

Original Research Paper

Seasonal fluctuation of birds in open landfill, Souk Ahras (Algeria)

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Abstract

Landfills have the advantage of meeting the energy needs of the birds quickly. They offer easy access to food and widely available throughout the year. In this study, birds were counted using observation points on an open landfill in the restored of Souk-Ahras region (north-eastern Algeria) for one year from July 2013 to April 2014. Seventeen species (17) bird species belonging to eleven (11) families were found: Ciconiidae, Corvidae, Accipitridae, Passeridae, Hirundinidae, Motacillidae, Columbidae, Ardeidae, Sturnidae, Laridae, and Pelecanidae, among them sedentary species, migratory, the visitors, and invasive species, which are exploiting the discharge for feeding or rest. Species richness and abundance in landfill site were found to be higher than that of naturel habitat around the site. Their abundance varied according to the seasons.landfill site support both common bird species as: *Columba palumbus*, *Columba livia*, *Streptopelia decaoto*, *Ciconia ciconia*, *Corvus corax*. In addition to that, rare bird species such as *Pelecanus crispus*. Ecology and dynamic of each species, during an annual cycle of bird's populations allow us observing all the interactions and reactions between the individuals and the different populations of birds. Souk Ahras landfill is a resting place and a source of food for birds, which means that it needs a censuses urgency update of migratory birds which frequent our region as well as monitor their state of health. It is also interesting to follow the process of colonization in urban Souk Ahras city.

Keywords: Birds; Migratory; Biodiversity; seasonal fluctuation; Landfill; Souk Ahras; Algeria

Introduction

The loss of biodiversity is a major concern in the world of ecology, and conservation always involves more scientific, researchers or voluntary. Despite all these efforts first require a thorough understanding of this biological richness, its functioning and its role in the balance of the living world. Birds are the most diverse phenotypic and ecological group. The birds have a special place as indicators for many reasons; they give messages that should not be ignored. They show that our environment is facing serious pressures, with a massive hemorrhage and increasing biodiversity (Bird Life International, 2004).

Extinctions were probably better studied in birds than any other animal group (Brooks, 2000). In total, 1211 species of birds (12% total) are glob naturel ally threatened. Of these, 179 are now critically endangered and

close to extinction. The most important impact is habitats destruction (degradation and fragmentation). Most of the work on animals, especially birds, focused on community-based approaches descriptive richness and taxonomic diversity (Mills et al., 1989; Clergeau et al., 1998; Macintyre, 2000).

The number of bird species “*Streptopelia decaoto*, *Columba palumbus*, *Ciconia ciconia*....” living in the city of souk ahras has increased significantly over the past century, which has led to a change in their habits nest site, Behavior, adaptation,... etc. Landfills have become attractive areas for birds that offer easy access to food and widely available throughout the year. Most studies dealing with birds that frequent the dumps are more interested in omnivorous species such as gulls, crows, raptors or scavengers (Isenmann, 1978, Kabouche and Brun ,1997 Sadoul,1998 Kabouche and Ventroux, 1999). Work on other groups of birds that are attracted to landfills are poorly documented, and in Algeria there are only two studies that treated the subject of the birds that frequent the dumps performed by Jacob (1979) on the discharge of Mostaganem western countries and Moulai (2007) on the discharge of Bejaia.

Our study focuses on the change in the number of different bird groups present at the garbage dump of the city of Souk Ahras during 10 months and their behavior.

Materials and methods

Study area

Souk Ahras city is located in the extreme east of the country, near the Tunisian border, 640 kilometers from Algiers. Its large area of 436,000 hectare including 254,000 hectare of fertile land and plenty of water, allows it to have a multitude of agricultural activities. 80 kilometers from the Mediterranean Sea, the penetration of wet marine currents is easy. The north is characterized by mountainous terrain covered by appreciable forest wealth. As for the south, it is formed by the extension of the highlands that line up in front of sub-Saharan regions, which exposes it to a relatively hot wind. As a result, the northern part has a semi-humid climate while the south has a semi-arid climate. Souk Ahras city is distinguished by a hot and dry summer and a cold and wet winter. The rainfall reaches 650mm per year in the north and 350 mm per year in the south. Heights show a significant snowfall during the winter, the temperature oscillating between 1 and 15 degrees in winter and between 25 and 32 degrees in summer. Our site is an open landfill, 6 km southeast of the town of Souk Ahras along the national rout “RN83” with surface of 12 hectares. Thus, it is not controlled; the two main modes of treatment are burying and incineration (Figure 1)

Methods

Followed the birds took place over a period of ten months (July 2013-April 2014). One visit per week was conducted during the period of intensive foraging birds that frequent the landfill. The observations were carried out to obtain a representative picture of the dynamics and temporal distribution of birds. Methods of counting consider in two characteristics of bird’s mobility (including migration) and their relatively wild behavior. Whatever the method, the counts are essentially based on the principle of estimation. During our counts, we conducted an individual counting when groups of birds were close to our observation point (J. Blondel, 1969). The equipment needed to count is: binocular, telescope and digital camera. Guides have been used for birds identification: Bird guide-Selection: Heinzel guide to birds of Europe from North Africa and the Middle East - Delachaux et niestlé 2004, Guide Heinzel des oiseaux d'Europe (Heinzel et al.,2014).

Bird’s population can be characterized by analyzing the following structural parameters: Abundance "N", Species richness "S". Graphical presentation of the data was based on the development of histograms; curves by Excel 2016. These data have been statistical processing by software R.3.2

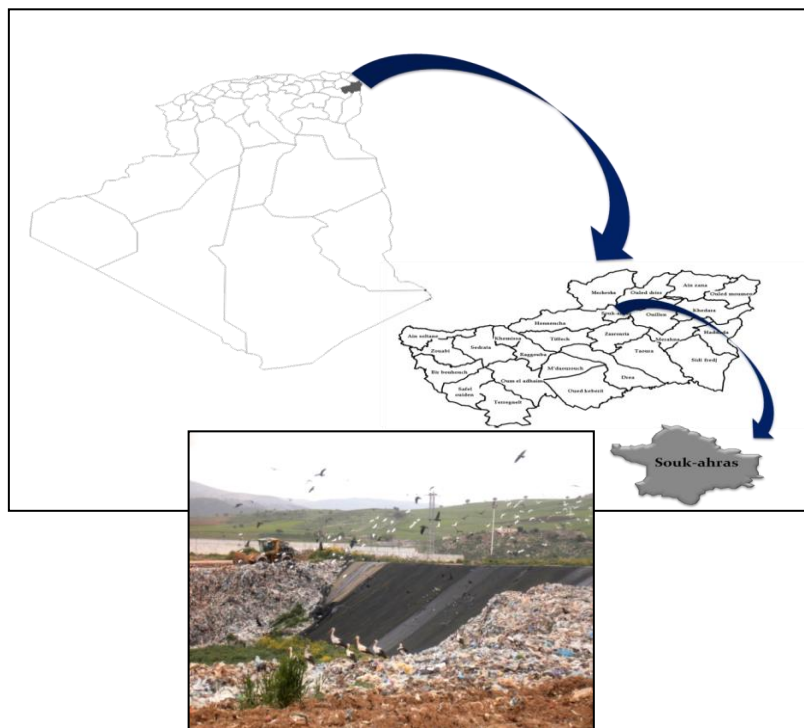


Figure 1. Study area (Souk Ahras)

Results

Bird's population observed in the landfill of Souk Ahras consists of 17 species distributed into 11 families: Ciconiidae, Corvidae, Accipitridae, Passeridae, Hirundinidae, Motacillidae, Columbidae, Ardeidae, Laridae, and Pelecanidae. Sturnidae, Ardeidae and Sturnidae were the most abundant family. The rarest families are Pelecanidae and Laridae. The most diverse Families in species are Accipitridae and Columbidae, the rest are represented by one species. (Fig. 2)

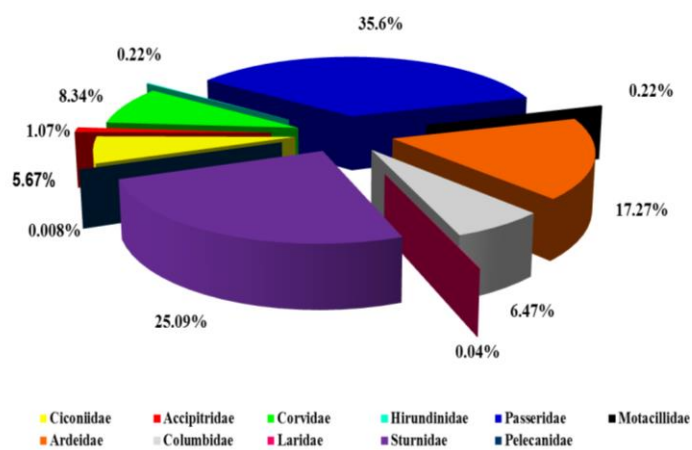


Figure 2. Distribution of abundances of bird's families

The peak in abundance of birds is observed during December with 27,664 individuals. The number was lower during July, August, September, and October. (Fig. 3)

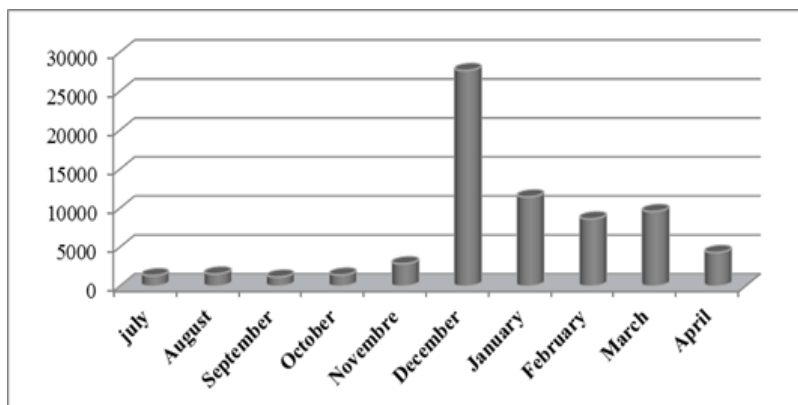
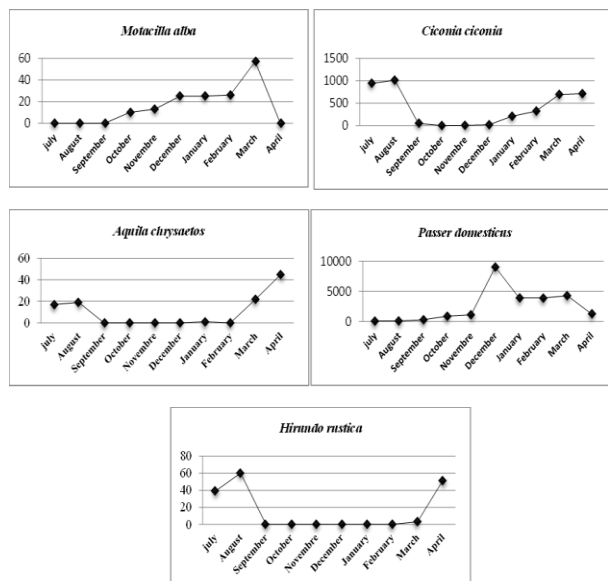


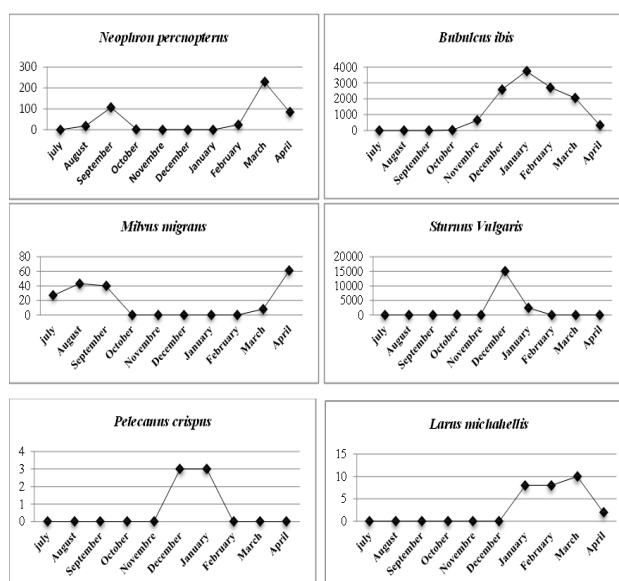
Figure. 3. Evolution abundance of bird populations in Open landfill of Souk Ahras.

The management of an area frequented by birds can only be considered after studying the overall operation of the site with various species present during an annual cycle. This functional study is based on knowledge of the behavior of birds in this case, phenology parking. (Figure. 4)

Species observed in winter



Species observed in spring and summer



Sedentary species

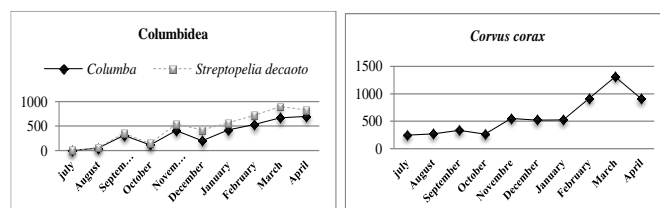


Figure.4. Dynamic abundance of bird's population in the discharge of Souk Ahras.

During our study several interactions were observed, the most important goals were feeding and habitat. One could perform statistical analysis using the R software that best explains our observations. (Figure. 5 and 6)

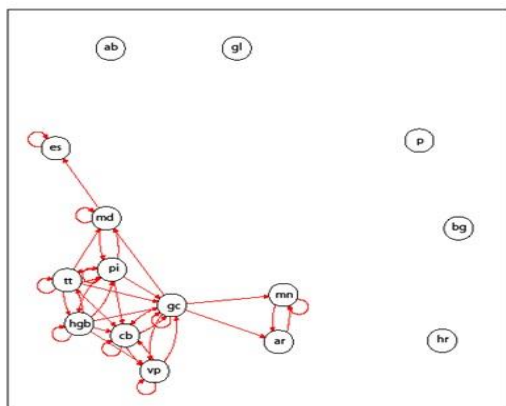


Figure 5. Visualization of relationships between and specific interaction in goal food (cleptoparasitism) can be represented only species interact.

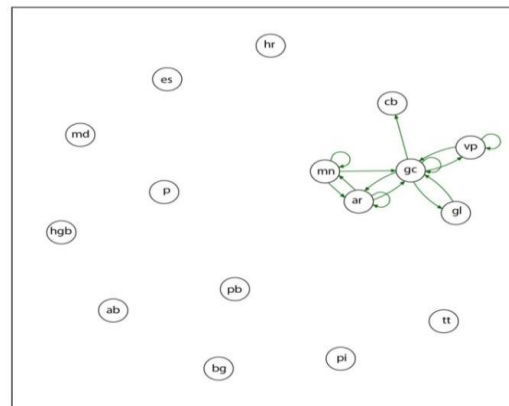


Figure 6. Visualization of relationships between and specific interaction with the goal is space, can be represented only species that interact.

Species practicing cleptoparasitism on a large number of species in descending order:

Heron.gb	Gd.corbeau	Pigeon. Tourterelle.Tur.
6	6	6
Cigogne.blan.	Moineau.domVautour.perc.	Milan.noirs
3	3	2
Aigle.royal	Etourneau.san.	aigle.bauteBerger..grise
1	1	0
Goeland.leuco.	Hirondelle.RustpelicanPigeon.Biset	0
0	0	0

The species that enters into transactions in order to earn spaces are represented by the following species.

Aquila chrysaetos (ar), *Ciconia ciconia* (cb), *Larus michahellis* (gl), *Corvus corax* (gc), *Milvus migrans* (mn) and *Neophron percnopterus* (vp)

Discussion

17 species belonged to 11 families were recorded from landfill. Passeridae (35.6%) and Sturnidae (25.9%) were the most abundant families, the most dominant families are also these two composed of a single species, which is the House Sparrow (*Passer domesticus*) and European Starling (*Sturnus vulgaris*). The less important families were presented by: Pelicanidae (0.008%) and Laridae (0.04%). But the richest family in species is the Accipitridae and Columbidae with 4 species and the rest of the family is represented by a single species.

Landfills insure quickly meeting, energy needs of the birds. They offer easy access food and widely available throughout the year. Landfills can compensate for seasonal variations in food availability (Duhem et al. 2002). The annual dynamics and structure of birds are related to the status of each species (migratory, sedentary), its ecological requirements (Morino, 1999). Our study focuses on the dynamics and ecology of birds present at the garbage dump during one year (10 months). The dynamic abundance of bird populations during the 10 months follow-up showed a very important dynamic composed of 17 species of birds which express the wealth in this food places to all bird families according to their diet (granivorous, omnivorous, insectivorous and carnivorous).

Landfill attracts more birds in autumn and winter than in summer. The food supply remains generally stable during the year. The drop in numbers observed in summer, may be due to the high temperatures recorded during this period, particularly in August where the average of temperatures can exceed 39 °C, it is added to the heat emitted following the fire grass discharge proximities, which induces very unfavorable to the bird conditions. The presence of the open dump there edible organic waste which is very beneficial for these birds, contributing to 68% of their food needs (Blanco, 1996; Tortosa et al. 2002).

Ciconia ciconia is one of the most known species in Algeria; it is a breeding summer visitor. From July to September we have recorded the most important abundant number and they decrease in October (20 individuals) followed by a total absence during the winter due to the migration of the species to the south in Mali and Niger to the rainy season (Metzmacher, 1979). The return of *Ciconia ciconia* is recorded from January for reproduction in the month of April when the first individuals were observed at the landfill.

Corvus corax is one of the most abundant species in the discharge, it was observed throughout the year with the highest numbers registered during winter (550 to 1310 individuals). Abundance appears stable and low especially between July and October, which corresponds to a period of high temperature or most of the discharge birds are poorly represented.

Aquila chrysaetos is widespread in North Africa and the Sahara (Heim de Balzac et al, 1962). Living conditions available in our study area (Souk Ahras) contains all the necessary life for this species especially that the landfill is located close to their habitat. According to our study, the migration begins in early September where we have recorded an absence of *Aquila chrysaetos* after a remarkable presence (17-19 individuals) during July and August. They return at the end of March for nesting (22 individuals) gradually increased up to 45 individuals in April which is the breeding season.

The presence of Columbiformes has been reported since last August consists of three species: rock pigeon (*Columba livia*), wood pigeon (*Columba palumbus*) and stock dove (*Columba oenas*) with remarkable variability effective until the month of December which gradually increases to April (700 individuals). Pigeons are sedentary, but the lack of food habitats may cause local displacements and abandonment of nest sites in breeding season (Thibault, JC et al., 1990). ***Streptopelia decaocto*** is a sedentary animal population. Indeed. It was observed in the landfill during the whole year, with dynamic variability according to the season.

Bubulcus ibis, is a sedentary and breeding species in Algeria and neighboring wetlands (Isenmann and Moali 2000, Si Bachir et al. 2001, Samraoui et al., 2007, Si Bachir et al. 2008). We have marked its presence at the end of October (32 individuals), following by absence during the summer, where they frequent the banks, water balancing areas and muddy places, certainly the richest and the most diverse in amphibians and aquatic insects share with other nosy species (Seddik, 2011). Progressive increases in abundance are rated from October with peak abundance (3750 individuals) in January, which is the wintering period (Hancock and Kushlan, 1989).

Sturnus vulgaris is a migratory population. It's a regular visitor, for bread, meal reliefs and waste ... etc. It is too awkward to feed on suspended feeders (Clergeau, 1997). A weak abundance was observed in October followed by an absence in November. The return was in December (15,050 individuals), then the population left the discharge completely in February. It is indicated that the starling and invasive species using transient migratory movements take place in September-November and February-April (Fernie and Tessier, 2005).

Larus michahellis is a breeding and sedentary species in Algeria (Jacob and courbet, 1980; Moulai et al. 2006). We noted the presence of our species from January to early April (2 and 10 individuals). It is considered that these individuals as a passing group were reported to the landfill where they are observed in the morning for a few hours, sometimes they stay all day before heading towards the Mediterranean (Estrada-Devesa et al, 1997).

Pelecanus crispus, is a migratory bird, widespread in areas with temperate and tropical climate, the Dalmatian Pelican travels a short distance. In winter, it flies to the Nile. It leaves the landfill area in late August and returned in March. Sociably, it has a strong herd instinct (Gill, F and D Donsker, 2012). It is a species endangered, vulnerable to human disturbance such as pollution and the drying up of large area of wet zone. During the study period, we observed three individuals attended the discharge in December and January, which used discharge as a roosting site.

The richness observed during the period study was variable depending on season, between 12 species recorded in March and 6 species recorded in July, with an average wealth equal to 9 species. The high content of March is related to the presence of migratory birds such as *Ciconia ciconia* and *Bubulcus ibis* and the arrival of summer migratory visitors as *Milvus migrans* and *Aquila chrysaetos*. In spring rates of food needs to increase the breeding season for most species. During the months of follow-up there was a balance in the values of the index Shannon and Weaver which measures the degree of complexity of a stand. Within ten months the index values range between (0.41 and 0.80 bits) corresponds to a species-rich population (6 and 12 species), the distribution of abundance is balanced, except for December the value of the index is high (1.36 bit) corresponding to a population characterized by a large number of individuals, in which there is a dominant species Common Starling (*Sturnus vulgaris*) with a workforce of 27,664 by contribution to the abundance of other individual species.

Birds that frequent landfill caused risk of avian diseases on human health by direct contact with employers and indirect with city dwellers because they form a reservoir of very dangerous bacteria and viruses, harmful species ones which caused damage to the technical landfill center (Electricity cable, waterproof cover).

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