

YEAR-ROUND MOVEMENTS OF A WAHLBERG'S EAGLE *AQUILA WAHLBERGI* TRACKED BY SATELLITE

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SUMMARY

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An adult female Wahlberg's Eagle from northern Namibia was tracked by satellite over a total distance of 8816 km and located 104 times between 11 February and 4 November 1994. It migrated on an almost due north heading to northern Cameroon, north-eastern Nigeria and western Chad through the rain forest belt of the Congo and Zaire after the breeding season. The total trans-equatorial distance between the breeding and non-breeding ranges was 3520 km. During the non-breeding season the bird ranged over a large area (ca. 60 000 km²) for about six weeks (29 April - 14 June) in these three countries in a rather nomadic pattern covering a minimum distance of 1256 km. During two further months (14 June - 14 August) it restricted its movements to an area of about 5000 km² near Maiduguri in the Sudan savannah of north-eastern Nigeria. The return migration took about two weeks longer than that to the north, which took about a month.

RESUME

MEYBURG, B.-U., MENDELSON, J. M., ELLIS, D. H., SMITH, D. G., MEYBURG, C. & KEMP, A. C. 1995. Mouvements saisonniers d'un Aigle de Wahlberg *Aquila wahlbergi* suivi par satellite. *Ostrich* 66: 135-140.

Un Aigle de Wahlberg, femelle adulte, du nord de la Namibie a été suivi par satellite sur une distance totale de 8816 km, 104 localisations ayant obtenues entre le 11 Février et le 4 Novembre 1994. A la fin de la saison de reproduction l'oiseau a migré presque plein nord vers le nord du Cameroun, le nord-est du Nigeria et l'ouest du Tchad, en traversant les forêts du Congo et du Zaire. La distance entre la zone de nidification et celle du séjour en dehors de la période de reproduction fut de 3520 km. Pendant six semaines, du 29 Avril au 14 Juin, l'aigle couvrit un territoire étendu (environ 60 000 km²) dans ces trois pays et parcourut au minimum une distance de 1256 km. Lors des deux mois suivants, du 14 Juin au 14 Août, il limita ses mouvements à une zone de 5000 km² environ dans la savane du nord-est du Nigeria aux environs de la ville de Maiduguri. La migration vers le nord prit un mois et celle vers le sud dura environ deux semaines de plus.

INTRODUCTION

Although Wahlberg's Eagle is one of the most common eagles in Africa, its migratory movements are not properly understood. Steyn (1962) was the first person to draw attention to the eagle's disappearance from southern Africa after the breeding season. According to Steyn (1982) its destination was unknown, but he suspected it to migrate to the southern Sudan.

Recent ring recoveries include a bird ringed in Zimbabwe and found a year later in Rwanda and three birds ringed in eastern South Africa near the Kruger National Park, one found in western Zambia, another ringed as a nestling and found dead three years later in northern Sudan, and the

third found in northern Zaire (Simmons 1990, 1991).

Satellite telemetry as used to track the movements of animals has developed considerably since its first experimental application in 1970. Most early efforts were necessarily associated with large terrestrial and marine mammals because of the size of the transmitter units. Already by the mid-1980s technology permitted effective deployment on large avian species, but it was only in late 1993 that a satellite transmitter, technically called a platform transmitter terminal (PTT) and small and light enough to be used for the Wahlberg's Eagle, became available.

METHODS

Satellite telemetry currently uses the Argos Data Collection and Location System, which is a cooperative international project of the Centre National d'Etudes Spatiales of France (CNES), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA) of the USA. This system includes equipment in Tiros-N satellites and a network of satellite tracking stations and communication links that transfer satellite data to processing centres in Toulouse (France) and Landover, MD (USA). The near-polar, sun-synchronous orbits of Tiros-N satellites permit coverage of a specific geographic area at approximately the same time each day. Locations of transmitters are estimated from the Doppler shift in its carrier frequency (410.650 MHz).

For normal processing, Argos requires four transmissions, or messages, during a pass of the satellite to calculate location, but special processing for wildlife research estimates locations from

as few as two Doppler measurements. Up to 15 June 1994 Argos graded locations according to precision (i.e. 68% of a series of locations expected within the given distance) with location quality indices (LQ): LQ3 = 150m, LQ2 = 350m, LQ1 = 1km, and LQ0 = undetermined. Within LQ0, Argos also provided an interpretative index, which helped in assessing estimated locations by explaining why normal processing failed. Since 15 June 1994 new location algorithms became operational. The location class is now alphanumeric (3, 2, 1, 0, A, B, or Z). The new codes indicate class 3 = better than 150 m, class 2 = better than 350 m, class 1 = better than 1000 m, class 0 = above 1000 m, classes A, B and Z = location without guarantee.

On 11 February 1994 we captured an adult female Wahlberg's Eagle (weight 1260 g) near Tsintsabis in the Tsumeb District of northern Namibia only ca. 300 m from where it nested a few months later. A 29 g PTT (size 64 x 19 x 23 mm, with a 215 mm antenna protruding posteriorly at a 45x angle, ID No. 21817) was attached as a backpack with teflon ribbon and sewn with biodegradable cotton thread. Transmitter life can be varied with timer setup. This unit was set on an 8 hours on/5.6 days off schedule. For the computer calculations of distances covered between Argos locations we used an integrated global mapping system displaying a true Mercator projection.

RESULTS

Between 11 February 1994 (day of capture and release) and 4 November 1994 (last day when a location was received) a total of 104 locations of different qualities were obtained for this eagle. The bird was tracked over a total distance of 8816 km excluding local movements near its nest. The PTT turned out to give on average more precise locations than most other satellite transmitters, according to our experience with over 30 birds tracked so far (e.g. Meyburg *et al.* 1994; Meyburg & Lobkov 1994).

The bird remained until at least 24 March in its breeding area, where 23 locations were obtained before it departed. Combining all the good quality locations at the breeding site both before and after its migration, a home range size of 12-15 km² has been calculated by the minimum polygon area method. This approximates to the known home range sizes derived by other methods (Tarboton 1977).

On 29 March the bird had already proceeded 715 km north into Angola (Fig. 1) and was located south of Vouga (12 22 S 16 44 E). From there it continued 213 km ENE. On 4 April it was located south of Saûtar (11 32 S 18 29 E). Afterwards it continued NNW and had reached the southern border of its non-breeding nomadic range in northern Cameroon by 29 April, having covered 3148 km since leaving the nesting area. Thus it took about a month for its migration between its breeding and non-breeding areas.

For about six weeks (29 April - 14 June) it moved around quite widely between eastern Nigeria, northern Cameroon and southwestern

Chad, covering a minimum of 1256 km (Fig. 2) before it restricted its movements to a much smaller range of 5000 km² south of Maiduguri in north-eastern Nigeria (Fig. 3). We obtained a total of 27 locations between 14 June and 14 August within this area, where the eagle was located in a variety of habitats ranging from broadleaved woodland to wooded shrub grassland with patches of woodland and wooded shrub (according to the vegetation and land use map of the Federal Dept. of Forestry of Nigeria, compiled in 1976/77). Here the minimum total distance covered was 388 km according to the Argos locations.

In general, this area on the Northern Jos Plateau (2000 m above sea level) has short grass with acacia trees (Sudan savannah). The mean annual rainfall varies between 508 and 762 mm. The rainy season lasts from about 1 June till 30 September, with a maximum rainfall in August (24 cm). The average temperature in July is 27°C. The density of the human population varied between 20-40 inhabitants per km² in 1963 (Fullard 1964; Agboola 1979). According to J.-M. Thiollay (pers. comm.) much of this area is quite heavily populated and densely cultivated now, most of the original Sudanese savannah woodland being replaced by fallow or cultivated fields dotted with isolated large trees.

The eagle was last located in its non-breeding range on 14 August. By 19 August the bird had already travelled 423 km to the SW and traversed westernmost Chad. On its way back to its breeding grounds the eagle migrated almost due south, following roughly the same route as on its migration north, passing through NE Cameroon, western Central African Republic, the north-eastern part of the Congo, western Zaire and Angola.

In northern central Angola it remained for about five days in an area near to but east of Nova Gaia (9 58 S 17 55 E), whence it almost returned some 239 km NW to an area west of Marimba (8 24 S 16 27 E). From there it returned to west of Nova Gaia or south of Mussola (10 19 S 17 12 E) where it was again located on 19 September.

By 4 October it had finally arrived back in its breeding area in Namibia. The migration to the breeding territory took about 50 days, thus two weeks longer than the one to the non-breeding grounds. The total distance travelled to return to the nest between 14 August and 4 October was 4 024 km. Eleven more locations were obtained before the batteries finally became too weak in November.

On 23 October the bird was found incubating her single egg in a nest in a mature marula tree *Sclerorarya caffra* in thick scrubby woodland only a few hundred metres away from where she was caught in February. By weighing the egg and calculating its volume the laying date could be estimated, using a previously derived graph of age vs. density for Wahlberg's eggs (R. Simmons pers. comm.). The egg was calculated to have been laid on 17 October, thus about two weeks after its arrival in the breeding area. Two weeks later the bird was again seen on the nest but on 4 January 1995 the eyrie was empty and seemed to have been

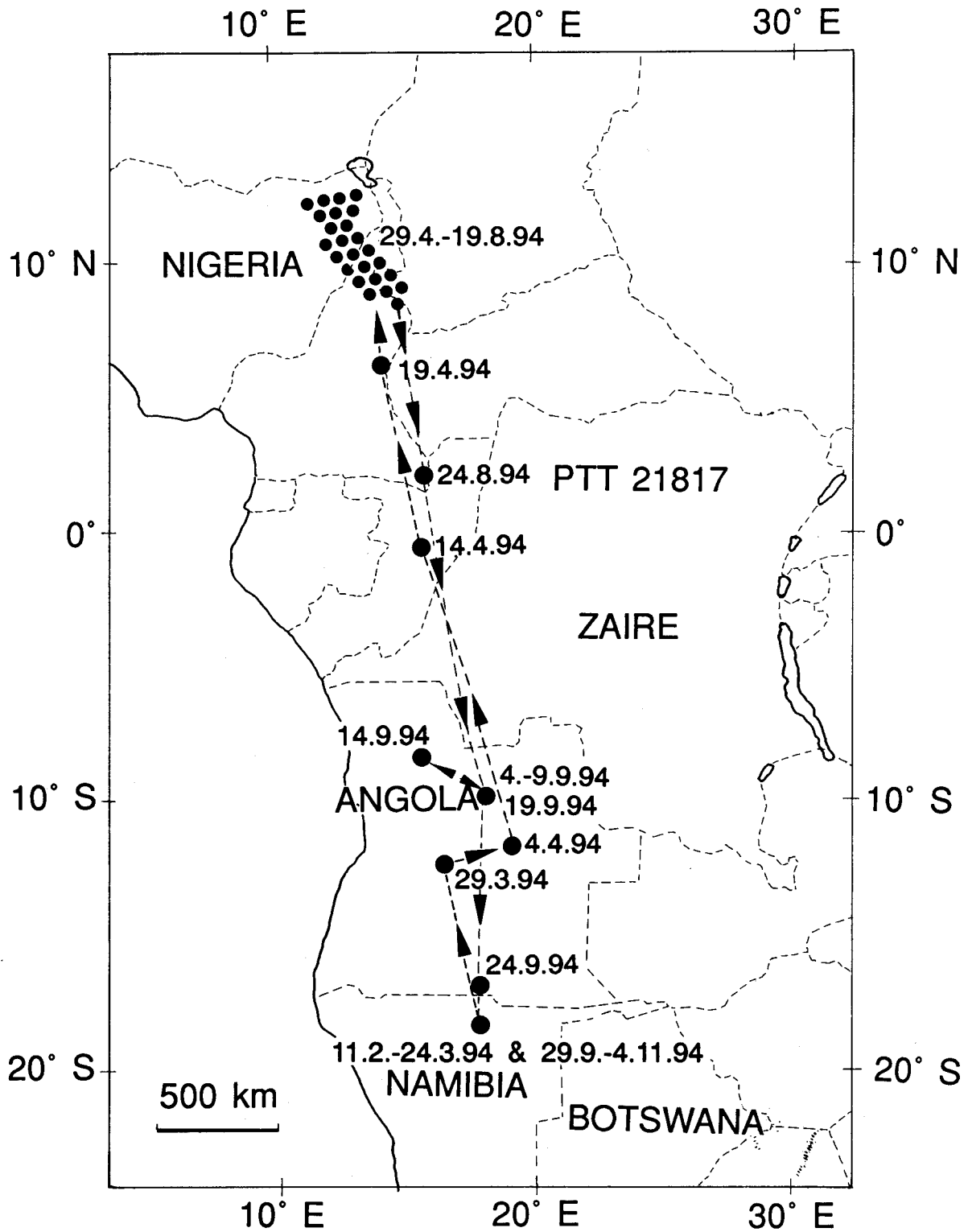


FIGURE 1

The migration route of the Wahlberg's Eagle tracked by satellite during the outward and return migration.

abandoned for at least two weeks already. During several days of observation the eagle was not seen in the area.

DISCUSSION

Steyn (1982) wrote that the migration pattern of Wahlberg's Eagle is still an intriguing problem

requiring clarification, but that on present circumstantial evidence southern African birds are transequatorial migrants. According to Brown *et al.* (1982) the non-breeding areas are still obscure, but probably in north tropical savannas of Sudan, Chad, west to Gambia, from March to August, during the rainy season. The northwards movements were suspected to take longer than the return to the

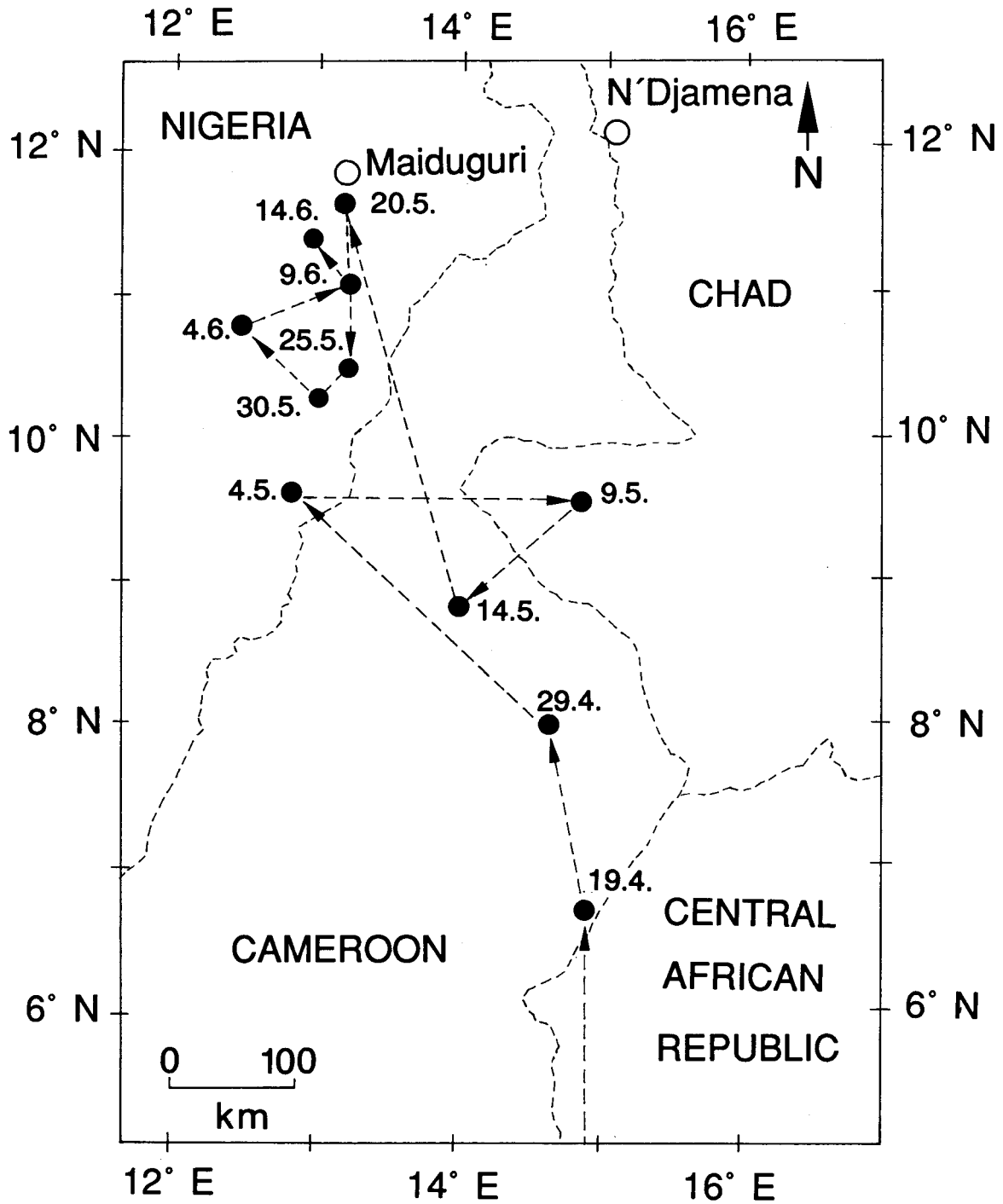


FIGURE 2

The movements of the Wahlberg's Eagle tracked by satellite between 19 April and 14 June 1994 during the outward migration.

breeding grounds. Few connected observations of migration have been recorded (e.g. Ulfstrand 1960). Thiollay (1975) saw more than 1200 Wahlberg's Eagles on 25th as well as 26 July 1974 in Kabalega Falls NP (Uganda).

This first Wahlberg's Eagle tracked by means of

satellite telemetry confirmed the hypothesis of intra-African transequatorial migration and is, indeed, the first proof of migration through the rain forest belt of the Congo and Zaire. Up to now the Ovambo Sparrowhawk *Accipiter ovampensis* was the only raptor known coming from southern

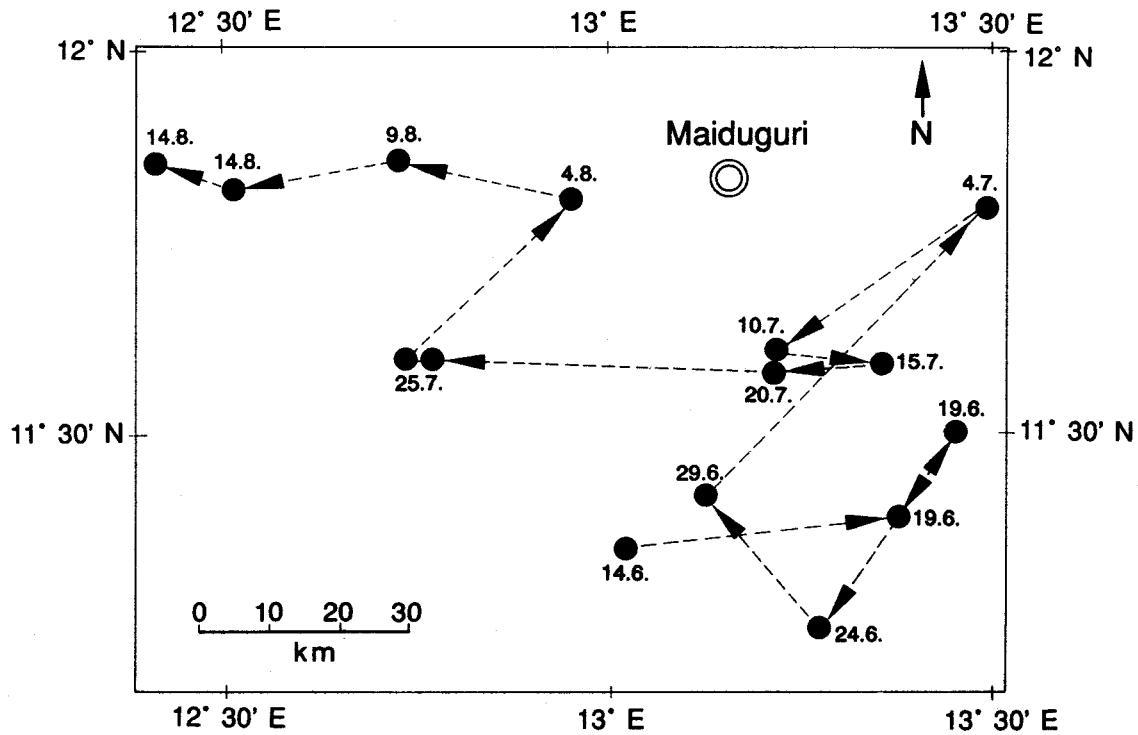


FIGURE 3

The movements of the Wahlberg's Eagle in its non-breeding quarters in north-eastern Nigeria tracked by satellite between 14 June and 14 August 1994.

Africa to spend the non-breeding season in West Africa (Thiollay 1976: 136 and pers. comm.).

In West Africa the Wahlberg's Eagle breeds between 12° and 14° N in the rainy season according to Thiollay (1977), who did not expect individuals from the southern hemisphere to spend the non-breeding period in this area because he did not become aware of any influx of birds. According to P. Souvairan in Thiollay (1976), Wahlberg's Eagles in Niger at 13° N arrive in late April/early May at the beginning of the rainy season and lay their eggs at the end of May. Hatching takes place around the 10th July and the young fledge by mid-September, when the grass has reached its greatest height.

The eagle from Namibia apparently arrived in its non-breeding range at the very beginning of the rainy season, at the same time as the local breeding population would be expected to arrive, and departed when the young of the local birds should be about half grown. The bird arrived about a month later than expected at its breeding place in Namibia but several species of migrants in eastern southern Africa (Wahlberg's Eagle, cuckoos, kingfishers) apparently returned from two weeks to a month later in 1994. Another nearby nest of Wahlberg's Eagles contained a chick in early January 1995, suggesting a laying date at about the

same time as the eagle with the PTT.

In view of the unlikelihood of collecting much coherent information on migration by means of ringing, wing marking, direct observation or any other methods (Anthony 1979; Auburn 1991; Brown 1970, 1978; Brown *et al.* 1982; Simmons 1990, 1991; Smeenk 1974; Steyn 1962, 1982; Thiollay 1975, 1976, 1977; Ulfstrand 1960; Van de Weghe 1979) it is suggested that more individuals be tracked by satellite in order to better understand the migration system of different populations of this species and its dependence on various environmental factors, as well as the conservation constraints and requirements in all parts of its range.

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Postscript

On 2 January 1995 another adult female Wahlberg's Eagle was caught close to its nest near Skukusa in the Kruger National Park and fitted with a transmitter (ID No. 23672). At that time it had a half-grown young. Up to the failure of the battery on 25 May 1995 we received 53 locations from this bird. On 13 April it was recorded for the last time in its nesting territory and on 17 April it was already 615 km NNW, about 70 km SW of Bulawayo in Zimbabwe (20.28S 28E). By 22 April it had travelled a further 1140 km almost due north to southern Zaire and was located 39 km NW of Kolwesi (10.35S 25.08E). A further 880 km were covered up to 27 April, when the eagle was fixed 93 km NW of Port Kindu in Zaire (02.41S 25.08E). The next location followed on 11 May, 1340 km further north in west Sudan at 09.18N 24.10E. The last location came on 25 May, 437 km further north-west in SE Chad at 11N 20.34E.

From its breeding ground to the place of its last location, some 800 km west of Maiduguri, where the first Wahlberg's Eagle tracked had stayed from 14 June to 14 August 1994, this bird had travelled 4412 km. During its passage through Zimbabwe and Zambia it covered a daily average of 253 km, and around 195 km per day crossing Zaire. Two locations received on 22 April showed that the bird covered 67 km in 97 minutes, giving an average speed of 41 km/h. If one takes this as the average speed on migration, then the bird must have spent 6 hours flying each day to cover its 253 km daily average.

The speed of travel calculated in this one case is higher than that of a Lesser Spotted Eagle *Aquila pomarina*, which in two instances was calculated by the same method, both giving about 30 km/h. (Meyburg *et al.* 1995b). With this Lesser Spotted Eagle, however, there was in each case a longer interval between locations, so that possibly it was occasionally inactive in between them. With a young Lesser Spotted Eagle, based on distance covered and estimated time spent daily during its migration, an average speed of 32-36 km/h was calculated. A speed of travel (43 km/h) similar to that of the Wahlberg's Eagle was, however, calculated for a Short-toed Eagle *Circaetus gallicus* which covered 157 km in three hours and 40 minutes (Meyburg in prep.).

The daily distances correspond with those of several Lesser Spotted Eagles and one Greater Spotted Eagle *A. clanga* investigated by the same method. The adult Greater Spotted Eagle flew up to 280 km each day, but a substantially shorter distance on many days however (Meyburg *et al.* 1995a). One adult Lesser Spotted Eagle, which was tracked throughout its whole migration from Germany to Zambia and back, varied considerably the length of its daily stages. Taking both outward and return journeys as a whole, it covered an average of 166 km per day (Meyburg *et al.* 1995b).