Monitoring and simulating threats to aquatic biodiversity in the Okavango Delta:
SymBioSys

Ref: 162/14/029

First Annual Report Jan 06 – Mar 06

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Darwin Initiative

Annual Report

1. Darwin Project Information

Project Ref. Number	162/14/029
Project Title	Monitoring and simulating threats to aquatic biodiversity in the Okavango Delta
Country(ies)	Botswana
UK Contractor	UCL
Partner Organisation(s)	Harry Oppenheimer Okavango Research Centre (HOORC) HOORC / Conservation International
Darwin Grant Value	£188,441
Start/End dates	01-Jan-06 to 31-Dec-08
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..)	1 Apr 2005 to 31 Mar 2006 Annual report 1
Project website	www.geog.ucl.ac.uk/~mtodd/simbiosys
Author(s), date	Mackay, A.W., Todd, M. & Wolski, P. April 2006

2. Project Background

The Okavango Delta (OD) in northwest Botswana is the world's second largest inland wetland region. The delta is maintained by annual pulse flooding of the Okavango River (whose catchment lies largely in the highlands of central Angola) creating unique wetland habitats with exceptionally high beta diversity. The annual flooding in the delta is out of phase with the local wet season so that uniquely it provides a water resource in the dry season. It is one of the WWFs top 200 eco-regions of global significance and the world's largest Ramsar site. The Okavango river system is considered by many to be the last near pristine river in Africa. However, the system is under threat from potential development initiatives in the basin and from climate change. This project (lead by Todd and Mackay at UCL) aims to build capacity in key institutions involved in conservation of biodiversity in the OD, to assist in implementation of the Convention on Biological Diversity (CBD). This will involve an integrated, multi-disciplinary programme of (a) scientific research to develop baseline aquatic biodiversity characterisations (phytoplankton, macroinvertebrate and macrophyte assemblages) and their relationship with hydrological drivers, namely the hydroperiod (flood duration and frequency), and water quality; (b) training in methods of aquatic biological data collection, analysis and system modelling. This will enable for simulation of aquatic biological diversity responses to scenarios of future changes to basin climate and hydrology, which will be crucial to informing policy decisions for biodiversity protection/conservation within the Okavango Delta Management Plan

(ODMP).

3. Project Purpose and Outputs

The project logical framework is included in Appendix 1

Purpose: Assist in the ability of Botswana to implement CBD in the OD region, through programme of capacity building, training and scientific research.

Outputs: The project outputs (as listed in the logical framework) are as follows

1. Acquisition of extensive baseline aquatic biodiversity and water quality data across hydroperiod gradients in OD.
2. Development of robust Indices of Biological Integrity (IBIs), sensitive to hydroperiod
3. Development of future scenarios of OD flood frequency, extent and duration and biodiversity response
4. Establishment of on-going systematic biodiversity monitoring programme based on identified IBIs.
5. Dissemination of results
6. Training programme for staff at HOORC/IC & Botswana students.
7. Relationship of project to CBD established through ODMP initiatives.

Please note that the project only started in Jan 2006. There have been no major changes to the project outputs or operational plan.

UCL press office were informed of the start of the Darwin Project. The project featured in UCL news see http://www.ucl.ac.uk/news/right-column/ucl-views/lake

4. Progress

4.1 Project History

UCL has a long-term research partnership with HOORC based on a previous EU project 'Water and Ecological Resources in regional Devlopment' (WERRD). The Darwin project builds on this and was conceived during a 1-week visit by Drs Todd and Mackay during September 2004 supported by a Drawin Initiative pre-project funding award. The project started in Jan. 2006 and we are therefore reporting on only the first three months of the project

4.2 Project Progress

The project acronym is 'SimBioSys' The milestones stated in the project timetable (see Appendix 2) are as follows. We note the progress made underneath each one

Appointment of HOORC technicians and Research Fellow

HOORC have appointed the relevant staff and have invoiced UCL for the associated salaries

Appointment of UCL Research Fellow

Dr. Tom Davidson was appointed 1/1/06

Launch of programme website

The project web page has been developed and is hosted both at HOORC and UCL www.geog.ucl.ac.uk/~mtodd/simbiosys

Article submitted to UCL magazine

A feature on the project appeared in UCL News. http://www.ucl.ac.uk/news/right-column/ucl-views/lake

UK Press informed of programme:

The UCL press office have been informed and will issue a press release in due course

HOORC RF visits UCL to attend training courses

The 3-week training programme for HOORC staff at the University of London was originally scheduled for March 2006. Belda Mosopele the HOORC research fellow on the project and Ineelo Mosie, the Chief Research Technician from HOORC both visited the UK between 26th March – 2nd April and participated on the course "Introduction to Invertebrates". The other courses (Macrophyte Analysis and Introduction to Diatom Analysis) are now due to be held in May 2006 and June 2006, respectively. Mrs Mosopele will return to the UK and participate in both.

Purchase of equipment and major consumables

The computing equipment and ecological software and have been purchases. With agreement of Darwin we have delayed the purchase of laboratory consumables until financial year 2006-7 for logistical reasons. Futhermore, again with the agreement of Darwin, some travel monies were brought forward into Year 1, to cover training of Mrs Mosopele and Mr Mosie at the University of London. The budget has been changed accordingly.

4.3 Project Achievements

During the first three months of the project we have carried out the stated work which lays the foundation for the project. The introduction to macroinvertebrate course was an important aspect of training on the Darwin project, as macroinvertebrates will form one of the major Indicators of Biological Diversity, collected and analysed in the field. HOORC staff received on the course over 35 hours of tuition, covering both ecological applications of macroinvertebrates in the field, supplemented by taxonomy practical classes in the afternoons of major families.

In addition to the specific activities noted above the project partners have discussed the scientific and capacity building components of the project extensively by email. HOORC staff have undertaken considerable work to support the project this includes

1. Literature review for macroinvertebrates in the Okavango
2. Review of other Biodiversity projects gaps
3. Identification of potential links to other projects
4. Review field protocol for macroinvertebrate sampling

5. Meeting in UK to discuss "Okavango Fieldwork" plan
6. Meeting at UB to discuss "Okavango Fieldwork" plan and identify lab equipment needs.
7. Identification of possible location of sampling sites based on previous biodiversity project sites
8. Ongoing training of field assistants on macroinvertebrates ID
9. Preparation of stakeholders workshop; invitation letter and project background
10. Refinement of the satellite based map of historical flood conditions in the Okavango delta, on which study site selection will be based.
    - consolidation of available satellite imagery database (94 landsat images available)
    - image preprocessing (import to ERDAS, extraction of relevant
11. bands, georeferencing, substetting)
    - development of methods for water mask classification.

4.4 Discuss any significant difficulties encountered during the year and steps taken to overcome them.

Employing project staff at UCL is complicated by the Darwin policy of agreeing funding on a year-by-year basis. To illustrate, UCL cannot offer a contract to the research scientist employed on this project beyond the period for which funding is guaranteed by Darwin. As a result we have had to use our own discretionary funds to guarantee his employment

4.5 Has the design of the project been enhanced over the last year, e.g. refining methods, indicators for measuring achievements, exit strategy?

The project has not changed substantially. Considerable progress has been made to refine the satellite-based map of historical flood conditions in the Okavango delta, on which study site selection will be based. These considerations will be highlighted in greater detail in the following report.

4.6 Present a timetable (workplan) for the next reporting period.

see below

Apr 06	Initial planning workshop to be held at HOORC Botswana press launch of programme
May 06	HOORC RF to attend macrophyte training course
Apr-Sep 06	Identification of up to 100 candidate sites for ecological sampling, based on analysis of satellite-derived hydroperiod (flood history) archive.
Jun 06	HOORC RF to attend diatom training course
Aug 06	Production of training manuals and protocols
Sep 06	Field and taxonomy methods training course held at HOORC
Sep 06	Sampling programme initiated: Fieldtrip 1 (UCL,HOORC,IC staff), followed by taxonomic identification and counting
Nov 06	1 UB Masters by Research studentship appointed
Dec 06	Sampling programme initiated: Fieldtrip 2 (HOORC, IC staff), followed by taxonomic identification and counting
Feb 06	Sampling programme initiated: Fieldtrip 3 (HOORC, IC staff), followed by taxonomic identification and counting

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

N/A

Have you responded to issues raised in the review of your last year's annual report?

N/A

Have you discussed the review with your collaborators? Briefly describe what actions have been taken as a result of recommendations from last year's review.

N/A

6. Partnerships

6.1 Describe collaboration between UK and host country partner(s) over the last year.

In addition to the formal activities of the project described about the project partners are in email contact on an almost daily basis to ensure problems can be identified and addressed quickly. In addition, UCL and HOORC staff have two joint publications, stemming from ongoing collaboration on the WERRD project (Todd) – these have direct relevance for the Darwin programme, and so details are included here.

- Andersson, L., Wilk, J**., Todd, M.C.**, Hughes, D., Kniveton, D., Layberry, R**.,** and Savenije, H.H.G. (in press) Scenarios of the impact of changes of climate and water use on water flow in the Okavango River . *Journal of Hydrology*

- Wilk, J., Kniveton, D., Andersson, L., Ringrose, S., Layberry, R., and **Todd, M.C** . (in press) Rainfall, water balance and land use of the Okavango basin. *Journal of Hydrology*

6.2 Are there difficulties or unforeseen problems or advantages of these relationships?

No

Has the project been able to collaborate with similar projects (Darwin or other) in the host country or other regions, or establish new links with / between local or international organisations involved in biodiversity conservation?

Yes. The project will dovetail with a UNEP GEF project on biodiversity in the Okavango Delta coordinated by HOORC.

We have established links with *Birdlife International* in Botswana.

7. Impact and Sustainability

Discuss the profile of the project within the country and what efforts have been made during the year to promote the work. What evidence is there for increasing interest and capacity for biodiversity resulting from the project? Is there a satisfactory exit strategy for the project in place?

Contacts have recently been made (April 2006) with the Bostwana Department of Water Affairs (DWA), the Okavango Delta Management Plan (ODMP) and local safari operators (or concessioners). There is a clear interest in the project from these stakeholders. The Department of Water Affairs had plans to conduct a similar biodiversity study already in 1998, but these were shelved due to lack of funds and expertise. The Darwin project will address this.

8. Outputs, Outcomes and Dissemination

8.1 Explain differences in actual outputs against those agreed in the initial 'Project Implementation Timetable' and the 'Project Outputs Schedule', i.e. what outputs were not or only partly achieved? Were additional outputs achieved?

The project output 'Research Fellow (RF, Motswana) from HOORC to be trained at UCL for 3 weeks in Freshwater invertebrate analysis, Macrophyte analysis, and Diatom analysis' was only partially achieved due to changes in the UCL short course timetable. The outstanding training will be completed by June 2006.

8.2 Provide details of dissemination activities in the host country during the year, including information on target audiences. Will dissemination activities be continued by the host country when the project finishes, and how will this be funded and

implemented?

Project profile has been raised through dialogue with with DWA, Safari Operators, ODMP, UNEP GEF, UB Dept of Environmental sciences, Birdlife International. This is being consolidated through the project Web site and on-going e-mail information. This is all funded by the project.

Please expand and complete Table 1.

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

Code No.	***Description***	***Year 1 Total***	***Year 2 Total***	***Year 3 Total***	***Year 4 Total***	***TOTAL***
6A/6B	Research Fellow (RF, Motswana) from HOORC to be trained at UCL for 3 weeks in Freshwater invertebrate analysis, Macrophyte analysis, and Diatom analysis.	*1/2*				
15C	Press releases produced via UCL Press Office	*1*				

Table 2: Publications

Type * *(e.g. journals, manual, CDs)*	*Detail (title, author, year)*	*Publishers (name, city)*	*Available from* (e.g. contact address, website)	*Cost £*
Journal	Scenarios of the impact of changes of climate and water use on water flow in the Okavango River . Andersson, L., Wilk, J.**,** Todd, M.C., Hughes, D., Kniveton, D., Layberry, R., **,** and Savenije, H.H.G. *Journal of Hydrology, In press.*	*Elsevier, Amsterdam*	*In press*	*0*

Journal	Rainfall, water balance and land use of the Okavango basin. Wilk, J., Kniveton, D., Andersson, L., Ringrose, S., Layberry, R., and **Todd, M.C** . *Journal of Hydrology, in press*	*Elsevier, Amsterdam*	*In press*	*0*

5. Project Expenditure

- *Please expand and complete Table 3.*

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

Highlight any recently agreed changes to the budget and explain any variation in expenditure where this is +/- 10% of the budget.

10. Monitoring, Evaluation and Lessons

10.1 Discuss methods employed to monitor and evaluate the project this year. How can you demonstrate that the outputs and outcomes of the project actually contribute to the project purpose? i.e. what are the indicators of achievements (both qualitative and quantitative) and how are you measuring these?

Project is in its initial stages. Project is monitored by email and regular meetings been partners. The only output to be partially fulfilled is the Training programme for HOORC staff at UCL. This has been successfully achieved so far. The measurement of achievement may be by the Attendance records for the training courses, and eventually the application of training in the field.

10.2 What lessons have you learned from this year's work, and can you build this learning into future plans?

The major lessons learnt concern the need for timely preparation of formal contracts between institutions to facilitate staff appointments, intellectual property rights etc.

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

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

In this section you have the chance to let us know about outstanding achievements of your project over the year that you consider worth highlighting to ECTF and the Darwin Secretariat. This could relate to achievements already mentioned in this report, on which you would like to expand further, or achievements that were in addition to the ones planned and deserve particular attention e.g. in terms of best practice. The idea is to use this section for various promotion and dissemination purposes, including e.g. publication in the Defra Annual Report, Darwin promotion material, or on the Darwin website. As we will not be able to ask projects on an individual basis for their consent to publish the content of this section, please note the above agreement clause.

APPENDIX 1: 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 benefits arising out of the utilisation of genetic resources**			
Purpose Assist in the ability of Botswana to implement CBD in the OD region, through programme of capacity building, training and scientific research.	By end of yr 3: HOORC staff appointed and trained. New knowledge on (i) aquatic ecosystem functioning (ii) hydrological responses to future climate and development scenarios. Key IBIs and predictive models developed. Long-term biodiversity monitoring programme established based on IBIs Inputs to ODMP complete.	HOORC annual reports. Scientific publications. Joint partner project reports	Government remains committed to CBD, Ramsar, and National Wetlands Policy.
Outputs Acquisition of extensive baseline aquatic biodiversity and water quality data across hydroperiod gradients in OD.	Within 1st 6 months of project: Candidate field sites (up to 100 for contingency) identified from existing 15 year satellite derived flood maps and local knowledge. By mid Yr 2: Datasets of baseline aquatic biological diversity archived. Contributions to UNDP GEF Wetland Biodiversity project underway	Manual of field and lab protocols Data archive of biological and chemical data. Reports	Field sites accessible during periods of flooding.
Development of robust Indices of Biological Integrity (IBIs), sensitive to hydroperiod	By end yr 2 IBIs developed and tested, and statistical models relating IBIs to hydrology developed.	Workpackage report sent to Darwin Initiative. Publications.	HOORC Computing facilities maintained.
Development of future scenarios of OD flood frequency, extent and duration and biodiversity response	By mid Yr 3: Multiple 20 yr datasets of monthly river discharge and OD flood will be created using hydrological models, from scenarios of climate change/water abstraction. Initial prediction of resulting IBI.	Workpackage report completed. Scientific publications.	Matched personnel at UCL will remain in post.
Establishment of on-going systematic biodiversity monitoring programme based on identified IBIs.	Staff trained. Monitoring equipment procured. In yr 3 monitoring programme initiated.	Workpackage report completed and sent to Darwin Initiative.	Botswana government maintains funding for HOORC.
Dissemination of results	Datasets compiled in dual archive at HOORC and UCL, accessible to all. Project website established at UCL. Journal and conference publications submitted (min. 6). Press releases for local and international media.	Data archives documented Copies of all manuals, reports, press releases and publications sent to Darwin Initiative	Computer facilities at UCL are constantly maintained.
Training programme for staff at HOORC/IC & Botswana students completed.	Min. 8 HOORC/IC & 4 Government staff trained in key aspects of project science. Min. 2 HOORC academic staff trained in UK. 2 UB Masters by research in Yr 2. UB students trained during HOORC Winter School (up to 10 per yr).	Training manuals Training feedback reports Attendance records for training courses Master theses	HOORC staff remain in post, and the Winter School continues
Relationship of project to CBD established through ODMP initiatives.	Annual/final project reports produced for ODMP. Presentation at meeting with ODMP. Workshops at start and end of project (ODMP	Workshop minutes, presentations and feedback compiled and sent to Darwin	Reports will positively influence ODMP

	and stakeholders). Report submitted to the tri-nation Permanent Okavango River Basin Water Commission (OKACOM).	Initiative.	
Activities	Activity Milestones (Summary of Project Implementation Timetable)		
Research	Yr 1: Identification of candidate study sites (up to 100) from historical 15-year satellite derived dataset of flood history, aerial photos and local knowledge. Sampling basin will be range of hydroperiod conditions. Yrs 1 & 2: Data collection from sites, laboratory analysis. Y2-3: Development of multiple high-resolution climate predictions (for 2030-50) using General Circulation and Regional Climate Models. Multiple 20-year hydrological model simulations over OD conducted, based on various (c 10) climate change and water abstraction scenarios. Development of IBI and statistical IBI models. Initial prediction of IBIs under hydrological scenarios.		
Training	Yr 1. Staff appointed at HOORC, equipment procured. Yrs 1-3: Training of Batswana staff in taxonomy, field methods, advanced numerical methods, computing and climate analysis. UCL staff will visit HOORC to deliver annual 1-week courses on each component, while key HOORC academic staff will visit the UK for specialist training. Senior undergraduate students from HOORC winter school trained each year. Yr 2: 2 UB Masters research projects		
Dissemination	Yr 1: Production of guidelines, training manuals, protocols and web site Yrs 1-3: Submission/presentation to ODMP. Attendance at conferences Yr 3: Submission of final results to international publications, ODMP, OKACOM and media.		
Management	UCL will retain overall responsibility for management of the programme. The establishment of a web site in Yr 1 will facilitate this. Project planning will be finalised at workshop at start of programme (Apr 2006)		

APPENDIX 2: Project timetable

Project implementation timetable		
Date	**Financial year**	**Key milestones**
	Jan-Mar 2006 Apr–Mar 2006/07 Apr-Mar 2007/08 Apr-Dec 2008	
Jan – Mar 2006	Jan-Mar 2006	
Jan.		Appointment of HOORC technicians and Research Fellow Appointment of UCL Research Fellow Launch of programme website. Article submitted to UCL magazine UK Press informed of programme
Mar		HOORC RF visits UCL to attend training courses Purchase of equipment and major consumables

	Apr–Mar 2006/07	
Apr		Initial planning workshop to be held at HOORC, attended by all participants and representatives of government departments, including the NCSA (focal point of the CBD), and OKACOM. Botswana press launch of programme 1 UB Masters by Research studentship appointed Taxonomy training course to be held at HOORC to train staff and Masters students
Jul		Identification of up to 100 candidate sites for ecological sampling, based on analysis of satellite-derived hydroperiod (flood history) archive.
Aug		蟋期》 維 擒 藕鋐 摷 ing manuals Production of training manuals and protocols
Aug		Field methods training course held at HOORC Sampling programme initiated: Fieldtrip 1 (UCL,HOORC,IC staff), followed by taxonomic identification and counting
November		Sampling programme initiated: Fieldtrip 2 (HOORC, IC staff), followed by taxonomic identification and counting
Feb		Sampling programme initiated: Fieldtrip 3 (HOORC, IC staff), followed by taxonomic identification and counting
	Apr-Mar 2007/08	
May		Sampling programme initiated: Fieldtrip 4 (HOORC/IC staff), followed by taxonomic identification and counting
July		Statistics for ecology, computing and climate analyses training course to be held at HOORC by UCL to train staff and Masters students
December		Key IBIs developed and statistical predictive models of IBIs and hydroperiod developed Database of high resolution future climate delivered from UCL to HOORC.
Jan		Work begins on creating multiple 20 yr datasets of future monthly river discharge and flood extent using hydrological models driven by future climate data inputs

	Apr-Dec 2008	
Apr 2008		Climate modelling and advanced statistics for ecologists training course to be held at HOORC by UCL to train staff and students Start of analysis to predict future biodiversity from simulations of future hydroperiod under climate change and development scenarios.
Sep 2008		Above analysis complete
Oct 2008		Final project meeting at HOORC Keynote presentation to ODMP and stakeholders Final project press releases
Dec 2008		Submission of final reports to ODMP and OKACOM Report submitted to Darwin 4 Papers submitted to international journals Long term on-going monitoring program initiated