

BIRD SPECIES DIVERSITY OF THE MITIDJA PLAIN (NORTHERN ALGERIA) WITH EMPHASIS ON THE DYNAMICS OF INVASIVE AND EXPANDING SPECIES

Raznovrstnost ptičjih vrst v nižini Mitidja (severna Alžirija) s poudarkom na dinamiki invazivnih in ekspanzivnih vrst

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This treatise investigates the poorly studied bird fauna of Mitidja Plain (Northern Algeria), with particular notes on the occurrence and expansion of new and alien species. Direct observations, supported by ornithological surveys carried out by Progressive Frequential Sampling (PFS), a version of a point count method, have allowed us to identify 125 bird species. These represent 31% of all species known from Algeria. The species recorded belong to 14 orders, 39 families and 37 genera. According to their biogeographic origins, 36 are Mediterranean, 32 Palearctic, 24 Holarctic, 17 European and 16 of European-Turkestanian origin. The Mitidja Plain holds 60 resident-breeder species (48% of all registered species) and is a transit zone for many migratory species (summer and winter migrants constituting 20% and 14% of the total, respectively) and occasional visitors (RA = 12%). Among recently expanding species (introduced or local), the Collared Dove *Streptopelia decaocto* and Wood Pigeon *Columba palumbus*, sampled by the spot-mapping method, experienced a very rapid population growth. The first observations of the former were made in 1996 in Algiers. Its numbers experienced a steep increase after 2002, starting from 5.75 pairs/10 ha to reach up to 31.5 pairs/10 ha in 2006. The same applies for the Rose-ringed Parakeet *Psittacula krameri*, surveyed by direct-count at roosting sites. This species has been able to increase and reproduce since its first introduction into the wild in 1996. The increase in study species populations, especially the Rose-ringed Parakeet, may derive from good weather conditions that favoured the species through providing better feeding conditions, thus high reproduction outcomes.

Key words: avian community, bird species diversity, alien species, expanding species, *Streptopelia decaocto*, *Columba palumbus*, *Psittacula krameri*, Mitidja Plain, Algeria

Ključne besede: ptičja združba, raznovrstnost ptičjih vrst, tujerodne vrste, ekspanzivne vrste, *Streptopelia decaocto*, *Columba palumbus*, *Psittacula krameri*, nižina Mitidja, Alžirija

1. Introduction

Worldwide, the monitoring of biodiversity is recognized as an urgent and necessary task accompanying measures to reduce and halt the loss of species, although it raises problems of great complexity (MAGURRAN *et al.* 2010, NORMANDER *et al.* 2012). Owing to their high position in food webs and wide range of ecological requirements, birds are good indicators of the state of biodiversity (BIGGS *et al.* 2008). Bird monitoring allows to assess the state of ecosystem health and to understand undergoing changes (LINDENMAYER & CUNNINGHAM 2011, MACLEOD *et al.* 2011, ŞEKERCIOĞLU 2012).

The Mediterranean region is considered one of the global biodiversity hotspots. However, large-scale habitat losses and deterioration influence the distribution of bird communities in the region. Many studies dedicated to bird diversity aim to understand factors driving the decline of species diversity and population numbers. Generally, habitat fragmentation (BROTONS & HERRANDO 2001, SANTOS *et al.* 2002) and land abandonment following rural exodus, timber harvesting and overgrazing are the main reasons for biodiversity losses in the Mediterranean basin (FARINA 1995, SUÁREZ-SEOANE *et al.* 2002, SIRAMI *et al.* 2008).

Biological invasions are one of the greatest threats to ecosystems and one of the main causes for the extinction of many native species. Moreover, interactions between native and alien species do not seem to be simply explained since they are governed by a complex amalgam of parameters (BLACKBURN & JESCHKE 2009). Furthermore, evaluating ecological and economic consequences of invasive species has currently become a top priority for biodiversity and ecosystem monitoring (KHUROO *et al.* 2011). Invasions have many ecological consequences affecting biodiversity and resulting in harmful interactions with native species or even for biota functioning (MACK *et al.* 2000, BONTER *et al.* 2010): (1) competition that may cause the elimination of native or introduced species (STRUBBE & MATTHYSEN 2007 & 2009), (2) predation that leads to severe decline or extinction of natives (MACK *et al.* 2000), (3) rapid change and expansion in species distribution (BLACKBURN *et al.* 2008, BONTER *et al.* 2010, SI BACHIR *et al.* 2011), (4) disease transmission (MACK *et al.* 2000), and (5) habitat and landscape modifications (SOH *et al.* 2002).

In recent years, the Mitidja Plain in Northern Algeria has experienced significant changes due to urban sprawl. As a result, the surface areas of agricultural lands and forests as well as urban green-

spaces have been significantly diminished (HADJIEDJ *et al.* 2003). Furthermore, recent habitat changes in the Mitidja Plain and the Sahel of Algiers seem to have been caused by climate changes that resulted in a severe drought (1990–2000) followed by irregular annual rainfall during an extended wet period since 2000 (NOM 2008).

This study aims to assess the birds' diversity and their ecological statuses (biogeographical and phenological) in relation to the rapid change of environmental conditions in the Mitidja Plain. Special emphasis is laid on the understanding of the population dynamics of two formerly unknown, but now rapidly expanding breeding birds – the Wood Pigeon *Columba palumbus* and Collared Dove *Streptopelia decaocto* – and on the recently introduced Rose-ringed Parakeet *Psittacula krameri*. Since few studies deal with aspects related to invasions and introductions of non-native bird species in Algeria and northern Africa, the study may be of great interest to conservationists as well as environmental managers.

2. Material and methods

2.1. Study area

The Mitidja Plain is the largest Algerian sub-coastal plain that stretches almost across 1,500 km² south of the Sahel of Algiers region and reaches the eastern seaboard at Bordj El Kiffan and Ain Taya. The Plain (36°29'N to 36°44'N, 2°25'E to 3°17'E) is the country's most fertile area which, however, has greatly been and still is subjected to agricultural activities. It is actually a depression enclosed by the Tellian Atlas Mountain range in the south and low-altitude sub-coastal hills (up to 60 m a.s.l.) in the north (BENDJOUDI 2008). In the east, the Plain borders on a series of hills between Boudouaou and Boumerdes, in the south and southwest on the Blidian Atlas Mountains, and in the west on the mountain ranges of Chenoua and Hadjout (Figure 1).

The climate is typically Mediterranean with dry season extending over four months per year and mean annual temperatures exceeding 15 °C. Precipitation, mostly occurring in winter (ca. 4 months), is characterized by great inter-annual and inter-monthly fluctuations. The coldest month is January (mean temperature 10.1 °C.), while the warmest month is August with a mean temperature of 35.6 °C (NOM 2008).

The Plain is covered by Mediterranean vegetation types. On the banks of wadis that cross the Plain, many forest stands of White Poplar *Populus alba*, European Ash *Fraxinus excelsior*, Field Elm *Ulmus minor*, Cork

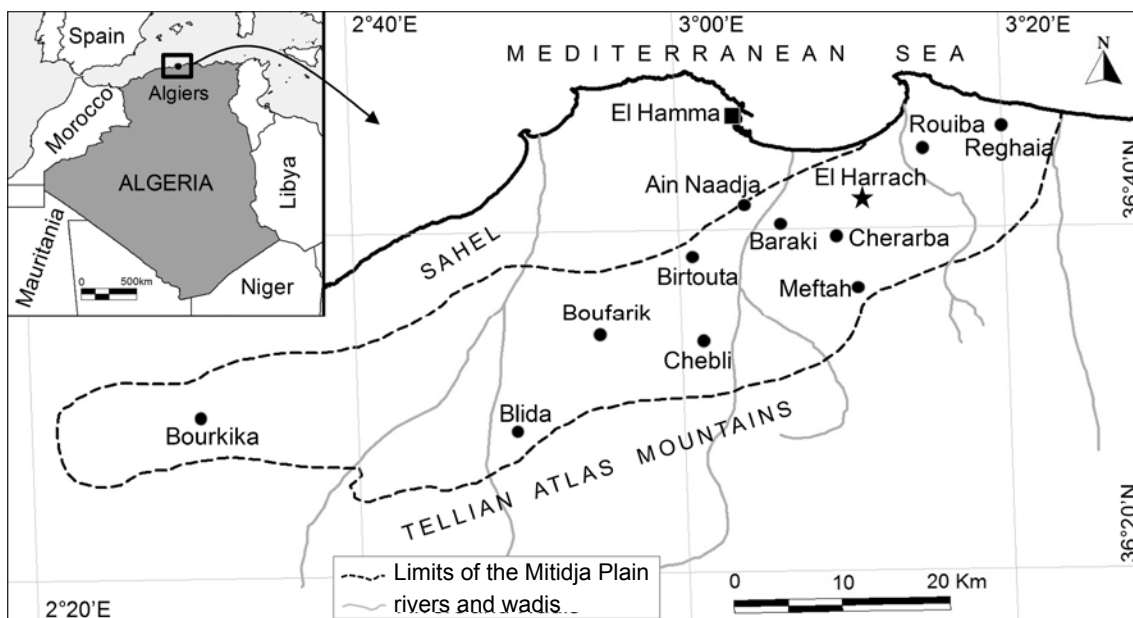


Figure 1: Location of the 12 census points in Mitidja Plain where general bird surveys for collecting data on species diversity (●) and specific census of Columbidae species (★) were carried out; (■) depicts site where Rose-ringed Parakeet *Psittacula krameri* was established for the first time

Slika 1: Lokacije 12 popisnih točk v Mitidji, kjer so potekali splošni popisi ptic z namenom zbiranja podatkov o raznovrstnosti ptic v tej nižini (●); lokacija, kjer je bil opravljen poseben popis vrst iz družine Columbidae (★); (■) ponazarja lokacijo, kjer je bil prvič zabeležen aleksander *Psittacula krameri*

Oak *Quercus suber*, River Red Gum *Eucalyptus camaldulensis* and other tree species can still be seen as remnants of fragmented forests. Large citrus orchards of the Plain are interspersed by plantations of Loquat *Eriobotrya japonica* and other Rosaceae trees, like apple, pear, peach, apricot, plum and almond, as well as patches of cereal and vegetable crops (BENDJOURI 2008).

2.2. Data collection and analysis

A set of 12 census points was allocated non-randomly, based on accessibility and habitat type. Points were chosen in the manner to get out as many data and information on the Plain's bird populations as possible. Census points were distributed from east to west, as: Reghaia (freshwater coastal marsh), Rouiba (settlements with surrounding orchards of Rosaceae), El Harrach (suburban forest park), Meftah et Cherarba, Baraki, Ain Naadja (agricultural lands), Chebli, Birtouta, Boufarik (citrus orchards), Blida (settlements with surrounding maquis and olive culture) and Bourkika (cereal crops with *Fraxinus*-stands) (Figure 1). Sites located southward the Plain are more natural and influenced by the barrier

created by the Tellian Atlas Mountains. However, sites positioned north of Mitidja are characterised by a decreasing gradient of urbanization from east to west. Reghaia site is a coastal wetland represented by marshes that are part of the Oued Reghaia estuary, which drains into the Mediterranean Sea about 30 km east of Algiers (Figure 1).

For collecting data on species diversity, the Progressive Frequential Sampling (Echantillonnage Fréquentiel Progressif) technique according to BLONDEL (1975) and BLONDEL *et al.* (1981) was selected. The PFS is a version of point count method that had already been used in several bird studies carried out in Algeria (e.g. BELLATRECHE 1999, BENYACOUB & CHABI 2000). It estimates species richness regardless of species abundances and should be applied under favourable weather conditions between 30 min before sunrise and 4 h after it at the most (BLONDEL *et al.* 1981). During each count, all birds heard or seen within a radius of 50 m around the observer were recorded, and eventually the number of species reported as abundance per 10 ha unit area. Counts were conducted flexibly between February 2004 and December 2006, with an average frequency of three counts per month.

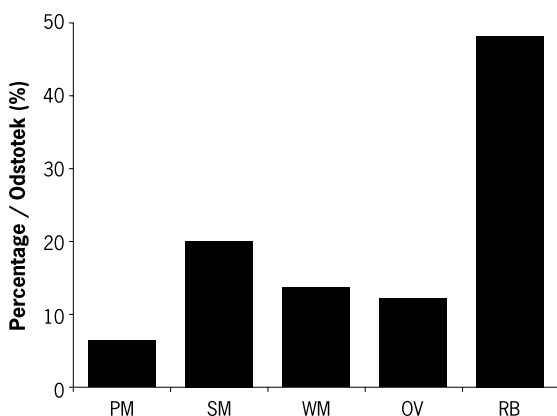


Figure 2: Phenological status of bird species recorded in Mitidja Plain (PM – partial migrant, SM – summer migrant, WM – winter migrant, OV – occasional visitor, RB – resident breeder)

Slika 2: Fenološki status ptičjih vrst, zabeleženih v Mitidji (PM – delna selivka, SM – poletna selivka, WM – zimska selivka, OV – občasna gostja, RB – stalnica-gnezdilka)

Population numbers of expanding species, such as Wood Pigeon and Collared Dove, were investigated by the Territory Mapping Method that is considered the most accurate procedure for measuring bird abundance, specifically in open habitats (BIBBY *et al.* 1992). The method that plots individuals seen or heard on a gridded map was applied in a single plot of 10 ha in a suburban environment of El Harrach area (Figure 1) during the breeding season (between 15 Feb and 15 Jun) from 1996 to 2006. During each census, the technique was applied during 2.5 hours after sunrise under favourable weather conditions. In total, a set of 7–14 counts was carried out yearly, with a frequency of 2–3 counts per month. Bird population density was given in number of pairs per 10 ha. Of all counts carried out in the 1996–2006 period, only data for the years 1996, 1999, 2002 and 2006 were analysed and included in the present study, as human disturbance was significant in the excluded years and data incomplete.

Population numbers of the Rose-ringed Parakeet were investigated by regular bi-annual counts of roost-sites throughout the Mitidja Plain between 1996 and 2006, with the help of 23 volunteer fieldworkers. The bird was searched at sites composed of *Eucalyptus* groves, old pine stands, trees of mulberry *Morus*, Pecan *Carya illinoensis* or ornamental palms scattered over parks, gardens and surrounding wadis of the Plain. In addition, bird species with large home ranges, such as raptors, waterbirds, swallows, swifts and starlings were

recorded occasionally by direct observation all over the Mitidja Plain. Their abundances were estimated semi-quantitatively according to the scale proposed by BENYACCOUB & CHABI (2000): (1) abundant species – the species is registered almost during every field visit, i.e. present constantly; (2) common species – regular occurrence but not constant; (3) uncommon species – finding the species requires some research effort; and (4) rare species – registered only accidentally, i.e. few observations during the entire study period.

All bird species identified in the study area were assigned according to VOOUS (1960) into biogeographic faunal types. Further, main types were grouped into five main biogeographic categories: Mediterranean, Holarctic, Palearctic, European, and European-Turkestanian (BLONDEL *et al.* 1978).

3. Results

3.1. Species diversity

In total, we recorded 125 bird species in the Mitidja Plain. Of these, 81 species were noted during PFS counts and additional 44 species by occasional observations during ornithological surveys. Of all species, only 14 (11%) were waterbirds. The 125 bird species recorded belong to 14 orders, 39 families and 37 genera. With 16 families and 74 species, the Passeriformes are best represented, followed by Falconiformes (2 families, 13 species), Columbiformes (1 family, 7 species) and Charadriiformes (2 families, 5 species) (Table 1). Two species – the Red Kite *Milvus milvus* and Audouin's Gull *Larus audouinii* – are cited in the IUCN Red List (IUCN 2012) as Near Threatened (NT).

3.2. Biogeographical origins and phenological status

The identified bird species were distributed across 12 faunal types with 25% belonging to the Palearctic faunal type. European and European-Turkestanian faunal types each held 12–14% of the species, while the Mediterranean and Holarctic types each included a little more than 10% of all species. Regarding main biogeographical categories, the Mediterranean category predominated with 29% over the Palearctic and Holarctic categories with 26% and 19% of all bird species, respectively (Table 2). Regarding to breeding status and migration behaviour, 60 species (48%) were resident breeders, followed by summer migrants (20%), winter migrants (14%) and occasional visitors (12%) (Figure 2).

Table 1: List of bird species recorded in Mitidja plain, Algeria between 2004 and 2006 (faunal type: C – Cosmopolitan, E – European, ET – European-Turkestani, ETH – Ethiopian, H – Holarctic, IA – Indo-African, M – Mediterranean, OW – Old World, P – Palearctic, PX – Palearctic, PXM – Paleo-Xero-Montane, TM – Turkestano-Mediterranean; phenological category: RB – resident breeder, WM – winter migrant, SM – summer migrant, PM – partial migrant, OV – occasional visitor; abundance data represents Progressive Frequential Sampling data, given as an average value of species presence per 10 ha and qualitative abundances of bird species with large home ranges: + rare, ++ uncommon, +++ common, ++++ abundant)

Tabela 1: Seznam ptičjih vrst, zabeleženih v nižini Mitidja (Alžirija) med letoma 2004 in 2006 (favniški tip: C – kozmopolitski, E – evropski, ET – evropsko-turkestanski, ETH – etiopski, H – holarktični, IA – indo-afriški, M – mediteranski, OW – stari svet, P – palearktični, PX – paleokserični, PXM – paleo-ksero-montanski, TM – turkestansko-mediteranski; fenološka kategorija: RB – stalnica-gnezdička, WM – zimska selivka, SM – poletna selivka, PM – delna selivka, OV – občasna gostja; podatki o številčnosti vrst, pridobljeni s progresivnim frekvenčnim vzorčenjem, so podani kot povprečne vrednosti pojavljanja vrst na 10 ha oz. kvalitativno pri ptičjih vrstah z velikim arealom: + redka, ++ občasna, +++ pogosta, ++++ zelo pogosta)

Species / Vrsta	Faunal type/ Favniški tip	Phenological category/ Fenološka kategorija	Abundance/ Številčnost vrste
<i>Anas platyrhynchos</i>	H	WM	++
<i>Aythya fuligula</i>	P	WM	++
<i>Alectoris barbara</i>	M	RB	0.67
<i>Coturnix coturnix</i>	OW	RB	0.07
<i>Nycticorax nycticorax</i>	C	PM	+
<i>Bubulcus ibis</i>	IA	PM	++++
<i>Ciconia nigra</i>	P	OV	+
<i>Ciconia ciconia</i>	P	PM	+++
<i>Phoenicopterus roseus</i>	OW	WM	++
<i>Milvus migrans</i>	OW	SM	++
<i>Milvus milvus</i>	E	WM	+
<i>Elanus caeruleus</i>	IA	RB	+++
<i>Circus aeruginosus</i>	P	RB	+
<i>Circus cyaneus</i>	H	WM	++
<i>Accipiter nisus</i>	P	RB	++
<i>Buteo buteo</i>	H	OV	+
<i>Buteo rufinus</i>	PX	RB	++
<i>Aquila chrysaetos</i>	H	RB	+
<i>Aquila fasciata</i>	IA	RB	++
<i>Falco naumanni</i>	TM	OV	+
<i>Falco tinnunculus</i>	OW	PM	++++
<i>Falco peregrinus</i>	C	RB	++
<i>Gallinula chloropus</i>	C	RB	0.31
<i>Fulica atra</i>	P	PM	++
<i>Scolopax rusticola</i>	P	WM	0.13
<i>Chroicocephalus ridibundus</i>	P	WM	++
<i>Larus audouinii</i>	M	WM	+
<i>Larus fuscus</i>	P	WM	+
<i>Larus michabellis</i>	M	RB	++++
<i>Pterocles orientalis</i>	PX	RB	0.10
<i>Columba livia</i>	TM	RB	17.1
<i>Columba oenas</i>	ET	WM	1.33
<i>Columba palumbus</i>	ET	RB	4.08
<i>Streptopelia decaocto</i>	IA	RB	2.14
<i>Streptopelia roseogrisea</i>	IA	RB	+
<i>Streptopelia turtur</i>	ET	SM	12.0
<i>Streptopelia senegalensis</i>	Eth	RB	0.44
<i>Psittacula krameri</i>	Eth	RB	++
<i>Cuculus canorus</i>	P	SM	0.14

Continuation of Table 1 / Nadaljevanje tabele 1

Species / Vrsta	Faunal type/ Favnistični tip	Phenological category/ Fenološka kategorija	Abundance/ Številčnost vrste
<i>Tyto alba</i>	C	RB	++++
<i>Otus scops</i>	OW	SM	++
<i>Athene noctua</i>	TM	RB	+++
<i>Strix aluco</i>	P	RB	++++
<i>Asio otus</i>	H	RB	++
<i>Apus apus</i>	P	SM	++
<i>Apus pallidus</i>	M	SM	++++
<i>Merops apiaster</i>	TM	SM	4.17
<i>Coracias garrulus</i>	ET	SM	0.18
<i>Upupa epops</i>	OW	SM	0.43
<i>Picus vaillantii</i>	E	RB	0.05
<i>Dendrocopos minor</i>	P	RB	0.04
<i>Jynx torquilla mauretanicus</i>	P	RB	0.14
<i>Oriolus oriolus</i>	OW	SM	0.18
<i>Tchagra senegalensis</i>	Eth	RB	0.10
<i>Lanius meridionalis</i>	H	RB	0.85
<i>Lanius senator</i>	M	SM	0.22
<i>Corvus monedula</i>	P	RB	+
<i>Corvus corax tingitanus</i>	H	RB	+++
<i>Regulus ignicapilla</i>	H	RB	0.08
<i>Cyanistes caeruleus</i>	E	RB	1.00
<i>Parus major</i>	P	RB	0.14
<i>Melanocorypha calandris</i>	M	RB	0.14
<i>Calandrella brachydactyla</i>	TM	RB	0.43
<i>Calandrella rufescens</i>	TM	RB	0.14
<i>Galerida cristata</i>	P	RB	0.54
<i>Galerida theklae</i>	M	RB	0.05
<i>Lullula arborea</i>	E	RB	0.21
<i>Alauda arvensis</i>	P	PM	1.20
<i>Pycnonotus barbatus</i>	Eth	RB	1.29
<i>Riparia riparia</i>	H	OV	+
<i>Hirundo rustica</i>	H	SM	++++
<i>Delichon urbica</i>	P	SM	++++
<i>Cettia cetti</i>	TM	RB	0.33
<i>Phylloscopus bonelli</i>	E	SM	0.11
<i>Phylloscopus collybita</i>	P	WM	1.50
<i>Phylloscopus trochilus</i>	P	OV	0.11
<i>Sylvia atricapilla</i>	E	RB	1.00
<i>Sylvia borin</i>	E	OV	0.67
<i>Sylvia communis</i>	ET	SM	0.67
<i>Sylvia conspicillata</i>	M	WM	0.47
<i>Sylvia cantillans</i>	M	SM	0.11
<i>Sylvia melanocephala</i>	TM	RB	0.89
<i>Locustella luscinioides</i>	ET	SM	0.33
<i>Iduna pallida</i>	M	SM	0.57
<i>Acrocephalus schoenobaenus</i>	ET	SM	0.33
<i>Acrocephalus scirpaceus</i>	ET	SM	0.33
<i>Cisticola juncidis</i>	IA	RB	0.56

Continuation of Table 1 / Nadaljevanje tabele 1

Species / Vrsta	Faunal type/ Favnistični tip	Phenological category/ Fenološka kategorija	Abundance/ Številčnost vrste
<i>Certhia brachydactyla</i>	E	RB	0.14
<i>Troglodytes troglodytes</i>	H	RB	0.50
<i>Sturnus vulgaris</i>	ET	WM	++++
<i>Sturnus unicolor</i>	M	RB	0.89
<i>Turdus merula</i>	P	RB	2.50
<i>Turdus philomelos</i>	E	WM	1.33
<i>Turdus viscivorus</i>	ET	PM	0.11
<i>Muscicapa striata</i>	ET	SM	1.00
<i>Ficedula albicollis</i>	E	OV	0.10
<i>Ficedula hypoleuca</i>	E	OV	0.09
<i>Erithacus rubecula witherbyi</i>	E	PM	1.00
<i>Luscinia megarhynchos</i>	E	SM	0.44
<i>Luscinia svecica</i>	P	OV	0.05
<i>Phoenicurus ochruros</i>	PXM	PM	0.50
<i>Phoenicurus moussieri</i>	M	RB	0.14
<i>Phoenicurus phoenicurus</i>	E	OV	0.10
<i>Monticola solitarius</i>	PXM	RB	0.04
<i>Saxicola rubetra</i>	E	OV	0.29
<i>Saxicola torquatus</i>	P	RB	0.93
<i>Oenanthe oenanthe</i>	P	OV	0.40
<i>Passer domesticus</i>	P	RB	0.10
<i>Passer hispaniolensis</i>	TM	SM	0.11
<i>P. domesticus</i> × <i>P. hispaniolensis</i>	/	RB	6.81
<i>P. montanus</i>	P	OV	0.05
<i>Motacilla flava</i>	P	SM	0.33
<i>Motacilla cinerea</i>	P	WM	0.29
<i>Motacilla alba</i>	P	WM	5.67
<i>Anthus trivialis</i>	ET	OV	0.11
<i>Anthus pratensis</i>	E	WM	0.38
<i>Fringilla coelebs africana</i>	E	RB	1.43
<i>Chloris chloris aurantiiventris</i>	ET	RB	2.33
<i>Serinus serinus</i>	M	RB	5.79
<i>Carduelis carduelis niediecki</i>	ET	RB	0.43
<i>Carduelis spinus</i>	P	OV	0.05
<i>Carduelis cannabina mediterranea</i>	ET	RB	0.54
<i>Loxia curvirostra poliogyna</i>	ET	RB	0.10
<i>Emberiza cirlus</i>	M	RB	0.15
<i>Miliaria calandra</i>	ET	RB	0.38

3.3. Population dynamics of the expanding species

Collared Dove *Streptopelia decaocto*

The first individual of this species was noted in 1996 in the suburban habitats of El Harrach near Algiers. In 2002, the Collared Dove breeding density amounted to 5.8 pairs/10 ha (Figure 3). Until 2006, its breeding density increased by almost six-fold to 31.5 pairs/10 ha.

Wood Pigeon *Columba palumbus*

The Wood Pigeon nests in both urban trees and in plantations in public parks of El Harrach, and even on roofs of nearby buildings. Its breeding density shows a similar trend as that of the Collared Dove. In 1996, only four pairs were counted by the Territory Mapping Method, while by 2006 its breeding density reached up to 57.3 pairs/10 ha, i.e. a more than 14-times

Table 2: Biogeographic origins of the bird fauna of Mitidja Plain, Algeria (for explanation of abbreviations see Figure 1)

Tabela 2: Biogeografsko poreklo ptičje favne v nižini Mitidja (za razlago okrajšav glej sliko 1)

Biogeographic category/ Biogeografska kategorija (BLONDEL <i>et al.</i> 1978)	No. of species/ Število vrst	Percentage/ Odstotek (%)	Faunal type/ Favnistični tip (VOOUS 1960)	No. of species/ Število vrst	Percentage/ Odstotek(%)
Mediterranean	36	28.8	M	13	10.4
			TM	9	7.2
			PX	2	1.6
			PXM	2	1.6
			IA	6	4.8
			ETH	4	3.2
Holarctic	24	19.2	H	13	10.4
			OW	7	5.6
			C	4	3.2
Palaearctic	32	25.6	P	32	25.6
European	17	13.6	E	17	13.6
European-Turkestanian	16	12.8	ET	16	12.8

increase since 1996 (Figure 3). A particularly massive population growth took place between 1999 and 2002 when nesting Wood Pigeon's density increased from 9.8 to 48.5 pairs/10 ha. Since then large flocks, sometimes exceeding a hundred individuals, were

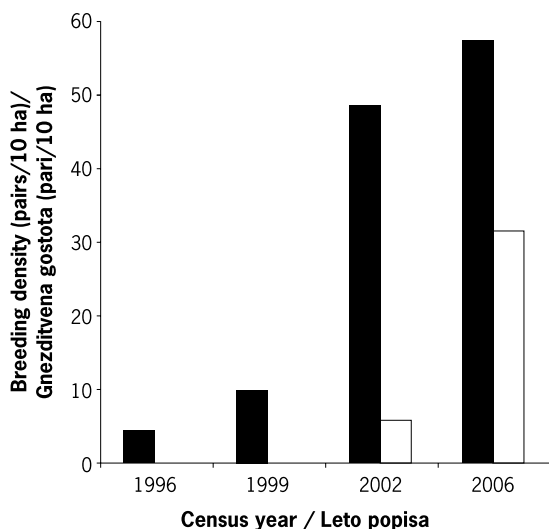


Figure 3: Population size of Wood Pigeon *Columba palumbus* (black columns) and Collared Dove *Streptopelia decaocto* (white columns) in the suburban environments of El Harrach (Mitidja Plain, Algeria) in the 1996–2006 period

Slika 3: Velikost populacij grivarja *Columba palumbus* (črni stolpci) in turške grlice *Streptopelia decaocto* (beli stolpci) v predmestnih okoljih El Harracha (nižina Mitidja, Alžirija) v obdobju 1996–2006

observed outside El Harrach, even at the limits of the Algiers littoral and Mitidja Plain.

Rose-ringed Parakeet *Psittacula krameri*

The Mitidja Plain's population densities increased simultaneously with the species' numbers in the littoral areas of Algiers. In all, we identified two periods of population growth: (1) in 1996–2002, the numbers of visual or auditory contacts with Rose-ringed Parakeets by regular controls of roost-sites throughout the Plain increased nearly 12-times from four to 46 individuals at all roost sites together, (2) the period 2002–2004 was marked by a rapid increase of Rose-ringed Parakeets in the Plain, where the total number of parakeets on all roost-sites jumped to 342 individuals in 2004, i.e. 80.1% of the total numbers recorded in 2006, which was 422 individuals (Figure 4). The number of roost-sites reported between 2004 and 2006 was seven and 11 sites, respectively. In 2004, about 80 parakeets were counted in a roost-site located around Reghaia. However, in 2006 over 108 Rose-ringed Parakeets were counted in Haouch El Makhfi (Meftah).

4. Discussion

4.1. Species numbers and species diversity

With 125 bird species recorded during our study, the avifauna of the Mitidja Plain is rich, despite various disturbances occurring in the region (urbanization, intensive farming practices, poaching, etc.). In

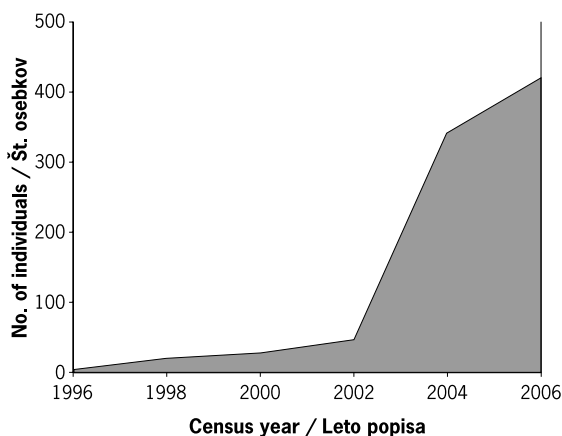


Figure 4: Population growth of Rose-ringed Parakeet *Psittacula krameri* in Mitidja Plain and surrounding areas of Algiers, based on the counts of individuals on roost-sites

Slika 4: Populacijska rast aleksandra *Psittacula krameri* v Mitidji in sosednjih območjih Alžira, ugotovljena s štetjem osebkov na prenočiščih

comparison to the Algerian bird list of 406 species (ISENMANN & MOALI 2000), our inventory embraces 31% of the country's bird fauna.

According to the classifications by VOOUS (1960) and BLONDEL *et al.* (1978), the majority of Mitidja's birds belong to the Palearctic fauna (32 species, 26%), followed by species of European (17 species, 14%) and European-Turkestanian (16 species, 13%) origins. Many studies in Algeria and in other North African countries have shown high proportions of bird species linked to the Palearctic biogeographic region (FELLOUS 1990, THEVENOT 1991, ISENMANN & MOALI 2000, ISENMANN *et al.* 2005, BENDJOUDI 2008). In the Mitidja Plain, most species belong to the Mediterranean broad biogeographical category (29%). This agrees with the former Algerian studies by LEDANT *et al.* (1981) for the nationwide avifauna (41%), BELLATRECHE (1994) for the Kabylie-Babors area (38%) and BELLATRECHE (1999) for the Babor Mountain (35%), all of which stated that the Algerian avifauna has clear Mediterranean affinities. Only FELLOUS (1990) found that in the bird fauna of the National Park of Theniet-El-Had in Tellian Atlas Mountains, species of Boreal origins predominate (65%).

The occurrence of some species in the Mitidja Plain depends on the presence of intensively cultivated fields of vegetables and cereals. This applies particularly for some granivorous birds, whose numbers are increasing, like Turtle *Streptopelia turtur*, Laughing *S. senegalensis*

and Collared Doves, Rock Dove *Columba livia* and Wood Pigeon. Obviously, the same concerns some Fringillidae and Passeridae, like Greenfinch *Chloris chloris*, Serin *Serinus serinus* and hybrid sparrows *Passer* sp. (BENDJOUDI 2008). It is noteworthy that the hybrid sparrows and doves are experiencing wide outbreak in several Algerian regions even in hyper-arid environments (GUEZOUL *et al.* 2013). Additionally, certain frugivorous species, in particular the Common Bulbul *Pycnonotus barbatus* and Blackbird *Turdus merula*, were found in high densities. In contrast, some species that are more susceptible to human impacts breed in smaller numbers; e.g. Nightingale *Luscinia megarhynchos*, Woodcock *Scolopax rusticola*, Wryneck *Jynx torquilla* and Lesser Spotted Woodpecker *Dendrocops minor*. In general, the dissimilarity between species densities may reflect the decrease of natural and agricultural lands, interspersed by trees, bushes and shrubs, following the expansion of urban and industrial areas in recent years.

Like in Morocco, the majority of breeding bird species inhabiting the Plain's cork oak forests are resident breeders (THEVENOT 1991). In the Kabylie-Babors (Algeria), the proportion of sedentary species is higher than that of summer migrants (BELLATRECHE 1994). With 69% out of 214 breeding species, the proportion of resident breeders also dominates in Algeria in general (ISENMANN & MOALI 2000). Our study further reveals that some partial migrants like the Yellow-legged Gull *Larus michahellis* and Cattle Egret *Bubulcus ibis* tend to be resident in the region for a longer period of the year over the last three decades. For example, the Cattle Egret was observed during almost the whole year of 2006, except in July. Its mean numbers were more important in March, August and December (BENDJOUDI 2008).

Similarly to the Kabylie-Babors region with 20% (BELLATRECHE 1994), the proportion of summer migrants is rather low in the Mitidja Plain, while in other areas of North Africa summer migrants surpass the numbers of other groups: e.g. in Moutas Cynegetic Reserve near Tlemcen in Western Algeria summer migrants dominate with 39% of all species (MOSTEFAI 1997), with 31% in Tamentit Oasis in the central Sahara (CHERIFI 2003), and with 28% in the Iforas-Adrar Massif in northern Mali (CLOUET & GOAR 2003). The small number of summer migrants in the Mitidja Plain may be due to lack of suitable nest-sites. In addition, the impact of human pressure, urban sprawl and intensive exploitation of farmland is probably among the causes for small number of summer migrant birds, which use Mitidja as a stopover before/after crossing the Sahara Desert. Resident

breeders are more abundant as they well adapt to the favourable climatic conditions of the Plain; therein these birds find sufficient food throughout the year (DOUMANDJI & DOUMANDJI-MITICHE 1992, BENDJOUDI 2008).

4.2. Recent trends of expanding species

Collared Dove and Wood Pigeon

The rapid increase of both Columbidae species in our study area coincides with similar trends of these species in several other regions worldwide (ERAUD *et al.* 2007, BARNARD & THUILLER 2008, BONTER *et al.* 2010, FUJISAKI *et al.* 2010).

The first observation of Collared Dove in Annaba in Algeria goes back to 1994 (BENYACOUB 1998), while in Tunisia the species is present for a longer period (ISENMANN *et al.* 2005). In Morocco, the species is a well-established breeding bird (BERGIER *et al.* 1999). Like in other parts of North Africa, population numbers have grown considerably in the Mitidja Plain. BENYACOUB (1998), who investigated the population dynamics of Collared Dove in the northern outskirts of Annaba city (eastern Algeria), highlighted a rapid expansion of the population newly established; nevertheless, he reported that this population growth could not be attributed to the local reproduction but to the migration flow. The species increased in a number of European countries. The increase was most notable along the Mediterranean and in Western Europe (BIRDLIFE INTERNATIONAL 2004).

Wood Pigeons occur everywhere in our study area. However, nearly two decades ago the species was absent in some habitats, while mainly frequenting parks and large gardens. A sudden and large increase of the breeding densities was noted between 2001 and 2002. The population growth is further reflected by large groups of sometimes more than a hundred Wood Pigeons, which could be seen in transition zone between the Algiers littoral and Mitidja Plain. In Egypt, the species still appears to be very rare. Only a single individual was observed in the 1990s (MILES 1998), similarly to a suburban park near El Harrach in the eastern littoral plain of Algiers. In different forests of the Kabylie-Babors area in North Algeria, breeding densities were relatively low, with numbers ranging from 0.02–0.35 pairs/10 ha (BELLATRECHE 1994). In France, the population increase may be linked to the establishment of resident winter populations – a phenomenon attributed by JULLIARD & JIGUET (2005) to the increase of cereal crops. However, in SE Austria the same trend was observed when cereal

crops have sharply declined; and the establishment of winter populations coincide with milder temperatures and less snow in winter (P. SACKL *pers. comm.*). The population growth of Wood Pigeon in the study area is probably due to the reduced hunting pressure for more than a decade in Algeria. Also, even if poaching continues, it remains insignificant. The growth may also be related to a change in the species diet. These birds used to feed mainly in the forests of the Atlas Mountains, where all kinds of food were abundant, but since 1990 the violent forest fires occurring each year in the region (SAHAR-MEDDOUR *et al.* 2008) have significantly reduced these food resources. Deprived of a large part of their usual food, the pigeons thus had to concentrate on food resources of adjacent farmlands in the Mitidja Plain.

According to personal observations of the species in different seasons and in several habitats (parks, gardens, suburban environments etc.), where it is present together with Turtle, Laughing and Rock Doves, the Collared Dove appears not to face any competition by other Columbidae, neither in winter (by Laughing Dove) nor in summer (by Turtle Dove). This is due to the fact that this highly synanthropic species does not utilise the same feeding habitats as the other two doves, which means that it resorts to eating somewhat different food (BENYACOUB 1998, BENDJOUDI 2008). Apparently, the invasion and range expansion of this species is closely related to human activities. Among factors influencing its colonization are those related to the size, fragmentation and connectivity between patches of urban areas, as well agricultural practices and weather conditions (ERAUD *et al.* 2007, FUJISAKI *et al.* 2010), which applies for many alien species as well (BLACKBURN *et al.* 2008).

Rose-ringed Parakeet

The occurrence of Rose-ringed Parakeet in the study area is due to 6–8 individuals that escaped from aviaries in the Garden of Hamma (Algiers) between 1988–1990. Free-ranging birds were maintained in Hamma Garden and its immediate vicinity, where the first signs of reproduction were noted a few years following their escape. From 1988–1990, the established pairs remained sedentary in Hamma Garden and its immediate neighbourhoods. After 1990, their offspring moved away from the centre to the periphery of Algiers, while increased population size was noted in various localities within the Algiers region, where the species had already established itself (METRITER *pers. comm.*, MOULAI 1997, BENDJOUDI *et al.* 2005A, FELLOUS *et al.* 2005, BENDJOUDI *et al.* 2006).

The Rose-ringed Parakeet started to expand its range in Algeria when offspring of the already established breeding pairs moved out of Hamma Garden into other localities of the Mitidja Plain (BENDJOUDI *et al.* 2005B). In Morocco, the first record of the species was noted in 1999 near Nador, located 60 km east from the border with Algeria (BERGIER *et al.* 2000).

From 1996–2002, the population numbers of Rose-ringed Parakeets in Mitidja Plain amounted to 11%, compared to a total population of 422 individuals in 2006. In Britain, the population was estimated at 1,508 individuals in October 1996, 1,880 individuals in August 1997 (20% increase) and 2,060 individuals in September 1998, i.e. a further 27% increase (PITHON & DYTAM 2002). The authors conclude the British population is relatively small and its expansion slow. Despite the low geographical expansion of the Rose-ringed Parakeet in Paris (France) compared to other European cities (CLERGEAU & VERGNES 2009), the establishment of the species and its current status suggest an expansion and a rapid increase in numbers (CLERGEAU *et al.* 2009).

Various reasons are under consideration to explain the slow expansion of Rose-ringed Parakeets in unfavourable habitats located outside their natural range. Climatic hazards such as frost and fog are among the main factors that can induce high mortality (TAMARA & ARNHEM 1996). However, this is not the case when considering the milder temperatures throughout the year in our study area. Thus, we suppose that other mortality factors such as (1) high predation rates by raptors, especially owls, (2) trapping of adults during the breeding season and (3) poaching play a key role in regulating the population size of the Rose-ringed Parakeet around Algiers.

The increase of Rose-ringed Parakeets in the Mitidja Plain may derive from favourable climatic conditions due to a significant amount of rainfall in 2003. The 2002 was a year of severe drought, probably the longest for decades in Algeria that lasted eight months from February to October. In contrast, 2003 was exceptionally wet, totalling 736 mm of precipitation spread over a wet period of almost seven months from mid-October to early May the following year. These weather conditions favoured the species through providing better feeding conditions, thus its high reproduction success and low mortality. In fact, the distribution of Algerian Rose-ringed Parakeet is governed mainly by the sub-humid climate with warm to temperate winter. Moreover, these climatic conditions support the development of many fruiting plant species in the Plain. Many tropical fruiting trees, which were introduced in the Garden of Hamma during the colonial period (1860–1962), were

eventually dispersed to home gardens throughout the Algiers Sahel and the northern edge of the Mitidja Plain, which has diversified food resources for many birds, including alien species (BENDJOUDI *et al.* 2005B).

Considering the faunal and phenological status, the bird community of Mitidja Plain is fairly similar to those in other regions in either Algeria or North Africa. However, during the last decades a rapid population increase has been observed in species established recently in the area. The review of the current distribution and further expansion of expanding bird species, including Collared Dove, Wood Pigeon and Rose-ringed Parakeet, in the Mitidja Plain within a broader geographic context is crucial for understanding environmental factors driving range expansion and population dynamics, which will help to mitigate potential risks they may pose to the environment.

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5. Povzetek

Pričujoči prispevek obravnava doslej slabo preučevano ptičjo favno nižine Mitidja v severni Alžiriji, s posebnimi poudarki o pojavljanju in širitvi novih in tujerodnih vrst. Neposredna opažanja s podporo progresivnega frekvenčnega vzorčenja (različica metode točkovnega štetja) so raziskovalcem omogočila določiti 125 vrst ptic, kar pomeni 31 % vseh vrst, pojavljajočih se v Alžiriji. Zabeležene vrste pripadajo 14 redovom, 39 družinam in 37 rodovom ptic. Glede na biogeografski izvor je 36 vrst sredozemskih, 32 palearktičnih, 24 holarktičnih, 17 evropskih in 16 evropsko-turkeških. Nižino naseljuje 60 gnezdkilistalnic (48 % vseh zabeleženih vrst), sicer pa je to nižavje tudi selitveno območje za mnoge selivke (poletne in zimske, ki sestavljajo 20 % oz. 14 % vseh vrst) in občasne gostje (12 %). Med novejšimi

ekspanzivnimi vrstami (vnešenimi ali avtohtonimi) je bilo s točkovnim kartiranjem opaziti zelo naglo rast populacij turške grlice *Streptopelia decaocto* in grivarja *Columba palumbus*. Prva opažanja turške grlice so bila zabeležena leta 1996 v Alžiru, njeno število pa je začelo naglo naraščati po letu 2002 s 5,75 para/10 ha, višek pa doseglo leta 2006 z 31,5 para/10 ha. Enako velja za aleksandra *Psittacula krameri*, ki je bil preštet neposredno na prenočiščih; širiti se je začel po letu 1996, ko je bil naseljen. Rast populacij preučevanih vrst, posebno aleksandra, gre verjetno pripisati ugodnim vremenskim razmeram, ki vrstam omogočajo boljše prehrano in zatorej tudi uspešno razmnoževanje.

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