Flamingo Conservation and Ramsar Site Management at Lake Bogoria, Kenya

SECOND ANNUAL REPORT

01.04.04 – 30.03.05

Earthwatch Institute (Europe) &
University of Leicester

Contents: **Page**

Darwin Initiative for the Survival of Species

Annual Report 2

1. Darwin Project Information

Project Ref. Number	*162/12/003*
Project Title	*Flamingo Conservation and Ramsar Site Management at Lake Bogoria, Kenya*
Country(ies)	*Kenya*
UK Contractor	*Earthwatch Institute (Europe)*
Partner Organisation(s)	*University of Leicester (UofL) through the Lakes of the Rift Valley (LoRV) project, Lake Bogoria National Reserve (LBNR), University of Nairobi (UofN), National Museums of Kenya (NMK)*
Darwin Grant Value	*£175,791*
Start/End dates	*July 2003 to June 2006*
Reporting period (1 Apr 200x to 31 Mar 200y) and report number (1,2,3..)	*1 April 2004 to 31 March 2005* *Annual Report No. 2*
Project website	*www.kenya-rift-lakes.org*
Author(s), date	*Dr David Harper, Project Leader, University of Leicester;* *Robert Llewellyn-Smith, Earthwatch Institute (Europe)* *30th May, 2005*

2. Project Background

The project is located at Lake Bogoria National Reserve, Rift Valley Province, Kenya. This is one of three central soda lakes in the series of lakes in the Eastern Rift that runs through Ethiopia, Kenya and Tanzania (Fig 1). These three lakes (Nakuru and Elmenteita are the other two) are the main feeding lakes of the lesser flamingo *Phoeniconaias minor* in the region. Four populations of *P. minor* exist (India-Pakistan; West Africa; South Africa and East Africa) but most of the individuals are in East Africa and most of those in Kenya. Lake Nakuru was Kenya's first Ramsar* site, Bogoria was declared in 2000 and Elmenteita has just been submitted as a candidate to Ramsar by KWS.

**Ramsar is an international convention on the protection and wise use of wetlands. Ramsar sites are designated by signatory countries as wetland areas to be sustainably managed.*

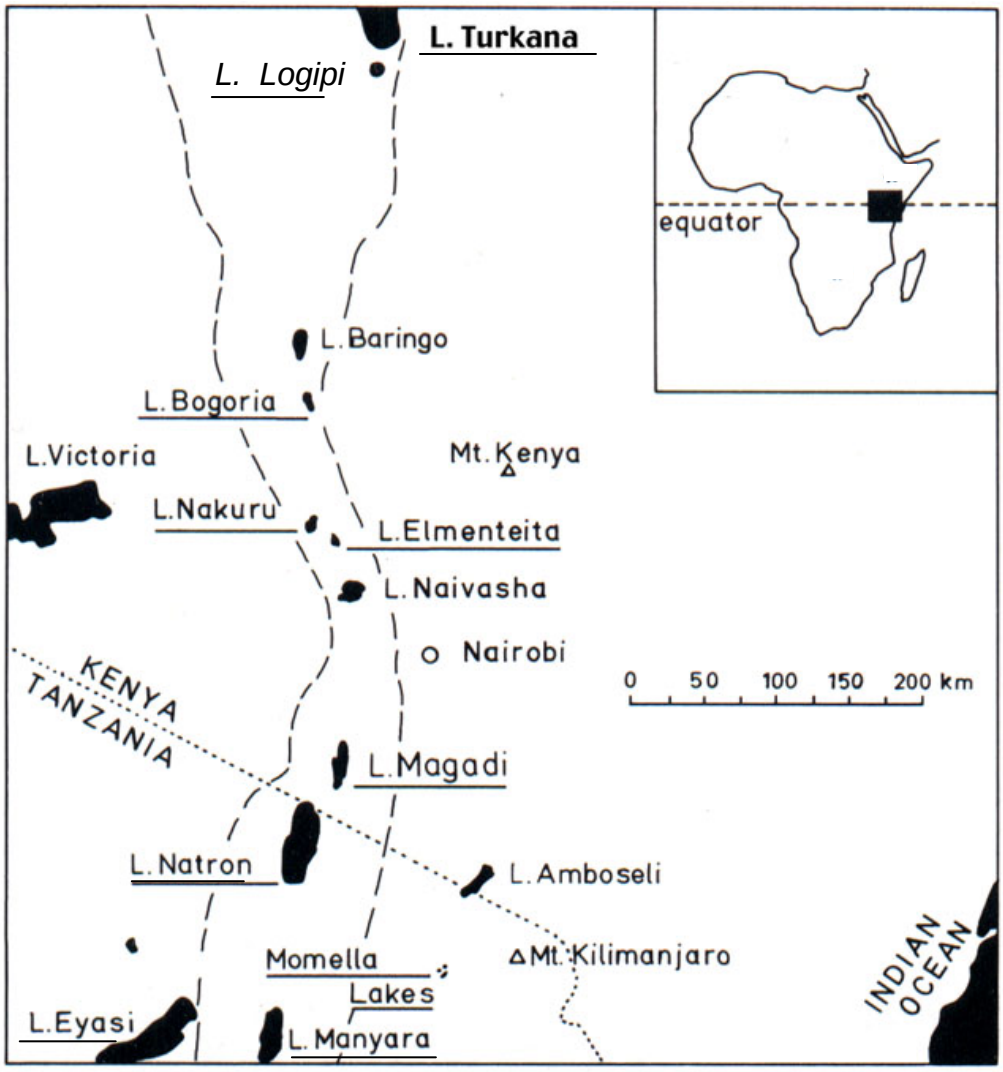


Figure 1. Lakes of the Kenyan Eastern Rift Valley. Saline lakes are underlined.

The feeding opportunities for *P. minor* are limited to the dozen or so saline lakes that contain adequate concentrations of cyanobacteria (mainly) and diatoms (occasionally) to provide food when filtered through the species' highly modified beak. *P. minor* only breeds in East Africa at one lake, Natron, where the colonial nest mounds are constructed on temporary salt islands (at appropriate lake levels) and breeding can be achieved relatively free from terrestrial predators.

The species is considered 'near-threatened' because a single breeding lake is vulnerable and Lake Natron is presently unprotected. Moreover, breeding is irregular and four outbreaks of large-scale mortality since 1975 have been recorded in Kenya, among dense populations. The most recent occurred in 1999-2000, when it is believed up to 200,000 birds died.

3. Project Purpose and Outputs

Project Purpose

To identify the essential lake ecosystem properties that sustain key populations of water bird species and thereby ensure LBNR's management plan completion. To explain the mass movements of *P. minor* that occur between Lake Bogoria and neighbouring lakes, and the causes of unpredictable mortality of *P.minor*. To advise on measures to minimise risk to the species.

Project Outputs

- Coherent explanation of effects of changes in external factors on the abundance of *P. minor*, cape teal and black-necked grebe populations at LBNR formulated, in the context of alkaline lakes' limnology.
- Causes of movements of *P. minor* between lakes and mass-mortality understood.
- Species health monitoring leg banding and tracking programmes established

These outputs are disseminated in scientific peer-reviewed journals and public scientific magazines. They are linked with the capacity-building of Kenyans from individual of project partners to pupils of lake Bogoria schools and the general public.

The project expands upon an Earthwatch project which supports three field research teams each year at Lake Bogoria. These Earthwatch teams continue to play a central role in the Darwin-funded project, which itself also involves more regular monitoring at the three lakes in the Rift Valley – Lakes Bogoria, Nakuru and Elementeita, which are the most important feeding sites for *P.minor.*

Project outputs in the second year are on track and contributing towards the project purpose. Achievements and progress are summarised in Annex 1 and described more fully below. The project's logical framework is shown in Annex 2.

At the end of Year 2, the overall project goal, purpose, outputs and activities were re-assessed and revised to take into account project developments and changing circumstances. The revised log frame is summarised in a hierarchical tree in Annex 4 and which presents a clearer and more logical project design. The log frame matrix, in particular the measurable indicators and means of verification, are currently being revised to match the activities. Once completed, the revised log frame will be sent to the Darwin Secretariat for their approval and will be reported on in the next 6 month report and final report.

4. Progress against objectives

1. Essential Lake Ecosystem Properties Identified

The year March 2004 through to March 2005 proved to be highly interesting in that a period of deoxygenation of the whole water column (probably caused by a succession of cloudy days inhibiting photosynthesis during March) was followed by a collapse of the cyanobacterial bloom, which reached a trough in July-August in an unusually brown, smelly, lake with very few flamingos, very low densities of benthic chironomid larvae and almost no Cape teal or black-necked grebes. Recovery had occurred by October, but flamingos had not returned in any numbers by the end of the reporting year. We were able to document this almost continuously through the combination of Earthwatch research teams, Darwin Project soda-lake surveys and 4 graduate students' contributions. The data are now being analysed to be presented to the 11th World Lakes Conference in Nairobi in November 2005 and subsequently published.

Preliminary analysis of a sediment core taken in September suggests that the bloom collapse may be a periodic occurrence. Further analysis of the core will yield the timing and may yield the cause of these oscillations.

2. Movement of flamingos between lakes

The soda lake surveys revealed that many of the flamingos not in Bogoria were in Nakuru in the second half of 2004 (but their location in the first part of the year were not clear). Movements of the satellite-collared birds continued to be monitored and reported at monthly intervals on the WWF website (e.g. March 2005 http://www.wwt.org.uk/flamingo/projectnews.asp?ArticleID=59). The data from the two lines of investigation are now being examined together.

3. Incidents of mass mortality

The Earthwatch research team at the beginning of this reporting period completed a set of protocols for flamingo health monitoring and post-mortem examination under field conditions and also lake ecosystem health monitoring. These were incorporated into this project's soda lake survey work and were passed to KWS and LBNR (and their Tanzanian equivalents) for use in any future mortality incidents. There was a short (1-week) incident at Lake Nakuru in July 2004, almost certainly caused by the death of exhausted birds in a large arrival group as well as a longer, larger, incident at Lake Manyara in Tanzania. Work in 2005 will strengthen the link with both the Tanzanian and KWS veterinarians.

Analyses of samples collected in 2004 from the lake, from hot springs and from flamingo tissues from post-mortem birds were carried out by Professor Codd's team at the University of Dundee. These revealed low levels of cyanobacterial toxins.

4. Public understanding of soda lakes

Education about the biodiversity value of Bogoria

The Bogoria schools work is reported below, because it is considered that the most important legacy of the project will be to leave usable, long-life, educational materials.

A set of posters was printed for the LBNR entrance gate and offices and given to them for display in March 2005. Reaction of reserve visitors to the posters will be monitored up to July 2005, and the experience used to influence the modification of these posters for a reserve guidebook by the end of project.

The educational book about the lake ecology, which will be produced both for visitors and senior schools through WCK, as outlined in the first report, is still being designed and written along the lines of the last annual report.

Formal training of key Kenyans

The workshop in April 2004 was oversubscribed and closed at 30 participants. All 30 questionnaires to participants at the end of the workshop were highly positive. A "test" of participants' information gave good results, and positive suggestions for future workshop topics were made at an open discussion (workshop summary in Appendix 3).

The number of Kenyans studying the UofL Distance Learning undergraduate certificate Global Ecology and Wildlife Conservation has increased to 6 from the partner organisations; the early participants are progressing well and it is expected most will complete by the end of project.

The main partner from the Ornithology Department of NMK, Nicodemus Nalianya, was awarded a place at the Mweka College of Wildlife Management, Tanzania and offered a half-scholarship to attend from October 2004 by a US citizen. The project is supporting him for the other half and his place on the soda lake survey taken by an intern, Timothy Mwinami. Timothy, plus two other Museum interns (from Entomology) each studied with Earthwatch research teams as part of their field training programme.

Laban Njoroge commenced his M.Sc. in Medical Entomology at the beginning of this financial year, after working with Professor Cooper on the Earthwatch research team of March 2004 on carcass decay at the soda lake edge and teaching on the April workshop. Laban was also sponsored through Earthwatch's African Fellowship Programme, to participate in a 2-week invertebrates research project in South Africa in January 2005 where his skills were further developed. It is of interest that Laban was a Museum Entomology Department intern taken onto our first workshop in July 2003, but he displayed such high promise that we have developed his skills. He will join the Earthwatch research teams as project scientist later this year when his M.Sc. is completed.

5. Additional achievements during the past year not in original logframe

Flamingo and Soda Lake Health

- Dr Chris Tuite, of the Department of Zoology, University of Bristol, joined the project team in October 2004 and is using data from *P. minor* morphometrics that will contribute to the calculation of an energy budget for it. He is also extending the coordination between existing flamingo interest groups in the four regions where *P. minor* occurs to organise a synchronous census of all known feeding lakes. He and David Harper are accumulating information to accurately estimate the population size of the species, which we believe is over-inflated by subjective estimates thirty years old. A paper on this topic will be presented to the 11th World Lakes Conference in Nairobi in November 2005 and subsequently published.
- Professors Ekkehard & Angelica Vareschi of the University of Oldenburg, Germany, have started work at Lake Manyara, Tanzania, for 2 years 2005-7, studying the limnological stability of soda lakes. We are collaborating to utilise the same methodologies in both countries and to encourage local residents at every soda lake to take weekly transparency readings with Secchi discs provided by EV. We are also seeking to have weekly water samples taken and preserved for our later analysis.
- Dr Jonathan Grey, of Queen Mary, London, analysed samples collected by him and other colleagues from the Earthwatch-funded LoRV programme using stable isotopes of Carbon and Nitrogen in 2003-4. This has enabled us to quantify the food chain links of water-land by separating the fate of flamingo feathers from flamingo carcase decomposition. A manuscript from this is in preparation.
- Dr Ian Donohue, of the Department of Zoology, Trinity College Dublin, has analysed a sediment core collected by him on a visit in September (see above). This will enable the frequency of *A. platensis* population collapses to be quantified and hence change in suitability of the lake for *P. minor* predicted.
- Graduate students Amy Deacon, Debra Bardowicks, Pavla Kohoutkova and Mr Richard Webster (each self-funded), participated in the research on flamingo mortality and the monitoring of spirulina densities during 2004. Their periods each overlapped with our Earthwatch-funded LoRV research teams for training, and then continued between teams, so that a near-complete picture of the ecological consequences of a spirulina decline on the lake (see above) was achieved.

Education

- Professor John Cooper utilised his existing links with the University of the West Indies and the World Society for the Protection of Animals (WSPA) to organise a workshop at LBNR in March 2005, which explored links between flamingo health and domestic animal health, developing the theme of our first July 2003 Darwin project workshop, of 'ecosystem health' (Annex 3).
- Mrs Claire Parsons, of Parsnips Productions, Leicester, worked with Maureen Harper to write two (of the three planned) Primary School storybooks about flamingos and the reserve. The first of these has been illustrated commercially in Kenya and is now being printed for distribution to Lake Bogoria schools and initial evaluation in July 2005.
- Debra Bardowicks who was undertaking an M.Sc. in Biological Imaging in 2003-4, conducted her dissertation at Lake Bogoria. She produced 10 posters of the habitats of the lake that have been printed and laminated at A3 size for the Reserve Loboi Entrance Gate. These are now being simplified by her and Amy Deacon as posters for Secondary schools and are being combined into a single booklet as the reserve handbook, for sale to tourists entering the reserve (see above).

- Professor Cooper was able to represent the project at a 'Transdisciplinary Symposium on Recent Mass Die-offs of Lesser Flamingos (*Phoeniconaias minor*) in Eastern and Southern Africa' at College of Veterinary Medicine, University of Illinois at Urbana-Champaign, September 24-26,2004 This has initiated a *Flamingo Specialist Network* by email circulation, to which Cooper, Harper, Childress and Tuite now subscribe.
- Dr Childress has become the Chairman of the IUCN/Wetlands International *Flamingo Conservation Group*, which is managed by the WWT. Harper and Tuite are members of this group.
- LoRV were awarded a grant of £5,000 in late 2004 from the Vodaphone Foundation *via* the Earthwatch Institute for communication. This will enable audio-visual presentations to be made more effectively at Bogoria in the final year of the project. A larger grant was given to Richard Brock, of the recently-formed 'Brock Initiatives' charity which incorporates film footage from international wildlife films with new clips to make short, appropriate films for local audiences. He trialled this approach in 2004-5 at Lake Naivasha with LoRV and in the final year of the project, this approach will be extended to several short educational films about this Darwin Project, Lake Bogoria and lesser flamingos.
- Plans were completed for a LoRV research-workshop team of 8 African Ramsar-site fellows to be held in April 2005, funded through the EWI African Fellowship Programme (EU & corporate sponsors), plus 4 Kenyans sponsored through this project. Its task was to answer the question 'Should Lake Elmenteita be a Ramsar site? A report of this workshop will come in the next annual report.

6. Main activities for the next twelve months (to end March 2006)

ACTIVITY	TIMING & DURATION
3-lake Soda Lake Surveys, repeated 7 times by Partners	8 days each; early-May, late-June, mid-August, early-October, end November, mid-January 2006, early-March 2006.
Workshops, 3rd, 4th & 5th	April 12th-27th 2005; July 21-27, 2005, March 2006
4 Earthwatch-funded LoRV Research team fieldwork campaigns	April 12th – 27th 2005 (Elmenteita), July 5th – 21st 2005, November 2005, March 2006 (all Bogoria).
David Harper to attend 11th World Congress of Lakes, Nairobi, to present a keynote paper, chair a session and present two papers about the project	October 31st – November 4th 2005

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

Following the first annual report, a number of questions were raised by the ECTF reviewer. David Harper responded to the queries as part of the subsequent sixth month report sent to ECTF (Stephanie Halfman) by email on 22.11.2004.

6. Partnerships

All the existing partnerships in the project, including the new ones reported in the first annual report, were consolidated –

1. The partnership with Soysambu Estate (Lake Elmenteita) was consolidated by the opening of a Field Studies Centre on the shores of the lake and advice given on the construction of a laboratory adjacent to it in 2004. Plans were completed for a research workshop to be held there in April 2005, details of which will be reported in the next Report.
2. The partnership with WWF and LBNR at Bogoria was developed by incorporating the WWF Project Ecologist and their student intern into the Earthwatch research teams in 2004 and giving all project data to the WWF Project Ecologist. The LBNR Ecologist was provided with additional laboratory training by the staff of the Nakuru Water Quality Laboratory under the support of this project, in the processing of samples collected during soda lake surveys.
3. WWF have purchased registration to the Wildlife Clubs of Kenya for the Bogoria areas schools, in support of our partnership with WCK, reported last year.

Two major changes were dealt with –

4. The first change that occurred was in KWS policy towards research during 2004, under a new Director. Dr Harper met with Dr Bagine, Head of Research and Mr Anderson Koyo, Head of Wetlands, in KWS HQ in January 2005, accompanied by Professor Mavuti of UoN. It was agreed there that a new MoU would be signed to reflect these changes and this is now being negotiated.
5. The second change is that in 2004 water and sewage was privatised in Kenya. Dr Harper met with the Director of the new company, NAWASCO (Nakuru Water and Sewage Company) together with Bernard Kuloba of KWS Nakuru and Andrew Kulecho of the company's Water Quality laboratory. He separately met with the Chief Engineer together with William Kimosop of LBNR. Both meetings discussed the project's involvement with the two laboratory staff, their use of consumables and the training given to them.

A new partnership was developed with the African Conservation Centre, who are working in the border area of Kenya-Tanzania, particularly over the sustainable future of the Shompole wetlands at the Ewaso Nyiro delta of northern Lake Natron. One of their Masaai game wardens attended the workshop at Elmenteita April 2005. Plans for post-project follow-up were discussed with the Director, David Western.

7. Impact and Sustainability

The lasting impacts, through the exit strategies for the project, continue to be developed with the partners. They fall into three sections – research, education and monitoring.

1. Three research proposals to extend and develop the Earthwatch/Darwin results, are being developed for 2006-8 –
    a) for an International initiative to census all 4 populations of lesser flamingos simultaneously
    b) to the EU Framework 6 'INCO' programme, targetting Arid & Semi Arid Environments, for a Regional (Kenya-Tanzania) initiative to develop an Integrated Water Management Strategy for Rift Valley water basins
    c) To the UK NERC, to understand further the unique biological diversity and food webs of the ecosystems of the main Kenyan soda lakes.

2. Education initiatives in schools have changed focus slightly in recognition of the reality of the sheer deprivation in all schools of the Lake Bogoria area. Our goal is still to provide long-lasting material that promotes biodiversity conservation within the context of sustainability in the daily lives of pupils and their families, but we recognise that it has to be on top of basic material, teaching environmental science, in order to ensure its understanding –

    a) All schools that requested a logo by suggesting a local animal (logo design by local artist/designer), have been provided it on 1000 sheets of headed notepaper together with an A3 laminated school sign (11 schools out of 13; example as Annex 5). We feel this is important to promote institutional identity and pride.

    b) Each school has been given 3, commercially-available, laminated, wall maps – of the World, of Africa and of Kenya.

    c) The two Secondary schools have been given a set of 12, linked Macmillan posters of global environmental topic (e.g. Water Cycle), around which lessons can be planned.

    d) All Primary schools have been given 3, commercially-available, activity colouring books with class work-packages, of major habitat types in East Africa – Lakes, Plains and Bush (Jennette Hanby & David Bygott, (1992) Longhorn Publishers, Nairobi & Kampala).

    e) Wall posters of the ecology of key common animals and birds that are indicators of habitats in the environment on a 'cross-section' of the Rift Valley at this latitude have been designed out of Debra Bardowick's dissertation material and are being prepared for the two Secondary schools.

    f) Simple and inexpensive wall posters (made from sisal sacking with figures stencilled on indelible felt-tip pen) have being designed by Maureen Harper, of animals and plants seen in the local environment, for all Primary Schools, and will be made by a local artist commissioned in March 2005.

    g) Two (out of three planned) stories in the series 'The Lake Bogoria Adventures' for Primary schools have been written and illustrated, and printing will shortly begin. The third is in concept.

3. A monitoring strategy for the lakes, that will be robust enough to be sustained post-project is still being developed. There are problems at each lake - of personnel changes not allowing build-up of experience (Nakuru), of conflicting demands on personnel time (Bogoria) and of financial/resource limitations (both lakes). We are attempting to tease out these problems by encouraging the simplest level of monitoring at weekly intervals in each lake – Secchi disc measurement of transparency together with water sample collection and preservation. We are planning to focus the workshop in July 2005 to help the Lake Bogoria management plan implementation committee with incorporating science and simple monitoring into the Ramsar Management Plan.

8. Post-Project Follow up Activities (max 300 words)

The reserve management plan for Bogoria is nearing release. Our July 2005 workshop will explain scientific research findings, integrate them in the plan and begin to develop a framework for long term monitoring, building on the experience of the Darwin/Earthwatch projects. Post-project follow-up will then be critical to ensure that this management plan is maintained as a coherent, effective and updated document, actively used by the Reserve authority and stakeholders to guide lake management. This will be a key opportunity to build confidence and capacity within Baringo and Koibatek County Councils (LBNR falls within the administrative jurisdiction of both) to help avoid the plan being 'shelved' - the fate of so many. This is important in the wider context, as Lake Baringo has recently been awarded Ramsar status so the same Councils are obliged to develop its management plan, yet there is no Kenyan Local Government experience in management plans. Furthermore, no Kenyan Ramsar site yet has a monitoring programme up and running. We would run 4 future workshops on -

- Stakeholder ownership of usable management plans for all Rift Valley Lakes
- Linking lakes with their basins' sustainability; particularly *via* forest restoration
- Operating practical and sustainable monitoring programmes
- Trans-boundary conservation management for Rift Valley lakes

This last workshop recognises that Kenya & Tanzania together hold almost all East Africa's lesser flamingos. Professor Vareschi is doing research with similar objectives, from Lake Manyara, 2005-7. We would use this unique opportunity to bring the countries together in concurrent soda lake monitoring by supporting regular surveys by a parallel team of staff from TANAPA and TAWIRI (already established for Vareschi's fieldwork). The only lesser flamingo breeding lake – Natron – spans the border; breeding frequency is irregular and unknown. We would base 2 workshops at Shompole wetland (north Natron), accessible to nationals from both countries and promote similar capacity building through Tanzanian partners and soda lake schools as in Kenya.

9. Outputs, Outcomes and Dissemination

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

Code No.	Quantity	Description
2	2	1 Kenyan studying for Masters qualification - Laban Njoroge 1 Kenyan studying for Diploma in Wildlife Conservation – Nicodemus Nalianya (both National Museums of Kenya)
3	6	6 Kenyans currently working towards undergraduate certificates by Distance Learning
5	2	2 Kenyans working full time on the project
6A	1	30 Kenyans attended one 1-week workshop in April 2004 "Taxonomy for Biodiversity Conservation"
6B	2	One 1-week workshop delivered (plus 1 non-Darwin workshop March 05, a follow-up from the first 2 Darwin ones)
8	32	32 weeks scientific work on project by UK staff and postgraduate students, with Kenyan interns
9	1	Web site set up (Kenya-rift-lakes.org) and under further development

11B	1	1 additional paper published in scientific journals – see Table 2.
14B	1	John Cooper made presentations at Flamingo Workshop in Illinois, September 2004.
15A	2	Darwin workshop article in NatureNet (Nature Kenya newsletter). Flamingo satellite-tracking article in Msafiri (Kenya Airways in-flight magazine)
23		Funding from EW volunteers = £11,200 Transport of mobile lab and donated equip from Amsterdam to Kenya by Shell = £*circa* 10,000 UofL co-funding programme through value of Dr Harper salary for 6 weeks; equivalent co-funding from employers of 5 UK scientists (or personal contribution where self-employed) for 10 weeks.

Table 2: Publications

Type * (e.g. journal, manual, CD's)	Detail (title, authors, year)	Publishers (name, city)	Available from	Cost £
Newspaper article on web	2003 (not reported in 1st year report) *Solar power tracks flamingos*, Alex Kirby	BBC News website	http://news.bbc.co.uk/2/hi/science/nature/3035091.stm	
Scientific newspaper article on web	2003 (not reported in 1st year report) *Darwin Flamingos summary*, Anon.	IUCN website	www.iucn.org/info_and_news/press/flamingocp.pdf	
Scientific Newspaper article on web	2003 (not reported in 1st year report) *Flamingo Conservation and Ramsar Site Management at Lake Bogoria National Reserve, Kenya* David Harper	RAMSAR website	http://www.ramsar.org/w.n.kenya_bogoria_harper.htm	
Scientific Newspaper article on web	2004, Flamingo Lakes of Kenya Explored	The Environment News Service -01	http://www.ens-newswire.com/ens/jan2004/2004	
Scientific Newspaper article	2004 *From Crayfish and Lake Naivasha to Flamingos and lake Bogoria* David Harper	NatureNet Nature Kenya's monthly newsletter	David Harper	
Magazine article	2005 *Winged Wonders*, Ron Toft	Kenya Airways in-flight magazine, Msafiri, vol 50 Feb-April 2005	Copy requested from airline	
Peer-reviewed scientific article	2004 *Bathymetry of Lake Bogoria, Kenya* Phil Hickley, Rosalind R.	Journal of East Africa Natural History 2004, *92*	Kenneth M. Mavuti when reprints available Abstract:	

	Boar & Kenneth M. Mavuti (UofL, Earthwatch and UofN respectively)		http://www.naturekenya.org/JournalEANH3.htm
Peer-reviewed scientific article	2005 *The Use Of GIS And Remote Sensing Techniques To Analyse Water Balance Of Lake Bogoria Under Limited Data Conditions* J. O. Onyando, F. Musila, M. Awer (Latter two authors WWF partners)	Journal of Civil Engineering Research and Practice, 2, 2005	M. Awer when reprints available abstract http://www.ajol.info/viewarticle.php?id=20683&jid=186&layout=abstract
Peer-reviewed scientific article	2005 *Mortalities of lesser flamingos in Kenyan Rift Valley saline lakes and the implications for sustainable management of the lakes* Robert Ndetei and Victor S. Muhandiki (1st author KWS partner)	*Lakes & Reservoirs* Volume 10 Issue 1 Page 51 - March 2005	Robert Ndetei when reprints available abstract http://www.blackwell-synergy.com/doi/abs/10.1111/j.1440-1770.2005.00255.x?cookieSet=1
Peer-reviewed scientific article	2004 *Satellite tracking documents the East African flyway and key site network of the Lesser Flamingo (*Phoenicopterus minor*).* Childress, B., B. Hughes, D.M. Harper, W. Van den Bossche, P. Berthold, & U. Querner, (in press).	Orally presented to Waterbirds Around the World Conference 2004. Manuscript submitted to journal *Waterbirds*	Brooks Childress, when reprints available

Outputs partially achieved

The mobile laboratory arrived in Mombasa in December 2004, was cleared customs by January 2005 (WWF East Africa Programme Office used their position to enable duty to be waived by the Kenya Treasury) and delivered to a secure location at Lake Naivasha by the end of that month. Examination of the contents revealed that little had been broken and nothing stolen. Time has been allocated in the present year for the unpacking and checking the functioning of all equipment. When dispatched from Amsterdam the lab was packed full (because the delay in shipment had enabled much more equipment , that had been thrown out by UofL, to be loaded into it) and we plan that the duplicate equipment will be donated to the other soda lake laboratories (WWF, NAWASCO and Jersey Hall). The laboratory will be moved to its final destination in Koibatek County Council by the end of the project.

10. Project Expenditure

Table 3: Project expenditure of Darwin funding 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

The virements and carry forwards indicated above were approved by the Darwin Secretariat.

11. Monitoring, Evaluation and Lessons

The April 2004 workshop was evaluated by a structured questionnaire, which was backed by a final session involving all participants. Fuller reports of this (Darwin 2004) together with the spin-off (UWI-WSPA 2005) workshops is in Annex 4

The effectiveness of the methods used in the Soda Lakes Survey censuses have continued to be evaluated by comparison with the NMK national waterbird count, done for Nakuru on adjacent days in July 2003 and for all lakes in an adjacent week in both January 2004. The procedures used in the Soda Lake Surveys have been modified following feedback from the participants after each one and also after each Earthwatch research team where necessary, so that the final protocols presented to the partner organisations as the core part of the exit strategy will have been thoroughly tested.

12. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum)

The project has now succeeded in bringing a mobile laboratory to the Rift Valley lakes which, as an unexpected benefit from its delay in shipping from Europe, was filled with glassware and other equipment, surplus to the over-technology-equipped laboratories of Europe. These items will now equip three soda lake laboratories to a much higher level of efficiency than before – Nakuru (NAWASCO), Bogoria (WWF) and Elmenteita (Jersey Hall) and will further serve as a “mother lab” for the smaller mobile lab based on a Toyota Land Cruiser of the Earthwatch Lakes of the Rift Valley project.

The project has achieved its capacity building in the partner organisations well, with Laban Njoroge (NMK, Entomology) half way through an M/Sc in Medical Entomology and Nico Nalyianya (NMK Ornithology) half way through a Diploma in Wildlife Management. Laban was also awarded an Earthwatch African fellowship for invertebrate project in South Africa, (to follow the one awarded last year to the LBNR warden). The UofL Distance Learning certificate Global Ecology & Wildlife Management (equivalent to 1 year full time undergraduate level study) is proving ideal for those practical field workers who may not have the ability for formal full-time study and do not wish/cannot afford to leave their jobs. The certificate assignments are being integrated with their existing practical responsibilities and outputs from their attendance on the Darwin Workshops.

At the beginning of this new reporting year (April 2005) we successfully combined the Earthwatch research team concept with this project's Darwin workshop concept, when 12 African fellows (4 Darwin-funded Kenyans) worked and discussed for 16 days building a scientific case for nominating Elmenteita as a Ramsar site to senior KWS staff. It will be fully reported next year. This project's successful combination of rigorous scientific research with capacity building from postgraduate to primary school level is invigorating many local people in the Lake Bogoria region and breaking new ground in cross-discipline collaboration. The two major challenges in Post Project follow-up – to use all the outputs in the practical implementation of a usable management plan and to take this model of success down the Rift Valley to other lakes in Kenya through to Tanzania – will be developed further in this final year.

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

Project summary	Measurable Indicators	Progress and Achievements April 2004-Mar 2005	Actions required/planned for next period
Darwin Initiative Overall 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			
Lake Bogoria & Lesser Flamingo Conservation Project Purpose • To identify the essential lake ecosystem properties that sustain key populations of water bird species and thereby ensure LBNR's management plan completion. • To explain the mass movements of P. minor between Lake Bogoria and neighbouring lakes, and causes of unpredictable mortality of P.minor. To advise on measures to minimise the risk to the species	• Research findings on lake ecosystems/water bird species submitted to LBNR management committee and KWS each year of project. • Flamingo and lake data incorporated into global accessible websites, and local databases • Recommendations adopted into reserve and trans-national species management plans; implementation started by EOP. • Species (flamingo) and ecosystem (alkaline lakes) health concepts incorporated	Findings completed for Year 2. details in Section3 Flamingo tracking information at *http://www.wwt.org.uk/flamingo*. Local databases await delivery of computers now in Kenya with mobile lab. Lake Bogoria Management Plan In draft form. Incorporation of our results has been suggested to the author organisations, and will be reported in full in Year 3. John Cooper attended International Workshop on Flamingo Health, Illinois, September 2004. Flamingo health protocols completed. Collaboration progressed between project and Kenya Wildlife Service at HQ and Lake Nakuru National Park.	Continued research by 3 Earthwatch field teams and monitoring 8-times by project partners' soda lake teams Computers will be checked in August 2005, delivered and set up after that. Next workshop will July 2005 on the topic of incorporating scientific research into management plans and developing lake monitoring protocols, using the draft Bogoria plan.

	into management plans.		
Outputs			
Coherent explanation of effects of changes in external factors on the abundance of P. minor, cape teal and black-necked grebe populations at LBNR formulated, in the context of alkaline lakes' limnology.	Physical infrastructure which has underpinned the fieldwork in place – mobile laboratory on-site with its computer worldwide web connections operational.	Mobile laboratory successfully delivered to Mombasa December 2004, cleared through customs by January 2005 with duty-remission organised by WWF East African Regional Programme Office, now in secure location at Naivasha	Laboratory will be unloaded in August 2005, all equipment checked for functioning and repacked. Duplicated equipment shipped out will be donated to 3 laboratories - at Bogoria (WWF), at Nakuru (NAWASCO) and at one newly-constructed at Elmenteita (Delamere) to ensure all three soda lakes have basic apparatus for simple analysis, on their shores
Causes of movements of *P. minor* between lakes and mass-mortality understood.	Scientific quality output evaluated by peer-review of publications	One peer reviewed publication by project leaders, three by project partners. One magazine article in Kenya Airways *Msafiri* Jan-March 2005 and one newsletter article in Nature Kenya *NatureNet* April 2005 issue.	Three further manuscripts in preparation, will be delivered orally at the 11th World Water Congress in Nairobi, November 2005. Subjects flamingo population numbers, short-term spatial relationships between flamingos & *A. fusiformis* and ecosystem effects of *A. fusiformis* density changes during 2004. John Cooper preparing publication of March-April 2004 research project on carcass decomposition at lake edge.

Annex 2 – Logical framework

Project summary	Measurable indicators	Means of verification	Important assumptions
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 identify the essential lake ecosystem properties that sustain key populations of water bird species and thereby ensure LBNR's management plan completion.* • *To explain the mass movements of* P. minor *between Lake Bogoria and neighbouring lakes, and causes of unpredictable mortality of* P.minor*. To advise on measures to minimise the risk to the species.*	• *Research findings on lake ecosystems/water bird species submitted to LBNR management committee and KWS each year o project.* • *Flamingo and lake data incorporated into global accessible websites, and local databases* • *Recommendations adopted into reserve and trans-national species management plans; implementation started by EOP.* • *Species (flamingo) and ecosystem (alkaline lakes) health concepts incorporated into management plans.*	• *Annual reports and recommendations from project to lake authorities and national agencies.* • *Databases available on the worldwide web.* • *Project final report and evaluation.* • *Reserve and species management plans incorporating project findings.* • *Adoption of flamingo health protocol as guide for other wild bird species.*	• Current national political and economic conditions do not deteriorate to the extent that it is unsafe to work in Kenya. • Reserve authorities remain receptive to cooperation and support. • New government (Jan 2003) allows laboratory to be imported to Kenya free of import duty.
Outputs • *Coherent explanation of effects of changes in external factors on the abundance of* P. minor*, cape teal and black-necked grebe populations at LBNR formulated, in the context of alkaline lakes' limnology.* • *Causes of movements of* P. minor *between lakes and mass-mortality understood.* • *Species health monitoring leg banding and tracking programmes established*	• *Physical infrastructure which has underpinned the fieldwork in place – mobile laboratory on-site with its computer worldwide web connections operational.* • *300+ flamingos banded, 300+ blood samples taken and analysed for health parameters* • *Three years tracking data from seven birds recorded and interpreted* • *Scientific quality output by evaluated by peer-review of publications*	• Two workshop protocols published as NMK occasional publications • *Over five scientific publications.* • Full *P minor* health database, and report • Banding records • Articles and photographs published in magazines and websites available to the general public • Specialised websites for *P minor* tracking data and alkaline lake ecology.	• Extreme climatic events do not occur to extent that data interpretation is limited and longer term monitoring is required before recommendations can be made • New flamingo capture method functions effectively. • Earthwatch volunteers can sustain funding and workforce for long term monitoring beyond three-year grant.

Annex 3. 2004-5 Workshop Reports

1. April 2004. *Taxonomy for Biodiversity Conservation*

The second workshop of this project was held in April 2004 at Loboi, Lake Bogoria. Its title was “Taxonomy for Biodiversity Conservation” and, like the first workshop, it was heavily over-subscribed with many applicants being advised they would be considered first for future workshops. This workshop was accommodated in the camp of the Earthwatch-funded ‘Lakes of the Rift Valley’ project, which had just completed a research team. This change in accommodation overcame many of the criticisms of the first workshop, which had been directed at the poor sanitation facilities and monotonous food provided at the local hostelry.

The camp was able to accommodate 24 people, in shared tents, together with local attendees (LBNR and WWF staff) who joined from home each day, making 30 participants. The tutors were David Harper; Dr Muthama Muasya (Herbarium, National Museums of Kenya); Mr Tony Drane (Earthwatch scientist, UK) and Mr Laban Njoroge (Entomology Department, National Museums of Kenya), Mr Kariuki Ndanganga (Ornithology Department, National Museums of Kenya). Professor John Cooper (University of the West Indies) introduced delegates on the first day to the history and importance of taxonomy as a discipline and his wife, Margaret Cooper, spoke about the role of taxonomy in international conservation conventions.

The group was divided into three from the second day onwards, and the groups then rotated every one and a half days between birds, invertebrates and plants. Each group had half a day of lectures and a whole day of field practical work. Work was focussed upon the area around Loboi, which contains several freshwater swamps fed by springs which Dr Muasya had worked on previously but were understudied ornithologically or entomologically.

Participants were tested at the end of the course with a series of questions about the theory (3-5 per topic, 4 topics) and practical specimens to identify (4-5 per taxon, 3 taxons). The average score was 23/30. Participants also filled in a questionnaire evaluating the course and the logistics. Consistent comments were poor public transport from Marigat on the assembly day; lack of time for the practical work; but every response out of the 30 was overwhelmingly positive.

The meeting was concluded by a discussion about future workshops. This, the second workshop had addressed a more practical need; the first one (‘Aquatic Ecosystem Health, July 2003’) had addressed the theoretical bases for understanding the issues of Lake Bogoria management. The group was split fairly evenly between those who felt that there was a need to repeat each workshop, because of the demand for both within the country. A small third group expressed interest in different topics; the ones mentioned were management plans for Ramsar sites and principles of aquatic ecology. All would have liked a longer time for the workshop than the five days allocated to each.

2. March 2005 *Wildlife And Livestock Health*

A Training Workshop on Ecosystem Health, incorporating both wildlife and domestic livestock, was held from Tuesday 28 March to Friday 1 April 2005. This was a collaborative venture between the University of the West Indies (UWI) and the World Society for the Protection of Animals (WSPA) and the University of Nairobi, the National Museums of Kenya and the Worldwide Fund for Nature (WWF). The Workshop was an extension of two previous years' work at Lake Bogoria funded by the Darwin Initiative grant , when the emphasis of the research had been on the causes of mortality in lesser flamingos (*Phoeniconaias minor*) and the possible relationship of recent "die-offs" of

these birds to changes in lake ecology. Following discussions at that stage with the local community, a decision was make to broaden the scope of the study in 2005. In particular, the examination and treatment of local livestock would be included in the programme in order to obtain a more comprehensive picture of the health of the Lake Bogoria ecosystem and its inhabitants. Such a holistic approach was alsp in keeping with recommendations made at the Transdisciplinary Symposium on flamingo health held at the University of Illinois, USA, in September 2004.

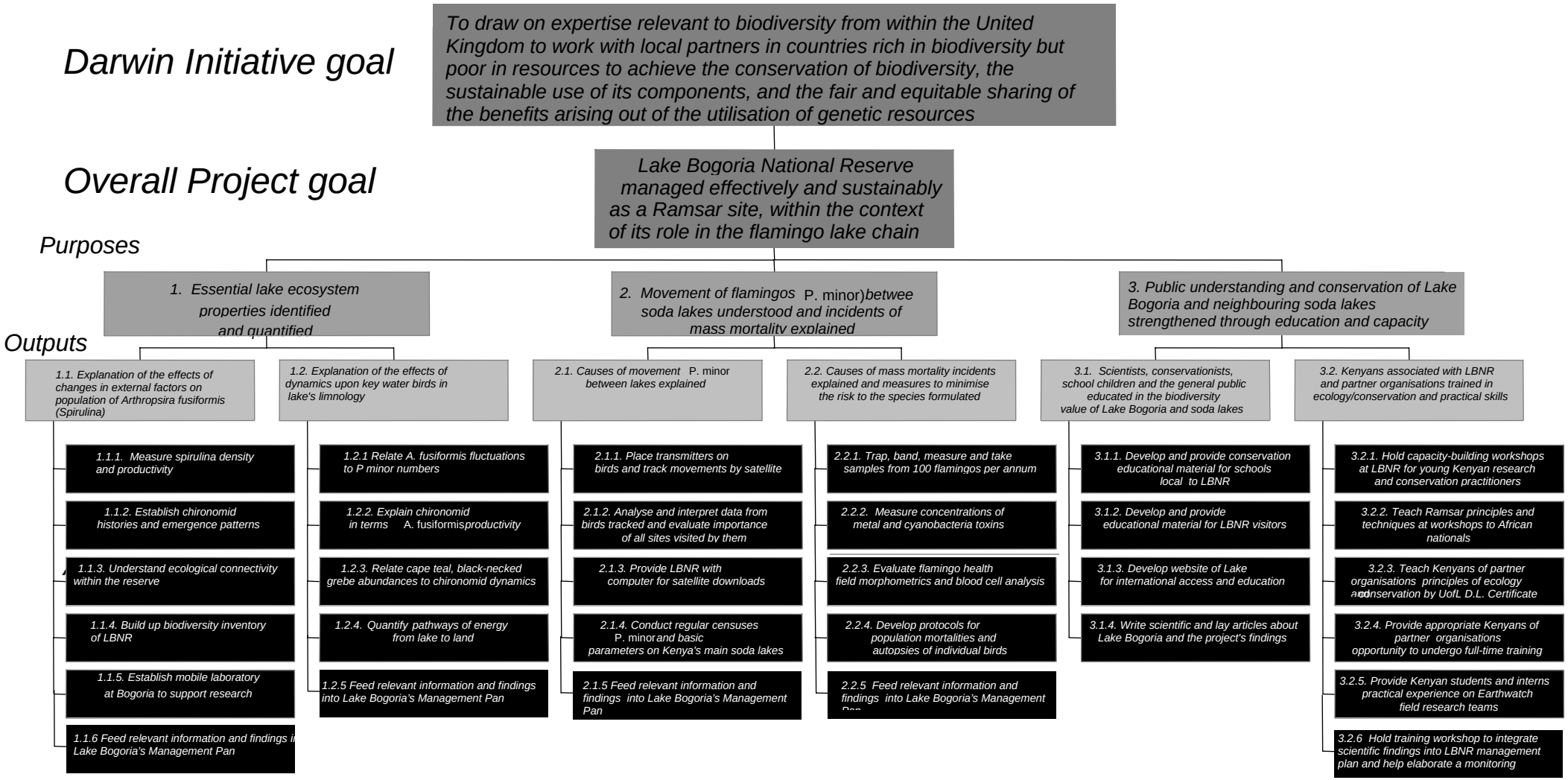
The first day of the Workshop consisted of a series of lectures, mainly in KiSwahili. Health and welfare of animals was discussed, with emphasis on the fact that healthy, well managed animals fared better, especially in the semi-arid areas of the Rift Valley, than did livestock that were inadequately fed, affected with infectious or non-infectious disease or badly treated. The session provided a forum for lively discussion, including pointed but good-humoured exchange between animal owners and government veterinary staff. Fifty-two people attended this session, including local chiefs and sub-chiefs, livestock owners, representatives of women's groups, agriculturalists, and veterinarians Formal lectures were supplemented with displays of literature, a talk by a representative of a pharmaceutical company, and practical sessions during which pathological lesions encountered during meat inspection at the local abattoir (a "slaughter slab") were demonstrated grossly, with a hand-lens and under a teaching microscope.

Day 2 consisted of a free clinic, organised by WSPA and implemented by a team of veterinary surgeons and animal health assistants. A total of 1095 animals (cattle, goats, sheep, dogs and cats) received a routine examination and treated with ectoparasiticides, anthelmintics or rabies vaccine as appropriate. In addition, 26 clinical cases were investigated and treated for specific ailments.

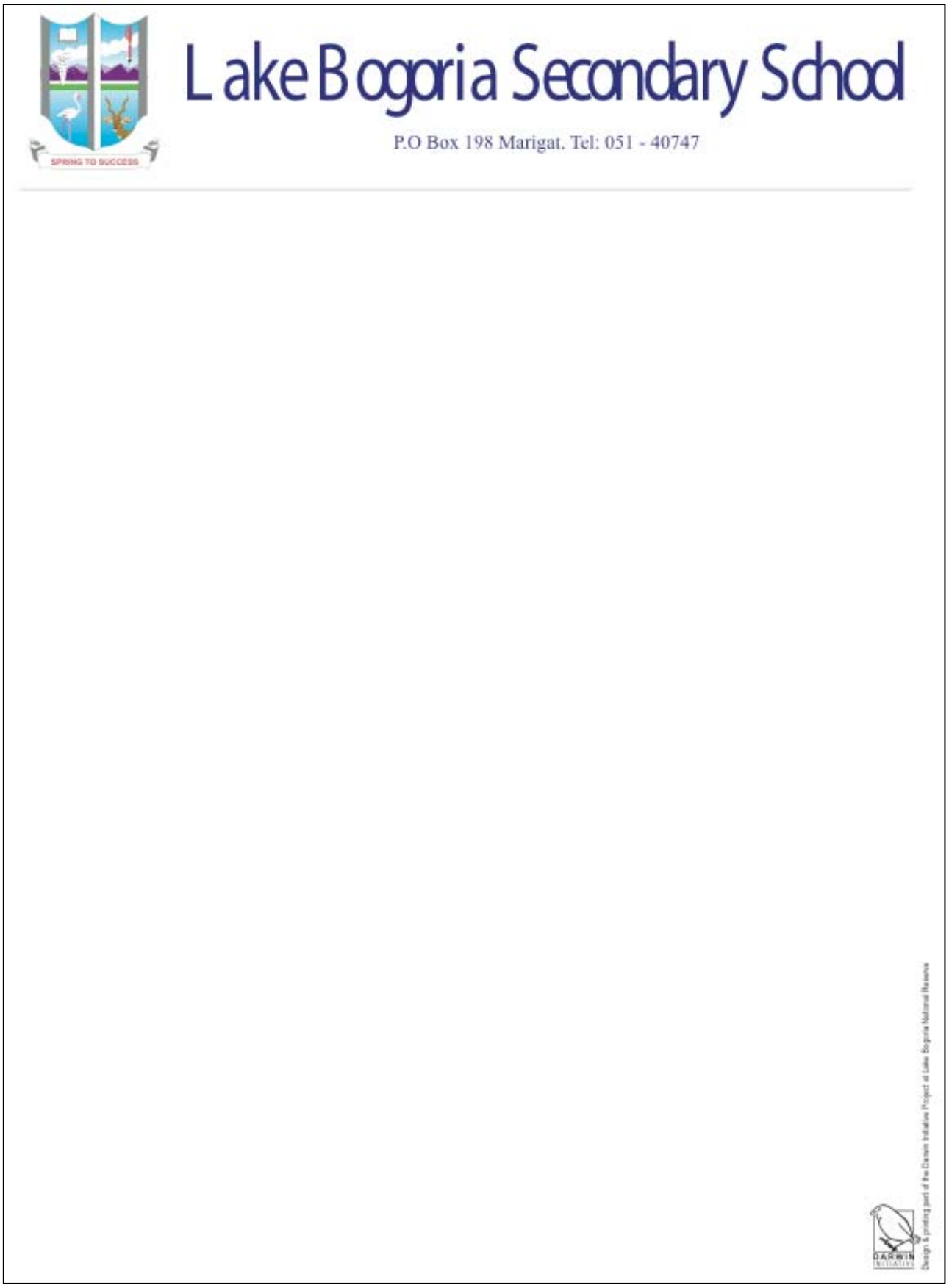
The third day of the Workshop focussed on Rift Valley flamingos and factors that might be contributing towards the spate of unexpected deaths in recent years. Participants were mainly veterinarians and scientists from the Lake Bogoria WWF Project, with some input by local agriculturalists and community leaders. The group explored the hypothesis that the flamingos might be sentinels, indicators of a "stressed" ecosystem that was having adverse effects on other wildlife, domestic animals and humans. Methods of testing this theory were discussed and a ten-point plan drawn up for future research, including greater involvement of local people in recording of incidents and collection of specimens, the organisation of seminars about health for Bogoria communities and the provision of research opportunities fr postgraduate students and others.

This Workshop, probably the first of its kind in East Africa, illustrated how an integrated approach - looking at the health of domestic animals and humans as well as that of wildlife - can reap benefits when investigating population changes in vulnerable species. The inhabitants of Bogoria were not only able to benefit from the veterinary assistance provided to them and their animals but also were a key part of discussion and planning concerning wider conservation issues in the area. It is now recognised that community involvement is an important part of any project or management plan: the working relationships and friendships developed at Bogoria in March-April promise to bring a new approach to tackling the problems that face the unique ecosystems of the Great Rift Valley.

Annex 4. Proposed revision to project logical framework for 2005-6 reporting



Annex 5. Illustrations of the school logos and the storybook



BOGOR THE FLAMINGO

Story by Claire Parsons

and Maureen Harper

Illustrated by Raphael Kimosop