

The Black Eagle Radio Telemetry Project in the Matobo Hills, Zimbabwe

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ABSTRACT

In 1995 a radio telemetry project was started to establish movements of juvenile Black Eagles, once they leave their natal territories. Nine transmitters were fitted to the backs of nestlings aged between 59 and 85 days. Tracking from a motor vehicle and Cessna 150 Reims aircraft had limited success. Problems included radio failure, sourcing of a suitable aircraft, and limited range of transmitters (10km²) in the hilly terrain, notwithstanding some successes in 1997 and 1998 with juveniles being followed through 'empty' areas and along the river valleys. It is concluded that satellite telemetry would prove a much more efficient method to achieve the aims of this study.

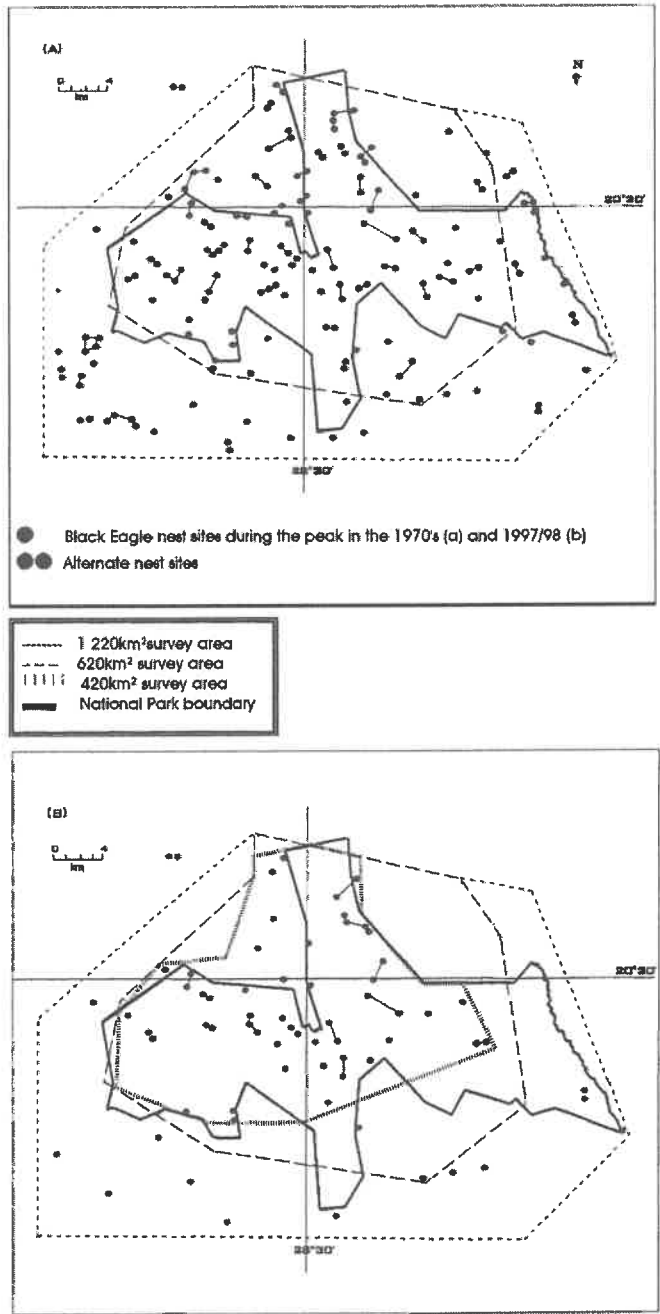
INTRODUCTION

Over the past 34 years Black Eagles of the Matobo Hills have been studied by members of the Black Eagle Survey team, made up mainly of amateur raptor enthusiasts. This is probably the longest ongoing study of any raptor species to date. Although much has been learned about this population, many questions remain unanswered. Over the past two decades dramatic declines in the number of breeding pairs of Black Eagle *Aquila verreauxii* (by 41%; (Gargett & Gargett 1993a; Goodwin 1997)) and the populations of hyrax (possibly 80%; Barry & Barry 1996) were noticed in the Matobo Hills. Between 1975 and 1977 there were 61 pairs of Black Eagles in the survey area which mainly includes protected areas and commercial farmland. There were only 35 occupied territories in 1997 (Banfield 1998) and 36 in 1998 (W. Goodwin unpubl.). In 1998 in the unprotected and increasingly depleted communal lands nearby only 12 of a total of 33 territories are still occupied (N. Chiweshe unpubl.). During the peak in the 1970's nowhere else were large eagles known to breed in such a density, with an average territory size of 10.3 km² (Gargett 1990).

An indication of a recruitment problem was highlighted in 1992 (Gargett & Gargett 1993b) when a single bird held a territory for almost nine months before attracting a replacement. In the 1970's this would have taken a few weeks or even days (Gargett & Gargett 1993). It seems therefore, that the recruitment problem is indicative of an apparent shortage of available unpaired adult birds (known as "floaters"). These birds are either moving further afield and not returning, or mortalities are occurring in excess of the normal mortality rate for immature birds produced per year, thereby leaving fewer birds for recruitment into the adult breeding population. This question, however, requires further investigation as almost nothing is known about mortality of Black Eagles and movements. (Gargett 1990).

As a result of the obvious decline in both Black Eagle and hyrax (dassie) populations, two new studies were initiated: 1) in 1992 a hyrax census in and around the study area (Barry & Barry 1996) and, 2) in 1995 the Black Eagle radio telemetry project which is described in this paper.

Figure 1. A comparison of Black Eagle nest sites in the survey area showing the decline in the number of occupied territories (Gargett 1990, Banfield 1997, W. Goodwin pers. obs.).



STUDY AREA

The Matobo hills are situated in Matabeleland in south- western Zimbabwe (Figure 1). The Hills are derived from an exposed granite batholith that covers 3 100 km². This study encompasses an area from Mangwe Pass in the west, to Umzingwane Dam in the east, an area approximately 100km long by 30km wide (Figure 2). It includes the Black Eagle Survey areas of Gargett and Banfield, 1965 - 1997 (see Gargett 1990). Three land-use categories influence the quantity of the habitat: National Park is protected area with intact habitats; Commercial Farmland is used mainly for cattle grazing and is sparsely populated with some intact habitats, while Communal Land is heavily populated by peasant farmers which has resulted in widespread habitat modification inducing degradation. The average annual rainfall is about 600mm, but it is unreliable (1963-1984 = 595mm and 1985- 1997 = 547mm; Department of Meteorological Services *in litt.*).

Figure 2. Position of study area and distribution of Black Eagles in Zimbabwe in relation to the granite shield.

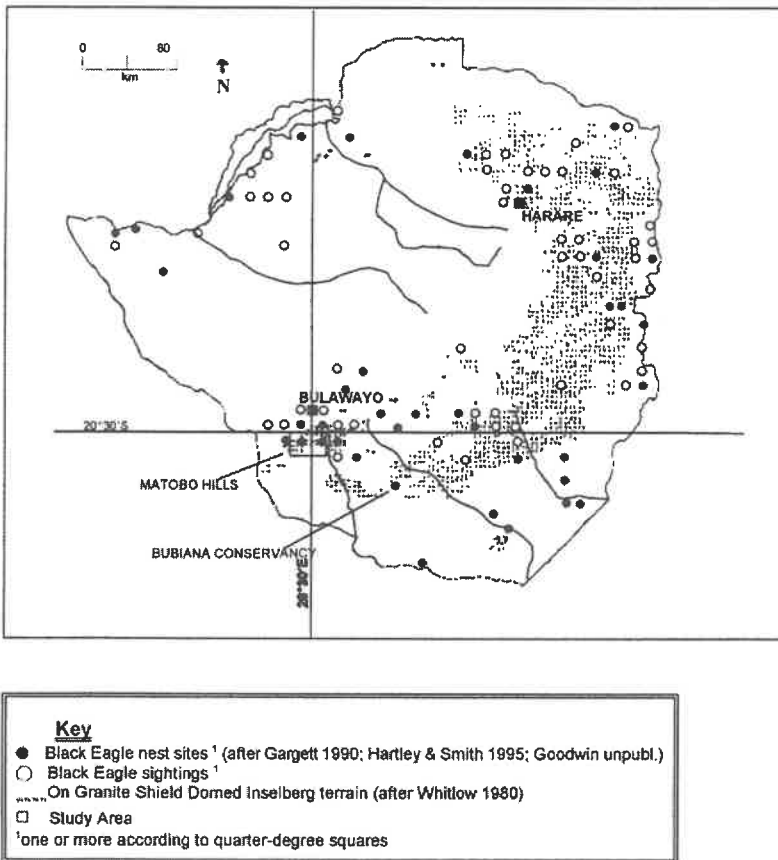
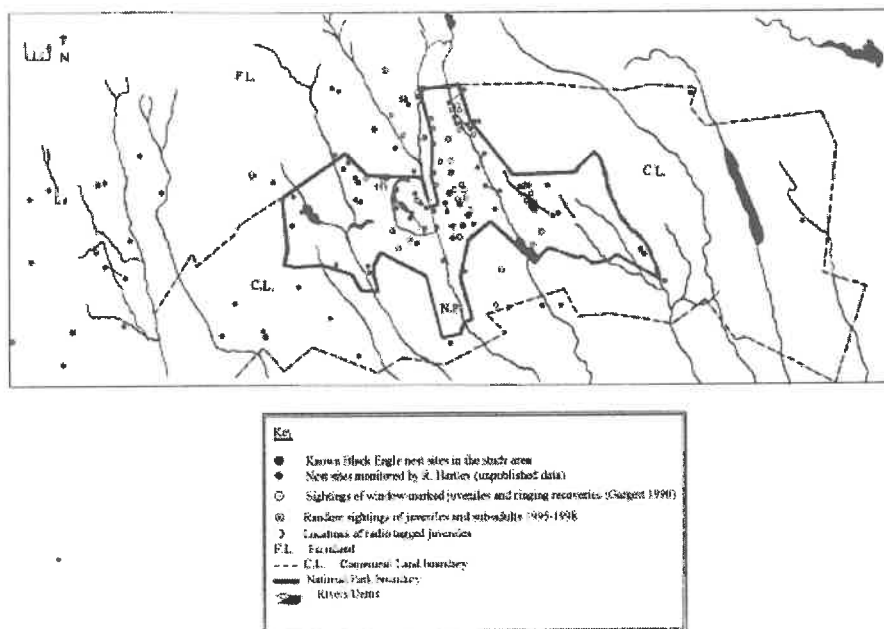


Figure 3. The Survey Area, indicating nest sites in 1995-1998, location of juvenile Black Eagles, rivers and land use categories.



METHODS

In September of the three years 1995 -1997 nine radio transmitters were attached by means of harnesses to the backs of Black Eagle nestlings between the ages of 59 and 85 days. Despite the risk of the eaglets leaving the nest prematurely, it was necessary to fit transmitters at this stage in order that the harnesses could be properly adjusted. Subject nests were selected from a cross-section of the area in order to obtain representative results. Nests also had to be easily accessible as they are on cliffs. In each instance ropes were used and eaglets were lowered to the ground in a bag.

During the second half of September 1995 radio transmitters were fitted to eaglets from four nests within the survey area. All four transmitters were fitted using a harness design adapted from that used on Cape Griffons *Gyps coprotheres* in the Cape Province (Boshoff *et al.* 1983). This harness design was first tested on a captive adult (female) Black Eagle at Larvon Bird Gardens (T. Couto pers. comm.) and adjusted accordingly. A weak link of cotton tape was used. Transmitters were AVM (California) module P2 type with a lithium battery having a current drain of 0.220 - 0.230 MA. The weight of the transmitter was 30g and had a theoretical life of around 15 months, with a range of ± 50 km (line of sight). Transmitters operated between 148 and 150 MHz. All transmitters were checked for operation a week before fitting and the magnets replaced. Each transmitter was again checked when fitted and all appeared to be working normally. In addition, all eaglets were ringed, weighed and examined.

Transmitters were also sourced from Merlin (Idaho). These were of a more robust design and operated between 146.47 and 146.800 MHz, having a mass of 40g, and an aerial length of 252mm. They measured 27mm x 67mm and were supplied with a teflon harness. These harnesses were fitted and then sewn with a light crochet cotton in order to facilitate a weak link as required. As these transmitters were received late in the 1996 season, only two were fitted, the remainder being fitted in 1997. Again, all transmitters were checked before fitting. However, the three that were stored for

a year were periodically run for a few hours in order to allow current to flow between the battery and the transmitter, which inhibits the build-up of battery corrosion. These eaglets were checked once weekly whilst still in the nest area, and a visual record, as well as the signal, was obtained where possible.

Tracking was effected by the use of a Yagi FT-290 RII All Mode Transceiver. The various frequencies were selected manually but changed every few minutes which proved difficult. Initial tracking was done using a bulky hand-held Yagi-type antenna making use of high vantage points. A suitable aircraft was not available during 1995 and 1996. A hoop aerial was devised (Kiel Electronics, Bulawayo) for use from within the cockpit of a light aircraft, as well as from a motor vehicle. This aerial was used mainly from a motor vehicle. Towards the end of 1997, three flights were made over the Matobo Hills in a Cessna 150 Reims (130 hp) aircraft and the hoop aerial was used inside the cockpit and held out of the window. On testing over a control transmitter it was effective only when directly above the signal. Consequently "bunny ear" type aerials (Kiel Electronics, Bulawayo) were mounted over each wing strut, and were connected to the transceiver (in the cockpit) through a directional switch, to alternate receiving and give some degree of direction-finding capability. Two test flights (1997) over a fitted nestling yielded a receiving capacity of approximately 10km² at a height of 630m above ground. Furthermore a fairly accurate position could be obtained by monitoring signal strength whilst circling the area. All flights made in 1997 lasted about 2_ hours (1_ hours over the Matobo Hills), covering a separate section on each occasion. It was also decided to evaluate all data provided by Gargett (1990), concentrating initially on "empty areas" (where no resident pairs of Black Eagles occur) and areas to the south and west of the source of two out of five ringing recoveries.

RESULTS

Due to the early failure of the AVM transmitters, no tracking took place in 1995. One eaglet was subsequently found dead below its nest in 1996. However, this bird had a strong odour and appeared to be suffering from diarrhoea when radio-tagged in 1995. It was of interest to note that the cotton tape "weak link" had degraded and broken, possibly accelerated by the decomposition of the bird.

Merlin transmitters fitted in 1996 and 1997 operated well and the harnesses did not appear to inhibit flight or movement in any way. Both tagged juveniles in 1996 were radio-fixed only once (from a motor vehicle) after leaving their respective natal areas. The juvenile from nest 111 was flying 2km south-west of its nest on 23 February 1997, having last been located in the vicinity of the nest 35 days previously, when it was mobbed by the parent birds. The other juvenile from nest 53 was located (the same day) flying in an empty area 8.5km south-south-east of its nest. It was previously located 2km south-east of the nest 73 days earlier. It had started to move away from the nest a week or so earlier.

Table 1. Successful field trips undertaken in order to track juvenile Black Eagles after leaving the nest area.

<i>Date Fixed</i>	<i>Mode Of Transport</i>	<i>Nest No. Of Juvenile</i>	<i>Distance And Direction From Nest</i>	<i>Time Lapsed Between Locations</i>
23.02.1997	Motor Vehicle	111	±2km south-west	35 days
23.02.1997	Motor Vehicle	53	±8.5km south-south-east	73 days
31.03.1998	Aircraft	111	±5km north-east	87 days
03.01.1998	Motor Vehicle	29	±1.5km south-east	10 days
17.01.1998	Aircraft	29	±2km south-east	14 days
21.02.1998	Aircraft	29	±2km south-east	35 days
17.01.1998	Aircraft	86	±2.5km north-west	14 days
20.06.1998	Aircraft	86	±17km south-east	154 days

All three birds monitored during 1998 were located on a number of occasions. The juvenile from nest 29 was located from the air 2km south-east on 17 January 1998 after being last monitored 1.5km to the south-east on 3 January 1998, 14 days earlier. It appeared to be following the river valley between the hills using it as a "corridor". The juvenile from nest 86 was located in the nest area and in an "empty" area at the head of the Mtshелеle valley ± 2.5 km north-west of its nest on 17 January, 89 days after its estimated first flight. It was located again 154 days later (20 June 1998) in the Khumalo Communal Land 17.5km south-south-east of the nest at the end of an open grassy corridor. The juvenile from nest 111 moved away from the nest area suddenly by 3 January 1998, it was seen in the nest area the previous week also ± 80 days after first flight. It did not linger in the natal territory as the other two. It was found from the air in an empty area 5km north-east of its nest and north-east of the same grassy corridor as the juvenile from nest 86 on 31 March/1998, 87 days later ± 130 days after first flight.

DISCUSSION

Radio telemetry, although more advanced than the previous methods (ringing, window marking, colour marking, colour flagging and patagial tagging (Gargett 1990) used in the Matobo hills, proved to be more difficult than expected and achieved little more than these earlier methods apart from more accurately ascertaining the dispersal dates. As this is the first time that this method has been attempted on wild birds in Zimbabwe, some useful lessons were learned. Transmitters that were received in 1995 all failed, due to having been stored for too long a period without being run (transmitters must be run periodically for a number of hours in order that corrosion does not build up between the battery and transmitter). This failure has occurred with AVM transmitters supplied to other users (G. Rasmussen pers. comm.). The limited range of transmitters in hilly terrain proved a major handicap for ground tracking. Availability and sourcing of a suitable aircraft, development of a suitable antenna, and a pilot willing to carry out regular flights also proved problematic. Together with the huge area to be covered, 2_ hours flying time over the Matobo hills achieved only 30% coverage. As this project was carried out by amateurs, tracking was confined to weekends only. Consequently the area was neither adequately nor systematically covered, so that results were random. In addition after 1996, extra funds had to be sourced in order to cover entrance fees to the National Park when tracking from a vehicle. Previously fees were waived for survey members.

The "corridor" theory was explored by Ferrer and Harte (1997) whilst tracking the movements of juvenile Spanish Imperial Eagles *Aquila adalberti*. In the Matobo hills immature Black Eagles were channelled via empty areas and river valleys mainly to the south, west, south-west and south-east (Figure 2) as there is little suitable habitat to the north of the area.

It also appears that, for the most part, juvenile Black Eagles do not initially wander far (Figure 2), but move in and out of the area for some time (and are harried by resident pairs) before moving further afield. The decline in resident pairs may have benefited juveniles as there is more space within the protected area, increasing their chances of survival. Recent re-occupancy (pers. obs.) of two territories within the Black Eagle breeding survey may be as a result of this.

The subject of juvenile Black Eagle mortality and movements requires further investigation in order to adequately track these birds. Satellite telemetry, although expensive, should prove to be the most successful method, as it can provide a continuous record of the movements of juvenile Black Eagles for a longer period, with much less time and manpower required than the methods used in this study. The Matobo hills cannot be viewed as an "island" but as part of a "network" of the population of this species, which occurs throughout Zimbabwe. The state of the Black Eagle is an important barometer of the well-being of the area in which it lives, and there is need to understand the movements of immature birds and possible hazards that they are subject to before they reach adulthood.

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