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Seasonal and daily activity pattern in Griffon Vulture (*Gyps fulvus*) colonies on the island of Crete (Greece)

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Morning and evening counts undertaken in Griffon Vulture *Gyps fulvus* colonies and communal roosts revealed that their numbers fluctuated by season and time of the day. In the colonies the vultures built up high numbers during the pre-breeding and incubation periods (November–February) with maxima in December–January and dropped during the fledging and dependence periods (July–October) with minima in June–July. On the contrary griffons started to use communal roosts during the chick-rearing period (March–June) while their numbers peaked when the young fledged (June–August). Daily use of colonies exhibited a bimodal pattern that was most pronounced in the pre-breeding period. Population size should be assessed by conducting morning counts starting at dawn in all active colonies and communal roosts during November–February.

1. Introduction

Birds of prey are difficult to study in the field as they occupy large home ranges and often inhabit remote inaccessible regions. Monitoring their populations is often difficult as most species are territorial and sparsely distributed over sizeable areas (Fuller & Mosher 1981). In addition their density exhibits local seasonal fluctuations and their activity may vary throughout the day (Newton 1979). Usually raptor censuses are restricted in the breeding season when rapid changes in their detectability take place. The counting units are occupied nest-sites or established breeding territories (Skirvin 1981, Diesel 1984, Bibby *et al.* 1992). In the case of colonial or flocking raptors, census work is facilitated by tracing the birds in localized areas such as their colonies or communal roosts (Parker 1975, Bildstein 1979, Fuller & Mosher 1987). Accurate estimates of their population can be made by conducting surveys in these sites during certain months of the year and times of the day (Taylor 1983, Keister *et al.* 1987, Rabenold 1987, Walk 1998, Hiraldo *et al.* 1993, Stolen & Taylor 2003). The vultures of the genus Gyps are large gregarious species that breed colonially in cliffs, forming large nesting groups (Cramp & Simmons 1980, Mundy *et al.* 1992, Donázar 1993). As a result improved monitoring techniques consist of counting birds at their breeding or roosting sites early in the morning or late in the evening before or after their daily foraging trips (Robertson & Boshoff 1986, Mundy *et al.* 1992, Marincovič & Orladič 1994a, Borello & Borello 2002).

The Greek Griffon Vulture (*Gyps fulvus*) population numbers ca. 300 breeding pairs, of which more than 70% are concentrated in Crete (Handrinos & Akriotis 1997, Xirouchakis & Mylonas 2005). The species seems to have undergone a 33% population decline on a national scale compared to the early 1980s (Handrinos 1985). However since no systematic survey has ever been carried out in the country the available data do not reflect the true magnitude of the decline. Particularly for the island of Crete, the existing literature goes back as the late 1970s (Vaglianos 1981, Halmann 1985), but most surveys lack a common methodology and do not allow inferences about the species population trends (Marincovič & Orladič 1994b, Tewes 1994, Halmann 1996). In addition many colonies look deserted during the spring and summer months (Halmann 1996) when many foreign ornithologists try to combine tourism and bird watching. Most disparities between surveys have been caused by temporal differences on their timing, while data collection becomes more complicated by the species seasonal distribution and variation in colony use (Xirouchakis 2003, Xirouchakis & Mylonas 2004) and its habit to abandon the colonies for a number of years and reoccupy them later (Xirouchakis & Mylonas 2005).

The aim of the present study was to investigate the seasonal fluctuations in the size of griffon colonies and the activity pattern of their daily use as relevant published accounts are lacking. The ultimate goal was to improve population monitoring schemes, so that future surveys in Crete are undertaken in meaningful time and comparisons between population estimates become reliable. All sites were selected for their stable occupancy by griffons and good sighting conditions that facilitated fieldwork. The colonies monitored were typical for the island in terms of population size (i.e. number of individuals and number of breeding pairs) but differed in weather conditions and the distances from the foraging areas.

2. Materials and methods

2.1. Study areas

Surveys were conducted in two colonies (i.e. A and B) and two communal roosts (i.e. C and D) ca. 5 km apart where exchange of vultures was observed during the years 1997–2001 (Fig. 1). Colonies were situated on limestone substrate, while communal roosts on granite. Colony A was located at 520 m on a small mountain, which was exposed to north–northwest winds. Colony B was placed at 300 m within a gorge 2 km long and 300 m deep (range= 500–700m) and was totally protected from gusty weather. In colony A, 11 and 10 pairs laid eggs during 1999 and 2000 respectively. Similarly in colony B, 10 nesting pairs were recorded during 1997. The nearest foraging ground for vultures were 12 km away from colony A and 6 km from colony B. Communal roosts were located on vertical cliffs (ca. 400–500 m) at altitudes of 1,450 m and 1,750 m facing north and northeast respectively.

2.2 Field procedures

Monitoring the seasonal use of colonies was made by conducting morning and evening counts in colony A from September 1999 to October 2001 with a total of 141 visits (on average 5.6/ month, range 5–7 visits). In morning observations vultures were tallied from 30 min before sunrise till all individuals left the colony while in evening ones vulture counts were initiated 4 h before sunset and ended 30 min after dusk. Fieldwork in communal roosts was carried out five times per calendar month during the years 1998, 2000 by counting the vultures as they entered the roosts 2–4 h before sunset.

Daily variability in colony use was examined by assessing vulture numbers in colony A from sunrise to sunset during October 1998–October 1999 and November 1999–November 2001 at a rate of two and one visit per month respectively (*n* = 50). Similarly in colony B bird counts were conducted during three visits per month (*n*= 39) from November 1997 to November 1998 inclusive. In these daylong observations the maximum number of birds present i.e. in all known roosts, nests or soaring close to the cliffs (< 500 m) was recorded rotationally at 30 min time intervals (scan sampling, Bateson & Martin 1990). Departure time was the moment that more than 50% of the vultures in the colony left the breeding cliff, whereas arrival time was the moment that at least 2/3 of the birds counted in the morning returned to the colony.

All visits were spaced out every 7–10 days so as to cover all months homogeneously. The annual cycle of the species was divided into three stages in relation to its breeding phenology (Xirouchakis 2003): a) the pre-breeding period (i.e. courtship, nest building), egg laying and incubation (November–February), b) the egg hatching and chick rear-

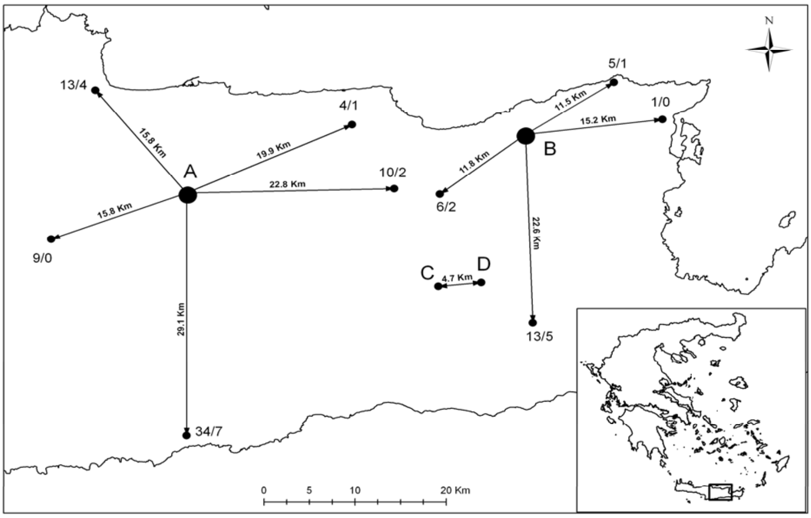

Fig. 1. Map of the study sites, location and population size (mean number of individuals/mean number of nesting pairs) of the nearest colonies during the study period.

ing period (March–June) and c) the fledging and dependence period (July–October). Daytime was divided into three periods namely morning (07:00–11:00), midday (11:00–15:00) and afternoon (15:00–19:00). Observations were made from a safe distance ranging 300–600 m from the cliffs with the aid of 10×50 binoculars and a spotting scope with 30× and 70× eyepieces.

2.3 Data analysis

In all analyses non-parametric tests were used (Zar 1996) at a 0.05 level of significance while data on the colony daily use were grouped by month and calendar year. Exceptional cases i.e. late departures because of inclement weather were excluded. The hypothesis that the differences in the monthly vulture numbers using colony A and communal roosts were significant was tested by detecting the seasonality of the data. After a visual inspection of the autocorrelation functions (AFC) of the mean monthly counts at lag of 12, the autocorrelation coefficients were examined by the Ljung-Box Q* test for time series data (Ljung & Box 1978, Makridakis *et al.* 1998). Comparisons of vulture counts between months were made by applying the Mann-Whitney test while those concerning the same breeding stage of different years by the Wilcoxon paired test. The frequency of colony size between morning and evening counts was tested by the chi-square test with a Yates' correction. Time was transformed to circular data (i.e. $a = (360^{o})(x)/k$, $k = 24h$) and the differences in the griffons' mean departure and arrival times of the two colonies were tested by the Watson U^2 test.

3. Results

3.1 Seasonal fluctuations in colony size

Griffon Vultures used colony A periodically (Ljung-Box Q*= 92.2, $P < 0.0001$) with high concentrations occurring during the pre-breeding and incubation periods. Their numbers started to increase from late August, peaked during December–January and decreased from February onwards as the breeding season progressed (Fig. 2). Maximum vulture numbers were greater in 1999–2000 (January, average = 42) than in 2000–2001 (December, average = 33, Mann-Whitney U = 0.5, P = 0.008), though their concentrations were similar in both years when the entire stage A was taken into account (33 vs. 30, Wilcoxon T = 3, P = 0.46). The opposite pattern of activity was detected in communal roosts (Fig. 3).

Bird numbers build up from the chick rearing period up to the fledging of the young and dropped thereafter (Ljung-Box Q*= 27.4, P = 0.02). Pooled data from 66 visits produced the maximum vulture count in June (mean ± s.d. = 38± 9, range = 30–54) and the minimum one in January (mean ± s.d. = 1± 2, range = 0–5).

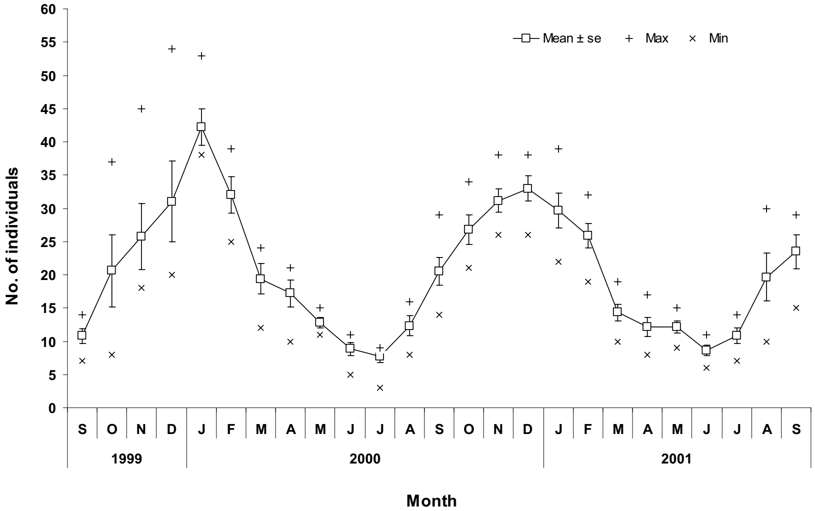

Fig. 2 Seasonal pattern of Griffon Vulture (*Gyps fulvus*) activity in one colony in Crete during 1999–2001 (n = 141).

3.2 Daily pattern of colony use

Griffon Vulture numbers fluctuated during the day according to their foraging sorties (Fig. 4). Departures lasted 3.35 hrs and were more concentrated than arrivals i.e. 6.08 hrs (n = 88, angular deviation 12° vs. 21°). For both colonies the mean departure time was 09:16 (range = 07:30–10:55) while the mean arrival one was 16:32 (range= 13:00–19:05). Griffon Vultures departed earlier and returned later in colony A than in colony B (09:09 vs. 09:26, Watson $U^2_{dep} = 0.23$, $P < 0.05$ and 16:42 vs. 16:20, Watson $U^2_{arr} = 0.33$, $P < 0.05$). However the daily pattern of colony use was associated with the stage of the breeding season (Table 1). More specifically the birds were away from the colonies, in search of food, during the late morning and midday hours only in the pre-breeding and incubation periods. On the contrary the number of vultures present in the colonies was stable throughout the day during the chick development, fledging and dependence periods (Fig. 5).

Vulture numbers between morning and evening counts differed from 0–25 individuals in colony A (mean ± s.d. = 4 ± 6.4) and 0–12 individuals in colony B (mean ± s.d. = 3 ± 2.9). Overall in 47% of the cases these differences were null while in more than 85% they lay within the range of 0–5 individuals. The frequency of elevated morning counts (35.7%) was smaller than the elevated evening ones (64.3%), though not significantly so ($\chi^2 = 3.38$, $P > 0.05$). In days when morning counts

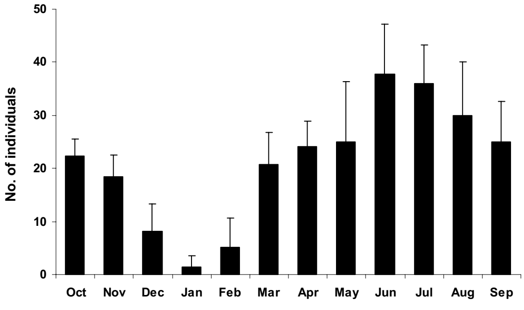

Fig. 3. Seasonal pattern of Griffon Vulture (*Gyps fulvus*) activity (mean ± s.d.) in two communal roosts in Crete during 1998–2000 (n = 66).

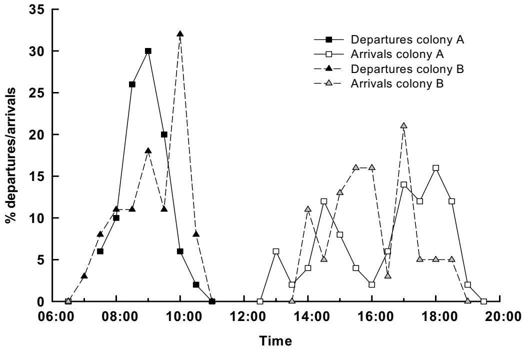

Fig. 4. Daily distribution of departure and arrival times in two Griffon Vulture (*Gyps fulvus*) colonies in Crete [colony A: 1998–2001 (n = 50), colony B: 1997–1998, (n= 38)].

Table 1. Number of Griffon Vultures (*Gyps fulvus*) present in two colonies in Crete (i.e. daily average per calendar month) in relation to the nesting population size and stage of the breeding season. Three breeding stages were distinguished. A: Courtship, nest building, egg laying and incubation (November–February). B: Egg hatching and chick rearing (March–June). C: Fledging and dependence (July–October). The ratio users / nesters describes the mean number of individuals present in the colony over the number of nesting individuals. The average ($\bar{x}$) is calculated over the two colonies.

Breeding stage	**Colony A** Daily users/Nesters (range)	**Colony B** Daily users/Nesters (range)	$\bar{x}$
A	0.91 (0.45–1.23)	1.00 (0.67–1.21)	0.95
B	0.55 (0.36–0.64)	0.75 (0.63–0.82)	0.65
C	0.32 (0.18–0.45)	0.35 (0.28–0.48)	0.33

surpassed evening ones, the number of vulture leaving the colonies was inflated by 20.1% in colony A and 12.6% in colony B. In contrast when morning counts fell short of evening ones, the number of vultures leaving the colonies was less by 16.1% in colony A and by 36.3% in colony B.

4. Discussion

The behaviour of communal roosting is well documented among old and new world vultures as well as in some flocking eagles (Cramp & Simmons 1980, Rabenold 1983, Tella 1991, Donázar 1993, Stolen & Taylor 2003, Wilson & Gessaman 2003). Seasonal fluctuations in roost size are typical for the migratory Egyptian Vulture *Neophron percnopterus* (Ceballos & Donázar 1990, Tella 1991, Donázar 1993) and for small cathartid vultures (i.e. *Cathartes aura, Coragyps atratus*), which gather year round at persistent communal roosts (Rabenold 1986, Sweeney & Fraser 1986, Buckley 1999). The temporal variation in the use of communal roosts is produced by different ecological pressures such as roost type, levels of human disturbance, climatic conditions and food availability (Donázar 1993, Thomson *et al.* 1990, Donázar & Feijóo 2002). Some species are restricted to big dead trees which can support many birds and have easy access (Ceballos & Donázar 1990) while others select trees with thick foliage where favorable microclimatic conditions occur (Wright *et al.* 1986). The formation of communal roosts is evoked by regular food supplies (Donázar *et al.* 1996, Margalida & Boudet 2003) although an element of social organization might also be involved (Rabenold 1986, Parker *et al.* 1995). In Crete griffons' communal roosts are located on vertical limestone cliffs, which are abundant within the species foraging range. Most of them are used seasonally with an additional increase in their number during summertime (Xirouchakis & Mylonas 2004). Weather constraints are not important as all of them are found in warm or cool places depending on the season. The communal roosting behavior should be linked to local food abundance (e.g. waste dumps) and the species dependence on pastoralism. Griffons feed exclusively on carrion originating from livestock (Xirouchakis 2005) thus their distribution demonstrates differences in space and time in relation to the movements of nomadic flocks (Xirouchakis & Mylonas 2004). The

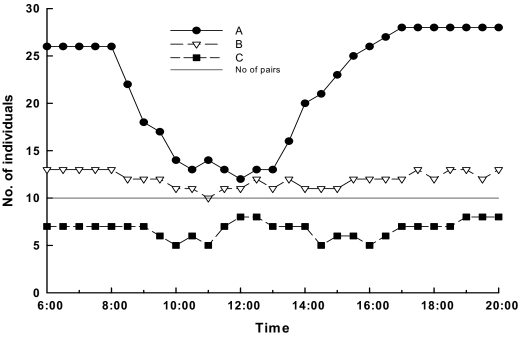

Fig. 5. Mean number of nesting pairs in two Griffon Vulture (*Gyps fulvus*) colonies in Crete (1997–2001) and daily number (average at 30 min time intervals) of individuals present in relation to the stage of the breeding season [A: Courtship, nest building, egg laying, incubation (November–February, n= 28), B: Egg hatching, chick rearing (March–June, n= 31), C: Fledging, dependence (July–October, n= 29)].

observed dynamics of the colony-roost system should be determined by their proximity to food resources in conjunction with the griffons' breeding status. Numbers in communal roosts build up by non-breeding birds and failed breeders that follow the domestic flocks in the upland pastures in an effort to forage optimally. The maximum counts in summer correspond to the influx of birds that abandon the colonies having completed successfully their breeding attempt. Unlikely in regions where livestock is kept in big farms throughout the year griffon colonies remain stable in size and exhibit a steady pattern of daily use similar to the one detected in the present study during the pre-breeding and incubation periods (e.g. Cape Vulture *Gyps coprotheres,* Jarvis *et al.* 1974, Robertson & Boshoff 1986).

The griffons' departure time was determined by the geographical position and topography of the colonies likewise other large soaring raptors (Houston 1976, Boshoff *et al.* 1984, Hiraldo & Donázar 1990). Colony A received north-northwest winds that produced strong upward currents and vultures abandoned the breeding cliff by entering the rising airflow as soon as 30–60min after dawn. In contrast in colony B north winds were blocked because of the orientation of the cliffs (i.e. NE–SW); thus griffons had to wait for 3–4 h after sunrise for the formation of suitable thermals in order to depart. In addition the differences of the colonies' distances from the foraging areas were reflected in the distribution of arrivals and the difference in the mean arrival times.

The daily pattern of colony use was quite distinct during the different stages of the breeding cycle. In the pre-breeding period vultures were gathered in the colonies in order to establish nesting territories, build nests and lay eggs producing the maximum bird counts. In the chick-rearing period vulture numbers mostly accounted for breeding individuals when one of the mates was attached to the nest brooding the young. In the fledging and dependence periods even fewer birds were present in the colony since the chicks were well grown and left unattended at the nest. Moreover newly fledged chicks remained in the colony depending on their parents for food. In some cases they roosted for the night in the vicinity of the colony and returned at noon to their natal cliff waiting for their parents to feed them. Midday peaks in vulture numbers in colony B were due to this phenomenon.

The differences between morning and evening counts were insignificant, though the former should be regarded as more reliable. One disadvantage was in days of suitable uplift currents when birds left the colony A by the first light, a fact that depended on the topography and the soaring conditions of the area. Evening counts were less accurate because arrivals were more dispersed through the day while some birds could not be detected as: a) they roosted in remote places out of range, b) moved around the colony and c) arrived after sunset.

In conclusion monitoring of all known colonies and communal roosts during the pre-breeding stage i.e. November–February would produce the most reliable population estimate. Surveys later than February should be avoided as non-breeding individuals abandon the colonies. Colonies void of birds during spring months do not reflect a decline in population size and should not be regarded as deserted. They might have hosted breeding pairs, which in case of total nest failures disappeared by early March. Morning counts should be preferred over the evening ones and if no prior knowledge on the weather conditions in the area exists they should initiate by dawn.

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Pesimäkauden ja vuorokaudenajan vaikutus Kreikan saariston hanhikorppikotkien aktiivisuuteen

Hanhikorppikotkien lukumäärät vaihtelivat yhdyskunnissa ja yleisillä lepopaikoilla vuorokauden ajan ja pesimäkauden mukaan. Yhdyskunnissa korppikotkien määrä oli suurin ennen pesintää ja haudonnan aikoina (marraskuulta helmikuulle) huipun ajoittuessa joulu- ja tammikuun vaihteeseen. Lentopoikasaikaan (heinä- ja lokakuussa) yksilöiden lukumäärä oli vähäisempi. Kesä- ja heinäkuussa yhdyskunnissa oli kaikkein vähiten korppikotkia. Tätä vastoin korppikotkat alkoivat käyttää yleisiä lepopaikkojaan maalis–huhtikuussa poikasten ruokinnan aikaan. Eniten korppikotkia nähtiin lepopaikoilla heinä–elokuussa, jolloin poikaset lähtivät pesästä. Tulosten mukaan hanhikorppikotkien populaatiokoko tulisi selvittää aamulaskennoin kaikissa aktiivisissa yhdyskunnissa sekä lepopaikoilla pesintää edeltävänä aikana marraskuun ja helmikuun välisenä aikana.

References

Bateson, P., & Martin, P. 1990. Measuring Behaviour, an introductory guide. — University Press, Cambridge.

Bibby, C.J., Burgess, N.D. and Hill, D. 1992: Bird Census Techniques. — Academic Press, London.

Bildstein, K.L. 1979: Fluctuations in the numbers of northern harriers (Circus cyaneus hudsonius) at communal roosts in south central Ohio. — Raptor Research 13: 40–46

Borello, W.D & Borello, R.M. 2002: The breeding status and colony dynamics of Cape Vulture Gyps coprotheres in Botswana. — Bird Conservation International 12: 79–97.

Boshoff, A.F., Robertson, A.S. & Norton, P.M. 1984: A radio-tracking study of an adult Cape Griffon Vulture Gyps coprotheres in the south-western cape province. — South African Journal of Wildlife Research 14 (3): 73–78.

Buckley, N.J. 1999: Black Vulture (Coragyps atratus). — In The birds of North America (ed. Poole, A & Gill, F.): No. 411. Inc. Philadelphia, Pennsylvania.

Ceballos, O. & Donázar, J.A. 1990: Roost-tree characteristics, food habits and seasonal abundance of roosting Egyptian Vultures in northern Spain. — Journal of Raptor Research 24: 19–25.

Cramp, S. & Simmon, K.E.L. 1980: The birds of Western Palearctic. — Oxford University Press, Vol. II. Oxford.

Diesel, D.A. 1984. Evaluation of the road survey technique in determining flight activity of red-tailed hawks. — Wilson Bulletin 96: 315–318.

Donázar, J.A. & Feijóo, J.E. 2002: Social structure of Andean Condor roosts : influence of sex, age and season. — Condor 104: 832–837.

Donázar, J.A. 1993: Los Buitres Ibericos, Biologia y Conservacion. — Reyero, J.M. Madrid.

Donázar, J.A., Ceballos, O. & Tella, J.L. 1996: Communal roosts of Egyptian Vultures (Neophron percnopterus): dynamics and implications for the species conservation. — In Biologia y Conservación de las Rapaces Mediterráneas, Monografias No.4 (ed. Muntaner, J. & Mayol, J.): 189–201. SEO/ BirdLife, Madrid.

Fuller, M. & Mosher, J.A: 1981. Methods of detecting and counting raptors. — Studies in Avian Biology 6: 235–246.

Fuller, M.R. & Mosher, J.A. 1987. Raptor survey techniques. — In Raptor Management Techniques Manual. (ed. Pendleton, B.A.G., Misslap, B.A., Cline, K.W. & Bird, D.M.). Sc. Tech. Series No. 10: 39–65. Institute for Wildlife Research National Wildlife Federation, Washington.

Hallmann, B. 1985: Status and conservation problems of birds of prey in Greece. — In Conservation studies in raptors (ed. Newton, I. & Chancellor, R.D.): 55–59. ICBP Technical Publication, No 5, WWGBP, Berlin.

Hallmann, B. 1996: Greece's Birds of Prey. Eleventh hour for 10 Species. — WWF Hellas, Athens.

Handrinos G. & Akriotis, T. 1997: The Birds of Greece. — Helm-A. & C. Black Ltd, London.

Handrinos, G. 1985: The status of vultures in Greece. — In Conservation studies in raptors (ed. Newton, I. & Chancellor, R.D.): 103–115. ICBP Technical Publication, No 5, WWGBP, Berlin.

Hiraldo, F. & Donázar, J.A. 1990: Foraging time in the Cinereous Vulture Aegypius monachus: seasonal and local variations and influence of weather. — Bird Study 37: 128–132.

Hiraldo, F., Donázar, J.A., Heredia B. & Alonso, J.C. 1993: Communal roosting of wintering red kites Milvus milvus (Aves, Accipitridae): Social feeding strategies for the exploitation of food resources. — Ethology 93: 117–124.

Houston, D.C. 1976. Breeding of the white – backed and Rueppel's Griffon vultures, Gyps africanus and G. rueppellii. — Ibis. 118: 14–40.

Jarvis, M.J.F., Siegfried W.R. & Currie, M.H. 1974: Conservation of the Cape Vulture in the Cape Province. — Journal of South African Wildlife Management Association 4: 29–34.

Keister, G.P., Anthony R.G. & O'Neil, E.J. 1987. Use of communal roosts and foraging areas by Bald Eagles wintering in the Klamath Basin. — Journal of Wildlife Management 51: 415–420.

Ljung, G.M. & Box, G.E.P. 1978: On a measure of lack of fit in time series models. —Biometrika 65: 297–303.

Makridakis, S., Wheelwright, S.C. & Hyndman, R.J. 1998: Forecasting: methods and applications. — John Willey & Sons, New York.

Margalida, A. & Boudet, J. 2003: Dynamics and temporal variation in age structure at a communal roost of Egyptian Vultures (Neophron percnopterus) in northeastern Spain. — Journal of Raptor Research 37: 252–256.

Marincovič, S. & Orladič, L. 1994a: Status of the Griffon Vulture Gyps fulvus in Serbia. — In Raptor Conservation Today (ed. Meyburg B-U & Chancellor, R.D.): 163–172. The Pica Press, Berlin.

Marincovič, S. & Orladič, L. 1994b: Census of the Griffon Vulture (Gyps fulvus) on Crčte Island. 6e Congrés Internacional de Zoogéographie et Ecologie de la Grčce et des Régions Avoisinantes. — Bios 2: 295–300.

Mundy, P.J., Butchart, D., Ledger, J. & Piper, S. 1992: The Vultures of Africa. — Acorn Books & Russel Friedman Books, Randburg.

Newton, I. 1979: Population Ecology of Raptors. — Buteo Books, Vermillion.

Parker, J.W. 1975: Populations of Mississippi kite in the Great Plains. — In Population status of raptors (ed. Murphy, J.R., White, C.M. & Harell. B.E.): 159–172. Raptor Research Report No. 3. Vermillion.

Parker, P.G., Waite T.A. & Decker, M.D. 1995: Kinship and association in communally roosting black vultures. — Animal Behaviour 49: 395–401.

Pennas, J. 1977: The climate of Crete. — Ph.D. Thesis. Aristotelian University of Salonica, Salonica. (In Greek)

Rabenold, P. 1983. The communal roost in black and turkey vultures – an information centre? In Vulture Biology and Management (ed. Wilbur, S.R. & Jackson, J.A.): 303–321. — University of California Press, Los Angeles.

Rabenold, P. 1986: Family associations in communally roosting black vultures. — Auk 103: 32–41.

Rabenold, P. 1987: Recruitment to food in black vultures: evidence for following from communal roosts. — Animal Behaviour 35: 1775–1785.

Robertson, A.S. & Boshoff, A.F. 1986: The Feeding Ecology of Cape Vultures Gyps coprotheres in a Stock-Farming Area. — Biological Conservation 35: 63–86.

Skirvin, A.A. 1981. Effect of time of day and time of season on the number of observations and density estimates of breeding birds. — Studies in Avian Biology 6: 271–274.

Stolen, E.D. & Taylor W.K. 2003: Movements of Black Vultures between communal roosts in Florida. — Wilson Bulletin 115:316–320.

Sweeney, T.M. & Fraser, J.D. 1986: Vulture roost dynamics and monitoring techniques in Southeastern Virginia. — Wildlife Society Bulletin 14: 49–54.

Taylor, D.M. 1983: Turkey vultures decline at a traditional roosting site. — Great Basin Naturalist 46: 305–306.

Tella, J.L. 1991: Dormideros de alimoche en el Valle Medio del Ebro. — In Actas I Congreso Internacional sobre Aves Carroñeras (ed. ICONA): 69–75. ICONA, Madrid.

Tewes, E. 1994: Situation of the European Black vulture (Aegypius monachus) and the Eurasian Griffon vulture (Gyps fulvus) in the Mediterranean. — In Proceedings of the VI Congress on the Biology and Conservation of the Mediterranean Raptors (ed. Muntaner, J & Mayol, J.): 35–51. SEO/ BirdLife, Madrid.

Thomson, W.L., Yahner, R.H. & Storm, G.L. 1990: Winter use and habitat characteristics of vulture communal roosts. — Journal of Wildlife Management 54: 77–83.

Vaglianos, C. 1981: Contribution au statut des rapaces diurnes et nocturnes nicheurs en Crète. — Rapaces Méditerranéens: 14–16.

Walk, J.W. 1998: Winter roost sites of northern harriers and short-eared owls on Illinois grasslands. — Journal of Raptor Research 32:116–119.

Wilson, R. & Gessaman, J.A. 2003: Two large Bald Eagle communal winter roosts in Utah. — Journal of Raptor Research 37: 78–83.

Wright, A.L., Yahner R.H. & Storm, G.L. 1986: Roost-tree characteristics and abundance of wintering vultures at a communal roost in south central Pennsylvania. — Raptor Research 20: 102–107.

Xirouchakis, S.M. 2003: The ecology of Griffon Vulture (Gyps fulvus) on the island of Crete. — Ph.D. Thesis, University of Crete, Heraklion. (In Greek)

Xirouchakis, S.M. 2005: The diet of the Griffon Vulture (Gyps fulvus) in Crete. — Journal of Raptor Research 39: 179–181.

Xirouchakis, S.M. & Mylonas, M. 2004: Griffon Vulture (Gyps fulvus) distribution and density in Crete. — Israel Journal of Zoology 50: 341–354.

Xirouchakis, S.M. & Mylonas, M. 2005: Status and structure of the Griffon Vulture (Gyps fulvus) population in Crete. — European Journal of Wildlife Research 51: 223–231.

Zar, J. 1996: Biostatistical analysis. 3rd ed. — Prentice Hall, New Jersey.