Monitoring of wintering geese in the AES Geo Energy Wind Farm "St Nikola" territory and the Kaliakra region in winter 2014/2015

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Contents

Introduction

This report presents results of the ornithological survey and monitoring at Saint Nikola Wind Farm (SNWF) in the period 01 December 2014 to 15 March 2015, continuing from similar studies in previous winters before and after construction of SNWF. The primary objective of wintering bird studies at SNWF is to investigate the possible effects of the wind farm on geese populations, notably the Red-breasted Goose *Branta ruficollis* (RBG) due to its globally threatened conservation status. Previous years' wintering studies at SNWF have been reported and presented for download on the AES SNWF website.

To date, as documented by previous reports, there have been no indications that SNWF has had any adverse impact on wintering geese, including RBG, and the more abundant Greater White-fronted Goose (*Anser albifrons*) (GWFG). This report presents the latest findings, from the 2014/15 winter, which continued to scrutinize the possibility of an adverse impact on wintering geese through SNWF's operation.

Methods

Methods were the same as in previous winter surveys. Data were collected within a 'core study area' that encompassed an area centered on the SNWF wind farm, but with additional areas in a buffer that extended at least 2 km from the wind farm (Figure 1): this is to distinguish this area of consistent effort across winters from a much wider area where observations were also undertaken periodically, that extended north, up the coast to the freshwater lake of Durankulak (see report for the 2010/11 winter). The 'footprint' of the SNWF wind farm, prescribed by a perimeter around the outermost turbines, is referred to as the 'SNWF territory' (also referred to as the Project Area in some previous reports) (Figure 1).

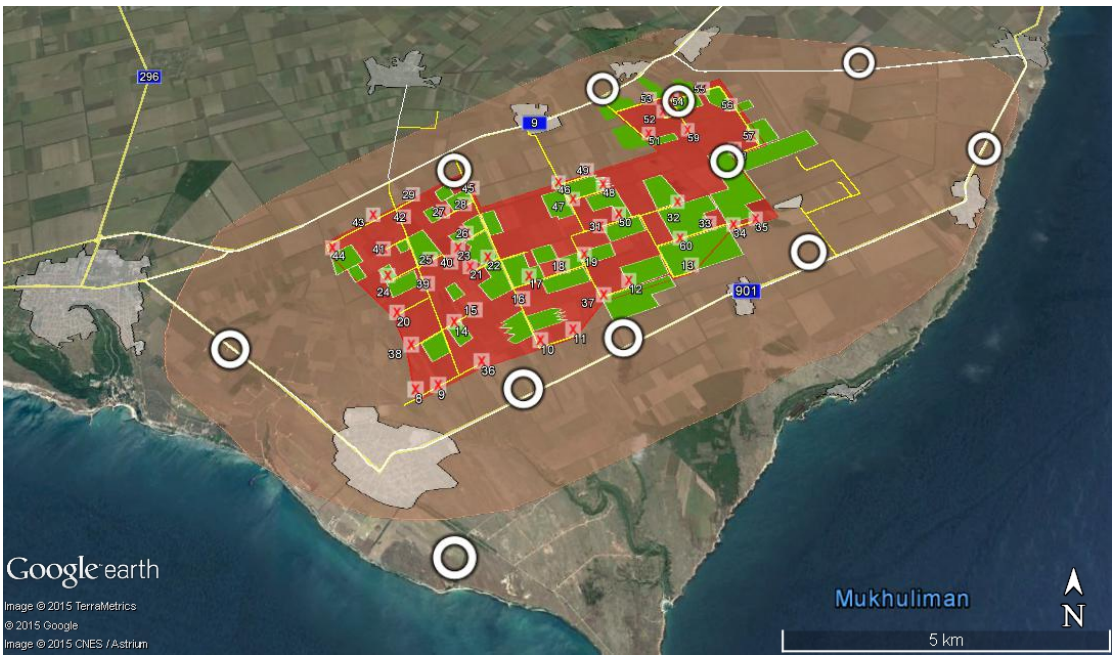

Figure 1. *Map of the "SNWF" study area (red and green), and the "core study area" (brown) and observation points covered by the winter monitoring 2014 – 2015. The green color indicates fields with wheat potentially suitable for feeding geese.*

The 75 days of the study encompassed the whole period when geese were recorded in the core study area, including SNWF, during 2014/15. Detailed observations were made daily, so far as possible within the constraints of suitable weather, on the location and counts (including species composition) of birds involved in flight activity and feeding behavior of any flocks within the wind farm and its vicinity. Observation points and the coverage of the BirdScan radar were as in the previous winters (for details see reports of winter monitoring 2008 – 2014 at http://www.aesgeoenergy.com/site/Studies.html).

Accordingly, several observation points were manned constantly in 2014/15 winter, whereas some observation points were attended less frequently, and were used adaptively according to weather condition constraints and the ongoing behavior of the geese. Those close to the SNWF turbines were only used to record feeding geese, after the main early morning flight activity period had finished. Observations were also taken occasionally from vantage points close to the Black Sea in order to check periodically if geese may have been using the sea as roost sites. These points were visited more frequently when it was apparent, from records at the points and from flight line timings and directions that such behavior was regular. Crop types within the core study area were also recorded.

Searches under turbines for collision victims were set to be undertaken, as in previous winters, under a protocol for a basic seven day search interval that was to be instigated after geese were first observed in the study area and conducted according to where the presence of geese could, potentially, result in collision. In practice for 2014/15, this protocol resulted in an average of 10 searches per turbine distributed over the monitoring period, as presented in Table 1.

Table 1. Number of searches per turbine in the period of winter monitoring (01 December 2014 – 15 March 2015).

Turbine	December 2014	January 2015	February 2015	March 2015	Total
8	1	3	4	2	10
9	1	3	4	2	10
10	1	5	3	2	11
11	1	5	3	2	11
12		4	4	2	10
13		4	4	2	10
14	1	3	4	2	10
15	1	4	4	2	11
16	1	5	3	2	11
17	1	5	4	2	12
18	1	5	4	2	12
19		4	4	2	10
20	1	4	5	2	12
21	1	5	3	2	11
22		5	3	2	10
23		5	3	2	10
24	1	5	5	2	13
25		5	5	2	12
26		5	3	2	10
27		4	3	2	9
28		4	3	2	9
29	1	5	4	1	11
31		4	4	2	10
32		4	3	2	9
33		4	4	1	9

Turbine	December 2014	January 2015	February 2015	March 2015	Total
34		4	4	1	9
35		4	4	1	9
36	1	3	3	2	9
37		4	4	2	10
38	1	3	6	2	12
39	1	3	5	2	11
40	1	5	5	2	13
41	1	5	4	1	11
42	1	5	4	1	11
43	1	5	4	1	11
44	1	5	4	1	11
45		5	3	2	10
46		5	4	2	11
47		5	3	2	10
48		5	4	2	11
49		5	4	2	11
50		4	3	1	8
51		3	5	1	9
52	1	4	4	1	10
53	1	3	4	1	9
54		4	3	2	9
55		4	3	3	10
56		4	3	3	10
57		4	2	3	9
58		4	2	3	9
59	1	4	2	2	9
60		4	4	2	10
Total	**24**	**222**	**193**	**96**	**535**

The searching procedures involved the use of GPS units to allow tracking and recording of search paths when observers were searching for collision victims under turbines, as in the previous winters (Figure 2).

A detailed description of methods underlying the decisions and procedures for switching off turbines (the Turbine Shutdown System: TSS) under a risk of bird collisions, is described in a number of previous reports and in the Owner Ornithological Monitoring Plan. The feeding grounds within the wind park territory identified in the winter surveys were investigated daily and the number of feeding geese at these sites and weather conditions (i.e. heavy mist, fog) were the bases of decisions for the TSS for reduction of the collision risk; as in previous winters.

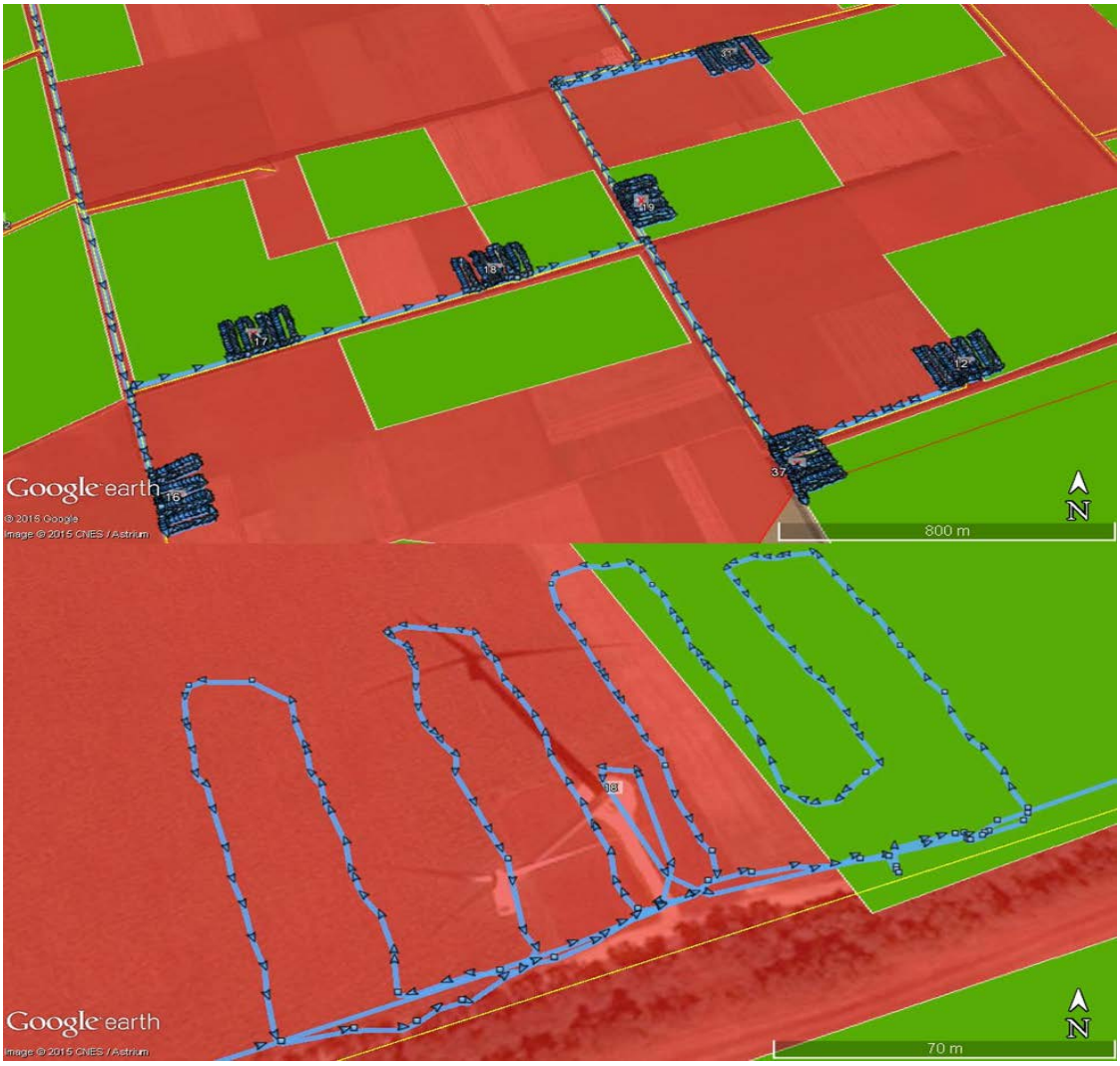

Figure 2. *Examples of plots searched for collision victims per day (upper map) and a single plot (lower map). The green color indicates fields with wheat potentially suitable for feeding geese.*

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Results

Geese were observed within the core study area between 16 December 2014 and 07 February 2015. As noted in reports for previous winters (see report for 2012/13 winter for details) in several flocks geese could not be identified to species due to distance, flock size and the rapidity of flight. In these cases birds in flocks were classed as Anser/Branta (i.e. GWFG/RBG) in mixed species flocks. The numbers of geese observed in the core study area each day are presented in Table 2.

Table 2. Geese numbers by species and day of monitoring in the core study area.

Row Labels	A. albifrons	A. anser	Anser/Branta	B. ruficollis	Total
16.12.2014	43				43
22.12.2014	1				1
29.12.2014	180				180
30.12.2014	520		60		580
05.01.2015	615	7	475	44	1141
06.01.2015	84		2110	40	2234
07.01.2015	1696	5	5627	6	7334
08.01.2015	484		7611	10	8105
09.01.2015	434		10331	215	10980
10.01.2015	325		1242	250	1817
11.01.2015	1544		17109	172	18825
12.01.2015			415	80	495
13.01.2015	1213	9	21158	290	22670
14.01.2015	500		10006	78	10584
15.01.2015	520		2630	12	3162
16.01.2015	55		1864		1919
17.01.2015	36		370	2	408
18.01.2015	59	17	380		456
20.01.2015	74		443	103	620
22.01.2015	23		25		48
23.01.2015		3		1	4

26.01.2015	55	7	237	1	300
27.01.2015	194	9	46	4	253
28.01.2015	38	6		31	75
29.01.2015	28	2	45		75
30.01.2015	2				2
03.02.2015			22		22
07.02.2015	8	9			17
Total	**8731**	**74**	**82206**	**1339**	**92350**

All species of geese were present in the core study area between the end of December 2014 and the end of January 2015, apart from a small number seen in the first week of February (Table 2 and Figure 3).

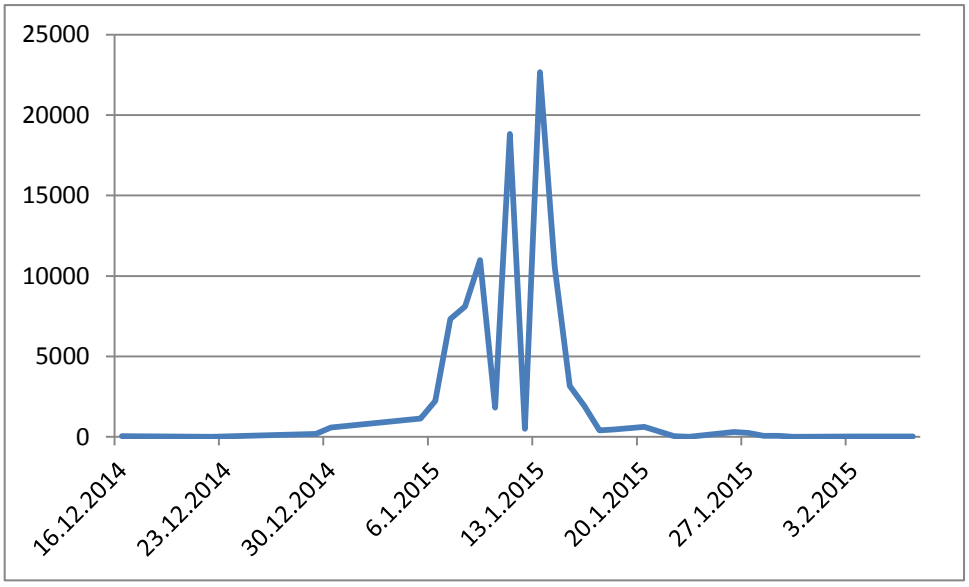
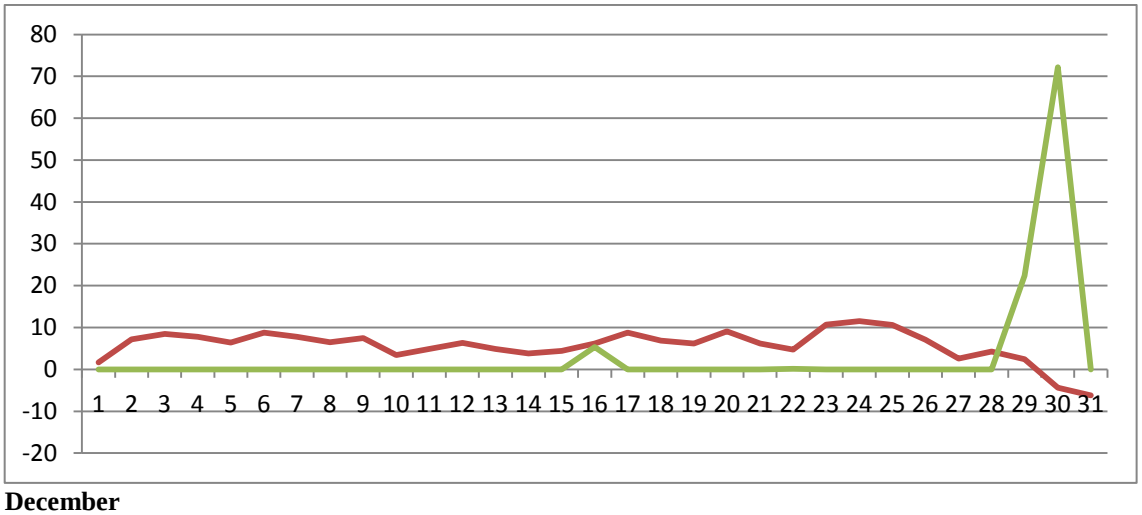
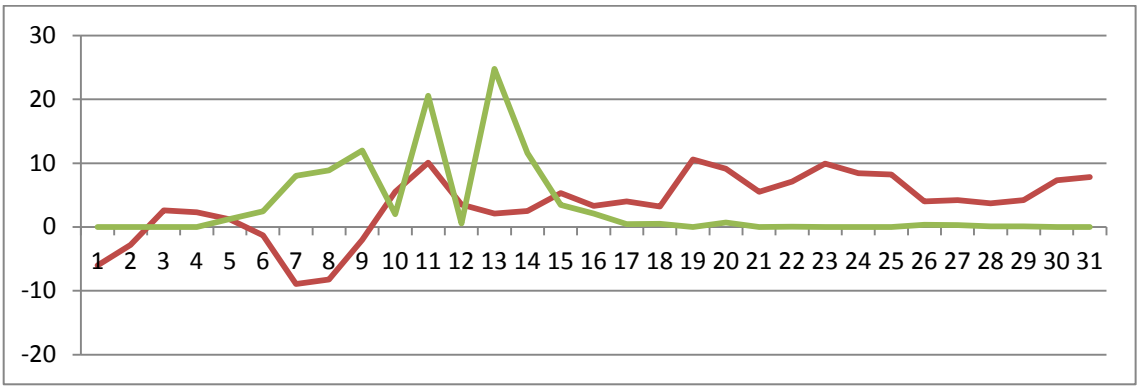


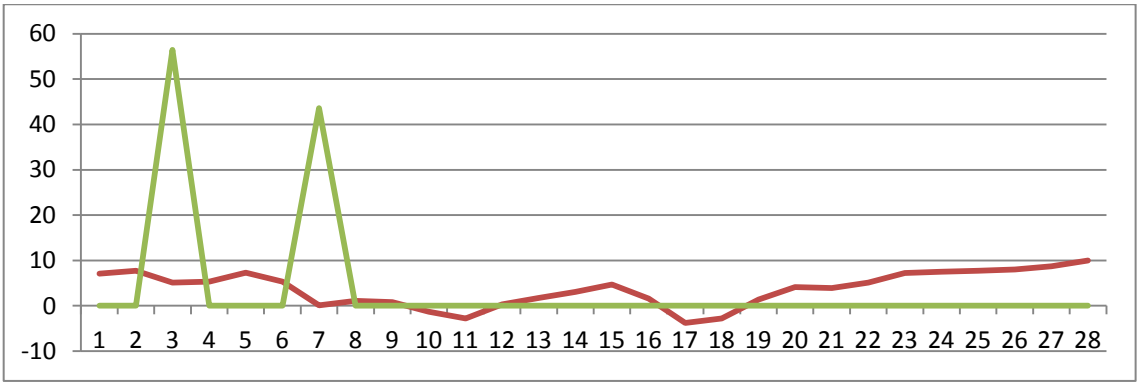
Figure 3. *Temporal distribution of geese (all species) observed in the core study area in winter 2014-2015.*



December



January



February

Figure 4. *Dynamics of daily temperatures (red line) (according to www.stringmeteo.com) and geese (green line: as daily percentage of the total for the month) in December, January and February.*

Overall there were relatively few geese present over a sustained period in the core study area in the 2014 – 2015 winter, with numbers lower than in most previous winters; the mild 2013 – 2014 winter being an exception when numbers were even lower (for details see reports at http://www.aesgeoenergy.com/site/Studies.html). Both the 2013 – 2014 and 2014 – 2015 winters were relatively mild.

Dynamics of the observed geese numbers and ambient temperatures in the 2014 – 2015 winter are illustrated in Figure 4. In January, when most geese were seen (Table 2) a period of low freezing temperatures in the days before 9 January, including temperatures between –6°C and –9°C, involved relatively stable numbers of geese using and returning to the study area (Figure 4). Suddenly increased temperatures after 9 January saw the observed number of geese drop and then fluctuate for a few days because of waves of birds passing through the study area and departing to the north. During the subsequent sustained warm period for the rest of January there were relatively few birds seen (Figure 4). The calculated Spearman's correlation between daily number of geese and daily ambient temperature for January suggested a strong tendency for more geese to be present during lower temperatures but marginally was not statistically significant (r_s = -0.326, p = 0.07, n = 31). It is likely that the correlation would be significant if the confounding effect of geese simply moving north through the study area were to be discounted.

The number of birds per species, excluding geese species, is presented in Table 3.

Probably because of the mild winter (average ambient temperature 4.8ºC according to http://www.stringmeteo.com/synop/temp_month.php) the abundance of observed species was higher than in all previous winters (Table 3). Notably, unusual observations of several flocks of pelicans (*Pelecanus crispus* and *P. onocrotalus*) were also probably an effect of the mild temperatures in winter 2014-2015 (Table 3).

Table 3. 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 2014 - 2015.

Species	**December**	**January**	**February**	**March**	**Total**
A. arvensis			22	35	57
A. cinerea		2			2
A. nisus	1	2	2	1	6
A. gentilis			1		1
A. penelope	24				24
A.arvensis			9	10	19
Anas platyrhynchos	1	12			13
B. buteo	93	45	27	3	168
B.rufinus	1				1
C. aeruginosus	2	3	1		6
C. albus		25	1		26
C. cannabina			9	5	15
C. corax			1	2	3
C. olor		96	107		203
C.carduelis			33		33
C.cornix	12		35	35	82
C.cyaneus	9	33	15	3	60
C.cygnus	4	129	293		426
Cygnus sp.		905	111		1016
C.monedula			3		3
C. spinus	26				26
D. major			1		1
E.rubecula			1		1
F. columbarius		2	2		4
F. peregrinus				1	1
F. tinunnculus	1	10	15		26
F.columbarius	1	4	3		8
Falco sp.			1		1
G. glandarius	1		1		2
H. albicilla		3	1		4
L. canus		7			7
L. michahellis	238	86	27	9	360
L.canus		2			2
P. apricaria	38	7	115		160
P. crispus	35		7		42
P. onocrotalus	42		1		43
P. perdix	6	26	21		53
P. pica	9		130	9	148
P.caeruleus			5		5
P.carbo	208	138	918	220	1484
P.major			3		3
P. viridis			1		1
Sc. apricaria	1				1
St.vulgaris	576		2091	433	3100
T.pilaris			27		27
T.tadorna	2				2
Tachibabtus ruficollis	1				1

Species	December	January	February	March	Total
Turdus pilaris	2				2
Turdus sp.			1		1
Turdus viscivorus	1				1
M. calandra		47	135	2	184
Motacilla sp.				3	3
Grand Total	**1335**	**1584**	**4177**	**772**	**7868**

Total number of observed goose species and their locations

The total numbers of three species of goose, RBG (*Branta ruficollis*), GWFG (*Anser albifrons*) and Greylag Goose (*Anser anser*) observed in the winter 2014/2015 in the core study area, are shown in Table 4.

Table 4. The number of geese of different species recorded in the core study area (data from visual observations in winter 2014/2015).

Species	December	January	February	Total
A. albifrons	744	7979	8	8731
A.anser		65	9	74
Anser/Branta	60	82124	22	82206
B.ruficollis		1339		1339
Total	804	91507	39	92350

The recorded numbers of feeding GWFG, RBG and mixed species (GWFG/RBG) flocks in the core study area and in SNWF are presented in Figures 5, 6 and 7, respectively. Sixteen flocks of GWFG were observed feeding in the core study area. None of these flocks which landed where indicated in Figure 5 was observed to feed in SNWF.

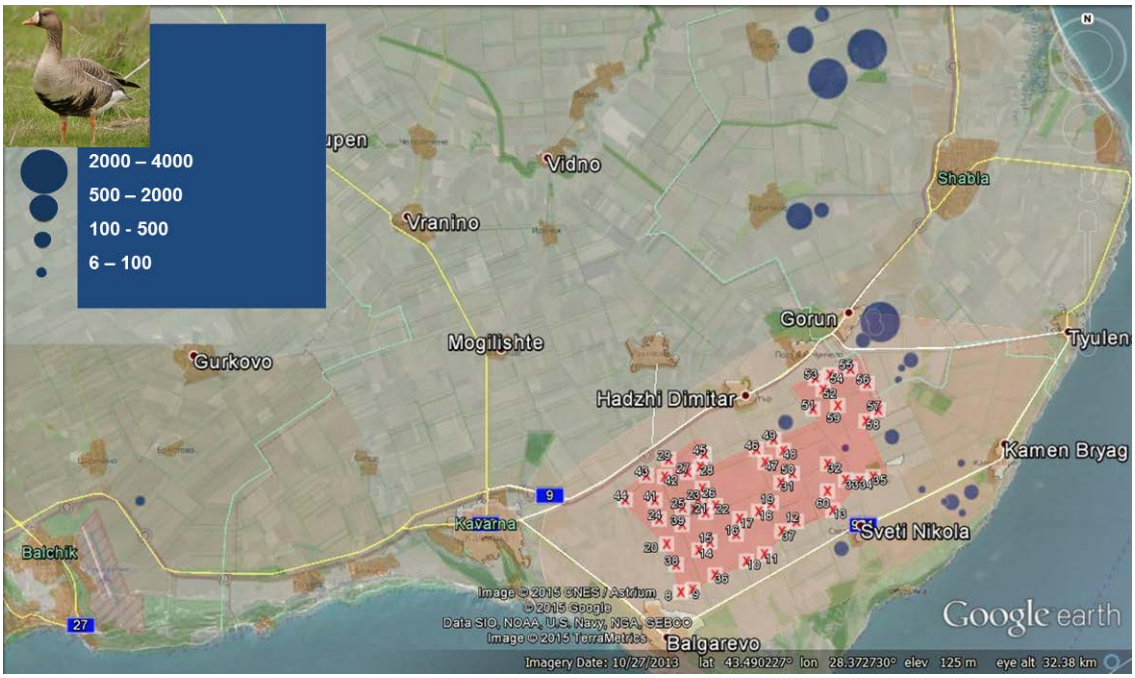


Figure 5. *Location and relative size of feeding GWFG flocks observed in the core study area and to the north.*

Seven single-species flocks of RBG were observed to use available fields in the core study area (Figure 6). None of these flocks were registered in SNWF during the winter 2014-2015.

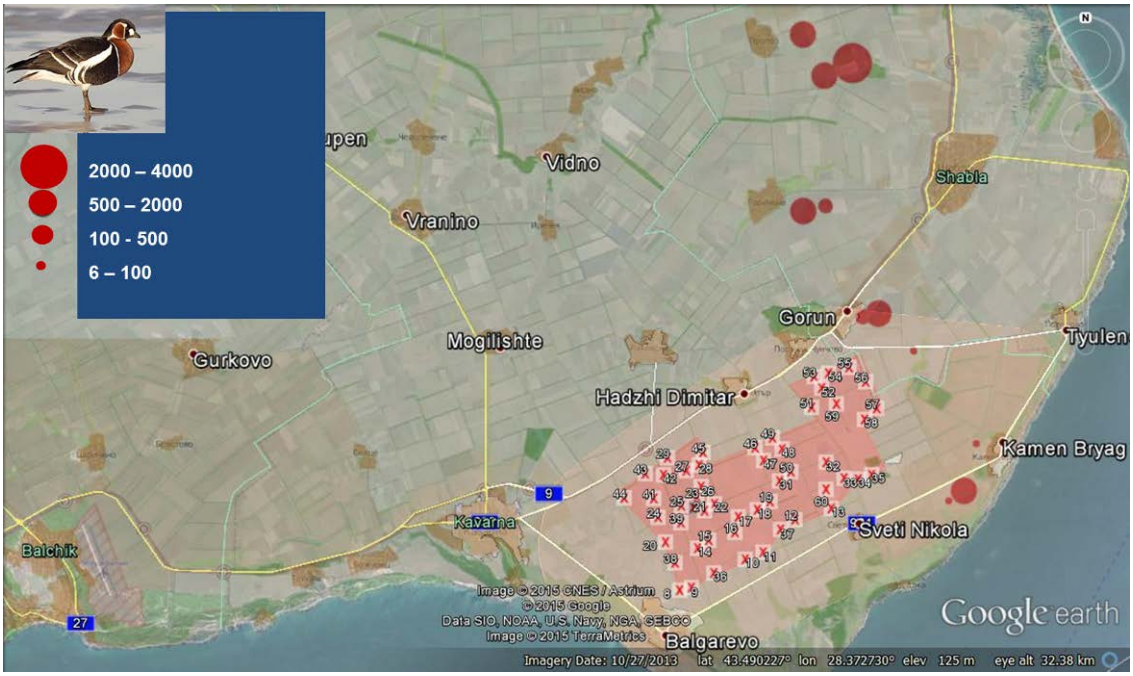


Figure 6. *Location and relative size of feeding RBG flocks observed in the core study area and to the north.*

The maximum number of RBG feeding in SNWF was observed in mixed geese flocks on 8, 9 and 11 of January when flocks of 1958, 1020 and 1000 geese respectively were feeding in mixed flocks in SNWF (Figure 7). The proportion of RBG could not be precisely evaluated but in all three flocks it was approximately between 10% and 50%.

Figure 7. *Location and relative size of mixed flocks of RBG and GWFG observed feeding in the core study area and SNWF.*

In circumstances where species could be identified and counted, around 944 flying RBG within SNWF were estimated in total for the whole winter 2014/2015. Estimated totals of all geese (RBG and GWFG) seen flying and feeding within SNWF were around 45000 and 9000, respectively (Table 3).

Table 3. Daily numbers of flying geese and geese feeding on the ground (RBG, GWFG, and mixed species flocks) inside SNWF and within the core study area ("outside SNWF") as observed in winter 2014-2015.

Date	Flights inside SNWF			Flights outside SNWF			Feeding inside SNWF			Feeding outside SNWF		
	RBG	GWFG	Mixed	RBG	GWFG	Mixed	RBG	GWFG	Mixed	RBG	GWFG	Mixed
16.12		43										
22.12		1										
29.12		180	60									
30.12		520										
05.01	10	100	250	34	515	225				30	330	
06.01		19	110	40	65	2000						
07.01		279	3523	6	1399	2104	6	680	250			
08.01	10	332	4411		152	3200			1958		194	
09.01	135	234	5762	80	200	4569	500	3000	1751			
10.01	250	45	150		280	1092				250	2150	
11.01	32	484	6302	140	1060	10087			1000			
12.01	80		415							180	350	
13.01	290	871	9230		342	11928						
14.01	40	243	6705	38	257	3301					331	380
15.01	12	376	1035		144	1595			306			
16.01		34	288		21	1576				500	500	

Date	Flights inside SNWF			Flights outside SNWF			Feeding inside SNWF			Feeding outside SNWF		
	RBG	GWFG	Mixed	RBG	GWFG	Mixed	RBG	GWFG	Mixed	RBG	GWFG	Mixed
17.01			240		36	130					104	
18.01		11	310		48	70						
20.01	85	21	150	18	53	293						60
22.01		12			11	25					12	
26.01			18	1	55	219				30	120	
27.01		26	46		168						30	
28.01		35								31		
29.01		28	45									
30.01												
03.02						22						
07.02		8										
total	**944**	**3902**	**39050**	**357**	**4806**	**42436**	**506**	**3680**	**5265**	**1021**	**4121**	**440**

Because of the mild winter and low numbers of observed geese detailed analysis of the flight altitudes as well as circadian variations in their activity are not warranted, and do not allow a useful comparison of the same parameters from the previous five winters.

Carcass monitoring results

All 52 turbines were programmed to be searched every seventh day (when turbines where accessible) for carcasses during the whole winter survey period (01 December 2014 – 15 March 2015). The enacted frequencies of searches are presented in Table 1. The environmental conditions (ambient temperature, rain and snow coverage) which may have an impact on the results of the searches has been previously discussed in a number of winter monitoring reports available at: http://www.aesgeoenergy.com/site/Studies.html.

There were three carcasses found which may be associated with a collision with the turbines in the 2014/15 winter: one Coot (*Fulica atra)* and one Grey Partridge *(Perdix perdix)* were found intact, and a third set of remains found was a Magpie (*Pica pica*) (Figure 8). All three species are of least concern according to the IUCN criteria and are not listed in Bulgarian Red Data Book.

Figure 8. Pictures of the carcass remains found during winter monitoring 2014 - 2015.

The other remains found during the winter collision victim monitoring include six single unidentified feathers and one bunch of Little Owl (*Athene noctua*) feathers. None of these remains indicated that they were the result of collision with turbines.

No body parts or intact remains of geese which could be considered as collision victims were detected after 535 cumulative searches of different turbines in the period 01 December 2014 – 15 March 2015 (Table 1). Therefore, no evidence for collision of any goose species, including RBG, has been found in the winters 2010 - 2015 when geese were present and turbines were operating.

In order to reduce the risk of collision with the rotors of the wind turbines in conditions of reduced visibility (fog or snowstorm), different groups of turbines as well as single turbines were stopped during the 2014/15 winter study period as during the previous four winters.

Conclusions

The methods applied to this study in 2014/15 were similar to those in the previous six winters (2008 - 2014).

Relatively few geese were seen in the wider ‘core’ study area and SNWF, probably because the weather was mostly mild. The main use of the core study area was during a period of freezing temperatures in early January, with geese leaving and other flocks seen flying north in the days afterwards when temperatures increased.

No remains of geese that could be attributed to collision with SNWF’s turbines were found during many searches under operational turbines in the 2014/15 wintering period of geese. No geese have been found as collision casualties in any of the five winters when SNWF has been operational.