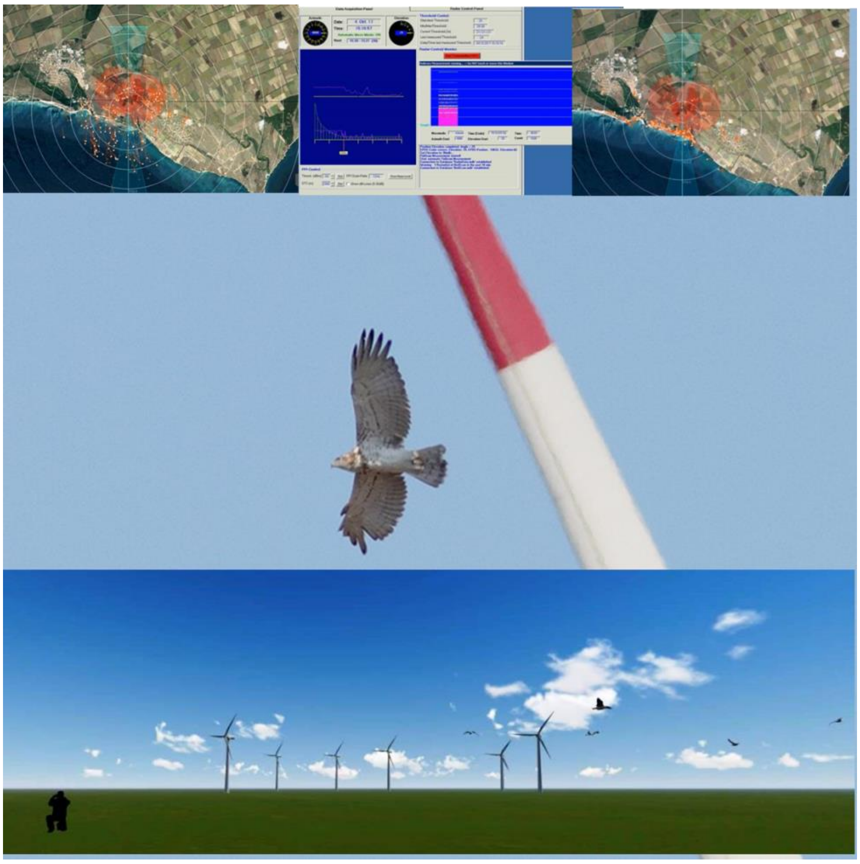
INTEGRATED SYSTEM FOR PROTECTION OF BIRDS

REPORT

Monitoring of the migration of birds through the territory of the Integrated System for Protection of Birds, Autumn 2019



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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.

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

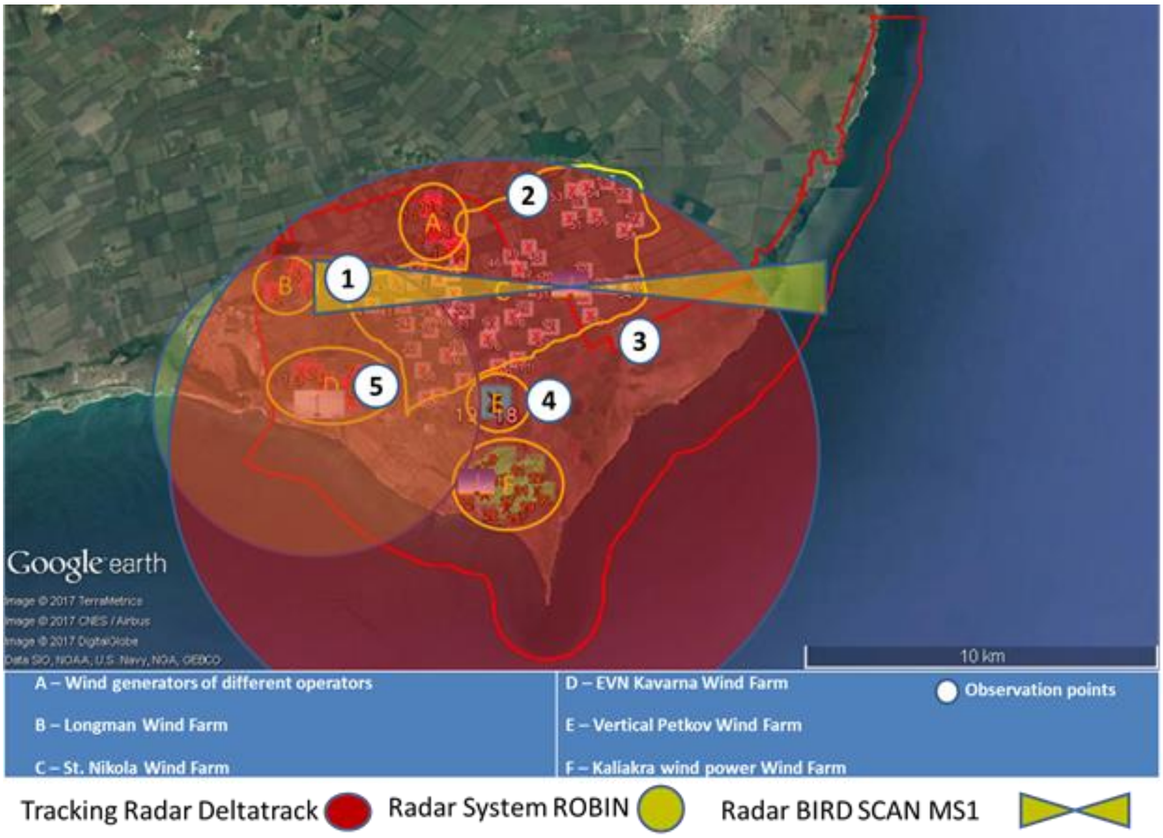


Figure 1. *A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.*

The recent surveys of bird migration in Bulgaria show that SPA Kaliakra is in the region of the country to the east of a defined migratory route -Via Pontica (Michev et al., 2012 http://acta-zoologica-bulgarica.eu/downloads/acta-zoologica-bulgarica/2012/64-1-033-041.pdf)(Figure 2).

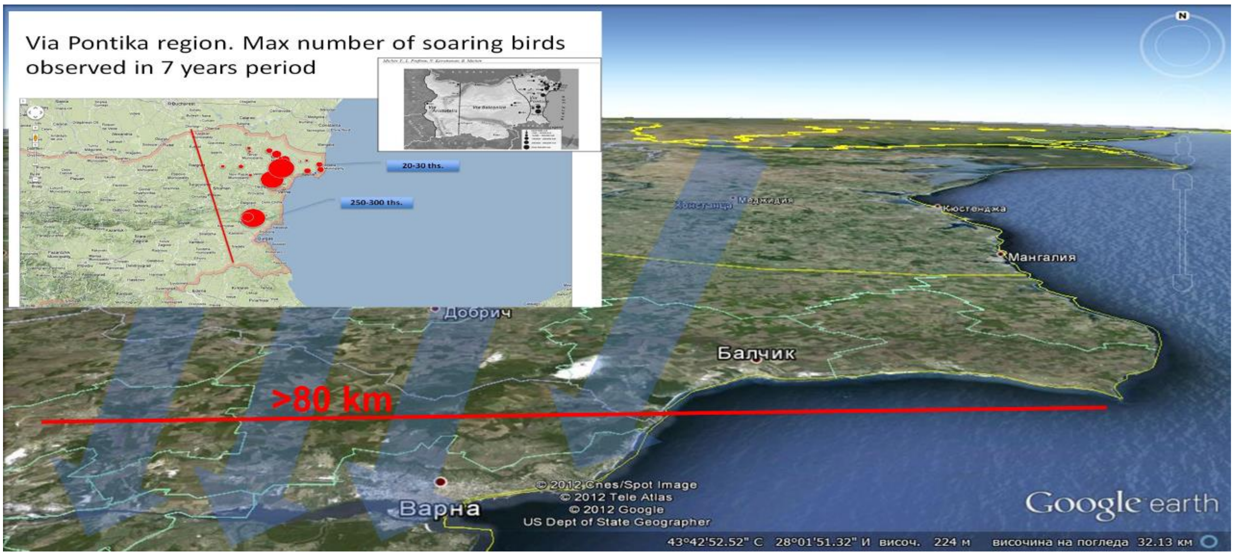


Figure 2. *Schematic location of the main migratory flows in the northeast of Bulgaria, known as Via Pontica.*

Over the past ten years, a series of studies have been carried out to study migratory, wintering and breeding birds in this area and specifically on the impact of a wind farm on birds: http://www.aesgeoenergy.com/site/Studies.html. These intensive surveys over several years have confirmed further that the study area on the Kailakra Cape is, indeed, away from the main migratory Via Pontica migration corridor. To date, moreover, these surveys found no evidence of significant impacts due to wind turbines on the populations of recorded species.

Under an agreement to establish and operate the ISPB, the ornithofauna was monitored during autumn migration in 2018 and 2019 on the above-mentioned territory.

This report covers the period of the autumn migration season (01.08-31.10.2019). The collected information was used to assess the effectiveness of the application of ISPB in Kaliakra in the autumn of 2019.

Taking into account the geographical location of the site and previous research (monitoring reports from the Saint Nikola Wind Farm,http://www.aesgeoenergy.com/site/Studies.html), as well as a report published by the MoEW on Nature of the Migration of 42 Birds from the Bulgarian fauna according to the level of modern knowledge http://natura2000.moew.government.bg/PublicDownloads/Auto/OtherDoc/276296/276296_Birds_120.pdf of migration, we consider the period covered in our study as optimal and representative for autumn bird migration of all target for ISPB species.

The study is specifically focused on target species for ISPB which are diurnal migrants. The data for all bird species flying over the territory, deemed as vulnerable to direct collision with wind facilities are presented in the report.

2. OBJECTIVES AND TASKS OF THE STUDY

The main objective of this monitoring study is to determine the quantitative characteristics of migratory birds in the area of ISPB during autun migration, to assess the effectiveness of the TSS applied here, in order to reduce the risk for birds, and to evaluate the impact of the wind farms on birds during autumn migration.

During the monitoring, the following characteristics of bird migration were identified:

1. Migration periods, species composition, changes in the number of birds during the season, daily activity, flight heights, as well as feeding, resting and roosting places of migrant birds passing through the area and observation points.

2. The significance of the study territory for feeding birds of prey.

3. Proportion of migrating birds in respect to the Western Black Sea migratory flyway - Via Pontica.

3. ORNITHOLOGISTS WHO CARRIED OUT THE SURVEY

- **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 Stoianov - 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.

4. MATERIAL AND METHODS

The methodology for ornithological monitoring has been developed in accordance with the methodological guidelines adopted by the National Council on Biological Diversity at the MOEW with Protocol No. 11 of 8 June 2010 and the Order of the Minister of Environment and Water of 15.02.2018 https://www.moew.government.bg/static/media/ups/tiny/filebase/Nature/Biodiversity/Preporyki%20Rykowodstwa%20Dokladi/Metodika_VEP.pdf) for the implementation of TSS in the Protected territories of Natura 2000 network of Bulgaria. Field observation protocols followed

Bibby et al. (1992) and Michev et al. (2010 and 2011) and were used to study the spring migration of birds in the territory covered by ISPB.

In addition, three radar systems were used in conjunction with real time observations by each of the field ornithologists. The range of the radar systems is presented in Figure 1.

The assessment of the effectiveness of the TSS utilizes the methodology developed in the USA (Morrison 1998) for monitoring bird collision with the turbines (and see methods described in http://www.aesgeoenergy.com/site/Studies.html).

All details about the application of the radar systems in the ISPB, ornithological methods, generic protocol for visual observations, site-specific protocol for visual observations, bird data recording collation, and physical characteristics of the environment recorded are given already in previous reports dedicated to spring and autumn migration 2018 and available from the web site of ISPB (https://kaliakrabirdmonitoring.eu/).

5. RESULTS

5.1. Direction of migrating birds

During the autumn monitoring of 2019, observations were made during all 92 days of the season. Comparisons of the observed monthly number of birds in two consecutive migratory seasons are presented in Figure 3.

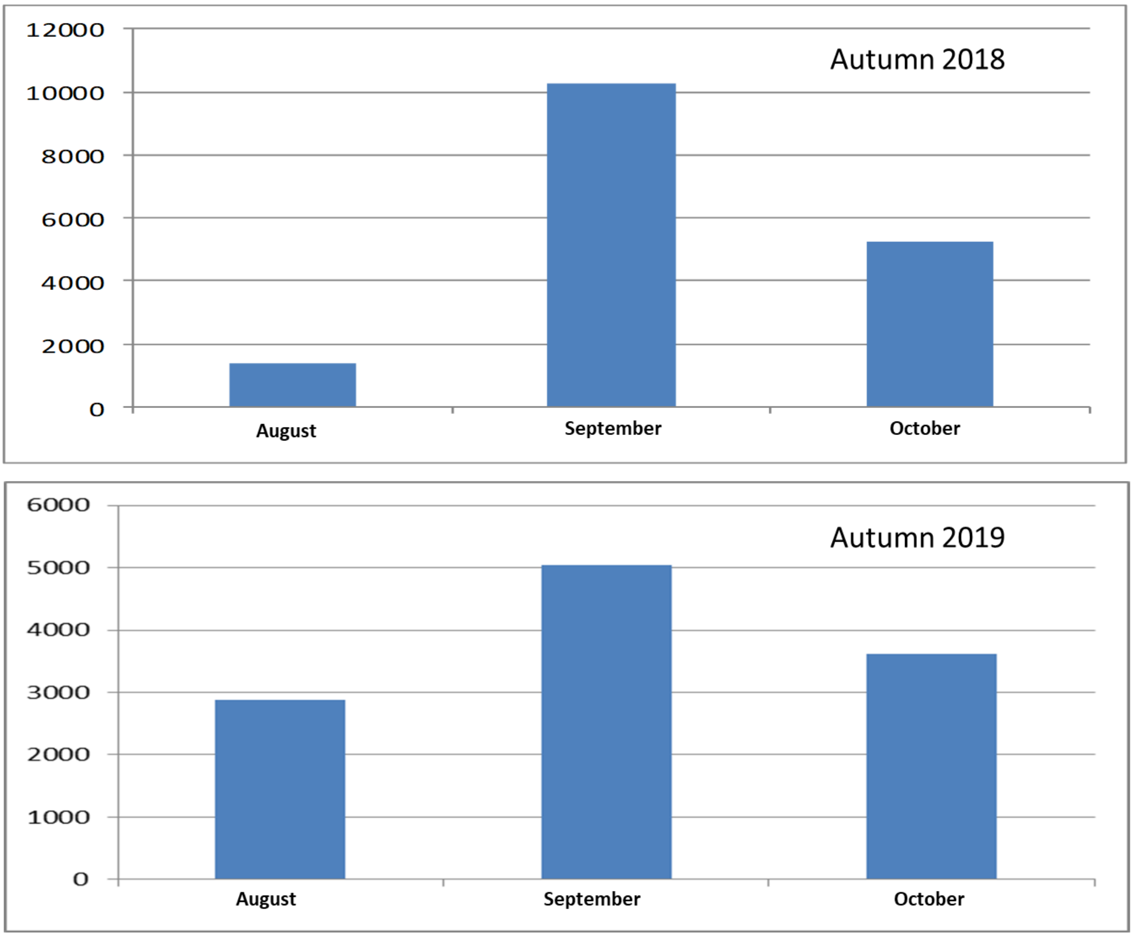
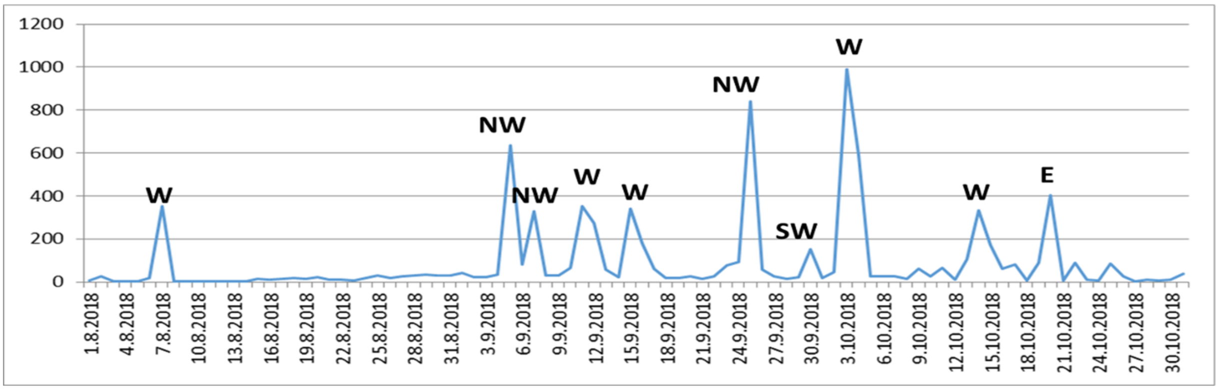


Figure 3. *Number of registered birds by months during the autumn migration period in the territory of ISPB in 2018 and 2019.*



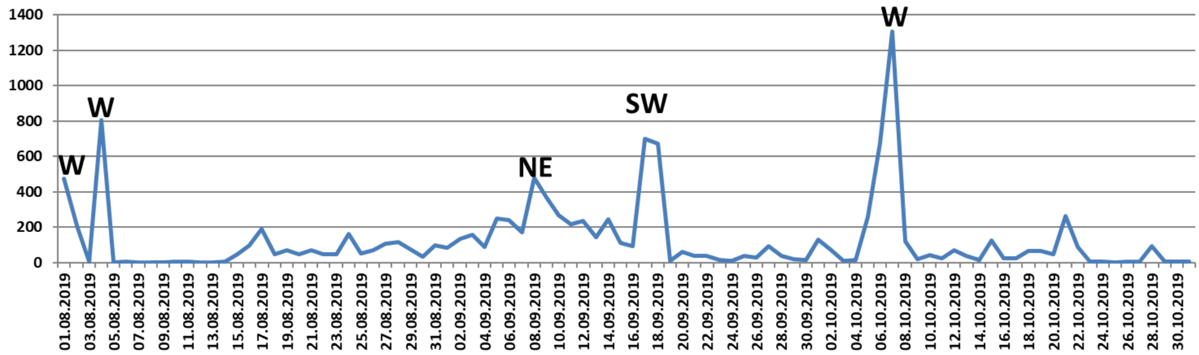


Figure 4. *Dynamics of the autumn migration of soaring bird species in the ISPB territory according to visual observations during the autumn migration in 2018 and 2019. Letters above spikes indicate the direction of wind in days with increased numbers of migrating birds.*

The number of birds in the ISPB study area apparently depended on the direction of the wind in autumn. The strong correlation of wind direction in the region and number of birds observed in the ISPB territory (Kalikara area) is supported by the direct comparison of days with westerly winds and number of birds registered for the whole season, in two consecutive years 2018 and 2019. The number of days with westerly wind directions in autumn 2018 was 18 and 10 in autumn 2019. The difference in number of days with westerly winds in 2018 (18 days) was reflected in a doubling in number of observed birds in ISPB (Figures 3 and 4).

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

In order to test for a potential barrier effect of the study area's wind turbines on migrating birds we analysed deviation of the flight directions from the expected main migratory direction of autumn migration – southerly directions. An important parameter for determining the presence of a barrier effect is the degree of observed circumvention of the ISPB territory with its operating wind turbines. The recorded flight directions in autumn are presented in Table 1.

Table 1. *Proportions of recorded birds by direction during autumn migration, in and approaching the territory of ISPB for the period 01 August – 31 October 2018 and 2019. In grey are the observed proportions as expected for autumn migration migratory directions.*

Direction	**Proportion of the bird 2018**	**Proportion of the bird 2019**
N	3,49%	1,51%
NE	8,73%	1,02%
NNE	0,02%	

Direction	Proportion of the bird 2018	Proportion of the bird 2019
NNW	0,01%	0,02%
NW	4,76%	1,77%
E	1,75%	5,83%
SEE	0,09%	
SE	5,64%	7,01%
SSE	0,01%	
S	41,52%	49,57%
SSW	0,12%	
SW	20,43%	19,35%
WSW	0,71%	0,01%
W	12,70%	13,91%
WNW	0,02%	

The main direction of birds during autumn migration was towards the south to southwest, with over 70 % of observations in both 2018 and 2019 autumn seasons (Table 1). Within this pattern of movement, the tendency of many migratory birds (around 20 %) to be on a southwesterly direction is also probably an indication that when winds came from the west more birds were observed in ISPB (as noted above), having been diverted from the major Via Pontica migratory route to the west. A southwesterly flight direction is indicative of birds attempting to return to that route. A trend in that southwesterly direction, around a general southerly path, is also likely to be related to the study area's geography, in that a persistent southerly flight path across ISPB and beyond would take birds over the Black Sea which would curtail any further migration through lack of supporting winds. Therefore, there was no observed marked deviation from the seasonal expectation of migratory flight directions, which were centered around the south in two consecutive years of monitoring. No changes were apparent in the migratory directions of the birds due to the presence of wind turbines.

5.2. Species composition and number of birds

The monitoring from 1 August to 31 October 2019 recorded 11105 individual birds, assigned to 48 bird species. The numbers of individuals recorded by species during autumn migration in two autumn seasons are shown in Table 2.

Table 2. *Composition of species and number of registered birds over the period 01 August to 31 October 2018 and 2019 in the ISPB territory*

Species name	***Autumn 2018***	***Autumn 2019***
A. brevipes	*309*	*123*
A. gentilis	*1*	*5*
A. nisus	*242*	*185*
A. cinerea	*21*	*8*
A. clanga	*0*	*1*
A. purpurea	*2*	*0*
A. pennata	*30*	*15*
A. pomarina	*232*	*29*
A. melba	*0*	*35*
A. apus	*0*	*100*
B. buteo	*2642*	*1980*
B. rufinus	*58*	*13*
B. lagopus	*3*	*1*
C. albus	*0*	*8*
C. aeruginosus	*442*	*180*
C. cyaneus	*37*	*15*
C. pygargus	*88*	*28*
C. macrourus	*8*	*5*
C. gallicus	*94*	*50*

Species name	***Autumn 2018***	***Autumn 2019***
C. ciconia	*451*	*1557*
C. nigra	*54*	*7*
C. garrulus	*1*	*37*
C. corax	*15*	*27*
C. cornix	*6*	*8*
C. monedula	*35*	*0*
C. frugilegus	*14*	*0*
C. oenas	*44*	*14*
C. crex	*0*	*1*
C. palumbus	*1200*	*2*
F. vespertinus	*472*	*149*
F. subbuteo	*48*	*46*
F. peregrinus	*4*	*0*
F. tinnunculus	*272*	*161*
F. cherrug	*2*	*0*
F. columbarius	*2*	*2*
F. eleonorae	*3*	*1*
M. migrans	*71*	*19*
M. milvus	*2*	*0*

Species name	*Autumn 2018*	*Autumn 2019*
M. alba	*414*	*0*
M. apiaster	*2963*	*4314*
M. calandra	*1430*	*0*
G. grus	*100*	*4*
G. virgo	*13*	*0*
L. michahellis	*234*	*62*
L. excubitor	*0*	*1*
L. fuscus	*1*	*0*
N. nycticorax	*0*	*12*
H. albicilla	*1*	*1*
H. rustica	*1000*	*86*
P. carbo	*576*	*512*

Species name	*Autumn 2018*	*Autumn 2019*
P. onocrotalus	*2021*	*1243*
P. crispus	*0*	*1*
P. apivorus	*801*	*9*
P. haliaetus	*17*	*12*
P. leucorodia	*5*	*1*
P. roseus	*1*	*0*
P. perdix	*10*	*25*
R. riparia	*76*	*0*
St. vulgaris	*400*	*0*
V. vanellus	*4*	*0*
E. garzetta	*1*	*0*
T. ferruginea	*0*	*8*

The most numerous migrating birds recorded in autumn 2019 were bee-eaters (*Merops apiaster*) with over 4,300 individuals registered. Within the soaring birds the most numerous birds recorded involved common buzzards (*Buteo buteo*), white pelicans (*Pelecanus onocrotalus*) and white storks (*C. ciconia*) with over 1000 individuals of each species (Table 2). The white pelican and white stork, the species with the highest recorded numbers, of over 1,500 individuals, were observed in short periods of time during the season. Most species were observed in lower numbers in autumn 2019 than in 2018, which can be explained by the lower number of days with westerly winds in 2018. One species with a marked increase in recorded numbers in 2019 was the bee-eater. The estimation of the real number of bee-eaters in the ISPB study area is imprecise as it can be highly dependent on their aerial feeding behavior. This imprecision and the difficulty in accurate recording of bee-eater numbers has been repeatedly noted in previous SNWF monitoring reports (http://www.aesgeoenergy.com/site/Studies.html).

In autumn 2018 and 2019, 451 and 1557 white storks (*Ciconia ciconia*) were recorded during ISPB studies, respectively. The reason why white storks were unusual in being more common in 2019 than in 2018 is in the number of days in 2019 with westerly winds coinciding exactly with the main period of white stork migration between the beginning of August and the beginning of September. The two days with westerly winds in the beginning of August 2019 (Figure 4) provided flight conditions pushing many birds in active migration to the west, towards ISPB: in these two days, 1470 out of 1557 white storks were observed in ISPB territory during autumn 2019.

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 western Black Sea flyway (Via Pontica), covering a region of northeastern Bulgaria. Our results confirm that white storks flying over the Kaliakra area have a negligible number (between 0.02 % and 0.06 % of the Via Pontica population) and the area still remains east of the main migratory route of white storks along the western Black Sea migration fly way.

The remaining registered bird species were also observed in low numbers in respect to total numbers of these species passing along the Via Pontica flyway observed in typical bottleneck sites – Burgas Bay (Michev et al. 2018). For example, black storks (*C. nigra*) in Kaliakra vary between 7 and 54 in contrast to Burgas where over 5,000 black storks were observed in autumn 2017. Marsh harriers (*Circus aeruginosus*) counts varied from 180 to 442 in Kaliakra compared to 1,468 in Burgas. Lesser-spotted eagles (*Aquila pomarina*) in Kaliakra varied between 29 and 232 in contrast to over 22,000 in Burgas. Red-footed falcons (*Falco verspertinus*) counted in Burgas reached over 15,000 in contrast to less than 500 in Kaliakra.

The differing proportions of the most numerous birds of prey using the ISPB area during autumn migration is shown in Figure 9.

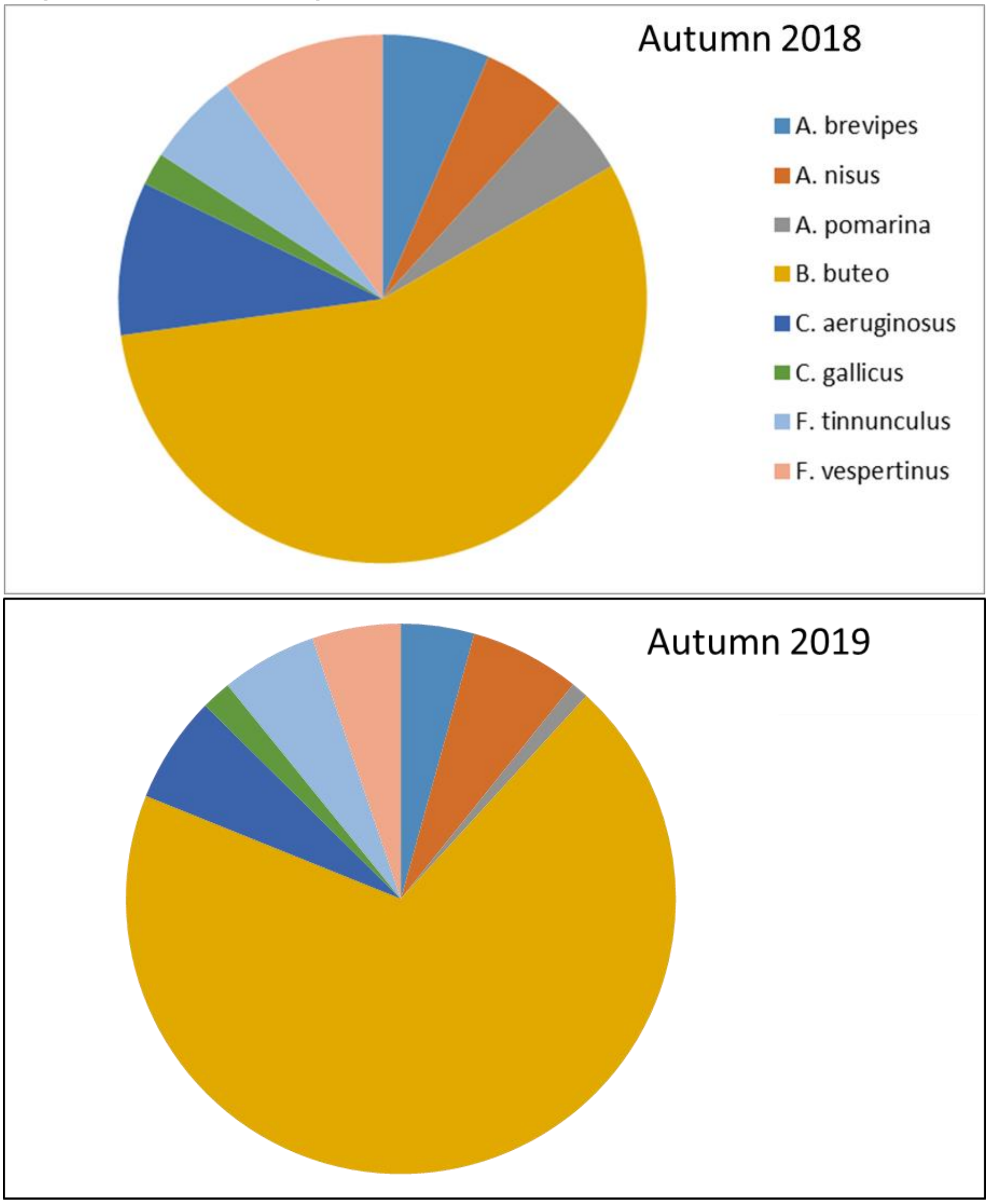


Figure 9. *Proportional representations of the eight most numerous birds of prey recorded during autumn migration in 2018 and 2019*

5.3. Frequency of appearance

The common buzzard and marsh harrier were found with the highest frequency of encounters in ISPB territory during the autumn migration of 2019. The sparrowhawk (*Accipiter nisus*) and the common kestrel (*Falco tinnunculus*) were the second most frequently registered birds of prey in the area. All other raptor species appeared episodically in the ISPB area in autumn 2019 (Table3).

The appearance of the observed species in different parts of the ISPB study area does not obviously indicate avoidance of the locations with operating wind turbines. This supposition is reached by virtue of the observed frequency of appearance of every species by observation points, indicated in location by Figure 1, and on data presented in Table 2.

***Table 3**. Number of days with records of the most numerous soaring bird species, according to every observation point, during the period of monitoring in ISPB territory in autumns of 2019 and 2018.*

Species	**OP1**		**OP2**		**OP3**		**OP4**		**OP5**	
	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018
A. brevipes	13	11	5		21	10	4	13	3	16
A. nisus	21	34	11		39	36	7	95	39	28
A. pomarina	8	18	1		2	9		21	5	17
B. buteo	80	80	22	4	72	75	23	78	87	80
B. lagopus					1	1		1		1
B. rufinus		15		1	10	15	1	9	1	10
C. aeruginosus	20	83	14	4	27	70	31	99	32	116
C. ciconia	1	1	1	4	10	10		2		3
C. cyaneus	4	15			7	1		9	2	8
C. gallicus	4	10	4	3	11	17	11	16	6	24
C. garrulus		1			2					
C. macrourus		3	3		1	1		2		2
C. nigra	3	5			1	3		5		3
F. columbarius					2			1		1
F. eleonore	1							2		1
F. subbuteo	11	13	1		9	21	11	4	3	6
F. tinnunculus	41	44	17	5	14	45	9	51	15	29
F. vespertinus	6	44	29		9	18	3	54	12	21
P. apivorus		15				27	4	17	3	17
P. onocrotalus	1	7			2	12		9	3	2

Activity of observed soaring birds in respect to wind turbines during the autumn migratory period did not indicate any avoidance of the area with turbines. The daily activity of autumn migratory birds from records collected in the ISPB is shown in Figure 10.

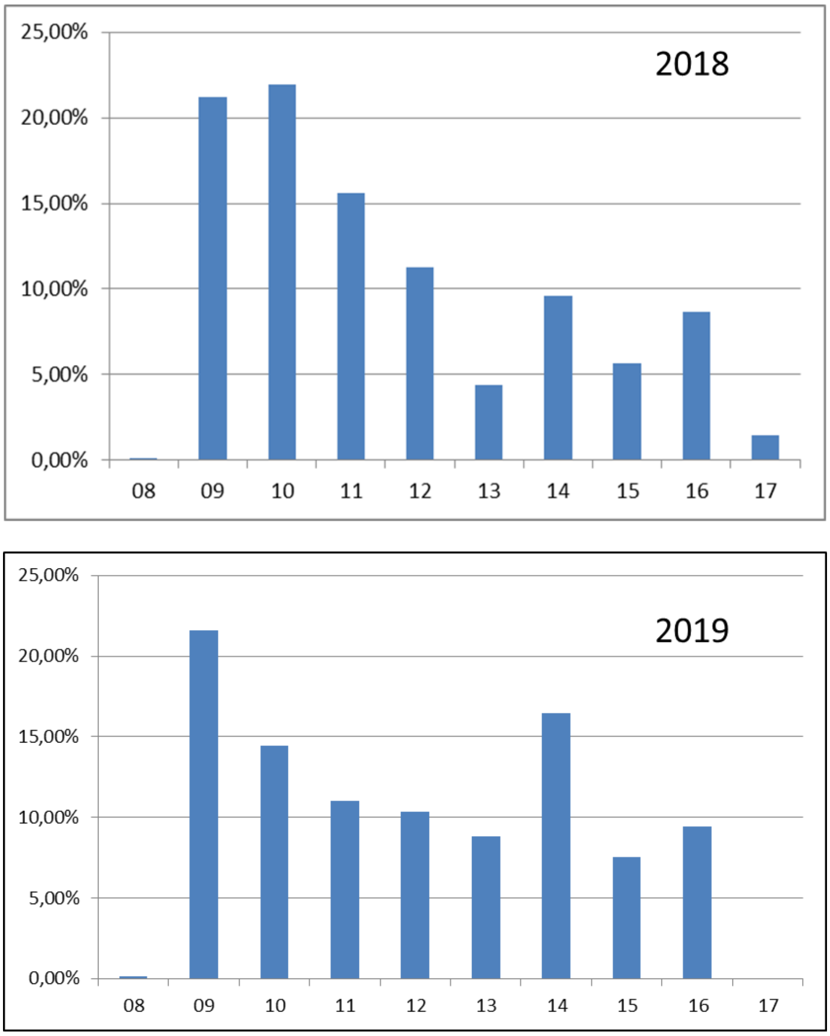


Figure 10. *The dynamics of the presence of birds by hour of the day in the ISPB territory in the autumns of 2018 and 2019.*

5.4. Altitude of birds

Over 50 % of birds observed in the ISPB flew at a height of less than 200 m above ground level in two autumn seasons of 2018 and 2019. No changes in flight height due to the proximity of wind turbines were observed. The distribution of migratory birds in height is shown in Figure 11.

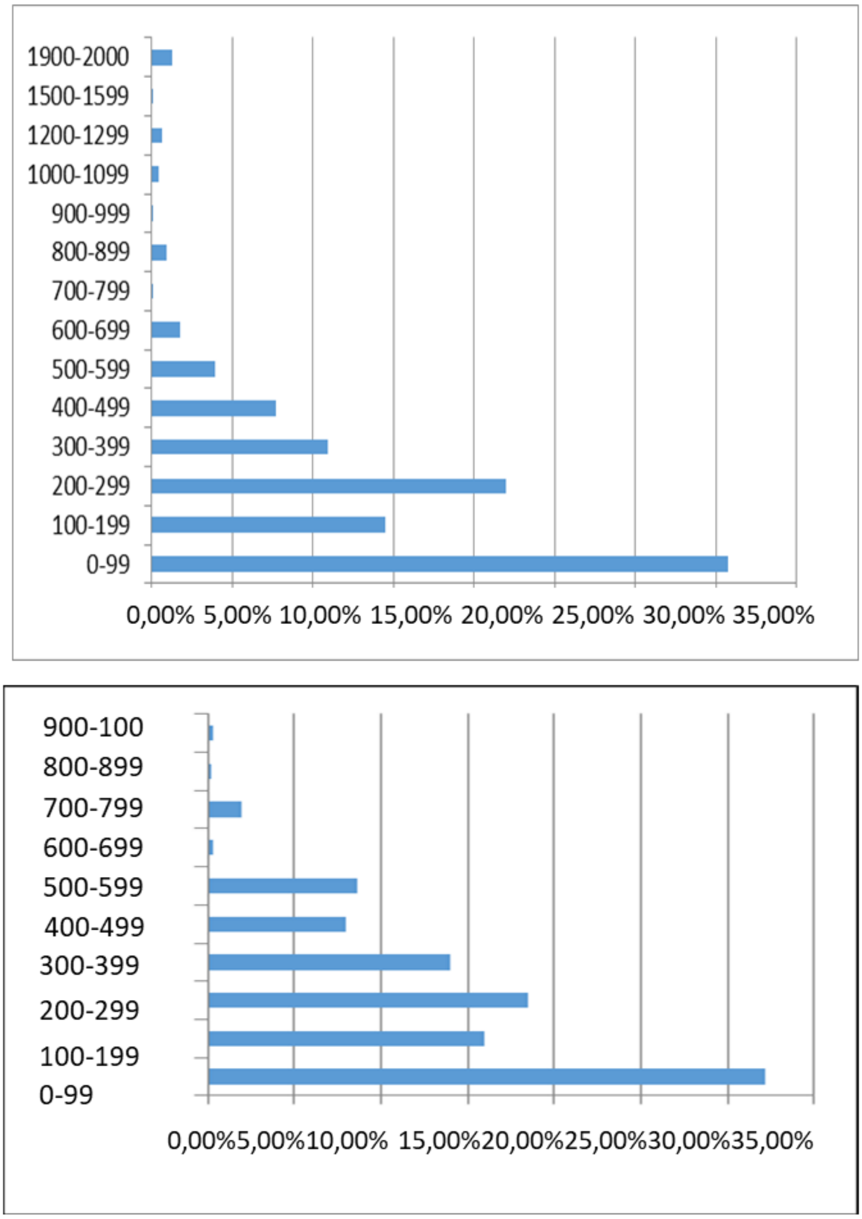


Figure 11. *Proportional (%) distributions of passing birds by altitude (metres) in ISBP as observed in autumn 2018 [upper graph?] and 2019 [lower graph?] monitoring periods.*

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

As a result of the simultaneous observations at five constant observation points and three radar systems (Figure 1) during the whole period of the 2019 autumn migration, there were a total of 30 automatic stops and two directed by field ornithologists of single turbines, groups of turbines or entire wind farms 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 birds passing through the territory. Detailed information on the duration of these two ordered stops is given in Table 4.

Table 4. *Data for stops of wind turbines ordered by field observers during the autumn migration of birds 2019.*

Date	***Wind Farm***	***Turbine code №/ Group***	***Species***	***Number of birds***	***Time stop***	***Time restart***
1.08.2019	*KWP*	*All turbines*	*Ciconia ciconia*	*300*	*9:55:00*	*10:14:00*

Date	*Wind Farm*	*Turbine code №/ Group*	*Species*	*Number of birds*	*Time stop*	*Time restart*
7.10.2019	AES	Zones E, F	P. onocrotalus	450	14:39:00	14:57:00

5.6. Observed flocks of target bird species for ISPB as documented in autumn migration 2019

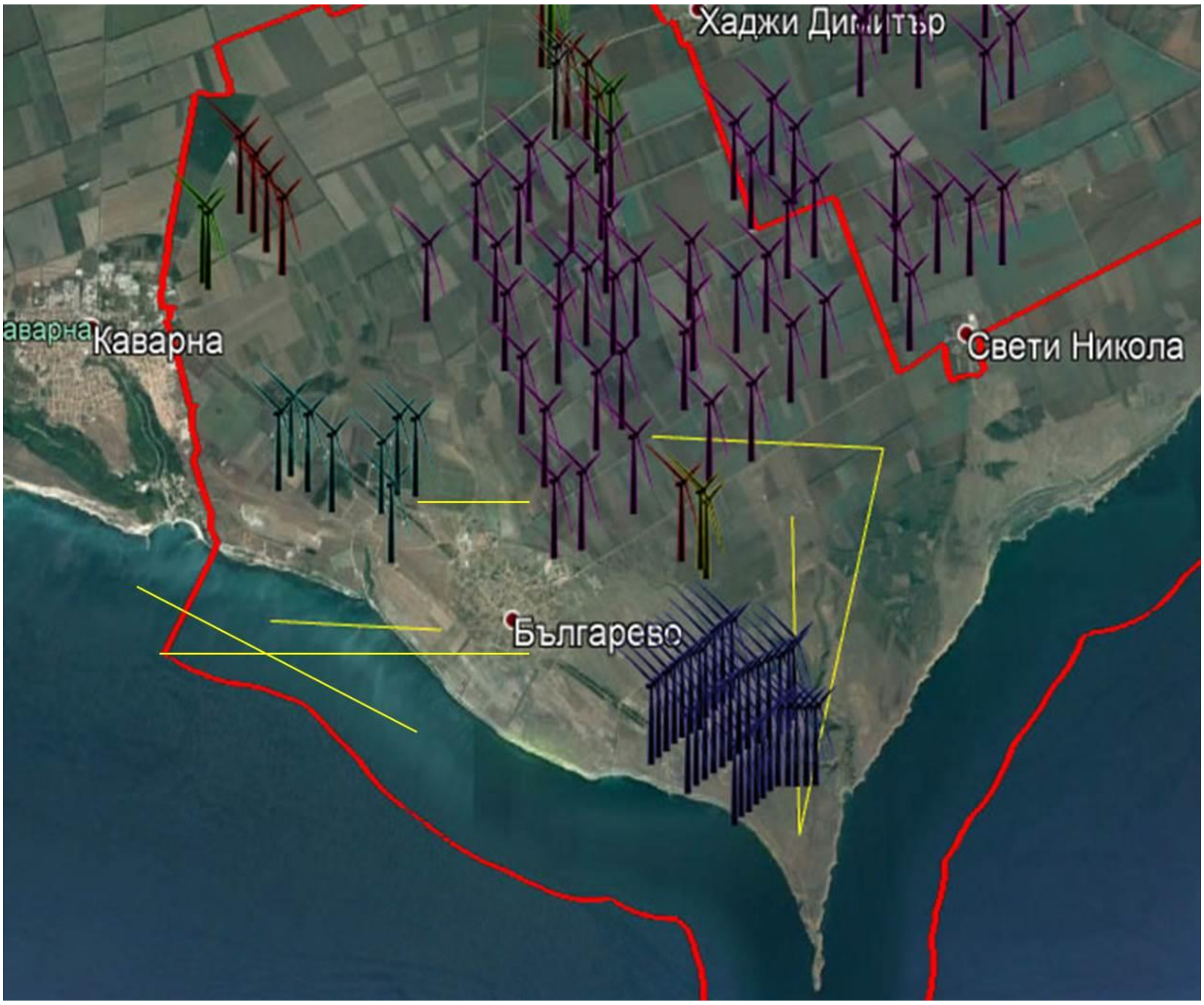


Figure 12. *Registered flocks of white storks in August 2019.*

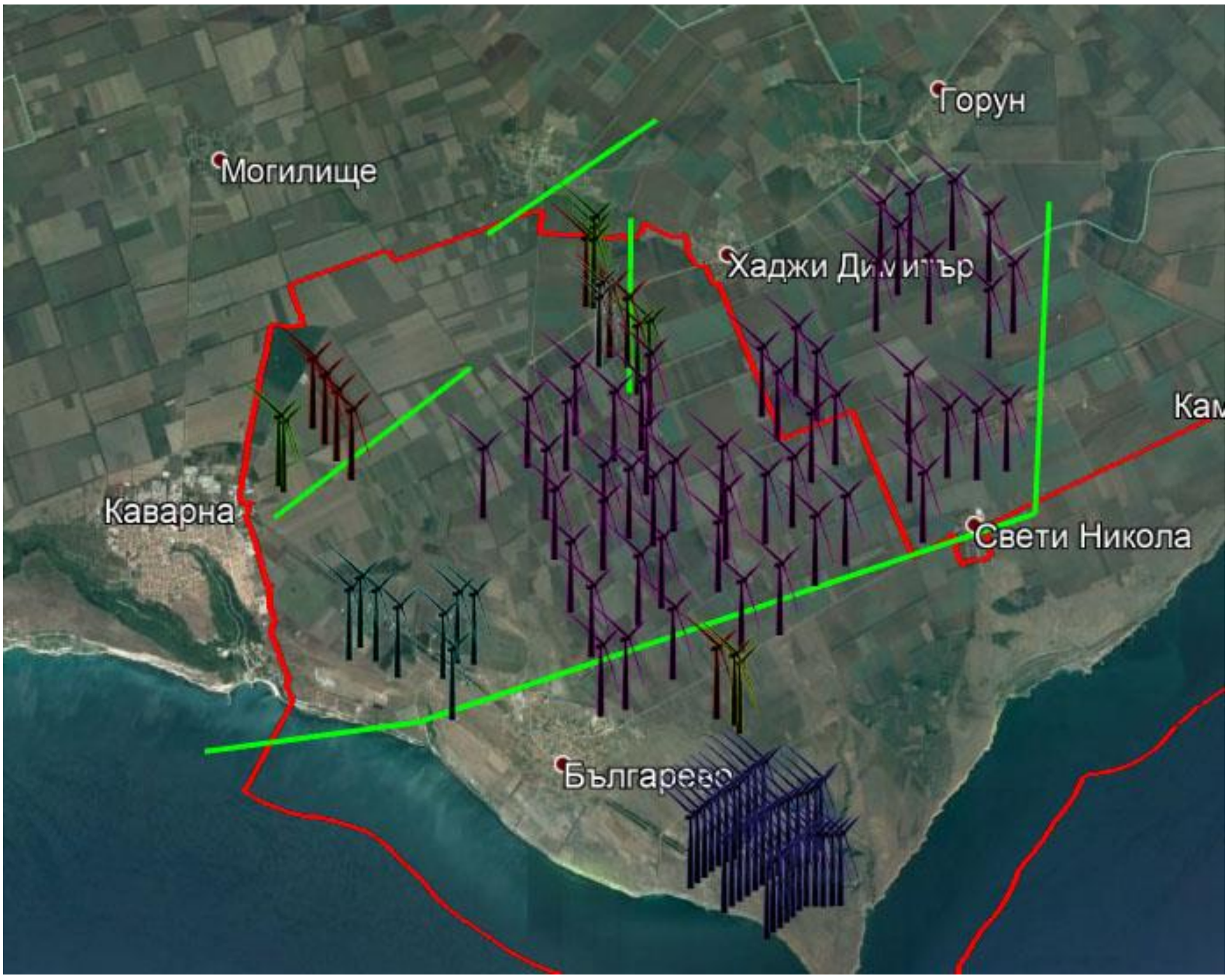


Figure 13. *Registered flocks of white pelicans in October 2019*.

5.7. Analysis of the recorded additive mortality caused by wind turbines on the bird populations passing through the ISPB territory

In order to check the effectiveness of the ISPB to prevent collisions of autumn migrating birds, each of the 114 turbines covered by the ISPB programme was checked at least once a week for collision victims during the autumn migration monitoring period of 2019. It is well known that in the search for victims of collision with working wind turbines do not detect all dead birds for several reasons. The two main factors behind this are the effectiveness of the searcher (the searchers fail to find all the dead birds) and the removal / disappearance of the dead birds before they can eventually be discovered by the searcher. Reporting on these two potential parameters can significantly improve the assessment of mortality due to collision in operating wind farms. To foresee such corrections, field experiments were undertaken in ISPB territory in autumn 2018. According to additional previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF (and repeated in spring 2018 with similar results), 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. Hence a frequency of four searches per month under every turbine allows estimation of the mortality of birds from collision with the turbines in the ISPB. This allows estimation of bird mortality from collision with the turbines in the Kaliakra SPA and others of the total 114 wind turbines included in the ISPB. For details of relevant previous studies at SNWF within the wider ISPB territory, see: http://www.aesgeoenergy.com/site/Studies.html

The total number of searches per turbine is presented in Table 7.

Table 7. *Number of checks for victims of collision in the territory of ISPB during the period 01 August 31 October 2019.*

Turbine	Aug.	Sep.	Oct.	Total
ABBalgarevo	4	4	4	12
ABΓ1	3	5	4	12
ABΓ2	3	5	4	12
ABΓ3	3	5	4	12
ABΓ4	3	5	4	12
ABMillenium group	4	4	5	13
ABMillenium group Micon	4	4	5	13
AE10	4	4	4	12
AE11	4	4	4	12
AE12	3	4	4	11
AE13	3	4	5	12
AE14	3	5	4	12
AE15	3	5	4	12
AE16	4	4	4	12
AE17	4	4	4	12
AE18	3	4	4	11
AE19	3	4	4	11
AE20	3	5	4	12
AE21	4	4	4	12
AE22	4	4	4	12
AE23	4	4	4	12
AE24	4	4	4	12
AE25	4	4	4	12
AE26	4	4	4	12
AE27	4	4	5	13
AE28	4	4	5	13
AE29	4	4	4	12
AE31	3	4	5	12
AE32	3	4	5	12
AE33	3	4	5	12
AE34	3	4	5	12
AE35	3	4	5	12
AE36	3	4	4	11
AE37	3	4	5	12
AE38	3	5	4	12
AE39	3	5	4	12
AE40	4	4	4	12
AE41	4	4	4	12
AE42	4	4	4	12
AE43	4	4	4	12
AE44	4	4	4	12
AE45	4	4	5	13
AE46	3	4	5	12
AE47	3	4	5	12
AE48	3	4	5	12
AE49	3	4	5	12
AE50	3	4	5	12
AE51	3	5	3	11
AE52	3	5	4	12
AE53	3	5	4	12
AE54	3	5	4	12
AE55	3	5	4	12
AE56	3	5	4	12

Turbine	Aug.	Sep.	Oct.	Total
AE57	3	5	4	12
AE58	3	5	4	12
AE59	3	5	4	12
AE60	3	4	5	12
AE8	3	5	4	12
AE9	3	5	4	12
DBΓ1	3	5	4	12
DBΓ1HSW250	4	4	4	12
DBΓ2	3	5	4	12
DBΓ2MN600	4	4	4	12
DBΓ3	3	5	4	12
DBΓ4	4	4	5	13
DBΓ5	4	4	5	13
DC1	4	4	5	13
DC2	4	4	5	13
E00	4	4	4	12
E01	4	4	4	12
E02	4	4	4	12
E04	4	4	4	12
E05	4	4	4	12
E07	4	4	4	12
E08	4	4	4	12
E09	4	4	3	11
M1	4	4	4	12
M10	4	4	5	13
M11	4	4	5	13
M12	3	4	5	12
M13	3	4	5	12
M14	3	4	5	12
M15	3	4	5	12
M16	3	4	5	12
M17	3	4	5	12
M18	3	4	5	12
M19	3	4	5	12
M2	4	4	4	12
M20	3	4	5	12
M21	3	4	5	12
M22	3	4	5	12
M23	3	4	5	12
M24	3	4	5	12
M25	3	4	5	12
M26	3	4	5	12
M27	3	4	5	12
M28	3	5	4	12
M29	3	5	4	12
M3	4	4	4	12
M30	3	5	4	12
M31	3	5	4	12
M32	3	5	4	12
M33	3	5	4	12
M34	3	5	4	12
M35	3	6	4	13
M4	4	4	5	13
M5	4	4	5	13

Turbine	Aug.	Sep.	Oct.	Total
M6	4	4	5	13
M7	4	4	5	13
M8	4	4	5	13
M9	4	4	5	13

Turbine	Aug.	Sep.	Oct.	Total
VP1	4	4	4	12
VP2	4	4	4	12
ABZevs	3	5	4	12
Grand Total	**391**	**489**	**500**	**1380**

As a result of 1380 single inspections of 114 individual turbines between 1 August and 31 October 2019, a total of two dead birds of two species were identified. One common swift (*Apus apus*) was found 06.08.2019 and one yellow-legged gull (*Larus michahellis*) was found 15.10.2019. Both bird species are Least Concern category according to IUCN evaluation and so are not focuses of species conservation criteria. Both species for which collision victims were found are numerous and the additional mortality caused by wind turbines would not impact the wider population numbers. Both species are not among the target ISPB species. In the case of collision mortality monitoring in the ISPB, no case of collision with turbines of target bird species was identified in autumn 2018 and 2019.

6. CONCLUSIONS

1) 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.

2) 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.

3) 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.

4) 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.

5) 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.

6) The quantitative characteristics of bird migration in the ISPB area during autumn 2018 and 2019, 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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