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J E L I N A K W F

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EURUS d.o.o., Split, June, 2015

MONITORING OF BIRDS INCIDENTS DURING JELINAK WF OPERATION – MONITORING REPORT FOR YEAR 2013. - 2014.
JELINAK WIND FARM

Sadržaj

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*
2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

Site area description

Jelinak WF is located in Split-Dalmatia County, northwest of Trogir, in municipalities Seget and Marina (Figure 1). It is spread over peaks Tišta (421 m), Šupljak (503 m), V. Jelinak (581 m) and Dabgora (523 m). It is located in sub-Mediterranean vegetation zone. Vegetation is mostly rocky pastures that are partly in advanced stages of succession towards climatozonal vegetation, i.e. underbrush and sub-Mediterranean vegetation zones forest.

There are no existing or planned protected areas of some protection category according to Nature Protection Regulation (Official Gazette "Narodne Novine" no. 70/05, 139/08, 57/11). This is an area of international importance for birds and therefore it is included in ecological network of Republic Croatia as region #HR1000027 Mosor, Kozjak, Trogir highlands. In immediate vicinity of each wind turbine tower location, as well as in wider Jelinak WF construction area, there is not inhabited place.

Figure 1. Preview of wider Jelinak WF locations

2. MATERIALS AND METHODS USED DURING REASEARCH

Monitoring methodology of birds incidents during wind farm operation is based on instructions of publication Guidelines for preparation of Environmental Impact Assessment Study for wind power plants (Ministry of Environmental Protection and APO Ltd. 2010.), and other relevant scientific literature were also used. Includes; monitoring of bird activity on Jelinak WF site and possible casualties.

Oikon was engaged to conduct researche of monitoring of bird population during operation of Jelinak WF.

During the first year of monitoring 2013, research was carried out through two terrain researches by month in period from March to November of 2013, and through one terrain research in November 2013 and February 2014. Total of 18 researches were caried out in aim of finding possibly injured birds, and monitoring of their activity was carried out 10 times.

During second year of monitoring, research was carried out through 2 monthly researches in period from March to August 2014. Total of 12 researches were carried out in aim of finding injured birds and monitoring of their activity.

Site location was researched from March 2013 till February 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- research of birds that are temporarily or permanently resident at location;
- research of potentially injured birds in wind farm location.

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behavior in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine.

Table 1. Dinamics of terrain researches of bird fauna during 2013 and 2014.

		Monitoring incidents	***Monitoring activities***
2013	**March**	21st - 22nd	21st - 22nd
		28th -29th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th

		Monitoring incidents	*Monitoring activities*
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th
		28th - 30th	
	November	12th - 15th	12th - 15th
2014	**February**	27th - 28th	27th - 28th
	March	17th -19th	17th -19th
		28th - 29th	
	April	12th - 14th	12th - 14th
		24th-25th	
	May	13th - 15th	13th - 15th
		26th-28th	
	June	12th - 14th	12th - 14th
		26th-27th	
	July	16th - 18th	16th - 18th
		28th - 30th	
	August	12th - 14th	12th - 14th
		24th-26th	

2.1 Monitoring of birds activity

During a research of bird populations on Jelinak WF were applied standard ornithological methods. During research of nesting birds' activity were used standard method of line transects. It have been used same transects defined in a "Compensation research for estimating the status of bird fauna on the Jelinak WF construction site in spring"from 2012 (Appendix 1). Length of transects is from 1 km up to 1.5 km , in the closest point they are distance from each other more than 3 km with cause to avoid recording of same individuals at different transect and to include all habitat types of site to give a more accurate representation of bird species diversity. At each transect with audiovisual methods have been noted all present bird species. During final interpretation of results were taken in consideration maximum value for each transect in order to avoid false high numbers in the case of record of the same individuals at different period . Field research on transect was made at dawn (from 04:30 - 07h) , because at that time the birds are most active. For exact locations have been used GPS navigation device type Garmin 60CSx. For picture of terrain and habitat types, as well as photographing birds used digital camera Canon (PowerShot S5IS) .

As required by the Decision, each field trip was researched transect length 2 km for the purpose of record of the current species present and their activities. Field research on the transect made at dawn (from 04:30 - 07h), making sure to avoid the weather with rain , fog and strong winds .

Transect 1 is set south of construction site of wind farm, at foot of top of the Tišta to Zelena. On the field is dominated by Mediterranean dry grasslands with a combination of arable land, specifically olive groves and orchards (Figure 2).

Figure 2 Characteristic appearance of habitat at transect 1

Transect 2 includes the area from State Road D58, through settlements D. Tomas, to the village Muštre. On this area dominated olive groves, orchards and arable land. Figure 3 shows one of them typical habitat on transect 2 - olive grove.

Figure 3 Characteristic appearance of habitat at transect 2

Transect 3 is set on the north side from wind farm area, from local road 6192, village Kursani to Podgaj. Prevailing scrub oak combined with arable land, mainly olive groves and orchards. Figure 4 shows the characteristic appearance of habitats along the transect 3.

Figure 4 Characteristic appearance of habitat at transect 3

Counting from certain positions (Eng. "vantage point watches" - Scottish Natural Heritage 2005) have been obtained data on overflights over the research area, and special attention is given to birds that are vulnerable to collision with wind turbines (Convention on the Conservation of European Wildlife and Natural Habitats 2003). For observation of the potential overflight of birds in the vicinity of wind turbines have been spent at least an hour for each wind turbine. Birds were observed and analyzed with optical devices (type Nikkon Monarch Binocular, 8x42, Durbin Swarovski STM 80, magnification 20-80x)

Figure 5 Birdwatching with Durbin

For recording of nocturnal species were used playback recording census technique for the induction of the territorial election, and are used in different locations in the narrow area around a wind turbines (1.5 km). Platform that have been used for this purpose have been used only in cases when wind turbines were no active to avoid casualties of individuals. Recordings of voting were released in intervals of 15 minutes, after which have been recorded specific responses of birds whit which are determined presence of nocturnal species.

2.2 Monitoring of birds incidents

Twice a month from March to October 2013, twice a month from March to August 2014, one time in November 2013 and in February 2014, with a time interval of at least five days, have been thoroughly searched area around each turbine at distances up to 70 m, with the aim of finding birds units that are possibly injured in a collision with the blades. Researching is carried out with help of trace on GPS device, depending on visibility on terrain morphology (Figure 6), and in duration of 1 – 1.5 h for each wind turbine (Figure 4). From July 2013, beside searching area around each turbine (at distances up to 70 m), a quick overview of platforms and slopes of each WTG have been carried out every day during the site visit (2-3 days), with purpose of determining the rate at which predators remove dead birds.

Figure 6. GPS trace during terrain research

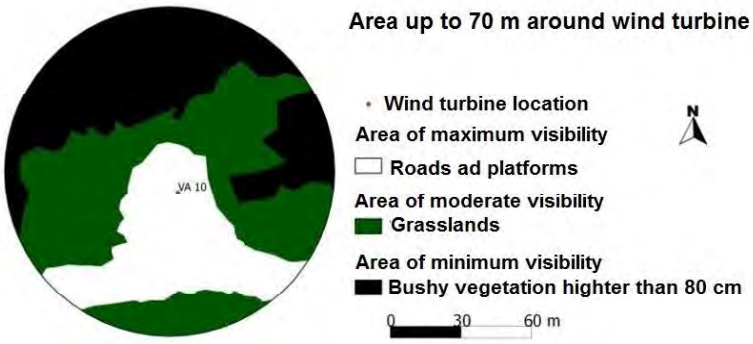

Figure 7. Example of cartographic overview of area visibility up to 70 m around wind turbine with purpose of finding injured birds

Considering determined visibility of area, and existing vegetation and morphology, the search with purpose of finding injured birds have been defined by three categories of visibility degree (Figure 7), and their share in surface varies depending on area of individual wind turbine (Appendix 2). Area with highest visibility (up 100%) are areas of platforms, roads and slopes, they covered a total of 23.5% of the circular area of radius 70 m. In area of moderate visibility grasslands are dominated with vegetation height 15-80 cm depending on the period of year cover about 48% of total area. Area of minimum visibility and difficult passability refers to dense bushy vegetation and covers about 29% of of research area.

Figure 8. Area of maximum visibility

Figure 9. Area of moderate visibility

Figure 10. Area of minimum visibility and difficult passability

During research, area of moderate visibility and area of minimum visibility have showed as unadequate for purpose of search for bird carcasses. For this reason, in the period from July to November 2013 and July to August 2014, a major effort of former has contribute in a search area of greatest visibility (with standard search the entire area around the wind turbine).

Table 2. Categories of area visibility at areas around WTG with radius of 70 m with purpose of finding injured birds

Categories of area visibility	Visibility with purpose of finding birds (%)	Proportion of areas around WTG with radius of 70 m (%)
Area of maximum visibility - roads, platforms and slopes	90-100%	23.45
Area of moderate visibility - grasslands and lop-sided slope	5-15%	47.92
Area of minimum visibility and difficult passability - bushy vegetation higher than 80 cm	0-5%	28.63

Injured birds have been photographed, their location (geographic coordinates, direction and distance from the nearest wind turbine) is recorded, condition of carcasses, their

taxonomic affiliation, gender, age and basic morphological measures depending on general condition of found individual is established.

Because of small number of found carcasses (five birds) was not carried out detailed numerical analysis of data (time required for removal of carcasses from area of wind farm, impact of distance from wind turbine tower on number of injured birds, estimate of total casualties at wind farms, etc.), only have been described circumstances of incidents.

3. RESULTS OF RESEARCH

3.1 Results of monitoring of birds activity

On location Jelinak WF has been conducted systematic field research during 2013 and 2014 with goal to determinate qualitative and quantitative composition of bird fauna and eventual impact of wind farm on bird fauna. Site research has included a narrower zone of construction and its immediate surroundings, minimum 1500 m in all directions from area of wind farm. At location during research period in 2013 and in 2014 have been noted total 52 bird species (Table 3).

Table 3 Time dynamic of species recorded during research in 2013 and 2014

SPECIES/MONTH	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Short-toed Eagle (*Circaetus gallicus*)		■	■	■	■		■			
Montagu's Harrier (*Circus pygargus*)		■	■							
Sparrowhawk (*Accipiter nisus*)								■		
Goshawk (*Accipiter gentilis*)								■		
Buzzard (*Buteo buteo*)	■	■	■		■					
Kestrel (*Falco tinnunculus*)		■	■	■	■		■	■		■
Rock Partridge (*Alectoris graeca*)		■	■				■	■		
Quail (*Coturnix coturnix*)			■							
Yellow-legged Gull (*Larus michahellis*)	■	■	■	■	■		■			■
Rock Dove (*Columba livia*)		■					■		■	■
Turtle Dove (*Streptopelia turtur*)			■							
Cuckoo (*Cuculus canorus*)		■	■							
Eagle Owl (*Bubo bubo*)			■	■						
Nightjar (*Caprimulgus europaeus*)				■		■				
Swift (*Apus apus*)			■	■	■	■	■	■		
Alpine Swift (*Tachymarptis melba*)			■							
Hoopoe (*Upupa epops*)		■	■							
Bee-eater (*Merops apiaster*)			■							
Woodlark (*Lulula arborea*)		■	■				■	■	■	
Swallow (*Hirundo rustica*)	■	■	■		■					
Coastal Pipit (*Anthus campestris*)			■	■	■	■				
Meadow Pipit		■	■							

SPECIES/MONTH	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
(*Anthus pratensis*)										
Nightingale (*Luscinia megarhynchos*)										
Robin (*Eritacus rubecula*)										
Stonechat (*Saxicola torquata*)										
Whinchat (*Saxicola rubetra*)										
Black Redstart (*Phoenicurus ochruros*)										
Wheatear (*Oenanthe oenanthe*)										
Black-eared Wheatear (*Oenanthe hispanica*)										
Blackbird (*Turdus merula*)										
Song Thrush (*Turdus philomelos*)										
Olivaceous Warbler (*Hippolais palida*)										
Blackcap (*Sylvia atricapilla*)										
Subalpine Warbler (*Sylvia cantilans*)										
Chiffchaff (*Phylloscopus collybita*)										
Goldcrest (*Regulus regulus*)										
Great Tit (*Parus major*)										
Sombre Tit (*Poecile lugubris*)										
Jay (*Garrulus glandarius*)										
Hooded Crow (*Corvus cornix*)										
Raven (*Corvus corax*)										
Golden Oriole (*Oriolus oriolus*)										
Starling (*Sturnus vulgaris*)										
House Sparrow (*Passer domesticus*)										
Chaffinch (*Fringilla coelebs*)										
Serin (*Serinus serinus*)										
Linnet (*Carduelis cannabina*)										
Corn Bunting (*Emberiza calandra*)										
Cirl Bunting (*Emberiza cirlus*)										
Black-headed Bunting (*Emberiza melanocephala*)										
Yellowhammer										

SPECIES/MONTH	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
(*Emberiza citrinella*)										

From data (Table 3 and Figure 11) trough number of recorded birds' species indirectly is visible bird activity throughout year. The activity is highest in the spring, during nesting, when most birds vote. Because of this reason, as well as an increased number of species during spring and autumn migration period has been recorded biggest activity as expected. Species recorded in spring during nesting are present during summer because of reduced activity have been recorded smaller number of species on site. Dalmatia is part of migration route between Europe and Africa, number of recorded species on site during spring and autumn migration is increase.

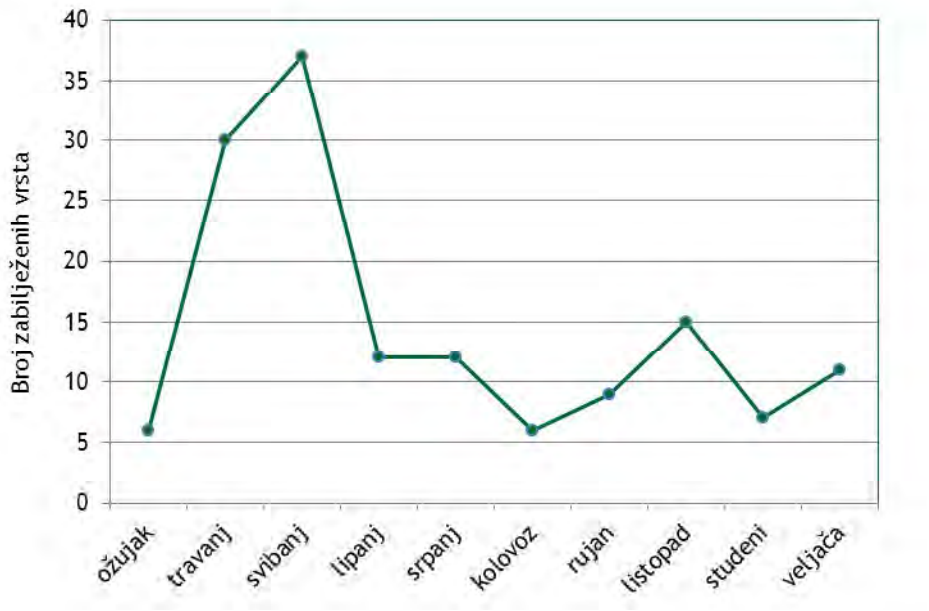

Figure 11 Number of species recorded during the 2013 and 2014

Research of nesting birds is based on transect research defined during zero state, which can be seen in Annex 1 Data from transects were compared in order to determine the possible impact of wind farms on nesting wider area.

On **transect 1** in the first year (2013-2014 years), there were 16 species of birds, unlike 2012 when he recorded 15 species. Species recorded during the 2012 2013 and 2014 years are shown in Table 4.

Table 4. List of species recorded with a number of observed units on Transect 1

Recorded species	Number of observed units	
	2012.	2013.-2014.
Anthus campestris	6	3
Anthus pratensis	-	5
Carduelis cannabina	7	-
Columba livia	-	13
Corvus cornix	-	1
Coturnix coturnix	-	1
Cuculus canorus	2	
Fringilla coelebs	-	2
Emberiza calandra	6	-
Emberiza melanocephala	9	-
Garrulus glandarius	2	1
Hippolais pallida	-	2
Lullula arborea	-	3
Lanius collurio	2	-
Lanius senator	1	-
Larus michahellis	7	-
Luscinia megarhynchos	1	9
Merops apiaster	2	-
Oenanthe hispanica	4	6
Parus major	-	5
Sylvia atricapilla	-	1
Sylvia cantilans	2	17
Sylvia melanocephala	1	-
Turdus merula	2	12
Upupa epops	-	1

At **transect 2** in the first year of research (2013-2014) were recorded 17 species of birds, which is the same as in 2012. Recorded species of nesting birds are shown in Table 5

Table 5. List of species recorded with a number of observed units on Transect 2

Recorded species	Number of observed units	
	2012.	2013.-2014.
Corvus cornix	-	1
Cuculus canorus	1	3
Emberiza cia	1	-
Emberiza cirlus	1	-
Emberiza melanocephala	11	3
Fringilla coelebs	17	6
Garrulus glandarius	-	1
Hirundo rustica	-	1
Hippolais polyglotta	2	-
Larus michahellis	4	-
Luscinia megarhynchos	13	10
Oenanthe oenanthe	-	1
Oriolus oriolus	2	2
Parus major	2	2
Passer domesticus	10	-
Phyloscopus collibita	1	2
Regulus regulus	-	1
Serinus serinus	-	1
Streptopelia turtur	3	3
Sylvia atricapilla	1	1
Sylvia cantilans	7	13
Turdus merula	18	9
Upupa epops	1	-

At **transect 3** in first year (2013 --2014ts) were recorded 19 species of birds, as opposed from 2012 during which have been recorded 18 species. Recorded species of nesting birds are shown in Table 6.

Table 6. List of species recorded with a number of observed units on Transect 3

Recorded species	Number of observed units	
	2012.	2013.-2014.
Anthus pratensis	-	1
Apus apus	2	-
Buteo buteo	2	-
Carduelis canabinna	2	4
Corvus cornix	-	2
Cuculus canorus	1	1
Emberiza calandra	-	4
Emberiza cirlus	1	1
Emberiza melanocephala	4	-
Fringilla coelebs	5	2
Garrulus glandarius	-	6
Hippolais polyglotta	3	-
Hirundo rustica	4	-
Larus michahellis	-	4
Lullula arborea	-	10
Luscinia megarhynchos	4	7
Oenanthe hispanica	1	2
Parus major	1	1
Passer domesticus	>10	-
Phylloscopus collybita	-	2
Regulus regulus	-	1
Serinus serinus	1	-
Streptopelia turtur	2	1
Sylvia atricapilla	-	1
Sylvia cantilans	12	7
Sylvia communis	3	-
Turdus merula	6	1

Number of species during research of zero state and states and during construction phase of wind farm, as shown in Figure 12 has not substantially changed.

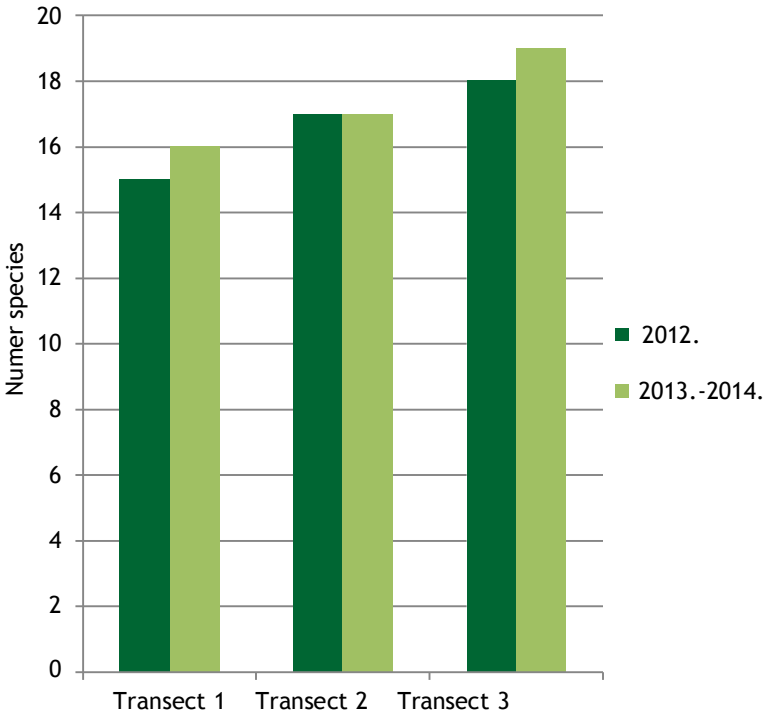

Figure 12 Number of bird species on transects in 2012 and 2013-2014 on transects 1, 2 i 3

3.2 Results of monitoring of birds incidents

During research that is carried out in 2013 and 2014 at Jelinak WF location there were recorded total of four species, ie. 6 injured birds unit. Species that are found: Buzzard (Buteo buteo), Robin (Eritacus rubecula) (Figure 13) and Song Thrush (Turdus philomelos) and Eurasian skylark (Alauda arvensis).

All injured individuals were found during site visit in 2013 are found in late March, during foggy weather, with reduced visibility and low precipitation, while during research that was carried out in 2014 one injured unit is found in late May. Part of found birds have been found in area of maximum visibility, ie roads, platforms and slopes, while Buzzard (Buteo buteo) and one Robin (Eritacus rubecula) have been found in denser vegetation. All injured individuals were found at 20-55 m from wind turbine (Appendix 3). Since March is time of spring migration, assumption is that birds were injured (or at least some of them) were passage birds on research area and that they have been injured because of poor visibility.

List of injured birds during research in 2013 and 2014, together with data of direction from WTG is shown in Table 7. Injured birds were left on site, and that areas were searched again next day, during which they have been not found again. Since weather conditions were not favorable for intensive decomposing of carcasses, their disappearance indicates presence of predators at site. To the same thing indicate number of droppings on platforms wind turbines at the time of incident.

Table 7. Findings of injured birds at area of JelinakWF in 2013 and 2014

WTG	Direction	Bird species	Date of finding
WTG 01	W	European Robin (*Eritacus rubecula*)	21st of March 2013
WTG 12	N	European Robin (*Eritacus rubecula*)	28th of March 2013
WTG 17	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013
WTG 02	N	Eurasian skylark (*Alauda arvensis*)	27th of May 2014

Figure 13 Finding carcasses of individual European Robin (*Eritacus rubecula*) along WTG 12

4. INTERPRETATION OF RESULTS

4.1 Ecology and distribution of injured birds species

Eritacus rubecula, Robin, LC, a strictly protected species (Linnaeus, 1758)

Habitat: It occurs in all types of inland forests of the plains to the highest mountains.
Ecology types: It feeds on insects and fruit that is in bush vegetation. It voicing throughout the year. In winter in Dalmatia their number increases due to wintering bird arrived from north.
Status: resident, migratory and wintering.
Distribution and status in Croatia: The species is common and widespread in the region. It is present at the location in areas with denser vegetation, which probably nests in small numbers.

Turdus philomelos, Song Thrush (Brehm 1831)

Habitat: It inhabits wooded areas, thickets, agricultural areas, orchards, parks and gardens.
Ecology types: Feeds with insects, gastropods, and fruits of plants. Voice from it is loud and clear, and it is easy to spot. Makes nest from sticks and mud, and inside sheathing only with hardened mud.
Status: migratory and wintering in coastal belt.
Distribution and status in Croatia: The species is common as wintering in coastal belt. It is present at the location in the whole area, and sometimes in the winter can be seen in flocks.

Buteo buteo, Buzzard, LC, a strictly protected species (Linnaeus, 1758)

Habitat: It inhabits forests, woods, agricultural areas with trees and open areas in winter.
Ecology types: It feeds mainly with small mammals, and often it can be seen how "flashing" in the air to catc prey. Voice from it is loud and clear, and it is easy to spot. Makes nest from sticks and mud, and inside sheathing only with hardened mud.
Status: resident, nesting, migratory and wintering.
Distribution and status of the Croatia: It is very common raptor in region. on location is estimated intense activity of at least one pair.

Eurasian skylark (Alauda arvensis)

Habitat: Open area, often without trees, agricultural areas, grasslands, alpine meadows.
Ecology types: Feeds with seeds and insects. Female in June in the grassy nest lays 3 to 6 eggs. Eggs are yellow / white with brownish / purple spots. The nest is very difficult to find.
Status: migratory and nestng species**.**
Distribution and status of the Croatia: The species is common and widespread in the region. It is present and this location in area with with denser vegetation, where probably nests in small numbers.

4.2 Risk assessment of bird fauna at location of Jelinak WF

In area of Jelinak WF were found 52 bird species , of which 35 are strictly protected (Nature Protection Act, Official Gazette NN 80/13; Rules of strictly protected species, Official Gazette NN 144/13). Croatia is a signatory to Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). At the same time in Croatia inhabited by 16 species listed in the Directive of Protection of Birds (79/409/EEC BD). Most birds are in categories IUCN category "least concern" (LC), but among the recorded species is one endangered species (EN) Montagu's Harrier and one vulnerable species (VU) Short-toed Eagle (Figure 14). Even 27% birds on the list is without assigned IUCN category.

Table 8 List of species recorded on location VE Jelinak during the investigation period

	SPECIES	Bern	Bonn	EU dir	HR status				EU status	Strictly protected
					gn	ngn	pre	zim		
1.	Short-toed Eagle (*Circaetus gallicus*)	II	II	I	VU				RARE	da
2.	Montagu's Harrier (*Circus pygargus*)	II	II	I	EN					da
3.	Sparrowhawk (*Accipiter nisus*)	II	II		LC					YES
4.	Goshawk (*Accipiter gentilis*)	II	II		LC					YES
5.	Buzzard (*Buteo buteo*)	II	II		LC					YES
6.	Kestrel (*Falco tinnunculus*)	II	II		LC					YES
7.	Rock Partridge (*Alectoris graeca*)	lll		I	NT				VU	
8.	Quail (*Coturnix coturnix*)	III	II	II-2	NT		NT		VU	
9.	Yellow-legged Gull (*Larus michahellis*)	III		II-2					(Secure)	
10.	Rock Dove (*Columba livia*)	III		II-1						
11.	Turtle Dove (*Streptopelia turtur*)	III		II	LC				DEC	
12.	Cuckoo (*Cuculus canorus*)	III								
13.	Eagle Owl (*Bubo bubo*)	II		I	NT				VU	YES
14.	Nightjar (*Caprimulgus europaeus*)	II		I	LC				DEC	YES
15.	Swift (*Apus apus*	III								

16.	Alpine Swift (*Tachymarptis melba*)	II							Secure)	YES
17.	Hoopoe (*Upupa epops*)	II			LC					YES
18.	Bee-eater (*Merops apiaster*)	II	II		LC				DEC	YES
19.	Woodlark (*Lulula arborea*)	III		I	LC				VU	
20.	Swallow (*Hirundo rustica*)	II			LC				DEC	YES
21.	Tawny Pipit (*Anthus campestris*)	II		I	LC				VU	YES
22.	Meadow Pipit (*Anthus pratensis*)	II					LC	LC		YES
23.	Nightingale (*Luscinia megarhynchos*)	II	II		LC				(Secure)	YES
24.	Robin (*Eritacus rubecula*)	II	II		LC					YES
25.	Stonechat (*Saxicola torquata*)	II	II		LC				(DEC)	YES
26.	Whinchat (*Saxicola rubetra*)	II	II		LC					YES
27.	Black Redstart (*Phoenicurus ochruros*)	II	II		LC					YES
28.	Wheatear (*Oenanthe oenanthe*)	II	II		LC					YES
29.	Black-eared Wheatear (*Oenanthe hispanica*)	II	II		LC				VU	YES
30.	Blackbird (*Turdus merula*)	III	II	II-2						
31.	Song Thrush (*Turdus philomelos*)	lll	ll	II-2						
32.	Olivaceous Warbler (*Hippolais palida*)	II	II		LC					YES
33.	Blackcap (*Sylvia atricapilla*)	II	II		LC					YES
34.	Subalpine Warbler (*Sylvia cantilans*)	II	II		LC					YES
35.	Chiffchaff (*Phylloscopus collybita*)	II	II		LC					YES
36.	Goldcrest (*Regulus regulus*)	II	II		LC				(Secure)	YES
37.	Great Tit (*Parus major*)	II			LC					YES
38.	Sombre Tit (*Poecile lugubris*)	II			LC				(Secure)	YES

39.	Jay (*Garrulus glandarius*)	III		II-2					(Secure)	
40.	Hooded Crow (*Corvus cornix*)	III		II-2						
41.	Raven (*Corvus corax*)	III							(Secure)	
42.	Golden Oriole (*Oriolus oriolus*)	II			LC					YES
43.	Starling (*Sturnus vulgaris*)	III		II-2						
44.	House Sparrow (*Passer domesticus*)	III								
45.	Chaffinch (*Fringilla coelebs*)	III								
46.	Serin (*Serinus serinus*)	II			LC					YES
47.	Linnet (*Carduelis cannabina*)	II			LC					YES
48.	Corn Bunting (*Emberiza calandra*)	III							(Secure)	YES
49.	Cirl Bunting (*Emberiza cirlus*)	II			LC				(Secure)	YES
50.	Black-headed Bunting (*Emberiza melanocephala*)	II			LC				(VU)	YES
51.	Yellowhammer (*Emberiza citrinella*)	II			LC				(Secure)	YES
52.	Eurasian skylark (Alauda arvensis)	III			LC				(Deplated)	NO

Explanation of the table:

HR Status: gn - nesting; Pre - migratory; zim - wintering; Vulnerability categories (IUCN): CR-- Critically Endangered, EN - Endangered, VU - sensitive, NT - Near vulnerable, LC - least concern, DD - deficient; Bern Convention NN 6/00 - Convention on the Conservation of European Wildlife and Natural Habitats: Appendix II. Strictly protected species; Appendix III. Protected animal species; Bonn conv. NN 6/00 – Convention on the Conservation of Migratory Species of Wild Animals: Appendix I Endangered migratory species; Appendix II. Migratory species that need to be subject to the agreement; BD 79/409/EEC - Directive on the Protection of Birds: Birds Annex I for which it is necessary to allocate Special Protection Areas (SPA), Appendix II. Species that may be hunted; Appendix III. Types that can be traded; Regulations on strictly protected species (NN 144/13).

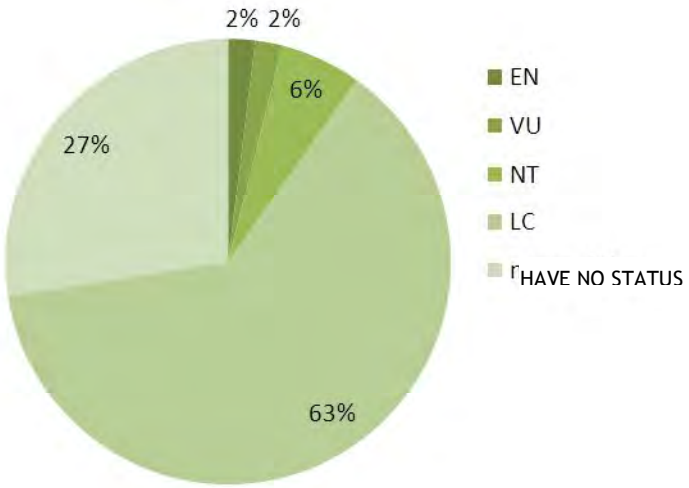

Figure 14 Distribution according to IUCN categories of vulnerability of recorded bird species

Birds, beside bats, consider as species that is most endangered by wind farms. The most frequently is mentioned four negative effects of wind farms on birds (Drewitt and Langston 2006): direct collision, displacement due to disturbance , barrier effects and habitat loss. Direct fatalities due have been particularly endangered migratory birds (Johnson et al . 2002) , although it depends on location, whether wind farm location is on migration corridor. This kind of corridor is Dalmatia , particularly are important " Bottlenecks " that birds use for rest and feeding before they continue migration (eg Vrana Lake near Pakoštane). Some groups are more endangered by collisions with wind turbines , thereby highlight are birds of prey , as frequent victims of incidents (Hotker 2008) . For Croatia there are few data of injured birds on wind farm. According to the data (Problemanalyse und Lösungsvorschläge , BMU - Project , 2010) for Croatia , there was only one injured birds (Aegolius funereus - Tengmalm's Owl) .

As mentioned, among species endangered by wind farms stand out birds of prey. For example, in Germany, birds of prey are the most numerous group injured at wind farms (Hötker 2008). It is the species that is not so numerous in certain areas as other groups, they are long lived (longer they need to reach reproductive maturity and raised by a small number of young) and they are usually top-predators (damage due to these impacts on the entire ecosystem). Therefore, special attention must be dedicate to this group and their protection on wind farms.

Birds of prey on Jelinak WF

From the list of recorded species can be point out birds with increased risk of collision with wind turbine blades (according to the report "Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues") **Short-toed Eagle** (Circaetus gallicus), **Montagu's Harrier** (Circus pygargus), **Goshawk** (Accipiter gentilis), **Sparrow hawk** (Accipiter nisus), **Buzzard** (Buteo buteo) and **Kestrel** (Falco tinnunculus).

Circaetus gallicus, Short-toed Eagle, VU

One pair was recorded several times at the location during ornithological research in 2013. Individuals were seen flying at altitudes up to 150 m, and have been recorded several landings on the dense vegetation in narrow research area, which indicates intensely use of this area for territorial and hunting. Short-toed Eagle are shown in Figure 15.

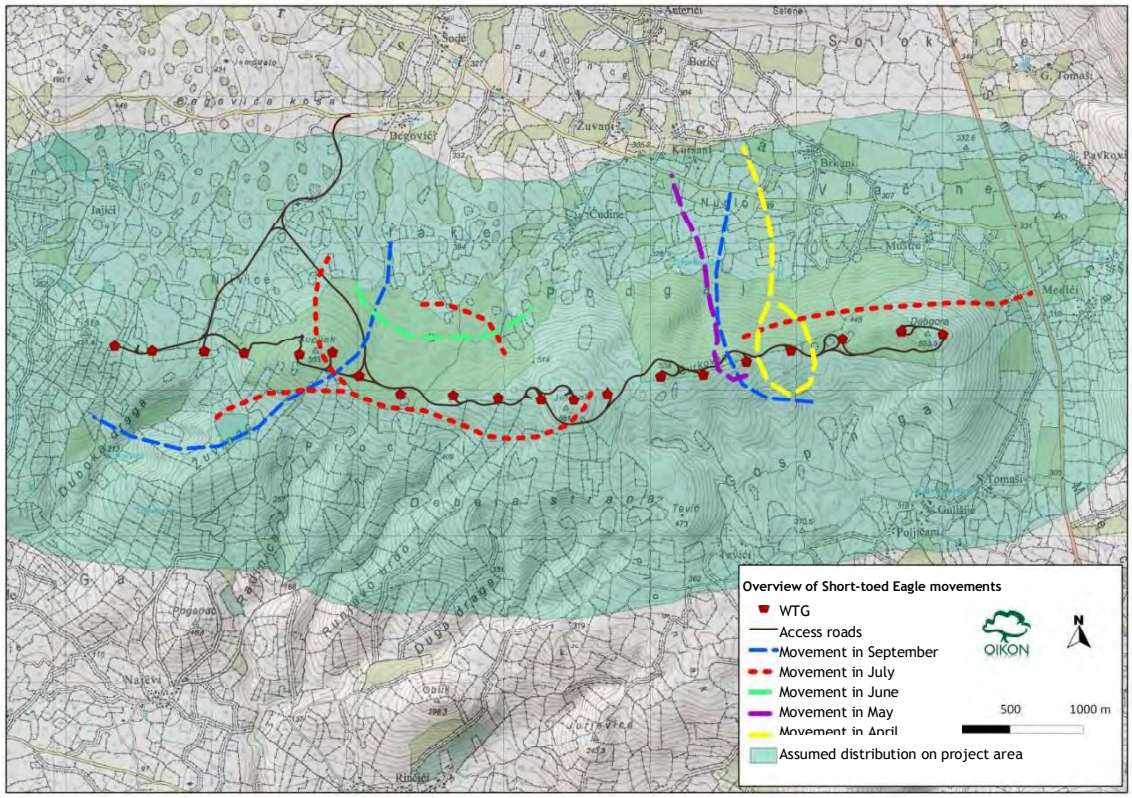

Figure 15 Overview of Short-toed Eagle movements (Circaetus gallicus)

[1] Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Convention on the Conservation of European Wildlife and Natural Habitats, T-PVS/Inf (2003) 12, Council of Europe, Strasbourg.

Circus pygargus, Montagu's Harrier, EN

One individual was observed during research. The bird was seen flying over on eastern part of area, and exact location of overflights is shown in Figure 16. Given the fact that the bird was seen flying over at the same area both times that was observed, the assumption is that this corridor used for overflights, and that not retains in narrow area of Jelinak WF.

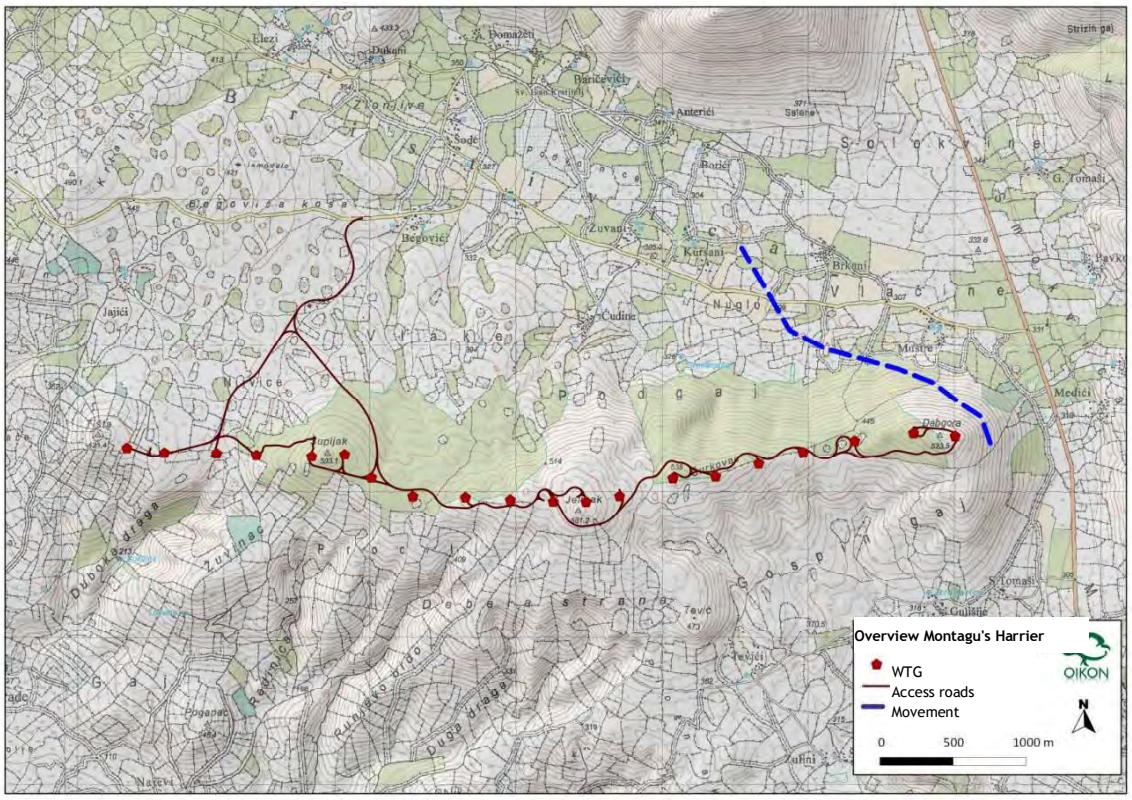

Figure 16 Overview of Montagu's Harrier movements (Circus pygargus)

Accipiter gentilis, Goshawk, LC

One individual of this species was observed during flight over, during research in June 2013. Whereas during the previous months of research was not recorded a single individual of this species in research area, assumption is that this is wintering bird. Recorded of individual movements is shown in Figure 17

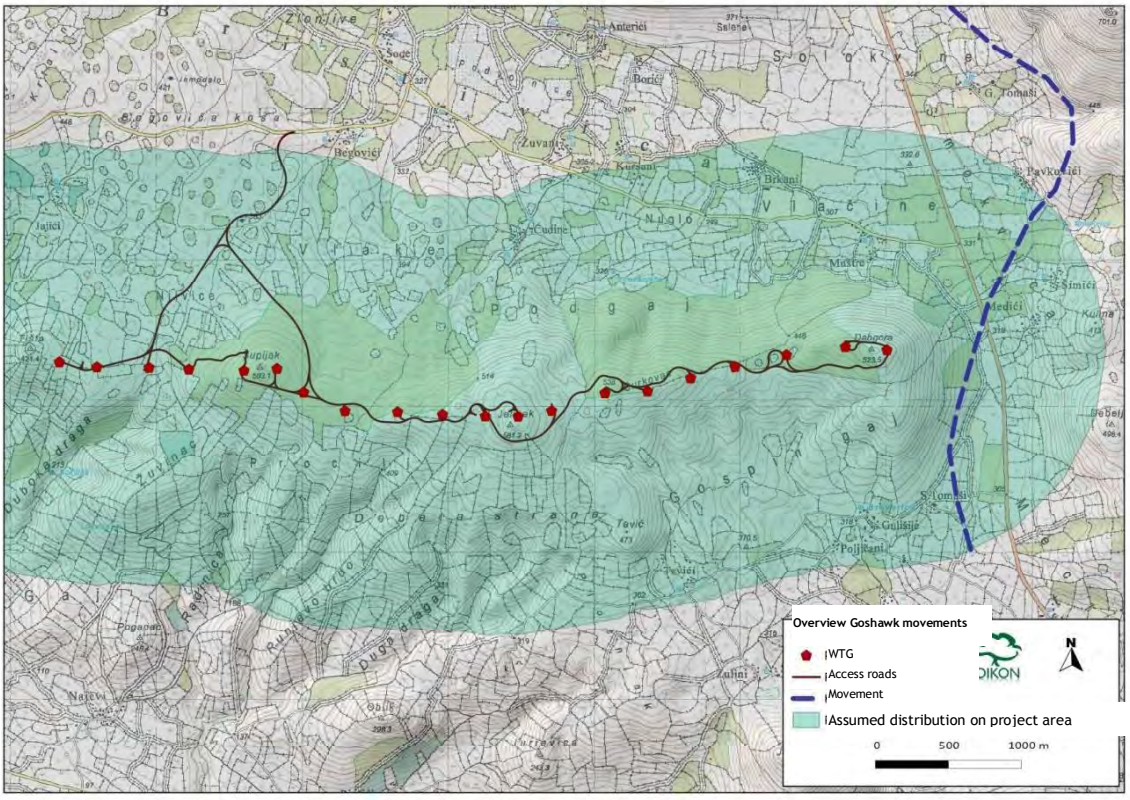

Figure 17 Overview of Goshawk movements (Accipiter gentilis)

Accipiter nisus, Sparrow hawk, LC

During research in the 2013 this species has been recorded only once, during October The bird was observed flying over the east in immediate zone of research area, as shown in Figure 18. Whereas during the previous months of research have not recorded a single specimen of this species in area, assumption is that this is wintering bird.

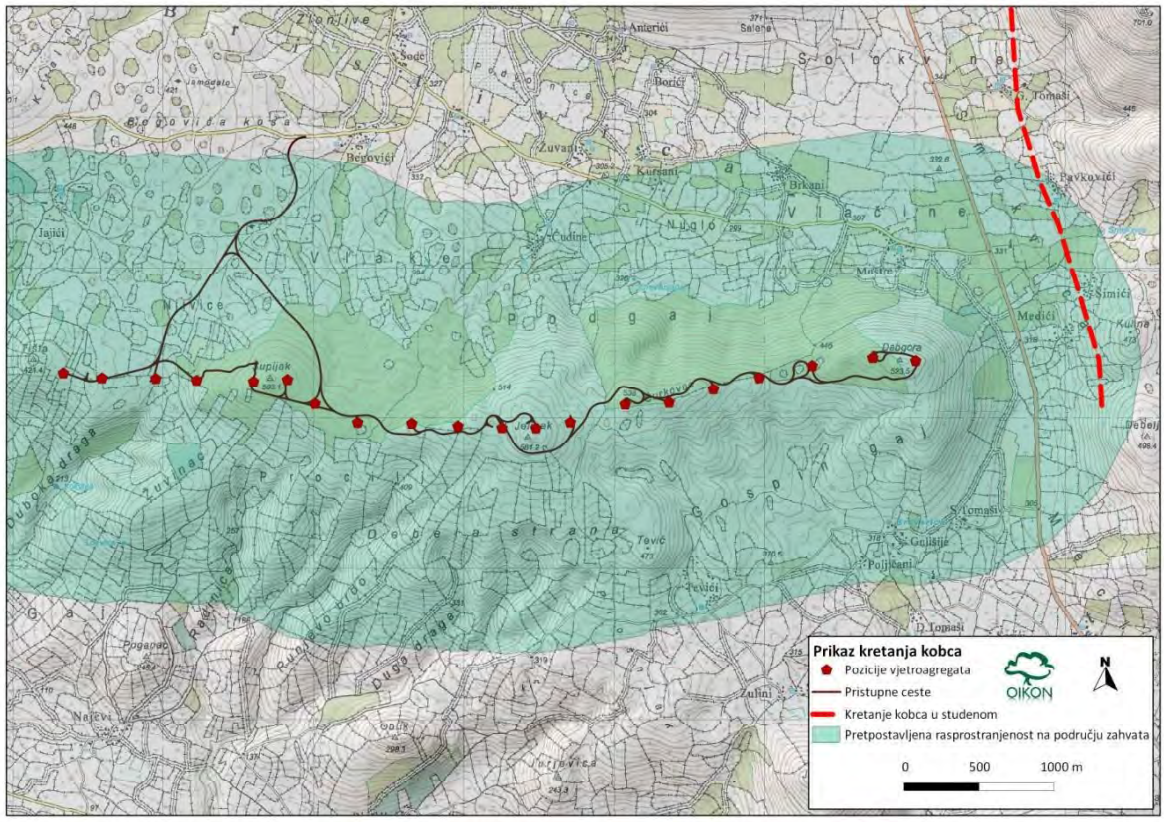

Figure 18 Overview of Sparrow hawk movements (Accipiter nisus)

Buteo buteo, Buzzard, LC

This species was observed at the location for several months, last time during s July 2013. The specimens were observed flying at a low altitude of the flight, about 20 m above the ground, to a height of about 250 m. Species using this area for hunting and fling, and how it was recorded during the nesting phase it is assumed that one pair is nesting in proximity Jelinak WF. Exactly movement of Buzzard on the area of WF is shown in Figure 19

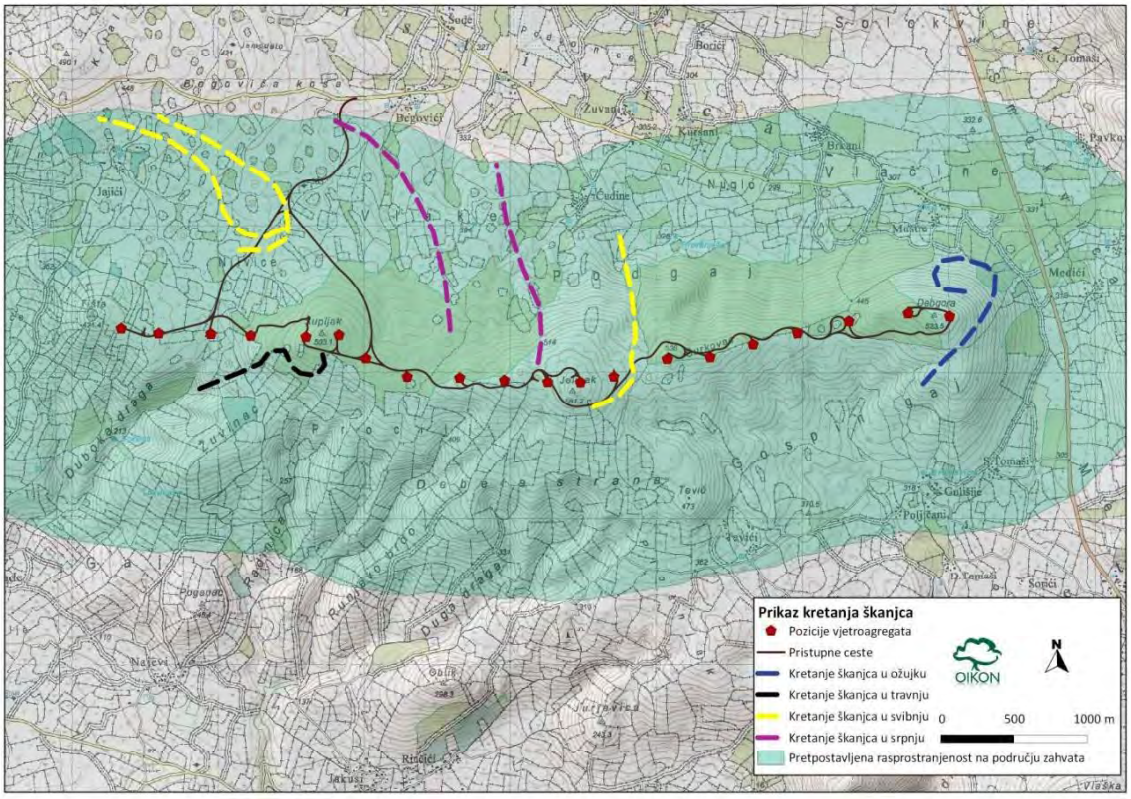

Figure 19 Overview of Buzzard movements (Buteo buteo)

Falco tinnunculus, Kestrel, LC

The species was recorded during several months during ornithological research in the 2013 at altitudes 30-150 m above the ground. Due to the high frequency of occurrence throughout the year assumption is that species of area used for hunting, breeding and fly. Moviment of Kestrel at area of WF is shown in Figure 20.

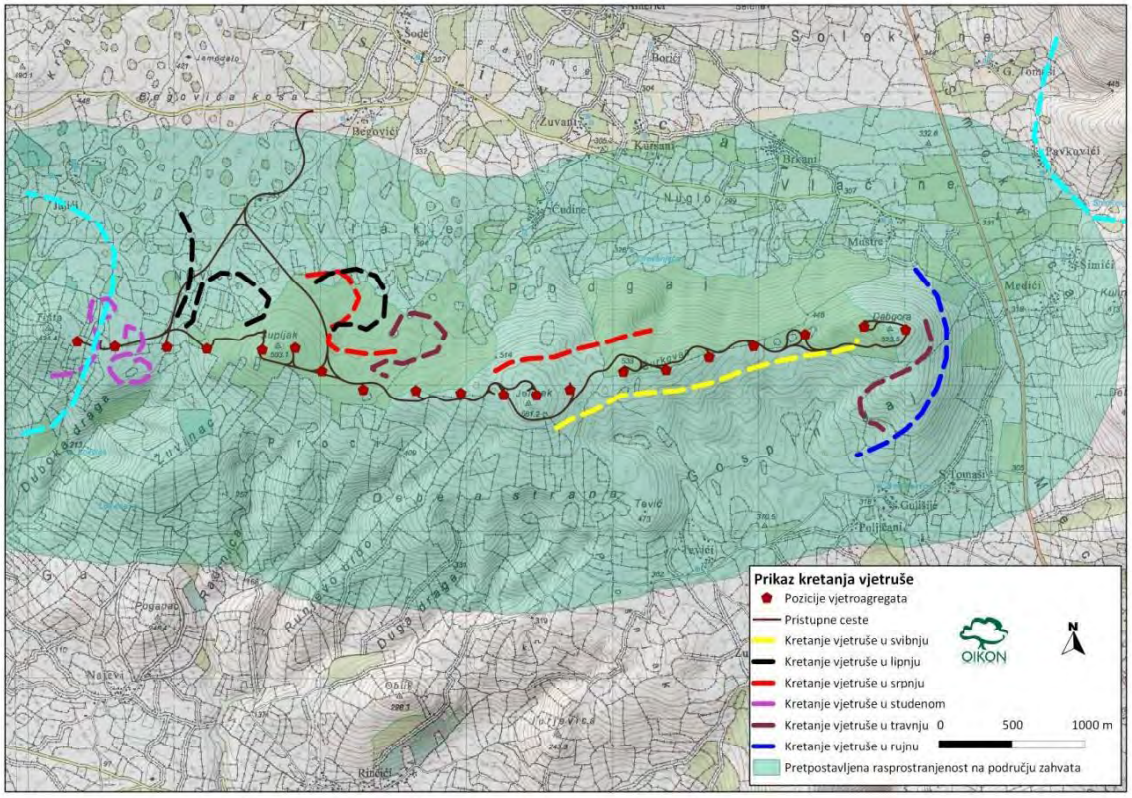

Figure 20 Overview of Kastrel movements (Falco tinnunculus)

6. CONCLUSION

IN area of Jelinak WF, during research in 2013 and 2014, total of 52 bird species were recorded. Activity is the highest as expected during the nesting period, which is evident from the number of recorded species through months of research. By comparing the number of species on same transects from 2012, 2013 and 2014 is concluded that there was no significant change in nesting bird number from this area.

Bird activity on narrower area of WF have not been decreased over the year, larger number of over flights have been recorded from March to November as expected due to seasonal bird activity (increased during nesting and migration season). From a list of all recorded species can be distinguished birds with an increased risk of collision with wind turbine blades (according to the report "Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues" 2): Short-toed Eagle (*Circaetus gallicus*), Montagu's Harrier (*Circus pygargus*), Goshawk (*Accipiter gentilis*), Sparrow hawk (*Accipiter nisus*), Buzzard (*Buteo buteo*) and Kestrel (*Falco tinnunculus*).

In the area of Jelinak WF during research 2013 and 2014, total casualties were recorded four spices, ie six injured bird specimens. Species found were: Common Buzzard (Buteo buteo), Robin (Eritacus rubecula), Song Thrush (Turdus philomelos) and Eurasian skylark (Alauda arvensis). All birds were found in March, during foggy weather, with reduced visibility and low rainfall, so it can be assumed that they killed in a collision with wind turbines due to poor visibility and bad weather conditions. Injured birds were left in situ, and these are the places searched again the next day. During re-search injured bird was gone. Since the weather conditions were not favorable for intensive decomposing of carcasses, their disappearance indicates the presence of predators. At the same point increased number of droppings on the platforms around a wind turbine at the time of incident.

Due to the small number of identified injured specimens (five birds), was not carried out detailed numerical data processing, but only circumstances of incidents have been described.

[2] Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Convention on the Conservation of European Wildlife and Natural Habitats, T-PVS/Inf (2003) 12, Council of Europe, Strasbourg.

7. DATA SOURCES

Professional and scientific literature

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Web pages

1. www.dzzp.hr
2. www.ornitologija.hr
3. www.nn.hr

List of regulations

1. BD 79/409/EEC - Direktiva o zaštiti ptica
2. Bernska konvencija NN 6/00 - Konvencija o zaštiti europskih divljih vrsta i prirodnih staništa
3. Bonnska konvencija NN 6/00 - Konvencija o zaštiti migratornih vrsta divljih životinja
4. Ministarstvo zaštite okoliša, prostornog uređenja i graditeljstva i APO d.o.o (2010): Smjernice za izradu Studija utjecaja na okoliš za vjetroelektrane za faunu ptica i šišmiša.
5. Zakonu o zaštiti prirode (NN 80/13)
6. Pravilnik o strogo zaštićenim vrstama (NN 144/13)

List of reports

1. Bird monitoring on Jelinak WF during construction (April 2012.)
2. Bird monitoring on Jelinak WF during construction (July 2012.)
3. Bird monitoring on Jelinak WF during construction (August 2012.)
4. Bird monitoring on Jelinak WF during operation (February 2013.);
5. Bird monitoring on Jelinak WF during operation (Listopad 2013.);
6. Bird monitoring on Jelinak WF during operation (September 2013.);
7. Bird monitoring on Jelinak WF during operation (August 2013.);
8. Bird monitoring on Jelinak WF during operation (July 2013.);
9. Bird monitoring on Jelinak WF during operation (June 2013.);
10. Bird monitoring on Jelinak WF during operation (May 2013.);
11. Bird monitoring on Jelinak WF during operation April 2013.);
12. Bird monitoring on Jelinak WF during operation – report for first year of monitoring (March 2014.);
13. Bird monitoring on Jelinak WF during operation (February 2014.);
14. Bird monitoring on Jelinak WF during operation (March 2014.);
15. Bird monitoring on Jelinak WF during operation (April 2014.);
16. Bird monitoring on Jelinak WF during operation (May 2014.);
17. Bird monitoring on Jelinak WF during operation (August 2014.);
18. Bird monitoring on Jelinak WF during operation (June 2014.);
19. Bird monitoring on Jelinak WF during operation (July 2014.).

8. ANNEXES

Annex 1: graphic overview of transect position in relation WF location

Annex 2: Categories of visibility areas degree around wind turbines (WTG) radius of 70 m with purpose of finding injured birds and bats

Annex 3: Overview of positions found injured bird individuals

Annex 4: Bird monitoring on Jelinak WF during construction (April 2012.)

Annex 5: Bird monitoring on Jelinak WF during construction (July 2012.)

Annex 6: Bird monitoring on Jelinak WF during construction (August 2012.)

Annex 7: Bird monitoring report during construction phase on Jelinak WF (February 2013.);

Annex 8: Bird monitoring on Jelinak WF during operation (April 2013.);

Annex 9: Bird monitoring on Jelinak WF during operation (May 2013.);

Annex 10: Bird monitoring on Jelinak WF during operation (June 2013.);

Annex 11: Bird monitoring on Jelinak WF during operation (July 2013.);

Annex 12: Bird monitoring on Jelinak WF during operation (August 2013.);

Annex 13: Bird monitoring on Jelinak WF during operation (September 2013.);

Annex 14: Bird monitoring on Jelinak WF during operation (October 2013.);

Annex 15: Bird monitoring on Jelinak WF during operation – report for first year of monitoring (March 2014.);

Annex 16: Bird monitoring on Jelinak WF during operation (February 2014.);

Annex 17: Bird monitoring on Jelinak WF during operation (March 2014.);

Annex 18: Bird monitoring on Jelinak WF during operation (April 2014.);

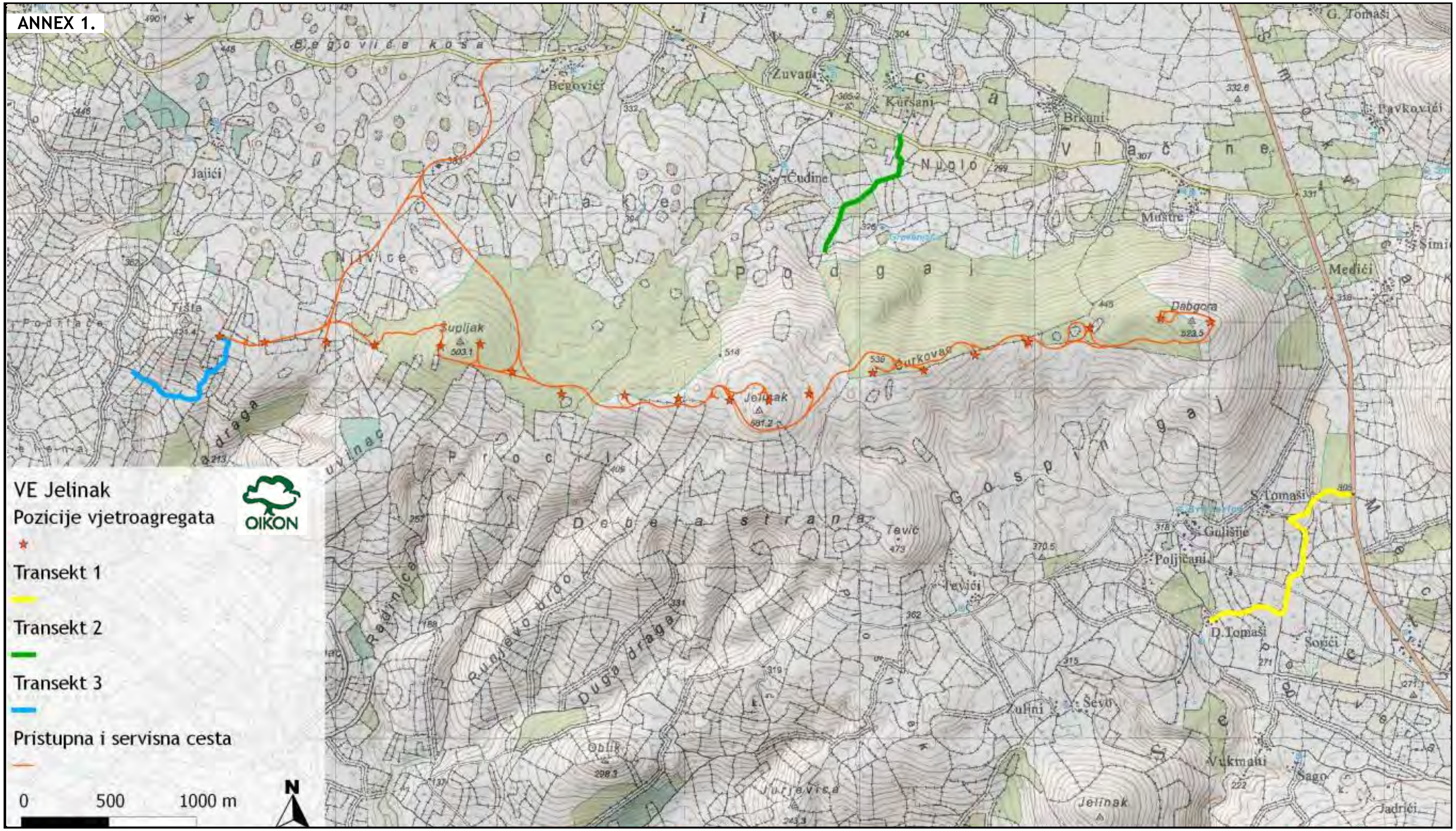
Annex 19: Bird monitoring on Jelinak WF during operation (May 2014.);

Annex 20: Bird monitoring on Jelinak WF during operation (June 2014.);

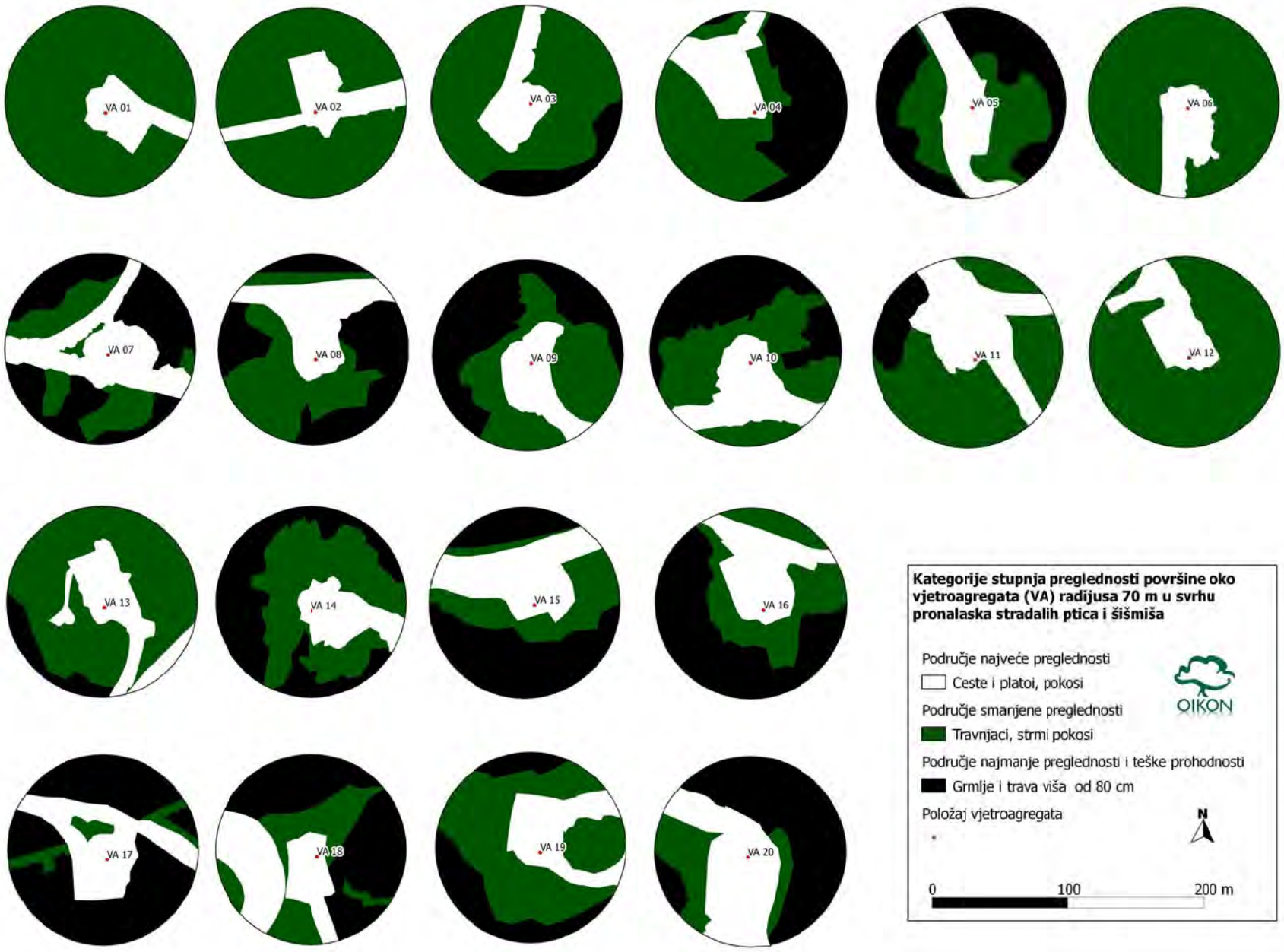
Annex 21: Bird monitoring on Jelinak WF during operation (July 2014.);

Annex 22: Bird monitoring on Jelinak WF during operation (August 2014.).

ANNEX 1.


VE Jelinak
Pozicije vjetroagregata
Transekt 1
Transekt 2
Transekt 3
Pristupna i servisna cesta
0
500
1000 m
N
OIKON
Jelinak
Šupljak
Dabgora
Čurkovac
Podgaj
Begovići
Žuvani
Kuršani
Brkuni
Čudine
Nuglo
Mustre
Medići
Pavkovići
G. Tomaši
S. Tomaši
D. Tomaši
Gulišće
Poljičani
Sorići
Zulini
Ševo
Vukmani
Sago
Jadrići
Jajići
Tišta
Nijivice
Begovica kosa
Debela strana
Tević
Gospingaj
Oblik
Jurjevica
Duga draga
Runjevo brdo
Radrnica

ANNEX 2.


VA 01
VA 02
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VA 06
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VA 09
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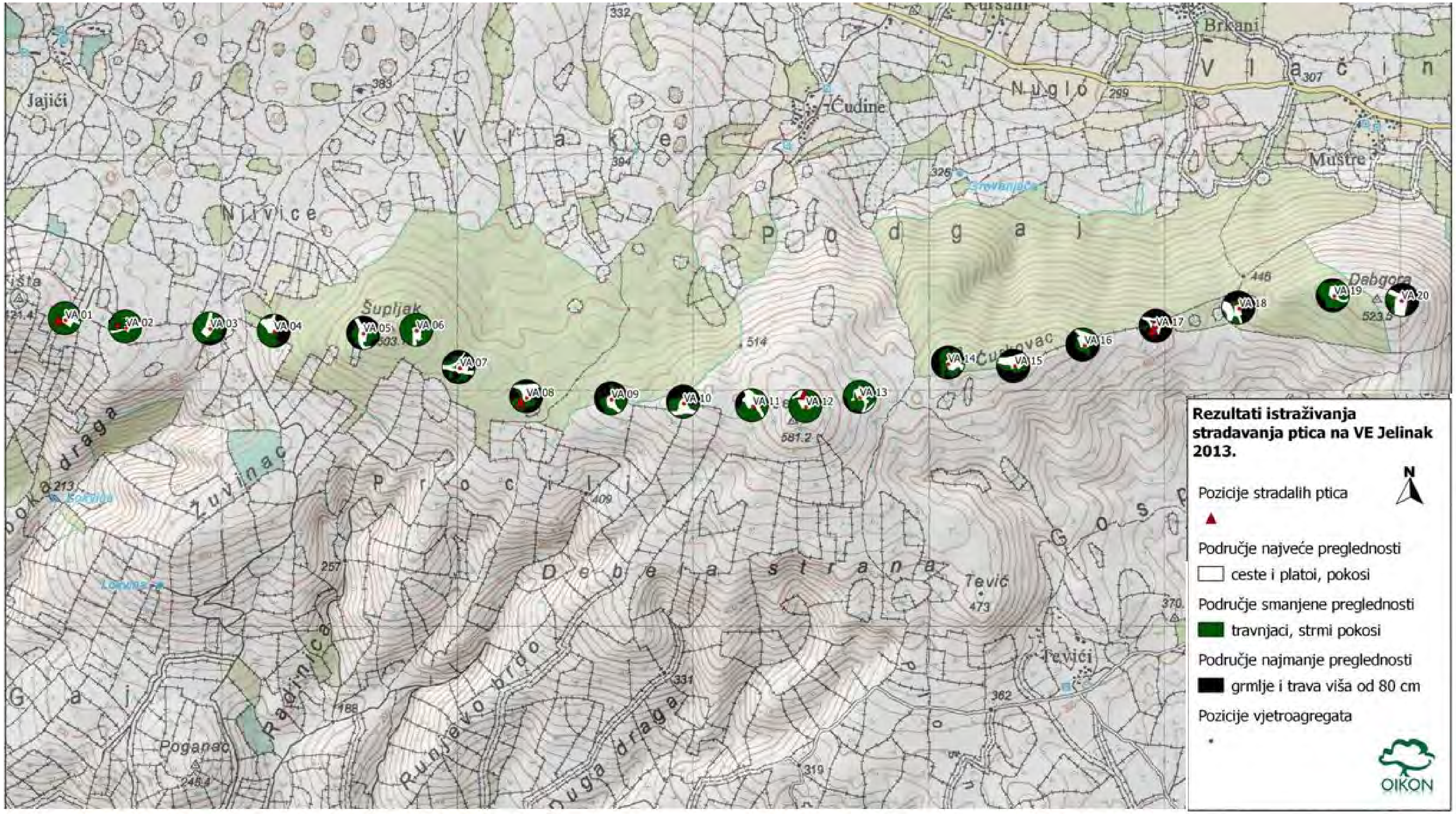
VA 11
VA 12
VA 13
VA 14
VA 15
VA 16
VA 17
VA 18
VA 19
VA 20
Kategorije stupnja preglednosti površine oko vjetroagregata (VA) radijusa 70 m u svrhu pronalaska stradalih ptica i šišmiša
Područje najveće preglednosti
Ceste i platoi, pokosi
Područje smanjene preglednosti
Travnjaci, strmi pokosi
Područje najmanje preglednosti i teške prohodnosti
Grmlje i trava viša od 80 cm
Položaj vjetroagregata
N
0
100
200 m
OIKON

ANNEX 3.



Rezultati istraživanja stradavanja ptica na VE Jelinak 2013.
N
Pozicije stradalih ptica
Područje najveće preglednosti
ceste i platoi, pokosi
Područje smanjene preglednosti
travnjaci, strmi pokosi
Područje najmanje preglednosti
grmlje i trava viša od 80 cm
Pozicije vjetroagregata
OIKON
VA 01
VA 02
VA 03
VA 04
VA 05
VA 06
VA 07
VA 08
VA 09
VA 10
VA 11
VA 12
VA 13
VA 14
VA 15
VA 16
VA 17
VA 18
VA 19
VA 20
Jajići
Čudine
Brkani
Muštre
Šupljak
Dabgora
Tević
Tevići
Poganac

Annex 4: Bird monitoring on Jelinak WF during construction (April 2012.)

Oikon d.o.o.
Institute of Applied Ecology

1. Report on bird monitoring during construction of Jelinak WF

Oikon d.o.o.
Institute of Applied Ecology

Client: **EHN d.o.o.**
Zrinsko – Frankopanska 64, 21 000 Split

Purchaser: **EURUS d.o.o.**
Smiljanićeva 2, 21 000 Split

Contractor: **OIKON d.o.o. Institute of Applied Ecology**
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: **JELINAK WF**

Subject: REPORT ON ORNITHOLOGICAL MONITORING DURING CONSTRUCTION OF JELINAK WF

Int. contract no. OIKON: 761-12

Report created by: Elena Patčev, Professor of Biology and Chemistry.
Sven Kapelj, Master of Ecology and Nature Preservation
Mirna Mazija, Graduate Biological Engineer (QC)

Zagreb, April 2012

CONTENTS

1. FIELD INSPECTION REPORT

Bird monitoring is performed in order to estimate the impact of works on bird fauna at the Jelinak WF construction site. Monitoring preparation consisted of a detailed study of previous bird research in the area, papers on bird disturbance by anthropogenic impacts during different cycles of the year and preparation of bases, i.e. methodology development. The goal of the research is to estimate the impact of works on nesting birds and passage birds, and also to conclude whether the birds still use this area in their daily activities.

1.1. WORK METHODOLOGY

The first ornithological research during the works on Jelinak WF was carried out on April 12 and April 13, 2012. Standard bird watching and counting methods and vantage point watches (*Scottish Natural Heritage 2005*) were used. Special attention was paid to bird species with large habitats, which were recorded in the previous research, especially birds of prey. During vantage point watches, attention was also given to passages and possible migration routes. Researchers were present at points from noon to sunset (2 pm - 6 pm) and in the morning period (8 am - 9 am).

A part of the research was conducted using point count method (*Bibby et al. 2000*) in the early morning (6 am - 8 am) which recorded songbirds. Representation and number of species were recorded using visual observation and listening to calls or songs.

Diurnal and nocturnal species were researched on the field by two ornithologists - Elena Patčev and Sven Kapelj. Birds were monitored using optical devices (Olympus binoculars, 10x40; Swarovski monocular, STM 80, 20-80x magnification).

1.2. FIELD WORK RESULTS

At the Jelinak WF area, during bird monitoring, works were carried out on wind generators beneath Šupljak and Ćurkovac peaks. All plateaus and access roads have been constructed. A part of monitoring was carried out on locations where works were being performed and another part on locations where there were no works, for comparative purposes.

Annex 1 contains a presentation of points where monitoring was performed. In Jelinak WF construction area 10 bird types were recorded in total (Table 1). On Šupljak-Jelinak transect 2 species were recorded (3 birds in total). On Jelinak-Ćurkovac transect the same 2 species were recorded (4 individuals in total). On Ćurkovac-Dabgora transect 5 species were recorded, 16 individuals in total.

Table 1. Bird findings on three transects in the Jelinak WF area during construction

Šupljak-Jelinak transect	
Species	**Number of individuals**
Subalpine Warbler(*Sylvia cantilans*)	2
Blackbird (*Turdus merula*)	1
Jelinak-Ćurkovac transect	
Species	**Number of individuals**
Subalpine Warbler (*Sylvia cantilans*)	2
Blackbird (*Turdus merula*)	2
Čurkovac-Dabgora transect	
Species	**Number of individuals**
Subalpine Warbler (*Sylvia cantilans*)	3
Linnet (*Carduelis cannabina*)	2
Black-eared Wheater (*Oenanthe hispanica*)	2
Blackbird (*Turdus merula*)	3
Common Swift (*Apus apus*)	6

Passage monitoring was performed at two points: Jelinak peak (581 MASL) and Dabgora peak (523 MASL). Both points are located on the highest peaks, where a good view of the wider area is possible. Researchers thus tried to conclude how works affect birds which pass or hunt in this area. In total, passages of 4 species were recorded, and monitoring findings from the points are presented in Table 2.

Table 2. Bird monitoring findings at two points in the area of Jelinak WF during construction

Jelinak peak, 12/04/2012		
Species	**Number of individuals**	**Location and movement direction**
Cestrel (*Falco tinnunculus*)	1	hunts south of the Šupljak-Jelinak park, over Debela strana
Raven (Corvus corax)	2	passage over Šupljak-Jelinak park
Buzzard (Buteo buteo)	1	about 500m west of the construction area
Vrh Dabgora, 13/04/2012.		
Species	**Number of individuals**	**Location and movement direction**
Cestrel (*Falco tinnunculus*)	1	hunts beneath Dabgora peak
Buzzard (Buteo buteo)	1	hunts over Dabgora peak and towards south
Barn Swallow (*Hirundo rustica*)	11	flies over Dabgora peak

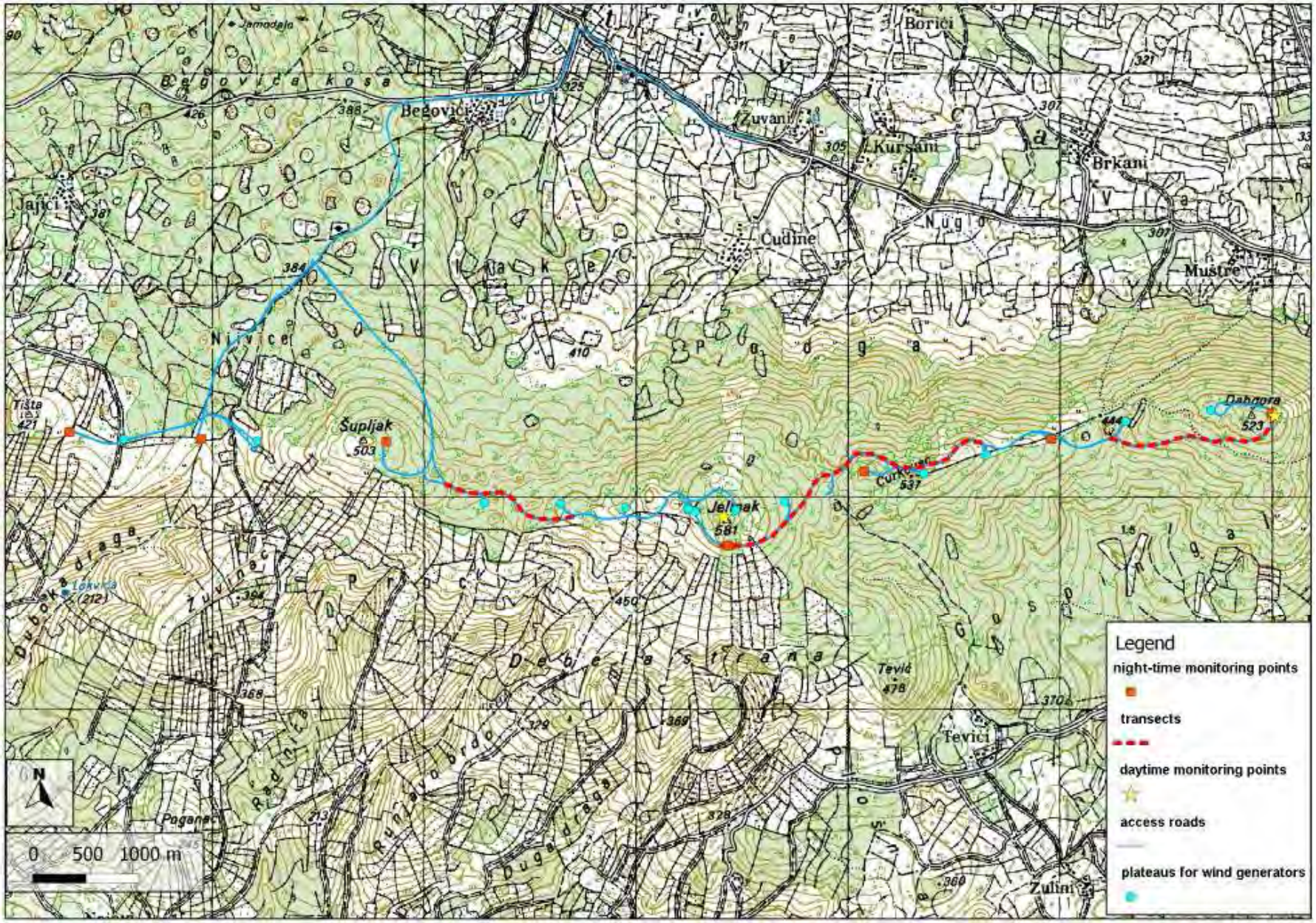
Night-time monitoring started after sunset, at 8 pm, and finished at 11:30 pm. The researchers stayed at each point for about half an hour. Monitoring points can be seen in the graphic exhibit at the end of the document. No nocturnal species were recorded.

2. CONCLUSION

From the results obtained, it can be concluded that frequency and number of individuals were increasing as monitoring was performed further from the construction site. In other words, works have a negative impact on songbirds which, due to a systematic disturbance, look for a quieter place for their nesting. Observation of passage birds shows that they still use this area, regardless of the disturbance in the habitat. Birds of prey use it for hunting (cestrels and buzzards) and a part of them for passage (ravens). Therefore, it can be concluded that the construction of roads and plateaus for wind generators has not significantly affected these species, so they still use this area for hunting. Absence of birds in the areas above plateaus on which construction is currently performed shows that larger birds and passage birds avoid the area next to plateaus and roads, where movement of people and machinery is constant and the noise is loud.

3. ANNEXES

Annex 1. Graphical presentation of transects and bird monitoring points in relation to the position of the planned wind farm location



Annex 5: Bird monitoring on Jelinak WF during construction (July 2012.)

Oikon d.o.o.
Institut za primijenjenu ekologiju

2. Bird monitoring report during construction phase on Jelinak WF

Oikon d.o.o.
Applied Ecology Institute

Client: **EHN d.o.o.**
Zrinsko – Frankopanska 64, 21 000 Split

Purchaser: **EURUS d.o.o.**
Smiljanićeva 2, 21 000 Split

Contractor: **OIKON d.o.o. Institut za primijenjenu ekologiju**
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: **VE JELINAK**

Subject: BIRD MONITORING REPORT DURING CONSTRUCTION PHASE ON JELINAK WF

Int. Contract no. OIKON: 761-12

Report created by: Elena Patčev, Professor of Biology and Chemistry
Sven Kapelj, Master of Ecology and Nature Preservation
Mirna Mazija, Graduate Biological Engineer (QC)

Zagreb, srpanj 2012.

SADRŽAJ

1. FIELD INSPECTION REPORT

Bird monitoring is conducted in order to estimate the impact of construction activities on bird fauna at Jelinak WF construction site. Monitoring preparation consisted of a detailed study of previous bird research in the area, reports on bird disturbance by antropogenic impacts during different cycles of the year and preparation of bases, i.e. methodology development. The goal is to estimate the impact of works on nesting birds and passage birds, and also to conclude whether the birds still use this area in their daily activities.

1.1. METHODOLOGY

The second ornithological research report during the construction phase on Jelinak WF was carried out on July 18th and 19th, 2012.

The method of linear transects were used during research, i.e. inventory of species during crossing the site in one circuit. Two transects of aproximately 1 km of lenght have been set with special attention on choosing the same habitats - one closer to construction activities (between WTG no. 1 and 4) than other. The other was gradually alienating from WTG 1 twards SW and it has been covering an area of minor noise impact coused by machinery. On each transect inherent species and number of units were recorded with audio-visual methods. Transects were done in dawn (from 04:30-07h) .

Standard bird watching and counting methods and vantage point watches (Scottish Natural Heritage 2005) were used. Special attention was paid on endangered and protected bird species with large habitats, especially birds of prey.During vantage point watches, attention was also given to passages and possible migration routes. Researchers were present at points from afternoon till sunset (14-18h) and in the morning period (08-09h). Representation and number of species were recorded using visual observation and listening to calls or songs.

Diurnal and nocturnal species were researched by two ornitologists – Maja Maslać and Sven Kapelj. Na terenu su istraživane dnevne i noćne vrste, a istraživala su dva ornitologa – Maja Maslać i Sven Kapelj. Birds were monitored using optical devices (Olympus binoculars, 10x40; Swarovski monokular, STM 80, 20-80x magnification).

1.2. RESULTS

At the Jelinak WF area, during bird monitoring, works were focused on preparations for all activities with sections. All platforms and acess roads have been constructed and the sections were already on platforms together with accompanying machinery. Part of monitoring was conduted on locations with construction activities in progress, in comparison with other part where no works were object of disturbance.

Annex one contains a presentation of points and transects where monitoring was done. On Jelinak WF construction area during this very research 11 bird types were recorded.

First transect is extended from WTG1 twards Podrtače on SW. Overall lenght of transect is 922m and it is mostly rocky pastures with shrubby vegetation sporadically and that kind of habitat is caracteristic for great part of the area affected by construction activities.

Slika 1. Karakterističan izgled staništa na transektu 1.

On tr ansect 1. (WTG1.-Podrtače) 8 bird species were recorded with 17 units (Table 1). It is important to note that most of the birds were found on the lower part of the transect, i.e. the number of birds was increasing moving from the WTG1 and all construction activities.

Table 1. Bird findings on transect no. 1. In the Jelinak WF area during construction

Transect 1	
Species	**Number of individuals**
Subalpine Warbler (*Sylvia cantilans*)	2
Blackbird (*Turdus merula*)	1
Meadow Pipit (*Anthus pratensis*)	1
Tawny Pipit (*Anthus campestris*)	2
Linnet (*Carduelis cannabina*)	2
Black-eard Wheater (*Oenanthe hispanica*)	6
Common Swift (*Apus apus*)	2
Raven (*Corvus corax*)	1

The second transect is extending from WTG 4 and follows the road twards WTG 1. Total lenght is 932 m and it is mostly rocky pasture with sporadic shrubby vegetation, just as Transect no.1 but with one difference only – this one is constantly exposed to noise from machinery.

Slika 2. Karakterističan izgled staništa na transektu 2.

On transect no. 2 (WTG 4 – WTG 1) 7 bird species were recorded with 21 units. It is important to note that 14 of 21 recorded units use this area only for flyback and thay did not dwell there.

Table 2. Bird findings on transect no. 2. In the Jelinak WF area during construction

Transekt 2	
Vrsta	**Broj jedinki**
Barn Swallow (*Hirundo rustica*)	1
Rock Dove (*Columba livia*)	10
Black-eard Wheater (*Oenanthe hispanica*)	4
Blackbird (*Turdus merula*)	1
Common Swift (*Apus apus*)	3
Hooded crow (*Corvus corone cornix*)	1
Tawny Pipit (*Anthus campestris*)	1

Passage monitoring was performed at two points: Jelinak peak (581 MASL) and Dabgora peak (523 MASL). Both points are located on the highest peaks, where a good view of the wider area is possible. Researches thus tried to conclude how works affect birds which pass or hunt on this area. During this research while monitoring flybacks no birds of prey were detected. In total, passages of 2 species were recorded and resulats are presented in table no. 3.

Table 3. Bird monitoring findings 2 points In the Jelinak WF area during construction

Vrh Jelinak, 18.07.2012		
Species	**Units**	**Location and movement direction**
Common Swift (*Apus apus*)	4	Hunts S of the Šupljak-Jelinak park
Vrh Dabgora, 18.07.2012.		
Species	**Units**	**Location and movement direction**
Barn Swallow (*Hirundo rustica*)	2	Hunts above Dabgora peak

Night-time monitoring started after sunset, at 20:00 (8 pm) and was finished at 23:00 (11:30 pm). The researchers stayed at each point for about half an hour. Monitoring points can be seen in the graphic exibit at the end of the document. During night-time monitoring the presence of *Caprimulgus europaeus* was detected on two points.

2. CONCLUSION

During bird research 11 species and 38 units were detected. While observing flybacks only two species were recorded - *Hirundo rustica* and *Apus apus*, and during night-time monitoring only *Caprimulgus europaeus* on two points. Such a small number of birds does not surprise at all since the research was conducted during summer period when birds activities are decreased.

From results obtained it can be concluded that frequency of species and number of units is bigger moving from construction activities, i.e. works have negative impact on singing birds which due to disturbance seek more quiet places. Monitoring of passage birds shows how they still use this area regardless disturbance around their habitats, and they use it mostly for passage (dowes, crows and ravens) and hunting (Barn Swallow, Common Swift). It could be concluded that construction activities on roads and platforms did not affect significantly those species and that they still use this area.

Absence of birds above plateus on which construction is currently performed shows that larger birds and passage birds avoid the area next to plateaus and roads where movement of people and machinery is constant and noise is loud.

ANNEX 1. Graphical presentation of transects and bird monitoring points in relation to the position of the planned WF location

Annex 6: Bird monitoring on Jelinak WF during construction (August 2012.)

Oikon Ltd.
Institute for applied ecology

3rd Bird monitoring report during construction phase on Jelinak WF

Oikon Ltd.
Institute for applied ecology

Investor: **EHN d.o.o.**
Zrinsko – Frankopanska 64, 21 000 Split

Contractor: **EURUS d.o.o.**
Smiljanićeva 2, 21 000 Split

Subcontractor: **OIKON Ltd. Institute for applied ecology**
Trg senjskih uskoka 1-2, 10 000 Zagreb

Construction: **JELINAK WF**

Subject: BIRD MONITORING REPORT DURING CONSTRUCTION PHASE ON JELINAK WF

Int. Contract no. OIKON: 761-12

Report created by: Elena Patčev, Professor of Biology and Chemistry
Sven Kapelj, Master of Ecology and Nature Preservation
Mirna Mazija, Graduate Biological Engineer (QC)

Zagreb, August 2012

CONTENT

1. FIELD INSPECTION REPORT

Bird monitoring is carry out in order to estimate impact of construction works on bird fauna at Jelinak WF site. Monitoring preparation consisted of a detailed study of previous bird research in the area, reports on bird disturbance by anthropogenic impacts during different cycles of the year and preparation of bases, i.e. methodology development. The goal is to estimate the impact of works on nesting birds and passage birds, and also to conclude whether the birds still use this area in their daily activities.

1.1. WORK METHODOLOGY

Third ornithological research report during the construction phase on Jelinak WF was carried out on 23rd and 24th August, 2012.

The method of linear transects were used during research, i.e. inventory of species during crossing the site in one circuit. Two transects of approximately 1 km of length have been set. During transects setup, special attention was paid to comparison of condition of the ornithofauna in the same habitat type at various noise impacts. It is based on logging of number and species of bird away from areas of construction work, that is from WTG 1 towards SW and logging of bird on transect which ranges from WTG 1 to WTG 4. On transect with audiovisual methods, present birds and number of individuals of each species has been recorded. Transects were set in dawn (from 05:30-07h).

Standard methods of bird watching and counting from certain position have been used - vantage point watches (Scottish Natural Heritage 2005). Special attention has been paid on endangered and protected bird species with large habitats, with a focus on birds of prey and migration birds. Passages and possible migration routes have been attend during vantage point watches. Researchers were present at points from afternoon till sunset (14-19h) and in the morning period (07-10h).

Diurnal and nocturnal species were researched by two ornithologists. Birds have been monitored using optical devices (Olympus binoculars, 10x40; Swarovski monocular, STM 80, 20-80x magnification).

1.2. RESULTS OF FIELD WORK

During bird monitoring at the Jelinak WF area all platforms and access roads have been finished, tower sections and blades were already on platforms together with accompanying machinery. Monitoring was carried out from location of WTG 1 towards SW and from WTG 1 to WTG 4. Annex 1 contains a presentation of points and transects where monitoring was done. On Jelinak WF construction area during this research 12 bird types were recorded.

First transect is extended from WTG 1 towards Podrtače on SW. Overall length of transect is 922m and it is mostly rocky pastures with shrubby vegetation sporadically and that kind of habitat is characteristic for great part of area affected by construction activities.

Figure 1 Characteristic appearance of habitat on transect 1

On transect 1 (WTG 1-Podrtače) 8 bird species were recorded with 18 units. It is important to note that most of birds were found on the lower part of transect, i.e. the number of birds was increasing moving away from the WTG`S and from noise from construction work.

Table 1. Bird findings on transect 1 In the Jelinak WF area during construction

Transect 1	
Species	**Number of individuals**
Tawany Pipit (Anthus campestris)	1
Blackbird (Turdus merula)	2
Wood Warbler (Phylloscopus sibilatrix)	2
Wheatear (*Oenanthe oenanthe*)	1
Sardinian Werbler (*Sylvia melanocephala*)	3
Black-Eared Wheatear (*Oenanthe hispanica*)	2
Willow Warbler (*Phylloscopus trochilus*)	3
Yellow-Lagged Gull (*Larus michahellis*)	4

The second transect is extending from WTG 4 and follows the road towards WTG 1. Total length is 932 m and it is mostly rocky pasture with sporadic shrubby vegetation, just as Transect 1 with difference that it is spread along road and includes area that is constantly exposed to noise from machinery.

Figure 2. Characteristic appearance of habitat on transect 2

On transect 2 (from WTG 4 to WTG 1) 4 bird species were recorded with 7 units. All record species use this area for flight over.

Table 2. Bird findings on transect 2 In the Jelinak WF area during construction

Transect 2	
Species	**Number of individuals**
Barn Swallow (*Hirundo rustica*)	3
Black-Eard Wheater (*Oenanthe hispanica*)	2
Blackbird (*Turdus merula*)	1
Tawny Pipit (*Anthus campestris*)	1

Monitoring of bird flight over have been performed in two points: Jelinak peak (581 MASL) and Dabgora peak (523 MASL). Both points are located on highest peaks, where is possible on good overview on wider area. In this way have been attempted to conclude how construction works have impact on birds that flight over or hunt in this area. During this research while monitoring flybacks no birds of prey were detected. In total, passages of 2 species were recorded and results are presented in table no. 3.

Table 3. Bird monitoring findings 2 points In the Jelinak WF area during construction

Vrh Jelinak, 18.07.2012		
Species	**Units**	**Location and movement direction**
Common Swift (*Apus apus*)	2	Transit over ablaut of the Šupljak-Jelinak
Vrh Dabgora, 18.07.2012.		
Species	**Units**	**Location and movement direction**
Barn Swallow (Hirundo rustica)	6	Flight above Dabgora peak

Night-time monitoring started after sunset, at 20:00 and was finished at 22:30 h. Researchers stayed at each point for about half an hour. Monitoring points can be seen in the graphic layout at end of document. During night-time monitoring the presence of European Nightjar (Caprimulgus europaeus) and Eurasian Eagle-Owl (*Bubo bubo*) was detected.

2. CONCLUSION

During bird monitoring in August, 12 bird species and 33 units were detected. This is time when bird migration is in progress, and present species don′t tweet intense as period before and during nesting.

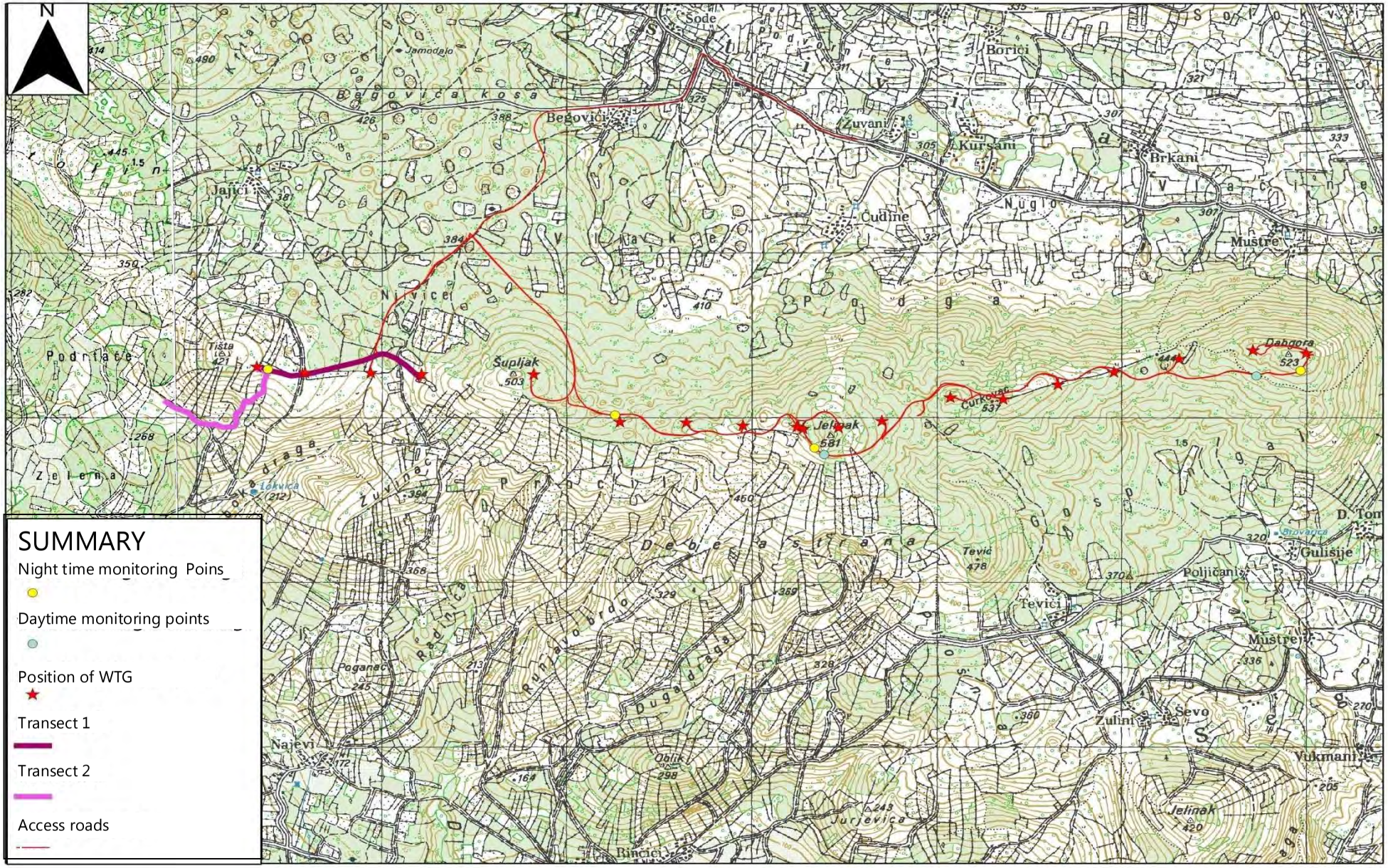
Such a small number of species in vicinity of construction works is expected as a result that shows that birds are moving few meters away from noise source because of obstruction.

Nearest recorded bird was Tawny Pipit (Anthus camestitris) at distance of 50 m from the first wind turbine. The next finding was two blackbirds (Turdus merula) at 94 m from starting point, i.e. wind turbine. The number of species and units is increasing by moving away from source of noise.

Monitoring of birds indicates how they still use this area regardless to disturbance around their habitats, and they use it mostly for flight over (Swift and Black Bird) and hunting (Barn Swallow). From this it can be concluded that construction activities on roads and platforms did not affect significantly those species and that they still use this area. The same can be concluded for nocturnal bird species that have been recorded near construction area. It is likely that these species are not heavily influenced by noise since there are no works after sunset.

Absence of birds above platforms on which construction is currently performed shows that larger birds and migration birds avoid the area next to platforms and roads where movement of people and machinery is constant.

ANNEX 1. Graphical layout of transects and bird monitoring points in relation to the position of the planned WF location



Annex 7: Bird monitoring report during construction phase on Jelinak WF (February 2013.);

OIKON
Oikon Ltd.
Institute for Applied Ecology

BIRD MONITORING REPORT DURING CONSTRUCTION PHASE ON JELINAK WF

Zagreb, February 2013

Oikon ltd.
Institute for applied ecology

Investitor: **EHN d.o.o.**
Zrinsko – Frankopanska 64, 21 000 Split

Contractor: **EURUS d.o.o.**
Smiljanićeva 2, 21 000 Split

Subcontractor: **OIKON d.o.o. Institute for applied ecology**
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: **JELINAK WF**

Subject: BIRD MONITORING REPORT DURING CONSTRUCTION PHASE ON JELINAK WF

Int. Contract no. OIKON: 761-12

Project Manager: Mirna Mazija, Master of Ecology and Nature Preservation
Report created by: Elena Patčev, Professor of Biology and Chemistry
Sven Kapelj, Master of Ecology and Nature Preservation
Maja Maslač, Master of Experimental Biology

Quality Control: Oleg Antonic, prof. PhD.

Person responsible of Executor: Dalibor Hatic, Master of Engineering Forestry

Zagreb, February 2013.

CONTENT

1. INTRODUCTION

Spatial plan of Split-Dalmatia County (Split-Dalmatia County Official Gazette no. 1/03, 8/04, 5/05, 5/06 and 13/07), among potential locations of wind farms, location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investitor is EHN Ltd.

Construction of Jelinak WF includes:

- instalation of 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- construction of macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- construction of internal 12 kV cable network Jelinak WF
- construction of internal communications network for remote monitoring and control of wind turbines operation
- construction of 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network.
- construction of connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- construction of access road to connect 12/110 kV Jelinak SS on public road

Pillars of wind turbines are installed on eleven angel foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1 Environmental protection measures during project preparation

Fauna

1. During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.

2. The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.

B.2 Monitoring the state of the environment during construction

Fauna

1. The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.

B.3 Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After the transect is made, all areas which were not included in the transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-day field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON:761/12). All research and documentation were made

according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010). Project resulted with elaborate of results of research of bird fauna at Jelinak WF Site during construction phase.

1.1. AREA DESCRIPTION

Construction area of Jelinak WF is located in central Dalmatia on area of Trogir hinterland and includes peaks above Trogir: Tišta, Šupljak, Jelinak and Dabgora (Figure 1). According to "National Ecological Network Regulation (Official Gazette "Narodne Novine" no. 109/07), Appendix 1.1." this is an area of international importance for birds and is therefore included in ecological network as a region #HR1000027 Mosor Kozjak Trogir highlands.

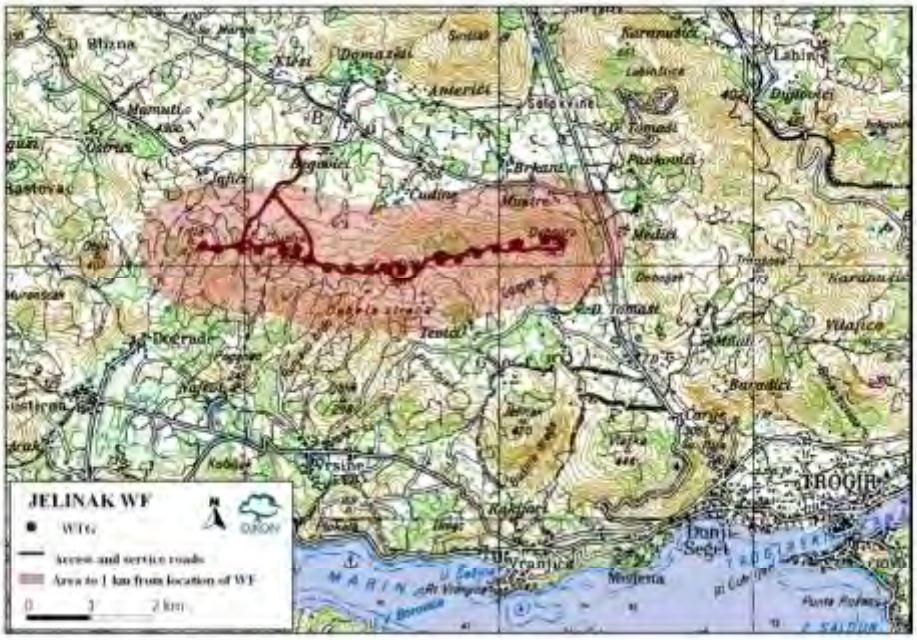


Figure 1 Spatial position of Jelinak WF construction area

The most significant features of this area are dry and rocky areas with numerous rocky cliffs suitable for nesting vulture. Also, there are large open areas and mosaic rural landscape with vineyards and olive groves. As for forest habitat is dominant youth sub-Mediterranean forest and scrubland. Within this zone, a few isolated habitats are important for some endangered bird species:

- sub-Mediterranean dry grasslands and tiny brambles:
- submediterranean thermophilous forests and scrub of Downy Oak
- eumediterranean shrubs:
- forest of macchia and Holm Oak
- settlements and cultivated land;
- rocks, rocky terrain and screes.

Vegetation on area of the location has been developed mainly in form of rocky pasture and scrub oak and hornbeam, which are occurring in advanced stages of succession according to climazonal vegetation (thickets and forests of sub-Mediterranean vegetation zone). Around manipulative platform of WTG 1 and WTG 2 are still extremely developed rocky pastures, while the successive processes more pronounced around platform of WTG 3 and WTG 4. Somewhere on are that have been researched are visible remains of the former (forest) vegetation, especially on areas where it have been burned.

2. MATERIALS AND METHODOLOGY

Research of birds during construction works on Jelinak WF was carried out over four two-day field research: during April, July, August and November 2012year. Therefore are research birds in season of nesting, autumn migration and wintering

April	July	August	November
12. 13.	18. 19.	23. 24.	5. 6.

During research were applied standard ornithological methods. One of them is a method of line transects and cataloging birds during crossing terrain in one line. During each field visit to relevant location were set transects length of about 1 km. In order to obtain a better insight into state on location, special attention is given to setting up transects in a way that covers the same habitat type, and that one is closer to construction site while other covers area that is less affected by noise and machinery during construction work. At each transect were recorded audiovisual methods present species of birds and the number of individuals of each species and a flight altitude. Transects were visit at dawn (from 4:30 to 8:00 am).

It has been used also standard method of monitoring and counting from certain positions ("vantage point watches"-Scottish Natural Heritage 2005). Special attention is given to endangered and protected birds species with wide living spaces that have been recorded in previous reports, with a focus on vulture and migratory species that could flyover in large swarm on this location. During monitoring from certain position have been paid attentions to most common overflights and possible migration routes. On points monitoring has been lasted for part of morning (8-9h) and part of afternoon until sunset (14-18h). Representation, species abundance and overflights height is recorded by visual observation and by tweet (singing).

During monitoring of nocturnal species was used playback recording census technique. In order to encourage tweeting of territorial units have been reproduced tweets with usage of portable speakers from certain positions and number of feedback tweets have been counted.

On field were two ornithologists researching simultaneously. Birds were monitoring with optical equipment (binoculars type Olympus 10x50, Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations was used GPS navigation, device type Garmin 60CSx. For photographing terrain and habitat types for report purpose, as well as photograph of birds were used Canon digital camera (Power Shot S5IS). Figure 2 shows the equipment used in the field research.

Names of birds in Croatian language are standard Croatian names of birds species that recommend Institute for Ornithology, Croatian Academy of Sciences and Arts. Foundations for this terminology can be found in the paper Sušić and Radović (1988), while the professional terminology is taken from Heinzel et al. (1999) (Croatian Edition).

Figure 2 Ornithological fieldwork equipment: binoculars, a GPS device, a map of the area, camera and field forms (Photo: E. Patčev)

Data collected were processed and analyzed, so that for each transect designated bird activity index that indicates the total number of individuals recorded on a transect through time spent for research (for all transects it is 45 min i.e. 0,75 h). Comparing activity index conclusions were drawn about the change in and abundance over time and in relation to vicinity of works on wind farm. For analyses and overview of data it was use Microsoft Excel 2010.

3. RESULTS OF FIELD RESEARCH

3.1. DAY SPECIES

April

At the area of Jelinak WF during bird monitoring in April, the works were carried out on WTG under peaks Šupljak and Ćurkovac. All manipulative platforms and access roads were finished. Part of research was carried out at areas where construction works were in progress, while other part were carried out at areas without works at that time.

Figure 3 overview of **transects** along which were researched activity and birds numbers at location. Transects Šupljak-Jelinak, Jelinak-Ćurkovac and Ćurkovac-Dabgora are located on ridge and follow access road. All three transects are surrounded by uniform vegetation characterized by scrub oak and hornbeam. Top Dabgora is the farthest from construction works at the time of research. The results from all three transects were compared to each other.

On transect Šupljak-Jelinak were recorded 2 species (total of 3 unit). On transect Jelinak-Ćurkovac were recorded same two species (4 unit total). On transect Ćurkovac-Dabgora were recorded 5 species from total 16 units recorded. The results of the April survey are overview in Table 1

Table 1 Outcome of birds monitoring on three transect on Jelinak WF during construction phase in April

Transekt Šupljak-Jelinak, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. bjelobrka sjenica,	Eng. Subalpine warbler	Lat. Sylvia cantillans,	2	4
Cro kos	Eng Blackbird	Lat. Turdus merula,	1	
Transekt Jelinak-Ćurkovac, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. bjelobrka sjenica	Eng. Subalpine warbler	Lat. Sylvia cantillans	2	5,33
Cro kos	Eng Blackbird	Lat. Turdus merula	2	
Transekt Ćurkovac-Dabgora, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. bjelobrka sjenica	Eng. Subalpine warbler	Lat. Sylvia cantillans	3	21,33
Cro. juricica	Eng. Linnet	Lat. Carduelis cannabina	2	
Cro. primorska bjeloguza	Eng. Black-eared Wheatear	Lat. Oenanthe hisparica	2	
Cro kos	Eng Blackbird	Lat. Turdus merula	3	
Cro. čiopa	Eng. Swift	Lat. Apus apus	6	

From two positions have been researched overflights and movement of birds across the location. These points are t top Jelinak (581 MASL) and top Dabgora (523 MASL)). Both points are located on a highest peak from which is possible good overview of t wider area in all directions. In this way it is researched how construction work and noise affect birds that fly over area or hunt there, and that while maintaining altitude. Total Flight was recorded four species, and monitoring results are shown in Table 2

During April, on researched area were recorded total of 10 bird species.

Table 2 The results of monitoring birds from positions Jelinak and Dabgora, highest peaks on area of Jelinak WF in April

Peak Jelinak, 12.04.2012.				
Species			**Unit number**	**Note**
Cro. vjetruša	Eng. Kestrel	Lat. Falco tinnunculus	1	hunts S of crook Šupljak Jelinak, over the area Debela strana
Cro. gavran	Eng. Raven	Lat. Corvus corax	2	Flight over the crook-Šupljak Jelinak
Cro. škanjac	Eng. Buzzard	Lat. Buteo buteo	1	cca 500 m W of the area of construction
Peak Dabgora, 13.04.2012.				
Species			**Unit number**	**Note**
Cro. vjetruša	Eng. Kestrel	Lat. Falco tinnunculus	1	Hunt under peak Dabgora
Cro. škanjac	Eng. Buzzard	Lat. Buteo buteo	1	Hunt under peak Dabgora and southern
Cro. lastavica	Eng. Swallow	Lat. Hirundo rustica	11	Fly over peak Dabgora

Figure 3 Layout of transects and bird monitoring position in April

July

At the area of Jelinak WF during bird monitoring phase of works on site was preparation for installation towers of WTG'S. On manipulative platforms were situated wind turbines parts and related machinery. Part of research was carried out on area of construction works, and for comparison, other part was carried out where works weren't in progress at the time.

The area was researched on two transects, during which was compare bird activity near and away from construction works at wind farm.

The first transect extending from position WTG 1 to Podrtače on SW. Total length of transect is 922 m. On transect dominated rocky pasture with sporadic bushy vegetation, and this habitat type is characteristic for greater part of work area (Figure 4). On WTG 1 work were in progress. On transect 1 (1 WTG - Podrtače) have been noted 8 species of birds, with total of 17 individuals (Table 3).

Table 3. The results of monitoring birds on transect 1 on Jelinak WF during construction phase in July (I - activity index, N-total number of individuals on the transect)

Transect 1, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. bjelobrka sjenica,	Eng. Subalpine warbler	Lat. Sylvia cantillans,	2	22,67
Cro kos	Eng Blackbird	Lat. Turdus merula,	1	
Cro livadna trepteljka	Eng. Meadow Pipit	Lat. Anthus pratensis	1	
Cro primorska trepteljka	Eng. Tawny Pipit	Lat. Anthus campestris	2	
Cro juričica	Eng. Linnet	Lat. Carduelis cannabina	2	
Cro primorska bjeloguza	Eng. Black-eared Wheatear	Lat. Oenanthe hispanica	6	
Cro čiopa	Eng. Swift	Lat. Apus apus	2	
Cro gavran	Eng. Raven	Lat. Corvus corax	1	

Figure 4 Characteristic appearance of habitat at transect 1

The second transect is extending from WTG 4 and follows the road towards WTG 1. Total length is 932 m and it is mostly rocky pasture with sporadic shrubby vegetation, just as Transect no.1 with difference that extends with entire length next to service road this area is constantly exposed to noise of machinery (Figure 5).

On second transect (WTG 4 - WTG1) were recorded 7 species of birds, total 21 individuals. It is important to note that 14 of 21 individuals that have been recorded used this are only to fly over and they did not retained in nearby areas of service road.

Table 4. The results of monitoring birds on transect 2 on Jelinak WF during construction phase in July (I - activity index, N-total number of individuals on the transect)

Transect 2, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. lastavica	Eng. Swallow	Lat. Hirundo rustica	1	
Cro. divlji golub	Eng. Rock Dove	Lat. Columba livia	10	
Cro. primorska bjeloguza	Eng. Black-eared Wheatear	Lat. Oenanthe hispanica	4	
Cro. kos	Eng. Blackbird	Lat. Turdus merula	1	28
Cro. čiopa	Eng. Swift	Lat. Apus apus	3	
Cro. siva vrana	Eng. Hooded Crow	Lat. Corvus cornix	1	
Cro. primorska trepteljka	Eng. Tawny Pipit	Lat. Anthus campestris	1	

Figure 5. **Characteristic appearance of habitat at transect 2**

Passage monitoring was performed **at two points**: Jelinak peak (581 MASL) and Dabgora peak (523 MASL). Both points are located on the highest peaks, where a good view of the wider area is possible. Researches thus tried to conclude how works affect birds which pass or hunt on this area. During this research while monitoring flyover no birds of prey were detected. In total, passages of 2 species were recorded and results are presented in table 5.

Table 5. Bird monitoring findings 2 points In the Jelinak WF area during construction

Peak Jelinak, 18.07.2012.				
Species			**Unit number**	**Note**
Cro. čiopa	Eng. Swift	Lat. Apus apus	4	Hunts S of the Šupljak-Jelinak park
Peak Dabgora, 18.07.2012.				
Species			**Unit number**	**Note**
Cro. lastavica	Eng. Swallow	Lat. Hirundo rustica	2	Hunts above Dabgora peak

A total of area of construction work WF Jelinak in this field visits were recorded 11 species of birds. Figure 6 shows transects and positions from which the survey was conducted during July.

Figure 6 Showing transects and position for bird watching in July

August

During bird monitoring at the Jelinak WF area tower sections and blades were already on platforms together with accompanying machinery. Monitoring was carried out from location of WTG 1 towards SW and from WTG 1 to WTG 4. Figure 7 contains a presentation of points and transects where monitoring was done. On Jelinak WF construction area during this research 12 bird types were recorded.

On transect 1 (WTG 1-Podrtače) 8 bird species were recorded with 18 units (Table 6).

Table 6. The results of monitoring birds on transect 1on Jelinak WF during construction phase in July (I - activity index, N-total number of individuals on the transect)

Transect 1, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. Primorska trepteljka	Eng. Tawny Pipit	Lat. Anthus campestris	1	24
Cro. Kos	Eng. Blackbird	Lat. Turdus merula	2	
Cro. Šumski zviždak	Eng. Wood Warbler	Lat. Phylloscopus sibilatrix	2	
Cro. Sivkasta bjeloguza	Eng. Wheatear	Lat. Oenanthe oenanthe	1	
Cro. Crnoglava sjenica	Eng. Sardinian Warbler	Lat. Sylvia melanocephala	3	
Cro. Primorska bjeloguza	Eng. Black-eared Wheatear	Lat. Oenanthe hispanica	2	
Cro. Brezov zviždak	Eng. Willow Warbler	Lat. Phylloscopus trochilus	3	
Cro. Galeb klaukavac	Eng. Yellow-legged Gull	Lat. Larus michahellis	4	

On **transect 2** (from WTG 4 to WTG 1) 4 bird species were recorded with 7 units. All record species use this area for flight over.

Table 7. The results of monitoring birds on transect 2 on Jelinak WF during construction phase in July (I - activity index, N-total number of individuals on the transect)

Transect 2, duration of transect 0,75 h				
Species			**Unit number**	**I(N/h)**
Cro. Lastavica	Eng. Swallow	Lat. Hirundo rustica	3	9,33
Cro. Primorska bjeloguza	Eng. Black-eared Wheatear	Lat. Oenanthe hispanica	2	
Cro. Kos	Eng. Blackbird	Lat. Turdus merula	1	
Cro. Primorska trepteljka	Eng. Tawny Pipit	Lat. Anthus campestris	1	

From two points, Jelinak peak (581 MASL) and Dabgora peak (523 MASL) were explored flyovers and movement of birds of wider area. During research no birds of prey, big migratory or flocks were detected. In total, passages of 2 species were recorded and results are presented in table 8.

Table 8. Bird monitoring findings 2 points In the Jelinak WF area during construction in August

Peak Jelinak, 18.07.2012.				
Species			**Unit number**	**Note**
Cro. čiopa	Eng. Swift	Lat. Apus apus	2	Transit over ablaut of the Šupljak-Jelinak
Peak Dabgora, 18.07.2012.				
Species			**Unit number**	**Note**
Cro. lastavica	Eng. Swallow	Lat. Hirundo rustica	6	Flight above Dabgora peak

Figure 7. Showing transects and position for bird watching in August

November

During bird monitoring at the Jelinak WF area during November all WTGS' was installed. Monitoring was carried out from location of WTG 1 towards SW (transect 1 from July and August research). Since there was no presence of noise and works results are compared with those obtained during research in August, and were compared to data from Tables 6 and 9
During November on transect, 10 bird species were recorded with 58 units, overview is in table 9.

Table 9. The results of monitoring birds on transect 1 on Jelinak WF during construction phase in August (I - activity index, N-total number of individuals on the transect)

Transect 1, duration of transect 0,75 h				
Species			**Unit number**	I(N/h)
Cro. Zlika	Eng.Chaffinch	Lat. Fringilla coelebs	17	77,33
Cro. Kos	Eng. Blackbird	Lat. Turdus merula	3	
Cro. Mrka crvenrepka	Eng.Black Redstart	Lat. Phoenicurus ochruros	6	
Cro Brezov zvrčidak	Eng. Willow Warbler	Lat. Phylloscopus trochilus	1	
Cro. Seva krunica	Eng. Woodlark	Lat. Lullula arborea	2	
Cro. Siva vrana	Eng.Hooded Crow	Lat. Corvus cornix	1	
Cro. Velika sjenica	Eng.Great Tit	Lat. Parus major	3	
Cro. Crvendać	Eng.Robin	Lat. Erithacus rubecula	2	
Cro. Zlatoglavi kraljić	Eng. Goldcrest	Lat. Regulus regulus	22	
Cro. Vjetruša	Eng.Kestrel	Lat. Falco tinnunculus	1	

Monitoring of bird flight over and movement has been performed **in four points**. In this way have been attempted to conclude how birds that flight over or hunt in this area use space that recently has been under construction works. During this research while monitoring flybacks only one bird of prey, Merlin (*Falco columbarius*) was detected. In total, passages of 7 species, 32 units were recorded and results are presented in table 11.

Table 10. Results of birds monitoring from the positions during November

Point A				
Species			**Unit number**	**Note**
Cro. Zlika	Eng.Chaffinch	Lat. Fringilla coelebs	3	
Cro. Kos	Eng. Blackbird	Lat. Turdus merula	1	
Cro. Mrka crvenrepka	Eng.Black Redstart	Lat. Phoenicurus ochruros	1	
Cro. Šojka	Eng. Jay	Lat. Garrulus glandarius	1	Voice in distance towards south
Cro. Mali sokol	Eng. Merlin	Lat. Falco columbarius	1	Flies along tops of vegetation towards S
Cro. Crvendać	Eng.Robin	Lat. Erithacus rubecula	1	
Point B				
Species			**Unit number**	**Note**
Cro. Mrka crvenrepka	Eng.Black Redstart	Lat. Phoenicurus ochruros	7	

Point C			
Species		**Unit number**	**Note**
Crv. štrka crnovrpka	Eng.Black Redstart	11	
Crv. Velika sjenica	Eng. Great Tit	1	
Point D			
Species		**Unit number**	**Note**
Crv. štrka crnovrpka	Eng.Black Redstart	3	

During bird monitoring in November 12 bird species were detected on area of construction work.

Figure 8. Showing transects and position for bird watching in November

3.2 NOCTURNAL SPECIES

Nocturnal species have been researched above-mentioned playback recording census technique from sunset until 23:30 pm. Positions of playback recording census are shown in Figure 9.
In July there was noted presence of Nightjar (*Caprimulgus europaeus*) at two points, in August was noted presence of Nightjar (*Caprimulgus europaeus*) and Eagle Owl (*Bubo bubo*) on wider area. During April was not noted nocturnal bird species.

Figure 9. Overview of position for playback recording census

4. ANALYSIS OF RESULTS AND DISCUSSION

Data obtained from four field research were analyzed according to adjacency or distance from noise of works according to the types and numbers of birds and their activities.

By comparing data obtained on three transects during the April research (Table 1) it is evident that number of species and individuals of same species, increases with distance from area of work and noise. Because of what on transect Ćurkovac-Dabgora were recorded activity of largest number of species and individuals (5 species and 16 units), opposed to the much smaller number on transects Šupljak-Jelinak and Jelinak-Ćurkovac (2 species and 2, that is 4 units).

During analysis of data from July field research there has been a similar number of species and individuals on both transects. Difference is that birds were observed on transect 2 close to construction work in most of the swept area without landing or retention. From this we can conclude that a certain species of birds and still uses area of construction works, mostly for flyover or they in its immediate vicinity remain short time.

Reduced number of species and individuals in the vicinity of the works has been confirmed to and during the analysis of results in August. At transect 2 in immediate vicinity of works were recorded only 4 species of birds (7 units), and on transect 1 that is out of the way from the noise,8 species and 18 individuals (Table 6 and 7). Nearest recorded birds during two field research was Tawny Pipit (Anthus campestris) at a distance of 50 m from WTG 1.

During November research of birds in there were 12 species recorded of 90 units total. This is the time period when migration is at end and species that are present are resident and wintering birds. Results are compared to number of species and individuals detected from August (when the noise was still present and high) to November (when the noise was not more present at the area). Results obtained show how birds use area that was recently under strong anthropogenic influence. It is evident that during August the birds are still avoiding area in immediate vicinity to wind turbines, while two months later birds number near wind turbines uniform across the entire length of the first transect. It can be concluded that the activity of birds returning to "normal" after the completion of works and that they use this space as before.

Contribution to above mentioned can be seen in Figure 10 that showing activity of birds during the four months of research with regard to proximity of works. It is evident that total number of individuals in vicinity of works (less than 100 m from the noise source) during April and August, considerably less than total number of individuals on transect further away from area of works (more than 100 m from the source of noise). During July there was an almost identical number of individuals on transect near and away from noise source. Reason for this is large number of overflights on second transect. But these birds have net retained or fed over area of research, unlike individuals on first transect. During November all wind turbines were installed, so there was no transects that would provide information of noise impact on birds. It is evident that on transect 1 is significantly more birds than was in previous months. Reason for this might be just end of work and the absence of noise.

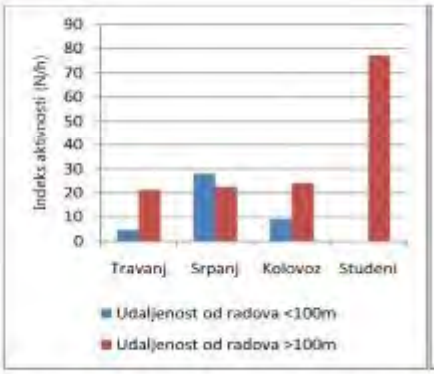


Figure 10. Index of bird activity during the months of research in relation to the closeness of construction works

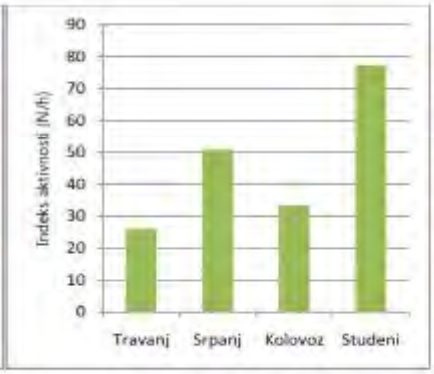


Figure 11. Activities birds during the months of research

If comparison have been made the total number of all recorded individuals on transects during the four months of research it is observed that in November have been recorded highest activity (Figure 11). Because that in that period was migration have been still in progress, it is assumed that increased number of birds in relation to the previous month, in addition to end of works, associated with migrating birds (ie recorded birds were that have been flayover from north on way to warmer regions, using this space for rest and feeding).

Analysis of data obtained by observing of flyover and activities of birds from certain positions is evident that larger birds use this area only for flyover, but they avoid the immediate vicinity of the works, which confirms recorded Flightover of two ravens (*Corvus corax*) over the pass Šupljak - Jelinak in April.

Part of bird were used broader area during works for hunting and so over the top Jelinak have been observed in April Kestrel (*Falco tinnunculus*) during hunting for at height of about 30 m

5. CONCLUSION

Works had negative impact on songbirds which were, due to systematic disturbance, seeking for quiet place for nesting. They were pulling away from manipulative plateau and access roads on which works were executed.

Certain numbers of bird species were using the observed area despite works execution on wind farm. They mostly did not retain for longer period, but they had used that area for flights over or they retained for short period in its immediate vicinity.

The nearest recorded bird during two terrain reconnaissance was Tawny Pipit (*Anthus campestris*) at distance of 50 m from wind turbine WT1.

Absence of birds above or by manipulative plateaus on which works were executing shows that both, larger and smaller birds, as well as birds of passage, avoid area close to plateau and road where people and machines constantly move, and noise is great.

Analysis of birds' activity on plateau during works execution was carried out by observing flights over from certain points. The results of analysis show that birds still use construction area of wind farm regardless of disturbance in habitat (prey birds use it for hunting, and some of them for flight over).

SOURCE OF DATA

Competent and scientific literature

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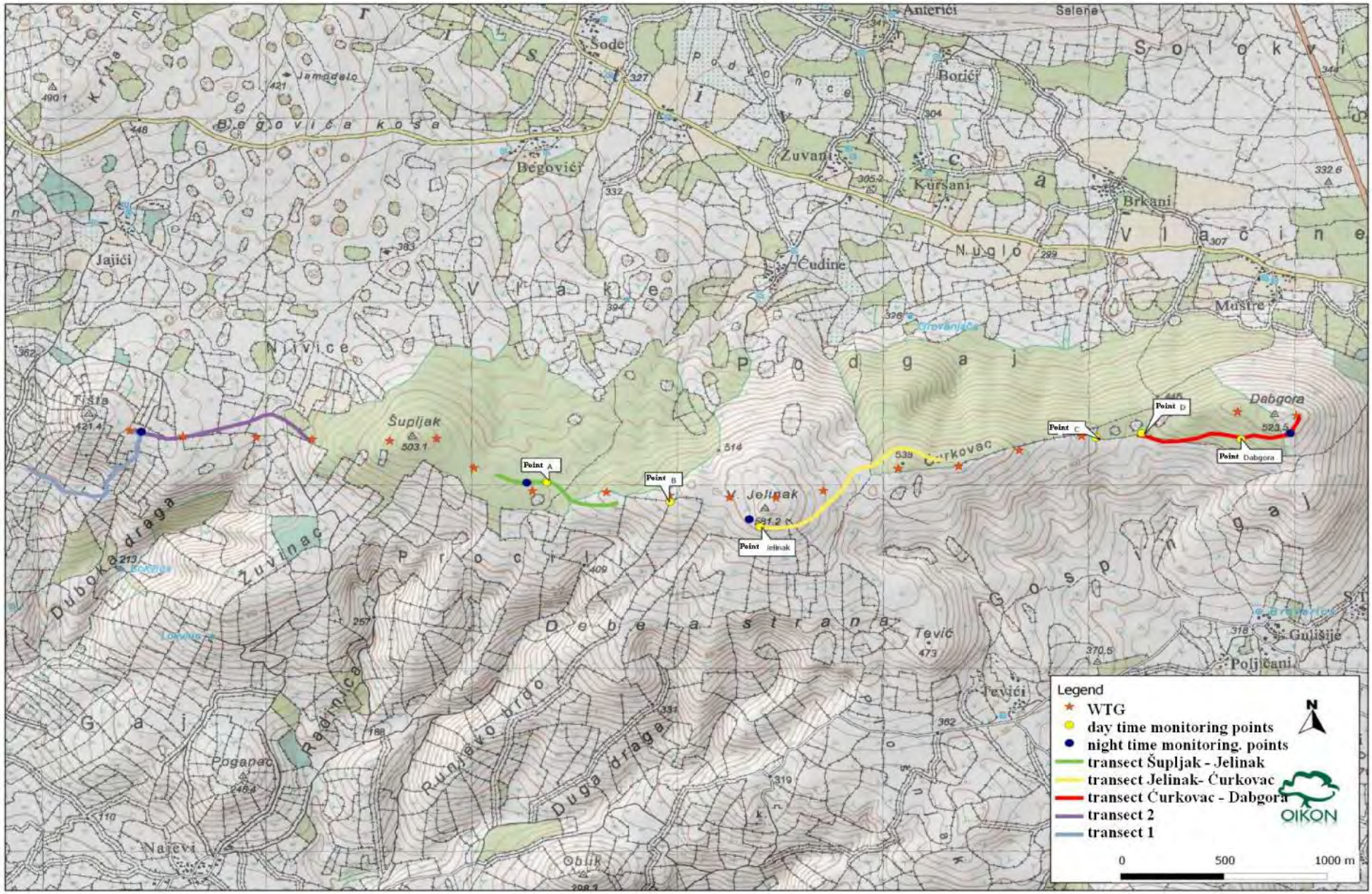
List of regulations

1. Regulation on proclamation of the ecological network (Official gazette "Narodne Novine 109/07")
2. Nature Protection Act (Official gazette "Narodne Novine 70/05,139/08, 57/11")

6. ANNEX

ANNEX 1. GRAPHIC LAYOUT OF TRANSECTS AND POSITION FOR OBSERVATION OF BIRDS IN RELATION TO POSITION OF WF LOCATION



Annex 8: Bird monitoring on Jelinak WF during operation (April 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 15th of April 2013

Oikon ltd.
Institute for applied ecology

Investor:	EHN Ltd. Zrinsko - Frankopanska 64, 21 000 Split
Contractor:	EURUS Ltd. Smiljanićeva 2, 21 000 Split
Subcontractor:	OIKON Ltd. Institute for applied ecology Trg senjskih uskoka 1-2, 10 000 Zagreb
Structure:	Jelinak WF
Subject:	**Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection** - Site visit report
Int.Contract no. OIKON:	761-12
Project Manager:	Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)

Terrain research and development of reports:

Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.

2. The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Jelinak WF location was explored during March and April in order to determine impact of Jelinak WF on bird population. Terrain research in March included observation of bird behavior in vicinity of wind turbines, as well as search for possibly dead birds. Terrain research in April included monitoring of local community of nesting birds and observation of bird behavior in vicinity of wind turbines, as well as research for possibly dead birds. Location is explored according to dates in Table 1.

Table 1. Dates of terrain research

March	April
21st, 22nd, 28th, 29th	8th, 9th, 10th, 11th

3. MATERIALS AND METHODS

Standard ornithological methods were applied during research. Three ornithologists were researching terrain during two day in March and four days in April. Birds were monitored with optical equipment (binoculars type Olympus 10x50, Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. For photographing terrain and habitat types for report purpose, as well as photograph of birds were used Canon digital camera (Power Shot S5IS).

For observing bird behavior in vicinity of wind turbines at least one hour for each wind turbine was spent. Species, height and movement direction were recorded for each bird species.

Separate and detail research of location was carried out in order to find possibly affected birds, for each wind turbine 1,5 h were spent. The area at distance up to at least 70 m from each wind turbine was researched, and distance between two adjacent lines was 3 m wherever vegetation and terrain allow it. Species, age and gender were recorded for each bird that was found.

Nesting birds were investigated by linear transect method that were based on results and methods of ornithological research of “zero” state of bird research. Three transect were carried out in the morning, from 06 – 08 h, and cartographic display is in Figure 1.

Figure 1. Graphical layout of transect in relation to position of wind farm location

4. RESULTS OF TERRAIN RESEARCHES

Thirty two (32) bird species, which are all nesting birds of wider area, were recorded during bird research in March and April. Twenty seven (27) nesting bird species (of which Rock Partridge (*Alectoris graeca*) recorded on ground next to wind turbine WTG1 can be sort out) were recorded on transect. Over flights of Common Buzzard (*Buteo buteo*), Yellow-legged Gull (*Larus michahellis*), Common Raven (*Corvus corax*), Common Kestrel (*Falco tinnunculus*) were recorded.

The search for possible dead birds in area below wind turbines resulted in findings of five birds' carcasses (Table 2). Birds' carcasses were found at 20-55 meters from wind turbines.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species
WTG	30	W	European Robin (*Eritacus*
WTG	55	N	European Robin (*Eritacus*
WTG	20	SW	Song Thrush (*Turdus*
WTG	31	SW	Song Thrush (*Turdus*
WTG	50	NE	Common Buzzard (*Buteo buteo*)

5. PLAN FOR FURTHER ACTIVITIES

Planed activities for May are: researching of nesting bird population, researching of over flights over wind farm and searching for possibly bird carcass. At least 4 days will be carried out on terrain, and standard ornithological methods will be used.

Annex 9: Bird monitoring on Jelinak WF during operation (May 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 17th of May 2013

Oikon ltd.
Institute for applied ecology

Investor:	EHN Ltd. Zrinsko - Frankopanska 64, 21 000 Split
Contractor:	EURUS Ltd. Smiljanićeva 2, 21 000 Split
Subcontractor:	OIKON Ltd. Institute for applied ecology Trg senjskih uskoka 1-2, 10 000 Zagreb
Structure:	Jelinak WF
Subject:	**Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection** - Site visit report
Int.Contract no. OIKON:	761-12
Project Manager:	Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)

Terrain research and development of reports:

Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.

2. The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

During March and April we explored the subject site to determine the impact of VE Jelinak on bird populations. Field research in March included the observation of behavior of birds in the vicinity of wind turbines, as well as search for possibly dead birds. Field survey in April and May include, in addition to the search for a possible dead birds, and monitoring of the local community and observing nesting behavior of birds in the vicinity of wind turbines. Location is explored to date in Table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	March	21st -22nd	27 th
		28th -29th	
	April	08th -11th	29th
		29th-30th	
	May	6th-8th	6th-8th

3. MATERIALS AND METHODS

Standard ornithological methods were applied during research. Three ornithologists were researching terrain during two day in March and four days in April. Birds were monitored with optical equipment (binoculars type Olympus 10x50, Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. For photographing terrain and habitat types for report purpose, as well as photograph of birds were used Canon digital camera (Power Shot S5IS).

For observing bird behavior in vicinity of wind turbines at least one hour for each wind turbine was spent. Species, height and movement direction were recorded for each bird species.

Separate and detail research of location was carried out in order to find possibly affected birds, for each wind turbine 1,5 h were spent. The area at distance up to at least 70 m from each wind turbine was researched, and distance between two adjacent lines was 3 m wherever vegetation and terrain allow it. Species, age and gender were recorded for each bird that was found.

Nesting birds were investigated by linear transect method that were based on results and methods of ornithological research of “zero” state of bird research. Three transect were carried out in the morning, from 06 – 08 h, and cartographic display is in Figure 1.

Figure 1. Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 36% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 47% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 17% of total area. It is important to note that during April vegetation grown and grass height is 15-25 cm and flick trough of bushy plants has begun. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to area visibility, the overall percentage of terrain research around wind turbine is minimum 33% and maximum 69%, and varies depending on surrounding of each wind turbine (Figure 6). Specified values and categories will be detail established and verify through further research.

Figure 2. GPS trace during terrain research (Photo: D.Kovač)

Figure 3. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4. Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5. Area of maximum visibility - roads, platforms (Photo: D.Kovač)

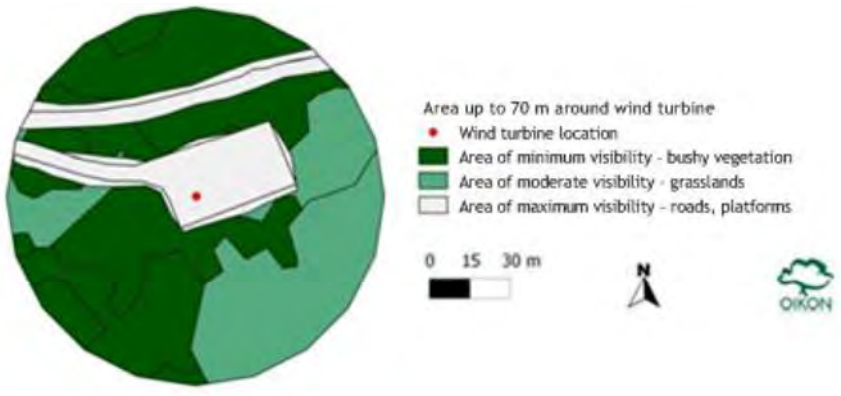


Figure 6. Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Thirty six (36) bird species, which are all nesting birds of wider area, were recorded during bird research in March and April. Twenty seven (27) nesting bird species (of which Rock Partridge (*Alectoris graeca*) recorded on ground next to wind turbine WTG1 can be sort out) were recorded on transect. Over flights of Common Buzzard (*Buteo buteo*), Yellow-legged Gull (*Larus michahellis*), Common Raven (*Corvus corax*), Common Kestrel (*Falco tinnunculus*) were recorded.

The search for possible dead birds in area below wind turbines resulted in findings of five birds' carcasses (Table 2). Birds' carcasses were found at 20-55 meters from wind turbines.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species
WTG 01	30	W	European Robin (*Eritacus rubecula*)
WTG 12	55	N	European Robin (*Eritacus rubecula*)
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)

Figure 7 Finding carcasses of individual Song Thrush (Turdus philomelos) with WTG 8

5. PLAN FOR FURTHER ACTIVITIES

Planed activities for June are: researching of nesting bird population, researching of over flights over wind farm and searching for possibly bird carcass. At least 4 days will be carried out on terrain, and standard ornithological methods will be used.

Annex 10: Bird monitoring on Jelinak WF during operation (June 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 20th of June 2013

Investor:	EHN Ltd. Zrinsko - Frankopanska 64, 21 000 Split
Contractor:	EURUS Ltd. Smiljanićeva 2, 21 000 Split
Subcontractor:	OIKON Ltd. Institute for applied ecology Trg senjskih uskoka 1-2, 10 000 Zagreb
Structure:	Jelinak WF
Subject:	**Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection** - Site visit report
Int.Contract no. OIKON:	761-12
Project Manager:	Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)

Terrain research and development of reports:

Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.

2. The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Location is researched in March, April, May and June, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research is carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring activity of nesting, flyover and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	March	21st -22nd	27th
		28th -29th	
	April	08th -11th	29th
		29th-30th	
	May	6th-8th	6th-8th
	June	12th - 14th	12th - 14th

3. MATERIALS AND METHODS

Three ornithologists were researching terrain. Birds were monitored with optical equipment (binoculars type Olympus 10x50, Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. For photographing terrain and habitat types for report purpose, as well as photograph of birds were used Canon digital camera (Power Shot S5IS). Standard ornithological methods were applied during research of birds on Jelinak WF.

For observing bird behaviour in vicinity of wind turbines at least one hour for each wind turbine was spent. Species, height and movement direction were recorded for each bird species.

Nesting birds were investigated by linear transect method. Birds have been research on one transect, length cca 2 km, in down from 05 - 07 h, cartographic overview is on Figure 1.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

Figure 1. Graphical layout of transect in relation to position of wind farm location

Separate and detail research of location was carried out in order to find possibly affected birds, for each wind turbine 1,5 h were spent. The area at distance up to at least 70 m from each wind turbine was researched, and distance between two adjacent lines was 3 m wherever vegetation and terrain allow it. Species, age and gender were recorded for each bird that was found. For purposes of this research Oikon Ltd. have started training search dog for detection of possibly injured birds and bats, which search area once a month. For now, in this way of search have been found one injured birds during March (on that site visit have not been found any other injured specie).

Considering so far approximately defined area visibility, three categories of exploration level are defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 36% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 47% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 17% of total area. It is important to note that during April vegetation grown and grass height is 15-25 cm and flick trough of bushy plants has begun. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to area visibility, the overall percentage of terrain research around wind turbine is minimum 33% and maximum 69%, and varies depending on surrounding of each wind turbine (Figure 6). Specified values and categories will be detail established and verify through further research.

Figure 2. GPS trace during terrain research (Photo: D.Kovač)

Figure 3. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4. Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5. Area of maximum visibility - roads, platforms (Photo: D.Kovač)

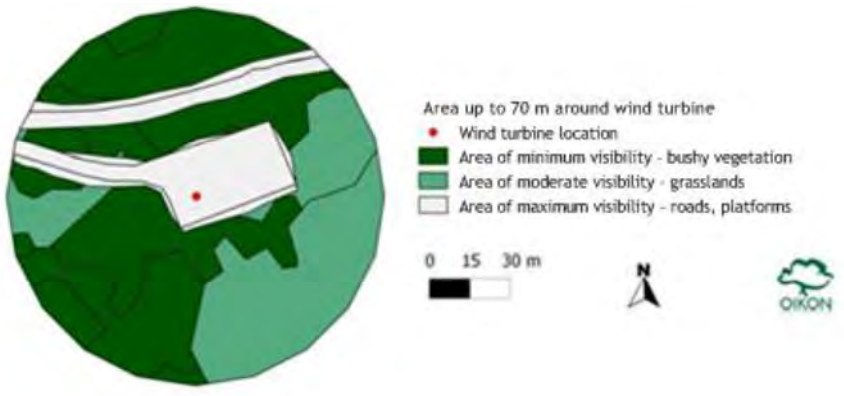


Figure 6. Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

At location during research in 2013 so far were recorded44 bird species. Rock Partridge (*Alectoris graeca*) recorded on ground next to wind turbine WTG1 can be sort out, birds of prey – several flyover of Short-toed Eagle (Circaetus gallicus) Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus) and Kestrel (Falco tinnunculus) have been noted. Among other species most common and most numerous are flyovers of Yellow-legged Gull (Larus michahellis), Bee-eater (Merops apiaster), Raven (Corvus corax) and Swift (Apus apus).

The search for possible dead birds in area below wind turbines resulted in findings of five birds' carcasses (Table 2). Birds' carcasses were found at 20-55 meters from wind turbines. During May and June site visit have not been found new carcasses.

Table 2. Findings of birds' carcasses on Jelinak WF area

Wind	Distance from	Direction from	Bird species	Date of
WTG 01	30	W	European Robin (*Eritacus rubecula*)	21.03.2013.
WTG 12	55	N	European Robin (*Eritacus rubecula*)	28.03.2013.
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28.03.2013.
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29.03.2013.
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29.03.2013.

Figure 7 Finding carcasses of individual Song Thrush (Turdus philomelos) with WTG 8

5. PLAN FOR FURTHER ACTIVITIES

Expectation during July is decrease of bird's activity that is caused by high temperature and preparation for migration. It is planned to continue with research of bird activity within each turbine, using line transects and the search for bird carcasses. Time spend for site visit will be at list 3 day using standard ornithological methods non-standardized searching of WF area., transect, point watches and playback recording census technique.

Annex 11: Bird monitoring on Jelinak WF during operation (July 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 20th of July 2013

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in March, April, May, June and July, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, flyover and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing bird behavior in vicinity of wind turbines at least one hour for each wind turbine was spent. Species, height and movement direction were recorded for each bird species.

Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 05 - 07 h, cartographic overview is on Figure 1.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

Figure 1. Graphical layout of transect in relation to position of wind farm location

Separate and detail research of location was carried out in order to find possibly affected birds, for each wind turbine 1 - 1,5 h were spent. The area at distance up to at least 70 m from each wind turbine was researched, and distance between two adjacent lines was 3 m wherever vegetation and terrain allow it. Species, age, gender and finding coordinate were recorded for each bird that was found. For purposes of this research Oikon Ltd. have started training search dog for detection of possibly injured birds and bats, which research area once a month. For now, in this way of search one injured birds have been found during March (any other injured species have not been found on that site visit).

Considering so far approximately defined area visibility, three categories of exploration level are defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 36% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 47% of total area. Area of maximum

visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 17% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability.

During June and July bushy vegetation become denser than it was in May, and grass height reached up to 75 cm. For this reason, percentage of terrain research in July is approximately 40%, and it is closest to minimum value of 35,6% of research considering 3 defined categories of area visibility. Specified values and categories will be detail established and verify through further research.

Figure 2. GPS trace during terrain research (Photo: D.Kovač)

Figure 3. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4. Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5. Area of maximum visibility - roads, platforms (Photo: D.Kovač)

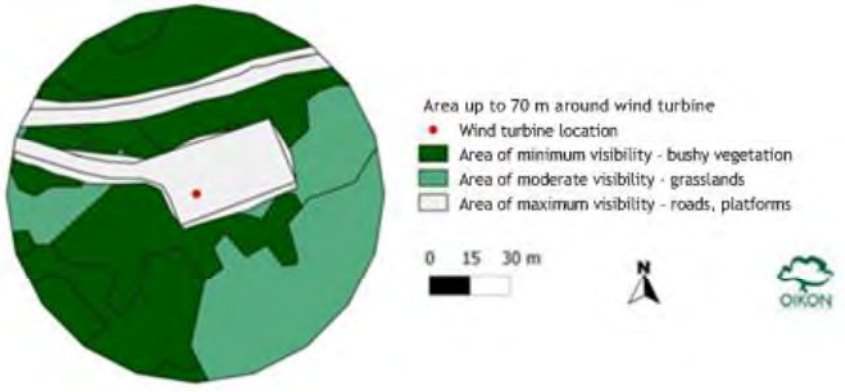


Figure 6. Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 44 bird species at site location were recorded during researching in 2013. Rock Partridge (Alectoris graeca) recorded on ground next to wind turbine WTG1, and several species of birds of prey (flights over of Short-toed Snake Eagle (Circaetus gallicus) (Figure 7), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus) and Common Kestrel (Falco tinnunculus) were recorded through wind farm area) can be sorted out. Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus). Activity of Eurasian Eagle-Owl (Bubo bubo) on area shown in Figure 7 and sound of European Nightjar (Caprimulgus europaeus) throughout researching area were recorded during night visit of area.

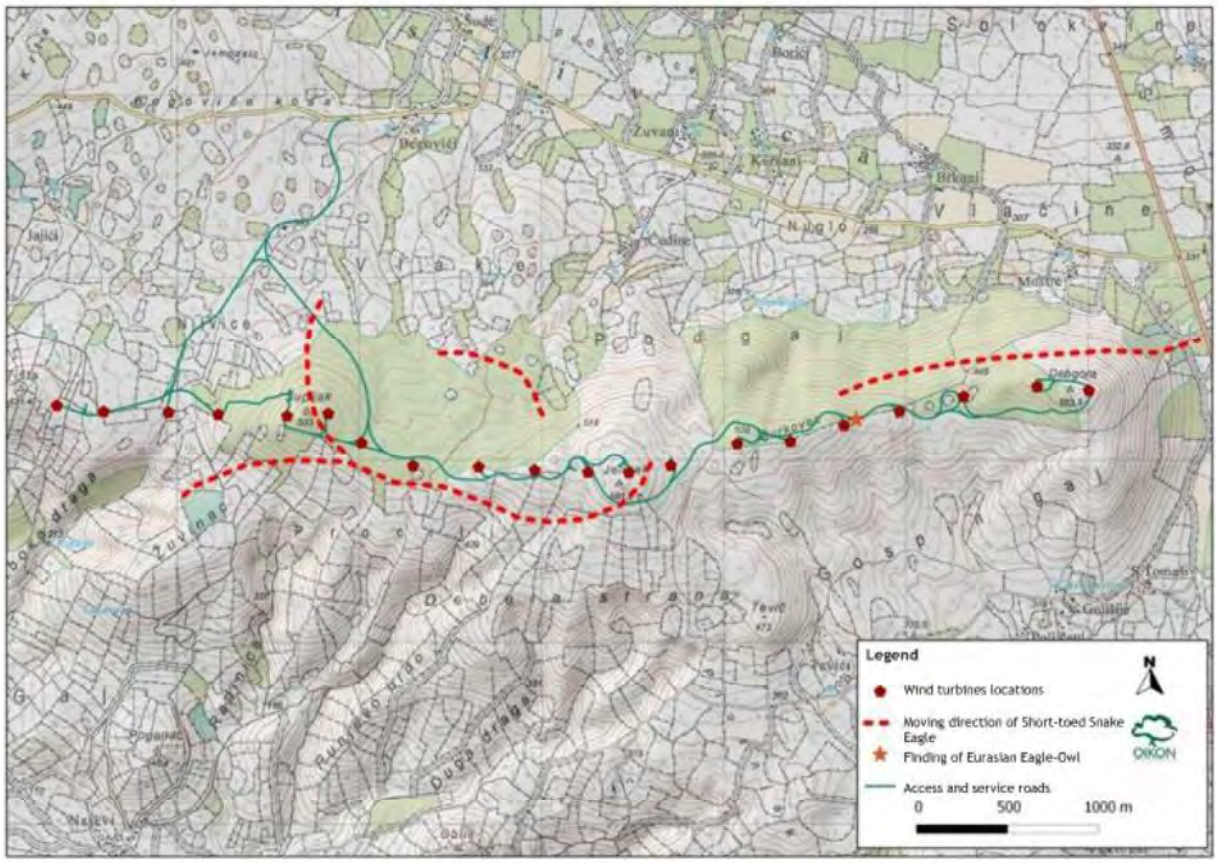


Figure 7. Graphical layout of Short-toed Snake Eagle and findings of Eurasian Eagle-Owl

The search for possible dead birds in area below wind turbines resulted in findings of five birds' carcasses (Table 2). Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in May, June and July newly birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus*	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 7 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

5. PLAN FOR FURTHER ACTIVITIES

Increased bird activity caused by preparations for autumn migration is expected in August. It is planned to continue with research of bird activities within area of each wind turbine, using line transect method and by searching for possibly injured birds. At least 4 days will be carried out on terrain, and standard ornithological methods - non standardized terrain research, line transect, monitoring from the points and night census technique will be used.

Annex 12: Bird monitoring on Jelinak WF during operation (August 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 15th of August 2013

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in March, April, May, June, July and August, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds'' flight overs in vicinity of wind turbines at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 05 – 07 h, cartographic overview is on Figure 1.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

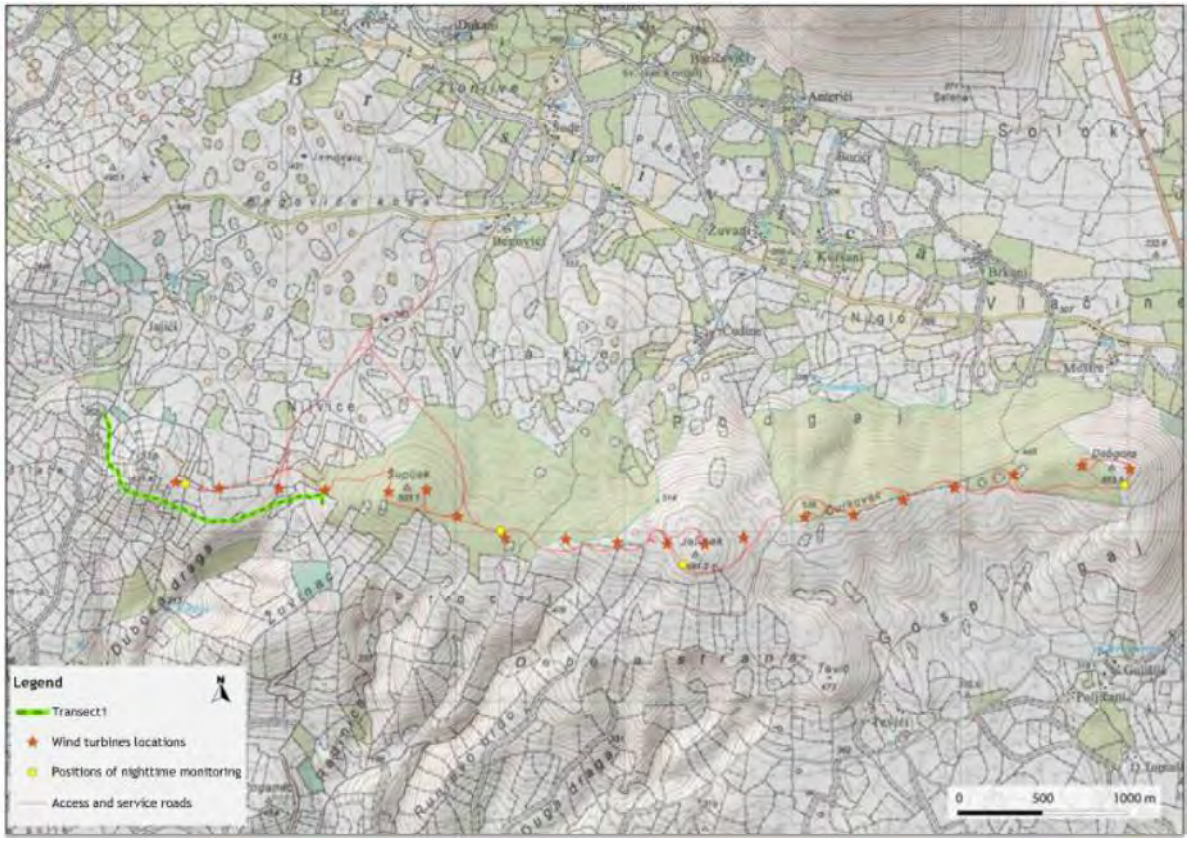


Figure 1. Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail

established and verified through further research. Considering that findings of injured individuals, primarily bats, were observed only on surfaces of plateaus, roads and slopes, and because of size and speed of decomposition they are very hardly visible. During research in August, the biggest effort was made for viewing areas of the greatest visibility (up to 30 minutes to 1 hour) (percentage of this surface is 18% of total surface).

In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2. GPS trace during terrain research (Photo: D.Kovač)

Figure 3. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4. Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5. Area of maximum visibility - roads, platforms (Photo: D.Kovač)

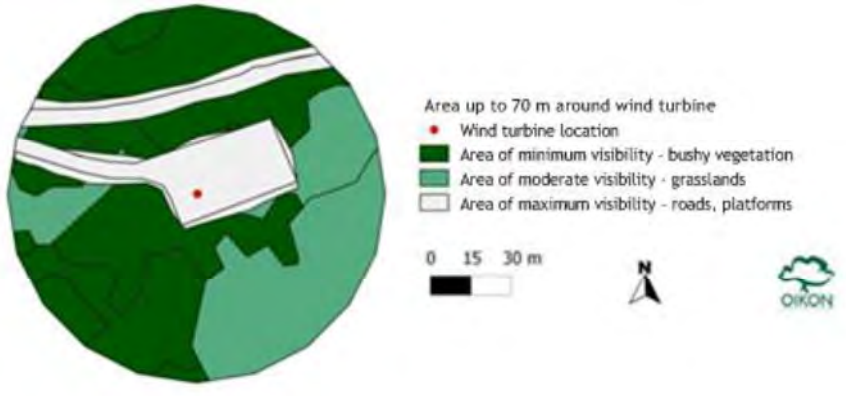


Figure 6. Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 44 bird species at site location were recorded during researching in 2013. Rock Partridge (Alectoris graeca) recorded on ground next to wind turbine WTG1, and several species of birds of prey (flights over of Short-toed Snake Eagle (Circaetus gallicus) (Figure 7), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus) and Common Kestrel (Falco tinnunculus) were recorded through wind farm area) can be sorted out. Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus). Increased activities of Common Swifts were noticed during terrain research in August. Flock of about 150 units were recorded in hunting in area of wind turbine WTG4, at height of 80 to 100 m. During night visit in August, activity of European Nightjar (Caprimulgus europaeus) was recorded, while Eurasian Eagle-Owl (Bubo bubo), that was previously seen on area shown in Figure 7., this time was not recorded.

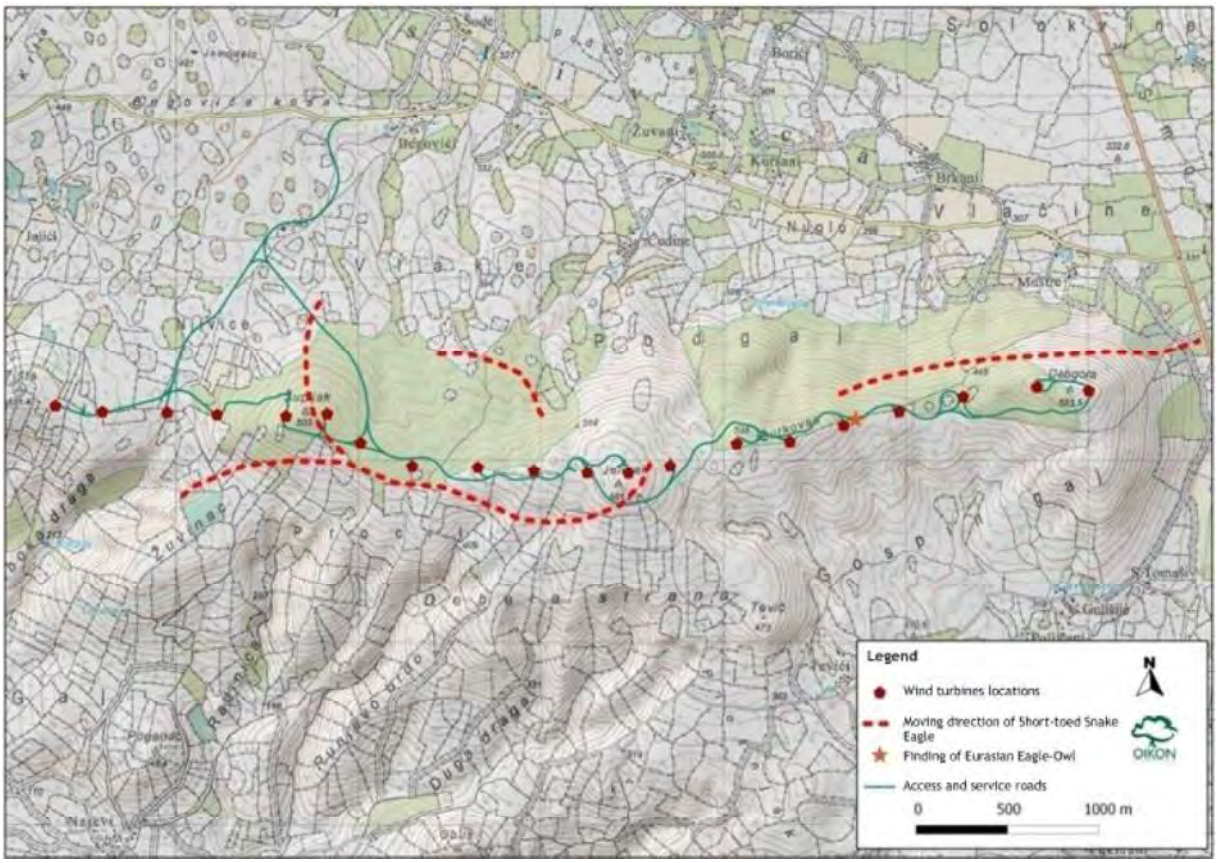


Figure 7. Graphical layout of Short-toed Snake Eagle and findings of Eurasian Eagle-Owl

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, ie. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in May, June, July and August newly birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus*	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 7 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

5. PLAN FOR FURTHER ACTIVITIES

Increased bird activity, especially of migratory species, caused by beginning of autumn migration is expected in September. It is planned to continue with research of bird activities within area of each wind turbine, using line transect method and by searching for possibly injured birds. Since all previous injured birds and bats were recorded in area of maximum visibility (areas of platforms, roads and slopes), monitoring of incidents will be focused on research of mentioned areas of maximum visibility, with intention that estimate of total mortality is presented in final annual report. Four days will be carried out on terrain, and standard ornithological methods - non standardized terrain research, line transect, monitoring from the points and night census technique will be used.

6. PONTENTIALLY SIGNIFICANT BATS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 13: Bird monitoring on Jelinak WF during operation (September 2013.);

Oikon ltd.
Institute for applied ecology

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 20th of September 2013

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in March, April, May, June, July, August and September, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 05 - 07 h, cartographic overview is on Figure 1.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

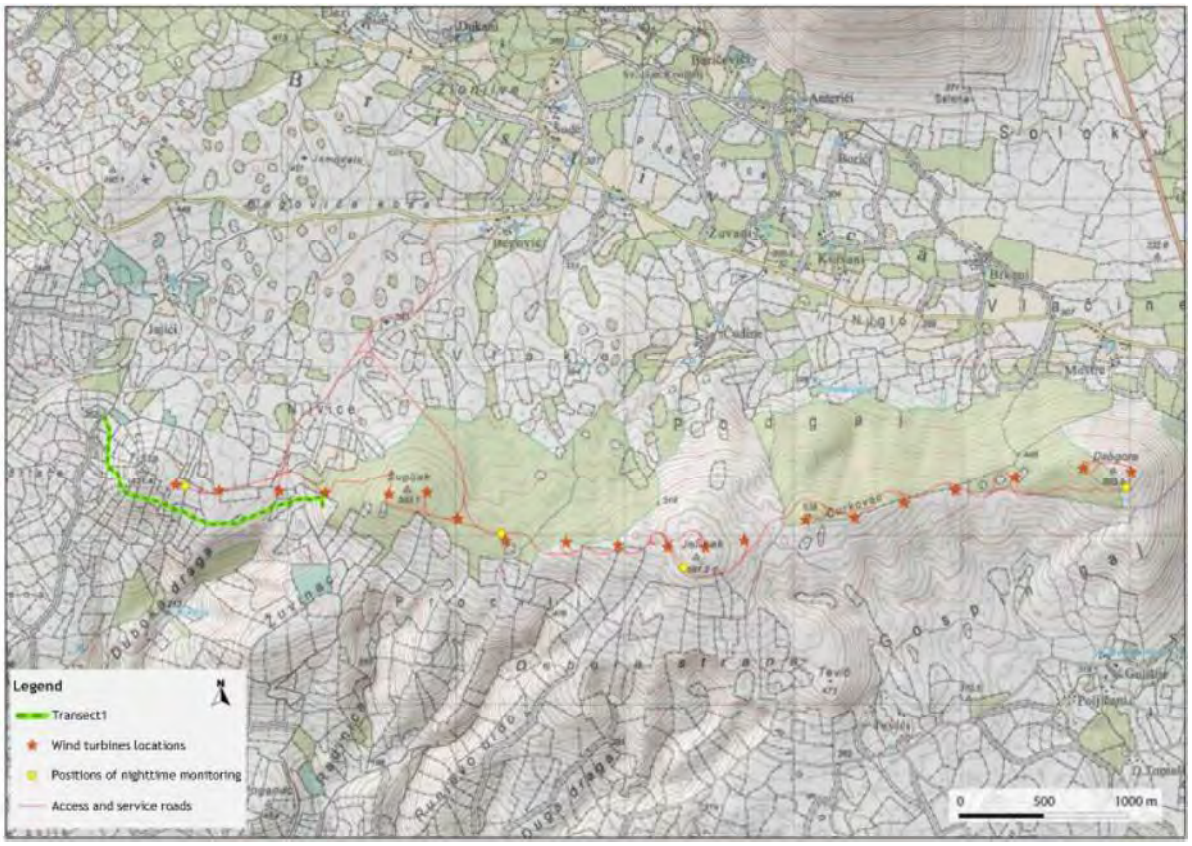


Figure 1. Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail

established and verified through further research. Considering that findings of injured individuals were observed only on surfaces of plateaus, roads and slopes, and because of size and speed of decomposition they are very hardly visible. During research in August, the biggest effort was made for viewing areas of the greatest visibility (up to 30 minutes to 1 hour) (percentage of this surface is 18% of total surface).

In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2. GPS trace during terrain research (Photo: D.Kovač)

Figure 3. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4. Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5. Area of maximum visibility - roads, platforms (Photo: D.Kovač)

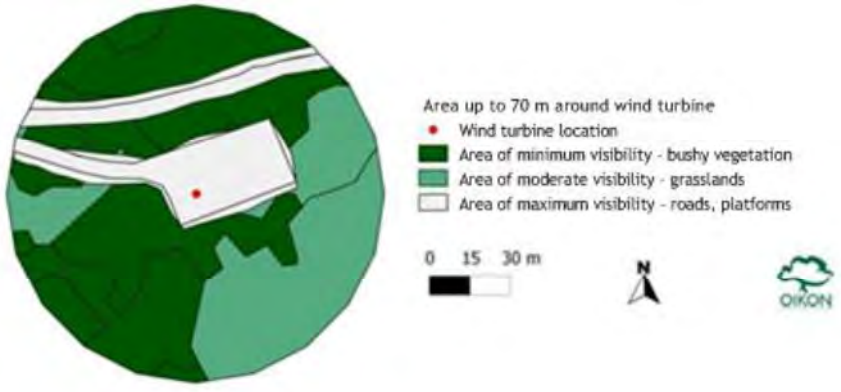


Figure 6. Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 45 bird species at site location were recorded during researching in 2013. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus) (Figure 7), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in September was observed activity of pairs of Snake Eagle that were recorded during the previous months. The pair was recorded twice during September research during their hunt between WTGs 16, 17,7 and 8 at height of 50 to 120 meters. Also, there was a recorded presence of 6 Rock Partridge flocks (Alectoris graeca) in vicinity of WTG 19, which were flying to the ground.

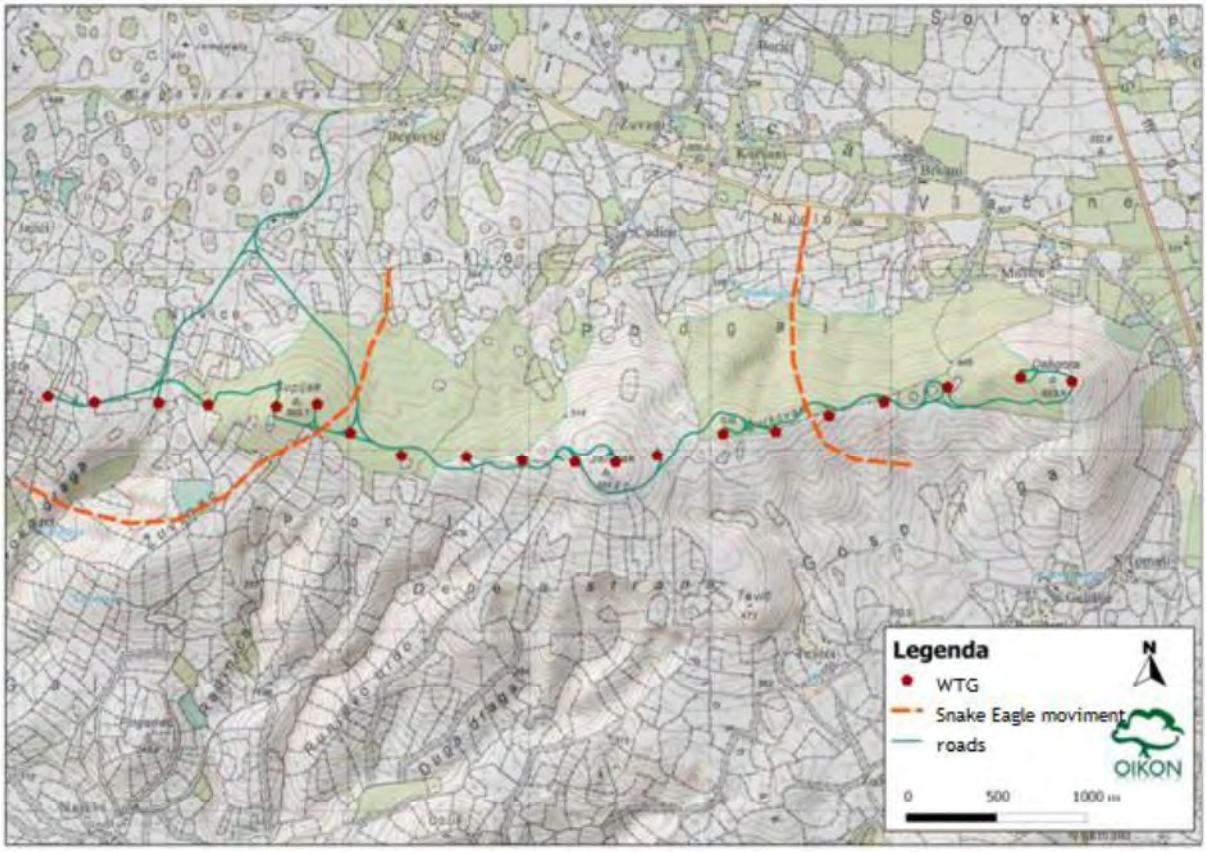


Figure 7. Graphical layout of Snake Eagle (*Circaeetus gallicus*) movement trend during site research during September

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, ie. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in May, June, July and August newly birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus*	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 7 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

5. PLAN FOR FURTHER ACTIVITIES

During October is planned to research bird activity within each turbine, with an emphasis on migratory species along transect, using standing observation points method and continue to search for possible casualties birds. Since all previous injured individuals were recorded in area of maximum visibility (areas of platforms, roads and slopes) monitoring of incidents will include in all future field research, standard search of area of 70 m around each WTG whit focus on area of greatest visibility with intention of estimation of total mortality in Final annual report (for total surface area below area of rotation of blades).

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 14: Bird monitoring on Jelinak WF during operation (October 2013.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, 22th of October 2013

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.)
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Oikon d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in March, April, May, June, July, August, September and October, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines have been use method vantage points during which at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 05 - 07 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

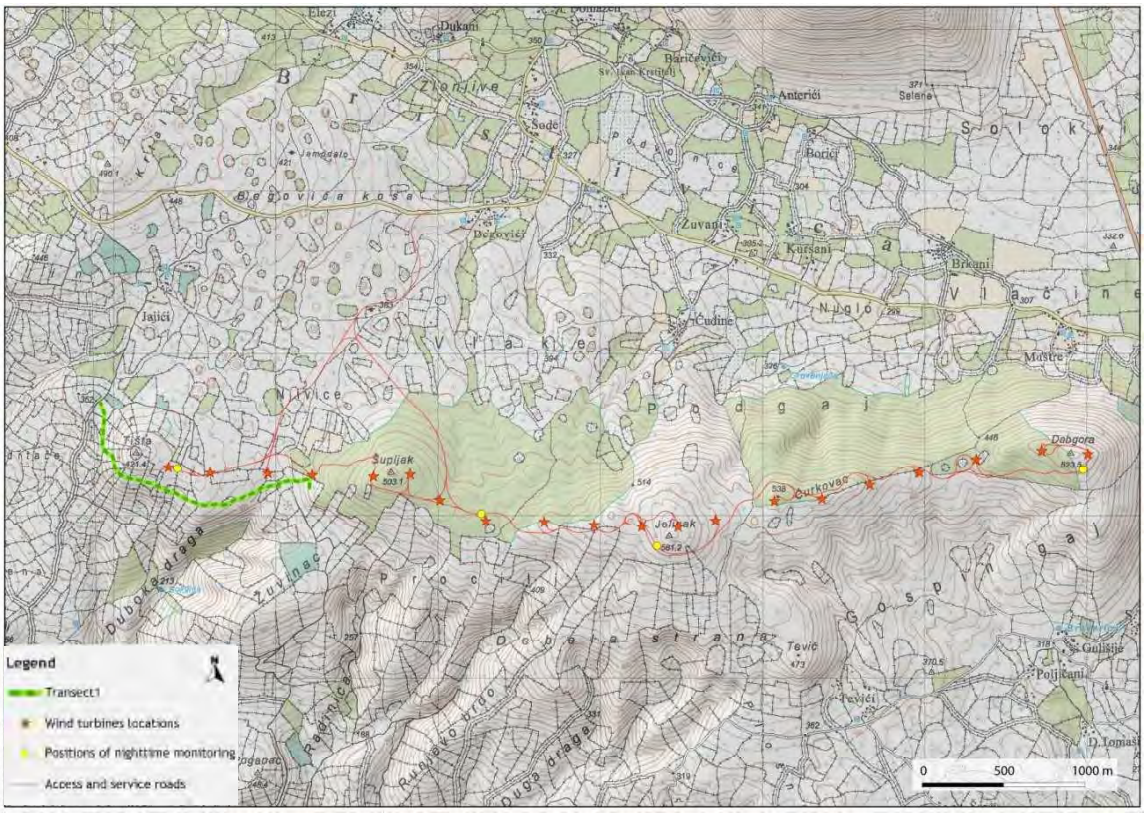


Figure 1 Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined. Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 - 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail

established and verified through further research. Considering that findings of injured individuals were observed only on surfaces of plateaus, roads and slopes, and because of size and speed of decomposition they are very hardly visible. During research in August, the biggest effort was made for viewing areas of the greatest visibility (up to 30 minutes to 1 hour) (percentage of this surface is 18% of total surface).

In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4 Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5 Area of maximum visibility - roads, platforms (Photo: D.Kovač)

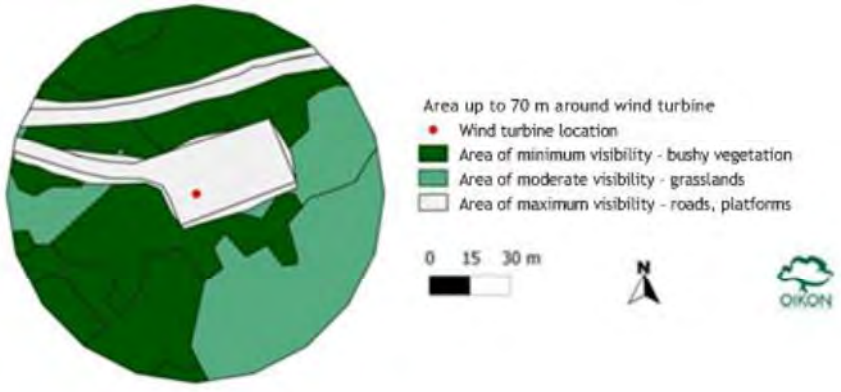


Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 47 bird species at site location were recorded during researching in 2013. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in October was observed increased activity of migratory species. Within WF, on several areas have been recorded presence of Black-eared Wheatear (Oenanthe hispanica), Whinchat (Saxicola rubetra), Stonechat (Saxicola torquata) and Black Redstart (Phoenicurus ochruros) that this area use as a temporary station of migratory route. Regarding birds of prey it have been recorded presence of Common Kestrel (Falco tinnunculus), Sparrowhawk (*Accipiter nisus*) and Goshawk (*Accipiter gentilis*) that are resident on this area. Migration overflying of vulture birds as well as larger flocks of songbird have not been noted. Also, on two occasions have been recorded activity Rock Partridge (Alectoris graeca) flocks near WTG 18 and WTG 20.

Figure 7 Graphical layout of Common Kestrel, Sparrowhawk and Goshawk movement trend during site research during October

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, ie. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind

turbines. During terrain research in October birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus*	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula)

5. PLAN FOR FURTHER ACTIVITIES

During November is planned to research bird activity within each turbine, with an emphasis on migratory species and winter birds along transect, using standing observation points method and continue to search for possible birds casualties. Since all previous injured individuals were recorded in area of maximum visibility (areas of platforms, roads and slopes) monitoring of incidents will include in all future field research, standard search of area of 70 m around each WTG whit focus on area of greatest visibility with intention of estimation of total mortality in Final annual report (for total surface area below area of rotation of blades).

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population

dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 15: Bird monitoring on Jelinak WF during operation – report for first year of monitoring (March 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Report for first year monitoring)

Zagreb, March 2013

Oikon ltd.
Institute for applied ecology

INVESTOR: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

CONTRACTOR: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

SUBCONTRACTOR: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

IN CO-OPERATION:

geonatura d.o.o.

SUBJECT: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**

- Report for first year monitoring

INT.CONTRACT NO. OIKON: 761-12

PROJECT MANAGER: Elena Patčev, mag. educ. biol. et chem.

Team members: Sven Kapelj, mag.oecol.et prot.nat.
Maja Maslać, mag. biol. exp.
Dina Kovač, mag.oecol.et prot.nat.
Vida Zrnčić, mag.oecol.et prot.nat.
dr. sc. Marin Grgurev , mag.oecol.et.prot.nat.
Goran Rnjak, bacc.ing.aedif.
Anja Bukovac, mag. oecol. et prot.nat.

PROJECT DIRECTOR: dr. sc. Zrinka Mesić

QUALITY CONTROL: prof. dr. sc. Oleg Antonić

RESPONSIBLE PERSON: Dalibor Hatić, mag. ing. silv.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

1. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

2. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

Site area description

Jelinak WF is located in Split-Dalmatia County, northwest of Trogir, in municipalities Seget and Marina (Figure 1). It is spread over peaks Tišta (421 m), Šupljak (503 m), V. Jelinak (581 m) and Dabgora (523 m). It is located in sub-Mediterranean vegetation zone. Vegetation is mostly rocky pastures that are partly in advanced stages of succession towards climatozonal vegetation, i.e. underbrush and sub-Mediterranean vegetation zones forest.

There are no existing or planned protected areas of some protection category according to Nature Protection Regulation (Official Gazette "Narodne Novine" no. 70/05, 139/08, 57/11). This is an area of international importance for birds and therefore it is included in ecological network of Republic Croatia as region #HR1000027 Mosor, Kozjak, Trogir highlands. In immediate vicinity of each wind turbine tower location, as well as in wider Jelinak WF construction area, there is not inhabited place.

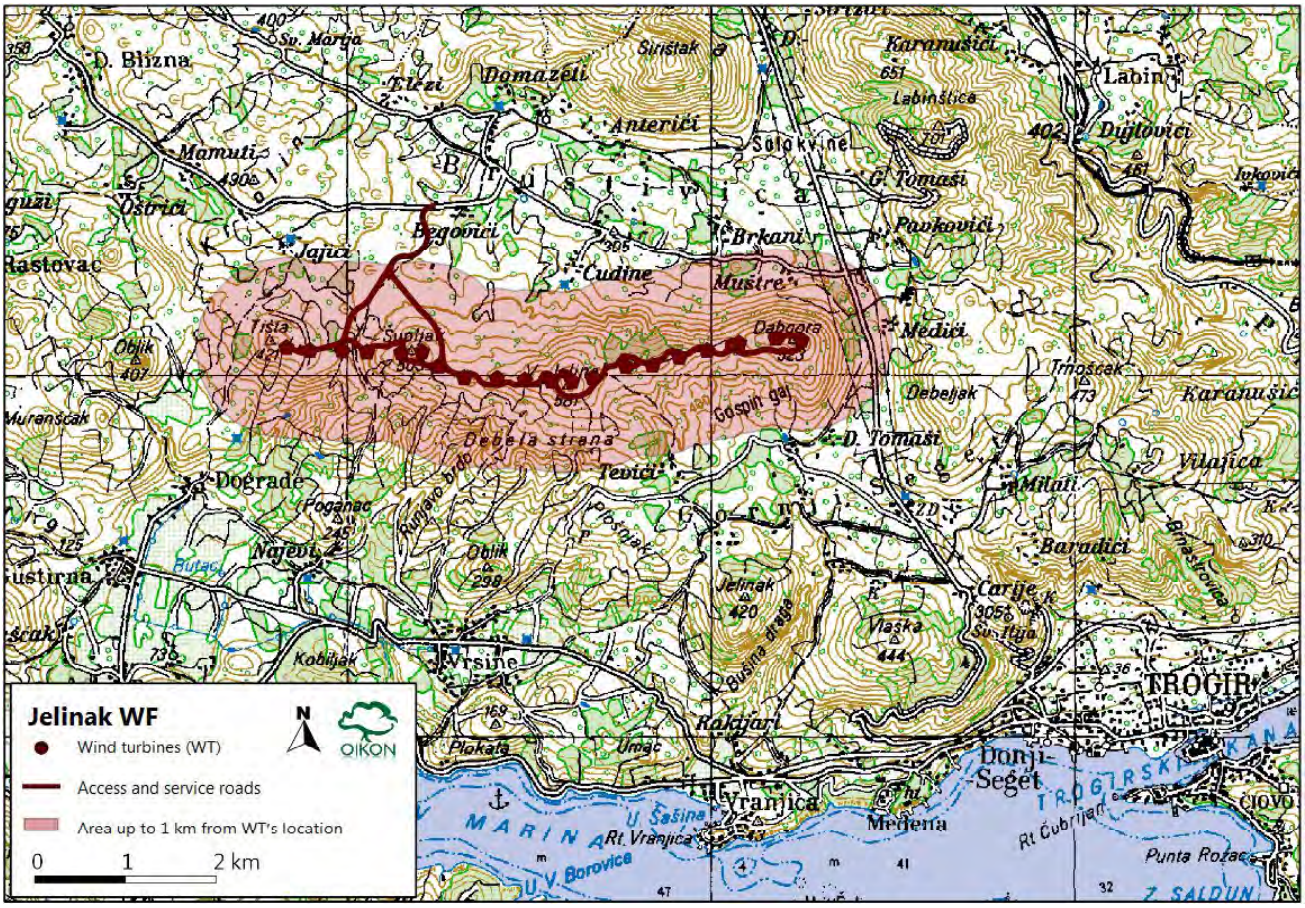


Figure 1. Preview of wider Jelinak WF locations, up to 1 km from location of wind turbine (WT)

2. MATERIALS AND METHODS USED DURING REASEARCH

Monitoring methodology of birds incidents during wind farm operation is based on instructions of publication Guidelines for preparation of Environmental Impact Assessment Study for wind power plants (Ministry of Environmental Protection and APO Ltd. 2010.), and other relevant scientific literature were also used. Includes; monitoring of bird activity on Jelinak WF site and possible casualties.

During first year of monitoring research have been carried out trough 2 site visit monthly, trough period from March until October in 2013, and one site visit per month in November 2013 and February 2014. It has been carried out research 18 times with cause search for possibly injured birds and 10 time birds activity monitoring was carried out. Note to the Client has been sent before every site visit.

Site location was researched from March 2013 till February 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behavior in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1 Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	March	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th – 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th – 28th	
	October	8th – 11th	8th - 11th
		28th - 30th	
	November	12th - 15th	12th - 15th
2014	February	27th – 28th	27th – 28th

2.1 MONITORING OF ACTIVITIES

During a research of bird populations on Jelinak WF were applied standard ornithological methods. During research of nesting birds' activity were used standard method of line transects. It have been used same transects defined in a "Compensation research for estimating the status of bird fauna on the Jelinak WF construction site in spring"from 2012 (Appendix 1). Length of transects is from 1 km up to 1.5 km , in the closest point they are distance from each other more than 3 km with cause to avoid recording of same individuals at different transect and to include all habitat types of site to give a more accurate representation of bird species diversity. At each transect with audiovisual methods have been noted all present bird species. During final interpretation of results were taken in consideration maximum value for each transect in order to avoid false high numbers in the case of record of the same individuals at different period . Field research on transect was made at dawn (from 04:30 - 07h) , because at that time the birds are most active. For exact locations have been used GPS navigation device type Garmin 60CSx. For picture of terrain and habitat types, as well as photographing birds used digital camera Canon (PowerShot S5IS) .

As required by the Decision, each field trip was researched transect length 2 km for the purpose of record of the current species present and their activities. Field research on the transect made at dawn (from 04:30 - 07h), making sure to avoid the weather with rain , fog and strong winds .

Transect 1 is set south of construction site of wind farm, at foot of top of the Tišta to Zelena. On the field is dominated by Mediterranean dry grasslands with a combination of arable land, specifically olive groves and orchards (Figure 2).

Figure 2 Characteristic appearance of habitat at transect 1(Photo: E. Patčev)

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Transect 2 includes the area from State Road D58, through settlements D. Tomas, to the village Muštre. On this area dominated olive groves, orchards and arable land. Figure 3 shows one of them typical habitat on transect 2 - olive grove.

Figure 3 Characteristic appearance of habitat at transect 2(Photo: E. Patčev)

Transect 3 is set on the north side from wind farm area, from local road 6192, village Kursani to Podgaj. Prevailing scrub oak combined with arable land, mainly olive groves and orchards. Figure 4 shows the characteristic appearance of habitats along the transect 3.

Figure 4 Characteristic appearance of habitat at transect 3 (Photo: E. Patčev)

Counting from certain positions (Eng. "vantage point watches" - Scottish Natural Heritage 2005) have been obtained data on overflights over the research area, and special attention is given to birds that are vulnerable to collision with wind turbines (Convention on the Conservation of European Wildlife and Natural Habitats 2003). For observation of the potential overflight of birds in the vicinity of wind turbines have been spent at least an hour for each wind turbine. Birds were observed and analyzed with optical devices (type Nikkon Monarch Binocular, 8x42, Durbin Swarovski STM 80, magnification 20-80x) (Figure 5).

Figure 5 Birdwatching with Durbin (Photo: E. Patcev)

For recording of nocturnal species were used playback recording census technique for the induction of the territorial election, and are used in different locations in the narrow area around a wind turbines (1.5 km). Platform that have been used for this purpose have been used only in cases when wind turbines were no active to avoid casualties of individuals. Recordings of voting were released in intervals of 15 minutes, after which have been recorded specific responses of birds whit which are determined presence of nocturnal species.

2.2 MONITORING OF BIRD INCIDENTS

Twice a month from March to October 2013 and one a month in November 2013 and February 2014, with a time interval of at least five days, have been thoroughly searched area around each turbine at distances up to 70 m, with the aim of finding birds units that are possibly injured in a collision with the blades. Researching is carried out with help of trace on GPS device, depending on visibility on terrain morphology (Figure 6), and in duration of 1 – 1.5 h for each wind turbine (Figure 4). From July 2013, beside searching area around each turbine (at distances up to 70 m), a quick overview of platforms and slopes of each WTG have been carried out every day during the site visit (2-3 days), with purpose of determining the rate at which predators remove dead birds.

Figure 6. GPS trace during terrain research

Figure 7. Example of cartographic overview of area visibility up to 70 m around wind turbine with purpose of finding injured birds

Considering determined visibility of area, and existing vegetation and morphology, the search with purpose of finding injured birds and bats have been defined by three categories of visibility degree, and their share in surface varies depending on area of individual wind turbine (Table 2, Appendix 1). Area with highest visibility (up 100%) are areas of platforms, roads and slopes, they covered a total of 23.5% of the circular area of radius 70 m. In area of moderate visibility grasslands are dominated with vegetation height 15-80 cm depending on the period of year cover about 48% of total area. Area of minimum visibility and difficult passability refers to dense bushy vegetation and covers about 29% of of research area.

Figure 8. Area of maximum visibility- roads, platforms (Photo: D. Kovač)

Figure 9. Area of moderate visibility - grasslands (Photo: D. Kovač)

Figure 10. Area of minimum visibility and difficult passability - bushy vegetation (Photo: D. Kovač)

During research, area of moderate visibility and area of minimum visibility have showed as unadequate for purpose of search for bird carcasses. Because of that reason, the biggest effort with purpose of find bats is contribute exactly on searching areas with greatest visibility (with standard search around wind turbines).

Table 2. Categories of area visibility at areas around WTG with radius of 70 m with purpose of finding injured birds and bats

Categories of area visibility	Visibility with purpose of finding birds (%)	Proportion of areas around WTG with radius of 70 m (%)
Area of maximum visibility - roads, platforms and slopes	90-100%	23.45
Area of moderate visibility - grasslands and lop-sided slope	5-15%	47.92
Area of minimum visibility and difficult passability - bushy vegetation higher than 80 cm	0-5%	28.63

Injured birds have been photographed, their location (geographic coordinates, direction and distance from the nearest wind turbine) is recorded, condition of carcasses, their taxonomic affiliation, gender, age and basic morphological measures depending on general condition of found individual is established.

Because of small number of found carcasses (five birds)was not carried out detailed numerical analysis of data (time required for removal of carcasses from area of wind farm, impact of distance from wind turbine tower on number of injured birds, estimate of total casualties at wind farms, etc.), only have been described circumstances of incidents. In case that in further research number of injured individuals increase will be carried out statistical analysis and models according to the existing literature.

3. RESULTS OF TERRAIN RESEARCHES

3.1 RESULTS OF MONITORING OF BIRDS ACTIVITIES

On location Jelinak WF has been conducted systematic field research during 2013 and February 2014 with goal to determinate qualitative and quantitative composition of bird fauna and eventual impact of wind farm on bird fauna. Site research has included a narrower zone of construction and its immediate surroundings, minimum 1500 m in all directions from area of wind farm. At location during research period in 2013 and in 2014 have been noted total 51 bird species (Table 3).

Table 3 Time dynamic of species recorded during research in 2013

SPECIES/MONTH	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Short-toed Eagle (*Circaetus gallicus*)										
Montagu's Harrier (*Circus pygargus*)										
Sparrowhawk (*Accipiter nisus*)										
Goshawk (*Accipiter gentilis*)										
Buzzard (*Buteo buteo*)										
Kestrel (*Falco tinnunculus*)										
Rock Partridge (*Alectoris graeca*)										
Quail (*Coturnix coturnix*)										
Yellow-legged Gull (*Larus michahellis*)										
Rock Dove (*Columba livia*)										
Turtle Dove (*Streptopelia turtur*)										
Cuckoo (*Cuculus canorus*)										
Eagle Owl (*Bubo bubo*)										
Nightjar (*Caprimulgus europaeus*)										
Swift (*Apus apus*)										
Alpine Swift (*Tachymarptis melba*)										
Hoopoe (*Upupa epops*)										
Bee-eater (*Merops apiaster*)										
Woodlark (*Lulula arborea*)										

Swallow (*Hirundo rustica*)	
Meadow Pipit (*Anthus pratensis*)	
Nightingale (*Luscinia megarhynchos*)	
Robin (*Eritacus rubecula*)	
Stonechat (*Saxicola torquata*)	
Whinchat (*Saxicola rubetra*)	
Black Redstart (*Phoenicurus ochruros*)	
Wheatear (*Oenanthe oenanthe*)	
Black-eared Wheatear (*Oenanthe hispanica*)	
Blackbird (*Turdus merula*)	
Song Thrush (*Turdus philomelos*)	
Olivaceous Warbler (*Hippolais palida*)	
Blackcap (*Sylvia atricapilla*)	
Subalpine Warbler (*Sylvia cantilans*)	
Chiffchaff (*Phylloscopus collybita*)	
Goldcrest (*Regulus regulus*)	
Great Tit (*Parus major*)	
Sombre Tit (*Poecile lugubris*)	
Jay (*Garrulus glandarius*)	
Hooded Crow (*Corvus cornix*)	
Raven (*Corvus corax*)	
Golden Oriole (*Oriolus oriolus*)	
Starling (*Sturnus vulgaris*)	
House Sparrow (*Passer domesticus*)	
Chaffinch (*Fringilla coelebs*)	
Serin (*Serinus serinus*)	
Linnet (*Carduelis cannabina*)	

Corn Bunting (*Emberiza calandra*)	
Cirl Bunting (*Emberiza cirlus*)	
Black-headed Bunting (*Emberiza melanocephala*)	
Yellowhammer (*Emberiza citrinella*)	

From data (Table 3 and Figure 11) trough number of recorded birds' species indirectly is visible bird activity throughout year. The activity is highest in the spring, during nesting, when most birds vote. Because of this reason, as well as an increased number of species during spring and autumn migration period has been recorded biggest activity as expected. Species recorded in spring during nesting are present during summer because of reduced activity have been recorded smaller number of species on site. Dalmatia is part of migration route between Europe and Africa, number of recorded species on site during spring and autumn migration is increase.

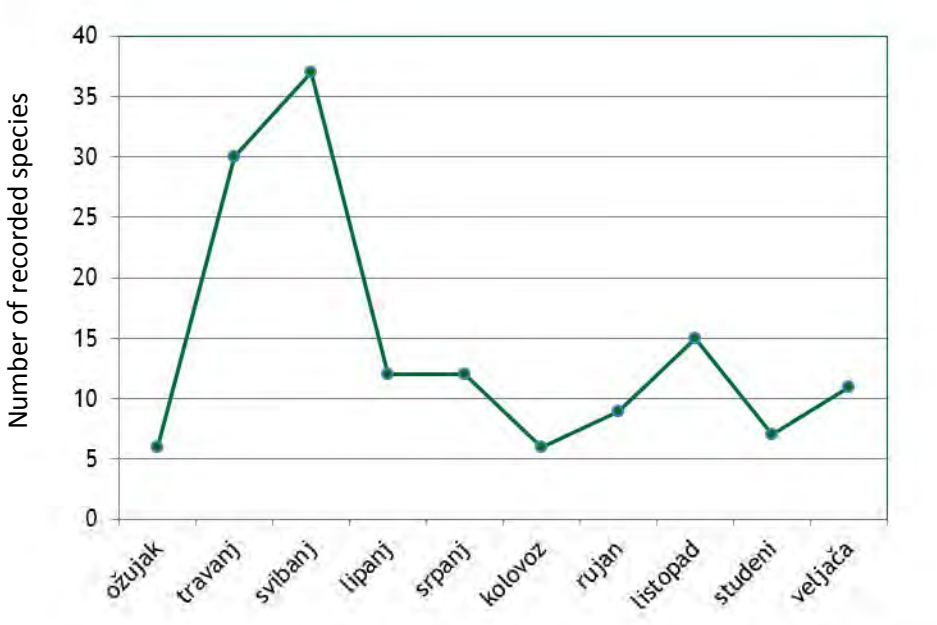

Figure 11 Number of species recorded during the 2013 and 2014

Research of nesting birds is based on transect research defined during zero state, which can be seen in Annex 1 Data from transects were compared in order to determine the possible impact of wind farms on nesting wider area.

On **transect 1** in the first year (2013-2014 years), there were 16 species of birds, unlike 2012 when he recorded 15 species. Species recorded during the 2012 2013 and 2014 years are shown in Table 4.

Table 4. List of species recorded with a number of observed units on Transect 1

Recorded species	Number of observed units	
	2012.	2013.-2014.
Anthus campestris	6	3
Anthus pratensis	-	5
Carduelis cannabina	7	-
Columba livia	-	13
Corvus cornix	-	1
Coturnix coturnix	-	1
Cuculus canorus	2	
Fringilla coelebs	-	2
Emberiza calandra	6	-
Emberiza melanocephala	9	-
Garrulus glandarius	2	1
Hippolais pallida	-	2
Lullula arborea	-	3
Lanius collurio	2	-
Lanius senator	1	-
Larus michahellis	7	-
Luscinia megarhynchos	1	9
Merops apiaster	2	-
Oenanthe hispanica	4	6
Parus major	-	5
Sylvia atricapilla	-	1
Sylvia cantilans	2	17
Sylvia melanocephala	1	-
Turdus merula	2	12
Upupa epops	-	1

At transect 2 in the first year of research (2013-2014) were recorded 17 species of birds, which is the same as in 2012. Recorded species of nesting birds are shown in Table 5

Table 5. List of species recorded with a number of observed units on Transect 2

Recorded species	Number of observed units	
	2012.	2013.-2014.
Corvus cornix	-	1
Cuculus canorus	1	3
Emberiza cia	1	-
Emberiza cirlus	1	-
Emberiza melanocephala	11	3
Fringilla coelebs	17	6
Garrulus glandarius	-	1
Hirundo rustica	-	1
Hippolais polyglotta	2	-
Larus michahellis	4	-
Luscinia megarhynchos	13	10
Oenanthe oenanthe	-	1
Oriolus oriolus	2	2
Parus major	2	2
Passer domesticus	10	-
Phyloscopus collibita	1	2
Regulus regulus	-	1
Serinus serinus	-	1
Streptopelia turtur	3	3
Sylvia atricapilla	1	1
Sylvia cantilans	7	13
Turdus merula	18	9
Upupa epops	1	-

At transect 3 in first year (2013 --2014ts) were recorded 19 species of birds, as opposed from 2012 during which have been recorded 18 species. Recorded species of nesting birds are shown in Table 6.

Table 6. List of species recorded with a number of observed units on Transect 2

Recorded species	Number of observed units	
	2012.	2013.-2014.
Anthus pratensis	-	1
Apus apus	2	-
Buteo buteo	2	-
Carduelis canabinna	2	4
Corvus cornix	-	2
Cuculus canorus	1	1
Emberiza calandra	-	4
Emberiza cirlus	1	1
Emberiza melanocephala	4	-
Fringilla coelebs	5	2
Garrulus glandarius	-	6
Hippolais polyglotta	3	-
Hirundo rustica	4	-
Larus michahellis	-	4
Lullula arborea	-	10
Luscinia megarhynchos	4	7
Oenanthe hispanica	1	2
Parus major	1	1
Passer domesticus	>10	-
Phylloscopus collybita	-	2
Regulus regulus	-	1
Serinus serinus	1	-
Streptopelia turtur	2	1
Sylvia atricapilla	-	1
Sylvia cantilans	12	7
Sylvia communis	3	-
Turdus merula	6	1

Number of species during research of zero state and states and during construction phase of wind farm, as shown in Figure 12 has not substantially changed.

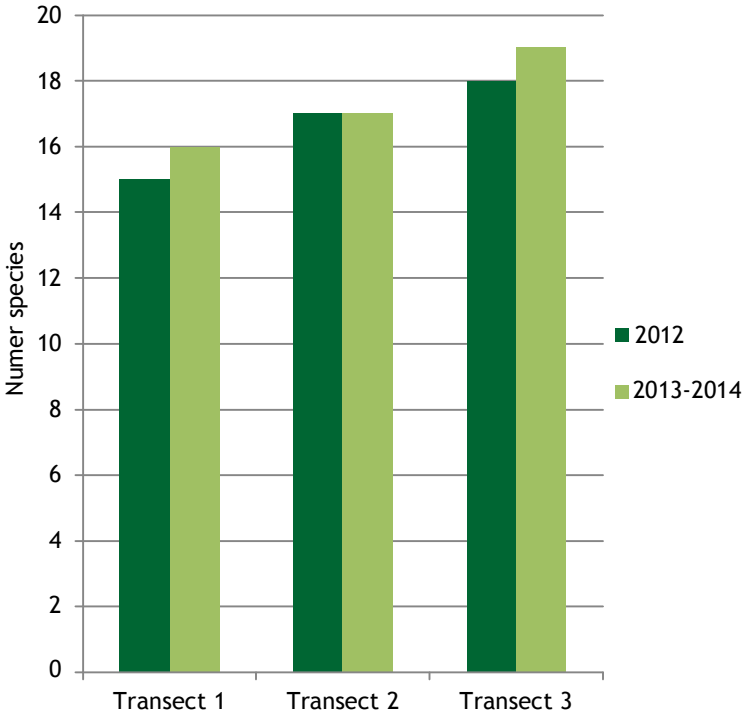

Figure 12 Number of bird species on transects in 2012 and 2013-2014

3.2 RESULTS OF MONITORING OF BIRDS INCIDENTS

During 2013 and February 2014 location of Jelinak WF were recorded total three types, ie five injured bird units. Species that are found: Buzzard (Buteo buteo), Robin (Eritacus rubecula) and Song Thrush (Turdus philomelos) (Figure 13).

All injured individuals were found during site visit in late March, during foggy weather, with reduced visibility and low precipitation. Part of found birds have been found in area of maximum visibility, ie roads, platforms and slopes, while Buzzard (Buteo buteo) and one Robin (Eritacus rubecula) have been found in denser vegetation. All injured individuals were found at 20-55 m from wind turbine (Appendix 3). Since March is time of spring migration, assumption is that birds were injured (or at least some of them) were passage birds on research area and that they have been injured because of poor visibility.

List of injured birds during research in 2013, together with data of direction from WTG is shown in Table 7. Injured birds were left on site, and that areas were searched again next day, during which they have been not found again. Since weather conditions were not favorable for intensive decomposing of carcasses, their disappearance indicates presence of predators at site. To the same thing indicate number of droppings on platforms wind turbines at the time of incident.

Table 7. Findings of injured birds at area of JelinakWF

WTG	Direction from WTG	Bird species	Date of finding
WTG 01	W	European Robin (*Eritacus rubecula*)	21st of March 2013
WTG 12	N	European Robin (*Eritacus rubecula*)	28th of March 2013
WTG 17	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 13 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

4. INTERPRETATION OF RESULTS

4.1 ECOLOGY AND DISTRIBUTION OF INJURED BIRDS

Eritacus rubecula, Robin, LC, a strictly protected species (Linnaeus, 1758)

Habitat: It occurs in all types of inland forests of the plains to the highest mountains.
Ecology types: It feeds on insects and fruit that is in bush vegetation. It voicing throughout the year. In winter in Dalmatia their number increases due to wintering bird arrived from north.
Status: resident, migratory and wintering.
Distribution and status in Croatia: The species is common and widespread in the region. It is present at the location in areas with denser vegetation, which probably nests in small numbers.

Turdus philomelos, Song Thrush (Brehm 1831)

Habitat: It inhabits wooded areas, thickets, agricultural areas, orchards, parks and gardens.
Ecology types: Feeds with insects, gastropods, and fruits of plants. Voice from it is loud and clear, and it is easy to spot. Makes nest from sticks and mud, and inside sheathing only with hardened mud.
Status: migratory and wintering in coastal belt.
Distribution and status in Croatia: The species is common as wintering in coastal belt. It is present at the location in the whole area, and sometimes in the winter can be seen in flocks.

Buteo buteo, Buzzard, LC, a strictly protected species (Linnaeus, 1758)

Habitat: It inhabits forests, woods, agricultural areas with trees and open areas in winter.
Ecology types: It feeds mainly with small mammals, and often it can be seen how "flashing" in the air to catc prey. Voice from it is loud and clear, and it is easy to spot. Makes nest from sticks and mud, and inside sheathing only with hardened mud.
Status: resident, nesting, migratory and wintering.
Distribution and status of the Croatia: It is very common raptor in region. on location is estimated intense activity of at least one pair.

4.2 RISK ASSESSMENT OF BIRD FAUNA AT LOCATION OF JELINAK WF

In area of Jelinak WF were found 51 bird species , of which 35 are strictly protected (Nature Protection Act, Official Gazette NN 80/13; Rules of strictly protected species, Official Gazette NN 144/13). Croatia is a signatory to Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). At the same time in Croatia inhabited by 16 species listed in the Directive of Protection of Birds (79/409/EEC BD). Most birds are in categories IUCN category "least concern" (LC), but among the recorded species is one endangered species (EN) Montagu's Harrier and one vulnerable species (VU) Short-toed Eagle (Figure 14). Even 27% birds on the list is without assigned IUCN category.

Table 8 List of species recorded on location VE Jelinak during the investigation period

	SPECIES	Bern	Bonn	EU dir	HR status gn	ngn	pre	zim	EU status	Strictly protected
1.	Short-toed Eagle (*Circaetus gallicus*)	II	II	I	VU				RARE	YES
2.	Montagu's Harrier (*Circus pygargus*)	II	II	I	EN					YES
3.	Sparrowhawk (*Accipiter nisus*)	II	II		LC					YES
4.	Goshawk (*Accipiter gentilis*)	II	II		LC					YES
5.	Buzzard (*Buteo buteo*)	II	II		LC					YES
6.	Kestrel (*Falco tinnunculus*)	II	II		LC					YES
7.	Rock Partridge (*Alectoris graeca*)	lll		I	NT				VU	
8.	Quail (*Coturnix coturnix*)	III	II	II-2	NT		NT		VU	
9.	Yellow-legged Gull (*Larus michahellis*)	III		II-2					(Secure)	
10.	Rock Dove (*Columba livia*)	III		II-1						
11.	Turtle Dove (*Streptopelia turtur*)	III		II	LC				DEC	
12.	Cuckoo (*Cuculus canorus*)	III								
13.	Eagle Owl (*Bubo bubo*)	II		I	NT				VU	YES
14.	Nightjar (*Caprimulgus europaeus*)	II		I	LC				DEC	YES

15.	Swift (*Apus apus*)	III								
16.	Alpine Swift (*Tachymarptis melba*)	II							Secure)	YES
17.	Hoopoe (*Upupa epops*)	II			LC					YES
18.	Bee-eater (*Merops apiaster*)	II	II		LC				DEC	YES
19.	Woodlark (*Lulula arborea*)	III		I	LC				VU	
20.	Swallow (*Hirundo rustica*)	II			LC				DEC	YES
21.	Tawny Pipit (*Anthus campestris*)	II		I	LC				VU	YES
22.	Meadow Pipit (*Anthus pratensis*)	II					LC	LC		YES
23.	Nightingale (*Luscinia megarhynchos*)	II	II		LC				(Secure)	YES
24.	Robin (*Eritacus rubecula*)	II	II		LC					YES
25.	Stonechat (*Saxicola torquata*)	II	II		LC				(DEC)	YES
26.	Whinchat (*Saxicola rubetra*)	II	II		LC					YES
27.	Black Redstart (*Phoenicurus ochruros*)	II	II		LC					YES
28.	Wheatear (*Oenanthe oenanthe*)	II	II		LC					YES
29.	Black-eared Wheatear (*Oenanthe hispanica*)	II	II		LC				VU	YES
30.	Blackbird (*Turdus merula*)	III	II	II-2						
31.	Song Thrush (*Turdus philomelos*)	lll	ll	II-2						
32.	Olivaceous Warbler (*Hippolais palida*)	II	II		LC					YES
33.	Blackcap (*Sylvia atricapilla*)	II	II		LC					YES
34.	Subalpine Warbler (*Sylvia cantilans*)	II	II		LC					YES
35.	Chiffchaff (*Phylloscopus collybita*)	II	II		LC					YES
36.	Goldcrest (*Regulus regulus*)	II	II		LC				(Secure)	YES
37.	Great Tit (*Parus major*)	II			LC					YES
38.	Sombre Tit (*Poecile lugubris*)	II			LC				(Secure)	YES

39.	Jay (*Garrulus glandarius*)	III		II-2					(Secure)	
40.	Hooded Crow (*Corvus cornix*)	III		II-2						
41.	Raven (*Corvus corax*)	III							(Secure)	
42.	Golden Oriole (*Oriolus oriolus*)	II			LC					YES
43.	Starling (*Sturnus vulgaris*)	III		II-2						
44.	House Sparrow (*Passer domesticus*)	III								
45.	Chaffinch (*Fringilla coelebs*)	III								
46.	Serin (*Serinus serinus*)	II			LC					YES
47.	Linnet (*Carduelis cannabina*)	II			LC					YES
48.	Corn Bunting (*Emberiza calandra*)	III							(Secure)	YES
49.	Cirl Bunting (*Emberiza cirlus*)	II			LC				(Secure)	YES
50.	Black-headed Bunting (*Emberiza melanocephala*)	II			LC				(VU)	YES
51.	Yellowhammer (*Emberiza citrinella*)	II			LC				(Secure)	YES

Explanation of the table:

HR Status: gn - nesting; Pre - migratory; zim - wintering; Vulnerability categories (IUCN): CR-- Critically Endangered, EN - Endangered, VU - sensitive, NT - Near vulnerable, LC - least concern, DD - deficient; Bern Convention NN 6/00 - Convention on the Conservation of European Wildlife and Natural Habitats: Appendix II. Strictly protected species; Appendix III. Protected animal species; Bonn conv. NN 6/00 – Convention on the Conservation of Migratory Species of Wild Animals: Appendix I Endangered migratory species; Appendix II. Migratory species that need to be subject to the agreement; BD 79/409/EEC - Directive on the Protection of Birds: Birds Annex I for which it is necessary to allocate Special Protection Areas (SPA), Appendix II. Species that may be hunted; Appendix III. Types that can be traded; Regulations on strictly protected species (NN 144/13).

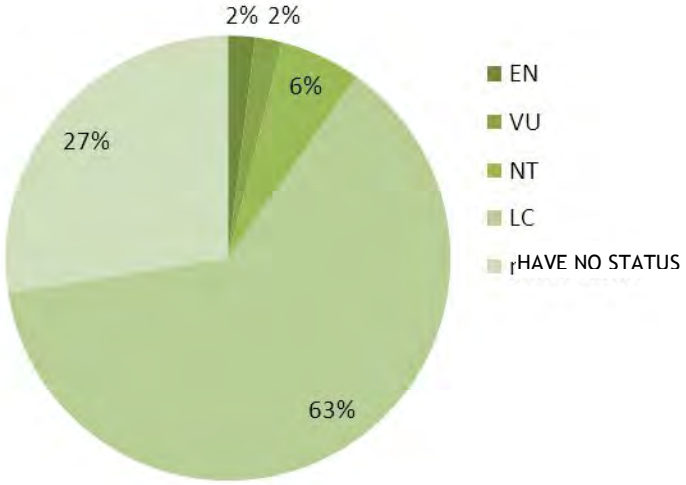

Figure 14 Distribution according to IUCN categories of vulnerability of recorded bird species

Birds, beside bats, consider as species that is most endangered by wind farms. The most frequently is mentioned four negative effects of wind farms on birds (Drewitt and Langston 2006): direct collision, displacement due to disturbance , barrier effects and habitat loss. Direct fatalities due have been particularly endangered migratory birds (Johnson et al . 2002) , although it depends on location, whether wind farm location is on migration corridor. This kind of corridor is Dalmatia , particularly are important " Bottlenecks " that birds use for rest and feeding before they continue migration (eg Vrana Lake near Pakoštane). Some groups are more endangered by collisions with wind turbines , thereby highlight are birds of prey , as frequent victims of incidents (Hotker 2008) . For Croatia there are few data of injured birds on wind farm. According to the data (Problemanalyse und Lösungsvorschläge , BMU - Project , 2010) for Croatia , there was only one injured birds (Aegolius funereus - Tengmalm's Owl) .

As mentioned, among species endangered by wind farms stand out birds of prey. For example, in Germany, birds of prey are the most numerous group injured at wind farms (Hötker 2008). It is the species that is not so numerous in certain areas as other groups, they are long lived (longer they need to reach reproductive maturity and raised by a small number of young) and they are usually top-predators (damage due to these impacts on the entire ecosystem). Therefore, special attention must be dedicate to this group and their protection on wind farms.

Birds of prey on Jelinak WF

From the list of recorded species can be point out birds with increased risk of collision with wind turbine blades (according to the report "Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues") **Short-toed Eagle** (Circaetus gallicus), **Montagu's Harrier** (Circus pygargus), **Goshawk** (Accipiter gentilis), **Sparrow hawk** (Accipiter nisus), **Buzzard** (Buteo buteo) and **Kestrel** (Falco tinnunculus).

Circaetus gallicus, Short-toed Eagle, VU

One pair was recorded several times at the location during ornithological research in 2013. Individuals were seen flying at altitudes up to 150 m, and have been recorded several landings on the dense vegetation in narrow research area, which indicates intensely use of this area for territorial and hunting. Short-toed Eagle movements recorded during the 2013th year are shown in Figure 155.

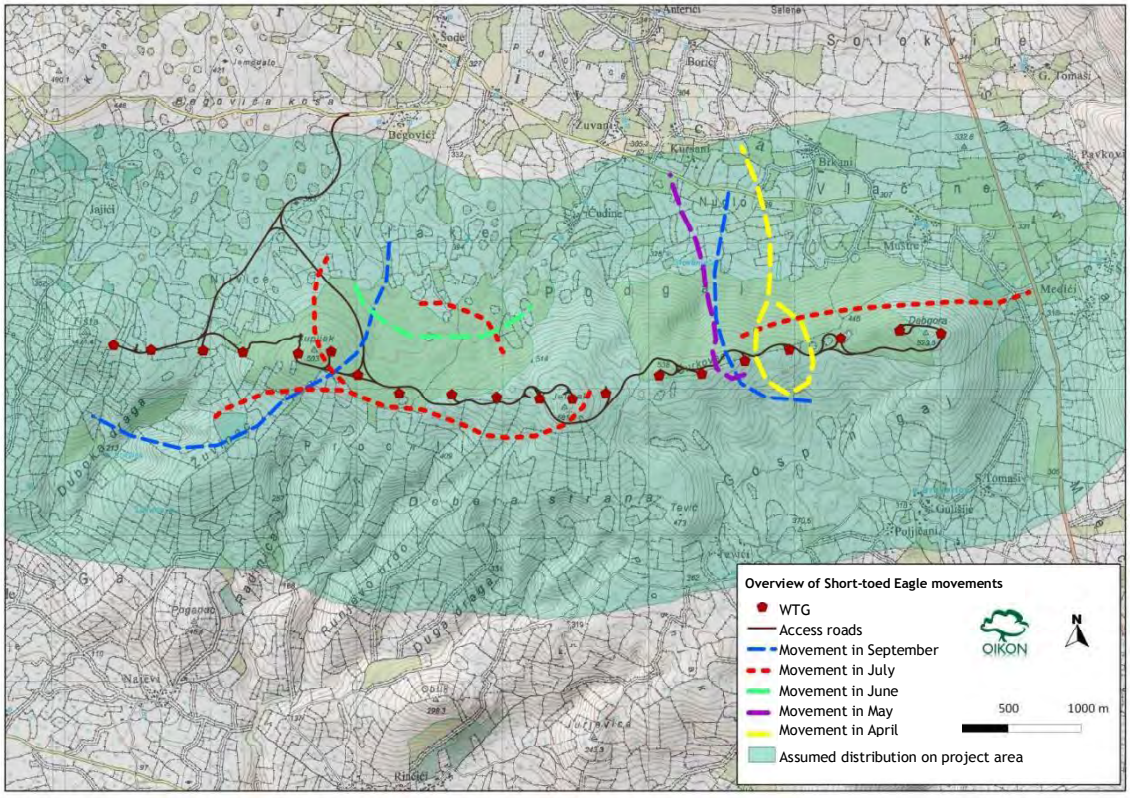

Figure 15 Overview of Short-toed Eagle movements (Circaetus gallicus)

Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Convention on the Conservation of European Wildlife and Natural Habitats, T-PVS/Inf (2003) 12, Council of Europe, Strasbourg.

Circus pygargus, Montagu's Harrier, EN

One individual was observed during April and May 2013. The bird was seen flying over on eastern part of area, and exact location of overflights is shown in Figure 16. Given the fact that the bird was seen flying over at the same area both times that was observed, the assumption is that this corridor used for overflights, and that not retains in narrow area of Jelinak WF.

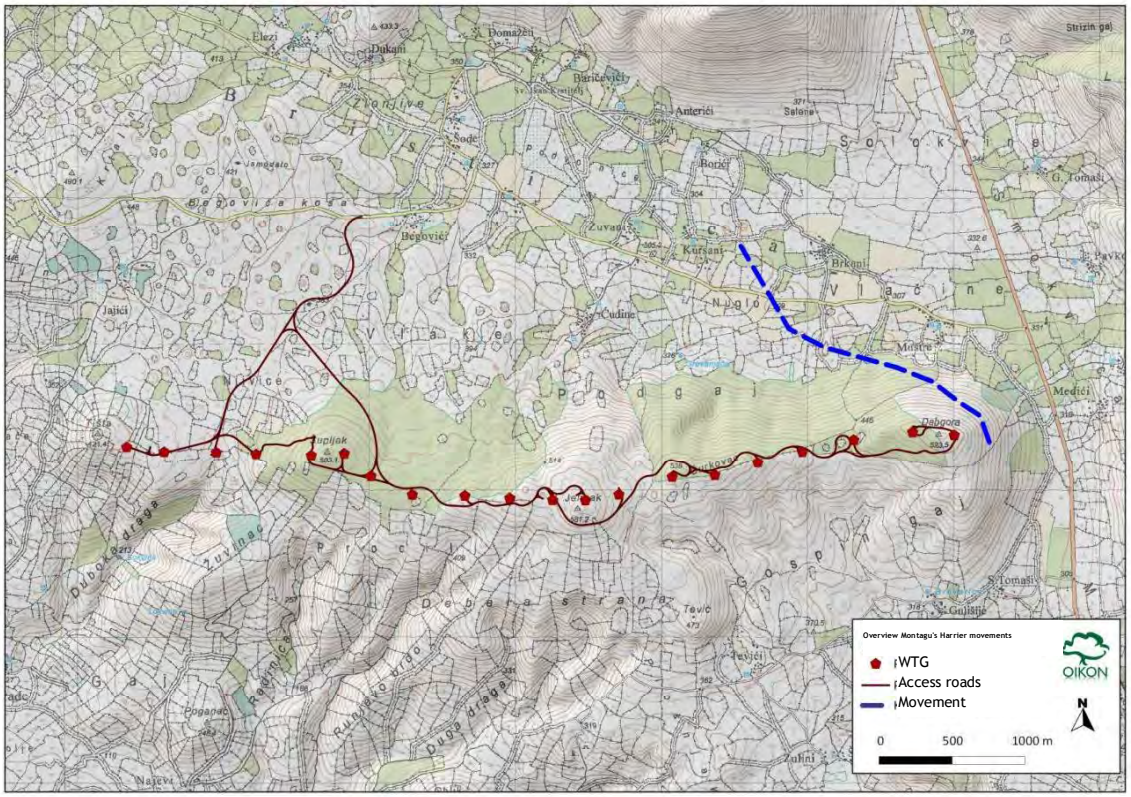

Figure 16 Overview of Montagu's Harrier movements (Circus pygargus)

Accipiter gentilis, Goshawk, LC

One individual of this species was observed during flight over, during research in June 2013. Whereas during the previous months of research was not recorded a single individual of this species in research area, assumption is that this is wintering bird. Recorded of individual movements is shown in Figure 17

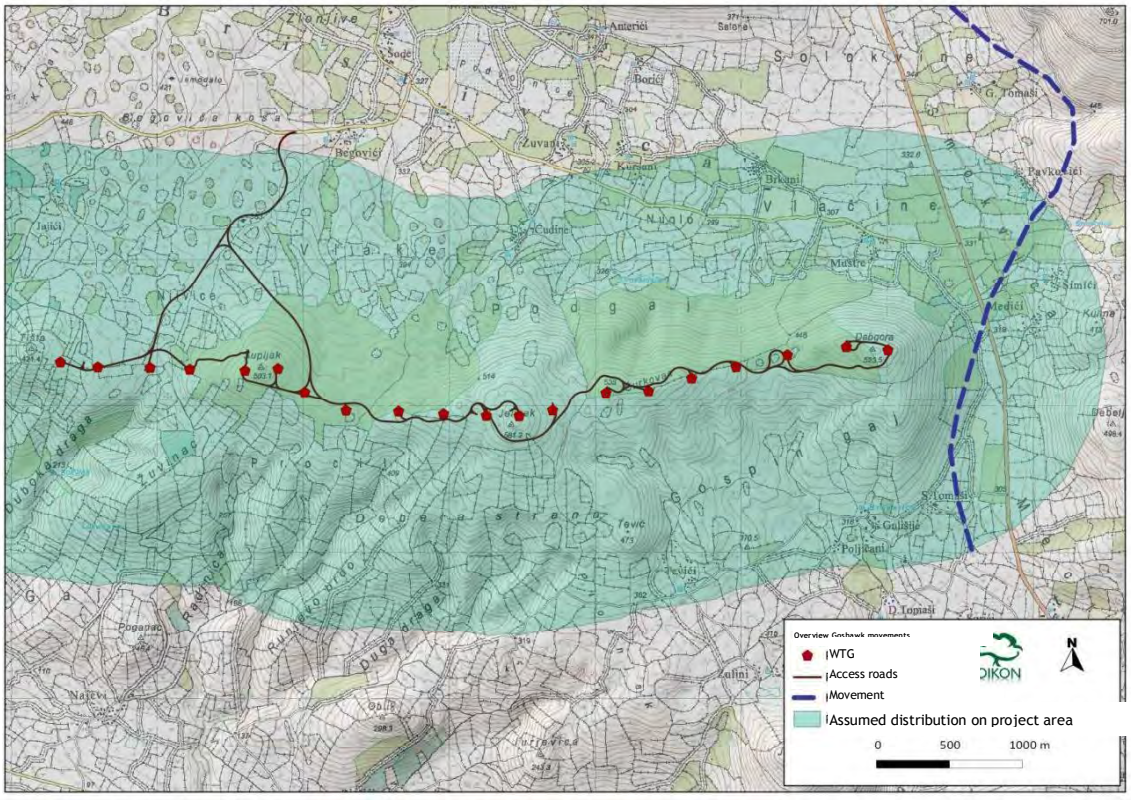

Figure 17 Overview of Goshawk movements (Accipiter gentilis)

Accipiter nisus, Sparrow hawk, LC

During research in the 2013 this species has been recorded only once, during October The bird was observed flying over the east in immediate zone of research area, as shown in Figure 18. Whereas during the previous months of research have not recorded a single specimen of this species in area, assumption is that this is wintering bird.

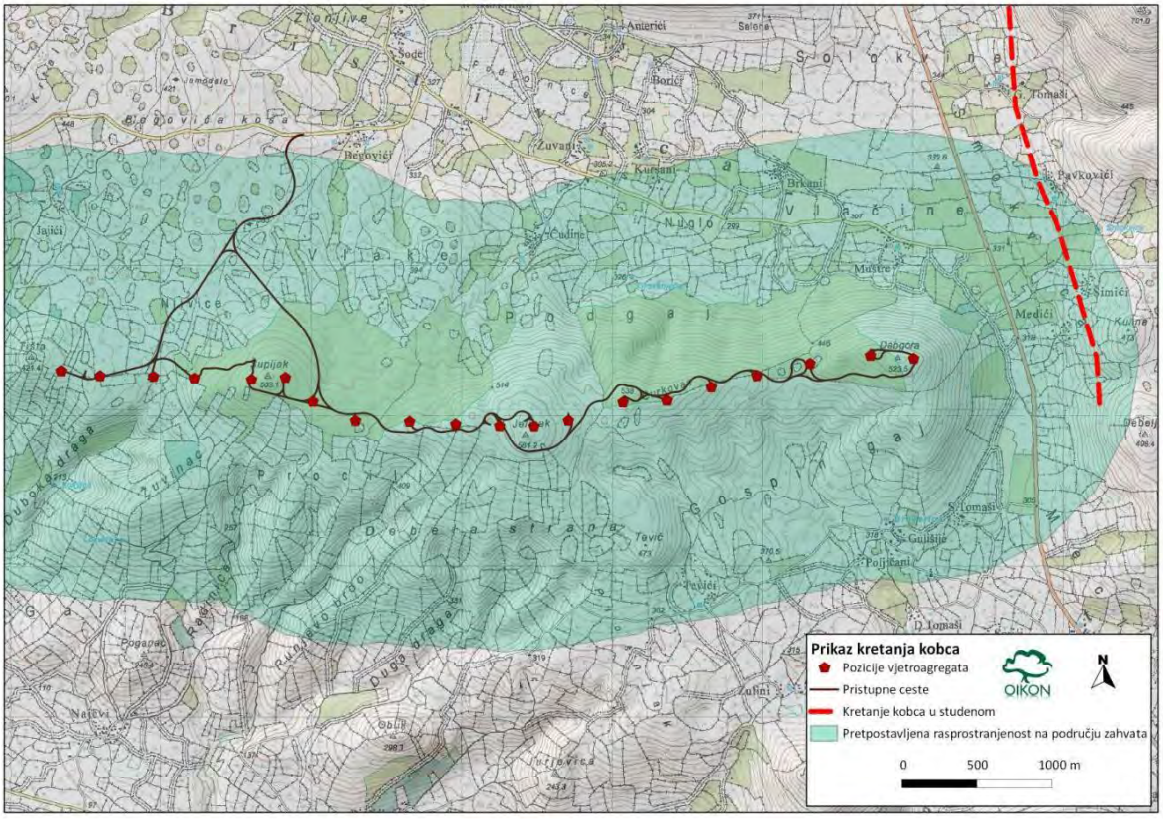

Figure 18 Overview of Sparrow hawk movements (Accipiter nisus)

Buteo buteo, Buzzard, LC

This species was observed at the location for several months, last time during s July 2013. The specimens were observed flying at a low altitude of the flight, about 20 m above the ground, to a height of about 250 m. Species using this area for hunting and fling, and how it was recorded during the nesting phase it is assumed that one pair is nesting in proximity Jelinak WF. Exactly movement of Buzzard on the area of WF is shown in Figure 19

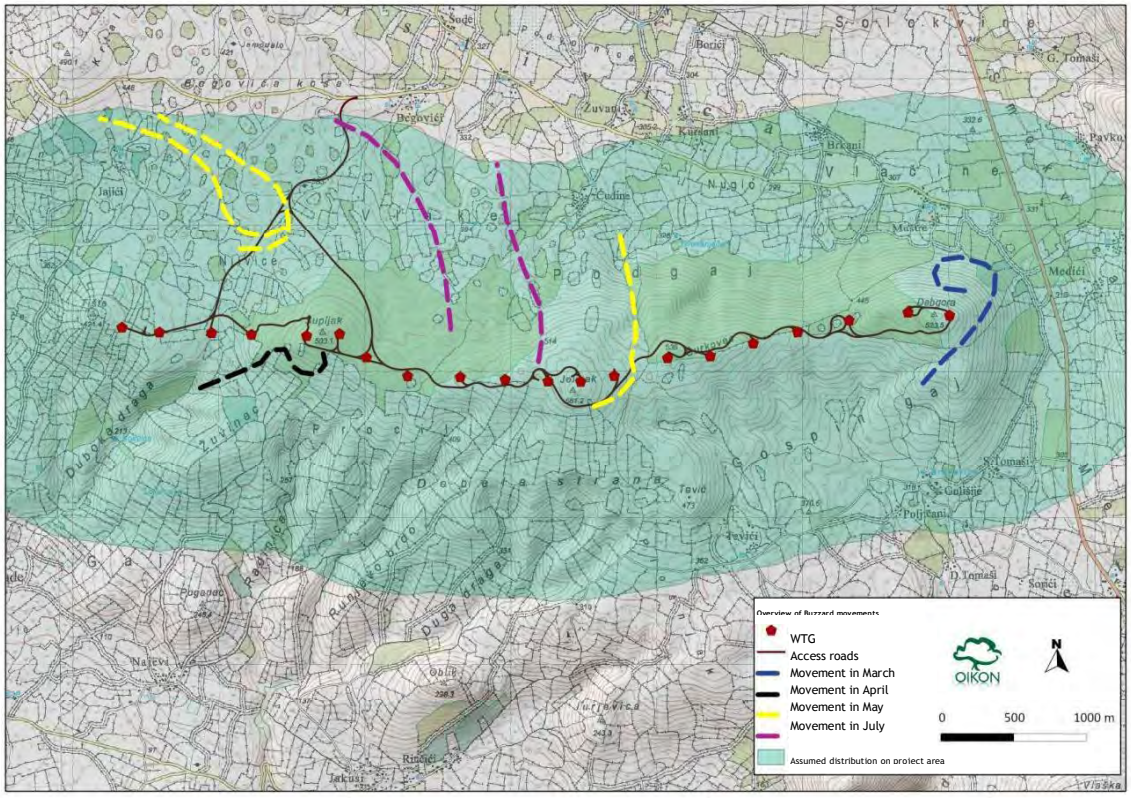

Figure 19 Overview of Buzzard movements (Buteo buteo)

Falco tinnunculus, Kestrel, LC

The species was recorded during several months during ornithological research in the 2013 at altitudes 30-150 m above the ground. Due to the high frequency of occurrence throughout the year assumption is that species of area used for hunting, breeding and fly. Moviment of Kestrel at area of WF is shown in Figure 20.

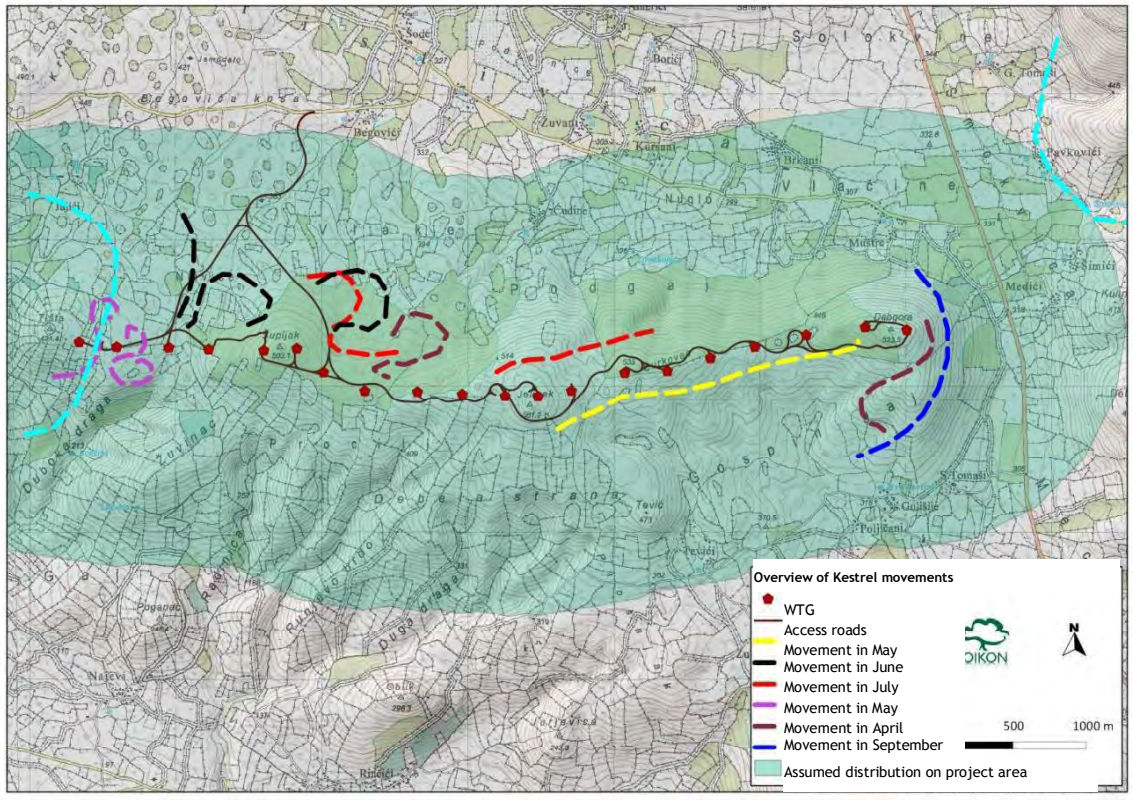

Figure 20 Overview of Kastrel movements (Falco tinnunculus)

5. PLAN FOR FURTHER ACTIVITIES

The next field research is planned for March 2014 when, as before is planned follow-up birds activities once a month, and twice a month search surrounding area of wind turbine for the purpose of finding injured birds. During witch will spend a minimum of three field days with two ornithologists on research area site every month.

6. CONCLUSION

In the area of VE Jelinak from March to November 2013 and in February 2014, have been recorded total of 51 bird species. Activity is the highest as expected during the nesting period, which is evident from the number of recorded species through months of research. By comparing the number of species on same transects from 2012, 2013 and 2014 is concluded that there was no significant change in nesting bird number from this area.

Bird activity on narrower area of WF have not been decreased over the year, larger number of over flights have been recorded from March to November as expected due to seasonal bird activity (increased during nesting and migration season). From a list of all recorded species can be distinguished birds with an increased risk of collision with wind turbine blades (according to the report "Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues" 2): Short-toed Eagle (Circaetus gallicus), Montagu's Harrier (Circus pygargus), Goshawk (Accipiter gentilis), Sparrow hawk (Accipiter nisus), Buzzard (Buteo buteo) and Kestrel (Falco tinnunculus).

In the area of Jelinak WF during research 2013 and 2014, total casualties were recorded three spices, ie five injured bird specimens. Species found were: Common Buzzard (Buteo buteo), Robin (Eritacus rubecula) and Song Thrush (Turdus philomelos). All birds were found in March, during foggy weather, with reduced visibility and low rainfall, so it can be assumed that they killed in a collision with wind turbines due to poor visibility and bad weather conditions. Injured birds were left in situ, and these are the places searched again the next day. During re-search injured bird was gone. Since the weather conditions were not favorable for intensive decomposing of carcasses, their disappearance indicates the presence of predators. At the same point increased number of droppings on the platforms around a wind turbine at the time of incident.

Due to the small number of identified injured specimens (five birds), was not carried out detailed numerical data processing, but only circumstances of incidents have been described. In the event that further study of injured individuals increase will be carried out statistical analysis and models according to existing literature data.

Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Convention on the Conservation of European Wildlife and Natural Habitats, T-PVS/Inf (2003) 12, Council of Europe, Strasbourg.

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Web pages

1. www.dzzp.hr
2. www.ornitologija.hr
3. www.nn.hr

List of regulations

1. BD 79/409/EEC - Direktiva o zaštiti ptica
2. Bernska konvencija NN 6/00 - Konvencija o zaštiti europskih divljih vrsta i prirodnih staništa
3. Bonnska konvencija NN 6/00 - Konvencija o zaštiti migratornih vrsta divljih životinja
4. Ministarstvo zaštite okoliša, prostornog uređenja i graditeljstva i APO d.o.o (2010): Smjernice za izradu Studija utjecaja na okoliš za vjetroelektrane za faunu ptica i šišmiša.
5. Zakonu o zaštiti prirode (NN 80/13)
6. Pravilnik o strogo zaštićenim vrstama (NN 144/13)

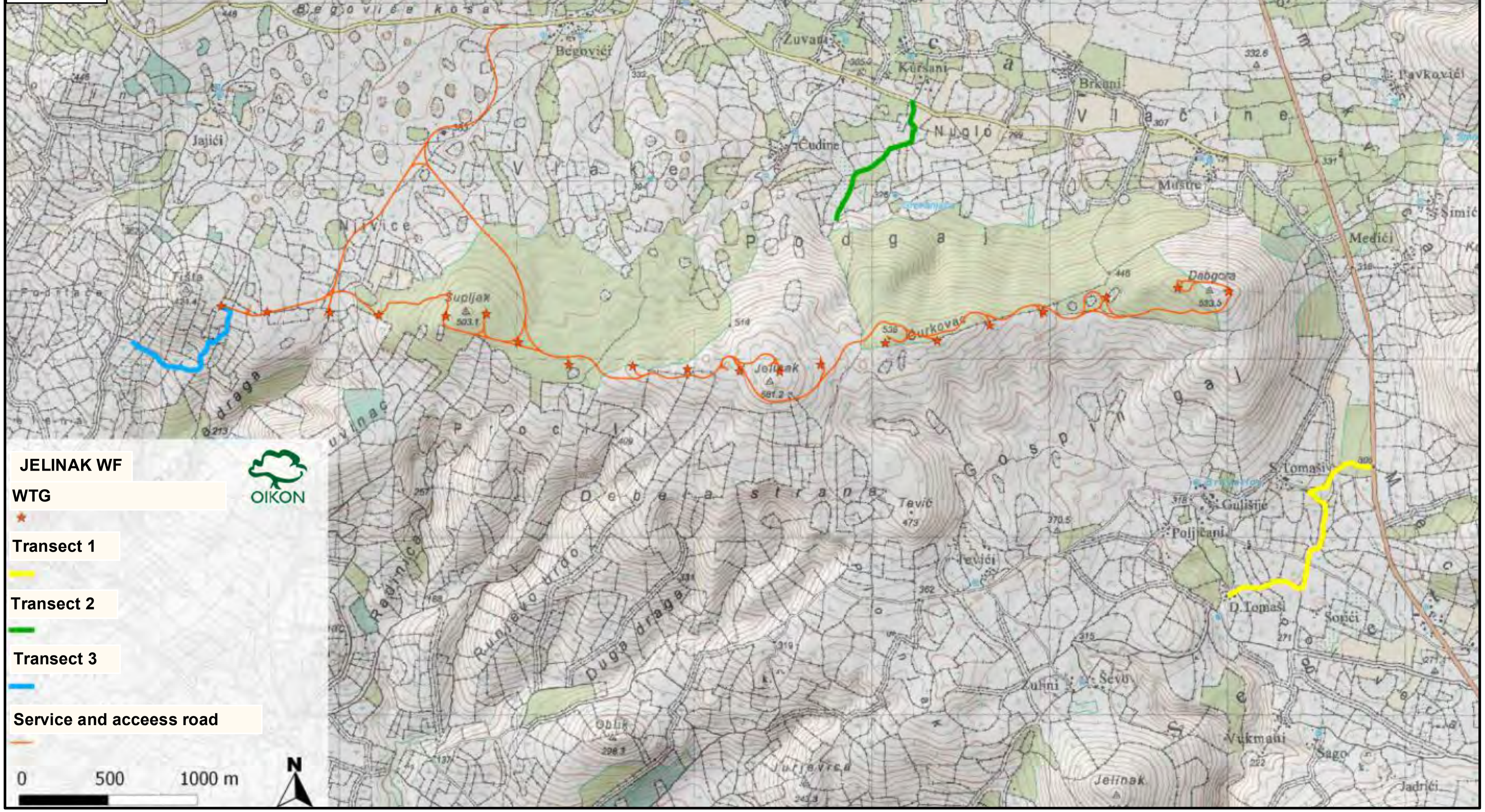
1. ANNEX

Annex 1 graphic overview of transect position in relation WF location

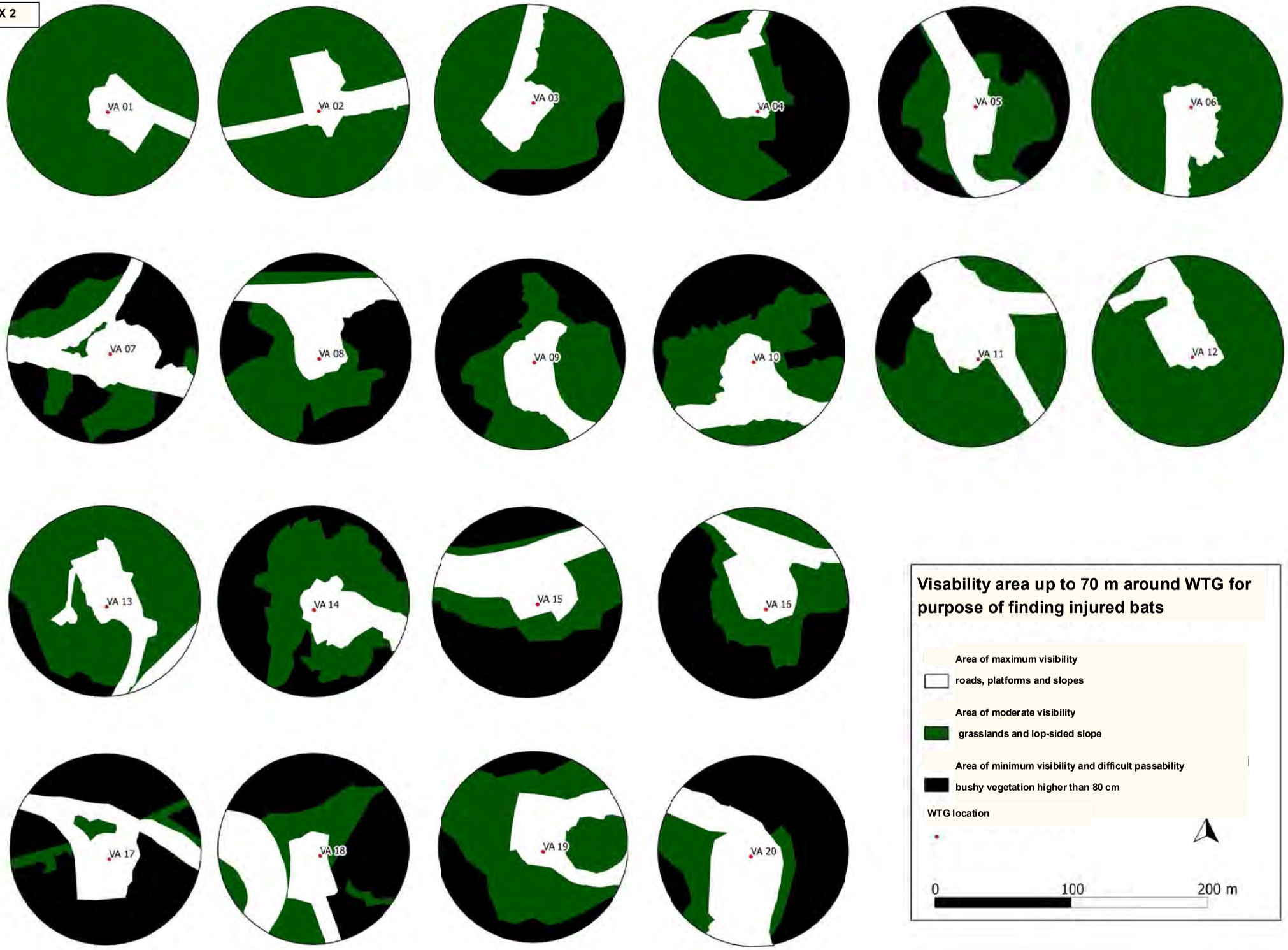
Annex 2 Categories of visibility areas degree around wind turbines (WTG) radius of 70 m with purpose of finding injured birds and bats

Annex 3: Overview of positions found injured bird individuals

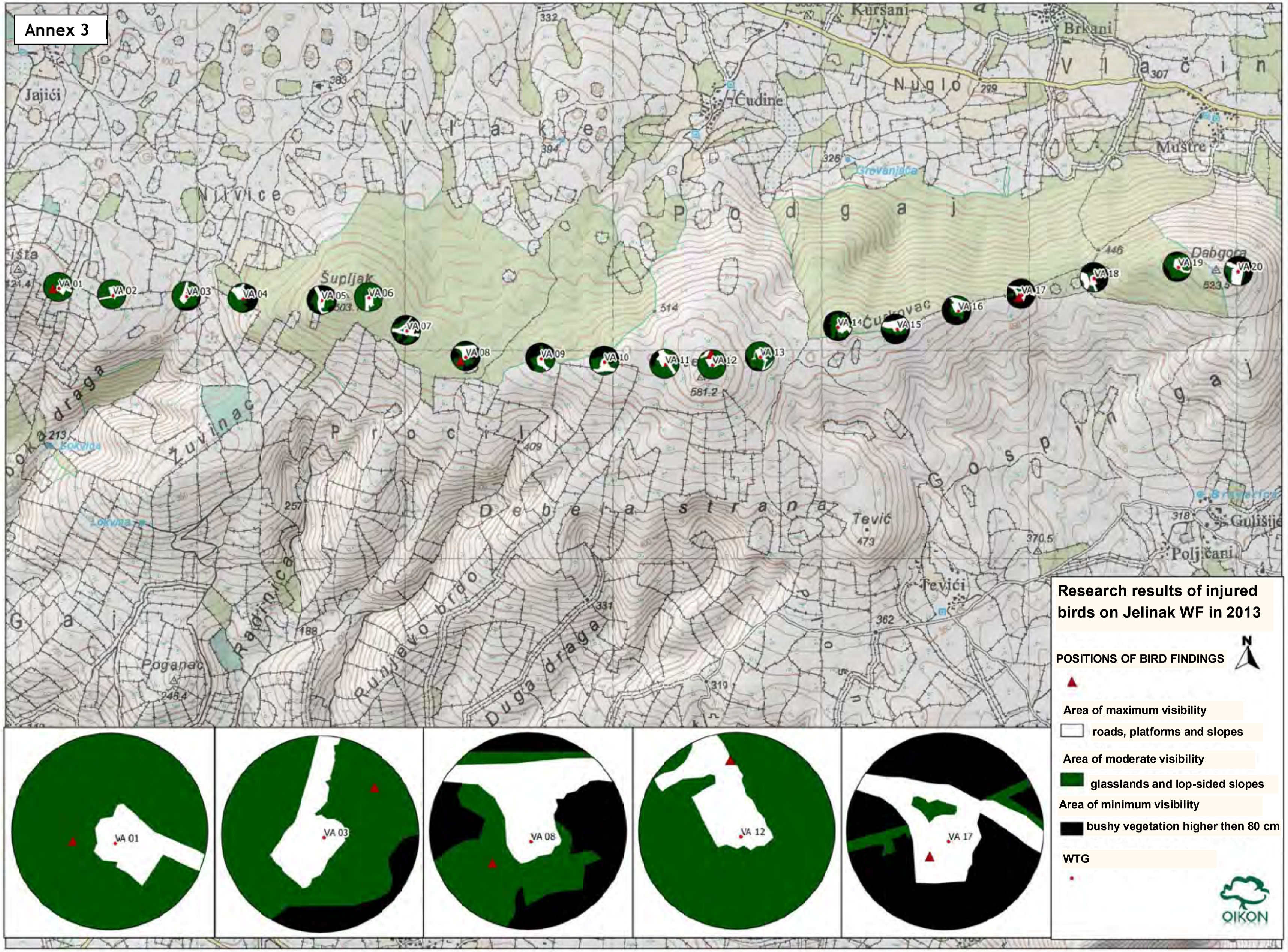
Annex 1


JELINAK WF
WTG
Transect 1
Transect 2
Transect 3
Service and acceess road
0
500
1000 m
N
OIKON
Begovići
Jajići
Čudine
Kuršani
Brkani
Žuvani
Mustre
Medići
Pavkovići
G. Tomaši
Šupljak
Jelinak
Dabgora
Đurkovac
Tević
Tomaši
Gulišije
Poljičani
D. Tomaši
Sorići
Tevići
Zulini
Ševo
Vukmani
Šago
Jadrići
Oblik
Jurjevrca

ANNEX 2


VA 01
VA 02
VA 03
VA 04
VA 05
VA 06
VA 07
VA 08
VA 09
VA 10
VA 11
VA 12
VA 13
VA 14
VA 15
VA 16
VA 17
VA 18
VA 19
VA 20
Visability area up to 70 m around WTG for purpose of finding injured bats
Area of maximum visibility
roads, platforms and slopes
Area of moderate visibility
grasslands and lop-sided slope
Area of minimum visibility and difficult passability
bushy vegetation higher than 80 cm
WTG location
0
100
200 m

Annex 3


Research results of injured birds on Jelinak WF in 2013
POSITIONS OF BIRD FINDINGS
Area of maximum visibility
roads, platforms and slopes
Area of moderate visibility
glasslands and lop-sided slopes
Area of minimum visibility
bushy vegetation higher then 80 cm
WTG
VA 01
VA 02
VA 03
VA 04
VA 05
VA 06
VA 07
VA 08
VA 09
VA 10
VA 11
VA 12
VA 13
VA 14
VA 15
VA 16
VA 17
VA 18
VA 19
VA 20
Jajići
Čudine
Kursani
Brkani
Nuglo
Vlačin
Muštre
Podgaj
Šupljak
Čukovac
Dabgora
Tević
Tevići
Gulišije
Poljičani
Poganac
Žuvinac
Proclj
Debela strana
Gospin gaj
Duga draga
Runjavo brdo
Radinica
Grovanjača
581.2
523.5
514
446
409
394
383
332
331
326
319
318
307
299
257
245.4
213
188
370.5
362
473
OIKON

Annex 16: Bird monitoring on Jelinak WF during operation (February 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, February 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Geonatura d.o.o.)
Anja Bukovac, Master of Ecology and Nature Preservation (Geonatura d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

2. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

3. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in 2013 and 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th
2014	**February**	27th-28th	27th-28th

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines have been use method vantage points during which at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Bird population activity in Jelinak WF area were researched by linear transect method. Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 06 - 08 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

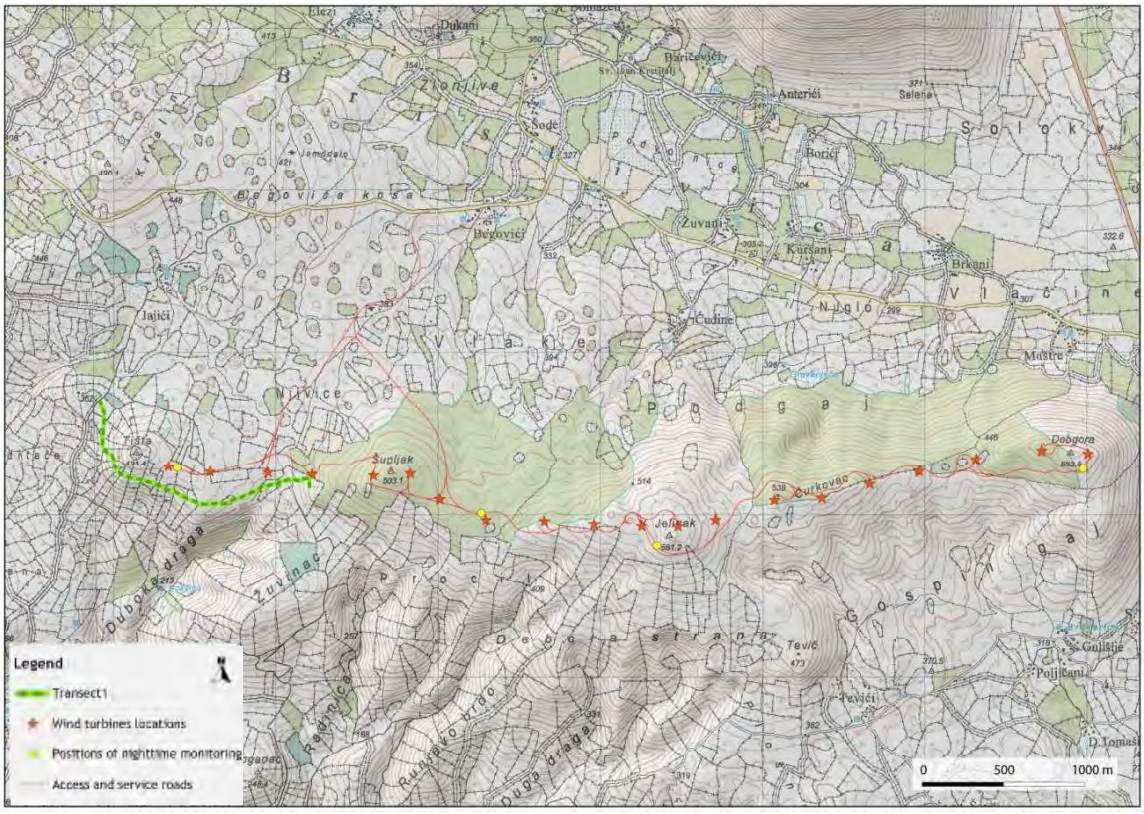


Figure 1 Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 - 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on

environment around each wind turbine. Specified values and categories will be detail established and verified through further research.

In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability - bushy vegetation (Photo: D.Kovač)

Figure 4 Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5 Area of maximum visibility - roads, platforms (Photo: D.Kovač)

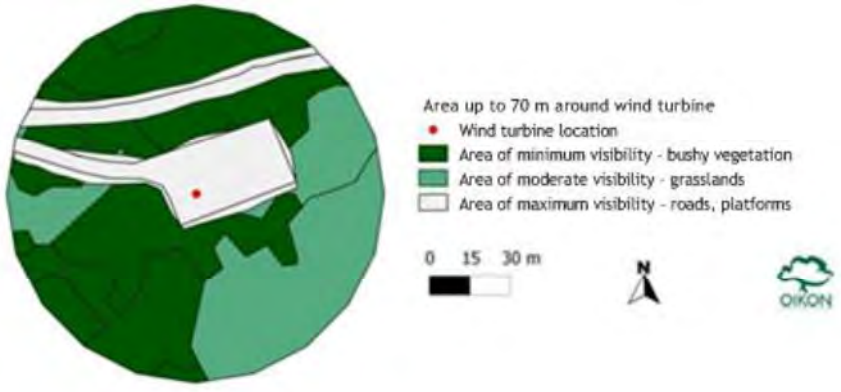


Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 47 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in February was observed increased activity of birds. At the time of site visit migration has just begun, and somewhat higher activity of migratory species is expected during the next site visit in March. On a few areas within wind farm have been recorded presence of resident birds, such as Blackbird (Turdus merula), Robin (Erithacus rubecula) and Great Tit (Parus major). Overflights of birds of prey on migration route, as well as larger flocks of songbirds were not recorded.

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, ie. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in February 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus*	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 7 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 8 Finding of carcasses of individual Robin (Erithacus rubecula)

5. PLAN FOR FURTHER ACTIVITIES

During March is planned to research bird activity within each turbine, with an emphasis on migratory species and winter birds along transect, using standing observation points method and continue to search for possible birds casualties.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 17: Bird monitoring on Jelinak WF during operation (March 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, March 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- Site visit report

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Geonatura d.o.o.)
Anja Bukovac, Master of Ecology and Nature Preservation (Geonatura d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

2. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

3. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in 2013 and 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	**March**	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th
2014	**February**	27th-28th	27th-28th
	March	17th-19th	17th-19th
		28th-29th	

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines have been use method vantage points during which at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Bird population activity in Jelinak WF area were researched by linear transect method. Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 06 - 08 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

Nocturnal species have been research with playback recording census technique, overview of monitoring location of nocturnal species is shown on Figure 1

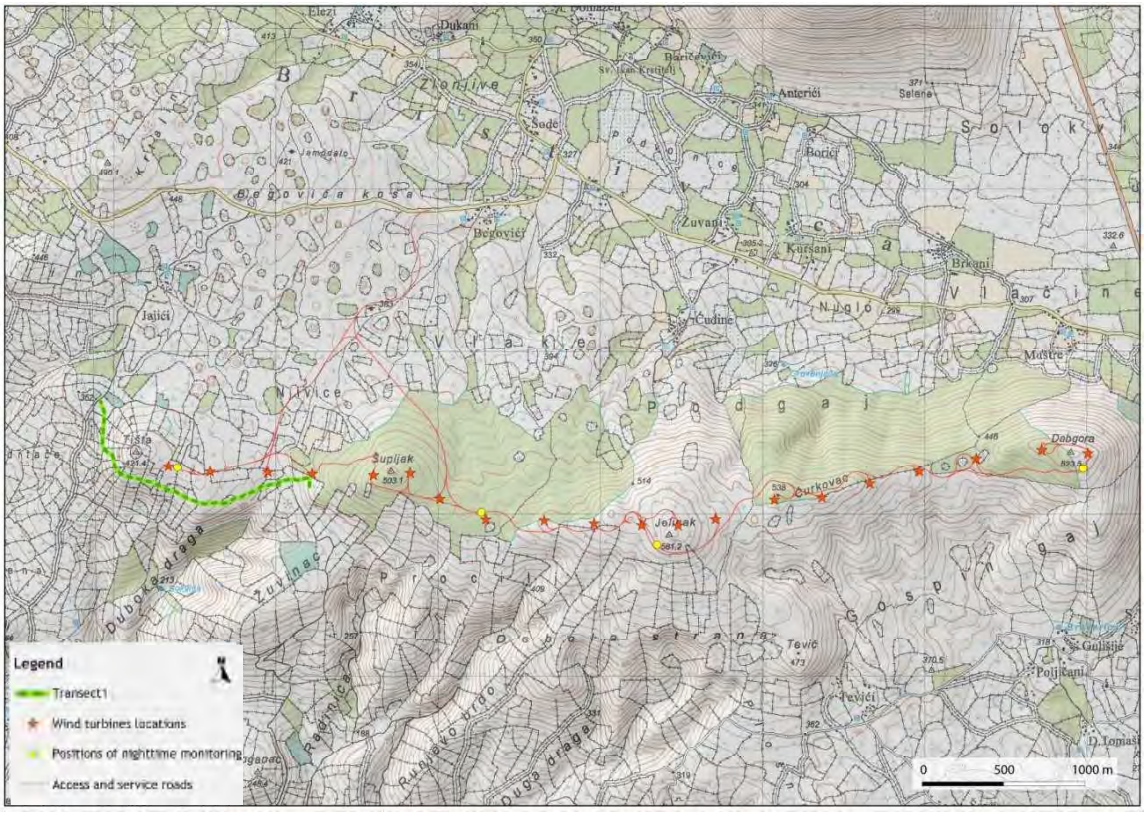


Figure 1 Graphical layout of transect in relation to position of wind farm location

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail established and verified through further research.
In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability – bushy vegetation (Photo: D.Kovač)

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Figure 5 Area of maximum visibility - roads, platforms (Photo: D.Kovač)

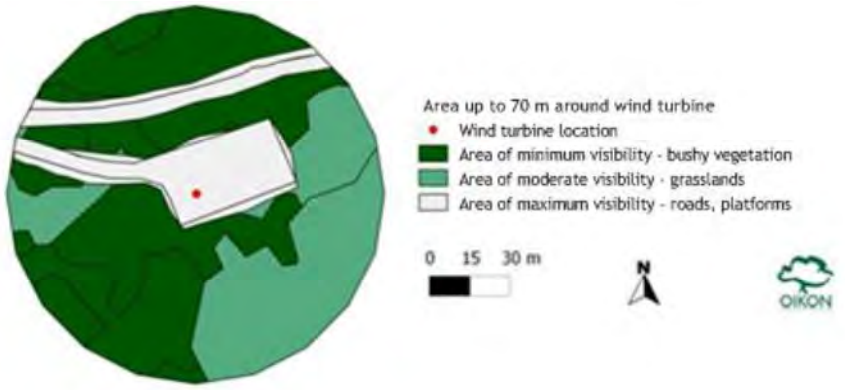

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 47 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in March was observed average activity of birds. At the time of site visit migration was in progress and could be observed increased activity of preparing for nesting (singing). Have been recorded presence of a single pair of buzzard in a narrow area of wind farm. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, ie. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in February 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
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Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula)

5. PLAN FOR FURTHER ACTIVITIES

During April it is planned to research activity of birds within each wind turbine. On transect will be carried out research of presence and abundance of nesting birds. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. Also search for eventual casualties will continue.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 18: Bird monitoring on Jelinak WF during operation (April 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, April 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- **Site visit report**

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
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Quality Control: Oleg Antonić, prof. PhD.

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- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
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Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

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2. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

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B.2. Monitoring the state of the environment during construction

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1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

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1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

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- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

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	August	6th - 9th	6th - 9th
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	October	8th - 11th	8th - 11th
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	March	17th-19th	17th-19th
		28th-29th	
	April	12th-14th	12th-14th
		24th-25th	

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

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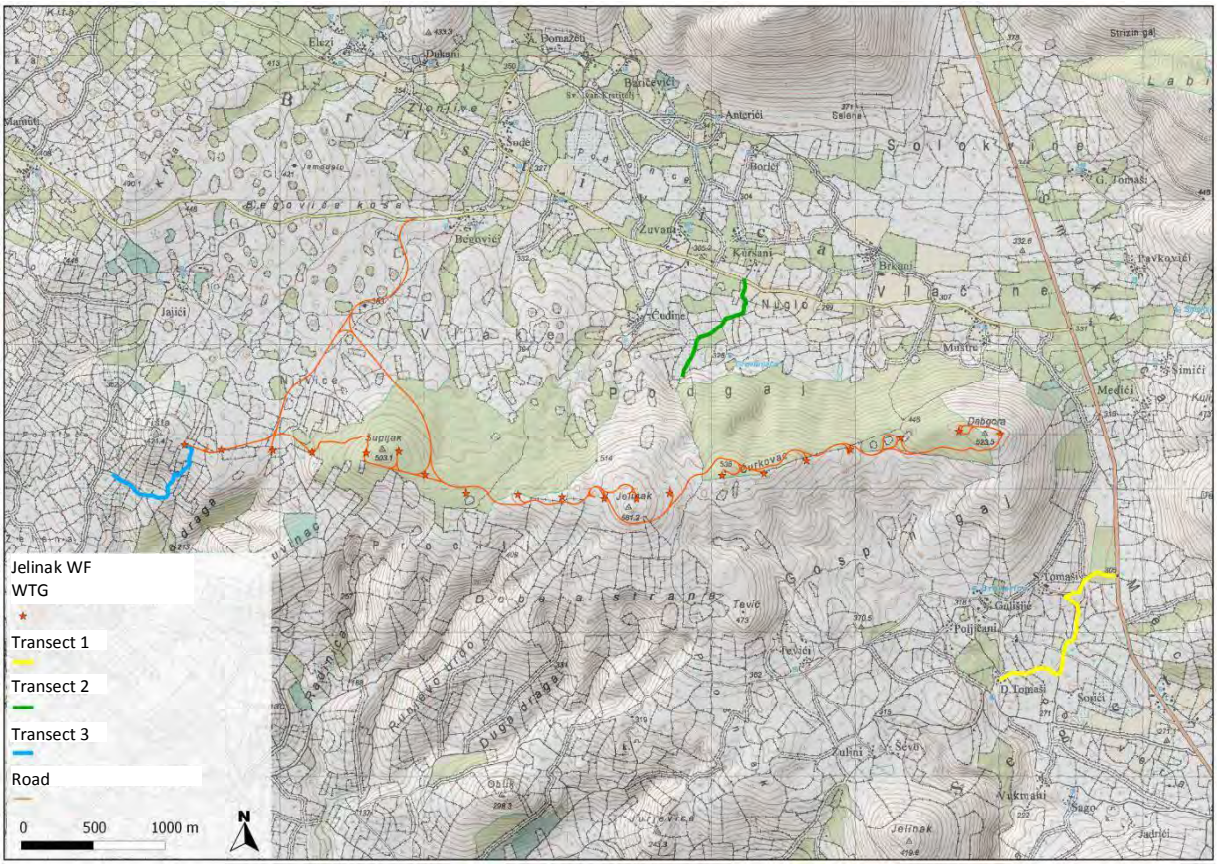

Figure 1 Graphical layout of transect at Jelinak WF

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail established and verified through further research.
In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability – bushy vegetation (Photo: D.Kovač)

Figure 4 Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5 Area of maximum visibility - roads, platforms (Photo: D.Kovač)

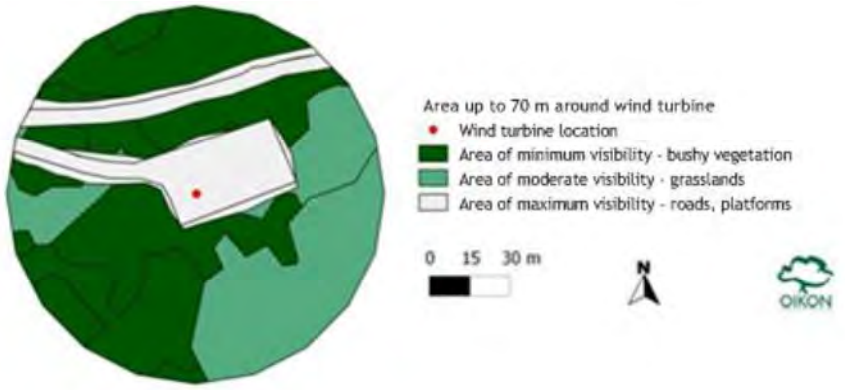

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 53 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in April was observed increased activity of birds, as it expected at beginning period of nesting season. Since this year migration started a little later, on site research have been recorded some migratory species. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, i.e. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in February 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
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WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013

Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula)

5. PLAN FOR FURTHER ACTIVITIES

During May it is planned to research activity of birds within each wind turbine. On transect will be carried out research of presence and abundance of nesting birds, same ,as during April. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. Also search for eventual casualties will continue.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 19: Bird monitoring on Jelinak WF during operation (May 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, May 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- **Site visit report**

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Geonatura d.o.o.)
Anja Bukovac, Master of Ecology and Nature Preservation (Geonatura d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

2. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

3. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in 2013 and 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	March	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th
2014	February	27th-28th	27th-28th
	March	17th-19th	17th-19th
		28th-29th	
	April	12th-14th	12th-14th
		24th-25th	
	April	13th-15th	13th-15th
		26th-28th	

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarch, 8x42; Swarovski binoculars, STM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines have been use method vantage points during which at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Bird population activity in Jelinak WF area were researched by linear transect method. Nesting birds were researched by linear transect method. Birds have been research on one transect, length approx. 2 km, in down from 06 - 08 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

Nocturnal species have been research with playback recording census technique.

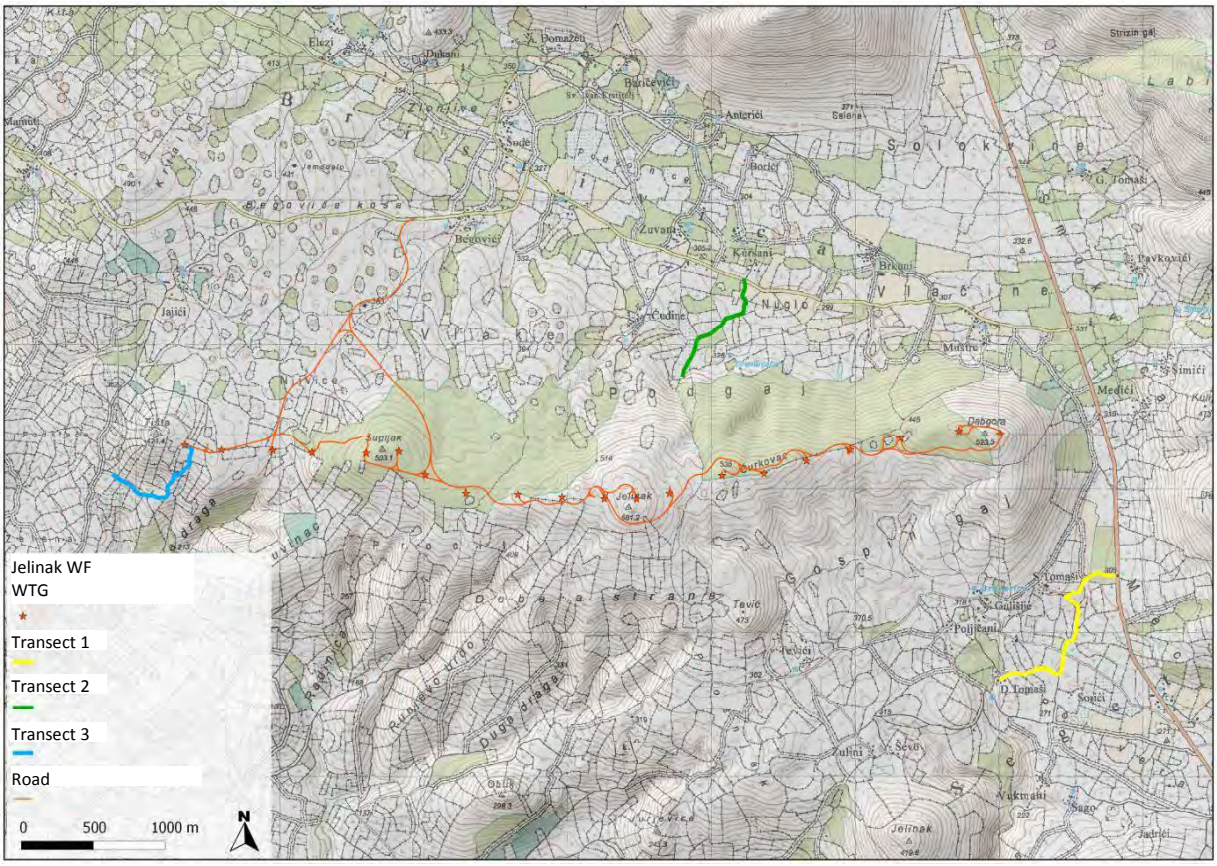

Figure 1 Graphical layout of transect at Jelinak WF

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail established and verified through further research.
In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability – bushy vegetation (Photo: D.Kovač)

Figure 4 Area of moderate visibility - grasslands (Photo: D.Kovač)

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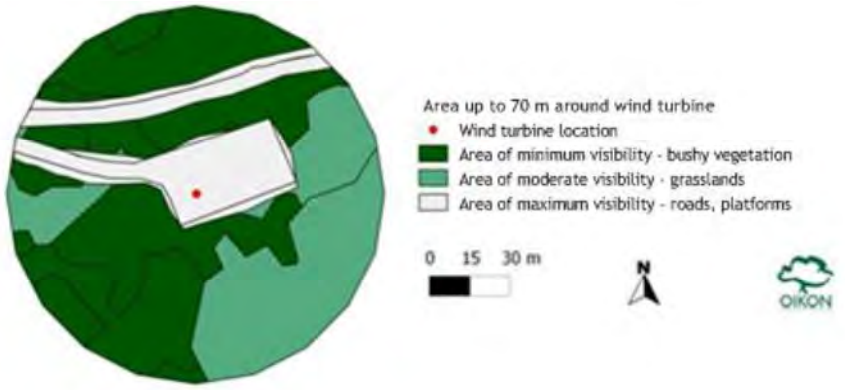

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 53 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Common Raven (Corvus corax) and Common Swift (Apus apus).

During a field research in May was observed increased activity of birds, as it expected at beginning period of nesting season. Since this year migration started a little later, on site research have been recorded some migratory species. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of five birds' carcasses (Table 2).All injured individuals were found in area of maximum visibility, i.e. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in February 2014 birds' carcasses were not found. During research in May of 2014 was found one injured individual of Tawny Pipit (Anthus campestris).

Table 2. Finding place of birds' carcasses during March and April in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus*	21st of March 2013
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WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013
WTG 02	0,40	N	Tawny Pipit (Anthus campestris)	27th of May 2014

Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula) along WTG 13

5. PLAN FOR FURTHER ACTIVITIES

During June it is planned to research activity of birds within each wind turbine. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. It will be researched nocturnal species. Also search for eventual casualties will continue.

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According to data of Institute for Ornitology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 20: Bird monitoring on Jelinak WF during operation (June 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, June 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- **Site visit report**

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
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3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarchan 8x42 and type Celestron Granite; Swarovski binoculars, ATM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

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Nesting birds were researched by linear transect method that is based on results and methods of ornithological part of research of "zero" state of bird research. Birds have been research on three transects, in down from 06 - 08 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

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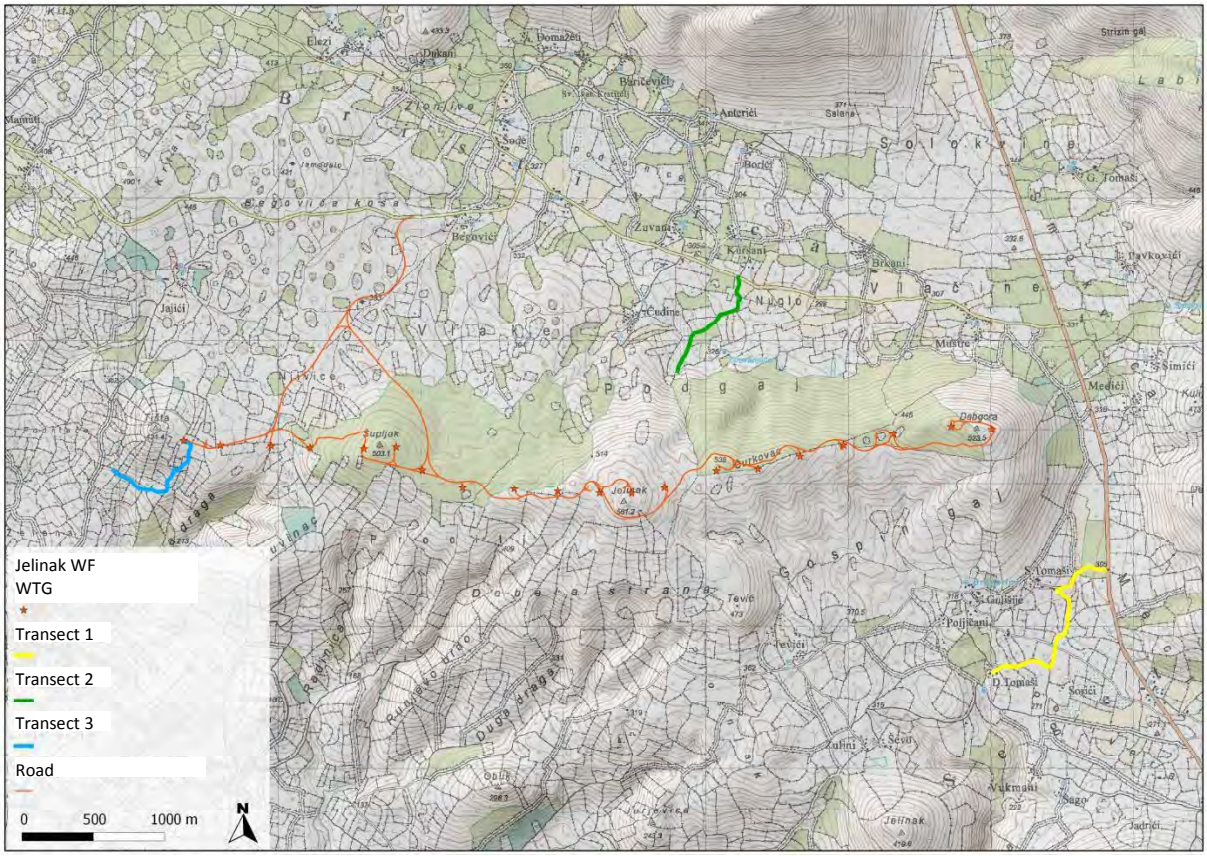

Figure 1 Graphical layout of transect at Jelinak WF

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In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

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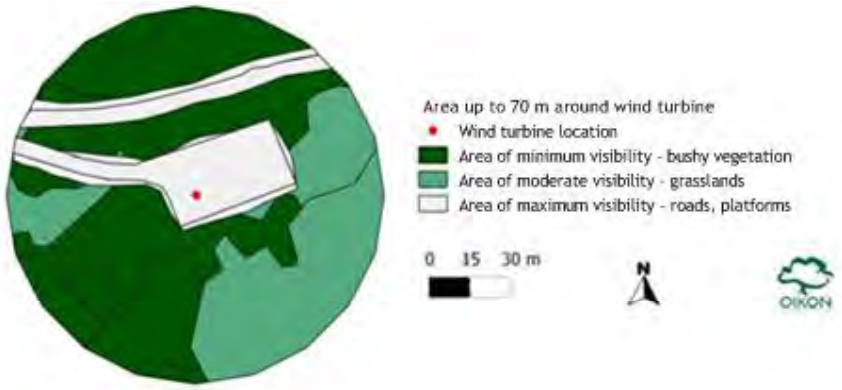

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 53 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Rock Dove (Columba livia), Common Raven (Corvus corax), Common Swift (Apus apus) and Barn Swallow (Hirundo rustica).

High activity of birds was observed during field research in June, since it is still period of nesting season. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of six birds' carcasses by now (Table 2).All injured individuals were found in area of maximum visibility, i.e. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in June 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus rubecula*)	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus rubecula*)	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
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WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013
WTG 02	0,40	N	Tawny Pipit (Anthus campestris)	27th of May 2014

Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula) along WTG 13

5. PLAN FOR FURTHER ACTIVITIES

During July it is planned to research activity of birds within each wind turbine. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. It will be researched nocturnal species. Also search for eventual casualties will continue.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornithology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 21: Bird monitoring on Jelinak WF during operation (July 2014.);

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, July 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- **Site visit report**

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

Research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
Sven Kapelj, Master of Ecology and Nature Preservation (Geonatura d.o.o.)
Maja Maslać, Master of Experimental Biology (Geonatura d.o.o.)
Anja Bukovac, Master of Ecology and Nature Preservation (Geonatura d.o.o.)

Quality Control: Oleg Antonić, prof. PhD.

Content

1. INTRODUCTION

Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

Jelinak WF includes:

- 20 wind turbines (WTG) each one with nominal installed power of 1.5 MVA, tower height 76.9 m and rotor diameter 82 m - Type AW 82/1500 class IIa T 80 m)
- macadam roads within WF, service road 7300 m length, width 9 m (for access to each individual VTG) and access road 3800 m length, wide 6 m (for access to the WF)
- internal 12 kV cable network Jelinak WF
- internal communications network for remote monitoring and control of wind turbines operation
- 12/110 kV Jelinak SS with corresponding facilities for connection of wind turbines to the HEP 110 kV transmission network
- connection 12/110 kV Jelinak SS on 110 kV Bilice-Trogir TL
- access road to connect 12/110 kV Jelinak SS on public road.

Pillars of wind turbines are installed on eleven angle foundation dimensions 15x15 m and platform around each column have dimensions 24x45 m. Final layer of platform is from stone and mixed material.

Based on requirements from E.H.N. Ltd., Ministry of Environmental Protection, Physical Planning and Construction have on 9th January 2009 issued a decision (Class: UP / I 351-03/07-02/63, Ur.br: 531 -08-1-07-09-15), based on that decision have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program, which includes the following measures of birds protection:

A.1. Environmental protection measures during project preparation

Fauna

2. *During designing process dense and scattered set-up of the wind generators shall be avoided because it has a negative impact on birds during the flight-overs of migratory birds and birds' of prey.*

3. *The state-of-the-art solutions to decrease the collision of birds and bats with the wind generators shall be applied.*

B.2. Monitoring the state of the environment during construction

Fauna

1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

B.3. Monitoring the state of the environment during operation

Fauna

1. The monitoring of the impact of the wind farm operation on the bird populations shall be conducted in the course of two years at least. The monitoring shall be based on the results and methods of the ornithological part of the environmental impact study, and it shall consist of three parts:

a) Monitoring of the local population of nesting birds consists of making transects. Transects shall be made at least two times, the first one in mid April and the other one in mid May. They shall be made in stabile weather without precipitation and stronger wind. If the weather worsens during the making of transect, the entire transect shall be repeated the next day, in the morning as well. The transect results shall be compared to the results of the environmental impact study and it shall be determined whether there are any significant differences. On the basis of this it shall be determined whether there is a real impact of the wind farm on the local bird population, and, if there is, the impact type and size shall be determined, as well as which bird species it affects.

b) Monitoring of the populations of passage and wintering birds shall be conducted throughout the whole year, meaning that throughout the whole year, according to the bird annual cycle, minimally ten field researches shall be allocated in order to include the autumn and spring migrations, nesting and after-nesting dispersion, and wintering. Each field research shall last at least two days, and it shall include the nocturnal bird species as well. During these researches it is also necessary to make at least a two-kilometer transect in the morning. After transect is made, all areas which were not included in transect shall be visited and inspected. The surface shall also be inspected at night in order to determine the presence of nocturnal species. The same procedure shall be carried out on each of at least ten two-days field researches. When planning transects and other tours all habitats shall be covered.

c) Monitoring birds' behavior near the wind generators and searching for possibly dead birds. This activity shall last minimally one hour per wind generator; it should be inspected from all sides and the number of flight-overs in its surroundings or through its radius shall be recorded. The species, and, if possible, age and sex shall be recorded for each flight-over or a found dead bird.

Analysis and results of these monitoring activities should be delivered to competent institution for Nature Protection (Nature Protection Department of Ministry of Culture). Depending on results, if it is necessary, it will be determined whether it is necessary to continue monitoring or to take any realistically possible, protective measures.

EURUS Ltd. ordered monitoring of bird fauna for location of Jelinak from Oikon Ltd. Institute for Applied Ecology (Int. Contract no. OIKON: 761/12). All research and documentation were made according to "Guidelines for preparation of environmental impact studies for wind power plants" (Ministry of Environmental Protection, Physical Planning and Construction, and APO Ltd. 2010) and Decision (Class: UP/I 351-03/07-02/63, Reg.no. 531-08-1-07-09-15), based on that decision it have been confirmed that planned civil intervention of Jelinak WF is environmentally acceptable with implementation of environmental measures and environmental monitoring program.

2. TERRAIN RESEARCH

Site location was researched in 2013 and 2014, as shown in Table 1. In order to determine the impact of Jelinak WF on bird population, research was carried out in two phases:

- Research of birds that are temporarily or permanently resident at location
- Research of bird carcasses on WF area

Research have included monitoring of activity of nesting, passage and wintering bird populations in wider area of WF (up to 5 km), observing bird behaviour in vicinity of wind turbines, as well as search for possibly dead birds within 70 m of each wind turbine, according to the date specified in table 1.

Table 1. Dates of site visit

		Monitoring incidents	*Monitoring activities*
2013	March	21st - 22nd	21st - 22nd
		28th -2 9th	
	April	08th - 11th	8th - 11th
		29th - 30th	
	May	6th - 8th	6th - 8th
		28th - 29th	
	June	12th - 14th	12th - 14th
		25th - 27th	
	July	2nd - 5th	2nd - 5th
		29th - 31st	
	August	6th - 9th	6th - 9th
		26th-29th	
	September	9th- 12th	9th- 12th
		25th - 28th	
	October	8th - 11th	8th - 11th
2014	February	27th-28th	27th-28th
	March	17th-19th	17th-19th
		28th-29th	
	April	12th-14th	12th-14th
		24th-25th	
	May	13th-15th	13th-15th
		26th-28th	
	June	12th-14th	12th-14th
		26th - 27th	
	July	16th-18th	16th-18th
		28th - 30th	

3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarchan 8x42 and type Celestron Granite; Swarovski binoculars, ATM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

For observing potential birds flight overs in vicinity of wind turbines have been use method vantage points during which at least one hour for each wind turbine was spent. Coordinate, species, height and movement direction were recorded for each flight over.

Nesting birds were researched by linear transect method that is based on results and methods of ornithological part of research of "zero" state of bird research. Birds have been research on three transects, in down from 06 - 08 h, cartographic overview is on Figure 1. Also, with standard method was used and not standardized site search.

Nocturnal species have been research with playback recording census technique.

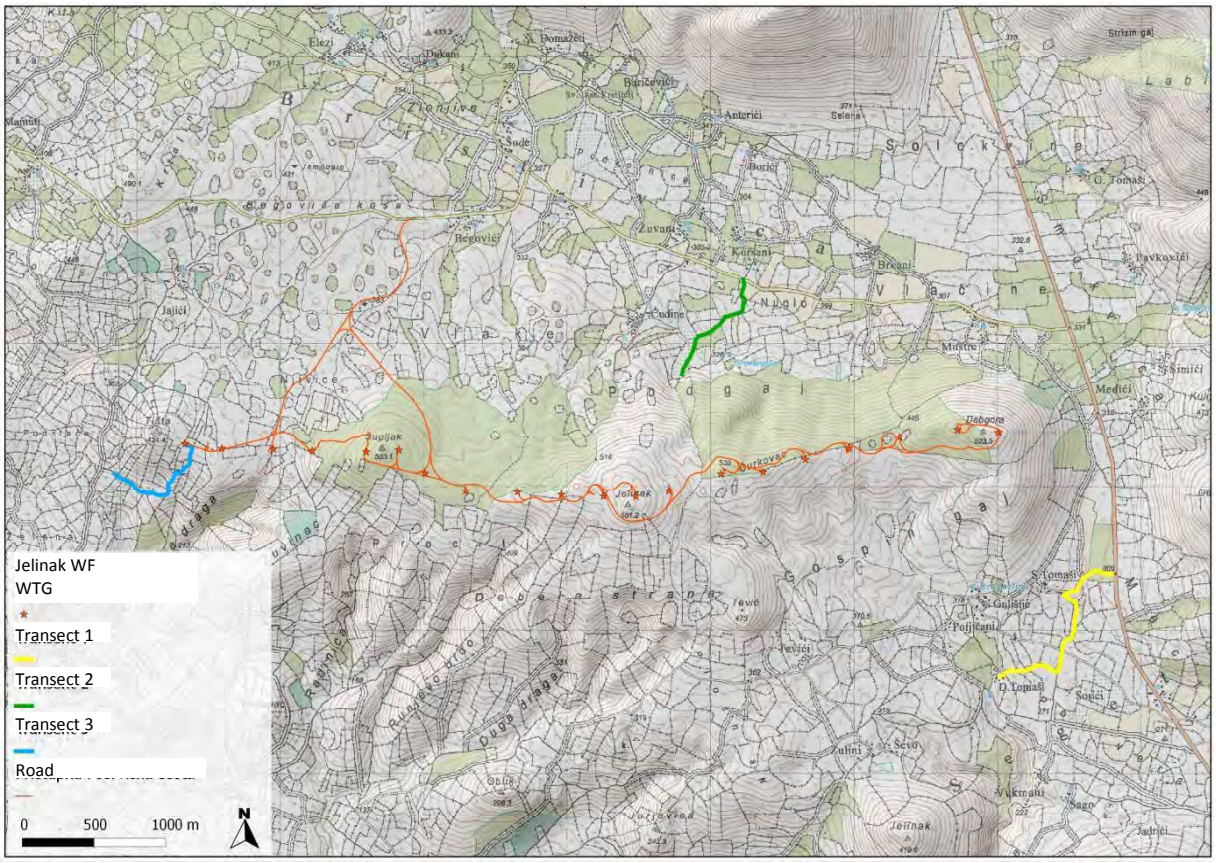

Figure 1 Graphical layout of transect at Jelinak WF

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail established and verified through further research.
In case of finding injured birds, researched area will be extra reviewed every next day of researching (10 - 30minutes for every WTG) to determine rapidity of predators and /or wind for removing injured birds from finding location.

Figure 2 GPS trace during terrain research (Photo: D.Kovač)

Figure 3 Area of minimum visibility and difficult passability – bushy vegetation (Photo: D.Kovač)

Figure 4 Area of moderate visibility - grasslands (Photo: D.Kovač)

Figure 5 Area of maximum visibility - roads, platforms (Photo: D.Kovač)

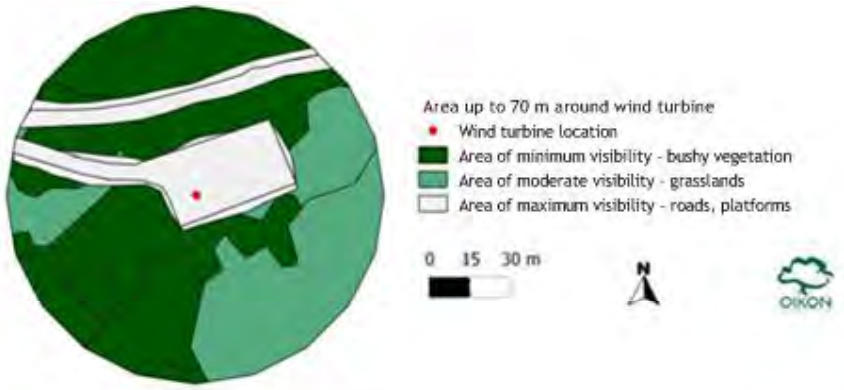

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 53 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Rock Dove (Columba livia), Common Raven (Corvus corax), Common Swift (Apus apus) and Barn Swallow (Hirundo rustica).

Reduced activity of birds was observed during field research in July 2014, as it is expected after period of nesting season. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of six birds' carcasses by now (Table 2).All injured individuals were found in area of maximum visibility, i.e. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in July 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
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WTG 12	55	N	European Robin (*Eritacus rubecula*)	28th of March 2013
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Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula) along WTG 13

5. PLAN FOR FURTHER ACTIVITIES

During August it is planned to research activity of birds within each wind turbine. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. It will be researched nocturnal species. Also search for eventual casualties will continue.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornithology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.

Annex 22: Bird monitoring on Jelinak WF during operation (August 2014.).

Oikon ltd.
Institute for applied ecology

ENGLISH TRANSLATION OF CROATIAN LANGUAGE DOCUMENT

Bird monitoring on Jelinak WF during operation

(Site visit report)

Zagreb, August 2014

Oikon ltd.
Institute for applied ecology

Investor: EHN Ltd.
Zrinsko - Frankopanska 64, 21 000 Split

Contractor: EURUS Ltd.
Smiljanićeva 2, 21 000 Split

Subcontractor: OIKON Ltd. Institute for applied ecology
Trg senjskih uskoka 1-2, 10 000 Zagreb

Structure: Jelinak WF

Subject: **Bird monitoring on Jelinak WF during operation - implementation of required measures for environment protection**
- **Site visit report**

Int.Contract no. OIKON: 761-12

Project Manager: Elena Patčev, Professor of Biology and Chemistry (Oikon d.o.o.) Terrain

Research and development of reports:
Elena Patčev, Professor of Biology and Chemistry (Geonatura d.o.o.
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Quality Control: Oleg Antonić, prof. PhD.

Content

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Jelinak WF is built on location Njivice that is determined for accommodation of wind turbines and associated facilities of Jelinak wind farm (WF) of which investor is EHN Ltd.

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B.2. Monitoring the state of the environment during construction

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1. *The parameters determined by the bird fauna starting point shall be monitored during the project construction with special attention to the birds of prey.*

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3. MATERIALS AND METHODS

Three ornithologists were researching this location. Birds were monitored with optical equipment (binoculars type Nikkon Monarchan 8x42 and type Celestron Granite; Swarovski binoculars, ATM 80, 20-80x magnification). For positioning exact locations, GPS navigation was used, device type Garmin 60CSx. Canon digital camera (PowerShot S5IS) was used for terrain and habitat type photographing, as well as bird photographing. Standard ornithological methods were applied during bird population research on Jelinak WF.

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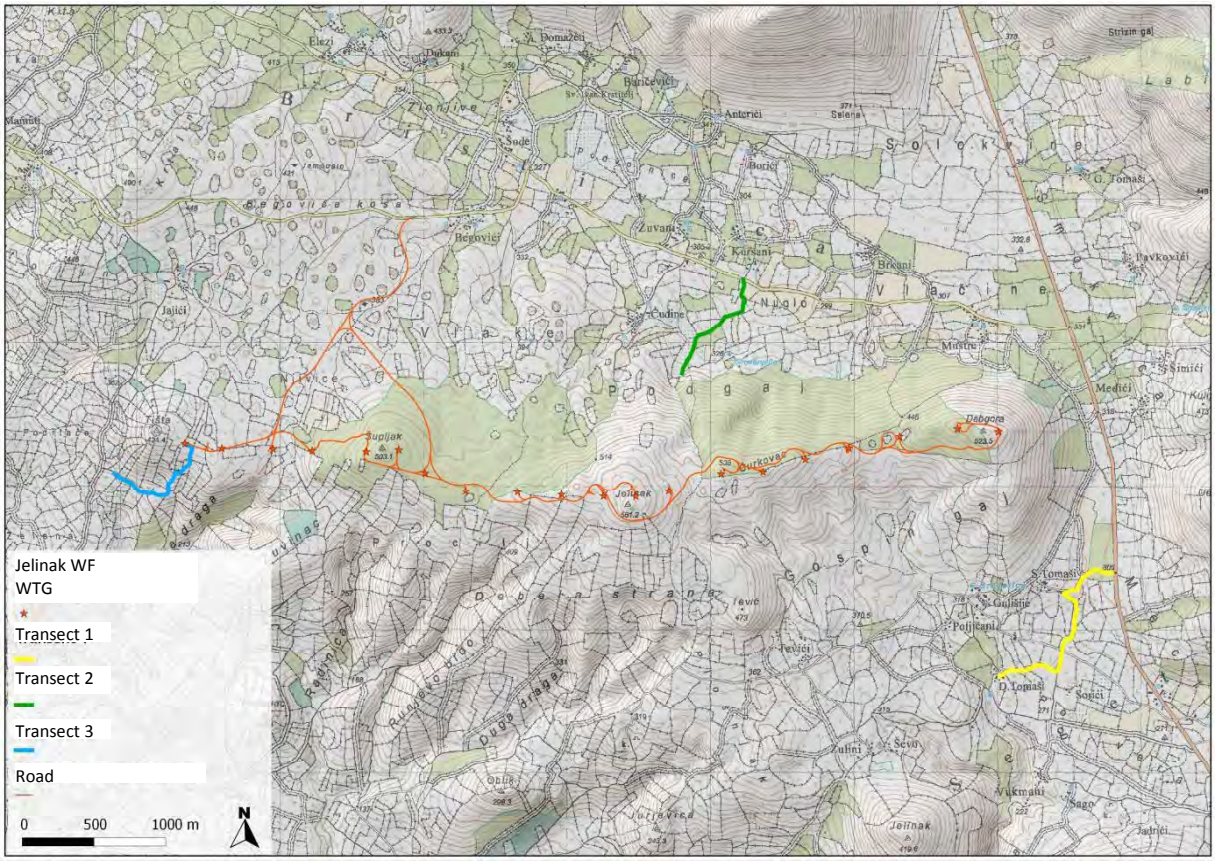

Figure 1 Graphical layout of transect at Jelinak WF

Considering so far approximately defined area visibility, three categories of exploration level are preliminary defined (Figure 6). Area of minimum visibility and difficult passability (percentage of exploration <40 %) refers to dense bushy vegetation (Figure 3) and covers about 29% of explored area. In area of moderate visibility (percentage of exploration 40 – 80%) grasslands are dominated (Figure 4) and that cover about 53% of total area. Area of maximum visibility (percentage of exploration 80 – 100%) refers to area of platforms, roads and slopes (Figure 5) and covers about 18% of total area. Parts of area covered by dense, bushy vegetation (shrubbery, bushes) are not detail researched due to their poor visibility and difficult passability. According to terrain visibility, overall percentage of exploration of areas around wind turbine is minimal 35.6% and maximum 72.1%, and varies depending on environment around each wind turbine. Specified values and categories will be detail established and verified through further research.
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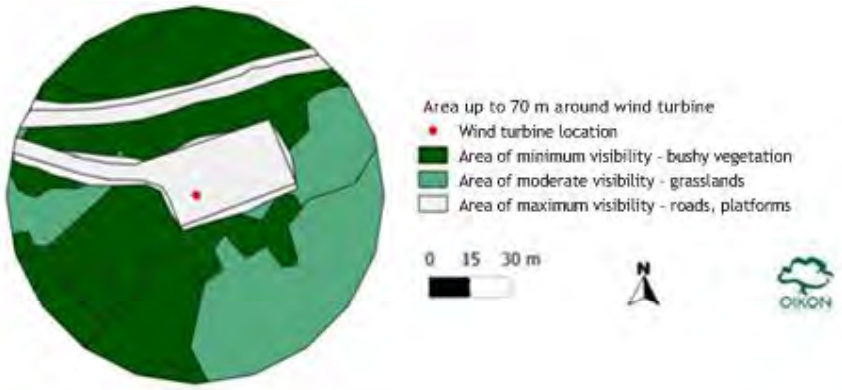

Figure 6 Example of cartographic overview of area visibility (percentage of research) up to 70 m around wind turbine (white: 80-100 %, light green: 40-80 %, dark green < 40 % of exploration)

4. RESULTS OF TERRAIN RESEARCHES

Total of 53 bird species at site location were recorded during researching in 2013 and 2014. Rock Partridge (Alectoris graeca) can be sorted out and over flights of several species of birds of prey through the wind farm area were recorded: Snake Eagle (Circaetus gallicus), Common Buzzard (Buteo buteo), Montagu's Harrier (Circus pygargus), Sparrowhawk (*Accipiter nisus*), Goshawk (*Accipiter gentilis*) and Common Kestrel (Falco tinnunculus). Of other species the most common and the most numerous are flights over of Yellow-legged Gull (Larus michahellis), Rock Dove (Columba livia), Common Raven (Corvus corax), Common Swift (Apus apus) and Barn Swallow (Hirundo rustica).

Moderate activity of birds in migration period, and assembling in flocks of some species of passerine such as Eurasian skylark (Alauda arvensis) was observed during field research in August 2014. Nocturnal species have not been noted.

The search for possible dead birds in wind farm's area resulted in findings of six birds' carcasses by now (Table 2).All injured individuals were found in area of maximum visibility, i.e. on platforms, roads and slopes. Birds' carcasses were found at 20-55 meters from wind turbines. During terrain research in August 2014 birds' carcasses were not found.

Table 2. Finding place of birds' carcasses in Jelinak WF area

Wind turbine	Distance from WTG/m	Direction from WTG	Bird species	Date of finding
WTG 01	30	W	European Robin (*Eritacus rubecula*)	21st of March 2013
WTG 12	55	N	European Robin (*Eritacus rubecula*)	28th of March 2013
WTG 17	20	SW	Song Thrush (*Turdus philomelos*)	28th of March 2013
WTG 08	31	SW	Song Thrush (*Turdus philomelos*)	29th of March 2013
WTG 03	50	NE	Common Buzzard (*Buteo buteo*)	29th of March 2013
WTG 02	0,40	N	Tawny Pipit (Anthus campestris)	27th of May 2014

Figure 8 Finding carcasses of individual Song Thrush (*Turdus philomelos*) along WTG 8

Figure 9 Finding of carcasses of individual Robin (Erithacus rubecula) along WTG 13

5. PLAN FOR FURTHER ACTIVITIES

During August it is planned to research activity of birds within each wind turbine. With method standing observation points method will be noted overflights of larger species of birds, in order to conclude how birds use area around wind farm. It will be researched nocturnal species. Also search for eventual casualties will continue.

6. PONTENTIALLY SIGNIFICANT BIRDS INCIDENT ON JELINAK WF

According to data of Institute for Ornithology (under Croatian Academy of Science and Art) over 250 of nesting and over 380 of passage birds species were recorded in Croatia so far. Risk of significant birds injuring at particular location cannot be defined generally for all species, but depends on the number of certain species at the site, size of national population and level of species endangering, individual's status (passage bird, nesting bird, wintering bird, non-migratory bird), and number of injured birds. For few species whose population is decreasing in Croatia, as the case with Golden Eagle (*Aquila chrysaetos*) is, injuring of only one individual can be alarm for taking additional actions, because one bird is more than 1% of total national population, which can significantly impact on population dynamics. There is not lot of protective measures that could extra reduce birds injuring (in addition to implemented protective measures) and therefore in case of finding injured birds it is necessarily to urgently estimate significance of incidents due to above mentioned, and if necessary take steps towards additional protective measures.