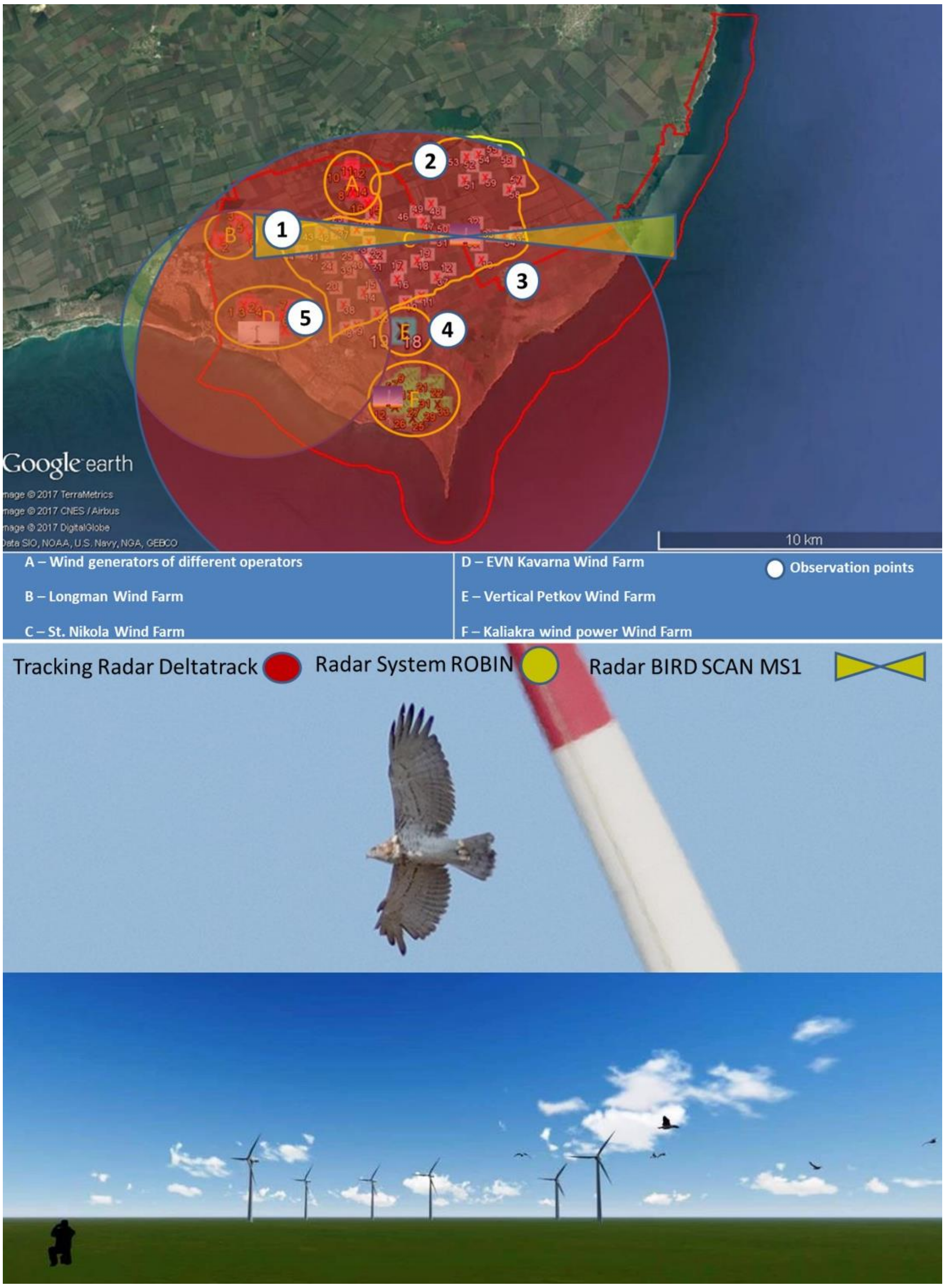
INTEGRATED SYSTEM FOR PROTECTION OF BIRDS

Summary of Activities and the Results of Ornithological Monitoring in the Integrated System for Protection of Birds, 2022



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Introduction

Integrated System for Protection of Birds (ISPB) 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 ornithological monitoring of ISPB is a 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 in 2022.

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/.

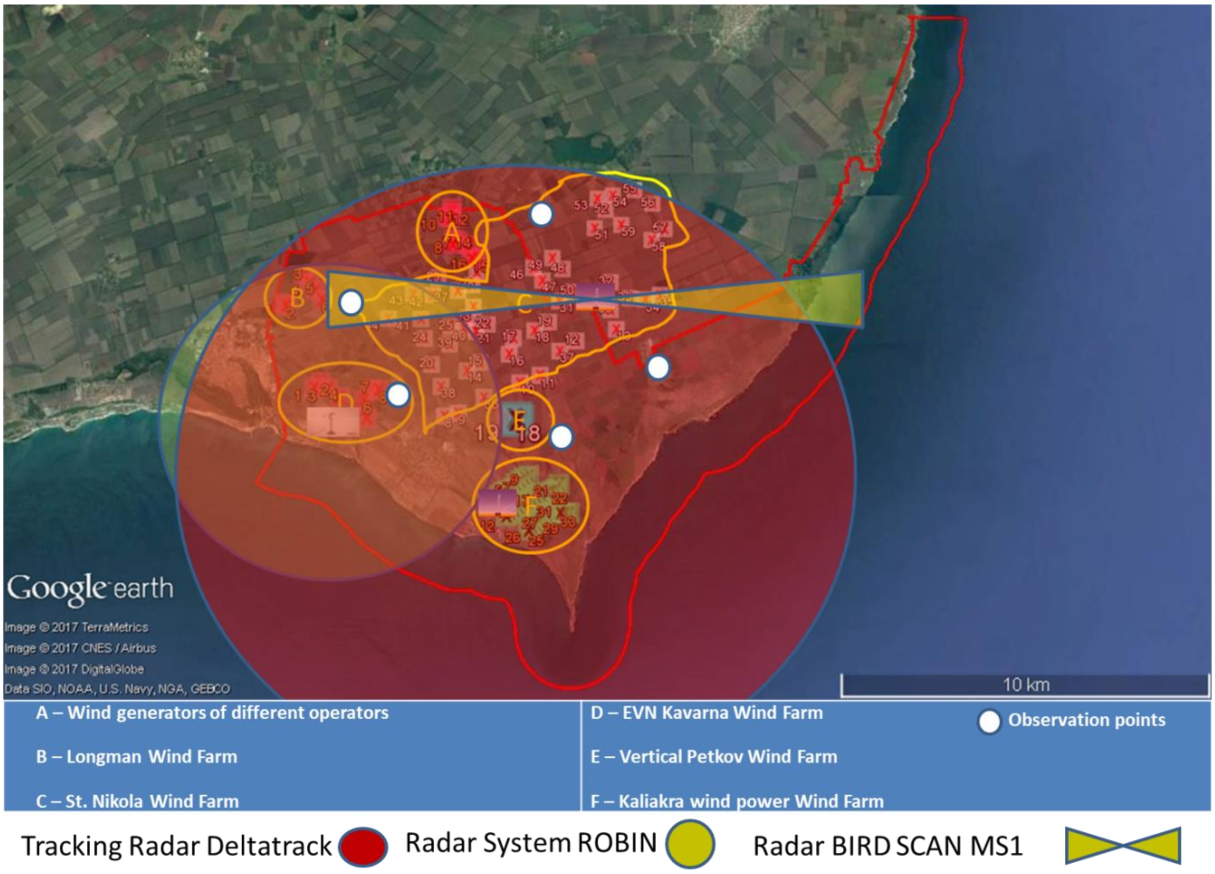

Figure 1. A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.

In order to provide objective data for the bird risk assessment, this summary presents activities and results of the monitoring in 2022.

The activities were supervised and coordinated by Prof. Dr. Pavel Zehtindjiev - 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; more than 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 an air volume of around 10 km^3 (https://youtu.be/-Kb70clGHOQ?t=2) (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, 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 (white dots).

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

Results

Monitoring of geese in Winter 2021-2022

The 90 days of the study encompassed the whole period when geese were recorded in the region during 2021-2022.

Total number of observed goose species and their numbers

In total very low numbers of geese of all observed species were present in the ISPB territory during the winter 2021-2022. According to the coordinated counting of the wintering geese in Ukraine, southeastern Romania and Bulgaria, the numbers of the wintering geese is lowest in Bulgaria. (https://bspb.org/en/over-500-000-greater-white-fronted-geese-counted-in-february/)

No flocks of geese were observed in December 2021 and February 2022.

Spatial distribution of feeding geese in the ISPB territory

The only flock of geese tracked and confirmed visually is presented in a map below, which was away from the turbines in ISPB (Figure 2). Due to the low number of wintering geese in this winter spatial analysis was not possible. More detailed analysis of the feeding preferences of wintering geese in ISPB territory are presented in previous reports available at the web site of ISPB. https://kaliakrabirdmonitoring.eu/Report_Winter 2018-2019,
https://kaliakrabirdmonitoring.eu/Report Winter 2019-2020,
https://kaliakrabirdmonitoring.eu/Report_Winter 2020-2021,
https://kaliakrabirdmonitoring.eu/Report_Winter_2021-2022

Figure 2. *Mixed flock of GWFG (Anser albifrons) and RBG (Branta ruficollis) (Green) observed during the monitoring period in winter 2021-2022 in ISPB territory.*

Carcass monitoring results

All 114 turbines were programmed to be searched every seventh day in the periods of autumn and spring migration as well as during the wintering period of geese. The rest of the time during the whole year every turbine was searched once per month if the areas under turbines were accessible. During the winter monitoring (subject of this report) all 114 turbines were searched for carcasses during the whole winter survey period (01 December 2021 –28 February 2022) when more birds were at risk of collision. The frequencies of searches are presented in Table 1.

Table 1. *Number of searches per turbine during the winter monitoring 2021-2022*

Turbine code	December	January	February	Total
ABBalgarevo	3	4	4	11
ABГ1	2	5	4	11
ABГ2	2	5	4	11
ABГ3	2	5	4	11
ABГ4	2	5	4	11
ABMillenium group	5	6	6	17
ABMillenium group Mikon	1	2	2	5
AE10	3	4	4	11
AE11	3	4	4	11
AE12	2	3	4	9
AE13	2	4	4	10
AE14	2	5	4	11
AE15	2	5	4	11
AE16	3	4	4	11
AE17	3	4	4	11
AE18	2	3	4	9
AE19	2	3	4	9
AE20	2	5	4	11
AE21	3	4	4	11
AE22	3	4	4	11
AE23	3	4	4	11
AE24	2	5	4	11
AE25	2	5	4	11
AE26	3	4	4	11
AE27	3	4	4	11
AE28	3	4	4	11
AE29	2	5	4	11
AE31	2	4	4	10
AE32	2	4	4	10
AE33	2	4	4	10
AE34	2	4	4	10
AE35	2	4	4	10
AE36	2	5	4	11
AE37	2	3	4	9
AE38	2	5	4	11
AE39	2	5	4	11
AE40	2	5	4	11
AE41	2	5	4	11
AE42	2	5	4	11
AE43	2	5	4	11
AE44	2	5	4	11
AE45	3	4	4	11
AE46	2	3	4	9
AE47	2	3	4	9
AE48	2	3	4	9
AE49	2	3	4	9
AE50	2	4	4	10
AE51	2	4	4	10
AE52	2	4	4	10
AE53	2	4	4	10
AE54	2	4	4	10
AE55	2	4	4	10
AE56	2	4	4	10
AE57	2	4	4	10
AE58	2	4	4	10
AE59	2	4	4	10
AE60	2	4	4	10
AE8	2	5	4	11
AE9	2	5	4	11
DBГ1	2	5	4	11
DBГ1HSW250	2	5	4	11
DBГ2	2	5	4	11
DBГ2MN600	2	5	4	11
DBГ3	2	5	4	11
DBГ4	3	4	4	11
DBГ5	3	4	4	11

Turbine code	December	January	February	Total
DC1	3	4	4	11
DC2	3	4	4	11
E00	3	4	4	11
E01	2	5	4	11
E02	2	5	4	11
E04	2	5	4	11
E05	2	5	4	11
E07	2	5	4	11
E08	2	5	4	11
E09	3	4	4	11
M1	3	4	4	11
M10	2	4	4	10
M11	2	4	4	10
M12	2	4	4	10
M13	2	4	4	10
M14	2	4	4	10
M15	2	4	4	10
M16	2	4	4	10
M17	2	4	4	10
M18	2	4	4	10
M19	2	4	4	10
M2	3	4	4	11
M20	2	3	4	9
M21	2	3	4	9
M22	2	3	4	9

Turbine code	December	January	February	Total
M23	2	3	4	9
M24	2	3	4	9
M25	2	3	4	9
M26	2	3	4	9
M27	2	3	4	9
M28	2	4	4	10
M29	2	4	4	10
M3	3	4	4	11
M30	2	4	4	10
M31	2	4	4	10
M32	2	4	4	10
M33	2	4	4	10
M34	2	4	4	10
M35	2	4	4	10
M4	2	4	4	10
M5	2	4	4	10
M6	2	4	4	10
M7	2	4	4	10
M8	2	4	4	10
M9	2	4	4	10
VP1	3	4	4	11
VP2	3	4	4	11
ABZevs	2	5	4	11
Grand Total	**253**	**472**	**456**	**1181**

Systematic searches under 114 turbines covered by ISPB (Table 1) in the period 01 December 2021 – 28 February 2022 resulted in four intact carcases which can be associated with collision with wind turbines. Details of the collision victims recorded in the ISPB during winter 2021-2022 are presented in Table 2.

Table 2. *Collision victims in ISPB in winter 2021-2022.*

Date	**Latin name**	**number**	**Red Data book**	**IUCN**
13.12.2021	*Sturnus vulgaris*	1	Not Listed	Least Consern
02.01.2022	*Accipiter nisus*	1	Endangered	Least Consern
23.01.2022	*Perdix perdix*	1	Not Listed	Least Consern
03.02.2022	*Pluvialis apricaria*	1	Not Listed	Least Consern

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 1181 searches under 114 turbines in the period 01 December 2021 – 28 February 2022. Therefore, no evidence for collision of any goose species, including RBG, has been found in the winter 2021 – 2022 when geese were potentially present, and turbines were operating.

There were no circumstances in the 2021-2022 winter which required the Turbine Shutdown System (TSS).

Experiment on the carcass removal rate: winter 2021-2022.

Such a winter trial at SNWF was first conducted in February 2010 using 25 domestic duck carcasses placed around five turbines. The results of the 2010 trial were very similar to the 2016 trial so far as carcass persistence rate was concerned, despite the difference in the carcass species. The new trial also confirmed that carcasses were apparently removed quicker in winter than in autumn: see several trial results reported in previous autumn monitoring reports: http://www.aesgeoenergy.com/site/Studies.html.

Table 3. *Periodicities for scavenging or removal of carcasses in winter 2021-2022*

Day after corpses disposal	AE39	AE41	E02	E04	M5	M6	Total number of chickens
0th day	5	5	5	5	5	5	**30**
1st day	4	1	5	4	3	5	22
2nd day	0	0	0	1	2	0	3
3rd day	0	0	0	0	0	0	0
4th day	0	4	0	0	0	0	4
5th day	0	0	0	0	0	0	0

The winter 2022 experiment showed higher scavenging (or otherwise removal) rate of carcasses in the ISPB in comparison to those previously estimated in experiments conducted. It could be explained by the increased number of scavengers in the variable habitats which are included in the ISPB.

Taking into account the previous results of searchers' efficiency which varied between 80 and 93 percent of the experimentally allocated dead chickens and a relatively higher scavenging rate, we have maintained a searching frequency of once per week on each of 114 turbines protected in the territory of ISPB. This frequency is the same as applied in previous monitoring periods in a part of the territory (SNWF) and allows comparision of the results in the long-term. Despite the higher scavenging rate discovered by the 2022 experiment we decided to keep the frequency of the searches at seven days. Practically, this allows coverage with the available resources of experienced ornithologists across all the 114 turbines included in ISPB. Even with increased scavenging rate, this frequency of seven days is also sufficient to allow the estimation of the 'real' mortality, via analyses noted later.

Additionally, to date there has been no indication of any target species' population being remotely affected by collision mortality, as revealed by the numerous weekly searches under all the turbines in last four years within the ISPB study area. An increased frequency of search effort may be suggested superficially by the winter 2022 trials with 30 chickens. That superficial indication, however, would only be valid if there was any substantive data from collision fatality data on which any potential search biases should or could apply. After many thousands of searches for dead geese as collision victims the total is still zero.

To date, there are no indications of any substantive collision fatality estimates to which corrective factors through searcher efficiency or carcass removal could reasonably apply. In other words, correcting fatality-zeroes is analytically fraught, and will not contribute towards or much-alter the basic finding – undertaken with a relatively frequent search regime of 7 d under every turbine, with no individual of a target species being found as a collision casualty, to date.

Some may argue that there is some circularity in this view, such that if the basic search regime is insufficiently frequent to record collision fatalities of target species, then they will not be recorded. However, this argument can be dismissed in this programme because of the basic necessity for the number of fatalities which would have to be recorded to create an adverse population impact for the target species. The recording of such a fatality level is well within the realms of the search programme to detect potentially adverse levels, and any potential biases (even if detection of fatalities may be lowered by the winter 2022 searcher/removal trial).

Conclusions: wintering geese 2021-2022

The relatively mild 2021-2022 winter is probably the main reason for low number of observed only one flock of geese in ISPB territory.

Daily observations from December 2021 to February 2022 (inclusive) revealed that the geese were present in one day in ISPB territory. This day is in a short time period within the winter, which was essentially the same as already established in 2020 and 2021 winter monitoring of the same territory as well as studies 2008 – 2019 in a part of the ISPB territory (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 of relatively distant roosting sites to ISPB territory of wintering geese at the two fresh water lakes used for roosting – Durankulak and Shabla.

114 wind turbines covered by ISPB were not a source of collision mortality for wintering geese, even though they could fly through or feed within turbines of ISPB territory (this was not recorded in the 2021-2022 winter). 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 2021-2022 winter but also in any of the 14 winters when all 114 turbines or 52 turbines at SNWF (part of ISPB) has been operational and searched systematically every winter season.

No displacement (disturbance) reaction from geese has been observed for the period 2008-2022 as a result of construction and operation of wind turbines in the ISPB 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.

From research associated directly with ISPB described in the present and previous reports (and see previous SNWF winter reports on the AES Geo Energy website, and earlier surveys from this part of the same territory) the area continues to be a potential 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, the investigated 114 wind turbines present 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.

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 2022. For the survey period, a total of 3779 migratory and resident birds were registered in spring 2022 (Table 4)

Table 4. *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 2022
15-31 March	1490
1-30 April	996
1-15 May	1293
Total for the period	**3779**

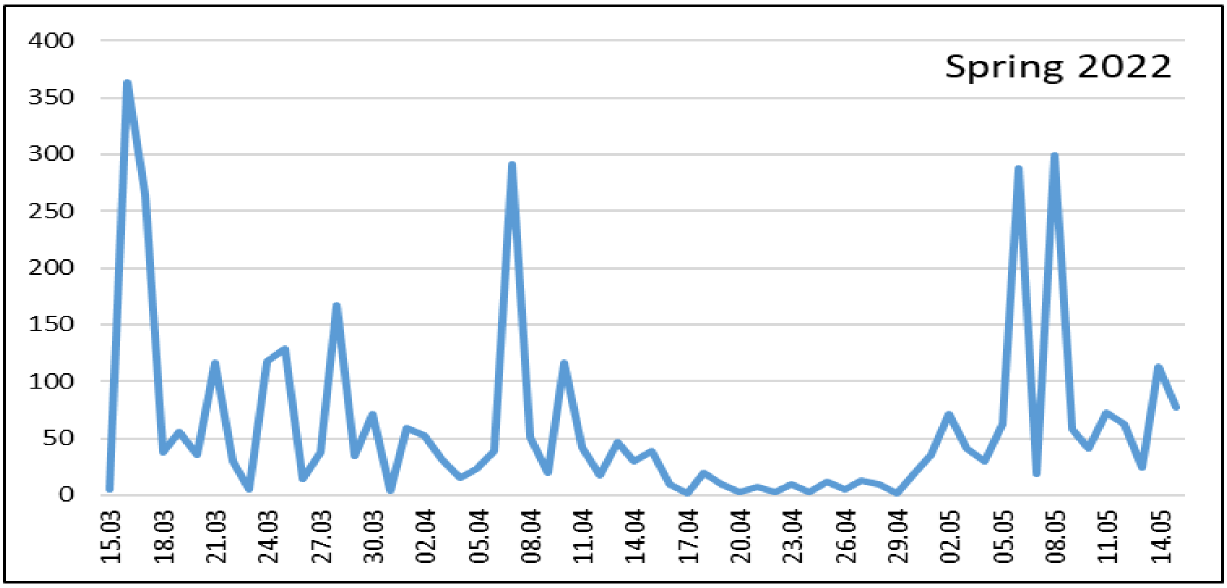

Figure 3. *Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2022*

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 four 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 total number of observed birds in the ISPB territory in spring 2022, was over twice that observed in spring 2018, 2020 and 2021 and almost equal to the number of birds observed in spring 2019.

Table 5. *Composition and number of registered bird species during the period 15 March - 15 May 2022 in the ISPB territory.*

Species name	*Number of birds*
A. apus	*35*
A. arvensis	*52*
A. campestris	*4*
A. cinerea	*13*
A. gentilis	*4*
A. heliaca	*1*
A. melba	*20*
A. nisus	*10*
A. palustris	*1*
A. pomarina	*1*
A. purpurea	*2*
A. querquedula	*170*
B. buteo	*142*

Species name	*Number of birds*
B. oedicnemus	*8*
B. rufinus	*14*
B. stelaris	*2*
C. aeruginosus	*35*
C. brachidactyia	*9*
C. canorus	*13*
C. carduelis	*2*
C. ciconia	*39*
C. corax	*21*
C. cornix	*16*
C. cyaneus	*24*
C. frugilegus	*45*
C. gallicus	*7*

Species name	*Number of birds*
C. garrulus	*1*
C. hybrida	*12*
C. livia	*60*
C. macrourus	*2*
C. monedula	*27*
C. oenas	*56*
C. palumbus	*16*
C. pygargus	*5*
D. urbicum	*35*
E. calandra	*2*
E. melanocephala	*1*
F. coeleps	*21*
F. peregrinus	*1*
F. subbuteo	*6*
F. tinnunculus	*56*
F. vespertinus	*12*
G. cristata	*6*
G. grus	*1*
G. nilotica	*1*
H. rustica	*52*
L. arborea	*5*
L. canabina	*2*
L. colurio	*2*
L. michahellis	*187*
L. minor	*4*
L. senator	*1*

Species name	*Number of birds*
M. alba	*35*
M. apiaster	*223*
M. calandra	*9*
M. flava	*13*
M. migrans	*1*
N. arquata	*1*
O. isabellina	*7*
O. oriolus	*11*
P. apivorus	*2*
P. apricaria	*36*
P. carbo	*596*
P. colchicus	*2*
P. falcinellus	*2*
P. hispeniolensis	*2*
P. onocrotalus	*33*
P. porzana	*1*
P. pugnax	*3*
S. decaocto	*12*
S. rubetra	*1*
S. turtur	*6*
S. vulgaris	*1507*
T. erythropus	*1*
T. philomelos	*1*
U. epops	*10*
Number of species	***76***

In total 76 bird species were observed in ISPB territory in the fifth spring season of study. The most numerous birds in spring migratory seasons in the region were Great cormorant (*Phalacrocorax carbo*), Common starling (*Sturnus vulgaris*) and some birds of prey – Common buzzards (*Buteo buteo*), Red-footed falcon (*Falco vespertinus*), Common kestrels (*Falco tinnunculus*) and Marsh harriers (*Circus aeruginosus*) (Table 5). During the spring migration monitoring 2022, 33 White pelicans (*Pelecanus onocrotalus*) were observed on the territory of ISBP, unlike observations in the 2020 and 2021 seasons, when only one white pelican was recorded.

Between 24 and 205 White storks (*Ciconia ciconia*) passed over the surveyed territory in the five 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 https://tethys.pnnl.gov/sites/default/files/publications/Shurulinkov-et-al-2012.pdf), 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 again 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.

No stops of turbines were ordered under the Turbine Shutdown System (TSS) during the spring migration period of 2022. 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 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/. Given the substamtially lower number of birds recorded during spring migration surveys, compared with autumn migration, the autumn tests on carcass recovery biases are as applicable as calibrations, if not more so, to turbine searches for collision casualties in spring.

Table 6. *Number of turbines searched for collision victims in the territory of ISPB during the period 15 March-15 May 2022. The name of the wind farm operators and the number of the turbines used in the table: AE8/60 - AES Geo Energy Ltd., M1/35 - Kaliakra Wind Power, E1/8 - EVN Kavarna, DC1/2 - Degrets OOD, DBГ1/5 - Disib OOD, DBГ2MN600/DBГ1HSW250 - Windex OOD, ABГ4 - Long Man Invest OOD, ABBalgarevo - Long Man Energy OOD, ABЗевс - Zevs Bonus OOD, VP1/2 - Vertikal-Petkov&Sie SD, ABГ3 - Wind Park Kavarna East EOOD, ABГ1/2 - Wind Park Kavarna West EOOD, AB Millennium Group Micon/ AB Millennium Group-Millennium Group OOD*

Turbine number	March 2022	April 2022	May 2022	Total
ABBalgarevo	2	5	2	9
ABГ1	2	4	3	9
ABГ2	2	4	3	9
ABГ3	2	4	3	9
ABГ4	2	4	3	9
AB Millennium Group	4	6	3	13
AB Millennium Group Micon	2	2	1	5
AE10	2	5	2	9
AE11	2	5	2	9
AE12	3	4	2	9
AE13	3	4	2	9
AE14	2	4	3	9
AE15	2	4	3	9
AE16	2	5	2	9
AE17	2	5	2	9
AE18	3	4	2	9
AE19	3	4	2	9
AE20	2	4	3	9
AE21	2	5	2	9
AE22	2	5	2	9
AE23	2	5	2	9
AE24	2	5	2	9
AE25	2	5	2	9
AE26	2	5	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	4	3	9
AE37	3	4	2	9
AE38	2	4	3	9
AE39	2	4	3	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	3	4	2	9
AE47	3	4	2	9
AE48	3	4	2	9
AE49	3	4	2	9
AE50	3	4	2	9
AE51	2	4	2	8
AE52	2	4	2	8
AE53	2	4	2	8
AE54	2	4	2	8
AE55	2	4	2	8
AE56	2	4	2	8
AE57	2	4	2	8
AE58	2	4	2	8

Turbine number	March 2022	April 2022	May 2022	Total
AE59	2	4	2	8
AE60	3	4	2	9
AE8	2	4	3	9
AE9	2	4	3	9
DBГ1	2	4	3	9
DBГ1HSW250	2	5	2	9
DBГ2	2	4	3	9
DBГ2MN600	2	5	2	9
DBГ3	2	4	3	9
DBГ4	3	4	2	9
DBГ5	3	4	2	9
DC1	3	4	2	9
DC2	3	4	2	9
E00	2	5	2	9
E01	2	5	2	9
E02	2	5	2	9
E04	2	5	2	9
E05	2	5	2	9
E07	2	5	2	9
E08	2	5	2	9
E09	2	5	2	9
M1	2	5	2	9
M10	3	4	2	9
M11	3	5	2	10
M12	3	4	2	9
M13	3	4	2	9
M14	3	4	2	9
M15	3	4	2	9
M16	3	4	2	9
M17	3	4	2	9

Turbine number	March 2022	April 2022	May 2022	Total
M18	3	4	2	9
M19	3	4	2	9
M2	2	5	2	9
M20	3	4	2	9
M21	3	4	2	9
M22	3	4	2	9
M23	3	4	2	9
M24	3	4	2	9
M25	3	4	2	9
M26	3	4	2	9
M27	3	4	2	9
M28	2	4	2	8
M29	2	4	2	8
M3	2	5	2	9
M30	2	4	2	8
M31	2	4	2	8
M32	2	4	2	8
M33	2	4	2	8
M34	2	4	2	8
M35	2	4	2	8
M4	3	4	2	9
M5	3	4	2	9
M6	3	4	2	9
M7	3	4	2	9
M8	3	4	2	9
M9	3	4	2	9
VP1	2	5	2	9
VP2	2	5	2	9
ABZevs	2	4	3	9
Grand Total	**277**	**489**	**244**	**1010**

Four records of dead birds after collision with wind turbines were documented during the 2022 spring migration of birds in ISPB territory (Table 7). 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 2022 (the target species are listed at https://kaliakrabirdmonitoring.eu/).

***Table 7**. Confirmed collision victims and species' conservation status as recorded during the 2022 spring migration period.*

English name	*Species name*	*Number of birds*	*Red Data Book*	*IUCN*
Skylark	*Alauda arvensis*	*1*	*Not listed*	*LC*
Common Starling	*Sturnus vulgaris*	*1*	*Not listed*	*LC*
Grey Partridge	*Perdix perdix*	*1*	*Not listed*	*LC*
Common Buzzard	*Buteo buteo*	*1*	*Not listed*	*LC*

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 spring bird migration in NE Bulgaria.

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

During 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 114 wind turbines.

The data presented in this report confirmed the absence of any adverse impact on sensitive bird species of the orders 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 ISPB area during spring 2022, 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.

Autumn migration

During the autumn monitoring, observations were made during all 92 days of the season 2022 (01.08-31.10.2022).

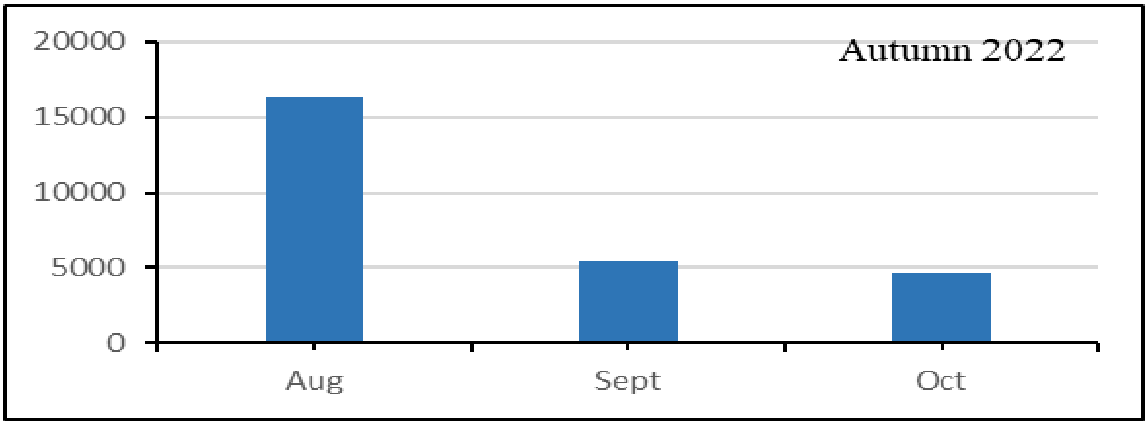

Figure 4. *Number of registered birds by months during the autumn migration in the territory of ISPB.*

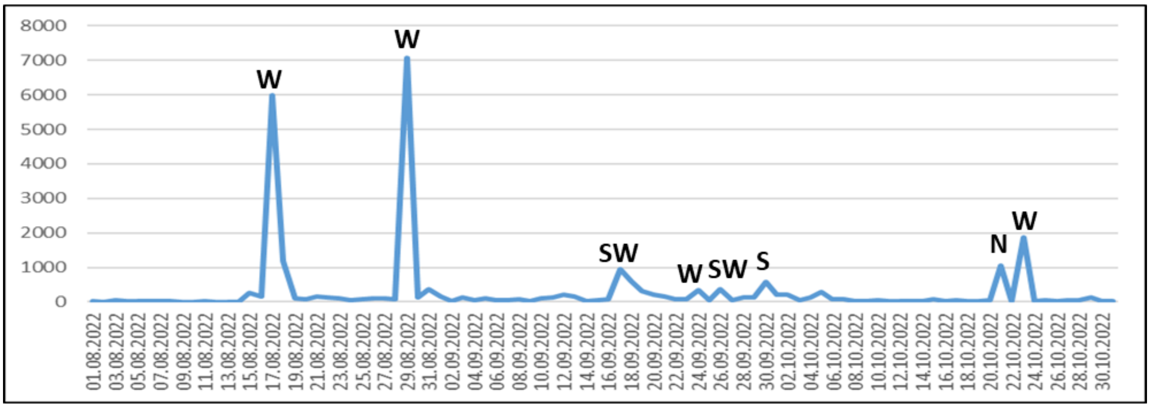

Figure 5. *Dynamics of the autumn migration of the flying bird species in the ISPB territory according to visual observations during the period 01 August - 31 October 2022. Letters indicate the direction of wind in days with increased number of migrating birds.*

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 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 2022 recorded 26437 individual birds, assigned to 48 bird species. The numbers of individuals recorded by species during autumn migration in 2022 are shown in Table 8.

Table 8. *Composition of species and number of registered birds over the period 01 August to 31 October 2022 in the ISPB territory.*

Species name	***Number***
A. apus	*88*
A. brevipes	*175*
A. cinerea	*3*
A. gentilis	*9*
A. heliaca	*1*
A. nisus	*144*
A. otus	*1*
A. pennata	*31*
B. buteo	*720*
B. lagopus	*2*
B. rufinus	*35*
C. aeruginosus	*321*
C. ciconia	*14249*
C. clanga	*2*
C. corax	*15*
C. cornix	*21*
C. cyaneus	*11*
C. frugilegus	*119*
C. gallicus	*67*
C. garrulus	*8*
C. macrourus	*9*
C. monedula	*37*
C. nigra	*39*
C. oenas	*48*

Species name	***Number***
C. palumbus	*1002*
C. pomarina	*124*
C. pygargus	*53*
E. calandra	*57*
F. peregrinus	*1*
F. subbuteo	*55*
F. tinnunculus	*311*
F. vespertinus	*19*
G. fulvus	*2*
G. gallinago	*4*
G. grus	*18*
L. melanocephalus	*1800*
L. michahellis	*1119*
M. apiaster	*4375*
M. migrans	*30*
P. apivorus	*371*
P. carbo	*114*
P. crispus	*5*
P. haliaetus	*7*
P. leucorodia	*10*
P. onocrotalus	*695*
P. roseus	*102*
S. decaocto	*5*
S. turtur	*3*

The most numerous migrating birds recorded in autumn 2022 were white storks (*Ciconia ciconia*) with over 14,000 individuals registered, but this included a single flock of 7000 registered 3000 m away from the wind farm area. This relatively big flock of white storks passed near by the ISPB on 20th August 11:30 AM under a westerly wind. In the second part of the same day the wind direction changed to S and intensity of bird migration decreased suddenly. Among the other soaring birds, the most numerous recorded birds were common buzzards (*Buteo buteo*) and great white pelicans (*Pelecanus onocrotalus*) with around 700 individuals of each species (Table 8). Six new species were recorded in autumn 2022. The newly observed species were long-eared owl (*Asio otus*), greater spotted eagle (*Clanga clanga*), corn bunting (*Emberiza calandra*), turtle dove (*Streptopelia turtur*), Eurasian collared dove (*Streptopelia decaocto*) and common snipe (*Gallinago gallinago*). Three of the new species, turtle dove, Eurasian collared dove and corn bunting are common species usually observed in villages throughout the country. The fact they appeared in the observations this autumn is probably due to some changes in the crops near by the observation point visited by the species in the period of our study.

As a result of the simultaneous observations at five constant observation points and three radar systems (Figure 1) during the whole period of the 2022 autumn migration, there were one stop of two groups of turbines (SNWF) and four complete wind farms (KWP and EVN) 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 9.

***Table 9**. Data for stops of wind turbines ordered by field observers during the autumn migration of birds 2022.*

Date	*Wind Farm*	*Turbine code №/ Group*	*Species*	*Number of birds*	*Time stop*	*Time restart*
17.09.2022	*SNWF*	*E and F zones*	*G. fulvus*	*1*	*10:58:00*	*11:42:00*
17.09.2022	*EVN*	*-*	*G. fulvus*	*1*	*11:02:00*	*11:42:00*
19.09.2022	*KWP*	*-*	*P. onocrotalus*	*23*	*09:34:00*	*09:43:00*
19.09.2022	*EVN*	*-*	*P. onocrotalus*	*23*	*09:34:00*	*09:43:00*
19.09.2022	*EVN*	*-*	*P. onocrotalus*	*1*	*10:24*	*10:49*
			G. fulvus	*1*		

According to additional previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF, a weekly search regime provides for a cost-effective method, which can also be calibrated, to discover any bird strike fatalities which may be of concern.

***Table 10.** Number of turbines searched for collision victims in the territory of ISPB during the period 01 August to 31 October 2022. The name of the wind farm operators and the number of the turbines used in the table: AE8/60 - AES Geo Energy Ltd., M1/35 - Kaliakra Wind Power, E1/8 - EVN Kavarna, DC1/2 - Degrets OOD, DBΓ1/5 - Disib OOD, DBΓ2MN600/DBΓ1HSW250 - Windex OOD, ABΓ4 - Long Man Invest OOD, ABBalgarevo - Long Man Energy OOD, AB3eвс - Zevs Bonus OOD, VP1/2 - Vertikal-Petkov&Sie SD, ABΓ3 - Wind Park Kavarna East EOOD, ABΓ1/2 - Wind Park Kavarna West EOOD, AB Millennium group Micon/ AB Millennium group - Millennium Group OOD.*

Turbine	**Aug.**	**Sep.**	**Oct.**	**Total**
ABBalgarevo	3	5	4	12
ABΓ1	3	4	5	12
ABΓ2	3	4	5	12
ABΓ3	3	4	5	12
ABΓ4	3	4	5	12
ABMillenium group	5	7	6	18
ABMillenium group Micon	1	3	2	6
AE10	3	5	4	12

Turbine	**Aug.**	**Sep.**	**Oct.**	**Total**
AE11	3	5	4	12
AE12	4	4	4	12
AE13	4	4	4	12
AE14	3	4	5	12
AE15	3	4	5	12
AE16	3	5	4	12
AE17	3	5	4	12
AE18	4	4	4	12
AE19	4	4	4	12

Turbine	Aug.	Sep.	Oct.	Total
AE20	3	4	5	12
AE21	3	5	4	12
AE22	3	5	4	12
AE23	3	5	4	12
AE24	3	4	5	12
AE25	3	4	5	12
AE26	3	5	4	12
AE27	3	5	4	12
AE28	3	5	4	12
AE29	3	4	5	12
AE31	4	4	4	12
AE32	4	4	4	12
AE33	4	4	4	12
AE34	4	4	4	12
AE35	4	4	4	12
AE36	3	4	5	12
AE37	4	4	4	12
AE38	3	4	5	12
AE39	3	4	5	12
AE40	3	4	5	12
AE41	3	4	5	12
AE42	3	4	5	12
AE43	3	4	5	12
AE44	3	4	5	12
AE45	3	5	4	12
AE46	4	4	4	12
AE47	4	4	4	12
AE48	4	4	4	12
AE49	4	4	4	12
AE50	4	4	4	12
AE51	4	4	5	13
AE52	4	4	5	13
AE53	4	4	5	13
AE54	4	4	5	13
AE55	4	4	5	13
AE56	4	4	5	13
AE57	4	4	5	13
AE58	4	4	5	13
AE59	4	4	5	13
AE60	4	4	4	12
AE8	3	4	5	12
AE9	3	4	5	12
DBГ1	3	4	5	12
DBГ1HSW250	3	4	5	12
DBГ2	3	4	5	12
DBГ2MN600	3	4	5	12
DBГ3	3	4	5	12

Turbine	Aug.	Sep.	Oct.	Total
DBГ4	3	5	4	12
DBГ5	3	5	4	12
DC1	3	5	4	12
DC2	3	5	4	12
E00	3	5	4	12
E01	3	4	5	12
E02	3	4	5	12
E04	3	4	5	12
E05	3	4	5	12
E07	3	4	5	12
E08	3	4	5	12
E09	3	5	4	12
M1	3	5	4	12
M10	3	5	4	12
M11	3	5	4	12
M12	4	4	4	12
M13	4	4	4	12
M14	4	4	4	12
M15	4	4	4	12
M16	4	4	4	12
M17	4	4	4	12
M18	4	4	4	12
M19	4	4	4	12
M2	3	5	4	12
M20	4	4	4	12
M21	4	4	4	12
M22	4	4	4	12
M23	4	4	4	12
M24	4	4	4	12
M25	4	4	4	12
M26	4	4	4	12
M27	4	4	4	12
M28	4	4	5	13
M29	4	4	5	13
M3	3	5	4	12
M30	4	4	5	13
M31	4	4	5	13
M32	4	4	5	13
M33	4	4	5	13
M34	4	4	5	13
M35	4	3	5	12
M4	3	5	4	12
M5	3	5	4	12
M6	3	5	4	12
M7	3	5	4	12
M8	3	5	4	12
M9	3	5	4	12

Turbine	Aug.	Sep.	Oct.	Total
VP1	3	5	4	12
VP2	3	5	4	12

Turbine	Aug.	Sep.	Oct.	Total
ABZevs	3	4	5	12
Grand Total	**391**	**488**	**505**	**1384**

As a result of 1384 single inspections of 114 individual turbines between 1 August and 31 October 2022, a total of 16 dead birds of eight species were identified. The numbers of identified collision victims by species are given in Table 11.

Table 11. *Victims of collision with turbines during the autumn migration period in 2022 according to the Red Data Book for Bulgaria and IUCN conservation status classifications (LC = Least Concern)*

Species name	*Scientific name*	*Number*	*Red Data Book*	*IUCN*
Calandra lark	*Melanocorypha calandra*	*2*	*endangered*	*LC*
Common buzzard	*Buteo buteo*	*2*	*not listed*	*LC*
Corn bunting	*Emberiza calandra*	*3*	*not listed*	*LC*
Eurasian skylark	*Alauda arvensis*	*1*	*not listed*	*LC*
Great white pelican	*Pelecanus onocrotalus*	*1*	*extinct species in Bulgaria*	*LC*
Grey Partridge	*Perdix perdix*	*1*	*not listed*	*LC*
Red-backed shrike	*Lanius collurio*	*3*	*not listed*	*LC*
Yellow-legged gull	*Larus michahellis*	*3*	*not listed*	*LC*

Six of the bird species identified as victims are not listed in the Red Data Book of Bulgaria. Two of the species are listed in Bulgarian Red Data Book - great white pelican and calandra lark. Great white pelican is an extinct breeding species in Bulgaria according to Bulgarian Red Data Book. In the period of autumn bird migration all birds of these two listed Red Data species found during carcass searches are very likely to be immigrants into Bulgaria. Therefore, for the evaluation of the population level impact of the additive mortality of wind turbines included in the monitoring, the international bird species status must be applied. IUCN clasifications as Least Concern (LC) were appropriate to all species identified as collision victims. The category Least Concern indicates that the species has been evaluated against the Red List criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category. Great white pelican is a target for ISPB species in monitoring. In the case of collision mortality monitoring in the ISPB area, this is the first collision with turbines of Great white pelican for all five autumn periods in 2018, 2019, 2020, 2021 and 2022. No collisions were recorded in the several previous years of monitoring undertaken only at SNWF, a major component of the ISPB study area, see: http://www.aesgeoenergy.com/site/Studies.html.

Conclusions: autumn migration

During the monitoring of ISPB territory, there were no substantive differences in the main characteristics of the ornithofauna typical for the autumn migration in the whole country and the specific characteristics of species' composition and phenology of bird migration in NE Bulgaria.

The results of the monitoring confirmed the relatively low importance of the ISPB territory for the birds flying through or over it and no apparent negative influence of the operating wind farms on bird populations during their autumn 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 and the observation points indicated the absence of a barrier effect of the 114 wind turbines covered by ISPB 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 autumn period.

The quantitative characteristics of bird migration in the ISPB area during autumns of 2018, 2019, 2020, 2021 and 2022 and absence of mortality which could remotely threaten populations of the target 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.
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.
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 ornithologists**

Experiences biologist, participant in number of 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.

- **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 numerouse conservation projects of BSPB – BirdLife Bulgaria. Midwinter counts of waterfowl birds in Bulgaria nad white stork census expert. Monitoring the migration of birds species composition and the number of nesting fauna 2007-2012 "Ecotan" EOOD. Over 10 years of experience in impact monitoring study of wind turbines in the study area

- **Jelyazko Dimitrov - Field ornitologist**

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

- **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.

- **Vasil Panayotov Dimitrov - Field ornithologist**

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

- **Aleksandar Nedialkov Petkov - Field ornitologist**

Student at the University of Forestry (UF) – Sofia and active member of Bulgarian Society for Protection of Birds (BirdLife Bulgaria).