2024

Migration of Soaring Birds at Gebel El Zeit (IBA) in relation to wind energy developments-SCATEC project

PREPARED FOR:

RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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Conclusions

The conclusions of this report have been grouped into three subjects. The first is the suitability of the SCATEC plot for a wind development based in the site specific pre-construction studies and all the previous existing information like potential effects in the IBA or the DECON study 2007. Secondly, is the comparison, and adequacy, of the areas further south (GoZ-7 "Red plot") for other wind developments in relation to the conservation of the biodiversity values within the Gebel el Zeit IBA. Finally, the third point relates to the current methods and analysis of the bird monitoring (Bird monitoring, PCFM, and SDOD) and the needs of improvements for a better understanding of the impacts and above all, adopting appropriate mitigation measures.

SCATEC Project Plot

- Considering the data analyzed the SCATEC plot does not fall inside to the existing bottleneck between the western coast of the Red Sea (Gebel el Zeit Mountain) and the Sinai Peninsula.

- The project shares the same species qualitatively as the other projects along the GoS, with higher passing rates (quantitatively) compared to those wind farms further north in spring. In the autumn season, the trend of the abundance reverses with higher passing rates in the northern projects. Overall, as expected, it is similar to the Acwa project just joining.

- The cumulative impact considering the existing and future developments results of a minor magnitude compared to what is existing in the IBA (SECTION 7). The project could move forward adopting an adequate SOD and PCFM, CONSIDERING THE GAPS IDENTIFIED IN THE ALREADY (ATMP, PCFM) EXISTING PROJECTS AND DESCRIBED IN THIS REPORT. The monitoring program should be supervised by an international ornithologist with background on wildlife interactions on birds and bats.

- The Wadi Dara chicken farms carcass disposal site has been removed but a Contingency Carcass Management and Social Action Plan should be developed to manage the dead chicken from the poultry farms in the surroundings and shared among developers to improve potential outcomes and reduce costs. Carcass removal management may exist in the future, and increasing the collision risk for the species potentially attending any new disposal site.

- In addition to implementation of the monitoring programs and managing potential attractions for MSBs, offsets should be implemented in accordance with lender requirements, potentially in a collaborative approach amongst developers.

Overall analyses of the Migratory Soaring Birds related to the Gebel el Zeit IBA

- The cumulative study analyzed the passing rates (birds/hour) for the eleven (11) most common MSBs species along the RVRSF in relation with the Gebel el Zeit IBA, and with the previous work developed in 2006-2007 (DECON 2007). This has been done using a multi WPPs approach with the bird baseline monitoring data. A second goal has been the identification of potential resting areas which would elevate the collision risk of the species.

- In spring, WPPs located along the north-south axis: Projects in the south, overlapping with the IBA, showed significant more MSBs that those projects in the northern latitude. This is related with the location of the narrowest Red Sea distance between the GoS and the Sinai Peninsula. MSBs use this area both in spring and summer as a crossing area. A second comparison in longitude –west to east- did not showed significant differences, with all the species occupying the entire region equally and migrating in a broad front.

- In the autumn, there are lower numbers of migratory birds and the risk is reduced to a smaller sample of species but there is greater variability of the flying heights.
- This study and that developed in 2006-2007, show consistency in their results, suggesting the s called "yellow, orange, and red zones" (Ecoda 2007) should remain with the same categorization.

- There are no specific sites where birds would roost when becoming exhausted, or forced to land, e.g. because of a sand storm. These places are unpredictable beforehand and selected randomly. However, there are predictable sites where birds feed on route, as it is the case of the Wadi Dara farming area, where dead poultry is dropped off. This site within the SWE Plot #2 concentrates several species, being the most important the Steppe eagle (IUCN Red List EN).
- Further site specific assessments should be done in any future project in the region during the pre-construction studies, not only focusing on VP monitoring.

- Examples of environmental constraints related to MSBs have been found already like the rubbish dump in Rash Gharib or the artificial dam in SWE-ACWA Plot 1, requiring a focused and special bird monitoring.

Monitoring needs and improvements, pre and post construction

- The pre and post construction bird monitoring, both for wind projects and OHTL's, show inconsistencies which require supervision of a wind and wildlife expert with science and statistics background. As far as have been reviewed, the current works rely on the decision of the site-specific teams /consultancies. The goals of this supervision are 1) establish data gathering and analyses consistent throughout the projects and time 2) allow preparing databases for the right analyses to get robust and comparable conclusions and 3) improve and evaluate the mitigation measure needs accomplishing to the lenders requirements.

- The number of VPs for SDOD should be revised according to the fatality data. This could improve the mitigation overall.

- Common recommendations among consultancies performing different bird monitoring and PCFM to improve are a) to adopt regional SOD criteria for the entire GoS region based on cumulative experience from the implementation of ATMP in RCREEE's windfarms and SOD program in NREA's to simplify the shutdown implementation and coordination b) To share the SCADA system shutdown logs with energy losses on regular basis or c) sharing the fatality monitoring program findings punctually in case of found fatalities under turbines. The SOD and PCFM are reported separately, which makes analysis if not impossible, very difficult.

- There is a need to clarify what, how, and why some information should be gathered: e.g. for "non-soaring birds", methods should be species focused. Otherwise, unless the presence of threatened taxa –where specific count methodology is required, e.g. sandgrouses- the collection and use of existing information is useless and limited to the presence/absence.

Future developments

- Any future strategic study should be carefully planned, starting with the goals, setting the monitoring needs and following a well based science based methodology. It is the only way as to get responses to renewable business and biodiversity conservation targets.

- Such a careful planning includes if the government to decided developments within the red zone (DECON study 2007/ Red Plot in this report) or any key critical areas identified in any future study. For the protection of MSBs it may require to identify "non-development areas" or "potential bird safe zones", allocating developments to restricted areas and conditions (e.g. spacing of turbines or turbine size).

ACRONYMS

AoA	Area of Analysis
CEA	Cumulative effects Analysis
EBRD	European Bank for Reconstruction and Development
PCFM	Post-construction fatality monitoring
GoE	Government of Egypt
GoS	Gulf of Suez
IBA	Important Bird Area
IFC	International Finance Corporation-World Bank
NREA	New and Renewable Energy Authority
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RVRSF	Rift Valley Red Sea Flyway
SCADA	Supervisory Control and Data Acquisition
SDOD	Shut-down of demand
SEACIA	Strategic Environmental and Cumulative Impact Assessment
WPP	Wind Power Project

Cover image. Red Sea IBA landscape. A. Camina.

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Introduction

In 2007 the DECON study, classified different areas in the GoS according to their risks to wind development because of the potential impact to Migratory Soaring Birds (MSBs). The zoning included red areas, where projects should not be developed and other called "orange" or "yellow" where conditions would apply. The importance of the area south to Ras Gharib is well known; there is the Important Bird Area of Gebel El Zeit, as described in the following section. Thus, a careful assessment is necessary to confirm the previous evaluation from 2007 once we have more detailed information of the existing wind developments.

Up to now, the scale of work has been "the project footprint", but a global analysis of the different projects altogether has been yet considered. The project scale is not enough to analyze the impacts on the MSBs using the Flyway. The footprint of a wind farm may seem huge from a human perspective, but it is not for the scale of the species specific migration routes. WE should keep in mind that birds migrate between Europe and Africa twice per year, covering a broad front with several hundred km wide. This is challenging, as birds do not have constraints –"bottlenecks"- where precise counts to be made. Birds may change flight directions according to macro scale weather conditions in the region.

This report brings together the multiple pre-construction monitoring databases for both spring and winter migratory seasons. It selects the most common species with enough data available, evaluating the flight intensity across multiple projects, but most importantly, across regional sections in the GoS, similar to what was made in 2007. In addition, the report explores the results of the current post-construction fatality monitoring programs (PCFM) and the migratory movements from the scientific literature.

Integrating all the information from the previous paragraph, the reports concludes about the feasibility of the SCATEC project moving forward, justifies "the go decision" and the requirements necessary for its success like the mitigation and post-construction monitoring of wind turbines and associated powerlines.

1 Area of Analysis (AoA): The Gebel el Zeit IBA

According to the baseline description in 2001, the Gebel El Zeit IBA (EG031), FIGURE 1, consists of a narrow, 100-km-long strip extending along the Gulf of Suez/Red Sea coast, from Ras Gharib in the north to the Bay of Ghubbet El Gemsa in the south. It is oriented in NW-SE direction and traversed by two mountain ranges. The smaller one is the one which gives the name to the IBA, reaching up to 457 m and falls steeply to the Red Sea. The western one slopes gently and merges with a 20-km-wide plain that separates Gebel El Zeit from the rest of the Red Sea hills further west, reaching up to 900 m. To the north there is a wide coastal plain fringed near the shore by several areas of sabkha, the largest of which is Sabkhet Ras Shukheir. This contains several pools of hyper-saline water and large patches of saltmarsh. To the south are Ghubbet El Zeit and Ghubbet El Gemsa, two large shallow bays with extensive intertidal mud and sandflats. Numerous small wadis drain the mountains of the area and dissect adjacent plains. These are lined with scattered Acacia trees.

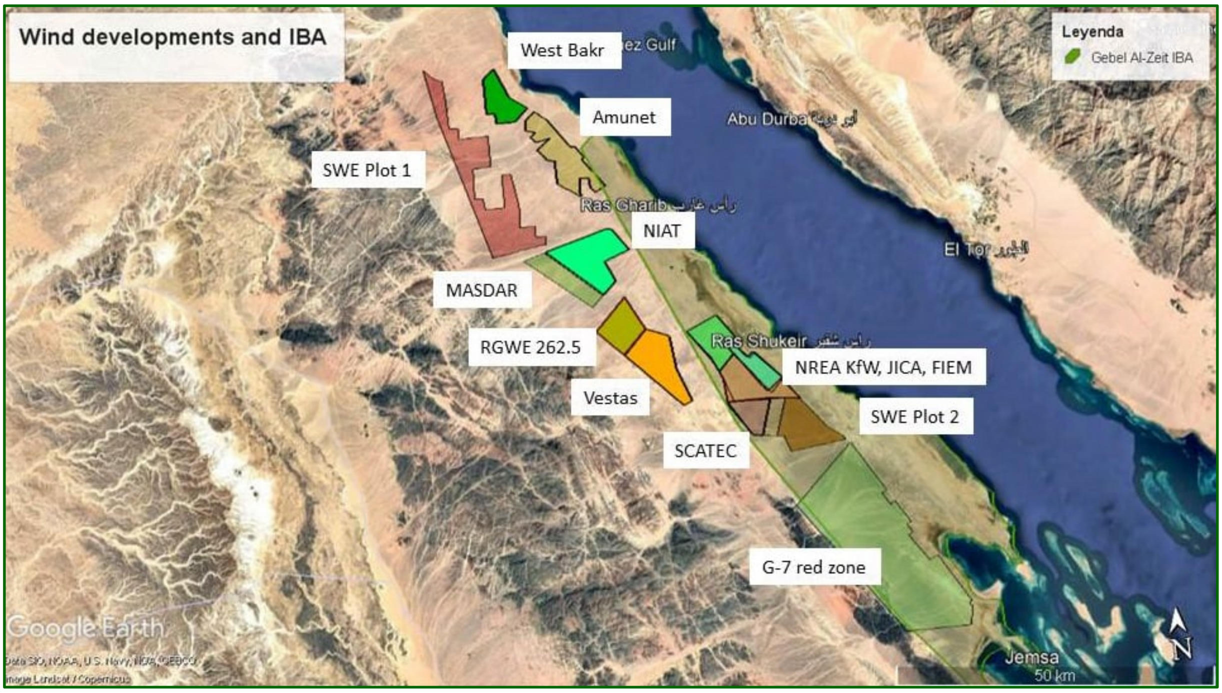

FIGURE 1 Location of the Gebel Al Zeit IBA and the wind developments inside and around.

IBAs are areas identified by BirdLife International, using an internationally agreed set of criteria, as being globally important for the conservation of bird populations. The Rift Valley/Red Sea (RVRS) flyway is the second largest flyway for migratory birds in the world. The Gebel El Zeit area is a very important migration corridor, and the narrowest point in the southern part of the Gulf of Suez with around 23 km from the Sinai Peninsula. Over 250,000 *Ciconia ciconia* and many other migrant soaring birds are funneled through this stretch of coast on both spring and autumn journeys. Birds of prey, storks and pelicans migrate through and usually land, rest or roost near the coastline and on the surrounding desert plains and hills. Resting and roosting storks, especially, utilize the two bays of Ghubbet El Zeit and Ghubbet El Gemsa and the saltmarsh at Sabkhet Ras Shukheir.

IBA criteria met there are:

- **A1**: Globally threatened species
- **A4iv:** Congregations, The site is known or thought to hold congregations of ≥1% of the global population of one or more migratory species on a regular or predictable basis.

1.1 The Wind energy projects

The Government of Egypt (GoE) has taken steps to adopt an energy diversification strategy with increased development of renewable energy and implementation of energy efficiency, including assertive rehabilitation and maintenance programs in the power sector (IRENA, 2018). For this purpose, in 2013, the Arab Republic of Egypt (through the Ministry of Electricity and Renewable

Energy) developed and adopted the Integrated Sustainable Energy Strategy (ISES) 2015 – 2035, providing an ambitious plan to increase the contribution of renewable energy to 20% of the electricity generated by the year 2022, of which 12% of wind power plants is foreseen, mostly in the Gulf of Suez (GoS) due to the availability of wind resource in the area.

For this purpose, the Government issued the Renewable Energy Law (Decree Law 203/2014) to support the creation of a favourable economic environment for a significant increase in renewable energy investment in the country. The law sets the legal basis to implement a Build, Own and Operate (BOO) scheme. Through this mechanism, the Egyptian Electricity Transmission Company (EETC) sets allowed capacities and invites private investors to submit offers for solar and wind development projects. Bidders are awarded based in the lowest Kilowatt Hour (kWh) price. In addition, the GoE through the New and Renewable Energy Authority (NREA) provides the land for the investors.

Surrounding the IBA there are several operational and planned wind power projects (WPPs) which are the backbone of this analysis, see Figure 1. The WPP projects are administratively located within the Red Sea Governorate and they are either planned or operational already. This CEA provides an assessment of the potential cumulative effects on birds of six WPPs. Of all the WPPs in the area, we have only selected those which are included or overlap with the Gebel el Zeit IBA.

2 Scope of the assessment

This study intends to analyze if the WPP located in the SCATEC plot falls within a high collision risk area, within a bottleneck in the RVRS Flyway and/or also resting/landing area for migration birds.
The study should try to demonstrate that the bottleneck migration and/or the resting / landing concentration sites are located within the southern parts of the IBA. The study should provide an opinion on: (i) sensitivity of the site and (ii) cumulative effects.
For this assessment we used the spring but also the autumn monitoring data. As it has been done in the CEA studies of the different wind farms approved by IFC or EBRD in the region (e.g. Serckx 2018, Amunet 2022, and IPH 2023) the spring data greatly outnumbers the autumn data.

2.1 Preliminary methodological considerations

The terms: “roosting” and “resting”

A question to keep clear since the early beginning is the use the different projects make of the terms roosting and resting. According to the Oxford Dictionary their meanings are the following:

- **Roost**: Of birds, bats, and other animals: to settle on a perch or other place for sleep or rest; a place where customarily birds or bats can sleep or rest safely.
- **Rest**: To stop doing a particular activity or stop being active for a period of time in order to relax and get back your strength, a period of relaxing, sleeping, or doing nothing after a period of activity.

When birds are recorded on the ground throughout the bird monitoring studies (BMSs), observers use either of the terms without accuracy. The difference between a roosting and a resting place is the adverb “customarily”, so the animals have a recurrent place –roost- where they return regularly, e.g. after feeding or foraging. This is not the case of most of the places where observations take place during the bird monitoring in the WPPs assessments in the GoS. Birds migrate and they tend to reach their breeding or wintering areas as soon as possible, whilst on route should face conditions which affect their movements.

The observers at the vantage points record birds on the ground (landed) and they do not know the reason why do the birds are there: if they are really roosting, if exhausted, if preying upon something… they just see. The same occurs when annotating in the spreadsheets that a bird/flock is “soaring” or “gliding”. Any soaring bird will glide at some time, as it is part of its performance when flying (Pennycuick 1972). We all are familiar with the mechanism of the soaring flight using thermal uplifts. The only difference is where do the birds find the thermal and use the space either for soar or glide, and thermals do not form exactly at the same place anytime.

Within the RVRS Flyway, birds are forced to stop because of two major reasons: exhaustion and adverse weather conditions (sand storms strong winds which make migration unsafe at critical sites like the sea crossing). But there is a third option which is voluntary, to feed on route, and not all the birds do so.

Places where to stop are thus predictable and unpredictable. Among the predictable ones there are the mountains of Gebel Zeit on the sea shore before the Red Sea crossing, a dam with water in the middle of the desert as occurs in the so-called ACWA Plot 1, a waste dump or a predictable food source in space and time like the Ras Gharib Rubbish dump (NIAT and IPH projects). Where conditions are unpredictable, these places are unpredictable as well, and they are recorded incidentally. These have implications for the mitigation of wind energy projects, as an unpredictable site should not constrain a wind development, .e.g. turbine location, whilst a predictable one does it, unless appropriate management, avoidance and mitigation measures are in place. This assessment will try to assess these two concepts too and guide on where and what management /mitigation measures should follow.

Monitoring time, Vantage points, and bird numbers

We must consider the following preliminary questions which affect the results:

1) Not all projects invest the same monitoring time neither have the same number of Vantage points. Thus is very important to note <u>THAT THE RAW BIRD COUNTS CANNOT BE USED FOR DIRECT COMPARISONS BETWEEN PROJECTS</u>. The monitoring time, rather than the number of vantage points has a strong influence in the results, the more time you invest, the higher numbers to be recorded (pers. obs.). Thus, we must use another metric for comparisons between projects, as it is the passing rate (birds per unit of time).

2) A second but very important point is <u>THAT WE CANNOT USE THE GLOBAL BIRD NUMBERS FOR AN ANALYSIS</u>. Each species has a migration timing and strategy (Shirihai et al. 2000). The White Stork primarily but also other species flying in large flocks (Great White Pelican, Levant

Sparrowhawk, and Honey Buzzard), may mask the pattern of the other species migrating in loose groups (Steppe eagle) or individually, like the Egyptian vulture. We require a species by species account which is not normally the case for any of the reports, e.g. Ecoda 2007. In addition, each species has its own characteristic like wing load, shape or weight, which influences the flight. Finally, not all the species are diurnal; the Lesser kestrel also migrates at night, or over large sea bodies, so counts can results in underestimates.

3 Macroscale approach

Up to now, each project has been assessed on an individual basis (microscale approach). However, very little has been done considering a series of projects altogether. Different databases from baseline studies of different projects have been kindly provided. However, it does not make sense to get all the projects and try to find a pattern or a magic response. Instead of that, we have selected those projects which could highlight the main two questions of the scope of the study.

Thus, projects to compare must belong to the same season and year. There can be weather variations in temperature or wind conditions, which have not been included in this rapid assessment. If required, this could be done, but would need from further data curation and preparation and more elaborated analysis methodology.

For the purpose of the scope of this rapid analysis we proceeded as follows:

- Analysis of the ongoing Strategic Assessment 2024 (SEACIA): geographical patterns of MSBs migration (Section 3.1).
- Comparison between the DECON study (2007) and both the current WPPs, and SEACIA (Section 3.2)
- Cumulative migration analysis of the WPPs along the IBA (Section 4)
- Site specific analysis of birds landing at the SCATEC and the other WPPs (Section 5)

3.1 Strategic Assessment RCREEE 2024 (SEACIA)

The data for this section have been kindly provided by RCREEE, as they are supervising the ongoing study entitled "*Potential approach for an updated Strategic Environmental Assessment and Cumulative Impact Assessment focused on biodiversity for wind energy in the Gulf of Suez, Egypt*" (SEACIA).

3.1.1 Zoning

The SEACIA includes thirty-six (36) Vantage Points distributed along the RVRS Flyway from Gemsa in the south, almost at the southeastern most tip of the Gebel el Zeit IBA, to the north of Zaafarana throughout 222 km; see an example in the FIGURE 2. It includes areas in and out of the IBA and is representative of different potential and existing wind development areas, either approved (Zaafarana, West Bakr, NREA) or in the process of construction (NIAT, Amunet).

For the purpose of the analysis and better comprehension and interpretation, the thirty-six Vantage Points have been grouped in three ways:

- **West to east**: Vantage points have been classified in three zones, Figure 2, as coastal on the seashore (S), plains (P) in the rather plain central area like the NREA operational wind farms and SWE Plot #2, and mountains (M) for those near the mountain range. It is well known that MSBs use either thermal wind uplifts for soaring but also the "slope-soaring" flight when the strong winds blow near rugged terrain (Pennycuick 1972).

- **North to south**: The SEACIA extends from the 27.5° latitude at the southernmost tip of Gebel el Zeit IBA (south to Vp36) to 29.5° latitude in its northernmost point (around 22 km north from Zaafarana at VPs 1 and 2).
  The division has been made based on 0.5° degrees latitude. The latitude from 27.5°N to 29.5°N runs two degrees. One degree arc has 60 minutes, which is equivalent to sixty (60) nautical miles or around 111 km. Thus, the two degrees of latitude has around 222 km. This allows a rough division in four sections of 55.5 km each. We called this four zones north (N), mid-north (MN), mid-south (MS) and south (S).

- **Inside/outside the IBA:** Each VP was classified as Yes/no if falling within the Gebel el Zeit IBA boundaries according to the Kmz file provided. Fifteen of the VPs of the SEACIA fall within the IBA boundaries.

This division allows a matrix of 3 zones (mountain, plains, and sea coast) X 4 latitudes (south, mid-south, mid-north, and north) = 12 zoning depending how far or close to the coast a project is, but also how north or south are located related to the IBA. In addition, also provides a dichotomy (inside /outside the IBA) which is rather theoretical and not fully based on real landscape features.

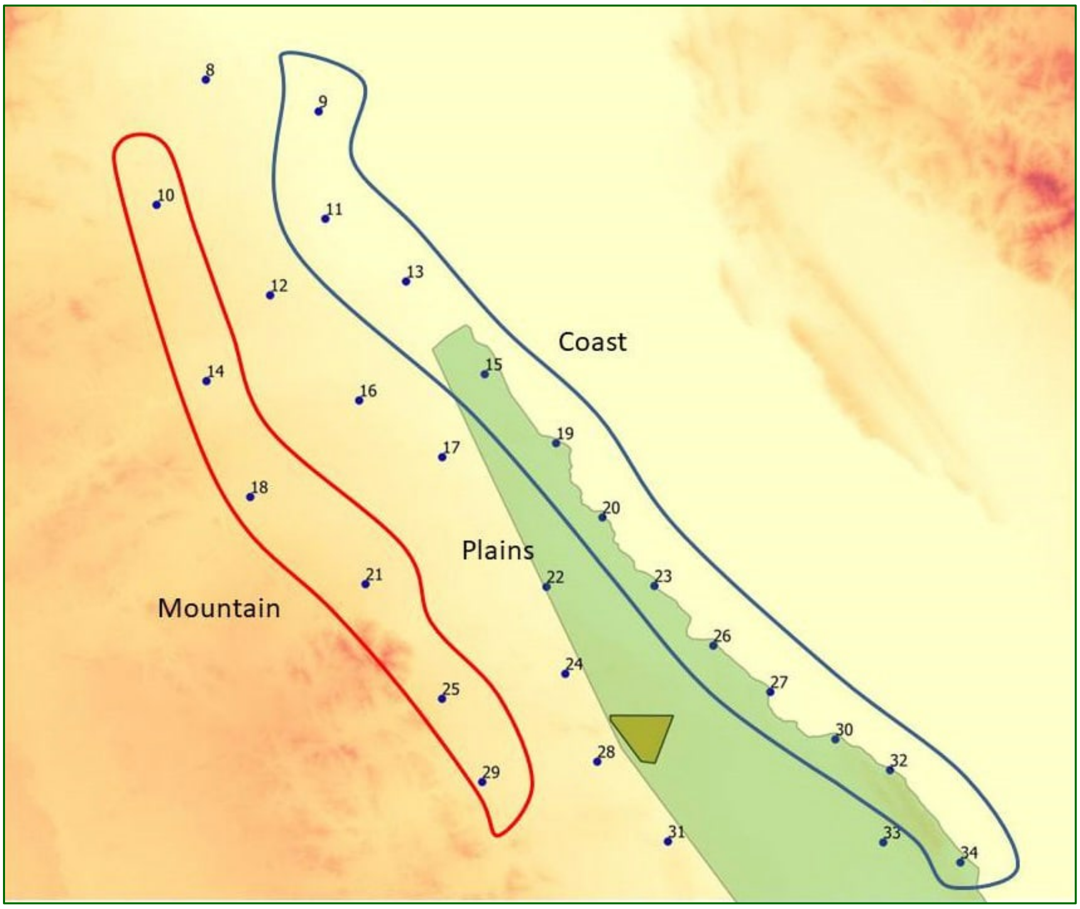

FIGURE 2 DEM model showing the SCATEC (dark green plot) and a portion the limits of the IBA (green area), and some of the Vantage Points under the Strategic Project GoS (RECREEE). See text for the zoning. The red line encompasses those VPs considered in the western side of the GoS (Mountains), those with the blue line the eastern ones (Coast), and those in the middle (Plains); see methods in the main text.

According to the above described classification, the current operational or planned WPPs are distributed as showed in Table 1. If one project overlaps with two zones it appears twice. Those overlapping the IBA, either entire or partially, are highlighted in green color.

Table 1 Distribution of WPPs according to the different zoning (north to south and mountains to sea coast zones), and Vantage points from the SEACIA study they include. Those WPPs highlighted in green are included, or portions of them, in the IBA.

Project area	Latitudes	Mountain	Plains	Coast	VPs
North	29.0°-29.5° L	- شمال خليج السويس 475 كم2 - الزعفرانة الجديدة 74 كم2			1 to 3, and 5
Mid-north	28.5°-29.0° L	- شمال خليج السويس 475 كم2	- RSWE 500 MW - ACWA Plot#1		4, 6 to 12, and 14
Mid-south	28.0°-28.5° L		- ACWA Plot#1 - NIAT500MW - RGWE 262.5 MW - VESTAS500MW - NREA (FIEM,JICA, and KfW) - IPH200MW - AMEA-Amunet - ACWA (SWE Plot #2) - **SCATEC**		13, 15 to 26, 28, and 29
South	27.5°-28.0° L		- SWE Plot #2 - GoZ_3000_7		27, and 30 to 36
VPs		1,3,7,8,12,16,22,24, 28, and 31	5,10,14,18, 21, 25, and 29	2,4,6,9,11,13, 15,17,19-20,23, 26-27, 30, 32 to 36	

3.1.2 Quantitative analysis

The spring 2024 has gathered good amount of data -472,208 birds and 4,406 records- over 3,098 hours and 20 minutes of bird monitoring (between 83 to 89 hours monitoring per Vantage Point) from March 18th to May 20th. It included twenty eight (28) species plus six major groups according to their morphology; these “groups” refer to the unidentified individuals to species level like buzzards, harriers, eagles, or even raptors. The monitoring covers most of the spring season, except from Feb 20th till March 17th, where some early migrants like the Egyptian vulture are passing already.

Overall, there was not equal sampling at all VPs because of different reasons like adverse weather conditions or logistical issues. As stated in the general methods, numbers were standardized prior to the analysis to make them comparable; there were instances with six hours difference in monitoring time among VPs. Standardization is a required method to allow comparisons when existing uneven sampling and robust results needed (Istúriz et al. 2022).

3.1.3 Species selection

To focus on the most representative (enough data collected) species we followed a four Step process using the field data, to have a representative sample but also suitable to get robust results as described below:

STEP 1: We excluded from the list those individuals which remained unidentified in the database and those recorded at very low numbers.

a) **Records and numbers which were not recorded at species level**: They are “raptor”, “buzzard”, “eagle”, “falcon”, “kestrel” or “harrier”.

b) **Species which are not true soaring birds or recorded at very low numbers**: The Crested honey buzzard is a rare species through the RVRS Flyway. All the Falco family, like the Eleanora’s falcon *Falco eleonorae* migrates through a broad front without following special topographical features (Mellone 2021) not restricted to the flyway. On the other side, the Lesser kestrel *Falco naumanni* also migrates at night, and detectability for the observers is much reduced due to the small size of the species (Sará et al. 2021). The Osprey (*Pandion haliaetus*), and despite being a VU species, is also a broad front migrant which do not require the mainland for migration (Monti 2021). The Eurasian griffon (*Gyps fulvus*) is partially migratory and passes in low numbers whilst the Bonelli’s eagle (*Aquila fasciata*) could be resident or dispersal individuals.

c)

As a result, the initial list is reduced from 27 to 20 species.

A	Individuals/records which cannot be assigned to species
B	Not true MSBs and/or very low numbers
C	Species with more than n = 30 records)
D	Congregatory vs. rather solitary
E	Species whenever & wherever recorder grounded in the GoS

Species	IUCN Red List	records	birds	birds/record
White stork *Ciconia ciconia*	LC	194	298223	1537.23
White pelican *Pelecanus onocrotalus*	LC	47	38421	817.47
Levant Sparrowhawk *Accipiter brevipes*	LC	33	20402	618.24
Steppe buzzard *Buteo buteo*	LC	1194	64081	53.67
Honey buzzard *Pernis apivorus*	LC	432	20844	48.25
Buzzard sp.		45	1860	41.33
Common crane *Grus grus*	LC	8	270	33.75
Raptor sp.		71	2349	33.08
Black Kite *Milvus migrans*	LC	840	20429	24.32
Black stork *Ciconia nigra*	LC	119	1691	14.21
Eagle sp.		83	521	6.28
Steppe Eagle *Aquila nipalensis*	EN	408	1393	3.41
Lesser spotted eagle *Clanga pomarina*	LC	203	637	3.14
Short-toed eagle *Circaetus gallicus*	LC	155	289	1.86
Booted eagle *Aquila pennata*	LC	164	264	1.61
Long-legged buzzard *Buteo rufinus*	LC	41	64	1.56
Egyptian vulture *Neophron percnopterus*	EN	68	106	1.56
G. Spotted eagle *Clanga clanga*	VU	11	16	1.45
Eurasian Sparrowhawk *Accipiter nisus*	LC	53	72	1.36
Marsh harrier *Circus aeruginosus*	LC	68	92	1.35
Montagu's harrier *Circus pygargus*	LC	8	10	1.25
Osprey *Pandion haliaetus*		27	30	1.11
Kestrel	-	75	83	1.11
Eastern imperial eagle *Aquila heliaca*	VU	20	22	1.10
Bonelli's Eagle *Aquila fasciata*		3	3	1.00
Crested Honey Buzzard *Pernis ptilorhynchus*	LC	1	1	1.00
Eleanora's falcon *Falco eleonorae*	LC	2	2	1.00
Falco sp.		7	7	1.00
Griffon vulture *Gyps fulvus*	LC	3	3	1.00
Harrier sp.		2	2	1.00
Hobby *Falco subbuteo*	LC	1	1	1.00
Lesser kestrel *Falco naumanni*	LC	4	4	1.00
Pallid harrier *Circus macrourus*	NT	16	16	1.00
Total		**4,406**	**472,208**	

STEP 2: We reduced the initial list by extracting those species which had less than thirty (n = 30) records in a migratory season. This further reduced the number of species to sixteen (16). We filtered the number of records to get as much as representative sample for the analyses.

A	Individuals/records which cannot be assigned to species
B	Not true MSBs and/or very low numbers
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Montagu's harrier	LC	8	10	1.25
Eastern imperial eagle	VU	20	22	1.10
Pallid harrier	NT	16	16	1.00

(1) We left the "Spotted eagle" to be considered together with the "Lesser spotted eagle". Distinction in the field is challenging and also hybridization has been described (Vali et al. 2010).

Step 3: We split the remaining list of sixteen (16) species into three groups according to the average flock size. There is a first group of seven species which are largely congregatory, two species with intermediate flocking behavior (loose groups), and another six which are rather solitary.

A	Individuals/records which cannot be assigned to species
B	Not true MSBs and/or very low numbers
C	Species with more than 30 records
D	Congregatory, intermediate vs. rather solitary
E	Species whenever & wherever recorder grounded in the GoS

Species	**IUCN Red List**	**records**	**birds**	**birds/record**
White stork	LC	194	298223	1537.23
White pelican	LC	47	38421	817.47
Levant Sparrowhawk	LC	33	20402	618.24
Steppe buzzard	LC	1194	64081	53.67
Honey buzzard	LC	432	20844	48.25
Black Kite	LC	840	20429	24.32
Black stork	LC	119	1691	14.21
Steppe Eagle	EN	408	1393	3.41
Lesser spotted eagle	LC	214	653	3.14
Short-toed eagle	LC	155	289	1.86
Booted eagle	LC	164	264	1.61
Long-legged buzzard	LC	41	64	1.56
Egyptian vulture	EN	68	106	1.56
Eurasian Sparrowhawk	LC	53	72	1.36
Marsh harrier	LC	68	92	1.35

STEP 4: From Step 3, and among all the projects throughout the GoS, we kept those wherever recorded on the ground in whatever the season, year, and wind project.

A	Individuals/records which cannot be assigned to species
B	Not true MSBs and/or very low numbers
C	Species with more than 30 records
D	Congregatory, intermediate vs. rather solitary
E	Species whenever & wherever recorder grounded in the GoS

Species	IUCN Red List	records	birds	birds/record	
White stork	LC	194	298223	1537.23	Very large groups
White pelican	LC	47	38421	817.47	
Steppe buzzard	LC	1194	64081	53.67	Large groups
Honey buzzard	LC	432	20844	48.25	
Black Kite	LC	840	20429	24.32	
Black stork	LC	119	1691	14.21	
Steppe Eagle	EN	408	1393	3.41	
Lesser spotted eagle	LC	214	653	3.14	
Short-toed eagle	LC	155	289	1.86	
Booted eagle	LC	164	264	1.61	
Egyptian vulture	EN	68	106	1.56	

We proceeded with the analysis for each species among the four major geographical areas. For this we used non-parametric tests and the median passing rate (birds /hour) of each species as explanatory variable (Istúriz et al. 2022).

3.1.4 Results

Spring season 2024

- **LONGITUDE (MOUNTAIN, PLAINS, COAST):** There were significant differences in the Median passing rate only for the Black kite ($p < 0.001$), and results were nearly significant for the White pelican ($p = 0.08$). All the remaining species did not show any clear pattern, suggesting a migration in a broad front through the landscape.
  The Black kite had a significant higher passing rate through the plains, followed by the mountains and the coastal area.

- **LATITUDE (SOUTH, MID-SOUTH, MID-NORTH, AND NORTH):** Results classified the species in two groups, with and without significant passing rates from south to north, TABLE 2. Seven species (7) out of 11: the Black kite, Booted, Short toed and Steppe eagles, Egyptian vulture, and the

Honey and Steppe buzzards, all had higher median passing rates in the south and/or mid-southern area. See Annex for the maps related to results in TABLE 2.

TABLE 2 Median passing rates (birds/hr) per area sorted from the highest (red) to the lowest (green), Interquartile range, and significance of the non-parametric test for the spring season.

Species	Zone	N records	Median	IQR (Q75-Q25)	Significance
Black Kite	S	385	2.75	5.25	**p <0.001**
	N	95	2.67	8.50	
	SM	302	2.02	5.50	
	MN	58	0.75	1.50	
Booted eagle	S	76	0.47	0.42	**p < 0.001**
	NM	36	0.25	0.20	
	SM	120	0.25	0.19	
	N	96	0.25	0.22	
Egyptian vulture	S	70	0.44	0.25	**p < 0.001**
	NM	10	0.25	0.46	
	SM	18	0.25	0.02	
	N	38	0.25	0.00	
Honey buzzard	S	227	7.00	13.25	**p <0.001**
	SM	144	5.05	13.67	
	N	29	4.25	15.75	
	MN	32	1.75	3.73	
Short-toed eagle	S	52	0.35	0.46	**p = 0.05**
	SM	33	0.25	0.22	
	N	56	0.25	0.46	
	MN	14	0.25	0.00	
Steppe buzzard	S	523	8.00	15.50	**p <0.001**
	SM	480	3.65	11.00	
	N	119	3.33	12.00	
	MN	72	1.00	3.99	
Steppe Eagle	SM	145	0.50	0.64	**p <0.05**
	S	188	0.50	1.00	
	N	42	0.50	0.25	
	MN	33	0.50	0.43	

The remaining four species, the Black and White storks, White pelican, and lesser spotted eagle did not show any significant difference among the different zones, The IQR value is a particularly good measurement of variability for skewed distributions or distributions with outliers. The IQR only includes the middle 50% of the data. The results also show that both the South (S) and mid-south (SM) even overlap in their values which reinforce their importance for the MSBs.

The FIGURE 3 shows the median passing rate of the Steppe eagle among the four zones. The median is the same but the variation in the passing rate (vertical bars) is much higher in the south (S) and mid-south (SM) compared to the north (N).

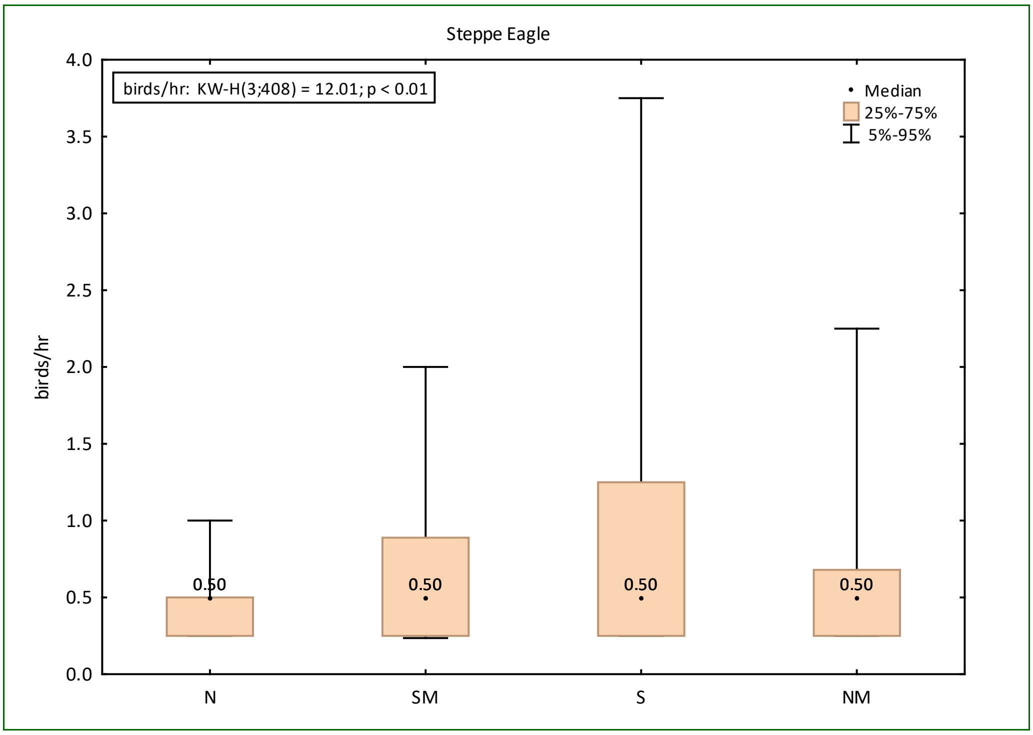

FIGURE 3 Box plot for the Steppe eagle showing the median passing rates per geographical area (N: north, NM: mid-north, SM: mid-south, and S: south).

Then we performed the same analysis but for the autumn season 2024. They recorded twenty seven (27) species and 472,208 birds (4,406 records). However, a 63% were White storks, followed by a 6% of Great white pelicans and 4% Honey buzzards. The trend turns the reverse compared to spring.

Autumn season 2024

TABLE 3 Median passing rates (birds/hr) per area sorted from the highest (red) to the lowest (green), Interquartile range, and significance of the non-parametric test for the autumn season.

Species	Zone	N records	Q25	Median	Q75	IQR (Q75-Q25)	Significance
Black Kite	N	15	0.25	0.50	0.75	0.50	**p < 0.05**
	NM	24	0.25	0.25	1.00	0.75	
	SM	58	0.25	0.50	1.22	0.97	
	S	39	0.26	0.75	4.47	4.21	
Honey buzzard	N	18	0.50	1.75	3.25	2.75	**p < 0.05**
	NM	138	1.25	7.58	21.70	20.45	
	SM	152	1.02	5.38	17.00	15.98	
	S	72	1.63	3.88	12.13	10.50	
Steppe buzzard	N	11	0.50	1.00	2.50	2.00	**p < 0.05**
	NM	34	0.25	0.75	1.75	1.50	
	SM	39	0.25	0.25	0.75	0.50	
	S	4	0.25	0.25	0.38	0.13	

Overall, in spring, eight out of the eleven species we analyzed, showed higher and significant higher passing rates from the south (S) > MS > > MN > to the north (N). However, only three showed great variations, as they migrate in "large" groups (Steppe and Honey buzzards, and Black kite).

For the four "solitary" ones (Booted, Steppe, and Short toed eagles, and the Egyptian vulture) we got median passing rates/hour around 0.25-0.50 birds per hour of observation, Table 2 (using the ICR it is between 0.9-1.5 birds/hour of observation). If having around 12 hrs daylight it equals to 11-18 birds /day despite the significant differences.

We have to exclude the "very large" congregatory species, another three species: White and black stork, and the Great white Pelican, and the almost solitary "spotted" eagles (one additional species). All these four do "whatever they want to do" as they cross the GoS through several or different zones (operational already, planned, or far from the wind farm as showed in the report) without any preference.

On the contrary, in the autumn, only the three species migrating in "large" groups (Steppe and Honey buzzards, and the Black kite) showed differences, whilst the remaining migrate on a random passage.

We consider this species specific approach is much better, as it helps to better understand and evaluate the collision risk related to birds passing.

TABLE 4 Median passing rates (birds/hr) per area for those species not exhibiting passage significant differences through the north to south zones.

Species	Zone	N records	Q25	Median	Q75	IQR (Q75-Q25)	Significance
Egyptian vulture	N	0	-	-	-	-	n.a.
	NM	1	0.25	0.25	0.25	0.00	
	SM	8	0.25	0.38	0.75	0.50	
	S	0	-	- -	-	-	
Lesser spotted eagle	N	1	0.50	0.50	0.50	0.00	n.a.
	NM	4	0.25	0.25	0.25	0.00	
	SM	3	0.25	0.25	0.25	0.00	
	S	0	-	-	-	-	
Marsh harrier	N	3	0.25	0.25	0.50	0.25	n.s.
	NM	20	0.25	0.25	0.25	0.00	
	SM	48	0.25	0.25	0.25	0.00	
	S	11	0.25	0.26	0.50	0.25	
Booted eagle	N	2	0.25	0.25	0.25	0.00	n.s.
	NM	1	0.25	0.25	0.25	0.00	
	SM	12	0.25	0.25	0.25	0.00	
	S	1	0.25	0.25	0.25	0.00	
Black stork	N	0	-	-	-	-	n.s.
	NM	1	0.25	0.25	0.25	0.00	
	SM	3	0.25	0.25	1.00	0.75	
	S	7	2.87	6.00	10.00	7.13	
Short-toed eagle	N	1	0.25	0.25	0.25	0.00	n.s.
	NM	3	0.25	0.25	0.25	0.00	
	SM	5	0.25	0.25	0.25	0.00	
	S	1	0.25	0.25	0.25	0.00	
Steppe eagle	N	2	0.25	0.25	0.25	0.00	n.s.
	NM	2	0.50	0.50	0.50	0.00	
	SM	3	0.25	0.25	0.25	0.00	
	S	0	-	-	-	-	
White pelican	N	0	-	-	-	-	n.s.
	NM	3	1.00	11.75	15.00	14.00	
	SM	26	17.50	41.25	87.50	70.00	
	S	1	150.00	150.00	150.00	0.00	
White stork	N	0	-	-	-	-	n.s.
	NM	2	1.00	3.50	6.00	5.00	
	SM	30	2.94	74.11	416.33	413.39	
	S	20	8.75	41.25	312.50	303.75	

3.2 The DECON study 2007, the existing WPPs, and the SEACIA

3.2.1 THE DECON Study and the Existing operational and planned projects

The DECON study (ECODA 2007) covered a portion of the Gebel el Zeit IBA in 2006-2007, which partially overlaps with the current SEACIA 2024 (Figure 4). The main difference is that the DECON used twenty-six (26) observation points in the same area where now the SEACIA covers roughly ten (10) or eleven (11) points. Observation times per VP also differed (between 200 and 300 hr.) but the monitoring methods are the same. The DECON study established yellow-orange-red zones based on risk of the monitored sites for the migration and wind development, as Table 4.1, page 31 showed. Here, we reproduce the same table with the VPs and colors, but overlapping the current operational WPPs or planned areas for development.

The VPs were mapped following Hilgerloh et al. (2009), and the global orange and red boundaries delineated based on these. We only used those VPs overlapping with the boundaries of each project; e.g. S12 and S13 fall within the Latitude of both KfW and FIEM, but they are some km away from the projects themselves, Table 5.

Table 5 Table with the Importance of the different parts of the concessionary area for autumn and spring migration and combined for total migration (red: extremely important; orange: very important; yellow: important), based in DECON 2007. In addition, each cell shows the existing operational WPPs or name of the future development areas.

This study	Vp	Autumn	Spring	Total	Vp	Autumn	Spring	Total
SM (28°-28.5°L)	M13	KfW	KfW	KfW	S13			
	M12	FIEM	FIEM	FIEM	S12			
	M11	FIEM	FIEM	FIEM	S11	JICA	JICA	JICA
	M10	**MASDAR/SCATEC**	**MASDAR/SCATEC**	**MASDAR/SCATEC**	S10	**SWE-ACWA**	**SWE-ACWA**	**SWE-ACWA**
	M09	SWE-ACWA	SWE-ACWA	SWE-ACWA	S09	**SWE-ACWA**	**SWE-ACWA**	**SWE-ACWA**
S (27.5°-28° L)	M08				S08			
	M07	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S07	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M06	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S06	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M05	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S05	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M04	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S04	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M03	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S03	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M02	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7	S02	GoZ-3000-7	GoZ-3000-7	GoZ-3000-7
	M01				S01			

Our results CONFIRM the previous Ecoda (2007) assessment, with the southern (S sector between 27.5°-28° Latitude which corresponds with VPs from 01 to 09, both "M" and "S") having the greater MSBs passing rates, also followed by the mid-south (28°-28.50°, VPs 10 to 13 for both "S" and "M" notations). Despite the time lapse (2007 to 2024) there is consistency in the findings. The Ecoda

2007 study was later published in scientific journals by Hilgerloh (2011) and Hilgerloh et al. (2009, 2012).

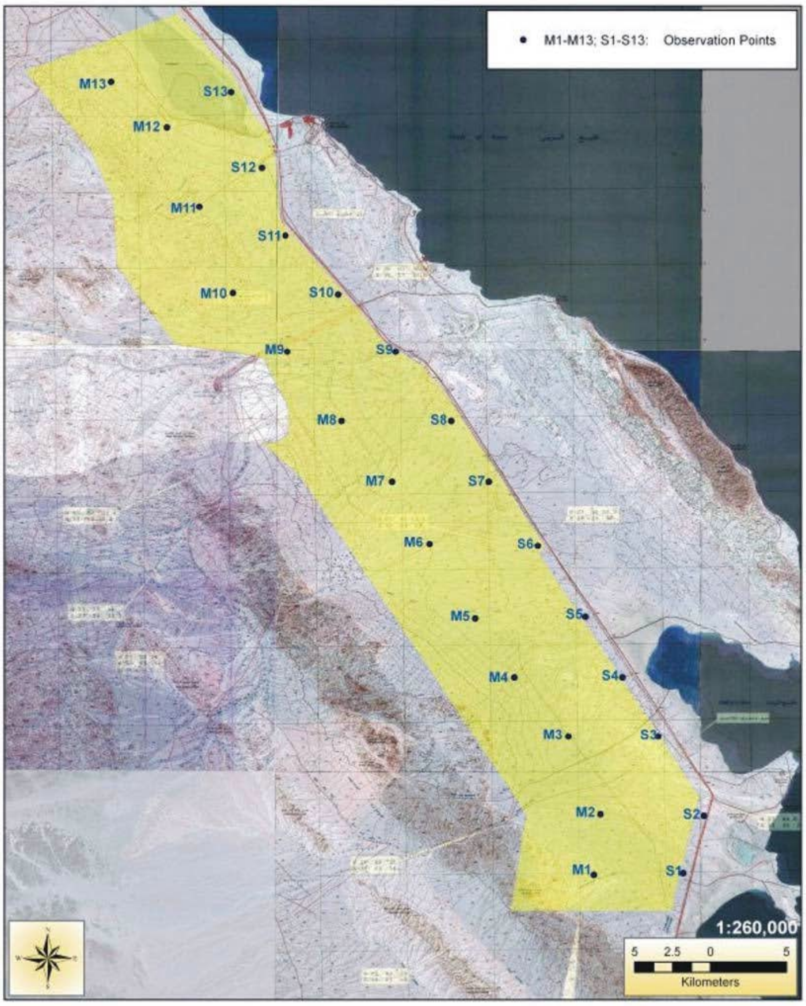

FIGURE 4 DECON study (Ecoda 2007) showing the distribution of the VPs

We attempted to classify the WPPs areas uniformly, having a single score for both spring and autumn, and an overall single orange and red zone. It is well known that migratory behavior differs between the two seasons, being spring the one the most numerous in both bird numbers and species. We scored the yellow, orange and red colors into a single categorical variable, with the values one for yellow, two for orange and three for red. The Global score was the average of the global "M" and "S" VPs from the DECON (2007), and grouped afterwards, TABLE 6.

TABLE 6 Global scoring for the DECON study colours into single yellow (1 value), orange (2), and red (3) zones together with the geographical distribution according to the Latitude of this study. Highlighted in bold the scoring of the SCATEC Plot #2.

This study	Vp	Autumn	Spring	Total	Vp	Autumn	Spring	Total	GLOBAL		Range
SM (28°-28.5°L)	M13	1	1	1	S13	1	2	1.5	1.25		1 ≤ X < 2
	M12	1	1	1	S12	1	2	1.5	1.25		
	M11	1	1	1	S11	1	2	1.5	1.25		
	M10	**1**	**2**	**1.5**	S10	2	2	2	1.75		
	M09	2	3	2.5	S09	2	3	2.5	2.5		2 ≤ X < 3
S (27.5°-28° L)	M08	2	3	2.5	S08	2	3	2.5	2.5		
	M07	2	3	2.5	S07	3	3	3	2.75		
	M06	3	3	3	S06	3	3	3	3		X = 3
	M05	3	3	3	S05	3	3	3	3		
	M04	3	3	3	S04	3	3	3	3		
	M03	3	3	3	S03	3	3	3	3		
	M02	3	3	3	S02	3	3	3	3		
	M01	3	3	3	S01	3	3	3	3		

Without GIS file, we attempted, based in the Figure 4, to delineate the orange and red zones of the DECON study compared to the geographical parallels (Section 3.1). According to the DECON study, the SCATEC falls within the yellow zone. In the classification in this study, would fall within the same zone, FIGURE 5.

The DECON study for spring was published by Hilgerloh (2009). One of the outcomes, contrary to ours, was that the lack of significant passing rates among "sites" (VPs M01 to M13 and S01 to S13) for any of the sixteen species except the Great White Pelican (see the Table included in the Supplementary Material 6, Hilgerloh 2009). The data for this study are the same as the DECON but peer reviewed. This finding would contradict the strict zoning. A second paper refers to the autumn season was that from Hilgerloh et al. (2011). As expected because of the lower number of birds in that season, the study did not go deeper in this question.

Each VP in the DECON (2007) has a 5 k diameter, which is too small for an overview of the migration in such a large region. We also found a gradient based in the 2024 Strategic study (Section 3), but we used a much broader scale within the Flyway. This classification in our opinion is better, as it establishes a range every 0.5° Latitude (which equals around 55 km distance) compared to the smaller DECON 5 k for species with such huge home ranges.

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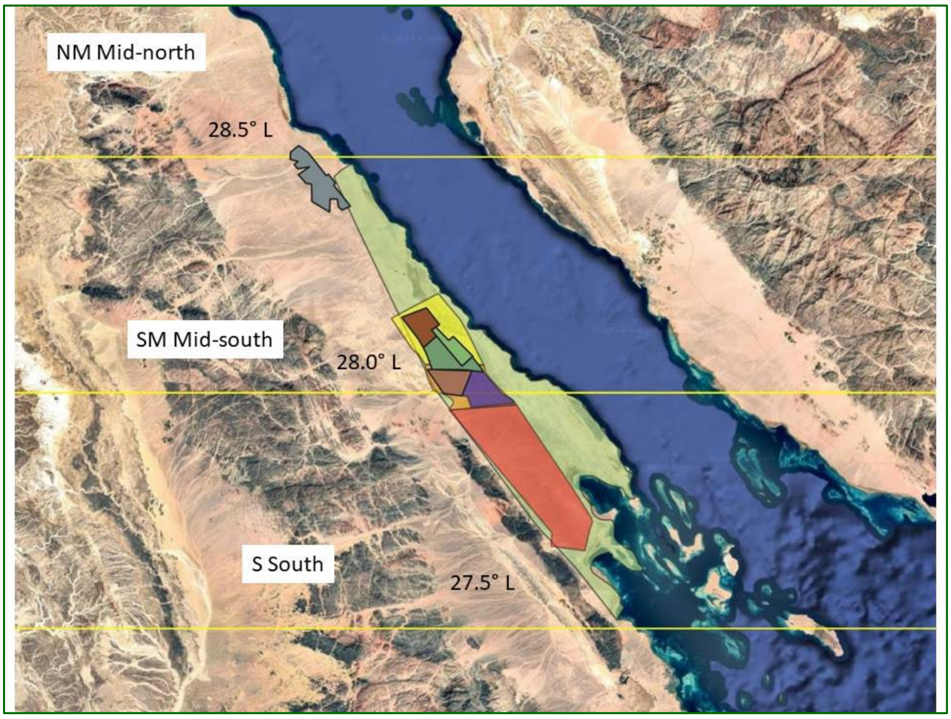

FIGURE 5 GoS showing the WPPs (from the north to the south AMEA-Amunet, KfW-FIEM-JICA, SCATEC in brown colour and SWE Plot #2), the DECON yellow, orange and red zones, the parallels 27.5°, 28°, and 28.5° L, and the areas designated in Section 3.1 (mid-north, south and mid-south).

4 Cumulative analysis of WPPs within the IBA

Migration occurs over a very broad front within the Flyway but the monitoring studies are referring to the individual project footprints. This does not allow understanding flight patterns and fluxes over bigger areas. Joining individual projects into single, and commonly formatted database, see e.g. IFC (2015) for Tafila (Jordan), helps to explore and analyze in this broader manner. For this to occur, individual projects may collect data under the same requirements. A further step in the assessment of this section tries to compare different WPPs within the same time frame (year) cumulatively. The purpose of this section is to explore the densities (birds /hr) of migratory species passing during both spring and autumn season, in the geographical gradient where the projects operate. Here we evaluate the migration at different sites under the same time frame.

4.1 Methods

The TABLE 7 shows the WPPs fully included, or with a portion of the development plot overlapping the Gebel el Zeit IBA. It also shows the years and migratory seasons of bird monitoring provided for this assessment. In this section we have compared the bird pass through different sections (WPPs) in the IBA. The only spring season within a year for most of the projects is 2022. We assume weather conditions (wind speed, direction, temperatures) should had been similar /simultaneous to all the projects despite their geographical locations. Between year conditions may differ although. This does not mean a multiple year, sites analysis is not possible, but would require the development of further advanced statistics, additional data which is out, and unavailable for the initial scope of this rapid analysis. Table shows the projects considered.

TABLE 7 WPPs project within or partially overlapping the Gebel el Zeit IBA, and migratory seasons with bird monitoring completed.

Project	Spring	Autumn
AMEA-Amunet	2020-2021-2022	2020-2021
NREA KfW	2021-2022-2023-2024	2021-2022-2023
NREA JICA	2021-2022-2023-2024	2021-2022-2023
NREA FIEM	2021-2022-2023-2024	2021-2022-2023
SWE Plot #2	2022-2023	2022-2023
SCATEC	2022	2022
Goz-7 (Red plot)	2024	2023

Once selecting 2022, we have considered the dates and monitoring times invested on each project. As the TABLE 8 and TABLE 9 show, there is uneven number of observation days (NREA projects investing around twelve -12)-days more compared to Amunet and SWE plot in spring), the start and end dates, and the timing of the counts over the years. There are also differences in the number of Vantage points.

To quantify migration patterns we took as variable the median number of individuals/hour (rate) of each species per WPP or group of projects. The median is a good variable especially for skewed distributions or distributions with outliers (e.g. a few counts of large flocks).

TABLE 8 WPPs project within or partially overlapping the Gebel el Zeit IBA, monitoring time, and dates of the monitoring period for the spring 2022.

IBA location	Project	Spring	Dates	VPs
North	AMEA-Amunet	2,157 hr. 49 min.	Mar 09th – May 20th	8
Middle	NREA KfW	10,595 hr.*	Feb 20th – May 20th	5
	NREA Jica		Feb 20th – May 20th	4
	NREA FIEM		Feb 20th – May 20th	4
South	SWE Plot #2	1,052 hr. 40 min.	Mar 09th – May 16th	9
	Scatec	3,122 hr.	Feb 22nd – May 18th	7
	GoZ Red plot	n.a.	n.a.	n.a.

(*) The NREA projects provide joint monitoring reports despite the databases are separate. They have separate databases although, but do not provide a daily monitoring schedule. Thus we present the global monitoring time.

TABLE 9 WPPs project within or partially overlapping the Gebel el Zeit IBA, monitoring time, and dates of the monitoring period for the autumn 2022.

IBA location	Project	Autumn	Dates	VPs

North	AMEA-Amunet	n.a.	n.a.	n.a.
Middle	NREA KfW	10,930 hr.[+]	Aug 10th-Oct 26th	5
	NREA Jica		Aug 10th -Oct 26th	4
	NREA FIEM		Aug 10th -Oct 26th	4
South	SWE Plot #2	2,468 hr.	Aug 10th –Nov 10th	9
	Scatec	2,542 hr.	Aug 10th- Nov 10th	7
	GoZ Red plot-2023	n.a.	n.a.	n.a.

As we did for the analysis of the Strategic study 2024 (Section 3.1), we adopted the following steps (conditions):

STEP 1: Filtering all the species as we did for the Strategic study 2024, leaving the same eleven (11) for each of the databases: AMEA-Amunet, NREA-KfW, NREA-JICA, NREA FIEM, and SCATEC plot.

STEP 2: Create a single database joining the four mentioned projects. The NREA KfW, JICA and FIEM were all three renamed as "NREA", FIGURE 6. They can be considered a single unit, as there is almost no difference in the boundaries of the three projects, and all have the same turbine type. Thus, we have Amunet (north of the IBA), NREA (middle) and SCATEC and Acwa (south).

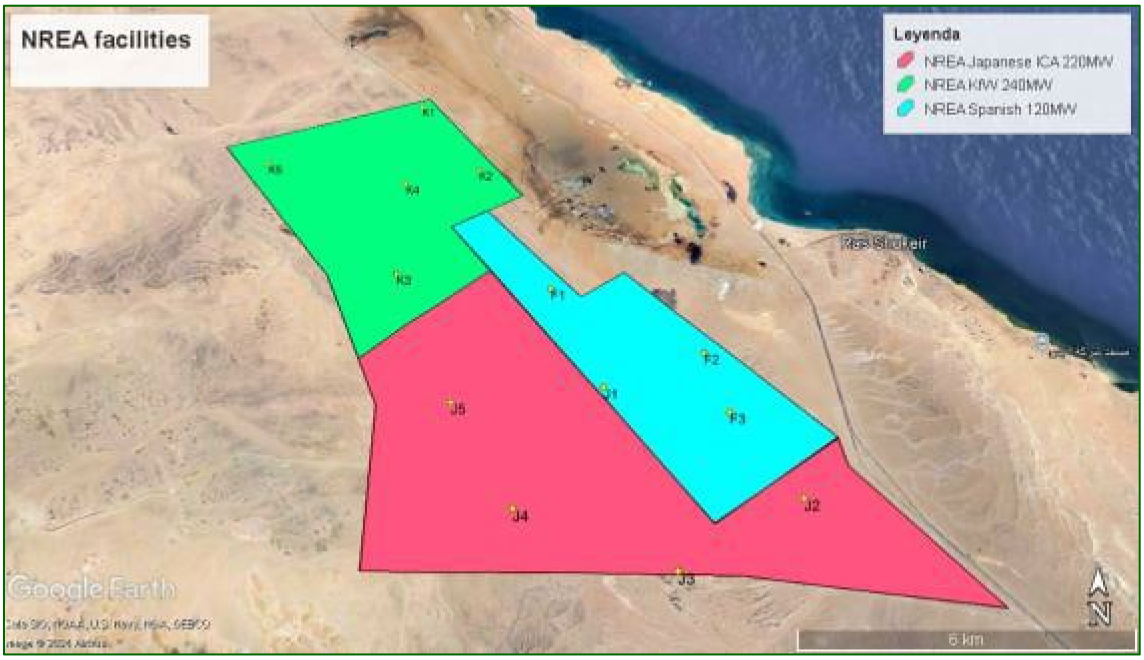

FIGURE 6 NREA wind energy facilities and Vantage points for the bird monitoring. These three were considered as a single unit (WPP).

STEP 3: We proceeded with the analysis for each species among the three major areas of the IBA. For this we used again the non-parametric tests and the median passing rate (birds /hour) of each species as explanatory variable.

Step 4: Finally, we explored the WPPs databases for species and bird numbers which were recorded landed anywhere in the monitoring period.

4.2 Results: bird monitoring

4.2.1 Spring

The results show that the eleven species HAD ALL THE HIGHER MEDIAN PASSING RATES, statistically and significantly (Non parametric Kruskal Wallis test), in the south of the IBA (SCATEC and Acwa plots), followed by the middle (NREA) and finally the north (Amunet). These differences were independent of the species-specific either individual or congregatory migratory behavior: Table 10, Table 11, and Table 12. For Amunet we used the data from 2021 as the most close related spring migratory season.

Table 10 Median passing rates per area sorted from the lowest (green) to the highest (red), Interquartile range, and significance of the non-parametric test.

WEF	Species	N records	Median	IQR (Q75-Q25)	Significance
Species migrating alone					
Amunet	Booted Eagle	47	0.00	0.00	p < 0.001
NREA		300	0.11	0.01	
ACWA		52	0.23	0.07	
Scatec		80	0.26	0.19	
Amunet	Egyptian Vulture	32	0.00	0.00	p < 0.001
NREA		157	0.11	0.05	
ACWA		44	0.24	0.07	
Scatec		33	0.22	0.07	
Amunet	Spotted Eagle	72	0.00	0.00	P <0.001
NREA		642	0.11	0.11	
ACWA		64	0.24	0.20	
Scatec		74	0.32	0.22	
Amunet	Short-toed Eagle	114	0.00	0.00	p < 0.001
NREA		320	0.11	0.03	
ACWA		91	0.29	0.21	
Scatec		93	0.25	0.11	
Amunet	Steppe Eagle	206	0.00	0.01	p < 0.001
NREA		2690	0.21	0.48	
ACWA		368	0.54	0.75	
Scatec		686	0.57	1.25	

All the species with statistical significance in Table 10, Table 11, and Table 12 have been represented in the ANNEX II into a single map, as all of them share the same categorization. WE MUST KEEP IN MIND THAT DATA FOR AMUNET 2022 ARE LACKING, SO WE USED 2021 AS THE BEST APPROACH.

Table 11 Species migrating in loose groups**:** Median passing rates per area sorted from the lowest (green) to the highest (red), Interquartile range, and significance of the non-parametric test.

WEF	Species	N records	Median	IQR (Q75-Q25)	Significance
Species migrating in large groups					
Amunet	Black Kite	435	0.02	0.05	**p < 0.001**
NREA		2780	0.43	1.34	
ACWA		559	1.00	2.14	
Scatec		401	0.89	2.59	
Amunet	Black Stork	50	0.01	0.03	**p < 0.001**
NREA		304	0.61	1.57	
ACWA		56	1.05	3.68	
Scatec		52	1.82	7.22	
Amunet	Honey Buzzard	122	0.03	0.06	**p < 0.001**
NREA		1927	1.87	5.05	
ACWA		197	3.14	7.86	
Scatec		309	2.52	7.77	
Amunet	Steppe Buzzard	494	0.03	0.09	**p < 0.001**
NREA		4891	0.48	1.35	
ACWA		685	1.71	4.48	
Scatec		619	1.03	4.03	

Table 12 Species migrating in very large groups: Median passing rates per area sorted from the lowest (green) to the highest (red), Interquartile range, and significance of the non-parametric test.

WEF	Species	N records	Median	IQR (Q75-Q25)	Significance
Species migrating in very large groups					
Amunet	White Pelican	17	0.10	0.07	**p < 0.001**
NREA		168	4.66	16.42	
ACWA		52	19.75	52.26	
Scatec		49	20.00	90.00	
Amunet	White Stork	131	0.60	1.63	**p < 0.001**
NREA		784	5.08	20.03	
ACWA		177	83.33	293.79	
Scatec		123	66.67	238.39	

The IQR is a particularly good measurement of variability for skewed distributions or distributions with outliers. The IQR only includes the middle 50% of the data, so unlike the IQR is not affected by extreme values. This is valuable for the White stork, White pelican, Honey buzzard and others, with many individual observations but also with records including hundreds or thousands of individuals. As a visual representation of the data, we have selected the Steppe eagle (FIGURE 7) and the White Stork (FIGURE 8).

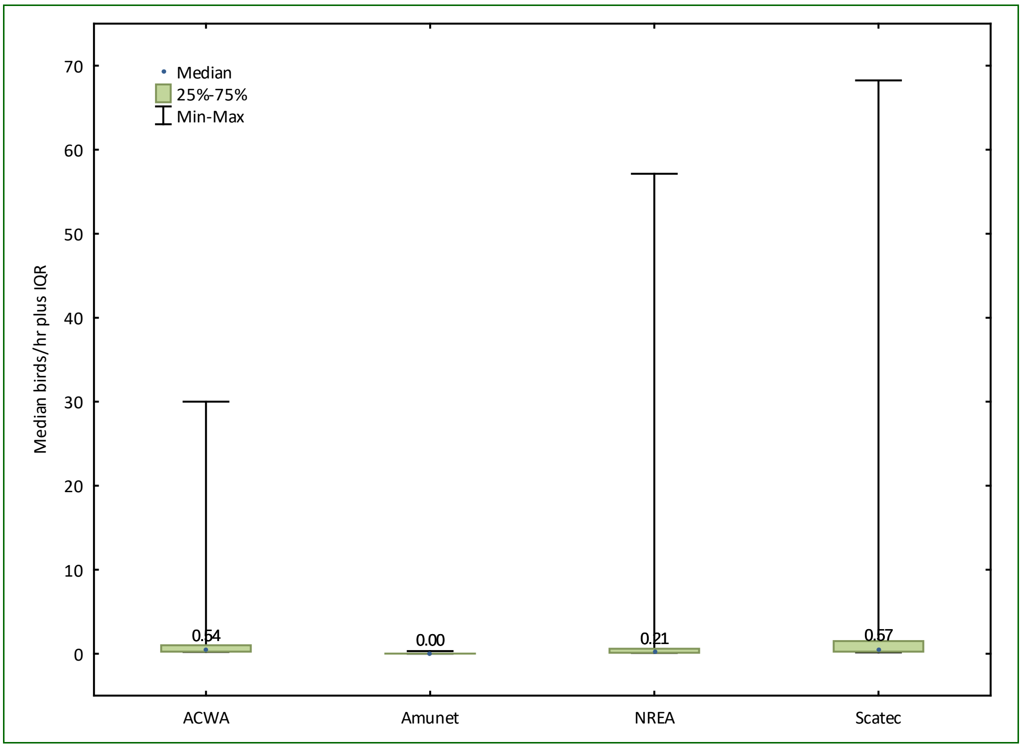

FIGURE 7 Box plot for the Steppe eagle showing the median passing rates per area in the IBA (ACWA and Scatec: south, Amunet: north and NREA: middle)

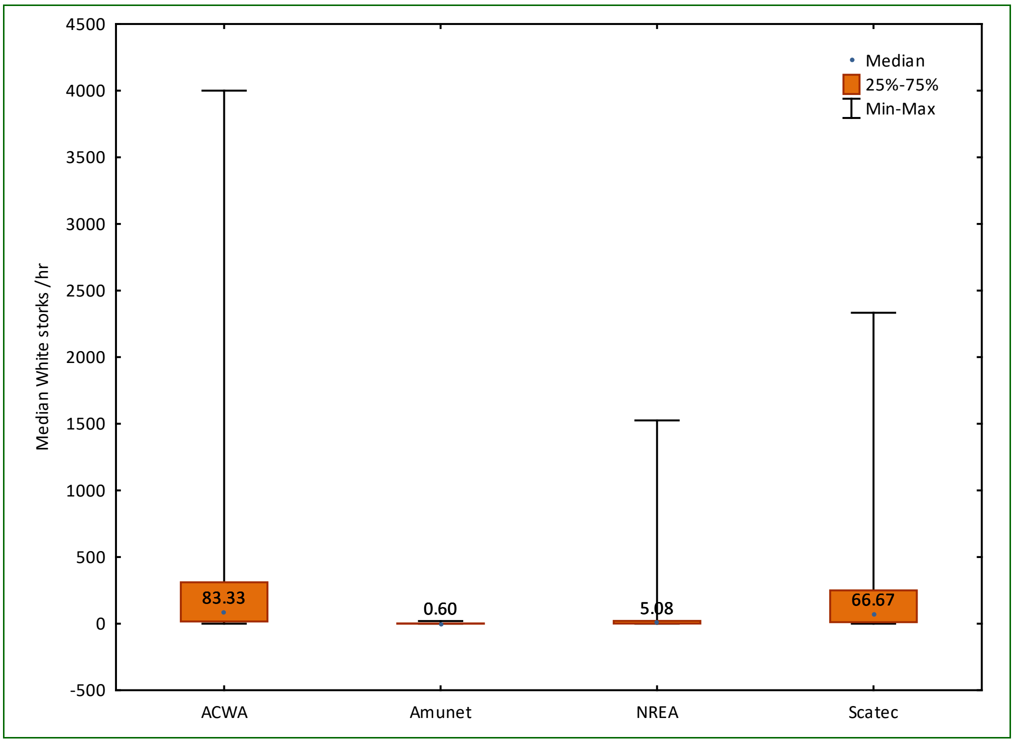

FIGURE 8 Box plot for the White stork showing the medina passing rates per area in the IBA (ACWA and Scatec: south, Amunet: north and NREA: middle)

The way of interpreting the boxplot: The point and number represents the median value. This shows that 50% of the data lies below of the median value and 50% above. The lower edge of the box represents the lower quartile; it shows the value at which the first 25% of the data falls up to. The upper edge of the box shows the upper quartile; it shows that 25% of the data lies above of the upper quartile value. The values at which the vertical lines stop at are the values of the upper and lower values of the data.

Considering the outcomes, we can conclude that the SCATEC had significant higher passing rates per hour -in the end potential more birds and risk- for MSB species compared to NREA, and similar to Acwa for the 2022 spring migratory season. The data for Amunet in 2021 were all lower, suggesting what said in our previous report 2024, for the Acwa plot.

The above results are based on a project basis. However, the SCATEC and Acwa plots are just joining ones; we performed a precautionary analysis but considering only three major zones, with Amunet in the north, the NREA in the middle, and Scatec-Acwa in the south, as it adds a better geographical understanding. We will not repeat the detailed results here; results show that the passing rate in the southern projects (Scatec plus Acwa) was higher than the median passing rate in the middle (NREA), which was also higher compared to the north (Amunet). All the above analyses reinforce the outline of the IBA as it was designed in 1999 (BirdLife International (2024) Important Bird Area factsheet: Gebel El Zeit (Egypt): https://datazone.birdlife.org/site/factsheet/gebel-el-zeit-iba-egypt

4.2.2 Autumn

AS for the spring, autumn there is no project with simultaneous counts every year, as Amunet had only 2020-2021 data. Those species in light grey have non-significant effects, either small bird counts as to perform statistical tests (e.g. Steppe and Short-toed eagles) or are absent during the autumn seasons at some projects.

TABLE 13 Median passing rates per area sorted from the highest (red) to the lowest (green), Interquartile range, and significance of the non-parametric test.

WEF	Species	N	Median	IQR (Q75-Q25)	Significance
Amunet	Booted Eagle	1	0.12	0.00	n.s.
NREA		68	0.09	0.00	
Acwa		15	0.21	0.00	
SCATEC		3	0.21	0.09	
Amunet	Egyptian Vulture	2	0.18	0.11	n.s.
NREA		45	0.17	0.19	
Acwa		6	0.21	0.17	
SCATEC		5	0.42	0.34	
Amunet	Lesser Spotted Eagle	0		0.00	n.s.
NREA		15	0.10	0.00	
Acwa		1	0.10	0.00	
SCATEC		0		0.00	
Amunet	Marsh Harrier	58	0.12	0.02	p < 0.001
NREA		499	0.10	0.01	
Acwa		68	0.21	0.16	
SCATEC		33	0.17	0.12	

Amunet	Short-toed Eagle	0		0.00	n.s.
NREA		14	0.10	0.00	
Acwa		4	0.10	0.08	
SCATEC		0		0.00	
Amunet	Steppe Eagle	0		0.00	n.s.
NREA		21	0.09	0.01	
Acwa		19	0.21	0.21	
SCATEC		8	0.31	0.49	

Table 14 Species migrating in loose groups in autumn: Median passing rates per area sorted from the highest (red) to the lowest (green), Interquartile range, and significance of the non-parametric test.

WEF	Species	N	Median	IQR (Q75-Q25)	
Amunet	Black Kite	63	0.12	0.01	**p < 0.001**
NREA		466	0.19	0.33	
Acwa		107	0.21	0.42	
SCATEC		53	0.42	0.63	
Amunet	Black Stork	1	0.26	0.00	**p < 0.001**
NREA		29	0.26	0.55	
Acwa		23	1.68	5.05	
SCATEC		3	0.44	1.21	
Amunet	Honey Buzzard	533	0.65	1.65	**p < 0.001**
NREA		1480	0.62	2.58	
Acwa		295	1.07	3.18	
SCATEC		169	1.05	2.19	
Amunet	Steppe Buzzard	31	0.13	0.24	n.s.
NREA		321	0.10	0.10	
Acwa		40	0.21	0.17	
SCATEC		17	0.21	0.09	

TABLE 15 Species migrating in large groups: Median passing rates per area sorted from the highest (red) to the lowest (green), Interquartile range, and significance of the non-parametric test.

WEF	Species	N	Median	IQR (Q75-Q25)	Significance
Amunet	White Pelican	6	4.99	5.96	**p < 0.001**
NREA		263	6.21	13.37	
Acwa		128	27.60	46.32	
SCATEC		67	22.22	41.04	
Amunet	White Stork	34	3.42	16.63	**p < 0.001**
NREA		539	21.28	83.06	
Acwa		176	63.16	413.16	
SCATEC		86	115.78	377.57	

Results for the autumn are not as consistent as in spring due to the lower number of both birds and species recorded. However, for the projects with 2022 data, the general pattern shows higher bird passing rates at both Acwa and SCATEC compared to NREA. This contradicts the idea of having higher passing rates in the northern projects. An explanation could be that migration flow comes from the Red sea (Gebel El Zeit Mountain) and not along the Red Sea coast from Suez.

We made a final attempt adding the GoZ-7 Red Plot 2024 data as to have a broad overview of the entire IBA, see section 5 below). When considering the global data, and without any statistical analysis, the Median passing rates and their respective IQR's are as follows in TABLE 16.

TABLE 16 Results of the overview for the "Amunet" in autumn within the broader area: number of records, median passing rate (birds/hr) and Inter quartile range (IQR). Last column shows the rank in decreasing order of the medians.

Species	year	WEF	N	Q25	median	IQR	Q75	Rank order of the medians
Black Kite	2021	Amunet	485	0.00	0.01	0.04	0.05	Acwa >Scatec>NREA>**Redplot**> Amunet
	2022	NREA	2788	0.20	0.43	1.33	1.53	
	2022	ACWA	615	0.43	1.03	2.24	2.67	
	2022	Scatec	401	0.41	0.89	2.59	3.00	
	2024	Red Plot	741	0.22	0.35	0.56	0.79	
Black Stork	2021	Amunet	50		0.01	0.03		
	2022	NREA	296	0.17	0.63	1.57	1.74	
	2022	ACWA	56		1.05	3.68		
	2022	Scatec	52	0.47	1.82	7.22	7.68	
	2024	Red Plot	211	0.24	0.82	2.24	2.47	
Booted Eagle	2021	Amunet	47	0.00	0.00	0.00	0.00	Acwa=Scatec > **Redplot**>NREA>Amunet
	2022	NREA	300	0.10	0.11	0.01	0.11	
	2022	ACWA	52	0.21	0.23	0.07	0.29	
	2022	Scatec	80	0.21	0.26	0.19	0.40	
	2024	Red Plot	203	0.11	0.12	0.01	0.12	
Egyptian Vulture	2021	Amunet	32	0.00	0.00	0.00	0.00	Acwa=Scatec > Redplot=NREA>Amunet
	2022	NREA	157	0.10	0.11	0.05	0.15	
	2022	ACWA	44	0.21	0.24	0.07	0.29	
	2022	Scatec	33	0.21	0.22	0.07	0.27	
	2024	Red Plot	82	0.11	0.12	0.01	0.12	
Honey Buzzard	2021	Amunet	122	0.01	0.03	0.06	0.07	**RedPlot**>Acwa>Scatec>NREA>Amunet
	2022	NREA	1927	0.53	1.87	5.05	5.58	
	2022	ACWA	197	0.89	3.14	7.86	8.75	
	2022	Scatec	309	0.67	2.52	7.77	8.44	
	2024	Red Plot	321	0.67	3.70	9.68	10.35	
Spotted Eagle	2021	Amunet	72	0.00	0.00	0.00	0.01	Acwa=Scatec>NREA>**Redplot**>Amunet
	2022	NREA	658	0.10	0.11	0.11	0.21	
	2022	ACWA	64	0.21	0.24	0.20	0.41	
	2022	Scatec	74	0.22	0.32	0.22	0.44	
	2024	Red Plot	91	0.11	0.11	0.01	0.12	
	2021	Amunet	114	0.00	0.00	0.00	0.01	Acwa>Scatec>**Redplot**>NRE>Amunet

Short-toed Eagle	2022	NREA	320	0.10	0.11	0.03	0.13	
	2022	ACWA	91	0.22	0.29	0.21	0.43	
	2022	Scatec	93	0.22	0.25	0.11	0.33	
	2024	Red Plot	177	0.11	0.12	0.01	0.12	
Steppe Buzzard	2021	Amunet	494	0.01	0.03	0.09	0.10	**RedPlot**>Acwa>Scatec>NREA>Amunet
	2022	NREA	4891	0.20	0.48	1.35	1.55	
	2022	ACWA	685	0.67	1.71	4.48	5.14	
	2022	Scatec	619	0.30	1.03	4.03	4.33	
	2024	Red Plot	1266	0.47	1.91	5.70	6.17	
Steppe Eagle	2021	Amunet	206	0.00	0.00	0.01	0.01	Scatec=Acwa>**Redplot**>NREA>Amunet
	2022	NREA	2690	0.11	0.21	0.48	0.59	
	2022	ACWA	368	0.25	0.54	0.75	1.00	
	2022	Scatec	686	0.25	0.57	1.25	1.50	
	2024	Red Plot	1117	0.12	0.34	0.56	0.67	
White Pelican	2021	Amunet	17	0.04	0.10	0.07	0.10	Scatec>Acwa>**Redplot**=NREA>Amunet
	2022	NREA	168	0.31	4.66	16.42	16.73	
	2022	ACWA	52	3.65	19.75	52.26	55.90	
	2022	Scatec	49	10.00	20.00	90.00	100.00	
	2024	Red Plot	45	1.92	8.24	16.90	18.82	
White Stork	2021	Amunet	131	0.12	0.60	1.63	1.75	Acwa=Scatec>**Redplot**>NREA>Amunet
	2022	NREA	784	0.48	5.08	20.03	20.51	
	2022	ACWA	177	16.55	83.33	293.79	310.34	
	2022	Scatec	123	11.61	66.67	238.39	250.00	
	2024	Red Plot	312	5.61	41.18	162.62	168.22	

The results from Table 16 are only informative, comparing the GoZ-7 Red Plot against the remaining projects in relation to migration intensity. Each species-specific passing rates (birds/hr) values of the median passing rate fall within those previously recorded for the other projects along the Flyway. The fact that data from the GoZ-7 Red plot fall within a different position for some projects may do not reveal real variations, as data were collected for 2024, when conditions could be different from 2022 (different year and different locations within the Flyway).

4.3 Results: Birds landing

There is limited information about where (coordinates), and circumstances of birds recorded on the ground but all came from the following individual databases:

- In spring 2022 AMEA-Amunet only recorded four species: two Steppe eagles, five (5) Steppe buzzards, one Honey buzzard (1), and 80 White storks. These data, as they are, do not represent anything. If we would have used the spring 2021 data the honey buzzards would be ten (19) and the White storks 1,540.
- We filtered the birds on the ground from the NREA databases. Observations had to be assigned to each VP, as there were only short notes regarding the precise location of the observations.
- We also filtered those observations from the GoZ-3000-7 and the SEACIA.

- The SCATEC 200MW data have been included as well but there were only 15 records out of 3,161 for the spring, and five out of 1,401. This information was very limited as to make any guess, and they do not provide the specific location of the resting birds.
- The case of the SWE Plot #2 is discussed in Section 6 as an example for the whole region, and it is the same section as in the previous study for the Acwa SWE Plot #2.

4.3.1 The White Stork

Being the most numerous species landing across the GoS the presence of birds on the ground extends over a large area, but mostly centered in the mid and southern parts of the IBA and thus, the NREA projects and further south. There were records at all the projects, FIGURE 9.

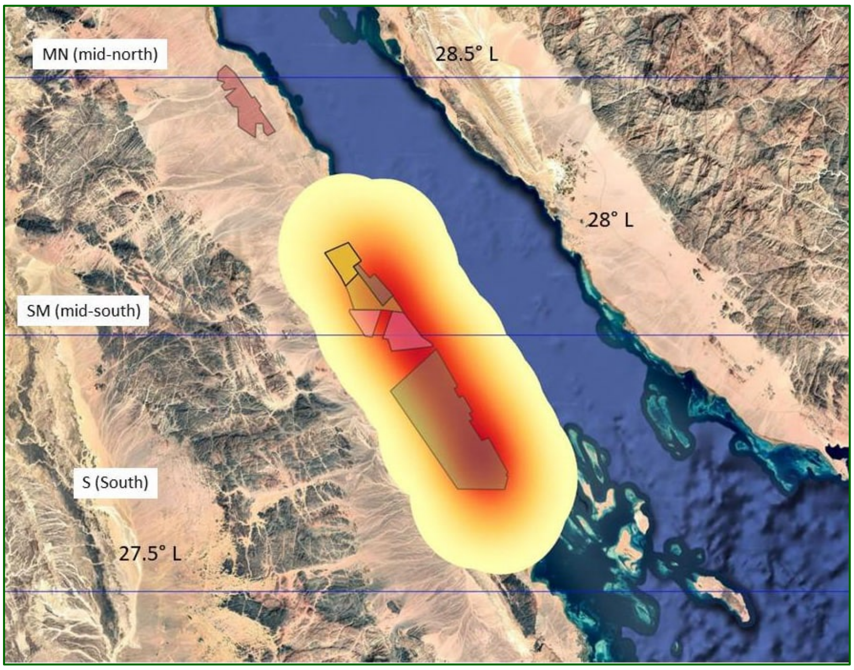

FIGURE 9 Kernel distribution of White stork landed among the WPPs monitoring programs, operational or not. The highest density of birds landing extends over a large area mostly from the NREA projects to the southernmost tip of the GoZ-3000-7 plot.

4.3.2 The Great White Pelican

Together with the White stork, the Great White Pelican is the second most abundant species observed on the ground. In 2007 there were no records for this species (0 birds or groups).The Figure shows the distribution of Great White pelican groups for all the projects altogether. The Strategic study lack of any landed bird; however, they recorded a group on the sea surface. This is the only species which can rest on water.

The distribution of observations could be skewed towards the projects with more monitoring, compared to other pre-construction studies with different monitoring effort. We cannot forget that the Great White pelican does not appear on every single project regularly, not being a common migrant throughout the monitoring seasons, FIGURE 10.

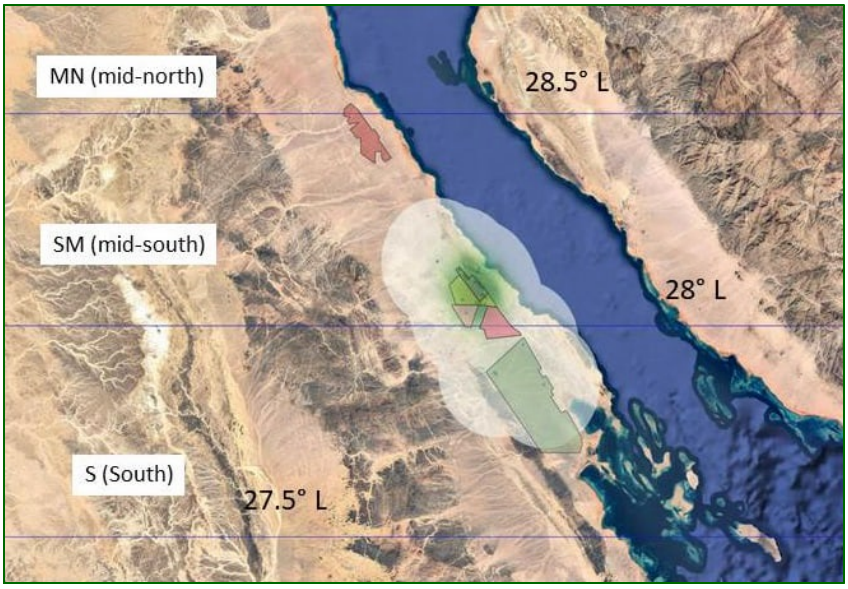

FIGURE 10 Kernel distribution of the Great White pelican landed among the WPPs monitoring programs, operational or not. The highest density of birds landing extends mostly from the NREA projects.

4.3.3 The remaining species

Out of the White stork and the Great White Pelican, there were up to sixteen (16) species which have been recorded on the ground, TABLE 17 and TABLE 18. The stork and the pelican comprise a 93.8% of all the individuals (69,418). Eleven species had a very small number of individuals and records, like the kestrels or falcons. These birds are difficult to detect from the distance unless the fly or the observer is very close.

TABLE 17 Species and bird numbers reported to be recorded on the ground: total number of birds, number of records and percentages per different projects

Species	#Birds	records	Birds/record	%
Black Kite	419	24	17.46	0.60%
Black Stork	316	10	31.60	0.46%
Common Crane	1,045	8	130.63	1.51%
European Honey Buzzard	238	4	59.50	0.34%
Kestrel	2	1	2.00	0.00%
Lannar Falcon	1	1	1.00	0.00%
Lesser Kestrel	4	3	1.33	0.01%
Lesser Spotted Eagle	1	1	1.00	0.00%
Long-legged Buzzard	2	2	1.00	0.00%
Montagu's Harrier	1	1	1.00	0.00%
Osprey	1	1	1.00	0.00%
Pallid Harrier	1	1	1.00	0.00%
Red-footed Falcon	1	1	1.00	0.00%
Steppe Buzzard	2,217	51	43.47	3.19%
Steppe Eagle	36	11	3.27	0.05%
Western Marsh-harrier	1	1	1.00	0.00%
White Pelican	3,588	27	132.89	5.17%
White Stork	61,544	62	992.65	88.66%
Total	**69,418**	**211**		**100 %**

With the remaining, we split their numbers into the south (S) and mid-south (MS) zoning, as we did for developing the analyses in the SEACIA (Section 3.1). All the species showed significant differences in bird numbers between the two areas, with more birds recorded in the southern area (red zone in DECON 2007).

TABLE 18 Number of individuals recorded on the ground in the mid-southern and southern plots. There are more birds in the southern area (red zone); significant differences for all the species (Chi square test).

Species	MS	S
Black Kite	356	63
Black Stork	125	191
Eurasian Crane	110	935
European Honey Buzzard	0	238
Steppe Buzzard	95	2,122
White Pelican	3,238	350
White Stork	22,775	38,769
Total general	**26,699**	**42,668**

TO IMPROVE: there is a need of improving the field data collection and reporting to make the databases clearer e.g. related to landing birds and duplicated records. See later in the report about distances of the birds to the observers.

5 The GoZ-7 "Red plot"

The name GoZ-7 "Red plot" refers to an area –no specific project decided yet- in the southeastern part of the GoS further south of the ACWA project, where there is currently a migratory bird monitoring. The suffix "red plot" refers to the DECON 2007 study, which divides the region in three zones (also known as traffic light), red, orange, and yellow, based in decreasing risk when decisions to be taken on wind development.

The only information we have received for this area are two databases "*as they were*" from the bird monitoring in the autumn 2023 and spring 2024. This area has been monitored by NREA for future wind energy developments related to Green hydrogen production. This plot has an approximate area of 354 sq. km, and falls entirely in the so called "red area" of the DECON study 2027, from which it takes its name. It also has a small NE portion in the "orange area" of that study.

They used twelve (12) vantage points in spring and only six (6) in autumn 2023. IT IS NOTEWORTHY THAT THE BIRD MONITORING TOOK PLACE IN SPRING 2024 FOR THE COMPARISONS WITH THE 2022 DATA ("SAME SITE" DIFFERENT TIME COMPARISON). There are inter annual variations which affect the migration, and the only real comparison would had been using data for the same year only.

The TABLE 19 shows the median passing rates for the species in this study. According to the criteria used in the previous sections, three species (3): Steppe and Honey buzzards and the White stork fall within the red classification, and the other eight (8) remaining under the yellow one.

TABLE 19 Results of the analysis for the "Red plot" in spring 2024: number of records, median passing rate (birds/hr) and Inter quartile range (IQR). Last column shows the rank in decreasing order of the medians.

Species	N records	Median	IQR (Q75-Q25)	Rank order for the medians
Species migrating in loose groups				
Steppe Buzzard	1266	1.805	5.396	**R.Plot>**Acwa>Scatec>NREA>Amunet
Honey Buzzard	321	3.504	9.141	**R.Plot>**Acwa>Scatec>NREA>Amunet
Black Kite	615	1.030	2.671	Acwa >Scatec>NREA>**R.Plot**> Amunet
Black Stork	211	0.778	2.111	ACWA > **R.Plot** > Scatec>NREA > Amunet
Species migrating alone				
Booted Eagle	203	0.111	0.005	ACWA=Scatec > **R. plot** > NREA > Amunet
Egyptian Vulture	82	0.111	0.005	ACWA=Scatec > **R. plot** = NREA > Amunet
Lesser Spotted Eagle	91	0.107	0.005	ACWA=Scatec > **R. plot** > NREA > Amunet
Short-toed Eagle	177	0.111	0.005	ACWA > Scatec>**R. plot** > NREA > Amunet
Steppe Eagle	1117	0.573	0.673	Scatec=ACWA > **R. plot** > NREA > Amunet
Species migrating in very large groups				
White Pelican	45	20.00	100.00	Scatec>ACWA > **R. plot** > NREA > Amunet

White Stork	312	83.33	301.34	ACWA=Scatec > **R. plot** > NREA > Amunet

When considering just the rank –without further statistical tests- we find that the Red plot medians are nearly to ones for the SWE-ACWA/SCATEC values compared to the northern projects. We have to recall that the data come from a single BUT DIFFERENT year (2023 versus 2022) of monitoring. The IQR values are broad enough, at least for those migrating in groups, as to "move" a species from the "red" to "yellow" threshold or vice versa, and the ranks presented have been solely based in their median values.

This is a broad scale view, and should not be interpreted at project level, but showing that the southern part of the IBA hosts more birds as previously had been planned when designing its boundaries.

TABLE 20 Results of the analysis for the "Red plot" in autumn 2023: number of records, median passing rate (birds/hr) and Inter quartile range (IQR). Last column shows the rank in decreasing order of the medians.

Species	N records	Median	IQR (Q75-Q25)	Rank order for the medians
Species migrating in loose groups				
Steppe Buzzard*	13	0.53	0.92	R. plot
Honey Buzzard	421	4.21	8.64	R. plot
Black Kite	126	0.86	2.11	R. plot
Black Stork	58	4.16	6.67	R. plot
Species migrating alone				
Booted Eagle	14	0.23	0.12	R. plot
Egyptian Vulture*	3	0.22	1.07	R. plot
Lesser Spotted Eagle*	6	0.22	0.15	R. plot
Short-toed Eagle	-	-	-	-
Steppe Eagle	-	-	-	-
Species migrating in very large groups				
White Pelican	53	6.00	33.80	R. plot
White Stork	165	66.67	322.20	R. plot

6 The Scatec project plot and its AoI (Wadi Dara)

This Section will only focus on the birds landed within the allocated plot. The data for the ACWA Plot #2 for this section come from the following sources:

- Bird monitoring assessment made in 2022
- Second bird monitoring assessment made in 2023 for SWE-Acwa Plot
- Own data collated during a site Supervision visit in February 2023 to both sites, Acwa and SCATEC.

6.1 Birds landed recorded from Vantage point monitoring

The SCATEC and Acwa projects are both joining, and were surveyed in 2022, whilst only Acwa in 2023. Thus, the more detailed study was for the latter, as poultry is potentially more risky compared to SCATEC. However, what happens in the farms may have effects on both. For this section we also use the data from Acwa to describe the risks for MSBs.

We extracted from the Acwa bird monitoring database 2023 (data were not in the same format as in 2022), all the records considering the observations of "roosting", and "resting". In this regard there were two datasets:

- Sheet called "roosting" with observations recorded from VP monitoring with the specific coordinates, species, and bird records. We double checked this sheet with the "*record sheet*" which includes all the records.
- Specific databases called *Wadi Dara farms sheets* for 2022 and 2023 as detailed in the methodology – specific counts at the dumping site- detailed to the field team during the site supervision visit in February 2023.

The following FIGURE 11 and FIGURE 12 present the data for spring 2023 according to the data recorded. Results show that the highest concentrations of birds landed occurred around the dumping area previously discovered and visited in February 2023. There have been six (6) species recorded: White stork, Steppe eagle, Marsh harrier, Egyptian vulture, Black kite, and White Pelican (all censused from VP 9). A second concentration, involving the same species, appears close to the first farms at the NE of Wadi Dara (VP 7). In 2022, there were not georeferenced bird observations so we are unable of representing a similar figure.

Overall, between 43% (2022) and 80% (2023) of the grounded (roosting) records took place near the vantage points #6, 7, and 9, indicating clearly the attraction effect of the dumping site to birds.

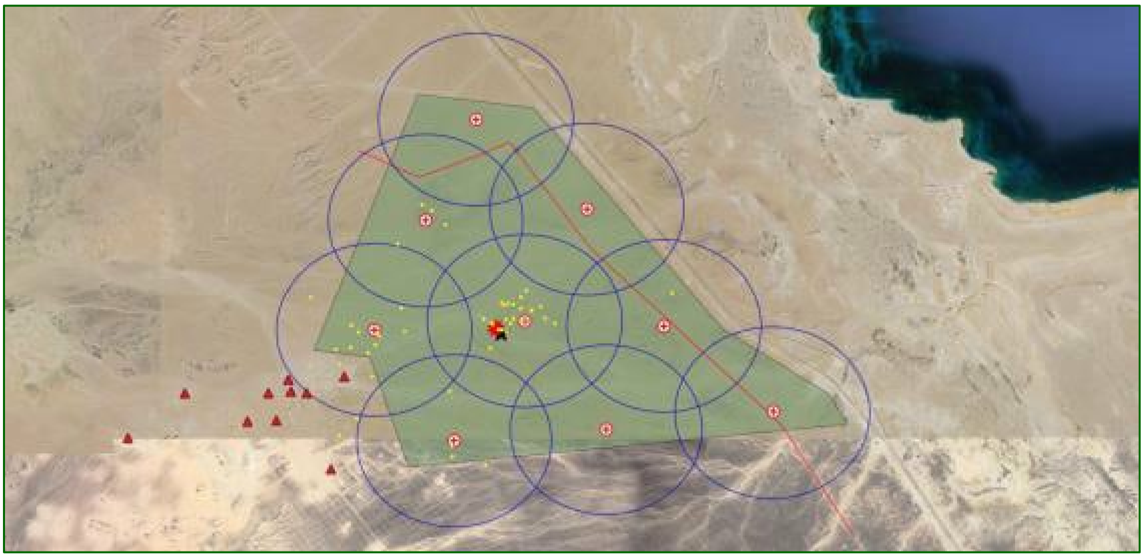

FIGURE 11 Concession area for SWE Plot #2 (greenish area). Yellow points all locations of birds seen on the ground during the spring 2023 bird monitoring, several species. Red star: dumping site, Red triangles: Wadi Dara Farms. Red line is a transmission line traversing the project area. Red crosses +circles are the Vantage points used for the bird monitoring.

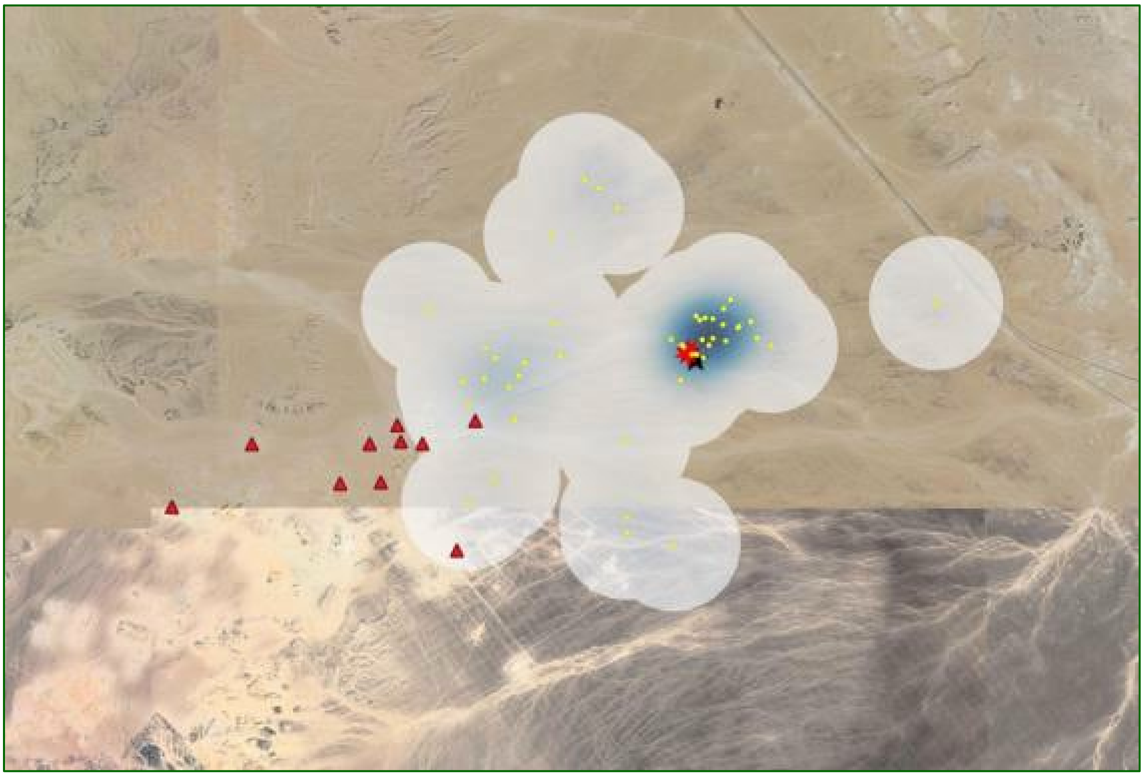

FIGURE 12 Kernel heat map with the bird contacts seen on the ground in spring 2023. The higher concentration of observations is around the dumping site (red star), and a second area in the surroundings of the other Wadi Dara farms.

On the contrary, there were only one and four observations during the autumn migration respectively in 2022 and 2023. All were recorded out from the Wadi Dara farms, involving two and twenty nine Honey Buzzards; and also one, three, and one Marsh harriers. The importance of the site in autumn could be related with a more straightforward migration flux.

6.2 Birds landed: specific bird monitoring of the Wadi Dara farms.

In addition to the traditional Vantage Point monitoring, in 2022 we provided guidelines to check the use birds do of the dumping site and the surroundings of the farms. These guidelines come from a previous work we developed for BirdLife International in 2015 for the RVRS Flyway and the Waste Management practices related to bird conservation (Martín et al. 2015).

There were 225 specific two hour census counts at three selected sites, despite two of them could be considered a single one, as they were separated 200 m apart. The dedicated sheet recorded the following bird and species numbers for a total 448 hr. of monitoring. The Steppe eagle is the main species in the area, followed by the Black kite. These are two species which take any opportunity of feeding on carrion, TABLE 21.

Table 21 Total number of MSBs species recorded during the specific site monitoring of the Wadi Dara dumping area.

Species	#birds on the ground	%
Steppe eagle	1,676	81.20%
E. imperial eagle	4	0.19%
Booted eagle	4	0.19%
Short-toed eagle	3	0.15%
Black kite	328	15.89%
Marsh harrier	3	0.15%
Pallid harrier	1	0.05%
Steppe buzzard	44	2.13%
Eur. Honey buzzard	1	0.05%
TOTAL	**2,064**	

Results suggest that the area provides food for migratory birds. Coupled with the Vantage Point observations mentioned in Section 5.2 it is clear that human activities related to poultry management could be acting as a factor of attraction, posing a risk for the project by increasing the collision risk.

Figure 13 View of the dumping site. In the front, rocky area fully covered by droppings. In the background, plastic bags with dead chicken.

The management of the chicken farms is a major social & biodiversity component which requires of a habitat management plan to further reduce the collision risk for MSBs, even more when the main species occurring is Endangered (IUCN 2024). The presence of the Steppe eagle at Wadi Dara and the weekly passage rates are highly related (r=0.87; p<0.001) as we expected, Figure 17 and Figure 18.

FIGURE 14 Detailed view of the open bags with the dead chicken spread out on the ground.

FIGURE 15 Steppe eagles taking off from the dumping site.

WHAT DOES THE RISKS FOR THE SCATEC PLOT ARE? The farming activity extends over an area which does not occupy the projects. However, farmers do not have ways to destroy the poultry carcasses produced. Up to now, they were dropping off at a point in the ACWA plot. However, they will need a way to destroy such sub-products of the farming activities. They could decide to leave the carcasses elsewhere, and this could mean they decide on their own to e.g. drop them off to the north of the farms. This would create a problem where currently do not exist. Thus, it is necessary to be ready to face any potential new risk not anticipated during the ESIA, as it did not exist.

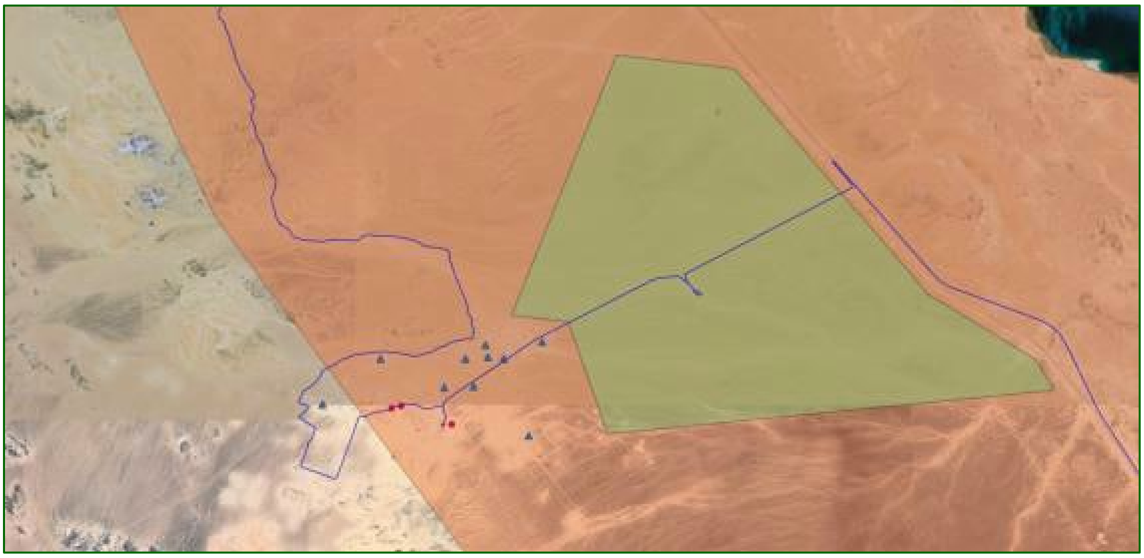

FIGURE 16 SWE Plot #2 (green area), limits of the Gebel el Zeit IBA (orange) and the location of the Wadi Dara farms (blue triangles) and the observation points (red circles). The line shows the roads transect followed in February 2023 during the Site supervision Visit.

In the FIGURE 16 the blue triangles are the farms, and the greenish area the ACWA plot. SCATEC is just north to the farms, and this area should be kept as it is. A social management plan would assists the farmers improving the poultry care, balancing the renewable development whilst safeguarding the migratory birds and social needs.

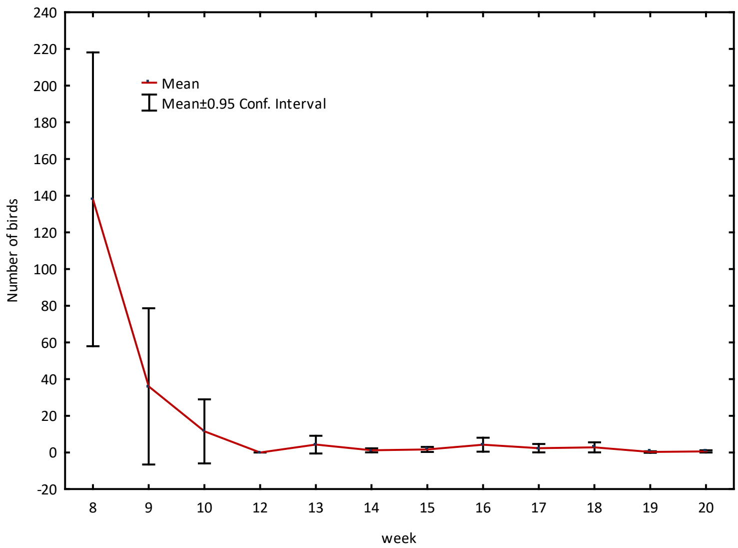

FIGURE 17 Average number of Steppe eagles recorded per week of observation during Vantage Point monitoring, spring 2023.

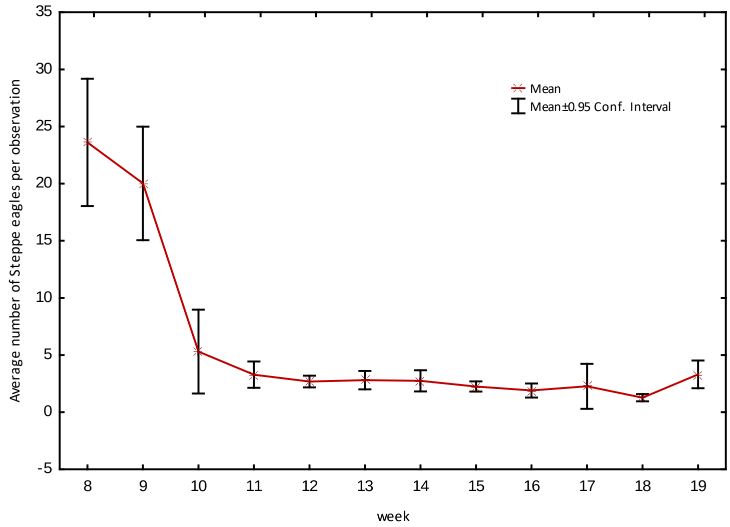

FIGURE 18 Average number of Steppe eagles at Wadi Dara area per week during the spring 2023.

The way farmers remove the dead poultry plays a vital role in the use of the site by the MSBs. The mechanisms causing the food availability (e.g. period of maximum deaths), if there is a single farmer or several who drop off the bags there, and other issues remain unclear.

Waste management has multiple types of waste, and carcasses from domestic animals are one of them. In 2015 (Martín et al. 2015) we developed a document entitled "*WASTE MANAGEMENT: BEST PRACTICES AND IMPACT TO CONSERVE MIGRATING SOARING BIRDS (MSB's) IN THE RIFT VALLEY-RED SEA FLYWAY*". This document highlighted the risk of this type of sites for the energy sector, wind because of increasing risk of fatalities and electric because the potential collisions and electrocutions. In addition to risks, it also has advantages, providing food contributing to MSBs conservation.

There is an additional issue which should be considered, as it is the fact MSBs feed also from birds. This means that any disease affecting poultry (e.g. Avian Influenza, Newcastle disease) can be spread out to wild bird populations. Any carcass disposal which provides bird carcasses to wild necrophagous birds should be controlled carefully.

6.3 Different pattern of behaviour: birds landed vs feeding at Wadi Dara

A difference exists between the birds which land among the turbines or in the region, and those attending the Wadi Dara area, FIGURE 12. We have standardized the values for a better visual perspective. Those which land on the GoS area, tend to leave as soon as possible after sunrise (the peak of records is found shortly after dawn. There is a much smaller peak in the afternoon before sunset, FIGURE 19.

On the contrary, at Wadi Dara there are two peaks, the first similar to the birds which land elsewhere, and a second one after noon, which could be interpreted as a re-fuelling opportunity because of the carcass or other potential food available.

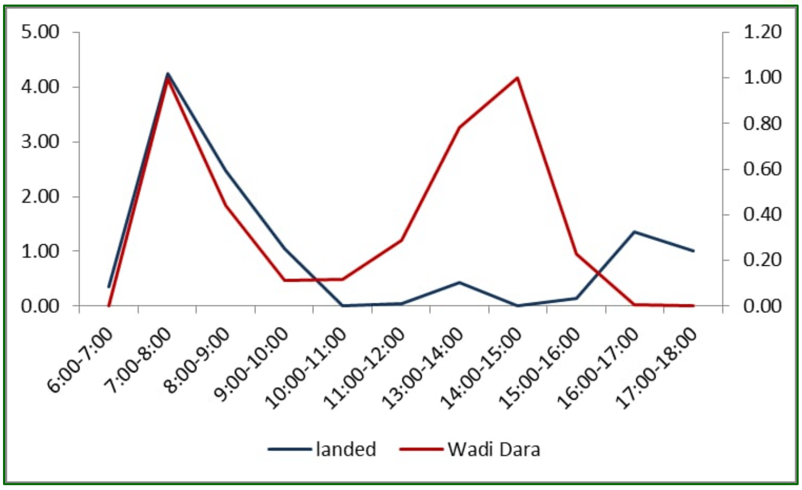

FIGURE 19 Different time pattern between the birds just landed (left Y axis) and those which feed/attend the dumping site in Wadi Dara (right Y axis).

MITIGATION: By Nov 2024 we were told the site has been removed. However, poultry activity remains, and breeders still need to remove the carcasses. The project should develop a **Carcass Management Plan** to keep the project area and its surroundings free of carcasses. This should be maintained for the life-span of the project, alone, or in cooperation with other developers which could be potentially affected.

6.4 Landed birds at the other wind projects and beyond

In the previous sections 5.2 to 5.4 we described as much as possible the behaviour of landing MSBs on the SWE Plot #2-ACWA, and how some species made use of the food resources available at Wadi Dara vicinity.

Unfortunately, the bird monitoring databases from the different projects and consultancies show a lack of consistency among them, and do not include specific coordinates for the birds recorded "landed" /seen on the ground. Instructions to bird observers only rely on VP monitoring, accounting for the starting and ending times, the flying heights and bird activity roughly described as "active", "soaring", or "roosting". Records including species and numbers refer to the VP only so the spatial distribution within the surroundings is unknown; as a VP entails a 2.5 km radius – which encompasses a 19.63 sq. km- any observation may fall wherever in this area without further accuracy provided.

In addition, wind projects only monitor areas within their respective project plots, without accounting for potential characteristics beyond their boundaries. As an example, recall that many ecological phenomena linked to weather do not relate to instantaneous prevailing meteorological conditions (the times when monitoring occurs), but to average or extreme figures during previous time spans of unknown duration that are necessary to estimate (Istúriz et al. 2022). The numbers of birds arriving to/departing from the Gebel el Zeit southern IBA areas are dependent of such conditions, and none of the projects in the region have accounted for, just relying on the supposed "best industry" but not “scientifically sound” practices. Examples of studies analysing the effect of weather conditions on the migration are Blas et al. (2020) for the White stork or Santos et al. (2020) for the Black kite, and are also applicable to the GoS. We must admit the limitations –technical and economical- of the current bird monitoring studies related to wind energy infrastructure in the GoS and elsewhere and be cautious with the information collected, its use, potential biases and conclusions to be made based on that limitations.

Finally, an overview of satellite track data revealed other sites along the Red Sea region where stationary positions show birds on the ground (zero speed) and fixed points between e.g. 7:00 pm and 5:00 am (darkness). Just as one example, the FIGURE 20 shows a water treatment plant and a salt quarry, where White storks have been recorded.

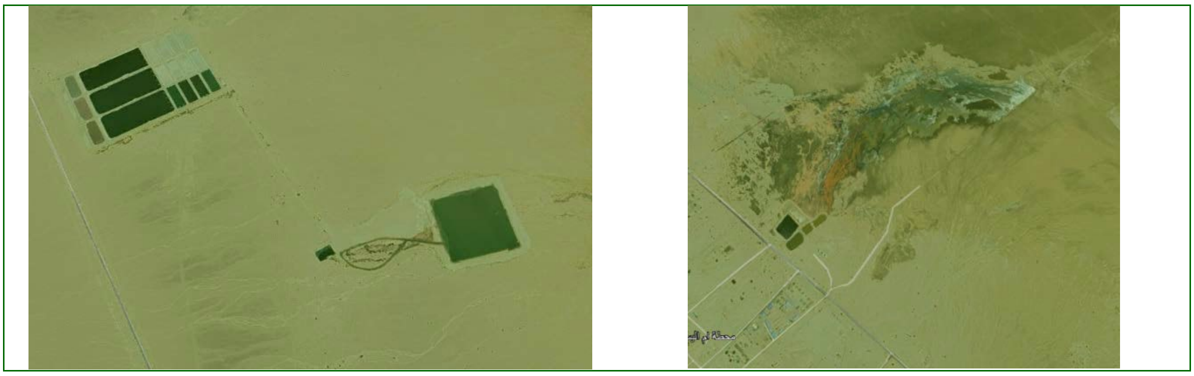

FIGURE 20 Examples of a water treatment plant (left) and Salt quarry (right) within the Flyway near the WPPs, and used by MSBs for overnight (See Martin et al. 2015).

6.5 The flying height

6.5.1 Spring and autumn 2022

Flying heights and time spent at each level is used to perform the CRM. However, this time is dependent on the number of birds passing at certain height, and in the end dependent to the monitoring time. The TABLE **22** shows the proportion (%) of birds at risk height for the spring 2022.

TABLE 22 Bird numbers and proportion of birds at risk height –collision risk calculated for a 200 turbine tip height- for the spring 2022.

Species	Spring 2022	
	% risk	Birds
Black kite	62.87%	5640
Booted eagle	48.67%	113
Black stork	86.25%	1578
Egyptian vulture	63.16%	38

Spotted Eagle	57.26%	5
Honey buzzard	57.29%	11640
Short-toed eagle	46.34%	123
Steppe buzzard	40.67%	12713
Steppe eagle	43.73%	5314
White pelican	88.83%	26960
White stork	59.73%	140636

In the TABLE **22** we did not consider the time flying at risk height so would require a step forward. Instead of using the bird numbers and time at risk heights, and due to the lack of having a turbine model to perform one CRM per year, we have calculated a new variable:

VARIABLE-*"Species-specific risk height rate" = Passing rate Species $_i$ X Total time at risk height of the Species$_i$*

This value considers the number of birds at risk height in each record (observation) and the overall time at such a risk (sum of times at all the heights during a certain monitoring time). For risk height we have considered those in the 0-200 m range, the highest reached by the current turbines in the market and installed in WPPs in the region. The clearance at the bottom of the turbine, between 0 and the lowest tip blade height, has been also considered as risk for the MSB here studied.

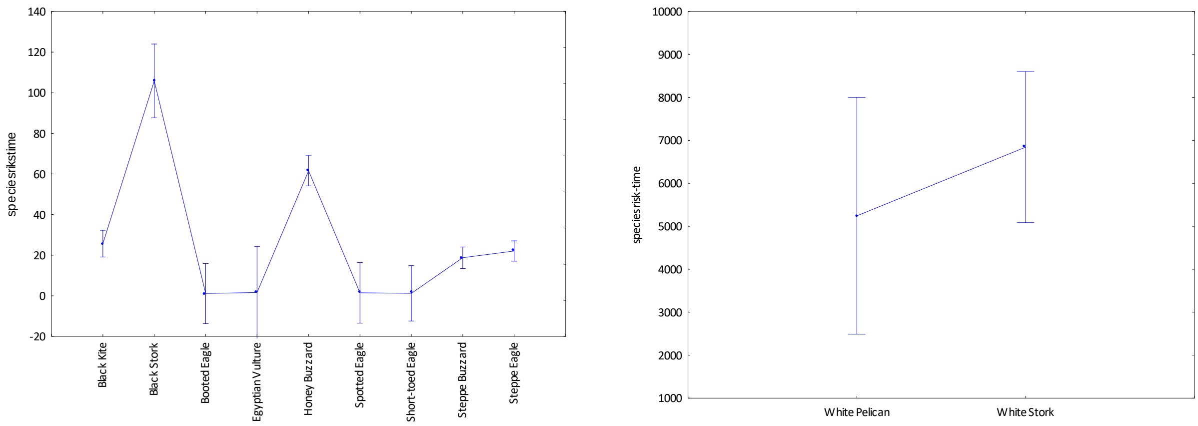

FIGURE 21 Estimated species specific risk height in the spring 2022 for the most constant species migrating over the SCATEC plot. TO NOTE: the different scaling between the left graph and that for the White Stork and White Pelican.

Two have been the main findings:

1) The risk is much higher for the White Stork and White Pelican due to the fact they are the two most numerous species.
2) There were species with very low risk like the Booted eagle or the Egyptian vulture. However, this are data for 2022, and conditions for other years may greatly change.

6.5.2 Autumn

The TABLE 23 shows the percentages of birds at risk height for the autumn 2022. We followed the same procedure as for the spring, and the graph in the FIGURE 22 the Inter quartile ranges for each species.

TABLE 23 Number of total birds recorded per species in the autumn 2022 and percentage of them flying at risk height.

Species	Autumn 2022	
	% risk	Birds
Black kite	80.00%	210
Booted eagle	33.33%	3
Black stork	100%	11
Egyptian vulture	100%	13
Spotted Eagle sp.	n.a.	n.a.
Honey buzzard	77.21%	2080
Short-toed eagle	n.a.	n.a.
Steppe buzzard	73.91%	23
Steppe eagle	60.00%	15
White pelican	83.76%	13,847
White stork	63.18%	186,010

When considering the species specific risk flight rate, as done for the spring, In autumn there was also a greater variability in the specifics risk rates compared to spring, as showed by the median confidence standard errors. FIGURE 22. This is the same overall trend as for the Acwa SWE plot analyses, and this could be the reason of more fatalities during the autumn compared to spring, despite the higher bird numbers passing. The White Stork remains as the species with most time at risk.

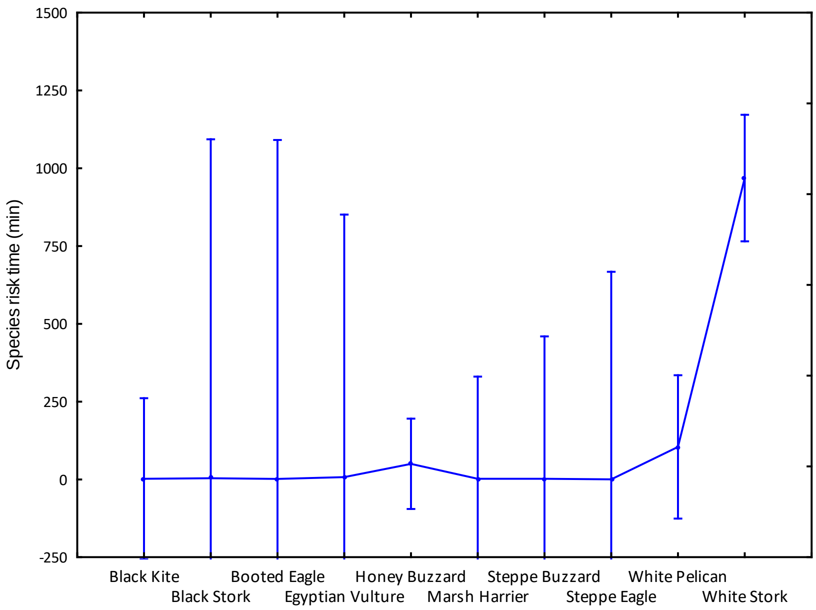

FIGURE 22 Estimated species specific risk height in the spring 2022 and 2023 for the twelve most constant species migrating over the SWE Plot #2.

7 Cumulative species assessment and other additional information supporting.

One of the shortfalls of the CIA studies up to now is to establish the origin of the birds passing through the GoS. Each individual WPP restricts the data collection to their respective AoI, which is based in a buffer area around their external boundaries and based on each 2.5 km radius around each VP. This creates a lack of knowledge of the use birds do of a wider area, e.g. the eastern side of the IBA, where developments do not occur or the Gebel el Zeit Mountain itself. It is also the case of the western mountain chain running SE-NW on the left side of many of the projects. Thus, it is difficult to assess how significant impacts of the developments could be on the species (King et al. 2009). The use of tracked bird data by means of satellite monitoring assists to assess the relative importance for foraging of areas occupied by windfarms, especially for those species for which data – number of individuals- are available in some numbers.

In addition, for the Cumulative Analysis, we followed the approach by Robinson Willmott et al (2013) but adapted to the ecology of the birds migrating through the GoS. Changes on the metrics of that model are explained under each section. WPPs impact bird populations directly through mortality from collisions (direct impact) and through displacement (indirect impact). Here we analyze data on population size and conservation, found from MSBs in the vicinity of the GoS, and ranking their relative sensitivity to the impacts of collision. We did not consider the indirect impacts. The approach of Willemott et al. (2013) is based on methods used by other European researchers (Garthe and Hüppop 2004, Desholm 2009, Furness and Wade 2012, Furness et al. 2013).

The method uses two metrics, the population sensitivity and collision indexes, to classify MSB vulnerability to wind turbines in the GoS. We also considered and estimated uncertainty values associated with the data, with values assigned to each species-metric combination based on the amount of data available, classifying each estimate value as having a low (10%), medium (25%), or high (50%) uncertainty; see the multiple CEA reports for the wind projects in the region as reference values (e.g. Amunet 2022).

For each species we calculated three potential scenarios:

- SCENARIO 1: Only includes the Amunet-Amea power and the three NREA projects.
- SCENARIO 2: Adds the SWE Acwa and the SCATEC plots to the previous ones.
- SCENARIO 3: Includes all the above plus the G-7 Red plot in the south.

TABLE 24 Summary of metrics used in calculating population and collision sensitivity.

Population sensitivity	Collision sensitivity
GPS- Global population size	FM-foraging multiplier
GoS- Proportion of the population migrating through the Gulf of Suez	DFR-Diurnal flight rank
TR- Threat raking according to the IUC Red List	Wind Turbine density
SR- Survival Rate	GR-Grouping FR-Foraging multiplier

Population sensitivity

Population sensitivity splits among widespread and common species where the effect of a collision would have a minimal impact on population dynamics. E.g. a more restricted-range species with smaller populations, effects might have a much more significant impact. Metrics used have been the following, and all were ranked from 1 (lowest) to five (highest):

- GPS is the Global population size, values were taken mainly from BirdLife International (2012) and expert consultations.

	GPS (Global pop. Size)
1	> 3 MM individuals
2	1 to 3 MM individuals
3	>500,000 to < 1MM individuals
4	100,000-500,000 individuals
5	< 100,000 individuals

- GoS is the percent of the population present in the GoS. The reference values were the same and collated for the individual CEA studies of the different WPP along the Red Sea. We took as the reference value, the highest among all the facilities.

	GoS
1	< 1% in GoS
2	1-33%
3	34-66%
4	67-99%
5	>99%

- Threat ranking, according to the IUCN Red List (2024) classification:

	Threat Ranking (TR)
1	LC
2	NT
3	VU
4	EN
5	CR

- Survival ranking: reflects the vulnerability of species to any increase in mortality above natural mortality. Information from the bird species has been gathered from Wetlands International (2006), Vorisek (2008), Birds in Europe (2004), and Ferguson Lees et al. (2001).

	Survival ranking
1	<0.75
2	0.75-0.8
3	>0.80-0.85
4	>0.85-0.90
5	>0.90

$$Population\ sensitivity = \frac{(\text{GPS} \pm \text{GPSu}) + (\text{GoS} \pm \text{GoSu}) + TR + (SR \pm SRu)}{4}$$

TABLE 25 Population Sensitivity scores obtained for each species according to the previous formula. See the text for details.

Common name	GPS		GoS		TR	SR		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.	Score	Score	Uncert.	Lower	Best	Upper
Egyptian Vulture	5	10	2	10	4	4	10	3.48	3.75	4.03
Booted Eagle	5	10	2	10	1	4	25	2.58	3.00	3.43
Lesser-spotted eagle	5	10	2	10	1	5	10	2.95	3.25	3.55
Short-toed Eagle	4	25	2	25	1	4	25	2.13	2.75	3.38
Greater spotted eagle	5	10	2	10	3	5	25	3.26	3.75	4.24
Steppe Eagle	4	10	2	10	4	5	25	3.29	3.75	4.21
Black kite	2	25	2	10	1	3	10	1.75	2.00	2.25
Black Stork	5	10	3	10	1	2	10	2.50	2.75	3.00
White Stork	3	10	3	10	1	2	10	2.05	2.25	2.45
Honey buzzard	3	25	2	10	1	4	10	2.16	2.50	2.84
Montagu's Harrier	5	25	1	10	1	3	25	1.98	2.50	3.03
Marsh Harrier	4	10	1	10	1	2	10	1.83	2.00	2.18
Steppe buzzard	1	10	2	10	1	4	10	1.83	2.00	2.18
Great white pelic-an	4	25	3	10	1	5	25	2.61	3.25	3.89

Collision sensitivity

For this purpose we discarded the avoidances, as there is still a great debate about macro or micro-avoidances. Using them or not, do not change the purpose of the cumulative approach. In addition, neither the macro nor micro-avoidance can be calculated, as there are no turbines installed from which to get data for. We scored six factors that represent aspects of the species' behavior which contribute to their potential vulnerability to collision. Collision sensitivity has been calculated as follows:

$$Collision\ sensitivity = \text{AO X RSZ occupancy X (GR} \pm \text{GRu) X FM}$$

- AO is the hourly annual occurrence of each species along the Red Sea, with birds occurring more in the GoS being more likely to collide with turbines. For species like the MSBs, that do not stop in the GoS, or if they do, they resume the migration rather sooner than later, we calculated the hourly occurrence by estimating the distance flown across the GoS divided by the bird's average flight speed (Alerstam et al. 2003 and Pennycuick 1978). We measured the distance across the GoS between the two extremes from the outermost limit of Amunet-Amea power project till the southeastern outermost boundary. These distances were respectively 115 km (from Amea till the Red plot included), 75 km (from Amea power to Acwa power plot), and 62 km (only the distance from Amea power to the NREA projects). The three distances define what we called, scenarios 3, 2, and 1.

- RSZ OCCUPANCY, and because of the lack of operational projects within the ACWA plot and the Red Plot,

	Rotor Swept Zone (RSZ)
1	Amea to NREA inclusive
3	Amea to Acwa Plot #2/SCATEC
5	Full development from Amea till the Red Plot.

- GR is the average group size of every species. We calculated the average groups' size for all the species during migration. Here, we calculated the median minus-plus the % variation of this measurement from the studies in the region (Amunet, Acwa, NIAT, RSWE, SCATEC).
- FM is the foraging behavior multiplier. It is known that most of the species do not feed during migration, whilst others like the harriers, refuel on route.

	Foraging multiplier
1	The species rarely forage over the project's areas for food
1.5	Some individuals forage for food
2	Individuals regularly forage over the areas.

We calculated three collision sensitivity scenarios, as showed in TABLE 27, and we classified the species afterwards.

TABLE 26 Collision sensitivity Table for the Scenario 3: full development of the IBA including the Red Plot.

Common Name	AO	DFR		RSZ		GROUPING		FR Multiplier	Collision Sensitivity Score		
		Score	Uncertain	Score	Uncertain	Collision	Uncertain		Lower	Best Estimate	Upper
Egyptian vulture	9.13	1	10	5	50	1	22	1	5.02	45.63	61.24
Booted eagle	10.18	1	10	5	50	1	9	1	2.29	50.88	61.01
Lesser-spotted eagle	9.83	1	10	5	50	1	30	1	7.37	49.15	70.28
Short-toed eagle	11.17	1	10	5	50	1	13	1	3.63	55.83	69.39
Spotted eagle	9.83	1	10	5	50	1	15	1	3.69	49.15	62.17
Steppe eagle	14.94	1	10	5	50	2	27	1.5	30.24	224.03	312.96
Black kite	9.83	1	10	5	50	2	15	1.5	11.06	147.44	186.51
Black stork	7.19	1	10	5	50	2	48	1	17.25	71.88	117.01

White Stork	7.19	1	10	5	50	3	25	1.5	20.21	161.72	222.36
Honey buzzard	11.39	1	10	5	50	2	30	1	17.08	113.86	162.82
Montagu's harrier	13.69	1	10	5	50	1	12	1.5	6.16	102.68	126.50
Marsh harrier	11.39	1	10	5	50	1	20	1.5	8.54	85.40	112.72
Steppe buzzard	10.95	1	10	5	50	2	15	1.5	12.32	164.29	207.82
Great White Pelican	7.37	1	10	5	50	3	89	1.5	73.81	165.87	344.83

Final Collision Scores

Final collision scores result from the multiplication of the population sensitivity score by the collision sensitivity score. Multiplying the lower and upper ranges of population sensitivity by the lower and upper range of collision sensitivity was also performed. This step accounts for the overall impact of collision. Final collision scores were then species specific, ranked and scaled from the lower value (0) to the highest one (3) by means of the Max-Min scaling procedure, is a normalization technique that transforms the values of a dataset to fit within a specific range:

TABLE 27 Results of the Final Collision risk values per species and Scenario: 1-with only Amunet and NREA projects, 2: Including the development of Acwa and SCATEC, and 3 the full development of the IBA, including the Red-plot.

	Scenario 1	Scenario 2	Scenario 3
Egyptian vulture	0	1	1
Booted eagle	0	1	1
Lesser-spotted eagle	0	2	1
Short-toed eagle	0	1	1
Spotted eagle	0	1	1
Steppe eagle	1	1	3
Black kite	1	1	2
Black stork	1	1	1
White Stork	1	1	2
Honey buzzard	1	1	2
Montagu's harrier	1	1	1
Marsh harrier	0	1	1
Steppe buzzard	1	1	2
Great White Pelican	1	1	3

These are theoretical scores which should be validated through PCFM. At this stage, the outcomes serve as a framework for future comparisons. The following sections dive into the real outcomes from the PCFM, their gaps and needs of improvement in data collection and analysis. Several studies, like Ferrer et al. (2012) have demonstrated the lack of relationship between pre-construction assessments and the post-construction fatality monitoring. The Table 27 shows a global framework for the region, whilst PCFM section refers on a project by project basis.

The TABLE 27 suggests the cumulative effects increase the collision risk of more species when developing the so called Red-Plot. The increase of the risk between scenarios 1 and 2 (developing SCATEC and Acwa) is smaller (increase index of 1.6 = sum of the scores divided by the number of species) compared to the increase from scenario 2 to scenario 3 (increase index of 2.4).

Anyway, the above analysis should be confirmed through more studies in the southern area of the IBA before any development be allowed. In addition to the proposed cumulative analyses performed, the data from multiple tracked birds with satellite devices, confirm the use different species make of the region, occupying the southern areas of the IBA in a more proportion of time/individuals, than the northern area.

7.1 White Stork

Over years, satellite tracking technology has provided with accurate data about bird movement (Berthold et al. 2024, Fiedler et al. 2022 or Carlson et al. 2021). These authors have been the IBA widely monitoring the migration of the White stork. We got tracking data from forty eight (48) birds, in multiple spring and autumn seasons. The FIGURE 23 and FIGURE 24 show the spring and autumn tracks of the species through the GoS.

The Figures show how the heat map of the species which crosses the Red Sea flying over the WPPs, showing highest densities over the IBA but also over the Go-7 Red Zone, compared to a lower density over Acwa and even lower further north. This map only presents densities, but it may involve several hundreds of thousands of birds.

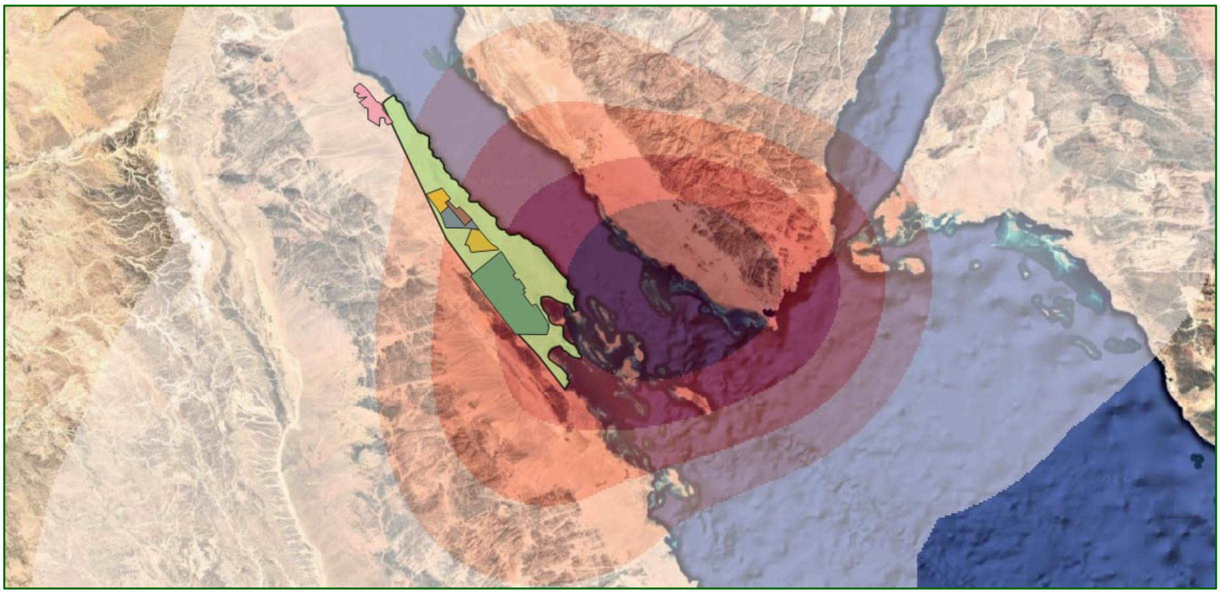

FIGURE 23 General view of the White Stork migration through the GoS. The main crossing area is the narrowest Red Sea area, which overlaps with the southernmost part of the IBA. Flights represent both spring and autumn migration.

The SWE Plot #2 and the three NREA projects is also subject of high passing. These allow us consider the flight direction recording in the datasheets. Globally at the Flyway level, the species moves in a NE-SW at all times spring or autumn.

However, when recording the direction of the flights within a 2.5 km radius around the VP, they are really microscale flights (VP project level), which could not be interpreted in relation to the Flyway but to specific conditions occurring at the time of observation at the VP. It would be more useful to know the bird numbers passing over a certain area rather to interpret flight directions when no other conditions over the area are known (e.g. thermal formations).

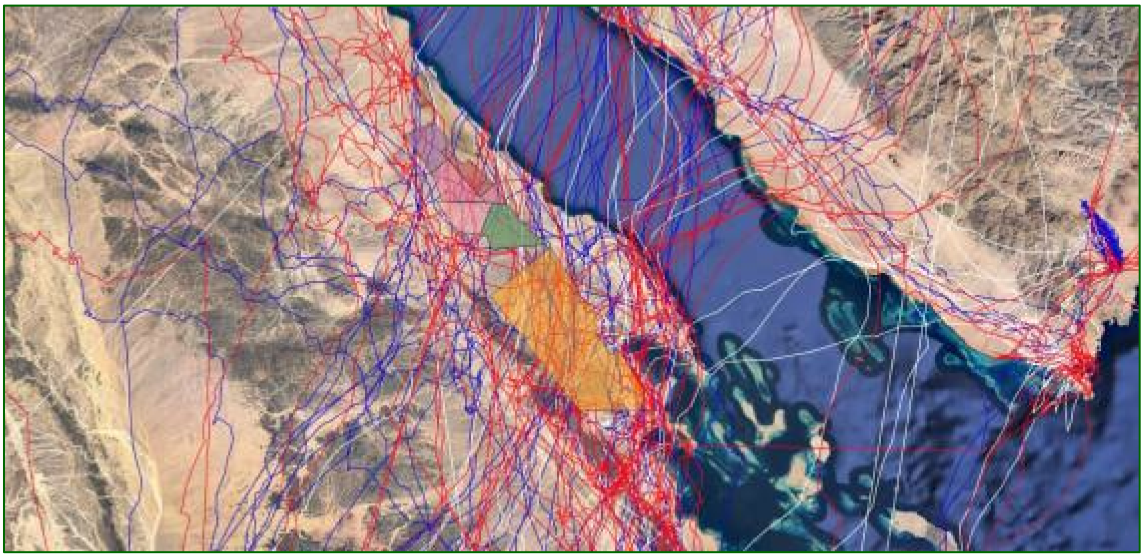

Figure 24 Closer view with the location of the windfarms inside the IBA (NREA, Masdar, SWE and GoZ-3000-7 from NW to SE) overlapped with > 20 yr. of White Stork satellite tracking data from spring and autumn migrations. Tracks in blue, red and white belong to different projects and large bird sample of > 80 individuals.

The global 2022-2023 median passing rate (birds /hour monitoring) for the SWE Plot #2 is 69.23 white storks per hour. Considering the monitoring time of a full season, this would equal to **152,237 White storks for the SWE Plot 2 in spring**, without considering confidence intervals. The upper quartile (75% of the records) was 342.85 birds /hour, providing context to the presence of large groups of storks. The European population is estimated at 224,000-247,000 pairs, which equates to 447,000-495,000 mature individuals (BirdLife International 2015). This provides an idea about the importance of the GoS for this species which comprises > 1% of the population according to the Critical Habitat criteria (EBRD, IFC 2012).

7.2 Long-legged buzzard

Despite not being a large migrant species through the GoS, the Long-legged buzzard tracking data (Friedemann G, Leshem Y, Izhaki I. 2016) provides a good example about how different is the migration strategy of different MSBs through the GoS, FIGURE 25. Instead of crossing through Gebel El Zeit IBA, they fly north to Suez. In addition to that, the track does not overlap with the wind farm developments.

The data show that flights do not follow the coast, flying from the SW in a broad front of hundreds of km wide, which gathers in Suez at the bottleneck. The Long-legged buzzard is not a species which has been recorded in large numbers at the WPPs and we excluded from the analysis. The median passing rate has been 0.25 birds per hour, which makes an equivalent of 550 Long-legged buzzards per spring season over Plot #2. The 75% quartile passing rate for the 2022-2023 periods was 0.46 birds/hour. This makes a higher equivalent number of 1,012 birds, which is unlikely given the migration pattern of the species seen below.

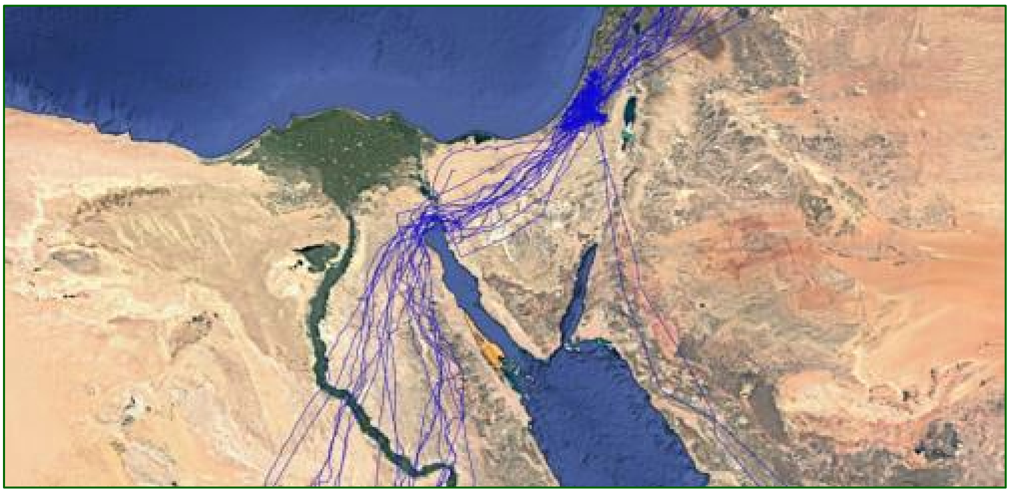

FIGURE 25 Satellite racking data for the Long-legged buzzard over the GoS. Note the different route compared to the White Stork.

7.3 Egyptian Vulture

As a third example we present the Egyptian vulture (Oppel et al. 2019), FIGURE 26. Despite the small sample size, birds follow a mix between what was presented for the White stork and the Long-legged buzzard. Birds may either cross the Red Sea at the Gebel el Zeit IBA or they can follow a further northern route along the axis of the mountains and plains overlapping or not with the WPPs depending on their locations and the route the bird/s follow in a precise year.

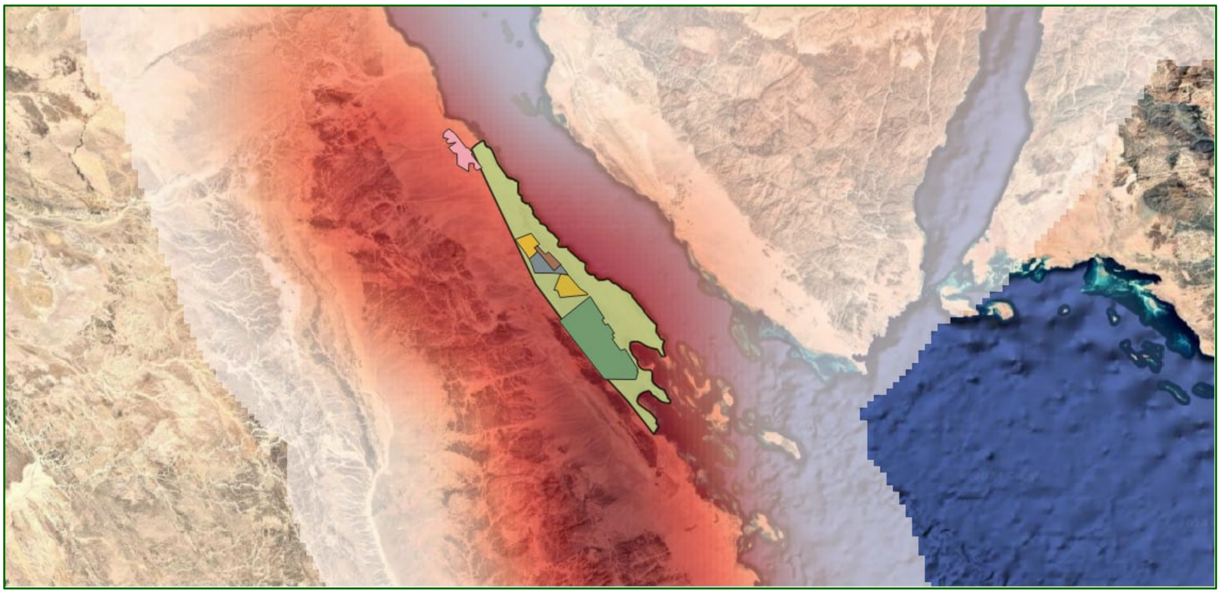

FIGURE 26 Satellite tracking of Egyptian vulture, using a mix of migration paths, either crossing from the Gebel el Zeit IBA, but also using the mountain corridor.

The species uses the mountain range for migrating with wide bands to both sides which overlap with the WPPs, even using the same migration route as the White stork over the sea.

7.4 Spotted eagles

A third different example is that of the Spotted eagles with wider migration corridors on a broad front, and different routes each year. The birds in the Figure, use a 160 km wide migration front, also with high densities over the mountain range and overlap with the WPP to some extent.

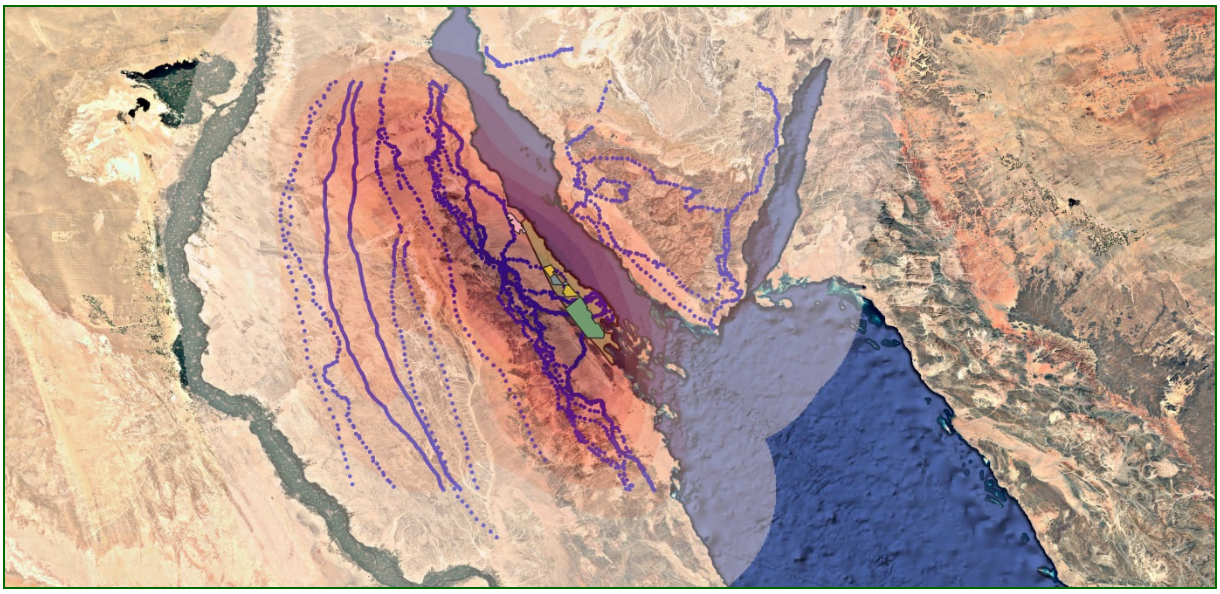

FIGURE 27 Broader view of the Spotted eagles tracking in the GoS.

7.5. Honey buzzard

Even a wider migration route and front is that of the Honey buzzard. Despite the high numbers recorded at the GoS, these numbers are a partial view of the many other migrating through Africa.

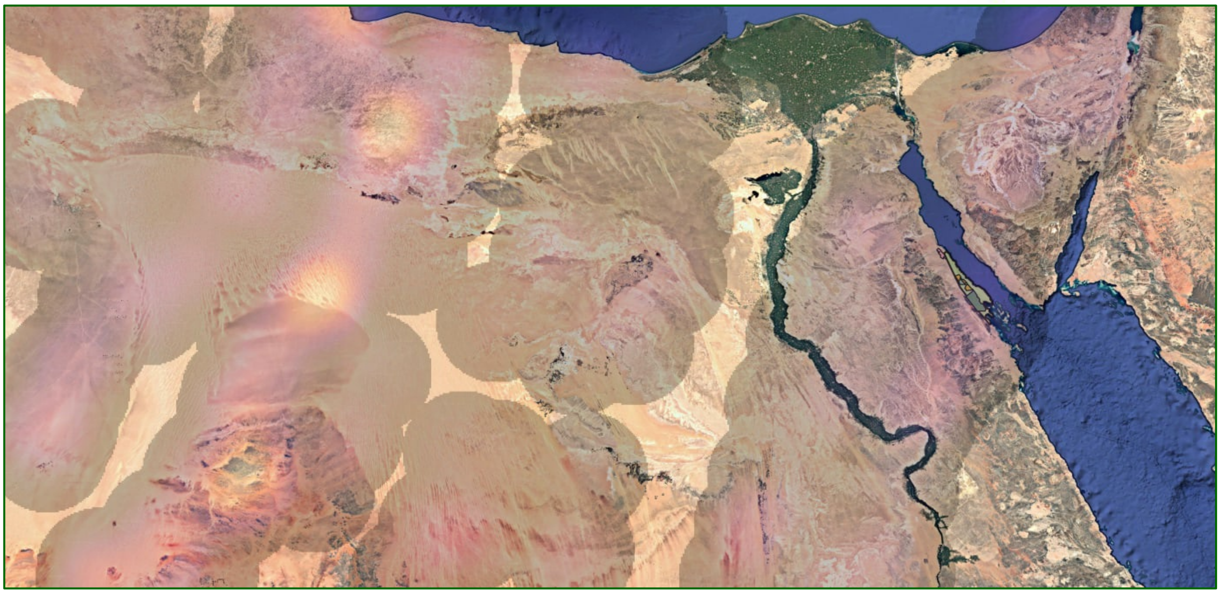

Figure 28 Broader front of the migration of the Honey buzzard in northern Africa.

Contrary to the classification by Birdlife International in the Migratory Soaring birds Tool and Avistep (2024), several MSBs are *facultative soaring birds*. This means they can migrate over the sea and their populations are not forced to fly over the mainland all the time. Among this species is the Honey buzzard. Vansteelant et al. (2017) found that none of the juveniles tracked died by drowning during the outbound migration, in contrast to the high mortality rate among larger soaring migrants that attempt long flights across the Mediterranean like the Griffon vultures. Concluding, not all the species and populations follow the same route over the same sites every season and year, so assessments should account on this (uncertainty).

8 Post-construction Fatality Monitoring (PCFM)

We must refer to the words in the Chapter 1 of the recent HANDBOOK OF POST-CONSTRUCTION BIRD AND BAT FATALITY MONITORING FOR ONSHORE WIND ENERGY FACILITIES IN EMERGING MARKET COUNTRIES by IFC, EBRD, and KfW (2023): "*Implementing a robust PCFM program during the operational phase of a WEF is critical for effective management and mitigation of biodiversity impacts. PCFM is not meant to be an exercise in just data collection but to inform implementation of a Biodiversity Management Plan (BMP) during the operations phase of a WEF, namely the effectiveness of mitigation, as prescribed in the Environmental and Social Impact Assessment* (ESIA), *which is the basis on where to develop Biodiversity Management Plans, offsets or whatever mitigation*".

This section reviews the existing PCFM programs which have been made available in the GoS. They are namely, the NREA projects (FIEM, JICA, and KfW facilities), the RGWE 262.5MW wind farm, and Lekela (West Bakr) 250 MW.

The PCFM refers mainly to the turbine fatality monitoring. However, some projects also perform OHTL fatality monitoring as well. There is a need to work with species and mitigate the impacts, which are subject to fatalities to both turbines and powerlines. For this reason, this section reviews these two when reports provide information.

8.1. RGWE 262.5 MW wind farm

For this WPP, data reviewed belong to five autumns and spring seasons each. Caused by the turbines at the RGWE 262.5 MW wind farm, there were a cumulative forty-one (41) fatalities and six (6) species colliding in the autumn seasons from 2019 to 2023, compared to thirty three (33) fatalities and eleven (11) species in the springs 2020 to 2024 (TABLE 28). These values are uncorrected, as not all the reports included a detailed number of searches performed per season neither calculated a fatality rate per turbine and year. However, it agrees qualitatively, with the observed migration patterns in the GoS, with more species crossing/colliding in spring compared to autumn which is reflected in the fatalities.

TABLE 28 Migratory bird fatalities found at the RGWE 262.5 wind farm through five consecutive spring and autumn migratory seasons.

Species Name	Scientific Name	Fatalities autumn (2019-23)	Fatalities spring (2020-24)
White Pelican	*P. onocrotalus*	1	0
White Stork	*Ciconia ciconia*	7	4
Black stork	*Ciconia nigra*	-	0
Egyptian Vulture	*N. percnopterus*	0	0
L. Spotted Eagle	*Aquila pomarina*	0	3
Spotted Eagle	*Aquila clanga*	0	0
Steppe Eagle	*Aquila nipalensis*	0	3
Booted Eagle	*H. pennatus*	0	0
Black Kite	*Milvus migrans*	0	7
Marsh Harrier	*Circus aeruginosus*	4	1
Long-legged Buzzard	*Buteo rufinus*	0	1
Steppe Buzzard	*Buteo buteo*	1	3
Honey Buzzard	*Pernis apivorus*	26	4
Common Crane	*Grus grus*	0	0
Kestrel	*F. tinnunculus*	1	5

E. Sparrowhawk	*Accipiter nisus*	1	2
Total		**41**	**33**

The unbalanced number of fatalities per species and year could mask in a long-term trend that the number of fatalities does not differ between autumn and spring. On the five year basis above, there were no significant differences in the total number of collisions (Chi square test = 0.86; p =0.35). Despite the qualitatively (number of species) differences they were not quantitatively (number of fatalities).

On the other side, the results of the OHTL's monitoring are hard to understand. The main gaps found, also applicable to the WTG surveys, are:

- At all times they refer to distances monitored as "*around X km*". The driven transects should be clearly specified and recorded with a GPS.
- Reports do not detail how many spans and pylons have been monitored each spring and autumn season, even changing the monitoring between years.
- There are no details of the pylon characteristics, if all are equal, their heights or cross-arm measurements.
- They lack the search schedule.

8.1.1 Comparison of the CRM and PCFM results

The Collision Risk Modelling (CRM) is considered as one of the approaches to make predictions on the potential species impacts a project may have once it becomes operational. It was developed in the UK (see Band et al 2007). However, to date there is no validation study available on the effectiveness and matches between the predictions and the findings. The PCFM reports provided qualitative and quantitatively real information of the existing collisions (TABLE 28). By the time of preparing this analysis, we only have complete pre and post-construction information available from the RGWE and Lekela projects, including the CRM.

For the RGWE, the Bird Migration study by Green Plus (2019), which covered the autumn 2018 and spring 2019 seasons, developed CRM calculations for both seasons, TABLE 29. In addition, the PCFM reports for the five autumn seasons 2019 to 2023 (Shodhi 2019, SENS 2020 & 2021a, and ENDECO 2022 & 2023a) and five spring seasons 2020 to 2024 (Shodhi 2020, SENS 2021b & 2022, and ENDECO 2023b & 2024) list the results of fatalities during the respective PCFM.

Thus, we extracted:

a) The CRM outputs for spring 2018 and autumn 2019 available from Green Plus (2019)
b) The fatality data regarding the MSBs species from the above cited references, TABLE 28.

To compare both datasets and a better visualization, we standardized both variables to values between 0-1, using correlation analysis to explore the relationships between CRM predictions and PCFM real findings. The TABLE 29 shows the outcomes of the CRM for both the autumn 2018 and spring 2019 seasons in the ESIA and their respective real field data in such seasons but joining.

TABLE 29 CRM output for the RGWE 262.5MW CRM based on data presented by Green Plus (2019), fatality numbers for autumns 2019-2023 (Shodhi 2019, SENS 2020 & 2021a, and ENDECO 2022 & 2023a), and springs 2020-2024 (Shodhi 2020, SENS 2021b & 2022, and ENDECO 2023b & 2024)

Species Name	Scientific Name	CRM Autumn	Fatalities (2019-23)	CRM Spring	Fatalities (2020-24)
White Pelican	*P. onocrotalus*	73.114	1	61.159	0
White Stork	*Ciconia ciconia*	0.876	7	11.288	4
Black stork	*Ciconia nigra*	-	-	0.257	0
Egyptian Vulture	*N. percnopterus*	0.002	0	0.044	0
L. Spotted Eagle	*Aquila pomarina*	0.000	0	0.198	3
Spotted Eagle	*Aquila clanga*	0.001	0	0.128	0
Steppe Eagle	*Aquila nipalensis*	0.000	0	0.890	3
Booted Eagle	*H. pennatus*	0.000	0	0.058	0
Black Kite	*Milvus migrans*	0.061	0	1.727	7
Marsh Harrier	*Circus aeruginosus*	0.094	4	0.037	1
Long-legged Buzzard	*Buteo rufinus*	0.005	0	0.090	1
Steppe Buzzard	*Buteo buteo*	0.008	1	16.14	3
Honey Buzzard	*Pernis apivorus*	6.779	26	1.892	4
Common Crane	*Grus grus*	0.000	0	0.000	0
Kestrel	*F. tinnunculus*	0.053	1	0.043	5
E. Sparrowhawk	*Accipiter nisus*	0.009	1	0.047	2
Total			**41**		**33**

Results show that <u>there is a very weak, and non-significant, relationship for the spring</u>, FIGURE 29 (r = -0.15) <u>between the CRM and the FMP</u>. What was predicted in the ESIA did not reflect afterwards in the field data collected during the PCFM. This is not new, and was highlighted already by Ferrer et al. (2012).

In spring, the species with the higher predicted fatalities was the Great white pelican, which in turn had none, and species with a lower collision risk like the, the kestrels (5), and the Black kite (7), have more than those predicted, nearly to be zero, FIGURE 29.

For the <u>autumn, results were similar to spring, a weak and lack of significant relationship between CRM predictions and FMP findings</u> (r =0.01), FIGURE 30. The ESIA predicted higher risk for the White pelican but just one fatality occurred, and e.g. a lower risk for the Honey buzzard (26 fatalities), which outnumbers any other species.

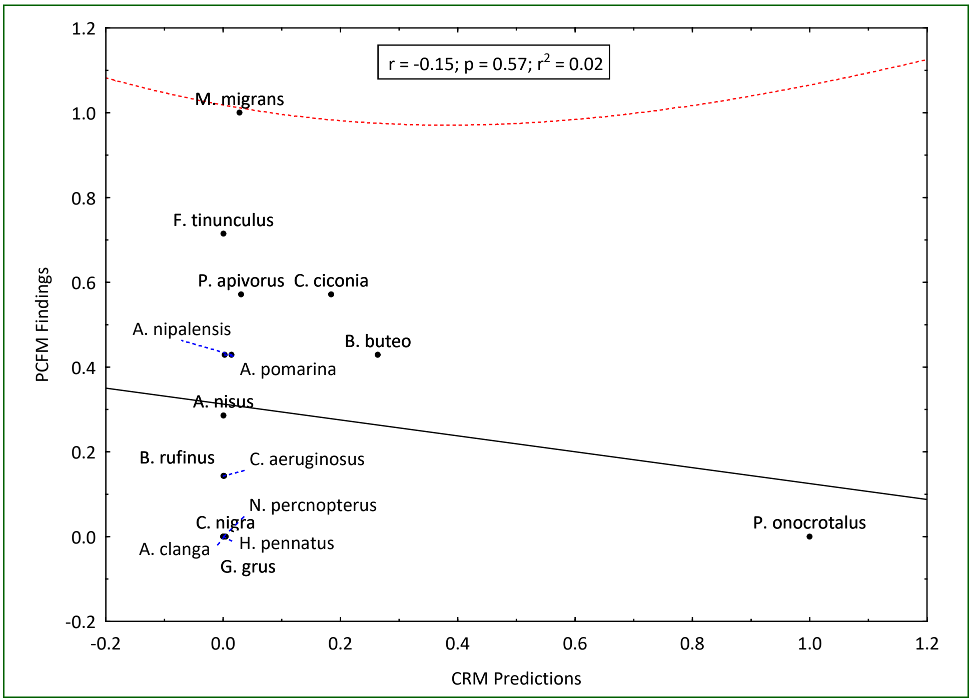

FIGURE 29 Relationship between the PCFM findings and the CRM predictions in the ESIA for the RGWE 262.5MW in spring.

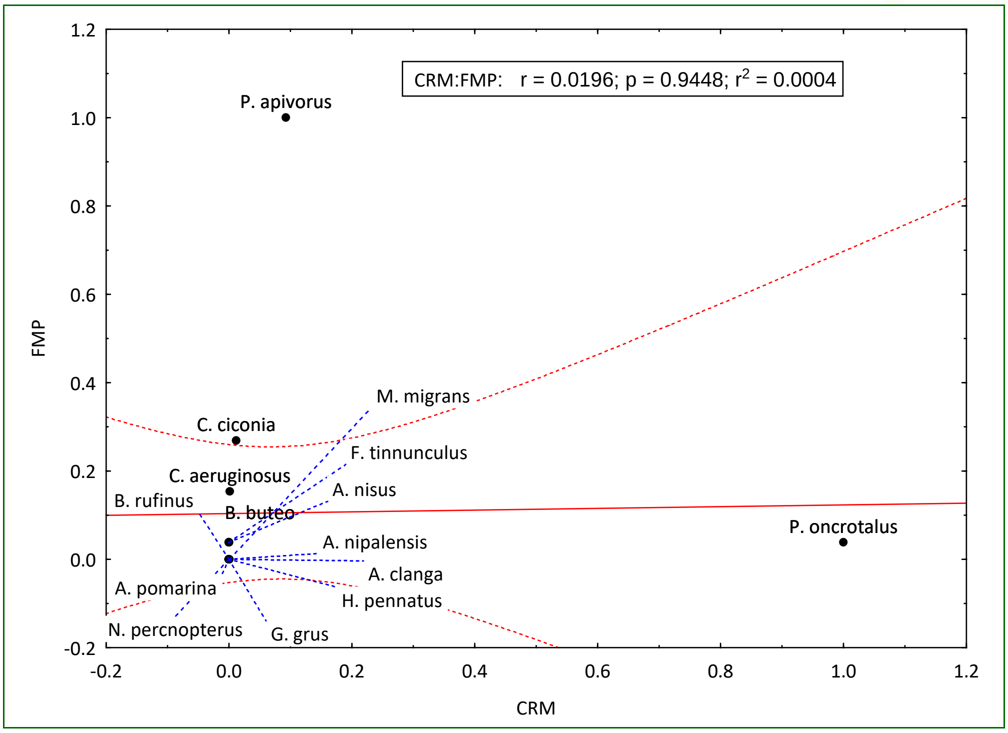

FIGURE 30 Relationship between the PCFM findings and the CRM predictions in the ESIA for the RGWE 262.5MW in autumn.

The RGWE 262.5MW project is the first on providing long-term results from the pre and post construction fatality monitoring periods. Further projects will become operational soon, and a careful review of the pre and post assessments is required to validate how the studies were done but above all their predictions against real findings.

Criticism could come saying that not all the fatalities are found as to make these relationships, which it is true, but the fatalities found are a representative sample of all the existing ones in the project so we do not need to use the absolute numbers but an index of abundance, the reason of using the ranks with the standardized values. In addition, the landscape is mostly comprised of bare ground allowing good visibility to the observers. Finally, it could be argued that the SDOD is affecting the above results, allowing a reduction of the CRM predictions. Preliminary results –data under analysis- seem to show there is no relationship between SDOD and PCFM findings.

8.2. West Bakr Lekela 250 MW wind farm

For the West Bakr Lekela wind farm we reviewed three autumns (ENDECO 2021, 2023, and 2024a) and another three spring ones (ENDECO 2022, 2023, and 2024b). At the wind turbines, and during the three springs eight (8) fatalities of four (4) species were found, whilst in the autumns, there were forty four (44) MSBs fatalities of six (6) species (TABLE **30**). Here data are significantly different, between spring and autumn (Chi square test = 24.92; $p < 0.001$).

TABLE 30 Fatalities found during the PCFM at West Bakr-Lekela 250 MW wind farm for three consecutive autumn (2021-2023) and spring (2022-2024) seasons.

Species	spring 2022-24	autumn 2021-23
Black Kite	4	0
Common kestrel	1	1
Honey Buzzard	1	37
Steppe eagle	2	0
Marsh Harrier	0	3
Montagu's Harrier	0	1
Sooty Falcon	0	1
White Stork	0	1
Total	**8**	**44**

The number of species colliding in autumn could be higher compared to spring, but given the short PCFM yet it is risky to assume this. What seems clear is the higher number of fatalities for the Honey Buzzard, as also recorded for the RGWE wind farm.

Regarding the OHTL, the reports fail in the same points as stated in the previous section, which need of improvement, see the conclusions). In the final report, including the autumn seasons, we will analyze the potential effect of the bird deterrents installed on the ground wire at the end of autumn 2021.

8.3 Spatial distribution of the fatalities (only MSBs)

For this section we considered all the fatalities of MSBs excluding the Marsh and Montagu's harriers, Falcons of whatever species, and the "kestrels". All of the fatalities have been plotted and Kernel polygons calculated for both spring and autumn with all the fatalities pooled.

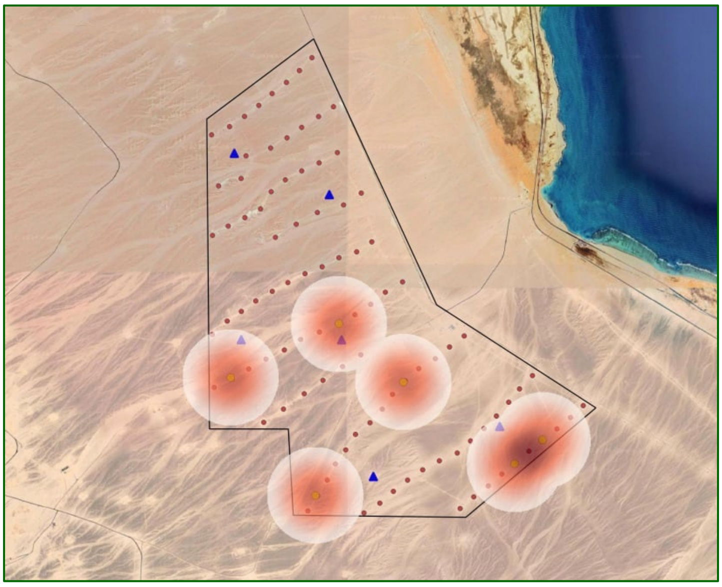

FIGURE 31 Spatial distribution of MSBs fatalities at the West Bakr Lekela wind farm; all spring data pooled

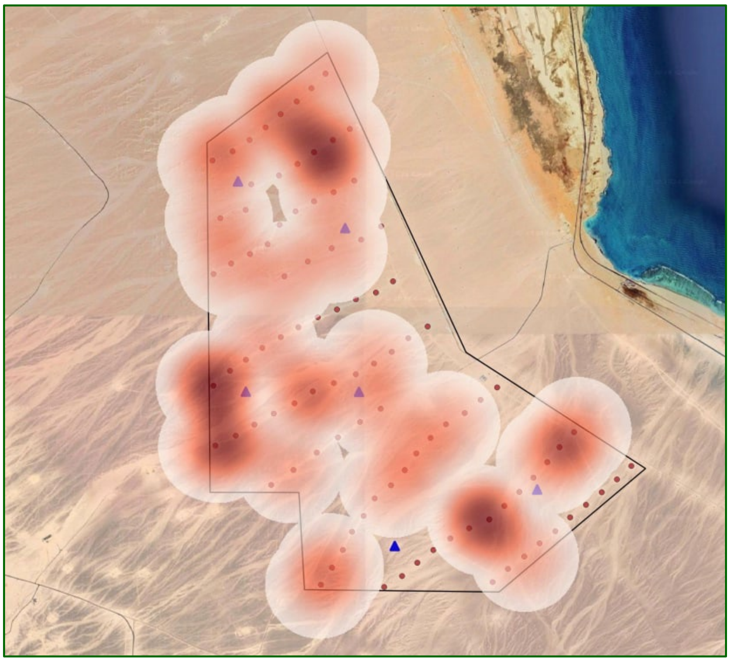

FIGURE 32 Spatial distribution of MSBs fatalities at the West Bakr Lekela wind farm; all autumn data pooled

The FIGURE 33 and FIGURE 34 represent the same analyses for the RGWE WPP.

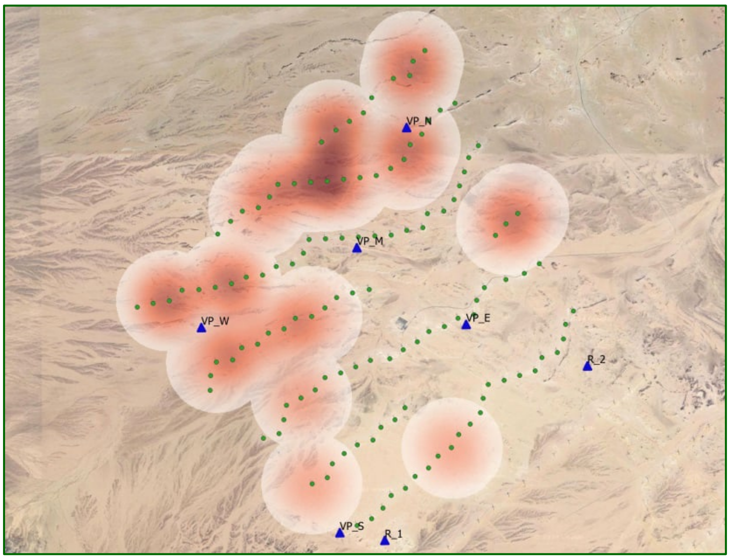

FIGURE 33 Spatial distribution of MSBs fatalities at the RGWE wind farm; all spring data pooled. The hotspots are near turbines which are far from the VPs, suggesting observers are not able of detecting the birds approaching.

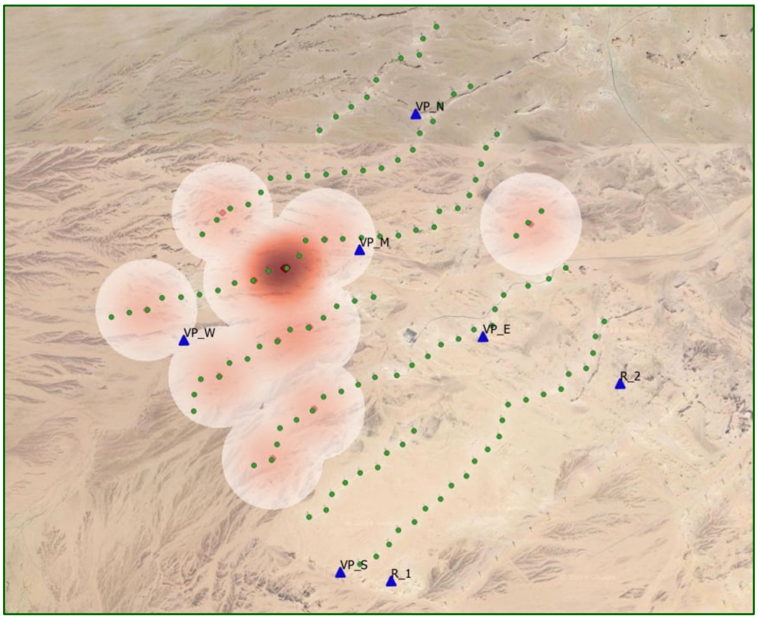

FIGURE 34 Spatial distribution of MSBs fatalities at the RGWE wind farm; all spring data pooled. Hotspots as for the previous Figure.

The result of these mapping exercises suggests the following:

- DIFFERENT PATTERNS OF FATALITIES BETWEEN PROJECTS AND SEASONS: Both wind farms exhibit different patterns in the distribution of the fatalities in spring. It appears as if the geographical location of each project affects the species colliding.
  At WBK Lekela, in spring fatalities occur at the southern "boundary", but not in the middle or northern turbines. In RGWE WPP they are concentrated in the NW and N parts of the facility. For the autumn season almost the entire Lekela had hotspots of fatalities, whilst RGWE expanded the "area of impacts" to the entire northern boundary. In autumn, this area reduced its extension although.
  These maps would need of updates as more PCFM seasons are completed.

- POTENTIAL EFFECT OF THE BIRD OBSERVERS IN THE FATALITIES: In other words, the observers would be unable of detecting all the migratory birds if using a 2.5 km radius for monitoring and potentially shutting-down the turbine(s) in case of meeting any of the criterions. With the purpose of going deeper into this question, we measured the distance (in m) between the turbine at which a large MSB fatality was found, and the nearest VP. As the overall number of fatalities (spring + autumn) was low when considering the separated projects /seasons for an analysis, we only considered the fatalities as a single dataset.

8.3.1. Bird records and Observers detection distance, Vantage Points per project

WPP assessments use the so called "Best industry practices", among which it is the CRM, mostly based in Band et al. (2007), but also including later updates (NatureScot). The VP monitoring is the basis of the assessment; the observers record bird activity up to a distance of 2.5 km around the observation point. However, THE ENTIRE wind farm studies worldwide lack of a basic assumption in the analyses, which it is included in the monitoring guidelines (Section 3.8.2.1 in SNH 2017), as "*Detectability of birds to human observers declines with distance*."

There is a chance of detecting a lower number of birds as distance increases from the observer (VP) and up to the 2.5 km radius. A flock of birds will have a higher detectability compared to a single individual; a bird may be more visible with the airspace in the background than when flying against the landscape, and also the bird size matters; finally, observers can also have influence in the detection rates, being some better than others. This undermines the data collection, but especially the detection distance results in lower numbers recorded against the real numbers crossing.

The above refers to the existing data from the pre-construction monitoring studies and the completion of the databases needs of a review about the methodology on how detection distances are recorded. It is not possible to detect birds –either groups or solitary individuals- at distances of >2, 3 or 8 km from the VPs as the databases show. The preliminary analyses on the detection distance for selected species show unexpected results which need from further elaboration.

TO IMPROVE: Data collection and fill in the databases but especially related to detection distances and double counts.

A second point is the distance at which fatalities have been recorded related to the VPs used for the SDOD. Both RGWE and WBWF have five Vantage Points from which observers at least control for the SDOD (no databases have been provided about bird monitoring despite they may exist). The Table below shows the average distances and confidence intervals, minimum and maximum for a sample of fatalities belonging to these two operational wind farms. The CHA and CEA studies have set thresholds for fatalities and also set the criteria on which turbines should be shut-down.

We selected those fatalities belonging to species included in the SDOD criteria protocol: the Honey Buzzard, Black kite, Steppe eagle, White stork, and spotted eagles. The TABLE 31 and FIGURE 35 show the information about at what a distance a fatality has been found related to the nearest Vantage Point which would perform a SDOD.

TABLE 31 Average distances of bird fatalities found to the nearest Vantage points. Data also includes confidence intervals, minimum and maximum distances.

	season	Average distance	C.I. -95%	C.I. +95%	N	Min. Dist.	Max. Dist.
WBWF	Sp	913.85	595.95	1231.75	7	330	1425
	Au	1178.69	1000.53	1356.85	36	474	2490
RGWE	Sp	1335.7	1093.75	1577.74	24	341	2500
	Au	1442.57	1096.84	1788.30	14	570	2325

The Table suggests that the distances, at which the Vantage points in charge of SDOD are, quite large, not allowing the protocol to be fulfilled correctly. The distance between the observer and the turbines is far enough for a bird to cross through whilst being undetected.

The other site in the world within a Flyway with bird observers for SDOD is the Strait of Gibraltar. There are 65 wind farms and nearly 1,000 operational turbines. The distance at which observers record and detect birds related to the towers is smaller, with people not beyond 300 m from the area to cover.

The following Figure has the percentages of fatalities between 500 and 1500 m highlighted. They represent between 68-73% of all fatalities. By increasing the number of observers the overall number of fatalities may be reduced with measurable gain in terms of “birds saved”.

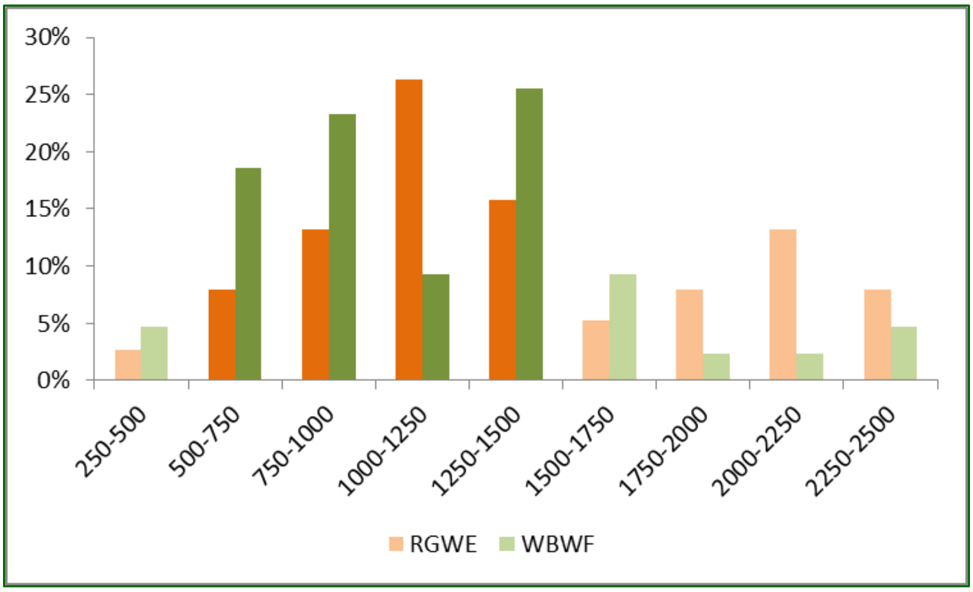

FIGURE 35 Distribution of distances to the nearest Vantage Points (% of fatalities) at RGWE and WBWF operational projects.

TO IMPROVE:

- Data collection and reporting of individual fatalities, information and analyses in the reports.
- Better mitigate the fatalities by means of increasing the number of observers, reducing the distances at which they can decide to stop the turbines or not.
- A deeper review of the SDOD databases to get a better understanding of the information.

- Monitoring of powerlines should be improved but systematically (Search frequency) to provide realistic information about their impact under such circumstances. **Clear definition of each powerline monitored (distance, pylon designs and heights, if in parallel or isolated ones).**

- **The monitoring of powerlines should be mandatory immediately after a SAND STORM as to clearly quantify the real impacts.**

- Fatality and SDOD monitoring team should keep contact at all times to improve the results of the monitoring and adoption of mitigation measures.
- It is necessary to make an urgent recommendation for the existing, planned and future developments, based on the PCFM data reports and data provided: THE FATALITY DATA COLLECTION AT OPERATIONAL WIND FACILITIES AND OHTLs REQUIRES FROM AN URGENT IMPROVEMENT –from the field data collection, analysis, and reporting- AS TO ALLOW A PROPER ANALYSIS AND INTERPRETATION OF THE CURRENT IMPACTS (e.g. to get metrics appropriate for comparisons). This applies to all projects reviewed, either developed through NREA or any Financial Institution. They lack of an external wind and wildlife expert supervisor or expert, with a proper background on data collection and statistical analysis before the reports being approved.

8.4. NREA wind farm projects: KfW, JICA, FIEM

Regarding the NREA projects the information provided was not included in any PCFM reports, but just a list of fatalities without further information about e.g. the dates or location (distance, orientation) neither coordinates nor photos. All the reports available relate to the SDOD procedures and bird monitoring. Further data have been gathered from Riad (2022) who collected eighty two fatalities belonging to the spring seasons at both turbines and OHTL's in the Eastern Desert between 2019 and 2022.

The FIGURE **36** shows the percentage of fatalities after Riad (2022). The unsystematic survey under powerlines resulted in a higher proportion of birds colliding compared to the wind turbines for the White Stork, and also the presence of congregatory species like the Black kite, Steppe and Honey buzzards.

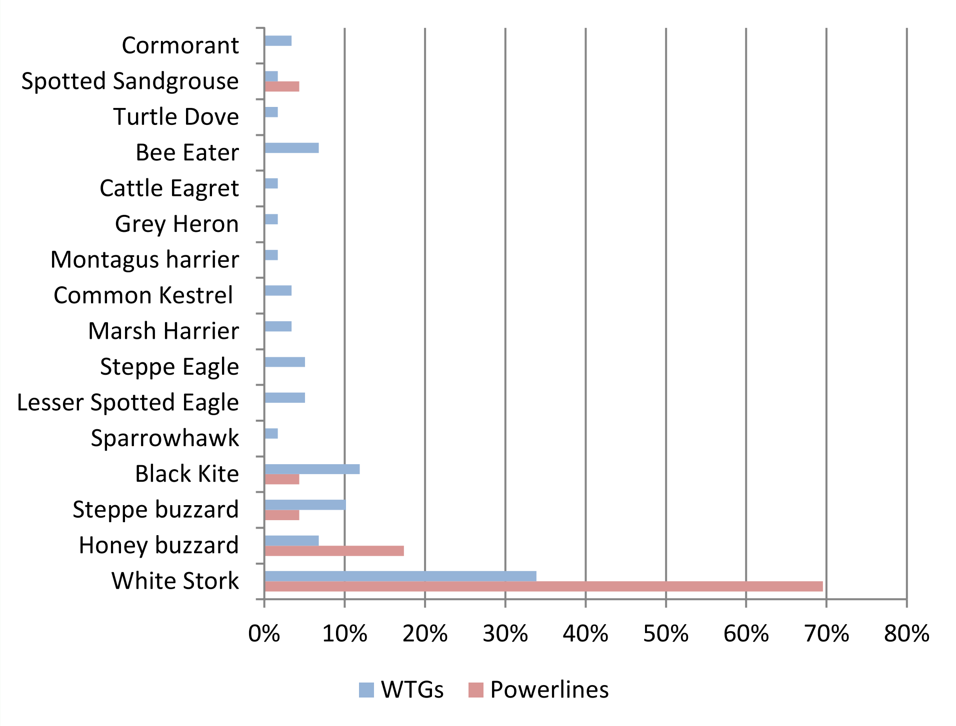

FIGURE 36 Proportion of bird fatalities at both powerlines and wind turbines (NREA projects) between March 2019 and March 2022 (only spring season), after Riad (2022).

The three NREA wind farms did not reached operational phase at the same time, and by the time of writing this report, we do not know the exact dates of the first monitored season at each facility, except the KfW wind farm was the first to start operations (Riad 2022). Data provided from the PCFM between 2015 and 2023, without reviewing the reports, resulted in forty six (46) fatalities of twelve (12) species of MSBs, TABLE 32 and TABLE 33.

TABLE 32 Number of MSBs fatalities per NREA wind farm facility between 2017 and 2023. See text referred to data accuracy

Spring season	FIEM	JICA	KFW	Total
2017	-	-	8	8
2018	-	-	7	7
2019	-	-	2	2
2020	2	0	7	9
2021	0	0	0	0
2022	2	4	7	13
2023	2	3	2	7
Total	**6**	**7**	**33**	**46**

TABLE 33 List of fatalities reported sorted by species and percentages over the totals reported for the spring season.

	FIEM	JICA	KFW	Total	%
Black Kite		2	4	2	4.35%
Booted Eagle			1	1	2.17%

Eagle sp.			1	1	2.17%
Harrier	2		1	3	6.52%
Honey Buzzard		2	2	4	8.70%
Kestrel sp.		1	1	2	4.35%
Lesser spotted eagle			1	1	2.17%
Levant Sparrowhawk			1	1	2.17%
Marsh Harrier		1	1	2	4.35%
Pallid harrier			1	1	2.17%
Sparrowhawk			2	2	4.35%
Steppe Buzzard			3	3	6.52%
Steppe Eagle	2		2	4	8.70%
White Stork	2	1	12	15	32.61%
Total general	**6**	**7**	**33**	**46**	

We finally compared the data from Raid (2022), between March 2019 and May 2022, versus the data provided for this study for the same time period. Raid (2022) reported more species (ten versus seven) and individuals (forty nine -49 versus twenty three -23), including the three EN Steppe eagles. This is a mismatch which should not happen, and would require further reports and detailed information to review. Thus, we must be cautious about potential data skewness based on limited information reported.

For the powerlines, as we have only received fatality numbers but not precise information as for the Lekela-West Bakr or RGWE WPPs any analysis we could make is just a guess.

8.5 Additional conclusions

Overall, the review of the pre and post construction monitoring would require from improvements which are essential in the near future under any potential scenario to develop projects within the red zone according the DECON study (2007) or the current defined " G_7_Red Plot".

There are initiatives to develop strategic studies across the region. However, there are key points which are mandatory in the near future. For that and before any bird counts, there should be a careful planning which should follow 1) what we do need to answer? 2) What are the best scientific approach and data needs? Otherwise, we can continue counting birds by means of VPs without focusing in key topics which may help to understand if additional projects are feasible, to improve the existing ones, and mitigate accordingly before jumping into offsetting. This recommendation is also for potential lenders, government of Egypt, and consultancies.

The appropriate approach will assist in a better planning or the need to keep safe zones fre of turbines or under strict conditions for preserving the MSBs.

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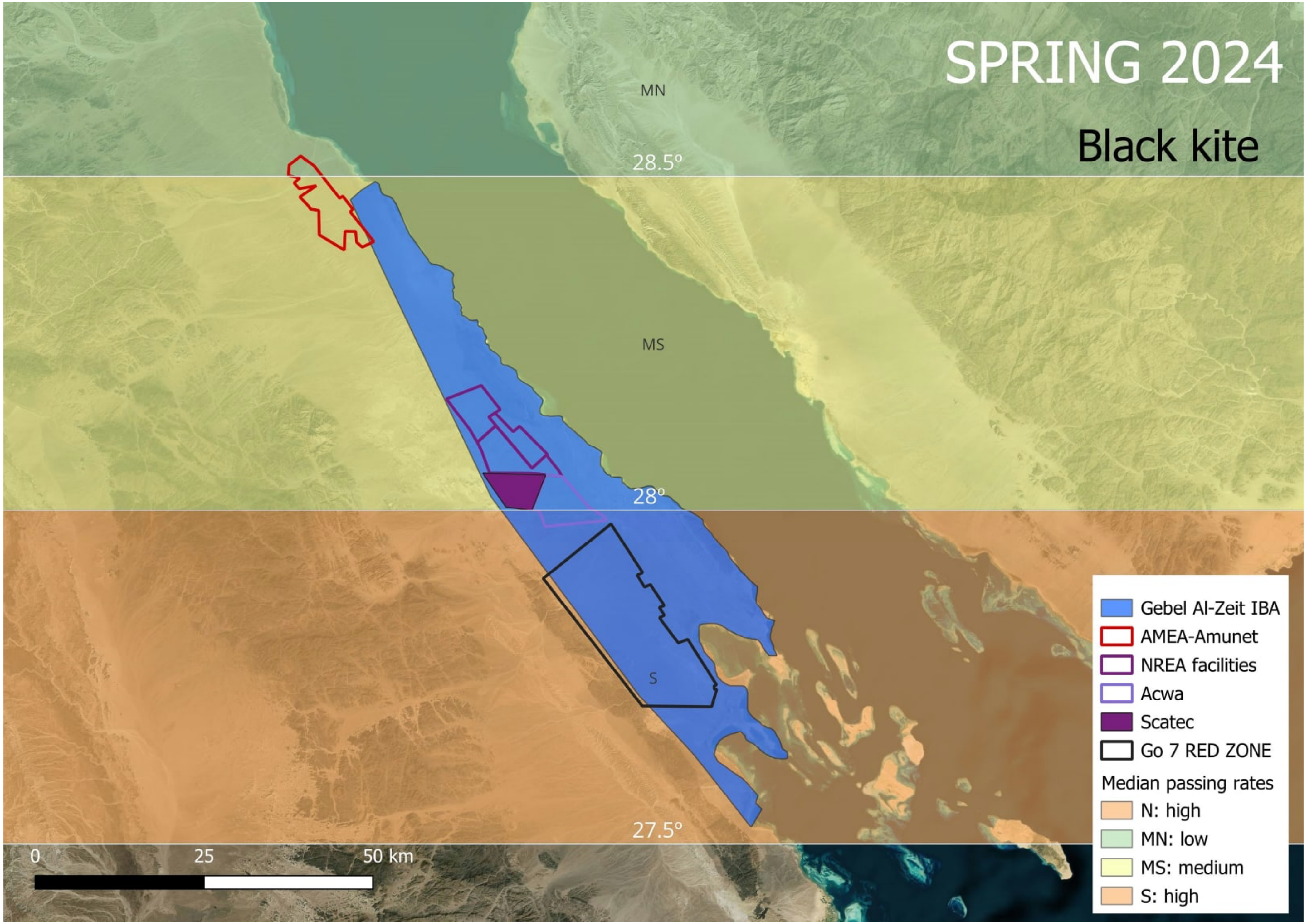
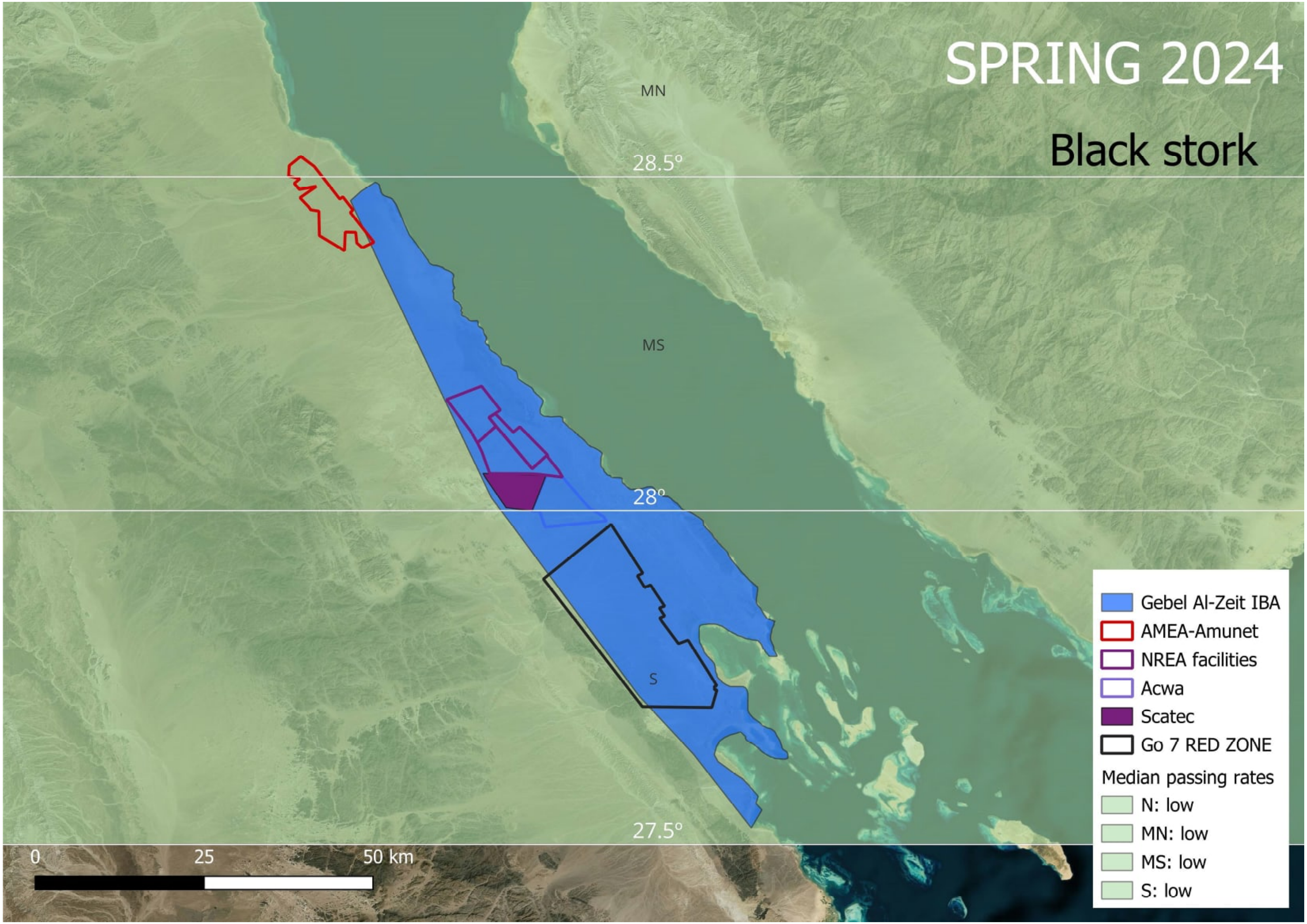
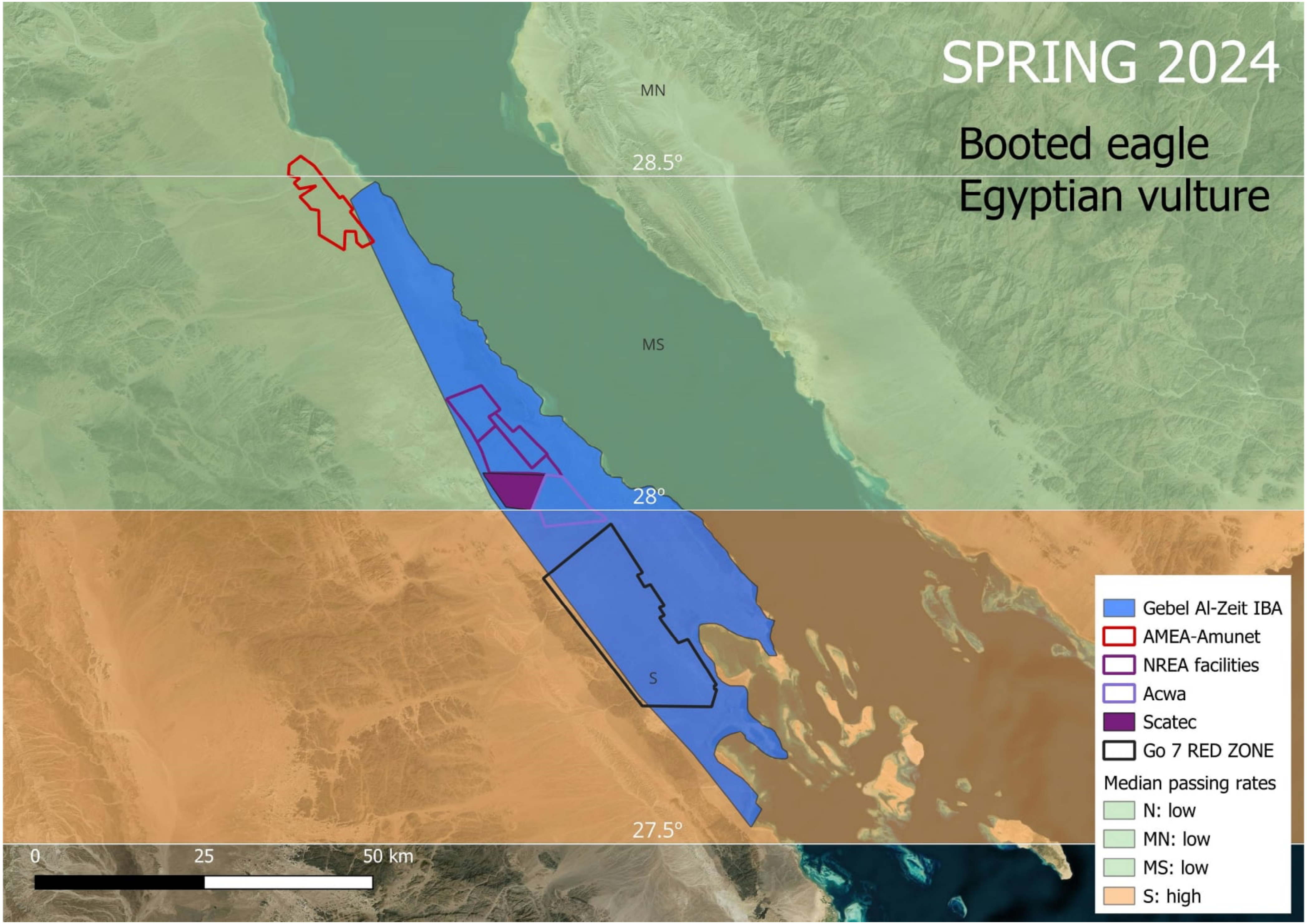
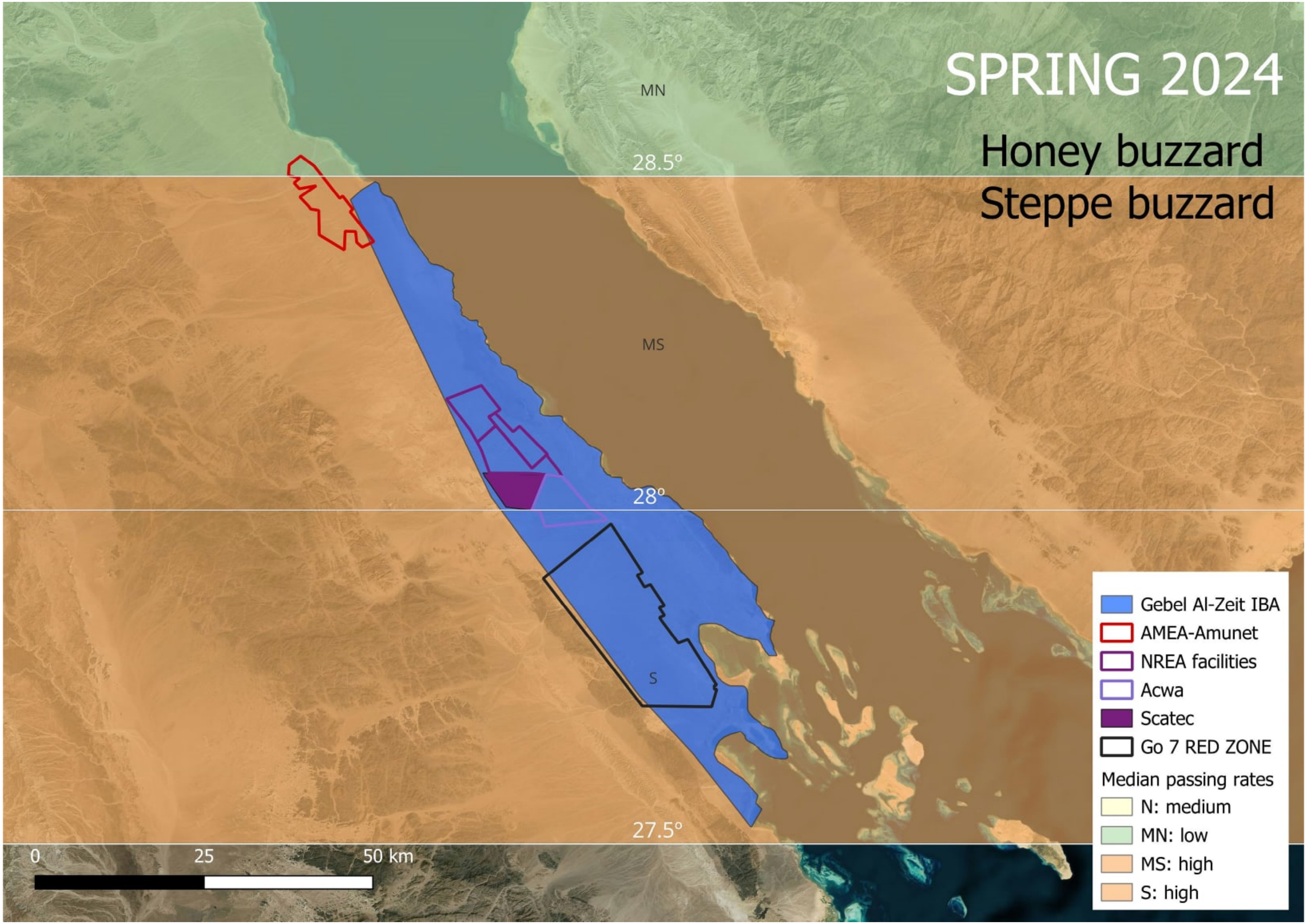
Annex I

- MAPS PRODUCED FROM THE DATA IN SECTION 3.1.4 , SPRING AND AUTUMN SEASONS

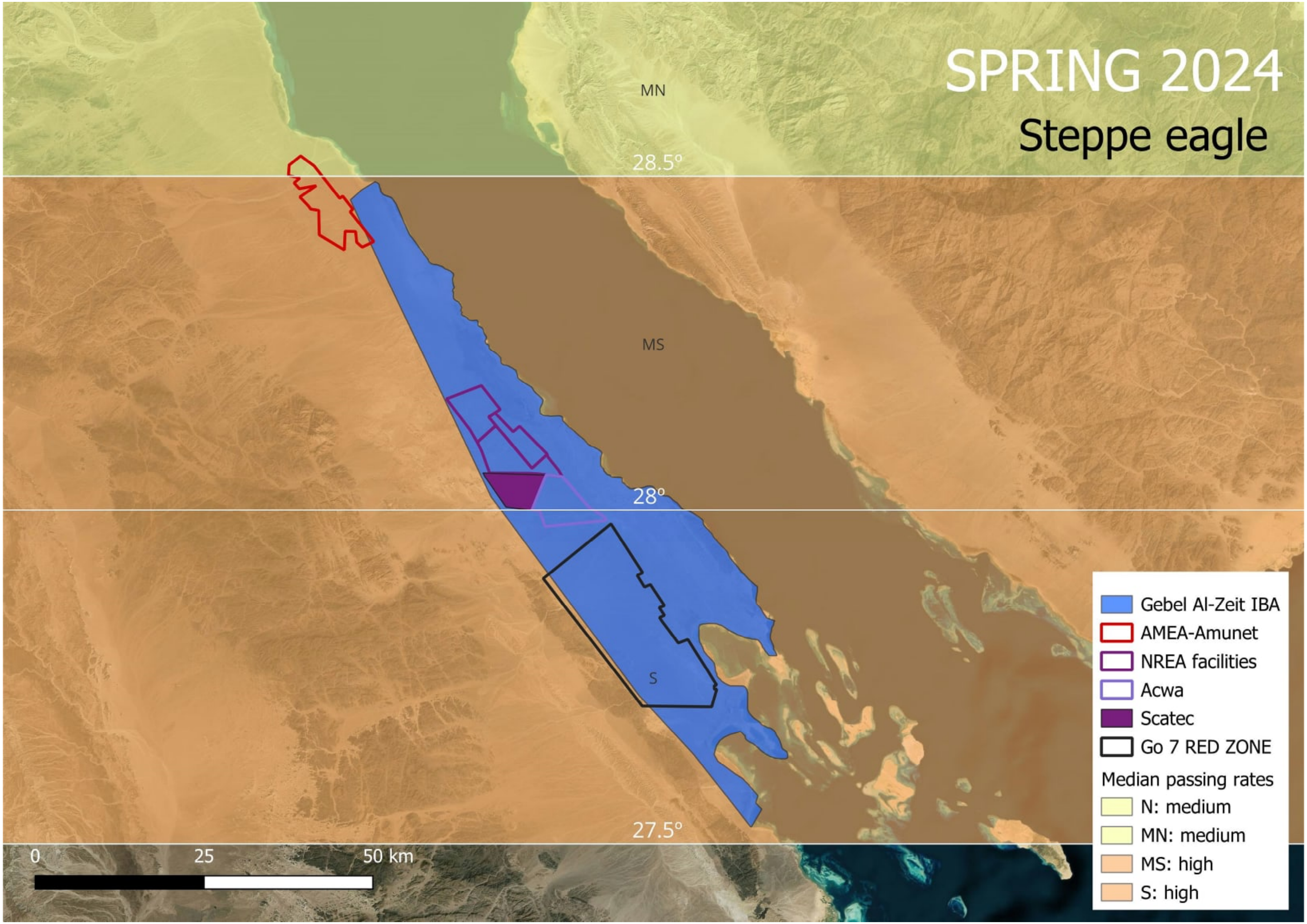

SPRING 2024
Black kite
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: high
MN: low
MS: medium
S: high


SPRING 2024
Black stork
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: low
MN: low
MS: low
S: low

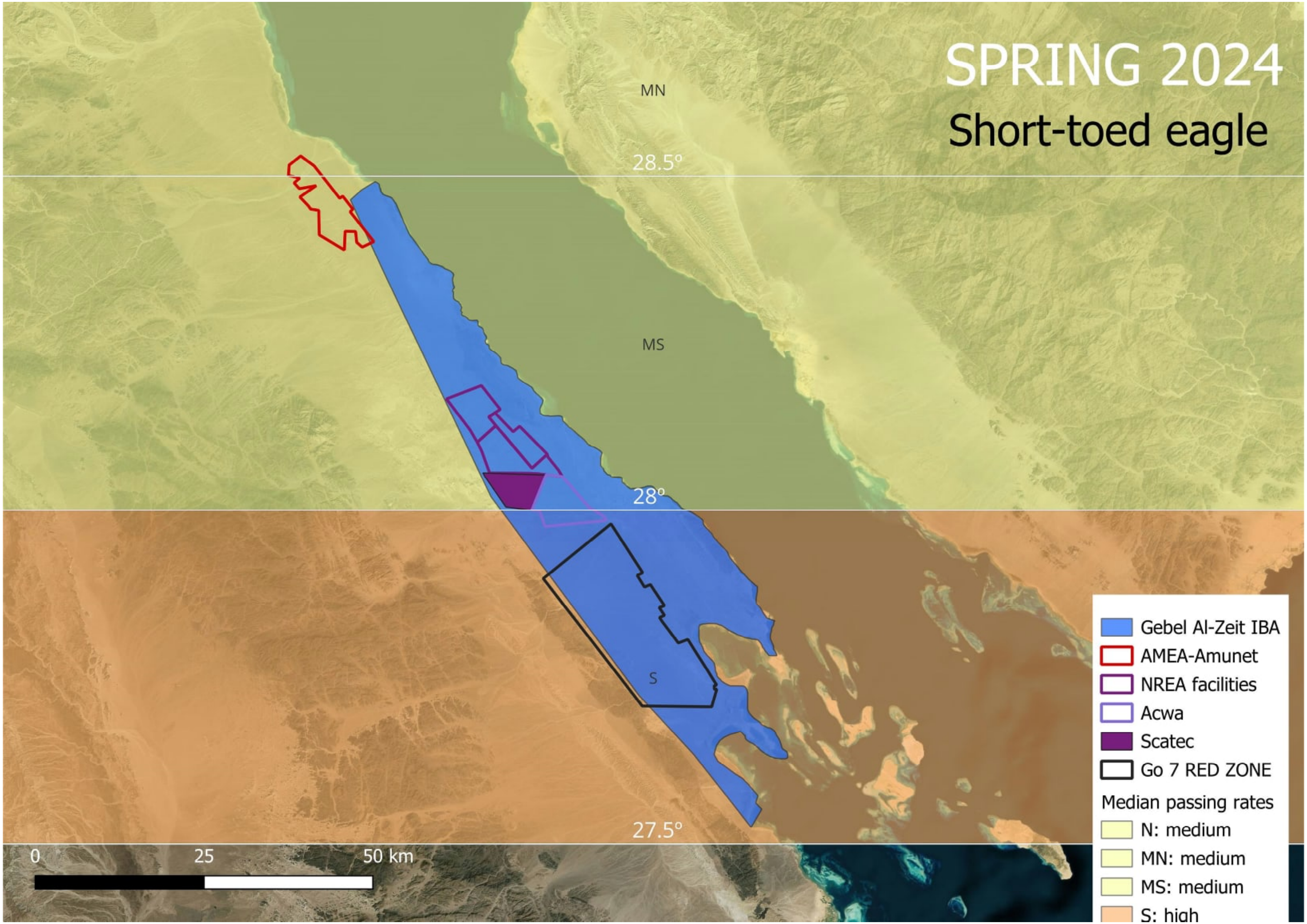

SPRING 2024
Booted eagle
Egyptian vulture
MN
MS
S
28.5°
28°
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: low
MN: low
MS: low
S: high

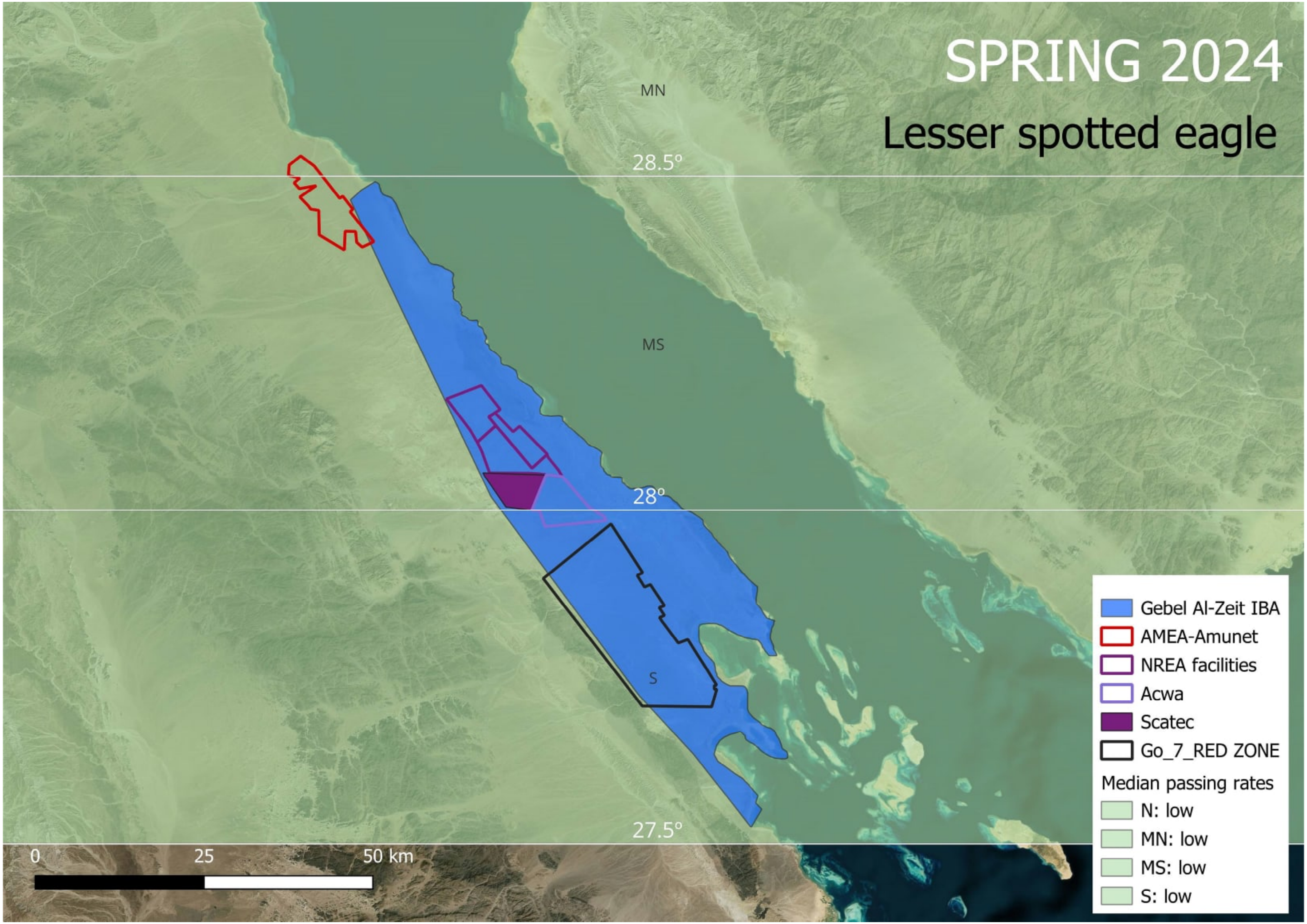


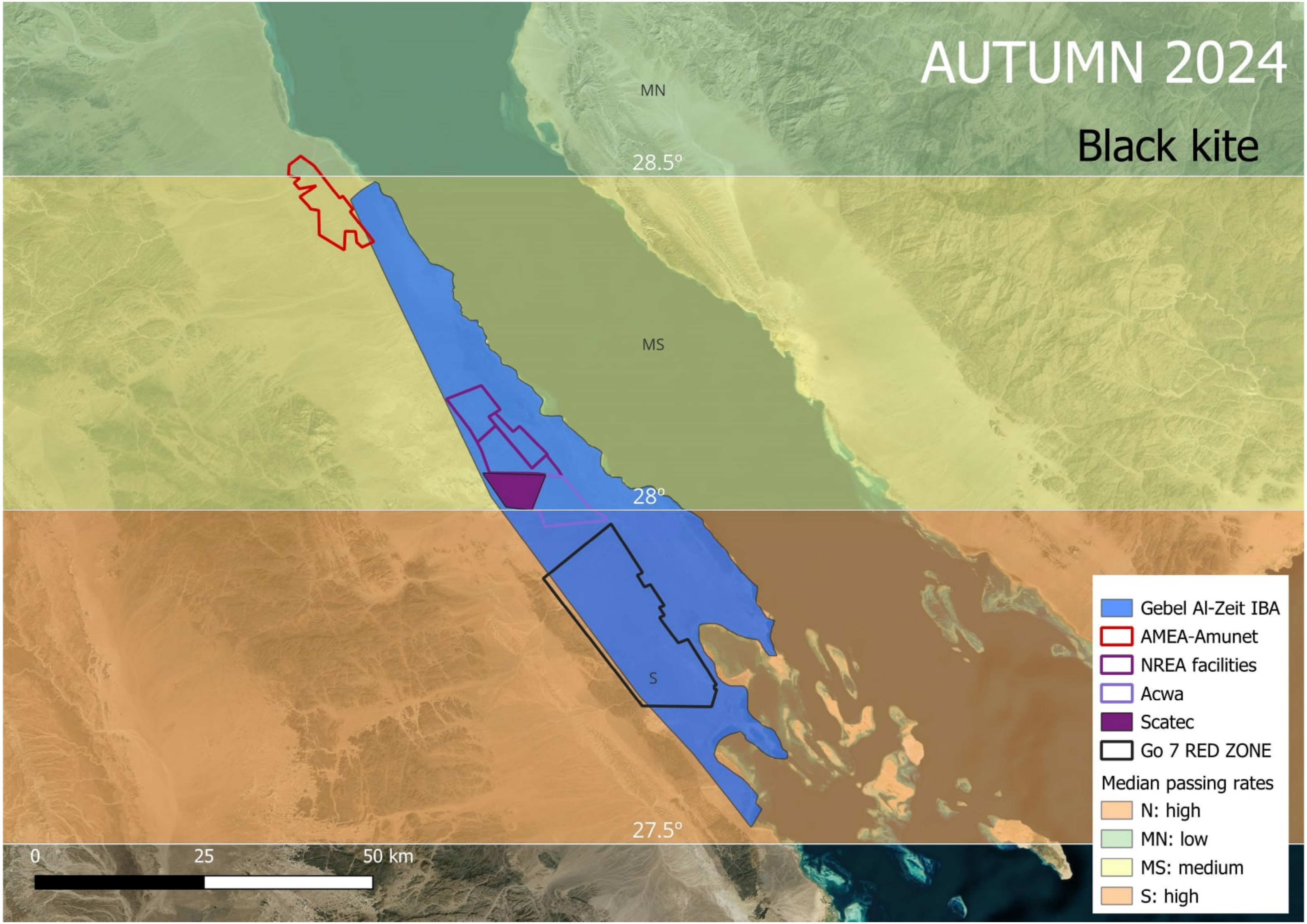
SPRING 2024
Honey buzzard
Steppe buzzard
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: medium
MN: low
MS: high
S: high

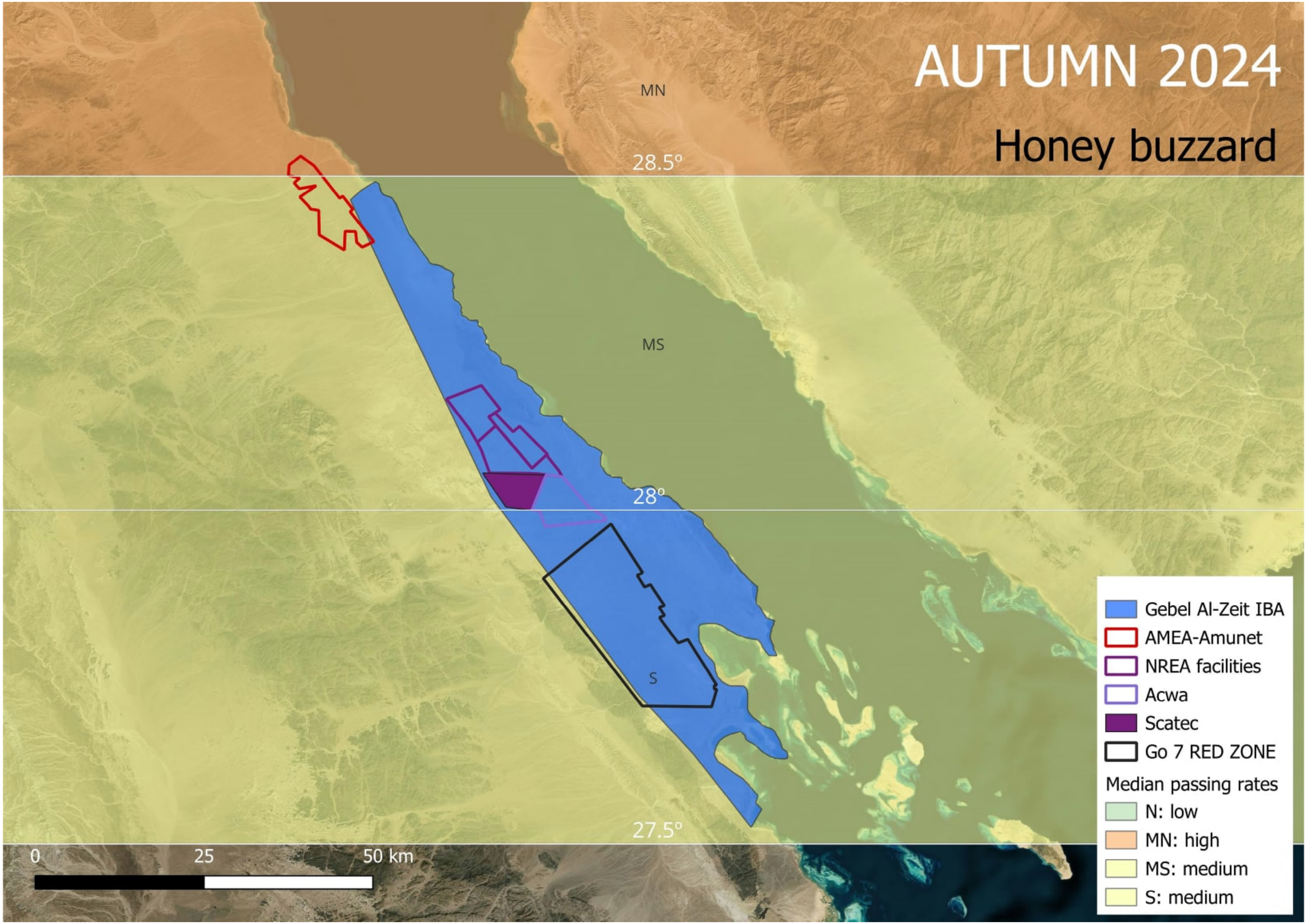


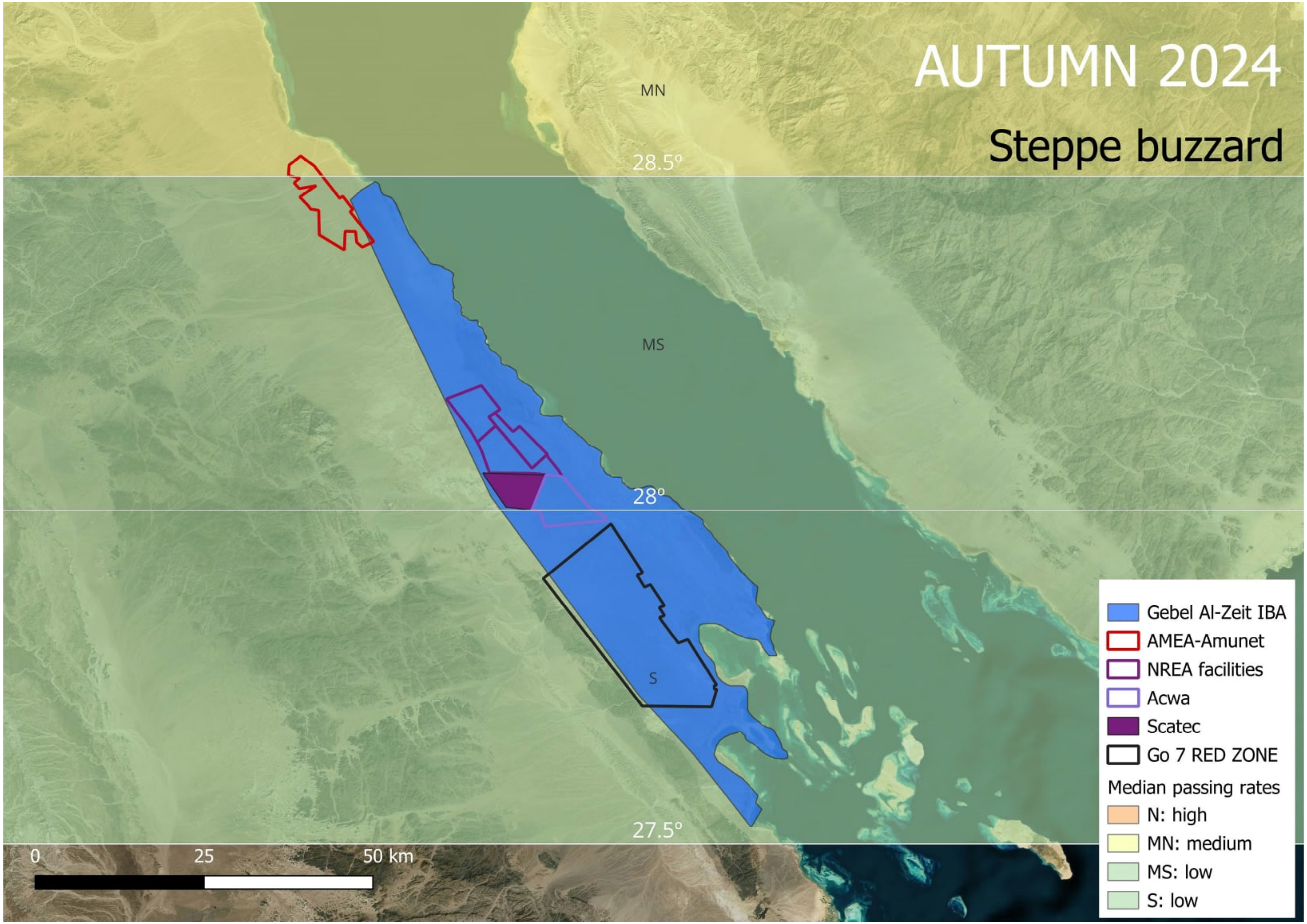
SPRING 2024
Steppe eagle
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: medium
MN: medium
MS: high
S: high


SPRING 2024
Short-toed eagle
MN
MS
S
28.5°
28°
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: medium
MN: medium
MS: medium
S: high


SPRING 2024
Lesser spotted eagle
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go_7_RED ZONE
Median passing rates
N: low
MN: low
MS: low
S: low


AUTUMN 2024
Black kite
MN
28.5º
MS
28º
S
27.5º
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: high
MN: low
MS: medium
S: high


AUTUMN 2024
Honey buzzard
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: low
MN: high
MS: medium
S: medium


AUTUMN 2024
Steppe buzzard
MN
28.5°
MS
28°
S
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet
NREA facilities
Acwa
Scatec
Go 7 RED ZONE
Median passing rates
N: high
MN: medium
MS: low
S: low

Annex II

- MAP PRODUCED FROM THE DATA IN SECTION 4.2, SPRING SEASON

Results which are the same for several species have been grouped in a single one

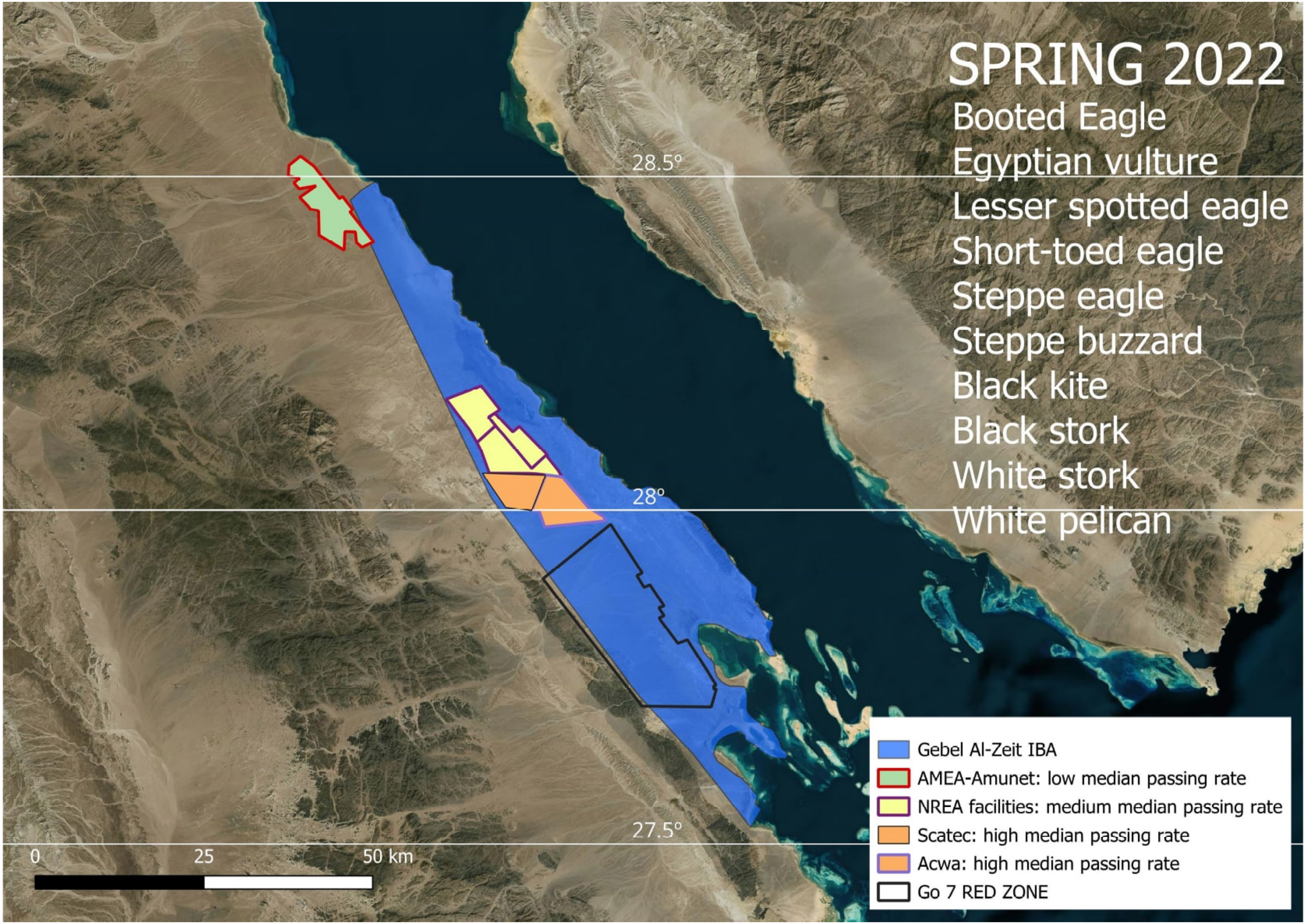
Maps for the autumn season have not been produced due to the lack of data for 2022 at the Amunet site.

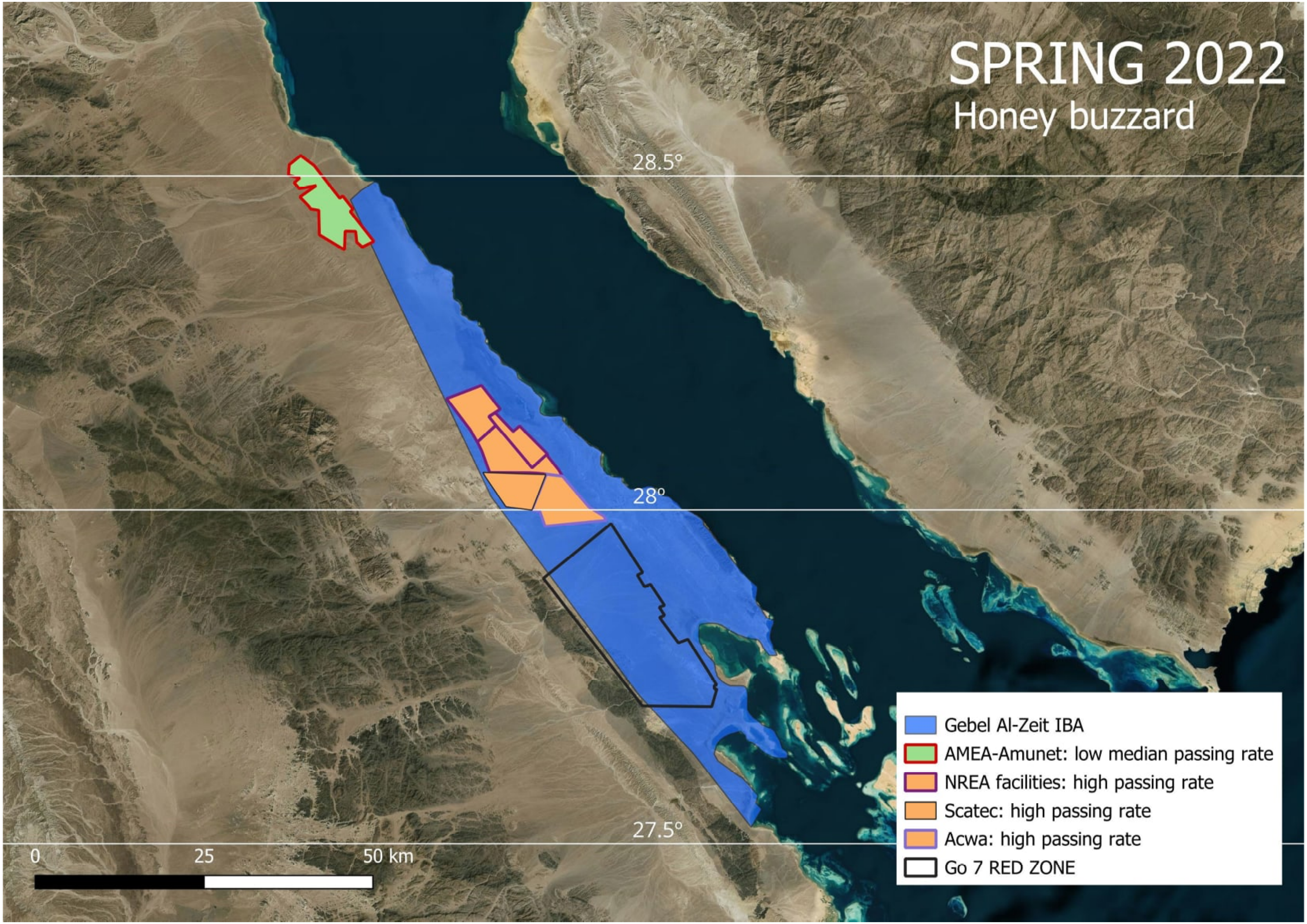
Annex II

- MAP PRODUCED FROM THE DATA IN SECTION 4.2, SPRING SEASON

Results which are the same for several species have been grouped in a single one

Maps for the autumn season have not been produced due to the lack of data for 2022 at the Amunet site.


SPRING 2022
Booted Eagle
Egyptian vulture
Lesser spotted eagle
Short-toed eagle
Steppe eagle
Steppe buzzard
Black kite
Black stork
White stork
White pelican
28.5°
28°
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet: low median passing rate
NREA facilities: medium median passing rate
Scatec: high median passing rate
Acwa: high median passing rate
Go 7 RED ZONE


SPRING 2022
Honey buzzard
28.5°
28°
27.5°
0
25
50 km
Gebel Al-Zeit IBA
AMEA-Amunet: low median passing rate
NREA facilities: high passing rate
Scatec: high passing rate
Acwa: high passing rate
Go 7 RED ZONE