 13.5 % and 10.8 %, respectively. Contrary to VP1, Kestrels spent more time in the vicinity of VP2 than Buzzards (cf. Table 4.12), mainly because two Kestrels were present for about three hours (predominantly hunting) during a single observation.

All other species were registered once or twice with single individuals and the total duration was quite low (less than 1 % of the whole observation time).

Two small flocks of White-fronted Geese and one flock of Cormorants were observed migrating over VP2 in the period from November 2010 to February 2011 predominantly at heights between 150 and 200 m.

About 37 % of all Buzzards and 9 % of all Kestrels were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. The ratio of Hobby, Hen Harrier, Montagu's Harrier and Rough-legged Buzzard flying at heights between 50 and 200 m was comparatively high. However, the explanatory power of this calculation is limited, because the results were derived from only a single observation for each species.

Table 4.12: Observations of target species by Team 2 at site VP2 during 37 observation units with a total of 102.5 hours

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | $duration_{rec}$ (min) | ratio of obs. time (%) | $duration_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Kestrel | 20 | 54.1 | 32 | 50 | 1 | 5 | 555 | 9.0 | 51 | 9.2 |
| Buzzard | 26 | 70.3 | 51 | 72 | 1 | 8 | 406 | 6.6 | 148 | 36.5 |
| Hen Harrier | 5 | 13.5 | 4 | 4 | 1 | 1 | 41 | 0.7 | 22 | 53.7 |
| Hobby | 4 | 10.8 | 4 | 4 | 1 | 1 | 40 | 0.7 | 20 | 50.0 |
| Montagu`s Harrier | 1 | 2.7 | 1 | 1 | 1 | 1 | 30 | 0.5 | 13 | 43.3 |
| White Stork | 1 | 2.7 | 1 | 1 | 1 | 1 | 20 | 0.3 | 0 | 0.0 |
| Rough-legged Buzzard | 1 | 2.7 | 1 | 1 | 1 | 1 | 13 | 0.2 | 13 | 100.0 |
| White-fronted Goose | 2 | 5.4 | 2 | 29 | 12 | 17 | 12 | 0.2 | 7 | 58.3 |
| Marsh Harrier | 1 | 2.7 | 1 | 1 | 1 | 1 | 11 | 0.2 | 0 | 0.0 |
| Cormorant* | 2 | 5.4 | 1 | 83 | 82 | 1 | 8 | 0.1 | 8 | 100.0 |
| Sparrowhawk | 1 | 2.7 | 1 | 1 | 1 | 1 | 4 | 0.1 | 0 | 0.0 |
| total | | | 99 | 247 | | | 1,140 | 18.5 | 282 | 24.7 |

*: one record without information about duration of observation

#### 4.3.2.3 Target species at site VP3

Most target species in the study area were detected at VP3. About 50 % of all recorded target species were present at least once at VP3. The most common species was the Buzzard, being recorded in 83 % of the observation units. Kestrels were observed at about half of all units but regarding observation time they were the most seen species at this VP. Common Kestrel, Peregrine Falcon and Marsh Harrier could be seen at least once hunting for long time in the surroundings of this VP (cf. Table 4.13). The portion of recordings of all other registered species was less than 1 % of the entire observation time.

Six flocks of White-fronted Goose and one flock of Cormorants were observed migrating over the VP3 in the period from November 2010 to February 2011 predominantly at heights between 150 and 200 m.

About 33 % of all Buzzards were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. About 10 % of all recorded flights of Kestrels took place at heights between 50 and 200 m. The flights of Hobbies at altitudes between 50 and 200 m derived from two individuals circling about 30 minutes near this VP. All other birds were observed at heights lower than 50 m. The number of Montagu's Harrier and Saker Falcon flying at heights between 50 and 200 m was comparatively high but in each case derived from only a single individual. All other species were not observed at altitudes between 50 and 200 m or only under unusual circumstances. Duration of observation of Cormorants was not reported.

Table 4.13: Observations of target species by Team 2 at site VP3 during 47 observation units with a total of 123 hours

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Kestrel | 22 | 46.8 | 34 | 48 | 1 | 3 | 1,430 | 19.4 | 32 | 2.2 |
| Buzzard | 39 | 83.0 | 85 | 174 | 1 | 19 | 1,039 | 14.1 | 311 | 29.9 |
| Peregrine Falcon | 1 | 2.1 | 1 | 1 | 1 | 1 | 180 | 2.4 | 0 | 0.0 |
| Marsh Harrier | 9 | 19.1 | 13 | 15 | 1 | 2 | 114 | 1.5 | 0 | 0.0 |
| Hobby | 5 | 10.6 | 6 | 6 | 1 | 1 | 76 | 1.0 | 30 | 39.5 |
| White-fronted Goose | 6 | 12.8 | 7 | 536 | 12 | 200 | 44 | 0.6 | 44 | 100.0 |
| Sparrowhawk | 6 | 12.8 | 7 | 7 | 1 | 1 | 35 | 0.5 | 5 | 14.3 |
| Hen Harrier | 5 | 10.6 | 5 | 5 | 1 | 1 | 33 | 0.4 | 0 | 0.0 |
| Montagu's harrier | 2 | 4.3 | 3 | 1 | 2 | 1 | 18 | 0.2 | 5 | 27.8 |
| Merlin | 1 | 2.1 | 1 | 1 | 1 | 1 | 15 | 0.2 | 0 | 0.0 |
| Cormorant* | 2 | 4.3 | 2 | 44 | 1 | 43 | 7 | 0.1 | 7 | 100.0 |
| Aquila spec. | 1 | 2.1 | 1 | 1 | 1 | 1 | 6 | 0.1 | 0 | 0.0 |
| Goshawk | 3 | 6.4 | 3 | 3 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| Marsh Harrier | 1 | 2.1 | 1 | 1 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| Saker Falcon | 1 | 2.1 | 1 | 1 | 1 | 1 | 5 | 0.1 | 5 | 100.0 |
| Red-Footed Falcon | 1 | 2.1 | 1 | 2 | 2 | 2 | 4 | 0.1 | 0 | 0.0 |
| total | | | 171 | 846 | | | 3,016 | 40.9 | 439 | 14.6 |

*: one record without information about duration of observation

#### 4.3.2.4 Target species at site VP4

At VP4 Common Buzzard and Common Kestrel were present at about 70 and 60% of all observation units, respectively. Both species were present at 6.1 and 5.5 % of the entire observation time. All other species were observed in about 1 % or less of the entire time (cf. Table 4.14).

Two smaller flocks of White-fronted and Greylag Goose, as well as one flock of Cormorants and one small flock of Common Crane were observed migrating over the VP in the period from November 2010 to February 2011: The Geese were flying predominantly at heights between 150 and 200 m, while Cormorants and Common Crane migrated higher than 200 m.

About 40 % of all Buzzards were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. About 6 % of all recorded flights of Kestrels took place at heights between 50 and 200 m.

The ratio of Hobby, Montagu's Harrier and Saker Falcon flying at heights between 50 and 200 m were comparatively high. However, the explanatory power of this calculation is limited, because the results were derived from single observations for each species

All other species were not observed at altitudes between 50 and 200 m.

Table 4.14: Observations of target species by Team 2 at site VP4 during 42 observation units with a total of 111 hours

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Buzzard | 29 | 69.0 | 41 | 77 | 1 | 7 | 424 | 6.4 | 176 | 41.5 |
| Kestrel | 25 | 59.5 | 38 | 61 | 1 | 11 | 386 | 5.8 | 42 | 10.9 |
| Marsh Harrier | 8 | 19.0 | 9 | 11 | 1 | 2 | 67 | 1.0 | 0 | 0.0 |
| Hen Harrier | 8 | 19.0 | 9 | 10 | 1 | 2 | 67 | 1.0 | 7 | 10.4 |
| Hobby | 1 | 2.4 | 2 | 2 | 1 | 1 | 29 | 0.4 | 29 | 100.0 |
| Greylag Goose | 2 | 4.8 | 2 | 153 | 29 | 124 | 24 | 0.4 | 24 | 100.0 |
| Cormorant | 2 | 4.8 | 2 | 97 | 36 | 61 | 20 | 0.3 | 0 | 0.0 |
| White-fronted Goose | 2 | 4.8 | 2 | 57 | 12 | 45 | 18 | 0.3 | 10 | 55.6 |
| Montagu's Harrier | 2 | 4.8 | 2 | 3 | 1 | 2 | 11 | 0.2 | 10 | 90.9 |
| Common Crane | 1 | 2.4 | 1 | 10 | 10 | 10 | 9 | 0.1 | 0 | 0.0 |
| Roller | 1 | 2.4 | 1 | 1 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| Saker Falcon | 1 | 2.4 | 1 | 1 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| | | | 69 | 483 | | | 641 | 9.6 | 122 | 19.0 |

4.3.2.5 Target species at site VP5

At VP5 Common Buzzard was present in about 985 % of all observation units, but the total duration of all observations was comparably low (502 min = about 8 % of the entire observation time). Hobby and Kestrel were present on 9 and 7 days, respectively, and in 1.4 and 1.1 % of the entire observation time. All other species were observed roughly at less than 1 % of the entire observation time (cf. Table 4.15).

Three small flocks of White-fronted Goose and two small flocks of Bean Goose as well as one flock of Cormorant were observed migrating over the VP in the period from November 2010 to February 2011 predominantly at heights between 150 and 200 m.

About 35 % of all Buzzards and 27 % of all Kestrels were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. Almost all flights of Hen Harrier, Hobbies and Goshawks that took place at heights between 50 and 200 m derived from a single observation. Saker Falcon, Booted Eagle, Merlin and were recorded once at heights between 50 and 200 m.

Table 4.15: Observations of target species by Team 2 at site VP5 during 40 observation units with a total of 109 hours

| | $units_{rec.}$ | degree of presence | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Buzzard* | 34 | 85.0 | 66 | 114 | 1 | 5 | 502 | 7.7 | 181 | 36.1 |
| Kestrel* | 11 | 27.5 | 11 | 14 | 1 | 2 | 82 | 1.3 | 21 | 25.6 |
| Hobby | 7 | 17.5 | 8 | 8 | 1 | 1 | 60 | 0.9 | 58 | 96.7 |
| Goshawk | 7 | 17.5 | 7 | 8 | 1 | 2 | 52 | 0.8 | 41 | 78.8 |
| Sparrowhawk* | 4 | 10.0 | 6 | 6 | 1 | 1 | 48 | 0.7 | 0 | 0.0 |
| White-fronted Goose* | 3 | 7.5 | 3 | 54 | 11 | 24 | 17 | 0.3 | 9 | 52.9 |
| Cormorant | 2 | 5.0 | 2 | 117 | 35 | 82 | 17 | 0.3 | 17 | 100.0 |
| Bean Goose | 2 | 5.0 | 2 | 47 | 13 | 34 | 13 | 0.2 | 13 | 100.0 |
| Hen Harrier* | 2 | 5.0 | 2 | 2 | 1 | 1 | 9 | 0.1 | 9 | 100.0 |
| Saker Falcon | 1 | 2.5 | 1 | 1 | 1 | 1 | 8 | 0.1 | 8 | 100.0 |
| Marsh Harrier | 1 | 2.5 | 2 | 1 | 1 | 1 | 7 | 0.1 | 0 | 0.0 |
| Booted Eagle | 1 | 2.5 | 1 | 1 | 1 | 1 | 5 | 0.1 | 5 | 100.0 |
| Merlin | 1 | 2.5 | 1 | 1 | 1 | 1 | 4 | 0.1 | 4 | 100.0 |
| | | | 112 | 374 | | | 824 | 12.6 | 366 | 44.4 |

*: one record without information about duration of observation

4.3.2.6 Target species at site VP6

At VP6 Common Buzzard was present in about 61 % of all observation units but the total duration of occurrence was comparably low (250 min = 4.8 % of the whole observation time). Marsh Harrier was detected during eight observation units for 119 min (2.5 % of the whole observation time). Montagu's Harrier was present during three units and in 1.2 % of the entire observation time. All other species could be observed during less than 1 % of the entire observation time (cf. Table 4.16).

One small flock of both White-fronted Goose and Greylag Goose were observed migrating over this VP in the period from November 2010 to February 2011 at heights above 200 m.

About 73 % of all Buzzards and 20 % of all Montagu's Harriers were observed at heights between 50 and 200 m, predominantly while hunting and searching for prey, respectively. Two Booted Eagles were observed for 28 minutes hunting near VP6 at heights between 50 and 100 m. Marsh and Montagu's Harrier and Kestrel were recorded only once at heights between 50 and 200 m.

All other species were not observed at altitudes between 50 and 200 m.

Table 4.16: Observations of target species by Team 2 at site VP6 during 26 observation units with a total of 98.5 hours

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Buzzard | 22 | 61.1 | 34 | 61 | 1 | 11 | 250 | 4.2 | 184 | 73.6 |
| Marsh Harrier | 8 | 22.2 | 10 | 10 | 1 | 1 | 119 | 2.0 | 7 | 5.9 |
| Kestrel | 10 | 27.8 | 10 | 12 | 1 | 2 | 58 | 1.0 | 26 | 44.8 |
| Montagu's Harrier | 3 | 8.3 | 4 | 4 | 1 | 1 | 57 | 1.0 | 11 | 19.3 |
| Hen Harrier | 3 | 8.3 | 5 | 5 | 1 | 1 | 38 | 0.6 | 0 | 0.0 |
| Booted Eagle | 2 | 5.6 | 2 | 3 | 1 | 2 | 34 | 0.6 | 28 | 82.4 |
| Greylag Goose | 1 | 2.8 | 1 | 28 | 28 | 28 | 9 | 0.2 | 0 | 0.0 |
| White-fronted Goose | 1 | 2.8 | 1 | 23 | 23 | 23 | 5 | 0.1 | 0 | 0.0 |
| Saker Falcon | 1 | 2.8 | 1 | 1 | 1 | 1 | 1 | 0.0 | 0 | 0.0 |
| | | | 68 | 147 | | | 571 | 9.7 | 256 | 44.8 |

## 4.4 Target species / Species of special interest recorded in the breeding period

### 4.4.1 Breeding bird (incl. foraging / hunting birds)

A total of 20 target species were recorded in the study area during the reproduction period. Five of them nested in the study area, 15 used it for foraging or hunting, respectively. Two species were only observed while flying over the study area.

Great Cormorant (*Phalacrocorax carbo*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In the field studies of team 2 it was observed rarely flying over the study area (a few small flocks and single individuals), showing no connection towards the habitats of the study area (cf. PAUNOVIĆ & KARAPANDŽA 2011a and 201b).

Pygmy Cormorant (*Phalacrocorax pygmaeus*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). It was observed in June 2010 with two and in October 2010 with one individual flying over the study area (RAŠAJSKI 2011). PAUNOVIĆ & KARAPANDŽA (2011a) did not detect this species.

Black-crowed Night Heron (*Nycticorax nycticorax)*

RAŠAJSKI & PAUNOVIĆ (2010) as well as PAUNOVIĆ & KARAPANDŽA (2011a) did not record this species in the study area. RAŠAJSKI (2011) detected two individuals flying over the study area.

Purple Heron (*Ardea purpurea*)

This species was classified in 2009 by RAŠAJSKI & PAUNOVIĆ (2010) as present during the reproductive period as well as migrants in the study area. In 2010 this species was not recorded by PAUNOVIĆ & KARAPANDŽA (2011a). RAŠAJSKI (2011) reported four sightings of this species. The flight heights were at 25 m.

White Stork (*Ciconia ciconia*)

This species was classified in 2009 by RAŠAJSKI & PAUNOVIĆ (2010) as present during the reproductive period as well as migrants in the study area. Two single individuals were recorded in 2010 while passing the study area (cf. PAUNOVIĆ & KARAPANDŽA 2011a). RAŠAJSKI (2011) recorded this species once; the closest breeding sites were located in settlements at the Danube.

Honey Buzzard (*Pernis apivorus*)

Honey Buzzards were recorded a total of three times by RAŠAJSKI (2011) in July and in September when single individuals of this species occurred at the border to Deliblato Sands. PAUNOVIĆ & KARAPANDŽA (2011a) did not detect this species.

White-tailed Eagle (*Haliaeetus albicilla*)

White-tailed Eagle was not recorded either in 2009 or in 2010 (cf. RAŠAJSKI & PAUNOVIĆ 2010 & PAUNOVIĆ & KARAPANDŽA 2011a). RAŠAJSKI (2011) did not report this species, either.

Western-Marsh Harrier (*Circus aeruginosus*)

This species was not recorded in 2009 (cf. RAŠAJSKI & PAUNOVIĆ 2010). In the field studies of team 2 individuals of Western-Marsh Harrier were regularly recorded hunting around VP3, 4 and 6 - in the majority of cases clearly at heights below 50 m. Only three recordings were made of birds higher than 50 m (cf. PAUNOVIĆ & KARAPANDŽA 2011a and 201b and Table 4.17).

RAŠAJSKI (2011) also reported this species in many locations of the study area but numbers were comparatively low. No individual was detected at heights above 50 m (cf. Table 4.18).

Table 4.17: Observations of Western Marsh Harriers by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 2 | 5.0 | 2 | 2 | 1 | 1 | 14 | 0.2 | 0 | 0.0 |
| VP2 | 1 | 2.7 | 1 | 1 | 1 | 1 | 11 | 0.2 | 0 | 0.0 |
| VP3 | 9 | 19.1 | 13 | 15 | 1 | 2 | 114 | 1.5 | 0 | 0.0 |
| VP4 | 8 | 19.0 | 9 | 11 | 1 | 2 | 67 | 1.0 | 0 | 0.0 |
| VP5 | 1 | 2.5 | 2 | 1 | 1 | 1 | 7 | 0.1 | 0 | 0.0 |
| VP6 | 8 | 22.2 | 10 | 10 | 1 | 1 | 119 | 2.0 | 7 | 5.9 |
| total | | | 37 | 40 | | | 332 | 0.8 | 7 | 2.1 |

Table 4.18: Observations of Western Marsh Harriers by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | 1 | 3.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| VP 2 | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| VP 3 | 2 | 3.3 | 2 | 2 | 1 | 1 | 3 | 0 | 0.0 |
| VP 4 | 2 | 2.2 | 2 | 2 | 1 | 1 | 2 | 0 | 0.0 |
| VP 5 | - | - | - | - | - | - | - | - | - |
| total | 6 | | 6 | | | | 13 | 0 | 0.0 |

Goshawk (*Accipiter gentilis*)

Rašajski & Paunović (2010) classified Goshawks as present in the study area during the reproductive period, as well as a migrating and wintering species in 2009. During field studies of team 2 it was recorded as a breeding species. Two nests were found at the boundary of Deliblato Sands about 1,000 m away from the study area. Furthermore, some birds occasionally used the area of the proposed wind farm as a hunting habitat, in particular the more structured sites like hedge-rows or tree lines, especially near the border to Deliblato Sands. The recorded individuals normally flew at heights below 50 m, four flights were observed at heights above 50 m (cf. Paunović & Karapandža 2011a and 201b and Table 4.19). According to Rašajski (2011), Goshawks were the second-most common bird of prey in the study area but generally rare in number. Rašajski (2011) found one nest in Deliblato Sands approximately 2.5 km away from the planned wind farm. There were hints of another breeding couple at a distance of 2.5 km. Most of the observations were done at VP4 and 5, while observations at the remaining VPs were comparatively low (cf. Table 4.20).

Table 4.19: Observations of Goshawks by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 3 | 7.5 | 3 | 3 | 1 | 1 | 10 | 0.2 | 5 | 50.0 |
| VP2 | - | - | - | - | - | - | - | - | - | - |
| VP3 | 3 | 6.4 | 3 | 3 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| VP4 | - | - | - | - | - | - | - | - | - | - |
| VP5 | 7 | 17.5 | 7 | 8 | 1 | 2 | 52 | 0.8 | 41 | 78.8 |
| VP6 | - | - | - | - | - | - | - | - | - | - |
| total | | | 13 | 14 | | | 67 | 0.2 | 46 | 68.7 |

Table 4.20: Observations of Goshawks by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | 1 | 3.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| VP 2 | 1 | 1.8 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| VP 3 | 4 | 6.7 | 4 | 4 | 1 | 1 | 9 | 0 | 0.0 |
| VP 4 | 18 | 19.6 | 18 | 21 | 1 | 2 | 46 | 0 | 0.0 |
| VP 5 | 14 | 25.5 | 14 | 16 | 1 | 2 | 47 | 0 | 0.0 |
| total | | | 38 | 43 | | | 112 | 0 | 0.0 |

Eurasian Sparrowhawk (*Accipiter nisus*)

RAŠAJSKI & PAUNOVIĆ (2010) classified the Eurasian Sparrowhawk in 2009 as present during the reproductive period as well as a migrating and wintering species in the study area. During field studies of both teams this species occasionally occurred while hunting at low altitudes of less than 50 m, predominantly close to Deliblato Sands. Individuals normally preferred medium-high and high vegetation for hunting flights in the study area (cf. PAUNOVIĆ & KARAPANDŽA 2011a and 201b, RAŠAJSKI 2011). No individual was recorded at heights above 50 m (cf. Table 4.21 and 4.22)

Table 4.21: Observations of Sparrowhawks of Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 1 | 2.5 | 1 | 1 | 1 | 1 | 2 | 0.0 | 0 | 0.0 |
| VP2 | 1 | 2.7 | 1 | 1 | 1 | 1 | 4 | 0.1 | 0 | 0.0 |
| VP3 | 6 | 12.8 | 7 | 7 | 1 | 1 | 35 | 0.5 | 5 | 14.3 |
| VP4 | - | - | - | - | - | - | - | - | - | - |
| VP5* | 4 | 10.0 | 6 | 6 | 1 | 1 | 48 | 0.7 | 5 | 10.4 |
| VP6 | - | - | - | - | - | - | - | - | - | - |
| total | | | 15 | 15 | | | 89 | 0.2 | 10 | 11.2 |

*: one record without information about duration of observation

Table 4.22: Observations of Sparrowhawks by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | - | - | - | - | - | - | - | - | - |
| VP 2 | 2 | 3.6 | 2 | 3 | 2 | 1 | 15 | 0 | 0.0 |
| VP 3 | 3 | 5.0 | 3 | 3 | 1 | 1 | 7 | 0 | 0.0 |
| VP 4 | 11 | 12.0 | 11 | 13 | 1 | 2 | 21 | 0 | 0.0 |
| VP 5 | 2 | 3.6 | 2 | 2 | 1 | 1 | 7 | 0 | 0.0 |
| total | | | 18 | 21 | | | 50 | 0 | 0.0 |

Common Buzzard (*Buteo buteo*)

Rašajski & Paunović (2010) classified the Common Buzzard in 2009 as present during the reproductive period as well as a migrating and wintering species in the study area. During field studies of team 2 individuals were observed during every field visit, predominantly at VP1 and VP3 (cf. Table 4.23). Individuals used the study area for both, nesting and hunting. Four nests, all of them outside the area of the planned wind farm, were detected. The agricultural landscape that covered large areas of the study area was used for hunting (cf. Paunović & Karapandža 2011a and 201b, Rašajski 2011a). Individuals of this species were often recorded at heights between 50 and 200 m (cf. Table 4.23; Paunović & Karapandža 2011a and 201b). In contrast to this, Rašajski (2011) pointed out that the average flight altitude was about 15 to 20 m, while their maximum flight altitude was 80 m (cf. Table 4.24). Rašajski (2011) recorded most individuals in January and February when maximum numbers of individuals were encountered. Until July the number of individuals was comparatively small (up to five individuals) but increased at the end of July and in August / September (cf. Table 4.23).

Table 4.23: Observations of Common Buzzards by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 15 | 37.5 | 15 | 25 | 1 | 3 | 1,259 | 19.3 | 39 | 3.1 |
| VP2 | 26 | 70.3 | 41 | 72 | 1 | 8 | 406 | 6.6 | 148 | 36.5 |
| VP3 | 39 | 83.0 | 85 | 174 | 1 | 19 | 1,039 | 14.1 | 311 | 29.9 |
| VP4 | 29 | 69.0 | 41 | 77 | 1 | 7 | 424 | 6.4 | 176 | 41.5 |
| VP5* | 34 | 85.0 | 66 | 124 | 1 | 5 | 502 | 7.7 | 181 | 36.1 |
| VP6 | 22 | 61.1 | 34 | 61 | 1 | 11 | 260 | 4.4 | 184 | 70.8 |
| total | | | 282 | 533 | | | 3,890 | 9.9 | 1,039 | 26.7 |

*: one record without information about duration of observation

Table 4.24: Observations of Common Buzzards by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | 5 | 19.2 | 5 | 24 | 2 | 9 | 19 | 0 | 0.0 |
| VP 2 | 16 | 28.6 | 16 | 132 | 2 | 17 | 71 | 0 | 0.0 |
| VP 3 | 11 | 18.3 | 11 | 77 | 2 | 12 | 89 | 0 | 0.0 |
| VP 4 | 47 | 51.1 | 47 | 256 | 2 | 12 | 89 | 0 | 0.0 |
| VP 5 | 17 | 30.9 | 17 | 104 | 2 | 11 | 52 | 0 | 0.0 |
| total | | | 96 | 593 | | | 320 | 0 | 0.0 |

Common Kestrel (*Falco tinnunculus*)

RAŠAJSKI & PAUNOVIĆ (2010) classified the Common Kestrel as present in 2009 during the reproductive period as well as a migrating and wintering species in the study area. During the field studies of team 2 individuals were observed during practically every field visit and could be reported at every VP (PAUNOVIĆ & KARAPANDŽA 2011a and 201b, RAŠAJSKI 2011 and Table 4.25 and 4.26). The birds used the study area for both, nesting and hunting. Three nests were detected: two on power transmission poles and one in an acacia tree. Each nesting site was located outside the planned wind farm area (cf. PAUNOVIĆ & KARAPANDŽA 2011a and 201b). In about 10 to 30 % of all observations units by PAUNOVIĆ & KARAPANDŽA (2011) Kestrels were detected at heights between 50 and 200 m. However, RAŠAJSKI (2011) reported no individuals in that height.

Table 4.25: Observations of Common Kestrel by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 22 | 55.0 | 34 | 47 | 1 | 4 | 532 | 8.1 | 49 | 9.2 |
| VP2 | 20 | 54.1 | 32 | 50 | 1 | 5 | 555 | 9.0 | 51 | 9.2 |
| VP3 | 22 | 46.8 | 34 | 48 | 1 | 3 | 1,430 | 19.4 | 32 | 2.2 |
| VP4 | 25 | 59.5 | 37 | 61 | 1 | 11 | 386 | 5.8 | 42 | 10.9 |
| VP5* | 11 | 27.5 | 11 | 14 | 1 | 2 | 82 | 1.3 | 21 | 25.6 |
| VP6 | 10 | 27.8 | 10 | 12 | 1 | 2 | 58 | 1.0 | 26 | 44.8 |
| total | | | 158 | 232 | | | 3,043 | 7.8 | 221 | 7.3 |

*: one record without information about duration of observation

Table 4.26: Observations of Common Kestrel by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | 8 | 30.8 | 9 | 24 | 1 | 4 | 54 | 0 | 0.0 |
| VP 2 | 15 | 26.8 | 15 | 43 | 1 | 5 | 53 | 0 | 0.0 |
| VP 3 | 16 | 26.7 | 16 | 38 | 1 | 6 | 65 | 0 | 0.0 |
| VP 4 | 40 | 43.5 | 40 | 120 | 1 | 6 | 129 | 0 | 0.0 |
| VP 5 | 20 | 55.0 | 20 | 51 | 1 | 4 | 53 | 0 | 0.0 |
| total | | | 100 | 276 | | | 354 | 0 | 0.0 |

Booted Eagle (*Aquila pennata*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 this species occurred as a rare hunting species at the southern border / part of the study area where its prey, the European Ground- Squirrel (*Spermophilus citellus*), occurs. Single individuals flew at heights between 30 an 100 m (cf. PAUNOVIĆ & KARAPANDŽA 2011a). RAŠAJSKI (2011) did not record this species in 2010.

Red-Footed Falcon (*Falco vespertinus*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 a single individual passed the study area near VP3 in April in about 10 m (cf. PAUNOVIĆ & KARAPANDŽA 2011). RAŠAJSKI (2011) did not record this species in 2010.

Eurasian Hobby (*Falco subbuteo*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 it was constantly present in the study area, mostly while hunting, and was reported at almost all VPs except VP6. The high number of recordings at VP1 resulted from a Eurasian Hobby pair that nested close to VP1 on a power transmission pole. During six observation units (about 1,080 min) two hobbies were observed sitting in the nest. During 50 minutes, individuals stood on a transmission pole. Accordingly, the degree of observations from heights between 50 and 200 m is comparatively low (cf. Table 4.27).

Hobbies used the vicinity of VP2 to 5, in contrast, occasionally for hunting or they flew directly trough the study area. The degree of flights at heights between 50 and 200 m is comparably high.

Near Deliblato Sands indications for another two breeding pairs existed (cf. PAUNOVIĆ & KARAPANDŽA 2011a).

In difference to these findings, RAŠAJSKI (2011) reported Hobbies to occur very rarely. In particular, he did not detect any individual in the north of the study area as PAUNOVIĆ & KARAPANDŽA (2011) did. According to RAŠAJSKI (2011) Hobbies occurred very rarely in the south and middle part of study area at the border to Deliblato Sands (cf. Table 4.28).

Table 4.27: Observations of Eurasian Hobby by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of duration in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 10 | 25.0 | 10 | 18 | 1 | 3 | 1,164 | 17.8 | 20 | 1.7 |
| VP2 | 4 | 10.8 | 4 | 4 | 1 | 1 | 40 | 0.7 | 20 | 50.0 |
| VP3 | 5 | 10.6 | 6 | 6 | 1 | 1 | 76 | 1.0 | 30 | 39.5 |
| VP4 | 1 | 2.4 | 2 | 2 | 1 | 1 | 29 | 0.4 | 29 | 100.0 |
| VP5 | 7 | 17.5 | 8 | 8 | 1 | 1 | 60 | 0.9 | 58 | 96.7 |
| VP6 | - | - | - | - | - | - | - | - | - | - |
| total | | | 30 | 38 | | | 1,369 | 3.5 | 157 | 11.5 |

Table 4.28: Observations of Eurasian Hobby by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | - | - | - | - | - | - | - | - | - |
| VP 2 | - | - | - | - | - | - | - | - | - |
| VP 3 | - | - | - | - | - | - | - | - | - |
| VP 4 | 1 | 1.1 | 1 | 1 | 1 | 1 | 5 | 0 | 0.0 |
| VP 5 | 2 | 3.6 | 2 | 2 | 1 | 1 | 7 | 0 | 0.0 |
| total | | | 3 | 3 | | | 12 | 0 | 0.0 |

Saker Falcon (*Falco cherrug*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 Saker Falcons were very rarely observed at almost every VP (except VP2). Individuals were reported in the vicinity of VP4 and above the road leading from the village of Mramorak to VP5 as well as in the surrounds of VP1. All observations were made when individuals were searching for prey – the European Ground Squirrel that lives in certain parts of the study area as well as in the boundary areas of Deliblato Sands. There was probably a nesting site on a transmission pole approximately 2 km of VP1 to the southwest (cf. PAUNOVIĆ & KARAPANDŽA 2011a and Table 4.29)).

RAŠAJSKI (2011) observed Saker Falcons even less often. He reported four observation units in the southeastern part of the study area in which Sakers occurred (cf. Table 4.30).

Table 4.29: Observations of Saker Falcon by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 1 | 2.5 | 1 | 1 | 1 | 1 | 5 | 0.1 | 5 | 100.0 |
| VP2 | - | - | - | - | - | - | - | - | - | - |
| VP3 | 1 | 2.1 | 1 | 1 | 1 | 1 | 5 | 0.1 | 5 | 100.0 |
| VP4 | 1 | 2.4 | 1 | 1 | 1 | 1 | 5 | 0.1 | 0 | 0.0 |
| VP5 | 1 | 2.5 | 1 | 1 | 1 | 1 | 8 | 0.1 | 8 | 100.0 |
| VP6 | 1 | 2.8 | 1 | 1 | 1 | 1 | 1 | 0.0 | 0 | 0.0 |
| total | | | 5 | 5 | | | 24 | 0.1 | 18 | 75.0 |

Table 4.30: Observations of Saker Falcon by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | - | - | - | - | - | - | - | - | - |
| VP 2 | - | - | - | - | - | - | - | - | - |
| VP 3 | - | - | - | - | - | - | - | - | - |
| VP 4 | 3 | 3.3 | 3 | 3 | 1 | 1 | 13 | 0 | 0.0 |
| VP 5 | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| total | | | 4 | 4 | | | 16 | 0 | 0.0 |

Grey Partridge (*Perdix perdix*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, distribution and abundance of this species in the study area is available.

RAŠAJSKI (2011) rarely saw individuals of this species and estimated about five breeding pairs in the study area.

Common Quail (*Coturnix coturnix*)

In 2009 this species was considered to be present in the area of the planned wind farm during the reproductive period (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 individuals of this species were often recorded at every VP. Males were also regularly heard at night during the survey on bats. The species seems to be a common and widespread breeding species in the study area (cf. PAUNOVIĆ & KARAPANDŽA 2011a).

RAŠAJSKI (2011) estimated 20 territories in the entire study area.

According to PAUNOVIĆ & KARAPANDŽA (pers. comm.) the number of territories is believed to be considerably higher.

Eurasian Woodcock (*Scolopax rusticola*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the abundance and spatial distribution of Eurasian Woodcock in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Whiskered tern (*Chlidonias hybrida*)

PAUNOVIĆ & KARAPANDŽA (2011a) did not observe this species during their study period.

RAŠAJSKI (2011) recorded single individuals very rarely flying over the study area.

European Turtle-dove (*Streptopelia turtur*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, distribution and abundance of European Turtle-dove in the study area is given.

According to RAŠAJSKI (2011) the presence of this species varied between several to 150 individuals. They were often observed in sunflower fields, which were identified as their main foraging habitat. This species is a common breeding bird In the vicinity of the study area.

Common Cuckoo (*Cuculus canorus*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, distribution and abundance in the study area is given.

According to Rašajski (2011) it was regularly seen and heard but was most frequent in neighbouring areas, particularly Deliblato Sands.

Long-eared Owl (*Asio otus*)

Paunović & Karapandža (2011) give no detailed information about the status and distribution of this species. They consider Long-eared Owl to occur regularly in the study area.
According to Rašajski (2011), up to ten couples existed in neighbouring habitats of Mramorak and Dolovo. In addition, a large number of wintering individuals resided in the parks of Dolovo and Mramorak.

Common Scops-owl (*Otus scops*)

As this species was not considered to be a target species by Paunović & Karapandža (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given. The authors consider Common Scops-owl to occur regularly in the study area.
According to Rašajski (2011), individuals of this species could regularly be recorded in the eastern part of the study area (along the old railway station and the abandoned farm) but they used the territory of the planned wind farm very rarely. The author estimated 10 to 15 breeding pairs in the wider area of the location.

Little Owl (*Athene noctua*)

As this species was not considered to be a target species by Paunović & Karapandža (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given. The authors consider Little Owl to occur regularly in the study area.
According to Rašajski (2011) this is the rarest Owl-species in the study area itself and in its wider surroundings. It was only recorded in the abandoned farm at the eastern border of the study area.

Barn Owl (*Tyto alba*)

Paunović & Karapandža (2011a) and Rašajski (2011) considered the Barn Owl to be a common breeding bird in the settlements in the surroundings of the planned wind farm. Rašajski (2011) observed single individuals within the entire study area, probably one couple was nesting in or near the abandoned farm at the east margin of the study area.

Tawny Owl (*Strix aluco*)

As this species was not considered to be a target species by Paunović & Karapandža (2011), no detailed information about the status, spatial distribution and abundance in the study area is given. The authors consider Tawny Owl as present in the study area.
Rašajski (2011) did not record this owl.

European Nightjar (*Capirmulgus europaeus*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) occasionally recorded individuals at the east border of study area that lead to their main breeding site in the whole area: Deliblato Sands.

Alpin Swift (*Apus melba*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Common Kingfisher (*Alcedo atthis*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

European Roller (*Coracias garrulous*)

RAŠAJSKI & PAUNOVIĆ (2010) classified the European Roller in 2009 as present in the surroundings of the study area during the reproductive period as well as a migratory species in the study area. RAŠAJSKI (2011) as well as PAUNOVIĆ & KARAPANDŽA (2011a) recorded a single individual of this species in the study area.

European Bee-eater (*Merops apiaster*)

The species is mentioned by RAŠAJSKI & PAUNOVIĆ (2010) in 2009 as present during their reproductive period as well as a migrating and wintering species in the study area. Nesting sites of the species existed in Deliblato Sands, whereas the study area was occasionally used for foraging (RAŠAJSKI 2011, PAUNOVIĆ & KARAPANDŽA 2011a).

Eurasian Hoopoe (*Upupa epops*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) regularly observed the species on freshly ploughed fields searching for insects. When flying, individuals moved at heights up to 5 m.

<u>Eurasian Wryneck (*Jynx torquilla*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

<u>Eurasian Green Woodpecker (*Picus viridis*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) recorded individuals of this species several times at locations at the border of the study area.

<u>Crested Lark (*Galerida cristata*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) considered the species to be a frequent breeding bird in the study area, predominantly in areas with low grass cover. He estimated a breeding population of about one hundred couples in the study area.

<u>Wood Lark (*Lullula arborea*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) rarely observed the species in the study area. When observable, individuals were present at the eastern border of the study area.

<u>Eurasian Skylark (*Alauda arvensis*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

According to RAŠAJSKI (2011) this is the most common breeding bird in the study area with an estimated breeding population of 200 to 250 couples. Individuals mostly flew at low altitudes but can reach heights of 20 m while displaying.

<u>Barn Swallow (*Hirundo rustica*)</u>

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

According to RAŠAJSKI (2011), during the summer months Barn Swallows often hunted in flocks of 5 up to 50 individuals in the air over the study area at heights of up to 25 m.

Northern House Martin (*Delichon urbicum*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

According to RAŠAJSKI (2011) recorded Northern House Martins hunting in the study area but significantly rarer than Barn Swallows. Nesting colonies of this species were found in the surrounding settlements (Mramorak and Vladimirovac).

Tawny Pipit (*Anthus campestris*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) mentioned possible breeding couples (up to five) at the border towards Deliblato Sands.

Northern Wheatear (*Oenanthe oenanthe*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

RAŠAJSKI (2011) assumed up to five breeding couples along the old railway. In the whole area of the planned wind farm the species was rarely observed on cultivated land during the migration period.

Barred Warbler (*Sylvia nisoria*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Spotted Flycatcher (*Muscicapa striata*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Red-backed Skrike (*Lanius collurio*)

The species is mentioned by RAŠAJSKI & PAUNOVIĆ (2010) to be present in the study area in 2009 during the reproductive period as well as a migrating and wintering species. Nesting sites of the species existed in Deliblato Sands and within the study area as well. The study area was also used for foraging. As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

According to RAŠAJSKI (2011) the species is a frequent breeding bird in the neighbouring forest steppe areas but comparably low in number (up to 15 pairs) in the planned wind farm area. It nested predominantly in more structured areas comprising shrubs or hedges.

Lesser Grey Shrike (*Lanius minor*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.
RAŠAJSKI (2011) very rarely observed it in the study area. Also, there was no indication for breeding couples of this species.

Common Starling (*Sturnus vulgaris*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.
According to RAŠAJSKI (2011) Starlings were very frequent, predominantly during the migration period. They used the area of the planned wind farm as a foraging ground in flocks of up to 200 individuals. However, no nesting sites were found in the area of the planned wind farm but are very frequent in the surrounding areas.

House Sparrow (*Passer domesticus*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.
According to RAŠAJSKI (2011) House Sparrows were very frequent. They used the area of the planned wind farm as a foraging ground and maybe also as a breeding site.

Eurasian Tree Sparrow (*Passer montanus*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.
According to RAŠAJSKI (2011) Tree Sparrows were very frequent but lower in number than House Sparrows. They used the area of the planned wind farm as a foraging ground and maybe also as a breeding site.

Yellowhammer (*Emberiza citronella*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).
RAŠAJSKI (2011) did not observe this species in the study area.

Ortolan Bunting (*Emberiza hortulana*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Black-headed Bunting (*Emberiza melanocephala)*

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given (although the species is mentioned in the report).

RAŠAJSKI (2011) did not observe this species in the study area.

Corn Bunting (*Miliaria calandra*)

As this species was not considered to be a target species by PAUNOVIĆ & KARAPANDŽA (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given.

According to RAŠAJSKI (2011) the species is a common breeding bird in the study area.

### 4.4.2 Resting and migrating birds

A total of 18 target species were recorded in the study area during the migration period or while using the study area as a resting habitat. If the species had also been observed as breeding or foraging / hunting birds within the breeding period, their occurrence has already been referred to in the previous Chapter and will not again be portrayed below.

White-fronted Goose (*Anser albifrons*)

White-fronted Geese were regularly observed flying over the study area during the migration period and during winter (November 2010 to February 2011). Individuals occurred at each of the six VPs. Main flight direction was north to south or northeast to southwest towards the Danube River or *vice versa*. In total 1,122 individuals in 20 flocks were encountered. The number of individuals per flock was approximately between 20 and 50 individuals whereas the biggest flock covered 300 individuals. Average flight height was estimated to be at about 100 to 200 m (cf. RAŠAJSKI 2011, PAUNOVIĆ & KARAPANDŽA 2011b and Table 4.31).

Table 4.31: Observations of White-fronted Goose by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 4 | 10.0 | 5 | 423 | 12 | 300 | 28 | 0.4 | 19 | 67.9 |
| VP2 | 2 | 5.4 | 2 | 29 | 12 | 17 | 12 | 0.2 | 7 | 58.3 |
| VP3 | 6 | 12.8 | 7 | 536 | 12 | 200 | 44 | 0.6 | 36 | 81.8 |
| VP4 | 2 | 4.8 | 2 | 57 | 12 | 45 | 18 | 0.3 | 10 | 55.6 |
| VP5* | 3 | 7.5 | 3 | 54 | 11 | 24 | 17 | 0.3 | 9 | 52.9 |
| VP6 | 1 | 2.8 | 1 | 23 | 23 | 23 | 5 | 0.1 | 0 | 0.0 |
| total | | | 20 | 1,122 | | | 124 | 0.3 | 81 | 65.3 |

*: one record without information about duration of observation

Greylag Goose (*Anser anser*)

Greylag Geese were occasionally observed flying over the study area during migration period and during winter (December 2009, January and February 2010 as well as November 2010 to February 2011), predominantly at the margins of the study area. Flight direction was mainly north to south or northeast to southwest towards the Danube River or *vice versa* (Rašajski 2011, Paunović & Karapandža 2011b).

The number of individuals per flock was approximately between 30 and 150 individuals whereas the biggest flock covered 200 individuals. Average flight height was estimated to be about 200 m (cf. Rašajski 2011, Paunović & Karapandža 2011b and Table 4.32 and 4.33)

Rašajski (2011) pointed out that it is possible that other species of "Grey Geese" (*e.g.* Bean Goose or White-fronted Goose) may not be detected due to difficulties of distinguishing these species from greater distances.

Table 4.32: Observations of Greylag Goose by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 2 | 5.0 | 2 | 183 | 83 | 100 | 10 | 0.2 | 10 | 100.0 |
| VP2 | - | - | - | - | - | - | - | - | - | - |
| VP3 | - | - | - | - | - | - | - | - | - | - |
| VP4 | 2 | 4.8 | 2 | 153 | 29 | 124 | 24 | 0.4 | 24 | 100.0 |
| VP5 | - | - | - | - | - | - | - | - | - | - |
| VP6 | 1 | 2.8 | 1 | 28 | 28 | 28 | 9 | 0.2 | 0 | 0.0 |
| total | | | 5 | 364 | | | 43 | 0.1 | 34 | 79.1 |

Table 4.33: Observations of Greylag Goose by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | 1 | 3.8 | 1 | 12 | 12 | 12 | 10 | 10 | 100.0 |
| VP 2 | 12 | 21.4 | 12 | 822 | 14 | 200 | 115 | 80 | 69.6 |
| VP 3 | - | - | - | - | - | - | - | - | - |
| VP 4 | - | - | - | - | - | - | - | - | - |
| VP 5 | - | - | - | - | - | - | - | - | - |
| total | | | 13 | 834 | | | 125 | 90 | 72.0 |

Bean Goose (*Anser fabilis*)

Bean Geese were rarely recorded flying over the study area during migration period or during winter (November 2010 to February 2011). Individuals occurred at VP1 and VP5. Flight direction was north to south or northeast to southwest towards the Danube River or *vice versa*. A total of 97 individuals in 3 flocks were encountered. The number of individuals per flock reached from 13 to 50 individuals. Average flight height was estimated to be about 200 m or even higher (cf. RAŠAJSKI 2011, PAUNOVIĆ & KARAPANDŽA 2011b and Table 4.34).

Table 4.34: Observations of Bean Goose by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 1 | 2.5 | 1 | 50 | 50 | 50 | 3 | 0.0 | 0 | 0.0 |
| VP2 | - | - | - | - | - | - | - | - | - | - |
| VP3 | - | - | - | - | - | - | - | - | - | - |
| VP4 | - | - | - | - | - | - | - | - | - | - |
| VP5 | 2 | 5.0 | 2 | 47 | 13 | 34 | 15 | 0.2 | 8 | 53.3 |
| VP6 | - | - | - | - | - | - | - | - | - | - |
| total | | | 3 | 97 | | | 18 | 0.0 | 8 | 44.4 |

*: one record without information about duration of observation

<u>Hen Harrier (*Circus cyaneus*)</u>

In 2009 this species was classified by RAŠAJSKI & PAUNOVIĆ (2010) as a foraging species during the reproductive period as well as a migratory species. In 2010 and 2011 single Hen Harriers occurred within the entire study area during migration and wintering period (cf. PAUNOVIĆ & KARAPANDŽA 2011b and Table 4.35).

RAŠAJSKI (2011) recorded this species only in October, November and December 2009 (before starting the vantage point census), thus observations from VPs cannot be given.

Table 4.35: Observations of Hen Harrier by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | presence (%) | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 6 | 15.0 | 6 | 6 | 1 | 1 | 67 | 1.0 | 27 | 40.3 |
| VP2 | 5 | 13.5 | 5 | 5 | 1 | 1 | 41 | 0.7 | 22 | 53.7 |
| VP3 | 5 | 10.6 | 5 | 5 | 1 | 1 | 33 | 0.4 | 0 | 0.0 |
| VP4 | 8 | 19.0 | 9 | 10 | 1 | 2 | 67 | 1.0 | 7 | 10.4 |
| VP5 | 2 | 5.0 | 2 | 2 | 1 | 1 | 9 | 0.1 | 9 | 100.0 |
| VP6 | 5 | 13.9 | 5 | 5 | 1 | 1 | 61 | 1.0 | 23 | 37.7 |
| total | | | 32 | 33 | | | 278 | 0.7 | 88 | 31.7 |

Montagu's Harrier (*Circus pygargus*)

This species was not recorded in 2009 (RAŠAJSKI & PAUNOVIĆ 2010). In 2010 Montagu's Harrier occasionally occurred in spring and autumn as a migratory species at every VP except VP5. PAUNOVIĆ & KARAPANDŽA (2011a) reported that individuals of this species flew at slightly higher altitudes than the other two Harrier species. However, it was only recorded three times above 50 m in the study area. During migration and winter from December 2010 to February 2011 about 50 % of all flights were observed at heights between 50 and 100 m (cf. PAUNOVIĆ & KARAPANDŽA 2011b and. Table 4.36).

RAŠAJSKI (2011) recorded Montagu's Harrier very rarely in 2010, in all cases lower than 50 m above the ground (cf. Table 4.37).

Table 4.36: Observations of Montagu's Harrier by Team 2 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | degree of presence | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | ratio of obs. time (%) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| VP1 | 1 | 3.4 | 1 | 1 | 1 | 1 | 30 | 0.5 | 0 | 0.0 |
| VP2 | 1 | 3.7 | 1 | 1 | 1 | 1 | 30 | 0.5 | 13 | 43.3 |
| VP3 | 2 | 5.4 | 3 | 1 | 2 | 1 | 18 | 0.2 | 5 | 27.8 |
| VP4 | 2 | 6.3 | 2 | 3 | 1 | 2 | 11 | 0.2 | 10 | 90.9 |
| VP5 | - | - | - | - | - | - | - | - | - | - |
| VP6 | 3 | 10.3 | 4 | 4 | 1 | 1 | 57 | 1.0 | 11 | 19.3 |
| total | | | 11 | 10 | | | 146 | 0.4 | 39 | 26.7 |

Table 4.37: Observations of Montagu's Harrier by Team 1 (abbreviation of variables see Chapter 3.4).

| | $units_{rec.}$ | degree of presence | $rec._{total}$ | $ind._{total}$ | $ind._{min}$ | $ind._{max}$ | duration $_{rec}$ (min) | duration $_{rec}$ at critical heights (min) | ratio of flights in critical height (%) |
|---|---|---|---|---|---|---|---|---|---|
| VP 1 | - | - | - | - | - | - | - | - | - |
| VP 2 | 1 | 1.8 | 1 | 1 | 1 | 1 | 3 | 0 | 0.0 |
| VP 3 | 1 | 1.7 | 1 | 2 | 2 | 2 | 1 | 0 | 0.0 |
| VP 4 | 1 | 1.1 | 1 | 2 | 2 | 2 | 1 | 0 | 0.0 |
| VP 5 | - | - | - | - | - | - | - | - | - |
| total | | | 3 | 5 | | | 5 | 0 | 0.0 |

Rough-Legged Buzzard (*Buteo lagopus*)

This species was not recorded in 2009 (Rašajski & Paunović 2010). In 2010 on 28 November a single individual passed the study area near VP3 about 150 to 200 m high (cf. Paunović & Karapandža 2011a). Rašajski (2011) did not observe the species in the study area.

Merlin (*Falco columbarius*)

This species was not recorded in 2009 (Rašajski & Paunović 2010). Two single individuals passed the study area in November 2010 near VP3 and VP5, respectively (cf. Paunović & Karapandža 2011a). Rašajski (2011) observed one individual of this species during the entire observation time.

Peregrine Falcon (*Falco peregrinus*)

This species was not recorded in 2009 (Rašajski & Paunović 2010). In 2010 one obviously migrating immature individual passed the study area near VP3 (cf. Paunović & Karapandža 2011a). Rašajski (2011) reported one direct flight over study area in October 2010.

Common Crane (*Grus grus*)

This species was not recorded in 2009 (Rašajski & Paunović 2010). In 2010 small and medium sized flock flew east of the study area. In addition several flocks took off from the central area of Deliblato Sands. But Common Cranes were not recorded within study area (cf. Paunović & Karapandža 2011a). In late February a flock of ten individuals migrated over VP4 at heights above 200 m (cf. Paunović & Karapandža 2011b).

Rašajski (2011) recorded one flock of 30 individuals on 18.10.2010 outside the study area.

Great Grey Shrike (*Lanius excubitor*)

As this species was not considered to be a target species by Paunović & Karapandža (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given. Rašajski (2011) observed this species regularly but in small numbers in November.

Linnet (*Carduelis canabina*)

As this species was not considered to be a target species by Paunović & Karapandža (2011a), no detailed information about the status, spatial distribution and abundance in the study area is given. Rašajski (2011) observed this species very rarely and in small flocks during the migration period in late autumn and winter.

## 4.5 Ecological significance of the study area for birds

### 4.5.1 Breeding bird (incl. foraging / hunting birds)

#### 4.5.1.1 General assessment of the importance of the study area for birds

With an overall number of 119 bird species the study area and its surroundings can be regarded as species rich. The main reason for this finding is that the area of the planned wind farm is located next to Deliblato Sands (about 1,000 m). Thus different types of ecological niches are present in the study area and its surroundings:

The study area mainly acts as a suitable habitat for breeding species that depend on open land structures, such as Common Quail, Skylark, Grey Partridge, Crested Lark and Yellow Wagtail. It also fulfils habitat requirements for species that basically depend on cultivated land for hunting or foraging, such as Common Buzzard, Common Kestrel, Western-Marsh Harrier, Hen Harrier and Common Starling.

Furthermore, some localities of the study area and particularly of its surroundings possess suitable habitat conditions for:

- species showing a preference for settlements and / or farms such as: Common Kestrel, House Sparrow, House Martin or Barn Swallow
- generalists, *i.e.* species with a wide ecological range without special habitat-requirements, *e.g.*: Common Blackbird, Blue Tit, Blackcap, Great Tit or Chaffinch
- species showing a preference for a mixture of open land and more structured habitats like hedge-rows, tree lines, and copses, *e.g.*: Nightingale, Red-backed shrike and Tree Pipit

Species that depend on habitats related to water or forests are absent in the study area or occur only sporadically.

Deliblato Sands, located next to but outside the study area are suitable to species adapted to habitats and structures typical for forest steppe and dunes:

- Escarpments: nesting sites for species like European Bee-eater and Sand Martin, which use the study area for foraging.
- Mixture of open land and forest steppe on sandy soil: nesting and foraging site for species like European Nightjar, Wryneck, Woodlark, Barred Warbler Whinchat, African Stonechat and Shrikes.

Due to the spatial distribution of existing habitat structures, the study area is basically divided into different main habitats and therefore ecological niches.

- Species of open cultivated land found large area of suitable habitats within the study area particularly in the area of the planned wind farm.
- Species of more structured landscape inhabit the few hedge-rows, tree lines or copses in the study area, in particular at the boundaries of the planned wind farm or its vicinity.

- Species of settlements are found mainly in the villages in the border area of the study area and in its vicinity.

Large parts of the study area are cultivated intensively and offer habitat features only to a few species specifically adapted to open land. Regarding criteria such as biodiversity or rarity of the species, the importance of these areas is usually low. For certain species the importance of the study area can be assumed to be moderate or high. Since the significance of a wide range of the study area is low, the general importance of the study area can be assessed as low to moderate.

#### 4.5.1.2 Species-specific significance of the area

Based on the occurrence of species in 2009 and 2010 as well as based on habitat features, the significance of the study area as a breeding habitat or as a foraging / hunting habitat (including its accessibility for large birds) during the breeding period will be assessed. Following BREUER (1994), five rating levels are used: low, low to moderate, moderate, moderate to high and high significance.

Great Cormorant

This species has an extremely large range of distribution. In Serbia it is a sedentary bird breeding in seven colonies, mainly along the Danube and Tisa. The most important wintering areas are situated on the Danube, where 5,000 to 8,000 individuals were counted (cf. TUCAKOV 2006). In Vojvodina the breeding population is estimated at about 1,000 to 1,200 pairs while the breeding trend is increasing (PUZOVIĆ 2003). It mainly breeds on coasts, cliffs and in trees but also increasingly within the land, building up and re-using colonies over years. It feeds predominantly on fish, hinting a wide variety of prey. Therefore open water surfaces are essential requirements for this species. Breeding and foraging sites can be about 20 to 25 km away from each other (BIRDLIFE INTERNATIONAL 2011).

Essentially the habitat requirements are not fulfilled in the study area. Furthermore, this species was rarely observed flying over the study area and showed no connection to it. In December 2010 and February 2011 six flocks with a total of 344 individuals migrated over the study site.

The study area thus has no significance as a breeding or foraging site for Great Cormorants (cf. Table 4.38).

Pygmy Cormorant

This species breeds in south-eastern parts of Europe and south-western parts of Asia. In Serbia it is a migratory species. According to PUZOVIĆ (2003) the estimated breeding population in Serbia is about 350 to 500 pairs. Between 2004 and 2006 PUZOVIĆ (2007) detected three breeding colonies and three more probable or possible breeding sites.

The species occurs in reedbeds, transition zones between reedbeds and open waters, extensively grazed or mowed shores and wet meadows and, in winter, in coastal wetlands, along rivers, and sometimes on inland lakes (BIRDLIFE INTERNATIONAL 2004). Its diet consists predominantly of fish.

Basically the species-specific habitat requirements are not fulfilled in the study area. Furthermore, this species was rarely observed flying over the study area and showed no connection to it.
The study area thus has no significance for Pygmy Cormorants (cf. Table 4.38).

Black-crowed Night Heron

This species has an extremely large range. It appears as several subspecies in wetlands throughout much of the world. In Serbia, PUZOVIĆ (2003) estimated the breeding population to be 2,100 to 2,400 pairs. According to RAŠAJSKI (2004) the species is predominantly restricted to the Vojvodina where it is widely distributed. It inhabits forested margins of shallow rivers, streams, lagoons, pools, ponds, lakes, or marshes. Individuals feed on fish, amphibians, reptiles as well as insects, spiders and molluscs.
Basically the species-specific habitat requirements are mostly not fulfilled by the study area. Furthermore, this species was rarely observed flying over the study area and showed no connection to it.
The study area thus has no significance for Black-crowed Night Heron (cf. Table 4.38).

Purple Heron

The species has a wide range inhabiting southern parts of middle Europe and southern Europe, parts of Africa and Asia. In Serbia the species inhabits the lowlands mainly of Vojvodina, where it can be found predominantly along river valleys (RAŠAJSKI 2004). The current increasing population of Vojvodina is about 1,000 to 1,200 pairs, like the size in entire Serbia (PUZOVIĆ 2003).
Purple Herons predominantly inhabit wetlands where they breed in loose single or mixed colonies (*e.g.* with Grey herons) on reeds stems, thickets or trees. Their diet consists of fish, amphibians, insects and spiders as well as small mammals and birds (BIRDLIFE INTERNATIONAL 2011).
The species-specific habitat requirements as a foraging area are, at best, poorly fulfilled by the study area. There was no nesting site and individuals were only supposed to be in the surroundings of the study area during their reproductive period or while migrating.
Therefore the species-specific significance of the study area is classified, at the utmost, as low (cf. Table 4.38).

White Stork

The White Stork migrates long distances and winters in Africa south of Sahara. In Serbia it is mostly restricted to the lowlands of Vojvodina and middle Serbia, where the species is widely distributed (RAŠAJSKI 2004). The population size in Vojvodina is about 1,000 to 1,100 pairs (entire Serbia 1,100 to 1,250) and in a stable condition (PUZOVIĆ 2003).
The habitats of the white stork are open to semi-open rural landscapes. Extended humid river valleys and floodplains are preferred with extensively managed grassland. Nesting sites and feeding areas

can be apart up to 5 to 10 km from each other. The breeding places can be located in rural settlements, on solitary towers (artificial nests) or house roofs as well as on solitary trees. Old nests may be used by individuals over several years.
Possible nesting sites are absent in the study area. During the breeding period most of area is covered by dense fields of corn and sunflowers. Individuals have no chance to catch prey during this time but after harvesting and in times when the heights of corn and sunflowers are still low these fields may be used for feeding.
In 2010 only two individuals were recorded passing the study area. Obviously it was not used as a feeding habitat in the time monitored in 2010.
Accordingly the study area has no or, at most, a low significance for White Storks (cf. Table 4.38).

Honey Buzzard

This species inhabits almost all of Europe and reaches to the north of China and to Mongolia in the east. To spend the winter south of Sahara it has to migrate long distances. In Serbia the population is about 550 to 700 breeding pairs (PUZOVIĆ 2003), being sparsely distributed through all parts of Serbia (RAŠAJSKI 2004). Vojvodina has a breeding population of about 60 to 70 pairs (PUZOVIĆ 2003).
The Honey Buzzard has specialized on feeding predominantly wasp larvae. It inhabits well-structured landscapes consisting of old woodlands as breeding habitats and various open lands as feeding grounds.
The study area fulfils the habitat requirements for feeding but not for breeding. PUZOVIĆ (2000) mentioned the species as a rarely breeding species in Deliblato Sands but no nest was found in the surroundings of the study area (RAŠAJSKI 2011). Furthermore, individuals were observed only rarely.
Thus the significance of the study area is assessed to be low at most (cf. Table 4.38).

White-tailed Eagle

The distribution of the eagle extends in a broad stripe across the temperate, boreal and arctic zones of Europe and Asia from Iceland to Kamchatka and Japan. In Europe it is a sedentary species while a migrant in Asia. The breeding population in Europe is estimated to number 5,000 to 6,600 breeding pairs (15,000 to 19,800 individuals BIRDLIFE INTERNATIONAL 2004). In Serbia the population size of this species has increased significantly from approximately 20 pairs at the end of the 1970’s to at least 86 (estimated 80 to 100) pairs in 2009 (HAM *et al.* 2009a & 2009b). In Serbia the distribution is mainly restricted to the river valleys of the lowlands of Vojvodina and central Serbia (HAM *et al.* 2009a, RAŠAJSKI 2004). The nearest nesting site of a White-tailed Eagle was located about 10 km east to the wind farm area in Deliblato Sands Special Nature Reserve. In 2009 this particular breeding-pair did not reproduce successfully (HAM *et al.* 2009b).

The species requires large and open expanses of lake, coast or river valley, close to undisturbed cliffs or open stands of large, old-growth trees for nesting. Its diet consists of vertebrates (fish, mammals and especially birds) from marine, freshwater and terrestrial environments.
The species-specific requirements are not or, at most, poorly fulfilled in the study area. Old trees as possible breeding sites are mostly absent, just like fresh water bodies as feeding grounds. In the investigations of 2009 and 2010 no White-tailed Eagle individuals were observed in the study area. Thus the study area is not even used as a flight corridor between nesting and feeding habitats.
Accordingly, the study area cannot be regarded as significant for White-tailed Eagles (cf. Table 4.38).

Western-Marsh Harrier
This species is widespread in Europe and Asia. Its range covers almost all European states, though absent from mountainous and subarctic Scandinavia. European populations are partly long-distance migrants mostly wintering in Sub-Saharan Africa, as well as short-distance migrants wintering in western or southern Europe. The breeding population in Europe is about 100,000 pairs (MEBS & SCHMIDT 2006). In Serbia this species is predominantly restricted to the lowlands of Vojvodina and central Serbia (RAŠAJSKI 2004). The number of breeding pairs in Vojvodina is estimated to be 250 to 300 (entire Serbia: 260 to 320) (PUZOVIĆ 2003).
This species primarily breeds in reed stands of sedimentation zones of water stretches. In some European areas (*e.g.* Germany) Western Marsh-Harries started increasingly to breed in cultivated land, perhaps due to the loss of suitable breeding sites. This habitat change could not be observed in Serbia yet (PAUNOVIĆ, personal comm.). Its hunting areas are open lands such as cultivated land where individuals can often be seen flying at low heights searching for prey. When vegetation is dense and high (as in certain growth stages of corn, grain or sunflowers as in the study area), individuals have to cover wide ranges and structures where the vegetation is low in density and in height, such as dirt roads bordered by ruderal vegetation. Under these conditions grasslands, broad margins of fields or fallow land become more and more important for feeding.

According to RAŠAJSKI (2011) this species nests in the wider area of Dolovo and there might be two breeding pairs in the vicinity of the study area. Large areas of the study area itself fulfil the requirements for hunting at least in certain periods in spring, beginning of summer and autumn, when the height of the vegetation and the density of corn and sunflowers are low or, later, fields have been harvested. The species was recorded at every VP except VP2. It was observed regularly - especially in middle of the study area, predominantly searching for prey in low heights below 50 m. Suitable nesting sites are not present in the study area.
The study area is regularly used for hunting by individuals nesting in wetlands nearby.
Taken all this into consideration, the significance of the study area as a hunting area is moderate, while it has no significance as a breeding site (cf. Table 4.38).

Northern Goshawk

This species has an extremely large range covering large areas of North America and Asia and most of Europe. BirdLife International (2004) assumes that in Europe the population is about 160,000 to 210,000 pairs. In Serbia it is sparsely distributed with a stable population number of 1,400 to 1,800 pairs (Vojvodina: 450 to 600 pairs Puzović 2003).

Goshawks prefer landscapes with a mix of closed forest areas, forested islands, copses and open land. The nesting sites are mostly located in forests with old trees where nests are built in tall trees (Mebs & Schmidt 2006). Goshawks hunt birds like thrushes, doves or starlings.

Cultivated land that covers large areas of the study area has no or at most few suitable conditions for goshawks. Possible nesting sites are not located in the area of the planned wind farm but are present nearby. In particular two nests were detected in Deliblato Sands more than 1,000 m away from the planned wind farm. The hedge-rows or tree lines in the north, east and south of the study area are used as hunting area more rarely.

Even where two nesting sites were located in the vicinity, the number of observed individuals was low. Therefore the significance of the study area for goshawks is regarded to be low (cf. Table 4.38).

Eurasian Sparrowhawk

This species is distributed over large areas of Asia and Europe. BirdLife International (2004) assumes the European population to be about 340,000 to 450,000 pairs. In Serbia it is dispersed with a stable population number of 700 to 900 pairs, while the population size in Vojvodina is estimated to be 50 to 80 pairs (Puzović 2003).

Eurasian Sparrowhawks inhabit diverse landscapes, consisting of closed forest areas, forested islands, copses and open cultivated land with a sufficient food supply of small preyed on birds (Mebs & Schmidt 2006).

Cultivated land that covers large areas of the study area has no or at most few suitable conditions for Eurasian Sparrowhawk. Possible nesting sites are not located within the area on the planned wind farm but are present nearby, particularly in Deliblato Sands more than 1,000 m away. Almost all observations of Eurasian Sparrowhawks were made at the eastern or south-eastern border of the study area to Deliblato Sands.

Because of these results the species-specific significance of the study area is assumed to be low (cf. Table 4.38).

Common Buzzard

The range of Common Buzzards covers most of Europe and extends into Asia. It is the most common bird of prey in Europe of more than 1,000,000 breeding pairs (MEBS & SCHMIDT 2006).

In Serbia it is a recurring and widespread breeding bird and with 2,600 to 3,400 breeding pairs the second-most bird of prey (first Kestrel) (BIRDLIFE INTERNATIONAL 2004). In Vojvodina the breeding population is about 800 to 1,000 pairs (PUZOVIĆ 2003).

The Common Buzzard inhabits almost all habitats in the landscape that hold trees as appropriate breeding sites. Preference is given to margins of woodlands, copses and groups of trees or individual trees as well as anthropogenic structures like poles of transmission lines. Almost all types of open land in the wider area of the nesting site are used for hunting by the Common Buzzard (MEBS & SCHMIDT 2006).

Species-specific requirements both as a nesting and a hunting site are fulfilled within the study area. Common Buzzards were often observed on every observation day and VP. Two nests were located at the eastern border of the study area; four more were recorded in Deliblato Sands outside the study area. Even though small numbers of possible nesting sites were present within the planned wind farm area, no nest of this species was found there.

Due to the high number of observations but relatively low breeding density within the study area (in comparison to the surrounding) the significance of the study area is assessed to be moderate to high (cf. Table 4.38).

Booted Eagle

This species breeds in southwest, southeast and east Europe, North Africa and across Asia. For wintering it migrates to Sub-Saharan Africa and South Asia (MEBS & SCHMIDT 2006). Its European breeding population is small (as few as 4,400 pairs BIRDLIFE INTERNATIONAL 2004). It is one of the rarest birds of prey in Serbia. PUZOVIĆ (2003) estimate 8 to 10 pairs breeding in Serbia (Vojvodina 1 breeding pair). According to RAŠAJSKI (2004) the next breeding pair is far away in the western par of Vojvodina. TUCAKOV *et al.* (2005) observed Booted Eagle five times near to or at Deliblato Sands and conclude that there probably breeding took place.

The species predominantly inhabits broad areas of old forests of deciduous trees like oaks, spotted by clearings. Normally individuals hunt small mammals, insects, reptiles and birds in the clearings or at the margins of forests (MEBS & SCHMID 2006).

The study area contains no suitable nesting sites but especially the areas next to the margins of Deliblato Sands are suitable hunting areas for Booted Eagles, particular areas inhabited by Ground Squirrels. PAUNOVIĆ & KARAPANZA (2011) noticed single individuals three times between May and June 2010 at the southern border of the study area, presumably hunting Ground Squirrels. Nests of the species were not found. Because of the occurrence of the species in the reproductive period PAUNOVIĆ & KARAPANZA (2011) assume that a pair may have nested in Deliblato Sands close to the study area.

Since TUCANOVIC *et al.* (2005) observed Booted Eagles near Deliblato Sands and PAUNOVIĆ & KARAPANZA (2011a) recorded the species in the study area during their reproductive period, it can be expected that the species - at least in some years - inhabits terrain in Deliblato Sands.·

However, the study area has no suitable nesting conditions and individuals of this species were occasionally reported hunting at the southern margins of the study area.

Because this species is very rare in Serbia it is justified to assess the significance of the study area - in spite of the low number of observations - as moderate (cf. Table 4.38).

Peregrine Falcon

The Peregrine Falcon is distributed almost all over the world. In Europe it can be found from the Arctic to Mediterranean regions as well but is patchily distributed in some regions or even absent in some states of eastern Europe (MEBS & SCHMIDT 2004). The estimated population size is about 12,000 to 25,000 pairs with an increasing population trend (BIRDLIFE INTERNATIONAL 2004).

In Serbia about 65 to 80 breeding pairs are recorded, mainly restricted to the mountainous regions of southern Serbia (PUZOVIĆ 2003). Peregrine Falcons do not breed in Vojvodina (PUZOVIĆ 2003, RAŠAJSKI 2004).

One obviously migrating individual that hunted within the study area for several hours was reported in the study by PAUNOVIĆ & KARAPANZA (2011a).

The study area thus has low species-specific significance (cf. Table 4.38).

Common Kestrel

Common Kestrels are common in Europe, Asia, and Africa (MEBS & SCHMIDT 2006). The population size in Europe is large (about 330,000 to 500,000 pairs, BIRDLIFE INTERNATIONAL 2004).

In Serbia it is the most abundant bird of prey with a population size of 3,000 to 4,000 pairs. According to PUZOVIĆ (2003) the highest density in Serbia is found in the lowlands of Vojvodina and central Serbia (Vojvodina 1,300 to 1,700 pairs).

This species is common in landscapes showing patterns of cultivated land, human settlements and more structured elements like ruderal vegetation, fallow land, hedge-rows and copses.

It nests at the edges of forests, in solitary trees and on anthropogenic structures like poles of transmission lines or in towns even in large buildings (like churches or TV towers).

The study area fulfils all demands that Common Kestrels make on their species-specific breeding and hunting habitat and thus individuals of the species used the study for both hunting and breeding. Three nests where found; all located at the margins of the study area. Individuals were also often observed hunting and resting in the study area.

Because of the high number of observations but the relatively low breeding density within the study area (in comparison to the vicinity) the significance of the study area is assessed to be moderate to high (cf. Table 4.38).

Red-Footed Falcon

The range of the Red-footed Falcon extends mainly from eastern to south-eastern Europe and extends in a broad band to inner parts of Siberia. The breeding range predominantly belongs to regions with forest or steppe vegetation (Mebs & Schmidt 2006). The population in Europe is estimated to be 26,000 to 39,000 breeding pairs (BirdLife International 2011)

In Serbia the distribution of the species is restricted to Vojvodina, where Puzović (2003) estimate a population size of 250 to 300 pairs. Purger (2008) stated that the population size varies from year to year and found an overall decreasing population. In Vojvodina 116 pairs were counted in 2000 and 61 pairs in 2001. In 2009 at least 150 breeding pairs were found (Attila 2009).

Red-footed Falcons nest solitarily as well as in colonies, mainly in abandoned nests of rooks (Purger 2008). For hunting they prefer open land with a high density of insects that they catch in flight (Mebs & Schmidt 2006).

Although the study area in small areas consists of suitable habitats - at least for hunting - only a single individual was recorded within the study area. There nearest known nesting site is 7 km to the north-west of Vrsac (more than 30 km away from the study area) (Purger 2008).

In summary the significance of the study area for red-footed falcon is maximally assumed to be low (cf. Table 4.38).

Merlin

The breeding range of this species is large and comprises northern parts of Europe, Asia as well as North America. In middle and south Europe as well as in North Africa it occurs while migrating or wintering (Mebs & Schmidt 2006). The breeding population is about 31,000 to 49,000 pairs whereas the wintering population is believed to be more than 4,000 individuals.

According to Rašajski (2004) it is a common wintering guest of Vojvodina and the lowlands of central Serbia.

Wintering or migrating Merlins prefer open landscapes such as coastal habitats or cultivated land where they predominantly prey on passerine birds.

Merlins were not observed in autumn and winter 2009 or in spring of 2010 but single individuals were seen two times in November 2010.

The significance of the study area for Merlins is classified as low (cf. Table 4.38).

Eurasian Hobby

The Eurasian Hobby is distributed over a wide range covering almost all of Europe and northern parts of Asia. It migrates long distances, wintering in Sub-Saharan Africa. The population in Europe consists of approximately 71,000 to 120,000 breeding pairs.

In Serbia the species is distributed sparsely (420 to 570 breeding pairs), mostly located in the lowlands of Vojvodina (150 to 200 breeding pairs) and central Serbia (220 to 300 breeding pairs).

Eurasian Hobbies predominantly live in well structured landscapes consisting of copses, edges of forest, solitary trees or anthropogenic structures like poles of transmission lines where individuals often occupy abandoned nests of Hooks or Carrion Crows. They hunt near open water bodies catching dragonflies in flight but also in open landscapes that house enough insects or passerine birds as prey.

The conditions for hunting and breeding are partially fulfilled by the study area, predominantly at the margins where potential nesting sites are present. One pair was recorded to successfully breed on the pole of a transmission line near VP1 in 2010 as well as in 2011 (Karapandža pers. comm.), and at least two more pairs were observed several times at the eastern boundary of the study area. Furthermore, the study area was regularly used for hunting, indicating no preference for certain locations.

Accordingly, the significance of the study area for Eurasian Hobbys is assumed to be moderate to high (cf. Table 4.38).

Saker Falcon

Saker Falcons are distributed over a wide range from eastern Europe to western China (BirdLife International 2011). According to BirdLife International (2004) the sparsely distributed European population is rather small (as few as 360 pairs).

In Serbia Puzović (2003) estimate the breeding population to be about 52 to 64 pairs, yet mostly restricted to Vojvodina with 50 to 60 breeding pairs. Puzović (2007) estimate about 55 pairs in Serbia and 50 breeding pairs in Vojvodina. According to Tucakov (2008) (cited in Ragyov *et al.* 2009) the Serbian breeding population trend is increasing, being about 55 to 60 pairs at that time. Taking everything into account the population seems to be stable. As about 13 % of the European breeding population is located in Serbia, this species has a special significance among all breeding birds of Europe.

Primary habitats of Saker Falcons are landscapes dominated by steppe or forest steppe where they nest in solitary trees or on the edges of forests as well as on rocks and loess outcrops. But habitat selection changed due to the fact that Saker Falcons nowadays predominantly nest on high voltage electricity pylons where they occupy abandoned or even inhabited nests of corvid birds (ravens or rooks). Therefore, Saker Falcons increasingly inhabit treeless cultivated land (Puzović 2007, 2008). The distribution depends on the presence of medium-sized rodents such as European Ground-Squirrels as the preferred prey (Mebs & Schmid 2006). Puzović (2007) in contrast reports that Saker Falcons actually shift their diet and certain kinds of birds become more important as a prey.

The study area contains all habitat elements required by this species, though predominantly at the north and south borders where broad bands of ruderal vegetation along dirt roads are prospective habitats for European Ground-Squirrels (cf. PAUNOVIĆ & KARAPANZA 2011a). Nearby poles of transmission lines may be used as nesting sites for Saker Falcons.

On a pole of a transmission line about 2,000 m west of the planned WT 1, PAUNOVIĆ & KARAPANZA (2011) recorded a site used for breeding, yet without success. RAŠAJSKI (2011) mentioned a breeding pair that was probably present in the wider area of Dolovo. Furthermore the study area was occasionally used for hunting. Main activity was restricted to the boundaries or areas outside the study area, however, where the preferred prey - European Ground-Squirrels - is present. The distribution of European Ground-Squirrels is mapped in PAUNOVIĆ & KARAPANZA (2011a). Two small areas with European Ground-Squirrels are located in the area of the planned wind farm. One location is in north to WT 1 and WT 23, another location south to WT 38. The main areas of distribution, though, are located in Deliblato Sands.

Taking into account that the breeding population in Europe is very small, the species-specific significance of the study area is assessed to be moderate to high (cf. Table 4.38).

Grey Partridge

This species is common throughout the world. It was successfully introduced for shooting in many parts of the world. As the population was decreasing in 1970 to 1990 in Europe and this trend is still going on in western parts of Europe, this species is categorized as vulnerable (SPEC 3). PUZOVIĆ (2003) estimated 25,000 to 45,000 breeding pairs in Serbia. It is predominantly distributed in the lowlands of Vojvodina (10,000 to 15,000 pairs) and middle Serbia (10,000 to 20,000 pairs).

Grey Partridges inhabit open landscapes, predominantly cultivated land. The required habitat elements are present in almost all parts of the study area.

Individuals were seen and heard irregularly during transects walks. RAŠAJSKI (2011) assumed up to five breeding couples to be present in the area of the planned wind farm, though distinct breeding areas could not be identified.

Because of the good habitat conditions and presence of five breeding pairs, the significance of the study area is assessed to be moderate to high (cf. Table 4.38).

Common Quail

The Common Quail migrates long distances to wintering sites in Africa north of the Sahara, the Middle East, and the Arabian Peninsula. In Serbia the species is common in the cultivated lowlands predominantly of Vojvodina and middle Serbia (RAŠAJSKI 2004). About 3,000 to 5,000 individuals are estimated to inhabit Vojvodina, though the population size is decreasing (PUZOVIĆ 2003). According to RAŠAJSKI (2011) the species meanwhile is comparably rare.

Common Quails prefer open landscapes such as agrarian fields, especially winter wheat, alfalfa and clover. Dirt roads and field margins are important habitat patches as well.
The required habitat elements are mostly present throughout the study area.
Individuals were often seen and heard during bird observations or bat investigations as well. The species seemed to be widespread as a breeding species in the entire study area, while distinct breeding areas could not be identified.
Because of the good habitat conditions and the high number of recordings of Common Quails during the breeding period the significance of the study area is assessed to be high (cf. Table 4.38).

Eurasian Woodcock

Eurasian Woodcocks occur in the subartic and temperate zones of Europe and Asia. In Serbia the species is sparsely distributed with an estimated breeding population of 500 to 800 pairs (Vojvodina: 70 to 100; PUZOVIĆ 2003).
For breeding the species requires extensive unfragmented areas of broadleaved deciduous or mixed broadleaved/coniferous forest containing a dense undergrowth of shrubs and ground cover (BIRDLIFE INTERNATIONAL 2004).
Suitable breeding habitats do not exist in the study area. Specimens were only supposed to be in the surroundings of the study area during their reproductive period or while migrating.
Therefore the species-specific significance of the study area is classified, at most, as to be low (cf. Table 4.38).

Whiskered Tern

This species has an extremely large range. It is scattered throughout Europe, Asia, Africa, North America and Australia. In Serbia it is the most common tern species with an estimated number of 1,400 to 1,700 breeding pairs. Its range is restricted to the lowlands of Vojvodina and middle Serbia, where 19 colonies with 2,231 to 2,483 breeding pairs were recorded (TUCAKOV 2009). It inhabits a variety of wetland habitats but shows a preference for freshwater marshlands with scattered pools, particularly where cattle or horses graze in the surroundings (BIRDLIFE INTERNATIONAL 2004). In Serbia it inhabits predominantly fish farms (TUCAKOV 2009).
Basically the species-specific habitat requirements are not fulfilled in the study area. Furthermore, this species was rarely observed flying over the study area, showing no connection to it.
The study area has no significance for Whiskered Tern (cf. Table 4.38).

Turtle-dove

The range of this species is extremely large. It is a widespread visitor to much of Europe in summer, predominantly southern Europe. Its breeding population is very large (>3,500,000 pairs) but it is decreasing in many countries. Thus its status is considered to be declining and therefore it is categorized as a SPEC-3-species (BirdLife International 2004). It is common in Vojvodina with a breeding population of 20,000 to 50,000 pairs (entire Serbia 50,000 to 100,000 pairs: Puzović 2003).

The species inhabits mainly well-structured open landscapes, with a mix of cultivated land, shrubs, hedge-rows and copses.

The study area has nearly suitable habitats for Turtle-doves, mainly at the margins. Rašajski (2011) detected a great number of pairs in the study area and its surroundings.

Thus the species-specific significance of the study area is high (cf. Table 4.38).

Cuckoo

This species is a widespread summer migrant to Europe and Asia, wintering in Africa. It is a brood parasite laying its eggs into the nests of other bird species. The European breeding population is very large (4,200,000 to 8,600,000 pairs: BirdLife International 2004). In Serbia the species is common (Rašajski 2004), with an estimated number of 16,000 to 22,000 breeding pairs (Vojvodina 8,000 to 10,000 pairs: Puzović 2003).

The species inhabits predominantly well-structured open landscapes with a mix of cultivated land, shrubs, hedge-rows and copses.

The study area consists of nearly suitable habitats for Cuckoos, mainly at the margins. Rašajski (2011) detected a comparably low number of nesting females in the study area.

Accordingly, the significance of the study area is assessed to be low to moderate (cf. Table 4.38).

Long-eared Owl

This species inhabits wide ranges of Europe, Asia and North America. Between 380,000 and 810,000 breeding pairs are believed to populate Europe (BirdLife International 2004) Puzović (2003) estimated a breeding population of 9,000 to 13,000 pairs in Serbia. It is common in Vojvodina (Rašajski 2004) with a number 3,000 to 4,000 pairs (Puzović 2003). Its habitats are forests close to open country. It nests in trees, often coniferous, using old stick nests of other birds such as crows, ravens, magpies and various hawks.

The study area does not fulfil the requirements for breeding individuals of this species though it can probably be used for feeding but individuals are obviously more common in the surrounds of the study area.

Thus the significance of study area is assessed to be low to moderate (cf. Table 4.38).

European Scops Owl

This bird breeds in southeastern Europe into western and central Asia. For wintering it migrates to southernmost Europe and Sub-Saharan Africa. In Europe its overall breeding population is 210,000 to 440,000 pairs. It is listed as a SPEC 2-species (BirdLife International 2004). In Serbia it is distributed very sparsely (Rašajski 2004) with an estimated a breeding population of 8,500 to 11,500 pairs (Vojvodina 70 to 100 pairs Puzović 2003).

The species prefers well-structured and insect-rich open landscapes with broad-leaved trees having old tree holes.

The habitat structure of the study area itself has only few suitable sites, mainly at the margins, while the habitat quality of surroundings areas - principally Deliblato Sands - is much better. Rašajski (2011) found a small number of breeding pairs in Deliblato Sands and well-structured areas at the eastern border of the study area (old railway, abandoned farm). At the area of the planned wind farm the species was almost absent.

The significance of the study area is low. Only small areas at the eastern border are of moderate significant (cf. Table 4.38).

Little Owl

Little Owls reside in much of the temperate and warmer parts of Europe, Asia east to Korea, and north Africa and are common in Europe (>560,000 breeding pairs, BirdLife International 2004). In Serbia Puzović (2003) estimates a breeding population of 8,500 to 13,000 pairs, the species being mainly restricted to the lowlands of Vojvodina and middle Serbia (Vojvodina 1,500 to 2,000 pairs: Rašajski 2004).

The species inhabits well-structured landscapes consisting of meadows and pastures as well as an appropriate number of trees with tree wholes.

The study area is largely unsuitable for Little Owls to breed or hunt. According to Rašajski (2011) it was the rarest Owl species in the study area and its surroundings but very likely bred at the abandoned farm at the eastern border of the study area.

Even though suitable habitats are largely absent a single breeding site was detected. Still, the significance of the study area has to be assessed to be low to moderate (cf. Table 4.38).

Barn Owl (*Tyto alba*)

The Barn Owl is the most widely distributed owl species and one of the most widespread of all birds. It is common in middle and south Europe with a number of more than 560,000 breeding pairs (BirdLife International 2004). Because of a recent decline it is categorized as a SPEC 3-species. In Serbia Barn Owls mainly inhabit Vojvodina with a breeding population of 2,000 to 2,500 pairs Puzović (2003).

This bird predominantly inhabits open landscapes such as farmland or grassland with some interspersed forests. Barn Owls primarily feed on small vertebrates, particularly rodents.

The area of the planned wind farm has no potential breeding sites for this species but may be used for hunting. Breeding individuals were found at the abandoned farm and predominantly in the settlement close to the study area.

As the study area has almost no potential breeding sites its significance is assessed to be low to moderate (cf. Table 4.38).

Tawny Owl (*Strix aluco*)

The Tawny Owl is widespread in Europe and Asia. Its stable population is about 480,000 to 1,000,000 breeding pairs in Europe (BIRDLIFE INTERNATIONAL 2004). According to PUZOVIĆ (2003) 9,500 to 12,000 breeding pairs inhabit Serbia, where it is sparsely distributed. In Vojvodina 400 to 700 breeding pairs are present PUZOVIĆ (2003).

This species is found in deciduous and mixed forests and sometimes mature conifer plantations, preferring locations with access to water.

On the whole the species-specific requirements are poorly fulfilled by the study area.

The significance of the study area is assessed as low (cf. Table 4.38).

Eurasian Nightjar

This species occurs throughout northern and central Europe as well as large parts of Asia, and winters in Africa, as far south as the Cape. In Europe it is widespread with a large population size of more than 470,000 breeding pairs. The Serbian population is estimated to be about 3,500 to 5,000 pairs. In Vojvodina the breeding population is about 600 to 800 pairs PUZOVIĆ (2003). According to HEATH & EVANS (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of 200 to 300 breeding pairs.

This species prefers woodlands with gaps in vegetation and clearings often in conifer forests or heathlands having an appropriate number of trees.

The intensively cultivated land of the study area does not fulfil the species-specific requirements. RAŠAJSKI (2011) found a few breeding pairs along the railway station in the buffer zone to the planned wind farm but found none within it. The species is common and frequent in Deliblato Sands.

Overall the significance of the study area is low (cf. Table 4.38).

Alpin Swift (*Apus melba*)

The breeding area of this long-distance migratory species extends from south and middle Europe to North Africa and Asia. In its European range it is common with an estimated number of 140,000 breeding pairs. In Serbia it is a rare species occurring with 60 to 100 breeding pairs. According to PUZOVIĆ (2003) 0 to 1 breeding pair is present in Vojvodina.

Alpine Swifts build their nests in colonies in a suitable cliff hole or cave, which is the factor mostly limiting their range.
The study area and the surrounds offer no suitable nesting sites. Furthermore, the species was only seen once with a single individual.
The study area has no significance for Alpin Swifts (cf. Table 4.38).

Common Kingfisher

The Common Kingfisher is widely distributed over Europe, Asia, and North Africa, mainly south of 60°N. Its breeding population in Europe is considered to be small (BIRDLIFE INTERANTIONAL 2004). In Serbia 1,200 to 1,800 (Vojvodina 300 to 400 pairs) breeding pairs are present, mainly restricted to river habitats PUZOVIĆ (2003).
The nests are in burrows excavated by both birds of the pair in a low vertical riverbank, or sometimes a quarry or other cutting. Its diet consists of fish and to a lower degree aquatic insects or crustaceans.
Basically the species-specific habitat requirements are not fulfilled in the study area. Furthermore, this species was rarely observed flying over the study area and showed no connection to it.
The study area has no significance for Common Swifts (cf. Table 4.38).

European Bee-eater

This species is widespread as a breeding bird in south and south-east Europe, south-west Asia as well as north-west Africa. It migrates long distances, wintering in tropical Africa, India and Sri Lanka. More than 480,000 pairs are estimated to breed in Europe (BIRDLIFE INTERNATIONAL 2004).
PURGER (2001) estimated the breeding population in Vojvodina based on a questionnaire survey to be about 1,000 to 2,000 pairs. According to PUZOVIĆ (2003) the population size is about 2,000 to 2,500 pairs (entire Serbia: 2,600 to 3,600).
In Vojvodina Bee-eaters predominantly nest in loess faces, vertical riparian banks, sand pits or in excavation sites (PURGER 2001). ANTAL (1973 cited in PURGER 2001) reported that within the sandy steppe of Deliblato, the number of breeding pairs was about 1,000. RAŠAJSKI (2011) mentioned an estimated number of 4,000 to 5,000 breeding couples in Deliblato Sands. Foraging grounds are situated in open and insect-rich landscapes, where birds mainly feed on bees and wasps but occasionally hunt other larger insects as well.
The study area may be used as a foraging ground while the adjacent habitats of Deliblato Sands offer suitable breeding conditions. According to RAŠAJSKI (2011) up to 300 couples bred along the old railroad.
All considered, the significance of study area is assumed to be moderate (cf. Table 4.38).

European Roller

According to BirdLife International (2004) the nominate form is distributed around the Mediterranean, east Europe and Asia Minor eastwards through north-west Iran to south-west Siberia (Russia). It migrates long distances, wintering in Sub-Saharan Africa.

The breeding population is approximately less than 110,000 pairs, showing declines in most European countries and throughout its entire breeding-range. According to the IUCN-category its conservational status is Near Threatened (NT) (BirdLife International 2004).

In Serbia Puzović (2003) estimates the breeding population to be about 60 to 75, with 15 to 20 pairs inhabiting Vojvodina. According to Puzović (2003) the population is decreasing.

European Rollers live in dry and insect-rich habitats with scattered trees or adjacent light forest. The species nests in tree holes or self-excavated holes - like the European Bee-eater - in loess faces, vertical riparian banks, sand pits or in excavation.

Deliblato Sands may be an appropriate breeding habitat (however no engaged nests were known at Deliblato Sands (cf. Rašajski 2011), while some parts of the study area has suitable foraging conditions, predominantly hedge-rows and broad insect-rich ruderal stretches along the dirt road to the margins of the study area.

A single individual was recorded in the study area in 2010 by both teams. No evidence of regular use of the study area at least as a foraging site could be recorded. Thus the significance of the study area for European Roller is assigned to be low at most (cf. Table 4.38).

Hoopoe

This species is very common in Europe, Asia and Africa. In Europe it is a widespread and numerous breeder of the southern half of Europe with a breeding population more than 890,000 pairs (BirdLife International 2004). In Serbia the breeding population is about 8,000 to 11,000, while Vojvodina is inhabited by 2,500 to 3,000 pairs.

The Hoopoe has two basic requirements on its habitat: bare or lightly vegetated ground to forage on, and vertical surfaces with cavities (such as trees, cliffs or even walls, nestboxes, haystacks, and abandoned burrows) to nest in. These requirements can be met by a wide range of ecosystems and as a consequence Hoopoes inhabit a wide range of habitats from heathland, wooded steppes, savannas and grasslands, as well as glades inside forests.

The study area is nearly devoid of potential breeding sites but after harvesting may potentially be used for foraging.

In Deliblato Sands the species nests and breeds in small numbers. The east border of study area is occasionally used for foraging, while the species was nearly absent in wide areas of the planned wind farm (Rašajski 2011).

Accordingly, the significance of the study area is assumed to be low (cf. Table 4.38).

Eurasian Wryneck

This species breeds in temperate regions of Europe and Asia. It migrates to winter in tropical Africa and southern Asia. According to BIRDLIFE INTERNATIONAL (2004) it is a widespread summer visitor with a breeding population of more than 580,000 pairs. In Serbia PUZOVIĆ (2003) assumes 5,600 to 8,000 pairs to be present (Vojvodina 900 to 1,100 pairs).

This bird prefers woodland and orchards. According to HEATH & EVANS (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of 100 to 150 breeding pairs.

There was no indication found that Wrynecks used the habitats of the study areas at least occasionally.

Thus the significance of the study area for Wrynecks is low at most (cf. Table 4.38).

Green Woodpecker

More than 75% of the range of the Green Woodpecker is in Europe, where it is absent from some northern and eastern parts and from Ireland, Greenland and the Macaronesian Islands but otherwise distributed widely. The European breeding population is large (>590,000 pairs) (BIRDLIFE INTERNATIONAL 2004). In Serbia it is common with a breeding population of 8,000 to 11,000 pairs (Vojvodina: 1,000 to 1,500 pairs).

A combination of old deciduous trees for nesting and nearby feeding grounds with plenty of ants for foraging is essential. This is usually found in semi-open landscapes with small woodlands, hedges, scattered old trees, edges of forests and floodplain forests. Suitable habitats for foraging include grassland, heaths, plantations, orchards and lawns.

The species is common in Deliblato Sands and near the study area (RAŠAJSKI 2011). The study area itself, however, has no suitable nesting sites for Green Woodpeckers in wide areas. Possible nesting sites could only be found at the margins of the study area but remained unused during the study period.

Individuals of the species were seen several times in the study area, so it might be used as a foraging ground.

Due to the lack of possible nesting sites the species-specific significance of the study area is low (cf. Table 4.38).

Crested Lark

The Crested Lark breeds across most of temperate Eurasia from Portugal to northeast China and eastern India, and in Africa south to Niger. The European population is very large (>3,600,000 pairs, BIRDLIFE INTERNATIONAL 2004). The species is common in the lowlands of Serbia (RAŠAJSKI 2004). PUZOVIĆ (2003) assumes 38,000 to 52,000 breeding pairs to be present in Serbia (Vojvodina 13,000 to 17,000).

This species occurs in open, mainly cultivated land, where it nests on the ground and feeds on seeds and insects.
The species-specific requirements regarding breeding and foraging are well fulfilled by the study area. Thus it was a frequent nesting species in the area.
The significance of the study area for Crested Larks is assessed as high (cf. Table 4.38).

Wood Lark

The range of this species extends throughout most of Europe (except the far north), the Middle East Asia and the mountains of North Africa. The very large breeding population is estimated to be more than 1,300,000 pairs (BIRDLIFE INTERNATIONAL 2004). In Serbia it distributed sparsely (RAŠAJSKI 2004), with a total breeding population of about 8,500 to 12,000 pairs (Vojvodina 2,500 to 3,500 pairs: PUZOVIĆ 2003). According to HEATH & EVANS (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of 400 to 700 breeding pairs.
While surroundings of the study area are fairly rich in breeding couples of this species (Deliblato Sands), wide areas of the study area themselves have no suitable habitats for Wooded Larks. Possible nesting sites could only be found at the borders of the study area. Thus this species was detected only rarely.
The significance of the study area for Wooded Larks is assessed as low (cf. Table 4.38).

Skylark

This species breeds across most of Europe and Asia and in the mountains of North Africa. The European population is extremely large with a total number of more than 40,000,000 pairs. As the species underwent large declines from 1970 with the decline continuing in many western countries, it is assessed to be depleted (SPEC 3) (BIRDLIFE INTERNATIONAL 2004). In Serbia it is common mainly in regions of lower altitude (RAŠAJSKI 2004). PUZOVIĆ (2003) estimates a breeding population of about 300,000 to 400,000 pairs (Vojvodina 260,000 to 300,000 pairs). According to HEATH & EVANS (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of 400 to 700 breeding pairs.
As a primary breeder in steppe areas, the species today is most common in open cultivated land, where it nests on the ground and feeds on seeds and insects.
The species-specific requirements regarding breeding and foraging are well fulfilled in the study area. Thus it was a species nesting frequently in the area.
The significance of the study area for Skylark is assessed as high (cf. Table 4.38).

Barn Swallow

The Barn Swallow is the most widespread species of swallow in the world. It is found in Europe, Asia, Africa as well as the Americas. Its breeding population in Europe is extremely large (>16,000,000 breeding pairs) but underwent a decline between 1970 and 1990 that still continues in central Europe. Thus this species is assessed as depleted (SPEC 3) (BIRDLIFE INTERNATIONAL 2004).

In Serbia it is common (RAŠAJSKI 2004), with a total of about 200,000 to 350,000 breeding pairs (Vojvodina 30,000 to 60,000 pairs).

The preferred foraging habitat of the Barn Swallow is the open country with low vegetation, such as pasture, meadows and farmland, preferably with water nearby. This swallow avoids heavily wooded or precipitous areas and densely built-up locations. The presence of accessible open structures such as barns, stables, or culverts to provide nesting sites, and exposed locations such as wires, roof ridges or bare branches for perching, are also important in the bird's selection of its breeding range.

While the settlements in the vicinity of the study area is fairly rich in breeding pairs of this species, wide areas of the study area offer no suitable breeding habitats for Bran Swallows. Possible nesting sites could only be found at some anthropogenic structures (abandoned farms) at the borders of the study area. However the Barn swallow is a common foraging guest to the study area.

Because of the almost complete lack of possible nesting sites, the species-specific significance of the study area is low (cf. Table 4.38).

Common House Martin

The Common House Martin is a migratory bird that breeds in Europe, North Africa and temperate Asia. Over 9,900,000 breeding pairs are estimated to inhabit Europe. As the population underwent a decline between 1970 and 1990 that still continues in central Europe, the species is evaluated as declining (SPEC 3) (BIRDLIFE INTERNATIONAL 2004).

In Serbia it is as common as the Bran Swallow but with a slightly lower breeding density of 130,000 to 200,000 breeding pairs. In Vojvodina the population size is a bit higher than that of the Barn Swallow (60,000 to 80,000) (PUZOVIĆ 2003).

The preferred foraging habitat of the Common House Martin is - as for Barn Swallows - open country with low vegetation, such as pasture, meadows and farmland, and preferably near water. Nesting site preference differs, however, as Common House Martins are much more urban and can even be found in city centres.

While the settlements in the vicinity of the study area is fairly rich in breeding couples of this species, wide areas of the study area offer no suitable habitats for House Martins. Possible nesting sites could only be found at some anthropogenic structures (abandoned farms) at the borders of the study area. However the House Martin is a common foraging guest to the study area.

Because of the almost complete lack of possible nesting sites, the species-specific significance of the study area is low (cf. Table 4.38).

Tawny Pipit

This species breeds in much of temperate Europe and Asia, and northwest Africa but is absent of most parts of central Europe. It is a migrant moving to tropical Africa and the Indian subcontinent in winter. More than 1,000,000 breeding pairs are assumed to be present in Europe but they underwent a large decline between 1970 and 1990 that still continues in some European states. Thus the species is evaluated as declining (SPEC 3) (BIRDLIFE INTERNATIONAL 2004).

In Serbia (3,000 to 4,500 breeding pairs) it is sparsely distributed, predominantly to Vojvodina (2,000 to 2,500 pairs) (PUZOVIĆ 2003, RAŠAJSKI 2004).

RAŠAJSKI (2011) assessed the species to be relatively common in the forest-steppe habitats close to the study area, while a very low number of breeding pairs may exist at the border areas to the study area.

Accordingly, the species-specific significance of the study area is assessed as moderate (cf. Table 4.38).

Northern Wheatear

The Northern Wheatear is a migratory, insectivorous species breeding in open stony country in Europe and Asia with footholds in northeastern Canada and Greenland as well as in northwestern Canada and Alaska. It is widespread in Europe with a total of more than 4,600,000 breeding pairs but suffered widespread declines in the 90ies of the last Century. Thus it is evaluated as declining (SPEC 3) (BIRDLIFE INTERNATIONAL).

The species is sparsely distributed in Serbia with a total number of 7,000 to 10,000 breeding pairs (Vojvodina: 700 to 1,000) (PUZOVIĆ 2003).

Typical habitats in Europe can be found land in mountain regions or coastal dunes. They also inhabit other landscapes where they prefer open and rocky habitats. They nest in rock crevices and rabbit burrows.

Typical habitats are poorly represented in the study area. Most suitable are areas along the old railway where RAŠAJSKI (2011) assumes five breeding pairs.

Because most of the study area has no suitable habitats for the species the significance is assessed as low to moderate (cf. Table 4.38).

Barred Warbler

The breeding range of the Barred Warbler extends from the temperate regions of central and eastern Europe to western and central Asia. It migrates long distances wintering in tropical eastern Africa. Its European breeding population is >460,000 pairs (BIRDLIFE INTERNATIONAL 2004).

In Serbia its distribution is mostly restricted to Vojvodina where 4,500 to 5,500 pairs are assumed to to breed (PUZOVIĆ 2003). According to HEATH & EVANS (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of about 800 breeding pairs.

The Barred Warbler prefers well-structured landscapes consisting of open land and bushes for nesting as well as hedge-rows, edges of forests and clearings within woodlands.
Typical habitats could be found mainly at the borders of the study area but there was no indication that these habitats were used by Barred Warblers at least occasionally.
Thus the significance of the study area for Barred Warbler is low at most (cf. Table 4.38).

Spotted Flycatcher

Spotted Flycatcher inhabits most of Europe and western Asia, migrating to Africa and south western Asia for the winter. The breeding population in Europe is extremely large (14,000,000). It is evaluated as depleted (BirdLife International 2004).
In Serbia it is sparsely distributed (6,000 to 8,000 breeding pairs), predominantly to Vojvodina (2,000 to 3,000 breeding pairs) and middle Serbia (Puzović 2003, Rašajski 2004).
They inhabit deciduous woodlands, parks and gardens, with a preference for open areas with trees.
The species-specific requirements are poorly fulfilled in the study area. Suitable habitats are only present at the border of the study area.
Furthermore no indication was found that Spotted Flycatcher used the habitats of the study areas at least occasionally. Thus the significance of the study area for Spotted Flycatcher is low at most (cf. Table 4.38).

Red-backed Shrike

This bird breeds in most of Europe and western Asia and winters in tropical Africa. According to BirdLife International (2004) its European breeding population is very large (more than 6,300,000 pairs).
The habitat requirements are very similar to that of the Barred Warbler. It prefers well-structured landscapes consisting of open land and bushes for nesting as well as hedge-rows, edges of forests and clearings within woodlands.
In Vojvodina the breeding population is about 15,000 to 20,000 breeding species (Puzović 2003). According to Heath & Evans (2000) Deliblato Sands is the most important breeding site for this species in Serbia with a total number of 1,000 to 1,500 breeding pairs.
Rašajski (2011) recorded up to 15 couples within the study area where they were found at more structured sites on the margins.
In comparison to Deliblato Sands this breeding density is low so the significance of the study area – bearing in mind that large areas are comprised of rather unsuitable habitats – for Red-backed Shrikes is assessed to be moderate (cf. Table 4.38).

<u>Lesser Grey Shrike</u>

The range of this migrating species extends from large areas in Asia to south-east and eastern Europe. It winters in southern parts of Africa. According to BirdLife International (2004) the breeding population is large (>620,000 breeding pairs) but suffered an extensive reduction. Thus the species is evaluated as declining (SPEC 3).

It is a sparsely distributed and rare species in Serbia with 350 to 450 breeding pairs (Vojvodina: 140 to 180) (Puzović 2003, Rašajski 2004).

Typical habitats for Lesser Grey shrikes comprise dry and open lands with solitary trees for perching with an appropriate amount of insects, predominantly ground-living beetles (forest-steppe or steppe). The species-specific requirements are best fulfilled in Deliblato Sands. In the study area Lesser Grey Shrikes occurred very rarely and no indication for a breeding couple was found.

The species-specific significance of the study area is low (cf. Table 4.38).

<u>Common Starling</u>

Recently the species showed a wide breeding range since it was introduced to many parts of the world. It can in fact be found in North America, Europe, Asia, Australia and North and South Africa. The European breeding population is extremely large (>23,000,000 pairs) but suffered a decrease due to intensification of agriculture and is thus evaluated as declining (SPEC 3) (BirdLife International 2004).

In Serbia it is very common, Puzović (2003) estimating 300,000 to 600,000 breeding pairs to be present (Vojvodina: 70,000 to 120,000 pairs).

Common Starlings prefer urban or suburban areas where anthropogenic structures and trees provide adequate nesting and roosting sites. They also commonly reside in grassy areas where foraging is easy – such as farmland and pastures. Their ability to adapt to a large variety of habitats has allowed for their dispersal and establishment throughout the world – resulting in a habitat range from coastal wetlands to alpine forests.

Common Starlings used the study area very frequently as a foraging ground (predominately during migration) while potential nesting sites are almost absent and thus no nesting site was found.

Because of the great number of foraging individuals the significance of the study area for Starlings is moderate (cf. Table 4.38).

<u>House Sparrow</u>

House Sparrows can be found in most parts of the world. Its European breeding population is extremely large (>63,000,000 pairs) but has been decreasing. Thus it is evaluated as declining (SPEC 3) (BirdLife International 2004).

In Serbia it is one of the most common breeding species with an overall number of 1,000,000 to 2,000,000 pairs with 200,000 to 400,000 inhabiting Vojvodina (Puzović 2003).

The House Sparrow is closely associated with human habitations and agriculture. The House Sparrow's nesting sites are varied but it prefers the shelter of a hole. Nests are most frequently built in eaves and other crevices of houses. Holes in cliffs and banks or in tree cavities are also used. House Sparrows mostly feed on the seeds of grains and weeds but it are opportunistic and adaptable and eat whatever kind of food is available.

House Sparrows were very frequent within the study area and used the habitats mainly for foraging. Breeding sites may be present but could not be detected.

Accordingly, the significance of the study area is assessed to be moderate (cf. Table 4.38).

Eurasian Tree Sparrow

This species is widely distributed in Europe and Asia and was introduced to many other regions of the world. Its European breeding population is extremely large (>26,000,000 pairs) but declined across Europe, particularly the western and central parts. It is thus evaluated as declining (SPEC 3) (BirdLife International 2004).

It is common especially in Vojvodina and middle Serbia. In total 300,000 to 450,000 breeding pairs are assumed to inhabit Serbia (Puzović 2003).

It is frequently found on coasts with cliffs, in empty buildings, in pollarded willows along slow water courses, or in open countryside with small isolated patches of woodland. The Eurasian Tree Sparrow shows a strong preference for nest-sites near wetland habitats and avoids breeding on intensively managed mixed farmland.

In the study area the species was frequent but rarer than House Sparrows. As for House Sparrows the study area is used a foraging ground and maybe as a breeding site as well, although no nesting birds were found.

Accordingly, the significance of the study area is assessed as moderate (cf. Table 4.38).

Yellowhammer

This species has a wide breeding range extending from Europe to Asia. Its European breeding population is extremely large (>18,000,000 pairs) (BirdLife International 2004).

It is most common in middle Serbia, Vojvodina has 5,000 to 6,000 breeding pairs (Puzović 2003, Rašajski 2004).

It is most commonly found on lowland arable and mixed farmland, probably due to the greater availability of seeds. It nests in hedges, patches of scrub, and brooks especially if surrounded by wide grass margins or a cereal field.

Although the species-specific requirements are partly fulfilled, no indication was found that Yellowhammer used the habitats of the study areas at least occasionally.

Thus the significance of the study area for Yellowhammer is low at most (cf. Table 4.38).

Ortolan Bunting

This species is widely distributed in Europe (except for the northern parts) and Asia. The breeding population is very large (>5,200,000 breeding pairs) but declined across much of Europe. Thus it is evaluates as depleted (SPEC 2).

In Serbia this species is predominantly distributed in middle Serbia (3,000 to 4,000 breeding pairs), while the population size in Vojvodina is about 350 to 400 pairs (PUZOVIĆ 2003).

It inhabits warm and open landscapes with bushes, trees and copses.

No indication was found that Ortolan Bunting used the habitats of the study areas at least occasionally.

Thus the significance of the study area for Ortolan is low at most (cf. Table 4.38).

Black-headed Bunting

This species breeds in southeastern Europe east to Iran. For wintering it migrates to India. BIRDLIFE INTERNATIONAL estimates a European breeding population of more than 2,800,000 pairs. It is evaluated as depleted (SPEC 3).

In Serbia it is very rare counting 250 to 470 breeding pairs mostly in Kosovo and Metohija. In Vojvodina, PUZOVIĆ (2003) estimates 15 to 20 breeding pairs.

Black-headed Bunting breeds in open scrubby areas and cultivated land.

No indication was found that Black-headed Bunting used the habitats of the study area at least occasionally.

Thus the significance of the study area for Black-headed Bunting is low at most (cf. Table 4.38).

Corn Bunting

This species breeds across southern and central Europe, North Africa and Asia into Kazakhstan. It is mainly resident but some birds from colder regions of central Europe and Asia migrate southwards in winter. The European population is very large (>7,900,000 breeding pairs). The species decreased across much of Europe, so it is evaluated as declining (SPEC 2) (BIRDLIFE INTERNATIONAL 2004).

In Serbia it is common mainly in lowlands (RAŠAJSKI 2004). PUZOVIĆ (2003) estimates a breeding population of 20,000 to 30,000 in Serbia (Vojvodina: 8,000 to 10,000).

This species occurs mainly in open land endowed with hedge-rows, solitary trees and ruderal vegetation along dirt roads.

The species-specific requirements regarding breeding and foraging are fulfilled in the study area. Thus it was a common nesting species in the area.

The significance of the study area for Corn Bunting is assessed as high (cf. Table 4.38).

Table 4.38: Species-specific significance of the study area as a breeding or foraging habitat

| target species / species of special interest | teritories/ breeding pairs / status | significane of the study area | significant portion of the study area |
|---|---|---|---|
| Great Cormorant | rare flyover | no significance | - |
| Pygmy Cormorant | rare flyover | no significance | - |
| Black-crowed Night Heron | rare flyover | no significance | - |
| Purple Heron | possible foraging guest | low significance (at most) | - |
| White Stork | possible foraging guest | low significance (at most) | - |
| Honey Buzzard | possible foraging guest | low significance | - |
| White-tailed Eagle | not observed / distance to next breeding site more than 10 km | no significance | - |
| Western-Marsh Harrier | regular hunting guest | moderate significance as a hunting, no significance as a breeding area | open land as hunting areas |
| Nothern Goshhawk | occasional hunting guest | low significance | - |
| Eurasian Sparrowhawk | occasional hunting guest | low significance | - |
| Common Buzzard | two breeding pairs / common hunting guest | moderate to high significance | open land as hunting areas / edge of forest or forests as breeding areas |
| Booted Eagle | occasional hunting | moderate significance | margins of the study area as hunting areas (habitats of Ground Squirrels) |

continuation of Table 4.38

| target species / species of special interest | teritories/ breeding pairs / status | significane of the study area | significant portion of the study area |
|---|---|---|---|
| Peregrine Falcon | rare migrant | low significance | - |
| Common Kestrel | three breeding pairs / common hunting guest | moderate to high significance | open land as hunting areas / power transmissoin line and solitary trees as breeding sites |
| Red-footed Falcon | probably hunting guest | low significance (at most) | - |
| Merlin | occasional hunting guest while migrating | low significance | - |
| Eurasian Hobby | one breeding pair, two more territories / regular hunting guest | moderate to high significance | margins of the study area as hunting areas / power transmisson line as breeding sites |
| Saker Falcon | regular hunting guest | moderate to high significance | margins of the study area as hunting areas / power transmisson line as breeding sites |
| Grey Partridge | up to five breeding pairs | moderate to high significance | open land as a breeding and foraging area |
| Common Quail | common breeding bird | high significance | open agriculture land as breeding and foraging area |
| Eurasian Woodcock | possible foraging guest | low significance | - |
| Whiskered Tern | rare flyover | no significance | - |
| Turtle Dove | frequent breeding bird | high significance | structured agriculture land as breeding and foraging area |
| Cuckoo | rare breeding bird | low to moderate significance | - |

continuation of Table 4.38

| target species / species of special interest | teritories/ breeding pairs / status | significane of the study area | significant portion of the study area |
|---|---|---|---|
| Long eared Owl | foraging guest | low to moderate significance | - |
| European Scops Owl | possible foraging guest | low significance | - |
| Little Owl | probably one breeding pair in the buffer zone / almost absent in the study site | low to moderate significance | - |
| Barn Owl | one breeding pair in the buffer zone / almost absent in the study site | low to moderate significance | - |
| Tawny Owl | possible foraging guest | low significance | - |
| Eurasian Nightjar | breeding bird in the buffer zone / almost absent in the study site | low significance | - |
| Alpine Swift | rare flyover | no significance | - |
| Common Kingfisher | rare flyover | no significance | - |
| European Bee-eater | common foraging bird | moderate | insect-rich open land |
| European Roller | possible foraging guest | low significance (at most) | insect-rich open land |
| Hoopoe | occassional foraging guest in the buffer zone | low significance | - |
| Eurasian Wryneck | possible foraging guest | low significance | - |

continuation of Table 4.38

| target species / species of special interest | teritories/ breeding pairs / status | significane of the study area | significant portion of the study area |
|---|---|---|---|
| Green Woodpecker | possible foraging guest | low significance | - |
| Crested Lark | frequent breeding bird | high significance | open land as breeding and foraging area |
| Wood Lark | possible foraging guest | low significance | - |
| Skylark | frequent breeding bird | high significance | open land as breeding and foraging area |
| Barn Swallow | common foraging guest | low significance | - |
| Common House Martin | common foraging guest | low significance | - |
| Tawny Pipit | probably breeding bird in the buffer zone / common foraging guest | moderate significance | open land as breeding and foraging area |
| Northearn Wheatear | up to five breeding pairs in the buffer zone / rare in the study area | low to moderate significance | - |
| Barred Warbler | possible foraging guest | low significance (at most) | - |
| Spotted Flycatcher | possible foraging guest | low significance (at most) | - |
| Red-backed Shrike | common breeding bird | moderate significance | well-structured open land at the margins as foraging and breeding area |

continuation of Table 4.38

| target species / species of special interest | teritories/ breeding pairs / status | significane of the study area | significant portion of the study area |
|---|---|---|---|
| Lesser Grey Shrike | possible foraging guest | low significance | - |
| Common Starling | frequent foraging guest | moderate significance | open land as a foraging area |
| House Sparrow | frequent foraging guest | moderate significance | open land as a foraging area |
| Eurasian Tree Sparrow | frequent foraging guest | moderate significance | open land as a foraging area |
| Yellowhammer | possible foraging guest | low significance (at most) | - |
| Ortolan Bunting | possible foraging guest | low significance (at most) | - |
| Black-headed Bunting | possible foraging guest | low significance (at most) | - |
| Corn Bunting | common breeding bird | high significance | open land as breeding and foraging area |

### 4.5.2 Resting and migrating birds

#### 4.5.2.1 General assessment of the importance of study area

The study area has predominantly suitable habitat conditions for bird species that depend on wide open land for resting and / or migrating.

Resting birds

The study area comprises predominantly cultivated land, offering suitable resting conditions for bird wintering or resting in habitats of open land. However, the recorded number of resting / wintering individuals was rather low. Only on a few observation days a low to medium number of geese were recorded in the study area (once up to 300), while in general over 10,000 geese winter in the floodplains of Danube River. Waders (like lapwings) were not observed in the study area.
The investigations in 2009, 2010 and 2011 yielded no evidence that the study area has at least a moderate significance for resting birds.

Migrating birds

Bird-migration in European inland is mainly determined by the broad-fronted migration of small birds and medium-sized birds (including wood pigeon). This broad-fronted migration (see BERTHOLD 2000) is typical for those species whose predominantly used migration routes are linked to appropriate habitats. Therefore broad-fronted migration may principally be observed at any location. As a result of landscape relief in certain areas, a concentration of bird-migration may arise. Under the influence of special geomorphologic conditions that lead to corridors (coastlines, mountain ranges, river valleys), broad-fronted migration receives more direction. The effect of concentration is enhanced by a) barrier effects of certain habitats (ocean, mountain ranges), b) the length of the corridor and c) compliance with the primary direction of migration. If the corridor bends too much from the main migration route, it will be left (GATTER 2001).

The flat and open study area encompasses no leading lines that could direct bird migration. The next - at least - regionally significant geomorphologic structure leading to a congregation of migrating birds is the Danube River approximately 17 km south to the study area. According to RAŠAJSKI (2011), the Danube River is - as well as the Tisa River - considered as a main migration route in Vojvodina. On a local scale Deliblato Sands may be used as guiding structure as well (cf. RAŠAJSKI 2011).

As a consequence bird migration observed in autumn 2009 as well as in spring and autumn 2010 and spring 2011 was rather low. No larger numbers of storks or cranes were recorded. In autumn 2010 and spring 2011 few smaller flocks of geese (mainly White-fronted Goose and Greylag Goose) were reported by PAUNOVIĆ & KARAPANZA (2011b) Only some very common species (predominantly certain passerine birds, Hooded Crow and Rook or Common Buzzard and Common Kestrel) were recorded in larger numbers while migrating, hunting, or resting. Overall the number of migrating target individuals is low. Some common passerine bird - mainly birds resting on cultivated land - migrate in moderate numbers (RAŠAJSKI & PAUNOVIĆ 2010, PAUNOVIĆ & KARAPANDŽA 2011a).

The overall significance of the study area for migration is assessed to be low.

#### 4.5.2.2 Species-specific assessment of the area

On the basis of the occurrence of each species in 2009 and 2010 as well as based on the habitat features, the significance of the study area (and for large birds the vicinity of the area) as a resting habitat or as a migration route will be assessed. Following BREUER (1994), five rating levels are used: low, low to moderate, moderate, moderate to high, and high significance.

White-fronted Goose

The subspecies *A. albifrons albifrons* breeds in the artic regions of Europe (Russia) and Asia. In most parts of Europe it occurs as a wintering species with an approximately total of 1,100,000 individuals (BIRDLIFE INTERNATIONAL 2004).

The wintering population of Serbia and Montenegro is estimated to be 10,000 to 15,000 individuals (BIRDLIFE INTERNATIONAL 2004). The wintering population of Serbia is mainly distributed to the lowlands of Vojvodina. The most important wintering areas in Serbia for wintering geese are the floodplains of the large rivers, in particular the Danube.

In total 1,122 individuals in 20 flocks were recorded flying over the study area. Single individuals used the area as a foraging area as well.

Thus the species-specific significance for resting individuals is assessed as low, wheras the significance for migrating White-fronted Goose is assessed to be moderate (cf. Table 4.39).

Greylag Goose

The Greylag Goose is a breeding bird in North and East Europe as well as in large areas of Asia. For wintering some of the population moves south, while other portions of the population remain resident. The breeding population in Europe is large (>120,000 pairs) and is increasing in many countries (BIRDLIFE INTERNATIONAL 2004).

There is a small breeding population of 100 to 130 breeding pairs in Vojvodina (PUZOVIĆ 2003) but most of the individuals appear for wintering.

The most important wintering areas in Serbia for wintering geese are the floodplains of the large rivers, in particular the Danube.

In total 16 flocks of Greylag Geese were observed during the investigation. Flock size of geese in the study area reached up to 200 individuals, while most of them were observed at the margins of the study area. Individuals predominantly flew over the territory in direction to the Danube. Resting individuals could be recorded around Smederevo outside the study area on fields of winter wheat..

Summing up, the significance for migrating as well as resting Greylag Geese is assessed as low (cf. Table 4.39).

Bean Goose

This species is strongly migratory and travels between breeding grounds in the high Arctic (in Europe: Finland, Norway, Sweden and Russia) to wintering grounds in the temperate and subtropical zones. The European breeding population is about 140,000 pairs, whereas the wintering population is estimated to be more than 390,000 individuals. Most Bean Geese spend the winter in Germany, Netherlands, Poland and Hungary. The wintering population of Serbia and Montenegro is about 2,000 to 6,000 individuals (BirdLife International 2004).

The wintering population of Serbia is mainly distributed to the lowlands of Vojvodina. The most important wintering areas in Serbia for wintering geese are the floodplains of the large rivers, in particular the Danube.

Three flocks of Bean Geese with a total of roughly one hundred individuals were observed flying over the study site.

The significance for migrating as well as resting Bean Geese is assessed as low (cf. Table 4.39).

Hen Harrier

The range of this species extends to the northern parts of North America and Eurasia. In Europe it is distributed patchily across much of northern and central Europe, and the estimated population size is comparatively small (59,000 pairs: BirdLife International 2004).

In Serbia this species is common while migration and wintering, with a total number of 300 to 900 individuals (BirdLife International 2004). Normally Hen Harriers stay from October to April. The range of the wintering population is restricted to the lowlands of Vojvodina and central Serbia where wintering individuals are common (Rašajski 2004).

During migration and when dwelling in the wintering regions they hunt small mammals and birds in areas with low vegetation such as cultivated landscapes.

The study area may be used for hunting while wintering but the recorded number of individuals of the species was low. No communities of sleeping or resting individuals were found in the study area. Thus within the study area the species is classified as an occasional feeding guest while wintering.

As Team 2 could observe individuals at every VP, the species-specific significance of the study area for migrating or wintering Hen Harriers is assessed as moderate (cf. Table 4.39).

Montagu's Harrier

The range of this species extends to the northern part of North America and Eurasia. It has a widespread but patchy breeding distribution in Europe and the number of breeding pairs is estimated to be approximately 35,000 to 65,000 (BIRDLIFE INTERNATIONAL 2004). In Serbia this breeding bird is very rare with four to six pairs, three to four of them in Vojvodina (PUZOVIĆ 2003).

Montagu's Harriers inhabit widely open, agricultural landscapes (predominately cereals), where they mostly fly at low altitudes (up to 20 m) searching for and hunting prey (mainly small ground-living animals). The original breeding habitats were heathland, bogs and river basins dominated by grassland. Individuals may have large home ranges. Foraging sites can be up to 10 km away from their breeding area.

The study area is far away from known breeding sites. Furthermore, no evidence was found that Montagu's Harriers bred within the study area or its surroundings. Individuals of this species were regularly observed in April and August / September during the spring migration and at the beginning of roaming at the end of summer and during the autumnal migration without showing any preferences in site-use.

For breeding Montagu's Harriers the study area has no significance. For migrating or hunting (during the migration period) the significance of the study area is assessed to be moderate (cf. Table 4.39).

Rough-Legged Buzzard

The breeding range of this species is northernmost Europe, Asia, and North America predominantly in the tundra zone. For wintering it migrates further south. In Europe it breeds in Scandinavia and Russia, for wintering it migrates to middle and (south)east Europe (like Serbia) (MEBS & SCHMIDT 2006). The breeding population in Europe is about 38,000 to 79,000 pairs; the wintering population is estimated to be more than 69,000 individuals (BIRDLIFE INTERNATIONAL 2004). In Serbia wintering individuals arrive in November and leave in March. They are restricted to the lowlands of Vojvodina and central Serbia as well as to river valleys of the rest of Serbia, though they are common during wintering (RAŠAJSKI 2004).

The species prefers wide open cultivated land where they predominantly hunt small mammals (MEBS & SCHMIDT 2006). Although the study area has the required characteristics for wintering for this species, only a single rough-legged buzzard was recorded.

The significance of the study area for this species is assessed to be low (cf. Table 4.39).

Common Crane

The breeding areas of Common Cranes are located in north-eastern Europe and northern Asia. The breeding population consists of 74,000 to 110,000 pairs. The breeding population declined until the 1990's but since then it is largely increasing, at least in Europe (BIRDLIFE INTERNATIONAL 2004).

In Serbia the species occurs only during migration of the East European populations using the so called Baltic-Hungarian migration route, whereas details on numbers of individuals, resting places and the routes themselves still remain unknown or are changing rapidly currently (STUMBERGER & SCHNEIDER-JACOBI 2010).

In the study one small flock of ten Common Cranes were observed. Several took off from central areas of Deliblato Sands leads to the assumption that some Common Cranes may have rested in the wider surroundings of the study area in Deliblato Sands.

On the whole, the study area cannot be regarded as significant for resting Common Cranes. For migrating Common Cranes the significance is low, at the most (cf. Table 4.39).

Northern Grey Shrike

This species breeds in northern Europe, northern Asia as well as in North America. For wintering it migrates to the south. More than 250,000 breeding pairs are estimated to inhabit Europe, probably suffering a slight decline. Thus it is evaluated as depleted (SPEC 3) (BIRDLIFE INTERNATIONAL 2004).

In Serbia it is a sparsely distributed wintering guest.

For wintering it prefers open land with solitary trees, hedge-rows or bushes for perching.

The preferred habitats for wintering Northern Grey Shrikes are to a low extent present in the study area. Individuals could regularly be observed.

Accordingly, the significance of the study area for wintering Northern Grey shrikes is moderate (cf. Table 4.39).

Linnet

This species breeds in Europe, western Asia and North Africa. It is partially resident but many eastern and northern birds migrate further south. According to BIRDLIFE INTERNATIONAL (2004) more than 10,000,000 breeding pairs inhabit Europe, showing decreases in some countries. Thus the species is evaluated as declining (SPEC 3).

In Serbia the species is mainly distributed to middle Serbia and Kosovo and Metohija (in total 25,000 to 35,000), while the breeding population of Vojvodina (100 to 150) is very low (PUZOVIĆ 2003).

In the study area it was rarely observed during migration and wintering.

Accordingly, the species-specific significance of the study area for migrating or resting individuals is assessed to be low (cf. Table 4.39).

Table 4.39: Species-specific assessment of the significance of the study area as a habitat for migrating and / or roosting target species

| target species | status in the study site | significance of the study site | significant portion of the study area |
|---|---|---|---|
| White-fronted Goose | occasional roosting / regular migrating | low significance for resting / moderate for migrating | |
| Greylag Goose | occasional roosting and migrating | low significance for resting and migrating | |
| Bean Goose | rarely migrating | low significance for resting and migrating | |
| Hen Harrier | regular hunting guest while migrating / wintering | moderate significance | open land as a hunting habitat |
| Montagu's Harrier | regular hunting guest while migrating | moderate significance | open land as a hunting habitat |
| Rough-legged Buzzard | rare hunting guest while migrating | low significance | - |
| Common Crane | migrating | low significance | - |
| Northern Grey Shrike | regular hunting guest while migrating | moderate significance | mix of open and structured land as a hunting habitat |
| Linnet | rare foraging guest while migrating | low significance | - |

# 5 Potential effects by wind power plants

All vertical structures, including wind power generators, present spatial obstacles to birds. The characteristic trait of wind power generators, spinning rotor blades, constitute a visual stimulus that varies depending on wind direction and velocity. In the zone facing away from the sun, rotor blades cause the so-called shadow impact. In addition to visual stimuli, a wind power plant (WPP) also generates acoustic stimuli that potentially change a bird's environment. The structural dynamics of wind turbines inevitably cause acoustic emissions due to the air flow around the rotor and due to vibrations within the rotor blades (KLEIN & SCHERER 1996, WAGNER *et al.* 1996). Gear boxes — except for WPPs by Enercon — can also produce further acoustic emissions. Lastly, rotors cause turbulences on the lee-side of rotors which, if too strong, compromise the aerodynamic stability of flying birds, as assumed by SCHERNER (1999).

All these impacts are specific for wind power facilities and their operation. Further impairments can arise from WPP construction as well as secondary effects (maintenance, 'wind energy tourism'), though these tend to constitute temporary disturbances only. Because these various stimuli are different in terms of their perceptibility, and because their intensity declines to differing extents depending on the distance from the WPP, it is appropriate to distinguish them.

With respect to the prognosis and assessment of effects by WPPs, several basic aspects ought to be considered. As a first, it has to be assumed that anthropogenic influences are species-specific. Different bird species vary according to their perceptive capabilities regarding stimuli and thus their sensitivity. For this reason, a project's presumptive effects have to be separately predicted for each individual species. Furthermore, it has to be assumed that anthropogenic influences affect birds breeding within an area differently than those using an area for resting, foraging or just flying over. Accordingly, a prognosis has to distinguish between breeding and resting birds in addition to migrating and visiting birds.

The question as to whether wind power facilities have an impact on birds and if so, how, already came up in the 1980s (*e.g.* VAN BON & BOERSEMA 1985). The scientific literature distinguishes various effects of wind energy utilization in terms of possible consequences on birdlife (cf. BENNER *et al.* 1993).

In recent years the construction of wind turbines has given rise to much controversy relating to bird conservational issues, mainly in Europe and the United States.

Considering utilization of wind energy within the study area, the major potential hazards to birds are mortality due to collision as well as barrier effects. Other possible impacts of wind turbines are displacement due to disturbance or direct habitat change and loss.

## 5.1 Collision Risk and Mortality

Wind turbines seem to add an obstacle for bird movements and research has shown that birds do fly into rotor blades. Although some studies have recorded bird collisions, other studies give evidence that birds could detect the presence of wind turbines and generally avoid them.

### 5.1.1 Results of Collision Risks at Different Wind Farms

Presently it is not possible to exactly predict the collision risk at WPPs because of a multitude of factors that have an influence on it (JOHNSON *et al.* 2,000). Studies from Northern, Western and Central Europe available up to now mostly conclude that the problem of bird strike at sites in 'normal' landscapes can be neglected (cf. BERKHUIZEN 1987, BÖTTGER *et al.* 1990, PEDERSEN & POULSEN 1991, WINKELMAN 1992a, MUSTERS *et al.* 1996, BERGEN 2001a, ISSELBÄCHER & ISSELBÄCHER 2001a, STÜBING 2001). Only exceptional locations, such as those close to the coast (*e.g.* EVERAERT & STIENEN 2006), seem to manifest higher rates of collision.

In middle Europe, specifically with the species of Red Kite (*Milvus milvus*) and White-tailed Eagle (*Haliaeetus albicilla*), comparably high rates of collision are implied (cf. DÜRR 2004, RASRAN *et al.* 2009), though according to current knowledge it is unclear if stocks are endangered by this. RATZBOR (2008) argues that since 2005 the number of Red Kites colliding with WPPs has been declining statewide (*e.g.* in Saxony or Brandenburg) but also nationwide, whereas the number of WPPs has been steadily increasing. Compared to other causes of death, collisions with wind turbines do not pose a real threat for Red Kite populations and its stock in Germany. Illegal hunting alone brought about a tenfold higher number of casualties. Contrasting the number of Red Kites usually being found to have been killed in accidents at WPPs every year (11 individuals) with the number of WPPs existing nationwide (20,000), RATZBOR (2008) estimates an incidence rate of 1:180 even when calculating the number of unreported cases to be 10 (meaning that only one in every ten individuals killed by WPP is found). Thus, in a wind park of 10 turbines a Red Kite would be killed every 18 years.

In contrast, HÖTKER *et al.* (2004) conclude that an increase of mortality rate by 0.3 % (corresponding to 100 individuals per year) would indeed have a negative impact on the Red Kite stock. MAMMEN *et al.* (2009) also assume that wind turbines in certain locations might have a negative effect on local Red Kite populations (see also MAMMEN *et al.* 2006).

ERICKSON *et al.* (2001) collected data from many studies conducted at different wind farms in the U.S. The results indicate an average of 2.19 avian fatalities per turbine per year in the U.S. for all species combined and 0.033 raptor fatalities per turbine per year. At different wind farms in Europe the annual number of dead birds per turbine varies between 0.04 (PERCIVAL 2000) and 35.0 (EVERAERT *et al.* 2002) depending on site characteristics and bird densities. MADDERS & WHITFIELD (2006) pointed out that simply presenting mortality rates per turbine or per installed MW, in the absence of further information on the abundance of birds (or birds at risk of death), does little to inform about the

collision risk by a wind farm. LANGSTON & PULLAN (2004), furthermore, suggested a low collision rate per turbine does not necessarily mean that collision mortality is insignificant, especially in wind farms comprising several hundreds or thousands of turbines.
Comparably high mortality rates due to collision have been recorded at large wind farms in areas with high concentrations of birds: Altamont Pass in California (ORLOFF & FLANNERY 1992, HUNT 1995, SMALLWOOD & THELANDER 2004, THELANDER & SMALLWOOD 2007, SMALLWOOD & THELANDER 2008) and in the Campo de Gibraltar region (Cádiz) in Spain (BARRIOS & RODRIGUEZ 2004). In particular, large numbers of raptors have collided with wind turbines at these sites, including substantial numbers of Golden eagles (*Aquila chrysaetos*) and Griffon vultures (*Gyps fulvus*). These wind farm areas are characterized by large numbers of turbines (*ca.* 7,000 at Altamont and 256 at Cádiz, which are often closely packed together) and by predominantly small turbines comprised of lattice towers and high-speed rotors relatively close to the ground (PERCIVAL 2005). Both areas are located in mountainous surroundings, sustain important food resources and, consequently, high densities of birds that are thus susceptible to collisions with turbines.
As with Altamont or Cádiz, most of all investigated wind farms affect stationary (breeding or wintering) birds and / or small passerines migrating at night. Thus, there is a vast lack of information about collision risk for migrating birds, in particular about migrating raptors or other large birds.

During a 14-month study, which included two autumn migration periods, only two bird carcasses were found at a wind farm (66 turbines) near the Strait of Gibraltar: a Griffon Vulture, which is a stationary (wintering) bird species in the region, and a Short-toed Eagle (*Circaetus gallicus*). JANSS (2000) estimated that about 45,000 Griffon Vultures and 2,500 Short-toed Eagles fly over the wind farm per year.

In contrast to these findings BARRIOS & RODRIGUEZ (2004), during a one-year period at a wind farm (called “PESUR”, 190 turbines) located less than 10 km away from the above mentioned study area, found 28 Griffon Vultures, twelve Common Kestrels, three Lesser Kestrels, two Short-toed Eagles, one Black Kite and two White Storks. The authors estimated a mortality rate of 0.36 raptors per year per turbine. Considering the number of turbines, such increases in mortality rates may be significant for some birds, especially large, long-lived species with a generally low annual productivity and long maturation. BARRIOS & RODRIGUEZ (2004) concluded that mortality at wind power plants reflects a combination of site-specific (wind-relief interaction), species-specific and seasonal factors.

During a three-year study (2000-2002) 13 wind power plants containing 741 turbines were studied in Navarra (Spain; LEKUONA & URSÚA 2007). Thirty seven study plots containing 277 turbines were selected for fatality searches and behavioural bird observations. Overall 345 bird fatalities were recorded. Most dead birds were raptors (72.8 %) with Griffon Vultures representing 63.1 % of raptor fatalities. Most raptors were killed during spring (March to June). By contrast, all three Lesser Kestrels were found during postbreeding migration due to a postbreeding roost near a wind plant.

At the wind farm “Al Koudia” (84 turbines) in northern Morocco, corpses were searched over a three-month period in 2001 (EL GHAZI *et al.* 2001). Only two carcasses were found in autumn 2001 (one Pallid Swift (*Apus pallidus*) and one Woodlark (*Lullula arborea*) but no raptor or large bird). In autumn 2000, four other birds (mainly local, stationary species) were found by chance. It has to be mentioned that the results might lead to an underestimation of collision risk, because no correction factors (*e.g.* for search efficiency or scavenger activity) were employed.

At a wind farm (220 turbines) at the western bank of the Gulf of Suez (Egypt) corpse were searched over a four-week period in spring 2007 (BERGEN 2007). Body parts, feathers and bones of three birds were found that had died weeks or months ago — possibly by collision with a turbine. No new bird corpse was found. Due to the characteristics of the study area and the high intensity of investigation, search efficiency and / or scavengers were not regarded to play an important role. Thus, the results strongly indicate that the number of collisions was very low if not zero throughout the period of investigation. It must be pointed out, however, that the study is limited because of the short period of investigation.

### 5.1.2 Factors Influencing Vulnerability to Collision

The risk of collision depends on a broad range of external and internal factors (JOHNSON *et al.* 2000).

#### 5.1.2.1 Weather, Visibility and Season

Collision risk seems to be greatest in poor flying conditions, such as strong winds affecting a birds’ ability to control flight manoeuvres, or in rain, fog, and on dark nights when visibility is reduced (WINKELMAN 1992a, LANGSTON & PULLAN 2004). But collisions occur in conditions of good visibility, too: all of the 68 collisions at turbines of the above mentioned wind farm “PESUR” occurred on clear days (BARRIOS & RODRIGUEZ 2004); and collision of Vultures rarely occurred in strong winds, which could have indicated little manoeuvrability by Vultures.
At “PESUR” wind farm all Vultures died between October and April, with 66.7 % of all accidents happening between December and February (although Griffon Vultures are resident species in the region). BARRIOS & RODRIGUEZ (2004) assumed that the seasonal pattern of vulture deaths might be explained by flight behaviour. As is known, Griffon Vultures need vertical air currents to gain altitude. In winter thermal uplifts are rarer due to lower temperatures. Birds are thus constrained to gain altitude by slope updrafts whose forces on most winter days may be insufficient to lift vultures well above a ridge, thereby exposing them to wind turbines.

### 5.1.2.2 Site-specific Factors

It is quite obvious that a higher collision rate is to be expected at locations with high bird densities (LANGSTON & PULLAN 2004), especially with species vulnerable to collision. When comparing wind energy facilities, it appears that birds tend to be killed at rates proportional to their relative abundance amongst wind farms (SMALLWOOD & THELANDER 2004). However, there are several wind farms where the correlation between usage of the area by birds and fatality is low (ERICKSON *et al.* 2001). An investigation at several wind power plants in Spain also confirmed that the relative abundance of species does not predict the relative frequency of fatalities (LEKUONA & URSÚA 2007).

CALIFORNIA ENERGY COMMISSION (2002) and ORLOFF & FLANNERY (1992) suggested that the abundance of ground squirrels within the Altamont Pass Wind Resource Area might significantly increases raptor foraging, and thus collision risk. Within some wind farms in Navarra (Spain), Vultures and Kites were apparently killed because of livestock carcasses and dump sites nearby (LEKUONA & URSÚA 2007).

HOWELL & DI DONATO (1991) identified significant topographical features associated with collision mortality. Notably mountain passes and hill shoulders that tend to be the preferred places for crossing soaring species were associated with multiple collisions.

Field studies in the Altamont Pass Resource Area have clearly shown that there's not an equal probability of causing raptor fatalities for all turbines (MORRISION *et al.* 2007). While some turbines were involved in multiple fatalities, others killed none. Fifteen turbine strings located in highly complex topographic areas were responsible for 60 % of all raptor fatalities: 80 % of Red-tailed Hawk (*Buteo jamaicensis*) and 100 % of Golden Eagle.

The 190 wind turbines at “PESUR” wind farm — that prompted a relatively high number of collisions (BARRIOS & RODRIGUEZ 2004) — are arranged in rows along the ridges of mountains or hills, too. However, the wind farm which is less than 10 km away from “PESUR” and which is arranged in a similar way, yielded evidence of only very few collisions casualties (DE LUCAS *et al.* 2004).

### 5.1.2.3 Turbine-specific Factors

ORLOFF & FLANNERY (1992) suggested that the high collision rate at Altamont Pass might be correlated to the lattice towers of the wind turbines that provide many perches, thus attracting birds, particularly raptors, into the collision-risk zone. However, recent investigation showed that perching on wind turbines is a less important factor contributing to mortality than previously suspected (SMALLWOOD & THELANDER 2004).

PERCIVAL (2005) assumed that collision risk is higher at small turbines with high-speed rotors and with turbines brought closely together.

Differences in collision rates also appear between turbines within a single wind farm although the same turbine type is used: in “PESUR” wind farm a single group of 28 turbines (from 190) was responsible for 57 % of Griffon Vulture mortality. These turbines were arranged in two rows with little space between consecutive turbines (Barrios & Rodriguez 2004). However, little or no risk was recorded for five turbine rows having exactly the same windwall spatial arrangement.

Smallwood & Thelander (2004) found that wind turbines were most dangerous at the ends of turbine strings, at the edges of gaps in strings, and at the edges of clusters of wind turbines. Furthermore, more isolated wind turbines killed disproportionately more birds.

Barclay *et al.* (2007) found that neither rotor diameter nor tower height have an effect on bird fatalities.

#### 5.1.2.4 Species-specific Factors

Manoeuvrability and flight behaviour might be crucial factors to explain differences in collision risk between species (Drewitt & Langston 2006).

Especially soaring birds like Griffon Vulture or Golden Eagle are believed to be particularly vulnerable to collision with wind turbines (Langston & Pullan 2004) because of their lower manoeuvrability and their dependence on thermals. In contrast, at "PESUR" other soaring birds, such as Common Buzzards (*Buteo buteo*) or Short-toed Eagles, often circled together with vultures in slope updrafts but did not closely approach the turbine blades and rarely collided with them. Barrios & Rodriguez (2004) suggest that these species have lower wing loads than vultures and make a more efficient use of the ascending currents, gaining altitude faster and farther away from turbines.

In the Altamont Pass Wind Resource Area Smallwood *et al.* (2009) found that fatality rates were high for Red-tailed Hawk (*Buteo jamaicensis*) and American Kestrel (*Falco sparverius*) but low for Common Raven (*Corvus corax*) and Turkey Vulture (*Cathartes aura*), indicating specific behaviours or visual acuity differentiated these species in terms of susceptibility to collision.

Ornis Consult (1999) subdivided soaring birds into four different categories depending on manoeuvrability and flight behaviour. On the basis of this classification we can deduce the vulnerability of different species to collision (see Table 5.1).

Nevertheless, collision risk seems to depend not only on manoeuvrability and flight behaviour but also to a large (or maybe larger) extent on species-specific avoidance behaviour.

In the wind farm at the western bank of the Gulf of Suez the majority of birds migrating at altitudes below 100 m showed clear avoidance behaviour in the presence of the wind turbines (Bergen 2007). While Steppe Buzzards predominantly changed flight direction and avoided to enter the wind farm area altogether, most Black Kites gained altitude and subsequently mostly entered the wind farm at heights above rotor blades though occasionally at rotor heights too, thus either passing the wind farm above or through it. Furthermore, the results of the study indicate that birds migrating individually are less sensitive to the presence of wind turbines than flocks. Large flocks seem to avoid wind turbines at greater distances.

Table 5.1: Assessment of species-specific vulnerability to collision depending on manoeuvrability and flight behaviour (according to ORNIS CONSULT 1999)

| category | description | species | vulnerability to collision |
|---|---|---|---|
| very passive fliers | very dependent on thermals | Egyptian vulture, Short-toed eagle and all Eagles of the genus Aquila | very high |
| less passive fliers | less dependent on thermals | Buzzards, Kites, Honey buzzard, Storks, Cranes and Pelicanes | medium to high |
| less active fliers | rely on thermals to a limited extent | Harriers and Sparrowhawks | low to medium |
| very active fliers | not dependent on thermals | Falcons | very low |

The preferred altitude of migration is likely to be another factor effecting collision risk in a species-specific way. Most birds of such species that tend to migrate at altitudes above 199 m (*e.g.* Eagles) are unlikely to come close to the area swept by wind turbine rotors. Other species that prefer to migrate at altitudes around turbine height might often come into the range of rotors and hence face a risk to collide.

There are indications that migrating passerines might be vulnerable to collision, especially when migrating at night (because of poor visibility; LANGSTON & PULLAN 2004). Collisions of passerines were recorded at several wind farms (*e.g.* ERICKSON *et al.* 2001). But mass collisions, which occurred at lighthouses during some nights, were not documented at wind turbines. Until now, collision risk of nocturnal migrants at onshore wind farms does not seem to be of major concern, possibly for several reasons:

- Usually nocturnal migration by passerines is at altitudes well above turbine height (*e.g.* ALERSTAM 1990), so there is a very low potential for these birds to come into a zone of collision risk. We can suggest that nocturnal migrants should be most vulnerable during take-off soon after sunset and during descent. Furthermore, birds facing strong headwinds, forcing them to fly at lower altitudes, might face an increased risk of collision.
- Due to the large populations of most passerine species they are not of major conservational interest. Results from studies in the United States indicate that the levels of fatalities are not considered significant enough to threaten local or regional population levels (STERNER *et al.* 2007).
- Most passerines have an r-selected reproductive strategy: individuals are short-lived, mature rapidly, have many offspring and a high adult and juvenile mortality. Consequently, additional mortality caused by wind turbines is unlikely to have a significant effect on populations of most passerine species.

- Mortality of passerines seems to be much higher at other anthropogenic structures compared to the mortality at wind turbines (ERICKSON *et al.* 2001).

#### 5.1.2.5 Individual Factors

Finally, collision risk might be influenced by individual attributes of a bird (*e.g.* age, experience, physical condition). It is quite obvious that the risk of collision varies depending on the stage of a bird's annual cycle (breeding, roosting or migrating).

Some studies indicate that immature birds are more vulnerable than adults, a phenomenon that may be attributed to younger birds being less experienced. However, within the Altamont Pass Wind Resource Area most Golden Eagle mortalities were not juveniles but subadults and non-breeding adults (CALIFORNIA ENERGY COMMISSION 2002).

At "PESUR" (as well as at "Al Koudia") victims were usually species with resident populations rather than species appearing during migration (EL GHAZI *et al.* 2001, BARRIOS & RODRIGUEZ 2004).

### 5.1.3 Conclusion

Many studies have shown that birds are generally able to avoid collisions with wind turbines and do not simply fly into them blindly (*e.g.* DIRKSEN *et al.* 1998, DE LUCAS *et al.* 2004, DESHOLM 2006). Nevertheless, at a few locations relevant numbers of collision casualties were found, leading to significant increases in mortality rates and possibly to population decreases.

As shown, the scale of collision depends on a wide range of factors that — in some cases — correlate with each other. It is quite plausible that a combination of factors (*e.g.* flight behaviour, wind speed and relief of location) influences collision risk. As a consequence, it is very difficult to transfer the results obtained at a particular wind farm to another. At present, the information available is insufficient to form a reliable judgement on the scale of collision at a proposed wind farm.

## 5.2 Barrier Effect

Broad flyways like most of middle Europe

Several observations show that migrating birds react to wind turbines with irritation or avoiding movements (MØLLER & POULSEN 1984, BÖTTGER *et al.* 1990). Data differ on the frequency of these reactions. WINKELMAN (1985a, b) observed changes in flight behaviour in 13 % of all individuals or flocks; with resident birds the fraction was at a mere 5 %. Most of the observed reactions were compensatory horizontal movements. Among various WPPs in Denmark, a reaction was shown by an average of 17 % of all registered individuals or flocks (ORNIS CONSULT 1989). At four sites in Western and Southern Germany, BERGEN (2001a) registered moderate or distinct reactions with 39 % of all individuals on average. In comparison to other studies a very high rate of reactions was found by ISSELBÄCHER & ISSELBÄCHER (2001b) at wind power sites in Rhineland-Palatinate. In one study SINNING & DE

BRUYN (2004) observed that during autumn migration songbirds flew through wind parks at the same rate as they flew through neighbouring settings without WPPs. In a study at the Vogelsberg (Hussia) on the behaviour of migrating birds in autumn, STÜBING (2004) detected a change of behaviour in 55 % of all observed species. Here, up to 350 m almost all animals evaded the WPP and about half up to 500 m. From 850 m on the birds scarcely changed their behaviour. Furthermore, the author points out that there were marked differences between various species or guilds. According to this, species with poor flight qualities (chiefly those living in woods) reacted substantially stronger overall than species with good flight qualities (birds of prey, swallows). From a literature survey GRUNWALD (2009, p. 25) concluded that "complexes of wind power plants are flown through without any disturbance if turbines had certain minimum interspaces between them" [at least 500 m], and that "accordingly, the significant aspect of wind parks was their penetrability".

Based on studies on the influence of wind parks on visible daytime migration on the island of Fehmarn, BIOCONSULT SH & ARSU (2010, p. 128) arrived at the following results:

- "Facing wind turbines, those birds crossing wind parks below the height of rotors show virtually no recognisable avoiding movements. Of birds crossing wind parks within the height of rotors, about 20 % show recognisable avoiding movements. In so doing there are no differences between individual groups of species; small birds show almost no avoidance movement at all. Thus, from the start birds apparently chose a path through the wind park that steered them clear of the turbines. [...]
- At altitudes higher than 200 m (ca. ¼ of the birds recorded on daytime migrations) about 60 % of the birds show avoiding movements, the movements apparently being vertical (ascending to fly over the wind park at high altitude). Birds of prey showing this kind of behaviour only constituted a small fraction of the total number of birds registered in the wind park area (ca. 7 to 10 %).
- Horizontal avoiding movements — which lead to higher numbers of birds being recorded to be outside the wind park area — were predominantly found among those species that occur in larger flocks (especially Starling, Geese, Eurasian Golden Plover, Wood Pigeon, Gulls by some measure)".

These investigations were done in middle Europe, where bird migration predominantly takes place in broad, dispersed flyways. Some investigations were done in areas with narrow flyways or even bottle necks for migration (Straight of Gibraltar).

<u>Narrow flyways or migratory bottle necks</u>

During a 14-month study at a wind farm (66 turbines in a single row on top of a mountain ridge) near the Strait of Gibraltar, 72,000 migrating birds were recorded during *ca.* 1,000 hours of observation from fixed observation points (JANSS 2000). The most abundant species were Black Kites, White Storks, House Martins (*Delichon urbica*) and Swallows (*Hirundo rustica*). Most of the migrating birds observed were passing over the wind farm but at higher average altitudes than over two control areas. Average flight altitude at the wind farm was more than 100 m above ground. Almost 72 % of all soaring birds (n = 16,225) displayed changes in flight direction in the wind farm area (DE LUCAS *et al.* 2004, DE LUCAS *et al.* 2007). Raptors appeared to be accustomed to the presence of turbines and many birds flew close to turbines (DE LUCAS *et al.* 2004).

Conclusion

In summary it can be stated that small and medium-sized birds are usually capable of flying through wind parks, meaning that wind parks do not pose a barrier effect over long distances. Avoiding movements can occur as a reaction to a single wind turbine within a wind park, depending on various factors (weather conditions, flock size, flight qualities, location, and others), and are different in terms of frequency and intensity. Occasionally, especially for flocks with larger numbers of individuals (*e.g.* Wood Pigeon), it can happen that the animals fly around a wind park altogether.
There are only few evaluations as to the relevance of observed reactions. KOOP (1996) assumes that large-scale avoiding movements consumed considerable energy reserves that would be necessary for travelling the migratory distances. For smaller birds this additional migratory distance, caused by horizontal avoiding movements, seems to be proportionally small. Taking into account that many small species of birds are theoretically capable of travelling distances of several hundred kilometres on their stores of fat fuels, the detours instigated by WPPs seem to be negligible.

PERCIVAL (2005) assumed that the ecological consequences of such barrier effects are unlikely to cause a problem at small wind farms. DREWITT & LANGSTON (2006) suggest that none of the barrier effects identified so far have significant impacts on populations. However, under certain conditions barrier effects might lead to population level impacts indirectly, *e.g.* where a wind farm effectively blocks a air route regularly used between nesting and foraging areas, or where several wind farms interact sequentially. Then large wind farms or a number of wind farms might lead to increased energy expenditures for birds and thus might reduce annual survival rates and / or breeding output (FOX *et al.* 2006, LANGSTON *et al.* 2006). In summary, until now it is not possible to reliably judge whether avoidance behaviour causes a significant effect on individuals and, ultimately, on populations.

## 5.3 Habitat loss due to avoidance behaviour

SCHREIBER (1993) found that two species of wading birds were influenced in their choice of resting place by the installation of a WPP. Most Eurasian Curlews (*Numenius arquata*) and Eurasian Golden Plovers (*Pluvialis apricaria*) kept distances of several 100 m to existing wind turbines even though they had used the area before. WINKELMAN (1992b) too registered a lower number of individuals of various resting and wintering species of birds after the construction of several turbines within an area.

With the installation of a wind park in Westphalia, habitat was lost for resting lapwings because they kept a distance of up to 200 m to the wind turbines (BERGEN 2001b). Considering further studies (*e.g.* PEDERSEN & POULSEN 1991, KRUCKENBERG & JAENE 1999), it can be assumed that WPPs constitute a disturbing stimulus for those species that rest or overwinter in larger flocks. In contrasting, in the course of monitoring a wind park with 42 turbines on the Wybelsumer Polder for several years, BRANDT *et al.* (2005) concluded that there were no negative consequences on this habitat for different visiting waders and water birds. In a wind park with 56 turbines in Western Germany, LOSKE (2007) established that outside breeding seasons most species habitating open countries showed no or only weak avoiding reactions towards turbines (up to a distance of 100 m). Only Lapwings, Tree Sparrows, and Redwings (*Turdus iliacus*) displayed clear avoidance reactions to the next wind turbine up to a distance of 200 m.

According to current knowledge, effects of WPPs on breeding birds, singular exceptions notwithstanding, seem to be low. Among breeding birds, high sensitivity is assumed mainly for quails and corn crakes (*Crex crex*) (cf. REICHENBACH *et al.* 2004). Breeding lapwings are presently supposed to display at maximum avoidance behaviour of up to 100 m to a WPP (STEINBORN & REICHENBACH 2008). Most songbirds living in open and semi-open country seem to be largely insensitive towards WPPs (cf. REICHENBACH *et al.* 2000, BERGEN 2001a, REICHENBACH *et al.* 2004, DEVEREUX *et al.* 2008, STEINBORN & REICHENBACH 2008). MÖCKEL & WIESNER (2007) too found that, breeding birds, especially when they live close to the ground, are scared off by WPPs only to a small extent, a finding that holds true for most songbirds but also most other bird species. Even for larger birds like Common Crane and Marsh Harrier, effects appear to be limited to small scales (SCHELLER & VÖKLER 2007). According to recent findings, Montagu's Harrier also seems not to show a pronounced avoidance behaviour, neither when choosing breeding sites nor during hunting (DULAC 2008, GRAJETZKY *et al.* 2008). MÖCKEL & WIESNER (2007) routinely found territorial centres of endangered larger bird species within close range (at a distance up to 300 m, often even to just 100 m) of wind turbines.

## 5.4 Dissection of functionally linked units of space

The installation of several wind turbines can reduce the quality of habitats beyond the location of the actual site of intrusion. Wind turbines supposedly present a barrier to birds, especially when erected serially (CLEMENS & LAMMEN 1995). This can lead to a dissection of functionally linked habitats. Dissecting effects of this kind can occur in coastal regions where birds regularly commute between resting places during high tide and mudflats, depending on tides. Similarly, in the inland, a species' forestal breeding site can be dissected from a foraging area located in open country. These effects will only arise, however, if individuals of a species avoid the surroundings of wind turbines during flight. Supporting evidence for such effects exist for wintering White-fronted Goose (*Anser albifrons*) (KÜHNLE 2004). So far, there is no strong evidence of this kind for other species.

# 6 Prediction and assessment of likely impacts

## 6.1 General considerations on the limits of risk assessment

As detailed in Chapter 5, collision rate depends on several factors and until now the cause-and-effect chain of collision is poorly understood.

There have been several attempts to predict collision rate at a given wind farm applying mathematical models (TUCKER 1996, BAND 2000, BAND *et al.* 2007). Modelling collision risk under the BAND model is a two-stage process. Stage 1 estimates the number of birds that fly through the rotor area. Stage 2 predicts the proportion of birds that will be hit by a rotor blade. The reliability of these collision models is limited by difficulties in gathering appropriate field data and by the large number of assumptions necessary during the modelling process, notably the level of collision avoidance. As a consequence, care must be taken not to overstate the model outputs. Nevertheless, MADDERS & WHITFIELD (2006) pointed out that alternative methods for estimating collision risk are less transparent or more subjective and at least vulnerable to the same potential biases. In contrast, CHAMBERLAIN *et al.* (2006) suggest that the value of the BAND collision risk model in estimating actual mortality rates is questionable until species-specific and state-specific avoidance probabilities can be better established. Therefore, the authors do not recommend the use of the model without further research into avoidance rates. LANGSTON & PULLAN (2004) sum up that collision risk models provide a potentially useful means of predicting the scale of collision attributable to wind turbines in a given location but only if they incorporate actual avoidance rates in response to fixed structures and post-construction assessment of collision risk at wind farms that do proceed, to verify the models.

In summary, it is very difficult for several reasons to assess collision risk as well as avoidance behaviour, which might lead to increased energy expenditure caused by a proposed wind power plant within the study area.

In practice, determining the level of significance (*e.g.* how many individuals can be killed without impacting local populations?) is another key problem.

## 6.2 Assessment of possible impacts on birds

### 6.2.1 Target species / species of special interest for which possible impacts can be excluded

Likely adverse effects by the proposed "Čibuk 1" wind farm on many of the observed species can be excluded, because

a. the significance of the study area was not assessed as at least moderate and / or
b. recent studies show that construction of wind turbines, turbines themselves or operation of turbines have no negative impact on these bird species

For these bird species it can be eliminated that likely effects of "Čibuk 1" wind farm will

- deteriorate the conservational status of the local population,
- deteriorate the ecological function of breeding or resting sites of a species and
- cause a deliberate killing during construction or operation (collision risk) of individuals.

Thus most species can be considered as not adversely affected by the planned "Čibuk 1" wind farm. Although it cannot be excluded that occasional collisions of single individuals with turbines occur, the likelihood is that low that collisions will not harm populations and, thus, are regarded as acceptable. Moreover, rare collisions are not regarded as "deliberate killing" in the sense of the bird-directive (cf. EUROPEAN COMMISSION 2007).

a. 41 target species or species of special interest can be excluded because the study area has no / low, or low to moderate significance (cf. Table 6.1 and 6.2)

Table 6.1: Species (recorded in the breeding period) for which the study area is assessed to have no, low, or low to moderate significance

| target species / species of special interest | significane of the study area |
|---|---|
| Great Cormorant | no significance |
| Pygmy Cormorant | no significance |
| Black-crowed Night Heron | no significance |
| Purple Heron | at the most low significance |
| White Stork | at the most low significance |
| Honey Buzzard | at the most low significance |
| White-tailed Eagle | no or at the most significance |
| Nothern Goshhawk | low significance |
| Eurasian Sparrowhawk | low significance |
| Peregrine Falcon | no significance |
| Red-footed Falcon | at the most low significance |
| Merlin | low significance |
| Eurasian Woodcock | at the most low significance |
| Whiskered Tern | no significance |
| Cuckoo | low to moderate significance |
| Long eared Owl | low to moderate significance |
| European Scops Owl | low significance |

continuation of Table 6.1

| target species / species of special interest | significane of the study area |
|---|---|
| Little Owl | low to moderate significance |
| Barn Owl | low to moderate significance |
| Tawny Owl | low significance |
| Eurasian Nightjar | low significance |
| Alpine Swift | no significance |
| Common Kingfisher | no significance |
| European Bee-eater | moderate |
| European Roller | low significance |
| Hoopoe | low significance |
| Eurasian Wryneck | at the most low significance |
| Green Woodpecker | low significance |
| Wood Lark | low significance |
| Barn Swallow | low significance |
| Common House Martin | low significance |
| Northearn Wheatear | low to moderate significance |
| Barred Warbler | at the most low significance |
| Spotted Flycatcher | at the most low significance |
| Lesser Grey Shrike | low significance |
| Yellowhammer | low significance |
| Ortolan Bunting | low significance |
| Black-headed Bunting | low significance |

Table 6.2: Resting or migrating species for which the study area is assessed to have no, low, or low to moderate significance

| target species / species of special interest | significane of the study area |
|---|---|
| Greylag Goose | low significance |
| Bean Goose | low significance |
| Rough-legged Buzzard | low significance |
| Common Crane | low significance |
| Linnet | low significance |

b. Eleven species are excluded because recent studies show that wind turbines have no or insignificant effect on the birds (predominantly passerine birds, cf. Chapter 4 and in particular REICHENBACH et al. 2004, MÖCKEL & WIESNER 2007, EU-COMMISSION 2010) or an adverse effect is very unlikely, because of the known behaviour of the species (cf. Table 6.3 and 6.4).

Table 6.3: Species (recorded in the breeding period) for which likely adverse effects can largely be excluded

| target species / species of special interest | significane of the study area | expected influence (without habitat loss) |
|---|---|---|
| Grey Partridge | moderate to high significance | no significant influence (Reichenbach *et al.* 2004) |
| Turtle Dove | high significance | no indications for significant influence in recent literature |
| Crested Lark | high significance | no indications for significant influence in recent literature |
| Skylark | high significance | no significant influence (Reichenbach *et al.* 2004) |
| Tawny Pipit | moderate significance | no indications for significant influence in recent literature |
| Red-backed Shrike | moderate significance | no significance influence (Reichenbach *et al.* 2004, Möckel & Wiesner 2007) |
| Common Starling | moderate significance | almost no significant influence (Reichenbach *et al.* 2004) |
| House Sparrow | moderate significance | no indications for significant influence in recent literature |
| Eurasian Tree Sparrow | moderate significance | no significant influence (EU-Commisson 2010) |
| Corn Bunting | high significance | no significant influence (Reichenbach *et al.* 2004) |

Table 6.4: Resting or migrating species for which likely adverse effects can be largely excluded

| target species / species of special interest | significane of the study area | expected influence (without habitat loss) |
|---|---|---|
| Great Grey Shrike | moderate significance | no significant influence (Möckel & Wiesner 2007) |

### 6.2.2 Target species / species of special interest for which likely adverse impacts cannot be entirely excluded

Disregarding all species separated in Chapter 6.2.1 the remaining species have to be considered in the impact assessment. These species regularly use the study area, so that its significance is at least assessed as moderate. Furthermore, significant adverse impacts cannot be excluded because these species might be affected either by disturbance effects or by collisions at wind turbines (cf. Chapter 5).

For the remaining species a violation of article 5 of the Birds Directive or article 6 of the Bern Convention, respectively, is not expected, if the project will not deteriorate the conservational status of the local population or the ecological function of breeding or resting sites.
As laid out in Table 6.5 and 6.6, nine breeding and three migrating / resting bird species have to be taken into further consideration. In addition to these species, the impact of "Čibuk 1" wind farm on White-tailed Eagle is assessed as well, due to its high collision risk, which is indicated by a number of investigations so far (cf. Chapter 5.1.1).

To predict and assess the likely impact of "Čibuk 1" wind farm the species-specific vulnerability is described first. Based on this and taking into account the species-specific significance of the study area as well as the spatial and temporal distribution of the species in the study area, it will be assessed whether the planned wind farm will lead to a

- deliberate capture or killing during construction or operation (collision risk) of individuals;
- deterioration or destruction of breeding / resting sites leading to a deterioration of the ecological function of breeding or resting sites of a species;
- deliberate disturbance of these species, particularly during the period of breeding, rearing, wintering and migration, leading to a deterioration of the conservational status of the local population.

Table 6.5: Species (recorded in the breeding period) for which likely adverse effects as such cannot be excluded

| species | significance of the study area |
|---|---|
| Common Quail | high significance |
| White-tailed Eagle | no or at the most no significance |
| Western-Marsh Harrier | moderate significance as a hunting area |
| Common Buzzard | moderate to high significance |
| Booted Eagle | moderate significance |
| Common Kestrel | moderate to high significance |
| Eurasian Hobby | moderate to high significance |
| Saker Falcon | moderate to high significance |
| European Bee-eater | moderate |

Table 6.6: Resting or migrating species for which likely adverse effects as such cannot be excluded

| species | significance of the study area |
|---|---|
| White-fronted Goose | moderate significance for migrating |
| Hen Harrier | moderate significance |
| Montagu's Harrier | moderate significance |

### 6.2.3 Breeding birds

Common Quail

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| Species-specific vulnerability at wind power plants | REICHENBACH *et al.* (2004) assess the Common Quail to be highly sensitive. The authors widely regard this evaluation as certain because all present studies document avoiding behaviour for this species (BERGEN 2001a, MÜLLER & ILLNER 2001, REICHENBACH 2003, REICHENBACH & SCHADEK 2003, REICHENBACH & STEINBORN 2004, SINNING 2004). As is contemporarily known, avoiding behaviour of Common Quails can largely be attributed to the acoustic stimuli of WPPs. It is being assumed that the rotors of WPPs produce aerodynamic noise which interferes with and masks the calls of the Common Quail and the Corn Crake making the birds cease calling (LÖBF 2011). As a consequence, the animals don't settle in the area close to a plant because communication between individuals is disturbed. The operation of a WPP can thus lead to a reduction of habitat quality and even to habitat loss for Common Quails. REICHENBACH *et al.* state about 200 to 250 m as avoidance distance.<br>In contrast, in their study of the avifauna of eleven wind fields, MÖCKEL & WIESNER (2007) could regularly detect quail patches closer than 200 m to existing WPPs, in one case even closer than 50 m. For nine examined quail patches, the minimal distance of the centre of the area to an existing WPP was 160 m on average. This study attributes the distribution pattern of the Common Quail areas to the year-to-year changes of land usage as well as to the strongly fluctuating number of Common Quail individuals.<br>In the context of the assessment of conflict it is assumed that Common Quails avoid WPPs up to a distance of 200 m. As the noise intensity decreases with increasing distance from a WPP, the area affected by noise is subdivided further. At a distance of 100 m avoidance is expected to be markedly stronger than at distances between 100 and 200 m. At distances more than 200 m to a WPP Common Quails are not expected to be substantially impaired.<br>Avoiding behaviour apparently is not an immediate reaction (like shock or flight) to acoustic stimuli. Considering this and that quails live close to the ground, it can be assumed that WPPs do not cause a dissection of spatially and functionally contiguous habitats for Common Quails by exerting a barrier effect. For this same reason the risk of collision also seems to be low. As of 08 July 2011, one Quail have been reported dead below a WPP in Europe (cf. DÜRR 2011). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>In 2010 the Common Quail was a common and widespread breeding and foraging bird-species within the open land in the study area.<br>Basically it can be assumed that adult individuals of the species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). There is a risk Common Quails might be killed or their eggs destroyed in the phase after egg deposition when nestlings are not yet capable of flight.<br>In comparison to the study area, the planning area for the construction of the proposed wind turbines and required infrastructure is very small. It is highly unlikely that a breeding pair could nest on areas affected by construction activities but it cannot be excluded entirely.<br>Because Common Quails as well as the habitat preferred by Quails, cultivated land, are common in the surroundings of the study area, the loss of a few individuals will have neither effect on the ecological function of the area nor the conservational status of the population. |

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| | Plant-related and operational effects<br>Common Quails predominantly live on the ground, so the risk of collisions at wind turbines is in general very low (see above). Collisions of single individuals at the planned wind farm cannot be excluded but are regarded to be highly unlikely. A significant collision risk can be excluded for the planned wind farm (and thus, the deliberate killing in the sense of article 5 of the Birds Directive, too). |
| Disturbance - particularly during the breeding period | Construction-related effects<br>Temporary disturbances of Common Quails related to construction can occur if the time of erection of the planned wind turbines or required infrastructure and the breeding period of the species overlap.<br>It is very likely that the effects of short-term disturbance during construction can be compensated by appropriate reactions by the affected individuals. It is not assumed that construction-related effects will lead to a deterioration of the conservational status of the local population.<br><br>Plant-related and operational effects<br>The operational wind turbines can interfere with communication between individuals. As a result Common Quails are believed to avoid the vicinity of wind turbines.<br>Predicting the impact of "Čibuk 1" wind farm, the affected area might be at the most 715 ha (*i.e.* 57 assuming an avoidance distance of 200 m around each of the 57 turbines). This is about 20 % of the study area.<br>As arable land-use is most common and widespread in the vicinity of the study area, it is very likely that Common Quails will find sufficient appropriate habitats in the surrounding, in which the species-specific requirements are fulfilled. Thus a deterioration of the local population of Common Quails is not expected (in the sense of article 5 of the Birds Directive or article 6 of the Bern Convention).<br>However, regarding the number of proposed wind turbines, it is recommended to compensate the decrease in habitat quality within the proposed wind farm by appropriate measures.<br>As there is a lack of concrete data about population size and spatial distribution of territories of the Common Quail, reliable Assumptions has to be suggested to measure, predict and assess the impact of the proposed wind turbines on Common Quails.<br>RAŠAJSKI (2011) assumed about 20 territories of Common Quail in the area of the proposed wind farm. Due to additional recordings of this species during bat investigations in 2010 PAUNOVIĆ & KARAPANDŽA (pers. comm.) believed the number of territories to be considerably higher. In the following considerations the number of territories is assumed to be about 30.<br>The wind farm area consists predominantly of open agriculture land which in general offers suitable habitats for breeding Quail. Thus it is assumed that the above mentioned 30 territories are distributed equally within the area of the proposed wind farm. As at the most 20 % of the area of wind farm will be affected (see above), 20 % of the territories (= 6 territories) would be disturbed by the operation of the wind turbines.<br>It is recommended to compensate the disturbance and the resulting deterioration of breeding and foraging habitats (see below) - as in comparable project – on an area of about 0,75 ha per territory in a distance of at least 250 m to a proposed wind turbine. In total compensatory measures are recommended on an area of about 4.5 ha (6 territories x 0.75 ha).<br>For Common Quails all measures leading to extensification of cultivated land is appropriate to increase habitat quality. In particular, the restoration of richly structured and large-scaled networks of small lots of cultivated land as well as the general absence of pesticides is important. The creation of large fallow strips |

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| | within arable land or broad and flower-rich field margins leads to higher food availability and can meet the above linking function between different habitat structures such as an extensive field use. A list of appropriate measurements can be found in Annex. Quails traditionally do not inhabit a specific acreage but occur regularly in the same field hallway. Consequently, high probabilities of colonization of the improved or newly-created areas can be assumed if located at sufficient distance (250 m) to a turbine. |
| Deterioration or destruction of habitats | <u>Construction-related effects</u><br>Common Quails are common breeders in the area of the planned wind farm. Therefore it cannot be excluded that breeding sites will be destroyed during the construction of the wind turbines and related infrastructure. However, the habitat preferred by Quails, cultivated land, are common in the surroundings of the study area, the loss of a few potential breeding sites will have no effect on the ecological function of the area nor the conservational status of the population.<br><br><u>Plant-related and operational effects</u><br>The planned wind turbines will be erected and operated in areas that may be used as breeding and foraging habitats. As outlined above the operation of the turbines could lead to a reduction of suitable breeding habitats in the study area. It is expected that breeding Common Quails will avoid turbines within a radius of approximately 200 m. The avoidance rate at turbines up to 100 m is much higher than at distances from 100 to 200 m to a WPP.<br>Overall a deterioration of (potential) breeding sites is likely to occur. As pointed out above, arable land-use is most common and widespread in the vicinity of the study area. Hence, it is very likely that Common Quails will find sufficient appropriate habitats in the surroundings in which the species-specific requirements are fulfilled. As a consequence, disturbance of individuals / pairs will have no significant effect on the local population of Common Quail or on the ecological function of the study area and its wider surroundings (in the sense of article 5 of the Birds Directive or article 6 of the Bern Convention). However, regarding the number of proposed wind turbines, it is recommended to compensate for the expected habitat loss or decrease in habitat quality by appropriate measures (see above). |
| Conclusion: Common Quail | The construction and operation of the proposed wind turbines will - under consideration of appropriate measures for compensation (cf. Chapter 7) - not lead to significant negative effects on Common Quails (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

White-tailed Eagle

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| Species-specific vulnerability at wind power plants | White-tailed Eagles seem to suffer from a particular collision risk at wind turbines, whereas habitat loss or disturbance (avoidance behaviour) appears to be much less important. Further evidence to this is the simultaneous settling of a breeding pair in the wind park Tempelberg during the erection of the first WPP.<br>Studying the effect of wind turbines on breeding and visiting birds in the area Niederlausitz, Möckel & Wiesner (2007) stated the following on White-tailed Eagle, though based on very limited observations:<br>- Within the wind farm under study, two nests of White-tailed Eagles were located at a distance of 1,000 and 2,200 m, respectively, to the nearest turbine.<br>- Occasionally individuals flew through the neighbouring wind park, suggesting a habituation effect.<br>- White-tailed Eagles approaching the turbines up 200 and 100 m appear to be little sensitive.<br>- A dead White-tailed Eagle was found at a distance of 70 m to a turbine in January 2004.<br>The authors conclude that for White-tailed Eagles the risk of collision was higher when they fly from their breeding grounds to feeding habitats. Furthermore, individuals were less cautious particularly when they became embroiled in intra- or interspecific conflicts.<br>Based on the high sensitivity of White-tailed Eagles to anthropogenic influence, the federal state of Brandenburg recommends keeping a distance of at least 3,000 m between breeding grounds and a WPP site, as well as an open space for a corridor 1,000 m wide to directly connect breeding grounds and feeding habitats at a radius of 6,000 m around the breeding site (MLUR 2003). The district council of Lower Saxony (NLT 2007) as well as the Consortium of Ornithological Stations in Germany (LAG-VSW 2007) endorse this recommendation. Möckel & Wiesner (2007) reckon that complying to these recommendations losses due to collisions can be reduced.<br>As of 08 July 2011 there is proof of 115 accidents of White-tailed Eagles at WPP in Europe (cf. Dürr 2011). Overall, the risk of collision for White-tailed Eagle at wind turbines can be regarded as high. |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). The risk that White-tailed Eagle might be killed or their eggs destroyed in the phase after egg deposition when nestlings are not yet capable of flight. The next breeding site is more than 10 km away from the planned wind farm. Furthermore, no suitable nesting sites are present in the study area.<br>It can be excluded that White-tailed Eagles could be killed or their eggs destroyed by the construction of the planned wind farm or related infrastructure.<br><br>Plant- related and operational effects<br>The next known breeding site is more than 10 km away from the planned wind farm. Individuals of the species were not observed in the study area. Furthermore, the study area does not consist of suitable habitats for breeding or hunting of White-tailed Eagle.<br>Taking all into account, Collisions of single individuals at the planned turbines or cannot ultimately be excluded but are regarded to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) is not to be expected in the planned wind farm. |

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| Disturbance - particularly during the breeding period | Construction-related effects<br>The next known breeding site is more than 10 km away from the planned wind farm. Individuals of the species were not observed in the study area. Furthermore, the study area does not consist of suitable habitats for breeding or hunting of White-tailed Eagle.<br>Disturbance of White-tailed Eagles during the construction of the wind farm is not to be expected.<br><br>Plant-related and operational effects<br>As outlined above White-tailed Eagles show no or rather low avoidance behaviour towards wind turbines. Disturbance of White-tailed Eagles during the construction of the wind farm is not to be expected. |
| Deterioration or destruction of habitats | Construction-related effects<br>The next known breeding site is more than 10 km away from the planned wind farm. In that distance a construction-related deterioration or destruction of the breeding site can be excluded.<br><br>Plant-related and operational effects<br>In addition to the above mentioned distance of the breeding site to the planned wind farm, the site also does not have suitable habitats for White-tailed Eagles. A deterioration or destruction of habitats due to the wind farm can be excluded. |
| Conclusion: White-tailed Eagle | The construction and operation of the proposed wind farm will not lead to significant negative effects on White-tailed Eagle (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Booted Eagle

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| Species-specific vulnerability at wind power plants | To date, there are no systematic studies on the behaviour of the Booted Eagle in the vicinity of wind turbines.<br>As of 08 July 2011 38 individual were found dead below wind turbines in Europe (cf. DÜRR 2011), thereof 37 in Spain, predominantly at wind farms in Cadiz, near one of the main migration route of the western flyway. |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult Booted Eagles are able to actively avoid potential risks (*e.g.* construction traffic). The risk that Booted Eagle might be killed or eggs might be destroyed exists in the phase from egg deposition until juveniles can flee from the nesting site.<br>There are no potential structures for nesting in the vicinity of the proposed turbine locations. Therefore, it can be excluded that individuals will be killed or eggs will be destroyed during the construction phase.<br><br>Plant-related and operational effects<br>Breeding sites of the species may exist in Deliblato Sands, but were not found within recent investigations. Individuals were recorded occasionally while hunting or flying at the margins of area of the planned wind farm and outside of it.<br>Taken this into account collisions of single individuals at the planned wind turbines cannot be excluded but are regarded to be unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. |
| Disturbance - particularly during the breeding period | Construction-related effects<br>The distances of suitable breeding sites in Deliblato Sands to locations of nearest turbines are large (more than 1 km) so that probable disturbance effects on nesting sites due to the construction of turbines or related infrastructure can be excluded.<br>However, the construction of turbines could lead to a temporary disturbance of hunting individuals during the reproduction period as well as during migration. It is very likely that such short-time effects can be compensated by appropriate reactions of affected individuals. Such effects will not impact the success of breeding pairs, reproduction rate or survival rate. The conservational status of the local population will not deteriorate due to any small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>The distances of suitable breeding sites to locations of nearest turbines are large so that plant-related disturbance effects on breeding individuals can be excluded.<br>The majority of birds of prey shows no or, at the most, little avoidance behaviour against wind turbines (up to 100 m). Even if operational turbines lead to a disturbance of hunting individuals at a small scale (*e.g.* up to 100 m), hunting areas at the margins of the project site or outside the wind farm site will not be affected. The significance of hunting areas within the planned wind farm is low.<br>A probably disturbance of single individuals occasionally hunting in the wind farm area will not lead to a significant effect of the local population. |

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| Deterioration or destruction of habitats | Construction-related effects<br>As outlined above, the distances of suitable breeding sites of the species to locations of nearest turbines are large so that a deterioration or destruction of breeding sites during the construction of the planned wind farm can be excluded.<br><br>Plant-related and operational effects<br>As already pointed out, the significance of the area of the proposed wind farm is low. Suitable hunting areas exist at the margins and outside the wind farm area. Furthermore, most birds of prey show no avoidance behaviour to wind turbines. Thus a deterioration or destruction of habitats can be excluded. |
| Conclusion: Booted Eagle | The construction and operation of the proposed wind farm will not lead to significant negative effects on Booted Eagle (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Western Marsh Harrier

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| Species-specific vulnerability at wind power plants | Currently there are few observations and verified findings on the effects of WPPs on Western Marsh Harriers.<br>BERGEN (2001b) repeatedly observed hunting Western Marsh Harriers after the erection of 17 WPPs in the area of a wind park in western Germany. The number of individuals, however, before and after the construction of the plants was too low to allow confident inferences on species-specific sensitivity. Still, the results indicate that wind parks don't exert a barrier effect for this species.<br>ÖKO & PLAN (2004) also repeatedly registered hunting Western Marsh Harriers in the vicinity of a wind park in eastern Germany. The breeding site had a small body of water at a distance of 1,000 m to an existing WPP.<br>According to HANDKE *et al.* (2004) two Western Marsh Harrier pairs bred around a wind park with 18 WPPs and seven individual plants, respectively. The distance between nesting sites and the closest WPP was between 400 and 600 m. Altogether, during this study hunting Western Marsh Harriers could be observed 53 times. Although individual observations derive directly from within the wind park, the results indicate an avoidance behaviour by this species. Close to a WPP (up to 100 m), in particular, occurrence of this species was markedly lower than expected. At distances ranging from 100 to 400 m, expected values were below those expected. At larger distances to the WPPs, numbers were no longer systematically lower than expected ones. HANDKE *et al.* (2004) indicate that the usage of the area mostly determined the distribution of observations, not allowing a conclusive ascertainment of the impact of WPPs on the use of land by Western Marsh Harriers.<br>Breeding Western Marsh Harriers at a distance of 300 m to an operating wind energy plant are known from Ahlum wind farm in eastern Germany (own observations). The breeding site was in a reed bed within a wet depression, surrounded by wood and shrubs towards all directions (thus probably shielding from optical and acoustic disturbances).<br>Surrounding a wind park with nine WPPs in Western Germany, hunting Western Marsh Harriers were observed repeatedly (ECODA 2005).<br>SCHELLER & VÖLKER (2007) studied the dependence of breeding site selection and breeding success of Western Marsh Harriers (and Common Cranes) from WPPs in twelve wind parks and nine reference areas in Mecklenburg-Western Pomerania. They could determine a statistically detectable avoidance effect for Western Marsh Harriers only at ranges of up to 200 m around the plants. Beyond that radius significant differences in breeding site selection could not be ascertained. Additionally, there was no statistically verifiable correlation between distance of breeding site to a WPP and breeding success.<br>As of 08 July 2011 there are 18 reports of Western Marsh Harriers having collided with a WPP in Europe (cf. DÜRR 2011). Due to the specific method of Western Marsh Harriers to hunt close to the ground, the collision risk of Western Marsh Harriers at WPPs can be regarded as low.<br>The Consortium of Ornithological Stations in Germany (LAG-VSW 2007) recommends keeping a distance of 1.000 m between WPPs and breeding sites of Western Marsh Harriers. |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). There is a risk that Western Marsh Harriers could be killed or their eggs destroyed in the period after egg deposition until the stage when juveniles are able to flee from the nesting site. Western Marsh Harriers did not breed in the study area in 2010. Typical nesting sites, reed stands of sedimentation zones of water stretches, are absent in the area. |

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| | It can be excluded confidently that Western Marsh Harriers could be killed or their eggs destroyed by the construction of wind turbines or related infrastructure.<br><br><u>Plant-related and operational effects</u><br>Western Marsh Harriers occurred regularly in the study area without showing any preferences to certain localities. They searched or hunted throughout the entire study area, almost exclusively observable flying close to the ground up to 50 m. Two flights were recorded at heights between 50 to 200 m.<br>The collision risk at wind turbines for Western Marsh Harriers is generally rated as low also (see above).<br>Based on previously published results and those of this study, it is not assumed that a significant risk of collision at the planned wind farm exists, despite the moderate hunting activity. Collisions of single individuals at the planned turbines cannot be excluded but are regarded to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. |
| Disturbance - particularly during the breeding period | <u>Construction-related effects</u><br>Temporary disturbances of Western Marsh Harriers related to the construction could appear if the time of the construction of the planned turbines or related infrastructure and the breeding period of the species overlap.<br>It is very likely that the effects of short-time disturbance during construction can be compensated by appropriate reactions by the affected individuals. Cultivated land is the dominant environment of the study area. Thus, many habitats with equal or almost equal ecological value exist in the closer and wider vicinity of the study area. Thus, individuals undoubtedly have enough equivalent space to switch to. An influence on the success of breeding pairs or on reproduction and survival of individuals is not expected. The conservational status of the local population will not deteriorate due to small-scale or temporary construction-related disturbances.<br><br><u>Plant-related and operational effects</u><br>Numerous observations suggest that Marsh Harriers hunt within wind farms without showing any avoidance behaviour against wind turbines (Only for breeders a low degree of avoidance concerning the choice of a breeding site is assumed.).<br>The planned wind turbines will therefore not lead to significant interference for Marsh Harriers. This also applies for resting Western Marsh Harriers. |
| Deterioration or destruction of habitats | <u>Construction-related effects</u><br>The locations of the turbines are planned without exception on cultivated terrain which is not a typical nesting habitat for Western Marsh Harriers in Serbia.<br>Accordingly, it can be excluded that breeding or resting sites will be deteriorated or destroyed.<br><br><u>Plant-related and operational effects</u><br>The species did not breed in the study area and suitable nesting sites are mostly absent. It is highly unlikely that Western Marsh Harriers would breed within the study area in future. Thus, a deterioration or destruction due to the operation of the planned wind farm can be excluded. |
| Conclusion: Western Marsh-Harrier | The construction and operation of the proposed wind farm will not lead to significant negative effects on Western Marsh Harrier (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Common Buzzard

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| Species-specific vulnerability at wind power plants | WPPs do not seem to affect the Common Buzzard, or only very marginally:<br>- In a before / after-study BERGEN (2001a, 2002) could not detect a significant influence on the intensity of Common Buzzards' land use by the construction of several WPPs. The distribution of registered individuals did not indicate avoidance behaviour by this species towards wind turbines, nor area-dissecting effects caused by the wind farm. Even at close-up range to turbines (below 100 m) the author could repeatedly observe Common Buzzards outside the breeding season.<br>- HOLZHÜTER & GRÜNKORN (2006) did not find a correlation between, on the one hand, population density or proximity to the next turbine and, on the other, breeding success. Breeding occurred as close as 160 m to a wind turbine.<br>- According to MÖCKEL & WIESNER (2007) Common Buzzards hunted fearlessly within several wind parks. Individual pairs bred at close range to turbines (less than 300 m).<br>- STRAßER (2006) often observed Common Buzzards in close proximity to a turbine. Some individuals often used the handrails and stairs of turbines as perches. There have even been observations of Common Buzzards flying through the rotating blades of wind turbines.<br>Considering these findings, the Common Buzzard does not seem to avoid the presence of wind turbines, neither when selecting breeding sites nor when feeding, neither during the breeding season nor outside.<br>As of 08 July 2011 there are 196 reports of Common Buzzards presumably killed in accidents with wind turbines in Europe (cf. DÜRR 2011). Accordingly, there is a specific collision risk for Common Buzzards which can be neglected, however, due to the large stock size. |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potentially occurring risks (*e.g.* construction traffic). There is a risk that Common Buzzards could be killed or their eggs destroyed in the phase after egg deposition until the stage when juveniles can flee from the nesting site.<br>There are no potential structures for nesting near the locations of the planned turbines. Therefore, it can be excluded that individuals will be killed or their eggs destroyed by the construction of the wind farm or related infrastructure.<br><br>Plant-related and operational effects<br>Based on the four breeding sites within the eastern part of the study area and two more at the margins, as well as the high numbers of observations of mainly hunting individuals at heights between 50 and 200 m, there will be a certain collision risk for the species in the area of the planned wind farm.<br>Comparing the high abundance of Common Buzzard with the rate of fatalities in Europe suggests that individuals of this species should principally be able to perceive the wind turbines and avoid them. Furthermore, no special features (*e.g.* aggregations of individuals) within the study area were observed that could lead to a significant collision risk at the proposed wind turbines compared to other locations.<br>Collisions of single individuals with turbines of the planned wind farm cannot be excluded but are regarded to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. In fact, the collision risk is expected to be so low that single fatalities will have no influence on the ecological function of the area or the conservational status of the local population. |

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| Disturbance - particularly during the breeding period | Construction-related effects<br>The distance of existing breeding sites to the nearest location of planned turbine is so long that possible disturbances of the nesting sites due to construction of the turbine or related infrastructure can be excluded.<br>However, the construction of turbines could lead to temporary disturbance of hunting individuals during the reproduction period as well as during migration and hibernation. It is very likely that the effects of short-time disturbance during construction can be compensated by appropriate reactions by the affected individuals. Cultivated land is the dominant type of habitat in the vicinity of the study area. That means a lot of habitats with an equal or nearly equal ecological value exist in the closer and wider vicinity of the study area. Thus, individuals will undoubtedly have enough equivalent space to switch to. An influence on the success of breeding pairs or on reproduction and the survival rate is not expected. The conservational status of the local population will not deteriorate due to any small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>As many observations show, Common Buzzards do not avoid wind turbines while breeding, hunting, resting or migrating (see above). Therefore, disturbance of individuals of this species can be excluded. |
| Deterioration or destruction of habitats | Construction-related effects<br>The distance of existing breeding sites to the nearest location of planned turbine is so long that possible deterioration or destruction of breeding sites during the construction of the wind farm can be excluded.<br><br>Plant-related and operational effects<br>According to many published observations, Common Buzzards do not avoid wind turbines while breeding or resting (see above). Therefore, an operational deterioration or destruction of breeding / resting sites in the vicinity of the wind farm can be excluded. |
| Conclusion: Common Buzzard | The construction and operation of the proposed wind farm will not lead to significant negative effects on Common Buzzard (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Common Kestrel

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| Species-specific vulnerability at wind power plants | The Common Kestrel does not seem to be sensitive to wind turbines or only to a very minor degree:<br>- In a before / after-study BERGEN (2001a, 2002) could not detect a significant influence on the intensity of the Common Kestrels' land use by the construction of several wind turbines. The distribution of observed individuals did not indicate an avoidance behaviour by this species towards turbines, nor area-dissecting effects caused by the wind farm. Even at close-up range to turbines (below 100 m) the author could repeatedly observe Common Kestrels outside the breeding season.<br>- SINNING *et al.* (2004) repeatedly observed Common Kestrels hunting in a wind farm. Occasionally the birds perched on the turbines' ladders and construction rings directly at the towers.<br>- According to MÖCKEL & WIESNER (2007) Common Kestrels hunted fearlessly within several wind farms. Individual pairs bred at close range to a turbine (less than 300 m). In two wind farms, individuals perched on the turbines.<br>- STRAßER (2006) often observed Common Kestrels sitting on the ground or flying / hunting in close proximity to a turbine. In one case a Common Kestrel was repeatedly seen flying through the rotating blades of a wind turbine.<br>Considering these findings, the Common Kestrel does not seem to avoid the presence of wind turbines, neither when selecting breeding sites nor when feeding, neither during the breeding season nor outside.<br>As of 08 July 2011 there are 240 reports of Common Kestrel presumably killed in accidents with wind turbines in Europe (cf. DÜRR 2011). Accordingly, there is a specific collision risk for Common Kestrel which altogether can be neglected, however, due to the large stock size. |
| Killing of individuals during construction or operation (collision risk) | <u>Construction-related effects</u><br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). The risk that Common Kestrels could be killed or their eggs destroyed exists in the phase after egg deposition until that time juveniles can flee from the nesting site.<br>There are no potential structures for nesting near the locations of planned turbines.<br>Therefore, it can be excluded that individuals could be killed or their eggs destroyed during the construction of the turbines or their infrastructure.<br><u>Plant-related and operational effects</u><br>Three breeding sites were found in the study area or its vicinity, respectively:<br>- In the north: one breeding site was located about 400 m northwest of the planned WT 1<br>- In the east: one breeding site was located more than 1 km east of the planned WT 57<br>- In the west: one breeding site was located approximately 2.5 km west of the planned WTs 14 and 15.<br>Common Kestrels generally hunt in open, agricultural landscapes. As a consequence Kestrels were often seen hunting in the study area. Due to the existence of three breeding pairs and the regular use of the wind farm area by Kestrels a certain risk of collision at the planned turbines will exist. Comparing the high abundance of this species with the number of fatalities, the collision risk is assumed to be very low. Collisions of single individuals cannot be excluded but are regarded to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. In fact the collision risk is expected to be so low that single fatalities will have no influence on the ecological function of the area and the conservational status of the local population. |

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| Disturbance - particularly during the breeding period | Construction-related effects<br>The distance of existing breeding sites to the nearest location of a planned turbine is so long that potential disturbances of the nesting sites due to construction of the turbines or related infrastructure can be excluded.<br>However, the construction of turbines could lead to temporary disturbances of hunting individuals during the reproduction period as well as during migration and wintering. It is very likely that the effects of short-time disturbance during construction can be compensated by appropriate reactions by the affected individuals. Cultivated land is the dominant type of terrain around the study area. That means a lot of habitats with an equal or nearly equal ecological value exist in the closer and wider surroundings of the study area. Thus, individuals will undoubtedly have enough equivalent space to switch to. An influence on the success of breeding pairs or on reproduction and survival rate is not expected. The conservational status of the local population will not deteriorate due to any small-scale or temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>As shown by many observations Common Kestrel does not avoid wind turbines while breeding, hunting, resting or migrating (see above). Therefore, disturbance of individuals of this species can be excluded. |
| Deterioration or destruction of habitats | Construction-related effects<br>As outlined above, the distance of existing breeding sites to the nearest location of a planned turbine is so long that a deterioration or destruction of breeding site during the construction of the wind farm can be excluded.<br><br>Plant-related and operational effects<br>According to many published observations, Common Kestrels do not avoid wind turbines while breeding or resting (see above). Therefore, an operational deterioration or destruction of breeding / resting sites in the vicinity can be excluded as well. |
| Conclusion: Common Kestrel | The construction and operation of the proposed wind farm will not lead to significant negative effects on Common Kestrel (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Eurasian Hobby

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| Species-specific vulnerability at wind power plants | Up to now there are no systematic studies on the behaviour of the Eurasian Hobby in the vicinity of wind turbines.<br>In 2003 and 2004 MÖCKEL & WIESNER (2007) detected a hatchery each in the vicinity of a wind park in eastern Germany. The distance to the closest turbine was a mere 600 and 200 m, respectively. Further, during the breeding season the birds regularly flew through the wind farm. In the wind farm Falkenberg, too, there were successful broods at a distance of less than 250 m to a turbine in 2004 and 2005 (*ibid.*). Close to the wind farm Woschkow (600 m south) a pair established a nesting site in 2004 and bred successfully (*ibid.*). During the concomitant inspection for animals dead due to collision, no casualty was found in any of the cited wind farms (*ibid.*).<br>As of 08 July 2011 ten individuals were found dead below a WPP in Europe (cf. DÜRR 2011).<br>The Consortium of Ornithological Stations in Germany recommends keeping a distance of at least 1,000 m between wind turbines and Eurasian Hobby breeding sites (LAG-VSW 2007). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). The risk that Eurasian Hobbies could be killed or their eggs destroyed exists in the phase from egg deposition until juveniles can flee from the nesting site.<br>There are no potential structures for nesting on the locations of the planned turbines. Therefore, it can be excluded that individuals can be killed or their eggs destroyed by the construction of the turbines or related infrastructure.<br><br>Plant-related and operational effects<br>One breeding site was found in the north of the study area on a power transmission pole about 470 m north to the planned WT 23. Consequently, in the northern part (at VP 1) this species was regularly recorded. In all other parts of the study area it occurred rarely, probably because the individuals were hunting in other habitats. In general, they often hunt dragonflies at fresh water bodies or other large insects that can be found in insect-rich habitats like Deliblato Sands. Thus, Eurasian Hobbys did not use the planned wind farm intensely as a hunting site. Taking this into account, as well as the comparatively low number of fatalities in Europe, the collision risk is expected to be very low.<br>Two other pairs were assumed to breed in the protected area of Deliblato Sands but more than 1 km east of the planned wind farm.<br>Collisions of single individuals at the planned wind turbines cannot be excluded but are regarded to be unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. In fact, the collision risk is expected to be so low that single fatalities will have no influence on the ecological function of the area or the conservational status of the local population. |
| Disturbance - particularly during the breeding period | Construction-related effects<br>The distance of existing breeding sites of the species to the location of nearest planned turbine is so large that probable disturbances of the nesting sites due to the construction of turbines or related infrastructure can be excluded.<br>However, the construction of turbines could lead to temporary disturbances of hunting individuals during the reproduction period as well as during migration. It is very likely that the effects of short-time disturbances during construction can be compensated by appropriate reactions by the affected individuals. An influence on the success of breeding pairs or on reproduction and the survival |

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| | rate is not expected. The conservational status of the local population will not deteriorate due to any small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>Observations provide no evidence that Eurasian Hobbies might avoid turbines while breeding, hunting, resting or migrating (see above). Therefore, disturbances of individuals of this species are excluded. |
| Deterioration or destruction of habitats | Construction-related effects<br>As outlined above, the distance of existing breeding sites of the species to the location of nearest planned turbine is so large that deterioration or destruction of breeding sites during the construction of the planned wind farm can be excluded.<br><br>Plant-related and operational effects<br>Observations provide no evidence that Eurasian Hobbies might avoid turbines while breeding hunting, resting or migrating (see above). Therefore an operational deterioration or destruction of habitats can be excluded as well. |
| Conclusion: Eurasian Hobby | The construction and operation of the proposed wind farm will not lead to significant negative effects on Eurasian Hobby (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Saker Falcon

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| Species-specific vulnerability at wind power plants | Up to now there are no systematic studies on the behaviour of Saker Falcon in the vicinity of wind turbines.<br>As of 08 July 2011 no individual was found dead below a wind turbine in Europe (cf. DÜRR 2011). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals are able to actively avoid potential risks (*e.g.* construction traffic). The risk that Saker Falcons might be killed or eggs might be destroyed exists in the phase from egg deposition until juveniles can flee from the nesting site.<br>There are no potential structures for nesting in the vicinity of the proposed turbine locations. Therefore, it can be excluded that individuals will be killed or eggs will be destroyed during the construction phase.<br><br>Plant-related and operational effects<br>One probable (unsuccessful) breeding site was found north to the study area on a power transmission pole more than 2 km west of the nearest planned turbines (WT 1 and WT 2). Another probable breeding pair was present in the wider vicinity of Deliblato Sands. Consequently, this species was occasionally recorded, predominantly at the margins of the planned wind farm area or outside of it. Within the project site Saker Falcons were rarely observed.<br>To sum up, collisions of single individuals at proposed turbines cannot be excluded but are regarded to be unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) for Saker Falcon at turbines of the "Čibuk 1" wind farm. |
| Disturbance - particularly during the breeding period | Construction-related effects<br>The distances of probable breeding sites to the locations of nearest turbines are large so that disturbance effects on nesting sites during the construction phase can be excluded.<br>However, the construction of turbines might lead to temporary disturbance effects on hunting individuals during the reproduction period as well as during migration. It is very likely that such short-time effects can be compensated by appropriate reactions of affected individuals. Hence, an impact on breeding success or survival rate is not expected. The conservational status of the local population will not deteriorate due to any small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>The distances of probable breeding sites are more than 2 km to the next location of a proposed turbine. Consequently, Plant-related disturbance effects of breeding individuals can be excluded.<br>Even if operational turbines lead to a disturbance of hunting individuals at a small scale (*e.g.* up to 100 m), hunting areas at the margins of the project site or outside the wind farm site will not be affected. The significance of hunting areas within the planned wind farm is low. A probably disturbance of single individuals occasionally hunting in the wind farm area will not lead to a significant effect of the local population. Therefore, significant disturbance effects on Saker Falcons are not expected. |

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| Deterioration or destruction of habitats | Construction-related effects<br>As outlined above, the distances of probably breeding sites to locations of nearest turbines is large so that deterioration or destruction of breeding sites during the construction phase can be excluded.<br><br>Plant-related and operational effects<br>As already pointed out, the significance of the project site for Saker Falcons is low. Furthermore, most birds of prey show no avoidance behaviour to wind turbines. Thus, a deterioration or destruction of habitats can be excluded. |
| Conclusion:<br>Saker Falcon | The construction and operation of the proposed wind farm will not lead to significant negative effects on Saker Falcon (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

European Bee-eater

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| Species-specific vulnerability at wind power plants | At present there are no scientifically substantiated findings on the influence of wind turbines on the European Bee-eater.<br>European Bee-eaters navigate visually and are very agile hunters in the air, and thus can be expected to recognize and evade wind turbines. Accordingly, the risk of birds of this species — just like other visually navigating birds that hunt insects in free airspace (swallows, swifts) — to collide with a modern wind turbine can be assessed to be low. As of 08 July 2011 no individual were found dead below a wind turbine in Europe (cf. DÜRR 2011). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals should be able to actively avoid potential risks (*e.g.* construction traffic). The risk that European bee-eater might be killed or eggs might be destroyed exists in the phase from egg deposition until juveniles can flee from the nesting site.<br>There are no potential structures for nesting in the vicinity of the proposed turbine locations. Therefore, it can be excluded that individuals will be killed or eggs will be destroyed during the construction phase.<br><br>Plant-related and operational effects<br>Nesting sites of this species exist in Deliblato Sands more than 1 km apart from the project site. Furthermore Bee-eaters are generally not expected to be particularly prone to collision at wind turbines.<br>Summing up, a significant collision risk for European Bee-eaters at "Čibuk 1" wind farm (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded. |
| Disturbance - particularly during the breeding period | Construction-related effects<br>The distances of existing breeding sites to the nearest turbines locations are large (at least 1 km) so that any disturbance effects on nesting sites due to construction of turbines or related infrastructure can be excluded.<br>However, construction of turbines might lead to temporary disturbance of hunting individuals during the reproduction period as well as during migration. It is very likely that such short-time effects can be compensated by appropriate reactions of affected individuals. Hence, an impact on breeding success or survival rate is not expected. The conservational status of the local population will not deteriorate due to any small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>The existing breeding sites are more than 1 km apart from the nearest turbine locations. Consequently, Plant-related disturbance effects of breeding individuals can be excluded.<br>Even if operational turbines lead to a disturbance of hunting individuals at a small scale (*e.g.* up to 100 m), the important hunting areas in Deliblato Sands will not be affected. The significance of hunting areas within the planned wind farm is low. A probably disturbance of single individuals occasionally hunting in the wind farm area will not lead to a significant effect of the local population. Therefore, significant disturbance effects on European Bee-eaters are not expected. |
| Deterioration or destruction of habitats | Construction-related effects<br>As outlined above, the distances of existing breeding sites and the nearest turbine locations are large so that deterioration or destruction of breeding sites during the construction phase can be excluded. |

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| | Plant-related and operational effects<br>As already pointed out, the significance of the project site is almost low. Significant habitats for Bee-eaters (Deliblato Sands) are located in a distance of more than 1 km from "Čibuk 1" wind farm. Thus deterioration or destruction of habitats can be excluded. |
| Conclusion: European Bee-eater | The construction and operation of the proposed wind farm will not lead to significant negative effects on European Bee-eater (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

### 6.2.4 Migrating or resting birds

White-fronted Goose

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| Species-specific vulnerability at wind power plants | REICHENBACH *et al.* (2004) assume a high vulnerability of resting White-fronted Geese. The avoidance distance is believed to be about 400 to 600 m.<br>In Europe only two fatalities of White-fronted Goose at wind turbines were recorded. The low number of recorded casualties might be linked to the pronounced avoidance behaviour of the species. Thus, the collision risk is generally assessed to be low (cf. DÜRR 2011) |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). White-fronted Geese do not breed in the study area. Thus, it can be excluded confidently that White-fronted Geese could be killed by the construction of the planned wind farm or related infrastructure.<br><br>Plant-related and operational effects<br>The known number of fatalities of this species is very low, thus the collision risk is assessed to be low as well.<br>Collisions of single individuals at the planned wind farm cannot be excluded but are regarded to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. |
| Disturbance - particularly during the period of hibernation and migration | Construction-related effects<br>Temporary disturbances of White-fronted Geese related to the construction can appear if the time of construction and the migration period of the species overlap. It is very likely that possible effects of short-time disturbances during construction can be compensated by appropriate reactions of the affected individuals. An influence on reproduction or the survival rate of individuals is not expected. The conservational status of the species will not deteriorate due to small-scale and temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>The species did not breed in the study area and is not expected to breed there in near future. Effects on breeding White-fronted Geese can thus be excluded.<br>There is evidence that White-fronted Geese avoid wind turbines while resting (see above). Neither breeding nor important resting sites of the species were found in the study area and it is highly unlikely that there will exist any of them in the near future. Thus, the conservational status of the population will not deteriorate due to operational effects. |
| Deterioration or destruction of habitats | Construction-, plant-related and operational effects<br>Neither breeding nor important resting sites of the species were found in the study area and it is highly unlikely that there will exist any of them in the near future. Hence a deterioration or destruction of breeding / resting sites can be excluded. |
| Conclusion: White-fronted Goose | The construction and operation of the proposed wind farm will not lead to significant negative effects on Greylag Goose (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Hen Harrier

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| Species-specific vulnerability at wind power plants | PHILLIPS (1994) studied the effects of a wind park with 22 wind turbines in Scotland. Comparing the data on the area of the wind farm to that of a reference area showed no significant effect on the local breeding population.<br>BERGEN (2001a, 2002) could repeatedly observe hunting Hen Harriers after the construction of a wind park with 17 turbines in Germany. The results indicate that constructing and operating turbines neither impairs feeding habitats nor dissects spatially and functionally contiguous habitats of this species. The sample size was too low, however, to verify the results statistically.<br>Based on observations at various wind farms and reference areas in Lower Austria, TRAXLER *et al.* (2004) cannot exclude avoiding behaviour of wintering Hen Harriers towards turbines. Hen Harriers could in many instances be observed east to a wind farm whereas this species did not occur in the wind farm itself. The authors partially explain this by the larger area lying fallow east to the wind farm. In addition, observations during winter consisted of relatively few singular incidents only, precluding any verifiable statements.<br>HANDKE *et al.* (2004) similarly detected Hen Harriers 28 times around a wind farm in northern Germany. There, Hen Harriers also strongly preferred fallow ground . There were only singular observations of Hen Harriers on the area close to the wind farm (up to 200 m). It could not be determined decisively if the distribution of the observed individuals was due to a preference towards fallow ground or due to an avoidance of turbines.<br>The results of MÖCKEL / WIESNER (2007) cannot be interpreted unambiguously. They found that Hen Harriers approached smaller wind farms as close as 200 and 100 m but kept a distance to larger facilities of at least 1,000 m. In an extensive wind park (30 turbines) at Falkenberg, however, Hen Harriers were observed hunting in the centre of the facility. Furthermore, Hen Harriers were seen to regularly hunt in high numbers between turbines in two wind farms in eastern Germany.<br>PEARCE-HIGGINS *et al.* (2009), however, could prove breeding Hen Harriers to significantly avoid turbines up to a distance of 250 m.<br>In summary, it cannot be excluded that breeding Hen Harriers appear to avoid turbines. For resting Hen Harriers, however, the availability of food on the areas under study seems to affect the incidence and spatial distribution of these birds much more strongly than the operation of a wind farm. Accordingly, for the following prognosis it can be assumed that resting Hen Harriers display no or at most very low avoiding behaviour towards wind turbines.<br>Due to the specific method of Hen Harriers to hunt close to the ground, the collision risk of Hen Harriers at turbines can be regarded as very low. WHITFIELD & MADDERS (2006) also point out that mortality caused by collision should only very rarely present a serious problem. As of 08 July 2011, there is one report of a Hen Harriers found dead below a wind turbine in Europe (cf. DÜRR 2011). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). The area of the planned wind farm is not located within the breeding range of the species. Thus it can be excluded confidently that Hen Harriers will be killed by the construction of the wind turbines or related infrastructure.<br><br>Plant-related and operational effects<br>Hen Harriers predominantly fly in low heights close to the ground. Furthermore, only one fatality of the species could be recorded up to now indicating that collision risk of the species is very low. Summing up, collisions of single individuals at the planned turbines cannot be excluded but are regarded to be |

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| | extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. |
| Disturbance - particularly during the period of hibernation and migration | Construction-related effects<br>Temporary disturbances of Hen Harriers related to the construction could occur if the time of construction of the wind farm and the wintering period of the species overlap.<br>It is very likely that the effects of short-time disturbances during construction can be compensated by appropriate reactions of the affected individuals. Cultivated land, as a hunting habitat for Hen Harriers, is the dominant type of terrain around the study area. That means a lot of habitats with an equal or nearly equal ecological value exist in the closer and wider vicinity of the study area. Thus there is no doubt that individuals will have enough equivalent space to switch to. An influence on reproduction or survival rate of individuals is not expected. The conservational status of populations will not deteriorate due to any small-scale or temporary construction-related disturbances.<br><br>Plant-related and operational effects<br>The planned wind farm is located outside the breeding range of Hen Harriers. Effects on breeding Hen Harriers can be excluded. There is no evidence that Hen Harriers avoid wind turbines while hunting (see above). A significant disturbance of individuals leading to a deterioration of populations can be excluded. |
| Deterioration or destruction of habitats | Construction-, plant-related and operational effects<br>As the study area is located outside the breeding range and no adverse effects of the operating turbines on hunting Hen Harriers is expected, a deterioration or destruction of habitats can be excluded. |
| Conclusion:<br>Hen Harrier | The construction and operation of the proposed wind farm will not lead to significant negative effects on Hen Harrier (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

Montagu's Harrier

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| Species-specific vulnerability at wind power plants | Available studies indicate that food availability affects the occurrence and spatial distribution of Montagu's Harriers much stronger than the operation of wind turbines (DULAC 2008, GRAJETZKY *et al.* 2008). With 24 broods studied by GRAJETZKY *et al.* (2008) in Germany, distances between nesting sites and the closest turbine were between 76 and 890 m. Most nesting sites were in a distance range of 301 to 500 m.<br>JOEST *et al.* (2008) did not detect a significant dependence of nesting site selection due to wind turbines in Germany. In the study area this species seems to prefer sites located low within the landscape for nesting grounds whereas turbines are built at elevated sites.<br>In summary it can be assumed that Montagu's Harriers display no or only very little avoidance behaviour towards wind turbines.<br>Due to the specific hunting behaviour of Montagu's Harriers close to the ground, the collision risk of Montagu's Harriers at turbines can be regarded as very low (at least if turbines are located at a certain distance to the nesting site where occasionally flights at higher altitudes occur). At present there are 17 known fatalities of Montagu's Harriers having collided with a wind turbine in Europe, thereof 15 in Spain (DÜRR 20011).<br>For reasons of wildlife protection, the Consortium of Ornithological Stations in Germany recommends keeping a distance of 1,000 m between wind turbines and breeding sites of Montagu's Harriers (LAG-VSW 2007). |
| Killing of individuals during construction or operation (collision risk) | Construction-related effects<br>Basically it can be assumed that adult individuals of this species should be able to actively avoid potential risks if they occurred (*e.g.* construction traffic). Montagu's Harriers did not breed in the study area and the next known breeding site is in the western part of Vojvodina. Hence it is extreme unlikely that Montagu's Harriers will breed in the study area during the construction of the wind farm. It can confidently be excluded that Montagu's Harrier could be killed by the construction of planned turbines or related infrastructure.<br><br>Plant-related and operational effects<br>Montagu's Harriers predominantly fly at low heights close to the ground. Furthermore, only 17 fatalities of the species could be recorded up to now. Considering this, the collision risk of the species is assumed to be low.<br>Collisions of single individuals at the planned wind farm cannot be excluded but are assumed to be extremely unlikely. A significant collision risk (and thus, the deliberate killing in the sense of article 5 of the Birds Directive) can be excluded for the planned wind farm. |
| Disturbance - particularly during the period of hibernation and migration | Construction-related effects<br>Temporary disturbances of Montagu's Harriers related to the construction can appear if the time of erection of the planned wind farm and the breeding or migration period of the species overlap. It is very likely that the effects of short-time disturbances during construction can be compensated by appropriate reactions by the affected individuals. Cultivated land, a hunting habitat for this species, is the dominant type of terrain around the study area. That means a lot of habitats with an equal or nearly equal ecological value exist in the closer and wider vicinity of the study area. Thus there is no doubt that individuals will have enough equivalent space to switch to. An influence on the on reproduction or survival of individuals is not expected. The conservational status of populations will not deteriorate due to any small-scale and temporary construction-related disturbances. |

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| | Plant-related and operational effects<br>The species did not breed in the study area and is not expected to breed there in near future. Effects on breeding Montagu's Harriers can be excluded.<br>There is no evidence that Montagu's Harriers avoid wind turbines while hunting (and also while breeding) (see above). A disturbance of individuals leading to a deterioration of population can be excluded. |
| Deterioration or destruction of habitats | Construction-, plant-related and operational effects<br>Neither breeding nor resting sites of the species were found in the study area and it is highly unlikely that there will be any of them in the near future. Hence a deterioration or destruction of breeding / resting sites can be excluded. |
| Conclusion: Montagu's Harrier | The construction and operation of the proposed wind farm will not lead to significant negative effects on Montagu's Harrier (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention). |

# 7 Measures for mitigation and compensation

## 7.1 General mitigation measures

As a general recommendation, mitigation measures developed to avoid impacts should be given priority over those that reduce impacts or compensate for impacts. Apparently a key factor in avoiding impacts is a careful placement of turbines (macro-siting), which means to ensure that key areas of conservational importance and sensitivity are avoided.

JOHNSON *et al.* (2007) distinguish between three primary types of mitigation measures to reduce collision risk at wind turbines: modifying the siting of entire wind farms including the placing of individual turbines, modification of turbines and other wind power plant structures, and modification of habitats.

### 7.1.1 Modification of the siting of entire wind farms including the placing of individual turbines

During the planning phase of "Čibuk 1" wind farm it was already taken into account that the wind farm will keep a distance of at least 1 km to the border of the Special Nature Reserve Deliblato Sands. In addition, no significant migration route or connecting corridor (breeding site to feeding ground) is detectable in the study area and hence cannot be affected.

Synopsis:

No further mitigation measures with regards to siting of the wind farm are needed.

### 7.1.2 Modification of turbines

Perching by raptors on wind turbines has been implicated in higher rates of mortality (ORLOFF & FLANNERY 1992). Although not all investigators support this assumption (*e.g.* THELANDER & RUGGE 2000, SMALLWOOD & THELANDER 2004), installation of turbines with tubular towers and avoiding other structures suitable for perching - as planned in the proposed wind farm - are simple measures to reduce raptor activity within an area and hence collision risk.

Lighting of turbines is believed to increase the risk of collision on anthropogenic structures by attracting and disorientating birds (*e.g.* DREWITT & LANGSTON 2006). This is mostly a problem for nocturnal migrants (primarily passerines) during conditions of poor visibility. According to UGORETZ (2001), birds are more sensitive to and even appear to be attracted by red light. Quickly flashing white strobe lights appear to be less attractive. The consensus among researchers is to avoid lighting turbines when and where possible (JOHNSON *et al.* 2007). If lighting is crucial, the current recommendation is to use the minimum number of intermittent flashing white lights of lowest effective intensity (DREWITT & LANGSTON 2006).

As collision risk of target species is not assessed to be significant (in the sense of article 5 of the Birds Directive or article 6 of the Bern Convention) (cf. Chapter 6.2.3 and 6.2.4) reducing collision risk by painting rotor blades seems to be dispensable. Nevertheless painting blades might be an appropriate measure for further reduction of collision risk. Research with captive American Kestrels (*Falco sparverius*) and Red-tailed Hawks indicates that painting turbine blades can increase blade visibility under a variety of conditions. Based on experiments with several patterns painted on blades, McIsaac (2001) recommended a pattern with square-wave black-and-white bands that run across the blade. Hodos (2003) proposed that motion smear may reduce the ability of raptors and other birds to see turbine blades. Thus, motion smear might be a reason for collisions during daytime, in which the visual faculty of birds is actually good. Motion smear primarily occurs at the tips of the blades and may make blades virtually transparent at high velocities. Anti-motion smear patterns may increase the visibility of turbine blades at distances at which raptors could still safely manoeuvre away from them. Studies with captive raptors indicate that a single, solid black blade paired with two white blades (or a single-blade, thin-stripe pattern) is the most visible stimulus (Hodos 2003).
Since most diurnal birds including raptors seem to be able of detecting Ultra Violet (UV) light, there have been efforts to reduce collision risk by painting turbine blades with UV reflective paint (Kreithen & Springsteen 1996, McIsaac & Kreithen 1996, see also Johnson *et al.* 2007). However, Young *et al.* (2003) who tested this hypothesis in the wind plant of Foot Creek Rim (Wyoming), found no evidence that there is a difference in bird use, collision risk or mortality (which was generally low) between turbine blades with a UV-light reflective paint and those covered conventionally.

Synopsis:
Summing up, effectiveness of the discussed measures (marking of wind turbines) are not tested or very poorly tested in field-studies yet. Thus, it remains unclear which pattern of painting blades will be most effective in reducing collision risk. If painting of single turbines is necessary due to requirements regarding civil aviation, turbines which are located near to nesting sites of birds of prey (especially near to the Eurasian Hobby) should be marked (WT 1, 2, 24 and 25).

### 7.1.3 Modification of habitats

Since the study area is a breeding and / or a feeding area for some species, modification of habitat seems to be an appropriate measure to minimize impacts. Several authors (*e.g.* Johnson *et al.* 2007, Sterner *et al.* 2007, Mammen *et al.* 2009) recommend the following habitat modifications in order to minimize impacts. In fact all measures shall minimize the attractiveness of the wind farm area and especially the locations of turbines for birds of prey:

- avoid natural or artificial perching sites (see above);
- no harvesting or mowing of field crops should take place in wind farms before mid of July;
- avoid structures within a wind farm that attracts birds (*e.g.* waste dump);

- the tower bases should be made unattractive for foraging birds of prey and should be kept as small as possible;
- fallow vegetation should not be mown within the wind farm.

Synopsis:

It is highly recommended to fulfil these mitigation measures.

### 7.1.4 Other mitigation measures

Apart from modification of turbines, DREWITT & LANGSTON (2006) recommend installing transmission cables underground and to mark overhead cables using deflectors or so-called bird flappers.

Synopsis:

It is highly recommended to fulfil this mitigation measure.

## 7.2 Species-specific mitigation measures

Common Quails breed in cultivated land and are common breeding and foraging species within the study area. As this species is believed to avoid wind turbines up to in a distances of about 200 m operational turbines are expected to cause a disturbance of Quails.

As arable land-use is most common and widespread in the vicinity of the study area, it is very likely that Common Quails will find sufficient appropriate habitats in the surrounding, in which the species-specific requirements are fulfilled. Thus a deterioration of the local population of Common Quails is not expected (in the sense of article 5 of the Birds Directive or article 6 of the Bern Convention).

However, regarding the number of proposed wind turbines, it is recommended to compensate the decrease in habitat quality within the proposed wind farm by appropriate measures.

As there is a lack of concrete data about population size and spatial distribution of territories of the Common Quail, reliable Assumptions has to be suggested to measure, predict and assess the impact of the proposed wind turbines on Common Quails.

RAŠAJSKI (2011) assumed about 20 territories of Common Quail in the area of the proposed wind farm. Due to additional recordings of this species during bat investigations in 2010 PAUNOVIĆ & KARAPANDŽA (pers. comm.) believed the number of territories to be considerably higher. In the following considerations the number of territories is assumed to be about 30.

The wind farm area consists predominantly of open agriculture land which in general offers suitable habitats for breeding Quail. Thus it is assumed that the above mentioned 30 territories are distributed equally within the area of the proposed wind farm. As at the most 20 % of the area of wind farm will be affected (see above), 20 % of the territories (= 6 territories) would be disturbed by the operation of the wind turbines.

It is recommended to compensate the disturbance and the resulting deterioration of breeding and foraging habitats (see below) - as in comparable project – on an area of about 0,75 ha per territory in a distance of at least 250 m to a proposed wind turbine. In total compensatory measures are recommended on an area of about 4.5 ha (6 territories x 0.75 ha).

For Common Quails all measures leading to extensification of cultivated land is appropriate to increase habitat quality. In particular, the restoration of richly structured and large-scaled networks of small lots of cultivated land as well as the general absence of pesticides is important. The creation of large fallow strips within arable land or broad and flower-rich field margins leads to higher food availability and can meet the above linking function between different habitat structures such as an extensive field use. A list of appropriate measurements can be found in Annex. Quails traditionally do not inhabit a specific acreage but occur regularly in the same field hallway. Consequently, high probabilities of colonization of the improved or newly-created areas can be assumed if located at sufficient distance (250 m) to a turbine.

The proposed measures will act as compensation for the deterioration of habitats in the area of the wind farm as well.

# 8 Summary

With “Čibuk 1” a wind farm of 57 wind turbines is planned for construction near the villages of Dolovo and Mramorak in the Municipality of Kovin (Autonomous Province of Vojvodina, Republic of Serbia).

The construction and operation of wind turbines may have negative effects on breeding, resting, wintering and migratory birds. The main purpose of the investigation is to collect baseline data on the occurrence of birds within the study area and to describe the temporal and spatial distribution of each species. As a result the aim of this expert opinion is to

- identify, predict and assess likely impacts of the project on breeding, resting, wintering and migratory birds;
- assess whether impacts of “Čibuk 1” wind farm remain at an acceptable level, or whether additional measures are necessary to minimize or eliminate unacceptable impacts;
- recommend mitigation measures or measures for compensation in order to minimize possible conflicts.

In terms of applicable assessment criteria and significance thresholds, this expert opinion adheres to guidelines followed in Germany and by the international community (*e.g.* EU-COMMISSION 2007, EU-COMMISSION 2010, INSTITUTE FOR NATURE CONSERVATION OF SERBIA 2010, LANA 2009, MUNLV 2010).

To build a data base for the prediction the expected impacts by the project, the breeding, resting and migratory birds were recorded within the area of the proposed wind farm and its surroundings. The data on birds leading to this expert opinion were collected by two independent teams doing field studies from September 2009 to February 2011. In total more than 220 days were spend in the field and birds were observed within about 1.279 hours.

Two different methods for gathering data were used: the transect method and vantage-point census.

With an overall amount of 119 bird species the study area and its surroundings can be mentioned as species rich, though the vast majority of species rarely occurred.

A total of 20 target species were recorded in the study area during the breeding period. Five of them nested in the study area, 15 used it for foraging or hunting, respectively. Two species were only observed while flying over the study site.

Furthermore, a total of 18 target species / species of special interest were recorded in the study area during the non-breeding period.

For the prediction and assessment of likely impacts of "Čibuk 1" wind farm twelve species have to be taken into consideration, in particular. These species

- regularly used the study area, so that its significance is assessed (at least) as moderate and
- are possibly vulnerable to specific effects of wind turbines or prone to collision with wind turbines.

For these nine species significant adverse impacts could not be entirely excluded.

The operation of "Čibuk 1" wind farm will cause disturbance effects of Common Quails.
As arable land-use is most common and widespread in the vicinity of the study area, it is very likely that Common Quails will find sufficient appropriate habitats in the surrounding, in which the species-specific requirements are fulfilled. Thus a deterioration of the local population of Common Quails is not expected (in the sense of article 5 of the Birds Directive or article 6 of the Bern Convention).
However, regarding the number of proposed wind turbines, it is recommended to compensate for the expected habitat loss or decrease in habitat quality by appropriate measures on an area of about 4.5 ha in a distance of at least 250 m to a proposed turbine. For Common Quails all measures leading to extensification of cultivated land is appropriate to increase habitat quality. A list of appropriate measurements can be found in Annex. The proposed measures will act as compensation for the disturbance and the resulting deterioration of breeding and foraging habitats of Common Quails.
Moreover, general mitigation measures (modification of turbines due to requirements of civil aviation, modification of habitats, installing transmission cables underground and mark overhead cables using deflectors or so-called bird flappers, cf. chapter 7.1) to minimize the attractiveness of the wind farm area, especially for birds of prey, are highly recommended.

Taken the recommended mitigation measures and compensatory measures for Common Quails into consideration it is expected that construction and operation of the proposed "Čibuk 1" wind farm will not lead to a

- capture or killing during construction or operation (relevant collisions) of individuals;
- relevant deterioration or destruction of breeding / resting sites;
- adverse disturbance of these species.

Summing up, the construction and operation of "Čibuk 1" wind farm will not lead to significant negative effects on bird populations (and will not violate article 5 of the Birds Directive or article 6 of the Bern Convention).

# Final Declaration

We confirm that this report was prepared impartially, according to the best and latest state of knowledge. Data collection was conducted with most possible accuracy.

Dortmund, October 26th 2011

Dr. Michael Quest

# Literature

ALERSTAM, T. (1990): Bird migration. Cambridge University Press.

ATTILA, A. (2009): Stand of Red-footed Falcon population (*Falco vespertinus*) in Serbia (1973-) 2000-2009. Presentation of the International Red-footed Falcon Conservation Workshop. http://www.kekvercse.mme.hu/uploads/File/Serbia.pdf

BAND, W. (2000): Windfarms and birds: Calculating a theoretical collision risk assuming no avoiding action. Guidance note series. Scottish Natural Heritage. [Available from http://www.snh.org.uk/pdfs/strategy/renewable/COLLIS.pdf]

BAND, W., M. MADDERS & D. P. WHITFIELD (2007): Developing field and analytical methods to assess avian collision risk at wind-farms. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 259-275. Quercus. Madrid.

BARCLAY, M. R., E. F. BAERWALD & J. C. GRUVER (2007): Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Can. J. Zool. 85: 381-387.

BARRIOS, L. & A. RODRIGUEZ (2004): Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. Journal of Applied Ecology 41: 72-81.

BENNER, J. H. B., BERKHUIZEN, J. C., DE GRAAF, R. I. & A. D. POSTMA (1993): Impact of wind turbines on birdlife. Final Report in order of the Commission of European Communities.

BERGEN, F. (2001a): Untersuchungen zum Einfluss der Errichtung und des Betriebs von Windenergie-anlagen auf die Vogelwelt im Binnenland. Dissertation an der Ruhr-Universität Bochum. Fakultät für Biologie.

BERGEN, F. (2001b): Windkraftanlagen und Frühjahrsdurchzug des Kiebitz (*Vanellus vanellus*): eine Vorher/Nachher-Studie an einem traditionellen Rastplatz in Nordrhein-Westfalen. Vogelkundl. Ber. Niedersachs. 33 (2): 89-96.

BERGEN, F. (2002): Einfluss von Windenergieanlagen auf die Raum-Zeitnutzung von Greifvögeln. In: TECHNISCHE UNIVERSITÄT BERLIN, INSTITUT FÜR LANDSCHAFTS- UND UMWELTPLANUNG (Hrsg.): Tagungsband zur Fachtagung Windenergie und Vögel – Ausmaß und Bewältigung eines Konflikts. S. 86-96.

BERGEN, F. (2007): Ornithological Investigation on Bird-Wind Power Interactions at a Wind-farm near Zafarana, Egypt. Report to DECON - Deutsche Energie-Consult Ingenieurgesellschaft mbH & New and Renewable Energy Authority (NREA). Dortmund. 36 pp.

BERKHUIZEN, J. C. (1987): Vogelschade door windturbines niet angetoond. Duurzame Energie 2 (4): S. 43-45.

BERTHOLD, P. (2000): Vogelzug: eine Einführung und kurze aktuelle Gesamtübersicht. 4. stark überarb. und erw. Aufl. Wiss. Buchges. Darmstadt.

BIOCONSULT SH & ARSU (2010): Zum Einfluss von Windenergieanlagnen auf den Vogelzug auf der Insel Fehmarn. Gutachten im Auftrag der Fehmarn Netz GmbH & Co. KG. Husum und Oldenburg. 195 S.

BIRDLIFE INTERNATIONAL (2004): Birds in the European Union: a status assessment. Wageningen, The Netherlands: BirdLife International.

BIRDLIFE INTERNATIONAL (2011): IUCN Red List for birds. Downloaded from http://www.birdlife.org

BÖTTGER, M., CLEMENS, T., GROTE, G., HARTMANN, G., HARTWIG, E., LAMMEN, C., VAUK-HENTZELT, E. & G. VAUK (1990): Biologisch-ökologische Begleituntersuchung zum Bau und Betrieb von Windkraftanlagen. Endbericht. Norddeutsche Naturschutzakademie. NNA-Berichte 3/ Sonderheft.

BRANDT, U., S. BUTENSCHÖN, E. DENKER & G. RATZBOR (2005): Rast am Rotor: Gastvogel-Monitoring im und am Windpark Wybelsumer Polder. UVP-report 19 (3+4): 170-174.

BREUER, W. (1994): Naturschutzfachliche Hinweise zur Anwendung der Eingriffsregelung in der Bauleitplanung. Inform. d. Naturschutz Nieders. 1/94: 1-60.

CALIFORNIA ENERGY COMMISSION (2002): Golden Eagles In A Perilous Landscape: Predicting The Effects Of Mitigation For Wind Turbine Blade-Strike Mortality. Consultant Report prepared for Public Interest Energy Research (PIER) - Environmental Area. 52 pp. + Appendices.

CHAMBERLAIN, D. E., REHFISCH, M. R., FOX, A. D., DESHOLM, M. & ANTHONY, S. J. (2006). The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. Ibis 148 (Suppl. 1): 198-202.

CLEMENS, T. & C. LAMMEN (1995): Windkraftanlagen und Rastplätze von Küstenvögeln – ein Nutzungskonflikt. Seevögel 16 (2): 34-38.

DE LUCAS, M., G. F. E. JANSS & M. FERRER (2004): The effects of a wind-farm on birds in a migration point: the Strait of Gibraltar. Biodiversity and Conservation 13: 395-407.

DE LUCAS, M., G. JANSS & M. FERRER (2007): Wind-farm effects on birds in the Strait of Gibraltar. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 219-228. Quercus. Madrid.

DESHOLM, M. (2006): Wind-farm related mortality among avian migrants — a remote sensing study and model analysis. PhD thesis. Dept. of Wildlife Ecology and Biodiversity, NERI, and Dept. of Population Biology, University of Copenhagen. National Environmental Research Institute, Denmark. 128 pp.

DEVEREUX, C. L., M. J. H. DENNY & M. J. WHITTINGHAM (2008): Minimal effects of wind turbines on the distribution of wintering farmland birds. Journal of Applied Ecology 45: 1689-1694.

DIRKSEN, S., A. L. SPAANS, J. VAN DER WINDEN & L. M. J. VAN DEN BERGH (1998): Nachtelijke vliegpatronen en vlieghoogtes van duikeenden in het Ijsselmeergebied. Limosa 71: 57-68.

ĐONIĆ ET JEČINAC (1991): Dunav od Bezdana do Timoka – nautičko-turistički vodič [The Danube from Bezdan to the Timok River – nautical-touristic guide]. *Pronalazaštvo*, 1–92, Belgrade.

DREWITT, A. L. & R. H. W. LANGSTON (2006): Assessing the impacts of wind-farms on birds. Ibis 148: 29-42.

DULAC, P. (2008): Evaluation de l'impact du parc éolien de Bouin (Vendée) sur l'avifaune et les chauves-souris. Bilan de 5 années de suivi. Ligue pour la Protection des Oiseaux délégation Vendée / ADEME Pays de la Loire / Conseil Régional des Pays de la Loire, La Roche-sur-Yon - Nantes, 106 pages.

DÜRR, T. (2004): Vögel als Anflugopfer an Windenergieanlagen in Deutschland – ein Einblick in die bundesweite Fundkartei Bremer Beiträge für Naturkunde und Naturschutz 7: 229-243.

DÜRR, T. (2011): Vogelverluste an Windenergieanlagen in Europa. Daten aus der zentralen Fundkartei der Staatlichen Vogelschutzwarte im Landesumweltamt Brandenburg. Stand: 08.07.2011. http://www.mluv.brandenburg.de

ECODA (2005): Umweltverträglichkeitsstudie zu einem Windpark mit 21 Windenergieanlagen in den Gemeinden Issum, Rheurdt und Kerken, Kreis Kleve. Unveröffentl. Gutachten. Dortmund.

EL GHAZI, A. & F. FRANCHIMONT (2001). Evaluation de l'impact du parc éolien d'Al Koudia Al Baïda (Peninsule Tingitane, Maroc) sur l'avifaune migratrice post-nuptiale. GOMAC & ABIES, Gardouch.

ERICKSON, W. P., G. D. JOHNSON, M. D. STRICKLAND, D. P. YOUNG JR., K. J. SERNKA & R. E. GOOD (2001): Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. Report by Western EcoSystems Technology, Inc. for National Wind Coordinating Committee. 62 pp.

EU-COMMISSION (2007): Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. Final version. 88 p. http://circa.europa.eu/Public/irc/env/species_protection/library?l=/commission_guidance/english/final-completepdf/_EN_1.0_&a=d

EU-COMMISSION (2010): Guidance document: Wind energy developments and Natura 2000. http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf.

EVERAERT, J., K. DEVOS & E. KUIJKEN (2002): Windturbines en vogels in Vlaanderen. Voorlopige onderzoeksresultaten en buitenlandse bevindingen. Rapport Instituut voor Natuurbehoud. R.2002.03. Brussel. 76 pp.

EVERAERT, J. & E. W. M. STIENEN (2007): Impact of wind turbines on birds in Zeebrugge (Belgium). Significant effect on breeding tern colony due to collisions. Biodivers. Conserv. 16: 3345-3359.

FOX, A. D., M. DESHOLM, J. KAHLERT, T. K. CHRISTENSEN & I. K. PETERSEN (2006): Information needs to support environmental impact assessment of the effects of European marine offshore wind-farms on birds. Ibis 148: 129-144.

GATTER, W. (2001): Vogelzug und Vogelbestände in Mitteleuropa: 30 Jahre Beobachtung des Tagzugs am Randecker Maar. Aula. Wiebelsheim.

GRAJETZKI, B., M. HOFFMANN & TH. GRÜNKORN (2008): Greifvögel und Windkraft: Teilprojekt Wiesenweihe Schleswig-Holstein. http://bergenhusen.nabu.de/BMU%20website/Grajetzky.pdf

GRUNWALD (2009): Ornithologisches Sachverständigengutachten zu potenziellen Auswirkungen von Windenergieanlagen auf den Vogelzug im östlichen Hunsrück. Unveröffentl. Gutachten. Schöneberg.

HAM, I., S. SKORIĆ & M. VUĆANOVIĆ, M. (2009a): Distribution, Nesting Efficiency and Number of White-Tailed Eagle *Haliaeetus albicilla* Population in Serbia during 2009. Ciconia, 18: 15–28

HAM, I, S. SKORIĆ & M. TUCAKOV (2009b): Status and breeding biology of the White-tailed Eagle Haliaeetus albicilla in former Yugoslavia and in Serbia. In PROBST, R [eds]: Seeadler in Herzen Europas: Tagungsband der WWF Österreich Seeadler Konferenz von 17.-18. November 2007 in Illmitz. 127 – 138.

HANDKE , K., J. ADENA , P. HANDKE & M. SPRÖTGE (2004): Untersuchungen an ausgewählten Brutvogelarten anch Errichtung eines Windparks im Bereich der Stader Geest (Landkreis Rotenburg/Wümme und Stade). Bremer Beiträge für Naturkunde und Naturschutz 7: 69 - 76.

HEATH, M. F. & M. I. EVANS (2000): Important Bird Areas in Europe: priority sites for conservation. Cambridge, UK:BirdLife International. The BirdLife Conservation Series Volume 2.

HODOS, W. (2003): Minimization of Motion Smear: Reducing Avian Collisions with Wind Turbines. Report for National Renewable Energy Laboratory. 33 pp.

HOLZHÜTER, T. & T. GRÜNKORN (2006): Verbleibt dem Mäusebussard (*Buteo buteo*) noch Lebensraum? Siedlungsdichte, Habitatwahl und Reproduktion unter dem Einfluss des Landschaftswandels durch Windkraftanlagen und Grünlandumbruch in Schleswig-Holstein. Naturschutz und Landschaftsplanung 2006 (5): 153-157.

HÖTKER, H (2006): Auswirkungen des „Repowering" von Windkraftanlagen auf Vögel und Fledermäuse. Untersuchung im Auftrag des Landesamtes für Natur und Umwelt des Landes Schleswig-Holstein. Michael-Otto-Institut im Naturschutzbund Deutschland, Bergenhusen.

HÖTKER, H., K.-M. THOMSEN & H. KÖSTER (2004): Auswirkungen regenerativer Energiegewinnung auf die biologische Vielfalt am Beispiel der Vögel und Fledermäuse - Fakten, Wissenslücken, Anforderungen an die Forschung, ornithologische Kriterien zum Ausbau von regenerativen Energiegewinnungsformen. Michael-Otto-Institut im Naturschutzbund Deutschland, Bergenhusen.

HOWELL, J. A. & J. E. DI DONATO (1991): Assessment of the avian use and mortality related to wind turbine operations: Altamont Pass, Alameda and Contra Costa Counties, California. Final Report prepared for Kenentech Windpower. 72 pp.

HUNT, G. (1995): A Pilot Golden Eagle Population Study in the Altamont Pass Wind resource Area California. Report for National Renewable Energy Laboratory. 218 pp.

INSTITUTE FOR NATURE CONSERVATION OF SERBIA (2010): Bird and wind turbines. Guidelines and recommodatuions for the protection of bird. Map of sensitive regions. Belgrade.

ISSELBÄCHER, K. & T. ISSELBÄCHER (2001a): Windenergieanlagen. In: RICHARZ, K., E. BEZZEL & M. HORMANN (Hrsg.) (2001): Taschenbuch für Vogelschutz. Aula. Wiebelsheim. S. 128-142.

ISSELBÄCHER, K. & T. ISSELBÄCHER (2001b): Vogelschutz und Windenergie in Rheinland-Pfalz. Materialien zur Landespflege 2/ 2001. Oppenheim.

JANSS, G. (2000): Bird Behaviour In and Near a Wind-farm at Tarifa, Spain: Management Considerations. In: NATIONAL WIND COORDINATING COMMITTEE (NWCC): Proceedings of the National Avian - Wind Power Planning Meeting III. p. 110-114.

JOHNSON, G. D., W. P. ERICKSON, M. D. STRICKLAND, M. F. SHEPHERD & D. A. SHEPHERD (2000): Avian monitoring studies at the Buffalo Ridge, Minnesota Wind Resource Area: results of a 4-year study. Final report. Northern States Power Company, Minneapolis. 62 pp.

JOHNSON, G. D., M. D. STRICKLAND, W. P. ERICKSON & D. P. YOUNG JR. (2007): Use of data to develop mitigation measures for wind power development impacts on birds. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 241-258. Quercus. Madrid.

KIEL, E.-F. (2005): Artenschutz in Fachplanungen. Anmerkungen zu planungsrelevanten Arten und fachlichen Prüfschritten. LÖBF-Mitt. 1/05:12-17.

KIEL, E.-F. (2007): Praktische Arbeitshilfen für die artenschutzrechtliche Prüfung in NRW. UVP-Report 21 (3): 178-181.

KLEIN, M. & R. SCHERER (1996): Schallemissionen von Rotorblättern an Horizontalachs-Windkraftanlagen. Anlagen laufen um bis zu vier Dezibel leiser. Wind Energie Aktuell 8/96: 31-33.

KOOP, B. (1996): Ornithologische Untersuchungen zum Windenergiekonzept des Kreises Plön. Teil I Herbstlicher Vogelzug. Unveröffentl. Gutachten, Kreis Plön.

KREITHEN, M. L. & A. SPRINGSTEEN (1996): Development of an optical painted pattern designed to reduce avian collisions with obstacles. 2nd International Conference on Raptors 1996. Urbino, Italy. p. 12.

KRUCKENBERG, H. & J. JAENE (1999): Zum Einfluss eines Windparks auf die Verteilung weidender Blässgänse im Rheiderland (Landkreis Leer, Niedersachsen). Natur und Landschaft 74 (10): 420-427.

KÜHNLE, C. (2004): Windenergienutzung im Überwinterungsgebiet arktischer Wildgänse - eine GIS-gestützte Analyse des Konfliktpotenzials am Unteren Niederrhein. Unveröffentl. Diplomarbeit am Institut für Geographie und Geoökologie I der Universität Karlsruhe (TH).

LAG-VSW (LÄNDERARBEITSGEMEINSCHAFT DER STAATLICHEN VOGELSCHUTZWARTEN) (2007): Abstandsregelungen für Windenergieanlagen zu bedeutsamen Vogellebensräumen sowie Brutplätzen ausgewählter Arten. Ber. Vogelschutz 44: 151-153.

LANA (2009): Hinweise zu zentralen unbestimmten Rechtsbegriffen des Bundesnaturschutzgesetzes Beschlossen auf der 98. LANA – Sitzung am 01./02.10.2009.

LANGSTON, R. H. W. & J. D. PULLAN (2004): Effects of wind-farms on birds. Nature and environment, no. 139. Council of Europe Publishing. 82 pp.

LANGSTON, R. H. W., A. D. FOX & A. L. DREWITT (2006): Conference plenary discussion, conclusions and recommendations. Ibis 148: 210-216.

LEKUONA, J. M. & C. URSÚA (2007): Avian mortality in wind power plants of Navarra (Northern Spain). In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. 177-192. Quercus. Madrid.

LÖBF (2001): Wachtelkönige und Windstrom-Industrie am Haarstrang im Kreis Soest - erste Analyse eines Konfliktes. Unveröffentl. Werkvertrag der LANDESANSTALT FÜR ÖKOLOGIE, BODENORDNUNG UND FORSTEN NRW - Staatliche Vogelschutzwarte. Bearbeitung: A. Müller.

LOSKE, K.-H. (2007): Auswirkungen von Windkraftanlagen auf Gastvögel im Windfeld Sintfeld. UVP-report 21 (1+2): 130-142.

LÜTTMANN, J. (2007): Artenschutz und Straßenplanung. Naturschutz und Landschaftsplanung 39 (8): 236-242.

MADDERS, M. & D. P. WHITFIELD (2006): Upland raptors and the assessment of wind-farm impacts. Ibis 148 (Suppl. 1): 43-56.

MAMMEN, U., K. MAMMEN, CH. STRAßER & A. RESETARITZ (2006): Rotmilan und Windkraft - eine Fallstudie in der Querfurter Platte. Poster auf dem 6. Internationalen Symposium Populationsökologie von Greifvogel- und Eulenarten vom 19.10. bis 22.10.2006 in Meisdorf/Harz.

MAMMEN, U., L. KRATZSCH, K. MAMMEN, TH. MÜLLER, A. RESETARITZ & RALF SINAO (2009): Interactions of Red Kites and wind-farms: results of radio telemetry and field observations. International workshop on Birds of Prey and Wind-farms, 21.10.2008. Berlin.

MCISAAC, H. P. & M. L. KREITHEN (1996): Addressing the problem of raptor strikes with turbines in the Altamont Pass Wind Plant. 2nd International Conference on Raptors 1996. Urbino, Italy. P. 13.

MCISAAC, H. P. (2001): Raptor acuity and wind turbine blade conspicuity. In: NATIONAL WIND COORDINATING COMMITTEE (NWCC): Proceedings of the National Avian - Wind Power Planning Meeting IV. p. 59-87.

MEBS T. & D. SCHMIDT (2006): Die Greifvögel Europas, Nordafrikas und Vorderasiens. Biologie, Kennzeichen, Bestände. Franckh-Kosmos Verlags. Stuttgart. 495 pp.

MÖCKEL, R. & T. WIESNER (2007): Zur Wirkung von Windkraftanlagen auf Brut- und Gastvögel in der Nierderlausitz (land Brandenburg). Otis 15, Sonderheft: 1-133.

MØLLER, N. W. & E. POULSEN (1984): Vindmøller og fugle. Vildbiologisk station. Kalø, Rønde.

MORRISON, M. L., K. C. SINCLAIR & C. G. THELANDER (2007): A sampling framework for conducting studies of the influence of wind energy developments on birds and other animals. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 101-116. Quercus. Madrid.

MÜLLER, A. & H. ILLNER (2001): Beeinflussen Windenergieanlagen die Verteilung rufender Wachtelkönige und Wachteln? Vortrag auf der Fachtagung „Windenergie und Vögel - Ausmaß und Bewältigung eines Konfliktes“. 29. und 30.11.2001. Berlin. www.tu-berlin.de/~lbp/schwarzesbrett/tagungsband.htm

MUNLV (2010): Verwaltungsvorschrift zur Anwendung der nationalen Vorschriften zur Umsetzung der Richtlinien 92/43/EWG (FFH-RL) und 2009/147/EG (V-RL) zum Artenschutz bei Planungs- oder Zulassungsverfahren (VV-Artenschutz).

MUSTERS, C. J. M., M. A. W. NOORDERVLIET & W. J. TER KEURS (1996): Bird casualties caused by a wind energy project in an estuary. Bird Study 43: S. 124-126.

ÖKO & PLAN (2004): Sonderuntersuchung Brutvögel zum Vorhaben Windpark Elster. Unveröffentl. Gutachten im Auftrag der WSB Planung GmbH & Co. KG. Plossig.

ORLOFF, S. & A. FLANNERY (1992): Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas 1989 - 1991. Final Report by BioSystems Analysis, Inc. to California Energy Commission.

ORNIS CONSULT (1989): Konsekvenser for fuglelivet ved etablering af mindre vindmøller. Rapport til Teknologistyrelsen, Styregruppen for vedvarende energi.

ORNIS CONSULT (1999): Biodiversity review of the western Gulf of Suez. Prepared by M. BAHA EL DIN & F. P. JENSEN. Copenhagen, Denmark. 43 pp.

PAUNOVIĆ (2010): Monitoring the State of the Orinthofauna and the Chiropteran Fauna in the Area Envisaged for the Construction of the Dolovo Wind Energy Park Autumn-Winter Period.

PAUNOVIĆ M. & B. KARAPANDŽA (2011a): Monitoring the Condition of the Ornithofauna in the Area of the Potential “Čibuk 1” and “Čibuk 2”Wind-farms Period March – November 2010.

PAUNOVIĆ M. & B. KARAPANDŽA (2011b): Monitoring the Condition of the Ornithofauna in the Area of the Potential “Čibuk 1” and “Čibuk 2”Wind-farms Period December 2010 – February 2011.

PAUNOVIĆ, M., HAM, I., PUZOVIĆ, S. (1995): The Wintering of Waterfowl on the River Danube 1988–1992. Bios (Macedonia, Greece), 2: 319–324.

PEARCE-HIGGINS, J. W., R. STEPHEN, R. A. W. LANGSTON, I. P. BAINBRIDGE, R. BULLMANN (2009): The distribution of breeding birds around upland wind-farms. Journal of Applied Ecology.

PEDERSEN, M. B. & E. POULSEN (1991): En 90 m/2 MW vindmølles indvirking på fuglelivet. Fugles reaktioner på opførelsen og idriftsættelsen af Tjæreborgmøllen ved Det Danske Vadehav. Danske Vildtundersøgelser. Hæfte 47. Danmarks Miljøundersøgelser Afdeling for Flora- og Faunaøkologi. 44 S.

PERCIVAL, S. M. (2000): Birds and wind turbines in Britain. British Wildlife 12: 8-15.

PERCIVAL, S. (2005): Birds and windfarms: what are the real issues? British Birds 98: 194-204.

PHILLIPS, J. F. (1994). The effects of a windfarm on the upland breeding bird communities of Bryn Titli, Mid Wales: 1993-1994. RSPB, The Welsh Office, Newtown.

PURGER, J. J. (2001): Numbers and breeding distribution of the Bee-eater *Merops apiaster* in province Vojvodina (northern Serbia) between 1987 and 1990. Vogelwelt 122: 279-282.

PURGER, J. J. (2008): Numbers and distribution of Red-footed Falcons (Falco vespertinus) breeding in Vojvodina (northern Serbia): a comparison between 1990-1991 and 2000-2001. Belg. J. Zool. 138 (1): 3-7.

PUZOVIĆ, S. (2000): Atlas of Serbian Birds of Prey, Distribution Maps and Population Assessment 1977–1996. Institute for Nature Conservation of Serbia. Belgrade. 262 p.

PUZOVIĆ, S., D. SIMIC, D. SAVELIJIC, J. GERGELJ, M. TUCAKOV, N. STOJNIC, I. HULO, I. HAM, O. VIZI, M. ŠĆIBAN, M. RUŽIĆ, M. VUCANOVIC & T. JOVANOVIC (2003): Birds of Serbia and Montenegro – breeding population estimates and trends: 1990-2002. Ciconia 12: 35-120.

PUZOVIĆ, S., TUCAKOV, M., GERGELJ, J., ŽULJEVIĆ, A., BARNA, K., RUŽIĆ , M., RADIŠIĆ, D. & ŠĆIBAN, M. (2006): New breeding sites of Pigmy Cormorant *Phalacrocorax pygmeus* in Vojvodina between 2004 and 2006. Ciconia 15: 78-83.

PUZOVIĆ, S. (2007): Projekt report: Survey of the Saker Falcon *Falco cherrug* population in Serbia 2007. http://www.pticevojvodine.rs/pdf/Project-Stepski-soko.pdf

PUZOVIĆ, S. (2008): Nest occupation and prey grabbing by Saker Falcon (*Falco cherrug*) on power lines in the province of Vojvodina (Serbia). Arch. Biol. Sci., Belgrade, 60 (2): 271-277.

PUZOVIĆ, S., GERGELJ, J., LUKAČ, Š. (1999). Colonies of Herons and Cormorants in Serbia 1998. Ciconia 8: 11 – 114.

RAGYOV, D., E. KMETOVA, A. DIXON, K. FRANZ, Y. KOSHEV & N. NEDIALKOV (2009): Saker Falcon *Falco cherrug* reinroduction in Bulgaria: feasibility study. Southeast Europe Saker Falcon Nework, Sofia, Bulgaria.

RASRAN, L., T. DÜRR, H. HÖTKER (2009): Analysis of collision victims in Germany. In: Hötker, H. (compiler): Birds of Prey and Wind Farms: Analysis of Problems and Possible Solutions. Documentation of an international workshop in Berlin, 21st and 22nd October 2008. Berlin: 26-30.

RAŠAJSKI, J. (2004): Birds of Serbia – with distribution maps. Triton Public, Vršac.

RAŠAJSKI, J. (2011): Study of the State and Conservation of Ornithofauna and Chiropterofauna at the site of the potential "Cibuk" Wind-farm.

RATZBOR, G. (2008): Windenergie und Vogelschutz – Wo liegt der Konflikt? In: BUNDESVERBAND WINDENERGIE (Hrsg.): Tagungsunterlagen zum BWE-Seminar Vogelschutz & Windenergie. 20.05.2008. Hamburg. 13 S.

REICHENBACH, M., C. KETZENBERG. K.-M. EXO & M. CASTOR (2000): Einfluss von Windenergieanlagen auf Vögel – Sanfte Energie im Konflikt mit dem Naturschutz. Teilprojekt Brutvögel. Unveröffentl. Endbericht, Mai 2000.

REICHENBACH, M., K. HANDKE, & F. SINNING (2004): Der Stand des Wissens zur Empfindlichkeit von Vogelarten gegenüber Störungswirkungen von Windenergieanlagen. Bremer Beiträge für Naturkunde und Naturschutz 7: 229-243.

REICHENBACH, M. & U. SCHADEK (2003): Langzeituntersuchungen zum Konfliktthema „Windkraft und Vögel". 2. Zwischenbericht. Unveröffentl. Gutachten im Auftrag des Bundesverbandes Windenergie. Oldenburg.

REICHENBACH, M. & H. STEINBORN (2004): Langzeituntersuchungen zum Konfliktthema „Windkraft und Vögel". 3. Zwischenbericht. Unveröffentl. Gutachten im Auftrag des Bundesverbandes Windenergie. Oldenburg.

REICHENBACH, M. (2003): Auswirkungen von Windenergieanlagen auf Vögel – Ausmaß und planerische Bewältigung. Dissertation an der TU Berlin. Fakultät VII Architektur Umwelt Gesellschaft.

SCHELLER, W. & F. VÖKLER (2007): Zur Brutplatzwahl von Kranich *Grus grus* und Rohrweihe *Circus aeruginosus* in Abhängigkeit von Windenergieanlagen. Orn. Rundbrief Meckl.-Vorp. 46 (1): 1-24.

SCHERNER E. R. (1999): Windenergieanlagen und Vögel: Bewertung des Standortes Luneort (Windpark Bremerhaven-Fischereihafen). Unveröffentl., dritter Zwischenbericht. Im Auftrag der TANDEM GmbH.

SCHREIBER, M. (1993): Zum Einfluß von Störungen auf die Rastplatzwahl von Watvögeln. Inform. d. Naturschutz Niedersachs. 13 (5): 161-169.

SINNING, F. (2004): Bestandsentwicklung von Kiebitz (*Vanellus vanellus*), Rebhuhn (*Perdix perdix*) und Wachtel (*Coturnix coturnix*) im Windpark Lahn (Niedersachsen, Landkreis Emsland) - Ergebnisse einer 6-jährigen Untersuchung. Bremer Beiträge für Naturkunde und Naturschutz 7: 97-106.

SINNING, F. & U. DE BRUYN (2004): Raumnutzung eines Windparks durch Vögel während der Zugzeit – Ergebnisse einer Zugvogel-Untersuchung im Windpark Wehrder (Niedersachsen, Landkreis Wesermarsch). Bremer Beiträge für Naturkunde und Naturschutz 7: 157-180.

SINNING, F., M. SPRÖTGE & U. DE BRUYN (2004): Veränderungen der Brut- und Rastvogelfauna nach Errichtung des Windparks Abens-Nord (Niedersachsen, Landkreis Wittmund). Bremer Beiträge für Naturkunde und Naturschutz 7: 77-96.

SMALLWOOD, K. S. & C. G. THELANDER (2004): Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report by BioResource Consultants to the Energy Commission, Public Interest Energy Research-Environmental Area. 363 pp. + Appendices.

SMALLWOOD, K. S. & C. G. THELANDER (2008): Bird mortality in the Altamont Pass Wind Resource Area, California. Journal of Wildlife Management 72 (1): 215-223.

SMALLWOOD, K. S., L. RUGGE & M. L. MORRISON (2009): Influence of Behaviour on bird mortality in wind energy developments. Journal of Wildlife Management 73 (7): 1082-1098.

STEINBORN, H. & M. REICHENBACH (2008): Vorher-Nachher-Untersuchung zum Brutvorkommen von Kiebitz, Feldlerche und Wiesenpieper im Umfeld von Offshore-Testanlagen bei Cuxhaven. Unveröffentl. Gutachten. Oldenburg.

STERNER, D., S. ORLOFF & L. SPIEGEL (2007): Wind turbine collision research in the United States. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 81-100. Quercus. Madrid.

STRAßER, CH. (2006): Totfundmonitoring und Untersuchung des artspezifischen Verhaltens von Greifvögeln in einem bestehenden Windpark in Sachsen-Anhalt. Unveröffentl. Diplom-Arbeit am Fachbereich VI Geographie / Geowissenschaften / Biogeographie der Universität Trier.

STÜBING, S. (2001): Untersuchungen zum Einfluß von Windenergieanlagen auf Herbstdurchzügler und Brutvögel am Beispiel des Vogelsberges (Mittelhessen). Diplomarbeit am Fachbereich Biologie der Philipps-Universität Marburg. Fachgebiet Tierökologie.

STÜBING, S. (2004): Reaktionen von Herbstdurchzüglern gegenüber Windenergieanlagen in Mittelgebirgen – Ergebnisse einer Studie im Vogelsberg. Bremer Beiträge für Naturkunde und Naturschutz 7: 181-1192.

STUMBERGER, B. & M. SCHNEIDER-JACOBI (2010): Importance of the Adriatic Flyway for Common Crane (Grus grus). 7th European Crane Conference. Stralsund.

THELANDER, C. G. & L. RUGGE (2000): Avian Risk Behavior and Fatalities at the Altamont Wind Resource Area. Report by BioResource Consultans to National Renewable Energy Laboratory. 22 pp.

THELANDER, C. G. & K. S. SMALLWOOD (2007): The Altamont Pass Wind Resource Area's effects on birds: A case history. In: DE LUCAS, M., G. F. E. JANSS & M. FERRER (2007): Birds and Wind-farms. Risk Assessment and Mitigation. p. 25-46. Quercus. Madrid.

TRAXLER, A., S. WEGLEITNER & H. JAKLITSCH (2004): Vogelschlag, Meideverhalten & Habitatnutzung an bestehenden Windkraftanlagen. Prellenkirchen – Obersdorf – Steinberg/Prinzendorf. Unveröffentl. Gutachten im Auftrag der WWS Ökoenergie, der WEB Windenergie, der evn naturkraft, der IG Windkraft und des Amts der NÖ Landesregierung. Endbericht Dezember 2004.

TUCAKOV, M. (2006): Seasonal variations in numbers of Great Cormorant (Phalacrocorax carbo) on the kolut fish farm (NW Serbia). Arch. Biol. Sci. 58 (2). 83-86.

TUCAKOV, M., PROBST, R., PUZOVIĆ, S. & M. VUČANOVIĆ (2005): Probable new breeding sites of Booted Eagle *Hieraaetus pennatus* in Vojvodina (N Serbia). Acrocephalus 26 (126): 147-149.

TUCAKOV, M., I. HAM, J. GERGELJ, K. BARNA, A. ŽULJEVIĆ, O. SEKEREŠ, G. SEKULIĆ, VUČANOVIĆ, I. BALOG, D. RADIŠIĆ, L. VIG, I. HULO, D. SIMIĆ, S. SKORIĆ, N. STOJNIĆ, N. SPREMO, M. RUŽIĆ, S. PUZOVIĆ, B. STANKOVIĆ, D. GRUJIĆ & Š. LUKAČ (2009): Gull and tern colonies in Serbia. Ciconia 18: 29-80.

TUCKER, V. A. (1996): A mathematical model of bird collisions with wind turbine rotors. Journal of Solar Energy Engineering 118: 253-262.

UGORETZ, S. (2001): Avian mortalities at tall structures. In: NATIONAL WIND COORDINATING COMMITTEE (NWCC): Proceedings of the National Avian - Wind Power Planning Meeting IV. p. 165-166.

VAN BON, J. & J. J. BOERSMA (1985): Is windenergie voor vogels een riskante technologie? Landschap 3/85: S. 193-210.

WAGNER, S., R. BAREISS & G. GUIDATI (1996): Wind turbine noise. Springer. Berlin. Heidelberg.

WHITFIELD, D. P. & M. MADDERS (2006): Deriving collision avoidance rates for red kites *Milvus milvus*. Natural Research Information Note 3. Natural Research Ltd, Banchory, UK.

WINKELMAN, J. E. (1985a): Impact of medium-sized wind turbines on birds: a survey on flight behaviour, victims, and disturbance. Neth. J. agric. Sci. 33: 75-78.

WINKELMAN, J. E. (1985b): Vogelhinder door middelgrote windturbines – over vlieggedrag, slachtoffers en verstoring. Limosa 60 (3): 153-154.

WINKELMAN, J. E. (1992a): De invloed van de Sep-proefwindcentrale te Oosterbierum (Fr.) op vogels, 1: aanvaringsslchtoffers. RIN-rapport 92/2. DLO-Instituut voor Bos- en Natuuronderzoek. Arnhem.

WINKELMAN, J. E. (1992b): De invloed van de Sep-proefwindcentrale te Oosterbierum (Fr.) op vogels, 4: verstoring. RIN-rapport 92/5. DLO-Instituut voor Bos- en Natuuronderzoek. Arnhem. 102 S.

YOUNG, D. P. JR., W. P. ERICKSON, M. D. STRICKLAND, R. E. GOOD & K. J. SERNKA (2003): Comparison of Avian Responses to UV-Light-Reflective Paint on Wind Turbines. Report by Western EcoSystems Technology, Inc. to National Renewable Energy Laboratory. 38 pp + Appendices.

# Annex:

## Appropriate compensatory measures for Common Quail

| Compensatory measure | Leaving of cereal stubbles on arable fields |
|---|---|
| Implementation | Leaving of cereal stubbles on arable fields to at least end of February, height of stubbles must be at least 20 cm; no use of herbicides. |
| Size of measure | Medium to large-sized |
| Where to develop | Fields of wheat |

| Compensatory measure | Cereals-strips with double row spacing |
|---|---|
| Implementation | Row spacing on average at least 20 cm. Width of a strip: usually 6 m to 15 m, but it is possible to fulfil this measure on acreages over 15 m width as well. The measure can be developed at the field margins as well as within the field. Normally, strips should be up to a total of 1 ha per acreage. |
| Size of measure | Small to medium-sized |
| Where to develop | Fields of wheat |

| Compensatory measure | Development of plant-rich strips at margins of fields and along dirt-roads |
|---|---|
| Implementation | Development of plant-rich strips at margins of fields and along dirt-roads with a width of at least 5 m; no use of herbicides and fertilization; no mowing before August 1st. |
| Size of measure | Medium to large-sized |
| Where to develop | Field margins and along dirt roads |