Darwin Initiative for the Survival of Species

Annual Report

2003-2004

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

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Project Reference 162/11/008

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1. Darwin Project Information

Project Ref. Number	*162/11/008*
Project Title	*Elephants of Mikumi National Park, Tanzania: Conservation, Education and Research*
Country	*Tanzania*
UK Contractor	*Dept. Life Sciences Anglia Polytechnic University*
Partner Organisation(s)	*Tanzania National Parks, Tanzania Wildlife Research Institute.*
Darwin Grant Value	*£107,800*
Start/End dates	*1 April 2002 to 31 March 2005*
Reporting period	*1 April 2003 to 31 March 2004 Annual Report #2*
Project website	*www.mikumi.org*
Author(s), date	*G.W. Norton, D. M. Hawkins, F. Mofulu 30 April 2004*

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 km^2) 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 Game 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 Purpose and Outputs

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.*
- *To train 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*

The relatively few modifications to the planned outputs or operational plan of the project were minor and were either additions and expansions that result from the general success of the project within Tanzania or changes to schedules which occur for a variety of reasons such as a administrative delays or climatic conditions.

Specific changes, delays or alterations were:

- Addition of MPhil student from Sokoine University of Agriculture, Morogoro, Tanzania to assess elephant impact on baobab (field work designed in collaboration with and supported by project).
- Addition of ABRU researcher to MPhil programme supported by Environmental Research Centre of Anglia Polytechnic University. This will facilitate analysis and dissemination of results on elephant ranging, seasonal patterns of movement and habitat use.
- Collaborative support and funding for upgrade to computer software for elephant identity database.
- Modification of planned workshops to take advantage of opportunities for improved efficiency of schedule and better participation by meeting at other venues.
- University undergraduate field courses need to be rescheduled in negotiation with the relevant departments and lecturers (see also last years report for discussion of this issue).
- Visa acquisition and leave arrangements delayed the host country project leader Fredrick Mofulu departure to UK for write up of MPhil and collaborative reports from February 2004 until April 2004.
- Incorporation of historical analysis of poaching and elephant population changes into MPhil research project of F. Mofulu.

4. Progress

History of Project to Beginning of reporting period

Progress in the first year of this project was in three 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.

Progress in year of reporting period

Introduction:

This year sees protocols, procedures and activities fully operational and ongoing. Similarly, capital equipment and resource facilities are acquired or set up and are in continuous use. Staff and participants are trained in the relevant use of equipment and actively using these in the field. The majority of milestones and outputs for the reporting period (as detailed in the project schedule Tables C & D and modified in the work plan for this period) were achieved. Several planned outputs were rescheduled or only partly achieved but this slippage was offset by the fact that the majority of these changes were in part to take advantage of opportunities arising for enhanced and/or additional outputs.

Progress, achievements and issues arising is summarised below for the various project components.

Ranger Training & Surveys

During the current year ranger surveys became a regular routine for all ranger posts within the park. This routine is based on training procedures, protocols and manuals developed during the first year of the project. There are six ranger posts regularly staffed with 5-6 rangers. At each post a senior 'Darwin Ranger has been trained in the use of GPS, the survey protocol and data sheet. All sightings of elephant, or elephant dung, tracks or vegetation use are recorded along with a GPS location. In addition, at the request of Tanzania Parks, rangers record all observation of giraffe by GPS location, counts of individuals and condition in relation to ear infections that are occurring within the Mikumi giraffe population. Each month the rangers return to park headquarters where datasheets are collected and GPS data downloaded. Rangers are provided with printout summaries of areas where patrols and surveys were conducted. These printout summaries serve both as a training reinforcement and an incentive. This feedback system has been highly motivating for ranger participants. Training is further enhanced by the senior rangers who conduct each individual patrol survey with other rangers on their team. These second rangers are given GPS and survey training by the senior rangers. Most rangers at a post alternate the role of assistant survey ranger. Thus all rangers are becoming trained in the survey methodology and GPS techniques. The survey data also includes information on poaching events or observations and provides a record of patterns and intensity of poaching as well as the extent of the area patrolled. ABRU or Park Ecology staff visited ranger posts on a regular basis to reinforce training (especially of non senior rangers) and to refine survey techniques.

There were some problems in computer systems at the Park Ecology Resource Centre but these were mitigated by backup systems at ABRU. Several senior rangers were transferred to other parks and this necessitated the training of new senior rangers at the effected posts. While the intent of this project is to disseminate the capacity to monitor by ranger patrol beyond Mikumi National Park, these transfers were premature and not planned for within the project. This emphasises the need for projects such as these to take into consideration the standard protocols for staff management within host country institutions. Similarly, a change in resources and policy has resulted in all posts being supplied with field vehicles by Tanzania National Parks. Consequently, surveys in some areas are now being conducted from vehicles as well as on foot. This has necessitated modification of the survey protocol to accommodate the greater distances and speeds of vehicle surveys.

Monitoring of established elephant transects and vegetation plots

There are now 19 permanent transects covering about 400km. These are distributed throughout the park and encompass all major habitats. Sixteen of these transects can be monitored throughout the year. Three other transects were found to be periodically inaccessible during the rainy season. However monitoring of portions of these transects was possible by finding alternative routes to them. This extended the monitoring period and the areas surveyed considerably. Assessable transects were monitored 1 to 2 times a month depending on work loads and weather conditions. Transects are monitored randomly without repetition until all available transects have been monitored. On all transects elephant sightings and resightings are systematically recorded at and between points, dung and vegetation use is quantified and individual elephants and elephant groups are photographed where possible and entered into an identity database.

During October of 2003 the principle UK participants met in Cambridge to assess the effectiveness of transect methods and refine them. Most refinements were minor

and related to datasheets and recording methods. The protocol for recording the indirect measure of elephant tracks and trails was simplified as was the protocols for visibility at transect points. Assessment of dung counts was enhanced to take into account variability in substrate and visibility. A similar adjustment was made for assessment of elephant woody plant use to take into account variability in the amount of woody vegetation available to elephant at different locations along a transect.

Aerial Survey

Aerial surveys for several related purposes are being conducted at 6 to 8 week intervals (depending on plane and pilot availability). Transect methods were further developed during this period with GPS points defined for multiple transects equally sampling the habitats (and visibility conditions) in Mikumi. In addition to transect surveys reconnaissance and general survey flights to assess habitat and visibility were conducted. Boundary and topography points were surveyed from the air to assess human population densities at boundaries and possible routes of movement by elephant into and out of the park. All relevant features and sightings were located by GPS and entered into the GIS database. In total there were 6 surveys conducted during 14 flights. Aerial surveys are being conducted in collaboration with the Wildlife Conservation Society, which is supplying the plane and pilot. During these surveys a number of poaching camps were located. Both wood poaching and meat/animal poaching camps were found. Boundary encroachment was observed and located or mapped in several locations although in general the surveys confirmed that population pressure is localised and generally low.

GIS and Elephant Identity Databases

Two separate databases are being compiled and disseminated. The first of these is a GIS database. This comprises satellite images, boundary, road and feature locations, transect locations and elephant sighting locations. The GIS is extensively used for ranger and aerial survey data. This database was considerably enhanced during the past year especially by the scheduled digitisation of the 1:50000 topographic maps covering Mikumi and the surrounding area. Extensive applied use has already been made of the GIS and it has been disseminated widely to Tanzanian stakeholders and institutions.

The elephant identity database has also been refined and enhanced during this period and this has delayed its full implementation. This enhancement was motivated in part by a workshop on the technological support for this project that was held in May 2004 and involved a range of elephant researchers, conservationists and GIS experts. Further revision of this database was made necessary by software glitches that required computer science expertise.

Advanced and Post Graduate Training

Senior wardens in Mikumi are being given training on monitoring techniques, GIS and database systems. This training is focused on the staff of the Park Ecology department but extends to wardens in the departments of Law Enforcement, Community Conservation and Tourism. A one-week advanced training session in GIS software and techniques was held in January of 2004 and other training is ongoing.

There are three postgraduate degrees now associated with this project. Two have been added in the past year. William Mmari a MSc student at Sokoine University of Agriculture approached the Park Ecology department and ABRU for assistance on his research project. We were able to collaborate with him on a question derived from the elephant studies. With project support, he investigated the use of and damage to baobabs by elephant. The data collection phase of his project has recently been completed and he is now writing up. The other new degree project is that of Jody Gunn the senior ABRU researcher on the project who will examine habitat use and seasonal patterns in Mikumi elephant for an MPhil at Anglia Polytechnic University (APU) in Cambridge, UK. Finally F. Mofulu has recently completed the field phase of his MPhil work and in now resident at APU where he is writing up. During review of his project and the historical data on elephant mortality now available we decided to include the historical analysis of mortality into his wider project on past and present elephant population densities and population trends.

Community Surveys

Community surveys to assess human elephant conflicts at park boundaries were implemented during the year under review. These surveys will be expanded and continue throughout the next year. Eighteen villages have been identified and eight were selected for preliminary assessment. Survey parameters included, human population size and demography, crops grown, seasonal pattern of crop growing and villager assessment of problem animals (crop raiding) in time and space. Elephants were not specifically focused upon to avoid bias in responses. However, elephant were listed amoung the top four problem species in seven of the eight villages surveyed.

Work plan

The work plan 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)
- Inclusion if logistically possible of riverbed foot surveys in less assessable areas
- An analysis of historical park records on the elephant population with a model of the current population parameters and changes due to poaching to be incorporated into Masters thesis of F. Mofulu (submission for publication on completion of thesis).
- F. Mofulu to submit Masters thesis at Anglia Polytechnic University (March 05)
- J Gunn to collect data for MPhil to April 05 and then travel to UK to write up
- Complete surveys of local communities to assess human – elephant conflicts (surveys through year end March 05).
- Training and comparative assessment tutorial from P. Lee from long-term Amboseli Elephant Project – Kenya (10 days probably October 2004)
- Enhanced identity software and database implemented on permanent basis at park ecology resource centre and research station
- Identity software disseminated to other long-term elephant projects for review and further enhancement
- Final workshop to assess results, plan and implement exit strategy and sustained program.
- Follow-up programme refined
- Management assessment and plan for Mikumi Elephant
- GPS-GIS outputs; vegetation, habitat, boundary and road maps enhanced refined and disseminated. Incorporate key GIS outputs into park management plan currently being drafted

5. Actions taken in response to previous reviews (if applicable)

From the review of our 2003-4 report we received a brief extract with comments and queries. These were highly positive and useful. It noted and found ''commendable the rapid mobilisation and implementation of the project'' and also found the report ''most informative'' The reviewer recommended that subsequent reports be organized under a set of headings and sections which reflect project components. We have organised the relevant sections of this report in line with this recommendation. The required format of the annual reports does not easily lend itself to such an organization but, we have hopefully responded adequately to this recommendation, which is the only actionable query of which we are aware.

The review extract as well as all guidelines and communications from the Darwin Initiative have been discussed in meetings between all principle participants and collaborators, most recently during a meeting held to plan the preparation of this report.

6. Partnerships

The host country partnerships and collaborations for this project are extensive and expanding. The principal partnership is with Tanzania National Parks (TANAPA). This partnership is at two levels. Firstly, it directly involves the senior wardens and staff of Mikumi National Park. The Mikumi Park Ecologist, Fredrick Mofulu, is a senior warden within the park and the principle host country coordinator of the project. During the current year, this partnership was enhanced with a new Senior Park Warden In Charge, John Shemkunde, who, like his predecessor, actively supports and facilitates this project. This support was especially crucial in planning the continuity of the project while F. Mofulu is in UK completing his MPhil. To do this Josephat Agustine, a senior warden in the law enforcement department, was transferred to park ecology and appointed acting park co-ordinator for the project. Agustine participated and assisted during the first year implementation phase and received the relevant training at that time. Moreover he was the principle translator for translating protocols and data sheets into Swahili. It is anticipated that his participation in the project will lead to further formal training for him.

The second level of collaboration with TANAPA is with the senior management based at Headquarters in Arusha. This collaboration is co-ordinated through the Park Ecology Division and the Chief Ecologist for TANAPA, Mr. I. Lejora. Both the Mikumi Park Ecology Department and ABRU report directly to Lejora who maintains receives and distributes reports assessments and other outputs from the project. Lejora was active and supportive in drafting an MOU for the Darwin project, which includes provisions for sustainability and continuity. The needed personnel changes were discussed and co-ordinated by him in collaboration with Mikumi Park Wardens.

The other principle host country partner is the Tanzania Wildlife Research Institute (TAWIRI), which has the responsibility for co-ordinating and administering all wildlife research within the protected areas of Tanzania. TAWIRI has been actively involved in the project since its inception. TAWIRI also administers the Conservation Inventory Monitoring Unit (CIMU) that has the overall remit for monitoring wildlife in protected areas. In the preceding year the Director of CIMU Simon Mduma was supported by this Darwin project to attend a workshop on distance sampling techniques in St. Andrews, Scotland. During the year under review we liased with CIMU to insure that the monitoring being done in Mikumi was included in the nationwide database and to ensure consistency and continuity. CIMU staff were consulted on techniques and timing of aerial surveys in the park and will be participating in these surveys when their schedules permit. The satellite images and useful portions of the Mikumi GIS database were disseminated to the CIMU GIS section.

TAWIRI hosts an annual research meeting every December. This involves most active researchers and conservationists working in Tanzanian protected areas as well as park ecologists and wardens, other TAWIRI and TANAPA staff and most Tanzanian wildlife biologists and conservationists. This years TAWRI meeting presented the opportunity to achieve the aims of the planned review workshop through discussions and meetings at this venue. This was particularly efficient as the headquarters of both TAWIRI and TANAPA are in Arusha. Consequently, more participants collaborators and stakeholders in the project could be present for these discussions. The progress of the project to date was reviewed, modifications were made to the MOU and various outputs such as the GIS database was discussed and distributed during these meetings. Refinements to methods and protocols especially for aerial surveys were also considered. The TAWIRI venue also allowed the strengthening and forging of links between a variety of agencies and conservation projects within Tanzania and the East African region.

A third collaborator is the Wildlife Conservation Society (WCS), which has worked with this project since inception. WCS provides the plane and pilot for aerial surveys and is working on the expansion of the park ecology departments in all Tanzanian

National Parks. ABRU is also active in this initiative and the Darwin project is directly linked to it. During the past year David Moyer of WCS piloted six aerial surveys (12 separate flights). He met with project staff in Mikumi on a number of occasions to discuss these surveys and other aspects of the project.

There are generally close collaborations between the project and wildlife biology staff at both University of Dar es Salaam and Sokoine University of Agriculture in Morogoro. As noted elsewhere it has been difficult despite these close contacts to schedule undergraduate field course participation in the project. However, at the graduate level several students have visited the project and one William Mmari collaborated with the project for his Masters thesis. Mmari in collaboration with ABRU researched aspects of elephant vegetation use that had been identified as important but not yet incorporated into the project. Mmari's participation allowed this research to be quickly designed and implemented.

Other links and partners include APU – Sensitise Programme (part of the European Community European Social Fund), 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, the Amboseli Elephant Project in Kenya and the MidZambezi Elephant Project in Zimbabwe. Representatives of most of these groups attended the 1-day workshop on technological support we held for the Darwin Initiative Project (see outputs). The technological developments of computer software for the identity database have led to an MOU between Resource Africa and the Darwin Initiative participants at APU. Oryx Mapping is supporting the GPS/GIS database development and works on this with project staff on a weekly basis. Nick McWilliams of Oryx Mapping was in Mikumi in January to standardise the GPS database at ABRU and at the parks Darwin Initiative Park Ecology Office and Resource Centre. He provided advanced training on MapInfo and ArcInfo GIS to ABRU staff, park ecology and park wardens. Other links are in progress for example with the MIKE (Monitoring the Illegal Killing of Elephants) project.

7. Impact and Sustainability

This project is designed to co-ordinate with the development of the Park Ecology Programme in Mikumi and facilitates its integration with other park departments. It builds on the prestige of the Darwin Initiative itself and the high profile of the long-term ABRU project. This profile was heightened in the last year when a BBC 'Natural World' documentary on aspects of the ABRU project was completed. This was well publicised within Tanzania and offered many opportunities to expand the impact of the project. TAWIRI recognised the contributions of the long-term work at ABRU to wildlife conservation at its Annual Meeting. This recognition was at a plenary session that honoured those long-term research projects that have made significant contributions to describing and conserving Tanzania's biodiverse wildlife. This commendation involved the offices of the President and Vice-President of Tanzania as well as the Ministry of Natural Resources and Tourism and thus received recognition at the national level and was publicised in the national press and on television. Such events have added weight to the impact of the Darwin Initiative project. Communication with a wide range of interested parties and organisations has been stimulated. Groups and individuals seeking more information on the elephant project now frequently approach both ABRU and the Park Ecology Department. In some cases this directly enhances the project. For example, William Mmari approached the project seeking advice and assistance for his masters research project.

To a large extent the fundamental capacity building that is a major goal of this project has already been achieved. Project activities are incorporated into the regular ongoing work of Mikumi National Park wardens and ranger staff. The long-term protocols of the Animal Behaviour Research Unit have been enhanced and are being used by both ABRU and Park Staff in a collaborative manner. Ongoing routines

operate well and are clearly sustainable beyond the duration of the project. A second goal of using elephant as an important flagship species to create a capacity to monitor manage and conserve large mammals and biodiversity is also showing early achievement with additions of other species to the ranger monitoring protocols (giraffe) to meet management needs. Habitat assessment has led to an expansion of information on the biodiversity of the park that emphasises both the importance of this area and the limitations of our knowledge of it. The GIS database is being used to document and respond to boundary encroachments. Similarly, data from elephant patrols have been used to assess and enhance antipoaching efforts throughout the park. Training is continuing and being conducted both by UK based and by host country (Tanzanian) personnel. This training is being conducted both collaboratively and by each unit separately as needed.

One notable achievement which is making a lasting impact and which will promote long-term sustainability is the resource centre of the park ecology department created and developed through this Darwin Initiative. This centre provides an increased presence, status and capacity for an existing within host country programme that is specifically focused on documentation management and conservation of biodiversity. Not only does the park ecology department have a higher profile within the park, it has a clear role integrated into the larger management system of the park (and the entire TANAPA system). Description and monitoring is now firmly embedded within the department and resource centre, as is the use of GPS/GIS. The wide-ranging applications of the work to other departments, especially law enforcement further promotes the exit strategy that is strengthened by TANAPA's continuing investment in and support for the park ecology programme. The project will be completing a management plan for elephant in the park as well as contributing to the new management plan for the entire park that is now being co-ordinated by the TANAPA planning department in Arusha.

8. Post-Project Follow up Activities

Two follow-up activities will strengthen the long-term impact of this project firstly by consolidating the advances made within the specific locale of Mikumi National Park and secondly by providing clear focus and impetus to the transfer of capacity to other parks and conservation areas within Tanzania. These activities build on the outputs and created capacity of this project and already have the active involvement of the Chief Ecologist of TANAPA and the Park Ecologists from other parks. The suggested activities are:

1. Capitalise on the multiple outputs on biodiversity in Mikumi (and the Mikumi-Selous system) derived especially from habitat & aerial survey, satellite image analysis and the GIS database outputs of this project. This project has documented virtually undescribed and highly diverse areas of the park that contain habitats of special note such as afromontane forests and extensive diverse woodlands. We have further documented a series of 4 separate water catchment systems that are likely to be crucial to the water supplies of southeastern Tanzania. An inventory and assessment of these areas is of the highest importance and can be quickly implemented using the established techniques from this project. Both the park ecology department and ABRU are consulting with specialists to construct a team to work with rangers and the park ecology department to describe and map these habitats.
2. Embed the capacity built by this project by expansion of that capacity to parks throughout Tanzania. National parks in Tanzania have active ecologists assigned to and committed to working on biodiversity inventories, locally relevant habitat and species assessments, and management of altering ecological processes such as fire. GIS training is now part of the park ecologists training and remit. But there is a strong need for a cost effective system for monitoring, ground truthing and data collection such as the ranger based system this project has implemented in Mikumi. There is a further need for coordination, integration and standardisation. A co-ordinated transfer of capacity beyond Mikumi would embed the capacity in a fluent and efficient manner.

9. Outputs, Outcomes and Dissemination

Most of the outputs scheduled for the current year were achieved and often enhanced. Some outputs were modified, rescheduled and usually integrated into additional outputs. The analysis of historical park records on the Mikumi elephant population has been recently enhanced by additional data from records kept at TANAPA head office in Arusha. Instead of publishing this analysis in the current form, we decided to include these additional data and incorporate these analyses into the MPhil project of Fredrick Mofulu. He will assess the observed elephant population size and demography in relation to that predicted by the historical records. On completion of his MPhil these data will be incorporated into a model of the long-term changes in the Mikumi elephant population and published collaboratively. As discussed in section 6, the planned review workshop was incorporated into a series of meetings and discussions during the TAWIRI annual meeting held in Arusha in December 2003. An additional workshop was held in May 2003 to discuss, improve and disseminate the technological developments which support this project. As a consequence of this meeting, the computer based identity data base is being upgraded and expanded to include a larger portion of the quantitative data on elephant observations. This upgrade is being supported by Resource Africa and the Sensitise programme of the European Community European Social Fund. This upgraded computer based protocol will soon be fully integrated in field work. The implementation of local community surveys was initiated during this year and will be

a major component for expansion during the next year. The only major slippage remains the inclusion of undergraduate field courses in the field work. These courses have proved too difficult to schedule within the current university time frames. However, a number of local student groups have visited the project and project goals and outputs presented to them. Moreover, individual students at both the undergraduate and post graduate level have met with project participants and been involved in the project as various levels. In particular, William Mmari of SUA joined the project to pursue his thesis research. Another additional output will be the MPhil of Jody Gunn the senior member of the ABRU staff running the project on a day to day basis in the field. We have expanded her role in the project to accommodate this graduate level work on habitat use and seasonality in the elephant population.

The principle form of dissemination is by transfer of outputs as well as reports directly to the institutions and staff who are both the primary partners and target recipients. The most extensive transfer to date consists of the GIS data, which includes digitised topographic maps, satellite images, vegetation assessments, boundary and road maps, assessments of poaching and of antipoaching efforts. F. Mofulu park ecologist and host country co-ordinator has prepared and presented to the target stakeholders a preliminary report on the Darwin project activities and the preliminary assessment of elephant populations within the park. Manuals, protocols and datasheets (in English and Swahili) have been transferred. Most of these products are or will be available on the project web page. Meetings and discussions with the targeted stakeholders particularly, TANAPA park ecology staff, other senior TANAPA officials, Mikumi wardens and rangers, TAWIRI and CIMU staff, have stressed the opportunities presented by these outputs, the uses these can be put to address a range of problems and questions both within Mikumi and elsewhere. These stakeholders are institutions and programmes within institutions with specific formal remits and procedures to address problems of biodiversity assessment and conservation. Consequently, there will be a continued use and dissemination of these products. The resource centre within the park and the centralized resource databases of the larger organisations will facilitate continued use. In addition to these target audiences, public and popular talks within Tanzania have publicised the activities and the goals of the project to a wider audience. Of note in this year was the invited plenary session talk by G. Norton at the TAWIRI Annual Meeting during recognition of the contributions of ABRU and other long-term research projects to wildlife conservation in Tanzania (see section 7).

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

Code No.	Quantity	Description
2	*3*	*F.Mofulu (Tanzanian with APU) completed field work and started write-up of research MPhil*
		W.Mmari (Tanzanian with SUA) completed field work writing up research masters
		J.Gunn (UK/Australia with APU) started research masters
6A & 6B	*6 senior + 24 junior rangers*	*Continue training of Tanzanian rangers in GPS; transect surveys and elephant identification at all six of MNP ranger posts. Senior rangers trained by ABRU and Park Ecology staff, junior rangers trained by senior rangers with ABRU/Park Ecology staff support. Top up training for senior rangers who received trained in first year and full start-up training given to 2 replacement senior rangers. Rotation of training amongst Junior rangers.*
	Training continuous throughout year	
	5 people for 2 days	*GIS training for ABRU and Park Ecology staff by Oryx Mapping personnel*
8	*154 weeks*	*Guy Norton (15 weeks); 1-3 ABRU Research Assistants (137 weeks); OryxMapping personnel (2 weeks)*
14A	*1*	*Workshop: Technological Support for the Mikumi Elephant Darwin Initiative Project, 15th May 2003*
14B	*4*	*Conference: International Conference on the Forest and Environmental History of the British Empire and Commonwealth, 19th-21st March 2003*
		Workshop: Royal Geographical Society Biogeography and GIS: new developments and future applications workshop, 4th April 2003.
		Conference: Tanzania Wildlife Research Institute 4th Annual Meeting, 4-6th December 2003
		Conference: Student Conference on Conservation Science, 24 - 26 March 2004.
15D	*4*	*Bulletin (APU Staff Magazine) January 2004*
		Cambridge Evening News 4th January 2004
		Agenda (Cambridge magazine) February 2004
		www.mikumi.org Website updates
20	*£ 17983.65*	*Toyota vehicle for Park Ecology Department*
	1492.25	*Computers etc: 2 laptops; 2 projectors*
22	*3*	*Aerial surveys 3 principle transect routes defined 6 surveys conducted 14 flights*
	1	*Elephant transects; additional to existing 18*
23	*£ 20,000.00*	*Animal Behaviour Research Unit (ABRU): overheads and capital for research station*
	33581.50	*Anglia Polytechnic University (APU): salaries, stationary & postage, travel insurance , student bursary, aviation fuel*
	3250	*British Airways Assisting Conservation: 4 flights*
	511.76	*Toyota Tanzania: special discount on vehicle purchase*

	7400	*OryxMapping: consultancy*
	4520	*TANAPA: salaries*
	5112.5	*Wildlife Conservation Society (WCS): logistical support, flying costs excluding fuel (14 Flights), vehicle purchase assistance contribution in kind*
	4500	*Sensitise Programme/Resource Africa: database development*
	400	*Dan Morse private contribution of spare parts*

Table 2: Publications

Type * *(e.g. journals, manual, CDs)*	**Detail** *(title, author, year)*	*Publishers (name, city)*	*Available from* (e.g. contact address, website)	*Cost £*
Presentation	*Norton, G.W. and Hawkins, D.M. (2003) Long term research in Mikumi National Park, Tanzania: historical processes and the implications for conservation.*	*N/a*	*www.mikumi.org*	*Free*
Presentation	*McWilliams, N., Norton, G., Hawkins, D. & Mofulu, F. (2003) A low-cost GIS for research and management in a Tanzanian National Park.*	*N/a*	*www.mikumi.org*	*Free*
Presentation	*Norton, G.W. (2003). Long-term perspectives on wildlife research for conservation.*	*N/a*	*www.mikumi.org*	*Free*
Confidential Report	*Observation of Poaching in Mkata River, Mikumi National Park*	*N/a*	*On written application to TANAPA HQ (Arusha)*	*Free*
Confidential Report	*Park Ecology Report on Contributions & Preliminary Assessments of Darwin Project in Mikumi*	*N/a*	*On written application to TANAPA HQ (Arusha)*	*Free*

10. Project Expenditure

Table 3: Project expenditure during the reporting period (Defra Financial Year 01 April to 31 March)

Item	*Budget (please indicate which document you refer to if other than your project schedule)*	*Expenditure*	*Balance*

11. Monitoring, Evaluation and Lessons

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 monitor field activity of staff especially ranger field time and research activities. 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 further 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 and to relate these to the established ground transects and aerial surveys. 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 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 is a further means of evaluation and monitoring. Moreover, the added outputs that have been achieved in both years of the project to date provide a means of evaluating both success and impact. The contribution of these outputs and outcomes to the project purpose is reflected in the extensive involvement of Tanzanian individuals ranging from field rangers to senior managers and academics. The skills most of these individuals have acquired and are now using on a regular daily basis represents a significant increase in capacity. The resource centre of park ecology department is in regular use and issues internal reports and assessments on a variety of related and relevant ecological parameters. These reports are evaluated by the senior management in Arusha as is the project itself.

The difficulty of co-ordinating schedules between participants in this project was noted in the last report. We also noted that the additional outputs and enhancement of outputs being generated would require careful integration into the logical framework. These remain important issues but the lessons of the past year are mostly positive suggesting ways of mitigating the continuing issues of co-ordination

and integration. In particular, it is clearly important to be aware of and take advantage of existing venues or protocols within the Tanzanian systems. By integrating meetings and the goals of review workshops into the TAWIRI annual meeting venue more individuals could be involved and consulted more effectively. There is a considerable infrastructure within Tanzania both at the institutional and NGO level which can utilised to effectively disseminate output and information of the project. Similarly, within this infra structure there are tools and information of use to the current project for example the databases of CIMU and poaching records at TANAPA headquarters. Increased awareness of and communication with such institutions, organisations and individuals will improve and heighten the effectiveness of the project.

12. Outstanding achievements of your project during the reporting period

■ **I agree for ECTF and the Darwin Secretariat to publish the content of this section**

We would like to highlight three results of our project to date. Firstly, there is the rapid implementation of the project and in particular the training for rangers and wardens. We can already qualitatively assess one of the key questions of the project; the occurrence of elephant in and elephant use of the two thirds of Mikumi National Park that was previously unsurveyed, an area of diverse habitat with thick woodlands and difficulty of access. Elephant occur in these areas and are using them with a regular intensity. This strongly suggests that elephant density in Mikumi has been underestimated due to a limited survey area and that the total elephant population is at the larger end of estimates (possibly in the range of 3000-4000 rather then 2000-3000 individuals).

Secondly, the success of the training and capacity building which is demonstrated not only in research and monitoring outputs but also by the enthusiastic involvement of the Tanzanian park rangers and wardens. This enthusiasm and interest is manifest when datasheets are returned and GPS data are downloaded. The mapped results of surveys from the GIS are given to rangers as feedback and leads to a heightened level of involvement and motivation. This process has also helped lead to the tangible results of an active park ecology resource centre where staff are pursuing a range of urgent ecological questions and problems complementary or collateral to those of this project.

Thirdly there are the benefits that are being derived from the GIS database and the aerial and ground surveys that contribute to it. For the first time an accurate park boundary is being mapped. Vegetation and habitat maps and assessments are being improved and upgraded. The first detailed and accurate road and track map of the park has been made and is being readied both for tourist as well as management use. These and other results of the GIS database will be used not just for a management plan for the Mikumi elephant population but also for the new management plan for the entire park. Perhaps the most impressive collateral result has been the application of GPS/GIS data to law enforcement and antipoaching efforts. Ranger surveys in the GIS database, identify the extent and pattern of antipoaching efforts and patrols. This information enables the law enforcement department to assess and plan improvements to the antipoaching efforts. The aerial and ground surveys have located and mapped the patterns of human population living adjacent to and occasionally encroaching into the park, clarified other boundary dispute issues and located and mapped poacher camps and other physical evidence of poaching. This is leading to a more detailed understanding of patterns of poaching and other human activities that could threaten the integrity of the park and the diverse species it contains.

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2003/2004

Project summary	Measurable Indicators	Progress and Achievements April 2003-Mar 2004	Actions required/planned for next period
Goal*:* To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose: *To create a permanent capacity to ensure the survival of African elephants and their habitats in Tanzania. To train Tanzania park ecologists and rangers in the continuous monitoring and assessment of the wild animal species and habitats under their protection. Quantitative understanding of the Mikumi elephant population*	*A continuous program of elephant research and monitoring within Mikumi.* *Application of techniques developed in Mikumi to other habitats, species and parks.*	*Elephant research & monitoring by research project, park ecology department & law enforcement rangers now ongoing and continuous. Monitoring & reporting included in permanent remit of Park Ecology Department, Co-ordinated through Initiative established Ecology Resource Centre.* *Surveys used to monitor giraffe and giraffe disease, GIS data and surveys applied to antipoaching, mapping and encroachment assessments. Two trained rangers active in other parks*	*Insure co-ordination with multiple partners and stakeholders, Integrate outputs especially enhanced and added outputs.* *Formalise and implement exit strategy with principle stakeholders.* *Plan follow-up activities in co-ordination with principle partners and stakeholders, contact needed specialists and participants.* *Refine long-term assessment and report procedures*
Outputs: *A permanent program within the Mikumi-Tanzania Park systems monitoring the elephant and other large mammal populations using the regular anti-poaching posts and patrols of rangers*	*A permanent elephant identity database in use by park ecology program, rangers and researchers.*	*Senior wardens trained in GIS and survey techniques. 8 Senior rangers trained with ongoing enhancement plus training of junior rangers at posts.* *Photo ID catalogue in use and archived at park ecology resource centre and*	*Use rapid feedback to motivate and maintain enthusiasm of ranger participants.* *Maintain close communication with administrators on ranger placement and transfer plans.*

		ABRU research station. *Computer ID data base being enhanced.*	*Anticipate computer software and hardware problems in field environment. Keep up to date antivirus software maintained.* *Fully implement centralised computer database and identification system in resource centre and research station*
A permanent program of trained analysis and assessment of this information by the Parks Ecology department.	*Regular critical assessments of elephant status in Mikumi-Selous.*	*Preliminary assessments of elephant status reported to TANAPA, qualitative assessment confirms elephant distribution and activity park and habitat wide. Remits for reports included in responsibilities of park ecology department*	*Prepare detailed assessments in co-ordination with MPhil projects of Mofulu and Gunn* *Continue analysis of current patterns to model past and present population trends in elephant population*
A core of rangers trained in transect monitoring	*Habitat evaluations in relation to elephant use*	*High motivation and involvement of ranger participants* *Vegetation use by elephant surveyed in plots and transects* *Surveys vegetation plots and satellite images used with GIS software to refine vegetation and habitat maps and assessments*	*Continue and refine feedback system for law enforcement and community conservation departments.* *Continue and complete surveys of local human populations and assess human elephant conflict at boundarys* *Finalise maps and habitat assessments, incorporate into Park Management Plan*

Appendix 1: Table A Logical framework from project schedule

Project summary	*Measurable indicators*	*Means of verification*	*Important assumptions*
Goal *To assist countries rich in biodiversity but poor in resources with the conservation of biological diversity and implementation **of the Biodiversity Convention***			
Purpose To create a permanent capacity to ensure the survival of African elephants and their habitats in Tanzania. To train Tanzania park ecologists and rangers in the continuous monitoring and assessment of the wild animal species and habitats under their protection.Quantitative understanding of the Mikumi elephant population	A continuous program of elephant research and monitoring within Mikumi. Application of techniques developed in Mikumi to other habitats, species and parks.	Reports and annual assessments to TANAPA head office. Publications arising from the monitoring programs Application of the management program for the elephants in Mikumi and their habitats by park staff.	Continuity of the ABRU research project in Mikumi. Continued support of the park ecology department by TANAPA and continued funding for Park Ecology & Antipoaching ranger patrols
Outputs A permanent program within the Mikumi-Tanzania Park systems monitoring the elephant and other large mammal populations using the regular anti-poaching posts and patrols of rangers. A permanent program of trained analysis and assessment of this information by the Parks Ecology department. A core of rangers trained in	A permanent elephant identity database in use by park ecology program, rangers and researchers. Regular critical assessments of elephant status in Mikumi-Selous. Habitat evaluations in relation to elephant use.	Reports and annual assessments to TANAPA head office. Publications arising from the monitoring programs. Upgraded inventory of biodiversity in southern 2/3 of park including maintenance and use of park reference herbarium.	Ranger time and willingness to participate. Sufficient motivation on part of ranger's reinforced by proper management of the park ecology and research teams.

Activities Training of senior patrol rangers in transect and vegetation monitoring techniques. Collection of long-term quantitative data on elephant population size, structure and habitat. Collaborative analysis of quantitative data with park ecology team. Verification, dissemination and refresher workshops	Vehicles for access to posts and for road transect. Computer and digital camera equipment and software for permanent identity catalogue. Ranger training sessions Workshops and refresher training courses. Vehicle and infrastructure maintanence.	Workshop outputs. Ranger evaluations and performance. Analysis of village surveys. Park records and reports. Reports and annual assessments to TANAPA head office. Publications arising from the monitoring programs	Access to southern 2/3 of park. Maintenance of park roads, Limited interruption to climatic problems (i.e. El Nino effects during wet seasons). Rigour and reliability of digital and computer equipment for database management.