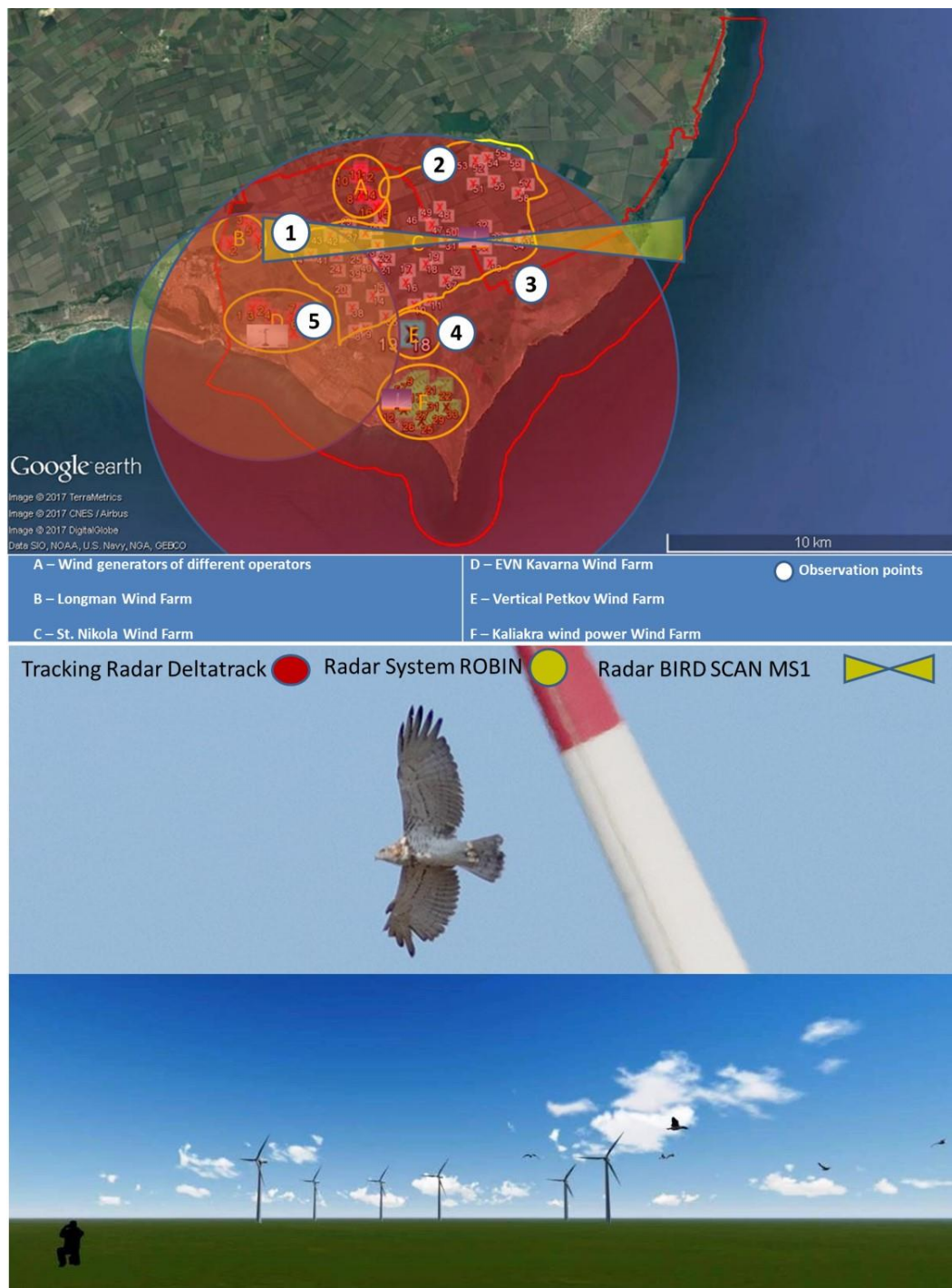


Summary of Activities and the Results of Ornithological Monitoring in 2020



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Introduction

The monitoring of Saint Nikola Wind Farm (SNWF) in 2020 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/>.

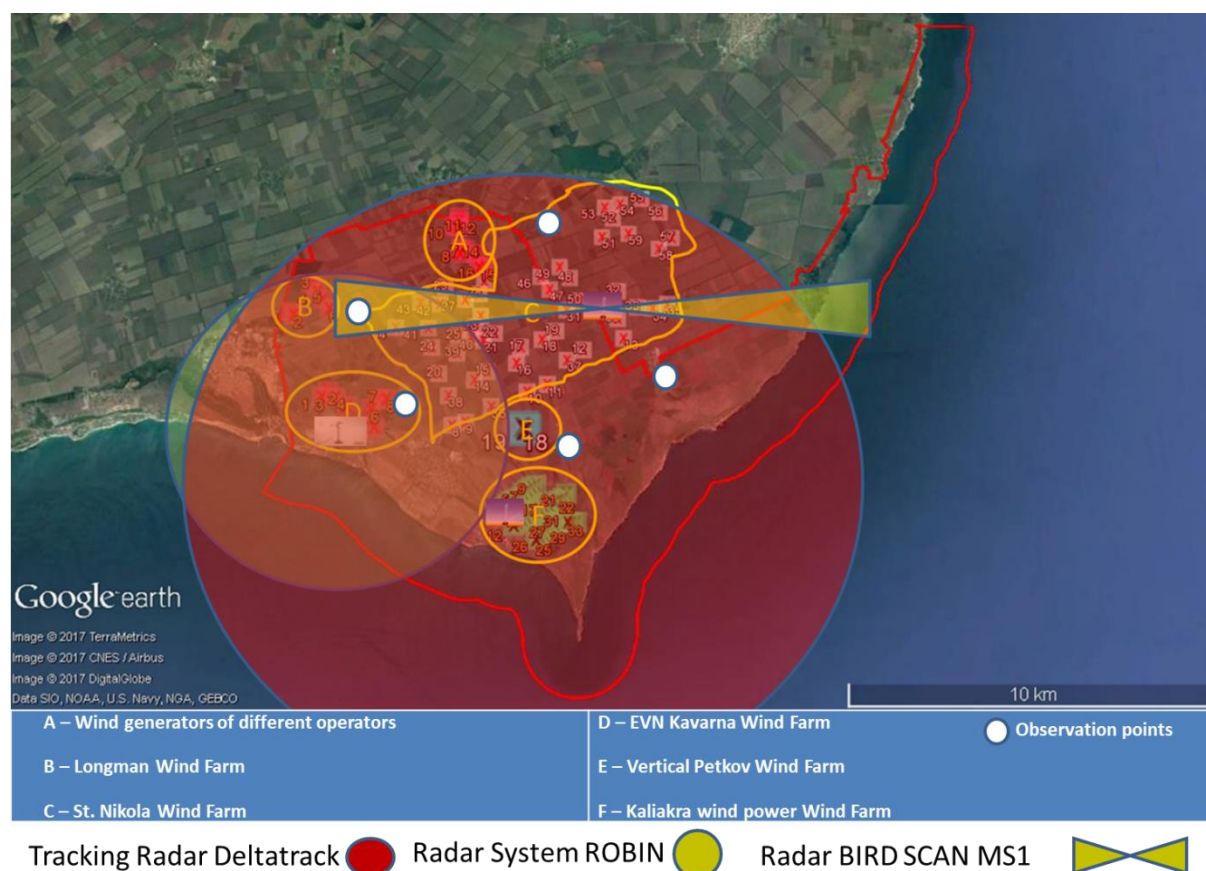


Figure 1. A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.

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 2020 with main focus on the territory of Saint Nikola Wind Farm.

The activities were supervised and coordinated by Prof. Dr. Pavel Zehtindjiev - Senior Field Ornithologist with over 25 years of research in ornithology. Over 85 scientific publications in international ornithological journals. Member of European Ornithologists Union and several other conservation organisations. Winner of the Revolutionary Discovery Award for Ornithology of an American Ornithological Society in 2016 – The Cooper Ornithological Society. 10 years of experience in impact monitoring of wind turbines on breeding, migrating and wintering bird species in the region of Kaliakra.

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 deepens on the distance to the birds and to the size of the migrating birds. In the case of ISPB the maximum distance we have used the Bird Scan MS1 radar is 10 km 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 (<https://www.youtube.com/watch?v=-Kb70clGHOQ&t=8s>) (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 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/>.

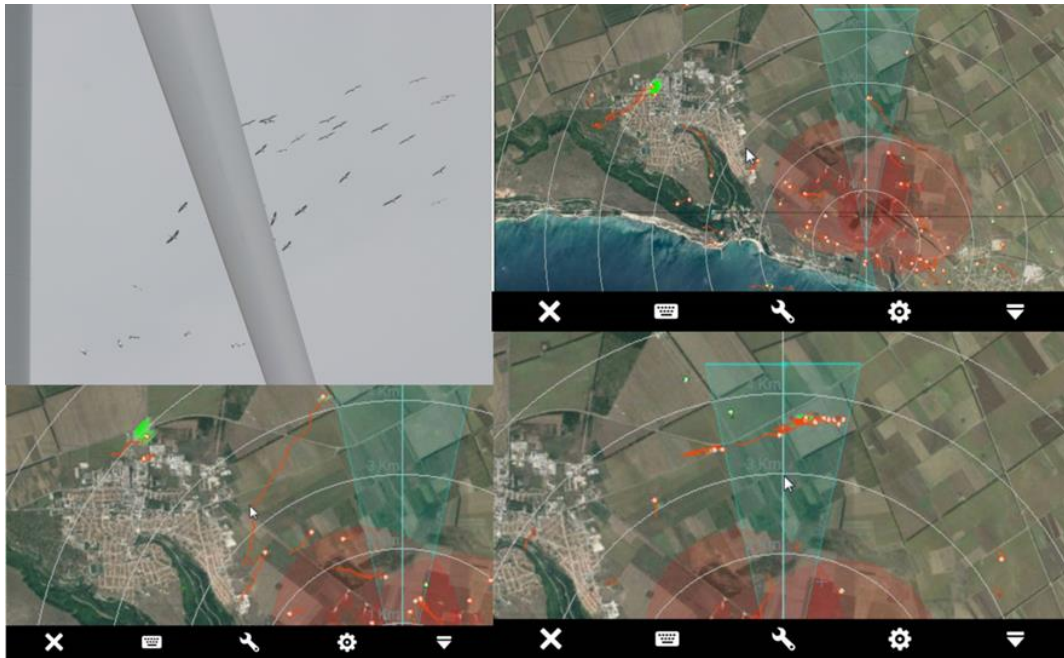


Figure 2. A flock of White pelicans: an illustration of the simultaneous records obtained by every ornithologist in real time information from Robin Radar System and visual observations. Every single bird and flock of birds from the target bird species were tracked by visual observations and the Robin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

Results

Wintering geese monitoring 2019/2020

In total, very low numbers of geese of all species were observed in the ISPB territory during the winter 2019-2020. Extremely low numbers of wintering geese were also observed in Bulgaria and Romania in general, throughout the winter season 2018-2019 and more so, in 2019-2020.

Less than 2,000 individual geese were observed during the surveys (Table 1). Three species of geese were observed: Red-breasted Goose (RBG: *Branta ruficollis*), Greater White fronted Goose (GWFG: *Anser albifrons*) and Greylag Goose (GG: *Anser anser*). No Lesser White-fronted Goose (LWFG) were seen in winter 2019/2020.

Table 1. All observed geese numbers by species and day of monitoring .

Date/Species	A. albifrons	A. anser	Anser/Branta	B. ruficollis	Grand Total
11.1.2020	292				292
15.1.2020	624	33	45		702
16.1.2020	49		150		199
21.1.2020			42		42
26.1.2020	218		45		263
1.2.2020	45				45
7.2.2020	18				18
12.2.2020				55	55
15.2.2020			57		57
Grand Total	1246	33	339	55	1673

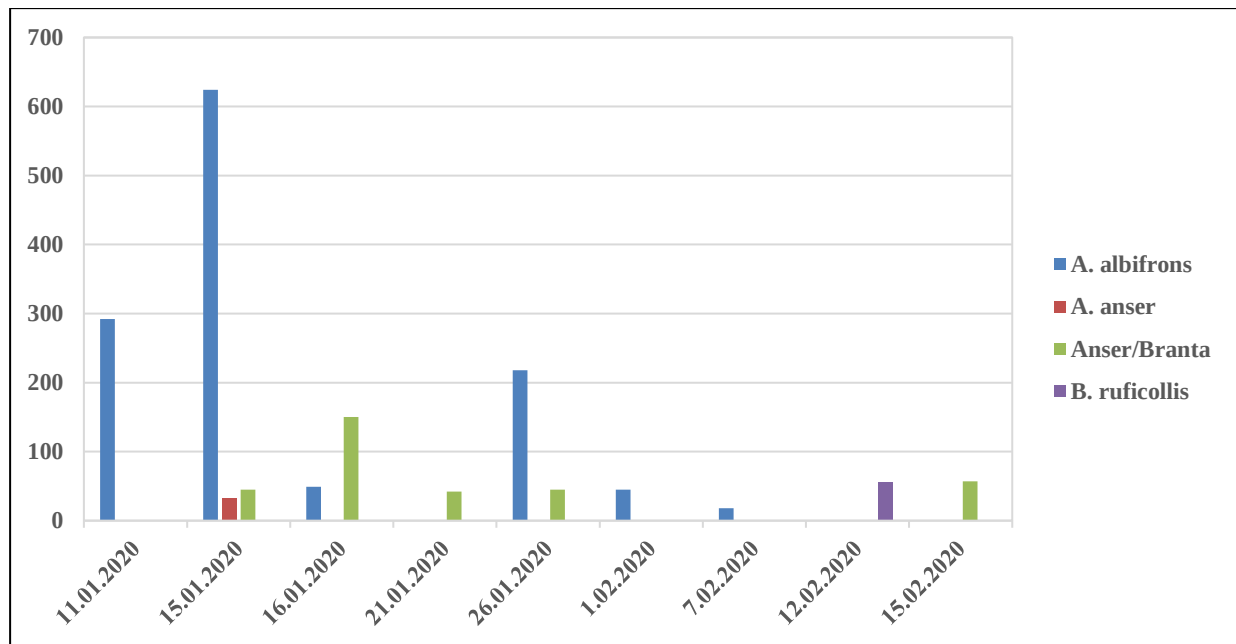


Figure 3. Temporal dynamics of wintering geese observed in ISPB territory, season 2019-2020.

The reason for the relatively low number of wintering geese in Bulgaria in general was likely due to the exceptionally mild winter of 2019-2020. Detailed analyses of correlation between ambient temperature and number of geese in a part of the same territory (Saint Nikola Wind Farm (SNWF) in the last 10 years, and discussion of the role of temperature, are presented in a previous report for the same territory:

(www.aesgeoenergy.com/site/images/Winter%20Report%202016-2017.pdf)

Spatial distribution of feeding geese in the ISPB territory

The density of flocks of geese tracked by the radar systems and confirmed visually are presented in maps below and indicate prevalence of geese activity (flights and feeding fields) in NE part of territory (Figures 4 and 5). Our results from winter 2019-2020 support the selective behaviour of wintering geese in favour of fields that were near to major roosts – the lakes Durankulak and Shabla (Harrison et al. 2017: Biodiversity Conservation <http://dx.doi.org/10.1007/s10531-017-1427-4>). The same conclusion has been published after 8 years of wintering geese monitoring at one of the wind farms included in ISPB (See <http://www.aesgeoenergy.com/site/Studies.html>)

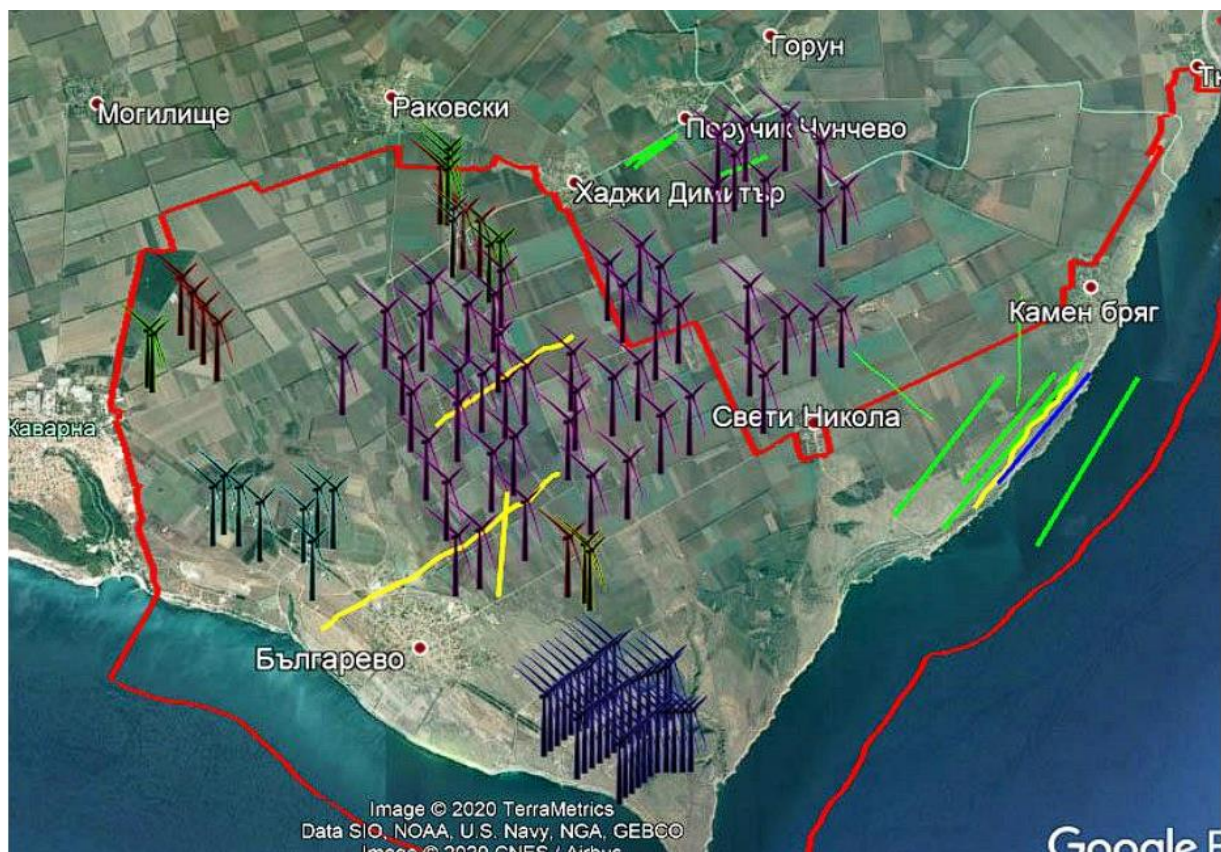


Figure 4. Flocks of GWFG (green) and GG (blue) and mixed flock (*Anser* spp./RBG) (yellow) registered in ISPB territory in January 2020.

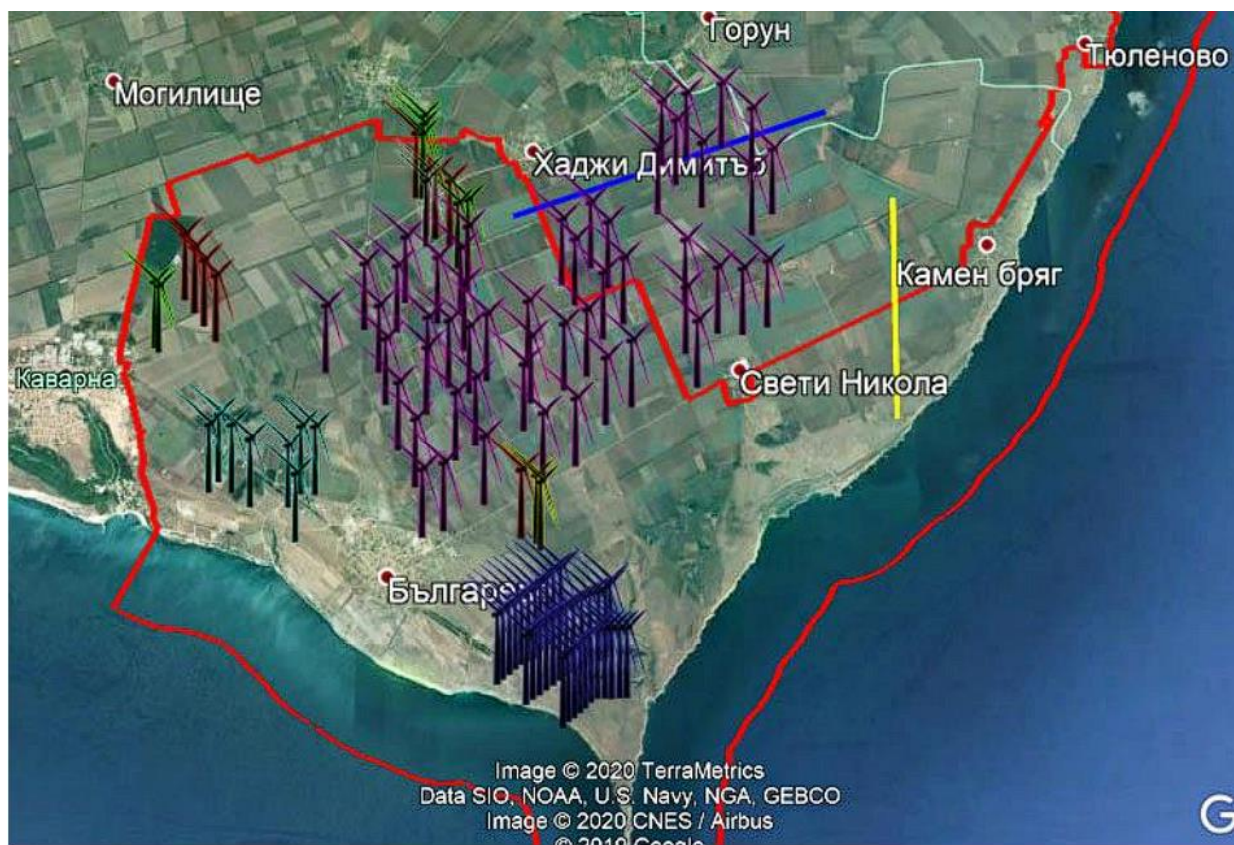


Figure 5. Flocks of GWFG *A. albifrons* (blue) and Whooper swan *C. cygnus* (yellow) registered in ISPB territory in February 2020.

Saint Nikola Wind Farm 2020 summary (SFO & IOE)

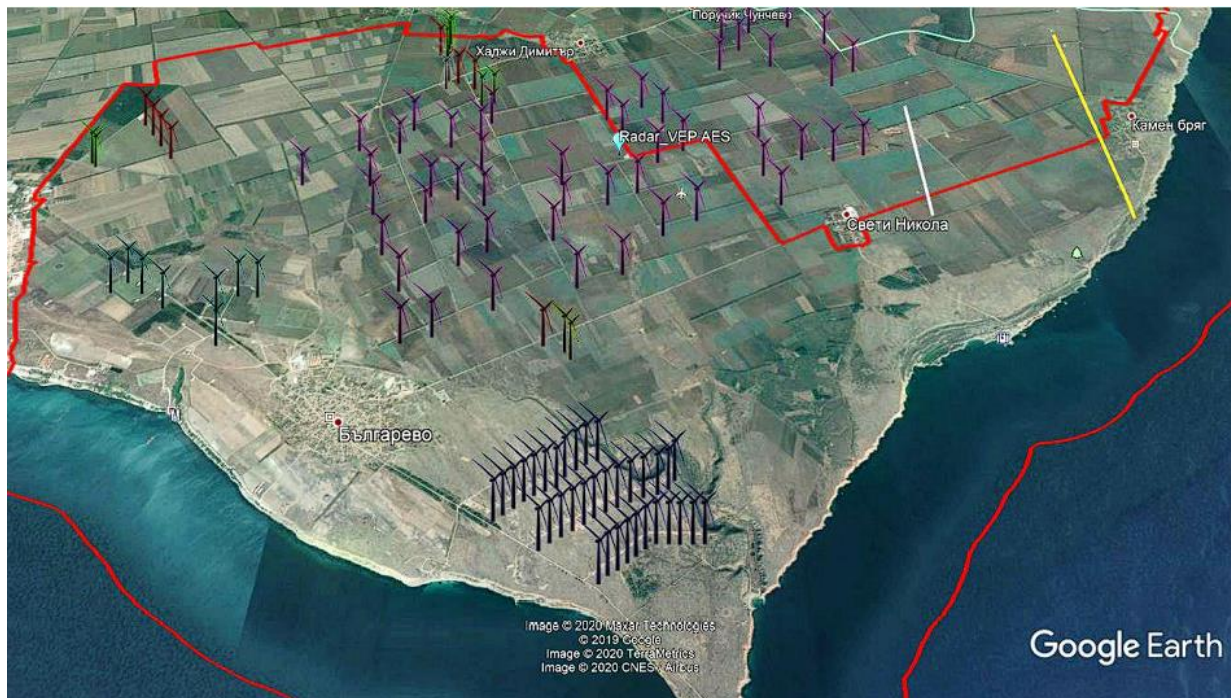


Figure 6. Flock of GWFG *A. albifrons* (white) registered on 7 February 2020 and Whooper swan *C. cygnus* (yellow) registered in ISPB territory on 3 February 2020.

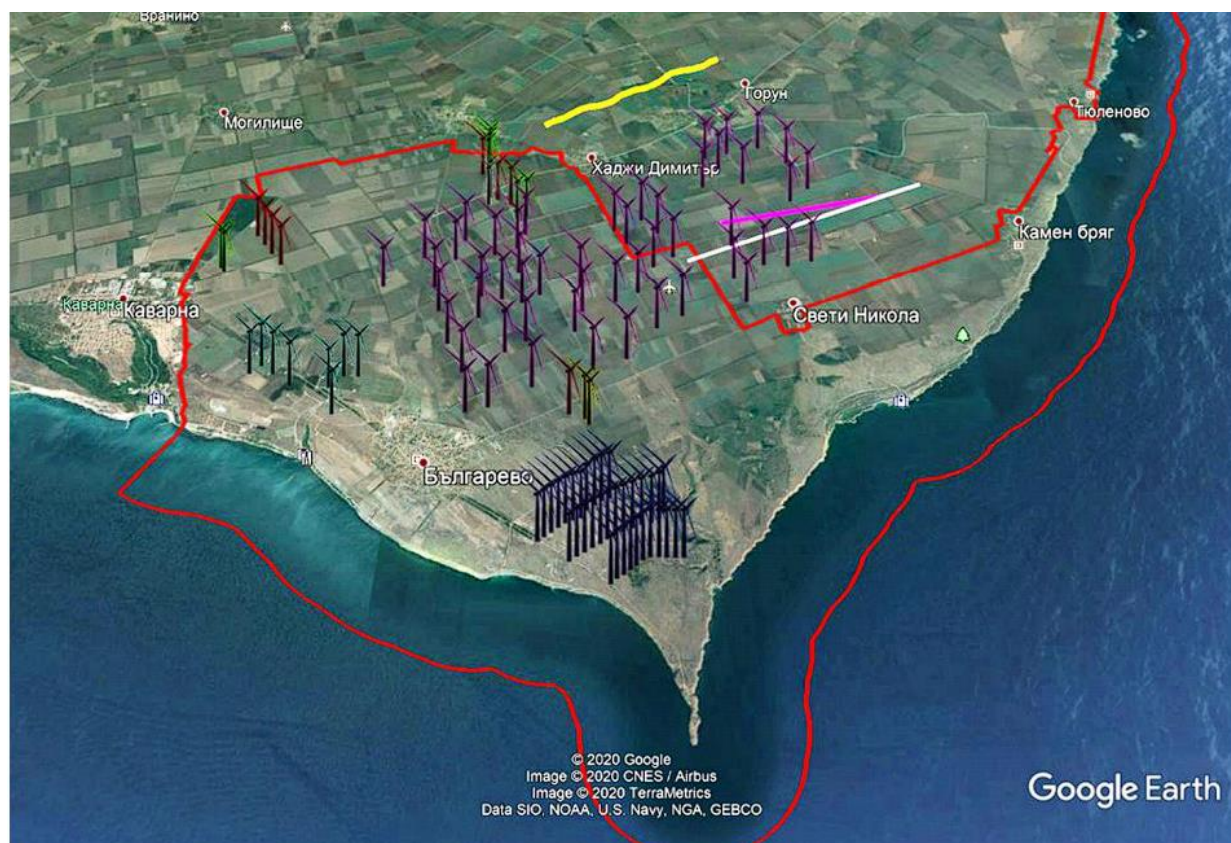


Figure 7. Flocks of 12 Whooper swan *C. cygnus* (white) registered in ISPB territory on 13 February 2020, 55 RBG *B. ruficollis* (pink) registered on 12 February and mixed flock of 57 geese (yellow) registered on 15 February 2020.

Carcass monitoring results

All 114 turbines were searched every seventh day (if the areas under turbines were accessible) for carcasses during the whole winter survey period (01 December 2019 – 29 February 2020) when more 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 St. Nikola Wind Farm (SNWF) territory are typically observed at the beginning of March; therefore, for surety of adequate coverage, the searches continued until the end of March. The actual frequencies of searches are presented in Table 2.

Table 2. Number of searches per turbine in the period 01 December 2019 – 31 March 2020.

Turbine	December	January	February	March	Total
AE8	2	4	4	4	14
AE9	2	4	4	4	14
AE10	2	4	4	3	13
AE11	2	4	4	3	13
AE12	2	6	4	4	16
AE13	2	4	4	3	13
AE14	2	4	4	4	14
AE15	2	4	4	4	14
AE16	2	4	4	3	13
AE17	2	4	4	3	13
AE18	2	5	4	4	15
AE19	2	5	4	4	15
AE20	2	4	4	4	14
AE21	2	4	4	3	13
AE22	2	4	4	3	13
AE23	2	4	4	3	13
AE24	3	3	5	3	14
AE25	3	3	5	3	14
AE26	2	4	4	3	13
AE27	2	4	4	3	13
AE28	2	4	4	3	13
AE29	3	3	5	4	15
AE31	2	4	4	3	13
AE32	2	4	4	3	13
AE33	2	4	4	3	13
AE34	2	4	4	3	13
AE35	2	4	4	3	13

Turbine	December	January	February	March	Total
AE36	2	4	4	4	14
AE37	2	5	4	4	15
AE38	2	4	4	4	14
AE39	2	4	4	3	13
AE40	3	3	5	3	14
AE41	3	3	5	3	14
AE42	3	3	5	3	14
AE43	3	3	5	3	14
AE44	3	3	5	3	14
AE45	2	4	4	3	13
AE46	2	5	4	4	15
AE47	2	5	4	4	15
AE48	2	5	4	4	15
AE49	2	5	4	4	15
AE50	2	4	4	3	13
AE51	2	4	2	4	12
AE52	2	4	2	4	12
AE53	2	4	2	4	12
AE54	2	4	2	4	12
AE55	2	4	2	4	12
AE56	2	4	2	4	12
AE57	2	4	2	4	12
AE58	2	4	2	4	12
AE59	2	4	2	4	12
AE60	2	4	4	3	13
Total	112	209	198	181	700

Systematic searches under 52 turbines in the period of 1 December 2019 – 31 March 2020 resulted in no collision victims.

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 700 searches under 52 turbines in the period December 2019 – March 2020. Therefore, no evidence for collision of any goose species, including RBG, has been found in the winter 2019 – 2020 when geese were present, and turbines were operating.

There were no circumstances in the 2019 - 2020 winter which required the Turbine Shutdown System (TSS) to be applied.

Conclusions: wintering geese 2019-2020

A relatively mild 2019 – 2020 winter is likely the main reason for the low number of observed geese in ISPB territory. Daily observations from December 2019 to February 2020 (inclusive) revealed that the recorded presence of geese in ISPB territory was compressed into a short time period within the winter, which was essentially the same as already established in studies 2008 – 2018 in SNWF.

The number of wintering geese observed in ISPB during winter broadly corresponds to the total number of wintering geese in the larger region of coastal Dobroudzha region; but is lower, because ISPB is relatively distant to roosting sites of wintering geese at the two freshwater lakes – Durankulak and Shabla.

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 2019-2020 winter but also in any of the ten 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.

No displacement (disturbance) reaction from geese has been observed for the period 2008-2020 as a result of construction and operation of wind turbines in the SNWF territory. Observed numbers of geese of all species as well as observed spatial distribution of flying and feeding geese does not indicate gross displacement from the operational turbines or its immediate environs. Wintering geese at SNWF do not apparently show mega-avoidance or even meso-avoidance (whole wind farm avoidance or turbine avoidance, respectively: May 2015: Biological Conservation 190, 179-187). Despite this lack of avoidance at such scales, they are clearly extremely capable of not being at risk of collision with turbine blades.

From research described in the present report and earlier SNWF surveys (see previous SNWF winter reports on the AES website) the study 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) documented avoidance of habitat by feeding geese with a small-scale loss around turbine bases. This “avoidance” could be due in part due 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 impact 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 62 days of the season (15 March – 15 May), with registered migratory, soaring birds being detected over 70 % of the time in spring 2020. For the survey period, a total of 1252 migratory and resident birds were registered in spring 2020 (Table 3).

Table 3. 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 2020
15-31 March	738
1-30 April	397
1-15 May	117
Total for the period	1252

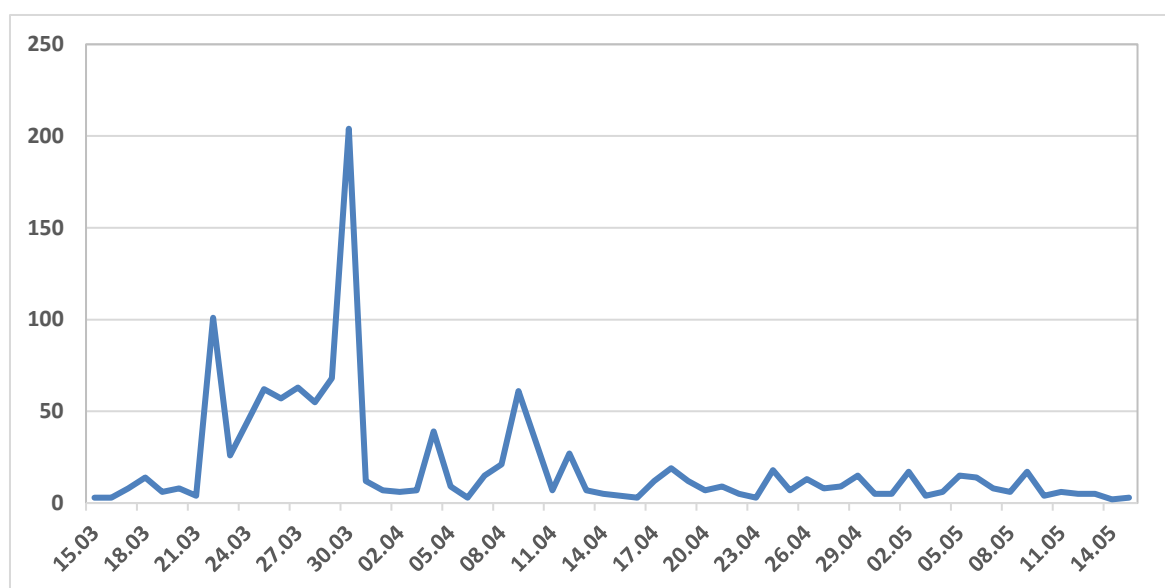


Figure 8. Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2020

The variations in bird numbers were substantial within the spring seasons of migration covered by the current monitoring study (Figure 8). The dynamics in numbers of birds in spring season 2020 remained relatively similar to previous 2019 (see previous reports), including a similar date for the peak of migration on 30 March.

The most numerous birds in spring 2020 in the region were Common cormorants (*Phalacrocorax carbo*), Common crane (*Grus Grus*) and some birds of prey – White stork (*Ciconia Ciconia*), Grey heron (*Ardea cinerea*), Demoiselle crane (*Grus virgo*) and Common buzzard (*Buteo buteo*) (Table 4).

Table 4. Composition and number of registered bird species during the period 15 March - 15 May 2020 in the ISPB territory

Species name	Number of birds	Species name	Number of birds
A. cinerea	78	F. subbuteo	12
A. heliaka	1	F. tinnunculus	30
A. nisus	11	F. vespertinus	13
A. pomarina	1	G. grus	182
A. purpurea	31	G. virgo	63
B. buteo	61	H. caspia	5
B. rufinus	33	L. fuscus	12
C. aeruginosus	45	L. limosa	29
C. ciconia	81	M. apiaster	10
C. corax	4	M. migrans	5
C. cyaneus	3	N. nycticorax	3
C. gallicus	3	P. apivorus	1
C. macrorus	3	P. carbo	434
C. olor	6	P. pugnax	61
C. pygargus	20	T. ochropus	1
E. alba	9	Number of species	32
F. peregrinus	1		

In the spring of 2020, a total of 81 White storks (*Ciconia ciconia*) passed over the surveyed territory. 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. Compared 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.

No stops of turbines were ordered under the Turbine Shutdown System (TSS) during the spring migration period of 2020. This was primarily because all the observed birds passing through the ISPB territory were outside the zone of the risk of collision with turbines.

In order to check the effectiveness of the ISPB to prevent collisions of spring migrating birds, each of the 114 turbines covered by the ISPB programme 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 with similar results), 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. Hence a frequency of four searches per month under every turbine allows estimation of the mortality of the birds from a collision with the turbines in the ISPB. For details, see previous studies of: <http://www.aesgeoenergy.com/site/Studies.html>

Table 5. Number of turbines searched for collision victims in the part of territory of SNWF during the period 15 March - 15 May 2020

Turbine	March	April	May	Total
AE8	3	4	2	9
AE9	3	4	2	9
AE10	2	4	3	9
AE11	2	4	3	9
AE12	3	4	2	9
AE13	2	5	2	9
AE14	3	4	2	9

Turbine	March	April	May	Total
AE15	3	4	2	9
AE16	2	4	3	9
AE17	2	4	3	9
AE18	3	4	2	9
AE19	3	4	2	9
AE20	3	4	2	9
AE21	2	4	3	9

Turbine	March	April	May	Total
AE22	2	4	3	9
AE23	2	4	3	9
AE24	2	4	2	8
AE25	2	4	2	8
AE26	2	4	3	9
AE27	2	5	2	9
AE28	2	4	3	9
AE29	2	4	2	8
AE31	2	5	2	9
AE32	2	5	2	9
AE33	2	5	2	9
AE34	2	5	2	9
AE35	2	5	2	9
AE36	3	4	2	9
AE37	3	4	2	9
AE38	3	4	2	9
AE39	2	4	2	8
AE40	2	4	2	8
AE41	2	4	2	8
AE42	2	4	2	8

Turbine	March	April	May	Total
AE43	2	4	2	8
AE44	2	4	2	8
AE45	2	5	2	9
AE46	3	4	2	9
AE47	3	4	2	9
AE48	3	4	2	9
AE49	3	4	2	9
AE50	2	5	2	9
AE51	3	4	2	9
AE52	3	4	2	9
AE53	3	4	2	9
AE54	3	4	2	9
AE55	3	4	2	9
AE56	3	4	2	9
AE57	3	4	2	9
AE58	3	4	2	9
AE59	3	4	2	9
AE60	2	5	2	9
total	128	218	113	459

Seven records of birds' remains were documented during the 459 searches under individual turbines during the 2020 spring migration of birds in the SNWF part of ISPB territory.

Table 6. Confirmed collision victims and species' conservation status as recorded during the 2020 spring migration period in SNWF territory

English name	Species name	Number of birds	Red Data Book	IUCN
Eurasian skylark	<i>Alauda arvensis</i>	4	not listed	Least Concern
Grey partridge	<i>Perdix perdix</i>	1	not listed	Least Concern
Common Starling	<i>Sturnus vulgaris</i>	1	not listed	Least Concern
Eurasian sparrowhawk	<i>Accipiter nisus</i>	1	not listed	Least Concern

No prospective case of collision with the turbines of a target bird species for the period of potential TSS application in ISPB required TSS initiation during the monitoring in spring 2020.

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 2020, 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 season 2020 (01.08 - 31.10.2020).

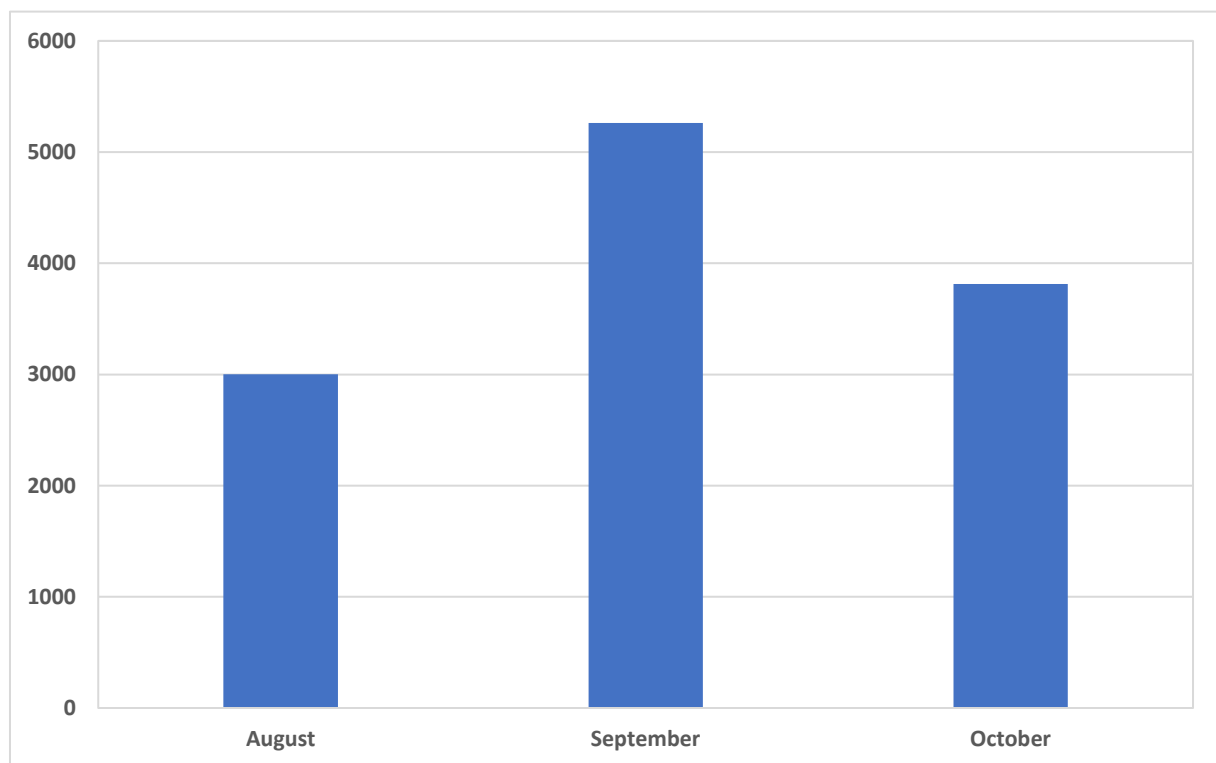


Figure 9. Number of registered birds by months during the autumn migration in the territory of ISPB.

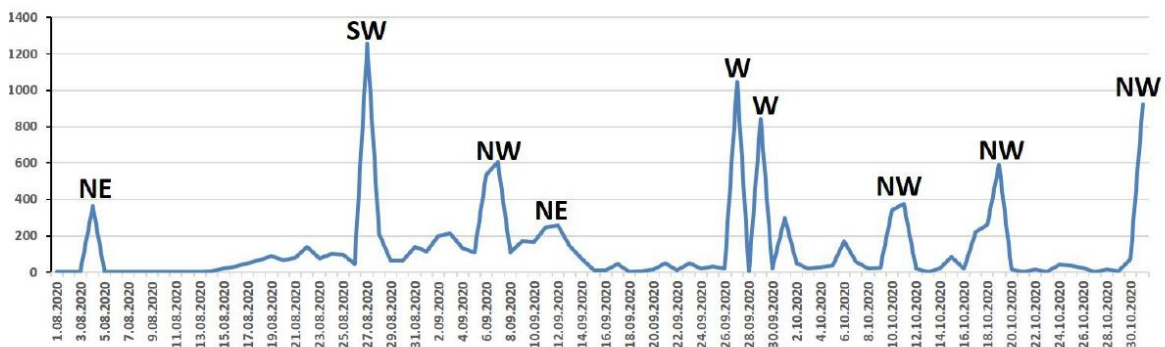


Figure 10. Dynamics of the autumn migration of the flying bird species in the ISPB territory according to visual observations during the period 01 August - 31 October 2020. Letters indicate the direction of wind in days with increased number of migrating birds.

The number of birds in the SNWF study area apparently depended on the direction of the wind in autumn 2020. Of the nine peak days with intense migratory flights of birds: in four, north-west winds prevailed, in two, west-wind, in two north-east wind and in only one day, the wind direction was south-west. (Figure 10).

The monitoring from 1 August to 31 October 2020 recorded 12079 individual birds, assigned to 40 bird species. The numbers of individuals recorded by species during autumn migration in two autumn seasons are shown in Table 7.

Table 7. Composition of species and number of registered birds over the period 01 August to 31 October 2020 in the ISPB territory.

Species name	Number	Species name	Number
<i>A. brevipes</i>	110	<i>C. pygargus</i>	60
<i>A. cinerea</i>	37	<i>F. columbarius</i>	1
<i>A. gentilis</i>	8	<i>F. peregrinus</i>	1
<i>A. heliaca</i>	2	<i>F. subbuteo</i>	38
<i>A. nipalensis</i>	1	<i>F. tinnunculus</i>	176
<i>A. nisus</i>	244	<i>F. vespertinus</i>	1215
<i>A. pennata</i>	40	<i>G. fulvus</i>	1
<i>A. pomarina</i>	22	<i>H. albicilla</i>	1
<i>B. buteo</i>	2965	<i>H. rustica</i>	1000
<i>B. lagopus</i>	15	<i>L. cachinnans</i>	1
<i>B. rufinus</i>	45	<i>M. apiaster</i>	3737
<i>C. aeruginosus</i>	264	<i>M. migrans</i>	20
<i>C. albus</i>	3	<i>M. milvus</i>	2
<i>C. ciconia</i>	1137	<i>P. apivorus</i>	96
<i>C. corax</i>	21	<i>P. carbo</i>	332
<i>C. cyaneus</i>	16	<i>P. crispus</i>	8
<i>C. gallicus</i>	59	<i>P. haliaetus</i>	3
<i>C. garrulus</i>	3	<i>P. leucorodia</i>	6
<i>C. macrourus</i>	13	<i>S. vulgaris</i>	360
<i>C. nigra</i>	13	<i>V. vanellus</i>	2

The most numerous migrating birds recorded in autumn 2020 were bee-eaters (*Merops apiaster*) with over 3,700 individuals registered. Within the soaring birds the most numerous birds recorded involved common buzzards (*Buteo buteo*), red-footed falcon (*Falco vespertinus*) and white storks (*Ciconia ciconia*) with over 1000 individuals of each species (Table 7). The common buzzards and red-footed falcon, the species with the highest recorded numbers, of over 1,200 individuals, were observed in short periods of time during the season.

As a result of the simultaneous observations of five constantly attended observation points with assistance from three radar systems (Figure 1) during the whole period of the autumn migration, only one stop of group of turbines in the territory of SNWF was ordered. The turbines in zones E and F (Figure 1) were stopped on 1 October 2020 to allow a Griffon vulture (*Gyps fulvus*) to

pass without risk of collision through the territory of SNWF. The turbines were stopped for the period between 14:38 – 15:09.

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 8.

Table 8. Number of checks for victims of collision in the territory of SNWF during the period 01 August-31 October 2020

Turbine	Aug.	Sep.	Oct.	Total
AE8	4	4	4	12
AE9	4	4	4	12
AE10	4	4	5	13
AE11	4	4	5	13
AE12	2	5	4	11
AE13	3	5	4	12
AE14	4	4	4	12
AE15	4	4	4	12
AE16	4	4	5	13
AE17	4	4	5	13
AE18	2	5	4	11
AE19	2	5	4	11
AE20	4	4	4	12
AE21	4	4	5	13
AE22	4	4	5	13
AE23	4	4	5	13
AE24	4	4	5	13
AE25	4	4	5	13
AE26	4	4	5	13
AE27	3	4	5	12
AE28	3	4	5	12
AE29	4	4	5	13
AE31	3	5	4	12
AE32	3	5	4	12
AE33	3	5	4	12
AE34	3	5	4	12
AE35	3	5	4	12

Turbine	Aug.	Sep.	Oct.	Total
AE36	4	4	4	12
AE37	2	5	4	11
AE38	4	4	4	12
AE39	4	4	4	12
AE40	4	4	5	13
AE41	4	4	5	13
AE42	4	4	5	13
AE43	4	4	5	13
AE44	4	4	5	13
AE45	3	4	5	12
AE46	2	5	4	11
AE47	2	5	4	11
AE48	2	5	4	11
AE49	2	5	4	11
AE50	3	5	4	12
AE51	4	4	4	12
AE52	4	4	4	12
AE53	4	4	4	12
AE54	4	4	4	12
AE55	5	4	4	13
AE56	4	4	4	12
AE57	4	4	4	12
AE58	4	4	4	12
AE59	4	4	4	12
AE60	3	5	4	12
Total	182	224	227	633

As a result of 633 searches under 52 individual turbines between 1 August and 31 October 2020 a total of seven dead birds of six species were identified as being victims of collision. One Grey partridge (*Perdix perdix*) was found on 13 August 2020, one Marsh harrier (*Circus aeruginosus*) was found on 19 August 2020, one Common swift (*Apus apus*) was found on 20 August 2020, one

Common kestrel (*Falco tinnunculus*) was found on 28 August 2020, one Mediterranean gull (*Larus melanocephalus*) was found on 30 August 2020 and two Calandra Larks (*Melanocorypha calandra*) were found on 31 August 2020. All bird species are Least Concern category according to IUCN evaluation and so are not the focus of species' conservation criteria. All species for which collision victims were found are numerous and the additional mortality caused by wind turbines would not impact the wider population numbers. All species are not among the target ISPB species. In the case of collision mortality monitoring in SNWF, no case of collision with turbines of target bird species was identified in autumn 2020.

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 of order Ciconiiformes, Pelecaniformes, Falconiformes, Gruiformes 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 2020, 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 the Ornithology of the American Ornithological Society for 2016 - The Cooper Ornithological Society. 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. 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.

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.

➤ **Janko Jankov - Field ornithologist**

Student in Biology, University of Shumen. Over seven years of experience in impact monitoring of birds in Wind Park projects in NE Bulgaria. Member of BSPB.

➤ **Nikolay Velichkov - Field ornithologist**

Field studies of the distribution and number of breeding bird species ENVEKO, Inspection of use of pesticides and pedigrees in the framework of the project "Urgent measures for the protection of the Egyptian Vulture (*Neophron percnopterus*) BSPB".

Monitoring the migration of birds species composition and the number of nesting fauna 2007-2012 "Ecotan" EOOD. 10 years of experience in impact monitoring study of wind turbines in the study area

➤ **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 the migration of birds species composition and the number of nesting fauna 2007-2012 "Ecotan" EOOD. 10 years of experience in impact monitoring study of wind turbines in the study area

➤ **Rusi Todorov Ivanov - Field ornithologist**

Bulgarian Swiss Program for Biodiversity Conservation - Bourgas Wetlands Project 1998 - 2004 mid-winter census of water birds 1998 - 2005 - BSPB. Monitoring of the ornithofauna of Burgas wetlands - monthly 1998 - 2005 2011 ECOTAN -Monitoring during the breeding season of the Imperial Eagle (*A. heliaca*) - Sladun village. 2011 Monitoring of the flying birds during the autumn migration of the reserve At. lake. ECOTAN. Study of the spatial migration of *L. michahellis* by marking with colored rings. - GICB 2010 - 2018 2011 -2013d Mapping and Determination of the Conservation Status of Natural Habitats and Species - Phase 1, Lot 7 - Determination and Minimization of Risks for Wild Birds. Union Econet - MOEW

➤ **Jelyazko Dimitrov 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.

➤ **Dimitar Jelyazkov Dimitrov - Field ornithologist**

Student in Biology at Sofia University Kliment Ohridski. Field activities - participation in a number of field studies - monitoring of some important zones on the territory of Bulgaria. (Durankulak lake and the Shabla lake complex (2010 - 2013) and the Soil Field (2014-2017),

regular winter monitoring of waterfowl in Shabla and Durankulak Lake in connection with the Life + project (2011 - 2017), monitoring of *Spermophilus cittelus* in the reintroduced colony near Kotel (2017), census of cetacean mammals on the northern Black Sea coast with ECO-Nord association, voluntary eye initiatives on reintroduction of the griffon vulture in the Kresna Gorge.

➤ **Boyan Michev - Field ornitologist**

PhD student at the Institute of Biodiversity and Ecosystem Research - BAS. He works in Risk Assessment and Conservation Biology department. Expert in the use of radars to study bird migration. Member of the European Migration Tracking Network through meteorological radars.