



Darwin Initiative for the Survival of Species
Annual Report
2002-2003

***Elephants of Mikumi National Park, Tanzania:
Conservation, Education and Research***

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1. Darwin Project Information

Project title	<i>Elephants of Mikumi National Park, Tanzania: Conservation, Education and Research</i>
Country(ies)	<i>Tanzania</i>
Contractor	<i>Anglia Polytechnic University</i>
Project Reference No.	<i>162/11/008</i>
Grant Value	<i>£107,800</i>
Start/Finishing dates	<i>1 April 2002 to 31 March 2005</i>
Reporting period	<i>1 April 2002 to 31 March 2003</i>

2. Project Background

The intense and acute poaching of elephant throughout Africa during the late 1970's and most of the 1980's lead to a dramatic decline in elephant numbers and extinguished or put under intense threat a number of elephant populations. The largest remaining population of open country elephants is that of the Mikumi-Selous but this has only been surveyed intermittently from the air. Recent ground studies in 1/3 of Mikumi suggest that the population is much larger and more mobile then earlier surveys suggest. Patterns once taken as evidence of poaching appear to be more consistent features of the population. This highlights both the need for more frequent and extensive surveys and the regular assessment of important conserved populations by conservation managers.

The Tanzanian government and wildlife agencies have been at the forefront of efforts to reduce poaching and conserve elephants in eastern and southern Africa. Tanzania contains a number of important elephant populations including that of the Mikumi-Selous complex. This world heritage site comprises the largest protected area in Africa (> 55,000 km²) and contains a high diversity of species and habitats. The elephant population is an integral part of these diverse communities but its ecological influence is as poorly understood as the population itself. Tanzania's conservation priorities include the maintenance, protection and informed management of the rich biodiverse natural heritage protected within its Parks, Forest Reserves and Games Reserves. Tanzania's efforts to conserve and manage its biodiversity are often linked to important keystone and flagship species such as the elephant. And the Mikumi-Selous complex has often been viewed as primarily a reserve for the elephant population and its range of habitats. One of the important priorities for wildlife management and conservation in Tanzania is an informed management policy based on quantitative data and a local management capacity to both obtain that data and derive policies.

This Darwin Initiative Project is designed to build on the long-term research and on-site expertise of the Animal Behaviour Research Unit (ABRU) project in Mikumi National Park that is directed by the Darwin Project Leader. Expanding on this ongoing UK- based, research; protocols and long-term data are being used to establish a research and monitoring program on elephants within the entire area of Mikumi National Park. This is creating a capacity within Tanzania National Parks to monitor large mammals and their habitats using trained park rangers.

3. Project Objectives

This project expands UK- based research it's protocols and long-term data base to establish a research and monitoring program on elephants within the entire area of Mikumi National Park. This in turn will establish a capacity within TANAPA to monitor large mammals and their habitats using trained park rangers. It will further establish a capacity within the park ecology program to analyse the information obtained and to construct species or habitat management plans based on that analysis. This project within a single park can be expanded to regular monitoring using ranger patrols within the nation-wide system of 12 parks. It builds on two existing systems within TANAPA: the regular use of ranger patrols through all major areas of national parks and the revitalised park ecology programs currently established in all parks. It has the following specific goals:

Developing a quantitative description of the elephant population in Mikumi National Park, Tanzania. Generating and testing hypotheses on habitat use, group size, group structure, group formation and ranging of the Mikumi elephants. Training rangers on patrol to collect quantitative data on large mammals and vegetation use. Increasing the capacity of Tanzania National Parks to assess and monitor the populations and habitats under its protection using current staff and resource levels. Refining an ABRU based protocol for the maintenance of an elephant identity catalogue and database.

There were no significant alterations to the project objectives. However, opportunities and developments noted in the half-year report significantly increased the capacity of this project to meet its goals and further increased the likely outputs from the project. These include increased collaboration with Wildlife Conservation Society, Oryx Mapping and Resource Africa. Funding supplements from Oxford Scientific Film enhanced the capital outlay on the initial phases of the project. These developments are discussed in sections 4 and 5.

4. Progress

The historical progress of the project over the past year may be summarised as consisting of 3 phases: 1) Preparation and procurement; 2) Design and planning; 3) Implementation with ongoing revision and refinement. During phase 1 (April – May 2002) all stakeholders, collaborators and participants were contacted, schedules co-ordinated and the procurement of materials and equipment implemented. During phase 2 (May-July 2002) a workshop and meetings involving stakeholders and collaborators in the project were held in Mikumi National Park. In these meetings detailed plans and timetables were developed and refined for the project as a whole and for the 2002-3 period in particular. Provisional protocols were developed and refined during these meetings. Logistical issues and concerns were outlined and contingency protocols were designed to allow modification of timetables and protocols as and if necessary. Phase 3 (August 2002 – March 2003) saw the implementation of research protocols and the selection of rangers and other individuals to be trained. Training programmes for rangers were established and implemented. Transects were established and data collection was implemented. Procurement of capital and operational material needed for the first year was completed.

The key milestones outlined in the timetable (Table D) for the reporting period were all met to schedule with the exception of the planned involvement of students from the University of Dar es Salaam. University student involvement was limited due to schedule conflicts at the university with other field courses. This problem was identified in our Half-Year Report and discussions with colleagues and collaborators at the universities are ongoing to address this issue. All other projected outputs from (Table C) for year one were achieved. The timetable is further detailed in the original application document.

In summary; the planning and procurement phase was completed to schedule in the first 6 weeks of the project. The workshop involving senior Tanzania Park staff, university colleagues, UK participants, representatives of the Wildlife Conservation Society and other stakeholders was held as planned in May. Protocols for data collection on elephant population parameters, group behaviour and characteristics and habitat use were developed during this period. During the implementation phase, existing vehicle transects were expanded and new vehicle and foot survey transects were established throughout Mikumi National Park. A Geographical Positioning System (GPS) protocol was initiated and linked to a MapInfo Geographical Information System (GIS). A transect methodology for park rangers on patrol was developed. Senior rangers at each ranger post were selected for training on transect surveys, GPS use and vegetation data collection. A protocol manual for rangers was written, translated into Kiswahili and distributed to rangers during training sessions and to all ranger posts. Following ranger training sessions at park headquarters, field exercises were held to standardise procedures and monitor inter-observer reliability. All ranger posts were visited and performance of rangers assigned to the survey teams monitored in situ. Aerial surveys and satellite images were integrated with the GIS and used to assess habitat distributions, map roads and map important natural and artificial features within the park. Aerial surveys and satellite imagery are also being used to identify human communities on the boundary of the park that may be effected by elephant movements. The planned preliminary assessment of local human populations was supplemented by visits to communities on the park boundary to develop protocols for assessing human-elephant conflicts. A park ecology resource centre and office was completed and furnished to schedule in March 2003. A prototype elephant identity database was developed and is currently undergoing testing and further development. This links to the planned analysis by F. Mofulu for his Masters work and to the scientific outputs of the project as a whole. The analysis of historical data on the Mikumi elephant population by Mofulu, Norton and Hawkins is on going.

There were several enhanced outputs and activities. The inclusion of aerial surveys and GPS-GIS technologies permits a more detailed assessment and mapping of habitats, local human population, large mammal counts and game trails. Collaborating with Oryx Mapping on the GPS-GIS protocols, this project will provide Mikumi National Park with the first detailed and reliable vegetation map of the park as a whole, the first detailed and accurate boundary map and a tourist road map. A collaboration with Resource Africa and the EU funded 'Sensitise' programme at Anglia Polytechnic University considerable enhances the identity database using the MS – Access database programme. This database design has extensive applications to any research or monitoring programme of elephants or other large mammals where individual identities and sighting, resighting rates are needed. The survey design has permitted the collection of data on the Mikumi Giraffe population which park management requested be monitored to assess the rate of otitis disease currently infecting park giraffe population.

There are two principle training components to this project. Firstly the training of the Park Ecologist, Frederick Mofulu and his senior staff. This training is primarily through the design and implementation of his thesis work for his MSc degree with the project leader as supervisor. Additional training is provided with the development of the GPS-GIS technologies and by the implementation of regular aerial surveys in the park. The second training component is of rangers conducting poaching patrols from ranger posts throughout the park. Six senior rangers were selected based on seniority degree of field experience and park management's assessment of motivation. These rangers were trained on GPS methodologies and a specific protocol and data sheet. During patrols, rangers record their GPS position at regular intervals and record all elephant observation, make elephant dung counts and record vegetation conditions and vegetation used by elephant. All such records are cross-referenced to a GPS location. At the request of park management, all observations of giraffe are also recorded and the incidence of health and diseased individuals noted. The giraffe population in Mikumi is currently infected with a degenerative ear disease of unknown origin and these data help monitor the severity and variation of the infection within the population. Rangers visit park headquarters monthly and at that time turn in data sheets and download GPS data onto the ABRU and park ecology computers. Under the supervision of key staff, these senior rangers are training all rangers at the posts in the techniques they are using.

Project research uses standard transect and distance-sampling techniques modified to the Mikumi conditions. During this year transects were created and expanded. There are now 18 vehicle transects with a total distance of about 350 kilometres. Transects are distributed throughout the park and encompass all major habitats. During transect surveys, elephant sightings are recorded, dung and vegetation use by elephant is quantified and individual elephants and groups entered onto an identification database. Sightings and resightings of known individuals are being quantified to establish encounter rates. All transects are monitored on a regular systematic basis constrained only by workloads, road and weather conditions. The data collection for this research is now ongoing. Aerial surveys are being used to survey a wider area, and map patterns of elephant movement and habitat use. A distance-sampling regime for aerial surveys is being developed in collaboration with experts at WCS. Satellite mapping and GPS-GIS technology is supplementing aerial and ground surveys. Surveys of boundaries and local human populations will be implemented during the next years work.

The only significant difficulty encountered during this phase of the project was rescheduling time allotted to the Darwin project from the other commitments of key staff. Because teaching and other commitments were already in place when the project was funded it was not possible to fully reallocate time to the extent planned. Thus time spent on Darwin Initiative work by key staff was less than that scheduled in the contract. Similarly, the schedules of other key participants were already heavily committed when the project was funded. These problems were overcome to a large extent by the high degree of motivation of participants and co-operation between them. Key staff committed a great deal of limited personal time to ensure the project was implemented successfully. Such an intense commitment is not sustainable in the longer term and efforts are currently being made to reallocate time commitments appropriately.

The workplan for the next reporting period is an enhanced and modified version of that agreed in Tables C & D of the project as follows:

- Monitoring of elephant and vegetation plots and transects throughout the park (throughout year)
- Ranger surveys during anti-poaching patrols (throughout year)
- Aerial surveys (throughout year)
- Completion of analysis of historical park records on the elephant population and submission for publication (by end of year)
- Completion of computer database protocols and final field implementation (by July 2003)
- Ordinance Survey Maps for park digitised and included on GIS.
- Implementation of surveys of local communities to assess human – elephant conflicts. (throughout year from June 2003)
- Review workshop (by December 2003).
- Review analysis and assessment of first years data collection (by December 2003)
- Preliminary report to TANAPA assessing the Mikumi elephant population (by April 2004)
- F. Mofulu to UK to complete Masters thesis at Anglia Polytechnic University (February 2004)
- GPS-GIS outputs; vegetation, habitat, boundary and road maps completed and disseminated.(by December 2003)

5. Partnerships

The Darwin Initiative is well known and respected within the wildlife management and conservation communities of Tanzania. This is especially true for the principle Tanzanian partners of this project; Tanzania National Parks and the Tanzania Wildlife Research Institute. The ABRU project and the principal UK investigators have close long-term links with these organisations and collaborative relationships with many individuals within them. The Darwin Initiative project has been greeted with enthusiasm by the Tanzanian partners and given their full support. The Chief Ecologist of TANAPA and the Director General and Research Director of TAWIRI have been actively involved in this project since its inception. The Darwin Funding enabled the development of park ecology programme in Mikumi National Park to be accelerated. In collaboration with the Wildlife Conservation Society this led to a strategic action plan for the park ecology department in Mikumi being developed and implemented earlier than in many other higher profile parks in Tanzania. This was specifically because of the Darwin Initiative funding and the fact that the ABRU project was already in place and able to rapidly implement the Darwin Project. There is very active support for and appreciation of the project among the staff and wardens within Mikumi National Park. In addition to the active involvement of F. Mofulu Mikumi's park ecologist, all other senior wardens are involved. This is especially true of the Law Enforcement department and wardens who are co-ordinating the training and work of the senior park rangers. The rangers selected for training and survey work have been enthusiastic over the use of GPS technology. The important applications of these technologies to a range of conservation and management

problems, for example anti-poaching, are readily apparent to all those involved. This has resulted in a high degree of motivation for the survey work of the project.

During the period under review, this project has increased the links and collaborations with both local and international projects and organisations. A number of these have been outlined in section 4 above. These include links to Wildlife Conservation Society, Resource Africa, Oryx Mapping, the Tarengire National Park Elephant Project in Tanzania, the Park Ecology Departments in most of the other National Parks in Tanzania, and the Amboseli Elephant Project in Kenya. There have been a number of meetings and discussions on the application of the GPS-GIS technologies being used with a number of agencies including UNEP-WCMC in Cambridge. Through TAWIRI the project participated in a distance sampling training which will be used in the aerial survey protocols. Future links are likely especially with the Africa wide Cites programme MIKE (Monitoring the Illegal Killing of Elephants).

6. Impact and Sustainability

This project has been initiated at a time of considerable development within Tanzania National Parks, Tanzania Wildlife Research Institute and other wildlife and conservation agencies. It is designed to co-ordinate with and facilitate that development most specifically with the rejuvenated Park Ecology programme. It builds on the high profile of the ABRU project, which was one of the contributors to the Park Ecology developments in collaboration with WCS. It also builds on the high profile and prestige of the Darwin Initiative within Tanzania. Park Ecologists throughout TANAPA are aware of this project and that its applications extend beyond Mikumi National Park and the monitoring of elephants. The Darwin Initiative project workshop was preceded by a workshop to write the Strategic Action Plan for the Park Ecology Department in Mikumi and the workshops were co-ordinated to maximise integration and impact. Participants of this project attended workshops and meetings held elsewhere in Tanzania (for example, GIS training in Tarengire National Park and the annual meeting of TAWIRI). These served as forums to promote the work of this project.

As envisioned in the logical framework (Table A) for this project, the biodiversity capacity will extend well beyond the monitoring of elephants. This is illustrated by the many enhanced outputs that are already evident (see section 4). These include the mapping of the parks habitat diversity, the identification and quantification of poaching and human encroachment within Mikumi, the quantification of the biodiversity in previously unstudied areas of the park, the creation of a park ecology resource centre and the enhanced GIS facility within that resource centre which will co-ordinate with similar facilities developing in other parks. The notable enthusiasm of park rangers for GPS technology and the conservation applications of that technology demonstrates that the capacity to monitor and protect the biodiversity within Tanzania's National Parks will be enhanced and sustained at many levels. A particular outcome of the first workshop was a commitment by the Chief Ecology to the continuation of ranger based survey teams after the end of this project. The teams trained in Mikumi will be able to move between parks training other rangers and adapting the methods used in Mikumi to the particular conditions of each park.

7. Post-Project Follow up Activities

Although the first year of this project has just been completed its first year, it is clear that the full potential of the achievements expected would be enhanced and consolidated by follow-up activities. A key element of the capacity building built into the logical framework of this project is the transfer of that capacity beyond Mikumi National Park to other parks and reserves. While the capacity building is designed to use current levels of funding, the transfer to other areas would be greatly facilitated by Post Project Funding. The very active involvement of the Chief Ecologist of TANAPA and the Park Ecologists from other parks shows a strong commitment to these follow-up activities. A funded and co-ordinated transfer of capacity beyond Mikumi would embed the capacity in a fluent and efficient manner.

8. Outputs, Outcomes and Dissemination

Table 1. Project Outputs (According to Standard Output Measures)

<i>Code No.</i>	<i>Quantity</i>	<i>Description</i>
6A	6 + 30	<i>Training of Tanzanian rangers in GPS, transect surveys and elephant identification (Senior rangers trained by key staff, junior rangers trained by senior rangers with key staff supervision)</i>
6A	1	<i>Introduction to Distance Sampling 14th-16th August 2002; Advanced Techniques and Recent Developments in Distance Sampling 19th-21st August 2002 Centre for Research into Ecological and Environmental Modelling St Andrews, Scotland. Training for Dr. Simon Mduma of TAWIRI</i>
8	52	<i>Weeks of UK participants in field (1-3 participants)</i>
10	6	<i>Protocol instructions, finalised datasheets, GPS instructions (N.B. English and Kiswahili versions)</i>
14A	1	<i>Planning workshop organised with representatives from all partners and collaboration organisations plus Mikumi Park and Park Ecology staff.</i>
14B	1	<i>Workshop to develop Mikumi Park Ecology Strategic Action Plan Co-ordinated with Darwin Workshop above</i>
14B	1	<i>Royal Geographical Society Biogeography and GIS: new developments and future applications workshop.</i>
14B	1	<i>TAWIRI 3rd Annual Meeting Arusha TZ December 02</i>
14B	1	<i>TANAPA Park Ecology Training Workshop in GPS August 03</i>
?	1	<i>APU Applied Sciences Newsletter Issue 3 March 2002</i>
15D	1	<i>Cambridge Evening News 15 March 2002</i>
?	1	<i>News & Events section of APU Life Sciences Webpage (http://www.apu.ac.uk/appsci/lifesci/events/darwin_initiative_02.htm)</i>

21	1	<i>Park Ecology Resource Centre (£5,583.33)</i>
20	2	<i>Computers (£4,761.81): 2 laptops; 2 desktops</i>
20	5	<i>Global Positioning Systems and accessories (£2,035.58)</i>
20	10	<i>Items of miscellaneous field equipment (£1,354.65): 6 tents; 1 set walky talkies; 2 timer watches; copper rain gauge</i>
20	2	<i>Items of miscellaneous office equipment (£1,593.93): solar lighting, charger and batteries; filing cabinet</i>
20	3	<i>Digital cameras and accessories (£1,180.82)</i>
20	6	<i>Software/digital data (£4,081.01): 4 MapInfos; satellite image; maps</i>
20	8	<i>Binoculars for rangers and Park Ecology (£900)</i>
20	1	<i>Vehicle (£19,362.82)</i>
?	4	<i>Aerial Surveys conducted to date</i>
22	18	<i>Permanent Transects for monitoring elephant and vegetation</i>
23	1	<i>£20,000.00 from Animal Behaviour Research Unit (ABRU): overheads for research station</i>
23	1	<i>£800.00 in-kind from A. Messer: consultancy</i>
23	1	<i>£24,545.53 (including £21,262.88 in-kind) from Anglia Polytechnic University (APU): salaries, stationary, postage, equipment</i>
23	1	<i>£400.00 in-kind from B.Klaasen: consultancy</i>
23	1	<i>£500.00 in-kind from British Airways Assisting Conservation: flight</i>
23	1	<i>£3,950.00 in-kind from OryxMapping: consultancy</i>
23	1	<i>£600.00 in-kind from R.Barbour: aerial surveys</i>
23	1	<i>£80.00 in-kind from Sokoine University of Agriculture: salaries</i>
23	1	<i>£8,710.00 from Oxford Scientific Films: contributions to vehicle and solar lighting</i>
23	1	<i>£3,960.00 in-kind from TANAPA: salaries; use of facilities</i>
23	1	<i>£5,006.67 (including 3666.67 in-kind) from WCS: logistical support, aerial surveys, consultation,</i>

Note that actual outputs exceed those agreed and planned. This enhancement is discussed in sections 4 and 5. The involvement of university field courses previously discussed is not included. The prototype identity and sighting database is not included as it is still under revision and therefore not completely implemented in the field. However, the progress to date on this database does constitute a major output of the project so far.

Table 2: Publications

Type *	Detail	Publishers	Available from	Cost £
(e.g. journals, manual, CDs)	(title, author, year)	(name, city)	(e.g. contact address, website)	
manuals	Norton, G., Josephat, Gunn, J. & Mofulu, F. (2003) Kiswahili translation of instructions for Garmin 12XL GPS Survey protocols and datasheet	ABRU, Mikumi National Park	d.hawkins@apu.ac.uk	free
manuals	Norton, G., Hawkins, D.M. Mofulu, F. & Gunn, J. (2003) Elephant data collection protocols: Mikumi Darwin Initiative Elephant Project	ABRU, Mikumi National Park	d.hawkins@apu.ac.uk	free
presentation	McWilliams, N., Norton, G., Hawkins, D. & Mofulu, F. (2003) A low-cost GIS for research and management in a Tanzanian National Park. Biogeography and GIS: new developments and future applications workshop. The Biogeography Research Group of the Royal Geographical Society, Friday 4 th April 2003, University of Brighton. (oral presentation).	APU, Cambridge	www.apu.ac.uk/abru	free

Dissemination through meetings and workshops effectively established a network between the Darwin project and park ecology departments in the Tanzanian National Parks. Reports and other submissions to TANAPA headquarters and the Chief Ecologist disseminated both the protocols and manuals beyond Mikumi National Park and involved all parties in the monitoring and quantification of progress. Such reports are a standard procedure both of ABRU and the Park Ecology departments and will continue to disseminate results beyond the duration of the Darwin Initiative Project. See also sections 7 and 10.

9. Project Expenditure

Table 3: Project expenditure during the reporting period

Item	Budget	Expenditure
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** Includes Conferences etc., and Travel & Subsistence*

10. Monitoring, Evaluation and Lessons

The principle indicators of achievement for this year are the successful completion of the key milestones summarised in Table D of the project and achieving the expected outputs of Table C of the project and Tables 1 and 2 above. Monitoring and evaluation is an ongoing process that includes the management of the budget, regular communication between key participants and monthly, quarterly and annual reports. The maintenance of budget and expense reports monitored the procurement and dissemination of equipment and the establishment of research facilities, the running of workshops and training sessions. Other reports quantify and summarise the number of transects set-up or expanded, the transect surveys conducted and the number and variety of elephant sighting in different habitats. The GPS technology requires central co-ordination and downloading of data onto computers. The monthly downloading of these GPS data and completed data sheets that go with them thus monitors ranger surveys. The GPS data are further used to examine the extent and consistency of ranger surveys within and between the different ranger posts. There are thus regular quantitative assessments of the data being obtained on the elephant population in Mikumi. Reports are sent monthly to the project leader. Quarterly and annual reports are disseminated to all partners in the project.

The principle lesson from this year is that it is difficult to co-ordinate schedules of participants who have other commitments. Senior staff at TANAPA and TAWIRI have many demands on their time, as do all key staff of the project. These difficulties were surmounted in most cases due to the motivation and co-operation of all interested parties. This was the first year of the project and time commitments could not be scheduled until funding was secured. This compounded the difficulty. Future plans need to take account of these various demands on time and plan further in advance with increased consultation with participants and their employers. Another important lesson is that there are a number of other possible outputs and enhancements of outputs possible. A number of these have already been integrated into the project but careful thought and planning is needed to maintain the coherency and logical framework of the project. However, these collateral opportunities if carefully included will enhance the primary capacity building goal of this project