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# Juvenile dispersion and migration among Griffon Vultures *Gyps fulvus* in Spain

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## RESUMEN

Entre 1990-93 se marcaron 31 jóvenes de Buitre Común en el norte de la Península Ibérica para estudiar la dispersión y migración juvenil mediante recuperaciones y observaciones. Se estudia también el percentaje de los individuos que cruzan el Estrecho de Gibraltar en otoño. Los resultados muestran que más del 90% de la población juvenil del norte de España abandona sus colonias natales hacia fines de octubre. Dos ó tres semanas después, gran parte de los jóvenes están reuniéndose en la zona del Estrecho de Gibraltar. Hasta mediados de 1995 en total 16 de los individuos marcados fueron observados o recuperados hasta 650 km al sur de sus colonias de nacimiento. Según datos obtenidos mediante radiotelemetría, las aves recorrieron distancias diarias de entre 31 y 54 km. En 1992 y 1993 se contaron aprox. 4000 Buitres comunes, en su mayoría jóvenes del año, cruzando a Marruecos. Los resultados muestran que la travesía exitosa del Estrecho depende de la dirección del viento y la altura de los nubes en la zona. Al menos el 30% de la población juvenil de España cruza el Estrecho cada otoño. El promedio de velocidades de vuelo es de entre 36 y 50 km/h, entre la costa de España y Marruecos (aprox. 15 km de distancia). Los resultados muestran que la mayoría de los jóvenes del norte de la Península Ibérica hacen recorridos migratorios y se reunen en el sur, donde gran parte de ellos cruzan al continente africano.

## ABSTRACT

In 1990-93, 31 juvenile Griffon Vultures have been marked in northern Spain in order to verify dispersion and migratory movements and to gain

data on the percentage of individuals crossing the Straits of Gibraltar. Results show that over 90 % of the juvenile population in Northern Spain leave the breeding colonies between mid and end of October. About 2 or 3 weeks later, a prominent part of them gathers in southern Spain. Until mid-1995 altogether 16 of the marked birds could be recovered or resighted up to 650 km to the south of their native colonies. According to radio tracking data, birds achieved migration rates of between 31 and 54 km per day. In 1992 and 1993, approx. 4000 mostly juvenile Griffons could be counted crossing over to Morocco. Data indicate that crossing of the Straits depends on e.g. wind direction and cloud base and that at least 30 % of the juvenile population in Spain migrate to Africa each year. Flying speeds of between 36 and 50 km/h were measured for the 15 km crossing of the Straits. Results demonstrate that most of the Spanish juvenile Griffons are migratory birds assembling in southern Spain and crossing over to Africa in major numbers.

## INTRODUCTION

The Griffon Vulture *Gyps f. fulvus* in Spain has long been considered a sedentary or partially migrant bird (Glutz et al., 1971). As far as countings from the Straits of Gibraltar until the beginning of the 1980ies have reported, migration to Africa occurred in minor numbers and has been qualified as sporadic and irregular (Cramp & Simmons, 1980). During my studies on the ecology and behaviour of Griffon Vultures in northern Spain between 1989 and 1993, however, I observed that approximately 90 % of the juvenile population left its breeding colonies in its first year. With altogether 120 fledged juveniles in the investigated colonies (Province of Huesca, southern Pyrenees), this meant more or less 100 young vultures per year seeking for a new habitat. I doubted whether this great amount of juveniles could disperse in Spain and wondered whether migration to Africa might not take place to a much larger extent. Since the juvenile Griffons leave their breeding colonies between mid and end of october, migration might happen exceptionally late and may thus not have been recorded.

## MATERIAL AND METHODS

In order to verify these suppositions, the following techniques were applied: From 1990-1993, altogether 31 Griffons were marked in the provinces of Huesca, Zaragoza and Segovia as nestlings (n=17) or juveniles (n=14) from a releasing station. Marking consisted in yellow leg bands delivered by the "Estación Biológica de Doñana (CSIC)", combined with plastic wing-tags (Young & Kochert, 1987) or hydrogen peroxide decolorizing primary and

secondary feathers. In addition, 16 of the birds were also equipped with radio transmitters (Griesinger, 1996 pers). In 1990, one juvenile bird could be equipped with a satellite transmitter (Berthold *et al.*, 1991). During the post-fledging dependent phase between end of June and October, presence of the juveniles was documented through visual observation and radio tracking in regular intervals.

By mid october, several groups of observers were installed at the proposed destination area of migration (Evans & Lathbury, 1973; Finlayson, 1992) that is the southernmost point of Spain near Tarifa, where the distance across the Strait is shortest, i.e. 15 kilometers. Regular controls were taken of the number of migration-disposed Griffons gathering in the area and visible migration across the Straits was counted in relationship to weather data, furnished by the meteorological office of the RAF, Gibraltar, e.g. wind force, wind direction, cloud base. In 1993, when decolorization combined with radio transmitters was applied, daily radio tracking controls of marked birds were taken. Statistics were done on a personal computer with SAS (SAS Inst. Inc., 1985).

# RESULTS

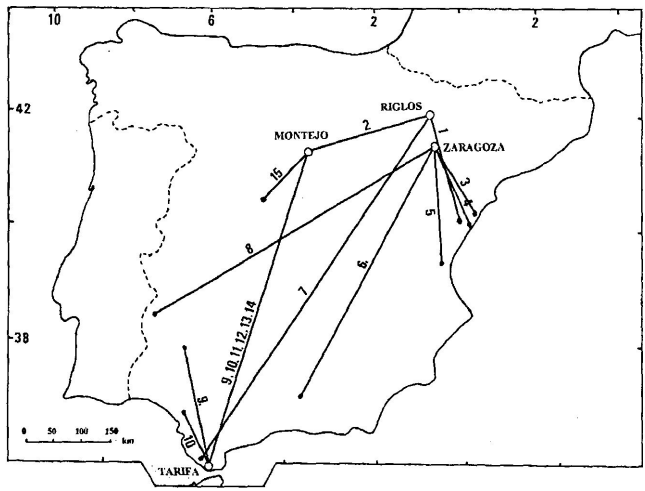
## Recoveries and resightings

Altogether 16 (51.61 %) of the 31 marked birds could be recovered or resighted until mid of 1995. In 1993, when radio telemetry was utilized combined with decoloration, the recovery rate even amounted to 87,5 %. Fig.1 illustrates their prominent flight directions: From the releasing/marking areas in Riglos and Zaragoza (province of Huesca and Zaragoza), and Montejo de la Vega (Segovia), the juvenile vultures mainly went SSE and SSW, direction southern Spain. In 1993, 6 out of the 8 marked birds could even be reidentified among migration-disposed Griffons near Tarifa. In the same year, continuous radio tracking of marked birds in their breeding area in the province of Segovia also allowed us to determine their departure within a few days range. They needed between 12 and 21 days to cover the 650 km from their breeding grounds to the coast of southern Spain. This comes up to daily migration rates of between 31 and 54 km.

## Crossings of the Straits of Gibraltar

In 1992 and 1993, approx. 4.000 Griffons could be counted crossing over to Morocco. Visual migration was concentrated on a few days only during the observation period of October 10 to November 10. Controls of migration-disposed Griffons in the area proved that the number of migrating Griffons per day was positively correlated with the flocking tendency, that is the total

**Figure 1: Recoveries of juvenile and immature Griffon Vultures 1990-94.**




Explanations to Fig.1:

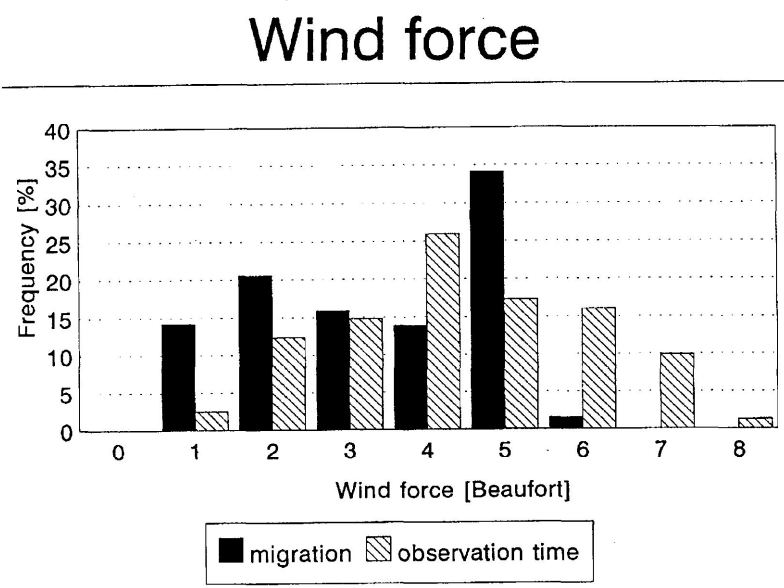
**1** Bird with Satellite transmitter (26.09.- 21.11.1990), last tracking contact in the province of Valencia.
**2** "Refugio de Rapaces de Montejo de la Vega" (Segovia) a) 01.11.1990 b) 23./24.02.1991
**3,4,5** Provinces of Castellón and Valencia;
**6** Near Granada, 25.11.1991
**7** Province of Cádiz, 13.02.1992
**8** a) Near Badajoz, 23.01.1993 b) Near Zaragoza, 14.05.1994
**9,10,11,12,13,14** Near Tarifa (Province of Cádiz), 21.10.-12.11.1993;
**9** Frontier provinces of Badajoz and Huelva, 05.12.1993
**10** El Rocío (Huelva), 16.12.1993
**15** Peguerinos (Ávila), 10.04.1994

number of circling birds per day. Griffons typically began to soar in the late morning, as soon as thermal updrafts formed, and formed large "whirls" for gaining altitude. Flocks of circling Griffons consisted of up to 450 individuals. As we could observe, the percentage of juveniles among migration-disposed Griffons was beyond 90 %. According to simultaneous monitoring from the Spanish and Moroccan coast (28.10.1993), different groups of Griffons needed between 18 and 25 min to cover the 15 km across the Straits. At a mean following wind of 8 knots (14.83 km/h), this amounts to calculated speeds of 36 to 50 km/h. For the crossing of the Straits the Griffons used powered flight, interrupted by short soaring flight phases of only a few seconds. The groups arriving at the coast rapidly gained height and dissappeared inland.

## Migration and weather factors

Thanks to weather data supplied by the meteorological office of the RAF at Gibraltar, combined with own recordings and observations, it could be demonstrated that migration is influenced by wind force. As shown in Fig

**Figure 2: Variation of wind forces (in Beaufort at 2000 FF altitude) in relation to migration (black bars) and observation time (hatched bars).**




2, crossings could be observed at wind forces between 1 and 6 Beaufort. On the first glance data may suggest a certain preference of wind force 5. But, as Fig. 3 shows, at this wind speed, westerly to northwesterly winds prevailed in 87,5 % of the cases, which indicates a preference for wind direction rather than wind force.

### Wind direction

Figure 3 shows the distribution of migration in relation to wind directions. Within the observation period of 81 days, wind directions from west and east were quite evenly distributed. Migration of Griffons, however, was significantly more frequent than expected at winds of WNW and NW directions (Watson $U^2$-Test, $U^2 = 0.427$, $p<0.001$). For the birds who migrate straight to the south, this means winds coming from the right side or even back (nearly tailwind).

### Cloud base

Crossings could be observed on days with cloud layers between 390 and 7500 meters (see Fig. 4). But in 85 % of the cases migration coincided with a cloud layer between 600 and 900 m. These were exclusively cumulus clouds. Although the cloud base was beneath 600 m on approx. 40 % of observation days, only 0.14 % of the crossings were undertaken under these conditions.

Figure 3: Distribution of migration in relation to wind direction (at 2000 FF altitude). The right circle indicates wind directions on non-migration days (d = 59), the left one wind directions during migration days (d = 22). Watson $U^2$-Test, $U^2$ = 0.427, $p<0.001$. Each small circle at the outer side symbolizes 1 day of observation (o = 1 day).

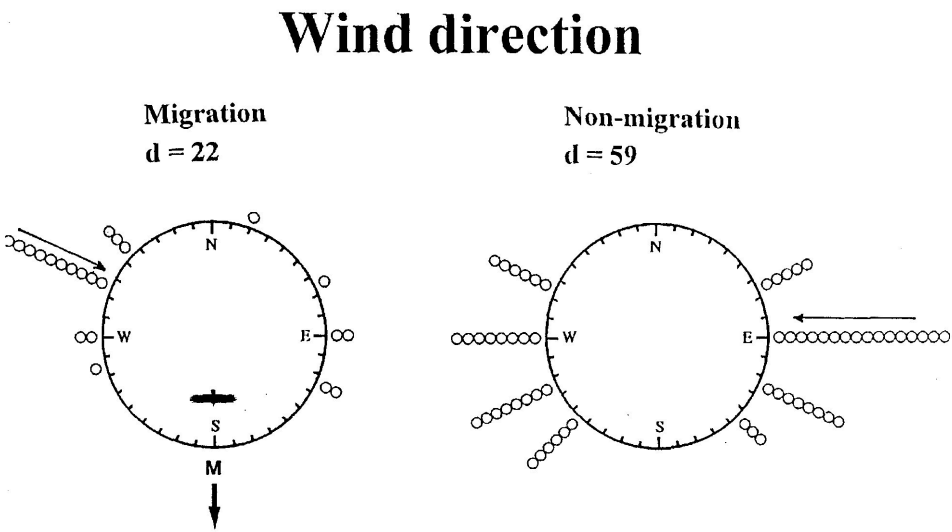



Figure 4: Cloud base prevailing on days with visible migration (black bars) and during observation time (hatched bars).

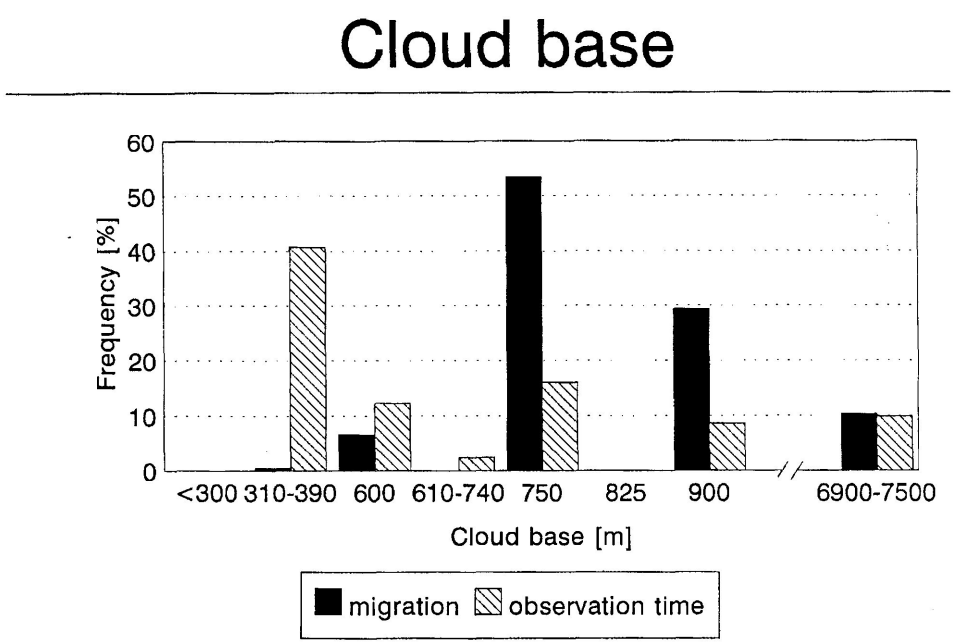
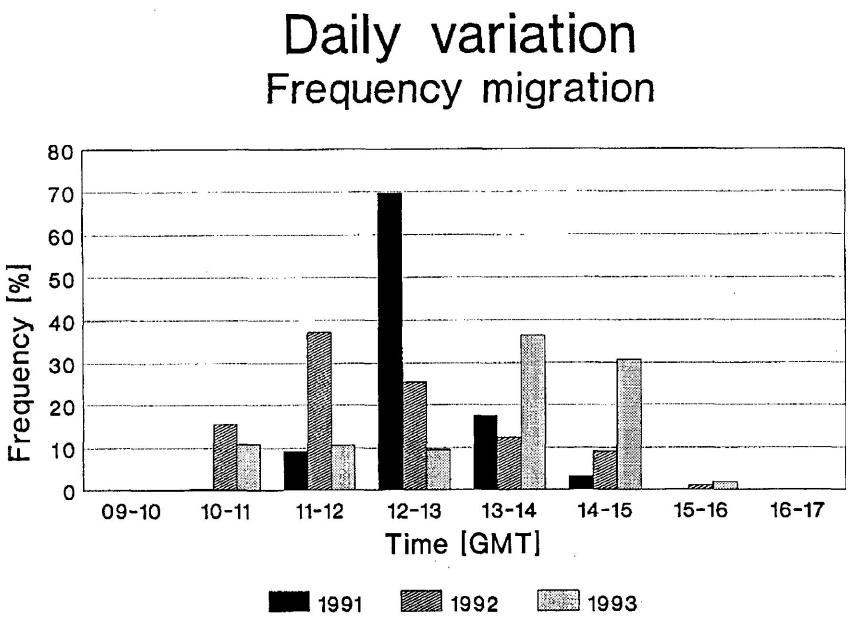


**Figure 5: Daily variation of migration movements.**




# DISCUSSION

Obviously, Griffon vultures take decisions before venturing the crossing of the Straits, at least with respect to cloud base and wind factors. In order to reduce energy costs to a minimum level, vultures of the genus *Gyps* use mostly soaring and gliding flight, and try to avoid flapping (Houston, 1974). Like storks, these heavy «gliders» (mean weight 7.44 kg) therefore seem to wait for the formation of cumulus clouds in the late morning in order to be able to reach a safe altitude for their crossing (see Fig. 5). If weather conditions are unfavourable (e.g. easterly winds, rain), the birds refrain from crossing, return to the inland and disperse (Bernis, 1980). The choice of wind conditions and flight altitude indicates that Griffons may be able to perceive wind direction and wind force in flight. Thus, birds venturing out over the sea and returning to the coast may probably check conditions for the crossing (Kerlinger, 1989). Griffons are inable to glide over to Africa, because over water convection is poor or not existent, so that they have to cross in a powered gliding, i.e. flapping flight with intermittent gliding phases of 2-3 seconds. Their physiological inability to sustain long periods of flapping flight (Pennycuick, 1972) hence puts them into severe danger during a sea-crossing. Data show that they therefore must initiate their crossing from an altitude safely beyond 600 m to forecome that they plunge into the sea and drown before reaching the Moroccan coast. This is underlined by the observation of exhausted

Griffons landing on ships passing the Straits of Gibraltar (Parkes, pers. comm.). The lack of visible crossings before 10th of october and resightings of our radio-marked juveniles near Tarifa not before 21.10.1993 give evidence that Griffon migration on a big scale does not begin before mid october.

These results give rise to the following questions:

(1) Could it be that the now emerging extent of migration among Griffons in Spain simply has not been recorded before, because the birds pass the Straits extremely late in the year and therefore escaped visual countings?

(2) Or should migration be regarded as a recent phenomenon among juvenile Griffons in Spain, maybe due to the regrowth of the species' population since the middle of the 1980ies (Donazar & Fernandez, 1990; Donazar, 1993)?

The destination of the Griffons in Africa as well as the time of their return remain quite unclear. Some data of Doval and Martinez (pers. comm.) of resighted leg-banded Griffons indicate that Griffons may return to their place of birth after a two years absence. There are also a few recoveries of Griffons in Morocco, Algeria (Bairlein *et al.*, 1984), Mauretania, Niger and Senegal (Mundy *et al.*, 1992), suggesting migration pathways across the desert as well as along the western coast of Africa to far beyond the Tropic of Cancer. The fact that the Griffon vulture is nearly extinct in Morocco (Soto 1986; Franchimont *et al.* 1994) precludes the suggestion that the birds migrating from Spain might reintegrate into Moroccan breeding colonies. Therefore further studies with the implementation of satellite telemetry will be needed to sufficiently answer the remaining questions.

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