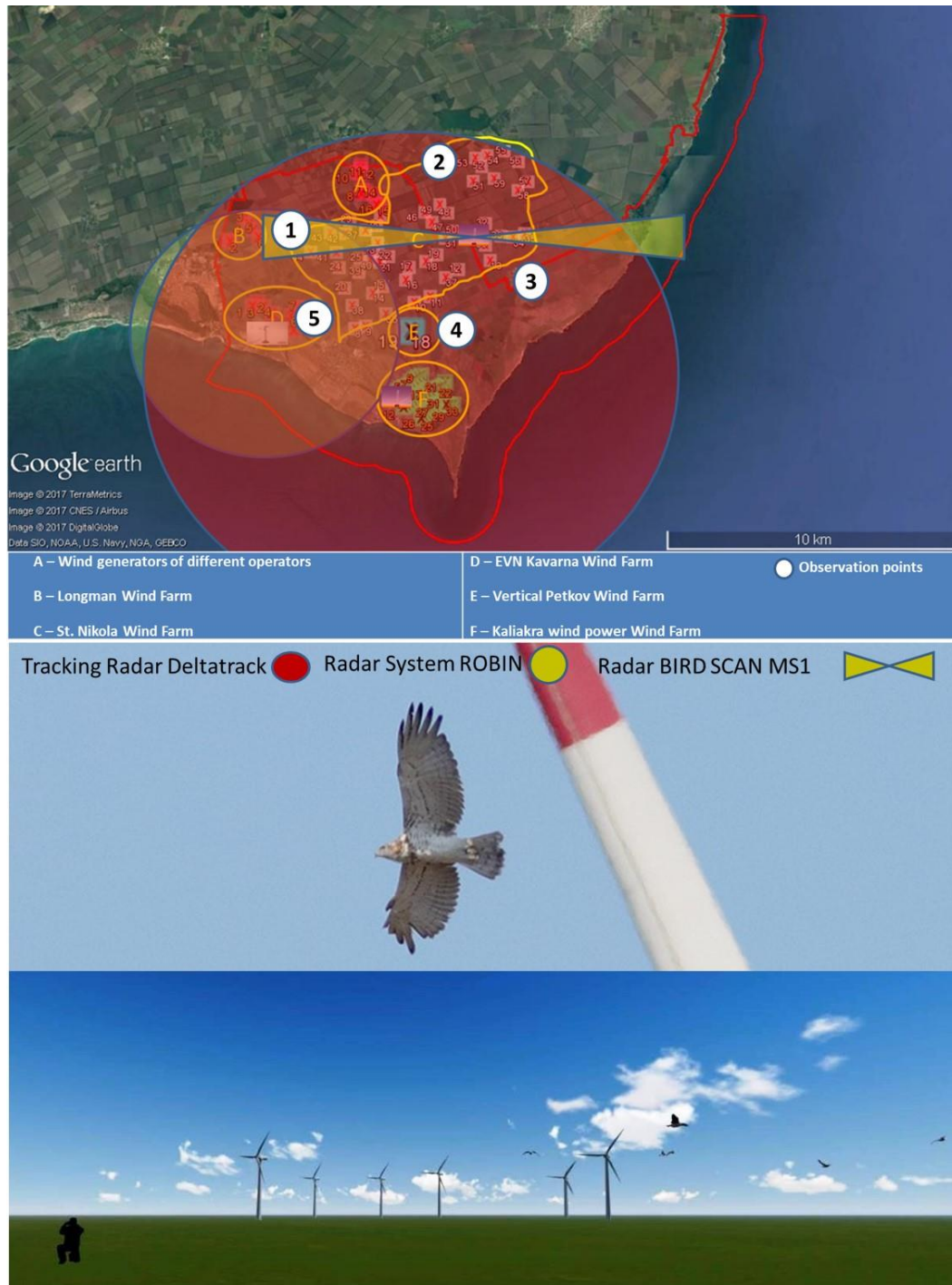


Summary of Activities and the Results of Ornithological Monitoring in 2023



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Introduction

The monitoring of Saint Nikola Wind Farm (SNWF) in 2023 was a part of more complex study assigned by the Wind farms, located in Kaliakra SPA BG0002051 - AES Geo Energy Ltd., Kaliakra Wind Power, Degrets OOD, Disib OOD, Windex OOD, Long Man Invest OOD, Long Man Energy OOD, Zevs Bonus OOD, Vertikal-Petkov & Sie SD, Wind Park Kavarna East EOOD, Wind Park Kavarna West EOOD, Millennium Group OOD. Effective of March 2018 the wind farms entered into agreement to implement and operate an Integrated System for Protection of Birds (ISPB) that includes 114 wind turbines, 95 of which are within the Kaliakra SPA BG0002051 and 19 are in the areas adjacent to the protected zone.

The ISPB consists of a combination of radar observations and meteorological data, integrated with field visual observations, which jointly used are essential for the accurate risk assessment and ensure that appropriate action is taken immediately to avoid collision risk. So far as potential adverse impacts of turbine collisions on birds, a Turbine Shutdown System is deployed supported by an Early Warning System.

The monitoring studies are based on the requirements of basic normative and methodological documents as follows: Environmental Protection Act, Biological Diversity Act, Bulgarian Red Data Book, Directive 92/43/EEC for habitats and species, and Directive 2009/147/EC on the conservation of wild birds, Protected Areas Act and Order RD-94 of 15.02.2018 of the Minister of Environment and Waters. Best international practices are also incorporated (T-PVS/Inf (2013) 15: <https://rm.coe.int/1680746245>). Detailed information on the scope, technical rules and monitoring procedures are publicly available at a dedicated website <https://kaliakrabirdmonitoring.eu/>.

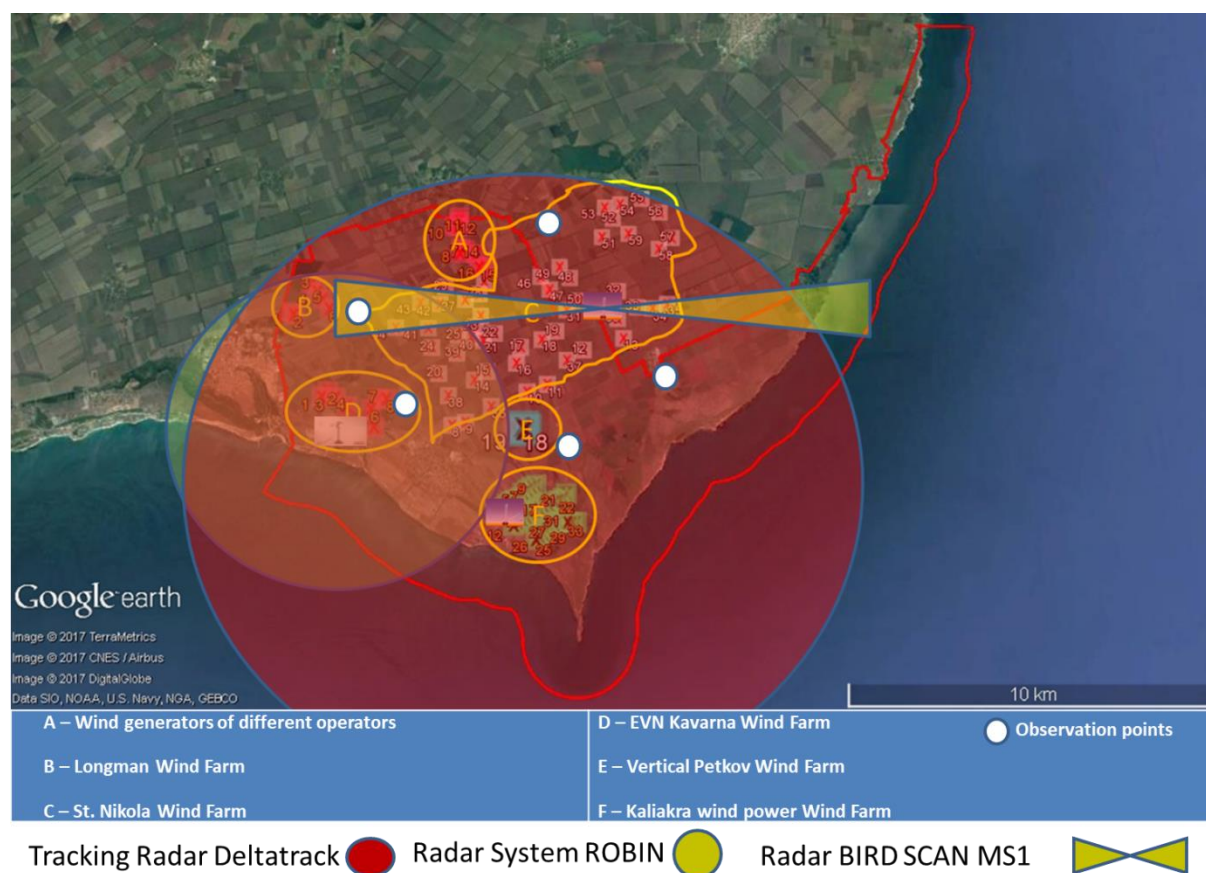


Figure 1. A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.

Figure 1 presents the locations of all 114 wind turbines within the study area covered by the ISPB.

In order to provide objective data for the bird risk assessment, this summary presents activities and results of the monitoring in 2023 with main focus on the territory of Saint Nikola Wind Farm.

Three types of radars integrated into the ISPB were used for monitoring and prevention of bird collisions:

Bird Scan MS1

The radar collects quantitative data and provides information about Migration Traffic Rate of birds through a specific sector where the fixed beam of the radar is directed (Figure 1). The quality of the data depends on the distance to the birds and to their size. In the case of ISPB the maximum distance we have used the Bird Scan MS1 radar is 10 km in a beam directed from west to east across the main migratory front of seasonal migrations. The data obtained by this radar system allow crude identification of ecological types of birds: for example, passerines, swifts, waders, and large birds. The radar data do not allow quantification of bird migration for every bird species observed in the ISPB territory and therefore do not allow any comparison with visual observations.

These data are not used for quantification and analysis of the characteristics of migration.

Deltatrack Radar System

This radar is a tracking radar system which allows detection of a single target or group of targets and tracking of their movements in a range of around 5 km (Figure 1). It is used in the monitoring as a real time tool for the tracking of already (visually) identified bird targets in the ISPB territory. The radar is not applicable for quantitative analysis of bird migration.

Radar System Robin

This is a 3 D radar system constructed for detection and tracking of moving targets in air volume of around 10 km³ ([Robin Radar in EVN Kavarna](#)) (Figure 1). It is a real time tool for tracking of moving targets and in combination with visual observations in the field provides highly reliable data on the distance as well as altitudes of birds already detected and identified by the field ornithologists. This radar does not provide quantitative data of migration at a species level because it does not allow species identification.

All three radar systems have been used as tools to assist field observations, detection of potential ingresses into the wind farms, and real time tracking of birds after visual observation through the ISPB during the period of monitoring.

All quantitative data and analysis of recorded bird numbers are based on the only possible quantification of bird migration of different bird species – the visual observations in the field. Locations of field observation points are presented in Figure 1.

Detailed descriptions of the technical characteristics of the three radar systems integrated within the ISPB are presented on the web site: <https://kaliakrabirdmonitoring.eu/Methodology>

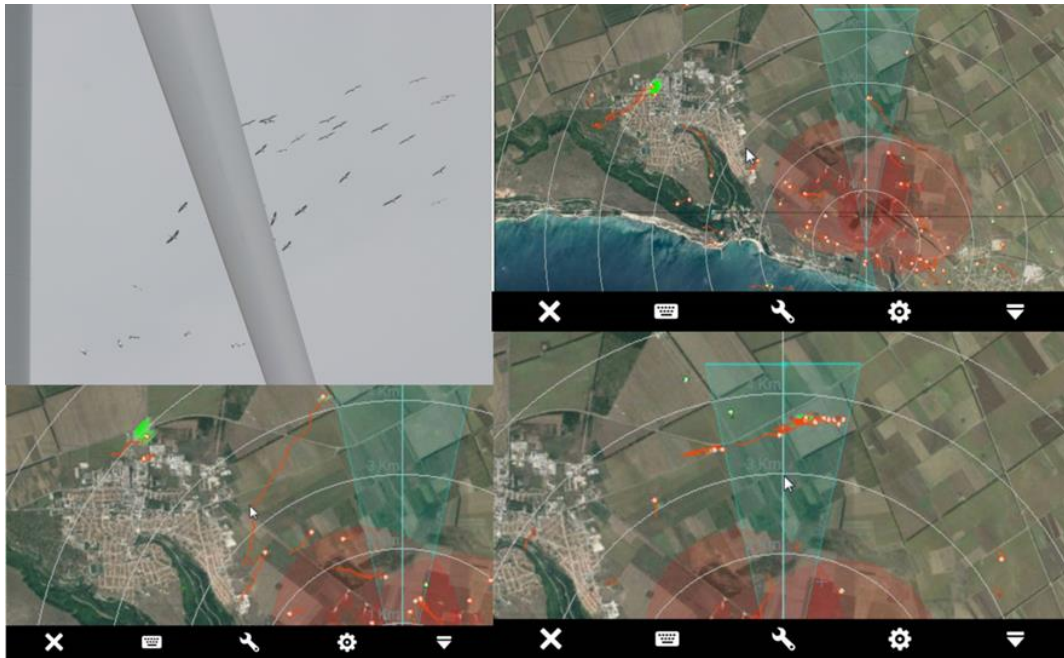


Figure 2. A flock of White pelicans: an illustration of the simultaneous records obtained by every ornithologist in real time information from Robin Radar System and visual observations. Every single bird and flock of birds from the target bird species were tracked by visual observations and the Robin radar simultaneously.

Results

Wintering geese monitoring 2022/2023

In total no birds of any goose species were observed in the ISPB territory (including Saint Nikola Wind Farm: SNWF) during the winter 2022-2023. Unusually low numbers of wintering geese were also observed in Bulgaria and Romania in general in the winter season 2022-2023. <https://bspb.org/>

The reason for the relatively low number of wintering geese in Bulgaria in general was likely due to the exceptionally mild winter of 2022-2023. Detailed analyses of correlation between ambient temperature and number of geese in SNWF, and discussion of the role of temperature, are presented in a previous report for the same territory: (www.aesgeoenergy.com/Winter_Report_2016-2017.pdf)

Spatial distribution of feeding geese

No flocks of geese were observed in the survey period in the study area. Due to the lack of wintering geese any winter spatial analysis was not possible.

Carcass monitoring results

All 52 turbines were targeted to be searched every seventh day (if the areas under turbines were accessible) for carcasses during the whole winter survey period (01 December 2022 – 28 February 2023) when in theory more wintering birds were at risk of collision. The weather condition (ambient temperature, rain and snow coverage) which may have an impact on the frequency and results of the searches has been previously discussed in several winter monitoring reports available at: <http://www.aesgeoenergy.com/site/Studies.html>. The last wintering geese in SNWF territory are typically observed at the beginning of March; therefore, for survey of

adequate coverage, the searches continued until the end of March. The actual frequencies of searches are presented in Table 1.

Table 1. Number of searches per turbine in the period 01 December 2022 – 31 March 2023.

Turbine	December	January	February	March	Total
AE10	4	4	4	2	14
AE11	4	4	4	2	14
AE12	5	4	3	2	14
AE13	4	4	4	3	15
AE14	4	4	3	2	13
AE15	4	4	3	2	13
AE16	4	4	4	2	14
AE17	4	4	4	2	14
AE18	5	4	3	2	14
AE19	5	4	3	2	14
AE20	4	4	3	2	13
AE21	4	4	4	2	14
AE22	4	4	4	2	14
AE23	4	4	4	2	14
AE24	4	4	3	2	13
AE25	4	4	3	2	13
AE26	4	4	4	2	14
AE27	6	4	4	2	16
AE28	6	4	4	2	16
AE29	4	4	3	2	13
AE31	4	4	4	3	15
AE32	4	4	4	3	15
AE33	4	4	4	3	15
AE34	4	4	4	3	15
AE35	4	4	4	3	15
AE36	4	4	3	2	13
AE37	5	4	3	2	14

Turbine	December	January	February	March	Total
AE38	4	4	3	2	13
AE39	4	4	3	2	13
AE40	4	3	3	2	12
AE41	4	4	3	2	13
AE42	4	4	3	2	13
AE43	4	4	3	2	13
AE44	4	4	3	2	13
AE45	6	4	4	2	16
AE46	5	4	3	2	14
AE47	5	4	3	2	14
AE48	5	4	3	2	14
AE49	5	4	3	2	14
AE50	4	4	4	3	15
AE51	4	4	3	2	13
AE52	4	4	3	2	13
AE53	4	4	3	2	13
AE54	4	4	3	2	13
AE55	4	4	3	2	13
AE56	4	4	3	2	13
AE57	4	4	3	2	13
AE58	4	4	3	2	13
AE59	4	4	3	2	13
AE60	4	4	4	3	15
AE8	4	4	3	2	13
AE9	4	4	3	2	13
Total	222	207	175	112	716

Systematic searches under 52 turbines in the period of 1 December 2022 – 31 March 2023 resulted in no intact carcass which could be associated with collision with wind turbines.

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 716 searches under 52 turbines in the period December 2022 – March 2023. Therefore, no evidence for collision of any goose species, including RBG, has been found in the winter 2022 – 2023 when geese were potentially present, and turbines were operating.

There were no circumstances in the 2022-2023 winter which required the Turbine Shutdown System (TSS).

Conclusions: wintering geese 2022-2023

The mild 2022-2023 winter is the main reason for absence of wintering geese in ISPB territory.

52 wind turbines of SNWF were not a source of collision mortality for wintering geese, even though they may frequently fly through or feed within wind farm territory. The evidence for this is that no remains of geese that could be attributed to collision with turbines were found during systematic searches under operational turbines not only in the 2022-2023 winter but also in any of the eleven winters when 52 turbines at SNWF (part of ISPB) have been operational and searched systematically every winter season.

Over several years, this evidence from SNWF consists of records of hundreds of thousands of geese flying through or feeding in SNWF (even though it is apparently not preferred habitat), and several thousands of searches under turbines to detect any strike casualties: no casualties have been found. It is beyond dispute that even the risk of collision mortality to wintering geese, of any species, presented by SNWF is remote in the extreme. Prospects of any possible adverse effect on geese populations through collision mortality are effectively zero.

From research described in the present report and earlier SNWF surveys (see previous SNWF winter reports on <https://www.aesgeoenergy.com/site/Studies.html>) the area continues to be a feeding ground for RBG as well as GWFG, but it also remains an unimportant area for both species, as indicated in pre-construction studies. Consequently, and based on other studies, SNWF presents no material threat through preventing use of food supplies: especially in light of other agricultural practices such as crop type and field size of the preferred crop of feeding geese. Harrison et al. (2017) (Scale-dependent habitat selection by wintering geese: implications for landscape management. Biodiversity and Conservation 27(1):1-22 DOI: 10.1007/s10531-017-1427-4 (<https://link.springer.com/article/10.1007/s10531-017-1427-4>) documented avoidance of habitat by feeding geese with a small-scale loss around turbine bases. This “avoidance” could be due in part to the concrete bases of turbines and farmers’ reluctance to cultivate areas in their immediate vicinity, to reduce potential damage to their machinery. Hence, the avoidance could have been the shortage of anything to eat, rather than the turbines *per se*. Whatever the reason, these potential losses (which would be zero if the crop is not preferred by geese; and crop choice is under the farmers’ discretion) are dwarfed by the more serious consequences of agricultural crop practices, such as crop type, field size, field boundaries’ habitat, and losses to farmers’ decisions (Harrison et al. 2017, Petkov et al. 2017: European Journal of Wildlife Research DOI 10.1007/s10344-017-1119-0). The impacts of hunting through direct and indirect pressures are also probably more severe than any consequence of wind farms in the region.

Spring migration

During the spring monitoring, observations were made during all 61 days of the season (15 March - 15 May), with registered migratory, soaring birds being detected over 70 % of the days in spring 2023. For the survey period, a total of 5148 migratory and resident birds were registered in spring 2023 (Table 2)

Table 2. Number of registered birds of all ecological groups by day during the spring migration in the territory covered by ISPB

Period	Number of birds in Spring 2023
15-31 March	663
1-30 April	4148
1-15 May	337
Total for the period	5148

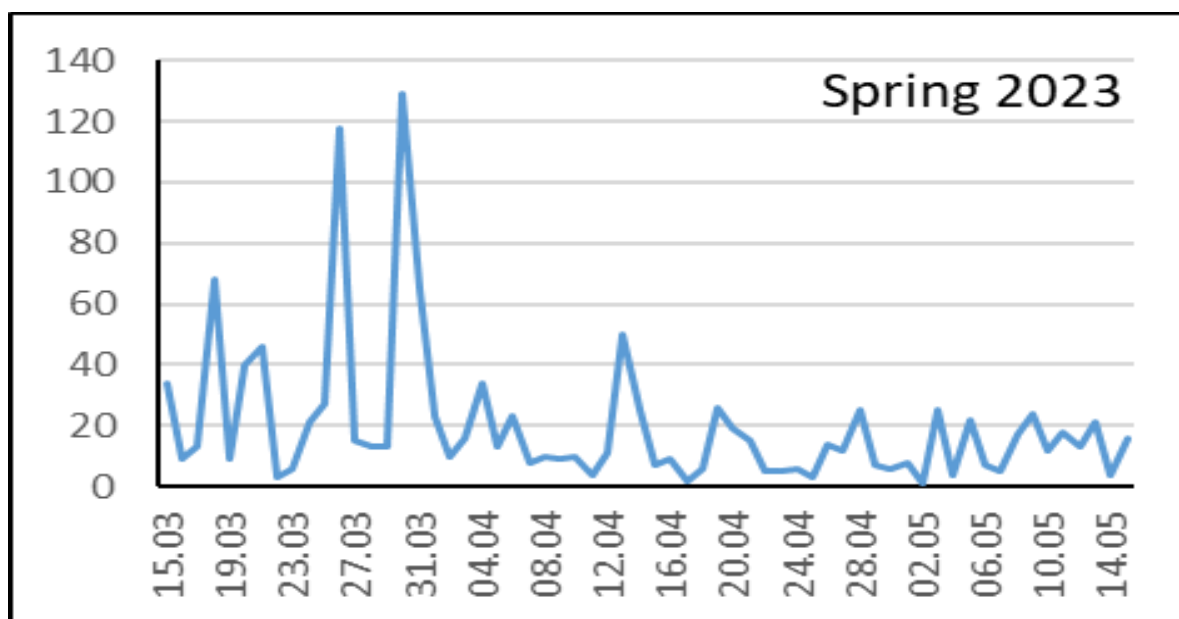


Figure 3. Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2023

The variations in bird numbers were substantial within the spring seasons of migration covered by the current monitoring study (Figure 3). The dynamics in numbers of birds in six spring seasons remained relatively similar, including an identical date for the peak of migration on 26 March in 2018 and 2019, 29 March in 2020 and 27 March in 2021. In spring 2022 season the peak of migration was observed 10 days earlier on 16 March. The peak of migration in spring 2023 was observed between 28 and 30 March and it is relatively similar to those in 2018, 2019, 2020 and 2021.

Table 3. Composition and number of registered bird species during the period 15 March - 15 May 2023 in the ISPB territory

Species name	Number of birds
<i>A. apus</i>	50
<i>A. cinerea</i>	15
<i>A. heliaca</i>	1
<i>A. melba</i>	42
<i>A. nisus</i>	7
<i>A. pennata</i>	2
<i>A. pomarina</i>	2
<i>A. purpurea</i>	1
<i>B. buteo</i>	155
<i>B. oedicnemus</i>	7
<i>B. rufinus</i>	9
<i>C. aeruginosus</i>	23
<i>C. brachydactyla</i>	1
<i>C. canorus</i>	7
<i>C. ciconia</i>	37
<i>C. corax</i>	13
<i>C. cornix</i>	31
<i>C. cyaneus</i>	13
<i>C. frugilegus</i>	62
<i>C. gallicus</i>	4
<i>C. garrulus</i>	3
<i>C. hybrida</i>	32
<i>C. macrourus</i>	1
<i>C. monedula</i>	16
<i>C. palumbus</i>	10

Species name	Number of birds
<i>C. pygargus</i>	1
<i>D. urbicum</i>	10
<i>E. melanocephala</i>	1
<i>F. albicollis</i>	3
<i>F. hypoleuca</i>	3
<i>F. semitorquata</i>	2
<i>F. subbuteo</i>	15
<i>F. timunculus</i>	97
<i>F. trochilus</i>	2
<i>F. vespertinus</i>	4
<i>H. rustica</i>	6
<i>L. collurio</i>	4
<i>L. megarhynchos</i>	2
<i>L. michahellis</i>	263
<i>L. minor</i>	1
<i>L. senator</i>	4
<i>M. apiaster</i>	42
<i>M. migrans</i>	2
<i>M. striata</i>	2
<i>N. nycticorax</i>	1
<i>O. oriolus</i>	2
<i>P. apricaria</i>	30
<i>P. carbo</i>	426
<i>P. collybita</i>	7
<i>P. falcinellus</i>	7

Species name	Number of birds
<i>P. onocrotalus</i>	25
<i>R. ignicapilla</i>	1
<i>S. communis</i>	1
<i>S. curruca</i>	1
<i>S. decaocto</i>	39
<i>S. rubetra</i>	1
<i>S. turtur</i>	31

Species name	Number of birds
<i>S. vulgaris</i>	3500
<i>T. glareola</i>	32
<i>T. philomelos</i>	11
<i>U. epops</i>	18
<i>V. vanellus</i>	7
Number of species	62

In total 62 bird species were observed in ISPB territory in the sixth monitoring spring season. The most numerous birds in spring in the region for six migratory seasons were Great cormorant (*Phalacrocorax carbo*), Yellow-legged gull (*Larus michahellis*), Common buzzard (*Buteo buteo*), European bee-eater (*Merops apiaster*) and Common kestrel (*Falco tinnunculus*) (Table 3).

Between 24 and 205 White storks (*Ciconia ciconia*) passed over the surveyed territory in the six spring seasons. The European nesting population of the White stork is estimated to be between 180,000 and 220,000 pairs, with about 80 % of the species migrating along the wider western Black Sea region, which also covers a part of north-eastern Bulgaria. According to these values, White storks flying over the Kaliakra area, substantially east of the main migratory path of White storks along the western Black Sea migration corridor, were an insignificant proportion (0.02 %) of the Via Pontica population. According to Shurulinkov et al. (2011), an estimate of the total population of White stork in SE Bulgaria flying along Via Pontica in spring was 23,358 individuals in their study period. In this respect our observations confirm the low significance of the territory of Kaliakra as part of the migratory corridor for spring migrating White storks along the Via Pontica component of the larger flyway.

During the whole period of the 2023 spring migration, there was one stop of one group of turbines (SNWF) in the territory of the Kaliakra SPA and adjacent territories. The stop orders given to the engineers on duty were executed in a timely manner, thus avoiding any collision risk of bird passing through the territory. Detailed information on the duration of the ordered stops is given in Table 4.

Table 4. Number of Turbine Shutdown System applications in spring 2023.

Date	Wind Farm	Turbine code №/ Group	Species	Number of birds	Time stop	Time restart
19.04.2023	SNWF	Zone B	<i>Pelicanus onocrotalus</i>	25	13:00:00	13:15:00

In order to check the effectiveness of the ISPB to prevent collisions of spring migrating birds, each of the 52 SNWF turbines covered by the ISPB program was checked at least once a week for collision victims. According to previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF (and repeated in autumn 2018 and in winter 2022 for ISPB territory), this search regime of weekly searches provides for a cost-effective method, which can also be calibrated, to discover any bird strike fatalities which may be of concern. For details, see previous studies of: <http://www.aesgeoenergy.com/site/Studies.html> and results of previous ISPB reports at: <https://kaliakrabirdmonitoring.eu/>.

Table 5. Number of turbines searched for collision victims in SNWF during the period 15 March - 15 May 2023

Turbine	March	April	May	Total
AE10	3	4	2	9
AE11	3	4	2	9

AE12	2	4	2	8
AE13	3	4	2	9
AE14	2	5	2	9

AE15	2	5	2	9
AE16	3	4	2	9
AE17	3	4	2	9
AE18	2	4	2	8
AE19	2	4	2	8
AE20	2	5	2	9
AE21	3	4	2	9
AE22	3	4	2	9
AE23	3	4	2	9
AE24	2	5	2	9
AE25	2	5	2	9
AE26	3	4	2	9
AE27	3	4	2	9
AE28	3	4	2	9
AE29	2	5	2	9
AE31	3	4	2	9
AE32	3	4	2	9
AE33	3	4	2	9
AE34	3	4	2	9
AE35	3	4	2	9
AE36	2	5	2	9
AE37	2	4	2	8
AE38	2	5	2	9
AE39	2	5	2	9

AE40	2	5	2	9
AE41	2	5	2	9
AE42	2	5	2	9
AE43	2	5	2	9
AE44	2	5	2	9
AE45	3	4	2	9
AE46	2	4	2	8
AE47	2	4	2	8
AE48	2	4	2	8
AE49	2	4	2	8
AE50	3	4	2	9
AE51	2	4	3	9
AE52	2	4	3	9
AE53	2	4	3	9
AE54	2	4	3	9
AE55	2	4	3	9
AE56	2	4	3	9
AE57	2	4	3	9
AE58	2	4	3	9
AE59	2	4	3	9
AE60	3	4	2	9
AE8	2	5	2	9
AE9	2	5	2	9
Total	123	224	113	460

Two records of dead birds after collision with wind turbines were documented during the 2023 spring migration of birds in the SNWF part of ISPB territory (Table 6). No case of collision with the turbines of a target bird species for the period of TSS application in ISPB was registered during the monitoring in spring 2023 (the target species are listed at [Target bird species](#)).

Table 6. Confirmed collision victims and species' conservation status as recorded during the 2023 spring migration period in SNWF territory

<i>English name</i>	<i>Species name</i>	<i>Number of birds</i>	<i>Red Data Book</i>	<i>IUCN</i>
<i>Eurasian skylark</i>	<i>Alauda arvensis</i>	<i>1</i>	<i>Not listed</i>	<i>LC</i>
<i>Woodlark</i>	<i>Lullula arborea</i>	<i>1</i>	<i>Not listed</i>	<i>LC</i>

Conclusions: spring migration

During the monitoring, there were no apparent changes in the main characteristics of the ornithofauna typical for the spring migration in the whole country and the specific characteristics of the species composition and phenology of bird migration in NE Bulgaria.

The results of the monitoring confirmed the relatively low importance of the SNWF territory for migratory birds in spring and the absence of negative influence of the operating wind farms on bird populations during their spring migration.

The migration periods, the species composition, the dynamics in number of birds, the daily activity, the height of the flights, as well as the feeding, resting and roost sites of the flying birds passing through the area indicated the absence of a barrier effect of the wind turbines.

The data presented in this report confirmed the absence of any adverse impact on sensitive bird species of the order Ciconiiformes, Pelecaniformes, Falconiformes, Gruiformes using migratory ascending air flows (thermals) for movement over long distances.

All these species were found to occasionally cross the study site, and their observed behaviour in respect to wind turbines did not indicate major changes which would impact on the energetics of these species during daily movements.

The quantitative characteristics of bird migration in the SNWF area during spring 2023, and the absence of mortality among the target bird species allows a continued conclusion that SNWF, as well as the other studied wind farms do not present a risk of adverse impact to migratory birds. The application of the ISPB's safeguards potentially was and can be an ongoing contributory part of the minimal risk posed to birds from wind farms in the Kaliakra region.

Autumn migration

During the autumn monitoring, observations were made during all 92 days of the 2023 season (1 August to 31 October 2023).

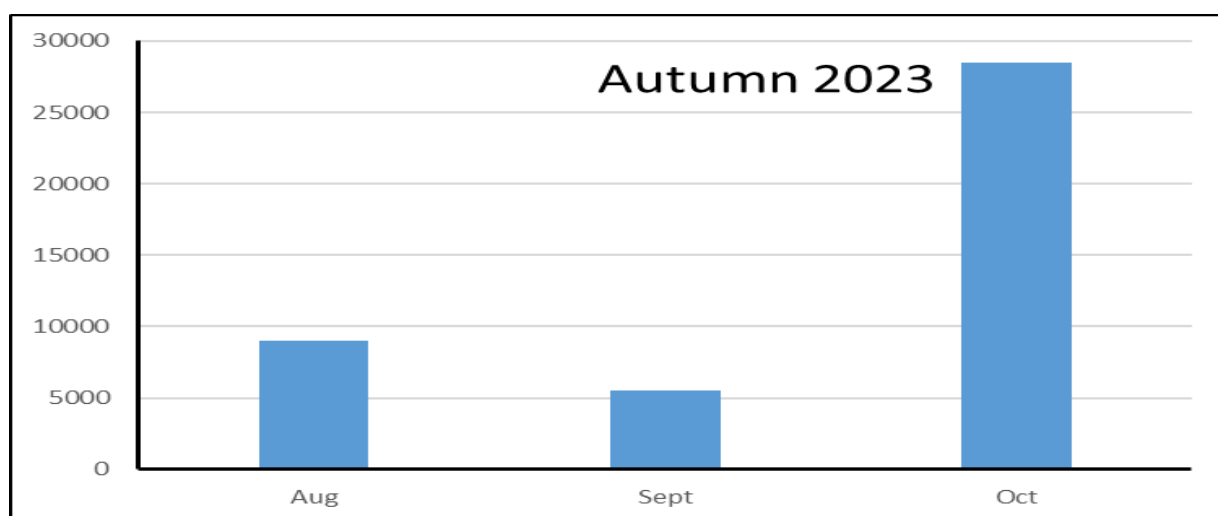


Figure 4. Number of registered birds by months during the autumn migration in the territory of SNWF.

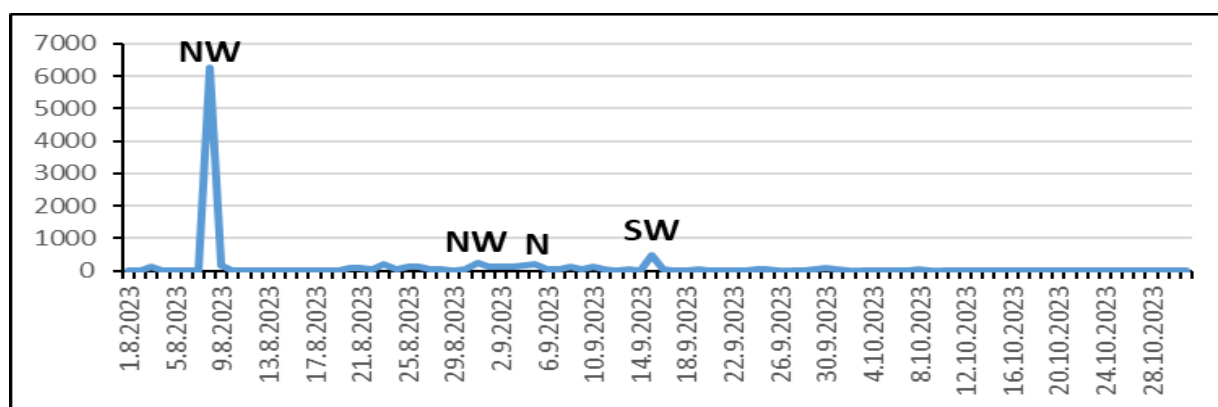


Figure 5. Dynamics of the autumn migration of the flying bird species in the SNWF territory according to visual observations during the period 01 August - 31 October 2023. Letters indicate the direction of wind in days with increased number of migrating birds.

This pattern in the number of birds recorded in Kaliakra in respect to westerly wind directions in autumn is confirmed in many previous studies at the St. Nikola Wind Farm (SNWF) which forms a major part of the ISPB territory (see reports <http://www.aesgeoenergy.com/site/Studies.html>).

The monitoring from 1 August to 31 October 2023 recorded 42983 individual birds, assigned to 63 bird species. The numbers of individuals recorded by species during autumn migration in 2023 are shown in Table 7.

Table 7. Composition of species and number of registered birds over the period 01 August to 31 October 2023 in the SNWF territory.

Species name	Number
<i>A. brevipes</i>	32
<i>A. gentilis</i>	1
<i>A. nisus</i>	79
<i>A. purpurea</i>	1
<i>A. heliaca</i>	2
<i>A. apus</i>	128
<i>B. buteo</i>	387
<i>B. oedicnemus</i>	1
<i>B. rufinus</i>	22
<i>C. aeruginosus</i>	117
<i>C. caeruleus</i>	30
<i>C. canorus</i>	1
<i>C. chloris</i>	15
<i>C. cyaneus</i>	1
<i>C. pygargus</i>	29
<i>C. pomarina</i>	18
<i>C. macrourus</i>	5
<i>C. gallicus</i>	38
<i>C. ciconia</i>	6386
<i>C. nigra</i>	1
<i>C. garrulus</i>	1
<i>C. corax</i>	9
<i>C. cornix</i>	67
<i>C. monedula</i>	107
<i>C. frugilegus</i>	8
<i>C. palumbus</i>	2002
<i>D. urbica</i>	200
<i>E. rubecula</i>	8
<i>F. coelebs</i>	153
<i>F. colchicus</i>	2
<i>F. vespertinus</i>	7
<i>F. subbuteo</i>	38

Species name	Number
<i>F. tinnunculus</i>	176
<i>F. columbarius</i>	1
<i>F. eleonora</i>	2
<i>M. cinerea</i>	1
<i>M. migrans</i>	5
<i>M. alba</i>	120
<i>M. apiaster</i>	2623
<i>M. calandra</i>	42
<i>L. canus</i>	2000
<i>L. michahellis</i>	2141
<i>L. melanocephalus</i>	33
<i>O. oenanthe</i>	2
<i>H. pennatus</i>	4
<i>H. rustica</i>	400
<i>P. carbo</i>	118
<i>P. collibita</i>	1
<i>P. onocrotalus</i>	128
<i>P. apivorus</i>	32
<i>P. haliaetus</i>	1
<i>P. leucorodia</i>	1
<i>P. sibilatrix</i>	1
<i>P. perdix</i>	24
<i>R. riparia</i>	210
<i>S. decaocto</i>	3
<i>S. spinus</i>	30
<i>S. turtur</i>	2
<i>S. rubetra</i>	5
<i>St. vulgaris</i>	24970
<i>U. epops</i>	6
<i>T. nebularia</i>	1
<i>T. philomelos</i>	4

The most numerous migrating birds recorded in autumn 2023 were white storks (*Ciconia ciconia*) with over 6000 individuals registered. Over 90% of white storks are observed in one day of the period. On 8 August 6250 white storks passed through the territory under a NW wind (Figure 5). Among the other soaring birds, the most numerous recorded birds were common buzzards (*B. buteo*) and great white pelicans (*P. onocrotalus*) with 387 and 128 individuals of each species respectively (Table 9). Fourteen new species were recorded in Autumn 2023. Song thrush (*Turdus philomelos*), wheatear (*Oenanthe oenanthe*), common chiffchaff (*Phylloscopus collybita*), wood warbler (*Phylloscopus sibilatrix*), whinchat (*Saxicola rubetra*), stone-curlew (*Burhinus oedicnemus*), blue tit (*Cyanistes caeruleus*), common cuckoo (*Cuculus canorus*), greenfinch (*Carduelis chloris*), robin (*Erithacus rubecula*), common chaffinch (*Fringilla coelebs*), common pheasant (*Phasianus colchicus*), grey wagtail (*Motacilla cinerea*) are common for the country. The fact they appeared in the observations this Autumn is probably due to changes in the habitats around the observation points and crops visited by the species in the period of our study. Common greenshank (*Tringa nebularia*) is a migratory species whose appearance is interesting for the species composition in autumn migration in this territory. The greenshank was registered as a single bird and therefore can be a sporadic case of a migratory bird in atypical habitat for the species. Another possible example for changes in species migrating through the region, probably related to dynamics of the climate in recent decades is the 2023 record of greater flamingo (*Phoenicopterus roseus*). This species was recorded

breeding for the first time in Bulgaria in 2023 and a flock of 76 birds was observed in Shabla lake 15 km to the north of the ISPB territory. The flock wintered in the same lake and so may become regularly present in the region.

As a result of the simultaneous observations of four constantly attended observation points with assistance from three radar systems (Figure 1) during the whole period of the autumn migration, there were two stops of one group of turbines in the territory of SNWF.

Table 8. Number of Turbine Shutdown System applications in autumn 2023.

<i>Date</i>	<i>Wind Farm</i>	<i>Turbine code №/ Group</i>	<i>Species</i>	<i>Number of birds</i>	<i>Time stop</i>	<i>Time restart</i>
08.08.2023	SNWF	Zone D	<i>C.ciconia</i>	26	12:19:00	12:24:00
05.09.2023	SNWF	Zone D	<i>P. onocrotalus</i>	10	14:09:00	14:29:00

According to previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF, a search regime of weekly searches provided for a cost-effective method, which can also be calibrated on the potential for missed carcasses, to discover any bird strike fatalities which may be of concern. Hence a frequency of four searches per month under every turbine allowed estimation of the mortality of the birds from a collision with the turbines. For details see previous studies on the same territory: <http://www.aesgeoenergy.com/site/Studies.html>

The total number of searches per turbine in SNWF is presented in Table 9.

Table 9. Number of checks for victims of collision in the territory of SNWF during the period 01 August-31 October 2023

Turbine	Aug.	Sep.	Oct.	Total
AE10	3	5	4	12
AE11	3	5	4	12
AE12	3	4	5	12
AE13	5	4	4	13
AE14	3	4	5	12
AE15	3	4	5	12
AE16	3	5	4	12
AE17	3	5	4	12
AE18	3	4	5	12
AE19	3	4	5	12
AE20	3	4	5	12
AE21	3	5	4	12
AE22	3	5	4	12
AE23	3	5	4	12
AE24	3	5	4	12
AE25	3	5	4	12
AE26	3	5	4	12
AE27	4	4	4	12
AE28	4	4	4	12
AE29	3	5	4	12
AE31	5	4	4	13
AE32	5	4	4	13

Turbine	Aug.	Sep.	Oct.	Total
AE33	5	4	4	13
AE34	5	4	4	13
AE35	5	4	4	13
AE36	3	4	5	12
AE37	3	4	5	12
AE38	3	4	5	12
AE39	3	4	5	12
AE40	3	5	4	12
AE41	3	5	4	12
AE42	3	5	4	12
AE43	3	5	4	12
AE44	3	5	4	12
AE45	4	4	4	12
AE46	3	4	5	12
AE47	3	4	5	12
AE48	3	4	5	12
AE49	3	4	5	12
AE50	5	4	4	13
AE51	3	4	5	12
AE52	3	4	5	12
AE53	3	4	5	12
AE54	3	4	5	12

Turbine	Aug.	Sep.	Oct.	Total
AE55	3	4	5	12
AE56	3	4	5	12
AE57	3	4	5	12
AE58	3	4	5	12
AE59	3	4	5	12

Turbine	Aug.	Sep.	Oct.	Total
AE60	5	4	4	13
AE8	3	4	6	13
AE9	3	4	5	12
Total	175	224	234	633

As a result of 633 searches under 52 individual turbines between 1 August and 31 October 2023. No casualties were identified as a result of collision on SNWF territory.

Conclusions: autumn migration

During the monitoring, there were no apparent changes in the main characteristics of the ornithofauna typical for the autumn migration in the whole country and the specific characteristics of the species composition and phenology of bird migration in NE Bulgaria.

The results of the monitoring confirmed the relatively low importance of the ISPB territory (including SNWF) for the migratory birds in autumn and the absence of negative influence of the operating wind farms on bird populations passing through the ISPB during their autumn migration.

The migration periods, the species composition, the dynamics in number of birds, the daily activity, the elevation of flights, as well as the feeding, resting and roost sites of the flying birds passing through the area indicated the absence of a barrier effect of the wind turbines in autumn migration period.

The data presented in this report confirmed the absence of impact on sensitive bird species using migratory upward airflows (thermals) to move (soaring) over long distances in autumn migration period.

All these species were found during the study to cross the site using suitable habitats without the need to increase their energy losses in their daily movements and to change their migratory strategy in the period of autumn migration.

The quantitative characteristics of bird migration in the SNWF area during autumn 2023, and the absence of mortality among the target bird species allows a continued conclusion that the studied wind farms do not present a risk of adverse impact to migratory birds. The application of the ISPB's safeguards potentially was and can be an ongoing contributory part of the minimal risk posed to birds from wind farms in the Kaliakra region.

List of participants in the observations

➤ Prof. Dr Pavel Zehtindjiev – Senior field ornithologist

More than 25 years of research experience in ornithology. Author of more than 85 scientific publications in international journals with an impact on the scientific field of bird biology, ecology and ecosystem conservation. Member of the European Ornithological Union and many nature conservation organizations. Winner of the Revolutionary Discovery Award for Ornithology of the American Ornithological Society for 2016 - The Cooper Ornithological Society.

Over 10 years of experience in impact monitoring study of wind turbines in the study area.

➤ Dr Viktor Vasilev – Field ornithologist

Senior researcher in the Faculty of Biology, University of Shumen.

Member of BSPB and participant in number of conservation projects in Bulgaria.

Author of over 20 scientific publications in international journals. Member of BSPB.

➤ **Veselina Raikova - Field ornithologist**

Natural History Museum of Varna. Member of BSPB. Author of more than 10 publications in international scientific journals. Over 10 years of experience in impact monitoring study of wind turbines in the study area.

➤ **Ivaylo Raykov - Field ornithologist**

Museum of Natural History, Varna. Member of BSPB. Author of over 20 scientific publications in international journals.

Over Five years of experience in impact monitoring in the region of Kaliakra.

➤ **Kiril Bedev - Field ornithologist**

Researcher in Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences. Active member of conservation organization Green Balkans. Long term study on migrating birds and biodiversity of Burgas lakes. Author of three articles in Bulgarian Red Data Book. Expertise in biotechnology, conservation biology and environmental monitoring. Over seven years of experience in impact monitoring of wind parks in Bulgaria. Member of Balkani NGO for conservation of birds and nature.

➤ **Hristo Gardov – Field ornithologist**

Experienced biologist, participant in several field studies of birds as part of many conservation projects. BSPB active member. Member of The Wildlife Conservation Society (WCS) and member of the management of the organization.

➤ **Svetoslav Stoyanov - Field ornithologist**

Bachelor in Biology diploma from Shumen University. Participant in numerous conservation projects of BSPB – BirdLife Bulgaria. Midwinter counts of waterfowl birds in Bulgaria and white stork census expert. Monitoring of bird migration, composition of species and the number of breeding fauna 2007-2012 "Ecotan" EOOD. Over 10 years of experience in impact monitoring study of wind turbines in the study area.

➤ **Nikolay Yordanov – Field ornithologist**

Master student in Sofia University, faculty of Biology. Two years monitoring of soaring birds in preconstruction stage of WF projects experience. Responsible for Radar application in the field survey of birds.

➤ **Jelyazko Dimitrov - Field ornithologist**

Member of BSPB from 31.12.2006 to 31.12.2010. Trained to monitor the severity of collisions of birds with wind turbines.

➤ **Vasil Panayotov Dimitrov - Field ornithologist**

Trained to monitor the severity of collisions of birds with wind turbines. Representative of local conservation organization in Balgarevo, Kavarna.