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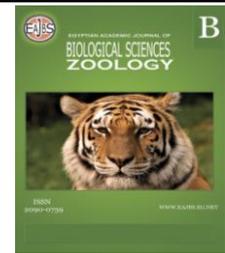


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## Quantity of Spring Migration of Migratory Soaring Birds Over the Eastern Desert of Egypt

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### ABSTRACT

The Gulf of Suez is an important flyway for migratory soaring birds because it is situated between the Eurasian and African landmasses that connect breeding grounds in Eurasia with wintering zones in Africa. During four weeks of spring migration, the magnitude and timing of the spring migration of 15 species of medium and large-sized raptors, White Storks "*Ciconia ciconia*", Black Storks "*Ciconia nigra*", White Pelicans "*Pelicanus onocrotalus*", Common Cranes "*Grus grus*" and Great cormorant "*Phalacrocorax carbo*" were studied near Ras Shukeir city, Eastern desert, Egypt. Observations were carried out on the ground by three vantage points between the Gulf of Suez and Gharib mountain. In total 3121 raptors of 15 species were counted in addition to 8380 White Storks, 2250 White Pelicans and 604 Common Cranes passed during the study time. The most common species were Northern Steppe Buzzard "*Buteo buteo vulpinus*", Black Kite "*Milvus migrans*" and Steppe Eagle "*Aquila nipalensis*" and recorded 17.21% of all raptors.

### INTRODUCTION

Egypt covers an enormous zone of the Great Rift Valley same with a few nations in this flyway, it is in a huge geographic area, with a wide range of temperatures and geology. Furthermore, the nation contacts a few distinct civic establishments, religions, and societies (Riad, 2019; Riad and Mahmoud, 2020; Mahmoud and Riad, 2020). Egypt benefits enormously from this biodiversity, it is an important pass for the soaring bird's migration as it is situated on the mainland connect between the Eurasian and African landmasses that connections rearing grounds in Eurasia with wintering zones in Africa (Bergen, 2007; CarlBro, 2010; Bergen and Gaedicke, 2013).

The Gulf of Suez territory lies at the core of the Rift Valley/Red Sea Flyway and at its tightest focuses that incorporate a few bottlenecks, these are Gebel El Zeit, Suez, Ain Sukhna and the Qaa' plain which are universally perceived as Important Areas for birds and biodiversity (IBAs) (Baha El Din, 1999; Hilgerloh, 2011). Hundreds of thousands of migrating raptors, storks, and pelicans pass each autumn and spring from their breeding areas in Eurasia to sub-Saharan Africa, where they spend the winter, returning in the next spring (Moreau, 1972). These vagrants face extremely cruel conditions as they cross enormous regions of ominous living spaces, for example, deserts and untamed oceans, without the

chance of taking care of or drinking. The greater part of the species, especially littler ones, perform immediate and active flights, choosing the most immediate way between rearing and wintering sites (Riad *et al.*, 2019).

A few factors decide the migration pattern in soaring birds, including optimal wind direction and the optimal ambient temperature for cooling the body, conserving water, and conserving energy during migration trips (Brudere and Steidinger, 1972; Torre-Bueno, 1978; Berthold, 1993). Flight altitude for soaring birds is related to the geographical areas (Kerlinger, 1989), geography (over ocean or land, along coasts and mountain ranges), time (night or day, or hour of the day), weather, and sort of flight (active or soar). Active flying birds use height bands which may vary during a flight in relation to one or more of the above-mentioned factors (Gauthreaux, 1970; Able, 1973).

The relative importance of the Rift Valley/Red Sea flyway for the spring migration of soaring birds was evaluated through a comparison of the number of migrants counted in the area with the flyway population for each species. The total number of birds per species recorded during the springs of 2016 and 2017 were used both separately and combined (i.e. average among years) (Strix, 2018). If a site is known to hold, on a regular basis, 1% or more of a flyway population, it is generally classified as an area of international importance (Delany and Scott, 2006; Hilgerloh, 2009; Laubek, *et al.*, 2009; Megalli and Hilgerloh, 2013). The Rift Valley/Red Sea Flyway population size for each species was calculated considering the most updated data available from BirdLife International (2018) and Wetlands International (2018a), who have compiled several sources from the available literature (Delany and Scott, 2006; BirdLife International, 2015; Wetlands International, 2015; 2018b). Globally threatened species such as Eastern Imperial Eagle *Aquila heliaca* ('Vulnerable'), Greater Spotted Eagle *Aquila clanga* ('Vulnerable'), Egyptian Vulture *Neophron percnopterus* ('Endangered') and the 'Near threatened' Pallid Harrier *Circus macrourus* are known to migrate through this area. The most numerous species are reported to be over the eastern desert of Egypt White Stork *Ciconia ciconia* and Levant Sparrowhawk *Accipiter brevipes* (Baha El Din, 1999). In the space of a very few days, the entire world population of Levant Sparrowhawks *Accipiter brevipes* migrate through this area, usually in large flocks (Baha El Din, 1999). The main route of White Stork *Ciconia ciconia* migrating along the eastern flyway passes through the site of Zait Bay (Schulz, 1988; Berthold, *et al.*, 2001).

The main migration corridors through Egypt are still not precisely identified because there have been no synchronous migration studies across the whole width of the flyway, the total number of soaring birds that fly through Egypt is still to be determined accurately, a few publications were published on the pattern of a flight of migrating birds and even fewer about soaring birds over Egypt. In the present study, we gathered data on the species, number, altitude and direction of soaring birds during spring migration in the great rift valley flyway from between the African and Eurasian over Egypt.

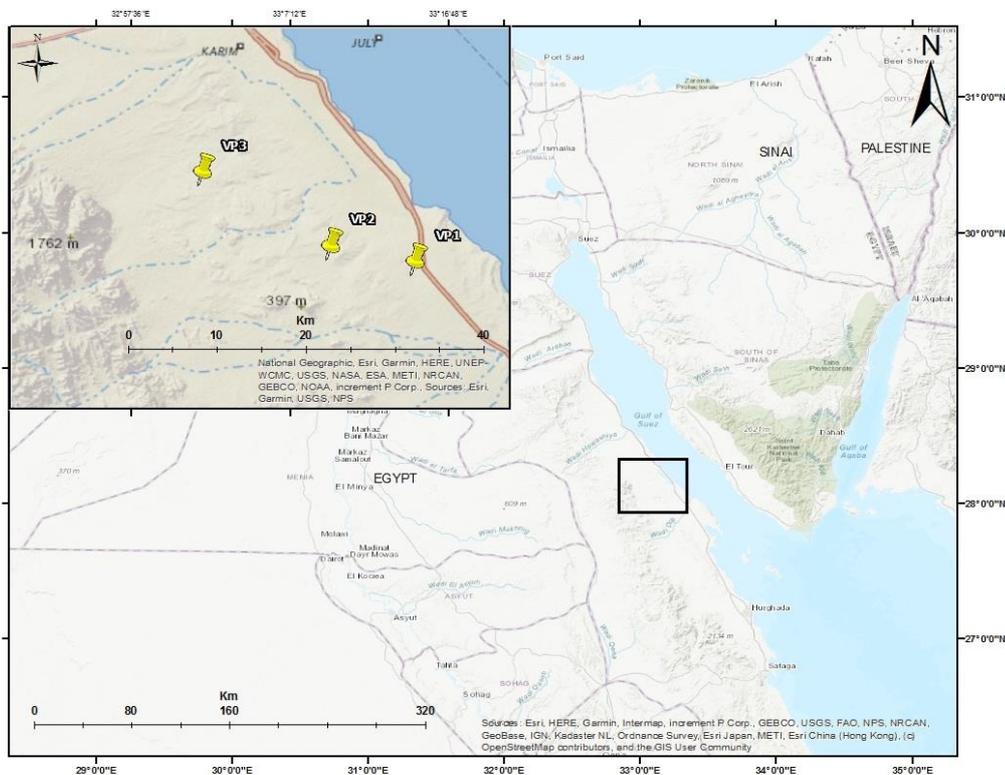
## MATERIALS AND METHODS

### Study Area:

The study area is situated on the western bank of the Gulf of Suez, the west of the port and town of Ras Shukeir and Ras Gharib, the closest fundamental urban communities are Ras Ghareb (ca. 20 km toward the north), and Hurghada (ca. 120 km to south-southeast) (Fig. 1). The landscape is for the most part level, undulating on the eastern side (where the least elevation above sea level is (ca. 100 m), yet progressively rough towards the west and northwest, where elevation arrives at 300 m. A few elevations uneven edges (300-400 m) separate the investigation zone from the Red Sea Mountain chain, where the most conspicuous mountain in the locale, Gharib mountain, remains at a height of 1,453 m around

20 km west of the study site. The study area is in an area surrounding three wind stations, two of which are operating and the other under construction, we selected three fixed observation points. The VP1 (28.086739N, 33.248717E) is 5.5 Km from the Gulf Coast, one-kilometer northeast of the nearest wind farm, and altitude 237m. The VP2 (28.103094N, 33.162408E) is 13 Km from the Gulf Coast, located in the southwestern part of a wind farm and altitude 750m. The VP3 (28.178072N, 33.032889E) is 17.5 Km from the Gulf Coast, 7.5 km northwest of the nearest wind farm, 13 km east of Gharib mountain, and altitude 204m (Fig. 1).

Visual observations were led during light hours day by day between February 20<sup>th</sup> and March 20<sup>th</sup>, 2019 covering the early part of the spring migration season. The standard technique for bird enumeration as per Scottish Natural Heritage guidance (SNH, 2010), and by following the methodology described in Scutherland (2006), bird monitoring was conducted through three fixed observation points, observation posts strategically positioned to provide the best visual coverage of the bird's movements, each vantage point almost complete coverage about 2500m view scope within each selected point in the study area (Fig. 1).



**Fig. 1:** Location of the study area near Ras Shukeir, eastern desert, Egypt.

### Observation Technique:

The survey covered all points watches for 8 hours/day, 7 days/weekly, from 7:30, am to 16:00 pm, with 30 minutes break. Bird altitude was recorded at time intervals of fifteen seconds, weather conditions (wind direction and speed, temperature, cloud/mist, rains, and visibility) were recorded hourly according to Riad (2019). Each point is supplied by professional binoculars, digital cameras, bird identification filed guides, clipboards, compass, recording (sheets & maps).

A sum of 224 survey hours for every vantage point (672 observation hours for the whole study area) were led in the field during the survey time, generally 4 hours morning session and 4 in the evening. To avoid repeated counting, observers met after fieldwork and analyzed every record collected during the day. This thorough analysis considered the exact

minute of every observation, bird movements' directions and altitudes and the existence of clues that the same bird/flock had been recorded by different vantage points. In this way, records that had been possibly or confirmedly double-counted were eliminated from the calculation.

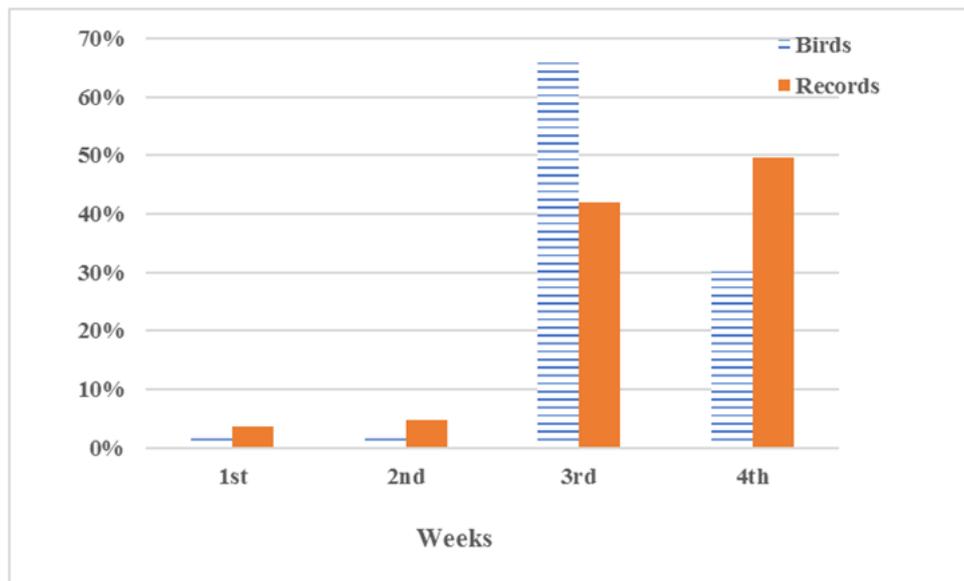
## RESULTS

Table 1 summarizes our results, we counted 3121 raptors belonging to 15 raptors species and some unidentified raptors species, plus 8380 White storks *Ciconia ciconia* comprised 57.86% of all observations, 2250 Great White Pelicans *Pelecanus onocrotalus* (15.64%), 108 Black Storks *Ciconia nigra*, 604 Common Cranes *Grus grus* and 5 Great cormorant *Phalacrocorax carbo*. The most common raptor species were Northern Steppe Buzzard *Buteo b. vulpinus*, Black Kite *Milvus migrans* and Steppe Eagle *Aquila nipalensis* and accounting for 17.21% of all records. lesser Spotted Eagle *Aquila pomarine*, Greater Spotted Eagle *Aquila clanga*, Short-toed Snake Eagle *Circaetus gallicus* and Long-legged buzzard *Buteo rufinus*, comprised another raptor species reported.

**Table 1:** Raptors and other soaring birds were seen during migration surveys in Egypt, 20 February – 20 March 2019.

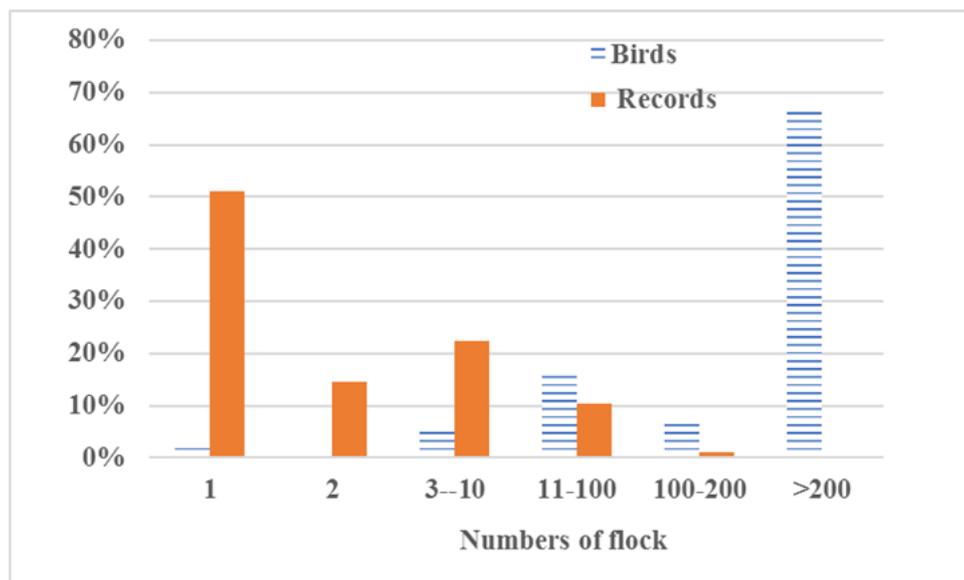
Name	Birds	% Birds	Records	% Records
White Stork <i>Ciconia Ciconia</i>	8380	57.86%	10	1.42%
White Pelican <i>Pelecanus onocrotalus</i>	2250	15.64%	6	0.85%
Steppe Buzzard <i>Buteo b. vulpinus</i>	1499	10.36%	259	36.69%
Steppe Eagle <i>Aquila nipalensis</i>	623	4.31%	189	26.77%
Crane <i>Grus grus</i>	604	4.17%	4	0.57%
Black Kite <i>Milvus migrans</i>	367	2.54%	65	9.21%
Raptor sp.	225	1.56%	24	3.40%
Unidentified Buzzard	194	1.34%	15	2.12%
Black Stork <i>Ciconia nigra</i>	108	0.75%	3	0.42%
Aquila sp.	94	0.65%	50	7.08%
Short-Toed Eagle <i>Circaetus gallicus</i>	49	0.34%	37	5.24%
lesser Spotted Eagle <i>Aquila pomarine</i>	19	0.13%	6	0.85%
Long-legged Buzzard <i>Buteo rufinus</i>	14	0.10%	13	1.84%
Booted Eagle <i>Aquila pennata</i>	9	0.06%	5	0.71%
Great Cormorant <i>Phalacrocorax carbo</i>	5	0.03%	1	0.14%
Egyptian Vulture <i>Neophron percnopterus</i>	5	0.03%	5	0.71%
Western Marsh Harrier <i>Circus aeruginosus</i>	4	0.03%	4	0.57%
Greater Spotted Eagle <i>Aquila clanga</i>	3	0.02%	3	0.42%
European Honey Buzzard <i>Pernis apivorus</i>	3	0.02%	1	0.14%
Common kestrel <i>Falco tinnunculus</i>	3	0.02%	3	0.42%
Saker Falcon <i>Falco cherrug</i>	2	0.01%	1	0.14%
Eurasian Sparrowhawk <i>Accipiter nisus</i>	2	0.01%	1	0.14%
Eastern Imperial Eagle <i>Aquila heliaca</i>	1	0.01%	1	0.14%

Considering the maximum count of birds recorded through the study area was during the third week of the study (absolute minimum without duplication with the other points) where was recorded 66% individuals and 42% from records of all migration rates (Fig.2).



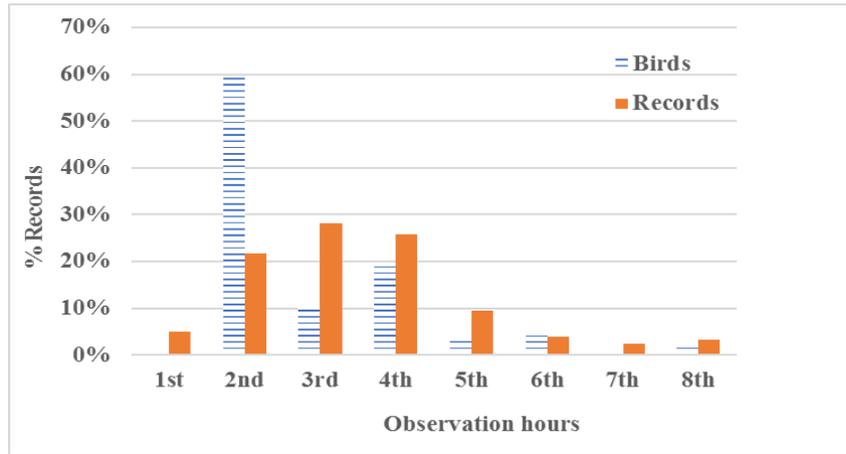
**Fig. 2:** Relative weekly distribution of individuals/records for all observation during the study.

Most individuals were recorded for flock more than 200 individuals (67%) however, they comprise less than 2% of all records. On the other hand, the observations composed of 11-100 birds were recorded 16% form 10% of all records, and the individual observations only 2% of birds but were forming 51% of all records (Fig. 3).

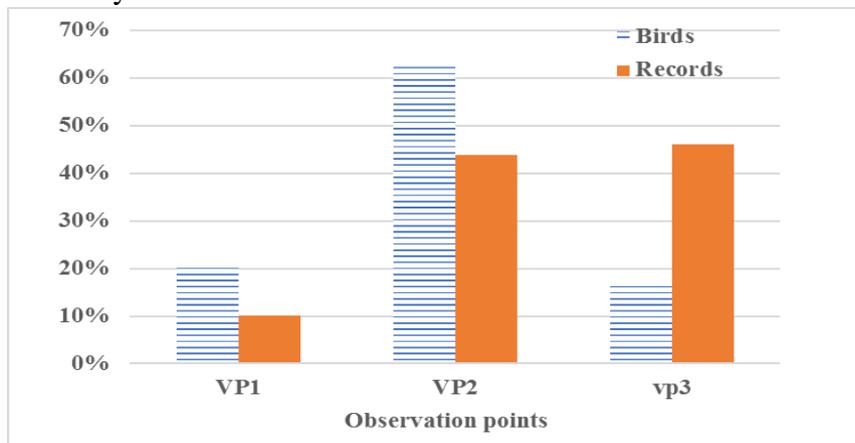


**Fig. 3** Relative frequency of individuals/records for numbers of the flock.

Migration activity was higher during morning hours for all the numbers of birds and records and from 10 am to 11 am was recorded more than 65% of all records of all migration rates (Fig. 4). The second observation point (VP2) was the most recorded for birds 63% representing 44% of all records, followed by the first observation point (VP1) 21% of birds representing less than 10% of records (Fig. 5).

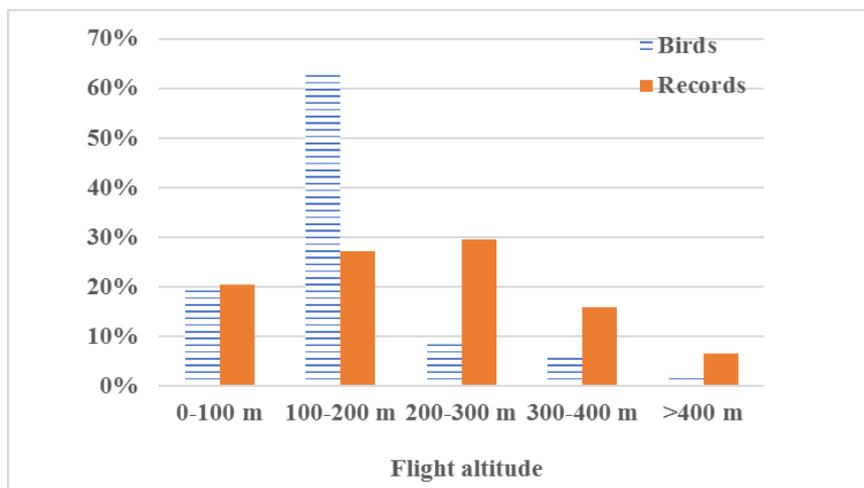


**Fig. 4:** Relative hourly distribution of individuals/records for all observations.



**Fig. 5:** Relative frequency of individuals/records for each vantage point during study time.

The flight altitude of all observations in the study area was classified into five classes (0-100, 100-200, 200 -300, 300-400 and >400 m), the majority of the most observations were recorded in the altitudes in the category of 100-200 m 63% of birds form 27% of all records, while was recorded more than 20% from records and bird numbers under 100m altitudes (Fig. 6). Fight direction of most observations revealed an expected northerly pattern (between northwest and the northeast quadrants) (Fig. 7).



**Fig. 6:** Percentage of flight altitudes of individuals/records observed in the study area.

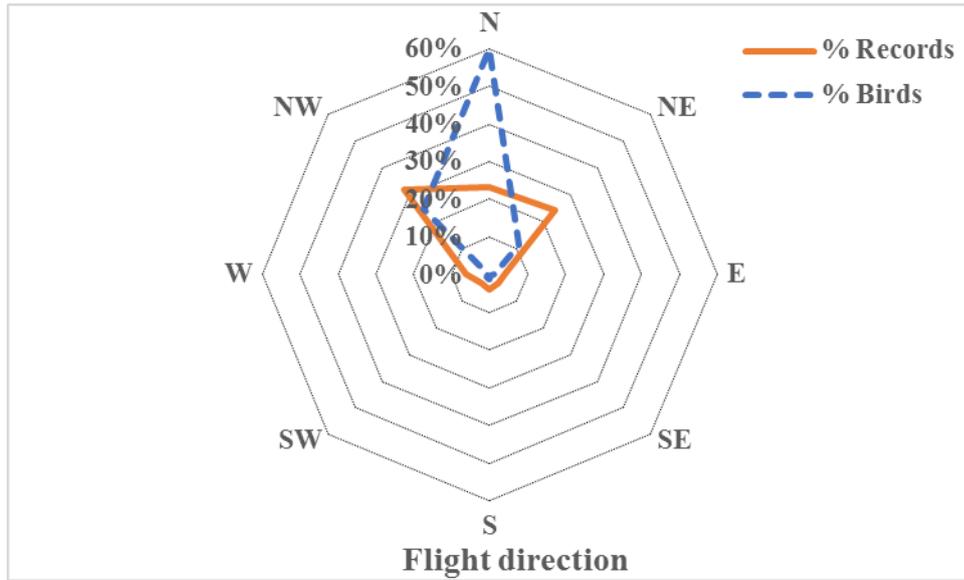


Fig. 7: Distribution of flight directions for all observations during the study.

When comparing the observed bird heights at each vantage point, most of the birds were at altitudes below the 200 m in all points including the points which were out of the wind farms, as well as VP2 inside the operated wind farm (Fig. 8). Also, when comparing the observed bird directions at each vantage point, most bird observations revealed an expected northerly pattern (between the northwest and the northeast quadrants) at all observation points (Fig. 9).

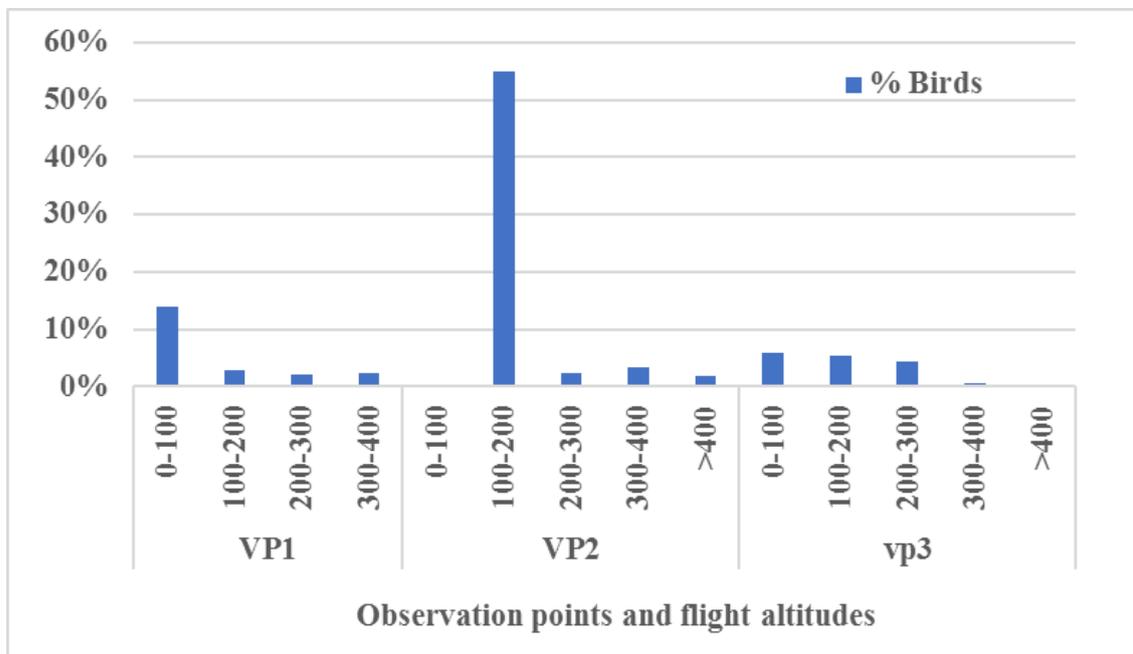


Fig. 8: Distribution of flight altitude of birds over each observation point.

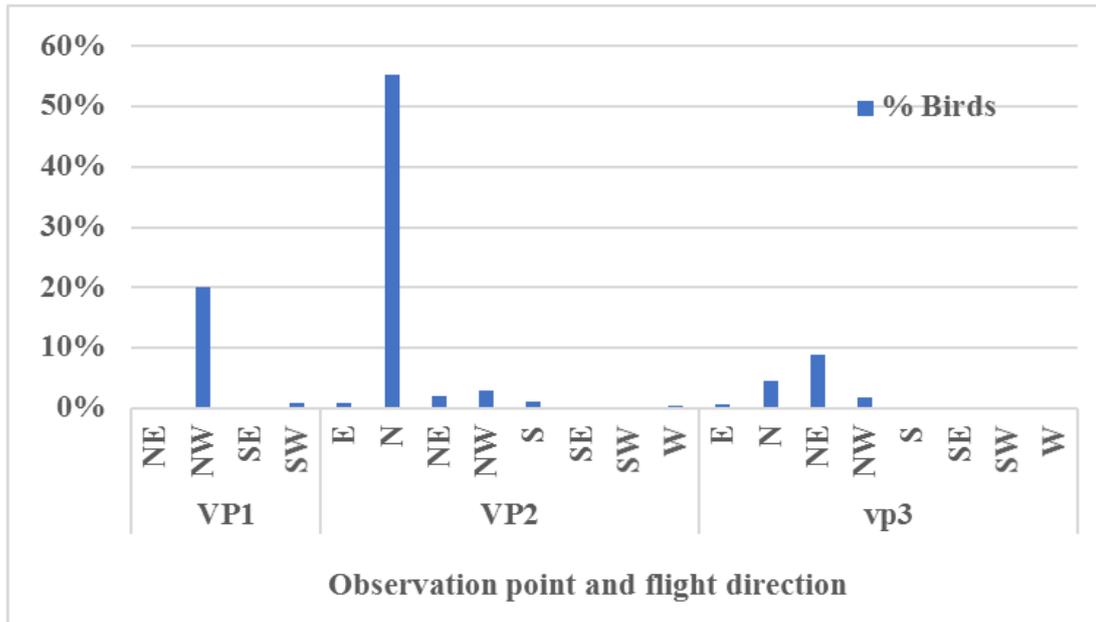


Fig. 9: Distribution of flight bird directions over each observation point.

## DISCUSSION

In the spring, the migratory birds are under great time pressure, as they must reach their summer dwellings early enough to successfully compete for a suitable breeding site so they can raise their young before leaving again for Africa. Birds arriving too late or too exhausted will not breed and reproduce successfully (Hilgerloh, 2009). In each study, the number of birds in each season and location is deduced assuming that observations were made in each site throughout the entire season. Since double observation is unavoidable, it is not permissible to collect the stable numbers of birds in several sites (Hilgerloh *et al.*, 2009; Hilgerloh 2009; Megalli and Hilgerloh 2013).

There was no detectable preference by migratory birds for any route through the study area. Migratory raptors migrated mostly individually or in small groups and showed a somewhat regular pattern. By contrast, storks, pelicans, and cranes, mostly migrating in massive herds, produced very distinct regional fluctuations (Langston and Pullan 2003; Drewitt and Langston 2006; Langston 2006). The storks, pelicans and crane that were concentrated in the VP2 site area, attracted a great distance from the coast to get the time to rise a great distance and the ability to cross the bay easily at the narrowest point in the bay Ras Shukier or Ras Gharib. In general, there was no significant effect on the altitudes and directions of bird migration as a result of wind farms. This is evident from the birds recorded in the VP2 and compared to the other two points, we need extensive studies of this matter in the upcoming migration seasons. The results revealed that many threatened species Steppe Eagle *Aquila nipalensis*, Egyptian Vulture *Neophron percnopterus*, Greater Spotted Eagle *Aquila clanga* and Eastern Imperial Eagle *Aquila heliaca* use this pathway migration from Africa to Eurasia (Hilgerloh *et al.*, 2009; Megalli and Hilgerloh 2013).

Many recorded numbers were seen flying at altitudes less than 200 meters, which suggests that they will continue to migrate north and cross the Gulf from Ras Gharib or may continue to the end of the Gulf at the city of Suez. Given these results, some numbers of migrants observed to the south of the study area migrants often head to Sinai at the latitude of El Gouna and the location of the Malaha Valley rest area the only freshwater valley. Migrants heading to Suez mainly concentrate along with the mountain range west of the Gulf. Most

white storks that reached the southern end of Sinai continue northwest of the country along the coast of Sinai before starting to cross the sea, thus reaching the mainland of Egypt between Ras Gharib and Ras Gamasa (Christensen and Jensen 2002). However, notes are needed to review their limits (Grieve 1996 and Baha El Din 1999).

Our observations revealed that migrants fly along the foothills of the Red Sea Mountains and then head for the coastal mountain chain Gebel El Zeit or the coast adjacent to the north. Especially in those species such as White Stork (Creutz 1985; Schulz 1988; Goodman and Meininger 1989; Berthold *et al.*, 2001), Sparrowhawk (Grieve 1996, Baha El Din 1999) and Common Crane, large portions of the population regularly cross the Gulf of Suez. Consequently, many options have no choice but to cross the study area. Others, such as lesser Spotted Eagle *Aquila pomarine*, a species that avoids any sea crossing and continue to migrate to Suez (Grieve 1996 and Meyburg *et al.*, 2002).

Migration patterns are highly variable from one year to another, namely regarding its number, phenology, and flight behavior during flyway, as they are highly dependent on weather conditions among other factors. This way, variation in weather conditions in the upcoming years may cause changes in the migratory patterns compared to what was recorded in the studied time. Future studies should clarify the areas that the soaring birds fly near the current study area and that they use to cross the Suez Canal to South Sinai, as well as to explore the complex migration patterns during different weather conditions of soaring birds especially storks, pelicans and crane that migrate through the Rift Valley/Red Sea Flyway.

#### **Acknowledgments**

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## ARABIC SUMMARY

### كمية الهجرة الربيعية للطيور الحوامة المهاجرة التي تعبر خليج السويس، مصر

صابر رياض

قسم علم الحيوان، كلية العلوم، جامعة الأزهر، مدينة نصر، القاهرة، جمهورية مصر العربية

يعد خليج السويس طريقاً مهماً للطيور الحوامة المهاجرة لأنه يقع بين كتل اليابسة الأوروبية الآسيوية والأفريقية التي تربط مناطق التكاثر في أوراسيا بمناطق الشتاء في إفريقيا. خلال 4 أسابيع من الهجرة الربيعية، تم تحديد حجم وتوقيت الهجرة الربيعية لـ 15 نوعاً من الطيور الجارحة المتوسطة والكبيرة الحجم، طائر اللقلق أبيض "*Ciconia Ciconia*"، والحدأة السوداء "*Milvus migrans*"، والبجع الأبيض "*Pelecanus onocrotalus*"، والكركي "*Grus grus*" والغاق الكبير "*Phalacrocorax carbo*". درست بالقرب من مدينة رأس شقير، الصحراء الشرقية، مصر. تمت عمليات المراقبة على الأرض من خلال ثلاث نقاط مراقبة بين خليج السويس وجبل غاب. تم إحصاء 3121 من الطيور الجارحة تمثل 15 نوعاً بالإضافة إلى 8380 لقلق أبيض، و2250 بجع أبيض، و604 كركي خلال فترة الدراسة. كانت الأنواع الأكثر شيوعاً هي حوام السهول "*Buteo buteo vulpinus*" والحدأة السوداء "*Milvus migrans*" وعقاب السهول "*Aquila nipalensis*" وسجلت 17.21% من جميع الطيور الجارحة.