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AGE, SEX AND SEASON RELATED BIOMETRICS OF THE DEAD SEA SPARROW *PASSER MOABITICUS*

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SUMMARY.—*Age, sex and season related biometrics of the Dead Sea Sparrow* Passer moabiticus
Aims: Analyse age and sex related dynamics and biometric differences in Dead Sea Sparrows *Passer moabiticus*.
Location: Eilat, Israel.
Methods: Data were collected during 18 springs and 17 autumns in the years 1984-2001. To date, a total of 2761 Dead Sea Sparrows have been ringed at Eilat.
Results: A significant difference was found in the proportion of juveniles over the year with smaller numbers of juveniles trapped in spring. The dates of catching for sexes and age during spring and autumn have not changed over the years (1984-2001). Differences in biometric measurements between the two sexes were recorded. Males had longer wing chords and were heavier than females in both the migration seasons. In spring, adult females were heavier than juveniles. The analyses of the body condition index showed, that only in spring, in both the sexes, adults were in better body condition than the first year birds.
Conclusions: The results suggest that Eilat is an important staging and wintering site for the non-breeding population of the Dead Sea Sparrow in the region.
Key words: Biometry, Dead Sea Sparrow, Israel, migration, *Passer moabiticus*.

RESUMEN.—*Edad, sexo y variación estacional de la biometría en el Gorrión del Mar Muerto* Passer moabiticus.
Objetivos: Se analiza para esta especie la dinámica temporal de las aves en relación a su edad y sexo, así como en relación a su biometría.
Localidad: Eilat, Israel.
Métodos: Los datos fueron recogidos durante 18 primaveras y 17 otoños entre los años 1984 y 2001. Un total de 2761 Gorriones han sido hasta la fecha anillados en Eilat.
Resultados: Se encontró una diferencia significativa en el porcentaje de juveniles a lo largo del año, con un menor número de juveniles trampeados en primavera. Las fechas de captura de los distintos sexos y edades no presentaron cambios en el periodo 1984-2001. Se registraron diferencias sexuales en la biometría, siendo los machos los que tienen un ala mayor y un mayor peso corporal tanto en la migración primaveral como en la otoñal. En primavera, las hembras adultas tuvieron un mayor peso corporal que las juveniles. El análisis del índice de condición corporal mostró que solamante en primavera y para ambos sexos, los adultos estaban en mejor condición corporal que las aves de primer año de edad.
Conclusiones: Los resultados sugieren que el área de estudio es una importancia zona de paso e invernada para los individuos no reproductores de la región.
Palabras clave: Biometría, Gorrión del Mar Muerto, Israel, migración, *Passer moabiticus*.

INTRODUCTION

The Dead Sea Sparrow (*Passer moabiticus* Tristram, 1864) has a disjunct and widely scattered range that stretches through southern Turkey, Cyprus, Israel, Jordan, Iraq, southwest Iran and southwest Afghanistan (Clement *et al*., 1993). In Israel and Jordan the species is restricted to the Syrian-African rift valley between Eilat and the Hula Valley and is found also in well-vegetated cultivated areas (Andrews, 1995; Snow & Perrins, 1998). The species occurs mostly in areas with tamarisk (*Tamarisk* spp.) or scrub associated with aquatic habitats in arid areas. Dead Sea Sparrows breed colonially and their populations can be migratory, partially migratory or dispersive outside of the breeding season (Shirihai, 1996).

Outside of the breeding season, Dead Sea Sparrows gather in large foraging flocks that

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can number in the hundreds and leave the breeding areas (Shirihai, 1996). Mixed species flocking is common and Dead Sea Sparrows are known to flock with Spanish (*P. hispaniolensis*) and House Sparrows (*P. domesticus*). In general, the movements are of a local character, but a true migration has also been observed, mainly in northern Israel, where the Dead Sea Sparrow occurs only in the summer (Shirihai, 1996). Observations at Eilat show a movement to the north in the spring and to the south in autumn. However, to date, no detailed studies or analyses have been published, and only observational data is available in Shirihai (1996).

Moreover, data on biometric measurements are limited mostly to museum skins with a small sample size (Clement *et al*., 1993; Olsson *et al*., 1995; Snow & Perrins, 1998). Morgan and Shirihai (1997) provided limited additional data, however they did not test for sex or age related differences. Hence, in order to enhance the understanding of the migration ecology of the different age and sex groups of the Dead Sea Sparrow, data was analysed for individuals ringed at Eilat, Israel, between 1984 and 2001. Additionally, sex and age related biometric differences were examined and an attempt made to elucidate the ecological pressures that have led to the differences.

Material and methods

Ringing by the International Birding & Research Centre in Eilat (IBRCE) was initiated in 1984. However, owing to changes in agricultural practices and political pressures, the ringing location changed three times in the area immediately to the north and east of Eilat (Morgan & Shirihai, 1997). Between the springs of the years 1984-1990 (except 1987) ringing was conducted in agricultural fields 3 km north of Eilat. Up to 1987 the major crop comprised mostly of Alfalfa *Medicago sativa* and from 1987-1989 was changed to melons and other cash crops. Between autumn 1990 to autumn 1995 the ringing station was relocated 1.5 km east of Eilat to a natural area of mixed salt marsh vegetation, dominated by Sea-Blite *Suaeda monoica*. Since spring 1996 the ringing program has been relocated 2 km north of Eilat in the boundaries of the «Bird Sanctuary» (29°33'N, 34°57'E) of the IBRCE.

Data were collected during 18 springs and 17 autumns in the years 1984-2001 (except autumn 1987 due to political restrictions). A total of 2.761 (range 6-650 per year) Dead Sea Sparrow have to date been ringed at Eilat and none recovered or controlled elsewhere. Birds were mist-netted during the day only (average 4.6 ± 1.2 h, 500m of mist-nets, details in Yosef & Tryjanowski, 2002). Birds were ringed, sexed and aged, and biometric parameters were measured. Birds were classified into four age or sex classes based on plumage characteristics: adult male, first-year male, adult female, first-year female (*e.g.* Svensson, 1992; Olsson *et al*., 1995). Flattened maximum wing cord was measured to the nearest millimetre, and body mass was determined with a Pesola 50-g spring balance to the nearest 0.5 g. The bird mass divided by the wing length obtained the body condition index of the birds.

Annual variations in local population size of the Dead Sea Sparrow are presented in two ways: 1.- The number of trapped individuals in a given year; 2.- As an index of a ringing point activity. We calculated the ringing point activity as the number of total birds of all species trapped (*cf.* Yosef & Tryjanowski, 2002) in a given year, and consequently the year number index is a percentage of the Dead Sea Sparrow trapped in relation to all individuals in the following years.

Statistical procedures

The trapping time was standardized for all years, separately for spring and autumn seasons, and is presented in Julian dates. It was estimated by subtracting the median Julian date of catching time for each trapping season from each catching date in that trapping season. In general, the whole data set was analysed to understand the local movements of the Dead Sea Sparrow. However, data on wing chord length, body mass and body condition of birds is not available for all individuals, and has resulted in large variations in sample sizes. Moreover, individuals not ascribed to one of the age or sex classes were excluded from the biometrical analyses. To analyse differences in age classes' among seasons, only seasonal data with a sample size that exceeds ten individuals ringed were used. Standard statistical

methods were used to describe and analyse the data (Sokal & Rohlf, 1995). All statistical tests were two-tailed.

RESULTS

Numbers, sex-ratio, age-ratio, dates of catching

A total of 2.761 Dead Sea Sparrows were trapped during 18 springs and 17 autumns during years 1984-2001. Great variance in numbers between years in both seasons (Fig. 1a and b) was found with no significant trend in the Dead Sea Sparrow numbers over the spring (r_s = –0.08, n = 18, P = 0.74) as well as autumn season (r_s = -0.11, n = 17, P = 0.69). The trends remained insignificant even when we used an index improved by ringing point activity (P > 0.5 for both seasons).

A highly significant difference in the number of male and female ringed in the spring seasons (χ^2 = 139.29, df = 1, P < 0.001) was found, wherein males comprised 27.2% of all ringed birds. In autumn, the sex ratio was also female-skewed (χ^2 = 108.63, df = 1, P < 0.001) but males consisted 30.7%. The proportion of juveniles ringed during spring and autumn differed significantly (χ^2 = 154.59, df = 1, P < 0.001). Juveniles comprised 43.2% in spring and 68.6% of the Dead Sea Sparrows ringed in autumn. Moreover, significant differences in the proportion of trapped birds from the different age classes in spring were found (χ^2 = 397.70, df = 9, P < 0.001), where the percent of juveniles in individual years ranged from 1.0% in 1985 to 73.6% in 1989. Also in autumn the differences among years were significant (χ^2 = 150.33, df = 13, P < 0.001), where the percent of juveniles in individual years ranged from 26.0% in 1990 to 91.7% in 1985.

The largest numbers of Dead Sea Sparrows ringed on migration was in late February and in March in the spring and early November during the autumn passage period. No changes were found in the dates of ringing of male and female Dead Sea Sparrow (spring: Mann-Whitney U-test, U = 153643, P = 0.32; autumn: U = 198092.5, P = 0.15). Moreover, no differences were found in dates between juveniles and adults in the spring (U = 202403, P = 0.98) and autumn passage (U = 130435, P = 0.21).

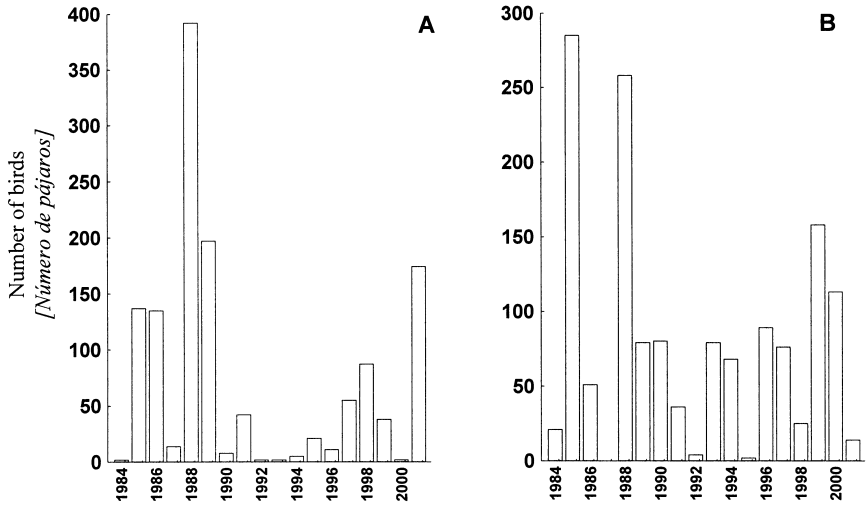

FIG. 1.—The number of Dead Sea Sparrow ringed during the spring (A, n = 1324) and autumn season (B, n = 1438) in Eilat, Israel.
[Número de Gorriones del Mar Muerto anillados durante la primavera (A, n = *1324) y el otoño (B,* n = *1438) en Eilat, Israel.]*

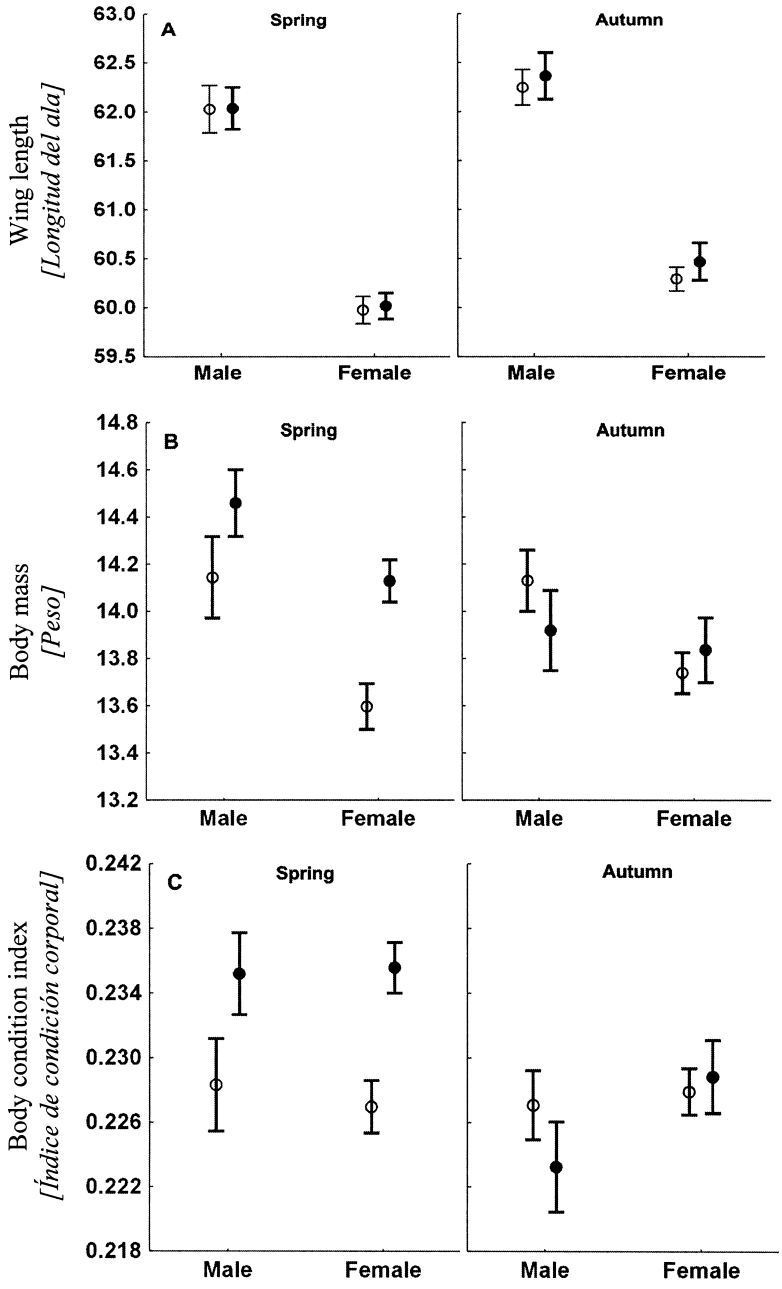

FIG. 2.—Mean values with 95% confidence limits, of wing length (mm, A), body mass (g, B) and body condition index (C) of male and female Dead Sea Sparrow of the different age groups (juveniles - hollow points; adults - full points) ringed during spring and autumn seasons at Eilat, Israel.
[Valor promedio con los límites de confianza del 95% de la longitud del ala (mm, A), peso corporal (g, B) y del índice de condición corporal (C) de machos y hembras de Gorrión del Mar Muerto en los distintos grupos de edad (juveniles –puntos blancos; adultos: puntos negros) anillados durante la primavera y otoño en Eilat, Israel.]

Differences in wing chord length and body mass and body condition in relation to sex and age

Significant differences were found in wing chord length between the sexes (factorial ANOVA, $F_{1,2196} = 854.74$, $P < 0.001$). Males had longer wing chords than females in both migration seasons. However, the age of birds did not affect on wing length ($F_{1,2196} = 1.50$, $P = 0.209$, Fig. 2a).

The effect of sex was statistically significant ($F_{1,2272} = 50.39$, $P < 0.001$) and age ($F_{1,2272} = 14.81$, $P < 0.001$) on body mass. The differences concerned spring season, where males were heavier than females (Fig. 2b). A significant interaction effect was found between age and season on the body condition of the Dead Sea Sparrow ($F_{1,2158} = 33.04$, $P < 0.001$). In spring, in both sexes, adults were in better body condition than the first year birds. However adults in spring were in better condition than in autumn season (Fig. 2c).

Body measurements in relation to catching date

No changes in wing chord length were recorded for birds from four sex-age classes in both migration seasons. However, body mass as well as body condition increase during the spring migration season but only for juvenile females (body mass: $r = 0.23$, $n = 409$, $P < 0.001$; body condition index: $r = 0.22$, $n = 389$, $P < 0.001$; relationships also significant with Bonferroni sequential correction for multiple comparisons). No significant relationship was found between body measurements and ringing date in autumn.

Discussion

Although Shirihai (1996) reported that Dead Sea Sparrows were present in Eilat throughout the year, Morgan & Shirihai (1997) stated that the species is mostly a passage migrant with variable numbers that over-winter in the Eilat region. Numbers of over-wintering flocks can range from singles to several 100s (R. Yosef, *unpubl. data*). The reasons for these fluctuations have not been studied to date but we consider it reasonable to assume that food and appropriate roost sites appear to be the limiting resources.

The over-all results in sex and age composition suggest that the local population is female-skewed. Unfortunately, there are no data on sex ratio in breeding populations, as well as comparable data from other regions and studies published to date. The number of juveniles was highest in autumn, as could be expected because this is the period immediately after the annual breeding cycle. However, the first of the juveniles appeared in April (see also Yom-Tov & Ar, 1980), and although known to not breed in the region, could be the result of an undiscovered breeding population in the region, possibly across the border in Jordan.

Biometric data are very difficult to compare with other studies, because the data presented in literature are either from museum skins (Olsson *et al*., 1995) or small sample sizes (*e.g*. Summers-Smith, 1988; Cramp & Perrins, 1994) or none stated at all (*e.g*. Clement *et al*., 1993). Similar to the pattern described by Olsson *et al*. (1995), at Eilat the males had longer wings and were heavier than the females, both in spring and autumn. Some seasonal and age differences were found in biometric measurements. Generally, they were similar to the pattern described for many passerines, where older birds are larger than juveniles, especially in the spring (see Morgan & Shirihai, 1997). However, more detailed explanations are impossible because there are no similar studies on other populations, or are there any studies pertaining to the movement patterns of the local populations.

Based on these results, it appears that Eilat is an important staging and wintering site for the non-breeding population of the Dead Sea Sparrow in the region. The arable fields and the semi-desert surroundings of the city and along the Arava (rift) valley offer good foraging habitats. However, no pattern in their movements was uncovered and the lack of data about their nomadic movements, environmental requirements and flocking habits stresses the importance of studying the non-breeding part of the life cycle of the Dead Sea Sparrow.

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