

# ***Darwin Initiative for the Survival of Species***

## ***Final Report***

### **1. Darwin Project Information**

Project Reference No.	13/018
Project title	Building Genetic Forensic Capacity to Reduce South Africa's Illegal Trade
Country	South Africa
UK Contractor	University of Sheffield
Partner Organisation (s)	University of KwaZulu-Natal
Darwin Grant Value	£216,581
Start/End date	April 2004 – March 2007
Project website	<a href="http://www.shef.ac.uk/misc/groups/molecol/parrotandcrane.html">www.shef.ac.uk/misc/groups/molecol/parrotandcrane.html</a> <a href="http://www.ukzn.ac.za/Biology/DarwinInitiative259.aspx">www.ukzn.ac.za/Biology/DarwinInitiative259.aspx</a>
Author(s), date	Terry Burke & Tiawanna Taylor January 2008

### **2. Project Background/Rationale**

- Describe the location and circumstances of the project

The project supported a new collaboration between the University of KwaZulu-Natal (South Africa) and the University of Sheffield (UK) aimed at building capacity in South Africa to address illegal trade issues by the use of DNA technology.
- What was the problem that the project aimed to address?

Without conclusive evidence it is difficult to prosecute illegal trade in wildlife, but DNA technology can provide this proof. DNA Forensic technology is in its infancy in South Africa. This project addressed a number of issues surrounding the use of DNA technology in addressing illegal wildlife trade issues:

  - the development of species-specific forensic microsatellite markers for Blue Cranes and Cape Parrots to assist in the detection of illegal trade
  - capacity building: South African students trained to develop species-specific microsatellites and characterise the markers for forensic profiling
  - training and increased awareness of wildlife investigators about the potential uses of DNA to investigate wildlife crime in South Africa
  - institutional capacity-building to train staff at a laboratory at UKZN in forensic protocols

- Who identified the need for this project and what evidence is there for a demand for this work and a commitment from the local partner?

The project was initiated following an approach from the partner university. Dr Taylor had prior knowledge in this area of work, following her PhD in the UK, and was regularly getting requests from the South African authorities and NGOs to develop DNA technology in South Africa for species at risk of illegal trade.

### 3. Project Summary

- What were the purpose and objectives (or outputs) of the project? Please include the project logical framework as an appendix if this formed part of the original project proposal/schedule and report against it. If the logframe has been changed in the meantime, please indicate against which version you are reporting and include it with your report.

Appendix V: Logframe

**Microsatellite marker development:** The purpose of this objective was to develop microsatellite markers for two species at risk of illegal trade in South Africa and incorporate this work in student training (see below)

**Protocols and Guidelines for forensic analysis:** The purpose of this output was to provide guidelines to the Molecular Biology Unit (UKZN) and wildlife officials in using DNA for forensic investigations and analysis.

**Wider awareness of methods to detect illegal trade (public/authorities):** The purpose of this output was to increase awareness in the potential use of DNA technology in addressing illegal trade in wildlife.

**Two MSc students trained in research and analysis:** To train two South African MSc students in the development of species-specific microsatellites, and in analysing and characterising markers to answer questions relating to parentage and identity for forensic use.

**Dissemination of results:** To inform others of the presence of microsatellite markers for these species, increase awareness of illegal trade in wildlife and how DNA technology can be used to investigate cases.

- Were the original objectives or operational plan modified during the project period? If significant changes were made, for what reason, and when were they approved by the Darwin Secretariat?

It had originally been intended that institutional capacity would be built at UKZN by training staff within the Molecular Biology Unit or Functional Genomics Platform at UKZN in forensic protocols for forensic analysis. However, after the start of the project both of these facilities failed and so this could not take place (detailed in previous reports).

There were no other significant changes, other than that more time (but not more funding) was allowed in which to complete and report on the objectives. This became necessary due to delays in the start of the project and to some delays experienced due to the merger of the University of Natal with the University of Durban-Westville to form the University of Kwazulu-Natal in 2004.

- Which of the Articles under the Convention on Biological Diversity (CBD) best describe the project? Summaries of the most relevant Articles to Darwin Projects are presented in Appendix I.

Research and Training, Access to and Transfer of Technology, Exchange of Information and General Measures for Conservation & Sustainable Use

- Briefly discuss how successful the project was in terms of meeting its objectives. What objectives were not or only partly achieved, and have there been significant additional accomplishments?

See above and also: Outputs - Logframe Appendix V

#### **Microsatellite marker development:**

A set of microsatellite markers was developed for each of the target species as proposed in the project.

#### **Protocols and Guidelines for forensic analysis:**

Guidelines were produced for the authorities and working groups relating to the use of DNA technology in assisting detect and prosecute illegal trade.

Following the collapse of the potential partner R&D NFP organisation the Functional Genome Platform and with the Molecular Biology Unit being unmanned no existing staff (other than Dr T. Taylor, our coordinator on the project) were available at the University of Kwazulu-Natal to be trained in forensic techniques.

#### **Wider awareness of methods to detect illegal trade (public/authorities):**

See also dissemination of results.

Presentations at workshops, seminars, and conferences reached a wide range of people nationally as well as internationally. In addition to several peer-reviewed publications, accepted or in progress, aimed at international journals there have also been publications in the local press, national radio, and specific interest group newsletters. This will have provided a wide awareness of the use of DNA forensics to address wildlife crime issues.

#### **Two MSc students trained in research and analysis:**

Two South African MSc students each spent two 6-month periods training at the University of Sheffield. In the first 6 months they received basic molecular biological training and examined sets of microsatellite markers previously developed for related species for use in the two species of interest, the Cape Parrot (60 markers examined) and Blue Crane (48). Subsequently the MSc students returned for a second period of 6 months to examine and analyse species-specific microsatellite markers developed for the two target species.

**Dissemination of results:**

One MSc thesis has been published. One MSc thesis is in preparation.

One scientific paper has been published (international peer-reviewed journal).

Four scientific papers aimed at international peer-reviewed journals are in preparation.

Further papers are envisaged.

Details of the microsatellite markers developed have been published in an open access database available to other researchers.

Recommendations on the genetic markers have been produced for the relevant species working groups.

Wider awareness of methods to detect illegal trade (public/authorities): Dr Taylor and the 2 MSc students have presented details of the work at a number of conferences, workshops and seminars to interest groups and the authorities.

Dr Taylor has written several local media or species interest articles aimed at increasing public awareness and has been interviewed for radio and the local press.

**Significant additional accomplishments:**

In addition to the development of species-specific microsatellite markers for the two target species, additional genetic analyses were undertaken:

- Cross-species markers originating in other species were examined in the target species
- The microsatellites developed for the target species were examined in other species

The development of a network for people interested in the use of forensics to address wildlife crime issues was encouraged by the project, including participation with other stakeholders in setting it up. The Environmental Forensics Working Group (EFWG) in South Africa is now in its initial stages, currently overseen by TRAFFIC and the government (DEAT).

**4. Scientific, Training, and Technical Assessment**

- Please provide a full account of the project's research, training, and/or technical work.
- **Research** - this should include details of staff, methodology, findings and the extent to which research findings have been subject to peer review.

Two MSc students undertook research to:

- examine the potential to utilise previously-developed microsatellite markers in the species of interest
- develop species-specific genetic microsatellite markers

In this laboratory component of the project, we isolated and characterised a large number of new microsatellite loci in each of the target species. In each case the marker set was more than sufficient to enable statistically powerful individual identification and parentage analysis – adequate to enable forensic investigation

and potentially support prosecution. The markers were similarly appropriate for confirming/ elucidating relationships to undertake population genetic studies of wild populations and to clarify studbook pedigrees in legitimate captive breeding populations.

Twenty-four polymorphic microsatellite loci were characterised in the Cape parrot *Poicephalus robustus robustus*. Twenty-one loci were isolated from Cape parrot genomic libraries and the other three polymorphic loci were identified by testing 79 loci originally isolated in other parrot species – reflecting the relatively high genetic distance between Cape parrots and the other parrots that have been studied in this way. Loci were characterised in 46 unrelated Cape parrots and displayed between 2 and 24 alleles, with the observed heterozygosity per locus ranging between 0.24 and 0.91.

Forty-two unique microsatellite loci were isolated from an unenriched and a tetranucleotide-enriched blue crane (*Grus paradisea*) genomic library. Fourteen polymorphic loci were characterised in 20 unrelated wild blue crane individuals from the Karoo region, South Africa, and displayed 4–27 alleles with observed heterozygosities ranging between 0.50–0.95. Forty-three further microsatellite loci originally isolated in *Grus americana* and *G. japonensis* were tested for polymorphism in the blue crane (*G. paradisea*). Amplified products were sequenced in the blue crane to aid in the design of homospecific primers. When characterized in unrelated blue crane individuals from South Africa, 15 loci were found to be polymorphic, with each locus displaying between 2–7 alleles, bringing the total number of informative polymorphic loci to 29. To identify if any loci were physically linked, a predicted microsatellite map was constructed for the crane, based on homology of crane–chicken sequences. Twenty-eight of these loci were also polymorphic in the grey-crowned crane (*Balearica regulorum*) and the wattled crane (*G. carunculatus*). It is therefore likely that the total marker set now available will be adequate to assist the identification of illegal trade, and for other conservation genetic applications, in most, if not all, crane species.

None of the available sex-typing loci were found to be suitable for inclusion in a multiplex genotyping set in any of the crane species. A newly developed sex-typing locus was therefore tested and this was found to successfully sex-type blue cranes.

The population structure of the blue crane in South Africa is currently unresolved (Meares, 2007). It is suspected that individuals inhabiting the Karoo “stronghold” (McCann *et al.* 2002) may exist as a single population. Twenty unrelated blue cranes from the Karoo stronghold and 11 individuals from the eastern stronghold were tested for amplification at the 15 polymorphic loci. Three loci (*Gamu5*, *Gamu25* and *Gamu101b*) only amplified in the eastern stronghold individuals, possibly suggesting population structure among the populations – this is the subject of further ongoing analysis.

Ongoing work in both species aims to better understand the population genetics of the native populations and will include further validation of the markers in a forensic context. This work builds on the collaborations established by the Darwin programme, both between the partners and with the other organisations responsible for their conservation in the wild and for the captive breeding programmes.

McCann K, Morrison K, Byers A, Miller P, Friedman Y (eds) (2002) *Blue crane (Anthropoides paradiseus). A population and habitat viability assessment*

*workshop. Final workshop report. Conservation Breeding Specialist Group (SSC/IUCN), Villiersdorp, South Africa.*

*Meares KM (2007) Characterising microsatellite loci in the blue crane (Grus paradisea). MSc Dissertation, School of Biological and Conservation Sciences, University of KwaZulu-Natal, South Africa.*

By utilising the markers developed as part of this project in other species in which they might be applied to assist biodiversity and/or conservation management issues, Dr Taylor has also undertaken additional research in the following areas:

- General research into other forensic techniques of use in investigating and preventing wildlife crime. This enabled the awareness of forensic techniques appropriate to wildlife investigations to be expanded.
  - Research into South Africa's forensic laboratory requirements.
- **Training and capacity building activities** – this should include information on selection criteria, content, assessment and accreditation.

Training:

- 2 MSc students trained in developing genetic microsatellite markers
- 50+ environmental management inspectors provided with workshops to increase awareness on DNA and other forensic techniques to detect and prosecute wildlife crimes, including practical instruction
- 20+ magistrates provided with increased awareness of DNA and other forensic techniques in addressing wildlife crimes and discussions on appropriate sentencing
- Numerous other wildlife investigators, government and NGO personnel have received presentations to increase their awareness on the use of DNA and other forensic techniques to tackle wildlife crimes.

Capacity-Building Activities:

- Training of students
- Participation and encouragement in initiating a forensic scientists' network/database – The Environmental Forensics Working Group (EFWG). This initiative is to be supported and co-ordinated by NGOs (TRAFFIC) and the government (DEAT). Dr Taylor was a member of the preliminary steering committee.

## **5. Project Impacts**

- What evidence is there that project achievements have led to the accomplishment of the project purpose? Has achievement of objectives/outputs resulted in other, unexpected impacts?

One MSc research thesis was completed and the degree awarded (with distinction); the work for the other has been completed and the thesis is expected to be submitted in the near future. One paper has been published and two are about to be submitted. It is too soon to be able to say if the relevant illegal trade activities have been deterred, though this seems likely.

- To what extent has the project achieved its purpose, i.e. how has it helped the host country to meet its obligations under the Biodiversity Convention (CBD), or what indication is there that it is likely to do so in the future? Information should be provided on plans, actions or policies by the host institution and government resulting directly from the project that building on new skills and research findings.

Training has been provided to 2 South African students in developing genetic markers aimed at addressing illegal trade issues.

Training and capacity building has taken place for both government and NGO personnel involved in detecting and prosecuting illegal trade in wildlife. The South African Government (DEAT) is continuing to train Environment Management Inspectors who will have a greater role in the detection and prosecution of environmental crimes and the training that this project developed is likely to be incorporated within that into the future.

The development of the forensics network encouraged by this project and managed through TRAFFIC and the government is likely to have a lasting positive effect in enabling wildlife investigators to source information appropriate to their needs.

- Please complete the table in Appendix I to show the contribution made by different components of the project to the measures for biodiversity conservation defined in the CBD Articles.

See Appendix I

- If there were training or capacity building elements to the project, to what extent has this improved local capacity to further biodiversity work in the host country and what is the evidence for this? Where possible, please provide information on what each student / trainee is now doing (or what they expect to be doing in the longer term).

The students obtained a thorough grounding in microsatellite analysis and its use in forensic and conservation applications. The students are likely to move beyond wildlife forensics, but to remain in the biodiversity field.

Ms Kate Meares: Following completion of her MSc began working as research assistant for Prof Perrin on biodiversity-associated projects. She is currently participating in fieldwork in Madagascar. Over the longer term Kate is looking to undertake a PhD.

Ms Kerusha Pillay - is still to complete her MSc. Her lab work is complete and she should be able to complete her write-up within a few months. On her return to South Africa after her final period of training in Sheffield she had to take some leave of absence from her studies for personal and health reasons.

Staff at the University of KwaZulu-Natal (Dr Tee Taylor) further developed their knowledge and expertise in wildlife forensics, conservation policy and in presentation skills – particularly in delivering the workshops. The training of forensic laboratory technicians did not go as planned due to organisational changes at the University of Kwazulu-Natal and the collapse of the facility in which this was planned.

Capacity building was achieved through several workshops and presentations to members of the authorities involved in wildlife investigations such as

Environmental Management Inspectors, Provincial Wildlife Investigators and Enforcers, and South African Police Services, plus other interested parties such as Magistrates and Customs officials.

In addition to undertaking workshops, investigating officers were provided with practical skills and knowledge to take appropriate DNA samples to assist forensic investigations.

Presentations were also provided at conferences and to NGOs to increase awareness of the possibilities of the genetic markers developed both for wildlife forensics and in the conservation of biodiversity.

- Discuss the impact of the project in terms of collaboration to date between UK and local partner. What impact has the project made on local collaboration such as improved links between Governmental and civil society groups?

The project funded a new collaboration between the UK and South Africa which remains active beyond the end of the funded project. In South Africa, there has been increased local collaboration and networking between some of the governmental groups interested in environmental crime and working groups and organisations interested in reducing wildlife crime. Exactly how much of this is due to this project is debatable. However, some initiatives have been facilitated following initial networking in South Africa and are likely to have resulted from this project.

- In terms of social impact, who has benefited from the project? Has the project had (or is likely to result in) an unexpected positive or negative impact on individuals or local communities? What are the indicators for this and how were they measured?

N/A

## **6. Project Outputs**

- Quantify all project outputs in the table in Appendix II using the coding and format of the Darwin Initiative Standard Output Measures.

See Appendix II

- Explain differences in actual outputs against those in the agreed schedule, i.e. what outputs were not achieved or only partly achieved? Were additional outputs achieved? Give details in the table in Appendix II.

See Appendix II

- Provide full details in Appendix III of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website database.

See Appendix III

- How has information relating to project outputs and outcomes been disseminated, and who was/is the target audience? Will this continue or develop after project completion and, if so, who will be responsible and bear the cost of further information dissemination?

See Appendix III. Tee Taylor and Mike Perrin are continuing this work in South Africa following completion of the project.



## 7. Project Expenditure

- Explain any variation in expenditure where this is +/- 10% of the budget.

There were no significant changes.

### Annual budgets in the proposal

2004/05	2005/06	2006/07	2007/08	Total Grant Allocation
£85,581	£69,000	£62,000	£0	£216,581

### Total expenditure by category

2004–07	Total budget (£)	Total spent (£)	Deviation (£)
Staff costs			
Rent, rates, heating, lighting, cleaning			
Postage, telephone, stationery			
Travel and subsistence			
Printing			
Conferences, seminars etc			
Capital items			
Others – consumables			
<b>TOTAL</b>			

## 8. Project Operation and Partnerships

- How many local partners worked on project activities and how does this differ from initial plans for partnerships? Who were the main partners and the most active partners, and what is their role in biodiversity issues? How were partners involved in project planning and implementation? Were plans modified significantly in response to local consultation?

Prof Mike Perrin and Dr Tiawanna Taylor were the main partners based at the University of KwaZulu-Natal. Dr Taylor co-ordinated the South African side of the project and was responsible for the planning and implementation in that country. Prof Perrin and Dr Taylor are both researchers with a keen interest in teaching and research in biodiversity and specifically conservation / illegal trade issues. Other local partners were also involved through this main contact many of these were actively involved in the protection of biodiversity on the ground and through legal channels. Plans were not modified significantly.

One of the local partners, an external not-for-profit organisation, the 'Functional Genomics Platform' dissolved part way through the project. As discussed in previous reports, negotiations had been ongoing for ~1 year between this R&D organisation and UKZN to lease the Molecular Biology Unit facility and equipment. It had been intended that this R&D platform would have incorporated the forensics initiative and staff training would have been provided to develop a forensic facility. In the meantime, staff at the original Molecular Biology Unit facility left and the unit was unmanned up to March 2007 and its future is still uncertain. The potential for other organisations to provide the long-term service has been and continues to be investigated. Meanwhile the genetic markers developed are in the public domain and the partner laboratories are able to support any immediate forensic needs.

The University of KwaZulu-Natal provided, in kind, the university structures to support the project, including space, staff time, internet facilities etc. Given the need to source alternative laboratory facilities when uncertainties arose with the FGP the School of Biological and Conservation Sciences provided laboratory space within their own facility, plus equipped the laboratory and supported an application to the University's large equipment grant to purchase several expensive pieces of equipment (e.g. PCR machines). This was extremely helpful to the project.

Both the Cape Parrot Working Group and South African Crane Working Group were very active participants as per the initial plans in sourcing and obtaining samples for genetic marker development and subsequent DNA analysis. Both these groups have also been involved in dissemination of information about the project and can benefit over the longer term from the potential use of the genetic markers both for forensic and conservation of species purposes. Both groups are actively conserving species in the wild and interested in detecting illegal trade. The SACWG is highly active in the conservation of biodiversity and was recently successful in obtaining a Darwin Initiative Award to expand its impact.

With regards to training and workshops, it had originally been planned that Dr Taylor would travel to provide workshops to government wildlife investigators in each province. However, following discussion with contacts at the Department of Environment and Tourism (DEAT) it was determined that a more effective strategy was to bring the relevant individuals together at a single venue. Dr Taylor was involved with DEAT in developing a 3-day training workshop, including 1 day dedicated to wildlife forensics. The other days included training in crime scene analysis, ballistics and environmental crime. Therefore, this slight expansion in the scope of the training provided for major training benefits.

- During the project lifetime, what collaboration existed with similar projects (Darwin or other) elsewhere in the host country? Was there consultation with the host country Biodiversity Strategy (BS) Office?

Within this project contact was with the relevant people involved in wildlife legal protection, forensics and biodiversity legislation.

Collaboration was undertaken with the Wildlife Biological Resources Centre, a South African DNA Bank which aims to collect biological samples from endangered South African species. Aliquots of all samples collected as part of the study have been lodged within the DNA Bank and are therefore accessible to other national and international researchers. Requests have already been made for access to these samples at both national and international levels.

Dr Taylor collaborated with government and NGOs to encourage the establishment of a Working Group for Wildlife Forensics.

Dr T Taylor collaborated with Ms G Gigot (who is involved in a similar Darwin Project) in providing information about this project that Ms Gigot included in a conference poster.

Gigot G (2007) *Molecular Tools and DNA Barcoding for Conservation, International Congress on Orchids and Conservation*, March 2007, Costa Rica.

- How many international partners participated in project activities? Provide names of main international partners.

All partners were based in South Africa or the UK.

University of KwaZulu-Natal was the main international partner. They coordinated the project activities enabling a large number of South African organisations to participate in several of the activities. These included:

- Cape Parrot Working Group
  - South African Crane Working Group
  - Department of Environment and Tourism, including the Environmental Management Inspectorate
  - KwaZulu Natal Wildlife Crime Working Group
  - South African Police Service
  - South African Customs & Excise
  - South Africa's Wildlife Forensic Laboratory Service
  - South African CITES officials
  - Provincial Wildlife Authorities
  - Justice College
  - NGOs e.g. TRAFFIC and Endangered Wildlife Trust.
- To your knowledge, have the local partnerships been active after the end of the Darwin Project and what is the level of their participation with the local biodiversity strategy process and other local Government activities? Is more community participation needed and is there a role for the private sector?

Our partners at University Kwazulu-Natal are actively pursuing the opportunities generated by the project and continue to be actively involved with the relevant species action programmes and government agencies.

Both the Cape Parrot Working Group & South African Crane Working Group are keen to continue working towards the aims of the project.

Department of Environment and Tourism is undertaking further biodiversity training for wildlife officers (including sections on using DNA technology

introduced by Dr Taylor).

A Steering Group was set up to develop a network of groups interested in providing forensic techniques to assist in the detection of wildlife and environmental crimes.

The Private Sector is showing interest in using the genetic markers developed in this project.

## 9. Monitoring and Evaluation, Lesson learning

- Please explain your strategy for monitoring and evaluation (M&E) and give an outline of results. How does this **demonstrate** the value of the project? E.g. what baseline information was collected (e.g. scientific, social, economic), milestones in the project design, and indicators to identify your achievements (at purpose and goal level).

The main immediate products were trained manpower, peer-reviewed papers and improved infrastructure. These were all demonstrably achieved in the course of the project. We believe that the work done will have reduced the incidence of illegal trade in the relevant species by making it possible to detect instances of such activity, but it is too early to demonstrate that this has actually been achieved, especially as the data on this are inevitably incomplete.

Baseline Data:

- A range of organisations were contacted within South Africa to determine species at risk of illegal trade that would benefit from this initial project.
  - Government and NGOs were contacted, and collaborated with, to determine personnel that would benefit from training and increased awareness of forensic techniques in addressing wildlife crime.
- What were the main problems and what steps were taken to overcome them?

The main difficulties came from having to interact with multiple agencies, each with its own legislative authority, even within a single country. Communication on both a one-to-one basis and via workshops were the main strategies used.
  - During the project period, has there been an internal or external evaluation of the work or are there any plans for this?

Paper(s) have (and will) be subject to full peer review.
  - What are the key lessons to be drawn from the experience of this project? We would welcome your comments on any broader lessons for Darwin Initiative as a programme or practical lessons that could be valuable to other projects, as we would like to present this information on a website page.

The project demonstrated that there is significant talent and enthusiasm in partner nations (in this case, South Africa), but to reach their full potential biodiversity scientists in partner countries just need some access to the appropriate scientific resources and expertise that we in the UK can readily provide but that are locally scarce.

## **10. Actions taken in response to annual report reviews (if applicable)**

- Have you responded to issues raised in the reviews of your annual reports? Have you discussed the reviews with your collaborators? Briefly summarise what actions have been taken over the lifetime of the project as a result of recommendations from previous reviews (if applicable).

None apply.

## **11. Darwin Identity**

- What effort has the project made to publicise the Darwin Initiative, e.g. where did the project use the Darwin Initiative logo, promote Darwin funding opportunities or projects? Was there evidence that Darwin Fellows or Darwin Scholars/Students used these titles?

The Darwin Initiative logo was used wherever possible on all products and publications resulting from the project. These included:

- In acknowledgements of all presentations (included on each slide of most presentations).
  - The Darwin Initiative was also acknowledged in all scientific publications.
  - Posters presented at many conferences and workshops.
  - Posters and the logo are also displayed in the School of Biological and Conservation Sciences at UKZN.
  - In all reports, including a MSc thesis, Darwin was acknowledged as the funder.
- What is the understanding of Darwin Identity in the host country? Who, within the host country, is likely to be familiar with the Darwin Initiative and what evidence is there to show that people are aware of this project and the aims of the Darwin Initiative?

There are several Darwin projects based in South Africa and we believe there is a reasonable awareness of the scheme among conservation professionals and academics. The Darwin Initiative was acknowledged on all presentations and posters. Several NGOs asked for information about the Darwin Initiative. Several have discussed their potential for obtaining funding themselves with Dr Taylor. A number seriously considered approaching the Darwin Initiative for funding and one has been successful in this.

- Considering the project in the context of biodiversity conservation in the host country, did it form part of a larger programme or was it recognised as a distinct project with a clear identity?

The project was a distinct project having a clear identity. However, it did interact widely with South African government agencies and NGOs within South Africa

## **12. Leverage**

- During the lifetime of the project, what additional funds were attracted to biodiversity

work associated with the project, including additional investment by partners?

Significant staff time was donated by the partner universities, as outlined in the original proposal.

Laboratory equipment: Two PCR machines were successfully sought from the University of KwaZulu-Natal's large equipment fund. (R76, 571 ~ £7,660)

Additional equipment and space to set up a molecular laboratory within the Zoology Department was bought or donated by the School of Biological and Conservation Sciences (e.g. fridges/freezers/centrifuges).

Dr Taylor had a grant application approved by the National Research Foundation of South Africa (R170,000), but unfortunately this could not be utilised as she is not a tenured staff member of UKZN. Future applications, which should have a good chance of success, will include other staff so that they comply with the funding conditions.

Dr Taylor developed proposals for significant funding from the South Africa Innovation Funding to develop a larger forensic research and development programme but these had to be dropped when the Functional Genomics Platform consortium, in which the project would have been based, collapsed. It is hoped that a way will be found to progress further with these plans.

- What efforts were made by UK project staff to strengthen the capacity of partners to secure further funds for similar work in the host country and were attempts made to capture funds from international donors?

This was not appropriate in this first phase of the research but may happen now that the R&D has been completed.

### **13. Sustainability and Legacy**

- What project achievements are most likely to endure? What will happen to project staff and resources after the project ends? Are partners likely to keep in touch?

The initial discussions with the relevant government departments, law officers and NGOs provided enthusiasm for the subject and an increased awareness on what could be achieved using DNA and other forensic techniques to address wildlife issues. This project came at a time when there was an increased worldwide interest in this subject and government and NGOs were looking for input. This project came at an ideal time and was able to provide training and increase awareness, encouraging people to consider these techniques. This enthusiasm is still expanding in South Africa, not just in response to wildlife crime but to environmental crimes in general.

Dr Taylor continues to be active in the research field of using forensics to detect and prosecute illegal wildlife trade.

The molecular laboratory facility and resources set up within the School of Biological and Conservation Sciences, at UKZN, remain and are being used by staff and students.

The partners will remain in touch and continue to produce papers resulting from this work aimed at international journals.

- Have the project's conclusions and outputs been widely applied? How could legacy have been improved?

Workshops examining the use of DNA in wildlife forensics were provided in South Africa to a wide range of interested parties, from throughout all the provinces of South Africa, to increase their awareness of the potential use of wildlife forensics in tackling illegal trade in wildlife, including Environmental Management Inspectors, Wildlife Investigators, South African Police Services and Magistrates. A video was also made in collaboration with DEAT on methods to detect and prosecute environmental crime.

Workshops and seminars providing wildlife investigators and the authorities with knowledge about how DNA technology can be utilised to assist wildlife crime will continue to be run in South Africa. Seminars were also provided to other interested government, NGO and University groups to increase the general awareness around wildlife forensics and illegal trade in wildlife.

The new markers made available for Cape Parrot and Blue Crane – in addition to their forensic applications – have further potential conservation applications. A number of groups are already using the genetic markers that were developed towards conservation research in the Blue Crane.

Dr Taylor continues to encourage the development of a Working Group for Wildlife Forensics. She attended a Preliminary Steering Committee meeting on 16 March 2007 at the University of Pretoria, South Africa and has remained in communication with the participating organisations; funding is being sought by the NGO and government parties involved to expand this.

Further forensic validation of the markers is in progress by the project partners.

- Are additional funds being sought to continue aspects of the project (funds from where and for which aspects)?

Dr Taylor has submitted several funding proposals (within South Africa) to seek funds to develop further genetic forensic techniques for wildlife but is currently awaiting responses on these. Details of the markers and access to biological samples have also been provided to other groups, in order that they may too benefit from this work and continue certain aspects of it.

Dr Taylor may seek funding to continue to provide training and workshops to wildlife investigators in South Africa.

#### **14. Value for money**

- Considering the costs and benefits of the project, how do you rate the project in terms of value for money and what evidence do you have to support these conclusions?

The project was good value to the Initiative in as much that many of the resources used were provided by the host institutions in South Africa and the UK or by the collaborators in South Africa. It is a little too early to judge the lasting value of the achievements, but the signs in terms of improved awareness and practice are positive.

## 15. Appendix I: Project Contribution to Articles under the Convention on Biological Diversity (CBD)

Please complete the table below to show the extent of project contribution to the different measures for biodiversity conservation defined in the CBD Articles. This will enable us to tie Darwin projects more directly into CBD areas and to see if the underlying objective of the Darwin Initiative has been met. We have focused on CBD Articles that are most relevant to biodiversity conservation initiatives by small projects in developing countries. However, certain Articles have been omitted where they apply across the board. Where there is overlap between measures described by two different Articles, allocate the % to the most appropriate one.

<b>Project Contribution to Articles under the Convention on Biological Diversity</b>		
<b>Article No./Title</b>	<b>Project %</b>	<b>Article Description</b>
<b>6. General Measures for Conservation &amp; Sustainable Use</b>	20	Develop national strategies that integrate conservation and sustainable use.
<b>7. Identification and Monitoring</b>		Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
<b>8. In-situ Conservation</b>		Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
<b>9. Ex-situ Conservation</b>		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
<b>10. Sustainable Use of Components of Biological Diversity</b>	10	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
<b>11. Incentive Measures</b>	10	Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
<b>12. Research and Training</b>	10	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries



		(in accordance with SBSTTA recommendations).
<b>13. Public Education and Awareness</b>	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
<b>14. Impact Assessment and Minimizing Adverse Impacts</b>		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
<b>15. Access to Genetic Resources</b>	5	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
<b>16. Access to and Transfer of Technology</b>	20	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
<b>17. Exchange of Information</b>	20	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
<b>19. Bio-safety Protocol</b>		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
<b>Total %</b>	<b>100%</b>	<b>Check % = total 100</b>

## 16. Appendix II Outputs

Please quantify and briefly describe all project outputs using the coding and format of the Darwin Initiative Standard Output Measures.

Code	Total to date (reduce box)	Detail (←expand box)
<b>Training Outputs</b>		
1a	Number of people to submit PhD thesis	-
1b	Number of PhD qualifications obtained	-
2	Number of Masters qualifications obtained	1 (+1 in progress)
3	Number of other qualifications obtained	-
4a	Number of undergraduate students receiving training	-
4b	Number of training weeks provided to undergraduate students	-
4c	Number of postgraduate students receiving training (not 1-3 above)	-
4d	Number of training weeks for postgraduate students	-
5	Number of people receiving other forms of <b>long-term</b> (>1yr) training not leading to formal qualification( i.e not categories 1-4 above)	-
6a	Number of people receiving other forms of <b>short-term</b> education/training (i.e not categories 1-5 above)	70+
6b	Number of training weeks not leading to formal qualification	-
7	Number of types of training materials produced for use by host country(s)	Training Workshops / Handouts / Manuals DVD (with DEAT)
<b>Research Outputs</b>		
8	Number of weeks spent by UK project staff on project work in host country(s)	-
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	-
10	Number of formal documents produced to assist work related to species identification, classification and recording.	-
11a	Number of papers published or accepted for publication in peer reviewed journals	1 accepted (3+ in prep)
11b	Number of papers published or accepted for publication elsewhere	9
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	2
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	2
13b	Number of species reference collections enhanced and handed over to host country(s)	-

<b>Dissemination Outputs</b>		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	-
14b	Number of conferences/seminars/ workshops <b>attended</b> at which findings from Darwin project work will be presented/ disseminated.	4 Workshops, 8 Oral presentations, 11 Poster presentations, 2 Conference Proceedings
15a	Number of national press releases or publicity articles in host country(s)	2-
15b	Number of local press releases or publicity articles in host country(s)	3
15c	Number of national press releases or publicity articles in UK	-
15d	Number of local press releases or publicity articles in UK	-
16a	Number of issues of newsletters produced in the host country(s)	-
16b	Estimated circulation of each newsletter in the host country(s)	-
16c	Estimated circulation of each newsletter in the UK	-
17a	Number of dissemination networks established	-
17b	Number of dissemination networks enhanced or extended	-
18a	Number of national TV programmes/features in host country(s)	-
18b	Number of national TV programme/features in the UK	-
18c	Number of local TV programme/features in host country	-
18d	Number of local TV programme features in the UK	-
19a	Number of national radio interviews/features in host country(s)	1
19b	Number of national radio interviews/features in the UK	-
19c	Number of local radio interviews/features in host country (s)	-
19d	Number of local radio interviews/features in the UK	-
<b>Physical Outputs</b>		
20	Estimated value (£s) of physical assets handed over to host country(s)	-
21	Number of permanent educational/training/research facilities or organisation established	Molecular lab set up as a result of this project at UKZN
22	Number of permanent field plots established	-
23	Value of additional resources raised for project	R75,107. specific to project - plus additional lab equipment (estimated at ~£10,000) provided in kind by UKZN to set up molecular lab

## 17. Appendix III: Publications

Provide full details of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications Database that is currently being compiled.

Mark (\*) all publications and other material that you have included with this report

<b>Type *</b> (e.g. journals, manual, CDs)	<b>Detail</b> (title, author, year)	<b>Publishers</b> (name, city)	<b>Available from</b> (e.g. contact address, website)	<b>Cost £</b>
Electronic Genetic Database Resource	Pillay,K., Dawson,D.A., Taylor,T.D., Perrin,M.R. & Burke,T. (2005) Identifying microsatellite loci for the Cape Parrot ( <i>Poicephalus robustus robustus</i> ).	National Center for Biotechnology Information, Bethesda, USA.	www.ncbi.nih.gov	FOC
Electronic Genetic Database Resource	Meares,K.F., Dawson,D.A., Horsburgh,G.J., Taylor,T.D., Perrin,M.R. & Burke,T. (2005) Genetic markers for the identification of the illegal trade in the Blue Crane, <i>Anthropoides paradisea</i> .	National Center for Biotechnology Information, Bethesda, USA.	www.ncbi.nih.gov	FOC
Electronic Genetic Database Resource	Meares,K.F., Dawson,D.A., Taylor,T.D., Burke,T. and Perrin,M.R. (2005) Characterisation of <i>Grus americana</i> microsatellite loci in the Blue crane, <i>Anthropoides paradisea</i> .	National Center for Biotechnology Information, Bethesda, USA.	www.ncbi.nih.gov	FOC
Magazine	Taylor T (2005) <i>Cape Parrot Studbook and DNA Databank</i>	Avizandum	aviproduct@mweb.co.za	
Newsletter	Meares K (2006) <i>Building Genetic Forensic Capacity to Reduce Illegal Trade. The Grus Grapevine</i>	South African Crane Working Group	crane@ewt.org.za	FOC
Conference Proceedings of the 17th South African Crane Working Group	T Taylor (2006) Collecting and Transporting DNA Sources to Assist Research and Wildlife Crime Investigations. 9 - 11 May 2006 Potberg, 16-20.	South African Crane Working Group	crane@ewt.org.za	
Conference Proceedings of the 17th South African Crane Working Group	K Meares (2006) Parentage testing in blue cranes <i>Anthropoides</i> , 9 - 11 May 2006 Potberg, 50-54	South African Crane Working Group	crane@ewt.org.za	
Electronic News Resource	Taylor TD (October 2006) Detection of	Science in Africa	www.scienceinAfrica.co.za/2006/october/trade.htm	FOC

	Illegal trade in the Cape Parrot and Blue Crane using DNA.			
Newsletter	Taylor TD (2006) Cape Parrot DNA Profiling Update	Cape Parrot Newsletter, p. 4	<a href="http://www.cpwg.unp.ac.za/CPNewsletter2.html">www.cpwg.unp.ac.za/CPNewsletter2.html</a>	FOC
MSc thesis	Meares K (2007) <i>Characterising microsatellite loci in the blue crane (Grus paradisea)</i> MSc thesis, School of Biological and Conservation Sciences	University of KwaZulu-Natal	University of KwaZulu-Natal Private Bag X01 Scottsville 3209 KwaZulu Natal South Africa <a href="http://www.ukzn.ac.za">www.ukzn.ac.za</a>	Library Lending Requirements
Newspaper article	Bishop, C (2007) When wildlife becomes witness to crime: animal DNA is being used to solve crime	The Natal Witness Saturday March 31, page 9	<a href="http://www.witness.co.za">www.witness.co.za</a>	
Newspaper article	"Forensic techniques provide a new way to catch poachers" Patrick Burnett	09 December, 2007 Sunday Independent	<a href="http://www.sundayindependent.co.za/">www.sundayindependent.co.za/</a>	
Newspaper article	Patrick Burnett (2007) DNA detection turns to wildlife poachers"	Sunday Tribune 09 December, 2007	<a href="http://www.sundaytribune.co.za/">www.sundaytribune.co.za/</a>	
Newspaper article	Patrick Burnett (2007)	Sunday Argus 09 December, 2007	<a href="http://www.capeargus.co.za/">www.capeargus.co.za/</a>	
Journal publication	Meares KF, Horsburgh GJ, Dawson DA, Perrin MR, Burke TA & Taylor TD (Accepted Dec 2007) Characterization of 14 Blue Crane <i>Grus paradisea</i> (Gruidae, AVES) microsatellite loci for use in detecting illegal trade. <i>Conservation Genetics</i>	(Accepted Dec 2007)	Conservation Genetics DOI: 10.1007/s10592-007-9490-0	
Journal Publication	Meares KF, Horsburgh GJ, Dawson DA, Perrin MR, Burke TA & Taylor TD (submitted) Cross-species utility of microsatellite loci in the blue crane <i>Grus Paradisea</i> , grey-crowned crane, <i>Balearica regulorum</i> and wattled crane, <i>Grus carunculatus</i> (Gruidae, AVES)			
Journal Publication	Pillay, K., Horsburgh GJ, Dawson DA, Taylor TD, Perrin MR & Burke T (in prep) Isolation of microsatellite loci from the Cape parrot <i>Poicephalus robustus</i> (AVES:Psittacidae)			
Journal Publication	Meares KF, Frantz A, Dawson DA, Taylor TD, Perrin M, Burke T (in prep) Population structure in the blue			

	crane			
Journal Publication	Meares KF, Dawson DA, Perrin MR, Burke T & Taylor TD (in prep) A predicted microsatellite map of the crane genome based on crane/chicken sequence similarity			
Journal Publication	Meares KF, Taylor TD, Burke T, Dawson DA Assessment of new PCR based sex-typing methods in cranes (in prep)			

## 18. Appendix IV: Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide contact details below.

<b>Project Title</b>	Building Genetic Forensic Capacity to Reduce South Africa's Illegal Trade
<b>Ref. No.</b>	13/018
<b>UK Leader Details</b>	
Name	Prof. Terry Burke
Role within Darwin Project	Project leader
Address	
Phone	
Fax	
Email	
<b>Other UK Contact (if relevant)</b>	
Name	
Role within Darwin Project	
Address	
Phone	
Fax	
Email	
<b>Partner 1</b>	
Name	Prof. Mike R Perrin
Organisation	University of KwaZulu Natal
Role within Darwin Project	Main project partner or co-ordinator in host country
Address	Dept of Zoology School of Biological and Conservation Sciences Private Bag X01 Scottsville 3209 KwaZulu Natal South Africa
Fax	
Email	
<b>Partner 2 (if relevant)</b>	
Name	Dr Tiawanna Taylor
Organisation	University of KwaZulu-Natal
Role within Darwin Project	Project co-ordinator in host country
Address	Dept of Zoology School of Biological and Conservation Sciences Private Bag X01 Scottsville 3209 KwaZulu Natal South Africa
Fax	
Email	

## 19. Appendix V: LOGICAL FRAMEWORK

<i>Project summary</i>	<i>Measurable indicators</i>	<i>Means of verification</i>	<i>Important assumptions</i>	
<b>Goal:</b>				
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 <ul style="list-style-type: none"> <li>the conservation of biological diversity,</li> <li>the sustainable use of its components, and</li> <li>the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</li> </ul>				
<b>Purpose</b>				
Endangered Cape Parrot and Blue Crane protected through institutional capacity building at the University of Natal, with wildlife genetic forensic techniques developed to enable claims of captive breeding to be confirmed or refuted in order to detect illegally caught wild birds	Microsatellites developed MSc students trained Forensic methods developed Illegal trapping reduced  Number of captive birds processed for database Successful prosecutions	Reports, scientific papers MSc theses Guidelines, manuals created Wildlife authority records  Genetic database records  Authorities records	Microsatellites are obtained Students complete studies Access to SA legal systems Traders deterred  Authorities and working groups submit samples Crimes committed & genetic profiling successful	Microsatellites developed 1 completed, 1 in progress Guidelines created Too early to determine, markers not used to date  2 genetic databases created  Too early to determine, markers not used to date
<b>Outputs</b>				
Microsatellite markers Protocols and Guidelines for forensic analysis Wider awareness of methods to detect illegal trade (public/authorities) Two MSc students trained in research and analysis Dissemination of results	Number of microsatellites Manuals produced for laboratory and authorities Number of talks, publications posters and media presentations MSc theses and scientific papers produced Interim reports, scientific and popular papers	Reports, scientific papers Details/copies to Darwin Initiative Details/copies to Darwin Initiative MSc's awarded. Copies of theses to Darwin Initiative Copies to Darwin Initiative	Microsatellites obtained Collaboration with authorities in development Interest in subject from authorities/public/media MSc students complete course	Microsatellites developed Laboratory manuals not produced re change of plan re MBU. Presentations, publications and media 1 MSc awarded (with distinction) 1 MSc still in progress 3+ publications accepted /in preparation Reports disseminated (more follow)