

# WORLD STATUS OF THE GREAT BUSTARD (*OTIS TARDA*) WITH SPECIAL ATTENTION TO THE IBERIAN PENINSULA POPULATIONS

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*World status of the Great Bustard (Otis tarda) with special attention to the Iberian peninsula populations.*— The aim of this paper is to review the current world status of this endangered and poorly known species. Its distribution and movement are analysed. The extreme variability of movement patterns (from migrant to sedentary, east to west, along the distribution area) classify the species as a partial migrant. A retrospective review shows that Great Bustard populational levels are decreasing, probably due to the increasing isolation of populations. There are only about 22480 - 23860 individuals from east of China to the Iberian peninsula and north-west Africa. The Spanish Great Bustard population may be 43-51% of the world total, Extremadura being the most important nucleus with almost one-fourth of the world population. The Spanish population in the last decade is reviewed, showing a decrease in most traditional areas with the exception of Castilla-Leon and Extremadura. On the other hand, seasonal fluctuations in population sizes denote the possibility of movement among the different populations.

Key words: Great Bustard, *Otis tarda*, Status, Distribution, Census, Iberian peninsula.

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## INTRODUCTION

*Otis tarda* with its two subspecies is widely distributed. According to FERGUSON-LEES (1966) the nominate *tarda* occupies the western two-thirds of the range, and *O. t. dybowskii* is restricted to the east. The overall range extends from north Africa and the Iberian peninsula, across central and southern Europe, Asia Minor, southern Siberia, Turkestan, Mongolia and Manchuria to the easternmost portion of China in the Amur valley. CRAMP & SIMMONS (1980) judge the range to have increased markedly in western and central Europe with forest clearance, reaching maximum extensions towards the end of the 18th century. A retreat then began due first to the conversion of steppes and dry meadowland to arable (ISAKOV, 1972, 1974), and then to mechanized farming, pesticide use, and excessive hunting pressure leading to progressive deterioration of the ha-

bitat (GLUTZ VON BLOTZHEIM et al., 1973; ISAKOV, 1974; LÜTKENS & EDER, 1977; STERBETZ, 1977, 1979, 1981; FARAGO, 1985b; among others).

Because of the sharp fall in numbers, this bird has been put of Spain's list of endangered species. Like all species of the family Otididae, its distribution is localized in the Old World. It is a wary bird (keeping off from man at flight distances sometimes more than 1 km) and thus hard to study. This difficulty in observation together with the extension and severe fragmentation of its distribution have always been the main obstacles in evaluating its status.

For most species, the advantages and disadvantages of migrating (such as energy cost, predation risks, risk of finding ecological conditions that are very different between the zones of wintering and breeding, etc.) show a clear balance that allows their classifications

as migratory or resident. For others, such as the bustard, the balance of costs and benefits of migration depends largely on the characteristics of the particular habitat, which supposes patterns of movement which differ over its range of distribution, and consequently a further difficulty in evaluating its status.

Although a major fraction of the literature on the species is centred on questions of status and conservation, most publications analyze a local population's distribution and demography (within either a country or a region). Much scarcer are those general reviews which, based on local population data, analyze the world status of this species, offering information on the overall distribution and number from different countries and describing their evolution (COLLAR, 1979, 1985; CRAMP & SIMMONS, 1980; GRACZYK, 1980; DORNBUSCH, 1983a, 1985a).

The aim of the present work is to review the status of this species, adding the latest data to the retrospective one on its demography and distribution at world level with special mention of the status and localization of the Iberian peninsula populations.

## DISTRIBUTION AND MOVEMENTS

Despite its area of distribution reaching south-east Scotland before 1526, the last episodes of breeding in Britain were recorded in Norfolk in 1830 and Suffolk in 1832 (FERGUSON-LEES, 1966; BRITISH ORNITHOLOGISTS' UNION, 1971).

The French population, established according to YEATMAN (1971) in Champagne and Vendée, also became extinct. CRUON (1982) questions its presence and nesting in the latter region, stating that there exists no proof that nesting in France took place anywhere but Champagne, for which there are nesting records up to 1845. The last cited date for its existence in that country is established in 1863 (YEATMAN, 1971).

Denmark and southern Sweden were breeding zones (FERGUSON-LEES, 1966). Bustards bred in Switzerland in 1553 (GLUTZ

VON BLOTZHEIM et al., 1973) and in western Germany, GLUTZ VON BLOTZHEIM et al., (1973) cite breeding data for Niedersachsen up to 1885 and for Holstein up to 1910.

The disappearance of the bustard from all these countries has meant that the Iberian population has been totally isolated from the central European. One can appreciate this separation on the map of figure 1 which shows the distribution of the species in the western Palearctic in 1980.

The current distribution is found to be even more extremely fragmented, giving rise to a series of small, isolated nucleus of population, which, together with the deterioration of the environment, is a serious threat especially to the peripheral and most isolated populations.

The fact that there exist wintering areas and breeding areas for the populations that exist from the eastern portion of Europe to the east of the overall range, indicates the existence of migratory habits in the species. Migration is defined by Lack (1945, in FERRINS & BIRKHEAD, 1984) as a large scale population movement that is periodic and regular between restricted areas of wintering and breeding. The USSR populations can then be defined as truly migratory, except those of southern Ukraine where they are resident (Dementiev & Gladkov, 1951, in CRAMP & SIMMONS, 1980). The migratory populations winter to the south of the breeding zones in areas of the Near and Middle East: in Siria, northern Iraq, Iran, and in zones of south-east USSR such as Transcaucasia and Dagestan (KUMERLOEVE, 1968; CRAMP & SIMMONS, 1980; CORNWALLIS, 1983). Further east, they also winter in zones of Soviet central Asia, mainly Tadzhikistan (MEINERTZHAGEN, 1954; VAURIE, 1965; DEMENTIEV et al., 1969). A peculiar feature of these migrations is that the autumn migration period is noticeably longer than the spring return (CRAMP & SIMMONS, 1980).

Some small populations resident in Iran breed there, and are confused with the winter visitors from the USSR, although there are exclusively wintering zones (CORNWALLIS,

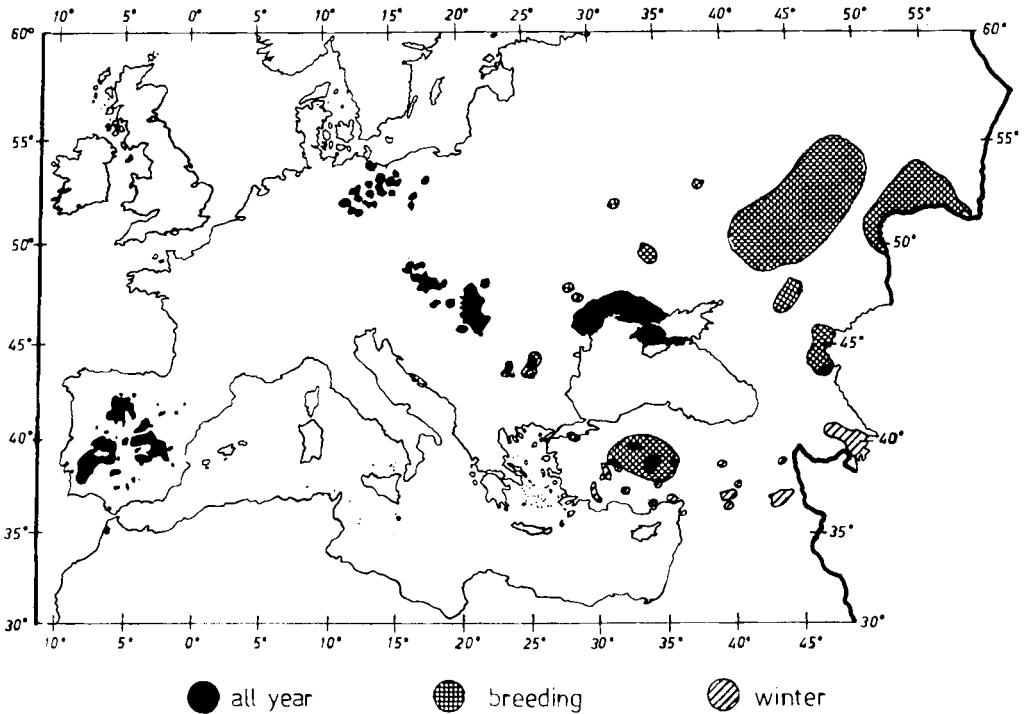


Fig. 1. Great Bustard distribution in the Western Palearctic, based on CRAMP & SIMMONS (1980) modified for the Iberian peninsula.

*Distribución de la Avutarda en el Paleártico oeste, basada en CRAMP & SIMMONS (1980) con modificaciones para la Península Ibérica.*

1983). On a larger scale, there are areas in Turkey where they are present the year round, with serious doubts about possible movement of these populations, and certain knowledge only about the movement of winter visitors towards the Near East which may cross and even settle in the south of Turkey (report of the Turkish Ornithological Society in CRAMP & SIMMONS, 1980).

The populations of Central Europe are considered locally dispersive or even resident when winter conditions are mild. Nevertheless, in severe winters, most flocks may be displaced over several hundred kilometres (GEWALT, 1959), although there are always individuals who remain, at the risk of exhaustion or death (GRACZYK & BERESZYNSKI, 1980). This occurs in many species that show a common characteristic: the availability of

food varies markedly from one year to another. When food is scarce or hard to get, the birds move, at times in large numbers, to more climatically favourable areas where feeding is easier. For the bustard, this has occurred recently in the winter 1962-63, 1969-70, 1978-79, and 1984-85, with groups, sometimes numerous (300-400 birds), of bustards moving from their breeding grounds in central Europe westwards, a few individuals reaching Holland, Belgium, Denmark, France, and even Britain (HUMMEL & BERNDT, 1971; CRAMP & SIMMONS, 1980; DE KNIJFF, 1981a, 1981b; HUMMEL, 1983a, 1983b, 1985 and HELLER, 1986, amongst others). The amplitude of the displacements is determined by the distance to the climatically favourable areas with sufficient available food, for which reason these movements are generally east-west, to-

wards countries with a less harsh, oceanically influenced, climate (LUCIO, 1983). Independently of whether or not such bad weather movements occur, there seems to exist a certain atavistic predisposition which is a relict of the migratory tendency of the species. Thus, for captive bustards in Poland, a highly excited state has been described which manifests itself in a great increase in motor activity (in the air or on the ground) and emitting of persistent sounds, especially during the night. This state lasts for from two to six days with differing intensity and occurs on concrete dates, being identifiable with the behaviour of other typically migratory birds (GRACZYK et al., 1980).

In the Iberian peninsula, the populations of *O. tarda* can be considered sedentary. This does not mean that there does not exist a certain seasonal movement of individuals, as detected by PINTO (1982) in Portugal: greater concentrations of individuals during the winter in cultivated areas with greater richness of vegetation, in detriment to the habitual numbers in breeding areas; or that deduced from finding that a fall in the numbers of individuals in Spanish flocks near Portugal (author's observations) correlates with an increase at the same dates of the bustard in areas of the latter country (Pinto, pers. comm.). LUCIO (1983) refers to a report by Garzon (1982) of a group of 12-14 birds in the Sierra de Gata between Cáceres and Salamanca, and the stomach contents of a dead individual in Salamanca being filled with olives, which would be hard to consume except to the south of the Central System. Both reports are an indication of passage to and from across the said System. There are also less recent data on the displacement of bustard in Andalusia when these populations were larger. Such movement, principally immatures, were towards the Guadalquivir delta during the nesting season (NICHOLSON et al., 1957). More recently, MARTÍNEZ et al. (in press) have detected seasonal displacement between Zamora and Leon of chicks that had been tagged on the wing. LUCIO (1983) mentions a report by J. Casariego (1979) respect-

ing two bustard that were found dead on the beaches of Luarca (Asturias) in 1925, stating the suspicion that Iberia must have at some time received individuals from the other side of the Pyrenees. This is difficult to prove, due to the enormous distance (more than 1500 km) separating this population from the nearest ones of central Europe, and the great quantity of obstacles that exist (mountain chains, zones of industry and high population density, etc.).

When a given species presents over its range some populations which are migratory while others are sedentary, it is considered to be *partial migrant* (PERRINS & BIRKHEAD, 1984). This is the case for the Great Bustard whose populations present a gradient passing from migratory through irruptive to sedentary. In this sense the Great Bustard follows the rule enunciated by Huxley in 1939, modifying and completing an earlier one due to Rensch (1936) (both in BERNIS, 1966). This rule indicates that in geographically widespread species, migratory tendencies recede or gradually diminish over the western Palearctic in the direction E-NE to W-SW.

## DEMOGRAPHIC SURVEY

For a comparative view of the data, table 1 presents the data from this and five other recent reviews. Contrasts can be observed of coincidences and discrepancies between some authors as to population counts, but one can draw the conclusion from the overall analysis of the data that from a world-level demographic point of view the Iberian peninsula is the geographical zone playing host to the largest contingent of this species. The rest, in order of importance, are partitioned between the USSR, Hungary, German Democratic Republic, Romania, Czechoslovakia, Austria, Iran, Morocco, Yugoslavia, and Poland. Turkey is not included in the list, because the available data is merely estimative (GORIUP & PARR, 1985). Nevertheless, an exhaustive survey (KASPAREK, 1989), while not yielding overall data, makes the decline in the

Turkish population manifest, both as to the number of bustards and the progressive reduction of breeding grounds.

The populations that were reduced to critical levels, despite protection measures in force in their respective countries, have declined irreversibly over the last years: Poland, Czechoslovakia, and, on a larger scale, the German Democratic Republic. Only the small Yugoslavian (GAROVNIKOV & MIKES, 1980) and Austrian KOLLAR, 1988) populations have registered a slower decline. Even the Hungarian population, the most important of central Europe (STERBETZ, 1983b), which had experienced an encouraging expansion due to strict protection measures and satisfactory performance of the captive breeding project in Dévaványa, has suffered a sharp fall over the last years. This is apparently due, in a large degree, to adverse climatological conditions during winters.

This decline in populations is found to be even more evident if one compares more retrospective regional or national demographic data (LUKSCHANDERL, 1971; RYABOV & IVANOVA, 1971; STERBETZ, 1976, 1978, 1980, 1983a, 1983b; LÜTKENS & EDER, 1977; BERESZYNSKI, 1977, 1980; FERIANC, 1978; RANDIK, 1978, 1980; BABO, 1979; BLIZNYUK et al., 1980; DORNBUSCH, 1980, 1983a, 1983b, 1985b; STERBETZ & PALNIK, 1980; FARAGO, 1982, 1985a; BERESZYNSKI & KACZMARKOWSKY, 1983; DOBAL, 1983; FEDORENKO & BOLDENKOV, 1983; COLLAR, 1985; GRACZYK, 1985; HEIDECHE, 1985 and KLAFS, 1985, among others).

#### IBERIAN POPULATION: EVOLUTION AND STATUS

There is prehistoric testimony to this bird's establishment in certain areas of Iberia. Neolithic paintings (4000 to 6000 B.C.) discovered in the Tajo de las Figuras in the province of Cádiz represent schematically but unequivocally, in the judgment of different experts (CABRE & HERNÁNDEZ PACHECO, 1914; BREUIL & BURKITT, 1929 and ACOSTA, 1968,

among others), silhouettes of bustards in different postures (fig. 2). There exists another wall painting representation of bustard in the Abrigo del Arco in Castellón (reported by BRODRICK, 1965), showing two bustards enclosed within a circle (fig. 2). The verisimilitude of the two sets of painting is enhanced when one takes into account that the sites are within the range of distribution of the species until recent times.

For Spain, references to the situation of populations in the past are scarce. Only VILANOVA Y PIERA (1874) put the status of the species in a world context, indicating that it had disappeared from Britain, was quite rare in Germany, and more in France and Spain, being more numerous in Hungary, the Russian steppes and central Asia, and remarking about its range: "... In Spain they are to be found equally on the fertile fields of the two Castiles, of Extremadura, and of Andalusia....". In contrast, there are the reports of some British ornithologists and hunter (Irby, 1875; Lilford, 1887; Chapman & Buck, 1893, 1910 and Verner, 1909 in COLLAR, 1985) which give a picture of relative abundance of the species in Iberia during the 19th century.

TRIGO DE YARTO (1971) made an estimative evaluation of the Spanish population (16000 birds) and its distribution by areas, being the first to raise the alarm about falling numbers, giving figures of some 2000 birds per year killed by hunting (legal or poaching). An updated estimate by PALACIOS et al. (1975) for the whole Iberian peninsula arrives at a total of 11890, providing, too, a map of the distribution. DE LA PEÑA (1980a, 1980b) gives a figure of 11282 bustards for 1977, and finds notable differences in comparing the partial regional numbers with the estimates of TRIGO DE YARTO (1971) and PALACIOS et al. (1975). The most recent attempt to evaluate rigorously the demography and distribution at a national level comes from the parallel surveys by the CODA and RENATUR (the latter only for a part of the range - OTERO 1985). According to GARZON (1981), the real population could be estimated at between 6000 and 8000 birds. PURROY (1982) judges a

Table 1. World demographic data of the Great Bustard according to countries. Five recent reviews and data from this study are included.

*Datos demográficos mundiales de la Avutarda por países. Se incluyen cinco revisiones recientes, junto a la del presente estudio.*

Countries	Reviews						Sources
	COLLAR 1979	GRACZYK 1980	CRAMP & SIMMONS 1980	DORNBUSCH 1985a	COLLAR 1985	This review	
Austria	110-120 (1977) *	150-170 (1975) **	110-120 ●	150 (1980) ●●	151 (1979) ○	120-130 (1982) ○○	* Eder (pers. comm.) ** Lütkens, 1976 ● LUTKENS & EDER, 1977 ○ Triebel, 1979 ○○ EDER, 1985 and TRIEBL, 1985
Czechoslovakia	400-500 (1976) *	410-693 (1973) **	600 ●	220 (1980) ●●	315 (1979) ○	201 (1983) ○○	* same author ** Randik, 1977 and Stollmann, 1977 ● Glutz et al. 1973 Hudel & Cerny, 1977 ○ Randik (pers. comm.) ○○ RANDIK & KIRNER, 1985
Germany	800 (1975) *	800 (1975) **	800 (1975) ●	500 (1979/80) ●●	560 (1980) ○	500 (1982) ○○	* Dornbusch, 1977 ** Dornbusch, 1977 ● Dornbusch (pers. comm.) ○ unknow ○○ DORNBUSCH, 1985a
Hungary	3237 (1977) *	3237 (1977) **	3237 (1977) ●	3400 (1980) ●●	3442 (1980) ○	2558 (1985) ○○	* Sterbetz (pers. comm.) ** STERBETZ, 1979 ● STERBETZ, 1977 ○ STERBETZ, 1980 ○○ FARAGO, 1986
Iran	50-150 (1978) *	--	100-200 (1978) ●	250 (1978) ●●	100-200 (1978) ○	100-200 (1978) ○○	* same author ● Collar (diverse evidences) ○ same author ○○ COLLAR, 1985
Morocco	50 (1972) *	--	50 (1972) ●	100 (1982) ●●	100 (1982) ○	100 (1982) ○○	* Pinaud & Giraud-Audine, 1977 ● Pinaud & Giraud-Audine, 1977 ○ same author ○○ COLLAR, 1985
Poland	80 (1978) *	25 (1979) **	90-100 (1976) ●	20 (1980) ●●	16 (1980) ○	2 (1983) ○○	* Bereszynski, 1978 ** BERESZYNSKI, 1980 ● BERESZYNSKI, 1977 ○ Bereszynski, 1981 ○○ BERESZYNSKI, 1987
Portugal	650-1000 (1977) *	--	650-1000 (1977) ●	1100 (1982) ●●	1015 (1981) ○	1000 (1988) ○○	* same author ● Collar, 1977 ○ Pinto (pers. comm.) ○○ Pinto (pers. comm.)
Rumania	296 (1976) *	296 (1976) **	296 (1976) ●	300 (1978) ●●	300-350 (1978) ○	350 (1978) ○○	* Barbu, 1976 ** Fodor, 1977 ● Fodor, 1977 ○ Munteanu, 1979; Cazacu & Neacsu, 1980 ○○ CAZACU & NEACSU, 1980
Spain	11282 (1977) *	11282 (1977) **	7000 (1977) ●	7000 (1980) ●●	5000-8000 (1981) ○	10200-11450 (1987) ○○	* DE LA PEÑA, 1980 ** De La Peña, 1978 ● Garzón ○ Garzón, 1982 ○○ This review

Table 1 (cont.)

Countries	Reviews						Sources
	COLLAR 1979	GRACZYK 1980	CRAMP & SIMMONS 1980	DORNBUSCH 1985a	COLLAR 1985	This review	
Turkey	200-1000 *	-	200-1000 ●	3000 (1981) ●●	145-4000 (1981) ○	4000 (1981) ○○	*Beaman & Porter, 1978 ● Turkish Ornithological Society (T.O.S) ○ Goriup, 1985 ○○ GORIUP & PARR, 1985
USSR	8650 (1971) *	-	7000 (1971) ●	2560-3560 (1980) ●●	2980 (1978-80) ○	3680 (1983) ○○	*Isakov, 1974 ● ISAKOV, 1974 ○ ISAKOV, 1982 ○○ PONOMAREVA, 1985
Yugoslavia	20 *	7 (1976) **	a few breeders (1977) ●	35 (1979) ●●	30-40 (1965-) ○	30-40 (1980) ○○	* same author ** Garovnikov, 1977 ● Vasic (pers. comm.) ○ GAROVNIKOV & MIKES, 1980 ○○ GAROVNIKOV & MIKES, 1980

●● Collar, 1982; Dornbusch, 1983; FARAGO, 1982, 1983; Goriup, 1983; Graczyk, 1983; Hellmich & Schulz, 1982; Ponomareva, 1983; Randik & Kimer, 1983; Triebel, 1979

synthesis of the two surveys to give a figure of 8000 to 9000 birds as the Spanish population in the years 1981-82. There are also the demographic studies of LUCIO & PURROY (1986, 1987) and of CABRERA et al. (1987) which, while referring to specific areas (León and Aragón, respectively) and restricted to the present decade, represent an important contribution to the detailed analysis of the changing numbers of those populations.

In the Iberian peninsula, there traditionally existed five population nuclei more or less intercommunicated corresponding to Castile-León, Navarra-Aragón, Castile-La Mancha, Andalusia, and Extremadura-Alentejo (PALACIOS et al., 1975; GARZON, 1981 and PURROY, 1982). The current map of the Great Bustard's distribution in the Iberian peninsula has been drawn up (fig. 3) on the basis of the data of CABRERA et al. (1987), CHARCO &

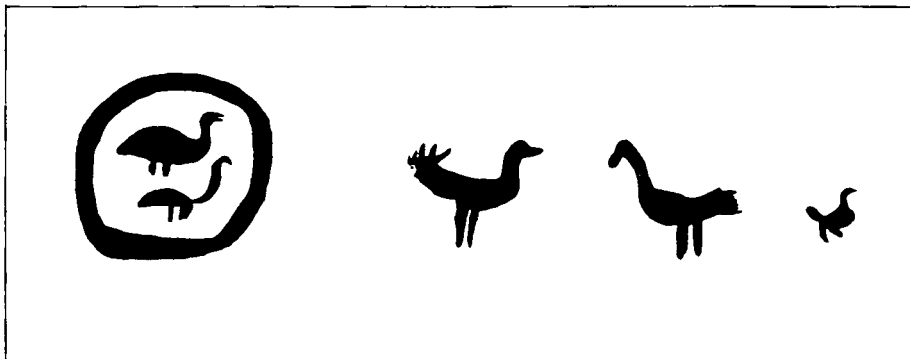


Fig. 2. Neolithic cave paintings (4000-6000 B.C.) of Great Bustard from Abrigo del Arco in Castellón (left, in the circle) and Tajo de las Figuras in Cádiz (centre and right).

*Pinturas neolíticas (4000 a 6000 años a. de C.) de avutardas del Abrigo del Arco en Castellón (representación dentro del círculo, izquierda) y el Tajo de las Figuras en Cádiz (centro y derecha).*

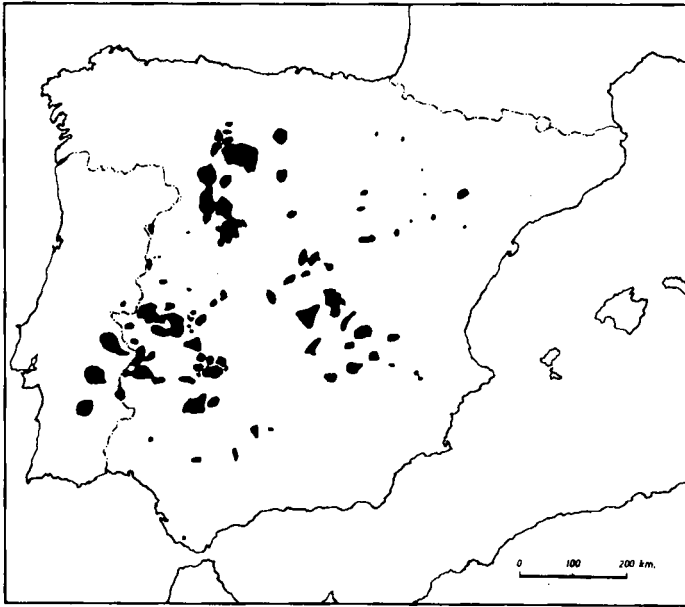


Fig. 3. Map of the Great Bustard current distribution in the Iberian peninsula.

*Mapa de la distribución actual de la Avutarda en la Península Ibérica.*

BLANCO (1987), MARTIN-HERRERO (1987), MARTIN-MONTES & ORTAS (1987), SAN SEGUNDO et al. (1987), SÁNCHEZ-GARCÍA et al. (1989), Ena (pers. comm.), Pinto (pers. comm.), among others, and those provided by the AMA of the Junta de Andalucía, and the Dirección General de Medio Ambiente of the Junta de Extremadura. The formerly important areas of Navarra-Ebro Valley and of the Guadalquivir Valley have become totally fragmented and reduced to a few tiny nuclei, whose demographic data (table 2) show the exiguity of the stocks, so that the process is feared to be irreversible and will mean the extinction of these flocks. A third area, Castile-La Mancha, also shows this process of decay, though less acute with still some important populations such as that of Toledo. ENA & MARTÍNEZ (1988) establish the reduction in

the Spanish total population for the period 1970-82 to have been 47%.

Since the Royal Decree 1497/86 (June 6) put the Great Bustard and the Little Bustard (*Tetrax tetrax*) on the protected species list there has been a slow but steady recuperation, most evident in the two most important populations of the Duero basin and Extremadura, the latter closely related to the portuguese population. Table 2 shows a comparative view of the national demographic data since 1981. There are clearly important seasonal fluctuations as to the number of birds in a specific zone, hence the importance of using data taken at the same time of the year in the overall estimates of the Spanish numbers (a fact not always taken into account). In light of this, one would propose spring as being the best period, because identification of the spe-

Table 2. Recent demographic data (1980's decade) of Great Bustard in Spanish regions and provinces. The source of information and the season are indicated.

*Datos demográficos recientes (década de los 80) de la Avutarda en España según comunidades y provincias, indicándose la fuente de información y la estación.*



Number of birds

Region	Province	Spring	Summer	Autumn	Winter	undated	Year	Source	
Andalucía	Cádiz	8-10	-	-	-		1987	Dir. Prov. AMA J. Andalucía	
	Córdoba	100	-	-	-		1981	ENA, 1984	
							10	1986	Invent. Fauna Andaluza Peligro
		70	-	-	-		1987	Dir. Prov. AMA J. Andalucía	
	Huelva	20	-	-	-		1981	ENA, 1984	
	Jaén	9	-	-	-		1981	ENA, 1984	
	Sevilla		50	-	-	-		1981	ENA, 1984
						20	1986	Invent. Fauna Andaluza Peligro	
Aragón	Huesca, Zaragoza y Teruel					70-80	1980	ARAGUES & LUCIENTES, 1980	
						80	1981	PURROY, 1981	
	5	3	11	-		1982	CABRERA et al., 1987		
	26	46	29	17		1983	CABRERA et al., 1987		
	34	7	23	4		1984	CABRERA et al., 1987		
	38	26	44	4		1985	CABRERA et al., 1987		
	36	17	40	-		1986	CABRERA et al., 1987		
Castilla La Mancha	Albacete	100	-	-	-		1981	CODA census (unpublished)	
	Ciudad Real					200-230	85/87	CHARCO & BLANCO, 1987	
		200	-	-	-		1981	ENA, 1984	
	Cuenca	381	-	-	-		1987	MARTIN-HERRERO, 1987	
Guadalajara	45-50	-	-	-		1981	ENA, 1984		
Toledo	757	-	-	-		1981	ENA, 1984		
Castilla/L León	Ávila	149	-	-	-		1981	SAN SEGUNDO et al., 1987	
		167	-	-	-		1987	SAN SEGUNDO et al., 1987	
	Burgos	340	-	-	-		1981	ENA, 1984	
	León	311	-	325	-		1981	LUCIO & PURROY, 1986	
		277	-	213	-		1982	LUCIO & PURROY, 1986	
		290	-	-	-		1983	LUCIO & PURROY, 1986	
		413	-	328	-		1984	LUCIO & PURROY, 1986	
		406	-	320	398		1985	LUCIO & PURROY, 1986	
		376	-	390	412		1986	LUCIO & PURROY, 1986	
		393	-	-	523		1987	LUCIO & PURROY, 1987	
	Palencia	800	-	-	-		1981	ENA, 1984	
	Salamanca		239	-	-	-		1981	ENA, 1984
							260-280	1987	CARNERO et al., 1987
	Segovia	54	-	-	-		1981	ENA, 1984	
	Soria	16	-	-	-		1981	ENA, 1984	
	Valladolid		1317	-	-	-		1981	ENA, 1984
			2523	-	-	-		1984	datos ICONA
Zamora	1377	-	-	-		1981	ENA, 1984		
Extremadura	Badajoz	-	-	2622	-		1986	Bielsa, pers. comm.	
		-	-	3002	-		1987	Bielsa, pers. comm.	
		1735	-	-	-		1988	SÁNCHEZ-GARCÍA et al., 1989	
	Cáceres	1246	-	2525	-		1986	Barrutia, pers. comm.	
		1557	-	2710	-		1987	Barrutia, pers. comm.	
		1787	-	-	-		1988	SÁNCHEZ-GARCÍA et al., 1989	
Madrid	Madrid	419	-	-	270		1986	MARTIN-MONTES & ORTAS, 1987	
		-	-	-	379		1987	MARTIN-MONTES & ORTAS, 1987	
Murcia	Murcia	-	-	25	15		1986	HERNÁNDEZ et al., 1987	
		-	-	-	18		1987	HERNÁNDEZ et al., 1987	
Navarra	Navarra	10	-	-	-		1981	ENA, 1984	

cimens is easier (thanks to the development of nuptial plumage in the male) and the number of birds counted corresponds to the breeding population and not to extraneous individuals passing through or to wintering groups originating in other areas.

If we estimate the world totals for the Great Bustard as between 22480 and 23860 (assuming possible overcounting errors on the basis of poorly confirmed estimates as is the case for Turkey), the current Spanish population, basically censured in spring, may be taken as between 43% and 51% of the said quantity. Spain therefore includes the principal area of distribution of the species.

It is worthwhile underlining the importance the Extremadura population has in the national context, where the number of breeding individuals represents more than 30% of the country's stock, and the overwintering population rises even further to nearly 51% of the said total. The Extremadura numbers oscillate between some 15% of the world total in the breeding season and 25% during autumn and winter.

## FINAL COMMENTS

For STERBETZ (1983b) the main causes of population decline in most populations would be:

- The destruction of the bustard habitat, so that the populations are incapable of surviving in them.

- Genetic deterioration as a result of population isolation, low abundance, reduced number of yearly progeny, and unfavourable balance in sex-ratio.

- Fast ecological changes that the Great Bustard's adaptability cannot assimilate.

If one analyzes the recent history of the species and compares the characteristics of the habitats in countries where it has become extinct and those where it still survives, one observes that the former are characterized by farming that is developed, modern (chemical controlled), and mechanized, as well as by a relatively high human population density. On the contrary, in zones where the species per-

sists, the farming practised is traditional and lightly mechanized, and the human population densities are very low. The type of farming and the level of human settlement must therefore be the main factors limiting the range of the species besides the required habitat which, nevertheless, shows a certain variability - zones lacking tree and scrub cover and, in some zones of Extremadura (author's observations) and of Portugal, areas of holm-oak parkland (OSBORNE et al., 1985; Pinto pers. comm.). Other factors, such as the climate, altitude, etc., are relegated to a secondary position as is demonstrated by the great variability that the different populations have with respect to this latter group of factors, a variability attested to by some workers even for populations within specific countries (PALACIOS et al., 1975).

In light of these considerations, the process of decline begins when, as the conditions of the habitat are changed by one of these limiting factors, there is first a resulting fragmentation of the population with a consequent greater isolation and rise in the degree of endogamy (especially in peripheral populations). If to this are added factors such as hunting pressure (nowadays almost eliminated) and the coincidence of the dates of harvesting and nesting in a good part of the range (with the consequent loss of clutches, for a species with such a low reproduction rate), the result is a steady decline in numbers ending in the complete elimination of the nucleus of population.

This whole process can be accelerated by other factors such as the use and abuse of chemicals in modern farming. The species has a diet which is seasonal in character, herbivorous or insectivorous at different times of the year (PALACIOS et al., 1975), and so the use of agricultural herbicides and pesticides is generating an irreversible toxic burden worsening from generation to generation. With the situation as it is, only the best nourished populations (perhaps only in the Iberian peninsula) are capable of subsisting, as long as protectionist measures are adopted to eliminate or, at least, mitigate such factors.

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## RESUMEN

*Estatus mundial de la Avutarda (Otis tarda) con mención especial de las poblaciones de la Península Ibérica.*

El objeto de este artículo es revisar el actual estatus mundial de esta especie poco conocida y amenazada. Se analizan su distribución y movimientos.

La gran variabilidad de la especie en cuanto a sus pautas de movimientos (mostrándose desde migradora a sedentaria a lo largo de su área de distribución), permite clasificarla como migradora parcial. Una revisión retrospectiva pone de manifiesto que los niveles poblacionales están disminuyendo, probablemente debido al aislamiento creciente de las poblaciones.

Hay sólo cerca de 22480 - 23860 individuos repartidos desde el este de China hasta la Península Ibérica y noroeste de África. La población española de avutardas puede representar entre 43-51% del total mundial, siendo Extremadura el núcleo más importante con casi un cuarto de la población mundial. Se revisa la población española en la última década, poniéndose de manifiesto un descenso en la mayoría de áreas tradicionales, con la excepción de Castilla-León y Extremadura. Por otra parte, las fluctuaciones estacionales en los tamaños de población indican la posibilidad de movimientos entre las diferentes poblaciones.

## REFERENCES

- ACOSTA, P., 1968. *La pintura rupestre esquemática en España*. Memorias del Seminario de Prehistoria y Arqueología, Universidad de Salamanca. Facultad de Filosofía y Letras, Salamanca.
- ARAGÜES, A. & LUCIENTES, J., 1980. *Fauna de Aragón. Las aves*. Guara Ed., Zaragoza.
- BABO, T., 1979. Occurrence of Euro-Siberian Great Bustard *Otis t. tarda*. New record at novel localities in Western Slovakia, Czechoslovakia. *Biologia (Bratisl.)*, 34(8): 673-676.
- BERESZYNSKI, A., 1977. Drop, *Otis tarda* L., w Wielkopolsce. *Roczniki Akademii Rolniczej w Poznaniu Rozprawy Naukowe*, 79: 1-42.
- 1980. Vorkommen und Anzahl der Großtrappe, *O. tarda*, in Polen in den Jahren 1936-1979. *Materialy III Miedzynarodowego Sympozjum Drowia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 31-35.
- 1987. Drop, *Otis tarda tarda* Linnaeus, 1758. w Polsce. *Roczniki Akademii Rolniczej w Poznaniu Rozprawy Naukowe*, 165: 1-84.
- BERESZYNSKI, A. & KACZMARKOWSKI, M., 1983. Bustard (*Otis tarda* L.) in Poland. In: *Bustards in decline*: 118-120 (P.D. Goriup & H. Vardman, Eds.). Tourism & Wildlife Society of India, Jaipur.
- BERNIS, F., 1966. *Migración en aves. Tratado teórico y práctico*. Publicaciones de la Sociedad Española de Ornitología, Madrid.
- BLIZNYUK, A.I., LYUBAEVA, L.I. & LYUBAEV, L.V., 1980. Data on the abundance and biology of rare steppe birds in Kalmyk-ASSR Russian-SFSR USSR. *Byull. Mosk. O-Va. Ispyt. Prir. Otd. Biol.*, 85(4): 34-41.
- BREUIL, H. & BURKITT, M., 1929. *Rock painting of Southern Andalusia*. Oxford.
- BRITISH ORNITHOLOGISTS' UNION, 1971. *The status of birds in Britain and Ireland*. Edited by B.O.U., Oxford.
- BRODRICK, A., 1965. *La pintura prehistórica*. Ed. Fondo de Cultura Económica, Mejico.
- CABRE, J. & HERNÁNDEZ PACHECO, E., 1914. Avance al estudio de las pinturas prehistóricas del extremo sur de España (Laguna de la Janda). *Com. Inv. Paleont. y Preh.*, Mem. nº 3, Madrid.
- CABRERA, M., HERNÁNDEZ, F., BALLARIN, I., PELA, O.E. & GUIRAL, J.J., 1987. Últimos datos sobre la distribución y estado de la población de avutarda (*O. tarda*) en Aragón. In: *I Congreso Internacional de Aves Esteparias*: 11-17. Ed. Junta de Castilla y León, León.
- CARNERO, J.I., CORRALES, L., & PERIS, S., 1987. Aves esteparias de la provincia de Salamanca (Fam. Otidiidae, Burhinidae y Pteroclididae). In: *I Congreso Internacional de Aves Esteparias*: 437-447. Ed. Junta de Castilla y León, León.
- CAZACU, I. & NEACSU, A., 1980. Reflections on the current situation of the Great Bustard (*O. tarda*) in Romania. *Symposium papers on Great Bustard (Sofia, Bulgaria, May 26th 1978) and the Houbara Bustard Chlamydotis undulata (Athens, Greece, May 24th 1979)*. FISG/CIC/Game Conservancy, Hampshire.
- CHARCO, J. & BLANCO, D., 1987. Distribución de la avutarda (*O. tarda* L. 1758) en la provincia de Albacete. In: *I Congreso Internacional de Aves Esteparias*: 19-25. Ed. Junta de Castilla y León, León.
- COLLAR, N.J., 1979. Bustard Group general report. *ICBP Bull.*, XIII: 129-134.
- 1985. The world status of the Great Bustard. *Bustard Studies*, 2: 1-20.
- CORNWALLIS, L., 1983. A review of the bustard situation in Iran. In: *Bustards in decline*: 81-88 (P.D.

- Goriup & H. Vardman, Eds.). *Tourism & Wildlife Society of India, Jaipur.*
- CRAMP, S. & SIMMONS, K.E.L. (Eds.), 1980. *The Birds of the Western Palearctic*, Vol. II. Oxford University Press, Oxford.
- CRUON, R., 1982. Le statut ancien de la Grande Outarde *O. tarda* en France. *Alauda*, 50(2): 146-147.
- DE KNIUFF, P., 1981a. The occurrence of the Great Bustard (*O. tarda*) in the Netherlands during the winter of 1978/1979. *Vogeljaar*, 29(1): 1-8.
- 1981b. The Great Bustard once more in the Netherlands 1978/1979. *Vogeljaar*, 29(6): 326.
- DE LA PEÑA, J., 1980a. The Great Bustard (*Otis tarda* L.) in Spain. *Symposium papers on the Great Bustard (Sofia, Bulgaria, May 26th 1978) and the Houbara Bustard Chlamydotis undulata (Athens, Greece, May 24th 1979)*. FISG/CIC/Game Conservancy, Hampshire.
- 1980b. La avutarda, protegida en España. *Trofeo*, 120: 21-25.
- DEMENTIEV, G., MEKLENBURTSEV, R., SUDILOVSKAYA, A., & SPANGENBERG, E., 1969. *Birds of the Soviet Union*. Vol. II. Israel Program for Scientific Translation, Jerusalem.
- DOBAI, Cs., 1983. Breeding, Protection and Management of the Great Bustard in Czechoslovakia and Europe. In: *Bustards in decline*: 104-113. (P.D. Goriup & H. Vardman, Eds.). *Tourism & Wildlife Society of India, Jaipur.*
- DORNBUSCH, M., 1980. Bestandsförderung und Wanderungen der Großtrappe, *O. tarda*, in der DDR. *Materiały III Międzynarodowego Sympozjum Drobia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 41-43.
- 1983a. Zur Bestandessituation der Großtrappe. *Naturschutzarb. Berlin u. Brandenburg*, 6: 3-5.
- 1983b. Status, Ecology and Conservation of Great Bustard in the German Democratic Republic. In: *Bustards in decline*: 89-90 (P.D. Goriup & H. Vardman, Eds.). *Tourism & Wildlife Society of India, Jaipur.*
- 1985a. Bestandssituation, Lebensraumstruktur und Schutzmaßnahmen bei der Großtrappe in der DDR. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR. 1983*: 7-10. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- 1985b. Bestandentwicklung und Bestandsstützung der Großtrappe im Einstandsgebiet Steckby, Zerbster Land. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR. 1983*: 33-36. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- EDER, F., 1985. A note on the Great Bustard in Lower Austria. *Bustard Studies*, 2: 101.
- ENA, V., 1984. Informe del Coordinador del Censo Nacional de Avutardas, based in data of the census of CODA and RENATUR with author's data. (unpublished report).
- ENA, V. & MARTINEZ, A., 1988. Distribución y comportamiento social de la avutarda. *Quercus*, 31: 12-20.
- FARAGO, S., 1982. A Hanság környéki tűzokállomány, éves Magyar-Osztrák szinkronfelvételek alapján. *Allattani Közl.*, 69(1-4): 75-84.
- 1985a. Großtrappenuntersuchungen in Ungarn. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR. 1983*: 17-19. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- 1985b. Investigations on the nesting ecology of the Great Bustard (*O. t. tarda* L., 1758) in the Dévaványa Nature Conservation District. I. Comparative studies of microclimate. *Aquila*, 92: 133-173.
- 1986. Magyarország tűzokállománya az 1981-1985. évi állományfelmérések tükrében. *Allattani Közlemények*, 73: 21-28.
- FEDORENKO, A.P. & BOLDENKOV, S.V., 1983. Great Bustard *Otis tarda* in the Ukrainian-SSR USSR and ways of its protection. *Vestn. Zool.*, 0(3): 34-39.
- FERGUSON-LEES, I.J., 1966. Studies of less familiar birds. 141. Great Bustard. *British Birds*, 59: 491-493.
- FERIANC, O., 1978. Bustard (*Otis tarda* L.) in Slovakia and notices on its ecology. *Quaestiones Geobiol.*, 22: 121-154.
- GAROVNIKOV, B. & MIKES, M., 1980. Schutz und Förderung der Großtrappe (*O. tarda*) in Jugoslawien. *Materiały III Międzynarodowego Sympozjum Drobia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 55-63.
- GARZON, J., 1981. El censo de avutardas confirma la regresión de la especie. *Quercus*, 1: 17-19.
- GEWALT, W., 1959. *Die Grosstrappe*. Die Neue Brehm-Bücherei, heft 223. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- GLUZF VON BLOTZHEIM, U.N., BAUER, K.M., & BEZZEL, E., 1973. *Handbuch der Vögel Mitteleuropas*. Vol. 5. Akademische Verlagsgesellschaft, Frankfurt am Main.
- GORIUP, P.D. & PARR, F., 1985. Results of ICBP bustard survey of Turkey, 1981. *Bustard Studies*, 2: 77-98.
- GRACZYK, R., 1980. Gegenwärtiger stand und Untersuchungsrichtungen der Zucht und ökologie der Großtrappe, *Otis tarda* L., 1758. *Materiały III Międzynarodowego Sympozjum Drobia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 7-20.
- 1985. Die aktuelle Situation der Großtrappe (*Otis tarda* L.) in Polen. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR. 1983*: 26-28. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- GRACZYK, R., & BERESZYNSKI, A., 1980. Obserwacje Ekologiczno-Etologiczne Dropi (*O. tarda*) podczas ciczkiej zimy 1978/1979. *Roczniki Akademii Rolniczej w Poznaniu*, 72: 77-87.
- GRACZYK, R., BERESZYNSKI, A. & MICHOCKI, J.,

1980. Wiosenny instykt wędrowkowy u Drogia (*O. tarda* L.). *Roczniki Akademii Rolniczej w Poznaniu*, 72: 97-100.
- HEIDECKE, D., 1985. Entwicklung und Wirksamkeit der Großtrappen-Schongebiete und ihrer Behandlungsrichtlinien in der DDR. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR*. 1983: 36-40. Ed. Akademie der Landwirtschaftswissenschaften DDR und ILN Halle, Halle.
- HELLER, M., 1986. Winterflüchtende Großtrappen (*O. tarda* L.) in Nordwürttemberg, im Kältewinter 1984/85. *Anz. Ornithol. Ges. Bayern*, 25(1): 77-80.
- HERNÁNDEZ, V., ORTUÑO, A., SÁNCHEZ, M.A., VILLALBA, J. SÁNCHEZ, P.A., LÓPEZ, J.M. & ESTEVE, M.A., 1987. Estado actual de algunas aves esteparias en la región de Murcia. Áreas de interés. In: *I Congreso Internacional de Aves Esteparias*: 459-468. Ed. Junta de Castilla y León, León.
- HUMMEL, D., 1983a. Der Einflug der Grosstrappe (*O. tarda*) nach West-Europa im Winter 1978/79 (1). *Vogelwelt*, 104(2): 41-53.
- 1983b. Der Einflug der Grosstrappe (*O. tarda*) nach West-Europa im Winter 1978/79 (2). *Vogelwelt*, 104(3): 81-95.
- 1985. A note on invasions of Western Europe by the Great Bustard in the winter seasons 1969/70 and 1978/79. *Bustard Studies*, 2: 75-76.
- HUMMEL, D. & BERNDT, R., 1971. Der Einflug der Grosstrappe (*O. tarda*) nach West-Europa im Winter 1969/70. *J. Orn.*, 112(2): 138-157.
- ISAKOV, YU.A., 1972. Present Status of Bustard Population in the USSR and the necessity of realization of "Steppe" Project. Conservation of Nature in the Soviet Union. *Rep. paper XIth Gen. Assembly & XIIth Techn. Meeting IUCN*, Moscow, 181-198.
- 1974. Present distribution and population status of the Great Bustard *O. tarda* L.. *J. Bombay Nat. Hist. Soc.*, 71: 433-444.
- KASPAREK, M., 1989. Status and distribution of the Great Bustard and the Little Bustard in Turkey. *Bustard Studies*, 4: 80-113.
- KLAFS, G., 1985. Die historische Entwicklung des Bestandes der Großtrappe (*Otis tarda* L.) auf dem Territorium der DDR und in einigen Nachbargebieten. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR*. 1983: 11-16. Ed Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- KOLLAR, H.P., 1988. *Arten- und Biotopschutz am Beispiel der Großtrappe (Otis tarda L.)*. No. 11. Ed. Verein für ökologie und Umweltforschung, Wien.
- KUMERLOEVE, H., 1968. Recherches sur l'avifaune de la République Arabe Syrienne: essai d'un aperçu. *Alauda*, 36(1-2): 1-26.
- LUCIO, A.J., 1983. *La avutarda (Otis tarda) en la provincia de León*. Tesis de Licenciatura, Universidad de León.
- LUCIO, A.J. & PURROY, F.J., 1986. Demografía de la avutarda (*Otis tarda*) en León. *Boletín de la Estación Central de Ecología*, Vol. XV, 30: 87-92.
- 1987. Datos sobre la sociabilidad de la avutarda (*Otis tarda*) en la provincia de León. In: *I Congreso Internacional de Aves Esteparias*: 69-75. Ed. Junta de Castilla y León, León.
- LUKSCHANDERL, L., 1971. Zur Verbreitung und ökologie der Großtrappe (*O. tarda*) in österreich. *Journal für Ornithologie*, 112: 70-93.
- LÜTKENS, R. & EDER, F., 1977. Über das Schicksal von Randpopulationen der Großtrappe (*O. tarda* L.) in Niederösterreich., *J. Orn.*, 118: 93-105.
- MARTIN-HERRERO, J., 1987. Situación de la avutarda (*O. tarda*) en la provincia de Cuenca. In: *I Congreso Internacional de Aves Esteparias*: 27-38. Ed. Junta de Castilla y León, León.
- MARTIN-MONTES, E. & ORTAS, J., 1987. Situación de la avutarda (*O. tarda*) en la provincia de Madrid. In: *I Congreso Internacional de Aves Esteparias*: 39-48. Ed. Junta de Castilla y León, León.
- MARTÍNEZ, A., OTERO, C. & ENA, V. (in press). Preliminary results on the social behaviour of the Great Bustard (*Otis tarda*), Zamora, Spain (1983-1986). *Bustard Studies*, Volume 5.
- MEINERTZHAGEN, R., 1954. *Birds of Arabia*. Oliver & Boyd, Edimburgh & London.
- NICHOLSON, E.M., FERGUSSON-LEES, I.J. & HOLLLOM, P.A.D., 1957. The Camargue and the Coto Doñana. *British Birds*, 50(12): 497-519.
- OSBORNE, P., COLLAR, N.J. & GORIUP, P.D., 1985. *Bustard*. Dubai Wildlife Research Centre, Cotsword Printing Company, Cambridge.
- OTERO, C., 1985. The Spanish Great Bustard census conducted by Recursos Naturales, S.A., in 1982. *Bustard Studies*, 2: 21-30.
- PALACIOS, F., GARZON, J. & CASTROVIEJO, J., 1975. La alimentación de la avutarda (*Otis tarda*) en España, especialmente en primavera. *Ardeola*, 21(especial): 347-406.
- PERRINS, C.M. & BIRKHEAD, T.R., 1984. *Avian ecology (Tertiary level biology)*. Blackie & Son Limited, Glasgow & London.
- PINTO, M.V., 1982. The Great Bustard in Portugal. *Simposio Internacional sobre Conservación de las Avutardas en Europa Occidental y Noroeste de Africa (21-24 de Septiembre)*. León, España.
- PONOMAREVA, T.S., 1985. Die Restitution (Bestandsstützung) natürlicher Populationen der Großtrappe (*Otis tarda* L.) in der UdSSR. In: *Berichte des 4. Symposiums ber die Großtrappe (Otis tarda) in der DDR*. 1983: 29-32. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- PURROY, F., 1981. La avutarda a solas con su destino. *Trofeo*, 131: 14-17.
- 1982. Simposio Internacional sobre conservación de avutardas en Europa Occidental. *Quercus*, 7: 13-16.
- RANDIK, A., 1978. Spreading, protection and manage-

- ment of Great Bustard (*Otis tarda* L.) in Czechoslovakia and Europe. *Ceskoslovenska Ochr., Prir.*, 18: 17-38.
- 1980. Verbreitung und Schutz der Großtrappe (*Otis tarda*) in der Tschechoslowakei im Jahr 1978 und 1979. *Materiały III Międzynarodowego Sympozjum Drowia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 65-70.
- RANDIK, A. & KIRNER, K., 1985. Die Bewirtschaftung der Großtrappe (*Otis tarda* L.) in der CSSR. In: *Berichte des 4. Symposiums über die Großtrappe (Otis tarda) in der DDR. 1983*: 19-24. Ed. Akademie der Landwirtschaftswissenschaften der DDR und ILN Halle, Halle.
- RYABOV, V.F. & IVANOVA, Z.Y., 1971. Ecology of the Great Bustard in northern Kazakhstan. *Vestn. Mosk. Univ. Ser. Vi. Biol. Pochvoved*, 26(5): 23-31.
- SAN SEGUNDO, C., CABALLERO, J. & NAVARRO, M., 1987. Censo preñupcial de la avutarda (*O. tarda*) en la provincia de Avila. Comparación con el censo de 1981. In: *I Congreso Internacional de Aves Esteparias*: 61-68. Ed. Junta de Castilla y León, León.
- SÁNCHEZ GARCÍA, A., DEL ARCO, E., BARRUTIA, C., MARTÍNEZ HELLIN, L.C. & BIELSA, J., 1989. El censo de avutardas (*Otis tarda*) en Extremadura durante 1987-1988. *Ecología*, 3: 299-304.
- STERBETZ, I., 1976. A kelet-magyarországi tüzök (*Otis t. tarda* L.) populációk területigényének alakulása. *Aquila*, 82: 155-163.
- 1977. A tüzök (*Otis t. tarda*) környezete Magyarországon. *Aquila*, 83: 53-73.
  - 1978. Magyarország Tüzökállománya (*O. t. tarda*) 1977-Ben. *Allattani Közl.*, 65(1-4): 127-136.
  - 1979. Investigations into the nutrition of the Great Bustard (*Otis t. tarda* L.) in the winter aspect of 1977/78. *Aquila*, 86: 93-100.
  - 1980. A tüzök (*Otis t. tarda* L.) s a reznek (*Otis tetrax orientalis* Hart.) Békés megyében. *A Békés Megyei Múzeumok Közleményei*, 6: 131-143.
  - 1981. Comparative investigations into the reproduction behaviour of monogamous, polygamous and unmated Great Bustard populations in South-Eastern Hungary. *Aquila*, 87: 31-47.
  - 1983a. Present situation of the Great Bustard (*Otis t. tarda*) in Hungary. In: *Bustards in decline*: 114-117 (P.D. Goriup & H. Vardman, Eds.). Tourism & Wildlife Society of India, Jaipur.
  - 1983b. A Magyarországi Tüzök (*O. t. tarda*) Populációk Elettékességének Vizsgálata 1971-1982 Időközéből. *Aquila*, 89: 93-98.
- STERBETZ, I. & PALNIK, F., 1980. Der Ungarische Trappenschutz in den Jahren 1977-1979. *Materiały III Międzynarodowego Sympozjum Drowia, W Europie. 17-18.IX.1979 Siemianice, AR w Poznaniu*: 37-40.
- TRIEBL, R., 1985. The situation of the Great Bustard in Burgenland, Austria: Causes of decline and measures for protection. *Bustard Studies*, 2: 99-100.
- TRIGO DE YARTO, E., 1971. *La avutarda en España*. Informe a la XVIII Asamblea General Trienal del Consejo Internacional de la Caza. Ed. Federación Española de Caza, Madrid.
- VAURIE, C., 1965. *The birds of the Palearctic fauna; Non-Passeriformes*. Witherby, London.
- VILANOVA Y PIERA, J., 1874. *Historia Natural*, Tomo IV. Montaner & Simon Eds., Barcelona.
- YEATMAN, L.J., 1971. *Histoire des Oiseaux d'Europa*. Paris.