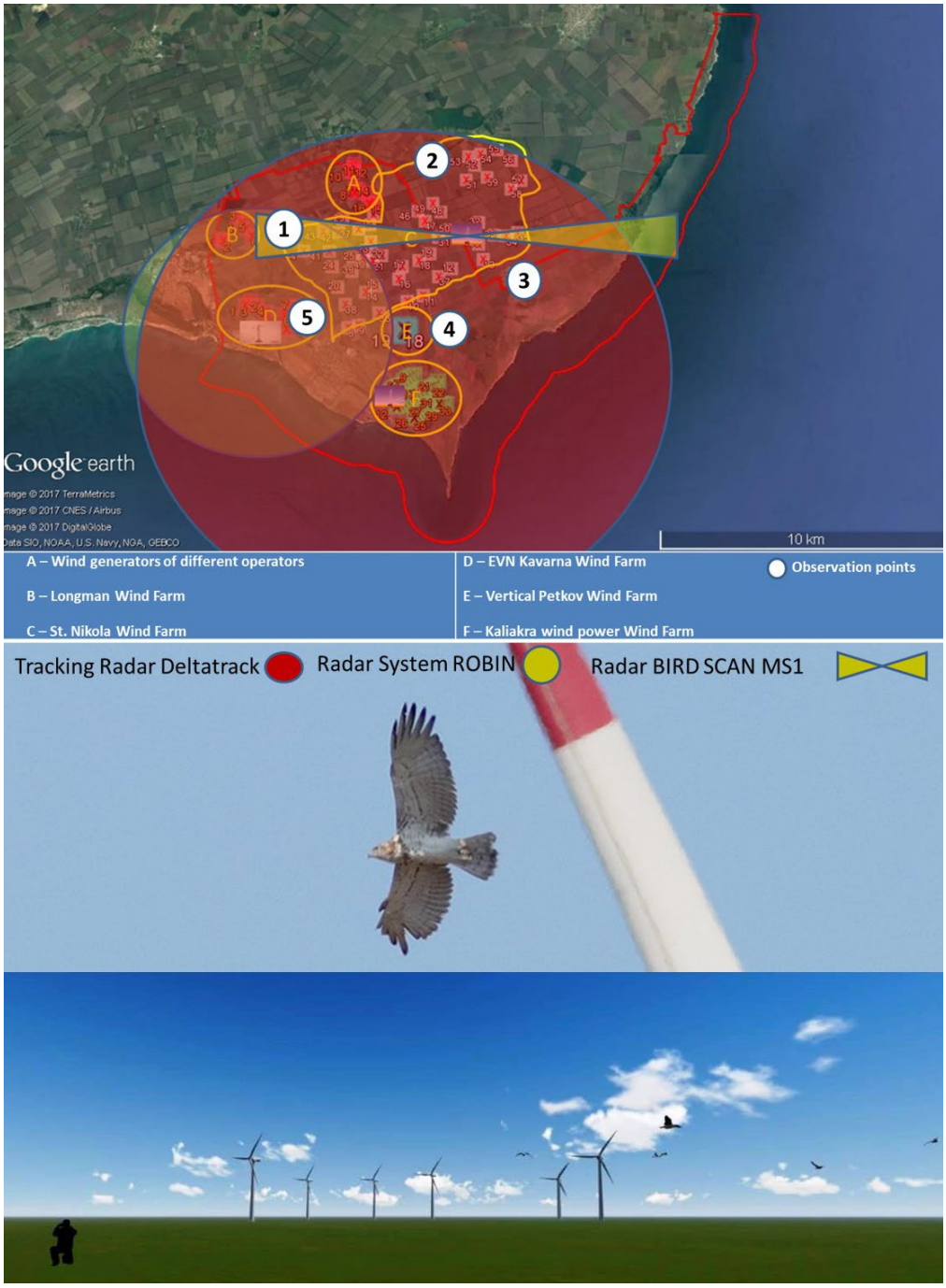
Summary of Activities and the Results of Ornithological Monitoring in the Integrated System for Protection of Birds, 2024



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Introduction

Integrated System for Protection of Birds (ISPB) includes 114 wind turbines, 95 of which are within the Kaliakra SPA BG0002051 and 19 are in the areas adjacent to the protected zone.

The ornithological monitoring of ISPB is a complex study assigned by the Wind farms, located in Kaliakra SPA: BG0002051-AES Geo Energy Ltd., Kaliakra Wind Power, Degrets OOD, Disib OOD, Windex OOD, Long Man Invest OOD, Long Man Energy OOD, Zevs Bonus OOD, Vertikal-Petkov & Sie SD, Wind Park Kavarna East EOOD, Wind Park Kavarna West EOOD, Millennium Group OOD in 2022.

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

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

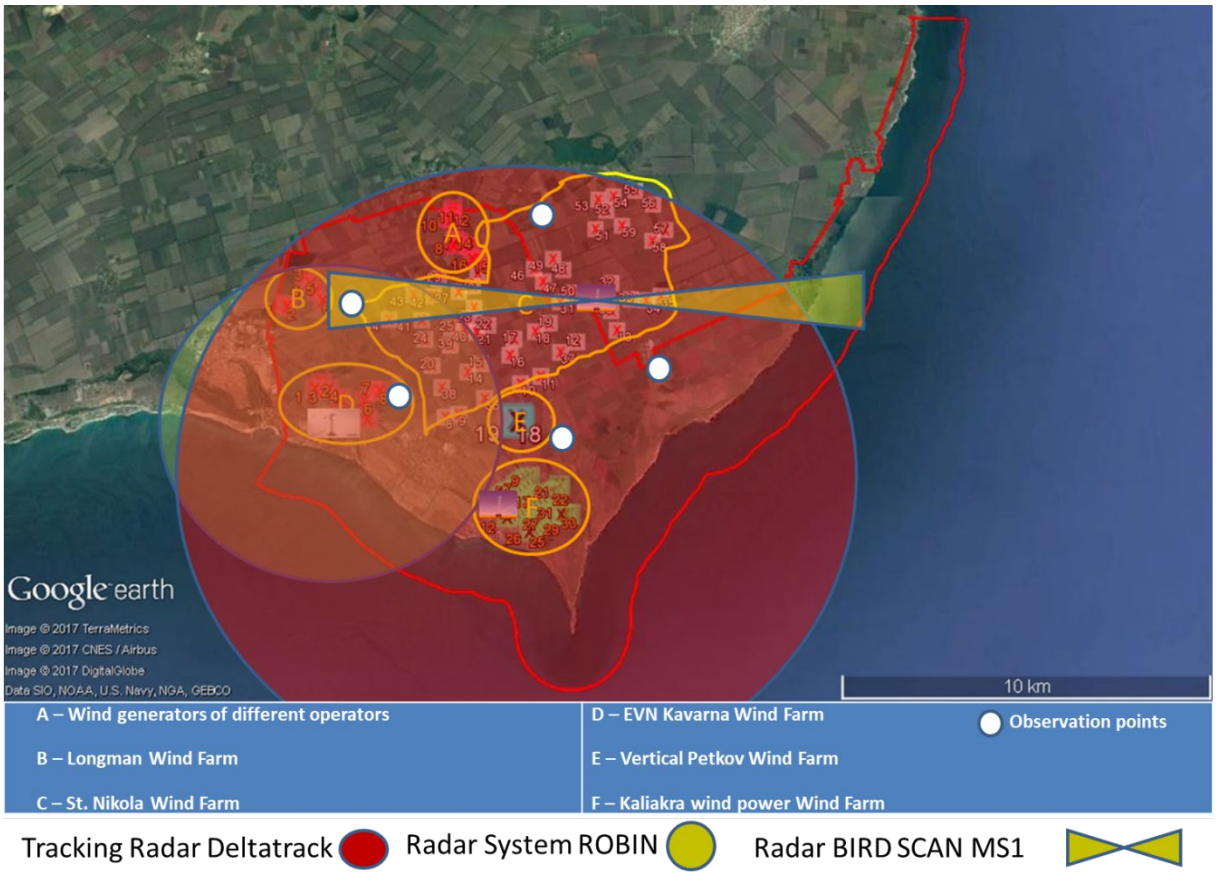

Figure 1. *A satellite photo with the location of the wind turbines covered by the ISPB and the boundaries of Kaliakra SPA (shown by the red line), together with the scope of three radar systems.*

In order to provide objective data for the bird risk assessment, this summary presents activities and results of the monitoring in 2024.

The activities were supervised and coordinated by Prof. Dr. Pavel Zehtindjiev - Ornithologist with over 25 years of research in ornithology; over 85 scientific publications in international ornithological journals; member of European Ornithologists Union and several other conservation organizations; winner of the Revolutionary Discovery Award for Ornithology of an American Ornithological Society in 2016 – The Cooper Ornithological Society; more than 10 years of experience in impact monitoring of wind turbines on breeding, migrating and wintering bird species in the region of Kaliakra.
Three types of radars integrated into the ISPB were used for monitoring and prevention of bird collisions:

Bird Scan MS1

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

Deltatrack Radar System

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

Radar System Robin

This is a 3-D radar system constructed for detection and tracking of moving targets in an air volume of around 10 km^3 (https://youtu.be/-Kb70clGHOQ?t=2) (Figure 1). It is a real time tool for tracking of moving targets and in combination with visual observations in the field provides highly reliable data on the distance as well as altitudes of birds already detected and identified by the field ornithologists. This radar does not provide quantitative data of migration at a species level because it does not allow species identification.

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

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

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

Results

Monitoring of geese in Winter 2023-2024

The 90 days of the study in 2023 -2024 encompassed the whole period when geese were previously monitored and recorded in the region.

Total number of observed goose species and their numbers

In total very low numbers of geese of all observed species were present in the ISPB territory during the winter 2023-2024 (Table 1). Relatively low numbers of wintering geese were also observed in Bulgaria and Romania in general in the winter season 2023-2024. https://bspb.org/

Table 1. *The number of observed geese by dates of different species (data from visual observations). The dates with zero observed birds are not included. Species involve Greater White-fronted Goose (GWFG: Anser albifrons), Greylag Goose (A.anser). No Red-Breasted Geese RBG (Branta ruficollis) were recorded.*

Date	A. albifrons	A. anser	Total
09.12.2023	2	7	9
10.1.2024	42		42
21.1.2024	6		6
25.1.2024	8		8
Grand Total	**58**	**7**	**65**

Spatial distribution of feeding geese in the ISPB territory

One flock of geese were tracked and confirmed visually are presented in the map below. Due to the lack of wintering geese in this winter spatial analysis was not possible.

Figure 2. *Flock of 42 GWFG (white) observed during the monitoring period in winter 2023-2024 in ISPB territory.*

More detailed analysis of the feeding preferences of wintering geese in ISPB territory are presented in previous reports available at the web site of ISPB. https://kaliakrabirdmonitoring.eu/Report_Winter 2018-2019, https://kaliakrabirdmonitoring.eu/Report Winter 2019-2020, https://kaliakrabirdmonitoring.eu/Report_Winter 2020-2021, https://kaliakrabirdmonitoring.eu/Report_Winter_2021-2022, https://kaliakrabirdmonitoring.eu/Report_Winter_2022-2023, https://kaliakrabirdmonitoring.eu/Report_Winter_2023-2024,

Carcass monitoring results

All 114 turbines were programmed to be searched every seventh day in the periods of autumn and spring migration as well as during the wintering period of geese. The rest of the time during the whole year every turbine was searched once per month if the areas under turbines were accessible. During the winter monitoring all 114 turbines were searched for carcasses during the whole winter survey period (01 December 2023 –29 February 2024) when more birds were at risk of collision. The frequencies of searches during the winter period are presented in Table 2.

Table 2. *Number of searches per turbine during the winter monitoring 2023-2024*

Turbine code	January	February	December	Total
ABBalgarevo	4	4	3	11
АВГ1	4	4	2	10
АВГ2	4	4	2	10
АВГ3	4	4	2	10
АВГ4	4	4	2	10
AE10	5	4	2	11
AE11	5	4	2	11
AE12	4	4	2	10
AE13	4	4	2	10
AE14	4	4	2	10
AE15	4	4	2	10
AE16	5	4	2	11
AE17	5	4	2	11
AE18	4	4	2	10
AE19	4	4	2	10
AE20	4	4	2	10
AE21	5	4	2	11
AE22	5	4	2	11
AE23	5	4	2	11
AE24	5	4	2	11
AE25	5	4	2	11
AE26	5	4	2	11
AE27	4	5	3	12
AE28	4	5	3	12
AE29	5	4	2	11
AE31	4	4	2	10
AE32	4	4	2	10
AE33	4	4	2	10
AE34	4	4	2	10
AE35	5	4	2	11
AE36	4	4	2	10
AE37	4	4	2	10
AE38	4	4	2	10
AE39	4	4	2	10
AE40	5	4	2	11
AE41	5	4	2	11
AE42	5	4	2	11
AE43	5	4	2	11
AE44	5	4	2	11
AE45	3	5	3	11
AE46	4	4	2	10
AE47	4	4	2	10
AE48	4	4	2	10
AE49	4	4	2	10
AE50	4	4	2	10
AE51	4	4	2	10
AE52	4	4	2	10
AE53	4	4	2	10
AE54	4	4	2	10
AE55	4	4	2	10
AE56	4	4	2	10
AE57	4	4	2	10

AE58	4	4	2	10
AE59	4	4	2	10
AE60	4	4	2	10
AE8	4	4	2	10
AE9	4	4	2	10
ДВГ1	4	4	2	10
ДВГ1HSW250	5	4	2	11
ДВГ2	4	4	2	10
ДВГ2MN600	5	4	2	11
ДВГ3	4	4	2	10
ДВГ4	4	5	3	12
ДВГ5	4	5	3	12
DC1	4	5	3	12
DC2	4	5	3	12
E00	4	4	3	11
E01	5	4	2	11
E02	5	4	2	11
E04	5	4	2	11
E05	5	4	2	11
E07	5	4	2	11
E08	5	4	2	11
E09	4	4	3	11
M1	4	4	3	11
M10	4	5	3	12
M11	4	5	3	12
M12	4	4	2	10
M13	4	4	2	10
M14	4	4	2	10
M15	4	4	2	10
M16	4	4	2	10
M17	4	4	2	10
M18	4	4	2	10
M19	4	4	2	10
M2	4	4	3	11
M20	4	4	2	10
M21	4	4	2	10
M22	4	4	2	10
M23	4	4	2	10
M24	4	4	2	10
M25	4	4	2	10
M26	4	4	2	10
M27	4	4	2	10
M28	4	4	2	10
M29	4	4	2	10
M3	4	4	3	11
M30	4	4	2	10
M31	4	4	2	10
M32	4	4	2	10
M33	4	4	2	10
M34	4	4	2	10
M35	4	4	2	10
M4	4	5	3	12
M5	4	5	3	12
M6	4	5	3	12
M7	4	5	3	12
M8	4	5	3	12
M9	4	5	3	12
VP1	4	4	3	11
VP2	4	4	3	11
ABZevs	4	4	2	10
ABMillenium group	4	5	3	12
ABMillenium group Mikon	4	5	3	12
Grand Total	**480**	**473**	**253**	**1206**

Systematic searches under 114 turbines covered by ISPB (Table 2) in the period 01 December 2023 – 28 February 2024 resulted in only one intact carcass which can be associated with collision with wind turbines. Details of the collision victims recorded in the ISPB during winter 2023-2024 are presented in Table 3.

Table 3. *Collision victims in ISPB in winter 2023-202*

Date	**Latin name**	**Red Data book**	**IUCN**
07.12.2023	*Perdix perdix*	Not Listed	Least Concern
14.01.2024	*Sturnus vulgaris*	Not Listed	Least Concern
15.02.2024	*Melanocorypha calandra*	Endangered	Least Concern
15.02.2024	*Sturnus vilgaris*	Not Listed	Least Concern

No body parts or intact remains of geese which could be considered as collision victims were detected after an accumulation of 1206 searches under 114 turbines in the period 01 December 2023 – 28 February 2024. Therefore, no evidence for collision of any goose species, including RBG, has been found in the winter 2023 – 2024 when geese were potentially present, and turbines were operating.

There were no circumstances in the 2023-2024 winter which required the Turbine Shutdown System (TSS).

Conclusions: wintering geese 2023-2024

The mild 2023-2024 winter is the main reason for absence of wintering geese in ISPB territory.

No remains of geese that could be attributed to collision with turbines were found during systematic searches under operational turbines not only in the 2023-2024 winter but also in any of the 16 winters when all 114 turbines or 52 turbines at SNWF (part of ISPB) have been operational and searched systematically every winter season.

From research associated directly with ISPB described in the present and previous reports (and see previous SNWF winter reports on the AES Geo Energy website, and earlier surveys from this part of the same territory) the study area continues to be a potential feeding ground for RBG as well as GWFG, but it also remains a relatively unimportant area for both species, as indicated in pre-construction studies. The presence of wintering geese is associated with colder winters when lakes in the northern part of the wintering range of geese is covered by snow and lakes with fresh water are frozen.

Based on previous studies in the same territory when geese were observed, the investigated 114 wind turbines present no material threat through preventing use of food supplies: especially in light of other agricultural practices such as crop type and field size of the preferred crop of feeding geese.

Spring migration

During the spring monitoring, observations were made during all 61 days of the season (15 March - 15 May), with registered migratory, soaring birds being detected over 70 % of the days in spring 2024. For the survey period, a total of 2973 migratory and resident birds were registered in spring 2024 (Table 4)

Table 4. *Number of registered birds of all ecological groups by day during the spring migration in the territory covered by ISPB*

Period	Number of birds in Spring 2024
15-31 March	1936
1-30 April	642
1-15 May	395
Total for the period	**2973**

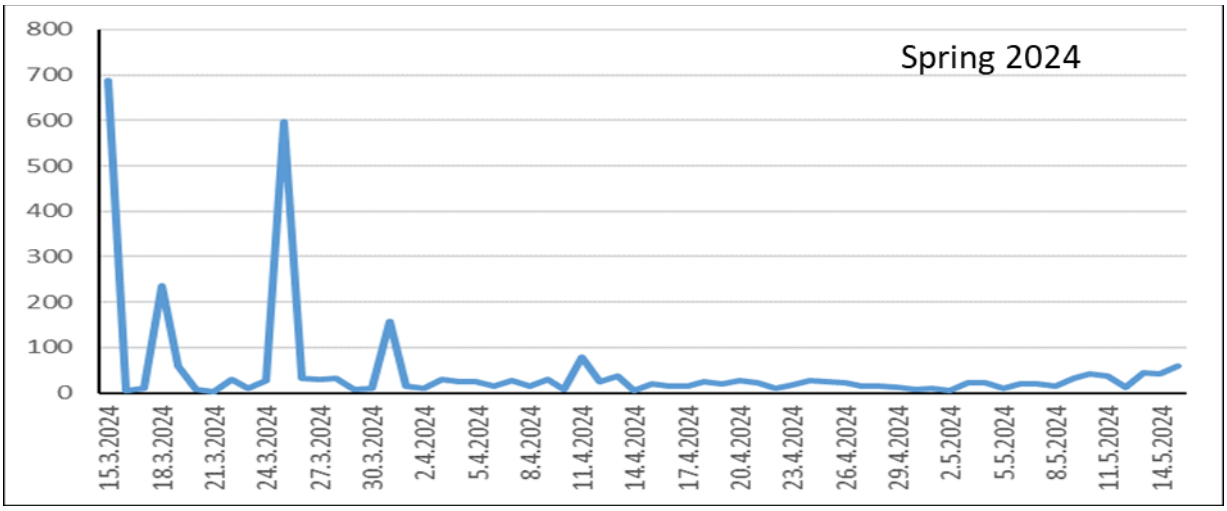

Figure 3. *Dynamics of the spring migration of birds in the ISPB territory based on visual observations during the period 15 March - 15 May 2024*

The variations in bird numbers were typically substantial within the spring seasons of migration covered by the current monitoring study (Figure 3). The dynamics in numbers of birds in seven 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 the peak of migration was observed 10 days earlier on 16 March. The peak of migration in spring 2023 was observed between 28 and 30 March and it is relatively similar to 2018, 2019, 2020 and 2021. Similar to seasons 2019, 2020, 2021 and 2023. Two peaks of migration were observed in spring 2024 first in the middle of the month and second in the second half of March.

Table 5. *Composition and number of registered bird species during the period 15 March - 15 May 2024 in the ISPB territory.*

Species name	***Number of birds***
A. apus	*36*
A. cinerea	*16*
A. melba	*46*
A. nisus	*5*
A. pennata	*12*
A. pratensis	*2*
B. buteo	*33*
B. oedicnemus	*8*
B. rufinus	*18*
C. aeruginosus	*18*
C. brachydactyla	*1*
C. canorus	*8*
C. ciconia	*20*
C. corax	*14*
C. cornix	*27*
C. coturnix	*1*
C. cyaneus	*7*
C. frugilegus	*61*
C. gallicus	*6*
C. garrulus	*3*
C. monedula	*65*
C. nigra	*1*
C. olor	*15*
C. palumbus	*91*
C. pygargus	*9*
D. urbica	*3*
F. coelebs	*162*
F. montifringilla	*25*

Species name	***Number of birds***
F. subbuteo	*3*
F. tinnunculus	*89*
F. vespertinus	*10*
H. rustica	*3*
L. cannabina	*2*
L. colurio	*1*
L. michahellis	*141*
L. senator	*2*
M. alba	*7*
M. apiaster	*119*
M. flava	*3*
M. migrans	*1*
O. isabellina	*4*
O. oenanthe	*1*
O. oreolus	*3*
P. carbo	*200*
P. colchicus	*1*
P. crispus	*27*
P. halietus	*1*
P. ochruros	*6*
P. onocrotalus	*698*
P. phoenicurus	*2*
P. pica	*3*
S. curruca	*1*
S. decaocto	*122*
S. turtur	*68*
S. vulgaris	*650*
T. ferruginea	*2*

Species name	*Number of birds*
T. philomelos	*7*
T. tadorna	*2*
T. viscivorus	*58*

Species name	*Number of birds*
U. epops	*21*
V. vanelus	*2*
Number of species	***61***

In total 61 bird species were observed in ISPB territory in the seventh monitoring spring season 2024. The most numerous birds in spring in the region for seven migratory seasons were great cormorant (*Phalacrocorax carbo*), yellow-legged gull (*Larus michahellis*), common buzzard (*Buteo buteo*), European bee-eater (*Merops apiaster*) and common kestrel (*Falco tinnunculus*) (Table 4). Only between 20 and 205 white storks (*Ciconia ciconia*) have passed over the surveyed territory annually in the seven spring seasons. The European nesting population of the White stork is estimated to be between 180,000 and 220,000 pairs, with about 80 % of the species migrating along the wider western Black Sea region, which also covers a part of north-eastern Bulgaria. According to these values, white storks flying over the Kaliakra area, substantially east of the main migratory path of white storks along the western Black Sea migration corridor, were an insignificant proportion (0.02 %) of the Via Pontica population. According to Shurulinkov et al. (2011 https://tethys.pnnl.gov/sites/default/files/publications/Shurulinkov-et-al-2012.pdf), an estimate of the total population of White stork in SE Bulgaria flying along Via Pontica in spring was 23,358 individuals in their study period. In this respect our observations confirm again the low significance of the territory of Kaliakra as part of the migratory corridor for spring migrating white storks along the Via Pontica component of the larger flyway.

No stops of turbines were ordered under the Turbine Shutdown System (TSS) during the spring migration period of 2024. This was primarily because all the observed birds passing through the ISPB territory were outside the zone of the risk of collision with turbines.

In order to check the effectiveness of the ISPB to prevent collisions of spring migrating birds, each of the 114 turbines covered by the ISPB program was checked at least once a week for collision victims. According to previously performed carcass removal and searcher efficiency tests during autumn migration and in winter at SNWF (and repeated in autumn 2018 and in winter 2022 for ISPB territory), this search regime of weekly searches provides for a cost-effective method, which can also be calibrated, to discover any bird strike fatalities which may be of concern. For details, see previous studies of: http://www.aesgeoenergy.com/site/Studies.html and results of previous ISPB reports at: https://kaliakrabirdmonitoring.eu/.

Table 6. *Number of turbines searched for collision victims in the territory of ISPB during the period 15 March-15 May 2024. The name of the wind farm operators and the number of the turbines used in the table: AE8/60 - AES Geo Energy Ltd., M1/35 - Kaliakra Wind Power, E1/8 - EVN Kavarna, DC1/2 - Degrets OOD, DBГ1/5 - Disib OOD, DBГ2MN600/DBГ1HSW250 - Windex OOD, ABГ4 - Long Man Invest OOD, ABBalgarevo - Long Man Energy OOD, AB3евс - 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 2024	April 2024	May 2024	Total
ABBalgarevo	3	4	2	9
ABMilenium Group	2	4	2	8

Turbine number	March 2024	April 2024	May 2024	Total
ABMilenium Group Micon	2	4	2	8
ABГ1	3	4	2	9

Turbine number	March 2024	April 2024	May 2024	Total
АВГ2	3	4	2	9
АВГ3	3	4	2	9
АВГ4	3	4	2	9
AE10	3	4	2	9
AE11	3	4	2	9
AE12	2	5	2	9
AE13	2	4	3	9
AE14	3	4	2	9
AE15	3	4	2	9
AE16	3	4	2	9
AE17	3	4	2	9
AE18	2	5	2	9
AE19	2	5	2	9
AE20	3	4	2	9
AE21	3	4	2	9
AE22	3	4	2	9
AE23	3	4	2	9
AE24	3	4	2	9
AE25	3	4	2	9
AE26	3	4	2	9
AE27	2	4	2	8
AE28	2	4	2	8
AE29	3	4	2	9
AE31	2	4	3	9
AE32	2	4	3	9
AE33	2	4	3	9
AE34	2	4	3	9
AE35	2	4	3	9
AE36	3	4	2	9
AE37	2	5	2	9
AE38	3	4	2	9
AE39	3	4	2	9
AE40	3	4	2	9
AE41	3	4	2	9
AE42	3	4	2	9
AE43	3	4	2	9
AE44	3	4	2	9
AE45	2	4	2	8
AE46	2	5	2	9
AE47	2	5	2	9
AE48	2	5	2	9
AE49	2	5	2	9
AE50	2	4	3	9
AE51	2	5	2	9

Turbine number	March 2024	April 2024	May 2024	Total
AE52	2	5	2	9
AE53	2	5	2	9
AE54	2	5	2	9
AE55	2	5	2	9
AE56	2	5	2	9
AE57	2	5	2	9
AE58	2	5	2	9
AE59	2	5	2	9
AE60	2	4	3	9
AE8	3	4	2	9
AE9	3	4	2	9
ДВГ1	3	4	2	9
ДВГ1HSW250	3	4	2	9
ДВГ2	3	4	2	9
ДВГ2MN600	3	4	2	9
ДВГ3	3	4	2	9
ДВГ4	2	4	2	8
ДВГ5	2	4	2	8
DC1		1		1
DC1	2	3	2	7
DC2	2	4	2	8
E00	3	4	2	9
E01	3	4	2	9
E02	3	4	2	9
E04	3	4	2	9
E05	3	4	2	9
E07	3	4	2	9
E08	3	4	2	9
E09	3	4	2	9
M1	3	4	2	9
M10	2	4	2	8
M11	2	4	2	8
M12	2	4	3	9
M13	2	4	3	9
M14	2	4	3	9
M15	2	4	3	9
M16	2	4	3	9
M17	2	4	3	9
M18	2	4	3	9
M19	2	5	2	9
M2	3	4	2	9
M20	2	5	2	9
M21	2	5	2	9
M22	2	5	2	9

Turbine number	March 2024	April 2024	May 2024	Total
M23	2	5	2	9
M24	2	5	2	9
M25	2	5	2	9
M26	2	5	2	9
M27	2	5	2	9
M28	2	5	2	9
M29	2	5	2	9
M3	3	4	2	9
M30	2	5	2	9
M31	2	5	2	9
M32	2	5	2	9
M33	2	5	2	9

Turbine number	March 2024	April 2024	May 2024	Total
M34	2	5	2	9
M35	2	5	2	9
M4	2	4	2	8
M5	2	4	2	8
M6	2	4	2	8
M7	2	4	2	8
M8	2	4	2	8
M9	2	4	2	8
VP1	3	4	2	9
VP2	3	4	2	9
ABZevs	3	4	2	9
Grand Total	**276**	**490**	**243**	**1009**

Four records of dead birds after collision with wind turbines were documented during the 2024 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 2024 (the target species are listed at https://kaliakrabirdmonitoring.eu/).

Table 7*. Confirmed collision victims and species' conservation status as recorded during the 2024 spring migration period.*

English name	*Species name*	*Number of birds*	*Red Data Book*	*IUCN*
Perdix perdix	*Grey partridge*	*2*	*Not listed*	*LC*
Melanocorypha calandra	*Calandra lark*	*2*	*Endangered*	*LC*

Conclusions: spring migration

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

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

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

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

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

The quantitative characteristics of bird migration in the ISPB area during spring 2024, and the absence of mortality among the target bird species allows a continued conclusion that the studied wind farms do not present a risk of adverse impact to migratory birds. The application of the ISPB's safeguards potentially was and can be an ongoing contributory part of the minimal risk posed to birds from wind farms in the Kaliakra region.

Autumn migration

During the autumn monitoring, observations were made during all 92 days of the 2024 season (1 August - 31 October 2024) (Figures 4 and 5).

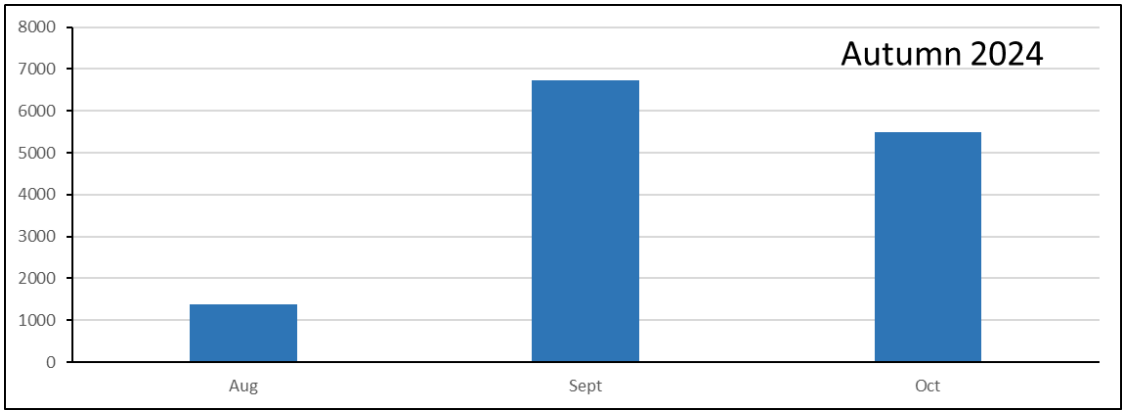

***Figure 4**. Number of registered birds by months during the autumn migration in the territory of ISPB.*

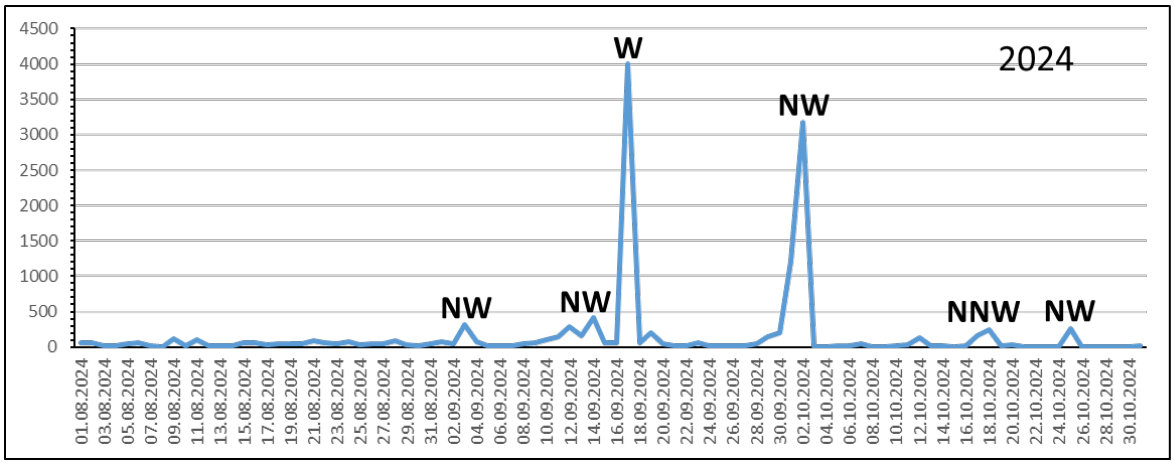

***Figure 5.** Dynamics of the autumn migration of the flying bird species in the ISPB territory according to visual observations during the period 01 August - 31 October 2024. Letters indicate the direction of wind in days with increased number of migrating birds.*

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

The monitoring from 1 August to 31 October 2024 recorded 13594 individual birds, assigned to 61 bird species. The numbers of individuals recorded by species during autumn migration in 2023 are shown in Table 8.

Table 8. *Composition of species and number of registered birds over the period 01 August to 31 October 2024 in the ISPB territory.*

Species name	***Number***
A. apus	*21*
A. brevipes	*77*
A. cinerea	*5*
A. gentilis	*4*
A. melba	*3*
A. nisus	*106*
A. pomarina	*114*
B. buteo	*1215*
B. oedicnemus	*73*
B. rufinus	*5*
C. aeruginosus	*117*
C. canorus	*2*
C. ciconia	*6*
C. corax	*9*
C. cornix	*5*
C. coturnix	*1*
C. crex	*13*
C. cyaneus	*7*
C. frugilegus	*37*
C. gallicus	*48*
C. garrulus	*11*
C. macrourus	*2*
C. monedula	*7*
C. nigra	*793*
C. palumbus	*7*
C. pygargus	*23*
D. urbica	*50*
E. alba	*1*
F. parva	*1*
F. subbuteo	*23*
F. tinnunculus	*127*

Species name	***Number***
F. vespertinus	*599*
G. fulvus	*6*
H. pennatus	*24*
H. rustica	*176*
L. canus	*439*
L. collurio	*1*
L. excubitor	*1*
L. michahellis	*705*
M. apiaster	*1975*
M. migrans	*112*
M. striata	*1*
O. oriolus	*2*
P. apivorus	*60*
P. carbo	*189*
P. collibita	*2*
P. haliaetus	*5*
P. ochrurus	*2*
P. onocrotalus	*6211*
P. phenicurus	*3*
R. riparia	*25*
S. borin	*1*
S. comunis	*1*
S. curruca	*2*
S. decaocto	*11*
S. nisoria	*1*
S. rubetra	*4*
S. turtur	*8*
S. vulgaris	*95*
T. troglodites	*10*
U. epops	*10*

The most numerous migrating birds recorded in Autumn 2024 were great white pelicans (*Pelicanus onocrotalus*) with over 6200 individuals registered. Most of the pelicans were observed in two days of the autumn period. On 17 September and 2 October, a total of 5687 great white pelicans passed through the territory under W and NW winds (Figure 4).
Among the other soaring birds, the most numerous recorded birds were common buzzard (*Buteo buteo*), black stork (*Ciconia nigra*) and red-footed falcon (*Falco vespertinus*) with 1215, 793 and 599 individuals of each species respectively (Table 8). Red-backedshrike (*Lanius collurio*), spotted flycatcher (*Muscicapa striata*), golden oriole (*Oriolus oriolus*), common redstart (*Phoenicurus phoenicurus*), black redstart (*Phoenicurus ochruros*), garden warbler (*Sylvia borin*), common whitethroat (*Sylvia communis*), lesser whitethroat (*Sylvia curruca*), barred warbler (*Sylvia nisoria*), Eurasian wren (*Troglodytes troglodytes*) are common for the country. The fact they appeared in the observations during Autumn 2024 is probably due to changes in the habitats around the observation points and crops visited by the species in the period of our study.

As a result of the simultaneous observations at four constant observation points and three radar systems (Figure 1) during the whole period of the 2024 autumn migration, there were only stops of one group of turbines (SNWF) and one complete wind farm (EVN) in the territory of the Kaliakra SPA and adjacent territories. The stop orders given to the engineers on duty were executed in a timely manner, thus avoiding any collision risk of bird passing through the territory. Detailed information on the duration of the ordered stops and their reasons is given in Table 9. The short duration of stops is indicative of the absence of serious risk of collision combined with the precautionary nature of the TSS,

Table 9. *Data for stops of wind turbines ordered by field observers during the autumn migration of birds 2024.*

Date	*Wind Farm*	*Turbine code №/ Group*	*Species*	*Number of birds*	*Time stop*	*Time restart*
17.09.2024	*EVN*	*-*	*P. onocrotalus*	*70*	*10:42:00*	*10:47:00*
02.10.2024	*SNWF*	*Zone E*	*P. onocrotalus*	*240*	*14:00:00*	*14:06:00*

Table 10. *Number of turbines searched for collision victims in the territory of ISPB during the period 01 August to 31 October 2024. The name of the wind farm operators and the number of the turbines used in the table: AE8/60 - AES Geo Energy Ltd., M1/35 - Kaliakra Wind Power, E1/8 - EVN Kavarna, DC1/2 - Degrets OOD, DBГ1/5 - Disib OOD, DBГ2MN600/DBГ1HSW250 - Windex OOD, ABГ4 - Long Man Invest OOD, ABBalgarevo - Long Man Energy OOD, AB3евс - Zevs Bonus OOD, VP1/2 - Vertikal-Petkov&Sie SD, ABГ3 - Wind Park Kavarna East EOOD, ABГ1/2 - Wind Park Kavarna West EOOD, AB Millennium group Micon/ AB Millennium group - Millennium Group OOD.*

Turbine	Aug	Sep	Oct	Total
ABBalgarevo	4	4	4	12
ABГ1	3	5	4	12
ABГ2	3	5	4	12
ABГ3	3	5	4	12
ABГ4	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	2	4	5	11
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	5	4	12
AE37	3	4	4	11
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	4	11
AE47	3	4	4	11
AE48	3	4	4	11
AE49	3	4	4	11
AE50	3	4	5	12
AE51	3	5	4	12

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
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
DBГ1	3	5	4	12
DBГ1HSW250	4	4	4	12
DBГ2	3	5	4	12
DBГ2MN600	4	4	4	12
DBГ3	3	5	4	12
DBГ4	4	4	5	13
DBГ5	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	4	12
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	6	13
M21	3	4	6	13
M22	3	4	6	13
M23	3	4	6	13
M24	3	4	6	13
M25	3	4	6	13
M26	3	4	6	13
M27	3	4	6	13
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	5	4	12
M4	4	4	5	13
M5	4	4	5	13
M6	4	4	5	13
M7	4	4	5	13
M8	4	4	5	13
M9	4	4	5	13
VP1	4	4	4	12
VP2	4	4	4	12
ABZevs	3	5	4	12
Grand Total	**390**	**489**	**505**	**1384**

As a result of 1384 searches under 114 individual turbines between 1 August and 31 October 2024, a total of 5 dead birds of five species were identified. The numbers of identified collision victims by species are given in Table 11.

Table 11. *Victims of collision with turbines during the autumn migration period in 2024 according to the Red Data Book for Bulgaria and IUCN conservation status classifications (LC = Least Concern)*

Species name	***Scientific name***	***Number***	***Red Data Book***	***IUCN***
Little crake	*Porzana parva*	*1*	*endangered*	*LC*
Red-backed shrike	*Lanus collurio*	*1*	*not listed*	*LC*
Eurasian sparrowhawk	*Accipiter nisus*	*1*	*endangered*	*LC*

Greater whitethroat	*Sylvia communis*	*1*	*not listed*	*LC*
Yellow-legged gull	*Larus michahellis*	*1*	*not listed*	*LC*

IUCN classifications as Least Concern (LC) were appropriate to all species identified as collision victims. The category Least Concern indicates that the species has been evaluated against the Red List criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

Three of the bird species identified as victims are not listed in the Red Data Book of Bulgaria. Two of the species are listed in the Bulgarian Red Book – little crake and Eurasian sparrowhawk. Both are endangered species in Bulgaria according to the Bulgarian Red Data Book. Both species are typically migratory as referring to the study site and in autumn the populations of these two species passing through Bulgaria usually have a more northern origin. Eurasian sparrowhawks from colder regions of northern Europe and Asia migrate south for the winter, some to north Africa (some as far as equatorial east Africa) and India; members of the southern populations are resident. Analysis of ringing data collected at Heligoland, Germany, found that males move further and more often than females; of migrating birds ringed at Kaliningrad, Russia, the average distance moved before recovery (when the ring is read and the bird's whereabouts reported subsequently) was 1,328 km (825 mi) for males and 927 km (576 mi) for females. Little crakes migrate from Europe to Africa and are typical nocturnal migrants. The records of both species in autumn in the period of seasonal migration indicate the migratory status of the birds of these two species found dead. Therefore, IUCN status has to be considered and both species have to be defined as LC.

Conclusions: autumn migration

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

The results of the monitoring confirmed the relatively low importance of the ISPB territory for the birds flying through or over it, and no apparent negative influence of the operating wind farms on bird populations during their autumn migration.

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

The data presented in this report confirmed the absence of impact on sensitive bird species using migratory upward airflows (thermals) to move (soaring) over long distances in autumn migration period.

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

The quantitative characteristics of bird migration in the ISPB area during autumn 2018, 2019, 2020, 2021, 2022, 2023 and 2024 and the low mortality among the target bird species allows a continued conclusion that the studied wind farms do not present a risk of adverse impact to

migratory birds. The application of the ISPB's safeguards potentially was and can be an ongoing contributory part of the minimal risk posed to birds from wind farms in the Kaliakra region.

List of participants in the observations

- **Prof. Dr Pavel Zehtindjiev – Senior field ornithologist**

More than 25 years of research experience in ornithology. Author of more than 85 scientific publications in international journals with an impact on the scientific field of bird biology, ecology and ecosystem conservation. Member of the European Ornithological Union and many nature conservation organizations. Winner of the Revolutionary Discovery Award for Ornithology of the American Ornithological Society for 2016 - The Cooper Ornithological Society.
Over 10 years of experience in impact monitoring study of wind turbines in the study area.

- **Veselina Raikova - Field ornithologist**

Natural History Museum of Varna. Member of BSPB. Author of more than 10 publications in international scientific journals. Over 10 years of experience in impact monitoring study of wind turbines in the study area.

- **Ivaylo Raykov - Field ornithologist**

Museum of Natural History, Varna. Member of BSPB. Author of over 20 scientific publications in international journals.
Five years of experience in impact monitoring in the region of Kaliakra.

- **Kiril Bedev - Field ornithologist**

Researcher in Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences.
Active member of conservation organization Green Balkans. Long term study on migrating birds and biodiversity of Burgas lakes. Author of three articles in Bulgarian Red Data Book. Expertise in biotechnology, conservation biology and environmental monitoring. Over seven years of experience in impact monitoring of wind parks in Bulgaria. Member of Balkani NGO for conservation of birds and nature.

- **Hristo Gardov – Field ornithologist**

Experienced biologist, participant in several field studies of birds as part of many conservation projects. BSPB active member. Member of The Wildlife Conservation Society (WCS) and member of the management of the organization.

- **Nikolay Yordanov – Field ornithologist**

Master student in Sofia University, faculty of Biology. Two years monitoring of soaring birds in preconstruction stage of WF projects experience. Responsible for Radar application in the field survey of birds.

- **Jelyazko Dimitrov - Field ornithologist**

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

- **Vasil Panayotov Dimitrov - Field ornithologist**

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