Searching for European Swallows *Hirundo rustica* in Zambia

The Zambia Barn Swallow Project 2007 - 2008

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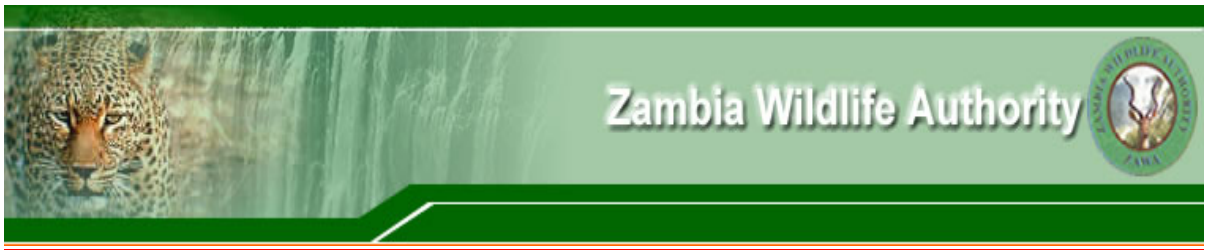

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1. Introduction

The Zambia Barn Swallow project is a collaboration between Stichting Hirundo and the BirdLife Partners in Zambia and the Netherlands (respectively Zambian Ornithological Society (ZOS) and Vogelbescherming Nederland).
The barn swallow lives on two continents and is well-known to people. It breeds in Europe during May till September (often two broods in a season) and spends the northern winter in Africa. Barn swallows feed exclusively on insects. When insect numbers start diminishing in late summer and autumn, the swallows depart for Africa where a full moult takes place. In Europe this is called 'wintering', but in Zambia the rainy season is about to begin, which heralds the start of the southern summer. In The Netherlands the barn swallow is a harbinger of spring, in Zambia of the start of the rainy season.

In The Netherlands the Barn Swallow has recently been added to the Dutch Red List (Vogelbescherming en SOVON 2005). It is classified as 'sensitive', which means that this once common species has declined by at least 50% in the past decades. This trend is not unlike the ones in other parts of – especially western - Europe. The main reason for this decline is generally considered to be changes in farmland and farming practices in the past century. In Western Europe the countryside is rapidly changing. Small farms have been replaced by industrial farms and massive use of chemicals (pesticides, herbicides) has drastically changed insect and plant life on farmland (Møller 1989, 2001). These developments have a direct bearing on the availability of nest sites and food for barn swallows.
Fledged juveniles and adults finished breeding barn swallows roost communally in reedbeds along lakes, rivers and in marshes. These roosts can contain hundreds of thousands of birds, in Africa sometimes more than one million birds.

Given the poor prospects of barn swallows in The Netherlands (read: Europe), the decline of the past decades, and the fact that it spends more than half of its life away from the breeding quarters, research on the ecology of swallows in their 'wintering' haunts seemed more than

opportune. Earlier research had shown that local conditions, more specifically rainfall, had a large impact on survival and speed of moult (Møller 1989, van den Brink *et al.* 1998). Maybe even more importantly, survivors of adverse conditions in the 'wintering' grounds and *en route* carry the side-effects thereof back to the breeding quarters, where they affect arrival date, reproduction and survival. These so-called carry-over effects can have far-reaching consequences on the population level (Pérez-Tris *et al*. 2001, Møller & Hobson 2004, Saino *et al.* 2004, Szép *et al.* 2006). However, studies of barn swallows in their wintering quarters are rather sparse compared to those in the breeding areas, and longer time series of research, both across years and across a single season, are sorely needed.

Since the early 1990s, a number of trips have been made by Dutch teams to various African countries in order to study barn swallows in their wintering grounds (van den Brink *et al*. 1997, 1998, 2000, 2003, Bijlsma *et al*. 1994, Bijlsma & van den Brink 2005). These studies focused on ringing, condition, moult and predation risks usually lasted one month. The present study in Zambia covers the entire wintering period.

The Zambian Ornithological Society is an educational, conservational and research organisation in environmental issues in Zambia. Projects include the Important Bird Areas (IBA) Conservation, the African Wildfowl Census, the Zambian Ringing Scheme and the Bird Atlas Project (Mwizabi 2006). As part of its educational programme in schools in or close to Important Bird Areas, ZOS uses barn swallows to raise awareness for nature and bird conservation. The present project – with a main focus on research – has close linkages with the IBA schools programme. During the period of fieldwork (October 2007 – March 2008) presentations were given at schools and some schools participated in twinning with Dutch schools through an internet weblog.
Besides education through the IBA schools, scientific research is an important tool which will contribute to the protection of the barn swallow and their habitat in Zambia. The results of this research project will contribute to the identification of an effective (science-based) conservation program in Zambia. Barn swallows, like many other migratory birds rely for their survival on differents countries. As a result conservation of such species relies on international collaboration. The Zambia Barn Swallow Project brought together organisations and individuals from Zambia and the Netherlands to improve the understanding and conservation of wintering barn swallows.

1.1 Project organisation

The Zambian Barn Swallow Project is a joint initiative of Stichting Hirundo, Zambian Ornithological Society / BirdLife Zambia (ZOS) and Vogelbescherming Nederland / BirdLife Netherlands (VBN). The project was funded by VBN after a succesfull appeal to its members in 2006.

Bennie van den Brink (Stichting Hirundo) was responsible for overall project management. He was also responsible for field training, communication with schools and the general public in the Netherlands.

Jacintha van Dijk en Sjoerd Duijns (students Wageningen University) coordinated all research activities, including research design, supervision of field activities and data analyses. Jacintha and Sjoerd were supervised by Dr. Frank van Langeveld (Wageningen University) and Dr Lizanne Roxburgh (ZOS / Percy FitzPatrick Institute of African Ornithology). Jacintha and Sjoerd's participation in the project was part of their M.Sc. study Forest and Nature

Conservation, spec. Ecology. The results of their research on body condition in relation to different roost sizes will be submitted to a peer-reviewed scientific journal.

Next to providing supervision for the students, ZOS was responsible for the linkage between the project and the ZOS program for IBA schools. Pius Lilanda coordinated the interaction between selected schools and the research team. Lizanne Roxburgh was responsible for the participation of Zambian University students in the bird ringing workshop. ZOS also provided all kinds of logistical support.

The Zambian Wildlife Authority (ZAWA) cooperated by seconding research officer Daniel Mwizabi to assist in starting up the project. During three weeks he accompanied us in the quest for swallow roosts and was our guide and interpreter. He was also trained as a bird ringer in this period. Daniel was of great help in getting an application letter from his superiors of ZAWA for the Immigration Office to provide research permits for the project.

Between January and the end of the project a number of Dutch licensed bird ringers assisted in trapping, ringing and measuring the birds, namely Symen Deuzeman, Andrea van den Berg, Joop van Ardenne, Marijke Vaneker, Gerrit Speek, Tineke Derksen, Rob Bijlsma and Frank de Roder. The Dutch participating ringers invested in the project by paying their own tickets.

This report was written by Bennie van den Brink (Stichting Hirundo). Rob Bijlsma, Barend van Gemerden, Sjoerd Duijns and Jacintha van Dijk commented the concept and improved the English text.

1.2 Acknowledgements

Many people contributed to the success of the Zambian Barn Swallow Project. All must be thanked for their support and commitment. A special note of thanks for those who went beyond the “call of duty”, namely Jacintha van Dijk, Sjoerd Duijns, Lizanne Roxburgh, Pius Lilanda and Daniel Mwizabi. At VBN Bernd de Bruijn and Barend van Gemerden were instrumental in getting the project going.

Mr. A. van der Heyden, Noordeinde contributed spontaneously to the project.
Mr. Hans Sportel of Limohire ‘kept us rolling’ and supplied useful contacts.
Several farm owners provided information and advice about roost sites: Tom Savory (†), Tim Robinson, Mr. and Mrs. Flynn (Lechwe Lodge), Dave and Marie Gordon (Sable Ranch), Mr. and Mrs Tim Ashworth. Their hospitality is greatly appreciated.
Accommodation and permission to work on their properties was given by: Ian and Emma Bruce-Miller of Nkanga Conservation Area, Francis Grogan of Huntley’s Farm, Chisamba, Theo de Lange (Zambeef), George Woodley (Fringilla Lodge), Donald and Debbie Burton of Mafundzalo Ranch, Kabwe, Kim Farmer of Kasanka National Park. Lesley Reynolds and Frank Willems assisted, and sometimes guarded, us during our stays in Kasanka National Park. Their help, hospitality and interest in our strange doings are beyond words. The Dutch Embassy in Lusaka provided new passports after Jacintha and Sjoerd were robbed, and the family Disbeschl accommodated us hospitably during the week after this event. Thanks all!

1.3 Objectives.

The Zambia Barn Swallow Project consists of three main components:

1. Research.
2. Increasing conservation capacity.
3. Communication.

2. Research.

Our main goal was to investigate fitness differences between swallows using roosts of various sizes and locations (Duijns *et al.* 2007, project proposal). Local weather conditions in the wintering quarters show huge variations between and within years, and in order to survive swallows need to show high versatility to successfully adapt to adverse conditions (droughts, heavy rainfall, variations in insect abundance, predators). Any protection measure in the wintering areas should take such information into account, especially noting the fact that swallows use communal roosts varying in size between several hundreds up to more than a million birds (e.g. van den Brink *et al.* 1997, van den Brink *et al.* 1998, Bijlsma *et al.* 1994, Szép & Møller 2005, Bijlsma & van den Brink 2005). Adverse conditions are likely to affect a great number of birds simultaneously.

The main research questions were focused on:

1. the condition of the swallows roosting in Zambia throughout the austral summer;
2. condition of barn swallows in relation to roosts size;
3. speed of moult in relation to roost size;
4. extent of exchange of swallows between roosts;
5. impact of local weather on condition;
6. importance of Zambia as a wintering quarter for barn swallows;
7. origin of barn swallows 'wintering' in Zambia.

2.1 Methods and study period.

Each evening, one hour before sunset, we erected mistnets with a total length of 36 metres (4 x 9 m or 3 x 12 m) in reedbeds. They were placed in one or two lanes square to the edges of the reedbed and swallows were attracted by broadcasting their song. All trapped swallows were ringed and, if possible, a random sample of 15 adult and 15 juvenile swallows were collected to investigate biometrics, moult and ectoparasites. The sampled birds were released the next morning. All other captures were ringed, sexed and aged if possible, and released at the site within minutes of capture.

Feather lice (Hirundoceus malleus) in tail feather of barn swallow. Chisamba, February 2008.

Roost size was estimated during the period that the swallows started gathering above the site; normally swallows descend simultaneously just before complete darkness, enabling a quick count of numbers. On every roost we trapped a minimum of three successive evenings, before setting off to the next roost.
Between 16 November 2007 and 20 march 2008 we made 6 trapping rounds along the research sites. The total of 102 trapping sessions resulted in the capture of 6358 barn swallows. 1734 birds were studied more closely for biometrics. A more in-depth analyses of the data will be presented in a separate publication by Jacintha van Dijk and Sjoerd Duijns. (i.e., van Dijk *et al*.: The body condition of Barn Swallows *Hirundo rustica* in relation to different roost sizes in one of their winter quarters, Zambia. (in prep).

The following is the preliminary abstract of the scientific publication, which is in preparation, based on the Zambia Barn Swallow Project.

Title: The body condition of Barn Swallows *Hirundo rustica* in relation to different roost sizes in one of their winter quarters, Zambia

ABSTRACT

Barn Swallows *Hirundo rustica* are declining throughout Europe due to agricultural practices in the breeding areas, however, the quality of their winter quarters in Africa are also suggested to contribute to this decline. Habitat destruction due to farming practices threaten large Barn Swallow roosts throughout Africa, which might have implications for the birds long term survival. We studied three Barn Swallows roosts of different size (i.e., small, intermediate, large) in Zambia to assess differences in roost variables and body condition of individual birds. A lower predator density was found at the largest roost, compared to the smallest roost, but food availability was similar among the roosts. Individuals of the largest roost were in a better body condition in terms of speed of primary moult, muscle score and body mass. The speed of tail moult and feather lice score did not differ between the three roosts. Our results show that large Barn Swallow roosts are more beneficial than smaller roosts in terms of body condition of individual birds and predator density, which implies the benefits for communal roosting to increase with increasing roost size. This study emphasises the importance of large Barn Swallows roosts for the survival of this species. If habitat destruction in Africa continues at the current rate, suitable roosting habitat for Barn Swallows will decline, negatively affecting the long term survival of this migratory passerine.

Key words: Africa, communal roosting, moult, fat, muscle, body mass

Apart from barn swallows, many other Palearctic and African birds were trapped and ringed (Appendix III).

Primary moult in barn swallow wing.
The brown feathers are old; the blue ones are freshly new. Chisamba Jan. 2008.

2.2 Search for study sites.

The first three weeks after our arrival in Zambia we searched the country for suitable locations with swallow roosts. Mr. Daniel Mwizabi (ZAWA) was our guide and interpreter.
The study sites had to meet the following conditions:

1. presence of reedbeds, preferably of *Phragmites communis*, along rivers, streams, dams or in marshes;
2. presence of a sufficient number of roosting barn swallows;
3. guaranteed access to reedbeds throughout the whole research period, also during the rainy season;
4. suitable accommodation in the vicinity of the roost.

Our search for possible roosts included the following sites:

- Bilili Hotsprings
- Nkanga River Conservation Area, Choma
- Lochinvar National Park, floodplain and Gwanda Springs.
- The Moorings Farm and Monze Dam, Monze
- several farms near Mazabuka, Robinsons Farm, Munali Coffee Plantation
- Kafue Fisheries, Kafue.
- several sites near Chisamba, among others Protea Hotel en Sable Farm
- Huntley's Farm (Zambeef), Chisamba
- Ashworth's Farm and Mafundzalo Ranch, Kabwe.
- Nsobe Game Park en Itawa dam, Ndola
- Kasanka National Park.

Daniel and Sjoerd bird ringing at Bilili.
Oct. 2007

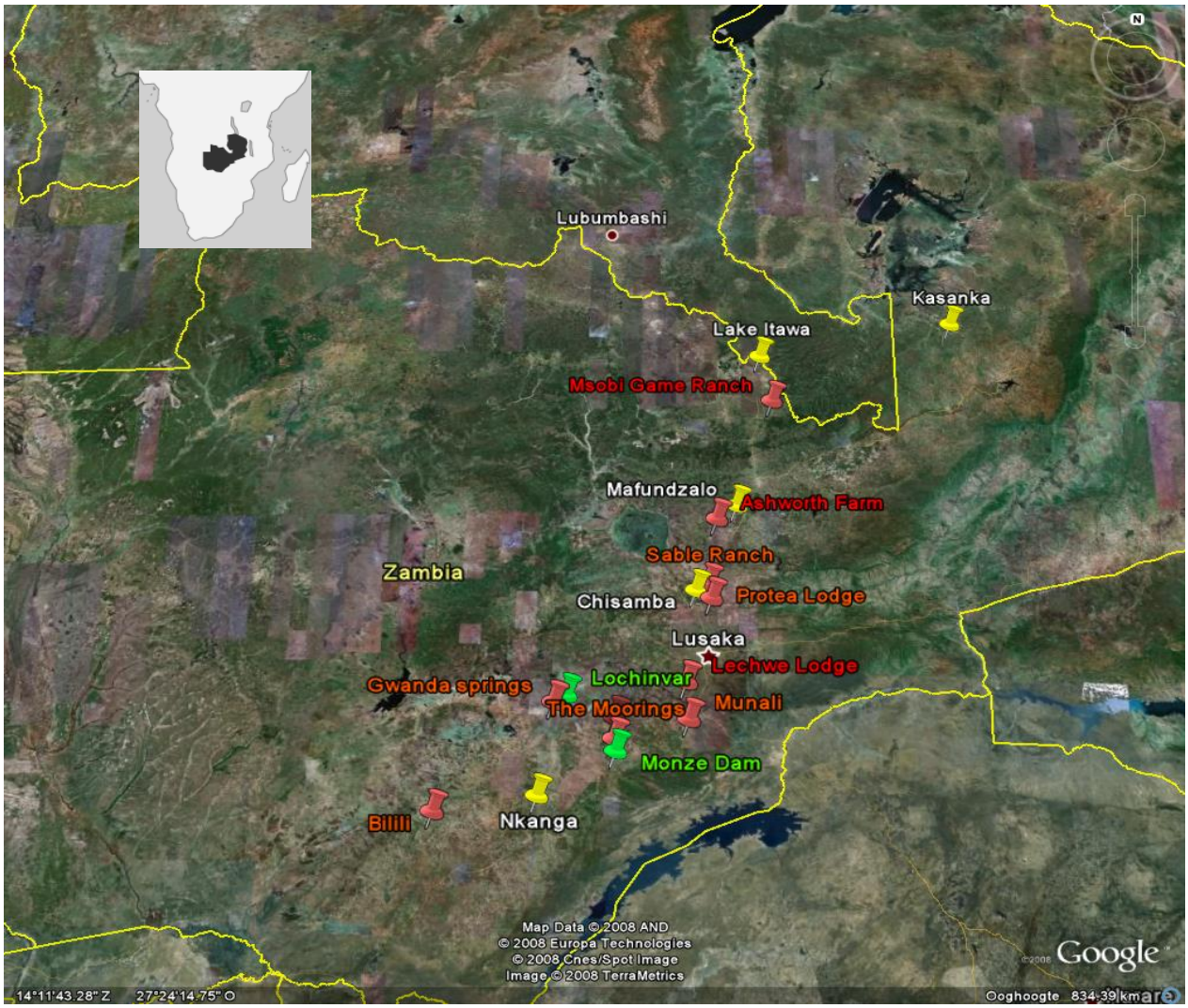


Fig. 1. Visited sites searching roosts.
Red = no swallows; green = swallows present; yellow = chosen locations

The selected locations fulfilling the right conditions were:

- Nkanga River Conservation Area, Choma 16° 37.193 S. 26° 59.530 E.
- Huntley's Farm (Zambeef), Chisamba 15° 01.275 S. 28°.08.892 E.
- Mafundzalo Ranch, Kabwe 14° 18.425 S. 28° 27.700 E.
- Itawa dam, Ndola 12° 58.189 S. 28° 39.596 E.
- Kasanka National Park 12° 35.197 S. 30° 14.372 E.

After having chosen the locations for research, we made a planning to visit every site in a fixed cycle of five days. After the first round we reduced our stay at roosts from five to four days, necessitated by the declining swallow numbers. This reduction allowed us to visit sites more frequently.

2.3 Roost sites.

Roost Nkanga Conservation Area, Choma. 16° 37.193 S, 26° 59.530 E.

Trapping site Nkanga. Dec 2007.

This roost site is situated at a dam with a patch of reed near a farm in an area designated as Conservation Area. The vegetation consisted mainly of Cattail *Thypha latifolia* with only a little African Reed *Phragmites communis;* the latter was the preferred roost of barn swallows. This site was known to have held a few hundreds of thousands swallows roosting in the past (Dowsett & Leonard 1999). During the last few years, however, the numbers of roosting birds have decreased (Ian Bruce Miller, pers. com.). We expected the number of roosting swallows to increase after our first visit, but unfortunately this did not happen. The numbers present varied between some hundreds to a few thousand birds. We trapped and ringed 891 swallows. Body mass was rather low, an indication of a poor food supply (insects) locally, most likely due to bad weather. During our visits in January and February, the roost was found deserted and we decided to skip the last round. We trapped a swallow with Polish ring at Nkanga.

Roost Huntley's Farm, Chisamba. 15° 01.275 S, 28°.08.892 E.

Photo 1: Trapping site Chisamba, lake and dam at Huntley's farm.
Photo 2: Jacintha at work. Dec. 2007

Behind the abattoir of Zambeef and the smelly dumpsite next to it, lies a beautiful lake which is very rich in birds. The reedbeds which fringe a great part of the shoreline consist of a mixture of Cattail and common reed, used by a large number of bird species for roosting, such as weavers, ducks, egrets and herons. During our first visit a small flock of swallows was found to roost here spontaneously, and we considered this an area with potention. During the rainy season, the water level of the lake rose considerably, making it impossible to use the initial trapping site. Therefore we had to move the nets to higher grounds, enlarging the distance between nets and roosting site which adversely influenced the trapping. We ringed a total of 1013 barn swallows, including a swallow we had trapped in Ndola on 10 November, 250 km north of Chisamba. This bird indicated that swallows at Ndola were still migrating southwards. We also caught a swallow with Budapest ring (Hungary).

Lizanne trapping passerine birds at the dyke at Chisamba. March 2008.

The vegetation fringing the dike near the pumping station was a favourable spot to trap reed birds in early morning. It also was a good place to show students and pupils of IBA-schools how and why bird research is carried out. We camped at Fringilla Campsite, situated opposite the trapping location.

Roost Mafundzalo Ranch, Kabwe. 14° 18.425 S 28° 27.700 E.

Photo 1: Dry Mafundzalo roost in nov. 2008.
Photo 2: Joop and Marijke ringing swallows in deep water. Mafundzalo Ranch, febr. 2008.

This roost was situated in a patch of Reed near a dam close to the farm, originally included as a small roost to cover the entire range of small, medium-szied and large roosts. Great was our surprise when we found 50.000 swallows sitting on electric wires in November, apparently waiting for us to be captured. We trapped and ringed 2487 swallows, including birds with a ring from Estonia and Turkey. Large numbers of weavers, notably Redbilled Queleas *Quelea quelea* and Village Weavers *Ploceus cuculatus*, used the reedbeds as a roost. Also at this site, the rising water level forced us to shift the trapping site to higher ground closer to the trees surrounding the dam which negatively affected the trapping.
The vicinity of the dam was covered with bushy vegetation and appeared to be a good place for trapping (Palearctic) birds in the morning.
The Burton family hospitably provided nice company and lots of food and kindly made their guestrooms available.

Roost Kasanka National Park. 12° 35.197 S, 30° 14.372 E.
The swallow roost in this national park is situated in the extended reedbeds along the Kasanka River. Between October and January several millions of straw-coloured fruit bats were roosting in daytime less than 1 km distant in bushes and trees. About the time that the bats departed their daytime roost, at about 18.00 h. local time, barn swallows started to arrive to settle in the reeds for the night. Our first trip revealed several hundreds of thousands of roosting swallows. Our expectations were high when we trapped over 400 birds. However, the swallows had almost disappeared when we arrived for the next trapping session on 4 December, and we only trapped 28 and 2 birds in two consecutive evenings. Park rangers told us, and we were able to confirm this by own observation, that the swallows regarded the bats as a threat. Departing bats were attacked by the arriving swallows. The swallows also went up to fly above the bats as if it concerned raptors. We trapped a total of 1703 barn swallows on this location, including a swallow with a Turkish ring.

Photo 1: Dry Kasanka trapping site in Nov. 2007.
Photo 2: Andrea and Symen wading to the trapping site. Jan. 2008.

Because of high rainfall the borders of the Kasanka Rivers overflowed from January onwards, and we had to wade through belly-deep water to reach the trapping site.

Roost Lake Itawa, Ndola. 12° 58.189 S, 28° 39.596 E.
Ndola is an industrial area situated in the Copperbelt Province and the second largest city of Zambia, lying close to the border with the Democratic Republic of Congo. Lake Itawa lies on the edge of the city, and is fringed with extensive marshes and mostly inaccessable reedbeds. When we had a try-out at this site on 10 November, we sighted more than half a million barn swallows. However during three successive trapping attempts in the next visit, only a few barn

swallows seemed to be present anymore and we only captured 8, 0 and 1 birds respectively. Apparently, this site is only used by swallows as a stop-over during their migration to more southerly regions. The recapture of a swallow ringed here and controlled at Chisamba corroborates this view.

The trapping site at Lake Itawa. Dec. 2007.

Our stay came to an abrupt end when the lodge we stayed was robbed by five armed men. A great part of the properties (money, clothes, passports, mobile phones) of Sjoerd and Jacintha was stolen. Nobody was wounded, fortunately, but the threat and danger was great. Because of this traumatic event, Sjoerd and Jacintha decided to return to The Netherlands on the first of January. We decided to skip Ndola from the list of trapping sites, also because no roost was established. In February we visited this location once for monitoring barn swallows, but no roosting birds were present.

2.4 Working scheme.

Our 'working day' was mostly as follows. We rose at 06.00 h, made coffee and started processing the 30 birds of the previous evening's capture. We finished this between 08.00 h. and 09.00 h. The birds were released immediately after processing. After breakfast we used the morning hours to input the data and for administration. In the afternoon we started cooking at about 16.00 h. and at 17.00 h. When driving to the trapping site we did the insect surveys. Arrived at the roost site we erected the nets. We were back at the camp about between 19.30 and 20.00 h. After that we weighed and ringed the 30 research birds (15 adults and 15 juveniles) to establish their evening weights. Then our work was done and we relaxed with a drink.

2.5 Results.

During the 102 trapping sessions a total of 6307 barn swallows were ringed, of which 1734 were fully processed and examined for biometrics and condition. Other Palearctic birds and African species were ringed and processed when captured. Large groups of weavers flying into the nets were immediately released to keep the nets available for swallows. On one occasion we largely missed the swallows when 249 weavers flew into the nets just before the swallows were to descend. Several species could not be ringed because we did not have the right ring sizes, such as Malachite Kingfishers and Little Bitterns, which were repeatedly caught during

swallow trapping. For more details see under miscellenious bird ringing, for numbers see Appendix 3.

2.6 Climate and weather and their impact on roosts.

Zambia has a moderate savannah climate with a dry and a wet season. There is little or no rainfall during austral winter (April through October). During austral summer (November through April) rainfall is 1000 – 1500 mm in the north, 600 - 1000 mm in the south. During the rainy season wet and dry days alternate frequently. Daily temperatures during the dry season vary from 26 to 42 °C during the warmest months (August-November), and between 24 and 32 °C in the rainy season (source: website Out to Africa, country information, Zambia).
During our period of research from late October till the end of March rainfall started in November. The amount of rainfall in November and December was extremely high in 2007, with totals by late December of 863 mm in Kasanka, 408 mm in Kabwe, 468 mm in Chisamba and 410 mm in Nkanga (Table 1). January counted few days without rainfall. The precipitation sum for the whole rainy season was in many areas already attained in January. The steady rainfall negatively affected foraging in barn swallows. Bedraggled swallows were seen sitting on low perches, waiting for the rain to stop. During this period, the condition of swallows was poor as shown by their low weights.

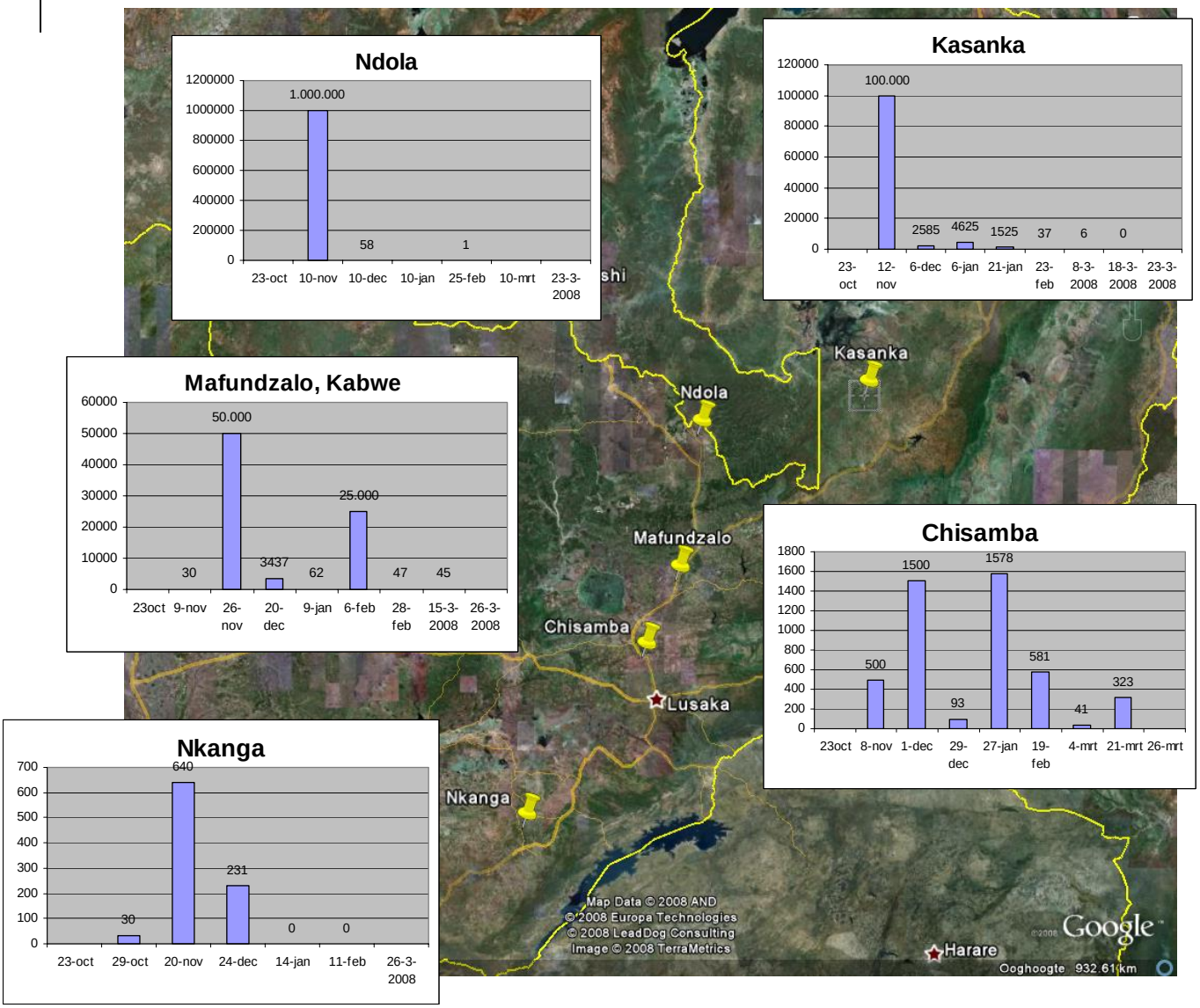
Adult barn swallow waiting in the rain for the weather to improve. Nkanga dec. 2008.

Table 1				
Rainfall in mm in 2007/08				
Research locations	Nkanga	Chisamba	Kabwe	Kasanka
October	10,8	0,0	0,0	0,0
November	139,3	76,5	102,0	124,0
December	255,9	414,0	306,0	739,0
January	372,7	382,0	314,8	462,0
February	97,3	72,0	77,4	179,0
March	141,0	58,0	184,0	114,0
total	1016,9	1002,5	984,2	1618,0

Regarding the decreasing numbers of roosting barn swallows (Figure 2), we got the impression that birds moved to more southern and drier regions where foraging would be less hampered

by adverse weather. Normally, once established, roosts remain occupied during the whole season until moult is almost completed, as found in Botswana (Boteti roost, Ngotwane-Dam roost, pers. inf.), Nigeria (Ebakken roost, Micheloni pers. inf.) and South Africa (Bloemfontein roost, Nuttall 2003), Middelburg roost, (H&Z Bernitz, pers. Inf.), Durban roost (Piper 2007). The Zambian roosts showed a different pattern. Swallows arriving in November used the roosts for some time, but in time numbers started to decline. This outcome suggests that roosts in Zambia were mainly used as stopovers by swallows on their way to more southerly wintering sites. A clear example is the roost at Ndola. On 10 November 2007, we estimated more than half a million barn swallows to use the reedbeds along Lake Itawa. Trapping was very successful resulting in 226 ringed swallows with 21 m. net within one hour. However, during our visit from 9-12 December no swallows were present anymore. We found a clear indication of movements southwards when we retrapped a Ndola-bird in Chisamba on 29 November, 250 km to the south. This strategy, of roosts only temporarily used during migration (especialy during southward passage), and of departure during the rains, is also suggested by Dowsett *et al*. (2008). The swallows wintering in Zambia are relatively small in numbers and widely scattered across roosts which are only used when local conditions are favourable.

Figure 2. Mean roost size per round during the research period at all trapping locations. The mean roost size is the estimated roost size on every trapping evening, divided by the number of trapping sessions (see appendix II).



3. Roosts and threats.

3.1 Quality of roosts.

Barn swallows favour roosts that are situated in reed beds along streams, lakes, dams and marshes. They prefer to roost in reedbeds with African Reed *Phragmites communis*, but other tall vegetation may also be used, such as sugar cane and elephant grass, and rarely, even trees (van den Brink et al. 2003).
Roosting in Reed surrounded by water gives protection against mammalian predators like mongoose, foxes, and cats. The vegetation must be sufficiently dense to give protection and cover against nocturnal predators like owls.
The direct surroundings of a roost should preferably be open. Trees or bushes close to the reeds are not favourable because they can be used by predators to launch surprise attacks (Bijlsma *et al.* 1994, Bijlsma & van den Brink 2005). Reedbeds can be destroyed, or rendered unsuitable by grazing cattle and bush fires. Conversion of marshland, including reedbeds, into farmland is another threat to roosts, and one that is likely permanent.
Zambia is traversed by many rivers, marshes and floodplains (Kafue, Luangwa, Zambesi, Bangweulu, Lusanka) offering a wide variety of suitable roosting sites. On a more local scale many new and big dams have been built to hold water during the dry period (Donald Burton, pers. comm.); many of the artificial lakes are fringed with reedbeds suitable for roosting. These lakes form a potential source for arising new reed vegetation that can form roosts for swallows. In this respect Zambia can provide sufficient roosting sites for swallows.

3,2 Size of roosts.

The size of swallow roosts can differ considerably. They can contain some thousands of birds up to a few million (Loske 1996, Van den Brink 1997). The more birds present the less risk an individual bird has to be caught by an enemy (e.g. Bijlsma & van den Brink 2005). Therefore one should expect that swallows prefer large roosts. But within an actiradius of 50 – 100 km of the roost (Oatley 2000) the countryside must have suitable habitat providing sufficient food for that huge number of birds. When there is less food or the size of the reed bed is small the numbers of roosting swallows will be smaller. Whether this can be related to the individuals's condition in terms of body mass, speed of moult and parasite abundance in the birds is uncertain. The research part of this Zambian Barn Swallow Project will give more insight in this matter.

3.3 Roosts during migration.

The migration of barn swallows starts in Europe in September. Recoveries of ringed barn swallows show that the first swallows arrive in their sub-Saharan non-breeding areas in October, but in southern Africa the bulk arrives in November (Oatley 2000, Dowsett *et al.* 2008). During migration barn swallows use temporary stopovers for roosting before establishing a more permanent roost in the wintering quarters. Having arrived in their African wintering quarters, swallows are supposed to stay in the area during the whole period of moult. Exchange between roosts is known, although roost fidelity is probably the most likely strategy when moulting (van den Brink 2003). Research using radiotags or transponders may gain more insight in the use of roosts in Africa. A permanent roost will contain swallows from December till April, when return migration back to the breeding areas in Europe starts (P. Micheloni pers. com.).
In Zambia roosts are known from Ndola and Kitwe (Dowsett 2001), at Kasanka National Park (Sinclair, pers comm.), Nkanga near Choma (Dowsett 2001) and in Lower Zambesi National Park (Sinclair, pers. comm.). During our research it appeared that some roosts were deserted by the swallows by January and February. The exceptional amount and duration of rainfall during

the first part of the rainy season in Zambia in 2007/08 may have caused food scarcity, or at least may have interfered foraging by swallows. However, Dowsett *et al.* (2008) remarked that this is apparently the normal behaviour for swallows when the rains start. Spacing of roosts may be closely related to migration patterns and dispersal across feeding areas (Winkler 2006). Migrating birds, flying at speeds of 40-80 km/hour, and leiseruly foraging birds, flying at speeds of 20-40 km/hour, may unhurriedly hop from site to site, as is possibly the case in Zambia where roosts are scattered throughout the country. Swallows are known to be able to cover >400 km per day whilst migrating (Turner 2006).

3.4 Threats at the feeding areas.

During daytime the swallows disperse across the countryside to forage for swarming ants and termites, and other flying insects. Herds of cattle and game are frequented for insects. In some parts of Africa foraging swallows are trapped for food with hooked termites attached to thin nylon wire; hundreds of thousands of swallows, of many species, are thus captured in Cameroon, the Central African Republic and Congo (P. Micheloni pers. com.; Micheloni in press), but these catching practices are not known from Zambia.
In agricultural areas birds sometimes form threats for crops, especially seed-eaters like queleas, weavers and finches. Farmers try to protect their crops by trapping and shooting birds visiting their fields. However insectivorous birds such as flycatchers and swallows that forage above the fields in hunt for insects are likely confused with the enemies and also killed. At the countryside villagers make artificial drinking pools which are filled with poisoned water. Birds visiting these water sources die. This way of eliminating birds is non-selective and can kill also non-target species like swallows (Chuma Simukonda, pers. comm.). It is unknown whether this is a real threat for swallows.
Some bird species in Zambia are trapped as cage birds, like love-birds, weavers and finches, but swallows are not included in this group.

3.5 Threats at the roosts.

At the end of the day, after having foraged in the countryside, barn swallows return to the roost. At about one hour before sunset they gather above the roost and form dense flocks, swirling around. About a quarter after sunset they descend in the reeds to stay there during the night. In the morning, about 15 minutes before sunrise, they leave the roost in large groups to disperse across the feeding areas (van den Brink *et al* 1997). Large numbers of birds attract predators and several species of raptors, like small hawks, falcons (especially hobby), take their chance of getting an easy prey both in the evening and in the morning (Bijlsma *et al.* 1994, Bijlsma & van den Brink 2005). During night owls visit the roosts to prey upon swallows (pers. obs.). The complicated manner of approaching roosts and the timing of descending and ascending to and from the roosts, are clear indications that roosting habits are formed by the threat of predation (Bijlsma & van den Brink 2005, Winkler 2006).
In some African regions the local people hunt swallows at the roosts for food, as in Nigeria, Cameroon, Central African Republic and the Congos (Loske 1996, Micheloni pers. com., Micheloni in press). In Zambia, swallows are not on the menu of the villagers.

3.6 Conclusion about threats.

Barn swallows ‘wintering’ in Zambia are not threatened by man. There are sufficient sites suitable for roosting and, apart from unfavourable weather conditions, they are not endangered in Zambia. As concluded in the research article of this project (van Dijk et al, in prep) large roosts are important for barn swallows and therefore deserve protection against disturbances and habitat changes by men.

However more extensive information at schools, institutions and through public media like radio, television, newspapers and magazines can improve a better understanding and greater awareness to nature conservation and bird protection and towards migratory birds like swallows. Organisations like ZOS and Birdlife International can play an important role in these.

4. Swallow ringing.

Within the research period a total of 6358 European barn swallows were ringed in 102 trapping sessions. 1734 of these birds were processed in detail to obtain biometrical data.
We captured 6 birds with rings from countries outside Zambia. We retrapped another 6 swallows which had been locally ringed by ourselves at an earlier date, indicating that at least some birds show site fidelity.

4.1 Recoveries.

The chances of getting a recovery of a European ringed bird depend on the numbers of birds that are ringed in the breeding areas. In 1998 Euring (the European ringing schemes) started the European Swallow Project, in which many barn swallows have been ringed in western European countries, but less so in eastern Europe and the former Soviet Union (Spina 2001). In fact, the ratio of ringed birds is very much smaller in swallows using the eastern flyway (hence passing Zambia) than in those using the western flyway (ending up in western, central or southern Africa) (Table 2). In fact, the ratio we found in Zambia (0.09%) was exactly as predicted by Table X. During the study period we captured six barn swallows ringed in Europe, of which five were trapped and released by us (a sixth was found dead, see below). This means that one in every 1270 trapped birds already carried a ring, or 0.09% (n=6358 birds).

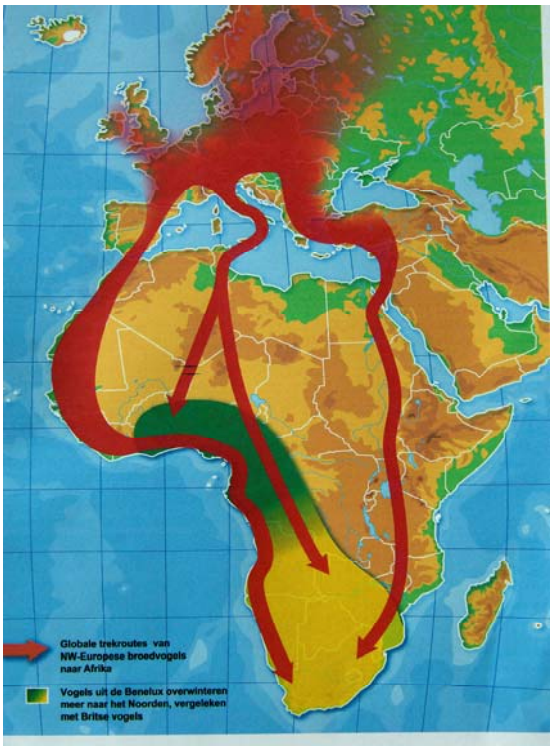
Tabel 2. Esimated population size of barn swallows in various European countries, the number of swallows ringed annually, and the ratio of ringed birds (calculated by dividing the number of ringed barn swallows by populaion size multiplied by 4, i.e. one pair + two juveniles), and average values for swallows using the western or eastern flyway (after Szép et al. 2006).

Country	**Population estimate**	**No. swallows ringed/year**	**Ratio ringed (%)**
Belgium	50.000	23.000	11.50
Norway	45.000	10.000	5.60
The Netherlands	150.000	11.400	1.90
United Kingdom	726.000	39.800	1.37
Denmark	225.000	4300	0.48
Sweden	225.000	1500	0.17
Western Flyway	1.421.000	90.000	1.58
Finland	155.000	20.000	3.23
Lithuania	225.000	2400	0.27
Estonia	200.000	1300	0.16
Poland	2.250.000	11.500	0.13
Latvia	296.000	600	0.05
Belarus	1.250.000	500	0.01
Ukraine	1.085.000	500	0.01
Russia	4.750.000	500	0.003
Eastern Flyway	10.211.000	37.300	0.09

4.2 European Barn Swallows ringed abroad, found in Zambia.

Regarding the origin of the ringed barn swallows we can corroborate earlier findings that showed most birds passing Zambia originate from eastern European countries, including Russia and the countries of the former Soviet Union. Dowsett & Leonard (1999) trapped and ringed 20.247 barn swallows in Zambia between 1980 and 2000 and their recoveries also originated from eastern Europe. We therefore conclude that Zambia is a non-breeding (wintering) area of birds from the eastern European population, with some birds from central and western European countries. Many of these birds merely use the eastern flyway through Zambia to final destinatons in southern Africa (Oatley 2000).

(source map: VBN)



The origin of the 6 birds carrying European rings was as follows.

T 119741 Budapest, Hungary.
Found as full-grown on 21-01-2004 at Bilili Hotsprings. 16°40'S, 26°10'E. Found dead at the roost site. This recovery was forwarded by headman John Kaingo at Bilili; a villager had found the dead bird earlier.
Ringed on 19-7-2000 as juvenile at Iszak, Bacs-Kiskun, Hungary. 46°47'N, 19°21' E. 7098 km.

B 77491 Matsalu, Estonia.
Trapped and released as juvenile on 24-11-2007 at the roost at Mafundzalo Ranch, Kabwe. 14° 18.425 S. 28° 27.700 E.
Ringed on 23-08-2007 as juvenile at Pärnumaa County, Häädemeeste, Linnujaam, Estonia. 58º 5. N, 24º 29'E. 7965 km.

6E8204 Budapest, Hungary.
Trapped and released as adult male on 3-12 2007 at the roost at Huntley's Farm, Chisamba. 15°01'S, 28°08'E.
Ringed as juvenile on 19-9-2005 at Davod, Bacs-Kiskun, Hungary. 46°00'N, 18°55'E. 6848 km.

JA 59864 Ankara, Turkey.
Trapped and released as adult male on 7-12 2007 at the roost in Kasanka N.P. 12°25'S, 30°14'E.
Ringed on 1-5-2004 at Titreyengöl, Antalya, Turkey. 36°46'N, 31°27'E. 5464 km.

KZ 11653 Gdansk, Poland.
Trapped and released as juvenile on 26-12-2007 at the roost in Nkanga Cons. Area., Choma. 16° 37.193 S. 26° 59.530 E
Ringed as juvenile on 12-07-2007 at Jeziorsko, Glinno, Lodzkie, Poland. 51 44 N, 18 39 S. 7643 km.

JB 03056 Ankara, Turkey.
Trapped and released as adult female on 5-2-2008 at the roost at Mafundzalo Ranch, Kabwe. 14° 18.425 S. 28° 27.700 E.
Ringed as adult female on 11-05-2007 at Aras, Igdir, Turkey. 40 07'N, 43 35'E. 6625 km.

4.3 Retraps of barn swallows.

Birds ringed and recaptured within the same season at the same location are considered as retraps. The chance of retrapping a bird depends of the size of the roost, the number of swallows ringed and roost site fidelity among swallows.

The data of the retraps are as follows.
AP 04604. Ringed as juvenile on 24-11-2007 at the roost at Mafundzalo Ranch, Kabwe.
Retrapped on 7-2-2008, after 75 days.

AP 06770. Ringed as juvenile on 8-12-2007 at the roost in Kasanka N.P.
Retrapped on 21-1-2008, after 44 days.

AP 07822. ringed as a juvenile on 30-12-2007 at the roost at Huntley's Farm, Chisamba.
Retrapped on 3-1-2008, after 4 days.

AP 08174. Ringed as juvenile on 5-1-2008 at the roost at Kasanka N.P.
Retrapped on 23-2-2008, after 49 days.

AP 08211. Ringed as juvenile on 5-1-2008 at the roost in Kasanka N.P.
Retrapped on 6-3-2008, after 61 days.

AP 08189. Ringed as a juvenile on 5-1-2008 at the roost in Kasanka N.P.
Retrapped on 7-3-2008, after 62 days.

We retrapped one of our own ringed birds at another location:
AP 03328. Cape town.
Ringed on 29-11-2007 at the roost at Lake Itawa, Ndola. 12°58.189 S. 28°39.596 E.
Trapped as juvenile on 10-12-2007 at the roost at Huntley's Farm, Chisamba. 15° 01.275 S. 28°.08.892 E.
This bird was recaptured after 11 days, covering a distance of about 250 km, that is 23 km per day. An indication of migration south.

When we assume that these swallows stayed in the area between the retraps (which is not certain), the retraps then show site fidelity among some barn swallows in Zambia. However, we cannot calculate the proportion of swallows showing site fidelity, and in fact the findings at Ndola and other roosts seem to indicate that many swallows pass through the area to more southerly wintering grounds.

5. Increasing conservation capacity.

Though the main project focused on collecting scientific data, it also offered opportunities to strengthen the capacity in Zambia for bird conservation. This can be achieved through training of ZOS and ZAWA staff, or students of the University of Zambia. Using the project activities in the environmental education program of ZOS at basic schools and IBA-schools a contribution was made to the conservation of birds in Zambia. A strong link between the project and Zambian organisations underlines the general Birdlife motto: ”Together for Birds and People”.

5.1. Cooperation with the Zambian Ornithological Society (ZOS).

The Zambia Barn Swallow Project offered the opportunity to stimulate and spread the ideas of nature conservation and bird protection. ZOS is an important intermediary in this by visiting schools and inviting them to participate in the school project. In 2006 much publicity was already given in newspapers and on TV about the poster design contest. The minister of education gave the prize to the winning school and their pupil. As a continuation of this project a number of schools and IBA-schools were visited to perform a power point presentation about the barn swallow as a European Red List species, showing migration, information about birdlife and the need of nature conservation and bird protection.
In February ZOS organised a waterbird count at the dam and lake of Huntleys Farm, Chisamba. Under surveillance of five ZOS-members and experienced birders a group of 15 IBA-school pupils took part. On this occasion the telescope, binoculars and bird field guides donated by Birdlife Netherlands were used.
To inform the members and the board of ZOS on 26 February 2008 a presentation was given about the barn swallow project at the office of ZOS in Lusaka. Thirty people were present, among them well-known and keen birders in Zambia. After the presentation a discussion came about bird protection and the need of giving lessons at schools and inviting students and pupils into field excursions, in which ZOS in particular had to play an important role. All cooperation should be given to promote and realise this in future.
Dr. Lizanne Roxburgh (ZOS president) accompanied us several times during our stay at the study site in Chisamba. She and her partner Claus assisted in trapping and ringing barn swallows and reedbirds. Experiences were exchanged and suggestions made about putting up a Zambian Constant Effort Site. Constant Effort Sites (CES) are sites were birds are trapped and ringed at the same place with the same number of nets at regular times. The aim is to get information about the presence and survival of migratory birds, the numbers and species of local birds and their breeding success. A CES at Chisamba offers a good opportunity to invite students and IBA-schools to show them bird research and involve them in bird protection. Lizanne invited a number of biology students from the University Of Zambia (UNZA).

5.2. Cooperation with the Zambian Wildlife Authority (ZAWA).

The project also needed permits to enter National Parks and protected areas of which ZAWA (Zambian Wildlife Authority) was the responsible body. Their contact person was Daniel Mwizabi, who is also a ZOS member. Daniel introduced us to the directors and research officers of ZAWA at the ZAWA headquarter in Chilanga.
ZAWA cooperated in the project by seconding Daniel for some weeks to help us in starting up the project. Daniel helped us during the first three weeks in our search for swallow roosts in entering and surveying areas with possible suitable research locations. Daniel was also trained in mistnetting, ringing and taking biometrical data of birds.

During my holiday visit on 2 July 2008 a presentation about the Zambia Barn Swallow Project was given at the office of ZAWA in Chilanga which was attended by eight staff members and research officers, a.o. Senior Wildlife Ecologist Dr. Chuma Simukonda and Senior Wildlife Planner Dr. Beem Nkata.

5.3. Contact with students.

Lizanne invited a number of biology students from the University Of Zambia (UNZA) and gave them the opportunity to participate in bird ringing and bird research. Because of the logistic problems (transport and accommodation) the research site at Chisamba was the only possibility to organise this. From 2 – 4 March 2008 five UNZA-students took part in a three-day trapping, ringing and research excursion: Mutale Musonda, Lunga Mutwale, Maimuna Abass, Kabuku Likando and Dickson Kabwe. They participated actively in extracting birds from the nets, ringing them and taking biometrical data of the birds. The students had never experienced this before and were highly enthusiast about this work. ZOS intends to continue this annually after this successful experience.

5.4. Contact with Zambian schools.

In February 2008, ZOS organised a waterbird count and an excursion around the dam and lake at Huntley's Farm, Chisamba for IBA-school pupils. On this occasion the telescope, binoculars and field guide were used, donated by VBN.
Mr. Pius Lilanda of ZOS was the contact person and manager of this part of the project. During our stay he arranged visits and presentations at a number of participating Zambian schools. VBN sponsored the binoculars and bird guides and Hirundo Foundation provided stickers for children, with the slogan "The swallow – your friend". The winning swallow poster was distributed, to increase awareness of nature conservation and bird protection. During the first part of our stay communication with schools was problematic due to the absence of Pius Lilanda and school holidays (end November – mid January). For the second period a number of school visits could be planned. The pupils of the higher classes with their teachers and IBA-school pupils attended the presentations. On every occasion one or two binoculars and a bird guide were donated and posters and stickers were distributed.

Pius before a class at the Nalituwe Basic School in Livingstone. March 2008

The following visits with presentations were held:
- On 30 November 2007 the Nkanga Basic School was visited;
- On 29 January 2008 a presentation was given at the Chisamba Basic School;
- On 14 February 2008 the Nalituwe Basic school in Livingstone was visited. Board and director of the school were very hospitable in receiving us. A laptop was donated to this school and to teacher Richard Phiri being the most active school in the project. On 15 February 2008 we visited the school again to start a twinning program with the Wereldweide Primary School in Wezep, The Netherlands.

The laptop was donated to teacher Richard Phiri of the Nalituwe Basic School in Livingstone. March 2008.

- Also on 15 February 2008 a presentation was given at the Palm Grove Basic School in Livingstone.
- On 16 February 2008 a swallow presentation was given at the opening of the annual Science Day at the Baobab College in Lusaka. This Science Day is attended by 12 schools from different regions in Zambia and promotes small-scale research programs by pupils. . Awards were handed out to the most innovative studies done by the students. Some 150 pupils with their teachers were present. The migration of swallows and the need of bird protection were an eye-opener for most of them.

6. Communication.

Migratory birds are an excellent tool to raise awareness for the need of international collaboration between conservationists. The barn swallow, living in two parts of the world, can be an example of how the continents of Africa and Europe are linked ecologically. Conservation work in Africa is therefore of relevance to Europeans and Africans.

6.1. Communication with Dutch organisations.

To inform the members of Vogelbescherming Nederland, every two weeks a newsletter was prepared and emailed to The Netherlands to detail the recent findings, illustrated with some photographs (see example). In total 15 Zambia letters were emailed to BirdLife Netherlands, and put on their website www.vogelbescherming.nl These newsletters were also forwarded to the website www.boerenzwaluw.nl Once a month (6 in total) a newsletter was sent to the Dutch radio program Vroege Vogels, specialised in nature, and put on their website.

During our stay in Zambia several Dutch newspapers paid attention to our activities and issued articles about the results. After return to The Netherlands an interview for the local radio was arranged.

An example of a Zambia letter is printed below, without photographs (translated from Dutch)

> Zambialetter no. 5 VBN 1dec07.
>
> First research session location Kabwe.
>
> From 24 till 28 November we held our 5-day trapping session at the roost at Kabwe. This rather small-sized reedbed (0,75 ha.) at a dam on the Mafundzalo Ranch of the Burton family we regarded as a small roost, fitting in our plan to investigate roosts of different sizes.
> To our surprise some 40.000 – 50.000 barn swallows were present now! A lot more than we had expected. When we drove to the trapping site at about 17.00 h. thousands of swallows had already gathered on the electrical wires in the near surrounding. Though a thunderstorm was threatening some evenings no rain came down and we could ring a total of 1202 barn swallows. Every evening 15 adult and 15 juvenile birds were taken for research and were set free the next morning. On the first night we trapped a juvenile swallow with a ring from Matsalu Ringing Scheme in Estonia. Our first European retrap!
> Of course we caught, beside the inevitable weavers, some other birds, like a jewel called Malachite Kingfisher (*Alcedo cristata*) and a beautiful African swallow species, the White-throated Swallow (*Hirundo albigularis*).
> After the first evening the youth of the neighbouring compound had got wind of our strange behaviour in the reeds. They came to look every evening and we could explain and show them what we did and with what purpose. The Jacaranda Trust School in Kabwe has invited us to give a presentation about our work in January. We eagerly comply with this request.
> We could make use of the guest rooms of Donald and Debbie Burton, who were great hosts for us. Now we will visit our next location, Chisamba. We are very curious to see what is going on there.
>
> Bennie van den Brink.
> Jacintha van Dijk.
> Sjoerd Duijns.

6.2 Contact with schools in The Netherlands.

The school board of Stichting Proo in Harderwijk was willing to cooperate in giving Bennie a year unpaid leave for executing and leading the project. They also put up a school weblog to facilitate contact between schools in Zambia and The Netherlands. Schools were invited to participate in the swallow project by giving lessons on Africa, Zambia, nature conservation and bird migration.
Eight newsletters in Dutch were written and sent to the weblog www.ictproject.web-log.nl to be used on schools in The Netherlands as a stimulant to start lessons about nature, people and culture of Zambia and Africa. Four newsletters in English were made for Zambian schools to learn about the Dutch country, nature and culture. The weblog manual was translated into English for the Zambian schools. Email addresses were exchanged to promote twinning between schools. A laptop was donated to a Zambian school to facilitate access to internet and email connections.
Making contact between schools in Zambia and The Netherlands proved to be far from easy. Hardly any school in Zambia has access to the internet and the different timing of the school holidays in The Netherlands and Zambia was a further obstacle for making contacts.

7. Miscellaneous bird ringing.

At some mornings we trapped Paleartic birds to get information on moult and condition . These attempts were largely aborted in December and January because of frequent and heavy rainfall. Trapping conditions improved in February and March, resulting in a subsequent increase in mistnetted passerines.
At Chisamba, the reedbeds and scrub bordering the dike near the water pumping station offered excellent opportunities for catching birds. Apart from many African species, we trapped a variety of Palearctic passerines, such as European Reed Warbler *Acrocephalus scirpaceus*, Great Reed Warbler *A. arundinaceus* and Sedge Warbler *A. schoenobaenus*.

Symen and Andrea while bird ringing in the morning. The local youth is very interested. Mafundzalo Ranch, jan. 2008.

At Mafundzalo Ranch, the local dam was surrounded with thickets of Lantana *Lantana camara* and other bushes, an area rich in birds. Among the Palearctic species we trapped here, were Whitethroat *Sylvia communis*, Garden Warbler *Sylvia borin* and Thrush Nightingale *Luscinia luscinia*.

Rob and Frank with African goshawk. Kasanka march 2008.

At Pontoon Campsite in Kasanka National Park very few birds were present and catching was a rather futile exercise. During the last visit, we put up nets near Fibwe Campsite, which proved to be more successful. Among the African species captured were African Goshawk *Accipiter tachiro* and Böhms Bee-eater *Merops boehmi*.
Surprisingly, a substantial number of Sand Martins *Riparia riparia* were captured on the swallow roosts at Chisamba and Kabwe. Normally, these species are completely segregated, and except for the accidental birds, Sand Martins are only rarely caught on communal roosts of barn swallows in Africa (pers. obs.). Most Sand Martins were fully processed and data of moult and weight were obtained.
For numbers ringed see appendix 3.
For biometrical data see appendix 4.

7.1 Retraps of Palearctic birds (see also Appendix IV).

AP 05951. Sedge Warbler. *Acrocephalus schoenobaenus.*
Ringed as juvenile on 30-11-2007 at Huntley's Farm, Chisamba.
Retrapped on 28-12-2007, after 38 days.

AP 08625 Whitethroat. *Sylvia communis*.
Ringed as juvenile on 10-1-2008 at Mafundzalo Ranch, Kabwe.
Retrapped on 7-2-2008, after 28 days.

W 99240 Willow Warbler. *Phylloscopus trochilus.*
Ringed as fullgrown on 10-1-2008 at Mafundzalo Ranch, Kabwe.
Retrapped on 7-2-2008, after 28 days.

AP 09509 Garden Warbler *Sylvia borin.*
Ringed as fullgrown on 7-2-2008 at Mafundzalo Ranch, Kabwe.
Retrapped on 15-3-2008, after 36 days.

BE 45239 Great Reed Warbler *Acrocephalus arundinaceus*.
Ringed as adult on 19-12-2007 at Mafundzalo Ranch, Kabwe.
Retrapped on 15-3-2008, after 87 days.

AP 09987 Sedge Warbler *Acrpcephalus schoenobaenus*.
Ringed as fullgrown on 3-3-2008 at Huntley's Farm, Chisamba.
Retrapped on 21-3-2008, after 18 days.

BE 45421 Great Reed Warbler *Acrocephalus arundinaceus.*
Ringed as fullgrown on 19-2-2008 at Huntley's Farm, Chisamba.
Retrapped on 21-3-2008, after 31 days.

AP 08930 European Reed Warbler *Acrocephalus scirpaceus.*
Ringed as fullgrown on 27-1-2008 at Huntley's Farm, Chisamba.
Retrapped on 21-3-2008, after 54 days.

AP 08938 European Reed Warbler *Acrocephalus scirpaceus*.
Ringed on as fullgrown on 27-1-2008 at Huntley's Farm, Chisamba.
Retrapped on 22-3-2008, after 55 days.

AP 08934 Sedge Warbler *Acrocephalus schoenobaenus*.
Ringed as fulgrown on 27-1-2008 at Huntley's Farm, Chisamba.
Retrapped on 22-3-2008, after 55 days.

AP 08943 European Reed Warbler Acrocephalus scirpaceus.
Ringed as juvenile on 27-1-2008 at Huntley's Farm, Chisamba.
Retrapped on 22-3-2008, after 55 days.

AP 08937 Sedge Warbler *Acrocephalus schoenubaenus*.
Ringed as juvenile on 27-1-2008 at Huntley's Farm, Chisamba.
Retrapped on 22-3-2008, after 55 days.

For biometrical details see appendix IV.

Juvenile barn swallow landing.
It shows a nice view of the moult pattern. Chisamba jan. 2008.

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9. Appendices.

9.1 Appendix 1. Itinerary 23 October 2007 – 25 March 2008.

22 oct. Departure via London to Lusaka.
23 oct. Arrival in Lusaka. Lizanne Roxburgh picks us up and drives us to our guesthouse Gossner Mission. Arranging car and shopping. In the evening barbecue at Lizanne's, meeting Daniel Mwizabi of ZAWA.
24 oct. Acclimatising. Packing car and checking ringing equipment.
25 oct. Visit to ZAWA office and meeting officials and cooperatives to get research permits. Shopping at Manda Hill to buy camping equipment.
26 oct. Visit to Zawa headquarters and offering a VBN binocular to Daniel. Shopping to buy food and equipment.
27 oct. Picking up Daniel at the Zawa office and driving to Bilili Hot springs. Arrival after sunset.
28 oct. Stay at Bilili. Meeting headman John Kaingo showing us the area. Trapping birds in the evening in the reedbed. No swallows had yet arrived here.
29 oct. Departure from Bilili. Drive to Nkanga. Surveying the area, visit to the trapping site.
30 oct. With guide Sylvester surveying Nkanga Conservation Area. Visit to mr. Bruce Miller and the local school. Bennie gives a swallow presentation. Swallow trapping.
31 oct. Drive to Lochinvar Nat. Park.. Swallow trapping on the flood plain.
1 nov. Morning swallow catch. Surveying the area and camping at Gwanda Springs. Swallow trapping in the evening.
2 nov. Search for roosts. Visit to The Moorings (farm of Tom Savory) and looking for reedbeds. Drive to Monze Dam and swallow trapping. Camping at The Moorings.
3 nov. Search for roosts. Visit to Robinsons Farm, Munali Coffee Plantation and Kafue Fisheries. Drive back to Lusaka. Overnight in Gossner Mission guesthouse.
4 nov. Visit to ZOS office. Discussion about school visits.
5 nov. Writing letters for website and weblog. Shopping food for the next survey.
6 nov. Pick up of Daniel and drive to Kafue Fisheries. Exploring the area. Swallow trapping in the evening. Overnight in Lechwe lodge.
7 nov. Drive north, visit of Protea Lodge, visit of Sable Ranch, Chisamba. Survey with Marie (Dave Gordons Dutch wife) to look for roost sites. Attempt to trap swallows, which failed because of heavy rains. Overnight at Sable Ranch.
8 nov. Drive to Huntley's Farm (Zambeef). Survey of the area and dam. Swallow trapping in the evening. Overnight at Fringilla Campsite.
9 nov. Drive to Kabwe. Visit to farm of Tim Ashworth and Mafundzalo Ranch of Donald Burton. Swallow trapping in the evening. Overnight at the Mafundzalo Ranch.
10 nov. Drive to Ndola in search for roosts.. Visit to Msobi Game Ranch. Visit to Lake Itawa and swallow trapping here in the evening. Overnight in Ambassador Hotel.
11 nov. Drive to Kasanka Nat. Park. Visit to fruit bat roost. Camping at Pontoon Campsite.
12 nov. Survey of the area. Search for roost site with park ranger Lesley. Swallow trapping in the evening.
13 - 15 nov. Drive back to Lusaka. Drop off Daniel at Zawa office. Visit to ZOS for support letter to get permits. Visit to Zawa office to ask for permits. Visit to Baobab College to plan swallow presentation at their Science Day. Visit to immigration office to get support letter for getting research permits. Writing letter for website and weblog. Overnight at Zebra Guest House.
16 - 18 nov. Drive to Nkanga. Swallow trapping in the evening..
19 - 21 nov. Drive to Lusaka, Zawa office to receive the support letter. Visits to Immigration Office to get permits. Overnight at Eureka Camp.
22, 23 nov. Drive back to Nkanga to continue swallow trapping.
24 - 28 nov. Drive to Mafundzalo Ranch, Kabwe. Swallow trapping. Stay at guest rooms in the farm. Birdwatching, writing letters for weblog and website, administration,
29 nov.- 3 dec. Shopping in Kabwe, drive to Chisamba. Arranging permits for our research at Huntley's Farm and bird watching. Swallow trapping in the evenings, administration, writing letters for website. On 2 dec. morning catch of passerines at dam. Stay at Fringilla Campsite.
4 – 8 dec. Drive to Kasanka. Swallow trapping in the evenings, bird watching, game drives, visit to fruit bat colony. Writing letters for website and weblog, administration.
9 -11 dec. Drive to Ndola. Swallow trapping at Lake Itawa. Stay at Garden Park Lodge.
12 dec. At 01.30 h. Sjoerd and Jacintha robbed in their chalet. To Masala police station to make reports. To Savoy hotel for phoning to block bank accounts and credit cards. Drive back to Lusaka to the Dutch Embassy for help. Overnight at guest room of fam. Disbeschl.

13, 14 dec. Visit to Dutch Embassy to get new passports. Drive to Lusaka Airport to look for possibilities to get flight return home. Impossible on short terms. Visit to Immigration Office to get new permits. Administration, writing letters for websites and weblog. Stay at gusthouse fam Disbeschl.
15, 16 dec. Visit to Lilaya Lodge outside Lusaka for a few days recovery of Sjoerd and Jacintha. Fully booked. Visit to Andrews Hotel. Bennie stays there, S&J return to guest house of fam. Disbeschl.
17, 18 dec. S&J pick up Bennie. Visit to Limohire for car maintance and tax sticker. Stay at guest house fam. Disbeschl. Shopping and internetting in Lusaka.
19 - 22 dec. Drive to Mafundzalo Ranch, Kabwe. Stay in the guest rooms of the farm. Swallow trapping, administration, writing letters for websites and weblog.
23 - 26 dec. Drive to Nkanga. Swallow trapping. Camping at Nkanga Campsite. On 25 dec. Christmas lunch at the house of Ian Bruce-Miller. Bird watching (Chaplins barbet).
27 dec. Drive to Chisamba. Stay at Fringilla Lodge. Decision of Sjoerd and Jacintha to return to The Netherlands.
28 dec. Visit S&J to Lusaka airport to arrange return flight. Booked 1 January. Administration, writing letters for websites and weblog. Swallow trapping.
29 dec. Transfer of input data etc. Making up a protocol to continue the research. Swallow trapping.
30 dec. Packing luggage of S&J. Swallow trapping.
31 dec. Drop-off S&J at the Continental Hotel, Lusaka. Bennie drives back to Fringilla Lodge. Swallow trapping.
1, 2 jan. 08 New Years Day. Bird watching and photographing. Administration. Search for new roost location. Writing letters for websites.
3 jan. Arrival of Symen and Andrea. Shopping and drive to Fringilla Lodge. Bird watching. Swallow trapping at new location.
4 - 8 jan. Drive to Kasanka. Swallow trapping. Bird watching, game drives, administration, Camping at Pontoon Campsite.
8 - 11 jan. Drive to Mafundzalo Ranch, Kabwe. Swallow trapping. Bird watching, administration, writing letters for websites and weblog. On 10 jan. morning catch of passerines near the dam.
12 - 15 jan. Drive to Nkanga. Swallow trapping. bird watching, administration. On 14 jan. morning catch of passerines around the campsite. Search for other roosts at surrounding farms. No result.
16, 17 jan. Drive to Livingstone. Visit to the Victoria Falls, game drive to Mosa-y Tunya National Park. Souvenir shopping. Overnight in Fawlty Towers Guest House.
18 jan. Drive to Chisamba. Try out trapping swallows at new location near the dam. Stay at Fringilla Campsite.
19 - 22 jan. Drive to Kasanka.. Swallow trapping. Administration, bird watching, Camping at Pontoon Campsite.
23 jan. Drive to Lusaka.
24 jan. Departure of Symen en Andrea. Visit to Lizanne/ZOS to arrange visits schools and give presentations. Search for swallow roosts at sewage farms near Lusaka. Stay at Zebra Guest House.
25 jan. Visit to Limohire for car repair and maintenance. Drive to Chisamba. Swallow trapping. Stay at Fringilla Lodge.
26 jan. Photographing. Arrival of Lizanne and Claus and swallow trapping.
27 jan. Morning trapping of passerines with Lizanne and Claus. Bird watching. Swallow trapping. After diner departure of Lizanne and Claus back to Lusaka.
28 jan. Preparing power point presentation for schools. Writing article for ZOS Newsletter. Swallow trapping.
29 jan. Visit of Pius Lilanda, ZOS and performing a swallow presentation at the Chisamba Basic school, participant in the Zambia Barn Swallow Project. Donation of VBN binoculars, bird guide and swallow stickers. Swallow trapping in the evening.
30 jan – 3 feb Drive to Lusaka and Limohire. Departure to South Luangwa National Park.
3 feb. In the afternoon flight back to Lusaka. Overnight in Eureka Camp.
4 feb. Drive to Mafundzalo Ranch, Kabwe. Swallow trapping with Donald Burton. Stay in the guest rooms of the farm.
5 - 7 feb. Arrival of Gerrit and Tineke Speek and Joop en Marijke. Swallow trapping. Bird watching.
7 feb. Morning trapping of passerines near the reedbed. Swallow trapping in the evening.
8 feb. Gerrit and Tineke leaving for holiday visit South Luangwa N.P. With Joop & Marijke continuation of the project. Visit to Lechwe Lodge, Kafue to search for swallow roost. Swallow trapping. No result.
9 - 12 feb. Drive to Nkanga. Swallow trapping, bird watching, administration. Camping at Nkanga Campsite.
13 feb. Drive to Livingstone. Meeting with Pius Lilanda (ZOS) and evening cruise on the Zambesi River. Stay at Decha Guest House.

14 feb. Visit of Joop&Marijke to the Victoria Falls. Bennie and Pius giving swallow presentations at the Nalituwe Basic School and donating laptop, binoculars, field guide and swallow stickers. After this, giving a presentation at the Palm Grove Basic School and donating binoculars and stickers. Evening game drive in the Mosi-y-Tunya Nat. Park.

15 feb. Visit to Nalituwe Basic School to arrange contact with Dutch basic school. Drive to Lusaka and stay at Eureka Camp.

16 feb. Visit to Baobab College for giving swallow presentation on Science Day, participated by 12 other schools. Writing letters for websites and weblog. Stay at Eureka Camp

17 - 19 feb. Drive to Chisamba. Arrival of Gerrit and Tineke at Fringilla Lodge. Swallow trapping. Bird watching, administration, on 19 feb. morning catch of palearctic birds.

20 feb. Departure of Gerrit and Tineke, leaving for holiday visit to Victoria Falls. Shopping in Lusaka. Swallow trapping.

21 - 24 feb. Drive to Kasanka. Swallow trapping, meeting Frank Willems and Frans Schepers. Bird watching. Camping at Pontoon Campsite.

25 feb. Drive to Ndola. Swallow trapping and monitoring the roost at Lake Itawa. No success. Overnight in the Henry Makulu House.

26 feb. Drive to Mafundzalo Ranch, Kabwe. Stay in the guest rooms of the farm. Bennie drives to Lusaka to give a presentation to members and board of the ZOS. Car-accident in Lusaka. Bennie sleeps at Lizanne's house.

27 feb. Because of road-accident making arrangements with car-owner. Making arrangements with Lizanne about visit and field stage of students of the University of Zambia. Bennie returns to Kabwe. Swallow trapping.

28, 29 feb., 1 mrt. Administration, writing letters for websites and weblog. Swallow trapping.

2 mrt. Drive to Chisamba. Arrival of 5 UNZA students, Lizanne and Claus. Swallow trapping. Stay at Fringilla Lodge.

3 mrt. Morning trapping of passerines with the students at the dam. Swallow trapping.

4 mrt. Early drive to Lusaka Airport. Departure of Joop and Marijke. Arrival of Frank and Rob. Also return of the students and Lizanne to Lusaka. Bird watching and swallow trapping.

5 mrt. Morning trapping of passerines near the dam. Administration, swallow trapping. Break down of the swallow recorder.

6 - 9 mrt. Drive to Kasanka. Shopping in Kabwe. Swallow trapping, bird watching. Camping at Pontoon Campsite.

10 - 12 mrt. Boat tour into the Bangweulu Swamps. Stay at Shoebill Camp. Search for the shoebill by boat. With success! Bird watching in the swamps.

13 mrt. Return by boat through the Bangweulu Swamp back to Kasanka.

14 - 16 mrt. Drive to Mafundzalo Ranch, Kabwe. Swallow trapping. Stay in the guest rooms of the farm. Morning trappings of passerines and waders.

17 - 19 mrt. Drive to Kasanka. Morning trapping of passerines near Pontoon and Fibwe.

20 - 22 mrt. Drive to Chisamba. Stay at Fringilla Lodge. Swallow trapping. Morning catch of passerines at the dam. Administration, writing letter for websites and weblog.

23 mrt. Drive to Lusaka. Souvenir shopping. Visit to the ZOS office, meeting Pius and leaving a part of the equipment. Stay at Eureka Camp.

24 mrt. Visit to Zawa office, meeting Daniel for saying goodbye. Visit to Limohire for arranging drop off at the airport tomorrow and returning the car. Diner with the fam. Muis (teacher at Baobab College).

25 mrt. Drop off at Lusaka Airport by Limohire driver. Departure home. Arrival at Schiphol at 23.15 h

9.2 Appendix II. Total of trapped barn swallows.

Table of trapped barn swallows and roost size within the six research rounds.

location	round	date	roost size	total ringed	adults	juv	full-grown
Nkanga	1	16-nov	250	119	25	94	
Nkanga	1	17-nov	2500	299	32	267	
Nkanga	1	18-nov	250	107	22	85	
Nkanga	1	22-nov	100	53	17	36	
Nkanga	1	23-nov	50	34	7	27	
Kabwe	1	24-nov	5000	196	54	142	
Kabwe	1	25-nov	50000	401	106	295	
Kabwe	1	26-nov	50000	221	52	169	
Kabwe	1	27-nov	50000	215	55	160	
Kabwe	1	28-nov	50000	168	39	129	
Chisamba	1	29-nov	1250	137	62	75	
Chisamba	1	30-nov	1250	112	35	77	
Chisamba	1	1-dec	1000	56	22	34	
Chisamba	1	2-dec	1000	89	39	50	
Chisamba	1	3-dec	3000	168	67	101	
Kasanka	1	4-dec	150	28	8	20	
Kasanka	1	5-dec	25	2	0	2	
Kasanka	1	6-dec	1500	127	110	17	
Kasanka	1	7-dec	1250	86	19	67	
Kasanka	1	8-dec	10000	284	43	241	
Ndola	1	9-dec	150	8	1	7	
Ndola	1	10-dec	0	0	0	0	
Ndola	1	11-dec	25	1	0	1	
Kabwe	2	19-dec	4000	136	52	84	
Kabwe	2	20-dec	6000	141	57	84	
Kabwe	2	21-dec	2500	107	34	73	
Kabwe	2	22-dec	1250	65	33	32	
Nkanga	2	23-dec	125	58	12	46	
Nkanga	2	24-dec	125	63	31	32	
Nkanga	2	25-dec	400	75	16	59	
Nkanga	2	26-dec	75	37	16	21	
Chisamba	2	28-dec	25	10	5	5	
Chisamba	2	29-dec	50	29	7	22	
Chisamba	2	30-dec	100	39	24	15	
Chisamba	2	31-dec	200	64	33	31	
Chisamba		3-jan		112	60	52	
Kasanka	2	4-jan	500	8	0	8	
Kasanka	2	5-jan	5000	224	48	176	
Kasanka	2	6-jan	8000	182	46	136	
Kasanka	2	7-jan	5000	114	24	90	
Kabwe	3	8-jan	50	19	12	7	
Kabwe	3	9-jan	50	26	18	8	
Kabwe	3	10-jan	50	42	21	21	
Kabwe	3	11-jan	100	17	11	6	
Nkanga	3	12-jan	0	10	1	9	
Nkanga	3	13-jan	0	7	0	7	

location	round	date	roost size	total ringed	adults	juv	full-grown
Nkanga	3	14-jan	0	4	4	0	
Nkanga	3	15-jan	0	4	2	2	
Kasanka	3	19-jan	3000	115	36	79	
Kasanka	3	20-jan	3000	30	5	25	
Kasanka	3	21-jan	100	7	1	6	
Kasanka	3	22-jan	0	17	7	10	
Chisamba	3	25-jan	5000	8	3	5	
Chisamba	3	26-jan	50	2	0	2	
Chisamba	3	27-jan	300	3	0	3	
Chisamba	3	28-jan	1000	42	14	28	
Kabwe	4	4-feb	10000	45	23	22	
Kabwe	4	5-feb	30000	58	32	26	
Kabwe	4	6-feb	30000	221	95	126	
Kabwe	4	7-feb	30000	248	84	164	
Nkanga	4	9-feb	0	1	0	1	
Nkanga	4	10-feb	0	0	0	0	
Nkanga	4	11-feb	0	1	0	1	
Nkanga	4	12-feb	0	3	0	3	
Chisamba	4	17-feb	1000	31	9	22	
Chisamba	4	18-feb	1000	7	1	6	
Chisamba	4	19-feb	300	5	3	2	
Chisamba	4	20-feb	25	5	1	4	
Kasanka	4	21-feb	0	1	0	1	
Kasanka	4	22-feb	0	1	0	1	
Kasanka	4	23-feb	0	12	5	7	
Kasanka	4	24-feb	150	30	18	12	
Ndola	4	25-feb	0	1	0	1	
Kabwe	5	27-feb	50	5	3	2	
Kabwe	5	28-feb	50	22	13	8	1
Kabwe	5	29-feb	50	40	9	25	6
Kabwe	5	1-mrt	40	4	1	2	1
Chisamba	5	2-mrt	0	0	0	0	0
Chisamba	5	3-mrt	30	5	3	1	1
Chisamba	5	4-mrt	15	3	0	1	2
Chisamba	5	5-mrt	120	0	0	0	0
Kasanka	5	6-mrt	25	20	4	12	4
Kasanka	5	7-mrt	0	4	0	4	0
Kasanka	5	8-mrt	0	0	0	0	0
Kasanka	5	9-mrt	0	0	0	0	0
Kabwe	6	14-mrt	35	6	0	1	5
Kabwe	6	15-mrt	50	13	0	3	10
Kabwe	6	16-mrt	50	3	0	0	3
Kasanka	6	17-mrt	0	0	0	0	0
Kasanka	6	18-mrt	0	0	0	0	0
Kasanka	6	19-mrt	0	0	0	0	0
Chisamba	6	20-mrt	100	46	0	15	31
Chisamba	6	21-mrt	370	5	0	4	1
Chisamba	6	22-mrt	500	3	0	1	2
Total:				**5577**	**1752**	**3758**	**67**

9.3 Appendix III. Total ringed birds per location.

Total ringed birds in Zambia per location.
Nomenclature after the Sasol Birds of Southern Africa, Edition 1993.

Total ringed birds Zambia 2007 – 2008; Palearctic migrants are in italic.

species	scientific name	Bililli Hotsprings	Huntley's Farm, Chisamba	Lake Itawa, Ndola	Lechwe Lodge,	Lochinvar	Kasanka	Mafundzalo Ranch, Kabwe	Monze Dam	Nkanga, Choma	total
Greater Painted Snipe	Rostratula benghalensis		2							1	3
Three-banded Plover	Charadrius tricollaris							1			1
Common Sandpiper	Actitis hypoleuca							3			3
Wood Sandpiper	Tringa glareola		3								3
Emerald-spottd Wood Dove	Turtur chalcospilos							2			2
Mozambique Nightjar	Caprimulgus fossii									1	1
Blue-cheeked Bee-eater	Merops persicus						4				4
Böhm's Bee-eater	Merops boehmi						1				1
Little Bee-eater	Merops pusillus						1				1
Blackcollared Barbet	Lybius torquatus							2			2
Yellow-fronted Tinkerbird	Pogoniulus chrysoconus							1			1
Barn Swallow	*Hirundo rustica*		*1013*	*236*	*1*	*17*	*1703*	*2487*	*10*	*891*	*6358*
White-throated Swallow	Hirundo albigularis							1			1
Wire-tailed Swallow	Hirundo smithii							2			2
Lesser Striped Swallow	Hirundo abyssinica							1			1
House Martin	*Delichon urbica*					*1*					*1*
Grey-rumped Swallow	Pseudhirundo griseopyga		3		1		3	13			20
Sand Martin	*Riparia riparia*		*90*				*24*	*114*		*13*	*241*
Banded Martin	Riparia cincta		1					3			4
Black-eyed Bulbul	Pycnonotus tricolor						8	32		2	42
Terrestrial Bulbul	Phyllastrephus terrestris							1		1	2
Yellowbellied Greenbul	Chlorocichla flaviventris							1			1
African Stonechat	Saxicola rubetra						1				1
White-browed Robin-chat	Cossypha heuglini		1					2			3
Thrush Nightingale	*Luscinia luscinia*							*2*			*2*
White-browed Scrub-robin	Cercotrichas leucophrys		1					2			3
Garden Warbler	*Sylvia borin*							*15*			*15*
Common Whitethroat	*Sylvia communis*							*16*			*16*
Great Reed Warbler	*Acrocephalus arundinaceus*		*28*	*2*			*13*	*1*		*7*	*51*
Eurasian Reed Warbler	*Acrocephalus scirpaceus*		*13*	*1*			*8*	*2*		*1*	*25*
African Reed Warbler	Acrocephalus baeticatus		28					2			30
European Marsh Warbler	*Acrocephalus palustris*						*1*	*2*			*3*
Sedge Warbler	*Acroceph. schoenobaenus*		*89*	*1*			*7*	*6*		*10*	*113*
Lesser Swamp Warbler	Acrocephalus gracilirostris		43	1			11	2		1	58
Greater Swamp Warbler	Acrocephalus rufescens						2	2			4
Little Rush Warbler	Bradypterus baboecala		10	1			1				12
Willow Warbler	*Phylloscopus trochilus*			*3*			*10*	*1*		*4*	*18*
Yellow-breasted Apalis	Apalis flavida						2	2			4

species	scientific name	Bi	Chi	Nd	Le	Lo	Kas	Kab	M	Nk	total
Long-billed Crombec	Sylvietta rufescens							1			1
Grey-backed Camaroptera	Camaroptera brevicaudatus							3			3
Singing Cisticola	Cisticola cantans							2			2
Red-faced Cisticola	Cisticola erythrops		1				1				2
Blackbacked Cisticola	Cisticola eximius		1								1
Chirping Cisticola	Cisticola pipiens						1				1
Pale Flycatcher	Bradornis pallidus							1			1
Spotted Flycatcher	*Muscicapa striata*							*1*			*1*
Ashy Flycatcher	Muscicapa caerulescens									1	1
Chinspot Batis	Batis molitor							1			1
African Paradise Flycatcher	Terpsiphone viridis						2	1			3
Cape Wagtail	Motacilla cinerea						2				2
Common Fiscal Shrike	Lanius collaris							1			1
Red-backed Shrike	Lanius collurio		1								1
Tropical Boubou	Laniarius aethiopicus		1					2		1	4
Coppery Sunbird	Cinnyris cupreus		1								1
Purple-banded Sunbird	Cinnyris chalcomelas		1								1
Variable Sunbird	Cinnyris venustus		1					1			2
Amethist Sunbird	Chalcomitra amethystina							1			1
Collared Sunbird	Hedydipna collaris							2			2
African Yellow White-eye	Zosterops senegalensis							4		1	5
Thick-billed Weaver	Amplyospiza albifrons							1			1
Spectacled Weaver	Ploceus ocularis		4				7	2			13
Village Weaver	Ploceus cucullatus		6					2			8
Southern Masked Weaver	Ploceus velatus		1								1
Golden Weaver	Ploceus xanthops						2				2
Cuckoo Finch	Anomalospiza imberbis		10							26	36
Red-throated Twinspot	Hypargos niveoguttatus						3	2			5
Red-billed Quelea	Quelea quelea	6	7				1			1	15
Red-headed Quelea	Quelea erythrops		26				11				37
Cardinal Quelea	Quelea cardinalis						2				2
Southern Red Bishop	Euplectes orix	1	3							1	5
Yellow-crowned Bishop	Euplectes afer		2								2
Redshouldered Widowbird	Euplectus axillaris		13					1			14
White-winged Widowbird	Euplectus albonotatus	3									3
Red-collared Widowbird	Euplectus ardens		1								1
Yellow-mantled Widowbird	Euplectes macrourus		1								1
Melba finch	Pytilia melba		4					10			14
Bluebilled Firefinch	Lagonosticta rubricata							2			2
Red-billed firefinch	Lagonosticta senegala		1								1
Brown Firefinch	Lagonosticta nitidula		2				4	12			18
Blue Waxbill	Uraeginthus angolensis		1					7			8
Common Waxbill	Estrilda astrild		3					2		1	6
African Qualfinch	Ortygospiza atricollis							1			1
Orange-breasted Waxbill	Amandava subflava		8					2			10
Bronze Mannakin	Spermestes cucullata							6			6
Red-backed Mannakin	Spermestis nigriceps						2				2
Pin-tailed Whydah	Vidua macroura							7			7
	Total:	**10**	**1425**	**245**	**2**	**18**	**1838**	**2799**	**10**	**964**	**7311**

9.4 Appendix IV. Biometrical data of Palearctic retraps.

Biometrical data of all retrapped palearctic birds except barn swallows in Zambia.
Wing length was measured while flattened and straightened (maximum in mm) (Svensson 1984).
Body mass was taken with an electronic balance (accuracy of 0.05 gr).
Fat classe after Busse (1970).
Age: fg = full-grown, age unknown; juv. = juvenile; ad = adult.

		Biometrical data of retrapped palearctic birds.								
ringnr	**species**	**date**	**locality**	**age**	**sex**	**wing**	**mass**	**fat**	**moult score**	**primary moult**
AP08625	whitethroat	10-1-2008	Kabwe	fg	0	74	13,65	0	7	222100000
		7-2-2008					14,65	0	37	555555322
W99240	willow warbler	10-1-2008	Kabwe	fg	0	65,5	8,15	0	16	444310000
		7-2-2008					8,20	0	39	555555540
AP09509	garden warbler	7-2-2008	Kabwe	fg	0	75,5	18,55	0		
		15-3-2008					21,70	3	45	555555555
BE45239	great reed warbler	19-12-2007	Kabwe	ad	0	96	30,00	0	5	
		15-3-2008					32,90	0	44	555555554
BE45421	great reed warbler	19-2-2008	Chisamba	ad	0	99	30,60	0	45	
		21-3-2008					37,10	3	45	555555555
AP08930	european reed warbler	27-1-2008	Chisamba	juv	0	67	11,95	0	0	
		21-3-2008					11,45	2	43	555555544
AP08938	european reed warbler	27-1-2008	Chisamba	juv	0	66	10,45	0	9	
		22-3-2008					10,30	0	42	555555543
AP08943	european reed warbler	27-1-2008	Chisamba	juv	0	65	11,25	0	14	543200000
		22-3-2008					10,50	0	44	555555554
AP05951	sedge warbler	30-11-2007	Chisamba	ad	0	68	10,85	0	0	
		28-12-2007					11,25	0	11	
AP08934	sedge warbler	27-1-2008	Chisamba	ad	0	68	10,75	0	0	
		22-3-2008					11,05	0	34	555555400
AP08937	sedge warbler	27-1-2008	Chisamba	ad	0	66,5	11,35	0	3	111000000
		22-3-2008					11,35	0	28	555543100
AP09987	sedge warbler	3-3-2008	Chisamba	juv	0	67	9,95	0	45	555555555
		21-3-2008					10,30	2	45	555555555

9.5 Appendix V. Biometrical data of trapped birds.

This appendix contains measurements and weights of birds, trapped in Zambia.
The amount of data is too extensive to be printed in this report.
This appendix can be found on www.boerenzwaluw.nl/afrika/zambia.
The full report can be downloaded as pdf file from the same website.