C. R. Biologies xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Comptes Rendus Biologies

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Ecology/Écologie

Impact of greenspaces in city on avian species richness and abundance in Northern Africa

Impact des espaces verts urbains sur la richesse spécifique et l'abondance d'oiseaux en Afrique du Nord

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ARTICLE INFO

Article history:
Received 17 November 2016
Accepted after revision 20 July 2017
Available online xxx

Keywords:
Algeria
Urbanization
Bird communities
Bird abundance
Greenspaces
Urban ecology

ABSTRACT

Increasing urbanization is a major challenge in the context of global changes, because this environment is known to negatively impact biodiversity. It is therefore important to identify factors maintaining biodiversity in such areas. Here, we tested in 650 sites whether the greenspaces in urbanized area of Annaba (Algeria) has positive effects on avian species richness and abundances. Our results show that species detection ($n = 26$) is more important during the breeding season as compared to the winter season, and that avian species richness is positively affected by the greenspaces. For most species, greenspaces impact positively their presence and abundances. Only the feral pigeon was less detected in greenspaces as compared to built-up areas. Our study therefore confirmed, for the first time in a Northern African city, that greenspaces significantly increase the species richness and abundances of birds, and shows that the season can profoundly affect such indicators.

Mots clés :
Algérie
Urbanisation
Communauté aviaire
Densité aviaire
Espaces verts
Écologie urbaine

RÉSUMÉ

Dans le contexte des changements globaux, l'accroissement de l'urbanisation est un important défi, puisque celui-ci affecte négativement la biodiversité. Il est donc primordial d'identifier les facteurs de l'environnement urbain qui favorisent la biodiversité. Dans cette étude, nous avons testé si les espaces verts de la ville d'Annaba (Algérie) avaient des effets positifs sur la richesse spécifique et l'abondance des oiseaux. Nos résultats montrent que la détection des espèces ($n = 26$) est plus importante pendant la saison de reproduction qu'en période hivernale, et que la présence d'espaces verts affecte positivement cette richesse spécifique. Pour la plupart des espèces, les espaces verts affectaient positivement leurs présences et abondances. Seul le pigeon biset était plus détecté en zone construite

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http://dx.doi.org/10.1016/j.crvi.2017.07.002

qu'en zone avec des espaces verts. Notre étude confirme, pour la première fois dans une ville d'Afrique du Nord, que les espaces verts en zones urbaines favorisent la richesse spécifique et l'abondance d'oiseaux.

1. Introduction

Nowadays, urban areas are in constant expansion (up to 1.2 million km^2 between 2000 and 2030 [1]) and are now recognized as a major challenge for biodiversity conservation in the context of global changes [2]. Indeed, the expansion of urban areas may have numerous and significant consequences on the evolution and ecology of population, and more largely on ecosystems. The ecological definition of urban areas, as "large concentrations of people and industrial activity that consume more available energy and material than can be produced, and produce more wastes than can be assimilated within the relatively small areas they occupy" [3], places humans at a keystone position in this environment. Urban ecosystems encompass specific environments regarding parasitism, pollutants or photoperiod, but also disturbances due to the presence of people, their activities, and wishes. For example, urban authorities can decide to manage urban nature to deal with negative perceptions of urban citizens. These social and bio-physical constraints contribute to classify urban ecosystems as "novel ecosystems" and may impact on local biodiversity. However, the functioning of such ecosystem remains poorly known, especially in the context of biodiversity [4].

A recent worldwide study has shown that urbanization decreased avian species richness, but tends to retain native species [5]. Such finding has been confirmed by local studies [6,7] and highlighted that avian species richness and abundances of an urban area can be used as indicators of biodiversity loss when compared to rural environments. It could be interesting to use a similar approach to investigate how the variability of urban environment would affect biodiversity. Indeed, urban areas are heterogeneous environments including built-up areas, open and greenspaces [8]. Recently, it has been advanced that the presence of greenspaces inside the cities could constitute a refuge for avian species and would host a high number of avian species [9]. Therefore, we first hypothesized that the greenspaces of urban areas could constitute a refuge for avian biodiversity [10,11], and we predicted that the avian species richness and abundances would be more important in greenspaces than in built-up areas. However, our indicators of avian biodiversity (species richness and abundances) can be highly variable among seasons. In particular, during the winter season, birds are supposed to be less detected due to lower activity and presences (migratory species) [12]. Therefore, the winter season could hide the positive effect of greenspaces when using such indicators of avian biodiversity. Unfortunately, little is known about the impact of the seasonal variability of avian biodiversity and how it is altering the measurements of avian species richness and abundances [13–15]. We thus hypothesized that seasons may alter our measurements of avian biodiversity and may hide the positive effect of greenspaces in urban areas. If true, we can predict that the positive effect of greenspaces on species richness and abundances should be more pronounced during the breeding season than during the winter season.

In this study, we tested these predictions by sampling avian species in the urban tissue of Annaba (Algeria). We collected the presences (detected or not) and abundances of 28 avian species using the "Indice pontuel d'abondance" for 650 sites distributed in three different types of urban habitats (greenspaces, intermediate and built-up areas) during two different seasons (breeding and winter seasons).

2. Material and methods

2.1. Study area

Our study has been realized in the furthest northeast limit of Algeria, in Annaba (36°.30 N & 37°.03 N &7°.20 E & 8°.40 E, Fig. 1). This city is located at 600 km from the capital Algiers; it extends at about 80 km on the

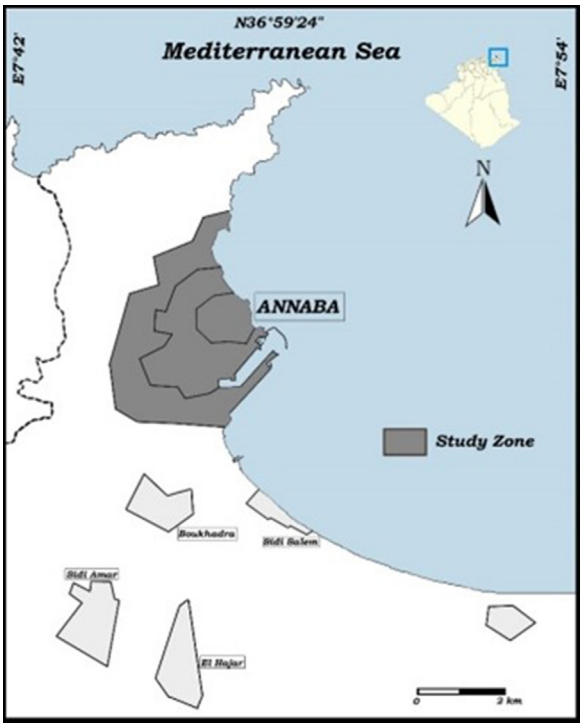

Fig. 1. Satellite map representing the study zone (From Belabed et al. [28]).

Please cite this article in press as: H.A. Aouissi, et al., Impact of greenspaces in city on avian species richness and abundance in Northern Africa, C. R. Biologies (2017), http://dx.doi.org/10.1016/j.crvi.2017.07.002