

PRELIMINARY BIRD FAUNA'S MONITORING IN DELENI – BOGDĂNIȚA AREA (VASLUI COUNTY, ROMANIA)

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Abstract. The paper presents the results of one year regularly monitoring (November 2008 – October 2009) on the territory where two future wind farms will be build in Vaslui County: Deleni and Bogdanita. Our study was focused on the birds and bats' monitoring, but also on the identification of the principal habitats inside and in the vicinity of these perimeters, establishing the importance of the habitats for birds and bats. Regarding the bird monitoring studies we assessed the bird fauna diversity and the bird population dynamics during the seasons. We identified the feeding and hunting territories for the breeding bird species. We paid our efforts mapping the hunting territories used by the raptor bird species during the wintering, migration and breeding time, in order to assess the impact of the future wind farms on this group. We focused, too, on the daily bird movement in the area. We had an unexpected collision situation of small passerines (five species) with the wires that were fixing the pillars with the wind measurement device in the Deleni site, only in the first part of the breeding season, trying to explain these collision incidents. We recommended some solutions in order to minimize the risks for birds after the development of the wind farms.

Keywords: bird fauna, monitoring, wind farms.

Rezumat. Monitorizare preliminară a avifaunei în aria Deleni – Bogdănița (județul Vaslui, România). Prezentul studiu cuprinde rezultatele unei activități de monitorizare pe durata unui an (noiembrie 2008 – octombrie 2009) pe un teritoriu unde vor fi amenajate două parcuri eoliene în județul Vaslui: Deleni și Bogdănița. Studiul nostru a urmărit monitorizarea avifaunei și a chiropterelor, dar și identificarea principalelor habitate din interiorul și vecinătatea acestor teritorii, stabilind importanța acestora pentru păsări și chiroptere. Cât privește avifauna, am urmărit diversitatea și dinamica sezonieră a populațiilor de păsări. Au fost identificate teritoriile de hrănire și vânătoare ale păsărilor clocitoare și au fost cartate teritoriile de vânătoare folosite de păsările răpitoare în timpul iernii, migrației și perioadei de reproducere, pentru a estima impactul viitoarelor parcuri eoliene asupra acestui grup de păsări. De asemeni, am urmărit deplasările cotidiene ale păsărilor. În situl Deleni, în prima parte a sezonului de reproducere, am întâlnit o situație neașteptată de coliziune a cinci specii de paseriforme cu firele de fixare a stâlpilor pe care este instalată aparatura de măsurare a vântului, încercând să explicăm aceste incidente mortale pentru păsări. Totodată, propunem și o serie de soluții care pot reduce impactul acestor proiecte asupra populațiilor de păsări prezente în teritoriile investigate.

Cuvinte cheie: avifauna, monitorizare, parcuri eoliene.

INTRODUCTION

In the present conditions, the obvious diminution of fossil natural resources (coal, oil, natural gas) and the ever increasing concerns regarding the diminution of carbon dioxide emissions in the context of the climate global changes, during the last decades and especially, in the last years, led to the development of new energetic national strategies and the research on the energetic production using the renewable, non-pollutant, resources (wind energy, sun energy, biogas etc.) intensified.

The initial starting point for the impact studies of the wind farms is represented by the protocol BACI (Before/After Control Impact), done in the middle '90 years in the last century, in the U.S.A., that follows the conservation status of the birds and bats populations before and after the settlement of one wind farm (RISSER et al., 2007). The standardization of one monitoring methodology aims to obtain comparable data in different study areas, but also to elaborate monitoring rules, flexible enough to adapt it in a specific investigated area and for the specific technical parameters of the future wind farm (HÖTKER, 2006).

The standard methodology starts from a monitoring study of the birds and bats populations done in two stages, minimum 12 months each, before and after the settlement of the wind farm because the specialists assess that this kind of impact study can offer enough and relevant data to evaluate the collision risk and other threatening factors for these two vertebrates groups. During the first working stage, the monitoring study is intended not only to establish the diversity of the birds and bats populations and to estimate the effectiveness of each species in the investigated site (including the perimeter and the neighbourhoods of the future wind farm) but also different aspects of these species biology and ecology: identification of the feeding, mating/breeding, resting and sheltering territories, identification of some migration flyways, the existence of breeding colonies and wintering sites, establishing the daily movements of birds and bats.

During the second work stage, it is possible to evaluate the direct impact on the birds and bats populations (mortality rate due the collision with the wind farm elements), but also the indirect impact (modifying of the daily movements and of the migration flyways, abandonment of the mating/breeding, feeding, resting/sheltering and wintering territories, modifying the sex and age structures, but also of the density for some species population).

During the period November 2008 - October 2009, we made a regularly monitoring focused on the birds and bats populations present during the all yearly phenological aspects, inside and in the neighbourhood of the area Deleni – Dinga – Bogdanita - Bogdanesti (Vaslui County), where two wind farms will be developed. Regarding the bird fauna, we paid our attention to different aspects, in order to obtain relevant data necessary to estimate the present status of the

birds populations in the ecosystems from inside and neighbourhood of this territory, following: the bird diversity, during the wintering period, spring and autumn migration time and in the reproduction period; the estimation of the bird populations present in the investigated area during all periods of the yearly biological rhythm; identifying the limits of the hunting and feeding territories for different bird groups (especially, raptors) inside and in the neighbourhood of the future wind farms; the monitoring the bird daily flyways between the breeding sites and feeding territories, but, also, the existence of bird flyways during the migration time inside and in the neighbourhood of the future wind farms.

On the other hand, we tried to identify the principal habitats inside and in the neighbourhood of each site, to evaluate their present status, following the potential evolution not only due to the construction of the wind farms but also due to the local community activities in this territory.

After the installation of the systems for registering the wind parameters in the area, we began a special monitoring activity around these pillars in order to collect information on the passerine collision situations (despite the fact that we did not find this kind of data in the references). The wires that are used to fixing the pillar in the ground are thin and grey, so, seems to be, practically, invisible for small birds that fly in the area. The main aim of this monitoring activity was to collect relevant information about this unexpected collision risk for passerine birds (involved species, habitats that increase the risk collisions etc.).

In the middle '70s, there was published a general study on the bird diversity in different ecosystems from Vaslui County (PAPADOPOLO, 1975), including preliminary data on the forest bird fauna. We must notice that there is not any previous study on the presence of birds and bats inside and in the nearest ecosystems of the future wind farms Deleni - Dinga and Bogdanita – Bogdanesti (Vaslui County).

METHODS AND PERIOD OF STUDY

We used the transects method, covering the perimeter of the future wind farms, but also in the forests and young woodlands situated in the vicinity of these sites, but also, the fixed points in order to follow the migration movements of birds (especially for the soaring birds – storks and raptors, but not only), to identify and map the feeding and hunting territories' limits used by birds, but also, looking for the daily birds' flying between the these places and breeding territories.

We identified the bird species and we estimated their effectives using the direct observation through the binoculars and telescope, through the visual recording and through the male sounds, too. We aimed to identify and estimate the wintering bird population, but also the diversity and the effectives present during the migration time and breeding period inside and in the neighbourhood of the future wind farm area. The forest birds were counted along transects and from fixed observation points, too. During the period May - June, we made nocturnal monitoring too, visiting each site twice in May and June, in order to identify the presence and the effectives of the Corncrake (*Crex crex*) and the nocturnal raptors in the investigated sites.

During the winter period, we tried to identify the number and the position of the large nests that could be occupied by the raptor birds or by the Raven (*Corvus corax*) in the forest areas along our observation transects and their vicinity. Till the middle part of April, especially in the meteorological conditions of the 2009 spring, we continued the monitoring of large nests in order to identify the bird species that occupied it (sedentary or summer visitor raptor species, respectively, the Raven - *Corvus corax*), inside or in the neighbourhoods of the investigated areas.

RESULTS AND DISCUSSIONS

The winter of 2008 presented a low level of rainfalls and snowing, associated with low temperatures. In March 2009, it was registered a very variable weather regime: the temperatures recorded a large variance from one decade to other; rainfalls lasted long and had a high level; in these conditions, the access was very difficult inside the investigated area. After this, beginning with the second decade of the April month, the weather became stable and evaluated to a dryness stage. During June and July, the weather conditions registered an excessive and oscillating character, recording a successive alternation of dry periods associated with very high temperatures (higher than 35°C) and periods of great instability associated with strong winds and torrential rainfalls.

In these conditions, the birds must adjusted the diurnal activity according the daily temperatures, wind speed and intensity, in order to search and find the food necessary for their own survival and to feed the young generation with minimum costs. During the fieldwork periods, we recorded situations when the diurnal birds prolonged their activity period, searching food and singing after the sunset. During the second part of summer, dryness prevailed, so, in September, most of the crops were harvested, while the wild vegetation was dried, ending the vegetative stage of this year. In late August, the people began the autumn ploughing and sowing works in this site, so, in the last part of October, after one period with high rainfall level (the second decade of October), the rape and winter wheat germinated and the fields turned green.

Both future wind farms have a long line form; the turbines will be arranged in a line of one – three pillars along the length of the parks. The site Deleni – Dinga presents a larger northern area, where the turbines will be fixed in lines of three to five. The northern limit is represented by Deleni village and Lipovat Forest, while the southern limit is formed by Parvesti village, Sihastrului Forest, and Calugaritei Forest. The western margin is represented by some

woodland plantations and Buda village; the eastern limit is located along some small young woodlands and Dinga village. The main ecosystems and habitats inside and in the neighbourhood of this site are: the arable lands (during the winter, we recorded the presence of some rape and winter wheat cultivated areas; the main crops in this site are: rape, wheat, barley, ryes, sunflower, maize, and alfalfa); the abandoned arable lands covering relatively large surfaces inside this site; the forests (the most important are Lipovat Forest in the north – north-western part of the site, respectively, Sihastrului Forest in the south-eastern part and Calugaritei Forest, representing the southern margin of the wind farm area, with a large plantation of acacia (*Robinia* sp.) nearest the study site); there exist, also, some small and young woodlands and plantations, especially of acacia. In the north-western part of the site, there appears a large area covered by small bushes and shrubs to the proximity of Lipovat Forest. The dry meadows cover small areas within the perimeter, larger in the neighbourhood of the site; there exists one small area of wet meadow with reed, in the western part of Dinga village and another one, covered by typically paludous vegetation, in the central part of the northern sector of the site.

The future wind farm Bogdanita – Bogdanesti will have a northern part with one – two turbines in a line, respectively, a southern sector with lines of four – five turbines and is situated between Bogdanita and Bogdanesti villages in the north, respectively, Cepesti village and Iepe Forest in the south. The main ecosystems and habitats inside and in the neighbourhood of this site are: the arable lands, covering large surfaces in the site perimeter; we identified perimeters cultivated with rape and winter wheat; the main crops in this site are: rape, wheat, barley, ryes, sunflower, maize, and alfalfa; the abandoned arable lands cover quite large surfaces in this site, while the dry meadows, with small herbs, isolated small “islands” of bushes and shrubs, cover large surfaces and represent one of the dominant habitats inside and near the wind farm perimeter. The most important forests are Balu Forest, covering a large area in the central-eastern part of the site, Hircioaia Forest and Iepe Forest, forming the south-eastern and southern limits of the wind farm perimeter. In the neighbourhood of the site, there appear two large woodlands: Buciumitei Forest, in west of Bogdanita village and Lipovat Forest, in north-eastern of the site. There exist, also, some young woodland plantations.

The recorded bird fauna list for the Deleni site includes 73 bird species, 57 of which are breeding species, while in the Bogdanita site, we met 80 bird species, 58 being breeding species in the area. The forest passerines are dominant through their diversity and effectiveness - tits (*Parus* sp.), finches groups (*Fringilla* sp. and *Carduelis* sp.). The raptors species and the woodpeckers have a constant presence, with enough large effectiveness. This is possible due the species and trees age structure of the Lipovat and Balu forests, especially, as well as to the vicinity of the villages with orchards coming into contact with the woodland plantation limits (Bogdanita). The raptors can find various kinds of preys in the open lands and near the houses from the small orchards.

During winter, these species were observed, especially, inside and at the margins of Lipovat, Sihastrului, Balu Forests and in the young woodland plantations Hircioaia and Iepe perimeter, forming small mixed flocks in search of food (fruits and seeds). During the wintering period, we observed, frequently, groups of forest passerines visiting the small orchards and gardens from villages, especially in Bogdanita and Cepesti perimeter, searching for food resources. The birds flew from the direction of the inside forest ecosystems of the site. During the cold season, in the open lands – cultivated or dry meadows – we met, especially, common passerine species, in small and medium mixed or mono-specific flocks, searching for seeds and fruits. We noticed the later presence of the Red-throated Pipit (*Anthus cervinus*) – one adult bird was observed on the 3rd November 2008, in the Deleni site, but also, the earliest presence, in the last decade of February (on the 25th February 2009) of one adult male of Red-backed Shrike (*Lanius collurio*) in a shrubs area near Bogdanita village.

In the investigated area of the two future wind farms, we did not identify main flyways of the soaring birds that fly using thermal streams (diurnal raptor species and storks – *Ciconia* sp.), during spring and autumn migration time.

During the spring migration period, inside the investigated areas, we observed different passerine bird species, characteristic for the arable cultivated or abandoned lands, with small isolated bushes or island of shrubs and bushes. Immediately after their arrival, we could observe the territorial behaviour, delimiting, occupying and defending their breeding territories through the males strong songs, for the species like *Alauda arvensis*, *Galerida cristata*, *Anthus campestris*, *Anthus pratensis*, *Motacilla alba*, *Motacilla flava*, and *Miliaria calandra*, which build their nests on the ground between herbs or in small shrubs. These bird species fly at lower heights (10 – 20 m), across the open lands searching for food (especially, insects), except the Skylark (*Alauda arvensis*) that use to fly upper in the sky, flying behaviour more evident during the mating display. The suddenly temperature decrease recorded in the beginning of 2009 spring, forced the birds to interrupted these behaviour displays, manifesting with higher intensity starting from the last decade of March and, especially, in April.

On the territory of the future wind farms, the dominant habitats are the cultivated and abandoned lands (Deleni site), respectively, grasslands (Bogdanita), with some isolated trees or clusters of shrubs and bushes. On these terrains, some passerine species build their nests on the ground, with a good camouflage between the herbs or on the base of some dense and high tufts of herbs. As we can see in the table 1, between these species, the biggest breeding effectiveness belong to the Skylark (*Alauda arvensis*), Crested Lark (*Galerida cristata*) and Corn Bunting (*Miliaria calandra*), species that are catching insects during this period of the year, despite their omnivorous or granivorous trophic regime. Other passerine species are present with a smaller number of breeding pairs (*Anthus campestris*, *Motacilla flava* and *Oenanthe oenanthe*). In the agricultural and open land area, we discovered some breeding pairs of Partridge (*Perdix perdix*) and Quails (*Coturnix coturnix*).

Table 1. The breeding bird fauna recorded in the area Deleni – Bogdanita.
Tabel 1. Avifauna clocitoare în perimetrul Deleni – Bogdănița.

No.	Species name	Presence & Effectives				Phenology	
		Deleni - Dinga		Bogdanita - Bogdanesti		Romania	Investigated Area
		Pairs	Individuals	Pairs	Individuals		
1.	<i>Falco tinnunculus</i>	-	-	1?	3	PM	SV
2.	<i>Perdix perdix</i>	5	28	10	52	S	S
3.	<i>Coturnix coturnix</i>	5	32	15	90	SV	S
4.	<i>Columba palumbus</i>	5	21	10	40	SV, RW	SV
5.	<i>Columba oenas</i>	4	14	-	-	SV	SV
6.	<i>Streptopelia turtur</i>	11	34	6	28	SV	SV
7.	<i>Cuculus canorus</i>	8	40	10	46	SV	SV
8.	<i>Athene noctua</i>	-	-	4	16	S	S
9.	<i>Asio otus</i>	3	14	3	12	S	S
10.	<i>Apus apus</i>	7	32	-	-	SV	SV
11.	<i>Upupa epops</i>	8	28	3	14	SV	SV
12.	<i>Picus viridis</i>	8	32	9	26	S	S
13.	<i>Dendrocopos major</i>	14	39	12	42	S	S
14.	<i>Dendrocopos medius</i>	9	28	7	28	S	S
15.	<i>Dendrocopos syriacus</i>	-	-	11	43	S	S
16.	<i>Dendrocopos leucotos</i>	-	-	1 – 2?	5	S	S
17.	<i>Jynx torquilla</i>	8	26	8	26	SV	SV
18.	<i>Galerida cristata</i>	17	54	12	56	S	SV
19.	<i>Alauda arvensis</i>	24	70	30	140	PM	SV
20.	<i>Lullula arborea</i>	-	-	10	39	SV	SV
21.	<i>Hirundo rustica</i>	22	128	25	143	SV	SV
22.	<i>Delichon urbica</i>	10	43	-	-	SV	SV
23.	<i>Anthus trivialis</i>	2	7	-	-	SV	SV
24.	<i>Anthus pratensis</i>	-	-	4	18	P, SV	SV
25.	<i>Anthus campestris</i>	6	22	12	54	SV	SV
26.	<i>Motacilla alba</i>	-	-	11	39	SV	SV
27.	<i>Motacilla flava</i>	6	26	8	34	SV	SV
28.	<i>Lanius collurio</i>	8	29	9	30	SV	SV
29.	<i>Lanius minor</i>	10	37	8	32	SV	SV
30.	<i>Oriolus oriolus</i>	12	45	15	64	SV	SV
31.	<i>Sturnus vulgaris</i>	28	150	30	156	PM	SV
32.	<i>Garrulus glandarius</i>	6	32	12	43	S	S
33.	<i>Pica pica</i>	4	18	8	28	S	S
34.	<i>Corvus monedula</i>	5	20	7	31	S	S
35.	<i>Corvus frugilegus</i>	11	86	-	-	S	S
36.	<i>Corvus corax</i>	2	7	3	10	S	S
37.	<i>Acrocephalus arundinaceus</i>	3	15	-	-	SV	SV
38.	<i>Acrocephalus scirpaceus</i>	7	28	-	-	SV	SV
39.	<i>Hippolais icterina</i>	8	32	7	32	SV	SV
40.	<i>Sylvia atricapilla</i>	18	60	14	54	SV	SV
41.	<i>Sylvia communis</i>	14	54	7	25	SV	SV
42.	<i>Phylloscopus trochillus</i>	-	-	9	28	P, SV	SV
43.	<i>Phylloscopus collybita</i>	22	78	22	80	SV	SV
44.	<i>Phylloscopus sibilatrix</i>	-	-	10	32	SV	SV
45.	<i>Ficedula hypoleuca</i>	7	32	5	24	P, SV	SV
46.	<i>Oenanthe oenanthe</i>	5	18	4	18	SV	SV
47.	<i>Saxicola rubetra</i>	15	67	12	43	SV	SV
48.	<i>Saxicola torquata</i>	14	59	9	39	SV	SV
49.	<i>Phoenicurus phoenicurus</i>	12	44	14	34	SV	SV
50.	<i>Erithacus rubecula</i>	9	36	12	45	SV, RW	SV
51.	<i>Luscinia megarhynchos</i>	12	41	9	32	SV	SV
52.	<i>Turdus merula</i>	18	78	22	98	PM	PM
53.	<i>Turdus philomelos</i>	23	104	25	108	SV	SV
54.	<i>Parus major</i>	32	148	40	180	S	SV
55.	<i>Parus coeruleus</i>	12	46	12	45	S	S
56.	<i>Sitta europaea</i>	22	102	18	56	S	S
57.	<i>Certhia familiaris</i>	6	26	-	-	S	S
58.	<i>Passer domesticus</i>	24	132	23	94	S	S
59.	<i>Passer montanus</i>	10	56	18	78	S	S
60.	<i>Fringilla coelebs</i>	34	118	60	234	PM	PM
61.	<i>Coccothraustes coccothraustes</i>	11	48	-	-	S	S
62.	<i>Carduelis chloris</i>	10	40	12	67	S	SV
63.	<i>Carduelis carduelis</i>	18	132	24	139	S, WV	S
64.	<i>Carduelis cannabina</i>	-	-	10	38	PM	SV
65.	<i>Miliaria calandra</i>	12	49	12	41	PM	SV
66.	<i>Emberiza hortulana</i>	-	-	3	11	SV	SV
67.	<i>Emberiza schoeniclus</i>	2	9	-	-	PM	SV
68.	<i>Emberiza citrinella</i>	18	70	25	102	S	S

Legend: S – sedentary species; PM – partial migratory species; SV – summer visitors; P – passage species; WV – winter visitors; RW – rare winter presence

In the north-western side of both future wind farms, there exist large surfaces of grassland with isolated young trees, shrubs and bushes used like breeding and feeding territories by some passerine species like the Whinchat (*Saxicola rubetra*) and the Stonechat (*Saxicola torquata*), warblers (*Sylvia communis* and *Sylvia atricapilla*), the Ortolan Bunting (*Emberiza hortulana*) – this last, was met only in the Bogdanita site - or shrikes (*Lanius collurio* and *Lanius minor*). These species build their nests in the shrub thicket, using the highest branches like resting sites and survey points to search the food in the surrounding open lands. This type of habitat is present in the vicinity of the swampy area from the central sector of Deleni future wind farm. Most of these bird species have the complete clutch just by the end April or even in the beginning of May, despite the territorial and mating displays start in March or in the first part of April. An interesting summer presence in the Bogdanita site was the Lapwing (*Vanellus vanellus*), wader species that is not breeding in the investigated site, but use the open lands like feeding territory, searching for the invertebrates on the recently ploughed terrains within the studied territory.

In the reed beds and marsh vegetation that cover the swampy terrains in the central sector of Deleni site, we found some breeding pairs of the Great Reed Warbler (*Acrocephalus arundinaceus*), Reed Warbler (*Acrocephalus scirpaceus*), and Reed Bunting (*Emberiza schoeniclus*), but there we met other bird specie, too, that looked for food, refuge or resting sites, using the high reed like survey points to identify the prey. The corncrake (*Crex crex*) was not recorded in this perimeter, but even in the cultivated and open lands from the both investigated sites; probably, in Deleni site, the wetland surface is not large enough and the surrounding vegetation, being too dry, does not offer good refuge sites for this globally threatened bird species.

The open lands represent feeding territories, also, for bird species that are breeding inside the perimeter of the villages - *Hirundo rustica*, *Delichon urbica*, *Passer domesticus* or *Passer montanus*. We must mention that, in this moment, no nest of White Stork (*Ciconia ciconia*) exists in the villages from this future wind farms and in its vicinity. In Bacani village, we met a nest occupied by White Stork (*Ciconia ciconia*), but the birds search for food on the ponds situated along the Simila rivulet valley, so, far away outside of the future Bogdanita wind farm area. Other breeding bird species inside the village ecosystems do not go far away from the villages limit (*Streptopelia decaocto*, *Apus apus*, *Athene noctua* or *Dendrocopos syriacus*), searching for food within the perimeter.

The forest ecosystems cover large surfaces on the limits of the future wind farms, but, excepting Balu Forest, in these woodlands we found a high human pressure, deforestation activities disturbing not only the trees clusters from the south-western sector of the Deleni site, but also the southern part of Lipovat Forest, still well preserved in the northern middle part. In this forest and in Sihastrului Forest, too, respectively, Balu Forest, there is concentrated the highest specific diversity of the breeding bird species in the study areas. The forest passerines are the most numerous group, represented by insectivorous and omnivorous species, but other bird groups present a high diversity, too - the woodpeckers group that do not search for food outside the forest perimeter (*Picus viridis*, *Dendrocopos major*, *Dendrocopos medius* and *Jynx torquilla*), pigeons and doves (*Columba palumbus*, *Columba oenas* and *Streptopelia turtur*). These birds use to search for food inside the forest and just, rarely, fly outside the forest skirts – we must notice that after the hatching of the chicks, the birds bring to the nest just eggs, larvae, caterpillars and adults of insects. The presence of the White-backed Woodpecker (*Dendrocopos leucotos*) in Balu Forest is remarkable (presenting a very well conservation status, being formed by old oaks - some trees are near or more than 100 years old); it is a breeding species, being one of the rarest woodpecker species in our country.

Between the breeding birds in woodlands, just the raptors, especially, the diurnal species, the Raven (*Corvus corax*) and the Hoopoe (*Upupa epops*) present hunting and feeding territories outside of the forest area. In Balu and Lipovat forests, in the nearest sectors to the future wind farms, we identified only the Long-eared Owl (*Asio otus*) that is a certainly breeding species, from the raptor bird species. We did not find any large nest in the part of Lipovat, Sihastrului and Balu forests from the vicinity of the study areas, despite the presence of suitable trees for breeding and of the large hunting habitats in this perimeter. But we do not exclude the possible breeding presence of some raptor bird species (*Buteo buteo* - *Pernis apivorus*, *Accipiter gentilis*, *Falco tinnunculus* and *Falco subbuteo*) in the woodland sectors from the vicinity of Lipovat village, because we met raptor birds hunting during the breeding season, on the open lands from the western side of Lipovat Forest, along the road from Lipovat village to Bogdanita village, so, very far away from the borders of the investigated areas. We mention, too, the presence of the Raven (*Corvus corax*) like breeding bird species in both locations, being the biggest bird that has the nest in the perimeter of the future wind farms. This presence certifies the low pressure of the local community in Balu and, partially, Lipovat forest areas. The adult individuals of Raven were observed searching for food in the same area like during the wintering time, on the agricultural lands situated in the north-eastern side of Lipovat Forest (a sector situated in the vicinity of the area where the turbines of the wind farm will be raise), respectively, on the Simila rivulet valley.

We must present one unexpected situation, too, recorded only in Deleni site. During May and the first decade of June, around the pillar with the wind measurement device, we found some died individuals of passerine birds due to the impact with the wires that fix the pillar on the ground. We recorded seven died birds: three individuals of Skylark (*Alauda arvensis*), one female of Blackcap (*Sylvia atricapilla*), one female of Whitethroat (*Sylvia communis*), one individual of Chiffchaff (*Phylloscopus collybita*), and one individual of Nightingale (*Luscinia megarhynchos*). On the land around the pillar, it was a barley crop. Another two passerine birds died due to the impact with the fixing wires

were found around another pillar for wind measurements, in the perimeter between Costesti and Dinga villages, not far away from our investigated area: one individual of Chiffchaff (*Phylloscopus collybita*) and a male of Blackcap (*Sylvia atricapilla*). Around this pillar, there were sunflower crops and some blackberry bushes (*Rubus idaeus*), while in the proximity, on the other side of the local road, there developed a young tree, the skirt of Sihastrului Forest being about 100 m away.

We mention that all the birds were adults, belonging to the summer visitor species in the area. Just one of these species breeds in the agricultural land (*Alauda arvensis*), where it search for the food, too and is the species with the biggest number of died birds due to the collision with the fixing wires. The other passerine species are forest breeding species, but they can fly outside of the forest skirt, searching for food in the sectors with bushes and shrubs. Through the present gathered field data we can propose two hypothesis trying to explain the collision incidents recorded in May and during the first decade of June in this site:

1. the birds need an accommodation period after the appearance of these pillars, new elements in their well-known landscape – all the died passerine birds belonging to migratory bird species that, immediately after their arrival in the breeding area, begin to fly searching for suitable breeding territories;
2. the birds were during the maximum behaviour excitability period, being in the initial part of the breeding season with the all behaviour components (the territorial behaviour, pairs forming time and mating display performing are associated with a high energetic consumption and an excessive psychic manifestations), when the birds fly on long or short distances, limiting and defending its territories, trying to attract the opposite sex partner to form a breeding pair, including by catching and offering insects like gifts.

We also thought about a third one hypothesis, respectively, the constant collecting of died passerine birds by the local community, frightened by the possibility that the wind farms development could be stopped. Some questions of the people made us believe this acting way is quite possible. But the appearance of the birds faeces on the pillars' fixing wires and on the ground surrounding it, suggest that the passerines started to use these new high elements from the land like survey and resting points.

The autumn migration begins during the first part of August in the investigated areas, when some breeding bird species (in the forest and woodland plantations from the nearest and inside the future wind farms) leave this region (*Cuculus canorus*, *Streptopelia turtur*, *Apus apus*, *Jynx torquilla*, etc.). In fact, starting even from July, numerous typical forest bird species form small or larger flocks, assembling juvenile and adult birds, and begin to rove searching more abundant food resources, swinging between the forest skirts and nearest agricultural lands (warblers – *Sylvia* sp., flycatchers – *Ficedula* sp., redstarts – *Phoenicurus* sp., and finches – *Fringilla* sp. and *Carduelis* sp.). By the end of August, some bird species can bring together tens and hundreds individuals, forming the flocks before the migration start (for example, *Sturnus vulgaris*). Most of the bird species typical for the forests and woodlands still search for their food inside the forest perimeter.

The swampy perimeter from the central area of the site Deleni – Dinga, was completely dried even in the first part of September, so, the warbler species (*Acrocephalus arundinaceus* and *Acrocephalus scirpaceus*) left this territory in August. In this sector, during the second part of the autumn migration, we could observe only some granivorous passerine species, eating seeds of marsh plants (*Miliaria calandra*, *Emberiza schoeniclus*) or insectivorous species that use the high reed wires like survey points in their feeding territories (*Lanius collurio*, *Lanius minor*, *Saxicola rubetra*, *Saxicola torquata*).

Beginning with the second part till the end of September, the vegetation drooped because the intensive dryness phenomenon and the local community started earlier to harvest the crops. By the end of September, the harvesting activities were finished, including sun-flower and stems of maize, used like fodder for the cattle; the autumn ploughing and some autumn sowings were made, some of these crops germinating (the rape). Then, we could observe some bird species flying to search for food at long distances from the forest skirts and their typical breeding suitable habitats. The typical forest birds were met wandering in small groups between the forest skirts and the nearest open lands (dry meadows, agricultural lands), using the food resources generated through the crops' harvesting and appeared in the herbal vegetation ending periods (fruits, seeds). The presence of one group of bee-eaters (*Merops apiaster*) was unexpected in Bogdanita site, flying upper the maize cultivated lands to catch insects.

In September, the bird fauna diversity decrease; the summer visitors leave the region while the passage species going to the southern wintering areas and the wintering visitors appear in this investigated perimeter (*Anthus cervinus*, *Turdus iliacus*, *Turdus viscivorus*, *Parus palustris*, *Carduelis spinus* etc.). The birds that cannot find more insects (due the arrival of the cold season), begin assembling in the territories where they can find seeds and fruits or collect invertebrates taken out from the soil during the autumn agricultural works in the cultivated lands.

In October, we recorded no more than 45 bird species, one cause being the large periods with abundant rainfalls and low temperatures; the last summer visitors left the study region during the first middle of October. An unusual presence for the last decade of October was that of some male individuals of Whinchat (*Saxicola rubetra*). The sedentary bird species diminished their activity, some of them being recorded inside the villages (*Galerida cristata*, *Garrulus glandarius*, *Parus major*, *Parus coeruleus*, *Carduelis carduelis* etc.). At the same time, we observed some passage species (*Turdus iliacus*) or wintering visitors (*Turdus viscivorus*, *Turdus pilaris*, *Fringilla montifringilla*, *Carduelis spinus* etc.) in this territory, eating the seeds and dry fruits from the forest skirts area, bushes and shrubs perimeters or even inside the villages.

Regarding the presence and activity of the raptor bird species, we must notice that, unexpectedly, the diversity and the effectives of this group presented low values during the whole study period in Deleni site. For the wintering time, we recorded two hunting areas inside the future wind farm perimeter, used sometimes by individuals of *Buteo lagopus* and *Buteo buteo*, both near Lipovat Forest, but we met the Raven (*Corvus corax*) searching for food in that area during the whole study period. Other raptor birds, hunting within these territories, were identified far away, in the western neighbourhood of Lipovat Forest, inclusively along the road from Lipovat village to Bogdanita village. In Bogdanita site, the diversity and the effectives of this group presented high values during the winter period, but the birds were met, especially, far away from the future wind farm perimeter, in the open lands along the Bogdana Valley, a tributary of the Simila River (we are not sure that the birds observed in this area come from the forest ecosystems from this site or from the large and closer Lipovat Forest or Buciumitei Forest). During the migration time and breeding season, most of the hunting territories of the raptor birds and Raven were identified outside of the future wind farms. Probably, the birds use the forest perimeter for breeding, resting and like night site, but the raptors do not use the territory of the future wind farms for hunting. In Bogdanita site, by the end of summer and during autumn, we met the Goshawk (*Accipiter gentilis*) and Buzzard (*Buteo buteo*) hunting, respectively, falcons (*Falco tinnunculus* and *Falco subbuteo*) hovering in a sector between Balu Forest and Coroiesti village, near the western margin of the future wind farm.

We must notice the presence of the Booted Eagle (*Hieraetus pennatus*), in Bogdanita site, with only one observation – one adult bird, on the 11th November 2008, respectively, one adult bird on the 27th March 2009. For the Peregrine (*Falco peregrinus*), in Bogdanita area, we recorded the biggest effectives counted on the territory of Vaslui County during the winter 2008 - 2009.

During the study period, we recorded 10 species that are rendered in Annex 1 of the Birds Directive. The Booted Eagle (*Hieraetus pennatus*) is a passage species during the first part of November and in March. The Peregrine (*Falco peregrinus*) presents a positive trend in Romania during the last ten years and is a constant presence, with a large number of individuals during the wintering time in the area. The Merlin (*Falco columbarius*) is a common winter visitor in this perimeter, while the three woodpecker species are sedentary species inside the forest ecosystems (*Dendrocopos medius* and *Dendrocopos leucotos*) or within the perimeter of the villages (*Dendrocopos syriacus*). The passerines species included in the Annex 1 of the Birds Directive are summer visitors in the open lands with shrubs and bushes (*Anthus campestris*, *Lanius collurio*, *Lanius minor* and *Emberiza hortulana*), flying at low heights hunting insects. Some of the summer visitors (*Streptopelia turtur*, *Upupa epops* or *Jynx torquilla*) and one sedentary species (*Corvus corax*) are included in the Romanian Red Book of the Vertebrates, being forest birds that are seen just rarely at the forest skirts (excepting the Hoopoe and Raven).

During our fieldwork, we observed a very high level of the deforestation activities in Deleni – Dinga site, especially in the young woodlands, prolonging Lipovat Forest, on the western margin of the site, but in the south-western part of this large and old forest, too. At the same time, Calugaritei Forest is affected by deforestation, but also by forest grazing activities. We did not observe any deforestation activity in Bogdanita - Bogdanesti site, but we noticed the presence of large groups of domestic animals, using the dry meadows for grazing. In the extreme dryness conditions of the year 2009, by the end of summer, the grasslands were completed dry and, practically, with no grazing value. For the first time during our monitoring activity, in the future wind farm Bogdanita – Bogdanesti perimeter, in September, we met a herd of sheep and goats at the skirt of Balu Forest (the very good conservation status of this forest ecosystem represent a prove of the absence of this kind of human activity in this area). Probably, the local community was forced to search grazing sites inside the forest due the hard diminution of the grazing possibilities in this territory, despite the obvious effects of the dryness in the forest area, too. The presence of cattle and sheep grazing in the woodlands perimeter from Deleni site represent a high disturbing factor for some breeding bird species, as well as for the quality of the forest ecosystems, this phenomenon being present, especially, in Calugaritei Forest.

CONCLUSIONS

Starting from the actual knowledge on the wind farm impact on the birds and bats populations, but also from our fieldwork studies during the last 12 months (November 2008 - October 2009), so, before the settlement of the future wind farms in the sites of Deleni – Dinga, respectively, we can estimate that:

1. the absence of the main migration flyways of birds and bats inside and near the perimeter of the future wind farms represents a safety element for these vertebrate groups after the construction of the wind farms;
2. both wind farms present a straight-elongated form on the direction north-south (so, a parallel line with the directions of the main bird migration flyways on the Romanian territory), with a lateral settlement of one – five turbines in a line (mostly one – three in a line); these aspects represent diminishing elements of the collision risk for the bird populations recorded in this investigated site;
3. the height of the turbines – minimum, about 50 m, respectively, maximum, about 150 m – represent other diminishing elements of the collision risk for the dominant species inside the future wind farm perimeters (the breeding passerines in the dominant habitats of the area – cultivated lands, grasslands and small isolated shrubs or bushes cluster – fly at about 30 – 40 m);

4. the raptor bird groups present small breeding effectives in the area and their hunting territories are situated completely outside the future wind farm perimeters; anyway, in order to increase the security level for these birds, we recommend to fix the nearest turbines at a distance of at least 500 m from the skirts of the forest;

5. most of the hunting territories of the winter visitors raptor birds and during the migration time of this group are situated completely outside of the future wind farm perimeters, except for two perimeters used during the wintering time by a small number of buzzard species (*Buteo buteo* and *Buteo lagopus*) and falcons (*Falco columbarius*), delimited on the eastern side of Lipovat Forest, within the northern-central sector of Deleni wind farm area, with a potential low collision risk for the group of raptor birds; as they are bird species very sensitive to the human activities disturbance, we assess that these birds will leave this perimeter searching for another hunting territory, even during the construction of the wind farms;

6. most of the forest bird species do not search for food outside of the forest area, just during the wintering period being observed no more than 500 m away from the skirts of the forest, preferring the nearest road lands or, in some species' case (tits – *Parus* sp., thrushes – *Turdus* sp., finches – *Fringilla* sp., *Carduelis carduelis*), the territory of the villages;

7. we assess a possible diminution of the breeding effectives and the density of some breeding species inside the future wind farm areas – part of the breeding bird populations will leave this perimeter, searching for more suitable habitats in the vicinity of the future wind farm; in order to reduce this type of potential impact risk, there could be created small shrubs and bushes clusters outside the future wind farm limits, planting samples of the existent bushes and shrubs species in the investigated area.

REFERENCES

- HÖTKER H. 2006. *The impact or repowering of wind farms on birds and bats*. NABU Publications. Germany: 36 pp.
- PAPADOPOL A. 1975. *Contribution à la connaissance de l'avifaune du district Vaslui*. Travaux du Museum d'Histoire Naturelle "Grigore Antipa". București. **16**: 249 - 264.
- RISSE P., SAMET J. M. et al. 2007. *Environmental impacts of wind-energy projects*. National Academy Press. Washington: 278 pp.
- ***. 2009. *Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds*.

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