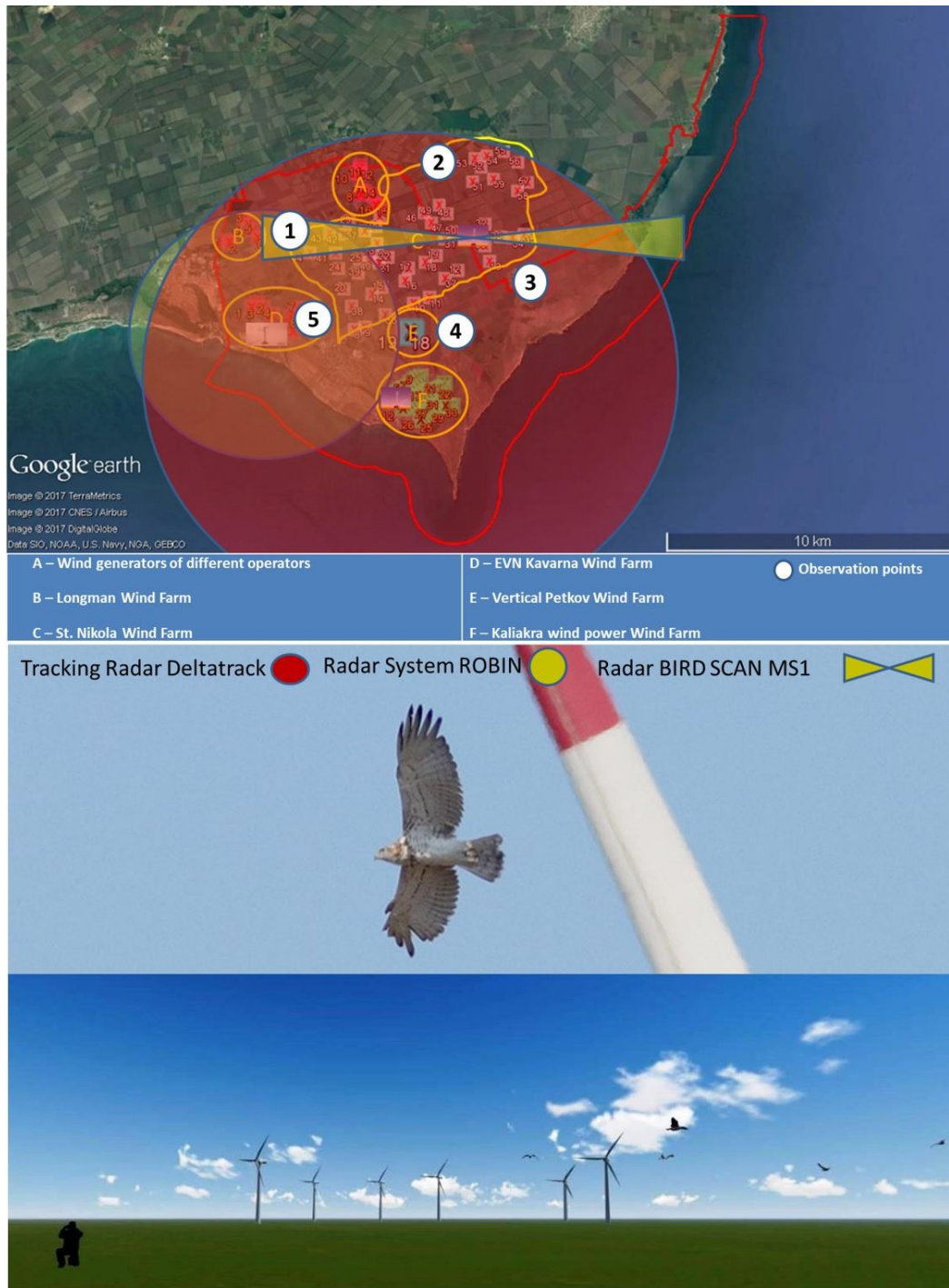


Summary of Activities and the Results of Ornithological Monitoring in 2018



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Introduction

The monitoring of Saint Nikola Wind Farm (SNWF) in 2018 was a part of more complex study assigned by the Wind farms, located in Kaliakra SPA BG0002051- AES Geo Energy Ltd., Kaliakra Wind Power., Degrets OOD, Disib OOD, Windex OOD, Long Man Invest OOD, Long Man Energy OOD, Zevs Bonus OOD, Vertikal-Petkov & Sie SD, Wind Park Kavarna East EOOD, Wind Park Kavarna West EOOD, Millennium Group OOD. Effective of March 2018 the wind farms entered into agreement to implement and operate an Integrated System for Protection of Birds (ISPB) that includes 114 wind turbines, 95 of which are within the Kaliakra SPA BG0002051 and 19 are in the areas adjacent to the protected zone.

The ISPB consists of a combination of radar observations and meteorological data, integrated with field visual observations, which jointly used are essential for the accurate risk assessment and ensure that appropriate action is taken immediately to avoid collision risk. So far as potential adverse impacts of turbine collisions on birds, a Turbine Shutdown System is deployed supported by an Early Warning System.

The monitoring studies are based on the requirements of basic normative and methodological documents as follows: Environmental Protection Act, Biological Diversity Act, Bulgarian Red Data Book, Directive 92/43/EEC for habitats and species, and Directive 2009/147/EC on the conservation of wild birds, Protected Areas Act and Order RD-94 of 15.02.2018 of the Minister of Environment and Waters. Best international practices are also incorporated (T-PVS/Inf (2013) 15: <https://rm.coe.int/1680746245>). Detailed information on the scope, technical rules and monitoring procedures are publicly available at a dedicated website <https://kaliakrabirdmonitoring.eu/>.

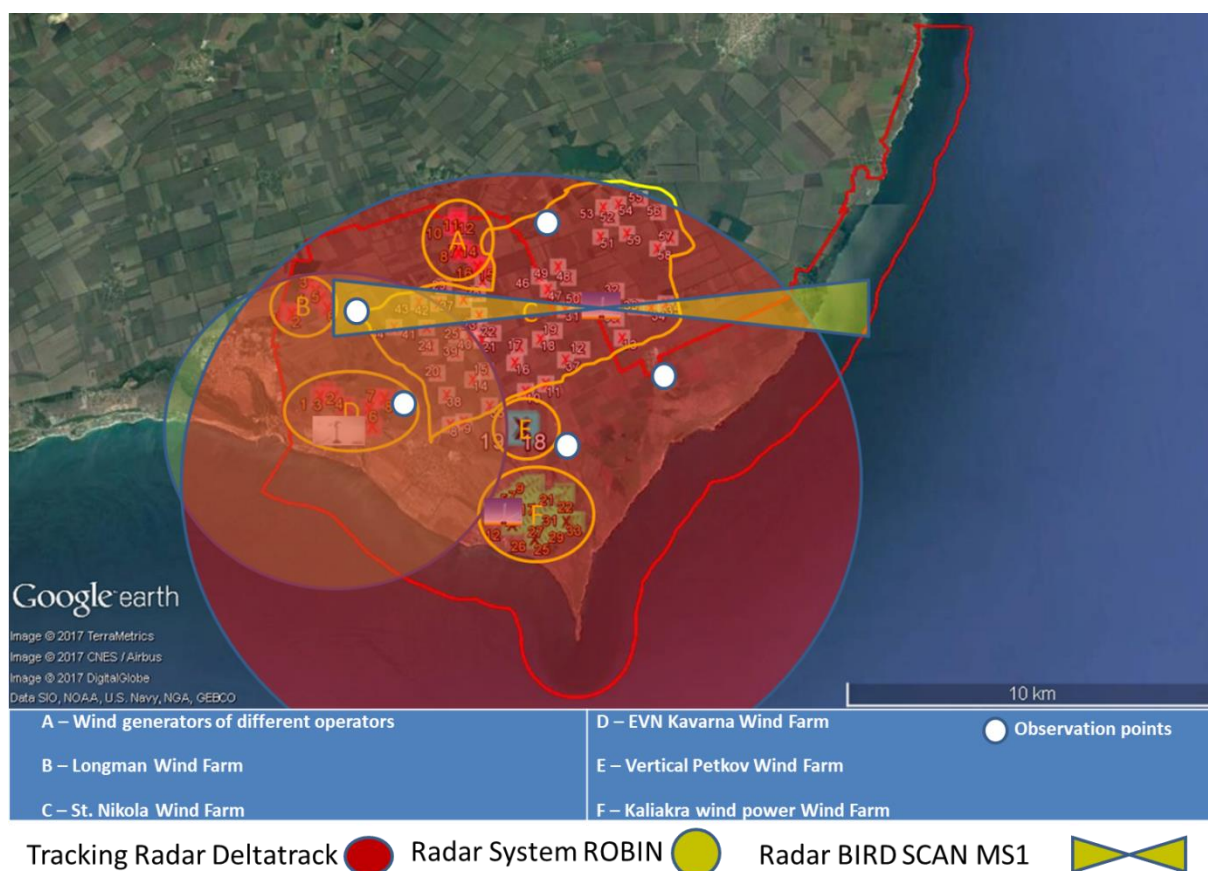


Figure 1. A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.

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

In order to provide objective data for the bird risk assessment, this summary presents activities and results of the monitoring in 2018 with main focus on the territory of Saint Nikola Wind Farm.

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

Three types of radars integrated into the ISPB were used for monitoring and prevention of bird collisions:

Bird Scan MS1

The radar collects quantitative data and provides information about Migration Traffic Rate of birds through a specific sector where the fixed beam of the radar is directed (Figure 1). The quality of the data deepens on the distance to the birds and to the size of the migrating birds. In the case of ISPB the maximum distance we have used the Bird Scan MS1 radar is 10 km beam directed from west to east across the main migratory front of seasonal migrations. The data obtained by this radar system allow crude identification of ecological types of birds: for example, passerines, swifts, waders and large birds. The radar data do not allow quantification of bird migration for every bird species observed in the ISPB territory and therefore do not allow any comparison with visual observations.

These data are not used for quantification and analysis of the characteristics of migration.

Deltatrack Radar System

This radar is a tracking radar system which allows detection of a single target or group of targets and tracking of their movements in a range of around 5 km (Figure 1). It is used in the monitoring as a real time tool for the tracking of already (visually) identified bird targets in the ISPB territory. The radar is not applicable for quantitative analysis of bird migration.

Radar System Robin

This is a 3 D radar system constructed for detection and tracking of moving targets in air volume of around 10 km³ (<https://www.youtube.com/watch?v=-Kb70clGHOQ&t=8s>) (Figure 1). It is a real time tool for tracking of moving targets and in combination with visual observations in the field provides highly reliable data on the distance as well altitudes of birds already detected and identified by the field ornithologists. This radar does not provide quantitative data of migration at a species level because it does not allow species identification.

All three radar systems have been used as tools to assist field observations, detection of potential ingresses, and real time tracking of birds after visual observation through the ISPB during the period of monitoring.

All quantitative data and analysis of recorded bird numbers are based on the only possible quantification of bird migration of different bird species – the visual observations in the field. Locations of field observation points are presented in Figure 1.

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

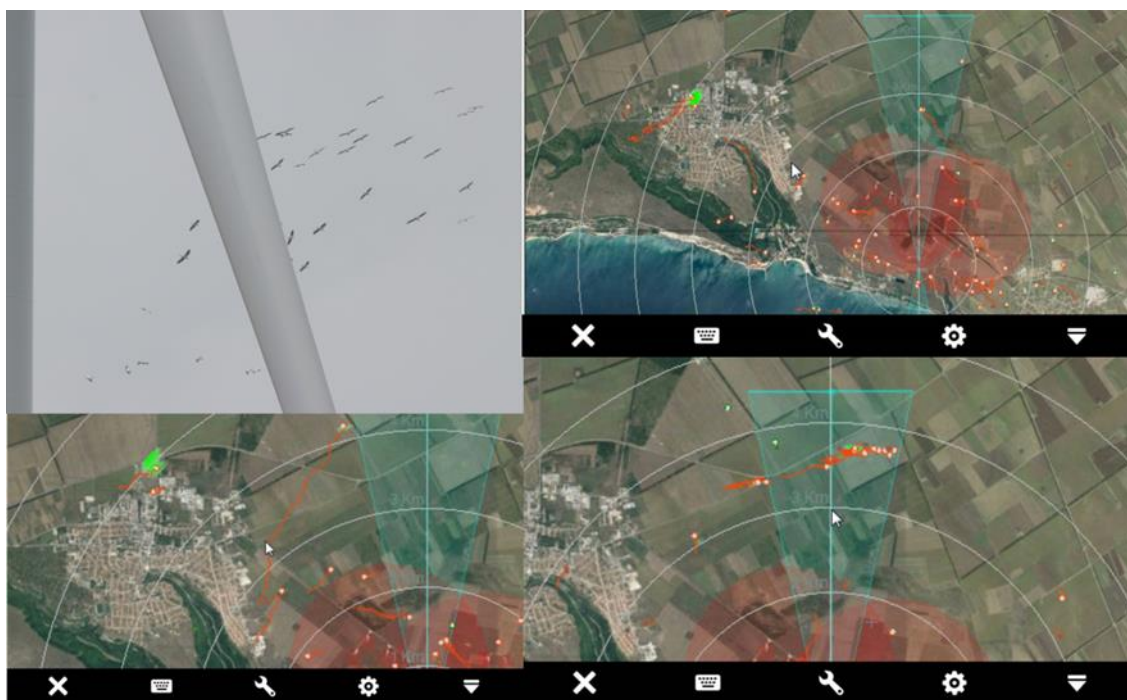


Figure 2. A flock of White pelicans: an illustration of the simultaneous records obtained by every ornithologist in real time information from Robin Radar System and visual observations. Every single bird and flock of birds from the target bird species were tracked by visual observations and the Robin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

Results

Spring migration

During the spring monitoring, observations were made during all 92 days of the season, with registered migratory, soaring birds being detected over 70 % of the time. For the survey period (March 15 - May 15), a total of 1560 migratory and resident birds (Table 1) were registered:

Table 1. 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 2018
15-31 March	882
1-30 April	445
1-15 May	233
Total for the period	1560

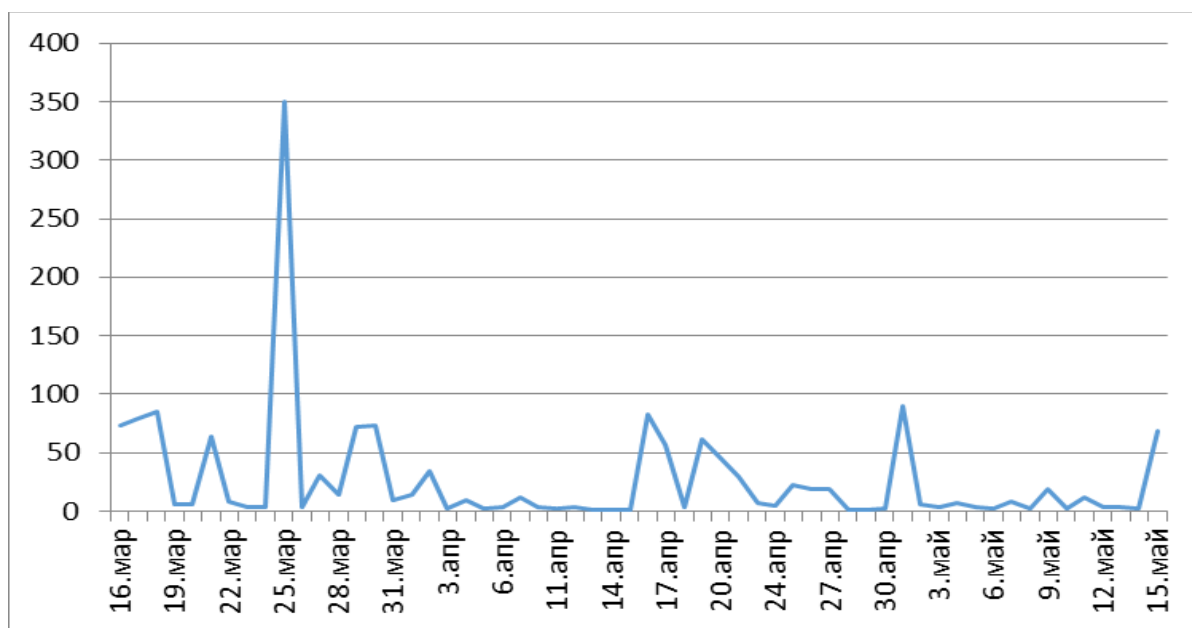


Figure 3. Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2018

The variations in bird numbers were substantial (Figure 3). The low number of migrating birds through the study area, because of the relatively low prevalence of westerly winds in this season, did not allow for an in-depth statistical analysis of the number of birds according to wind direction.

Migratory birds were poorly represented during the spring migration period in the surveyed territory.

Of the total of 1560 birds registered in the course of the study, 1519 individuals were identified to species. The species and number of birds recorded during spring migration is shown in Table 2.

Table 2. Composition and number of registered bird species during the period 15 March - 15 May 2018 in the ISPB territory.

English name	Latin name	Number
Common swift	<i>A. apus</i>	2
Alpine swift	<i>A. melba</i>	5
Northern Goshawk	<i>A. gentilis</i>	1
Eurasian sparrowhawk	<i>A. nisus</i>	1
Grey heron	<i>A. cinerea</i>	6
Squacco heron	<i>A. ralloides</i>	1
Booted eagle	<i>A. pennata</i>	2
Lesser spotted eagle	<i>A. pomarina</i>	1
Common buzzard	<i>B. buteo</i>	75
Long-legged buzzard	<i>B. rufinus</i>	2
Marsh harrier	<i>C. aeruginosus</i>	23
Hen harrier	<i>C. cyaneus</i>	8
Montagu's harrier	<i>C. pygargus</i>	8
Pallid harrier	<i>C. macrourus</i>	1
Short-toed snake eagle	<i>C. gallicus</i>	5
White stork	<i>C. ciconia</i>	81
Black stork	<i>C. nigra</i>	4
Mute swan	<i>C. olor</i>	9
European roller	<i>C. garrulus</i>	3
Raven	<i>C. corax</i>	2
Hooded crow	<i>C. cornix</i>	6

English name	Latin name	Number
Red-footed falcon	<i>F. vespertinus</i>	21
Eurasian hobby	<i>F. subbuteo</i>	8
Peregrine falcon	<i>F. peregrinus</i>	1
Kestrel	<i>F. tinnunculus</i>	37
Saker falcon	<i>F. cherrug</i>	1
Black kite	<i>M. migrans</i>	1
Common crane	<i>G. grus</i>	62
Demoiselle crane	<i>G. virgo</i>	25
Yellow-legged gull	<i>L. michahellis</i>	43
White-tailed eagle	<i>H. albicilla</i>	1
Golden oriole	<i>O. oriolus</i>	2
Common cormorant	<i>P. carbo</i>	601
White pelican	<i>P. onocrotalus</i>	259
European honey buzzard	<i>P. apivorus</i>	2
Grey partridge	<i>P. perdix</i>	2
European turtle dove	<i>S. turtur</i>	1
Common tern	<i>S. hirundo</i>	1
Starling	<i>St. vulgaris</i>	80
Hoopoe	<i>U. epops</i>	3
Common shelduck	<i>T. tadorna</i>	35
European bee-eater	<i>M. apiaster</i>	85
Northern lapwing	<i>V. vanellus</i>	2

The most numerous in spring in the region were common cormorants (*Phalacrocorax carbo*), white pelicans (*Pelecanus onocrotalus*) and some birds of prey – Common buzzards (*Buteo buteo*), Red-footed falcon (*Falco vespertinus*), Common kestrels (*Falco tinnunculus*) and Marsh harriers (*Circus aeruginosus*) (Table 2).

In the spring of 2018, 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. 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.

Similar numbers of two different crane species - Common and Demoiselle cranes - were seen. Common cranes were recorded for three days in March, and Demoiselle cranes were observed over seven days in April and May. Remarkable was the behaviour of a pair of Demoiselle cranes which stayed in the ISPB area for nearly 30 days between April and May. A pair of these beautiful birds used a temporary pond of surface water for feeding within SNWF without showing any apparent signs of fear of the nearby wind turbines.

As a result of the systematic observations carried out during the whole period of the spring migration a total of 11 stops of individual turbines, groups of turbines or entire wind farms in the territory covered by ISPB were undertaken. Detailed information on the duration of these stops is given in Table 3.

Table 3. Data for ordered stops of wind turbines of SNWF as a result of the application of ISPB in the Kaliakra study area during the 2018 spring migration of birds.

Date	Turbine №/ group	Species	Number of birds	Time stopped	Time started
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<i>Date</i>	<i>Turbine №/ group</i>	<i>Species</i>	<i>Number of birds</i>	<i>Time stopped</i>	<i>Time started</i>
30.03.2018	D, C	Common cranes (<i>Grus grus</i>)	13	13:07	13:20
02.04.2018	F	White pelicans (<i>P. onocrotalus</i>)	19	11:07	11:29
09.04.2018	A	White tailed eagle (<i>H. albicilla</i>)	1	12:45	12:58
11.04.2018	B	Demoiselle crane (<i>G. virgo</i>)	2	13:25	13:41
18.04.2018	A	Demoiselle crane (<i>G. virgo</i>)	2	11:16	11:45
18.04.2018	B	Demoiselle crane (<i>G. virgo</i>)	2	12:15	12:48
18.04.2018	B	Demoiselle crane (<i>G. virgo</i>)	2	13:23	14:00
18.04.2018	B	Demoiselle crane (<i>G. virgo</i>)	2	14:05	14:17

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 spring 2018 with similar results), this search regime of weekly searches provides for a cost-effective method, which can also be calibrated, to discover any bird strike fatalities which may be of concern. Hence a frequency of four searches per month under every turbine allows estimation of the mortality of the birds from a collision with the turbines in the ISPB. For details, see previous studies of: <http://www.aesgeoenergy.com/site/Studies.html>

Table 4. Number of turbines searched for collision victims in the part of territory of SNWF during the period 15 March 15 May 2018.

Turbine	March	April	May	Total
AE8	2	4	2	8
AE9	2	5	2	9
AE10	2	5	2	9
AE11	1	5	2	8
AE12	3	4	2	9
AE13	3	3	2	8
AE14	2	5	2	9
AE15	2	5	2	9
AE16	3	4	2	9
AE17	3	4	2	9
AE18	3	4	3	10
AE19	3	4	3	10
AE20	2	4	2	8
AE21	2	5	2	9
AE22	2	5	2	9
AE23	2	5	2	9
AE24	2	5	2	9
AE25	2	5	2	9
AE26	2	5	2	9
AE27	3	4	2	9
AE28	2	4	2	8
AE29	2	5	2	9
AE31	2	4	2	8
AE32	3	4	2	9

Turbine	March	April	May	Total
AE33	3	4	2	9
AE34	3	4	2	9
AE35	3	4	2	9
AE36	2	7	2	11
AE37	3	5	2	10
AE38	2	6	2	10
AE39	2	5	2	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	2	4	3	9
AE47	2	4	3	9
AE48	2	4	3	9
AE49	2	4	3	9
AE50	2	3	2	7
AE51	3	5	2	10
AE52	3	5	2	10
AE53	3	5	2	10
AE54	3	5	2	10
AE55	3	5	2	10
AE56	3	5	2	10
AE57	3	5	2	10
AE58	3	5	2	10
AE59	3	5	2	10
AE60	3	3	2	8
total	126	238	110	474

Three records of birds' remains were documented during the 474 searches under individual turbines during the 2018 spring migration of birds in the SNWF part of ISPB territory. Most numerous were records of single feathers and groups of feathers (Table 4). There were five records of feather groups and one single feather. Such findings of single feathers as well as groups of body feathers are often remains of hunting and feeding of raptor species in the wind farms.

Table 5. *Confirmed collision victims and species' conservation status as recorded during the 2018 spring migration period in SNWF territory*

<i>English name</i>	<i>Species name</i>	<i>Red Data Book</i>	<i>IUCN</i>
<i>Common buzzard</i>	<i>Buteo buteo</i>	<i>Least Concern</i>	<i>Least Concern</i>
<i>Grey partridge</i>	<i>Perdix perdix</i>	<i>Least Concern</i>	<i>Least Concern</i>

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 2018.

Conclusions

During the monitoring, there were no apparent changes in the main characteristics of the ornithofauna typical for the spring migration in the whole country and the specific characteristics of the species composition and phenology of bird migration in NE Bulgaria.

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

The migration periods, the species composition, the dynamics in number of birds, the daily activity, the height of the flights, as well as the feeding, resting and roost sites of the flying birds passing through the area indicated the absence of a barrier effect of the 114 wind turbines.

The data presented in this report confirmed the absence of any adverse impact on sensitive bird species of the order Ciconiiformes, Pelecaniformes, Falconiformes, Gruiformes using migratory ascending air flows (thermals) for movement over long distances.

All these species were found to occasionally cross the study site, and their observed behaviour in respect to wind turbines did not indicate major changes which would impact on the energetics of these species during daily movements.

The quantitative characteristics of bird migration in the SNWF area during spring 2018, and the absence of mortality among the target bird species allows a continued conclusion that SNWF, as well as the other studied wind farms do not present a risk of adverse impact to migratory birds. The application of the ISPB's safeguards potentially was and can be an ongoing contributory part of the minimal risk posed to birds from wind farms in the Kaliakra region.

Autumn migration

During the autumn monitoring, observations were made during all 92 days of the season 2018 (01.08-31.10.2018). There were a total of 16973 birds of 53 species.

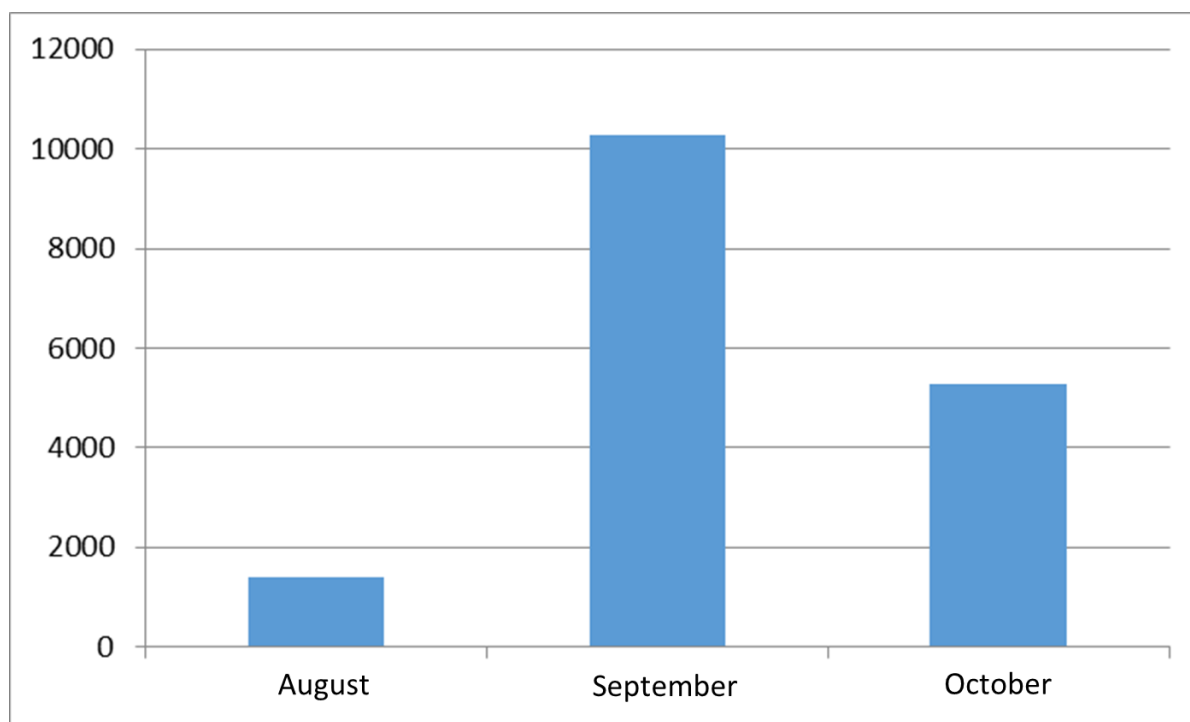


Figure 4. Number of registered birds by months during the autumn migration in the territory of ISPB.

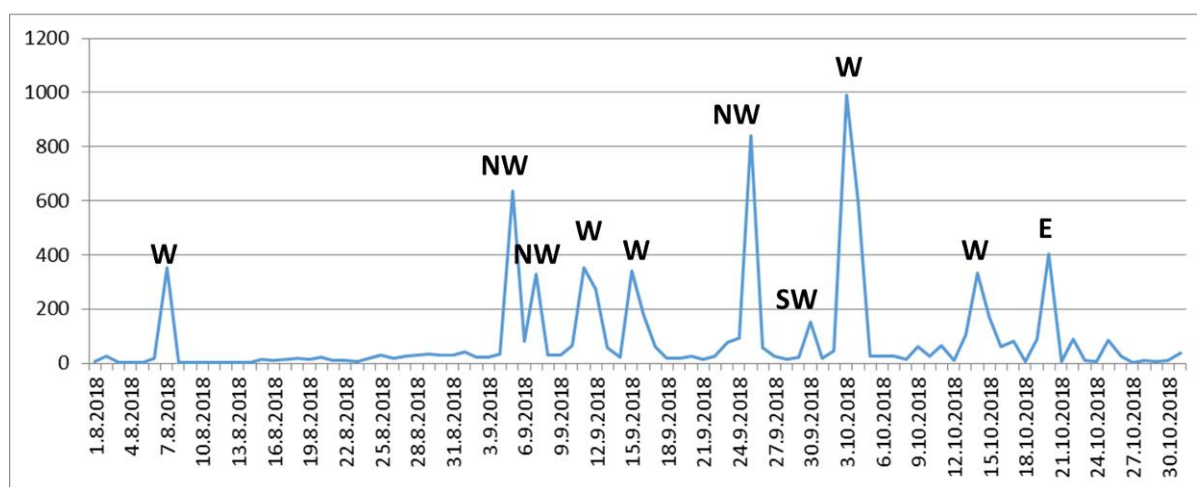


Figure 5. Dynamics of the autumn migration of the flying bird species in the ISPB territory according to visual observations during the period 01 August - 31 October 2018. Letters indicate the direction of wind in days with increased number of migrating birds.

The number of birds in the ISPB study area apparently depended on the direction of the wind in autumn 2018. Of the 10 peak days with intense migratory flights of birds: in nine, westerly winds prevailed, and in only one day with a relatively high number of registered migrants, the wind direction was eastern (Figure 5).

Observations during the monitoring from 1 August to 31 October 2018 recorded 16973 individual birds which were assigned to 53 bird species. The recorded number of individuals according to species during autumn migration is shown in Table 6.

Table 6. Composition of species and number of registered birds over the period 01 August to 31 October 2018 in the ISPB territory.

Species name	Number
<i>A. brevipes</i>	309
<i>A. gentilis</i>	1
<i>A. nisus</i>	242
<i>A. cinerea</i>	21
<i>A. purpurea</i>	2
<i>A. pennata</i>	30
<i>A. pomarina</i>	232
<i>B. buteo</i>	2642
<i>B. rufinus</i>	58
<i>B. lagopus</i>	3
<i>C. aeruginosus</i>	442
<i>C. cyaneus</i>	37
<i>C. pygargus</i>	88
<i>C. macrourus</i>	8
<i>C. gallicus</i>	94
<i>C. ciconia</i>	451
<i>C. nigra</i>	54
<i>C. garrulus</i>	1
<i>C. corax</i>	15
<i>C. cornix</i>	6
<i>C. monedula</i>	35
<i>C. frugilegus</i>	14
<i>C. oenas</i>	44
<i>C. palumbus</i>	1200
<i>F. vespertinus</i>	472
<i>F. subbuteo</i>	48
<i>F. peregrinus</i>	4

Species name	Number
<i>F. tinnunculus</i>	272
<i>F. cherrug</i>	2
<i>F. columbarius</i>	2
<i>F. eleonora</i>	3
<i>M. migrans</i>	71
<i>M. milvus</i>	2
<i>M. alba</i>	414
<i>M. apiaster</i>	2963
<i>M. calandra</i>	1430
<i>G. grus</i>	100
<i>G. virgo</i>	13
<i>L. michahellis</i>	234
<i>L. fuscus</i>	1
<i>H. albicilla</i>	1
<i>H. rustica</i>	1000
<i>P. carbo</i>	576
<i>P. onocrotalus</i>	2021
<i>P. apivorus</i>	801
<i>P. haliaetus</i>	17
<i>P. leucorodia</i>	5
<i>P. roseus</i>	1
<i>P. perdix</i>	10
<i>R. riparia</i>	76
<i>St. vulgaris</i>	400
<i>V. vanellus</i>	4
<i>E. garzetta</i>	1

The most numerous migrating birds in the autumn of 2018 in the region were Common buzzards (*Buteo buteo*) and White pelicans (*Pelecanus onocrotalus*) with over 2,000 individuals of each species (Table 6). Bee-eaters (*Merops apiaster*) were also numerous with over 2,900 individuals registered during the autumn migration period. Third, with a little more than 1,000 individuals were Barn swallow (*Hirundo rustica*), Calandra lark (*Melanocorypha calandra*), and Wood pigeon (*Columba palumbus*), flocks of which are registered to feed in the ISPB during the autumn migration in 2018.

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, a total of 7 stops of single turbines, groups of turbines in the territory of SNWF. 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 stops is given in Table 7.

Table 7. Data for ordered stops of wind turbines as a result of the application of EWS in SNWF during the autumn migration of birds in 2018.

Date	Turbine code №/ Group	Species	Number of birds	Time stop	Time restart
05.09.2018	D	<i>P. apivorus</i>	17	16:14	16:20
10.09.2018	B	<i>C. ciconia</i>	7	9:31	9:41
12.09.2018	C	<i>P. onocrotalus</i>	17	10:25	10:33
12.09.2018	E	<i>P. onocrotalus</i>	13	10:33	10:44
12.09.2018	B	<i>P. haliaetus</i>	2	13:30	13:41
12.09.2018	D	<i>P. haliaetus</i>	2	13:33	13:41
12.09.2018	C	<i>P. haliaetus</i>	2	13:36	13:41

According to previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF, a search regime of weekly searches provided for a cost-effective method, which can also be calibrated on the potential for missed carcasses, to discover any bird strike fatalities which may be of concern. Hence a frequency of four searches per month under every turbine allowed estimation of the mortality of the birds from a collision with the turbines in the ISPB. This allows to estimate bird mortality from collision with the turbines 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>

The total number of searches per turbine in SNWF is presented in Table 8.

Table 8. Number of checks for victims of collision in the territory of SNWF during the period 01 August 31 October 2018

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

turbine	Aug.	Sept.	Oct.	total
AE36	3	5	4	12
AE37	4	4	5	13
AE38	3	5	4	12
AE39	3	5	4	12
AE40	3	5	4	12
AE41	3	5	4	12
AE42	3	5	4	12
AE43	3	5	4	12
AE44	3	5	4	12
AE45	4	4	4	12
AE46	4	4	5	13
AE47	4	4	5	13
AE48	4	4	5	13
AE49	4	4	5	13
AE50	4	4	5	13
AE51	4	4	13	21
AE52	4	4	4	12
AE53	4	4	4	12
AE54	4	4	4	12
AE55	4	4	4	12
AE56	4	4	4	12
AE57	4	4	4	12
AE58	4	4	4	12
AE59	4	4	4	12
AE60	4	4	5	13
Grand Total	192	224	233	649

As a result of 649 searches under 52 individual turbines between 1 August and 31 October 2018 a total of 8 dead birds of 6 species were identified as being fatalities through collision (Table 9). Individuals found as collision victims did not involve the target ISPB species.

Table 9. Victims of collision with turbines of SNWF during the autumn migration period in 2018

Species	Number of birds	Red Data Book	IUCN
<i>A. apus</i>	1	Not listed	LC
<i>A. arvensis</i>	1	Not listed	LC

<i>L.michahellis</i>	2	Not listed	LC
<i>P. perdix</i>	2	Not listed	LC
<i>F. tinnunculus</i>	1	Not listed	LC
<i>E. citrinella</i>	1	Not listed	LC
<i>total</i>	8		

Conclusions

During the monitoring, there were no apparent changes in the main characteristics of the ornithofauna typical for the autumn migration in the whole country and the specific characteristics of the species composition and phenology of bird migration in NE Bulgaria.

The results of the monitoring confirmed the relatively low importance of the ISPB territory (including SNWF) for the migratory birds in autumn and the absence of negative influence of the operating wind farms on bird populations passing through the ISPB during their autumn migration.

The migration periods, the species composition, the dynamics in number of birds, the daily activity, the elevation of flights, as well as the feeding, resting and roost sites of the flying birds passing through the area indicated the absence of a barrier effect of the 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 of order Ciconiiformes, Pelecaniformes, Falconiformes, Gruiformes using migratory upward airflows (thermals) to move (soaring) over long distances in autumn migration period.

All these species were found during the study to cross the site using suitable habitats without the need to increase their energy losses in their daily movements and to change their migratory strategy in the period of autumn migration.

The quantitative characteristics of bird migration in the ISPB area during autumn 2018, 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.

Wintering geese monitoring 2017/2018

Unusually low numbers of geese were observed in the 2017-2018 winter monitoring period. Geese were observed within the core study area between 16 January 2018 and 11 March 2018. There was only one day with observations of geese in February. The numbers of geese observed in the core study area each day are presented in Table 10.

No Greylag goose (*Anser anser*) was observed during the monitoring period in winter 2017-2018.

Table 10. All observed geese numbers by species and day of monitoring in the core study area.

Date	A. albifrons	Anser/ Branta	B. ruficollis	Total
16.1.2018	44			44
17.1.2018		40	200	240
18.1.2018		6		6
20.1.2018	762		43	805
23.1.2018	32			32
24.1.2018	106	570	85	761
25.1.2018			60	60
26.1.2018	50	290		340
28.1.2018	38	482	50	570
2.2.2018		25		25

1.3.2018	100			100
3.3.2018	350		220	570
5.3.2018	72	47	3	122
9.3.2018		120		120
11.3.2018	26			26
Grand Total	1580	1580	661	3821

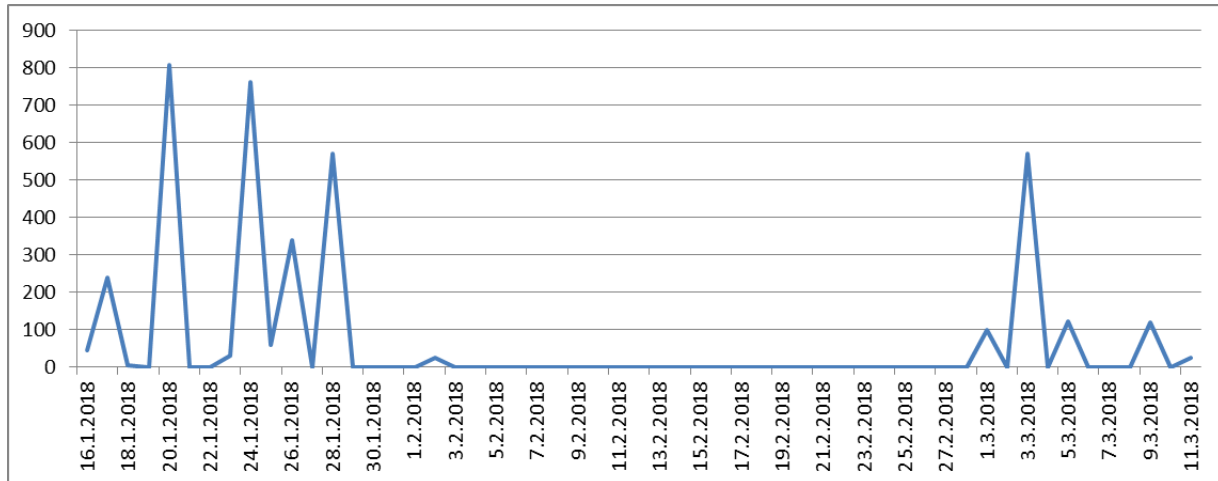


Figure 6. Temporal distribution of geese (all species) observed in the core study area in winter 2017-2018.

Unusual for the season and the long-term records, but two pelican species were observed, also recorded in the previous three winters (see winter reports 2014-2015, 2015-2016 and 2016-2017): two White Pelicans (*Pelecanus onocrotalus*) were observed on 23 January 2018 and two Dalmatian Pelicans (*Pelecanus crispus*) were observed 3 March 2018 (Table 11).

The numbers of birds per species, excluding geese species, are presented in Table 11.

Table 11. The total number of observed birds of different species (excluding geese: see Table 2 for geese) in the core study area (Figure 1) recorded in winter season 2017 - 2018.

Species	December	January	February	March	Total
<i>A. acuta</i>				26	26
<i>A. alba</i>		2		3	5
<i>A. cinerea</i>		2			2
<i>A. crecca</i>				16	16
<i>A. flammeus</i>			2		2
<i>A. gentilis</i>	1	1			2
<i>A. nisus</i>	2	5	3	4	14
<i>A. penelope</i>				5	5
<i>A. platyrhynchos</i>				78	78
<i>A. pratensis</i>		50			50
<i>A. querquedula</i>				196	196
<i>B. buteo</i>	7	68	39	30	144
<i>B. lagopus</i>	1	1		2	4
<i>B. rufinus</i>	1		12	3	16
<i>C. aeruginosus</i>	2			4	6
<i>C. albus</i>		7			7
<i>C. alpina</i>				3	3
<i>C. cannabina</i>			21		21
<i>C. carduelis</i>			18	12	30
<i>C. chloris</i>			20	7	27
<i>C. ciconia</i>				1	1
<i>C. corax</i>	1			1	2
<i>C. cornix</i>			2		2
<i>C. cyaneus</i>	13	53	39	13	118

Species	December	January	February	March	Total
<i>C. cygnus</i>		58	64	70	192
<i>C. ferruginea</i>				1	1
<i>C. macrourus</i>		2			2
<i>C. olor</i>		10	5	9	24
<i>F. coelebs</i>				45	45
<i>F. columbarius</i>		1			1
<i>F. tinnunculus</i>	3	6	6	3	18
<i>G. gallinago</i>				2	2
<i>G. grus</i>				2	2
<i>L. cachinans</i>			10		10
<i>L. excubitor</i>		1			1
<i>L. ichthyaetus</i>			1		1
<i>L. limosa</i>				13	13
<i>L. michahellis</i>	8	3			11
<i>M. alba</i>				1	1
<i>M. calandra</i>		248	67	185	500
<i>N. arquata</i>				2	2
<i>P. apricaria</i>		37		219	256
<i>P. carbo</i>		117	229	778	1124
<i>P. crispus</i>				2	2
<i>P. onocrotalus</i>		2			2
<i>P. falcinellus</i>		1			1
<i>P. ochruros</i>			1		1
<i>P. perdix</i>		25			25
<i>P. pugnax</i>			1	286	287
<i>P. squatarola</i>				75	75
<i>S. rusticola</i>				1	1
<i>S. torquatus</i>				1	1
<i>S. vulgaris</i>			49	313	362
<i>T. pilaris</i>			119		119
<i>T. viscivorus</i>				69	69
<i>U. epops</i>				9	9
<i>V. vanellus</i>				52	52
Grand Total	39	700	708	2542	3989

Total number of observed goose species and their locations

The total numbers of all observed individuals of two species of goose, Red-breasted goose (RBG) (*Branta ruficollis*) and Greater white-fronted goose (GWFG) (*Anser albifrons*) during the whole period of the winter monitoring 2017-2018 in the core study area, are shown in Table 12 (as noted earlier no Greylag geese were seen in 2017-2018 winter).

Table 12. The number of geese of different species recorded in the core study area in winter 2017/2018.

Species	January	February	March	Total
<i>A. albifrons</i>	1032		548	1580
<i>Anser/ Branta</i>	1388	25	167	1580
<i>B. ruficollis</i>	438		223	661
Grand Total	2858	25	938	3821

The recorded movements of geese as well as feeding locations were mapped day by day. Identification of all individuals in the mixed flocks of geese is impossible from a distance in early morning and evening hours. The numbers indicated in the maps, presented in Annex 1 represent total geese numbers observed day by day in the period when RBG were present in the core study area. The green color indicates fields with wheat potentially suitable for feeding geese. Feeding geese of any species were not observed in either the core study area or in the wider SNWF study area in winter 2017-2018.

The same color-coding and symbols are used in summarized presentations of all observed mapped records of geese for January, February and March, shown in Figure 7, 8 and 9 respectively.

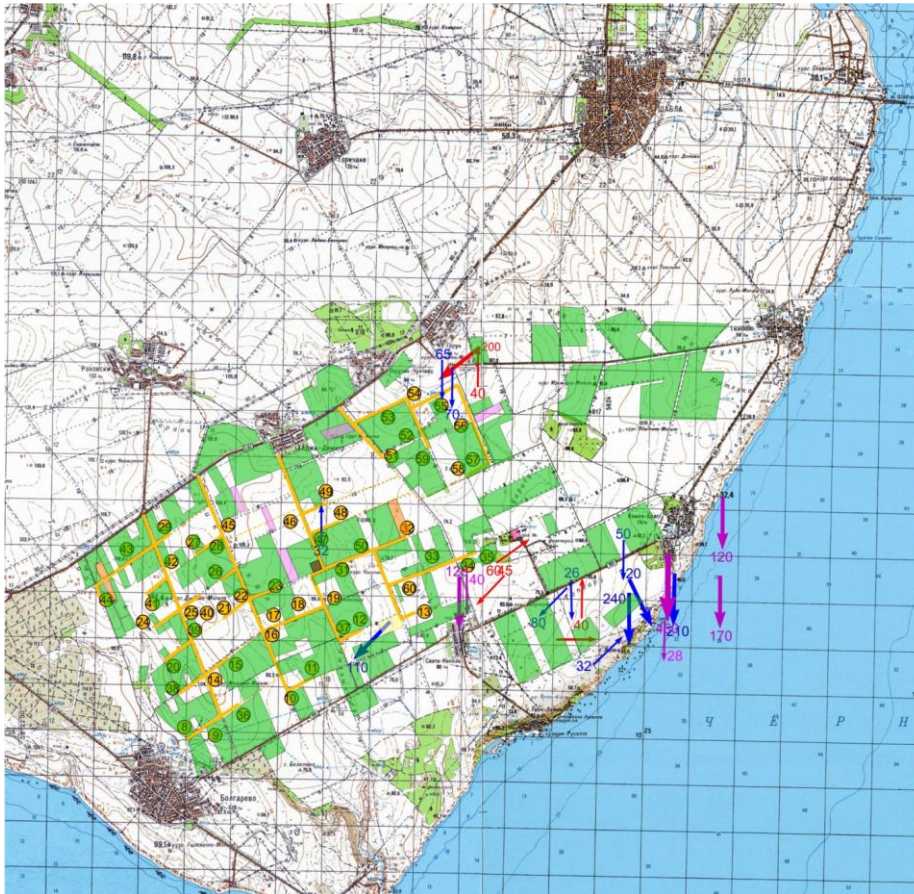


Figure 7. Spatial summary of geese records in January 2018.

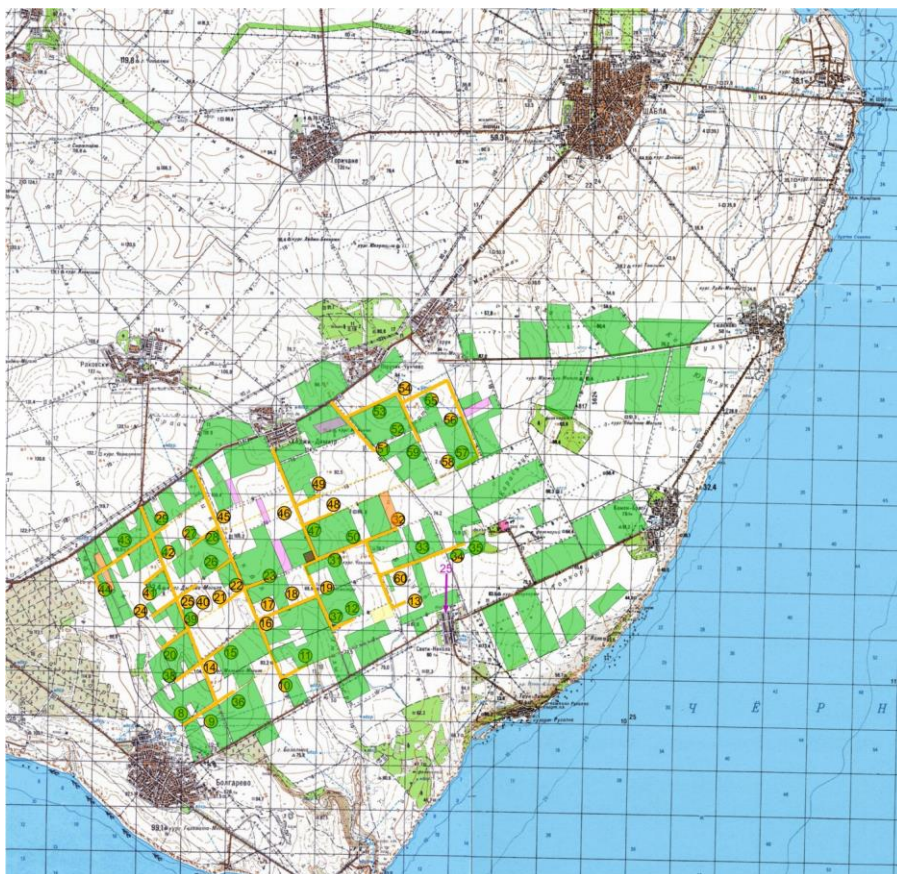


Figure 8. Spatial summary of mixed species geese flocks in February 2018

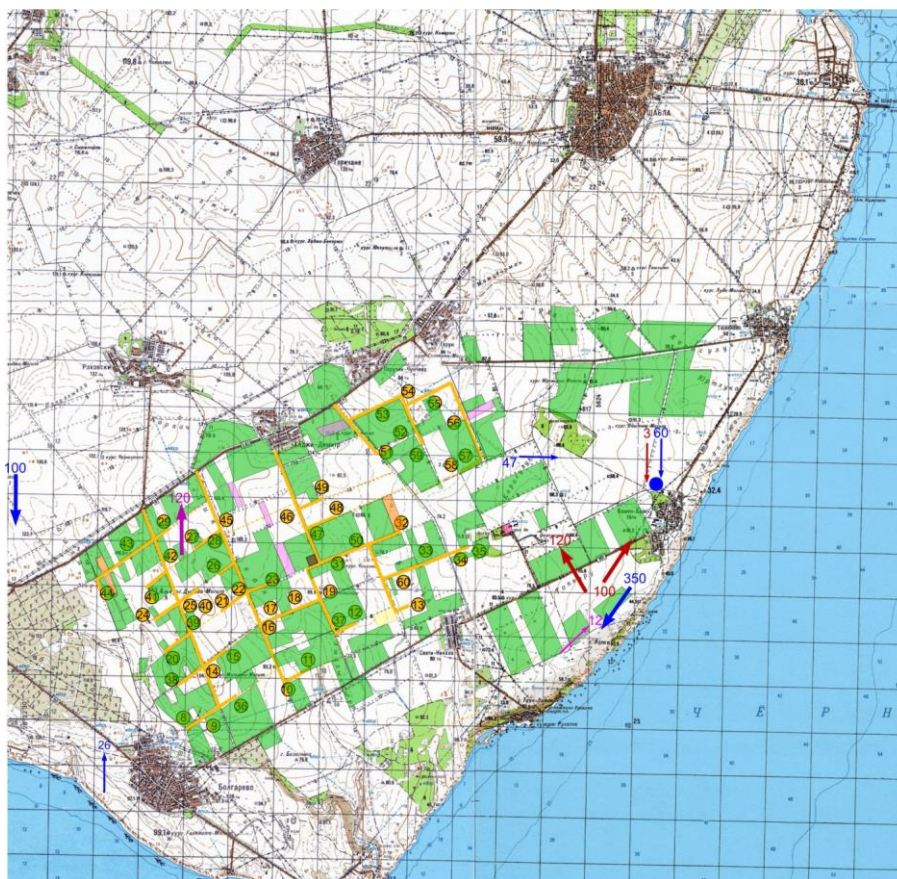


Figure 9. Spatial summary of geese records in March 2018

In total very low numbers of geese of all observed species were present in the SNWF and core study areas. Unusually low numbers of wintering geese was also observed in Bulgaria and Romania in general in the winter season 2017-2018 (<http://wildlifeconservation.bg/english/red-breasted-geese-wintering-season-2017-2018/> and <http://savebranta.org/en/news/the-peak-of-red-breasted-geese-numbers-in-coastal-dobrudzha-registered-at-the-end-of-january>).

The maximum number of geese including RBG in SNWF was observed in mixed species flocks between 17 and 30 January.

The proportion of RBG could not always be precisely evaluated but in all the observations available where the proportions of species could be identified it was consistent with previous winters' records, and varied between 10% and 50%. The numbers of geese observed in February was much lower than the number of geese in January. In March there was a second peak in number of flying geese on passage of both dominant species.

All observed geese in winter 2017-2018 were in flight and, as noted earlier, no feeding geese were registered in the wider SNWF study area or the core study area. The number of flights per day is presented in Table 10.

The reason for the relatively low number of wintering geese in Bulgaria in general was likely due to the exceptionally mild winter and high temperatures in the 2017-2018 winter. Detailed analyses of correlation between ambient temperature and number of geese in SNWF territory in the last 10 years, and discussion of the role of temperature, are presented in a previous report (<http://www.aesgeoenergy.com/site/images/Winter%20Report%202016-2017.pdf>).

Carcass monitoring results

All 52 turbines were programmed to be searched every seventh day (if the areas under turbines were accessible) for carcasses during the whole winter survey period (1st December 2017 – 15th March 2018) when more birds are at risk of collision. The last wintering geese in SNWF 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 13.

Table 13. Number of searches per turbine in the period 01 December 2017 – 30 March 2018.

№ Turbine	December	January	February	March	Total
8		3	3	3	9
9		3	3	3	9
10		2	4	3	9
11		2	4	2	8
12	1	4	3	4	12
13	1	4	3	3	11
14		2	3	3	8
15		2	3	3	8
16		2	4	4	10
17	1	4	3	4	12
18	1	4	3	4	12
19	1	5	3	3	12
20		2	3	3	8
21		1	4	3	8
22		1	4	3	8
23		2	4	3	9
24		1	3	3	7
25		2	3	3	8
26		1	4	3	8
27		1	4	4	9

№ Turbine	December	January	February	March	Total
28		1	4	3	8
29		3	3	3	9
31	1	3	3	3	10
32	1	4	3	3	11
33	1	4	3	3	11
34	1	4	3	3	11
35	1	4	3	3	11
36		3	3	3	9
37	1	4	3	4	12
38		1	3	3	7
39		2	3	3	8
40		2	3	3	8
41		2	3	3	8
42		2	3	3	8
43		2	3	3	8
44		2	3	3	8
45		2	4	4	10
46	1	3	4	3	11
47	1	4	4	3	12
48	1	3	4	3	11
49	1	3	4	3	11
50	1	4	3	3	11
51	1	3	4	3	11
52	1	3	4	3	11
53	1	4	4	3	12
54	1	3	4	3	11
55	1	3	4	3	11
56	1	3	4	3	11
57	1	3	4	3	11
58	1	3	4	3	11
59	1	3	4	3	11
60	1	4	3	3	11
Grand Total	26	142	179	162	509

The weather condition (ambient temperature, rain and snow coverage) which may have an impact on the frequency and results of the searches has been previously discussed in several winter monitoring reports available at: <http://www.aesgeoenergy.com/site/Studies.html>.

Searcher efficiency and carcass persistence has been examined twice during winter monitoring at SNWF – in February 2010 and in January 2016. The results were similar and broadly confirm the efficiency in searches and carcass removal rates under turbines for a programme of searches every seven days.

Systematic searches under turbines (Table 13) in the 2017-2018 winter resulted in four sets of remains being found which may have been associated with a collision with the turbines: one Common gull (*Larus canus*) and three Common buzzards (*Buteo buteo*) (Figure 10). These species are of least concern according to the IUCN criteria and are not listed in Bulgarian Red Data Book. The Common gull carcass was in a severely decomposed condition indicating a long time period after its death (Figure 10). The carcass was found in a shelter belt and probably the bird had died in the summer but was not discovered then because of dense vegetation; which had been lost in the winter. No birds of this species were seen in the winter but were recorded earlier in the year. Therefore, this carcass should be not considered as a victim of collision in the winter period.

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 509 searches under different turbines in the period 1

December 2017 – 30 March 2018 (Table 13). Therefore, no evidence for collision of any goose species, including RBG, has been found in the winters 2010 - 2018 when geese were present and turbines were operating.



Figure 10. The carcasses of three Common Buzzards (*Buteo buteo*) were recorded in SNWF as victims of collision in winter 2017-2018. One older carcass (upper right corner) of Common Gull (*Larus canus*) had probably resulted from a death in summer 2017.

The TSS in the 2017-18 winter was activated in situations where White-tailed eagles (*Haliaeetus albicilla*) and pelicans of two species White pelicans (*Pelecanus onocrotalus*) and Dalmatian pelicans (*Pelecanus crispus*) were observed in SNWF. There were no occasions when the TSS required activation because of collision conditions which may have endangered geese. All of the turbine stops associated with the bird observations and the reasons why they were enacted are given in Table 14.

Table 14. Circumstances of turbine stops under the TSS associated with minimizing collision risk of sensitive bird species during the winter 2017-2018 in SNWF. Refer to previous reports for the wind turbine groupings (WTG).

Date	Stop time	Re-start time	Species	Species	Number of birds	WTG	Ordered by	Remarks
16.01.2018	11:45	12:22	Haliaeetus albicilla	White-tailed eagle	1	T13, T33, T34, T35	I. Raykov	flying in low altitude 50-100m between the turbines
23.01.2018	12:12	12:17	Pelecanus onocrotalus	White pelican	2	E	Y. Yankov	flying in low altitude 50-100m between the turbines
03.03.2018	13:25	13:54	Pelecanus crispus	Dalmatian pelican	2	B, D, E	K. Bedev	flying in low altitude 50-100m between the turbines

Conclusions

The relatively mild 2017-2018 winter is probably the main reason for the low number of observed geese of two species in the vicinity of SNWF in this season.

Daily observations from December 2017 to March 2018 (inclusive) revealed that the recorded presence of geese in and around SNWF was compressed into a short time period within the winter, which was essentially the same as already established in studies 2008 – 2017.

The number of wintering geese observed in SNWF during winter broadly corresponded to the total number of wintering geese in the larger region of coastal Dobroudzha region; but was lower, in keeping with SNWF being a fundamentally less-preferred area (grossly and intrinsically, irrespective of the wind farm's presence).

The studies in the 2017-2018 winter continued to show that SNWF is not a source of collision mortality for wintering geese, even though they fly through or feed within SNWF (with varying regularity but sometimes frequently – as in previous winters). The evidence for this is that no remains of geese that could be attributed to collision with SNWF's turbines were found during systematic searches under operational turbines in any of the eight winters when SNWF has been operational.

No gross displacement (disturbance) reaction from geese has been observed for the period 2008-2018 as a result of SNWF's construction and operation. Observed numbers of geese of all three species as well as observed spatial distribution of flying and feeding geese does not indicate gross displacement from the operational SNWF or its immediate environs.

From research associated directly with SNWF described in the present report (and see previous SNWF winter reports on the AES website, and earlier surveys) the core study area remains a feeding ground for RBG as well as GWFG, but it also remains an unimportant area for both species, as indicated in pre-construction studies. Consequently, and based on other studies, SNWF presents no material threat through preventing use of food supplies (and especially in light of other agricultural practices such as crop type and field size of the preferred crop of geese). SNWF also poses no material risk of mortality to geese through collision with turbine blades.

List of participants in the observations

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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

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