INTEGRATED SYSTEM FOR PROTECTION OF BIRDS

REPORT

Monitoring of Spring Bird Migration in the Integrated System for Protection of Birds 2022

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Contents

1. Introduction

The present study was commissioned by AES Geo Energy Ltd., Kaliakra Wind Power, EVN Kavarna, 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, and Millennium Group OOD in order to collect and summarize the information about the performance of the 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.

Considering the potentially adverse effects of wind farms on environmental features, notably birds (Abbasi et al. 2014), the Integrated System for Protection of Birds (ISPB) was implemented in 2018 aiming towards systematic monitoring of any potential adverse effects, and their mitigation: primarily including fatalities through collision with rotating turbine blades, disturbance leading to the displacement of birds from feeding, drinking, roosting or breeding sites (effectively a form of habitat loss), and turbines presenting a barrier to flight movements, thereby preventing access to areas via those movements or increasing energy expenditure to fly around the turbine locations (Hötker et al. 2006, Madders & Whitfield 2006, Drewitt & Langston 2008, Masden et al. 2009, 2010, de Lucas et al. 2004, 2008, Ferrer et al. 2012).

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 (TSS) 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/.

It should be noted that this is the fifth report dedicated to the spring migration period and the ISPB is a subject of continuous improvement based on the observations and any challenges revealed by the several inherent monitoring protocols.

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

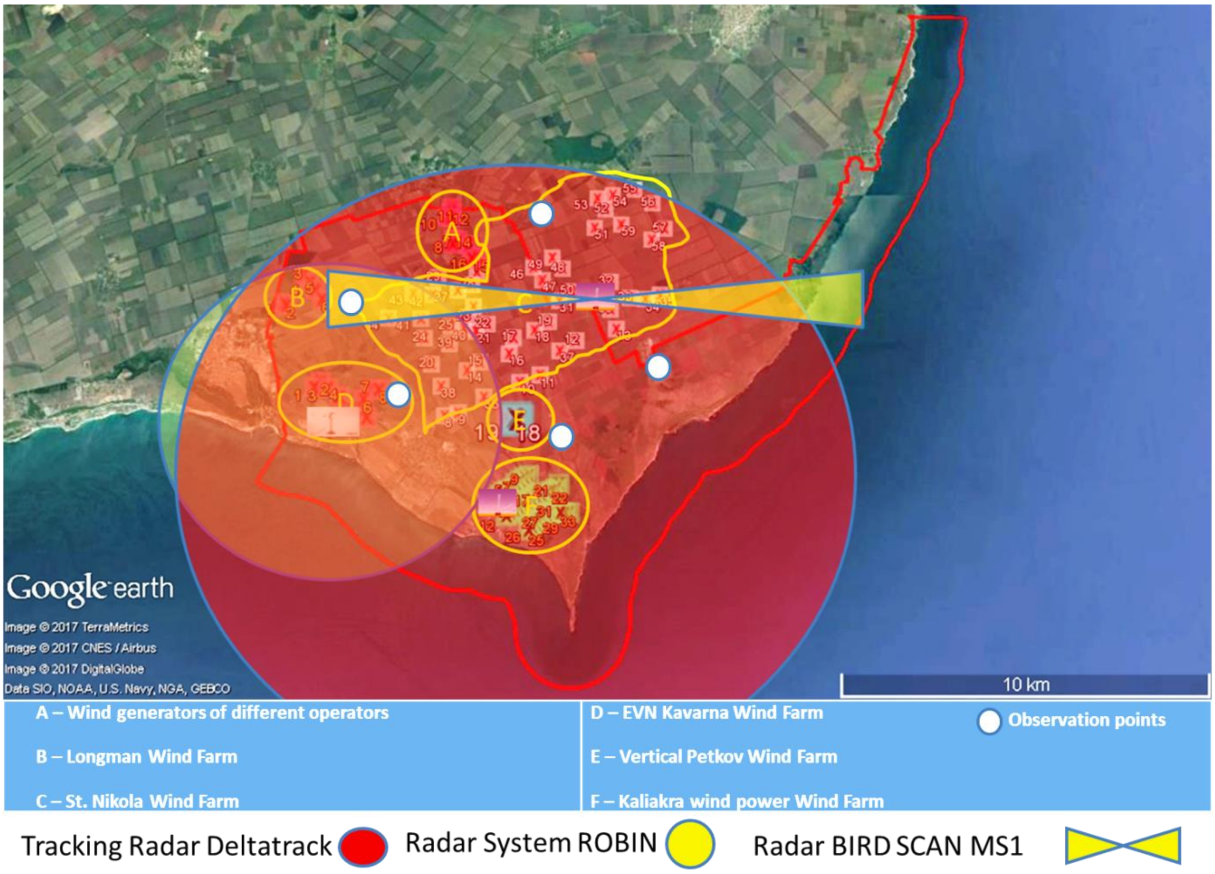

Figure 1. *A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.*

The current report present results of monitoring of the territory described above in spring 2022. The objectives and tasks of the study are the same as presented before in the report for spring 2018, 2019, 2020 and 2021 available at the web site of ISPB (https://kaliakrabirdmonitoring.eu/). In order to collect comparative data on spring migration in 2018, 2019, 2020, 2021 and 2022 the same methods were applied in the study by the same team of ornithologists as described in detail in the report for spring migration 2018 (https://kaliakrabirdmonitoring.eu/).

2. Results

2.1. Dynamics of spring migration and direction of migrating birds

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 time both in spring 2018, 2019, 2020, 2021 and 2022. For the survey period, a total of 1560 migratory and resident birds were registered in 2018, 3578 in 2019, 1252 in 2020, 1012 in 2021 and 3779 in 2022 (Table 1).

Table 1. *Number of registered birds of all taxa by day during the spring migration period in the territory covered by ISPB.*

Period	**Number of birds in Spring 2018**	**Number of birds in Spring 2019**	**Number of birds in Spring 2020**	**Number of birds in Spring 2021**	**Number of birds in Spring 2022**
15-31 March	882	1900	738	590	1490
1-30 April	445	1203	397	354	996
1-15 May	233	476	117	68	1293
Total for the period	1560	3578	1252	1012	3779

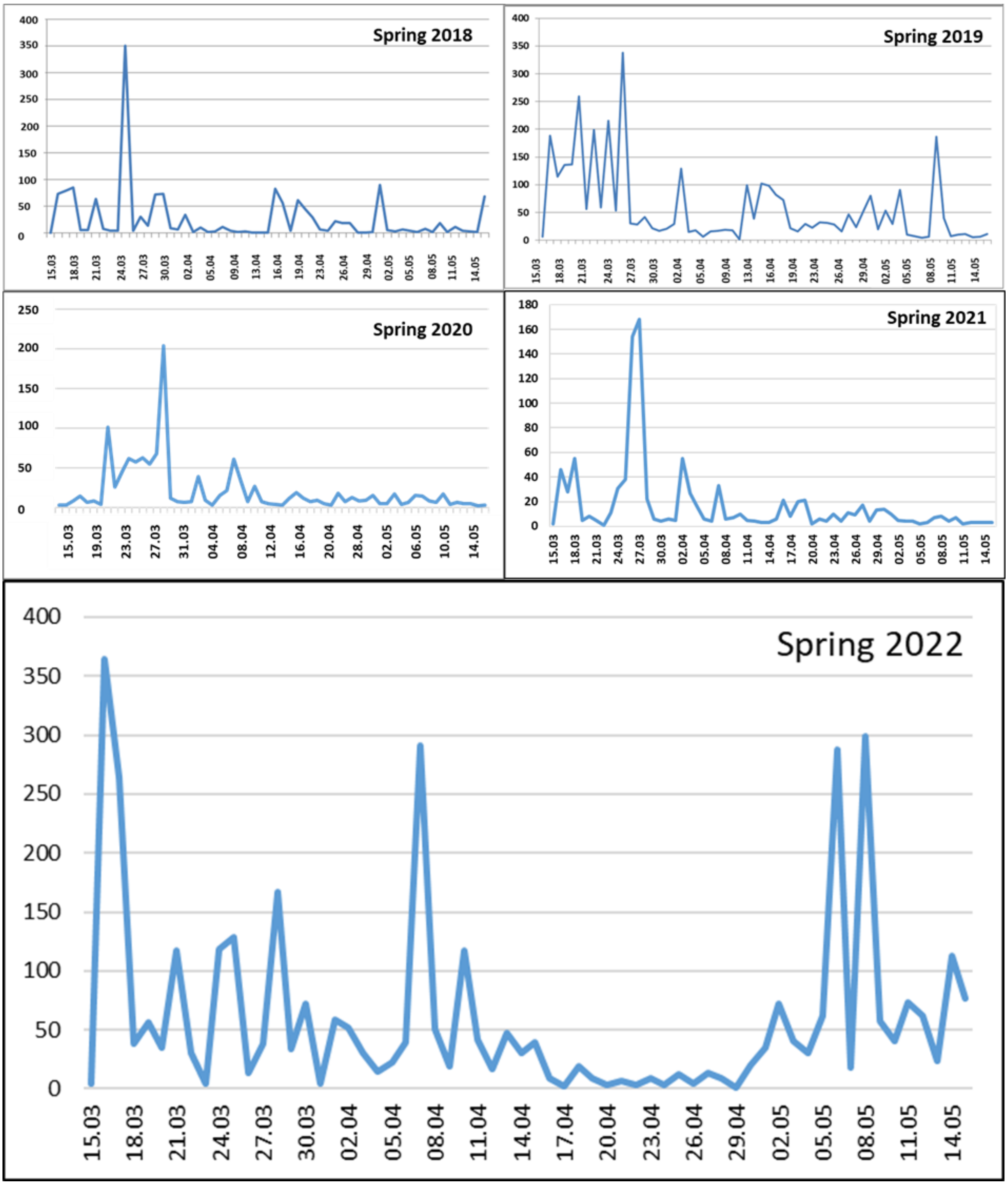

Figure 2. *Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May in 2018, 2019, 2020, 2021 and 2022.*

The variations in bird numbers were substantial within the spring seasons of migration covered by the current monitoring study (Figure 2). 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.

An important parameter for determining the impact of wind turbines on birds is whether or not the general direction of the migration was changed by the presence of the turbines. For birds with registered flight directions, the distribution of directions in spring 2018, 2019, 2020, 2021 and 2022 is presented in Table 2.

Table 2. *Proportion of registered birds by direction during spring migration on the territory of ISPB for the period 15 March - 15 May 2018, 2019, 2020, 2021 and 2022. In grey are the expected directions for the prevailing spring migration.*

Direction	Percent of birds 2018	Percent of birds 2019	Percent of birds 2020	Percent of birds 2021	Percent of birds 2022
N	28,88%	19,73%	23,76%	13,34%	26,94%
NE	41,91%	34,51%	56,16%	56,52%	25,75%
NW	5,98	7,15%	1,08%	3,36%	10,16%
NNW	0,34%	8,83%	0	0	4,44%
NNE	2,82%	0,06%	0	0	4,82%
ENE	0	1,93%	0	0	0
WNW	0,13%	0	0	0	0,21%
WSW	0	0,50%	0	0	0,09%
S	1,75%	3,63%	4,54%	2,27%	2,56%
SE	0,54%	3,27%	2,38%	2,47%	1,62%
E	9%	4,81%	6,59%	10,28%	7,26%
ESE	0	0,14%	0	0	0,09%
SW	2,8%	5,76%	1,30%	1,09%	2,56%
SSW	0	0,08%	0	0	3,93%
W	1,68%	3,80%	4,21%	2,57%	8,07%
SSE	0	0	0	0	1,49%

The main direction of flight in the migratory birds during the spring migration in five years 2018, 2019, 2020, 2021 and 2022 was N-NE. There was no observed deviation from the seasonal expectation of migratory flight directions which were centred towards the N-NE (Table 2). No changes were identified in the migratory directions of the birds due to the proximity to wind turbines under surveillance.

2.2. Species composition and number of birds

The species and number of birds recorded during spring migration in 2018, 2019, 2020, 2021 and 2022 are shown in Table 3.

Table 3. *Composition and number of registered bird species during the period 15 March - 15 May 2018, 2019, 2020, 2021 and 2022 in the ISPB territory.*

Species name	*Number in Spring 2018*	*Number in Spring 2019*	*Number in Spring 2020*	*Number in Spring 2021*	*Number in Spring 2022*
A. alba		*22*			
A. apus	*2*	*18*			*35*
A. arvensis					*52*

Species name	Number in Spring 2018	Number in Spring 2019	Number in Spring 2020	Number in Spring 2021	Number in Spring 2022
A. campestris					4
A. cinerea	6	136	78	58	13
A. gentilis	1	1			4
A. heliaca		1		1	1
A. melba	5	9			20
A. nisus	1	12	11	13	10
A. palustris					1
A. pennata	2			1	
A. pomarina	1	3	1	3	1
A. purpurea		1	31	22	2
A. querquedula		240			170
A. ralloides	1				
A. heliaca			1		
B. buteo	75	137	61	56	142
B. oedicnemus		6			8
B. rufinus	1	27	33	30	14
B. stelaris					2
C. aeruginosus	23	70	45	92	35
C. brachydactyla					9
C. canorus		3			13
C. carduelis					2
C. ciconia	81	205	81	24	39
C. corax	2	31	4	16	21
C. cornix	6	13			16
C. coturnix		1			
C. cyaneus	8	38	3	4	24
C. frugilegus		2			45
C. gallicus	6	17	3	10	7
C. garrulus	4				1
C. hybrida					12
C. livia					60
C. macrourus	1	6	3	3	2
C. monedula					27
C. nigra	4	1			
C. oenas					56
C. olor	9	12	6		
C. palumbus					16
C. pygargus	8	41	20	7	5
C. ridibundus		26			
D. urbicum					35
E. alba			9	12	
E. calandra					2
E. melanocephala					1
E. garzetta		1			
F. cherrug	1				
F. coelebs		305			21
F. columbarius		1			
F. peregrinus	1	1	1		1
F. subbuteo	8	18	12	5	6
F. tinnunculus	37	61	30	32	56
F. vespertinus	21	11	13	17	12
G. cristata					6
G. grus	62		182		1
G. nilotica					1
G. virgo	25		63		
H. albicilla	1				

Species name	***Number in Spring 2018***	***Number in Spring 2019***	***Number in Spring 2020***	***Number in Spring 2021***	***Number in Spring 2022***
H. caspia			*5*		
H. himantopus				*1*	
H. pennatus				*1*	
H. rustica					*52*
L. arborea					*5*
L. canabina					*2*
L. colurio					*2*
L. fuscus		*1*	*12*		
L. melanocephalus		*120*			
L. limosa			*29*		
L. michahellis	*43*	*56*			*187*
L. minor					*4*
L. ridibundus				*21*	
L. senator					*1*
M. alba		*1*			*35*
M. apiaster	*85*	*130*	*10*		*223*
M. calandra					*9*
M. flava		*2*			*13*
M. migrans	*1*	*1*	*5*	*2*	*1*
N. arquata					*1*
N. nicticorax			*3*	*6*	
O. isabelline					*7*
O. oriolus	*2*				*11*
P. apivorus	*2*	*1*	*1*		*2*
P. apricaria		*4*		*41*	*36*
P. carbo	*601*	*1452*	*434*	*469*	*596*
P. colchicus					*2*
P. falcinellus		*37*			*2*
P. haliaetus		*1*		*1*	
P. hispaniolensis					*2*
P. onocrotalus	*259*	*201*		*1*	*33*
P. porzana					*1*
P. pugnax			*61*		*3*
P. perdix	*2*				
S. decaocto					*12*
S. melanocephala		*2*			
S. rubetra					*1*
S. rusticola		*1*			
S. turtur	*1*				*6*
S. hirundo	*1*				
S. vulgaris	*80*				*1507*
T. erythropus					*1*
T. philomelos					*1*
T. tadorna	*35*	*3*		*63*	
T. ochropus			*1*		
T. torquatus		*1*			
U. epops	*3*	*12*			*10*
V. vanellus	*2*	*2*			
Number of species	***43***	***53***	***32***	***29***	***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 3). 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 1 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), an estimate of the total population of White stork in SE Bulgaria flying along Via Pontica in spring was 23,358 individuals in their study period. In this respect our observations confirm the low significance of the territory of Kaliakra as part of the migratory corridor for spring migrating White storks along the Via Pontica component of the larger flyway.

Common buzzards, Marsh harriers, Eurasian hobby (*Falco subbuteo*) Common kestrels and Red-footed falcon were the most numerous birds of prey recorded during spring migration. The proportional contribution to records of raptors from the five most commonly recorded species during spring migration 2018, 2019, 2020, 2021 and 2022 is shown in Figure 3.

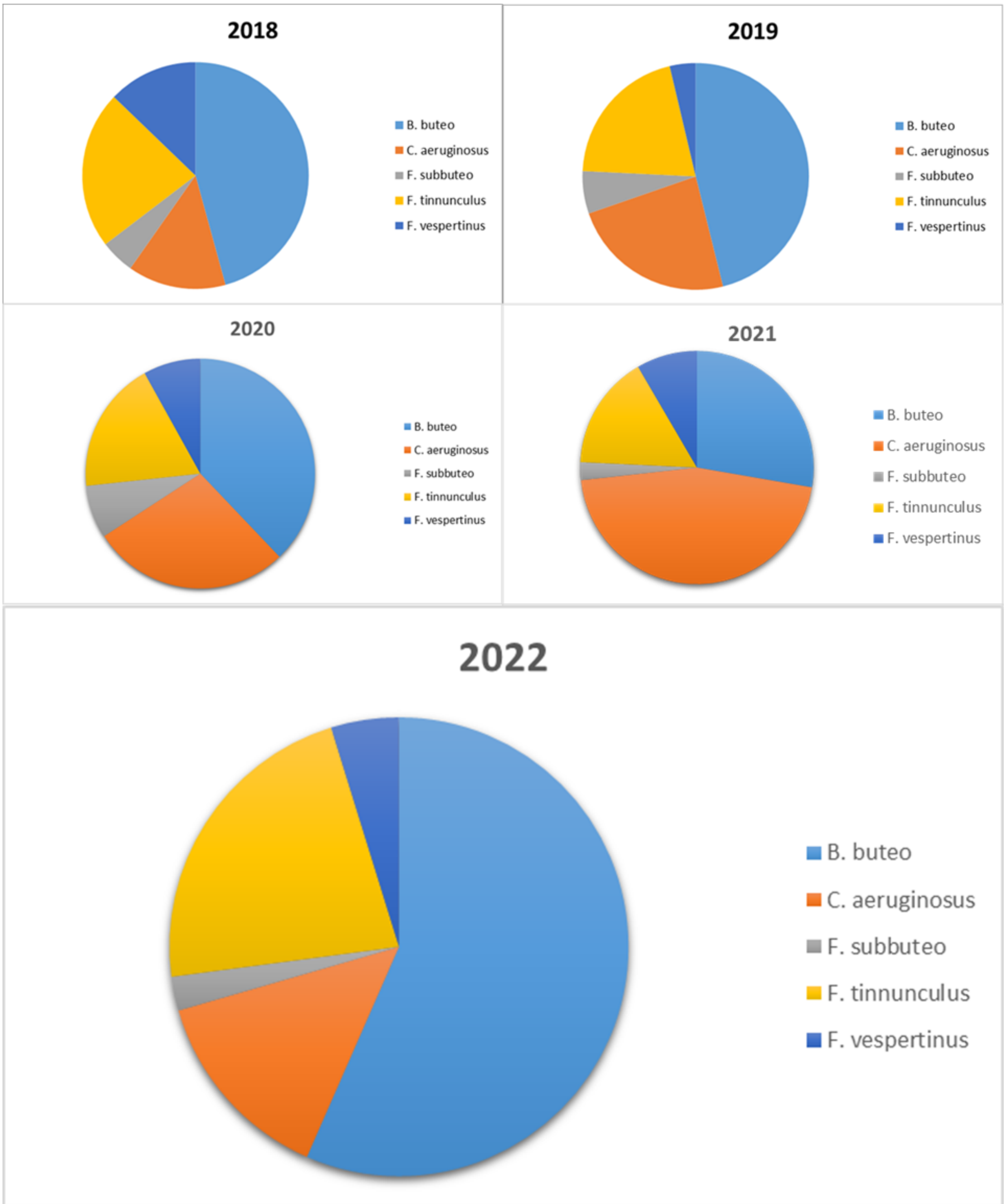

Figure 3. *Proportional representations of the five most numerous birds of prey recorded during spring migration 2018, 2019, 2020, 2021 and 2022 respectively.*

2.3. Frequency of appearance

During the spring migration in 2018, 2019, 2020, 2021 and 2022 over the surveyed area, migratory species of soaring birds were noted on an average of 80 % of the days covered by observations in spring migration. In the majority of days, only one bird was observed, predominantly Falconiformes, some of which are local breeding species for the area. These were mostly Common buzzard and Common kestrel. These species were regularly observed to hunt in the area covered by ISPB in all five spring seasons. Flocks of migratory birds having more than three individuals were observed in only few days. In most cases, they were flocks of cormorants. Another more regularly observed species was Red-footed falcon. The most frequent migrant bird of prey during the spring monitoring period was the Common buzzard. White storks were observed on only nine days during the monitoring in spring 2018, 28 days in spring 2019, 27 days in 2020, 19 days in 2021 and 24 days in 2022. In fact, only three flocks of White storks were observed respectively in 2018 and 2019 spring migration periods and only one flock in spring 2020. The rest of White storks observed in spring migration periods were single individuals and most probably breeding individuals which were observed in different days of the monitoring.

2.4. Altitude of flights

The substantial majority of observed migrating birds in the monitoring periods of 2018, 2019, 2020, 2021 and 2022 passed through the area with wind turbines at altitudes below 300 m above the ground. Between 60% and 90% of birds were observed to fly at a height of less than 200 m above ground level in spring 2018, 2019, 2020, 2021 and 2022 respectively. No changes in flight height due to the proximity of wind turbines were observed. The distribution of migratory birds according to flight altitude is shown in Figure 4.

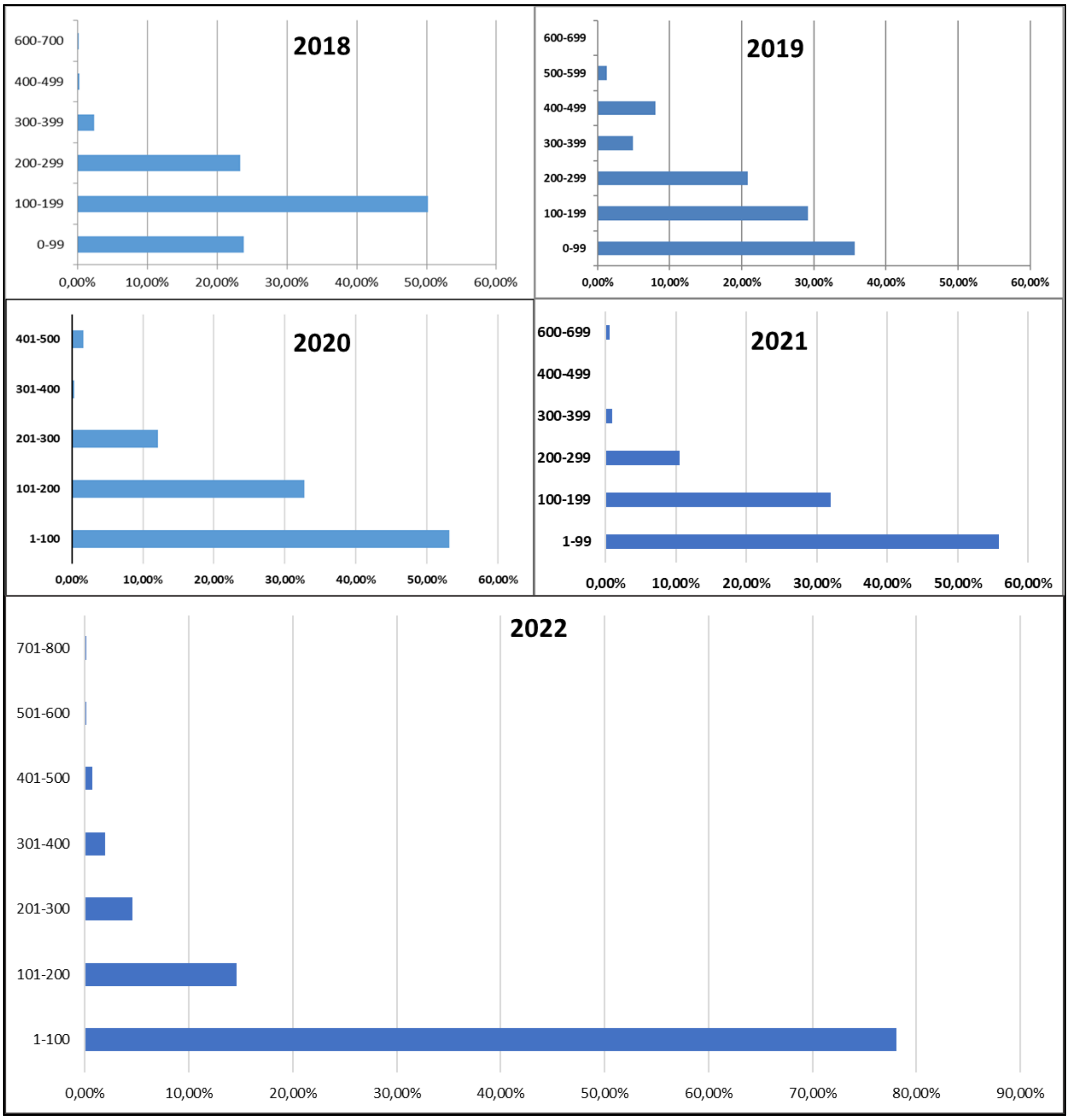

Figure 4. *Distribution of passing birds in 10 % classes according to flight altitude (m) in spring 2018, 2019, 2020, 2021 and 2022.*

2.5. Ordered and automatic wind turbine stops during the spring migration period

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.

2.6. Flocks of target bird species for ISPB as observed in spring migration

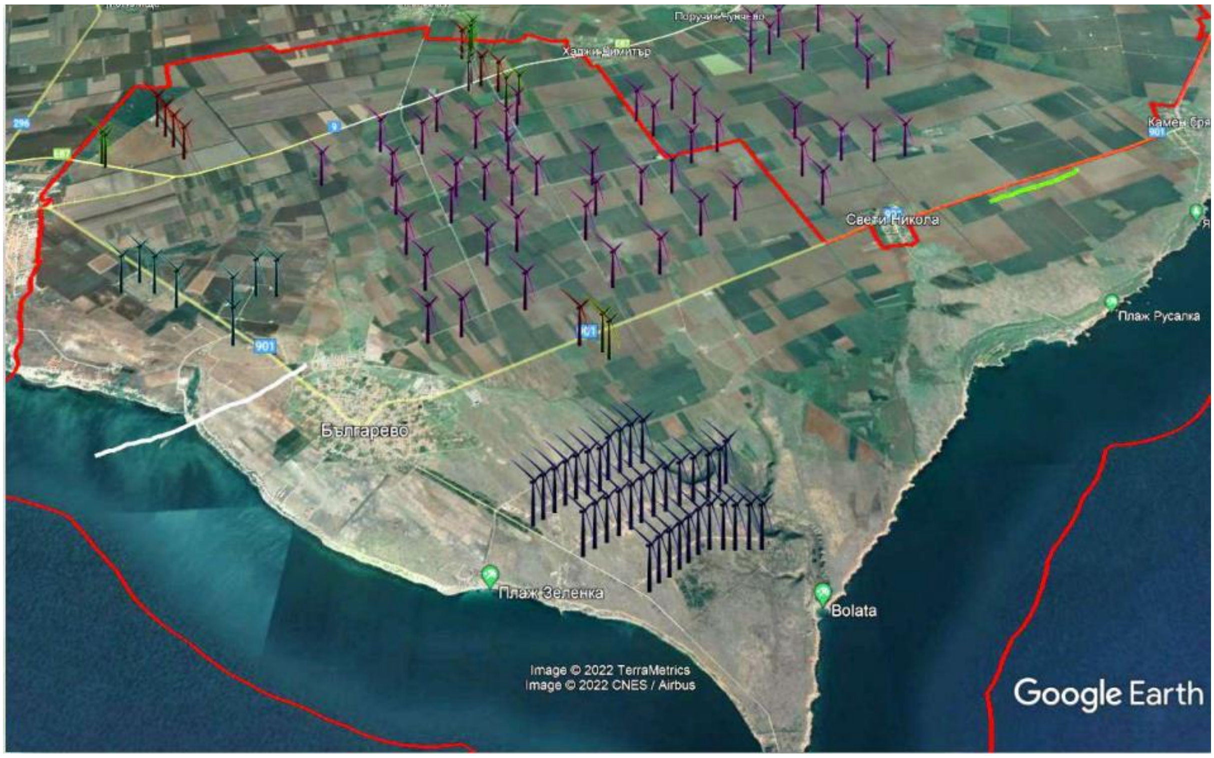

Figure 5. *Flock of 10 European golden plover (green) observed 22 March 2022; flock of 110 yellow-legged gull (white) observed 25 March 2022.*

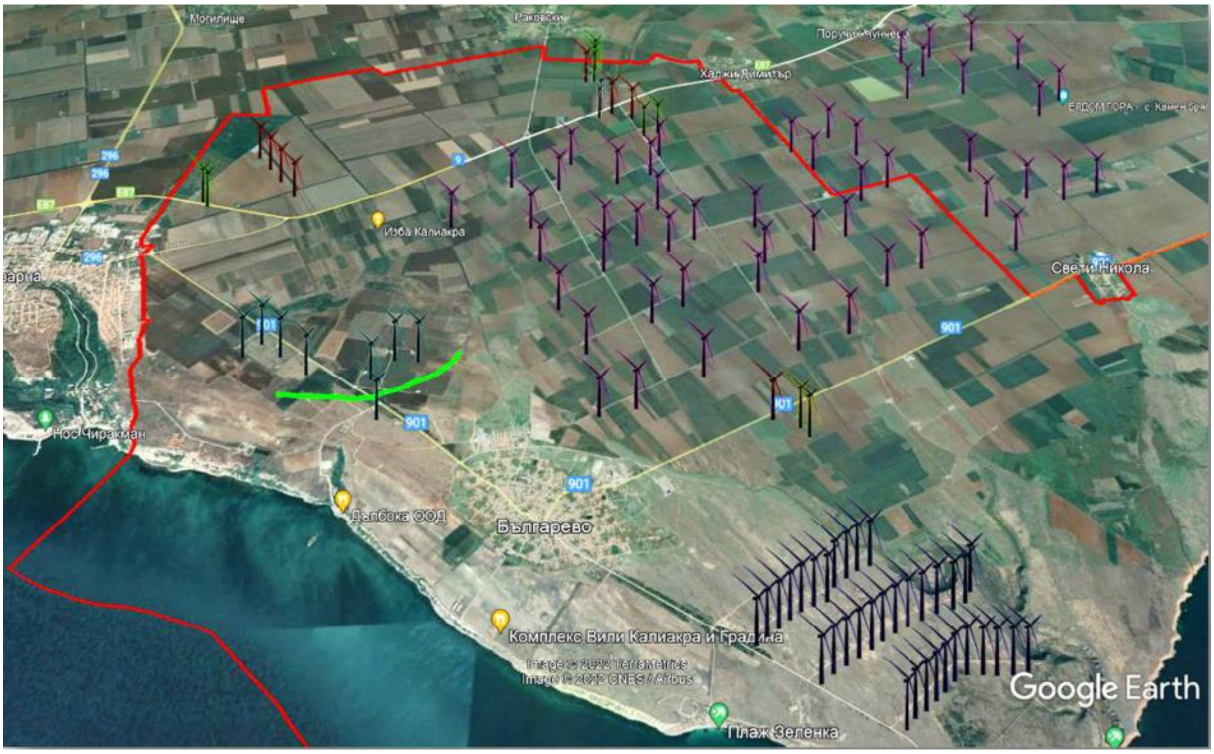

Figure 6. *Flock of 32 great white pelicans (green) observed 10 April 2022.*

2.7. Results of searches for collision victims

In order to check the effectiveness of the ISPB to prevent collisions of spring migrating birds, the surroundings of each of the 114 turbines covered by the ISPB programme was searched for collision victims at least once a week. 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 and results of previous ISPB reports at https://kaliakrabirdmonitoring.eu/.

The total of turbine searches per turbine is presented in Table 4.

Table 4. *Number of turbines searched for collision victims in the territory of ISPB during the period 15 March - 15 May 2022. The Code of every turbine incudes the abbreviation of the wind farm and the number of the turbine:* ***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,* ***ABZevs*** *- 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

Turbine number	March 2022	April 2022	May 2022	Total
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

Turbine number	March 2022	April 2022	May 2022	Total
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
AE59	2	4	2	8
AE60	3	4	2	9
AE8	2	4	3	9
AE9	2	4	3	9
DBΓ1	2	4	3	9
DBΓ1HSW250	2	5	2	9
DBΓ2	2	4	3	9
DBΓ2MN600	2	5	2	9
DBΓ3	2	4	3	9
DBΓ4	3	4	2	9
DBΓ5	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

Turbine number	March 2022	April 2022	May 2022	Total
M14	3	4	2	9
M15	3	4	2	9
M16	3	4	2	9
M17	3	4	2	9
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 5). 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 5. *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*

3. CONCLUSIONS

1) 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.

2) 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.

3) 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.

4) 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.

5) 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.

6) 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.

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