PROJECT FOR
ESTABLISHMENT OF INSTALLATION FOR
THE WIND POWER UTILIZATION FOR ENERGY PRODUCTION –
WIND FARM "STIP", MACEDONIA

STUDY OF THE WIND FARM "STIP" IMPACT ON BIRD AND BAT FAUNA

REPORT ON THE WINTER SURVEY

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Content

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Summary and Recommendations

Based on the location of individual wind turbines, the area covered by the Wind Farm "Stip" has been divided into three sectors for monitoring. These sectors are:

a) Gjupski Rid

b) Orlov Kamen – Sreden Rid, and

c) Brdo – Kula.

The following status has been established through specially designed surveys undertaken for the purpose of assessing the likely negative effect on potentially most affected animal groups (birds and bats) by the construction and operation of the Wind Farm "Stip" for the winter period between November and mid March:

1. During the winter period, presence of major bird flocks, most of those present in the autumn period, was recorded; the largest among them in terms of number of individuals (200) was the flock of Columba palumbus (Wood Pigeon), recorded in the middle of November in the sector Orlov Kamen.
2. During winter period, in the Gjupski Rid sector, presence of 2 species was recorded as potentially at risk, both with safe status in Europe.
3. In the sector Orlov Kamen-Sreden Rid, 3 species were recorded as potentially at risk, two of which were with safe status, and one with higher status of threat in Europe (vulnerable -V, Circus cyaneus).
4. In the sector Brdo-Kula, only one species was detected as potentially affected by the presence of wind turbines in the area, its status in Europe being safe.
5. With reference to all sectors, it was confirmed that that the potentially affected species, due to their elevational distribution (below 30 meters) were out of danger related to the operation of wind turbines during winter period.
6. From among birds in the surrounding area (up to 10 km from the boundary of the wind farm site), the status of initially recorded four species was surveyed in the winter period as well. From among them, Hunting Falcon was detected in the area of the accumulation Mantovo, while White Stork has not returned in Macedonia and thus in the area of the wind farm Stip before the end of February, which is normal.
7. Two individuals (a pair) of Imperial Eagle were recorded near the last year's nest (on a power line) by the end of February 2012. Kestrel was recorded at several spots within the range of the wind farm, but nesting territory was not confirmed. Nevertheless, according to its elevational distribution during its prey watching and chasing, which did not exceed 30 meters, this species was beyond any danger related to the operation of wind turbines during winter period.
8. With regard to bats, no significant colony or activity was detected during the winter period on the area of the wind farm. The reason for this is absence of underground shelters (caves, tunnels, recesses, etc.). Bats were recorded only in November in a much lower number and amount, given the fact that during winter period, after the sunset, the temperature of the air drops down rapidly and bats withdrew in their shelters, mainly holes in the trees along the river Kriva Lakavica and structures (houses and buildings) in Stip and old houses in villages surrounding the area of the wind farm.

Based on the above conclusions, it may be confirmed that the wind farm will not have significant negative effect on bird and bat fauna, being the two most affected animal groups, during winter period.

The completion of the monitoring during winter period has provided full picture of the status of composition and seasonal changes occurring in the composition of the fauna of birds and bats in the area of the Wind Farm – Stip for a full annual cycle.

The end of the winter period correlates with the closure of the cycle of the minimum prescribed annual preinstallation monitoring, establishing the necessary basis for post-installation monitoring which will be a check of the correctness of the conclusions and mitigation measures proposed, i.e. application of the recognized and compulsory BACI principle (Before and After Construction Impact Study), (Rodrigues et al., 2008).

Introduction

Construction of the Wind Farm "Stip" has been planned in the region south of the city of Stip, in the area between the village Dolani and village Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Wind Farm "Stip" has been divided into three sectors for the purposes of the surveys, easier organization of field activities and more appropriate processing, analysis and presentation of the obtained data. These sectors are:

a) Gjupski Rid
b) Orlov Kamen – Sreden Rid, and
c) Brdo – Kula,

as shown on figure 1 below.

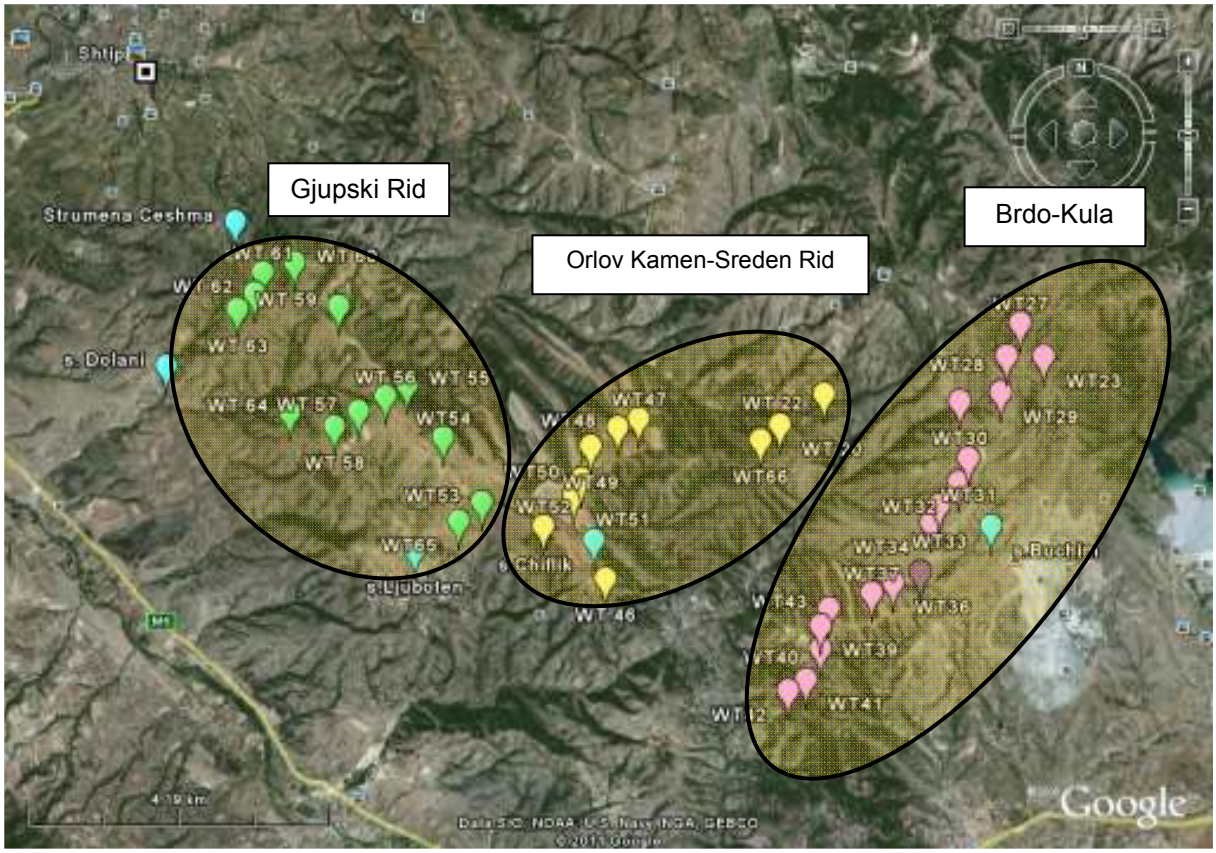

Figure 1 – Disposition of wind turbines and sectors of the Wind Farm "Stip"

The Terms of Reference for the performance of analysis of potential impacts on bird and bat fauna during winter period specified the following objectives:

a. To identify possible functions of individual parts of explored area of the wind farm:
   - For birds - resting, nesting and feeding;
   - For bats - resting (old trees), feeding, swarming and migration;
b. To find out if, where and when the different species of birds or bats visit the area of the wind farm for feeding during winter period.
c. To confirm which species inhabit the area of the planned wind farm during the winter period, with particular accent on species from Natura 2000 List, i.e. annexes concerning the exploitation of the wind power in line with the EU nature legislation (2010).

1 Methodology and Approach to Work

In order to achieve the above defined objectives, specifically designed and adjusted methods were applied to respond to the Terms of Reference. The area of the wind farm has been divided into three sectors:

i. Sector 1: Gjupski Rid -- 13 wind turbines (no. 53-65)
ii. Sector 2: Orlov Kamen – Sreden Rid -- 10 wind turbines (no. 22, 20, 46-52 and 66), and
iii. Sector 3: Brdo – Kula -- 17 wind turbines (no. 23 and 27-42).

During the winter period, and in correlation with the findings from the spring, summer and autumn periods, attention was paid to the following aspects:

- New species that would arrive in different sectors of the wind farm area, up to 1 км from the last (edge) wind turbines.

- Population density and distribution of prior (during spring, summer and autumn periods) indicated significant species with regard to which the risk of collision has already been established at European level.

- Ecology of the prior indicated (registered) significant species (aquatic birds and birds of pray) in the surrounding of the wind farm (up to 10 km from the last wind turbine).

- Creation of winter flocks of birds - social behavior (after the nesting period and the period of the main autumn migration for some of the bird species) and their distribution in the area in relation to their feeding and resting (or overnight stay).

- Definition of distribution and density of winter bird flocks in the wind farm area and its surrounding.

In the winter period of survey, we proceeded with the same intensity of field investigations as in the spring, summer and autumn periods, to enable generation of comparable data.

a. During the winter period, from the beginning of November to the middle of March, the terrain within the range of the wind farm was visited, in order to establish the time of arrival and the time of stay of certain bird species in the area.

b. In each sector, the work was based on the method of linear transect over pre-determined route of the spring period, also used during the summer and autumn surveys, mostly along the line (row) of the planned wind turbines, in order to enable comparison in the phase of the post-installation impact monitoring with the data obtained from linear transects carried out along the same routes.

c. During the performance of the linear transects, apart from other data recorded for the purposes of this study, the elevations of fly (or overflight) were recorded for individual species and the threat degree was determined for the registered species accordingly.

d. We proceeded with the monitoring of the status of registered nests of the more prominent species of birds (aquatic birds and birds of pray) within a perimeter of up to 10 kilometers around the last (edge) wind turbines; with regard to bats, the existence

of potential underground and aboveground shelters, old trunks and inhabited spots was checked within perimeter of up to 10 kilometers.

e. In relation to bats, the work continued on the selected most representative sites which were also monitored during spring, summer and autumn periods, and these were mostly close to the micro locations of individual wind turbines. The goal of the work was to explore their qualitative and quantitative representation in different habitats. The work concerning the bats in the winter period was commencing as in the spring, summer and autumn period - one hour before sun set, provided that weather conditions permitted it. In order to confirm the presence of bats in the area, heterodyne detectors of the type Bat MKIIb were used, and then by Petersson D 240 X (heterodyne and time expansive) and TT – time expansive Bat detector and digital recorder (EDIROL 09), bats were recorded for further analysis (Figure 2).

Figure 2 – Equipment used in bats monitoring

The analysis of bat species was carried out based on experience and by Russo&Jones (1999, 2002), Obrist, Boesch & Flückiger (2004), Ahlen, (2004) and Ahlen & Baagoe (1999) using the program software "Batsound".

2 Results and Findings

2.1 Birds

The area of the wind farm in Stip will cover an area of around 35 km^2. The area which was subject to selective inventory included additional zone of 10 kilometers beyond the perimeter of the installation (last/edge wind turbines) and its total area reached around 500 km^2.

With regard to birds in sector Gjupski Rid (figure 3 below), linear transects were conducted along the planned wind turbines on the following stretches:

a) Semenski Grobisata – Rusa

b) Gorni Lozja

In addition to the above listed, free observation was performed in the surrounding area close to these stretches and in the area of wind turbines that could not be included in any of the linear transects, i.e. on sites below:

a) vicinity of the village Ljuboten

b) village Ljuboten-Senki,

c) Semenski Grobista-Gjupski Rid,

d) Gjupski Rid-Gorni Lozja.

With regard to birds, additional control was carried out on the surrounding area, including mainly prominent biotopes (wetlands), rocky landscapes and sites in which some of birds of pray species were localized during the summer period and this provided full overview of the area in which bird fauna could be affected, their distribution, spatial and seasonal spread and relative abundance in the period from the beginning of November to the middle of March.

Results are presented in summary form in order to incorporate crucial aspects of the analysis and resulting findings towards the main objectives of the survey:

- For the birds, overview of the entire fauna of birds identified in each sector separately is presented first. Tables also contain data on spring, summer and autumn species and those which have been identified during winter period, with a possibility for easy identification of newly registered species and species absent during winter period.

- This is done for the purpose of fast identification of quantitative and qualitative changes occurring during winter period compared to spring, summer and winter periods.

- Data is presented in tables, together with full valorization of these species. Then, from these tables, the species for which field investigations indicated that they could be potentially affected and species recognized by the European Council as significant among birds were distinguished.

- Bird species, for which negative effect (of various intensity) has been confirmed, have been valorized separately in order to determine the level of the impact and assessment has been made of each of the three sectors separately.

- Finally, the entire significant fauna on the area up to a distance of 10 kilometers from the last / edge wind turbines has been included, mainly with regard to nests of prominent species of birds of pray and aquatic birds in a manner recommended by the EC (2010). The subject species were identified during spring, summer and autumn periods, and continued to be monitored during winter period.

2.1.1 Potential impact of the wind farm on birds in the sector Gjupski Rid

This sector extends from the village Ljuboten to Gorni Lozja. It covers 13 wind turbines as presented on Figure 3.

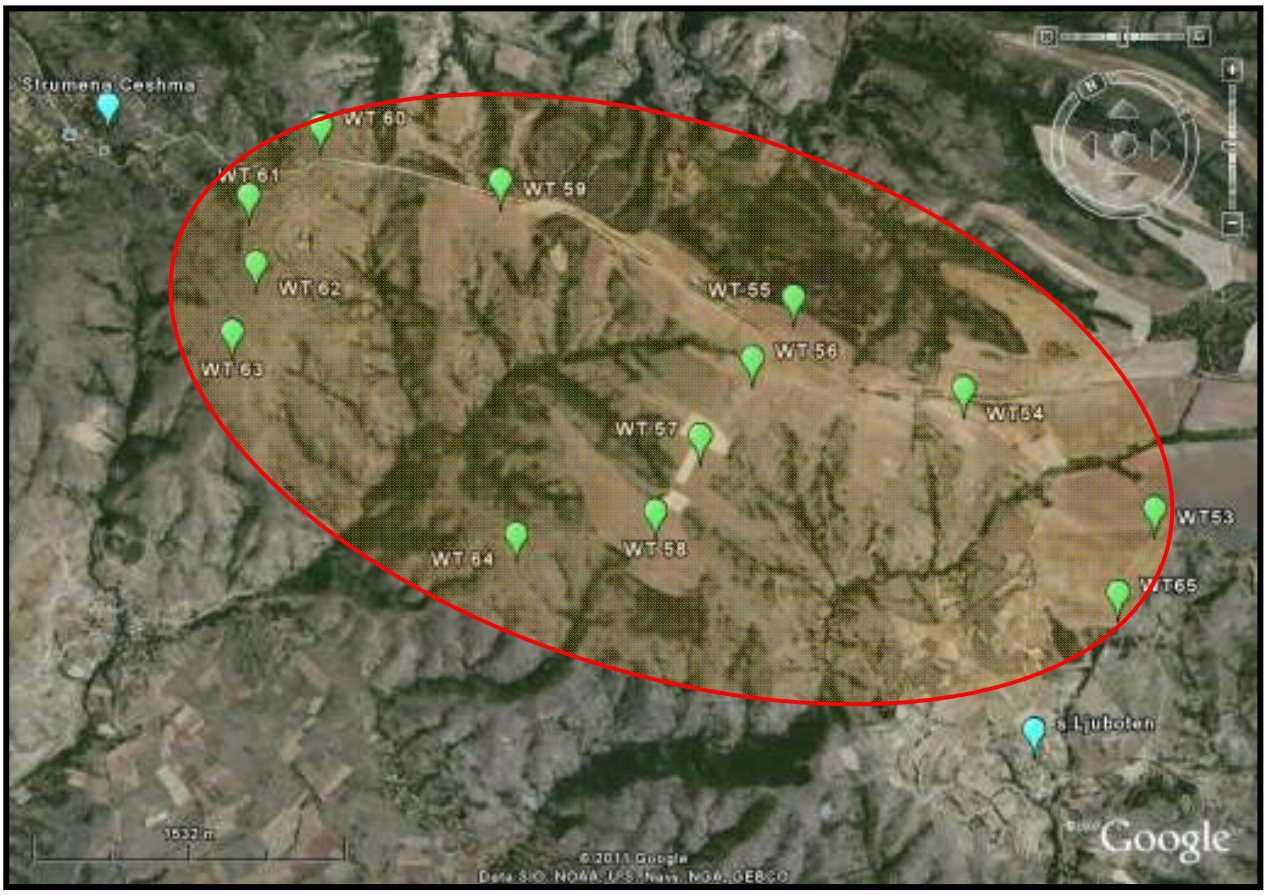

Figure 3 – Disposition of wind turbines in the sector Gjupski Rid

Table 1 below presents an overview of the bird fauna registered during field investigations carried out in winter period, together with the time period of their discovery, their valorization and type of the affect they are subjected to by wind turbines according to EC (2010).

Table 1 – Ornithofauna in the sector Gjupski Rid, in the winter period

Total number – annual cycle	Number of species – winter	**Species**	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1		Accipiter nisus - Sparrowhawk	+					S					
2	1	Aegithalos caudatus - Long-tailed Tit	+		+	+		S					
3	2	Alauda arvensis - Skylark	+		+	+	3	V	II/2	III			HD(X1)
4		Aquila heliaca-Imperial Eagle			+		1	E	I	II	II	t	HD(X1)BC(X1)
5	3	Anthus trivialis - Tree Pipit	+		+	+		S					
6		Athene noctua- Little Owl		+	+		3	D		II			
7	4	Buteo buteo - Common Buzzard	+	+	+	+		S					HD (Xo), BC(X2), BE(Xo)
8		Caprimulgus europaeus- European Nightjar		+			2	(D)	I	II		t	HD(X1),BC(X1)
9		Carduelis carduelis - Goldfinch	+					(S)					
10		Carduelis chloris - Greenfinch	+	+			4	S		II			
11	5	Co.coccothraustes - Hawfinch	+	+	+	+		S					
12	6	Columba palumbus - Wood Pigeon	+		+	+	4	S	II/1 & III/1				BC (Xo)
13	7	Circus cyaneus - Hen Harrier	+			+	3	V	I	II	II	t	
14	8	Corvus corax - Common Raven	+	+	+	+		(S)					
15		Cuculus canorus - Cuckoo	+	+				S					BC (Xo)
16		Delichon urbica - House Martin	+					S					
17	9	Dendrocopos syriacus - Syrian Woodpecker	+	+	+	+	4	(S)	I	II		t	
18	10	Emberiza cia-Rock Bunting				+	3	V		II			
19	11	Emberiza calandra - Corn Bunting	+	+	+	+	4	(S)		III			HD(Xo)
20		Emberiza cirlus - Cirl Bunting	+	+			4	(S)		II			
21		Emberiza melanocephala-Black-headed Bunting		+			2	(V)		II			
22	12	Erithacus rubecula - Robin	+		+		4	S		II	II		
23	13	Falco subbuteo-Hobby			+			S					BE(Xo)

24	14	Falco tinnunculus - Kestrel	+	+	+		3	D		II	II		HD(X1); BC(X2); BE(X1);
25	15	Fringilla coelebs - Chaffinch	+	+	+	+	4	S		III			
26	16	Galerida cristata - Crested Lark	+	+	+	+	3	(D)		III			
27	17	Garrulus glandarius - Jay	+	+	+	+		(S)					
28		Hirundo daurica- Red-rumped Swallow			+			S					
29		Hirundo rustica - Barn Swallow	+	+	+		3	D		II			
30		Jynx torquilla- Wryneck		+			3	D		II		3	
31		Lanius collurio- Red-backed Shrike		+	+		3	D	I	II		t	
32	18	Lanius excubitor- Great Grey Shrike			+	+	3	D		II			
33		Lanius minor-Lesser Grey Shrike			+		2	(D)	I	II		t	
34		Lanius senator - Woodchat Shrike	+	+	+		2	V		II			
35	19	Lullula arborea - Woodlark	+	+	+	+	2	V	I	III		t	
36		Luscinia megarhynchos - Nightingale	+	+			4	(S)		II	II		
37	20	Melanocor. calandra - Calandra lark	+	+	+	+	3	(D)	I	II		t	
38		Merops apiaster - European Bee-eater	+		+		3	D		II	II		
39		Oenanthe oenathe - Wheatear	+					S					HD (X2)
40		Oriolus oriolus - Golden Oriole	+	+	+			S					
41		Otus scops - Scops Owl	+	+			2	(D)		II			
42	21	Parus caeruleus - Blue tit	+		+	+	4	S		II			
43		Parus lugubrus - Sombre Tit	+				4	S		II			
44	22	Parus major - Great Tit	+	+	+	+		S					
45	23	Passer domesticus - House Sparrow	+	+	+	+		S					
46	24	Passer montanus - Tree Sparrow	+	+	+	+		S					HD(Xo);
47	25	Perdix perdix - Gray Partridge	+			+	3	V	II/1 & III/1	III			
48		Phoenicurus ochruros-Black Redstart			+			S					
49		Phoenicurus phoenicurus - Common Redstart	+				2	V		II	II		
50		Phylloscopus collybita - Common Chiffchaff	+		+			(S)					
51		Phylloscopus sibilatrix-Wood Warbler			+		4	(S)		II	II		
52	26	Pica pica - Magpie	+	+	+	+		S					
53	27	Picus viridis - Green Woodpecker	+			+	2	D		II			
54		Prunela modularis-Dunnock			+		4	S		II			
55		Pyrrhula pyrrhula-Bullfinch			+			S					

56		Regulus ignicapilus - Firecrest	+		+		4	S		II	II		
57	28	Regulus regulus - Goldcrest	+			+	4	S		II	II		
58		Saxicola rubethra-Whinchat			+		4	S		II	II		
59		Saxicola torquata - Stonechat	+		+		3	(D)		II	II		
60		Streptopelia turtur - Turtle-Dove	+	+			3	D	II/2	III			BC(Xo)
61	29	Sturnus vulgaris - European starling	+	+	+	+		S					HD(X2); BE(Xo);(NB)
62		Sylvia atricapilla - Blackcap Warbler	+		+		4	S		II	II		
63		Sylvia communis - Common Whitethroat Warbler	+	+			4	S		II	II		
64		Sylvia curruca - Lesser Whitethroat Warbler	+					S					
65		Sylvia hortensis - Orphean Warbler	+	+			3	V		II	II		
66	30	Troglodytes troglodytes - Wren	+		+	+		S					
67	31	Turdus iliacus – Redwing				+	4w	S	II/2	III	II		
68	32	Turdus merula - Common Blackbird	+	+	+	+	4	S	II/2	III	II		
69	33	Turdus philomelos - Song Thrush	+			+	4	S	II/2	III	II		
70	34	Turdus pilaris - Fieldfare	+			+	4w	S	II/2	III	II		
71	35	Turdus viscivorus - Mistle Thrush	+	+	+	+		S	II/2	III	II		
72		Upupa epops - Hoopoe	+	+				S					BC(Xo)

Interpretation of symbols:

(i) HD - Habitat displacement

(ii) BC - Bird strike, collision

(iii) BE - barrier effect

(iv) CH - Change in habitat structure

(v) PP - potential positive impact

(vi) Xo - small or non significant impact
X3 - substantial risk of impact ; X2 - Indications of risk or impact ; X1 - Potential risk or impact;

During the winter period, 26 species from the spring period, 18 species from the summer period and 21 species from the autumn period were not registered, while 2 species were newly registered in the area of the wind farm. The total number of species registered for the periods is 72. From among the above listed species, 14 species for which potential danger of different but still significant scope has been identified are listed in Table 2 below, based on the existing literature, especially EC (2010).

Table 2 - Potentially affected fauna in the area of Gjupski Rid sector

Total number-annual cycle	Number of species – winter	**Species**	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1	1	Alauda arvensis	+		+	+	3	V	II/2	III			HD(X1)
2		Aquila heliaca			+		1	E	I	II	II	t	HD(X1)BC(X1)
3	2	Buteo buteo	+	+	+	+		S					HD (Xo), BC(X2), BE(Xo)
4		Caprimulgus europaeus		+			2	(D)	I	II		t	HD(X1),BC(X1)
5	3	Columba palumbus	+		+	+	4	S	II/1 & III/1				BC (Xo)
6		Cuculus canorus	+	+				S					BC (Xo)
7	4	Emberiza calandra	+	+	+	+	4	(S)		III			HD(Xo)
8		Falco subbuteo			+			S					BE(Xo)
9		Falco tinnunculus	+	+	+		3	D		II	II		HD(X1); BC(X2); BE(X1);
10		Oenanthe oenathe	+					S					HD (X2)
11	5	Passer montanus	+	+	+	+		S					HD(Xo);
12		Streptopelia turtur	+	+			3	D	II/2	III			BC(Xo)
13	6	Sturnus vulgaris	+	+	+	+		S					HD(X2); BE(Xo);(NB)
14		Upupa epops	+	+				S					BC(Xo)

During the winter period survey, 5 potentially affected species from the spring period were not registered:

- Cuculus canorus – Cuckoo
- Falco tinnunculus – Kestrel
- Oenanthe oenathe - Wheatear
- Streptopelia turtur - Turtle-Dove
- Upupa epops - Hoopoe

During the winter period, 5 species from the summer period were not registered:

- Caprimulgus europaeus- European Nightjar
- Cuculus canorus - Cuckoo
- Falco tinnunculus – Kestrel
- Streptopelia turtur - Turtle-Dove
- Upupa epops – Hoopoe,

and 3 species from the autumn period:

- Aquila heliaca-Imperial Eagle
- Falco subbuteo-Hobby
- Falco tinnunculus – Kestrel

No new species were registered in Gjupski Rid sector during the winter period survey, from among potentially affected bird species.

From among the above listed group of birds, the species that are affected in terms of potential collision with wind turbines as the most drastic effect were analyzed separately, given the fact that other impacts do not constitute significant negative effect as this type of area is rather frequent and represented not only in the close surrounding, but also throughout Macedonia.

Table 3 – The most affected group of birds in the area of Gjupski Rid sector

Total number-annual cycle	Number of species – winter	**Species**	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1		Aquila heliaca			+		1	E	I	II	II	t	HD(X1)BC(X1)
2	1	Buteo buteo	**+**	**+**	+	+		S					HD (Xo), BC(X2), BE(Xo)
3		Caprimulgus europaeus		**+**			2	(D)	I	II		t	HD(X1),BC(X1)
4	2	Columba palumbus	**+**		**+**	**+**	4	S	II/1 & III/1				BC (Xo)
5		Cuculus canorus	+	+				S					BC (Xo)
6		Falco tinnunculus	+	+	+		3	D		II	II		HD(X1); BC(X2); BE(X1);
7		Streptopelia turtur	+	+			3	D	II/2	II I			BC(Xo)
8		Upupa epops	+	+				S					BC(Xo)

The following species from the spring-summer-autumn period were absent in this sector in the winter period:

- Aquila heliaca - Imperial Eagle
- Caprimulgus europaeus - European Nightjar
- Cuculus canorus – Cuckoo
- Falco tinnunculus – Kestrel
- Streptopelia turtur - Turtle-Dove
- Upupa epops - Hoopoe

Based on the above, it may be concluded that only two species remained in the winter period as affected by potential collision with wind turbines, and both of the species are with safe (S) status in Europe.

During the winter period, there was an evident association of individual bird species in this sector as part of the process of their late autumn migration for hibernation. On this occasion, we will mention only species detected in compact floks, as potentially most affected compared to rarefied floks notable in a larger space composed of few individuals (6-7) each.

Larger flocks of the following species presented in the table below were recorded in this sector.

Table 4 – Social structure of the bird community in Gjupski Rid sector (winter 2011/12)

N	Species	Maximum size of recorded flock (in individuals)	Substrate /elevation of overfly
1	Emberiza cia – Rock Bunting	25	On lower trees-while flying
2	Sturnus vulgaris – European starling	70	On ground
3	Turdus viscivorus - Mistle Thrush	150	On ground and wires
4	Turdus pilaris - Fieldfare	30	On ground and lower trees

As shown in the table, the most numerous flock recorded is the flock of the Mistle Thrush, which was noted in the middle of November 2011.

The type of substrate they use and the height of the recorded overfly lead to the conclusion that none of these species will not be subject to any negative effect from the wind farm in Gjupski Rid sector, during winter period, especially with regard to collision.

2.1.2 Potential impact of the wind farm on birds in Orlov Kamen – Sreden Rid sector

This sector covers the stretch from the village Ciflik to the beginning of Sreden Rid and its length is 4.5 km. 10 wind turbines are located in this sector. Overview of the area is shown on Figure 4 below.

Figure 4 – Distribution of wind turbines in the sector Orlov Kamen-Sreden Rid

Table 5 below shows an overview of bird fauna recorded during field surveys conducted in winter period, together with the time period of their discovery, their valorization and type of the affect they are subjected to by wind turbines according to EC (2010).

From among the species listed in Table 5, the species for which potential danger of different but still significant scope has been identified have been separated, based on the results of the completed field surveys and existing literature, especially by EC (2010) and Langston & Pullan (2003).

Table 5 - Ornithofauna in the sector Orlov Kamen-Sreden Rid (winter period)

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	Corine	EC, 2010, Wind Energy developments and Natura 2000 & Langston & Pullan 2003
1		Accipiter nisus - Sparrowhawk	+						S				
2	1	Acanthis cannabina- Linnet			+		4	S		II			
3	2	Aegithalos caudatus - Long-tailed Tit	+		+	+		S					
4		Alauda arvensis - Skylark	+	+	+	+	3	V	II/2	III			HD(X1);
5		Anthus trivialis - Tree Pipit		+	+			S					
6		Ardea cinerea- Grey Heron		+				S					
7		Athene noctua - Little Owl	+				3	D		II			
8	3	Buteo buteo - Common Buzzard	+	+	+	+		S					HD (Xo), BC(X2), BE(Xo)
9		Caprimulgus europeaeus- European Nightjar	+	+			2	(D)	I	II		t	HD(X1),BC(X1)
10	4	Carduelis carduelis - Goldfinch	+			+		(S)					
11		Carduelis chloris - Greenfinch	+				4	S		II			
12	5	Co.coccothraustes - Hawfinch	+	+	+	+		S					
13	6	Circus cyaneus - Hen Harrier	+			+	3	V	I	II	II	t	HD (X2), BC(X1), BE(Xo
14		Circus pygargus – Monatgu's Harrier	+				4	S	I	II	II	t	HD (X1), BC(X2)
15	7	Columba palumbus - Wood Pigeon	+	+	+	+	4	S	II/1 & III/1				BC(Xo);
16	8	Corvus corax - Common Raven	+	+	+	+		(S)					
17		Coturnix coturnix- Common Quail		+			3	V	II/2	III	II		
18		Cuculus canorus - Cuckoo	+	+				S					BC (Xo);
19		Delichon urbica- House Martin		+				S					
20	9	Dendrocopos syriacus - Syrian Woodpecker	+	+		+	4	(S)	I	II		t	

21	10	Emberiza calandra - Corn Bunting	+	+	+	+	4	(S)		III			HD(Xo);
22		Emberiza cia - Rock Bunting	+		+		3	V		II			
23	11	Emberiza cirlus - Cirl Bunting	+		+	+	4	(S)		II			
24		Erithacus rubecula - Robin	+	+	+		4	S		II	II		
25		Falco tinnunculus - Kestrel	+		+		3	D		II	II		HD(1); BC(X2); BE(X1);
26		Falco subbuteo- Hobby			+			S					BE(Xo)
27	12	Fringilla coelebs - Chaffinch	+	+	+	+	4	S		III			
28	13	Galerida cristata - Crested Lark	+	+		+	3	(D)		III			
29	14	Garrulus glandarius - Jay	+	+	+	+		(S)					
30	15	Hirundo rustica - Barn Swallow	+	+	+		3	D		II			
31		Lanius collurio- Red-backed Shrike		+	+		3	D	I	II		t	
32		Lanius senator - Woodchat Shrike	+	+			2	V		II			
33	16	Lullula arborea - Woodlark	+	+	+	+	2	V	I	III		t	
34		Luscinia megarhynchos - Nightingale	+	+			4	(S)		II	II		
35		Melanocor. calandra - Calandra lark	+	+		+	3	(D)	I	II		t	
36	17	Merops apiaster - European Bee-eater	+				3	D		II	II		
37		Motacilla flava – Yellow-headed Wagtail	+		+			S					
38		Muscicapa striata- Grey Flycatcher			+		3	D		II	II		
39		Oenanthe oenathe - Wheatear	+					S					HD(X2)
40		Oriolus oriolus - Golden Oriole	+	+	+			S					
41		Otus scops - Scops Owl	+				2	(D)		II			
42	18	Parus caeruleus - Blue tit	+	+	+	+	4	S		II			
43		Parus lugubrus - Sombre Tit	+	+	+		4	S		II			
44	19	Parus major - Great Tit	+	+	+	+		S					
45	20	Passer domesticus - House Sparrow	+	+		+		S					
46	21	Passer montanus - Tree Sparrow	+	+		+		S					HD(Xo);
47	22	Perdix perdix- Gray Partridge				+	3	V	II/1, III/1	III			
48		Phoenicurus phoenicurus - Common Redstart	+				2	V		II	II		
49		Phylloscopus collybita - Common Chiffchaff	+	+	+			(S)					
50		Phylloscopus sibilatrix – Wood Warbler			+		4	(S)		II	II		
51		Pica pica - Magpie	+					S					
52	23	Picus viridis - Green Woodpecker	+		+	+	2	D		II			
53		Prunela modularis – Dunnock	+				4	S		II			

54	24	Regulus ignicapilus - Firecrest	+		+	+	4	S		II	II		
55		Regulus regulus - Goldcrest	+				4	S		II	II		
56		Saxicola rubethra- Winchat			+		4	S		II	II		
57		Saxicola torquata-Stonechat			+		3	(D)		II	II		
58		Streptopelia turtur - Turtle-Dove		+	+		3	D	II/2	III			
59	25	Sturnus vulgaris - European starling	+		+	+		S					HD(X2); BE(Xo);(NB)
60		Sylvia atricapilla - Blackcap Warbler	+	+			4	S		II	II		
61		Sylvia cantillans – Subalpine Warbler	+	+			4	S		II	II		
62		Sylvia communis - Common Whitethroat Warbler	+	+			4	S		II	II		
63		Sylvia curruca - Lesser Whitethroat Warbler	+					S					
64	26	Troglodytes troglodytes				+							
65	27	Turdus merula - Common Blackbird	+	+	+	+	4	S	II/2	III	II		
66		Turdus philomelos - Song Thrush	+				4	S	II/2	III	II		
67	28	Turdus pilaris- Fieldfare				+	4w	S	II/2	III	II		
68	29	Turdus viscivorus - Mistle Thrush	+		+	+	4	S	II/2	III	II		

* Symbols are the same as in Table 1

The total number of species recorded during the winter survey was 35 of the total number of 68 species recorded in this sector so far. 26 species from the spring period and 14 species from the summer period were not recorded.

Table 6 below shows the species for which potential effects of different but still significant scope have been identified, based on the existing literature (EC, 2010) and Langston & Pullan (2003).

Table 6 - Potentially affected fauna in the area of Orlov Kamen-Sreden Rid sector

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	Corine	EC, 2010, Wind Energy developments and Natura 2000 & Langston & Pullan 2003
1	1	Alauda arvensis	+	+	+	+	3	V	II/2	III			HD(X1);
2	2	Buteo buteo	+	+	+	+		S					HD (Xo), BC(X2), BE(Xo)
3		Caprimulgus europeaeus	+	+			2	(D)	I	II		t	HD(X1),BC(X1)
4	3	Circus cyaneus	+			+	3	V	I	II	II	t	HD (X2), BC(X1), BE(Xo
5		Circus pygargus	+				4	S	I	II	II	t	HD (X1), BC(X2)
6	4	Columba palumbus	+	+	+	+	4	S	II/1 & III/1				BC(Xo);
7		Cuculus canorus	+	+				S					BC (Xo);
8	5	Emberiza calandra	+	+	+	+	4	(S)		III			HD(Xo);
9		Falco tinnunculus	+		+		3	D		II	II		HD(1); BC(X2); BE(X1);
10		Falco subbuteo			+			S					BE(Xo)
11		Oenanthe oenathe	+					S					HD(X2)
12	6	Passer montanus	+	+		+		S					HD(Xo);
13		Streptopelia turtur		+	+		3	D	II/2	III			
14	7	Sturnus vulgaris	+		+	+		S					HD(X2); BE(Xo);(NB)

Out of the total number of 14 endangered species in this sector, five species from the spring survey were not recorded, namely:

- Caprimulgus europeaeus-European Nightjar
- Circus cyaneus - Hen Harrier
- Circus pygargus - Monatgu's Harrier
- Cuculus canorus - Cuckoo
- Oenanthe oenathe - Wheatear

Furtheron, three species from the summer period were not recorded during the winter survey:

- Caprimulgus europeaeus- European Nightjar
- Cuculus canorus – Cuckoo
- Streptopelia turtur- Turtle-Dove

and three species from the autumn period:

- Falco tinnunculus
- Falco subbuteo
- Streptopelia turtur

During the winter period survey, no new species was registered in Orlov Kamen-Sreden Rid sector.

From among the said group of affected birds listed in Table 6, species that are affected in terms of potential collision with wind turbines as most drastic effect are analyzed separately in Table 7, given the fact that other potential impacts do not pose any significant negative effect, bearing in mind the fact that this type of area is rather common and represented not only in the close surrounding, but also throughout Macedonia.

Table 7 - Most affected group of birds in the area of Orlov Kamen-Sreden Rid sector

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	Corine	EC, 2010, Wind Energy developments and Natura 2000 & Langston & Pullan 2003
1	1	Buteo buteo	+	+	+	+		S					HD (Xo), BC(X2), BE(Xo)
2		Caprimulgus europeaeus	+	+			2	(D)	I	II		t	HD(X1),BC(X1)
3	2	Circus cyaneus	+			+	3	V	I	II	II	t	HD (X2), BC(X1), BE(Xo
4		Circus pygargus	+				4	S	I	II	II	t	HD (X1), BC(X2)
5	3	Columba palumbus	+	+	+	+	4	S	II/1 & III/1				BC(Xo);
6		Cuculus canorus	+	+				S					BC (Xo);
7		Falco tinnunculus	+		+		3	D		II	II		HD(1); BC(X2); BE(X1);
8		Streptopelia turtur		+	+		3	D	II/2	III			

Out of the total number of eight species, four species from the spring period were not recorded, namely:

- Caprimulgus europaeus – European Nightjar
- Circus cyaneus - Hen Harrier
- Circus pygargus – Monatgu's Harrier
- Cuculus canorus - Cuckoo

In the winter period, three species from the summer period were absent:

- Caprimulgus europaeus - European Nightjar
- Cuculus canorus – Cuckoo
- Streptopelia turtur- Turtle-Dove

In relation to the autumn period, the following species were absent:

- Falco tinnunculus - Kestrel
- Streptopelia turtur - Turtle-Dove

In the winter period, three species remained two of which are with safe status in Europe, and one is with vulnerable (V) status in Europe, namely:

- Circus cyaneus - Hen Harrier

This species was not recorded in the winter period at elevations above 30 meters, which minimizes the danger of its collision with wind turbines in winter period.

During the winter period, well defined flocks larger than 10 individuals were recorded in this sector, composed of the following species:

Table 8 – Social structure of bird community in the sector Orlov Kamen-Sreden Rid (winter 2011/12)

N	Species	Maximum size of recorded flock (in individuals)	Substrate /elevation of overfly
1	Carduelis carduelis	60	On ground and lower trees
2	Columba palumus	200	On ground
3	Emberiza calandra	60	On ground and lower trees
4	Sturnus vulgaris – European starling	150	On ground
5	Turdus pilaris - Fieldfare	30	On ground and lower trees
6	Turdus viscivorus - Mistle Thrush	150	On ground and wires

During the winter period, all these species feed mainly on ground, and while moving to an another location they use elevation of flght lower than around 30 meters, and thus they remain out of the reach of danger for collision with wind turbines, except maybe when chased by their predator. The latter case was not recorded during our inventory.

2.1.3 Potential impact of the wind farm on birds in Brdo-Kula sector

The sector extends from the peak Brdo on northeast near the village Koshevo, up to the peak Kula, on west of the village Bucim. Its length is 6.2 km and comprises 17 wind turbines. The overview of this sector and wind turbines distribution is shown on Figure 5 below.

Figure 5 – Distribution of wind turbines in Brdo-Kula sector

During the conducted inventory of bird fauna in the winter period, total of 36 bird species was recorded. Full list of birds in this sector recorded in the winter period, together with those recorded in the spring, summer and autumn periods, part of which were not recorded, is presented in Table 9 below. The total number of bird species in this sector reached 73.

Table 9 below shows an overview of bird fauna recorded during field survey conducted during winter period, together with the months of their detection and birds recorded in spring, summer and autumn periods, their valorization and the type of affect by wind turbines according to EC (2010).

Table 9 - Ornithofauna in the sector Brdo – Kula (spring-summer-autumn-winter)

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1	1	Aegithalos caudatus - Long-tailed Tit	+	+	+	+		S					
2	2	Acanthis canabina - Linnet	+		+	+	4	S		II			
3		Accipiter nisus- Sparrowhawk		+	+			S					
4	3	Alauda arvensis - Skylark	+		+	+	3	V	II/2	III			HD(X1)
5		Anthus campetris- Tawny Pipit			+		3	V		II		t	
6	4	Anthus trivialis - Tree Pipit	+	+	+	+		S					
7		Asio otus – Long-eared Owl	+					S					BC(Xo)
8	5	Buteo buteo - Common Buzzard	+	+		+		S					HD (Xo),BC(X2),BE(Xo)
9	6	Carduelis carduelis - Goldfinch	+	+	+	+		(S)					
10	7	Carduelis chloris Greenfinch		+		+	4	S		II			
11	8	Coccothraustes coccothraustes- Hawfinch	+		+	+		S					
12		Cettia cetti - Cetti's Warbler	+					S					
13		Columba palumbus- Wood Pigeon		+			4	S	II/1 & III/1				BC(Xo)
14	9	Corvus corax - Common Raven	+	+	+	+		(S)					
15	10	Corvus c cornix – Hooded Crow	+		+	+		?					
16		Coturnix coturnix- Common Quail		+			3	V	II/2	III	II		
17		Cuculus canorus - Cuckoo	+	+				S					BC (Xo);
18		Delichon urbica – House Martin	+					S					

19	11	Dendrocopos medius-Middle Spotted Woodpecker				+	4	S	I	II		t	
20	12	Dendrocopos minor-Lesser Spotted Woodpecker				+		S					
21	13	Dendrocopos syriacus-Syrian Woodpecker			+	+	4	(S)	I	II		t	
22	14	Emberiza calandra - Corn Bunting	+	+	+	+	4	(S)		III			HD(Xo);
23	15	Emberiza cirlus - Cirl Bunting	+	+	+	+	4	(S)		II			
24	16	Emberiza citrinela-Yallowhammer			+	+	4	(S)		II			
25	17	Erithacus rubecula - Robin	+		+	+	4	S		II	II		
26		Falco tinnunculus - Kestrel	+	+	+		3	D		II	II		HD(X1),BC(X2),BE(X1);
27	18	Fringilla coelebs - Chaffinch	+	+	+	+	4	S		III			
28	19	Galerida cristata - Crested Lark	+	+	+	+	3	(D)		III			
29	20	Garrulus glandarius - Jay	+	+	+	+		(S)					
30		Hirundo rustica - Barn Swallow	+	+	+		3	D		II			
31		Hippolais pallid – Olivaceous Warbler		+			3	V		II	II		
32		Lanius collurio- Red-backed Shrike		+	+		3	D	I	II		t	
33	21	Lanius excubitor- Great Grey Shrike				+	3	D		II			
34		Lanius minor- Lesser Shrike			+		2	(D)	I	II		t	
35		Lanius senator - Woodchat Shrike	+	+	+		2	V		II			
36	22	Lullula arborea - Woodlark	+	+	+	+	2	V	I	III		t	
37		Luscinia megarhynchos - Nightingale	+	+	+		4	(S)		II	II		
38	23	Melanocor. calandra - Calandra lark	+	+		+	3	(D)	I	II		t	
39		Merops apiaster- European Bee-eater		+	+		3	D		II	II		
40		Motacilla alba – White Wagtail	+	+				S					
41		Muscicapa striata – Spotted Flycatcher			+		3	D		II	II		
42		Oenanthe oenanthe - Wheatear	+		+			S					HD(X2);
43		Oriolus oriolus - Golden Oriole	+	+				S					
44	24	Parus caeruleus - Blue tit	+		+	+	4	S		II			
45	25	Parus lugubris – Sombre Tit	+		+	+	4	S		II			
46	26	Parus major - Great Tit	+		+	+		S					
47	27	Passer domesticus - House Sparrow	+	+	+	+		S					
48	28	Passer hispaniolensis – Spanish Sparrow	+	+		+		(S)					
49		Passer montanus - Tree Sparrow	+	+	+	+		S					HD(Xo);

50	29	Perdix perdix - Gray Partridge	+			+	3	V	II/1 & III/1	III			
51		Phoenicurus phoenicurus - Common Redstart	+		+		2	V		II	II		
52		Phylloscopus collybita - Common Chiffchaff	+	+	+			(S)					
53		Phylloscopus sibilatrix – Wood Warbler			+		4	(S)		II	II		
54	30	Pica pica - Magpie	+	+	+	+		S					
55	31	Picus viridis – Green Woodpecker	+		+	+	2	D		II			
56		Regulus ignicapilus – Firecrest			+		4	S		II	II		
57		Regulus regulus - Goldcrest	+				4	S		II	II		
58		Saxicola rubethra – Winchat			+		3	(D)		II	II		
59		Saxicola torquata - Stonechat	+				4	S		II	II		
60		Streptopelia turtur - Turtle-Dove	+	+	+		3	D	II/2	III			BC(Xo)
61		Streptopelia decaocto – Collared Dove		+				(S)					
62	32	Sturnus vulgaris - European starling	+	+	+	+		S					HD(X2),BE(Xo),(N-b)
63		Sylvia atricapilla - Blackcap Warbler	+	+	+		4	S		II	II		
64		Sylvia cantillans – Supalpine Warbler	+				4	S		II	II		
65		Sylvia communis - Common Whitethroat Warbler	+	+	+		4	S		II	II		
66		Sylvia curruca - Lesser Whitethroat Warbler	+					S					
67		Sylvia hortensis - Orphean Warbler	+				3	V		II	II		
68	33	Troglodytes troglodytes - Wren	+		+	+		S					
69	34	Turdus merula - Common Blackbird	+	+	+	+	4	S	II/2	III	II		
70		Turdus philomelos - Song Thrush	+				4	S	II/2	III	II		
71	35	Turdus pilaris-Fieldfare				+							
72	36	Turdus viscivorus - Mistle Thrush	+		+	+	4	S	II/2	III	II		
73		Upupa epops - Hoopoe	+					S					BC(Xo)

During winter period, 23 species from the spring period and 18 species from the summer period and 18 species from the autumn period were not recorded, while 3 species were newly registered within the area of the windfarm. The total number of registered bird species in the annual cycle was 73.

From among the listed species, Table 10 below presents an overview of species for which potential danger of various but still significant scope was identified, in accordance with the available literature, especialy EC (2010).

Table 10 - Potentially affected fauna in the area of Brdo-Kula sector

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1	1	Alauda arvensis	+		+	+	3	V	II/2	III			HD(X1)
2		Asio otus	+					S					BC(Xo)
3	2	Buteo buteo	+	+		+		S					HD (Xo),BC (X2),BE(Xo)
4		Columba palumbus		+			4	S	II/1 & III/1				BC(Xo)
5		Cuculus canorus	+	+				S					BC (Xo);
6	3	Emberiza calandra	+	+	+	+	4	(S)		III			HD(Xo);
7		Falco tinnunculus	+	+	+		3	D		II	II		HD(X1),BC(X2) ,BE(X1);
8		Oenanthe oenanthe	+		+			S					HD(X2);
9		Passer montanus	+	+	+	+		S					HD(Xo);
10		Streptopelia turtur	+	+	+		3	D	II/2	III			BC(Xo)
11	4	Sturnus vulgaris	+	+	+	+		S					HD(X2),BE(Xo) ,(N-b)
12		Upupa epops	+					S					BC(Xo)

During the winter survey, 6 potentially affected species from the spring period were not recorded, namely:

- Asio otus – Long-eared Owl
- Cuculus canorus –Cuckoo
- Falco tinnunculus –Kestrel
- Oenanthe oenanthe – Northern Wheatear
- Streptopelia turtur - Turtle-Dove
- Upupa epops – Hoopoe
-

Also, during the winter period, 4 species from the summer period were not recorded:

- Columba palumbus- Wood Pigeon
- Cuculus canorus –Cuckoo
- Falco tinnunculus –Kestrel
- Streptopelia turtur - Turtle-Dove

During winter period, 4 species from the autumn period were not recorded in Brdo-Kula sector:

- Falco tinnunculus - Kestrel
- Oenanthe oenanthe - Northern Wheatear
- Passer montanus – Tree Sparrow
- Streptopelia turtur – Turtle-Dove

In the winter period, new species affected by the operation of wind turbines were not recorded in Brdo-Kula sector.

From among the group of birds presented in Table 10, Table 11 below analyses the species that are affected in terms of potential collision with wind turbines as the most drastic effect, as other impacts do not pose any significant negative effect.

Table 11 – Species affected by collision with wind turbines in Brdo-Kula sector

Total number-spring-summer-autumn-winter	Number of species-winter	Species	Spring period	Summer period	Autumn period	**Winter period**	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1		Asio otus	+					S					BC(Xo)
2	1	Buteo buteo	+	+		+		S					HD (Xo),BC(X2),BE(Xo)
3		Columba palumbus		+			4	S	II/1 & III/1				BC(Xo)
4		Cuculus canorus	+	+				S					BC (Xo);
5		Falco tinnunculus	+	+	+		3	D		II	II		HD(X1),BC(X2),BE(X1);
6		Streptopelia turtur	+	+	+		3	D	II/2	III			BC(Xo)
7		Upupa epops	+					S					BC(Xo)

Five species from the spring period were absent during winter survey:

- Asio otus – Long-eared Owl
- Columba palumbus- Wood Pigeon
- Cuculus canorus – Cuckoo
- Falco tinnunculus-Kestrel
- Streptopelia turtur- Turtle-Dove
- Upupa epops - Hoopoe

Four species from the summer period were absent:

- Columba palumbus- Wood Pigeon
- Cuculus canorus – Cuckoo
- Falco tinnunculus- Kestrel
- Streptopelia turtur- Turtle-Dove

Two species were absent from the autumn priod:

- Falco tinnunculus- Kestrel
- Streptopelia turtur- Turtle-Dove

Based on the above, only 1 species remained in the winter period affected by potential collision, with S (safe) status in Europe. During the inventory carried out for several days in the area, this species was not registered at elevations higher than 30 meters above ground, which minimizes the negative impact of wind turbines during winter period.

Low number of bird species was recorded in Brdo-Kula sector associated in flocks larger than 10 individuals. All these flocks were registered at low elevations, mostly on ground or smaller trees/shrubs, mainly at elevations lower than around 30 meters.

Table 12 – Social structure of bird community in the sector Brdo-Kula (winter 2011/12)

N	Species	Maximum size of recorded flock (in individuals)	Substrate /elevation of overfly
1	Carduelis carduelis - Goldfinch	15	On ground and lower trees
2	Fringilla coelebs - Chaffinch	130	On ground and lower trees
3	Parus caeruleus - Blue Tit	15	On ground
4	Turdus pilaris - Fieldfare	130	On ground and lower trees

2.1.4 Potential impact of the wind farm on birds in the surrounding area

In the winter period again, the conducted surveys, apart from the area to be under direct impact of the wind farm, also included inventory of the wider area (up to around 10 km distance from the last wind turbines), covering only the groups of birds of pray and aquatic birds as potentially most affected by the operation of the wind turbines. In this period, monitoring continued in relation to the condition of already registered nesting species in the spring and summer periods, in order to obtain data on the use of the surrounding area during their breeding of hatchlings (range of coverage was the area of foraging).

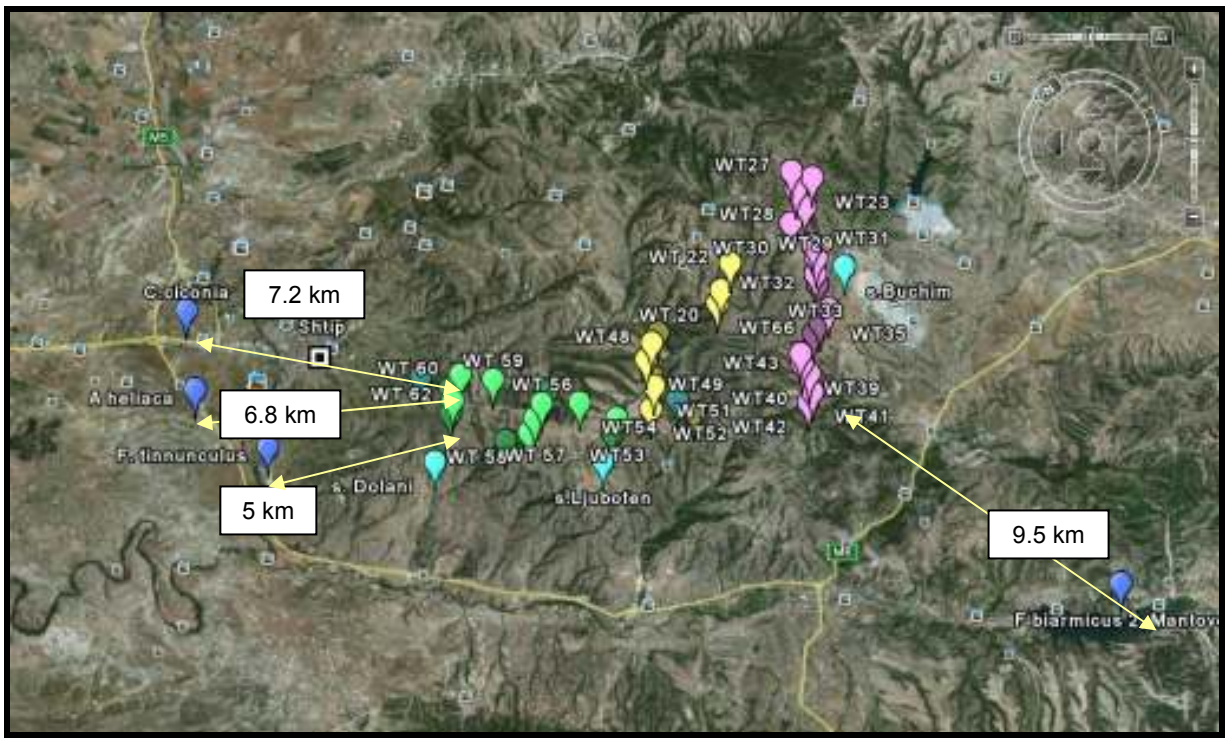

Figure 6 - Distribution of nests of significant bird species in the surrounding of the wind farm Stip (blue colour)

The analysis of ecological preferences of registered species (Table 13 below) confirmed the following condition in the winter period:

a) The nest of the Lanner Falcon (*Falco biarmicus*) was flied over (occupied) already in February, i.e. it is active again and thus the new nesting cycle has started.

b) By the end of February, the White Stork was not returned in Macedonia and the nest was empty. Nest is expected to be occupied in the spring period.

c) Same as in the case of previous species, we monitored the status of the Imperial Eagle. The conducted monitoring confirmed that by the end of the winter period, the pair of eagles nesting there earlier returned to the same nest and thus this species started the new cycle of reproduction, too.

d) Any nest of Kestrel or any special behavior was not located close to the city of Stip, nor on the area of the wind farm. One of the reasons for this was unaccessibility of the whole terrain during winter period, which was impossible to reach due to heavy snow falls.

Table 13 below shows overview of these species. All four species are of 1 to 3 SPEC categories, three of them are on the first list of the Bird Directive, and they are at the same time Corrine species. For some of them, there are indications for potential affect by the proximity of wind fields, i.e. wind turbines during late winter period.

Compulsory monitoring is proposed for all species during the operational phase, i.e. once the wind turbines are put into operation.

Table 13 – Affected bird group in the wider area (up to 10 km) of the wind farm identified during

N	Species	SPEC	ETS	WBD	Bern	Bonn	COR	EC, 2010, Wind Energy developments and Natura 2000
1	Aquila heliaca-Imperial Eagle	1	E	I	II	II	t	HD(X1); BC(X1);
2	Ciconia ciconia-Stork	2	V	I	II	II	t	BC(X2); BE(X1);
3	Falco biarmicus–Lanner Falkon	3	(E)	I	II	II	t	-
4	Falco tinnunculus-Kestrel	3	D		II	II		HD(X1); BC(X2); BE(X1);

Large flocks composed of individuals of Rock Pigeon (Columba livia) were recorded during the winter period in the wider range of the wind farm "Stip", located mainly along vast wheat fields, planted with wheat or barley.

Figure 7 – Large flocks of Rock Pigeon (Columba livia) over what fields along the road from Stip to Veles

There is no such type of biotopes on the area of the wind farm Stip, with such abundance and trophic potentials and so the number status of these flocks was reduced minor levels and mostly composed of other bird species.

2.1.5 Final considerations for birds

Based on the above stated, we may summarise the following state for the winter period:

a) Gjupski Rid sector

The number of recorded bird species in this sector during the winter survey was 45, while the total number of registered bird species during the annual cycle of survey was 72. During the winter survey, 26 species from the spring period, 18 species from the summer period and 21 species from the autumn period were not registered, while 2 species were newly registered.

From among the mentioned species, potential danger of different, but still significant scope was confirmed for 6 species from the winter survey, out of the total number of 14 identified affected species for this sector so far.

From among species affected by potential collision with wind turbines, 4 species from the spring period, 4 from the summer and 2 species from the autumn period were absent in the winter period. Thus, there were only 2 species affected by potential collision with wind turbines during the winter period, both with safe (S) status in Europe.

In the winter period, social association of individual bird species was recorded in the process of their late autumn migration or hibernation. Outstanding socialization was noted in this sector with 4 species (out of the 7 species registered in the autumn period), the largest flock among which (150 individuals) was the one of the Turdus viscivorus – Mistle Thrush, recorded in the middle of November. The type of substrate used and the elevation of the

recorded overfly clearly indicate that none of these species in the winter period will not be negatively affected by the wind farm in the Gjupski Rid sector, especially by collision.

Recommendations and assumptions related to winter period proved justified because it was confirmed that winter period, despite of continued social association, does not pertain any major threat to their survival in this sector. The level of the real threat will be identified during the operation of wind turbines in this sector.

b) Orlov Kamen-Sreden Rid sector

The number of registered species in the winter period was 35 or 68 bird species registered for the whole annual cycle. 28 species from the spring period, 18 species from the summer period and 17 from the autumn period were not registered during the winter survey. Two new species were registered in this sector in the winter period.

Out of the total number of bird species, 14 are threatened in this sector. Out of those, 5 species from the spring period, 3 from the summer and and 2 from the autumn period were not registered with the winter survey.

From among species affected by potential collision with wind turbines (8 in total so far), only 3 species were registered in the winter period. Four species from spring, 3 species from summer and 2 species from the autumn period were absent in the winter survey.

Among the three species recorded in the winter period:

- Buteo buteo, S
- Circus cyaneus, V
- Columba palumbus, S

2 are with safe status in Europe (Buteo buteo and Columba palumbus), while Circus cyaneus is with vulnerable (V) status at European level. This species was not registered during field investigations at elevations of 30 meters and thus the danger for their collision with wind turbines in the winter period is minimized.

During the winter period, well defined flocks larger than 20 individuals of 6 species were registered in this sector, among which Wood Pigeon with 200 individuals feeding on ground, i.e. on freshly planted wheat fields, was the largest flock.

All these species, in the winter period, are fed mostly on ground, and when they move to another location, they use flight elevations lower than around 30 meters, which are mainly beyond the reach of the danger for collision with wind turbines in winter period. This is the conclusion from field observations, which does not necessarily mean that under different conditions (predator, hunting or other type of disturbance) they could not be captured by panic or involved in unfavourable situation vis a vis wind turbines.

c) Brdo-Kula sector

The total number of recorded bird species for winter period was 36, or 73 for the annual cycle. During the winter survey, 23 species from spring, 18 species from the summer and 19 species from the autumn surveys were not recorded, while 3 species were newly recorded on the area of the wind farm.

With regard to 12 of the mentioned species, potential danger of different, but still significant scope was confirmed. In the winter period, 6 potentially affected species from the spring survey, 4 species from the summer and autumn periods, were not recorded. There were no newly recorded affected species for this sector in the winter period.

In the winter period, out of the total number (7) of bird species affected by collision with wind turbines, 5 from the spring, 4 from the summer and 2 from the autumn period were absent. Thus, only species remained as affected by potential collision with wind turbines, with safe (S) status in Europe. In the course of the area inventory carried out for several days, this species was not detected at elevations of more than 30 meters above ground and thus the negative impact of wind turbines is minimized in the winter period.

On the area of Brdo-Kula sector, four bird species were recorded associated in flocks larger than 15 individuals. Flocks of around 130 individuals of Fringilla coelebs (Chaffinch) and Turdus pilaris (Fieldfare) were recorded. For these, as well as other species of this group, danger has been minimized because these species were registered on ground and smaller trees, i.e. at elevations not exceeding 30 meters and thus the danger of collision with wind trbines during winter period is minimal.

d) Surrounding area

In the wider range of the wind farm, four significant bird species were recorded.

Out of those, during the winter period, the White Stork has not returned from south (Africa), while pair of Hunting Falcon, as well as Imperial Eagle, have been approaching their nests from the previous year. No active nests of Kestrel were registered within the wider range of the wind part, or in its proximity, by the middle of March, although individuals were observed in immediate proximity.

With regard to all those species, absence of probable impact of the WF Stip operation was confirmed for the winter period.

2.2 Bats

2.2.1 Bats composition and distribution in the area of the wind farm

For the purposes of the analysis of the bat status during the winter period, the same monitoring points were monitored as in the autumn period survey, as long as weather conditions allowed that. Locations were selected near the forest biotopes, old trunks, populated places and close to wetlands. It was notable that there was no single wetland within the range of the wind farm during autumn period, except one tap in Gjupski Rid region. The presence of bats in different habitat types was explored by application of several types of bat detectors, heterodyne and time expansive. Heterodyne detectors of the type Bat MKIIb and Skye SBR 1200 were used to confirm preliminary the presence of bats in the area, and then by Pettersson D240x (heterodyne and time expansive) and TT (Tranquility Transect) – time expansive Bat detector, the sounds were recorded by digital recorder (EDIROL R-09) as wav documents. Recorded voices were further processed by specific software for bats sound signals analysis (Batsound). Based on processed sounds, the table presented below shows the confirmed bat species on the area of the wind farm during the winter period.

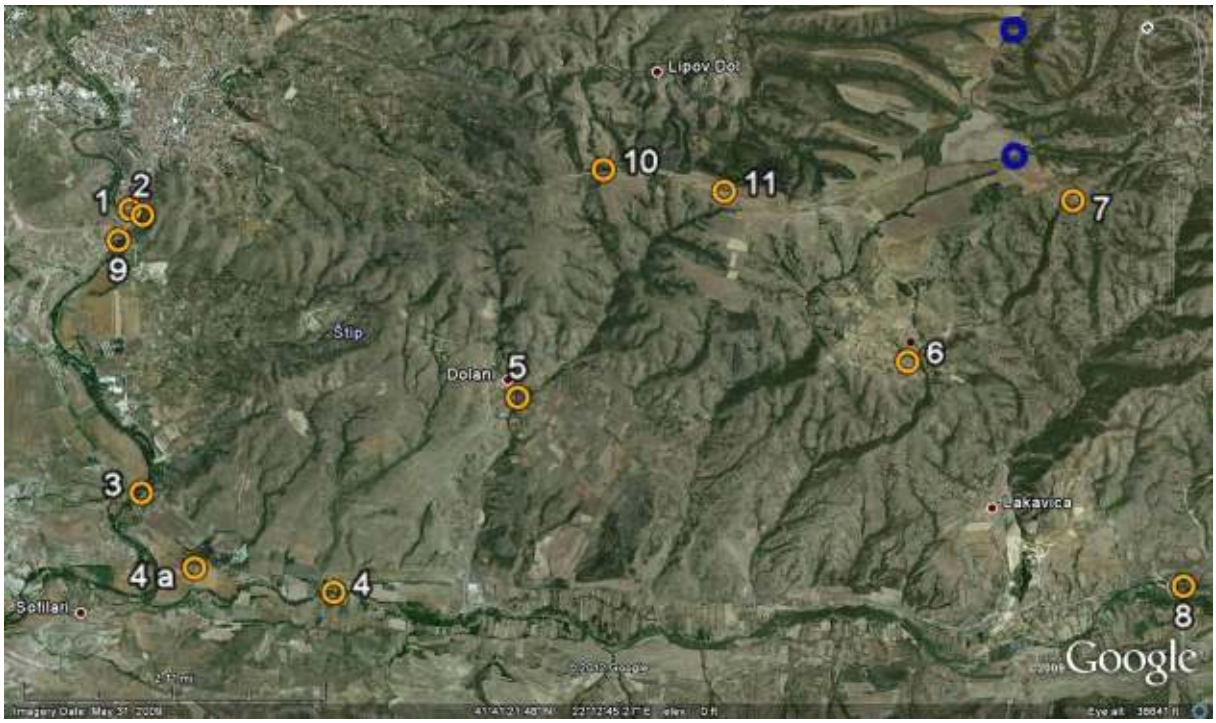

Figure 8 - Locations of bat monitoring points in the area of the wind farm in the winter period

1 – River Bregalnica near Novo Selo; 2 – River Bregalnica at the pedestrian bridge site; 3 – River Bregalnica, cross-road of the road section Skopje-Stip; 4 – River Kriva Lakavica near the petrol station and road to village of Selce (4a); 5 – village Dolani; 6 - village Ljuboten; 7 – village Ciflik; 8 – site Rajska Gradina; 9 – Kezovica Spa; 10-Gorni Lozja; 11-Gjupski Rid;

Note: Blue circles indicate spots where inventory was carried out without bats being registered or their activity was insignificant.

Table 14 presents summary overview of the presence of bats by individual monitoring points throughout the year.

Table 14 – Overview of bird fauna in the area of the wind farm (spring 2011 -winter 2011/2012)

N	Site (monitoring point)	Miniopters schreibersii	Myotis daubentonii	Nictalus noctula	Pipistrellus kuhlii	Pipistrellus pygmaeus	Pipistrellus savii	Tadarida teniotis	Vespertillio murinus	Myotis emarginatus	Myotis myotis & sp
		1	2	3	4	5	6	7	8	9	10
1	River Bregalnica near Novo Selo, Stip										
2	River Bregalnica near pedestrian bridge, Stip										
3	River Bregalnica, Skopje-Stip cross-road										
4	River Kriva Lakavica near Makpetrol Petrol station and near village Selce										
5	Village Dolani										
6	Village Ljuboten and below village Ljuboten & K.Lakavica, below village										
7	Village Ciflik and below Village Ciflik										
8	Rajska Gradina										
9	Kezovica spa, Stip										
10	Gorni Lozja										
11	Gjupski Rid										

Spring | Summer | Autumn | Winter

Almost all species are on the II list of the Bern Convention and Corine species. Most of them are on the lists the Council of Europe Directives, and Schreiber's Long-Fingered Bat has been enrolled in IUCN NT category.

Table 15 - Valorization of bats in the area of the wind farm

N	Species	CD	Bern	IUCN	CORINE
1	*Miniopterus schreibersii* - Schreiber's Long-Fingered Bat	II, IV	II	NT	C
2	*Myotis daubentonii* - Daubenton's Bat	IV	II	LC	C
3	*Myotis emarginatus* –Geoffroy's Bat	II,IV	II	LC	C
4	*Nyctalus noctula* - Common Noctule	IV	II	LC	C
5	*Pipistrellus kuhlii* - Kuhl's Pipistrelle	IV	II	LC	C
6	*Pipistrellus pygmaeus* - Soprano Pipistrelle	IV	II	LC	-
7	*Pipistrellus savii* – Savi's Pipistrelle	IV	II	LC	C
8	*Tadarida teniotis* – Free-tailed Bat	-	II	LC	C

9	*Vespertilio murinus*-Parti-coloured Bat	IV	II	LC	-
10	*Myotis myotis* – Great Mouse-eared Bat	IV	II	LC	C
11	*Myotis sp.* – Small Mouse-eared Bat	-	-	-	-

Legend: NT – Near threatened; LC - Least concern.

Special table was prepared for the registered species analyzing the potential effects on bat fauna during the operational phase of the wind farm in the annual cycle (see Table 16 below).

Table 16 – Potential effects on bats identified in the area (Rodriges & all.2008)

N	Species	Migratory species	Attracted by light	Identified problems related to ultra-sound of wind turbines	Flight altitude	Species suffering collision	Risk of hunting sites loss/ confirmed loss
1	*Miniopterus schreibersii*	+	+	-	> 40 m	+	-
2	*Myotis daubentonii*	-	-	-	>40m	+	-
3	*Myotis emarginatus*	-	-	-	>40m	-	-
4	*Nictalus noctula*	+	+	+	>40m	+	+
5	*Pipistrellus kuhlii*	-	+	-	>40m	+	-
6	*Pipistrellus pygmaeus*	+	+	-	>40m	+	-
7	*Pipistrellus savii*	-	+	-	>40m	+	-
8	*Tadarida teniotis*	-	+	-	>40m	+	-
9	*Vespertilio murinus*	+	+	-	>40m	+	+
10	*Myotis myotis*	+	-	-	>40m	+	-
11	*Myotis sp.*	-	-	-	-	-	-

Almost all registered bats use high altitudes both during migration or foraging, which implies potential risk of confrontation with wind turbines.

Limited amount of existing research does not allow full establishment of the role of wind turbines in the loss of the recent bat habitats. In the case of the Wind Farm "Stip", only two bat species were registered for which the latter has been confirmed at European level (Rodriges & all.2008).

Below is a brief overview of the registered species with part of their biology which indicates their stronger or weaker association with the planned wind turbines in the region of Stip, as well as information of their distribution in the area.

- *Miniopterus schreibersii* (Schreiber's Long-Fingered Bat)

It is easy to recognize by the great speed of flight reaching up to 55 km/h. It inhabits rocky landscapes. During summer, roosting sites are located in caves, but also in buildings and houses and can count up to more than 1000 individuals. Juvenile and male bats are found (live) there as well. They hibernate in caves from October to March. They forage mostly on open grounds often far away from their roosting sites. The presence of this species within the area of the wind farm is significant, along rivers and close to populated places.

- *Myotis daubentonii* (Daubenton's Bat)

They hibernate from September / October to the end of April, mostly in underground roost sites (caves, holes in earth, etc.), where up to several thousand specimens can be found. They usually come out half an hour after sunset. They feed on various aquatic insects they take from the water or above the water itself, but they can also be found away from water. Their foraging sites are usually at around 6 km from roosting sites. They form

breeding colonies from the middle of May onwards. They usually count 20-50 adult females, and they usually settle in a building, house or crack in a tree. Hatchlings are delivered by the end of June or July. Colonies remain up to October, and breeding colonies by the end of August.

- *Myotis emarginatus (*Geoffroy's Bat*)*

It is mostly sedentary species. It occurs rather late in the evening. They feed above the ground (1-5 m) or above water. They may also chase the pray on the tree branches as well. Winter breeding sites on the Balkans can count as many as 1000 females. Reproduction process starts in autumn, breeding colonies are formed in May next year, and disintegrated in September. They prefer warmer areas.

- *Nyctalus noctula* (Common Noctule)

It stays in woodlands and parks. In summer, it resides in tree holes. In winter, it stays in tree holes, rock cracks, buildings and bridges. They hibernate from October-November to March-April. It feeds on insects on/above meadows, wetlands and above tree tops. It also flies at heights above 70 m above ground. It reaches away from its roost site up to 2.5 km at most. It is migratory species. This species has been registered in the vicinity of most of the populated places and along the river Kriva Lakavica.

- *Pipistrellus kuhlii* (Kuhl's Pipistrelle)

They usually inhabit human settlements and establish breeding colonies in buildings' cracks. In winter, they hibernate in rock cracks and basements. They usually chase near street lights existing in populated areas within the range of the wind farm (village Ljuboten, village Ciflik).

- *Pipistrellus pygmaeus* (Soprano Pipistrelle)

This bat is found in forests, agricultural areas, but also in cities where it roosts on attics and buildings. During inventory, this species was recorded in the vicinity of Stip and along the rivers Kriva Lakavica and Bregalnica.

- *Pipisterllus savii (*Savi's Pipistrelle)

It inhabits valleys and rocky mountains, edeges of Alpine meadows and forests, cities and villages. In summers, maternity colonies have been located in holes of trees, cracks on rocks and houses, while in winters they hibernate in rock cracks, holes in trees, caves and buildings. It hibernates individually. In the region of the WF Stip, it was recorded only in one occasion.

- *Tadarida teniotis (*Free-tailed Bat*)*

It stays in mountains with steep cliffs and gorges and human settlements. Summer roosts are located in rock cracks and caves and in cracks on buildings. While chasing, it needs large open areas. In the region of the WF Stip, it was recorded near the river Bregalnica close to the village Novo Selo, around rocky region.

- *Vespertillio murinus* (Parti-coloured Bat)

It is migratory species. It occurs in cities, in forested but also steppe-like areas (which are abundant in the area of the WF Stip). In summer, it stays in cracks on buildings and recesses in caves. In winter, it hibernates in deep caves, attics and holes on trees. It hibernates between October and March. Only one of those was found in the vicinity of the City of Stip, in rocky areas near the village Novo Selo next to the river Bregalnica.

- *Myotis myotis (*Great Mouse-eared Bat)

It goes out rather late. It feeds mostly on insects chased while flying or from grounds. They mostly inhabit forested sites, and feed far away from their roosts. They are partially migratory. They breed colonies of up to several thousand females (in houses or caves), while males are solitary. They reproduce after June.

2.2.2 Final considerations on bats during winter period

Based on the conducted winter monitoring, the findings are presented below with reference to the winter period:

(i) The number of registered species in the winter period (beginning of November) is two species.

(ii) In the area of the wind farm, no significant water resources were formed in the course of 2011, which is probably the reason for absence of bats even at sites with favourable nesting conditions (old oak trunks, tall and old poplars) which offer opportunity for utilization as place for formation of breeding colonies or so called maternity colonies. This can be also connected with the exceptionally dry year of 2011, during which there were only few rainy days for almost three months.

(iii) In the area of the wind farm, bats in higher numbers and diversity of species were registered only near populated places, and their movement was rather intensive close to public lights.

(iv) There were no underground hibernation or roosting sites registered in the area, also confirmed by way of intensive interview with local population, and also by survey of the area during night hours. It could be confirmed that majority of recorded bats stayed in cracks or holes of old poplar trees along the rivers Kriva Lakavica and Bregalnica and along abandoned houses in villages.

Upon the completed winter survey, all unclarities related to bat fauna in the area of the wind farm were clarified.

(i) Qualitative and quantitative composition of bats in the area of the wind farm has changed drastically with the first colder days and high number of bats vanished from the recent sites of registration almost at the same time.

(ii) The exact day of hibernation for individual species starts probably in line with the temperature conditions that change from day to day, and in principle this occurs at temperatures below 10^{o}C.

(iii) Based on information provided by the local population and inspections made in the villages and the City of Stip, we may conclude that most of the bats stay in cracks of buildings and houses. Part of the bats found shelter in the holes of old poplar trees along the rivers Bregalnica and Kriva Lakavica, especially Common Noctule.

Reference

1. Ahlen, I., 2004. Heterodyne and Time-Expansion Methods for identification of Bats in the field and through Sound Analysis:72-79 (in Brigham, R.M., et al., eds. 2004. Bat Echolocation: tolls, techincques & analysis. Bar Conservation International. Austin, Texas.).
2. Ahlen, I. & H.J.Baagoe, 1999. Use of ultrasound detectors for bat studies in Europe: experiences from field identification, surveys and monitoring. Acta Chiropterologica 1, 2:137-150.
3. Convention on the Conservation of Migratory Species of Wild Animals, 2002. Wind turbines and migratory species. Resolution 7.5, Bonn.
4. European Commission, 2010. EU Guidance on wind energy development in accordance with the EU nature legislation, pp 114.
5. Langston, RHW & JD, Pullan, 2003. Wind farms and Birds: Analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues. Report prepared by RSPB for the 23rd Bern Convention Standing Committee meeting.
6. Mitchell-Jones, A.J et al. 2007. Protecting and managing underground sites for bats. EUROBATS Publication Series No.2. UNEP/EUROBATS Secretariat, Bonn, 38 pp.
7. Obrist M. K., Boesch R. & Flückiger P. F. 2004. — Variability in echolocation call design of 26 Swiss bat species: consequences, limits and options for automated field identification with a synergetic pattern recognition approach. *Mammalia* 68 (4): 307-322.
8. Rodrigues, L., et al. 2008. Guidelines for consideration of bats in wind farm projects. EUROBATS Publication Series No.3. UNEP/EUROBATS Secretariat, Bonn, 51 pp.
9. Russo, D. & G. Jones, 1999.The social calls of Kuhl's pipitrelles Pipistrellus kuhli (Kuhl, 1819) : structure and variation (Chiroptera: Vespertilionidae). J. Zool., Lond. 249:476-481.
10. Russo, D. & G. Jones, 2002. Identifican of twenty-two bat species (Mammalia: Chiroptera) from Italy by analysis of time-expanded recordings of echolocation calls. J. Zool., Lond. 258, 91-103.
11. Waters D.A. and G. Jones, 1995. Echolocation call structure and intensity in five species of insectivorous bats. The journal of experimental biology, 198: 475–489.
12. Zagmajster, M., 2003. Display song of parti-colored bat Vespertilio murinus Linnaeus , 1758 (Chiropetra, mammalian) in southern Slovenia and preliminary study of its variability. Natura Sloveniae, 5,1, :27-41.

Internet web-sites:

1. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document http://www.wind-watch.org/documents/wp-content/uploads/wild-71-08-45.pdf
2. Bats and wind turbines- advice from an expert http://www.awea.org/faq/sagrillo/ms_bats_0302.html
3. Bats and Wind Turbines. Pre-siting and pre-construction survey protocols (Revised May 2008) http://www.srd.gov.ab.ca/fishwildlife/guidelinesresearch/pdf/inventoryguide/Bats_and_wind_survey_protocol_May_2008.pdf
4. Bulgarian general guidance for wind farms http://www.bgwindenergy.com/bgwindenergy/en/doc/Final_SER_Report_ENG.pdf
5. California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development http://www.energy.ca.gov/windguidelines/index.html
6. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses.- http://www.bu.edu/cecb/reprints/2007/Kunz.Bats%20&%20Wind.07.pdf
7. Environmental Assessment Studies on wind turbines and bat populations - a step towards best practice guidelines http://www.bach-freilandforschung.de/download/Harbusch_Bach_2005.pdf

8. EU guidance on assessing windfarm impacts on birds in the Natura 2000 context: http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf
9. Guidelines on the environmental impact assessment for wind farms in Serbia, general guidance <<Serbia_EIA_windfarms_Jun10_en.pdf>>
10. Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines http://www.fws.gov/sfbayrefuges/Farallon/cryan&brown_2007_biocon.pdf
11. Specific guidance on assessing impacts on bats: http://www.eurobats.org/publications/publication%20series/pubseries_no3_english.pdf
12. Polish guidelines on assessing windfarm impacts on birds: http://www.elektrownie-wiatrowe.org.pl/en/files/guidelines_for_assessment of_wind_farms_impacts_on_birds.pdf
13. Western Bat Working Group http://wbwg.org/conservation/windenergy/windenergy.html
14. Wind Energy and Wildlife: Frequently Asked Questions http://www.awea.org/pubs/factsheets/050629_Wind_Wildlife_FAQ.pdf
15. Wind Turbine Guidelines Advisory Committee Technical Workshop and FACA Meeting February 26-28, 2008 http://www.fws.gov/habitatconservation/windpower/Meeting_Feb_26_28_2008/Technical_Workshop_and_FACA_Mtg1.html
16. Wind turbine interactions with birds and bats: a summary of research results and remaining questions http://www.nationalwind.org/publications/wildlife/wildlife_factsheet.pdf