

CLIMATE VARIATION IMPACT ON BIRDS OF LEBANON - ASSESSMENT AND IDENTIFICATION OF MAIN MEASURES TO HELP THE BIRDS TO ADAPT TO CHANGE

Ghassan Ramadan-Jaradi

Faculty of Science, Section 1, Lebanese University, Beirut, Lebanon
r-jaradi@cyberia.net.lb

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ABSTRACT

The main aim of this study is to assist the national research community in its work of collecting, analyzing, evaluating and synthesizing information relevant to national and international impact of climate variation on the avifauna. The paper discusses the ornithological changes that are most probably caused by increased mean of temperature through the study of the birds of Lebanon during the period 1994-2010. Another aspect of this paper is providing birds of Lebanon with outlines of main adaptation measures, and policy makers with indicators of how climate variation affects some components of the Lebanese environment.

Keywords: bird, monitoring, climate change, climate variation, global warming, adaptation, Lebanon

INTRODUCTION

There is no doubt that climate is changing on a global scale. The observed trend has been towards increasing mean temperatures, particularly since about 1976; night-time minimal temperatures have increased twice as fast as day-time maximal temperatures, leading to fewer winter nights with freezing temperatures in temperate regions. Trends in Lebanon are similar to those observed on the global scale (Figure 1). Within this context, the aim of the present study has not been to provide an extensive literature review of how Lebanon's birds may be affected by environmental change, but to firstly see to which extent the climate variation is, most probably and partly, responsible for the installation of bird species new to Lebanon or for the extension of breeding ranges of others; and secondly to identify the appropriate measures that should be taken in order to help the affected bird species adapt to climate variation.

THE STUDY AREA

The study area encompassed the entire country that is of typical Mediterranean climate, humid to sub-humid in the wet season and sub-tropical (littoral), Mediterranean (middle mountains), semi-arid continental (Beqaa Valley) and arid continental (north of Beqaa Valley) in the dry season. It contains the following habitats: islands, sandy and rocky shorelines, urban areas, coastal plains, maquis and garrigue woods, olive groves; pine, oak, fir and cedar forests;

tragacanth area of the subalpine and alpine zones, arid and semi-arid uplands and hills of the Anti-Lebanon Range, orchards, cultivation lands, lakes, marshes, rivers and streams, riparian areas, and the semi-desert that is limited to small areas of Baalbeck, Hermel and Qaa of north Beqaa, where rainfall—partially inhibited by the high mountains—is about 250 mm/year. It is a direct extension of the Syrian Desert *via* the Homs depression.

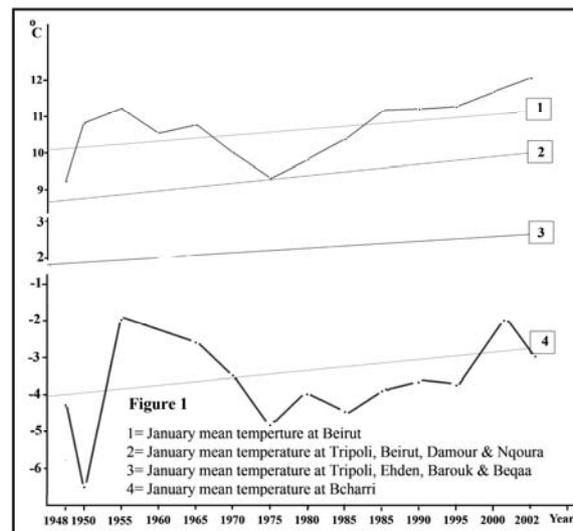


Figure 1. Trends of mean January temperature in various localities in Lebanon between 1948 and 2002.

METHODS

To census birds, the 20-minute point-count method was used, whereby all species noted during this time period are recorded at different places and different times of year in the most characteristic habitats of a given area (Blondel, 1975; Blondel *et al.*, 1981). This method is semi-quantitative and changes in abundance of a species are estimated by changes in the frequency of this species over a series of point counts.

On days of heaviest bird movement, it was necessary on occasion to estimate the number of birds passing. At other times, birds were individually counted. In addition, some birds were identified through capture in single-shelf mist-nets, during several surveys.

RESULTS AND DISCUSSION

Many types of data have been collected in a standardized way, covering wide geographical and habitat ranges over long time spans (1974-2007) (Tohmé & Neuschwander 1974; Tohmé & Tohmé 1986; Evans 1994; Ramadan-Jaradi & Ramadan-Jaradi, 1997; Bara 1998; Ramadan-Jaradi & Ramadan-Jaradi, 1999; Beale & Ramadan-Jaradi, 2001; Ramadan-Jaradi & Ramadan-Jaradi, 2001; Ramadan-Jaradi & Ramadan-Jaradi, 2002; Ramadan-Jaradi,

2006; Ramadan-Jaradi *et al.*, 2004; 2005; 2008; Ramadan-Jaradi & Bara, 2008) or at single sites over shorter time spans (2008-2010) to ensure the validity of the gathered information.

The present list of birds in Lebanon contains 395 species (Ramadan-Jaradi *et al.*, 2008) against 334 in the Lebanon's Biodiversity Country Study Report (Ramadan-Jaradi in Ministry of Agriculture (MoA), 1996a; 1996b). The 61 new bird species to Lebanon (see Tables 1 and 2) are categorized as follows:

TABLE 1

Species Inadvertently Omitted from the List of Birds in the BCS Report (See Text)

Scientific name	English name	Vag-rant	Passage and/or wintering	Last seen
<i>Ammoperdix heyi</i>	Sand Partridge	+		1946
<i>Puffinus yelkouan</i>	Yelkouan Shearwater		+	2010
<i>Puffinus griseus</i>	Sooty Shearwater	+		1981
<i>Gypaetus barbatus</i>	Lammergeier	+		1980
<i>Buteo b. vulpinus</i>	Steppe Buzzard		+	2010
<i>Aquila nipalensis</i>	Steppe Eagle		+	2009
<i>Larus cachinnans</i>	Caspian Gull		+	2010
<i>Larus genei</i>	Slender-billed Gull		+	2009
<i>Columba oenas</i>	Stock Dove		+	2009
<i>Regulus ignicapilla</i>	Firecrest	+		1958
<i>Regulus regulus</i>	Goldcrest		+	2001
<i>Sitta europaea</i>	Eurasian Nuthatch	+		1885
<i>Passer montanus</i>	Eurasian Tree Sparrow	+		1955
<i>Montifringilla nivalis</i>	White-winged Finch	+		1864
<i>Motacilla f. cinereocapilla</i>	Ashy-headed Wagtail	+		1975
<i>Motacilla flava beema</i>	Sykes's Wagtail		+	2008

Sixteen are already present prior to 1996 but inadvertently omitted from the country study report (*e.g.* Sand Partridge *Ammoperdix heyi*, Sooty Shearwater *Puffinus griseus*, Slender-billed Gull *Larus genei*, Goldcrest *Regulus regulus*). They include four originated from three parent taxa following upgrades from subspecies to species level (*e.g.* Steppe Buzzard *Buteo b. vulpinus*, Caspian Gull *Larus cachinnans*, Ashy-headed Wagtail *Motacilla flava cinereocapilla*, Sykes's Wagtail *Motacilla flava beema*). Forty five species are totally new to Lebanon. Of them 19 are first recorded by the author of the present paper (*e.g.* Red-crested Pochard *Netta rufina*, Horned Grebe *Podiceps auritus*, Crested Honey Buzzard *Pernis ptilorhynchus*, Chestnut-shouldered Petronia *Gymnoris xanthocollis*) and 26 by other eleven observers (*e.g.* Barbary Falcon *Falco pelegrinoides*, Pacific Golden Plover *Pluvialis fulva*, Terek Sandpiper *Xenus cinerea*, Bearded Reedling *Panurus biarmicus*).

TABLE 2
New Species to Lebanon not in BCS Report Due to Being Lately Discovered

Scientific name	English name	First recorded by	Status	Last seen
<i>Anser anser</i>	Greylag Goose	Beale	+	2000
<i>Cygnus olor</i>	Mute Swan	R-Jaradi	I	2006
<i>Netta rufina</i>	Red-crested Pochard	R-Jaradi	+	1995
<i>Mergus serrator</i>	Red-breasted Merganser	Bara	+	2002
<i>Hydrobates pelagicus</i>	European Storm Petrel	R-Jaradi	+	2003
<i>Oceanodroma leucorhoa</i>	Leach's Storm Petrel	R-Jaradi	w	2003
<i>Podiceps auritus</i>	Horned Grebe	R-Jaradi	+	2004
<i>Falco pelegrinoides</i>	Barbary Falcon	Evans	+	2000
<i>Pernis ptilorhynchus</i>	Crested Honey Buzzard	R-Jaradi	+	2006
<i>Aquila verreauxii</i>	Verreaux's Eagle	R-Jaradi	+	2002
<i>Pluvialis fulva</i>	Pacific Golden Plover	Bara	+	1996
<i>Limosa lapponica</i>	Bar-tailed Godwit	Bara	+	2004
<i>Numenius arquata</i>	Eurasian Curlew	Bara	+	2006
<i>Xenus cinerea</i>	Terek Sandpiper	Bara	pm	2005
<i>Phalaropus lobatus</i>	Red-necked Phalarope	R-Jaradi	pm	2003
<i>Larus armenicus</i>	Armenian Gull	R-Jaradi	+	2001
<i>Larus heuglini</i>	Heuglin's Gull	Al-Mecija	+	2004
<i>Oena capensis</i>	Namaqua Dove	Haaraldsson	Es	2005
<i>Psittacula krameri</i>	Rose-ringed Parakeet	R-Jaradi	I, r	2010
<i>Pterocles orientalis</i>	Black-bellied Sandgrouse	Bara	+	1996
<i>Streptopelia tranquebarica</i>	Red Turtle Dove	Al-Mecija	Es	1999
<i>Lanius i. phoenicuroides</i>	Turkestan Shrike	R-Jaradi	Pm,wv	1998
<i>Lanius m. pallidirostris</i>	Steppe Grey Shrike	Beale	+	2004
<i>Corvus (corone) orientalis</i>	Oriental Crow	Prior	+	2007
<i>Ammomanes cinctura</i>	Bar-tailed Lark	Beale	sb	2006
<i>Scotocerca inquieta</i>	Scrub Warbler	Jensen	r	2006
<i>Acrocephalus stentoreus</i>	Clamorous Reed Warbler	Beale	Sb	2007
<i>Gymnoris xanthocollis</i>	Chestnut-shoulder Petronia	R-Jaradi	v	2006
<i>Phylloscopus neglectus</i>	Plain Leaf Warbler	R-Jaradi	+	1996
<i>Phylloscopus t. viridanus</i>	Greenish Warbler	Beale	+	2000
<i>Panurus biarmicus</i>	Bearded Reedling	Naylor	+	2005
<i>Acridotheres tristis</i>	Common Myna	Bara	I, R	2010
<i>Turdus atrogularis</i>	Dark-throated Thrush	R-Jaradi		2002
<i>Oenanthe cyprica</i>	Cyprus Wheatear	R-Jaradi	+	2005
<i>Oenanthe picata</i>	Variable Wheatear	Al-Mecija	+	2000
<i>Ficedula semitorquata</i>	Semi-collared Flycatcher	R-Jaradi	pm	1997
<i>Lonchura malabarica</i>	Indian Silverbill	Al-Mecija	Es	2000
<i>Prunella collaris</i>	Alpine Accentor	R-Jaradi	pm	2003
<i>Prunella ocularis</i>	Radde's Accentor	Bara	+	2002
<i>Motacilla flava lutea</i>	Yellow-headed Wagtail	R-Jaradi	+	2002
<i>Motacilla flava thunbergi</i>	Grey-headed Wagtail	Carruthers	pm	2009
<i>Motacilla citreola</i>	Citrine Wagtail	R-Jaradi	pm	2002
<i>Anthus r. japonicus</i>	Buff-bellied Pipit	Balmer	+	2007
<i>Emberiza leucocephalos</i>	Pine Bunting	Shirihai	wv	2000
<i>Emberiza rustica</i>	Rustic Bunting	Shirihai	+	2003

(+=vagrant, w=wintering, pm=migrant, sb=summer breeding, r=resident, I=introduced, Es=escaped)

Of the new species, five are originated from recently escaped or introduced birds (Mute Swan *Cygnus olor*, Rose-ringed Parakeet *Psittacula krameri*, Red Turtle *Streptopelia tranquebarica*, Common Myna *Acridotheres tristis* and Indian Silverbill *Lonchura malabarica*) where the Parakeet and the Myna have had successfully established growing colonies of breeding birds; one species is of uncertain status (Namaqua Dove *Oena capensis*) as it is not known whether it is an escapee or range expanding species; twenty seven are vagrants; nine rare passage migrants and/or winterers; two resident breeding and one summer breeding visitor.

Impact of Climate variation

Birds may be affected simultaneously by climate variation and several types of environmental change, and determining which impact has been responsible for changes in behavior or population dynamics is not always a simple task. In some cases, different impacts may have opposite effects of the same magnitude, with the result that no net effect can be detected. Great care is thus necessary when interpreting results such as those presented in this paper, a matter which implicates that we better avoid analyzing impacts on productivity, mortality, migration pattern, timing of migration and timing of breeding because such analyses require huge effort and time as well as specific types of data. Instead we prefer limiting our investigation to breeding range shifts and winter range shifts that are among the bird reactions to global warming. When reacting to global warming, species of southern desert zones or of African or of Tropical origin are more likely to expand to the northern latitudes than those of northern origin (Palearctic & Holarctic). Examining this list of birds, it appears that:

Of the above new species to the country, only two breeding species are apparently affected by climate variation: Bar-tailed Lark *Ammomanes cinctura* (species of hot desert) and Scrub Warbler *Scotocerca inquieta* (species of desert and semi-desert). Their appearance in Lebanon (e.g. Qaa, Hermel, Baalbek) doesn't seem to be subsequent to increased observation efforts or habitat change but most probably the result of global warming. More research at the regional level may elucidate the ornithological scene of these two species. The recent appearance of the Namaqua Dove *Oena capensis* could probably represent the vanguards of the colonizers in Lebanon, especially that this species is a widespread resident breeding bird in Sub-Saharan Africa and Madagascar where it is found near desert with scattered trees and bushes, whilst its range is progressively extending into the Arabian Peninsula, southern Palestine, Jordan and as far north as Turkey.

During the last decade the information of at least 65% (235) of the species that were listed in Ramadan-Jaradi & Ramadan-Jaradi (1999) was amended. However, the most significant changes are those related to the status of 83 species; where 28 (Table 3) of them proved to breed for the first time in the country. Of them, 24 are influenced by a complex of ecological, climatic and anthropological (lack of efficient observation) factors whereas the other four are apparently most influenced by global warming:

The Cream-coloured Courser *Cursorius cursor* is a bird of dry open country, preferably desert. In 2002, it found at Qaa and Hermel (arid continental area) a suitable habitat for breeding. Prior to this date it was irregular and rare non breeding species.

The Desert Lark *Ammomanes deserti*, Temminck's Lark *Eremophila bilopha* and Mourning Wheatear *Oenanthe lugens* (species of desert, semi-desert and desert-like areas) were considered vagrants until 2000-2003 when found breeding in the arid desert of Qaa and at Ras Baalbek and in the semi-arid Anti-Lebanon mountain.

The most southern parts of Lebanon formed until recently the northern limit of the Palestine Sunbird *Cinnyris osea* breeding range, whereas Beirut was the northern limit of its wintering range. After 2002, the species extended its breeding range for about 80 km north to incorporate Beirut whilst the wintering range was shifted 20 km further north.

TABLE 3

The 28 Species That Have Changed their Status to Breeding During the Last Decade

Scientific name	English name	Recorded as breeding by	Status
<i>Anas platyrhynchos</i>	Mallard	R-Jaradi	sb
<i>Anas querquedula</i>	Garganey	Beale & Springer	sb
<i>Circus gallicus</i>	Short-toed Snake Eagle	R-Jaradi	sb
<i>Circus aeruginosus</i>	Western Marsh Harrier	Conroy	sb
<i>Buteo rufinus</i>	Long-legged Buzzard	R-Jaradi	R
<i>Aquila fasciatus</i>	Bonelli's Eagle	R-Jaradi	R
<i>Vanellus spinosus</i>	Spur-winged Lapwing	R-Jaradi	sb
<i>Cursorius cursor</i>	Cream-coloured Courser	R-Jaradi	sb
<i>Larus michahellis</i>	Yellow-legged Gull	R-Jaradi	R
<i>Chlidonias hybrida</i>	Whiskered Tern	R-Jaradi	sb
<i>Streptopelia decaocto</i>	Eurasian Collared Dove	R-Jaradi	R
<i>Bubo bubo</i>	Eurasian Eagle Owl	Prior & Bayle	r
<i>Apus pallidus</i>	Pallid Swift	R-Jaradi	sb
<i>Upupa epops</i>	Eurasian Hoopoe	R-Jaradi	R
<i>Dendrocopos syriacus</i>	Syrian Woodpecker	R-Jaradi	R
<i>Lanius collurio</i>	Red-backed Shrike	R-Jaradi	SB
<i>Oriolus oriolus</i>	Eurasian Golden Oriole	R-Jaradi	sb
<i>Pyrrhocorax graculus</i>	Yellow-billed Chough	R-Jaradi	R
<i>Cyanistes caeruleus</i>	Blue Tit	Bara	r
<i>Remiz pendulinus</i>	Eurasian Penduline Tit	Bara & Al-Mecija	sb
<i>Ammomanes deserti</i>	Desert Lark	Conroy	sb
<i>Eremophila bilopha</i>	Temminck's Lark	R-Jaradi	Sb or r
<i>Phylloscopus collybita</i>	Common Chiffchaff	Bara	SB
<i>Sylvia atricapilla</i>	Eurasian Blackcap	R-Jaradi	SB
<i>Sylvia mystacea</i>	Ménétries's Warbler	R-Jaradi	sb
<i>Luscinia megarhynchos</i>	Nightingale	R-Jaradi	SB
<i>Oenanthe lugens</i>	Mourning Wheatear	Bara	r
<i>Serinus syriacus</i>	Syrian Serin	R-Jaradi	SB

(SB= Common Summer Breeder, sb= rare summer breeder, R= Resident, r= rare resident)

The above study has shown that due to climate variation and resulting desertification some areas in Lebanon (mainly Qaa and Hermel) transformed from semi-arid to arid after getting hotter and drier. Consequently, these areas have become viable for the reception of bird species of arid or desert areas located further to the south after the latter became hyper-

arid. The seven species which reacted to global warming by shifting or expanding their breeding range to the north are of Tropical origin and they can subsequently be considered good indicators of climate change. Further studies of regional level will necessary reveal which of these species are shifting their breeding range north and which of them are expanding it to the north. As for the introduced or escaped tropical Parakeet and Myna, it appears that they thrived better in warmer temperature to the extent that their expansion in Lebanon is getting dramatic and threatening other species.

Semi-desert areas like Qaa and Hermel or Ras Baalbek are more responsive to desertification that is caused not only by climate variation but also by overgrazing and/or poor grazing management; destruction of vegetation, often for fuel wood; and inappropriate irrigation practices. When the causes of desertification or the practices described above coincide with drought, the rate of desertification is dramatically increased. In this case, the breeding birds of Qaa, Hermel and Ras Baalbek (*Calandrella rufescens* Lesser Short-toed Lark, *Melanocorypha bimaculata* Bimaculated Lark, *Sylvia mystacea* Ménétries's Warbler, *Oenanthe isabellina* Isabelline Wheatear, *Oenanthe lugens* Mourning Wheatear, *Oenanthe finschii* Finsch's Wheatear and *Carpospiza brachydactyla* Pale Rock Finch) may expand or shift their breeding range further north, leaving the space – through departure or reduced density - to the recently installed new species to Lebanon. Nevertheless, it is of high importance to reduce the inappropriate practices mentioned above to help the bird species of semi-arid areas adapting to climate change. In addition, there will be a need to integrate conservation and sustainable use of avifauna and related natural resources in legislation, policies and programs. Since hunting in Lebanon is considered as one of the most destructive tool to birds, the development and implementation of a national strategy for hunting is a must.

This study has especially highlighted the arrival of new species from the south or the desert. It would be interesting to complement it with the observation of the more temperate areas' species that recently appeared in Lebanon (Blue Tit *Cyanistes caeruleus* and Common Chiffchaff *Phylloscopus collybita*) at the southern limit of their distribution. Will the global warming make them disappearing again to fly back towards the North?

Adaptation to climate variation

Most, if not all, of the threats to avifauna are derived, in some way, from the causes discussed briefly above. The adaptation to climate variation requires the following actions:

- Reduce conversion of natural habitats to lands of urban, industrial and/or agricultural uses;
- Decrease degradation of coastal ecosystems by reducing population excessive growth;
- Diminish the use of pesticides and other agro-chemicals;
- Reorganize grazing that may destroy natural regeneration and compact soils;
- Control illegal hunting;
- Control forest fire and root causes.
- Ban the introduction of invasive alien species;
- Mitigate negative impact of quarries on natural ecosystems;

Many of the threats listed above involve the loss of forest cover. Loss of cover means loss of habitat for biodiversity but it also means watershed degradation - which, in turn, leads to floods and droughts, soil erosion, and landslides that can result in the loss of bird lives and the perturbation of many ecosystems.

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