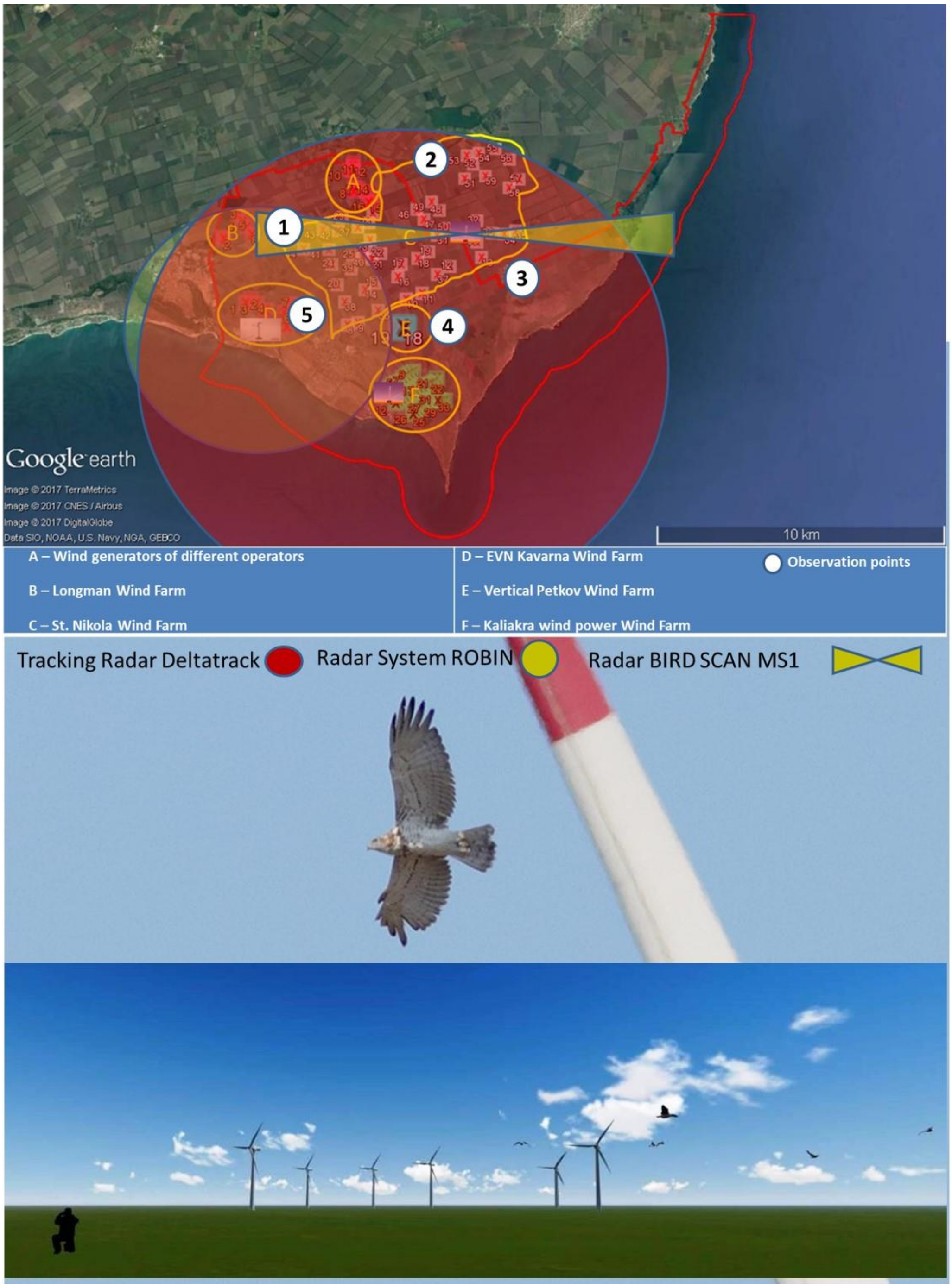
INTEGRATED SYSTEM FOR PROTECTION OF BIRDS

Summary of Activities and the Results of Ornithological Monitoring in the Integrated System for Protection of Birds, 2020



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Contents

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 2020.

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/.

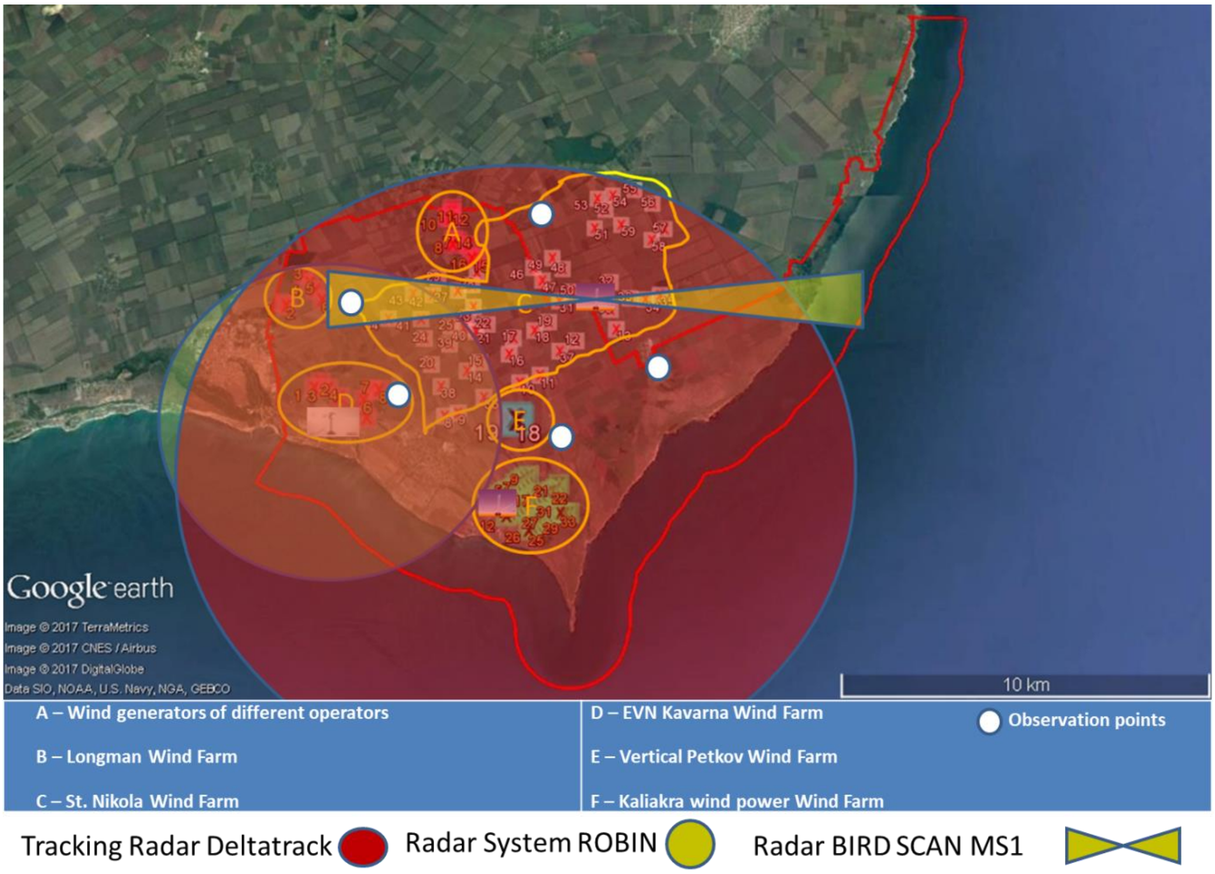

Figure 1. *A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.*

In order to provide objective data for the bird risk assessment, this summary presents activities and results of the monitoring in 2020.

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; 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://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, 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: https://kaliakrabirdmonitoring.eu/.

Results

Monitoring of geese in Winter 2019-2020

The 91 days of the study encompassed the whole period when geese were recorded in the region during 2019-2020. The study involved Red-breasted goose (RBG: *Branta ruficollis*), Greater white-fronted goose (GWFG: *Anser albifrons*) and Greyleg goose (GG: *Anser anser*). No Lesser white-fronted geese were seen in winter 2019-2020.

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 2019-2020. An unusually low number of wintering geese was also observed in Bulgaria and Romania in general in the winter season 2018-2019 as well as 2019-2020 (http://wildlifeconservation.bg/english/red-breasted-goose-wintering-season-2017-2018/ and https://greenbalkans.org/en/Low_numbers_of_wintering_geese_in_the_Coastal_Dobrogea-p6918). Less than 2000 geese were observed during the survey period. (Table 1)

Table 1. *The number of observed geese by dates of different species (data from visual observations). The dates with 0 observed birds are not included in the table.*

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

The maximum number of geese was observed on 15 January. The number of geese observed in February was much lower than the number of geese in January. No RBG were observed in January and March. The number of flights per day is presented in Table 1.

Temporal dynamics of geese number during the period when geese were observed in ISPB territory are presented in Figure 2.

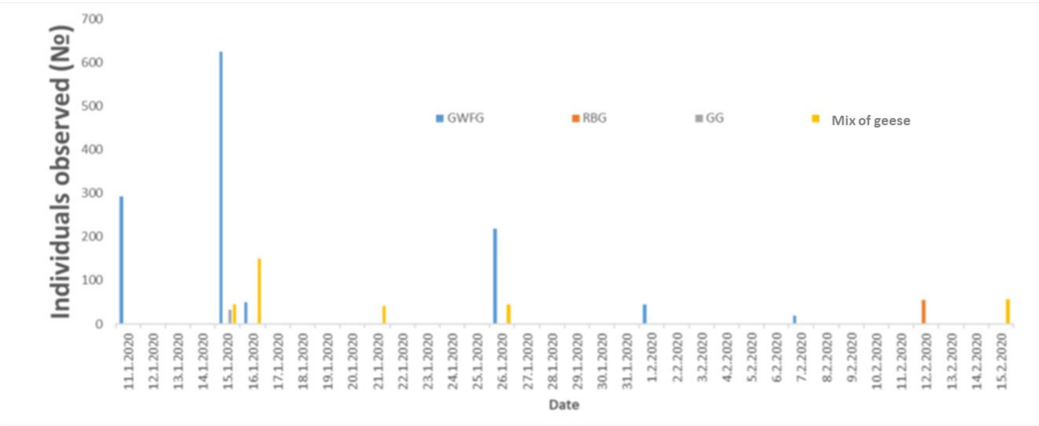

Figure 2. *Temporal dynamics of wintering geese observed in ISPB territory, season 2019-2020.*

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 3 – 7).

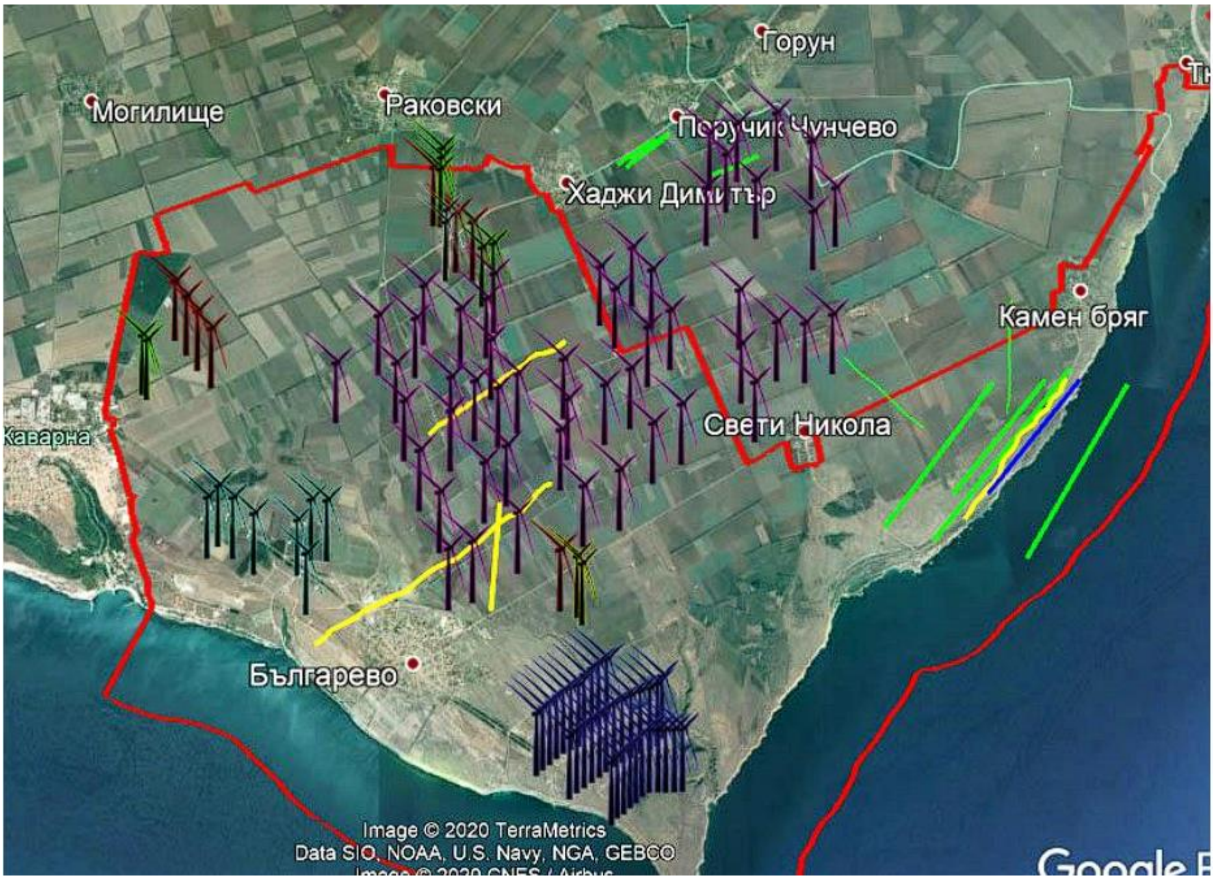

Figure 3. *Flocks of GWFG (green) and GG (blue) and mixed flock (Anser/Branta) (yellow) registered in ISPB territory in January 2020.*

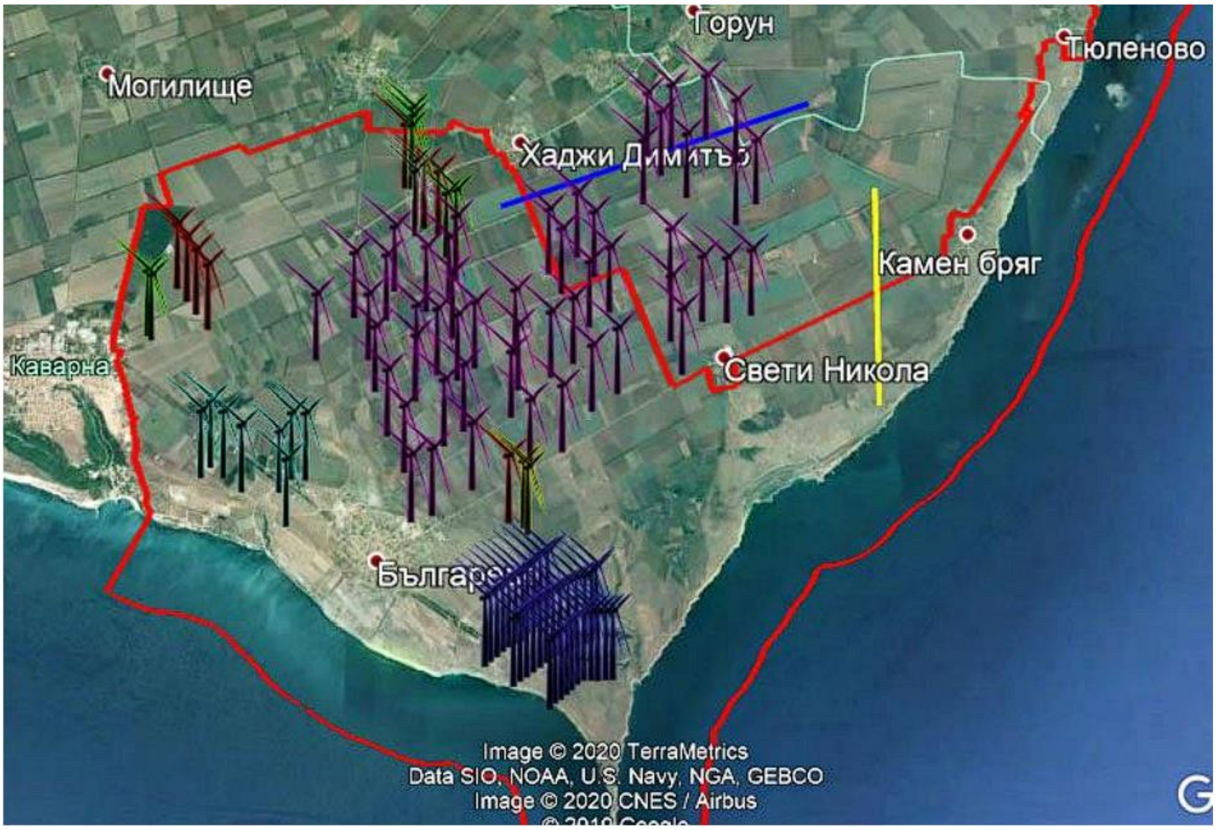

Figure 4. *Flocks of GWFG A. albifrons (blue) and Whooper swan C. cygnus (yellow) registered in ISPB territory in February 2020.*

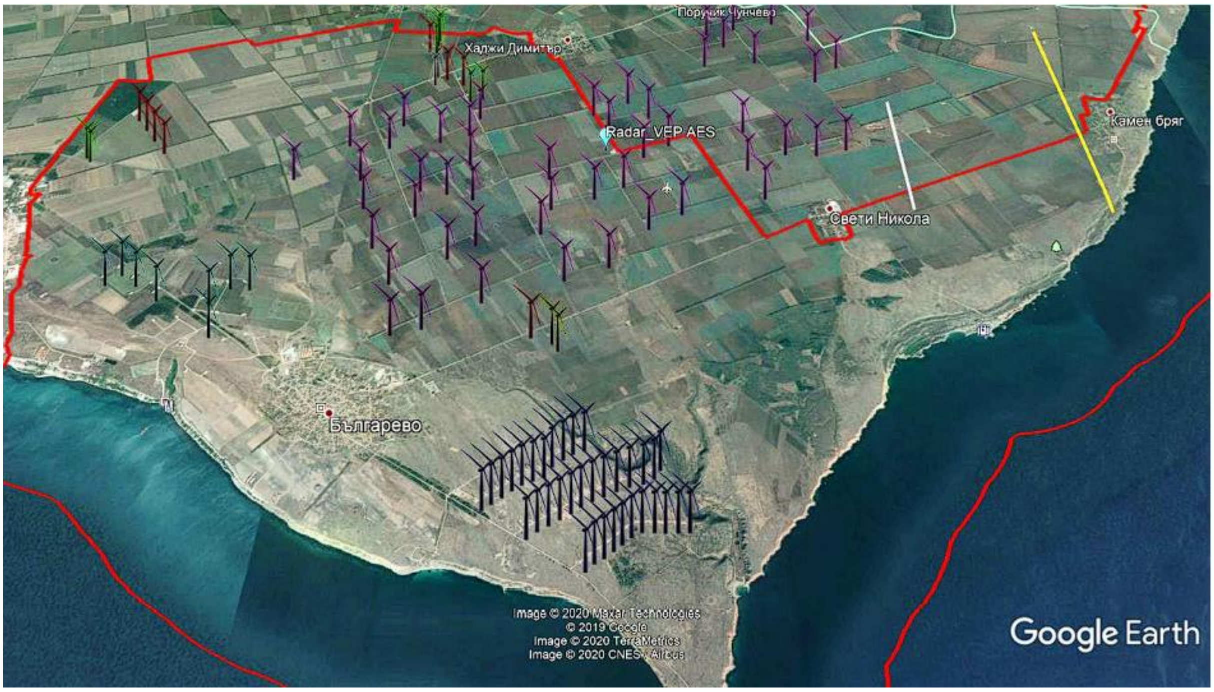

Figure 5. *Flock of GWFG A. albifrons (white) registered on 7 February 2020 and Whooper swan C. cygnus (yellow) registered in ISPB territory on 3 February 2020.*

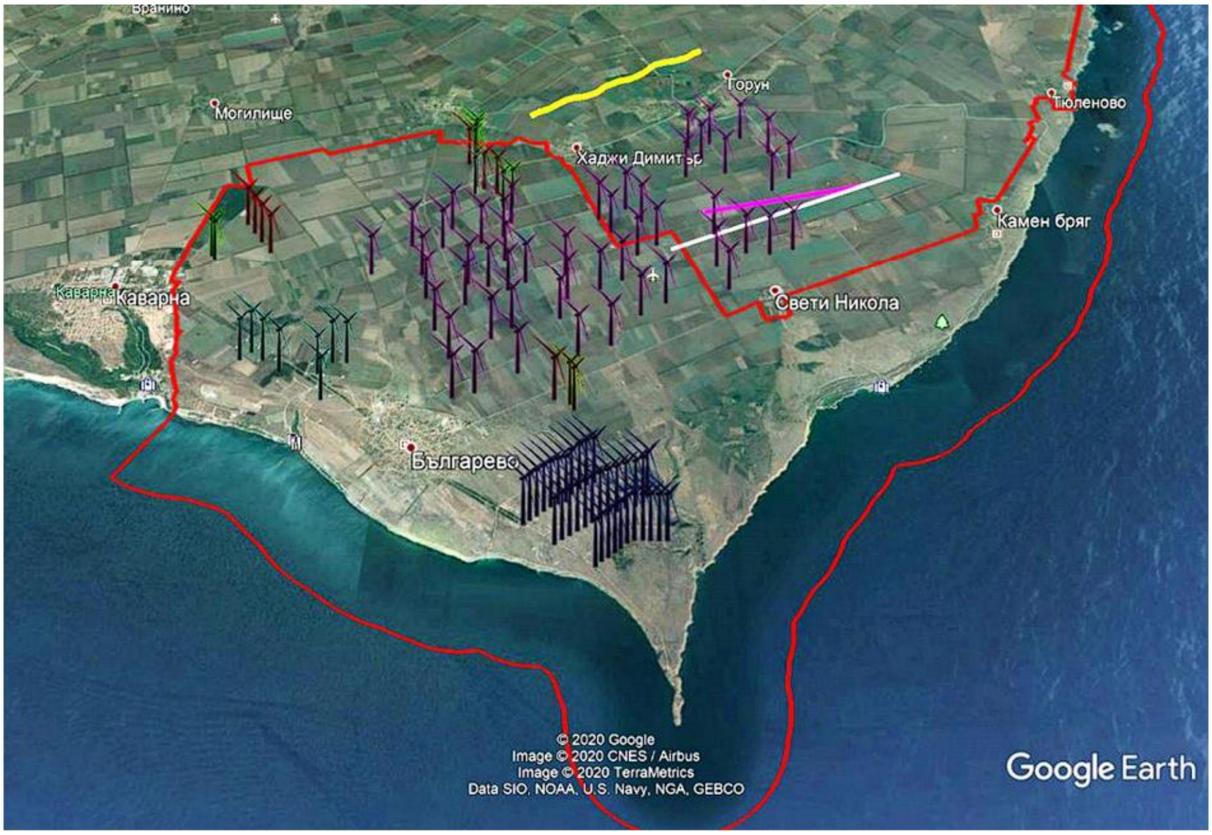

Figure 6. *Flocks of 12 Whooper swan C. cygnus (white) registered in ISPB territory on 13 February 2020, 55 RBG B. ruficollis (pink) registered on 12 February and mixed flock of 57 geese (yellow) registered on 15 February 2020.*

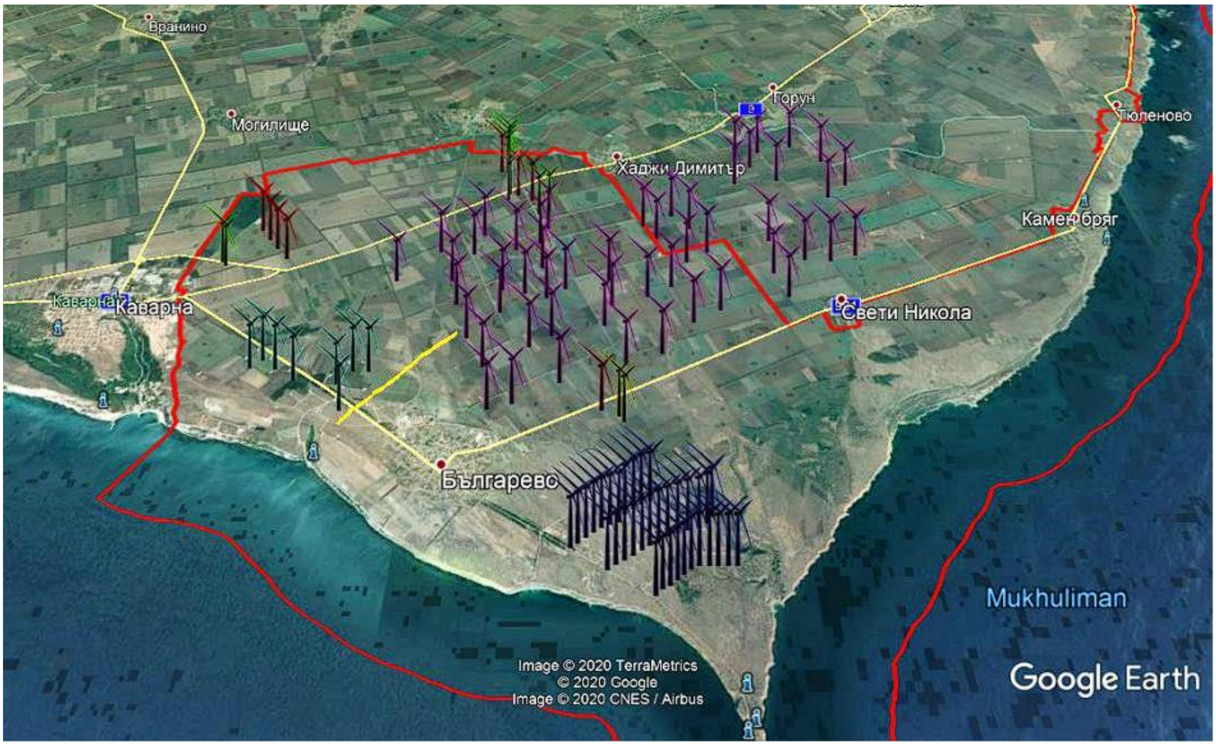

Figure 7. *Flock of 12 Tundra swan C. columbianus (yellow) registered on 19 February 2020.*

Carcass monitoring results

All 114 turbines were programmed to be searched every seventh day (if the areas under turbines were accessible) for carcasses during the whole winter survey period (1 December 2019 – 29 February 2020) when more birds are at risk of collision. The last wintering geese in ISPB territory (see previous reports from St. Nikola Wind Farm (SNWF) – a part of the 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 during the winter monitoring 2019-2020*

Turbine code	December	January	February	Total
ABBalgarevo	2	4	4	10
ABГ1	3	3	4	10
ABГ2	3	3	4	10
ABГ3	3	3	4	10
ABГ4	3	3	4	10
ABMillenium group	2	4	4	10
ABMillenium group Mikon	2	4	4	10
AE10	2	4	4	10
AE11	2	4	4	10
AE12	2	6	4	12
AE13	2	4	4	10
AE14	2	4	4	10
AE15	2	4	4	10
AE16	2	4	4	10
AE17	2	4	4	10
AE18	2	5	4	11
AE19	2	5	4	11
AE20	2	4	4	10
AE21	2	4	4	10
AE22	2	4	4	10
AE23	2	4	4	10
AE24	3	3	5	11
AE25	3	3	5	11
AE26	2	4	4	10
AE27	2	4	4	10
AE28	2	4	4	10
AE29	3	3	5	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	4	4	10
AE37	2	5	4	11
AE38	2	4	4	10
AE39	2	4	4	10
AE40	3	3	5	11
AE41	3	3	5	11
AE42	3	3	5	11
AE43	3	3	5	11
AE44	3	3	5	11
AE45	2	4	4	10
AE46	2	5	4	11
AE47	2	5	4	11
AE48	2	5	4	11
AE49	2	5	4	11
AE50	2	4	4	10
AE51	2	5	4	11
AE52	2	5	4	11
AE53	2	5	4	11
AE54	2	5	4	11
AE55	2	5	4	11
AE56	2	5	4	11
AE57	2	5	4	11
AE58	2	5	4	11
AE59	2	5	4	11
AE60	2	4	4	10
AE8	2	4	4	10
AE9	2	4	4	10
DBГ1	3	3	4	10
DBГ1HSW250	3	3	5	11
DBГ2	3	3	4	10
DBГ2MN600	3	3	5	11
DBГ3	3	3	4	10
DBГ4	2	4	4	10
DBГ5	2	4	4	10
DC1	1	4	4	9
DC2	2	4	4	10
E00	2	4	4	10
E01	3	3	5	11
E02	3	3	5	11
E04	3	3	5	11
E05	3	3	5	11
E07	3	3	5	11
E08	3	3	5	11
E09	2	4	4	10
M1	2	4	4	10
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

Turbine code	December	January	February	Total
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	2	4	4	10
M20	2	5	4	11
M21	2	5	4	11
M22	2	5	4	11
M23	2	5	4	11
M24	2	5	4	11
M25	2	5	4	11
M26	2	5	4	11
M27	2	5	4	11
M28	2	5	4	11
M29	2	5	4	11
M3	2	4	4	10

Turbine code	December	January	February	Total
M30	2	5	4	11
M31	2	5	4	11
M32	2	5	4	11
M33	2	5	4	11
M34	2	5	4	11
M35	2	5	4	11
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	2	4	4	10
VP2	2	4	4	10
ABZevs	3	3	4	10
Grand Total	**251**	**466**	**472**	**1189**

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 1189 searches under 114 turbines in the period 1 December 2019 – 29 February 2020. Therefore, no evidence for collision of any goose species, including RBG and the more abundant GWFG, 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 a part of the ISPB territory.

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 to the north – Durankulak and Shabla.

114 wind turbines covered by ISPB were not a source of collision mortality for wintering geese, even though they fly through or feed within ISPB 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) has been operational and searched systematically every winter season.

No substantive 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 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 report (and see previous SNWF winter reports on the AES website, and earlier surveys from this part of the same territory) 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, 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, which are likely more influential. As is the hunting pressure which geese face at the main freshwater roost sites to the north.

Spring migration

During the spring monitoring, observations were made during all 62 days of the season (March 15 - May 15), with registered migratory, soaring birds being detected over 70 % of the days 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**

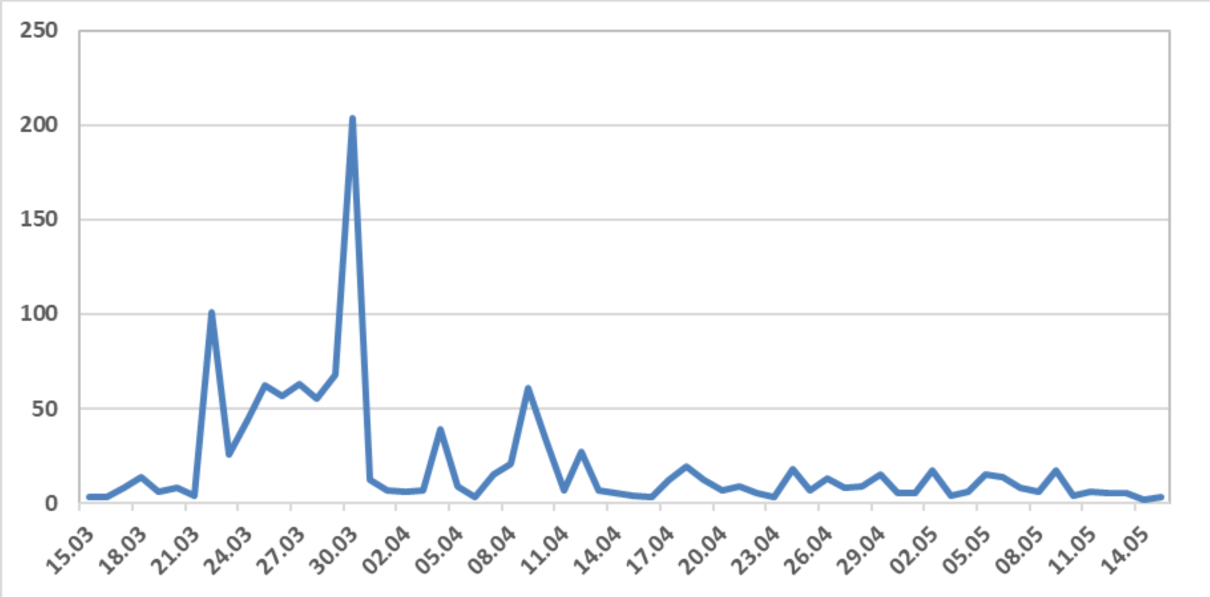

Figure 8. *Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2020*

The most numerous birds in spring in the region for three migratory seasons were Common cormorants (*Phalacrocorax carbo*) and some birds of prey – Common buzzards (*Buteo buteo*), Red-footed falcon (*Falco vespertinus*), Common kestrels (*Falco tinnunculus*) and Marsh harriers (*Circus aeruginosus*) (Table 4). One of the most numerous species in the previous two spring seasons, the White pelican (*Pelecanus onocrotalus*), was not observed in the spring migration monitoring of 2020, but a flock of 120 white pelicans was observed out with the programmed monitoring period in the ISPB territory (on 29 May 2020) and is not presented in 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*
A. cinerea	78
A. heliaca	1
A. nisus	11
A. pomarina	1
A. purpurea	31
B. buteo	61
B. rufinus	33
C. aeruginosus	45
C. ciconia	81
C. corax	4
C. cyaneus	3
C. gallicus	3
C. macrorus	3
C. olor	6
C. pygargus	20
E. alba	9
F. peregrinus	1

Species name	*Number of birds*
F. subbuteo	12
F. tinnunculus	30
F. vespertinus	13
G. grus	182
G. virgo	63
H. caspia	5
L. fuscus	12
L. limosa	29
M. apiaster	10
M. migrans	5
N. nycticorax	3
P. apivorus	1
P. carbo	434
P. pugnax	61
T. ochropus	1
Number of species	***32***

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 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 the territory of ISPB during the period 15 March 15 May 2020. 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, AB3eвc - 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	March	April	May	Total
ABBalgarevo	2	4	3	9
ABГ1	2	4	2	8
ABГ2	2	4	2	8
ABГ3	2	4	2	8
ABГ4	2	4	2	8
AB Millennium Group	2	5	2	9
AB Millennium Group Micon	2	5	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
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
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

Turbine	March	April	May	Total
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
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
AE8	3	4	2	9
AE9	3	4	2	9
DBГ1	2	4	2	8

Turbine	March	April	May	Total
DBГ1HSW250	2	4	2	8
DBГ2	2	4	2	8
DBГ2MN600	2	4	2	8
DBГ3	2	4	2	8
DBГ4	2	5	2	9
DBГ5	2	5	2	9
DC1	2	5	2	9
DC2	2	5	2	9
E00	2	4	3	9
E01	2	4	2	8
E02	2	4	2	8
E04	2	4	2	8
E05	2	4	2	8
E07	2	4	2	8
E08	2	4	2	8
E09	2	4	3	9
M1	2	4	3	9
M10	2	5	2	9
M11	2	5	2	9
M12	2	5	2	9
M13	2	5	2	9
M14	2	5	2	9
M15	2	5	2	9
M16	2	5	2	9
M17	2	5	2	9
M18	2	5	2	9
M19	2	5	2	9
M2	2	4	3	9

Turbine	March	April	May	Total
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	3	4	2	9
M29	3	4	2	9
M3	2	4	3	9
M30	3	4	2	9
M31	3	4	2	9
M32	3	4	2	9
M33	3	4	2	9
M34	3	4	2	9
M35	3	4	2	9
M4	2	5	2	9
M5	2	5	2	9
M6	2	5	2	9
M7	2	5	2	9
M8	2	5	2	9
M9	2	5	2	9
VP1	2	4	3	9
VP2	2	4	3	9
АВЗевс	3	4	2	9
Grand Total	**269**	**488**	**245**	**1002**

13 records of dead birds after collision with wind turbines were documented during the 2020 spring migration of birds in ISPB territory (Table 6). Most numerous among the confirmed collision victims during the study period were Skylarks and Common starling; but only four and two respectively (Table 6). No case of turbine collision for the target bird species identified in the ISPB programme was registered during the monitoring in spring 2020 (the target species are listed at https://kaliakrabirdmonitoring.eu/).

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

English name	*Species name*	*Number of birds*	*Red Data Book*	*IUCN*
Eurasian skylark	*Alauda arvensis*	*4*	*not listed*	*LC*
Common Starling	*Sturnus vulgaris*	*2*	*not listed*	*LC*
Common chaffinch	*Fringilla coelebs*	*1*	*not listed*	*LC*
Grey partridge	*Perdix perdix*	*1*	*not listed*	*LC*
Eurasian sparrowhawk	*Accipiter nisus*	*1*	*not listed*	*LC*
Common blackbird	*Turdus merula*	*1*	*no listed*	*LC*
Eurasian blackcap	*Sylvia atricapilla*	*1*	*no listed*	*LC*
Lesser whitethroat	*Sylvia curruca*	*1*	*not listed*	*LC*
Common Wood pigeon	*Columba palumbus*	*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.

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 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.

Autumn migration

During the autumn monitoring, observations were made during all 92 days of the season 2020 (01.08-31.10.2020).

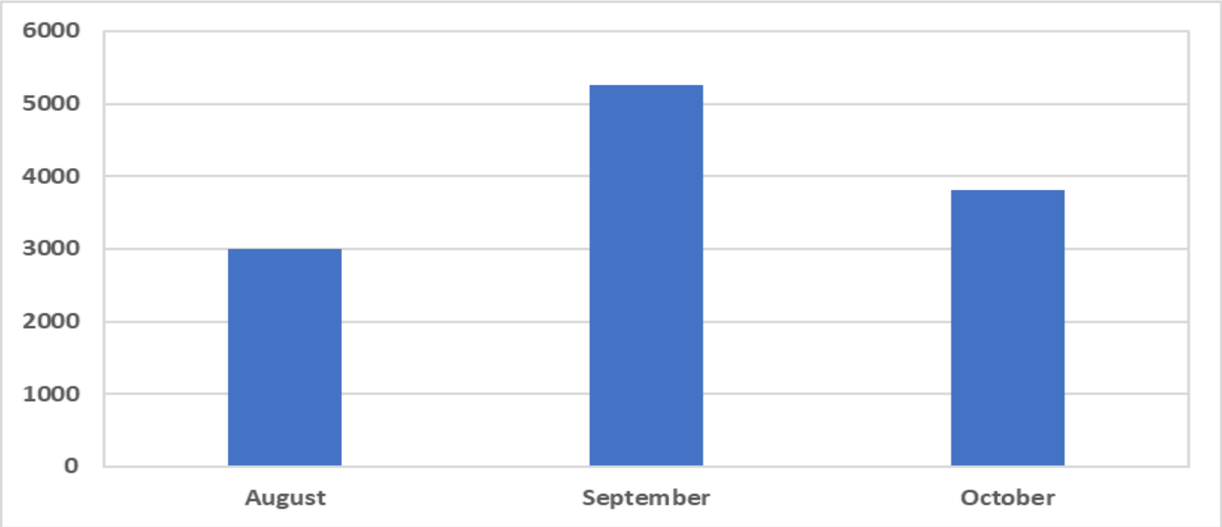

Figure 9*. Number of registered birds by months during the autumn migration in the territory of ISPB.*

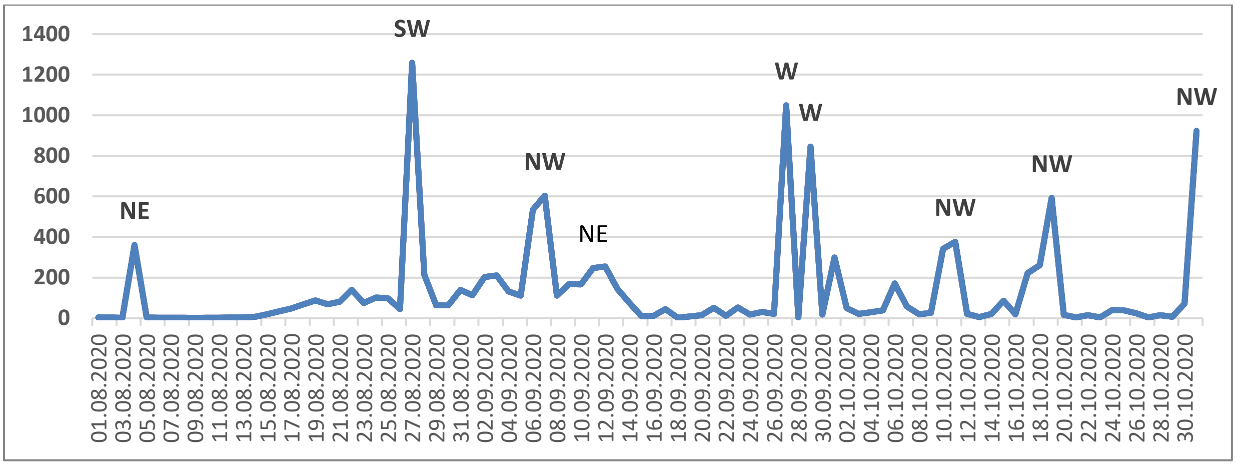

Figure 10. *Dynamics of the autumn migration of the flying bird species in the ISPB territory according to visual observations during the period 01 August - 31 October 2020. Letters indicate the direction of wind in days with increased number of migrating birds.*

The number of birds in the ISPB 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 2020 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***
A. brevipes	*110*	*C. pygargus*	*60*
A. cinerea	*37*	*F. columbarius*	*1*
A. gentilis	*8*	*F. peregrinus*	*1*
A. heliaca	*2*	*F. subbuteo*	*38*
A. nipalensis	*1*	*F. tinnunculus*	*176*
A. nisus	*244*	*F. vespertinus*	*1215*
A. pennata	*40*	*G. fulvus*	*1*
A. pomarina	*22*	*H. albicilla*	*1*
B. buteo	*2965*	*H. rustica*	*1000*
B. lagopus	*15*	*L. cachinnans*	*1*
B. rufinus	*45*	*M. apiaster*	*3737*
C. aeruginosus	*264*	*M. migrans*	*20*
C. albus	*3*	*M. milvus*	*2*
C. ciconia	*1137*	*P. apivorus*	*96*
C. corax	*21*	*P. carbo*	*332*
C. cyaneus	*16*	*P. crispus*	*8*
C. gallicus	*59*	*P. haliaetus*	*3*
C. garrulus	*3*	*P. leucorodia*	*6*
C. macrourus	*13*	*S. vulgaris*	*360*
C. nigra	*13*	*V. vanelus*	*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*), White storks (*C. ciconia*) with over 1000 individuals of each species (Table 7). One species with a marked increase in recorded numbers in 2020 was the Red-footed falcon (*Falco vespertinus*). Three new species were recorded in autumn 2020. The Griffon vulture (*Gyps fulvus*) is previously observed in autumn but since 2018 when the ISPB was started it is the first observation in autumn migration period. Another two species of interest observed in autumn 2020 for the first time are the Steppe eagle (*Aquila nipalensis*) and Imperial eagle (*Aquila heliaca*). The white pelican (*Pelecanus onocrotalus*) which usually appears in the ISPB territory in short time periods in autumn was not observed in autumn 2020.

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 two group of turbines in the territory of SNWF is ordered. The stop order 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 stop is given in Table 8.

Table 8*. Data for stops of wind turbines ordered by field observers during the autumn migration of birds 2020.*

Date	***Wind farm***	***Turbine code №/ Group***	***Species***	***Number of birds***	***Time stop***	***Time restart***
01.10.2020	*AES*	*F, E zones*	*Gyps fulvus*	*1*	*14:38:00*	*15:09:00*

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 collisions with the turbines in the ISPB and in the Kaliakra SPA under all 114 wind turbines included in the ISPB. For details see previous studies on the same territory: http://www.aesgeoenergy.com/site/Studies.html

Table 8. *Number of turbines searched for collision victims in the territory of ISPB during the period 01 August to 31 October 2020. 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	Aug.	Sep.	Oct.	Total
ABBalgarevo	4	4	4	12
ABГ1	4	4	4	12
ABГ2	4	4	4	12
ABГ3	4	4	4	12
ABГ4	4	4	4	12
ABMillenium group	3	4	5	12
ABMillenium group Micon	3	4	5	12
AE10	4	4	5	13
AE11	4	4	5	13

Turbine	Aug.	Sep.	Oct.	Total
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

Turbine	Aug.	Sep.	Oct.	Total
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
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
AE8	4	4	4	12
AE9	4	4	4	12
DBΓ1	4	4	4	12
DBΓ1HSW250	4	4	5	13
DBΓ2	4	4	4	12
DBΓ2MN600	4	4	5	13
DBΓ3	4	4	4	12
DBΓ4	3	4	5	12
DBΓ5	3	4	5	12
DC1	3	4	5	12

Turbine	Aug.	Sep.	Oct.	Total
DC2	3	4	5	12
E00	4	4	4	12
E01	4	4	5	13
E02	4	4	5	13
E04	4	4	5	13
E05	4	4	5	13
E07	4	4	5	13
E08	4	4	5	13
E09	4	4	4	12
M1	4	4	4	12
M10	3	4	6	13
M11	3	4	6	13
M12	3	5	3	11
M13	3	5	3	11
M14	3	5	3	11
M15	3	5	3	11
M16	3	5	3	11
M17	3	5	3	11
M18	3	5	3	11
M19	3	5	2	10
M2	4	4	4	12
M20	3	5	3	11
M21	3	5	3	11
M22	3	5	3	11
M23	3	5	3	11
M24	3	5	3	11
M25	3	5	3	11
M26	3	5	3	11
M27	3	5	4	12
M28	3	4	3	10
M29	3	4	3	10
M3	4	4	4	12
M30	3	4	3	10
M31	3	4	3	10
M32	3	4	3	10
M33	3	4	3	10
M34	3	4	3	10
M35	3	4	3	10
M4	3	4	5	12
M5	3	4	6	13
M6	3	4	6	13
M7	3	4	6	13
M8	3	4	6	13
M9	3	4	6	13
VP1	4	4	4	12
VP2	4	4	4	12
ABZevs	4	4	4	12
Grand Total	**392**	**488**	**480**	**1360**

As a result of 1360 searches under 114 individual turbines between 1 August and 31 October 2020, a total of 13 dead birds of nine species were identified. The number of identified collision victims by species are given in Table 9.

Table 9. *Victims of collision with turbines during the autumn migration period in 2020 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***
European skylark	*Alauda arvensis*	*1*	*not listed*	*LC*
House martin	*Delichon urbicum*	*1*	*not listed*	*LC*
Yellow-legged gull	*Larus michahellis*	*3*	*not listed*	*LC*
Grey patridge	*Perdix perdix*	*1*	*not listed*	*LC*
Marsh harrier	*Circus aeruginosus*	*1*	*endangered*	*LC*
Common swift	*Apus apus*	*1*	*not listed*	*LC*
Common kestrel	*Falco tinnunculus*	*1*	*not listed*	*LC*
Mediterranean gull	*Larus melanocephalus*	*1*	*vulnerable*	*LC*
Calandra Lark	*Melanocorypha calandra*	*3*	*endangered*	*LC*

Six of the bird species identified as victims are not listed in the Red Data Book of Bulgaria. Two species are endangered, and one is vulnerable in Bulgaria but in the period of autumn bird migration all birds found during carcass searches are migrants and have to be considered as 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. Accordingly, all recorded victims were not among the target ISPB species.

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 the 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 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 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. 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 ornitologist**

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 ornitologist**

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.