SPRING FLYWAYS OF MIGRATING SOARING BIRDS IN AKKAR/NORTHERN LEBANON

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ABSTRACT

Beale and Ramadan-Jaradi initiated in 2001 the first large scale survey in Lebanon to trace the main routes of migrating raptors and other soaring birds, aiming at contributing to the conservation of flyways and stopover sites through the identification of areas where protection is most needed. Nowadays, the study of the flyways and stopover sites at micro level becomes necessary following the development of the national wind atlas map that will assist among others in locating potential wind farms which on their turn may influence the migratory birds' flyways, especially that the wind farms use winds for their function and the soaring birds use wind for their transportation. The present work starts from where the work of Beale and Ramadan-Jaradi ended but in an attempt to provide policy makers, scientists and experts with a conceptual framework, as well as methodological and operational tools for dealing with wind farms impacts and to prevent collisions of birds with blades of wind turbines. The study is meant to be conducted during spring and autumn passage of birds. This paper concerns the spring migration as at the time of writing it the autumn migration didn't start yet. The present spring season study revealed among others that the migratory soaring birds that may use the wind ridge lifts for their soaring travel in windy areas are more influenced by two other main factors: 1) presence of depressions perpendicular to mountain's ridges and 2) abundance of the thermals in these depressions, a matter that naturally reduces the impact of wind turbines by attracting the birds away from their blades.

Keywords: wind farms, migratory flyways, soaring birds, Lebanon

INTRODUCTION

As the demand for clean energy increases, wind power generating stations are being constructed across many countries, including Lebanon as their infrastructure is under installation in north Lebanon's mountain since the end of 2011. However, concerns have been raised about the possible impact of these power generating stations on birds, especially when endangered raptors were observed being injured and killed after flying into wind turbines in various wind farms where research has focused primarily on mortality caused by birds striking turbine blades and associated wires. Researchers like Airola (1987), Crockford (1992), Desholm and Kahlert (2005), McIssak (2001) and Craig *et al*. (2010) have focused their work on the potential impact of wind turbines on bird species. Meek *et al*. (1993) and Percival (1999 have attempted, among others, to bring birds and wind turbines to coexist through mitigating the wind turbines impact. Unfortunately, Lebanon's literature is lacking avian studies in relation to wind energy, whilst the disturbance to breeding, wintering or staging birds as a result of turbines functioning has not been examined in the country yet because these turbines, as indicated above, are still under installation. In this case, this study of the spring flyways at micro level over the windy area of Lebanon will not only complement the study of the fall flyways in Lebanon of Beale & Ramadan-Jaradi (2001) but will also assist in detecting if the windy areas and the soaring bird flyways will overlap and in predicting the specific impact of wind turbines on soaring birds in the country.

With respect to avian mortality at wind power generating stations, the greatest concern has been for raptors and other soaring birds. The concern stems from the fact that many populations are small and thus even a few deaths can lead to declines (Morrison,.1998). Subsequent to this, all soaring bird species will be recorded and analyzed in attempt to avoid installing wind farms in places where threatened species are at the stake.

The goal of the project behind the present study is fourfold: 1) Trace the micro-bird-flyways within the windy areas (potential sites of wind farms) in Lebanon, 2) Study the effect of wind farms installation on the existing habitats, 3) Recommend ways of reducing potential impacts of turbines on birds in windy areas of North Lebanon, including preventing wind farms installation on the bird flyways, and 4) Recommend a program whereby potential effects of wind turbines on birds can be monitored at the windiest parts of Lebanon that are indicated on the Wind Atlas of the country. Most of these goals will not be fully achieved before studying the micro flyways of the fall migration. Even though, the first fold is presently fully achieved.

STUDY AREA

The study area lies in an elliptical shape area with a center at a longitude of 36°15'23.68"E and a latitude of 34°26'27.98"N (Fig. 1). It covers about 800 km^2 of mountain range running NNE-SSW. The ridge of these mountains varies roughly between 1000 meters a.s.l. in the north and 2840 meters in the south of the northern quart. The most important feature of the range is its western slopes of mainly NE-SW oriented hills and valleys that provide a variety of lift types to soaring birds.

METHODS

To chart the picture of micro migration in the northern quart of Lebanon during the spring 2014, three groups of sites were selected (Figure 1) running in a W-E direction across the mountain range. The first northern group includes three sites (Aydamoun 34°35'57.48"N & 36°16'28.94"E, Oudine Valley 34°35'33.69"N & 36°19'21.98"E and Akroum 34°35'7.69"N & 36°21'4.57"E), the second central group of the northern quart contains three sites (Akkar Attiqa 34°31'19.23"N & 36°14'32.74"E, Chambouq 34°31'10.29"N & 36°17'55.13"E and Bustane 34°30'34.88"N & 36°19'34.39"E) and the third group lies further to the south to encompass also three sites (Jroud El Dounniyeh 34°24'28.81"N & 36° 8'23.96"E, Marjhine 34°24'3.00"N & 36°14'37.39"E and Jroud El Hermel 34°24'28.98"N & 36°21'7.08"E). In addition to the three groups, a study was also conducted at a tenth site in Mrebin 34°20'5.73"N & 36° 9'41.89"E so that the most important windy sites are covered. From all these sites, one gathered information concerning routes, numbers, dates and species diversity. Observations took place between the last week of February and the first week of June 2014, and were made continuously between 08:30 and 18:00 on 10 days from hillsides where good vision is possible. Each group of sites was studied on a similar number of survey days (3 days). Observations made during the period of the study involved identification of all species of soaring and semi-soaring birds. Numbers of individuals were recorded, together with an indication of distance from the observer and approximate direction of flight. Where birds were seen at great distance or darkened under brightening sky and could not be specifically identified, they were identified to the highest taxa possible, *e.g. Falco* sp.).

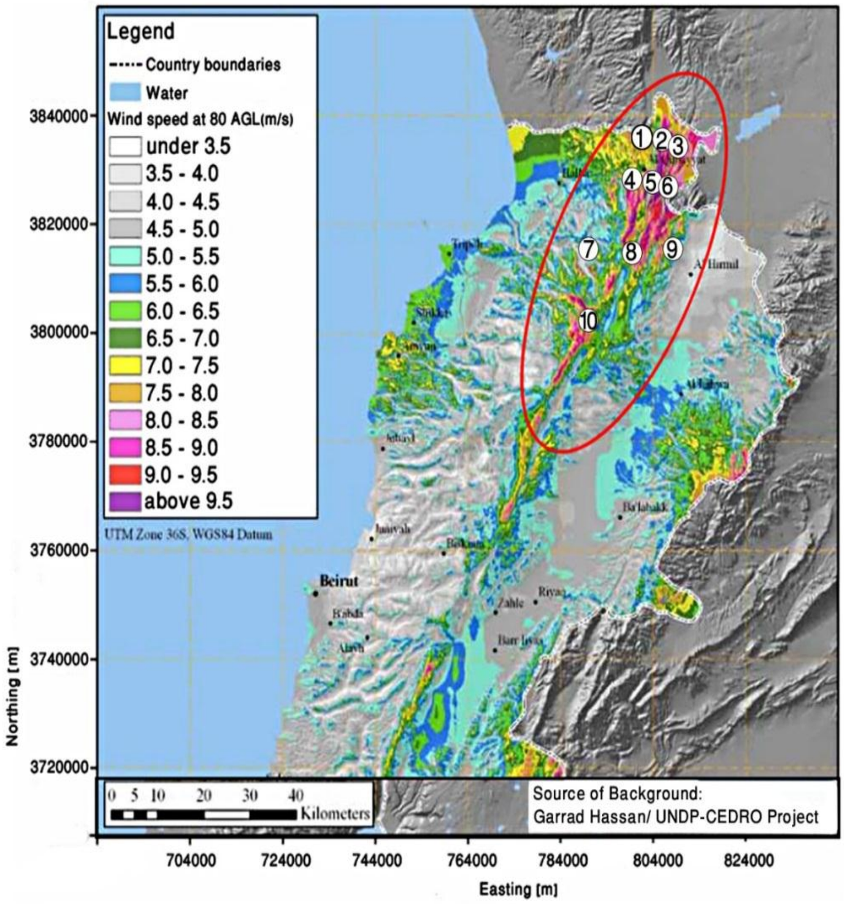


Figure 1. Wind map of Lebanon with circled study area and numbered study stations.

RESULTS AND DISCUSSION

During 10 days in the study period, 12397 individuals of soaring birds were counted in 10 different sites. They belong to 17 soaring raptor species and 4 non-raptor soaring bird species (Ramadan-Jaradi *et al.*, 2008). Of these 21 species, the most abundant and significant nine were totalling 10854 individuals, to which were added 10 individuals belonging to four globally threatened species (the last 4 species in Table 1) as they are of high significance (Birdlife International, 2010) even if they are represented by one individual each (Table 1).

TABLE 1

Number of Birds' Individuals per Species and Sites

Species	Total	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Lesser Spotted Eagle	3128	113	518	38	55	680	213	355	627	239	290
Honey Buzzard	3034	107	558	89	30	543	180	213	676	254	384
Levant Sparrowhawk	1695	16	450	235	75	254	118	42	116	124	265
Steppe Buzzard	968	48	195	56	67	175	61	134	161	48	23
Red-footed Falcon	549	30	93	22	25	106	15	0	200	41	17
White Pelican	465	14	88	60	33	76	42	16	45	37	54
White Stork	411	45	150	11	2	64	0	35	31	12	61
Short-toed Eagle	376	4	18	26	32	59	27	55	81	0	74
Common Crane	228	12	27	14	0	35	8	7	66	0	59
Greater Spotted Eagle	4	0	1	0	1	2	0	0	0	0	0
Imperial Eagle	4	1	1	0	0	0	0	0	2	0	0
Egyptian Vulture	1	0	0	0	0	1	0	0	0	0	0
Cinereous Vulture	1	0	0	0	0	0	0	1	0	0	0
Total	10864	390	2099	551	320	1995	664	858	2005	755	1227

Of the raptors, the most abundant are the Lesser Spotted Eagle *Aquila pomarina* (3128 individuals) and the Honey Buzzard *Pernis apivorus* (3034) followed by the Levant Sparrowhawk *Accipiter brevipes* (1695), Steppe Buzzard *Buteo buteo vulpinus* (968), Red-footed Falcon *Falco vespertinus* (549) and the Short-toed Eagle *Circaetus gallicus* (376). Of the non-raptor soaring birds, the most abundant is the White Pelican *Pelecanus onocrotalus* with 465 individuals followed by the White Stork *Ciconia ciconia* with 411 individuals and the Common Crane *Grus grus* with 228 individuals. The abundance of these 9 species is visualized in Figure 2; whereas the peaks for the most abundant species are given in Table 2.

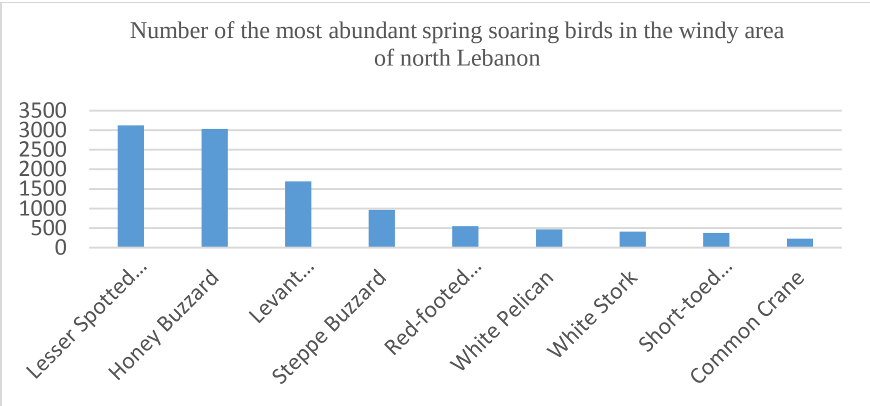
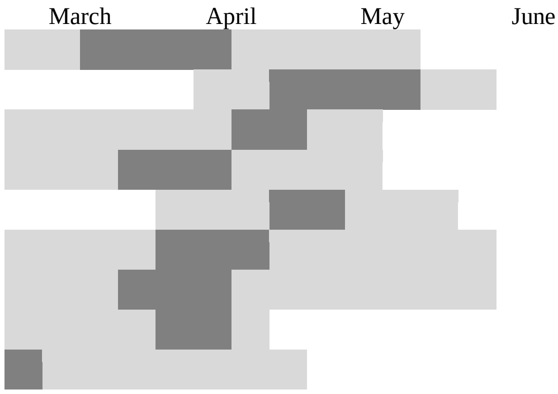


Figure 2. Total recorded numbers of the most abundant soaring bird species in the study area of the north Lebanon.

TABLE 2

Peaks Periods for Each of the Most Abundant Soaring Migratory Species in North Lebanon

Lesser Spotted Eagle	3128
Honey Buzzard	3034
Levant Sparrowhawk	1695
Steppe Buzzard	968
Red-footed Falcon	549
White Pelican	465
White Stork	411
Short-toed Eagle	376
Common Crane	228



Generally, Table 2 records show that the most abundant nine species peaked from end of March till end of April. This is the case of Lesser Spotted Eagle, Steppe Buzzard, White Pelican, White Stork and Short-toed Eagle. The Honey Buzzard, Levant Sparrowhawk and Red-footed Falcon peak in late April – early May. Only the Common Crane peaks in early March.

The number of migrants in each of the different inspected sites (Figure 2) suggests the migratory front in northern Lebanon is wide. Moreover, there were migrants passing between the sites of each group (pers. obs.) indicating clearly that our total will be lower than the true figure for the entire spring migration in the observed area. Nevertheless, the survey allows a clear idea of the pattern of migration. The results in Plate 2 indicate that Oudine Valley, Chambouq, Marjhine and to a lesser extent Mrebine which are longitudinally aligned, account for 67 % of the total recorded. With the volume of concentration they have between Oudine Valley and Mrebine, the birds trace the main route of spring migration in the northern quart of Lebanon. This route differs slightly from the fall route in the same quart that was traced by Beale and Ramadan-Jaradi in 2001 (Figure 3).

Jabal Akroum is a mountain (Jabal) with many villages on its slopes, one of which is also called Akroum (Site 3). The latter represents 5% of the individuals of the most 9 abundant species, whereas in the south of Jabal Akroum, more precisely at Bustane area (site 9), the total recorded is insignificantly higher (7%). Compared to the 67% at the main spring flyway, the sites 3 and 9 of Jabal Akroum hold about 10% of those birds passing in the main flyway. In addition, our own observation showed that the migratory soaring birds fly under the effect of ridge lift at a relatively high altitude above the recently installed few wind turbines that are under testing and waiting for Environmental Impact Assessment (EIA) before they are increased to establish wind farms. As for the Oudine Valley that extends along c.14 km in N-S direction, it forms an ideal rich in thermals passage that is a depression perpendicular to the mountain ridge, where birds prefer to soar either in thermals rising from the floor of the valley or in lifts. Such depression may create a bottleneck for the soaring birds (Ramadan-Jaradi, in prep.). The lifts are created by updrafts that are generated when a steady wind strikes a hill, cliff, and this is referred to as obstruction lift. The latter is formed on the eastern facing west slopes of the valley.

Figure 3. Fall migration routes traced by Beale and Ramadan-Jaradi (2001) and spring migration route determined by the present study.

CONCLUSIONS AND RECOMMENDATIONS

These surveys confirmed that the main spring flyway of the soaring bird species is not traversing the potential wind farms area in Jabal Akroum. But this finding doesn't mean that an EIA is not a must everywhere there is a plan to erect wind turbines and their accessories.

Recognizing that the migration of soaring birds differs in numbers and pattern between autumn and spring, the fall migration needs to be explored during the second phase of our project in the study area in order to trace the true flyways within or adjacent to the potential wind farms.

Key species found during this study (example: globally threatened species) should be covered by conservation activities and their frequented sensitive sites should be determined with the hope to incorporate them in a network of sites that are termed important for transiting or over flying soaring birds and worthy of management and protection. Further studies in the Anti-Lebanon Range would assist in the estimation of the overall size of migrants in Lebanon and may identify new hotspots or significant stopover sites for inclusion in the network of important bird areas (Evans, 1994) as well as for promoting bird watching as a tool of awareness and eco-tourism in the country.

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