

# Ethiopian Wolf Conservation Programme



Review of activities and achievements, 2000 – 2004  
& work that remains to be completed

October 2004

# Support



Over the past four years, the Wildlife Conservation Research Unit of the University of Oxford, UK is grateful to the Government of Ethiopia for permission to operate the Ethiopian Wolf Conservation Programme in the country. The programme has operated under Memoranda of Understanding with the Government of Ethiopia at federal and regional levels, and specifically with the Wildlife Conservation Department (formerly the Ethiopian Wildlife Conservation Organisation) at a federal level, and the Oromiya Rural Land & Natural Resources Administration Authority (formerly the Oromiya Agricultural Bureau) and the Amhara Agriculture and Rural Development Bureau (formerly the Amhara Agricultural Bureau). The EWCP has also enjoyed the support of many people and organisations, both within and beyond Ethiopia. The programme works under the aegis of the IUCN/SSC Canid Specialist Group.

The Born Free Foundation has been the primary donor and supporter of the EWCP over the past years. The programme has also received significant support and funding from the Frankfurt Zoological Society, Wildlife Conservation Society, Disney Wildlife Conservation Fund and the Wildlife Conservation Network. Further funding has also been received from St. Louis Zoo's Field Research for Conservation Program, the African Wildlife Foundation's Charlotte Fellowships, the John Aspinall Foundation, members of the Ethiopian Wildlife & Natural History Society, visitors to Ethiopia with Discovery Initiatives, the IFMP-GTZ project in Adaba-Dodola, Conservation International, CEPA, the Wolf Conservation Trust - UK, Bern Thies Foundation, Fiona McKenzie and a number of private donors. Karen Laurenson's work, operated from the Centre for Tropical Veterinary Medicine of the University of Edinburgh, UK, on rabies has been funded by The Wellcome Trust, the Morris Animal Foundation and the World Society for the Protection of Animals. The surveys carried out by Claudio Sillero and Jorgelina Marino were also supported by the National Geographic Society. Support in kind has been received from Giovanni Berti for various materials, Martin Harvey for the freedom to use his photographs in promotional material (including the cover photo) and Book Aid International for a contribution of books to the library in the Research Buildings in the Bale Mountains. Terra Nova, Rab Carrington and Field & Trek all provided field equipment for the EWCP team at reduced prices.

Without this support the activities and achievements described in this review would, of course, never have been carried out and attained.

## Summary

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The Wildlife Conservation Research Unit (WildCRU) of the University of Oxford, UK is seeking to extend its agreements with the Government of Ethiopia to continue to operate the Ethiopian Wolf Conservation Programme (EWCP) for the coming five years (2005-09). In order to do so, the programme has been examining its activities and achievements over the past four years in relation to the proposals that were submitted to the Government of Ethiopia at federal and regional levels. The key achievements are:

1. Over the past four years, the EWCP has expanded its activities from a focus only in the Bale Mountains. We now maintain a permanent presence in the field within six of the seven known wolf ranges in the country.
2. The programme currently employs 25 full-time staff (21 of whom are recruited from local communities in the wolf ranges); in addition, the programme employs over 50 part-time or casual workers from local communities each year. As a result, the EWCP is the organisation with the biggest contribution to the local economy in Dinsho and surrounding areas in the Bale Mountains.
3. The EWCP has better knowledge of the distribution and status of Ethiopian wolf populations than ever before. We currently estimate that there are 610 wolves in seven areas in Ethiopia. A total of 294 in 44 packs are intensively monitored in the Bale Mountains; an estimated 222 wolves in 36 packs are monitored in five other areas in Ethiopia. Baseline data is also now being collected in seventh population, the Arsi range
4. The Bale Mountains population of Ethiopian wolves has more than doubled since the 1991-92 outbreak of rabies, canine distemper and political upheaval, even when the 2003-04 outbreak of rabies that killed an estimated 75-81% of one of the high density sub-populations in the area is taken into consideration.
5. While the programme was not able to prevent the outbreak of rabies in the Web valley of the Bale Mountains in 2003-04, the programme implemented an emergency intervention to contain the disease. A total of 69 wolves in the two adjacent high density areas (Morebawa and Sanetti) were caught and parenterally vaccinated. The disease did not spread through these populations.
6. Over the past five years, the programme is the only organisation in Ethiopia to systematically vaccinate domestic dogs (cf. other organisations' policies of destroying the animals). Thus 9,155 dogs have been vaccinated by the EWCP vet team.

7. The programme has levered significant funding for conservation in Ethiopia and specifically for the Bale Mountains. As a direct result of EWCP's direction and advice, Frankfurt Zoological Society is seeking an agreement with the Oromiya Regional State that will amount to over € 1.5 million over a period of ten years. In addition, the EWCP is working with a coalition of international donors to fund a development project for the sustainable use of natural resources in the Bale Mountains massif. The estimated budget for this project is € 5.9 million over five years.
8. The EWCP has been instrumental in reviving the ancient natural resource management system in the Guassa-Menz area of north Shoa. The system dates back over four hundred years but declined with the land reforms under the socialist regime. Under EWCP mentoring, the system is working again and, as a consequence, protecting the Afroalpine ecosystem in the area. This work was internationally recognised with the short-listing of the Guassa-Menz community, following the EWCP's nomination, for UNDP's Equator Initiative Prize. This has made the community eligible to receive up to \$ 50,000 from a GEF Small Grant.
9. The EWCP is committed to building the capacity of Ethiopian institutions and people. This is, in part, reflected in the facilitation work that we do - for example for the development of the Bale Mountains. In addition, four MSc students have been trained at Addis Ababa University and carried out their thesis work with EWCP, one MSc student was trained in the UK, we are currently working with two PhD candidates, we work with one BSc student, we have taught wildlife Conservation and management at Wondo Genet Forestry College, we have given GIS training to the federal wildlife conservation organisation, we mentor and train EWCP staff to become leaders of conservation within Ethiopia and one of our members of staff received a Darwin Biodiversity Scholarship from the UK government which recognises outstanding biodiversity experts in developing countries.
10. Overall, the EWCP, over the past four years, has championed wildlife conservation in Ethiopia. For this, the programme has received widespread international recognition.

Despite the magnitude of these achievements, the presence of the programme is critical for the foreseeable future to continue to counteract the threats to the Ethiopian wolf and its Afroalpine habitat.

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## Background

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### **Preamble**

The Ethiopian Wolf Conservation Programme (EWCP) has operated in Ethiopia since 2000 under agreements between the Wildlife Conservation Research Unit (WildCRU) of the University of Oxford, UK and the Government of Ethiopia. The agreements are specifically with the Wildlife Conservation Department (WCD, formerly the Ethiopian Wildlife Conservation Organisation) of the Ministry of Agriculture and Rural Development at a federal level, and the Oromiya Rural Land and Natural Resources Administration Authority (formerly the Oromiya Agriculture Bureau) and the Amhara Agriculture and Rural Development Bureau (formerly the Amhara Agricultural Bureau).

These agreements expire on 31 December 2004. The Wildlife Conservation Research Unit of the University of Oxford is seeking to extend those agreements for a further five years. Indeed, the current Memoranda of Understanding state that:

*"Due to small population sizes and the nature of the endangering factors (hybridisation and disease) threatening the Ethiopian wolf it will be necessary to manage the species in perpetuity. There is, therefore, no foreseeable end to this programme. Consequently, this is a long-term programme and an extension beyond this date will be sought for the programme beyond 2004, conditional to the availability of funding".*

The above clause specifies that the extension of the Memoranda of Understanding is dependent on two factors: a) continuation of the threats to the Ethiopian wolf and its Afroalpine ecosystem, and b) the availability of funding. First, the majority of the endangering factors to the Ethiopian wolf persist. This was most recently and acutely illustrated by the outbreak of rabies that killed over 75% of a single sub-population of wolves in the Bale Mountains. Second, the programme has now received a confirmation of funding in excess of one million dollars over the forthcoming five years.

This document examines the activities and achievements of the EWCP over the past four years in relation to the proposals that were submitted to the Government of Ethiopia at federal and regional levels. It goes on to indicate the work that is not only currently ongoing but which are necessary to continue for the foreseeable future to counteract the threats to the Ethiopian wolf and its Afroalpine habitat.

## ***History, goal and programme purpose***

The history of work on the Ethiopian wolf and the Afroalpine ecosystem, like many others around the globe, has been marked by the work of individuals. Attention was first brought to the plight of the Ethiopian wolf, then known as the Simien fox or jackal, by British naturalist Dr Leslie Brown who visited Simien, Bale and Arsi in the early 1960s. Dr James Malcolm visited Bale several times since 1974 and has continued to champion this rare canid's plight outside Ethiopia. Dr Chris Hillman from the New York Zoological Society set up the Bale Mountains Research Project in 1983. He collected the first population information on the species and lobbied to establish a research team to assess the conservation needs of the Ethiopian wolf. As a result, Claudio Sillero and Dada Gottelli initiated the Ethiopian Wolf Project in Bale in 1988. This study was completed in 1994.

Since 1995, the Ethiopian Wolf Conservation Programme has continued under the auspices of the Wildlife Conservation Research Unit of Oxford University, and in collaboration with the Zoological Society of London and Edinburgh University. A five-year funding pledge secured in 1999 from the Born Free Foundation coupled with the signing of Memoranda of Understanding with the Government of Ethiopia (at federal and regional levels) in 2000 meant that the activities of the EWCP began in earnest at this time.

The overall goal to which the Ethiopian Wolf Conservation Programme (EWCP) contributes is:

**The conservation of the Ethiopian wolf and its Afroalpine habitat, and the social and economic well being of local communities are mutually and sustainably secured.**

In the long-term, this can be achieved through solutions that require transferring the ownership, activities and responsibilities to Ethiopian institutions with relevant mandates. This, in turn, requires the capacity of those institutions to be built.

However, the EWCP is a relatively small programme with a limited budget. Therefore, the goal and objectives listed herein, necessary though they are for the persistence of the Ethiopian wolf and its Afroalpine ecosystem, are in no way attainable by this programme alone. Consequently, the EWCP has and must continue to act as a catalyst or play a facilitatory role in some circumstances. In doing so, it can significantly contribute to but not always be sole executor for the achievement of those goals and objectives.

In the long-term, the purposes of the programme are:

- To secure the conservation of areas of Afroalpine ecosystem, their biodiversity and ecological processes. The importance of the Afroalpine ecosystem in which the Ethiopian wolf lives cannot be overemphasised. Many of the endemic plants and animals that have been described for Ethiopia are specifically associated with this ecosystem. Thus, the conservation of the Ethiopian wolf and its Afroalpine ecosystem has a profound knock-on effect on the conservation of many endemics confined to this ecosystem.
- To assess, address and counteract threats to the survival of Ethiopian wolves
- To enhance the focus on and strength of the environment sector, and particularly biodiversity conservation, within Ethiopia

The goal, threats and project purposes determine the levels at which the EWCP should operate within Ethiopia.

## **Threats**

Much of the EWCP's work must pivot around predicting, analysing and counteracting threats to the Ethiopian wolf and their Afroalpine ecosystem. There are different levels at which the threats operate and those most relevant are briefly examined here.

The threats to the Afroalpine ecosystem, defined as the altitudinal range that is critical to the Ethiopian wolf and other associated endemics (3,200 - 4,600m), are underpinned by increasing human pressure - 80% of the human population of Ethiopia are found in the highlands. While data on changes in the land area of the ecosystem are not available, people are tilling land at increasingly high altitudes. In some areas in northern Ethiopia, land is being tilled for barley production up to 4,100m. A further symptom of the change has been the increase in the use of the Bale Mountains recorded by the EWCP. In the rainy season of 2002, the number of livestock in the Web valley of the Bale Mountains reached the unprecedented 22,000 head of livestock (thus, a density of 314 animals/km<sup>2</sup> in the 70km<sup>2</sup> area). This means that the areas are now: 1) Limited in size. The entire area of Afroalpine ecosystem in Sub-Saharan Africa is 11,817km<sup>2</sup> (0.0005% of the area of SSA); of this, 73% is found in Ethiopia with 17.5% of the total being found in the Bale Mountains alone, and 2) Fragmented. Even within Ethiopia, the Afroalpine ecosystem is divided into at least nine geographically isolated areas.

Finally, an estimated 610 individual Ethiopian wolves survive today. The wolves are found in seven Afroalpine areas (see Figure 1); some of these populations are further sub-divided. The largest population (even following the rabies outbreak of 2003/04) of approximately 330 animals is found within the Bale Mountains, in the south-central Ethiopia. All the other populations are small and isolated.

Work carried out from 1988 - the present day has led to the determination of the main threats to the wolves, some of which overlap with the threats to the Afroalpine ecosystem to which the wolf is inextricably linked. In approximate order of importance, these are:

1. Lack of protection of the habitat, whether through sustainable use by local communities or through meaningful management within the two Afroalpine protected areas (Bale and Simien Mountains National Parks). This has led to: a) habitat loss and fragmentation due to high-altitude subsistence agriculture, and b) habitat loss due to overgrazing of highland pasture when domestic livestock densities are very high - as they currently are. [At lower densities, domestic livestock may replace the ecological role that wild ungulates used to play. Wild ungulates have been all but eliminated from the Afroalpine ecosystem.]
2. Canid related diseases, particularly rabies and canine distemper
3. The inherent threats to a species that exists in such small and isolated populations
4. Human interference and persecution due to conflict over livestock losses
5. Indiscriminate poisoning in reprisal for livestock losses, usually to spotted hyaenas
6. Some areas have been put forward for the development of commercial sheep farms - which would not be compatible with Ethiopian wolf conservation
7. Hybridisation with domestic dogs, and
8. Interference competition with domestic dogs, and road kills on the increasing number of roads crossing the Afroalpine habitats.

## **Activities and achievements**

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In each of the following sections, the activities and their associated objectives are described. These sections and objectives appear as they were originally set out in the project proposal that was submitted to the Government of Ethiopia and which was attached to each of the Memoranda of Understanding with the Ethiopian Wildlife Conservation Organisation, and the Amhara and Oromiya Agricultural Bureaux.

Under each section, the associated achievements for the period 2000 - 2004 (thus, the period covered by the present Memoranda of Understanding) are described.

Finally, the "Future Work" that is listed under each section describes those activities that are necessary to continue implementing. These activities are specifically to counteract those factors that remain a threat to the Ethiopian wolf and their Afroalpine ecosystem.

There are some problems with listing achievements in the field of conservation. First, conservation programmes in developing countries, in working to build the capacity of local institutions and people, and changing the attitudes and behaviour of local communities, must work in long timeframes to have significant impacts. Second, we do not run a 'controlled experiment' in our interventions. Therefore, we do not leave 'control' areas in which no activities take place: there are so few wolves and so few areas with wolves that we act in all areas. As a consequence, we have few direct measures to determine the direct success of our activities. Changes could, arguably, have occurred even in our absence - particularly those that happen over long periods of time. However, we can say that in our absence, the threats to the Ethiopian wolf and its Afroalpine ecosystem would be more acute. Overall, we can say that, despite the threats to their survival, the Ethiopian wolf remains in its habitat! There are, however, many achievements of the EWCP in the past four years. Therefore, with the notable exception of the emergency intervention to protect two high density sub-populations of wolves from the outbreak of rabies that occurred in the Bale Mountains in 2003-04, mostly they are indirect measures of success.

### ***A. Coordination and Administration of the Conservation Programme***

#### **A1. Coordination of the Ethiopian Wolf Conservation Programme**

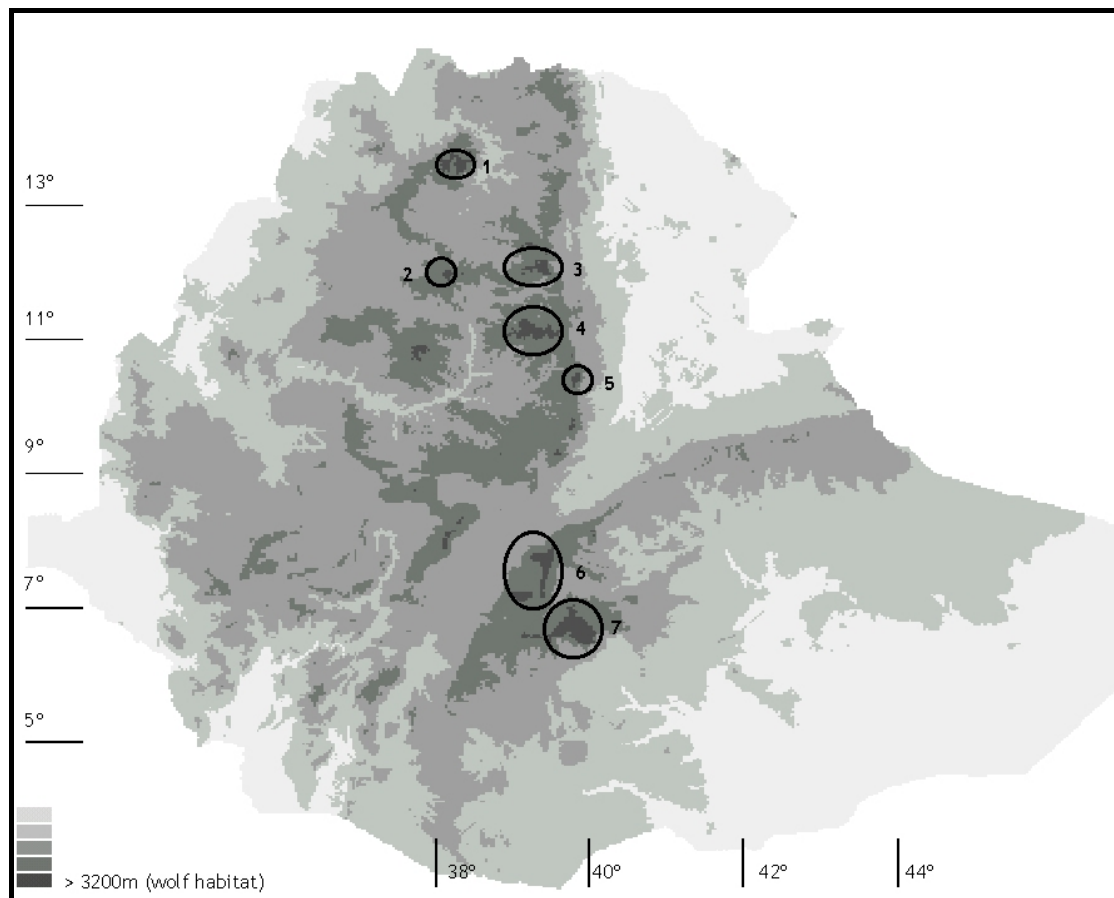
*Objectives: To support a full-time coordinator for the EWCP to oversee the progress of the different tasks in the EWCP, to assure the continuity of various objectives, liaise with donors and international agencies and promote EWCP activities*

##### **Achievements**

- The appointment of a full-time Coordinator, Dr Stuart Williams. He has been EWCP Coordinator from June 2000 - present

- The programme has worked in close collaboration with the Government of Ethiopia, both at a federal and regional level
- Memoranda of Understanding with the Government of Ethiopia were signed in 2000, both with the federal and regional governments. The agreements were specifically with the Ethiopian Wildlife Conservation Organisation (EWCO, currently known as the Wildlife Conservation Department) at a federal level and with the Agricultural Bureaux of the Amhara National Regional Government and the Oromiya Regional State.
- The budget of the programme is currently € 200,000 per year. This is € 85,000 per year more than given in the estimated budget in 2000. This increase in budget comes from successful fund raising. The current funding comes from a broad range of donors including the Born Free Foundation, Frankfurt Zoological Society, Wildlife Conservation Society, Disney Wildlife Conservation Awards, Wildlife Conservation Network.
- The amount of funding that is going into rural areas where wolf ranges are found means that the EWCP is the organisation with the biggest contribution to the local economy in Dinsho and surrounding areas in the Bale Mountains.
- The programme works under the aegis of the IUCN/SSC Canid and Veterinary Specialist Groups
- The programme has championed wildlife conservation in Ethiopia. For example, we led the initiative to have the Ethiopian Highlands included as one of Conservation International's Biodiversity Hotspots. Once the new edition of CI's Hotspots book is published (expected late 2004), Ethiopia will be eligible for funding from a variety of CI's funding mechanisms.
- The programme acts as a focal point for the international community on matters regarding wildlife conservation in Ethiopia. For example, the programme is facilitating research on many aspects of wildlife in the country, including: a) human-gelada conflict, b) hormonal influences on gelada behaviour, c) ecology of mountain nyalas, d) the trophic relationships in the Afroalpine ecosystem of the Bale Mountains.
- Over the past four years, the EWCP has featured prominently in national (Meet ETV) and international television (BBC, German TV).
- With the cooperation and collaboration of the EWCP, internationally renowned photographers (for example, Martin Harvey, Anup Shah) have photographed the wolves.
- There have been numerous publications in prominent popular and scientific magazines and journals, including *BBC Wildlife*, *African Geographic*, *Conservation Biology*, *Animal Conservation*, *Molecular Ecology* and *Oryx* (see publication list for full details). An article on the Ethiopian wolves and the work of the EWCP in the globally reaching *National Geographic* is currently in press.
- The programme currently employs 25 full-time staff (21 of whom are recruited from local communities in the wolf ranges) ; in addition, the programme employs over 50 part-time or casual workers from local communities each year
- The programme expanded its focus over the past four years. Whereas before 2000, the programme was focused almost entirely in the Bale Mountains, the programme now maintains a permanent presence in the field in six (of a total

of seven) areas in which the Ethiopian wolf is known to persist in the country (Figure 1).



**Figure 1.** The areas in Ethiopia where Ethiopian wolves are known to persist and where the EWCP is carrying out its activities: 1) Simien Mountains, 2) Mt Guna, 3) north Wollo, 4) south Wollo, 5) Guassa-Menz, 6) Arsi Highlands, and 7) Bale Mountains.

### Future Work

- A steering committee for the EWCP needs to be established to guide the EWCP Coordinator and the activities of the programme. The steering committee would include national and international technical experts in the fields in which the EWCP is active (thus, disease prevention, environmental education, protected area management, community participation, natural resource management, ecotourism development, monitoring, capacity building and research).
- A full-time Coordinator is still required:
  - To oversee, manage and administer the activities of the EWCP
  - To liaise and collaborate with, and advise the Government of Ethiopia on matters pertaining to the conservation of the Ethiopian wolf and its Afroalpine ecosystem
  - To raise and manage funding for the programme
  - To promote the activities of the project, through publications and by acting as a spokesperson for the project
  - To promote the environment sector and particularly wildlife conservation in Ethiopia

- To champion the Ethiopian wolf, the Afroalpine ecosystem, the biodiversity and wildlife conservation in Ethiopia

## **A2. Establishment of an Ethiopian Wolf Conservation Committee**

*Objectives: To organise a conservation committee that will be a multi-disciplinary group to review the EWCP progress in regular meeting and address special biological and logistic needs.*

### **Achievements**

- Two meetings of the Ethiopian Wolf Conservation Committee have been held (2001 and 2003) in Addis Ababa
- A meeting of the IUCN/SSC Ethiopian Wolf Working Group was convened at the Conference on Canid Biology and Conservation (held in the Department of Zoology, University of Oxford, UK, 17 - 21 September 2001)

### **Future Work**

- The Ethiopian Wolf Conservation Committee is still a good body through which to address broader issues within EWCP, including aspects such as agreement extension.

## ***B. In situ conservation of Ethiopian wolf populations***

### **B1. Determine distribution, numbers and status of all Ethiopian wolf populations**

*Objectives: Determine distribution, numbers and current status of all Ethiopian wolf populations; evaluate the quality and availability of suitable habitat for each of the known wolf populations throughout the range using GIS and landscape ecology theory*

#### **Achievements**

- Surveys completed of the majority of Afroalpine areas (thus, areas over 3,200m ASL) in Ethiopia. These surveys were carried out by Dr Claudio Sillero, Dr Jorgelina Marino, both of the Wildlife Conservation Research Unit of the University of Oxford, UK and Mr Neville Ash, currently of the Millennium Ecosystem Assessment of the UNEP/WCMC and EWCP staff members.
- Wolf populations confirmed in:
  - Simien Mts (Gich, Sabat Minch, Ras Dashen, Chenek, Silki)
  - Mt Guna
  - north Wollo highlands (Abune Josef, Aboi Gara and Delanta)
  - south Wollo highlands (Antot-Kewa, Belechuma, Denkoro)
  - Guassa-Menz
  - Arsi highlands (Mt Chilalo, Galama, Mt Kaka) and
  - Bale Mountains
- The data from the surveys were compiled in a central database; using GIS software the spatial interrelationships of the populations were examined.
- The surveys have been reported in the international scientific press: Marino, J. (2003) Threatened Ethiopian wolves persist in small isolated Afroalpine enclaves. *Oryx*, 37, 62-71.
- The results were also reported in: Marino, J. (2000). Status and distribution of the Ethiopian wolf. In *Ethiopian Wolf: Conservation Strategy Workshop* (eds C. Sillero-Zubiri, J. Malcolm, S.D. Williams, J. Marino, Z. Tefera, K. Laurenson, D. Gottelli, A. Hood, D. Macdonald, D.E. Wildt & S. Ellis). Ethiopian Wolf Conservation Programme, Dinsho
- The extent of these areas has been mapped and changes in their extent are being monitored. The results of the initial mapping are reported in: Marino, J. (2004) *Spatial Ecology of the Ethiopian wolf*. DPhil thesis, University of Oxford, UK and in Marino, J. (2003) Threatened Ethiopian wolves persist in small isolated Afroalpine enclaves. *Oryx*, 37, 62-71. The mapping of the extent of the areas of Afroalpine ecosystem in the country continues. Further data will be available in December 2004.
- Further surveys by EWCP staff were carried out in Arbe Gona (wolf signs detected and questionnaires suggest presence of wolves but no confirmed sightings of wolves) and Gara Mulata (no wolf signs or reports from local people - wolf presence highly unlikely)

- A report of a single sighting of an Ethiopian wolf in the Hurri Hills from 1985 was received. The area was surveyed and local people interviewed: no wolves persist in the area.
- Overall estimates of wolf numbers in these areas known to harbour populations are more accurate than ever before. The current total estimate for wolves in the country is 610.
- In most areas in the Bale Mountains, the wolf population has been increasing since the 1991-92 outbreak of disease and upsurge of disorder.
- In the Web valley of the Bale Mountains, the population increased beyond these previous densities at which point they crashed from an outbreak of rabies in 2003-04.

### Future Work

- Further analysis is necessary to determine the biological characteristics of the Ethiopian wolf that has allowed it to persist in small, isolated populations.
- It is essential that the programme starts to consider the long-term effects of global warming on the Ethiopian wolf. Because altitudinal variation in populations does exist, comparison of the ecology across populations would suggest how adaptable the wolves might be to the changes in vegetation that will be associated and inevitable with global warming.
- The Afroalpine habitat on Mt Choke in Gojjam needs to be surveyed to assess its suitability for the re-introduction of Ethiopian wolves. If the habitat is found to be suitable (thus, rodent densities are high, domestic dog densities are low, livestock use of the area is limited), a trial re-introduction should be carried out. This would involve a multi-disciplinary team to select and move the animals to the area.
- A few areas remain to be surveyed by EWCP staff. They include:
  - Mt Gurage (c. 3,600m)
  - Rabel (c. 3,900m)
  - Degem (c. 3,550m)
  - Mt Guge (c. 3,570m although anecdotes from other people that visited the area suggest that wolves are not present)
  - Wib Hamer (c. 3,350m)
  - Arbe Gugu (c. 3,625m)

## **B2. Taxonomy and inter-population variability of Ethiopian wolves**

*Objectives: Determine whether wolf populations on both sides of the Rift valley deserve sub-specific status and quantify variation across populations*

### Achievements

- This work has been led by Dada Gottelli from the Institute of Zoology of the Zoological Society of London
- The work is complete and has been published in: Gottelli, D., J. Marino, C. Sillero-Zubiri & S. M. Funk (2004) The effect of the last glacial age on speciation and population genetic structure of the endangered Ethiopian wolf (*Canis simensis*). *Molecular Ecology*, 13(8), 2275-2286. The principal findings of the work are:

- The results do not support taxonomic classification of the Ethiopian wolf into two subspecies
- The wolves diverged from a wolf-like ancestor approximately 100,000 years ago
- At the onset of deglaciation approximately 15,000 years ago, the partitioning of the mtDNA haplotypes occurred
- Further analysis of the samples using other genetic markers (using microsatellites rather than mitochondrial DNA as in the above work) is now complete; these data are being prepared for publication in a scientific journal.

#### Future Work

- The majority of this work is complete
- The data should be further analysed to use the genetic variation among Ethiopian wolf populations to prioritise conservation efforts to ensure the protection of at least 90% of the genetic variation of the Ethiopian wolf.

### **B3. Study of dog/wolf hybridisation and genetic variability in wolf populations**

*Objectives: Quantify the degree of wolf-dog hybridisation; determine levels of genetic variability within populations; quantify rate of genetic loss*

#### Achievements

- This work has also been led by Dada Gottelli from the Institute of Zoology of the Zoological Society of London
- The work on the levels of genetic variability within and among populations is partially complete. The results of the inter-population variation has been published in: Gottelli, D., J. Marino, C. Sillero-Zubiri & S. M. Funk (2004) The effect of the last glacial age on speciation and population genetic structure of the endangered Ethiopian wolf (*Canis simensis*). *Molecular Ecology*, **13**(8), 2275-2286.
- A study on the social and behavioural determinants of genetic variation within and among populations of Ethiopian wolves has also been initiated and is ongoing. This work is being carried out by Deborah Randall.
- The above study will also model the maintenance of genetic variation over time.

#### Future Work

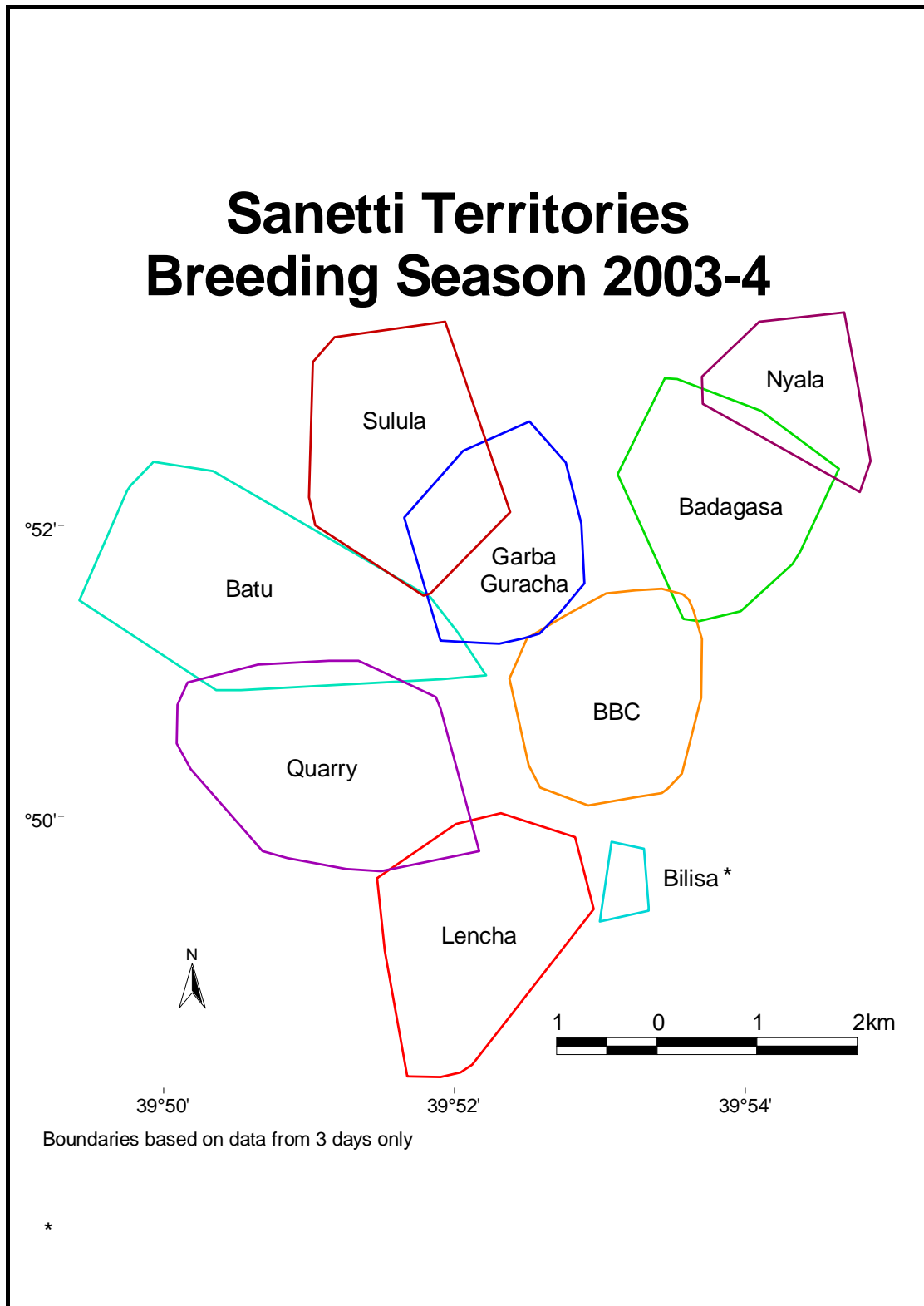
- The work on the degree of wolf-dog hybridisation is ongoing, but preliminary results were originally published in Gottelli, D., Sillero-Zubiri, C., Applebaum, G.D., Roy, M.S., Girman, D.J., Garcia-Moreno, J., Ostranders, E.A., & Wayne, R.K. (1994) Molecular genetics of the most endangered canid: The Ethiopian wolf *Canis simensis*. *Molecular Ecology*, **3**, 301-312.
- Further work is necessary on the intra-population variation. Data are available on the intra-population variation in the Bale Mountains, but not for other populations. The Bale Mountains data are currently being analysed.
- The genetic variation within and among populations will be monitored over time to determine to actual loss of variation. These data will be compared to the models produced in Deborah Randall's study (see above).

## **B4. Monitor demography and dynamics of selected Ethiopian wolf populations**

*Objectives: To monitor the demographic trends of selected, critical wolf populations*

### **Achievements**

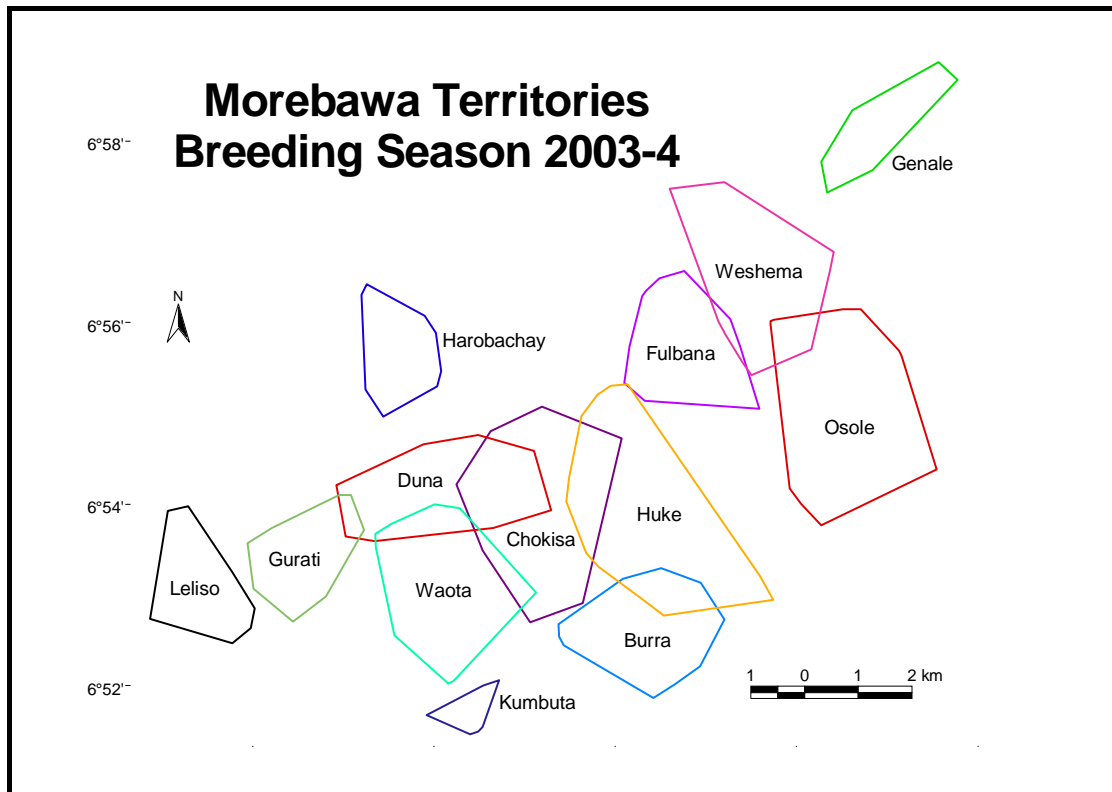
- The Ethiopian wolf has recently been downlisted by the IUCN/SSC Canid Specialist Group from Critically Endangered to Endangered. It may not be strictly possible to attribute this to the work of the EWCP but we can say with certainty that they would be more threatened in our absence.
- Until the crash in the Web valley population (one of three high density sub-populations in the Bale Mountains), the number of Ethiopian wolves in the Bale Mountains increased since the inception of the EWCP. In the other two high density sub-populations (Sanetti and Morebawa), the number of wolves has been steadily increasing. In 1991, the population of wolves in Bale crashed as a result of a rabies and canine distemper epidemic. It is estimated that there were approximately 150 animals that survived the disease outbreak. At present, the EWCP monitors 300 wolves in the Bale Mountains. Note that this is the post-rabies estimate: it does not include the estimated 60 - 64 animals that died or disappeared (and were presumed dead) during the 2003-04 rabies outbreak.
- Since the outbreak of rabies in 2003, this work has been led by Ms Deborah Randall, currently a PhD student in the Wildlife Conservation Research Unit of the University of Oxford, UK.
- The EWCP monitoring team has expanded considerably over the past four years, in part because of the need to follow-up on the emergency vaccination of wolves in the Bale Mountains that was implemented to contain the disease to the Web valley.
- The EWCP has staff monitoring all wolf ranges where wolves are known to exist. In six (of the seven) areas, the EWCP has a permanent presence. EWCP staff visit the remaining area (Mt Guna) at least three times per year.
- We have a more accurate understanding of the wolf populations than ever before.
- The information on Ethiopian wolf populations is better than for any other species in Ethiopia.
- In the Bale Mountains, the quality of the data on the wolf populations has increased, culminating in the data that has followed on from the outbreak of rabies in the Bale Mountains in 2003-04 and the intervention that took place to contain the disease (see below; Table 1). Preliminary data from this monitoring are in press (D. Randall, *et al.* In press. *Emerging Infectious Diseases*). Other publications from this work are being prepared.
- Similarly, the quality of the data in other populations has improved such that population estimates are made from actual sightings of wolves (Table 2) rather than the previous method which was extrapolation from the extent and estimates of the quality of the habitat (see Marino, J. 2003 Threatened Ethiopian wolves persist in small isolated Afroalpine enclaves. *Oryx*, 37, 62-71.). These data are being prepared for publication.



**Figure 2.** As an illustration of the detailed monitoring data collected by the EWCP, the territories of the packs found in the high density area of the Sanetti plateau in the Bale Mountains.

- For the first time, data are available for the populations in northern Ethiopia for two consecutive years
- For the first time for a number of years, we have established a network of rain gauges in the Bale Mountains. These are storage rain gauges with the rainfall

being recorded once a month. Rain gauges have been installed in Dinsho, Morebawa, Sodota and Sanetti. They are either monitored by the team or, in Sodota, by persons from the local community. Further rain gauges are to be installed in Rira and possibly Chochora once the ranger post is manned.



**Figure 3.** Similar pack territories from the Morebawa area of the Bale Mountains. Similar data were available for the Web valley before the rabies outbreak of 2003-04. The Web valley continued to be monitored to determine how the survivors of the rabies outbreak will organise themselves, both socially but also spatially.

- The publication of the Field Manual (S. Newey and C. Sillero-Zubiri 2002 *Monitoring Ethiopian wolf populations: A Field Manual*. Wildlife Conservation Research Unit, Oxford University, UK) has proved to be a useful tool for all the teams in the field that are monitoring the wolf populations and the Afroalpine areas. Its primary function has been to standardise the data collection regimes used in the monitoring of wolf populations and areas.
- Permanent rodent trapping grids in the Guassa-Menz area have been established and monitored since 1997. Changes in the rodent densities in these grids have been logged as a result.
- Permanent rodent trapping grids are currently being established in the Bale Mountains.
- Human use of the Afroalpine areas has also been monitored. Permanent transects were travelled every month (Bale Mountains) and every two-three months (northern Ethiopia) to determine density of users and seasonality of use of the Afroalpine areas. The use of the areas falls predominantly into the following categories: livestock grazing, mineral spring (hora) use, grass cutting (for thatch), construction material collection and firewood collection.

#### Future Work

- The populations require monitoring at the same intensity as the current monitoring effort in order to perceive changes in their status (thus, to determine whether the populations are increasing or decreasing). The monitoring of all populations needs to be maintained in the long-term for population dynamics to be understood.
- Detailed ecological research is necessary on the small and isolated populations of Ethiopian wolf outside of the Bale Mountains. This would allow us to understand more on the mechanisms that allow these small and isolated populations to persist over time.
- In the long-term, a cost-effective protocol for monitoring wolf population in all ranges needs to be developed. This requires the comparison of monitoring techniques (e.g., line transects, capture-mark-recapture techniques using genetic markers from faecals or monitoring pack compositions over time). EWCP staff will then have to be trained in the field methods, and data entry and analysis.
- Given the success of the capture, handling and anaesthetising of wolves in the Bale Mountains following the outbreak of rabies in 2003-04 (see below), tagging wolves using ear tags and, occasionally, radio-telemetry collars, could be considered for other populations. These tags will significantly improve the quality of the monitoring data in these areas as they have for the monitoring of the wolves during the follow-up from the capture intervention in the Bale Mountains.
- The monitoring of these populations will evaluate the success of future any future Ethiopian wolf conservation work.

## **B5. Monitor the prevalence of disease in domestic dog and wild carnivores in Bale Mountains**

*Objectives: Determine and monitor the incidence of disease in Ethiopian wolves and sympatric domestic dogs; obtain information in health status, diseases and causes of mortality in wolves to assess prevalence and threat of canid pathogens to wolves*

### **Achievements**

- This work has been led by Dr Karen Laurenson, formerly of the Centre for Tropical Veterinary Medicine of the University of Edinburgh, UK and currently an Africa Programme Officer for the Frankfurt Zoological Society.
- Despite vaccination of dogs around the BMNP, an outbreak of rabies occurred in 2003. The monitoring team were successful in documenting the outbreak and collecting a large number of samples for diagnosis. Rabies was confirmed from wolf brain samples sent to Centres for Disease Control and Prevention, Atlanta, USA. Emergency disease management was carried out through the parenteral vaccination of wolves in adjacent subpopulations (see below).
- The area in which the outbreak took place, the Web valley (also known as the Kotera plain), between 60 - 64 (67 - 71%) of the 90 wolves that had been in the area prior to the outbreak died or disappeared and were thus assumed to have died from rabies. A total of 41 carcasses were recovered by the EWCP monitoring team.
- The presence of the EWCP wolf monitoring team in the field detected the rabies outbreak in its infancy. In the absence of such a team and the subsequent intervention, the rabies outbreak may well have spread throughout

the Bale Mountains. This may have resulted in the loss of over half the global population of wolves if mortality elsewhere was similar to that recorded in the Web valley.

- Preliminary data collected from the outbreak are being published in an eminent scientific journal: Randall, D., Williams S, Shiferaw F, Argaw, K, Tallents, L, Knobel, DL, Sillero-Zubiri, C., MK Laurenson. (in press) Rabies outbreak in endangered Ethiopian wolves. *Emerging Infectious Diseases*.
- A random interview survey of households in all villages and hamlets in the Bale Mountains was also carried out following the rabies outbreak. The aim of this survey was to determine the track of the disease through the domestic dog population, the economic cost through loss of livestock and the health risk to people through the number of people bitten by rabid animals. These data are being entered onto the EWCP database for further analysis.
- The prevalence of disease among wild carnivores has been studied. A number of species of small wild carnivore were caught. Blood was collected from these animals and the sera was screened for antibodies to canid diseases. The species caught included: common genets, African civets, golden jackals and white-tailed mongooses.
- This work has demonstrated that domestic dogs are the reservoir for canid diseases such as rabies. This is reinforced by EWCP surveys which show that the people in the Bale Mountains own a mean number of 2.1 domestic dogs per household and that all households own dogs. In contrast, a house-to-house interviews carried out among local communities living within and surrounding wolf ranges in northern Ethiopia revealed that only 44.4% of households (n=524 over all areas in the north) own dogs at all and less than 8% own more than one dog. However, household densities are higher in northern Ethiopia - thus, dog densities may be equivalent in the two areas of the country.
- The behavioural ecology of several species of wild carnivore was also studied to correlate with the results of the screening of their sera. The species included white-tailed mongooses, common genets, African civets and golden jackals. The results of this study are published:
  - Admasu, E., 2001 *The ecology of small wild carnivores in the Bale Mountains, Ethiopia*. MSc thesis, Addis Ababa University
  - Admasu, E., Thirgood, S.J., Bekele, A. & Laurenson, M.K. (2004) Spatial ecology of golden jackal in farmland in the Ethiopian Highlands. *African Journal of Ecology* 42, 144-152.
  - Admasu, E., Thirgood, S.J., Bekele, A. & Laurenson, M.K. (2004) Spatial ecology of white-tailed mongoose in farmland in the Ethiopian Highlands. *African Journal of Ecology* 42, 153-159.
  - Admasu, E., Thirgood, S.J., Bekele, A. & Laurenson, M.K. (2004) A note on the spatial ecology of African civet and common genet in farmland in the Ethiopian Highlands. *African Journal of Ecology* 42, 160-162.
- The EWCP teams have been trained to carry out post mortem on dead animals and collect samples for diagnostic testing
- In addition to the above work, the EWCP carried out a detailed ecological study of the domestic dogs on the wolf range (the Web valley) in the Bale Mountains. This study was carried out by Anagaw Atickem in partial fulfilment of his MSc

degree and was conducted in collaboration with Addis Ababa University. Key findings include:

- The density of domestic dogs is greater than ten-fold higher than that of Ethiopian wolves
- All dogs in the wolf range are owned: over the course of 21 months of fieldwork, no ownerless or feral dogs were recorded. It was suggested that feral dogs may move through the ecosystem very rarely.
- Despite being owned, a small proportion of the dogs (<3%), move relatively widely in the habitat. These dogs have frequent and often close interactions with Ethiopian wolves. It was suggested that they would be the dogs that are most difficult to catch for vaccination purposes.
- The dogs have two functions for the people: i) they reduce depredation of domestic livestock by spotted hyaenas by acting as an 'early-warning' system, and ii) they keep the villages and hamlets clean of human refuse, including livestock carcasses, food preparation waste and human faeces.
- Only 2% of 362 households in the Web valley have any sort of protective enclosure for livestock at night.

#### Future Work

- A permanent presence, in the form of the EWCP wolf monitoring team, will be maintained in all areas in order to detect disease outbreaks among Ethiopian wolves, domestic dogs and other species of wild carnivore
- The data that have already been collected by the EWCP need to be analysed and published.

### **B6. Test methods to prevent disease transmission in domestic and wild carnivores**

*Objectives: Investigate the feasibility, effectiveness and sustainability of a vaccination scheme to protect Ethiopian wolves in BMNP from disease transmission; improve disease monitoring practices in Ethiopia*

#### Achievements

- This work has also been led by Dr Karen Laurenson, formerly of the Centre for Tropical Veterinary Medicine of the University of Edinburgh, UK and currently an Africa Programme Officer for the Frankfurt Zoological Society.
- An individual-based mathematical model of a wolf population that incorporates disease as a dynamic process was used to explore the consequences for wolf population persistence of different wolf vaccination strategies (Haydon *et al.*, 2002 *Conservation Biology*, **16**, 1372-1385). Further analysis using this model explored the effect of variation in patterns of wolf population vaccination coverage (Laurenson *et al.*, under review). Results suggest that in large populations, extinction risk is substantially reduced by vaccinating just 10-20% of pups or 25% of packs, and that most of the potential reduction in extinction risk is realized by vaccinating 40-60% of pups. However, in small populations, reduction in extinction probability continues by increasing coverage beyond 90%, but complete removal of extinction risk requires vaccination of at least 75% of packs. This is primarily a function of the fragility of these very small

populations and that any additional mortality confers extinction risk. The simulation results also clearly indicate that if resources only permit vaccination of a certain percentage of the population, then this effort is best deployed by vaccinating all individuals in a restricted number of packs, rather than a restricted number of individuals in all packs i.e. effort should be concentrated in a subset of packs rather than dispersed through the population. This is an encouraging result, given the potential time involved in finding den sites in unmonitored wolf populations. The actually coverage that may be obtained under field conditions must now be determined.

- This work has been published in Haydon, DT, MK Laurenson & C Sillero Zubiri. 2002. Integrating epidemiology into population viability analysis: the risk posed by rabies and CDV to Ethiopian wolves *Conservation Biology* 16, 1372-1385
- Trials to examine the cost-effectiveness of both oral and parenteral vaccination in Ethiopia wolves have been instigated. As a first step, oral bait acceptance trials have been conducted in the Bale Mountains to determine the preference of wolves for 4 candidate baits. Wolves preferred locally caught rodents, the wolves' main prey followed by chicken heads. Commercial racoon baits and commercial fox baits were least preferred. Further experiments this year using topical biomarkers and beads in baits have shown that direct observation is the only method available to ascertain which animals have ingested baits. Six wolves, that had ingested rodent baits and that were caught 24-48 hours afterwards as part of the wolf vaccination intervention (see below), did not have staining on the oral mucosa. In addition, although beads are passed in faeces, defecation occurs too infrequently to be a reliable indicator of pack coverage.
- In response to the outbreak of rabies in the Bale Mountains in 2003, the EWCP carried out an emergency intervention to contain the outbreak to the Web valley. The Web valley is one of three areas with the capacity to support high densities of wolves. The intervention took place to prevent the spread of the rabies outbreak to the remaining two areas - the Sanetti plateau and the Morebawa areas of the Bale Mountains. The method used was capture and parenteral vaccination of the wolves. The majority of the wolves were also anaesthetised a) to reduce the stress to the wolf while it was being handled, 2) to enable various samples to be taken (for individual identification, analysis of MHC complex and serology). A total of 72 wolves were captured and vaccinated; a sub-sample of 18 wolves was recaptured 30 days after vaccination to determine the extent of antibody response to vaccination. All 18 recaptured wolves had sero-converted on vaccination. A further sample of these animals will be recaptured 9-12 months after initial capture to determine the duration of protection. These data are being published (Randall *et al.* In press *Emerging Infectious Diseases*). Further papers from the outbreak of rabies are also being prepared for publication including modelling work to examine how the disease spread through the population.
- Overall, this work has produced the following other publications:
  - Laurenson MK, Mlengeya, T, Shiferaw F & Cleaveland S. 2004. *Approaches to canid disease control for the conservation of endangered wild carnivores*. Proceedings of the AHEAD Meeting, Durban, South Africa Sept 2003;
  - Laurenson, MK, Cleaveland S, Artois M & Woodroffe R. 2004 The disease threat to canids; guidelines for investigation and

management. In *Canid Action Plan* (Eds C Sillero Zubiri & DW Macdonald.). IUCN publications, Gland, Switzerland;

- Woodroffe, R, Cleaveland S, Courtenay, O, MK Laurenson, & M Artois. 2004. Infectious disease in the management and conservation of wild canids. In *The Biology & Conservation of Wild Canids*, Edited by David W. Macdonald & Claudio Sillero-Zubiri Oxford University Press;
- Laurenson MK, DT Haydon & EWCP. 2001. Target or reservoir disease control in endangered species: Cost-effectiveness of dog and Ethiopian wolf vaccination. *Proceedings of the sixth Conference of the Southern and East African Rabies Group*, Lillongwe, Malawi, June 2001.

### Future Work

- There is a need to carry out research and development necessary to test the efficacy and cost-effectiveness of using oral vaccines in domestic dogs and Ethiopian wolves as a method for reducing the risk of rabies among Ethiopian wolves. This could be the most cost-effective method of protecting Ethiopian wolf populations against disease (see Haydon *et al.* 2002 *Conservation Biology*, 16, 1372-1385 for a full discussion on this).
- Carry out pilot work to reduce domestic dog populations in wolf ranges by removing their functionality (see results of domestic dog ecology study mentioned above). Thus, people in villages and hamlets in and surrounding wolf range could be persuaded not to replace their current dogs once they die off but that the people could be taught i) to construct predator-proof enclosures in which to keep their livestock at night and ii) to dig pits for refuse disposal and defecation.
- A disease prevention strategy should be developed so as to ensure that it is being cost effective. Disease prevention strategies include:
  - Parenteral vaccination of domestic dogs (requires handling of dog which, as stated below, can be impossible because of the highly aggressive nature of the dogs)
  - Oral vaccination of domestic dogs (research and development under way; permission to carry out vaccination trials pending)
  - Oral vaccination of Ethiopian wolves (research and development under way; permission to carry out vaccination trials pending)
  - Reduce dog population (through education, seeking alternative strategies for the local communities to reduce depredation and refuse disposal, see above, and/or a dog oral contraceptive campaign)
  - Law enforcement in protected areas (the legislation for which states that domestic animals are prohibited)
  - Strengthen the capacity of local veterinary clinics to enable them to carry out vaccination campaigns
  - Educate local people voluntarily to have their dogs vaccinated in local vet clinics
  - Promote legislation change that would enforce dog owners to have their dogs vaccinated against rabies

## **B7. Prevention of disease transmission in domestic and wild carnivores through vaccination of domestic dogs**

*Objectives: Protect Ethiopian wolves from canid-related diseases, by implementing domestic dog vaccination schemes*

### **Achievements**

- Since 1999, the EWCP has been carrying out a vaccination campaign among domestic dogs within and surrounding wolf ranges in the Bale Mountains. The EWCP has also vaccinated dogs in south Wollo and Guassa-Menz.
- The EWCP is the only organization in Ethiopia that is systematically vaccinating domestic dogs against canid diseases and particularly rabies. This is particularly notable because a) rabies is pandemic in Ethiopia (Yimer, E., Newayeselassie, B., Teferra, G., Mekonnen, Y., Bogale, Y., & Zewde, B. 2002 Situation of rabies in Ethiopia: a retrospective study 1990-2000. *Ethiopian Journal of Health Development*, 16, 105-112.) and b) human mortality from rabies in Ethiopia is the highest in the world (Haupt, W. 1999 Rabies - risk of exposure and current trends in prevention of human cases. *Vaccine*, 17, 1742-1749).
- The EWCP's policy on disease prevention (see above) is in contrast to accepted government strategies which include the periodic destruction of large numbers of dogs particularly in towns.
- Over the period 1999 - present, the EWCP veterinary team administered 8632 rabies vaccines to dogs within and surrounding the wolf ranges in the Bale Mountains. The annual figures break down as follows: 1998 (Dec only): 373 dogs, 1999: 1022 dogs, 2000: 1676 dogs, 2001: 1138 dogs, 2002: 1588 dogs, 2003: 2835 dogs.
- While the vet team was simultaneously carrying out the pilot sterilisation campaign (see below), the vaccination coverage was lower than expected.
- In general, vaccination coverage in each village in the Bale Mountains that was visited by the EWCP vaccination team was over the target of 70% that is recommended and required to prevent outbreaks of rabies among dog populations (Coleman, P.G. & Dye, C. 1996 *Vaccine*, 14, 185-186)
- Domestic dog vaccination was also carried out around the Guassa area of Menz in 2003. A total of 835 dogs were vaccinated in the period from 3 May - 15 July. The vaccination campaign covered 81.2% of the dog population found up to a distance of 20km from the Guassa area.
- Following information of an outbreak of rabies among domestic dogs in peasant associations close to the Afroalpine area in the Guassa-Menz area in November - December 2003, a vaccination campaign was carried out by a vet officer from the woreda agricultural office in Mehal Meda under the supervision and with funding and vaccine from the EWCP. Over 200 dogs were vaccinated.
- A further 189 dogs were vaccinated in the Guassa-Menz area in February - March 2004 in response to an outbreak of rabies in Mahal Meda town.
- Similarly, the EWCP worked with the local agricultural bureau in Delanta following an outbreak of rabies among domestic dogs in the area in 2003. Under EWCP supervision, 12 days were spent vaccinating dogs in two *kebeles* which are very close to the wolf habitat. A total of 134 dogs were vaccinated.

- The data from the vaccination campaign are currently being analysed for publication and to assess the success of the campaign. Thus, data have been collected on: a) the number of rabies cases among the domestic dog population over the past eight years, and b) the distribution and number of dogs covered by the vaccination campaign. The relationship between these parameters will be analysed.

#### Future Work

- It is imperative that the EWCP vaccination campaign continue for the indefinite future or until effective disease prevention strategies are implemented (see section above). This substantially protects the Ethiopian wolves against the threat of rabies.

### **B8. Pilot sterilisation campaign of domestic dog population inside BMNP**

*Objectives: Limit the growth of the domestic dog population in wolf range to prevent dog-wolf hybridisation and STD transmission by means of a voluntary scheme to surgically sterilise dogs in settlements in BMNP*

#### Achievements

- Over the two years that the pilot sterilisation campaign was carried out in target areas of the wolf range in the Bale Mountains, a total of 496 dogs were sterilised (68 females spayed and 428 males castrated).
- By the end of 2002, this meant that 69% of the male dogs and 28% of the female dogs had been sterilised in the target areas. In certain target areas, up to 77% of the sexually mature males were sterilised.
- While carrying out sterilisation surgery, an average of 3.4 (range 1-6) dogs were operated per day. The wide variability resulted from influences such as weather, time spent on treatment of other local animals (e.g., livestock), time taken to catch dogs, and the number of females sterilized (females sterilizations take up to four times as long as male castrations - 2hrs vs. 30min).
- The pilot sterilisation campaign was not effective in limiting the growth of the dog population; to achieve that, an estimate of over 95% of the male dogs and a significant proportion of the female population would have to be sterilised.
- These levels were not achieved while the dog sterilisation team visited a given area because of the following reasons:
  - Dogs were not present at the household. On rare occasions, the dog accompanied the owner away from the village.
  - Dogs could not be caught. Over 50% of the males that were not sterilized could not be caught, primarily because of their extremely aggressive nature and their reluctance to be handled. This is primarily because they are never handled by their owners - which is usually attributed to religious taboo but is understandable given the dogs' functional significance (see above)! However, dogs that had previously been sterilized appeared to be wary; this has the potential to hamper future efforts to maintain coverage through parental vaccination.
  - Owners were not present at the house.

- A small proportion of people did not want their dogs to be anaesthetised because they were concerned that the dog would die (despite the reassurance of the team).
  - A group of people were concerned that the (male) dogs would not be effective guard dogs once the procedure was complete and refused to allow their dogs to be castrated. Several people allowed one of their male dogs to be castrated but not the other.
  - Similarly, several owners wished to breed their female dogs, thus, refusing to allow them to be spayed.
  - A small number of people refused because no post-operative food was offered and they were concerned that they would not be able to feed the dog adequately following surgery.
  - Certain people suggested their dog(s) were too young to be sterilized even though all dogs selected for sterilization were over six months.
  - A number of dogs were rejected for sterilization by the team themselves. These included lactating and pregnant females, and old or emaciated dogs.
  - A further concern was the amount of time that was wasted in attempting to catch the dogs and begs an improvement in capture technique (or the use of the oral route for vaccination). Acepromazine (ACP) tablets were administered to wildly aggressive, unapproachable dogs, but these mild sedative tablets have proven completely ineffective, even at 10 times the normal dosage!
- Thus, while the sterilization of up to 77% of the sexually mature male dog population is a good achievement, owner resistance and difficulty in catching dogs might mean that exponentially more time and effort would go into sterilizing the remaining number, who still pose a threat to the genetic integrity of the wolves and still remain viable for maintaining the dog population.
  - The issue of cost-effectiveness of female sterilization is complex. In a closed system, with population change being driven only by female fecundity, pup survival and adult mortality, female sterilization would obviously have a major influence on population growth. In reality several other factors act to drive population growth. The demand for dogs to protect livestock means that each household probably maintains an average number of dogs each year. New dogs will be acquired to replace those dead or missing. Again, in a closed system the supply of new dogs would be cut by female sterilization. However, with the seasonal return of the people to the 'source' villages surrounding the park, new replacements can be found. Growth of the dog population in the park also parallels human population growth - more seasonal households mean more seasonal dogs.
  - Therefore, sterilization of domestic dogs has not had the effect that was originally hoped. Until another, more cost-effective and successful means is used - perhaps such as oral contraception (e.g., long-acting oestrus suppressants) or reducing the dog population by removing their functionality - the pilot sterilization campaign of the EWCP was halted.
  - However, it is notable that no hybrids have been born in the Bale Mountains over the past four years. The EWCP continues its policy of hybrid management if and when they are observed. The hybrids are removed from the gene pool

simply by catching and sterilizing them. If absolutely necessary, in circumstances when they pose other threats to the wolves, they will be caught and euthanized.

- The two hybrids that were found in the Web valley of the Bale Mountains and which were caught and sterilised in 1999, both died in the recent outbreak of rabies.
- A joint Ethio-Russian expedition to Mt Guna in 2001 reported sighting what appeared to be a dog-wolf hybrid. They also reported seeing a female domestic dog appeared to remain largely within the wolf range. Recent visits to the area by EWCP staff has confirmed that there are three hybrid animals in the population. Plans are being made to catch and sterilise these animals.

#### Future Work

- The sterilisation campaign has been stopped but alternative methods of reducing the domestic dog population are being sought (see above).

### **B9. Community education and extension in wolf range**

*Objectives: Involve local communities in the protection of Afroalpine wildlife; develop a conservation education and extension campaign at community level*

#### Achievements

- The programme currently employs 25 full-time staff (21 of whom are recruited from local communities in the wolf ranges) ; in addition, the programme employs over 50 part-time or casual workers from local communities each year
- Taking into account the families of the employees, an estimated 950 people derive their principal source of income directly from the EWCP.
- The consequence is that the local economy (with Dinsho having an estimated 3,500 people) is dependent on the presence of the EWCP.
- Nationwide assessment of attitudes of local people towards the Afroalpine ecosystem, and wildlife and the Ethiopian wolf in particular (results published in: Dejene, Deresse 2003 *Attitudes of local communities to wildlife in the ranges of the Ethiopian wolf*. MSc thesis, Durrell Institute for Conservation and Ecology, University of Kent at Canterbury, UK)
- Annual "Wolf Day" held in Dinsho, Bale - a sports event with primary school and open participation strongly linked to the Ethiopian wolf
- Establishment of an "Ethiopian wolf" football team in the Bale area
- School visits by the EWCP education officer reaching over 3,000 school children per year
- Community-wide meetings held once a year in each community (particularly Bale Mountains, Guassa-Menz and Abune Josef) to inform local people of the Ethiopian wolf, and the objectives and activities of the programme
- Three consecutive grants from the Disney Wildlife Conservation Fund for education work
- Regular meetings with community-wide local elders and authorities to elicit their support but also to listen to their views and concerns
- Annual household-to-household visits by the EWCP Adult Education Officer in the Bale Mountains to promote domestic dog vaccination and sterilisation, and

to improve local people's understanding of the Ethiopian wolf, and the aims and objectives of the programme.

- Production and distribution of educational materials, including a children's book, a wildlife information booklet, a rabies information booklet and posters, stickers
- Production and distribution of a detailed and informative Guidebook and Trekking Map for the Bale Mountains, primarily targeting tourists
- Production of postcards (using Martin Harvey's images) with simple information statements.
- Provision of school materials to Dinsho Primary School, including books and desks.
- Provision of funding for Dinsho Elementary School for their connection to the water system in Dinsho.
- Provision of seedlings and tree-planting equipment to schools in the Bale area to promote tree planting.
- Provision of an emergency 'ambulance' service for the local community in the Bale Mountains; thus, transporting at least two people per month to the hospital in Goba for emergency treatment or medical attention.
- When the vet team is in the field, people in the settlements make use of the veterinary services and drugs provided for the treatment of their livestock. This work is important as it improves the peoples' attitude towards the project.
- Regular (three times a year) with woreda administrators to reinforce local authority support for the project and to enhance their understanding of the activities of the programme
- Upgrading the Museum displays at the Headquarters of the Bale Mountains National Park which is visited by an estimated 2,000 people from the local community a year.
- Assessment of school and college curricula to examine environmental education within the country in general but within the wolf ranges in particular (assessment carried out by Million Belay)
- The domestic dog vaccination is highly appreciated by the local communities who understand the link between the vaccination of their dogs and the reduction in health risks to themselves and their families, and the economic costs of rabies to their domestic livestock.

### Future Work

- The education of the people of Ethiopia is essential for the persistence of the Ethiopian wolf and its Afroalpine ecosystem. This is true at many levels, in particular: i) the highest levels in the government such that the decision-makers will guide the policy and legislation of the country to take into account the needs of the Ethiopian wolf and the Afroalpine ecosystem, and ii) local communities, both of school children (and thus, future exploiters of the environment) but also of elders and women (current exploiters of the environment). The EWCP has a pivotal role to play in and surrounding the wolf ranges.
- There is a need to make the linkage between the benefits that the programme provides (e.g., employment, largest organisation in the economy of Dinsho and

surrounding areas; emergency hospital trips for people from the local communities; Wolf Day, tourism revenue and employment, etc) and the persistence of the Ethiopian wolf. In particular, people need to understand that the benefits accrue directly from the wolf itself and the ecosystem on which it is dependent.

- The conservation education campaign for EWCP, and the BMNP in general, including the development of a proposal for a conservation education centre for Dinsho needs to be re-evaluated and designed. This work is currently being carried out by Million Belay, a conservation education consultant.
- Incorporation of the radio as a medium for educating people in Ethiopia. To date, the EWCP has rarely used the radio as a medium for transmitting educative material to people in Ethiopia.
- There is a need to erect road signs along all roads that cross Ethiopian wolf habitat. New roads are being built in the Afroalpine ecosystem. Given the Ethiopian suspicion that a jackal (or wolf) crossing one's path is bad luck, drawing the attention of drivers to the presence of wolves and their precarious conservation status is essential.

## **B10. Support for Bale Mountains National Park and other protected areas**

*Objective: Ensure long-term conservation of Afroalpine ecosystem in BMNP and other protected areas; promote conservation and research projects; promote eco-tourism activities; assist relevant organisations in obtaining additional funding to support protected areas infrastructure*

### **Achievements**

- Support for patrolling activities in the Bale Mountains National Park (BMNP) with scouts accompanying EWCP staff into the field
- We assisted the Oromiya government with the development of their wildlife policy for the region. The draft document that we produced was used as a basis for this policy document.

### *Bale Mountains Development Project*

- Following an effort for the best part of three years, we have finally managed to attract donor interest in the Bale Mountains area. The first step toward a project that will focus on the development and conservation of natural resources in the Bale Mountains is all but complete. The underlying premise to the work was that despite its importance and fragility, at present, there has been little active or effective management of the natural resources of the Bale Mountains. The immediate consequence of this has been degradation of the area; the unsustainable exploitation of the resources within the massif means that its ecological processes are now threatened. Through the Belgian Cooperation and, more recently, the Belgian Technical Cooperation (BTC), we secured funding to carry out a study and design mission for a new project initiative aimed at conserving the unique biodiversity and ecological functions of the Bale Mountains ecosystem in harmony with enhanced local community livelihoods. An important aspect of the mission was to identify strategies for enhancing stakeholder cooperation and participation in the conservation and management of the ecosystem's natural resources, especially ways of involving local communities in natural resources management and in conservation-compatible economic development activities. A priority in bringing about more

effective management of the ecosystem was to establish consensus on how the integrated management of the diverse landscape of the Bale Mountains can best be achieved, in terms of land use priorities, optimal legal status, administrative responsibility and institutional capacity. Reaching such a consensus was beyond the scope of the study as it requires a participatory process with many stages, starting with a definition of the entire area of interest (on the basis of social and political as well as ecological considerations); an understanding of existing land usage within this area; followed by a debate on how best to manage each land use class so that the biodiversity of the whole is conserved while at the same time enhancing the livelihoods of local communities that are dependent on the ecosystem's resources and life systems. Developing a framework for such consensus building and landscape-level planning was a priority of this project design mission.

- While the Belgian government is now phasing out its development cooperation in Ethiopia. Thus, while it was first envisaged that the Belgians would fund the project, this will now not happen. As a result, we have sought other donors to finance this project: a small donor coalition is now prepared to fund the project. The total value of the project will be an estimated € 6 million over five years. One of the donors is now prepared to fund the project formulation mission; this is planned for November 2004.
- In addition, the EWCP has been instrumental in securing ten years of funding (over € 1.5 million over this period) and technical assistance for a project to strengthen the management and operation of the Bale Mountains National Park. This project will be funded and implemented by Frankfurt Zoological Society.

#### *Guassa-Menz community conservation*

- The Guassa area of Menz is the most important area for the Ethiopian wolf in northern Ethiopia.
- Currently the area has no formal protected area status. However, it is remarkable for the unique system of natural resource management, known locally as 'Qero', that arose in 17th century. The system achieved the Holy Grail of sustainable development: sustainable management of a common property resource! It arose under land tenure systems that were based on the agreed division of the land and which were supported by the authority of the Ethiopian Orthodox church, a powerful component of this ancient society. The Qero system ensured equitable use of essential natural resources among the user community. This was achieved through the establishment of by-laws created by the people themselves. The natural resources (thatching grass, fuelwood and grazing for livestock) underpin the livelihood security of the community: the resources are harvested during hardship periods and, therefore, represent a survival or coping strategy for the local community. By regulating exploitation, the system has also protected the biodiversity of the Guassa-Menz area, which, as Afroalpine ecosystem, harbours the majority of the fauna and flora that is endemic to Ethiopia. The Qero system declined in 1975 with land tenure reform, the Agrarian Reform, introduced under the socialist regime that came to power in the revolution of 1974.
- During this period, when it became apparent that the resource management system was declining, the community responded by establishing the Guassa Committee. Despite this apparent resilience, the system has been floundering.
- In addition to the weakening of the traditional system, over the past few years, the area has come under threat and pressure, primarily from commercial operators that wish to 'lease' the land or to be granted a concession for sheep

production. If granted, this would not only threaten the livelihoods of the many people dependent on and involved in the natural resource harvesting but commercial sheep farming would probably not be perceived to be compatible to conserving a population of Ethiopian wolves.

- Led by Dr Zelealem Tefera, the EWCP has been working, successfully, to revive, strengthen and consolidate this natural resource management system along traditional lines. As such, the programme is assisting to protect a system that is, first, unique in Ethiopia - if not sub-Saharan Africa, second, pivotal to the livelihood security of the local community and, third, critical for the conservation of the biodiversity of the ecosystem. We have used the following mechanisms to carry out the conservation work in the Guassa-Menz area:
  - We held a workshop in Mahal Meda in October 2002. The majority of the attendees were people from the local communities surrounding the Guassa area. In addition, the workshop was attended by authorities from the Amhara government and by representatives from the federal government and NGOs. The workshop resulted in a group, led by the EWCP, being given the mandate to develop a draft management plan for the area.
  - The EWCP has established a woreda (district) committee composed of the woreda Administration, Rural Development Office, Agriculture Office, Environmental Protection & Land Use Authority, police, representatives of 8 farmers association and a representative from EWCP.
  - Because of the drought that has afflicted much of Ethiopia for the past fifteen months, many local people wished to graze livestock in the area. Previously this was restricted. The situation escalated and resulted in a standoff between various groups of people. On 11 May 2003, facilitated by the EWCP, local communities met to discuss the problems. This meeting ended with the resolution that the area will not be used by people, whether for grazing, the collection of fuelwood or the collection of thatching grass, for the forthcoming four years.
  - The EWCP is currently monitoring the effectiveness of this protection and working to examine how the communities cope with the absence of what was a survival strategy for them.
  - The management plan is now complete. Working with the committee, the EWCP has demarcated the boundary of the Guassa area and prepared by-laws that are accepted by all user communities of the area.
  - A second workshop is being held on 12 - 13 October 2004 so that the management plan can be agreed upon by the local community and then ratified by the regional government.
  - If the management plan is ratified, the area would therefore be a regionally recognised and designated protected area.
  - In addition, following the nomination by the EWCP, the Guassa-Menz community was short listed for UNDP's Equator Initiative Prize. Representatives from the community were invited to attend the seventh Convention of Parties for Convention of Biological Diversity held in Kuala Lumpur, Malaysia from the 4-21 February 2004. By

being short-listed for this Prize, the community is now eligible to receive \$ 50,000 from the GEF Small Grants Program.

- In addition to this work in the Bale Mountains National Park and the Guassa-Menz area, we have successfully carried out the following activities:
  - Our monitoring of the wolf population in Simen Mountains in the past three years has clearly indicated that the majority (75%) of wolf range falls outside of the gazetted National Park boundaries. In these unprotected areas, the wolves have been persecuted by local communities. As a consequence, we have been working with the NP authorities on the extension of the park boundaries to include these areas and populations.
  - We will be using the model developed in Guassa-Menz to develop further community-based conservation areas elsewhere. Three areas have been identified for this work: Abune Josef in north Wollo, Belechuma in south Wollo and the Arsi range.
- Tourism:
  - Publication of a Guidebook and Trekking Map for the Bale Mountains (with funding from the GTZ-IFMP project)
  - Construction of two huts in the Bale Mountains (Sodota and Sanetti) to which trekking tourists have access
  - Establishment of trekking routes within the Bale Mountains National Park
  - We continue to lobby the Oromiya government to lease the management of the Lodge in Dinsho to a private operator. This has apparently been paying off and the government has agreed in principle to the concept although further internal consultations are required.
  - Working with the Nyala Guides Association in Bale in an attempt to improve services and coordination between tourist guides in Bale
  - Worked with the Oromiya Agricultural Bureau to re-open the sport trout fishing in the Bale Mountains
  - Re-arranged and improved the displays in the Museum at the Headquarters of the Bale Mountains National Park
  - The EWCP retains an important role in an interest group that is working to promote community-based tourism in Ethiopia. Both Zelealem Tefera and Stuart Williams are founding members of this group and both were part of the organising team for a workshop titled *Options for Sustainable Livelihoods: Community-based Tourism* and held in the Ghion Hotel in Addis Ababa in April 2003.
  - We have examined and mapped potential tourist trekking routes in north Wollo and particularly from Ethiopia's tourism flagship, Lalibela, through Abune Josef and Aboi Gara to Woldia.

#### Future Work

- If the Ethiopian wolf is to persist into the indefinite future, the Afroalpine areas in which it lives requires protection. Protection can come in the form of conservation areas that exclude human exploitation and areas in which local communities have rights to use the areas but at reduced, sustainable rates.

The EWCP will continue to play a pivotal role in the development, strengthening and consolidation of protected areas in Ethiopia.

- Work is starting for the establishment of two pilot community-based tourism ventures - one in Guassa-Menz, the other in the Abune Josef/Aboi Gara area. Funds are being sought for the construction of sites and for the training of the local community. Where possible, a private-public partnership will be sought as then private tour operator will then provide the expertise to train local people to deal with and manage tourists.
- In the future, community-based tourism in the Bale Mountains National Park and surrounding areas should be implemented.
- The EWCP is continuing to fund raise for the conservation of the Guassa-Menz area and specifically for the implementation of the management plan. We have been invited to submit a proposal to the Christensen Fund to do this.
- Because the EWCP maintains a permanent presence in six of seven wolf ranges around the country, agreements could be made with the protected area authorities, and most specifically with the Bale and Simien Mountains National Parks, whereby this presence is recognised by the park authorities and the EWCP members of staff given 'honorary' scout status. This would give them status and the authority to carry out some protection work.

## **B11. Capacity building of Ethiopian institutions and people**

Objective: Increase the capacity of Ethiopia in the field of ecology, conservation and protected area management.

### **Achievements**

- Training & mentoring:
  - Completion of Dr Zelealem Tefera's PhD thesis: Tefera, Zelealem (2001) *Common Property Resource Management of an Afro-alpine habitat: supporting a population of the critically endangered Ethiopian Wolf Canis simensis*. PhD, University of Kent, Canterbury, Kent.
  - Dr Zelealem Tefera has been mentored through the programme to become one of the leaders in the field of wildlife conservation in Ethiopia
  - Two outstanding candidates, Anteneh Shimelis and Ermias Admassu, for the field of conservation and ecology have been mentored and trained. They are now registering as PhD students.
  - Dr Zelealem Tefera was one of five winners in the first ever round of the Darwin Biodiversity Scholarship. This prestigious award targets outstanding biodiversity experts in developing countries.
  - GIS training for staff from the Ethiopian Wildlife Conservation Organisation (given by Ian May of the World Conservation Monitoring Centre, WCMC, Cambridge, UK)
  - One MSc student at the Durrell Institute for Conservation and Ecology of the University of Kent at Canterbury (Deresse Dejene)
  - Four MSc students from Addis Ababa University (Ermias Admassu, Anagaw Atickem, Gashaw Tilahun, Alemu Fetene)

- One 'summer' BSc degree student at the Wondo Genet Forestry College of Debu University (Woldemedhin Zebene)
  - Training of tourist guides from the Dinsho area, Bale (training in Dodola carried out by Vedasto Izoba)
  - Ongoing training of EWCP staff in a) wolf monitoring, b) rodent monitoring, c) post mortem techniques, d) use of computers, and data entry and management, e) construction and building maintenance, f) project administration
  - Training of EWCP (Leta Idea, Dinku Dega) and EWCO vets (Drs Fekadu Shiferaw and Kifle Argaw) in a) sterilisation of domestic dogs, and b) capture, handling and anaesthetising Ethiopian wolves
  - Zelealem Tefera has taught wildlife conservation and management at the Wondo Genet Forestry College
- There has been substantial infrastructure development within the Bale Mountains. This has been funded and managed by the EWCP. At the Headquarters of the Bale Mountains National Park, the Bale Mountains Biodiversity Centre (BMBC, previously the area known as the 'Research Buildings') can now house:
    - Three - four full time PhD students (each with their own room)
    - Six MSc students (accommodated in a bunk house)
    - Facilities now include:
      - *At the base within the BMNP HQ area:* a library with over 300 titles, an office with two laptop and two desktop computers, a fully equipped living area (for cooking, eating and recreation), a workshop, five stores for equipment, parking areas, an intranet (that includes a printer and printer driver, a server and data backup system). There is a functional stable and horse camp.
      - *Within wolf range.* Two satellite camps, each of which has a communal hut (for food preparation, eating and relaxation), A-frame structures under which to pitch tents (the A-frame lengthen the life of the tents by protecting them against UV radiation and the claws of ravens that frequent the camp), a shower, a guard's hut, a latrine and a horse enclosure; raingauges.
  - In addition, we have registered the centre with Conservation International's TEAM initiative. Since the Ethiopian Highlands will be considered as a Biodiversity Hotspot, the centre will be eligible to receive funding from CI. The funding will primarily be for monitoring but some funds will be available for infrastructure development.

### Future Work

- The EWCP will continue to play a pivotal role in the country in capacity building for the foreseeable future. The capacity of Ethiopian institutions needs to be built such that the Ethiopian wolf and its Afroalpine ecosystem are not threatened by human activities and will persist in perpetuity. This will require:
  - Training Ethiopian nationals in all aspects of natural resource management, and wildlife and ecosystem conservation
  - Finding sustainable financial mechanisms for protected areas

- Ensuring that appropriate legislation is in place (for example, that all domestic dogs in the country should be vaccinated against rabies)
- Finding livelihood alternatives for people living within and surrounding wolf ranges
- Ensuring that the exploitation of natural resources within and surrounding wolf ranges is sustainable in perpetuity

## **C. Other achievements**

The programme has had other activities and achievements beyond the activities that were proposed in the original project proposals to the government.

### **C1. International students & research**

In addition to the training of Ethiopian students (see above), the programme has also worked with four international PhD students:

- Jorgelina Marino, thesis completed: Spatial Ecology of the Ethiopian wolf (*Canis simensis*), Wildlife Conservation Research Unit, University of Oxford, UK
- Deborah Randall, eighteen months remaining: The genetics of the Ethiopian wolf, implication of their mating system and for their conservation, Wildlife Conservation Research Unit, University of Oxford, UK
- Lucy Tallents, eighteen months remaining: Factors affecting Ethiopian wolf pup survival, Wildlife Conservation Research Unit, University of Oxford, UK
- Darryn Knobel, twenty-four months remaining: an analysis of the cost-effectiveness of alternative strategies to prevent canid diseases among wildlife, Centre for Tropical Veterinary Medicine, University of Edinburgh, UK

#### **The genetics of the Ethiopian wolf: implications of their mating system and for their conservation - Deborah Randall**

The objectives of this project are 1) to explore the contribution that molecular genetics can make to our understanding of the Ethiopian wolf's behavioural ecology, and 2) examine the importance of genetic considerations in the overall requirements for the species' survival.

The first component of this research will specifically use molecular genetic techniques to examine the Ethiopian wolf's mating system. Parentage analysis of pups will be used to determine which individuals in the population are reproducing and to quantify 1) the magnitude of reproduction by subordinates particularly males, and 2) the level of multiple and extra-pair paternity among litters and within the population as a whole.

The second component will investigate the impact of social and behavioural factors on the level and distribution of genetic variation within the wolf population. This will include comparison of genetic variability among social groups and sub-populations to determine the patterns by which genetic variation is partitioned in the population. The results will be used to model the loss of genetic variability over time in different population scenarios and will accurately determine the need for metapopulation management.

The study focuses on wolves in the Bale Mountains and particularly the packs in the Web valley and Sanetti plateau. A further study population (Morebawa) will be included in the forthcoming field season. Together these three areas comprise the major wolf areas in Bale.

Faecal samples are collected from wolves seen to be defecating and preserved in 96% ethanol. Samples have been collected from all animals in the Web valley and from the pups (from around the dens) in Sanetti.

Molecular analyses are ongoing at present, but sufficient variation has been found to identify individuals. All genetic analyses for this study are being conducted in collaboration with Dr. Robert Wayne at the University of California, Los Angeles. Deborah is carrying out her DPhil within the Wildlife Conservation Research Unit

(WildCRU) in the department of Zoology of the University of Oxford. She is working with Hussein Adam to collect the data in the field.

### **Determinants of pup survival - Lucy Tallents**

The objectives of this project are 1) to assess the effect of territory quality on the pack size, structure and pup survival of Ethiopian wolves, 2) to quantify provisioning behaviour by breeders and alloparents, and correlate this with pup survival, and 3) to test for indirect fitness benefits of alloparental behaviour in Ethiopian wolves.

A core part of the project will, therefore, examine why subordinate wolves help to rear the dominant female's litter. This will focus on the connection between relatedness and alloparenting, and the energetics of helping behaviour. The second will be to assess the effect of territory quality on wolf recruitment, looking at habitat and prey availability, the density of livestock and domestic dogs, and human activities within a given pack's territory.

Lucy is also carrying out her DPhil within WildCRU. She is working with Mustefa Dule and Gedlu Tessara to collect data in the field. In addition, she is working with a small team of people collecting data on rodent distribution and abundances.

### **Spatial ecology of the Ethiopian wolf (abstract) - Jorgelina Marino**

Ethiopian wolves (*Canis simensis*) have developed a refined specialization to prey upon the rich rodent fauna of the Afroalpine ecosystem, a once widespread habitat persisting in mountain relicts. She applied a multi-level approach to investigate ways in which wolves respond to their environments at various scales of Afroalpine patchiness and heterogeneity. She focused on Afroalpine rodents as the critical resource and on the ecological constraints in their use at various scales, interpreting ecological patterns in terms of wolf behaviour and life-history traits.

Extensive field surveys showed that high habitat specificity and a specialized diet confine wolves at present to Afroalpine islands at the top of the highest mountains, mostly limited on the lower end by the extent of subsistence agriculture. While wolves persist in almost every Afroalpine range in Ethiopia, habitat loss has resulted in local extinctions in two small Afroalpine patches and all seven extant populations are small (ranging from 10 to 250 wolves) and virtually isolated from each other. The Ethiopian wolf's specialization seems to have appeared early in the short evolutionary history of the species. Mitochondrial DNA phylogeography showed strong links between the genetic structuring of populations and the dynamical biogeography of Afroalpine ecosystems during the late glacial-interglacial period. The genetic data showed that Ethiopian wolves originated around 100,000 years ago, when Afroalpine habitats were widespread across Ethiopia. After an initial population expansion, the subsequent partition of haplotypes reflected random fixation of alleles in isolated populations as the climate warmed, matching the reconstructed pattern of Afroalpine reduction and fragmentation at the onset of the deglaciation ca. 15,000 years ago.

The dynamics of local populations in the Bale Mountains showed that, in the absence of infectious diseases, Ethiopian wolf numbers were relatively stable and resilient to livestock grazing and human disturbance, but disease epizootics severely affected wolves living at high densities in rodent-rich areas. A stable environment and a stable prey resource, combined with the high adult survivorship observed, may facilitate the long-term persistence of populations in spite of small numbers and isolation. In saturated environments, the production of 'surplus' adult wolves led to philopatry via delayed dispersal, and some long-distance female dispersal. At low densities resulting from an epizootic, these surplus animals

participated in the recovery via pack augmentation and the formation of new breeding units. However, the surviving packs initially expanded to incorporate vacated areas and augmented via delayed dispersal, so that new breeding units only formed once a pack was large enough to allow for splitting, or when sufficient numbers of dispersers coalesced to ensure the successful defence of a new territory. In consequence, reproduction at the lowest densities was initially limited to the few surviving breeding units, leading to inverse density dependence in the rate of population growth. This natural experiment unveiled intrinsic mechanism of regulation, mediated by territoriality, delayed dispersal and reproductive suppression, operating at the levels of packs but expressed at the population level. The prevalence of expansionism at reduced densities, and the lack of evidence of direct benefits from cooperative breeding in larger groups, strengthens the prevailing thesis that long-term food security and the inheritance of a high quality territory may be the main selective pressures behind sociality in the Ethiopian wolf.

The ecological conditions for sociality and expansionism, however, were constrained by the local pattern of resource availability within populations. In an area with overall low prey density, neighbouring pairs with large territories defended similar amounts of rich-rodent habitats than larger groups with smaller territories in the more productive areas. This contradicts the prediction that animals will defend the minimum territory necessary to fulfil the metabolic requirements of its owners. In one case, group augmentation and territorial expansion appeared to be favoured by the high aggregation of prey, such that larger territories showed proportional increments in the areas of rodent-rich habitats. In the other, patches of high quality habitat existed within a matrix of poor habitat, so that the costs of expanding an already large territory to include more rich patches may be too high, and the benefits for the primary pair nil or minimal. High aggregation of resources may shift the balance of costs and benefits towards sociality in an arm race to secure a portion of a very rich area.

This thesis exemplifies the utility of combining studies of a species biology at various levels of biological organization and of the spatial distribution of a critical resource to understand better the effects of constraints in their use, and how these affect habitat selection, the dynamics of populations and ultimately the adaptive value of behavioural strategies. The implications for the conservation of this highly threatened canid are discussed in relation to the spatial scale at which threats take place and possible solutions may be implemented.

#### **Oral vaccination of wolves: bait trails - Darryn Knobel**

The 2002/2003 denning season saw work begin on the development of a technique to protect wolves against rabies using new oral vaccines. If successful, such technology would allow wolves to be vaccinated safely and cheaply against rabies.

In the past, control of the killer disease has relied on the immunisation of domestic dogs in and around wolf habitat. These dogs are responsible for maintaining rabies and other diseases such as canine distemper, which are then passed on to the wolves. Successful control of rabies relies on vaccinating at least 70% of the dog population - a difficult task when dealing with local people who are not compliant.

Although this target has been met through the hard work of the EWCP Vet Team, difficulties in catching highly aggressive dogs for vaccination has lead researchers to seek unique alternatives to disease control. One such solution could be the use of oral vaccines, both in domestic dogs and in the Ethiopian wolves themselves.

Trials thus began in December 2002 to devise a bait capable of delivering the oral rabies vaccine to the wolves. Such a bait would need to be acceptable to both

adult wolves and to pups, and would need to be thoroughly chewed rather than being gulped down whole. This is because the vaccine needs to be absorbed through the mucous membranes of the mouth - if it is swallowed whole it is destroyed by the acid in the stomach.

Trials were conducted using six wolf packs in Web Valley, BMNP from January-March 2003. Four bait types (two commercially produced and two locally available) were tested in a series of preference trials. Rodents (the wolves' natural prey) were found to be the most preferred bait and all subsequent trials were therefore conducted using this bait type. Rodents were also shown to be capable of delivering a placebo oral vaccine: 6/9 (66.7%) adult wolves and 4/6 (66.7%) pups showed staining of the oral cavity and tongue following ingestion of a rodent containing a 2-ml sachet of methylene blue dye as a vaccine placebo.

Loss of rodent baits to diurnal non-target species proved problematic. In 130 hours of observation, 36 rodents were taken by non-target species. All bait losses were to raptors or corvids (black kite *Milvus migrans* 17, augur buzzard *Buteo augur* 4, tawny eagle *Aquila rapex* 4, Montagu's harrier *Circus pygargus* 4, fan-tailed raven *Corvus rhipidurus* 3, Eurasian marsh harrier *Circus aeruginosus* 3, lanner falcon *Falco biarmicus* 1). More than 50% of bait losses occurred between 09h00 and 13h00. Placement of baits around dens in the mid-afternoon should therefore reduce bait losses to raptors.

Rodents therefore provide a potential means for delivering oral rabies vaccine to Ethiopian wolves. They fulfil the criteria of an ideal bait, being acceptable to both adults and pups, and being inexpensively obtained through snap-trapping within the wolf ranges. Vaccination of wolves as young as ten weeks is achievable through this method. Although younger pups also set upon them with vigour, they often do not chew them sufficiently to rupture the vaccine capsule. Older pups, however, develop the adult habit of biting the rat on the neck to 'kill' it. Trials using a dye as a vaccine placebo showed that more than two-thirds of pups aged 10-12 weeks could be vaccinated by placing the capsule under the skin of the rodent's neck. This is an ideal age, as the pups are still at the den and are therefore easy to find. These results are a promising step towards protecting wolf populations from the threat of rabies.

This work forms the basis to Darryn's PhD which he is carrying out in the Centre for Tropical Veterinary Medicine in the University of Edinburgh.

## **C2. Facilitation**

Because it is one of a few conservation organisations that is operating in Ethiopia and because it has a high international profile, the EWCP is regularly approached to facilitate and assist other workers to carry out research in Ethiopia. A few examples are herein listed:

### **Hotspots listing**

Because the EWCP plays a prominent role in wildlife conservation in Ethiopia, we were approached to lead an analysis of whether, in conjunction with several other ecologically similar areas in sub-Saharan Africa, the 'Ethiopian Highlands' qualify for listing as a Conservation International Biodiversity Hotspot. The results of the analysis are in press (Williams, S.D., Vivero Pol, J-L., Spawls, S., Shimelis, A. & Kelbessa, E. (in press) Ethiopian Highlands. In *Hotspots* (eds. Mittermeier, R., Hoffmann, M. *et al.*). Conservation International: Cemex Press). This will be published later in 2004 and this will make Ethiopia eligible for funding from various of CI's funding mechanisms.

## Glaciation in the Bale Mountains

The EWCP also facilitated the visit of Henry Osmaston, an eminent glaciologist who has studied the mountains of East Africa for a lifetime. Henry and his colleague, Wish Mitchell, spent two weeks in Bale in November 2002 to examine 1) the extent of glaciation within the massif, 2) the striations that are found on the Sanetti plateau and 3) whether the 'mima' mounds of the Bale Mountains might also be related to freeze-thaw processes as well as current thinking that they are caused largely by giant molehills. The main objective was to clarify the degree of glaciation, which has been a matter of dispute among various workers.

They report that, it could be anticipated that glaciation on the high Sanetti Plateau of the Bale Mountains at 4000-4300m would have been even more extensive than elsewhere in the country. Their fieldwork showed that Messerli *et al.* (1977)'s inferences that the high plateau was completely covered by an ice-cap of 600km<sup>2</sup> with valley glaciers descending from it and an estimated lowest altitude at about 3700m was an oversimplification. Instead, they found evidence of Quaternary glaciation of different types and probably different ages in two distinct areas, besides the unique periglacial features outside these.

The area they name the "northeast slopes glacial stage" appears to include an area that was unlikely to have exceeded 200km<sup>2</sup> down to an altitude of 3,700m, possibly lower and characterised at present by a wide scatter of large erratic boulders, singly and in small groups. There are also bouldery moraines at similar altitudes, some on the open moorlands, others perched above the cliffs on each side of the Togona valley.

They also recognised that the upper Togona valley has clearly been glaciated down to an altitude of c.3400m, where its deeply incised, flat-bottomed, steep-sided form changes to a narrow fluvial V-form. They found moraines on the floor of the upper valley and a very conspicuous glacially-striated *roche moutonnée*. They observed from aerial photographs that the valleys of the Kaficho and Shaya rivers appear similar. Around the heads of these valleys is an area backed by steep slopes or cliffs which appears to have been the snow and ice accumulation area for these glaciers, centred on Mt. Batu (4350m, scarcely lower than Tullu Dimtu). They estimate that the "Togona Valley Glacial Stage" had an area estimated at about 50 km<sup>2</sup>. Within this area lies Lake Garba Guracha, within a partial cirque and dammed by a prominent moraine, breached by its outlet stream. This must date from a later stage than the main valley glaciation.

In addition, they report that for a radius of c.4km around the Bale Mountains' highest peak, Tullu Dimtu (4377m), there is conspicuous scatter of large erratic boulders on the nearly level plateau at c.4000m. This they named the "Tullu Dimtu Big Boulder Moraine", which has a clear limit beyond which there are no boulders. They observed a series of small parallel ridges of till running N - S to the east of Tullu Dimtu and named the event which caused these features the "Tullu Dimtu Glacial Stage".

At the southeast corner of the plateau, just outside the limits of the Tullu Dimtu Big Boulder Moraine, they examined the eroded remnants of three small volcanic plugs. The boulder slopes around their bases, especially on Kara Tuluke, display remarkable features dissimilar to any described elsewhere in the world. The slopes themselves have gradients of only 4° - 7°, and are composed of boulders nearly buried in a stable soil matrix. The surface is vegetated and nearly smooth, but cut into it is a series of parallel down-slope grooves, up to 2m deep, 3 - 7m wide and spaced 3 - 7m apart, lined with loose angular boulders. They have provisionally

attributed a periglacial origin to them and proposed the name "grooved boulder slopes" for them.

Finally, they commented that the lack of any connections between these areas of glaciation and periglaciation, and the dissimilarities in some of their features made attempts at correlation between them hazardous. However, they collected rock samples from key sites for cosmogenic dating, which should enable correlation and thus establish a chronological framework for the Bale Mountains.

### **Vegetation of the Bale Mountains**

Pascale Nuake visited the Bale Mountains for her final field trip to collect data for her doctoral thesis. As usual, we extended support to Pascale's work which focuses on the *Kniphofia* sp.; she is testing the hypothesis that heavy, sustained (over-?) grazing of the Afroalpine ecosystem leads to an increase in *Kniphofia*, and will be examining methods for its control and management.

Her work has also led to the publication of the 'Plants of the Bale Mountains'. This is a description of all known plants of the area. The EWCP has a CD-ROM version of the publication in Dinsho.

### **Mountain nyala**

The EWCP is still encouraging people to carrying out work on the mountain nyala. As such, we hosted a student, Agneta Heuman, from the University of Berne to carry out her MSc thesis on the distribution and ecology of mountain nyala within the Bale Mountains. Unfortunately, this did not work out and she left Ethiopia.

We also assisted, where possible, with James Malcolm's surveys of all nyala range in Ethiopia.

At present, we are encouraging an Ethiopian student to develop a proposal to carry out a study of the effect of humans and their livestock on mountain nyala. This will be for his PhD and we expect to be seeking funding for this within the forthcoming months.

### **Wild dog survey**

From 21 December 2000 to 5 January 2001, the EWCP conducted a questionnaire survey of the African wild dog (*Lycaon pictus*) population in the Haremma Forest and adjacent Mena-Angetu National Forest Priority Area. The survey was carried out by Dr Guy Dutson, Zegeye Kibret and counterparts from the Agricultural and Administrative Bureaux from Goba, Delo Mena and Angetu. The survey received financial support from the WWF-DGIS project and the Liacone Fund. These funds were kept apart from EWCP funds and accounted for independently.

The conclusion was that there may be only one pack of wild dogs in this area. They are threatened by increasing human encroachment and habitat loss. Some recommendations were made at the completion of the survey, both in support of the WWF sustainable forest-use project, and specific large-carnivore education and awareness programmes.



	Chufo	1 3				4
	Dimma	1 1				2
	Rafu	1 3 1			3	8
	<b>TOTAL</b>					<b>18</b>
<b>Central Peaks</b>	Worgona 1	1 3		1	3	8
	Worgona 2	1 1 1				3
	Worgona 3	1 3			2	6
	Wasama	1 2 1		2 1	3	10
	<b>TOTAL</b>					<b>27</b>
<b>Bale Total</b>	Packs = 44					294

**Table 2.** The packs of Ethiopian wolves monitored by the EWCP in areas other than the Bale and Aris Mountains

Region	Study Area	Pack ID	Pop. Size (Actual)	Pop. Size (Expected)	AM	SaM	AF	SaF	Juv	Pup	Unk	
South Wollo	Kewa-Antot	Antot	7	9	1	1	2	1	1		1	
		Goliito	3	4	1		1	1				
	Belechuma	Shemegeera	5	8	1	2	1		1			
		Deksios	7	7	2		1		4			
		Belechuma	6	9	1		1		2		2	
	Denkoro	Limmesk	6	8	2		2				2	
		Mesobit	4	6	1		2				1	
		Libanos	6	6	1		1				4	
	North Wollo	Aboy Gara	AG1	4	6	1		1		2		
AG2			3	5	1		1	1				
Delanta		Key Washa	7	8	1	2	1	1			2	
		Ate Gedel	6	6	1	2	1	1			1	
Abune Yoseph		Rim Gedel	5	9	1		1	1	2			
		Atimata	7	7	1	1	1	2			2	
North Shoa	Guassa	G1 Gera 1	5	7	1	1	1	2				
		G2 Gera 2	3	4	2		1					
		M1 Murtina1	4	4	1	1	2					
		R1 Sefed Meda	6	8	1	1	1	1	2			
		R2 Ras Ketema	5	5	1		2	1			1	
		A2 Tor Mesaya	2	4	1		1					
		A1 Zegu Beret	4	4	1	1	2					
		Ate Wuha	4	5	1		1	1	1			
Simen	Geech	Enatye	6	8	1		2	1			2	
		Imet Gogo	5	6	1		1	1	1		1	
	Chenek	Buhait	4	5	1	1		2				
		Aynameda	4	6	1	1		1				
		Zana	5	8	1	1	1	1	1			
	Ras Dejen	Arba Regreg	Sebat Minich	5	6	1	1	1				1
			Arba Regreg	7	6	1	1	2	1			1
		Midir Dar	5	7	1		2		2			
		Tefaw Lezer	5	5	1	1	1		2			
		Gagen Bahir	4	4		1	2	1				
	Silki	Ayit Joro	4	7	1	1		1	1			
Walia Kend		5	5	1		1	2	1				
KidusYared		4	5	1	1	1				1		
South Gondar	Guna	Mokish	5	5	1		2	1			1	
			177	222								

## **E. Publications**

Over the past four years, the programme has produced numerous technical and financial reports (e.g., annual reports, accounting reports to the University of Oxford, updates to donors, the University of Oxford, and to persons and organisations specifically interested in the outbreak of rabies). These documents do not appear here.

In addition, there is a vast amount of information available on the EWCP on the internet. A simple google.com search for 'Ethiopian wolf' comes up with 23,800 websites (cf. 15,100 for 'mountain nyala' or 546 for 'walia ibex'). Using the 'Ethiopian Wolf Conservation Programme' for the search results in 2,720 websites.

Hence, the EWCP has been successful in publicising the plight of the Ethiopian wolf and its Afroalpine ecosystem throughout the globe.

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Mullu Yemar	Bale Stable Cleaner
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Contracted builders, carpenters, manual workers in all infrastructure development

Contracted staff for veterinary, scout and eco-tourist guide training, and education assessment work