THE UNIVERSITY OF HULL

Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt and the Red Sea

Final Report 2007

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Darwin Initiative for the Survival of Species

Final Report

1. Darwin Project Information

Project Reference No.	EIDPO8/10-027
Project title	Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt and the Red Sea
Country	Egypt
UK Contractor	University of Hull
Partner Organisation (s)	Suez Canal University, EEAA, GAFR
Darwin Grant Value	£80, 176
Start/End date	May 2005 to October 2007
Project website	
Author(s), date	Dr A Lawrence, Dr R Khatab, Mr M Ahmed,

2. Project Background/Rationale

2.1 Project Location and Circumstances

This is a follow up project to an original study supported by the Darwin Initiative (Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt, Reference: 162/10/027). The project was centred in Hurghada, Egypt but based along the whole of the Egyptian coastline. The original project has clearly identified over-fishing of sea cucumber in the Egyptian Red Sea as a significant problem. The management plan developed during the first study made a number of recommendations which the new project aimed to encourage the relevant agencies to adopt. Most importantly, the management plan recommended the continued ban of the fishery in the Egyptian Red Sea together with the establishment of a Monitoring Programme to assess any recovery in sea cucumber stocks. Ultimately, these should help in stock recovery and the future sustainable use of the resources, the principal goal of the original Darwin Initiative project.

In addition, data from the original Darwin project suggested that environmental factors may alter the secondary metabolites produced by some species of sea cucumbers. This has been reported in other, mostly microbial, systems but it was the first time that this has been reported in sea cucumber. Now, however, there was a clear need to determine, in the case of sea cucumbers, whether the differences in metabolites were triggered by environmental factors or whether there was some genetic basis to the differences. This clearly has important implications on the identification of species and future management of stocks.

The project was highlighted as a priority by the local partners. The original partners wished to continue with the project and were joined by several new partners including the GAFR and, later, the National Institute of Oceanography

3. Project Summary

3.1 The Purpose and Objectives of the Project

The purpose of the project were threefold:

• To Encourage the relevant agencies in Egypt to adopt the recommendations from the Sea Cucumber Management and Monitoring Plan by maintaining the previously initiated ban on the sea cucumber fishery and beginning a post-project monitoring programme to assess the recovery of depleted commercial stocks in Egypt during the period of the continued project. The monitoring was to be undertaken primarily by EEAA Rangers (under supervision of the previously trained student) thereby further embedding and transferring skills within the relevant agency.

• Further examine the relationship between some sea cucumbers ability to modify the secondary compounds that they produce in different environments, to establish the relationship between environmental and genetic components of this relationship so that these can be interpreted in relation to taxonomy and any future release of cultured animals (highlighted as an important consideration both by the current project referee and in relation to ex-situ conservation/release of captive animals).

• To begin the process of broadening the project and technology transfer (in relation to species identification, monitoring of stocks, and adoption of sustainable fishery practices at a Red Sea/ East African regional level through the running of two regional workshops.

The main Outputs of the project would include: An updated Stock Monitoring Report & Management Plan, Updated Field Guide to the Holothuria of the Red Sea, GTA Species Diversity & Population Genetics Final Report, Research Fellow Final Report on Bioactive Substances, Publication of a Status Report and Proposed Strategic Plan for Sustanable Use and Conservation of Sea Cucumber in the Red Sea/ East African Region, Production of a project website (See Logical Framework, Appendix 5).

3.2 Changes to the Objectives and Operational Plan

Following the meeting of the Scientific Committee, together with follow up meetings with USAID and NIOF a number of significant changes were made to the project and the allocation of project budget. These were:

- Money from the budget was diverted into the establishment of a Marine Biotechnology Laboratory in the Marine Sciences Department at Suez Canal University. The money for this was saved from the Egyptian partner salaries. The Laboratory was established with an initial £19,000. However, £30,000 worth of equipment for the laboratory was raised from this.
- Only one Regional Meeting would be held (rather than the originally proposed two). Additional funding for this meeting would be sought from PERSGA
- The money set aside for the Monitoring Programme would be diverted towards a further study towards a mariculture system at the National Institure of Oceanography and Fisheries facility in Hurgada. Dr Soliman (then Director of NIOF) agreed to make the facility available to the project and help financially in the development of the facility.

- The monitoring of sea cucumber stocks would continue. The funding for this would be provided through the USAID Life Project/ EEAA to a minimum of the equivalent originally outlined in the Darwin project.

Based on these changes, modified work plans and budgets were adopted. The changes were approved by the Darwin Secretariat in November 2005.

Further changes were made to the project when it was realised that, an administrative error at the University of Hull, resulted in the loss of £20,000 from the budget. These changes included the cancellation of the regional workshop, a reduction in the work undertaken in the biotechnology laboratory and a significant reduction in the work undertaken at NIOF. This, together with changes in Management Team at the USAID Life Project and the re-focussing of this project, meant that significantly less money was available for the monitoring programme. One result from this was that the Strategic Plan for Sustanable Use and Conservation of Sea Cucumber in the Red Sea/ East African Region would no longer be produced. Again the Darwin Secretariat was made aware of these changes when the reduction in budget was discovered.

3.3. Main CBD articles

The main Articles of the CBD that best describe the project are: Article 7, Identification and Monitoring; Article 9, Ex-Situ Measures; Article 12, Research and Training; Article 16, Access to and Transfer of Technology and Article 17, Exchange of Information.

3.4 Success of the Project

The project has been mostly successful in meeting its objectives:

Several of the recommendations of the original management plan were approved, including a continuation of the current ban on the fishery whilst further monitoring of any stock recovery could be undertaken. Furthermore, the ban was extended to include the whole of the Egyptian coastline. This monitoring was completed and an updated Stock Monitoring Report & Management Plan has been submitted.

The taxonomy of the holothurian species discovered during the project has been further resolved. An updated Field Guide to the Holothuria of the Red Sea has been produced, The GTA Species Diversity & Population Genetics Final Report has been submitted and the GTA is continuing to work toward his PhD thesis.

The production of secondary metabolites between species and populations of the same species has been further examined by the Research Fellow. Results from this work have been submitted in a Final Report on Bioactive Substances. A significant additional achievement has been the development of the Biotechnology Laboratory in the Department of Marine Science at Suez Canal University together with the transfer of technology and skills to others within the department.

A further additional achievement has been the work carried out at NIOF. Whilst this has not lead to a system of mariculture of Red Sea Holothuria, it has improved our understanding of the relationship between Holothuria and their environment. This work is continuing beyond the period of Darwin funding.

The one area of the project that has not been achieved was the broadening the project and technology transfer (in relation to species identification, monitoring of stocks, and adoption of sustainable fishery practices at a Red Sea/ East African regional level. Unfortunately, changes in the objectives of the project, and later budgetary constraints, meant that the regional workshops were cancelled and Status Report and Proposed Strategic Plan for Sustanable Use and Conservation of Sea Cucumber in the Red Sea/ East African Region was not produced. Despite this, however, the project has undoubtedly gained a higher profile within the region, with collaboration and advice being offered to workers in the United Arab Emirates, Yemen and Iran, via links with PERSGA in Saudi Arabia.

4. Scientific, Training, and Technical Assessment

4.1 Species Taxonomy and Molecular Biology

4.1.1. Project Team

Staff included Dr Andrew Lawrence, Dr David Lunt and Mr Mohammed Ahmed (GTA project student) and Dr T Paget.

4.1.2 Methodology

Methodology included sea cucumber taxonomy, spicule isolation and identification against recognised dichotomous keys, development of primers, isolation of the CO1 gene, PCR and sequencing. Full details of the project methodology and results are given in the final report (Appendix 6)

Mr Mohammed Ahmed's First Year Report was examined by two independent internal examiners from the Department of Biological Sciences and work is progressing toward the submission of his PhD thesis, one paper has been submitted to coral reefs, further papers are in preparation.

4.2 Bioactive Substances Study

4.2.1 Project Team

The Bioactive Substances Team included Dr Rafat Khattab (Darwin Research Fellow), Dr Tim Paget (University of Kent) Dr Lawrence and Professor Khalifa (Suez Canal University).

4.2.2. Methodology

Darwin Research Fellow, Dr Rafat Khattab, gained further/ advanced training in HPLC, NMR, Maldi-toff, and bioassay methodologies during a 4 month study period at Hull University. In addition, Dr Khattab set up the new biotechnology laboratory in Egypt. He is now able to perform anti-fungal assays in the new laboratory together with preliminary isolation work on bioactive substances. Full details of the project methodology and results are given in the project final report (Appendix 7).

In addition, Dr Khattab is now training the following students in these methods in the new biotechnology laboratory in Egypt: 1) Ibrahim Sultan (PhD student from the Arabic Repuplic of Yemen) working on natural products from marine plants.

2) Tarek Temraz (PhD student from Marine Science Department, Ismailia) working on chemotaxonomy and bioactivities in soft corals. 3) Amro Khalil (MSc student from Marine Science Department, Ismailia) working on chitosans from crustaceans.
4) Basma Nomany (project student) working on antibacterial and antifungal activities from marine invertebrates.

Papers in preparation include: 1) Status and value of sea cucumbers from red the Egyptian Red Sea 2) Bioactivities of natural products from Red sea Holothurians
3) Isolation and identification of saponin like compounds from Red Sea holothurians.

4.3 Mariculture/ Holothurian Feeding

4.3.1 Project Team

Staff Included: Mr Metwaly Khabana (EEAA) Dr Lawrence, Dr T. Paget and Dr Soliman (Director of NIOF).

Mr Metwaly Khabana has been gaining experience and training in aspects of sea cucumber mariculture. Due to lack of main commercial species breeding stocks, and given interest in secondary metabolites, the project has focussed on sea cucumber maintenance in ponds, feeding, reproductive cycle of *H. atra*, and their impact on the diversity of microbes/ reef health.

During a 3 month period based at Hull University, Mr Khabana has received training in sample preparation for DNA extraction, DNA extraction using Hot Shot and Proteinase K, PCR and agarose gel electrophoresis.

This study is still at its preliminary stage and is anticipated to go through to 2009. Initial studies, set up within the ponds at NIOF have looked at the effect of sea cucumber grazing on sediment bacteria and particularly bacterial health indicators. These will be compared to natural populations found in a variety of reef and other ecosystems. In addition, the gametogenic cycle of H. atra is being determined.

There has been no peer review of the work at this stage but a first year report will be examined by two independent examiners from within the Department of Biological Sciences at Hull University.

4.4 Monitoring Project

4.4.1 Project Team

Mr M. Ahmed (Research Student), Dr R. Khatab (Darwin Fellow), Dr A Lawrence, Mr Abdalla Eliwa (EEAA).

4.4.2. Methodology

A number of sites were selected that had been identified as either partially protected or heavily over-fished in the original project. Sites were accessed by boat and surveyed using scuba. The methodology followed that described in the original project using a 50m belt transect laid at depths between 5-30m. All sea cucumber observed within each belt transect were identified and counted. Detailed methods and results have been published (see M.I. Ahmed & A.J. Lawrence (2007) The Status of Commercial Sea Cucumbers from Egypt's Northern Red Sea Coast. Beche de Mer 26, 14-18, (Appendix 8) for details.

4.5 Training and Capacity Building

Mr Mohammed Ahmed was selected based on his previous taxonomic training in Holothurian identification (MPhil, University of Hull, Darwin Project 1). During the current project Mr Ahmed has gained further training and experience in molecular methods, sample collection and preservation, spicule analysis (including one day at the Natural History Museum, London) DNA preservation and isolation, development of appropriate primers, PCR, sequencing and data manipulation. This work is leading toward the submission of a PhD thesis anticipated in 2008. In addition, Mr Ahmed will have gained a Certificate in Post Graduate Studies from the University of Hull. This involves gaining 60 credits of training from a range of post-graduate courses. Courses that Mr Ahmed attended included Advanced molecular biology and regulation of gene expression, first year report and Higher Education Teaching. Current peer review has been via the submission of his first year report and viva examination of this by two independent examiners. In addition, one paper is currently under review and others are in preparation. Peer assessment will also involve the submission of his PhD thesis and viva examination of this.

Dr R.Khattab was selection based on previous training (PhD, University of Hull, Project 1) He has gained further/ advanced training, particularly in chemical characterisation methods including NMR, MS-MS, Maldi-Toff at the University of Hull. There has been no specific assessment or accreditation at this stage although a number of scientific papers are in preparation. His training of students at Suez Canal will lead to their completion of BSc, MSc and PhD qualifications.

Mr M. Khabana was selected based on previous experience in marine microbiology and environmental management. Mr Khabana is the Manager of the recently established EEAA Environmental Monitoring Unit in Hurghada. Consequently, it is anticipated that the training of Mr Khabana will lead to the transfer of technologies and skills to staff within this new establishment. Training has included species identification, together with 6 month period of training in the UK on molecular biology methods in the ID of bacteria including, DNA isolation, PCR and sequencing. Mr Khabana has also gained additional training through the post-graduate training scheme at Hull University. Mr Khabana has been registered for a part-time PhD, funded by the University of Hull, and training will include completion of 60 credits worth of training in modules including: numerical techniques, English for academic purposes and his first year report. Assessment and accreditation at this stage includes independent examination of his first year report. It will also include the examination of his final PhD thesis, anticipated in 2009.

The monitoring programme has also involved the additional training of several EEAA Rangers in species identification and survey methods. These staff have included Mohamed Abdelghany, Tamer Mouner and Abdullah Ellioa from the Hurghada office, Mohammed Negm and Mohammed Besar from the Marsa Alam office and Amgd shafaay from the Safaga office.

5. Project Impacts

5.1 Project Purpose, Achievements and Additional Unexpected Impacts

The project has undoubtedly further embedded the work of the original study within Egypt. As a result of this, and the follow up project, the original ban on the fishery was extended beyond the jurisdiction of the Red Sea Governorate to include the whole of the Egyptian coastline, and has been maintained throughout the duration of the follow up project. This was agreed following a meeting of the Egyptian Partners in Sharm El-Shekh in 2005 at which evidence for the collapse of the fishery, determined in the first project, was presented to the Egyptian partners. These partners included both the EEAA and GAFR who had originally clashed over the adoption of a country wide ban. On seeing the evidence for the collapse of the fishery, the maintenance and extension of the ban was approved by all. In addition, a monitoring programme was initiated with the support of the Egyptian partners, notably the EEAA. EEAA Rangers gained training in species identification and survey methods, under the direction Mr Mohammed Ahmed (the GTA student) and with support of several members of the Department of Marine Science, Suez Canal University, thereby further embedding and transferring skills within the relevant agency. Unfortunately, the evidence from this monitoring is that there is little sign of any recovery of depleted stocks at this time.

Furthermore, examination of the production of secondary compounds and the environmental/ genetic component to this, has helped to further resolve taxonomic issues within the group both nationally and internationally. These studies have confirmed the genetic separation of the populations examined. They have separated *Actinopyga mauritiana* into at least 2 species and shown that there is genetic separation within species based on their habitat preferences. This clearly has implications both on the fishing of sea cucumber and the loss of genetically distinct populations (reduction of genetic diversity) as well as for the release of any captive bred individuals in the future. It may also have implications for mariculture regards the optimisation of conditions required for particular species populations and previous problems encountered regarding optimal culture/ feeding conditions. Potentially it does also lead to the use of organism level of biocatalysis - a biological route of compound synthesis as opposed to chemical route. Biocatalysis is potentially easier and cheaper in the production of complex compounds such as the saponins found in sea cucumber).

Unfortunately the cancellation of the planned Regional Workshops has lessened the impact of the project at a regional level. However, the profile of the project has increased regionally and there has been collaboration and skills transfer with projects taking place in the UAE, Yemen and Iran. This was in part facilitated by the appointment of Dr Kotb (Suez Canal University Partner) as Director of PERSGA, based in Saudi Arabia. Regional cooperation is consequently developing although not as quickly as might have been the case if the Regional Workshops had run.

A significant additional achievement of the project has been the establishment of a new biotechnology laboratory in Egypt. This, together with the training provided through the project, clearly leaves a lasting capacity in Egypt to continue this work both in Holothuria but also in other groups such as the soft corals.

A further notable outcome has been the development of a relationship with the National Institute of Oceanography (NIOF). This organisation came to the project late but was keen to offer facilities in relation to mariculture of sea cucumber. It is anticipated that this relationship will develop beyond the time of the Darwin project. Indeed, the PI has already been asked to supervise a PhD project on sea cucumber mariculture in Alexandria, beginning in 2008, as a result of this partnership.

Further notable additional outcomes include: The invitation to present a workshop in Iran on Coastal Zone Management (January, 2007) funded by the British Council. The workshop took place in Bandar Abas, and included participants from across Iran. Whilst focussed on CZM issues, time was set aside to present the work of the sea cucumber project in the context of sustainable fishery management. This has lead to the development of at least one post-graduate project in Iran examining the sea cucumber stock. Dr Lawrence is also liaising with partners in Iran on the production of a paper from this study.

5.2 Assisting Egypt to Meet its Obligations under the CBD

The project has provided further detailed information on the taxonomic and genetic diversity of a poorly known group or marine organisms in Egyptian coastal waters. Furthermore, monitoring of the populations of these animals has shown that there has been little evidence of recovery of stocks following their original over-exploitation. This information has been made available to staff within the EEAA and other partners who are in direct and regular contact with Dr Moustafa Fouda (the Egyptian CBD Focal Point). Furthermore, members from the project team met with Dr Fouda in 2005 to specifically consider the results of the current project. Thus the results of the project are available for incorporation into Egypt's Biodiversity Status Report and Action Plan. We are not aware, at this stage of how this might further modify Egypt policy on the fishery. Appendix 1 shows the extent to which the different components of the project contribute to conservation defined in the CBD Articles.

5.3 Training and Capacity Building

The project has undoubtedly improved Egypt's capacity to further biodiversity work and training has lead to the establishment of capacity within the country to further develop work of this nature. At the current time:

Mr Mohammed Ahmed is completing his research toward a PhD. This further builds on Mr Ahmed's taxonomic skills and will expand these into the field of molecular biology. Mr Ahmed is likely to take up a post as a lecturer in the Department of Marine Sciences, Suez Canal University, on completion of his PhD. This will clearly give him the opportunity to transfer his skills to others in the Department. Mr Ahmed has also further trained Rangers within EEAA and students at Suez Canal University in holothurian taxonomy and survey methods. The methodologies, in particular, could be modified to include survey of other species.

Dr Rafat Khattab is now working in Suez Canal University as a lecturer in the Department of Marine Science. With funding from the project we have established a Biotechnology Laboratory within the Marine Science Department. He currently has four students working with him who are specifically gaining training in natural product isolation and characterisation techniques.

Whilst completing his PhD part-time, Mr Metwaly Khabana is also working in Hurghada as the Senior Manager within the EEAA Environmental Monitoring Unit. As such, he oversees the work of several departments. The additional training gained during the project will clearly support this work in the future, particularly with regard to the identification of possible disease and bacterial pathogens in reef environments.

5.4 Collaboration between UK and Local Partners

Collaboration between the partners has been a strength of the project throughout. This is evidenced by the fact that the individuals, from each partner institute, were prepared to use the money set aside for their salaries into the establishment of a new laboratory at Suez Canal University. The link with Suez Canal University has been particularly strong and supportive and staff from the Marine Science Department have helped with both the monitoring programme and collection of species for the taxonomic and biotechnology work. The support of the Egyptian Environmental Affairs Agency has remained strong with the provision of facilities, manpower and equipment for stock assessment surveys. The EEAA has also provided partial release of Mr Khabana from work, so that he can conduct research toward a PhD. They have also made the facilities of the Environmental Monitoring laboratories available for aspects of his work.

The University of Hull is providing a final year of tuition fees to Mr Ahmed, to enable him to complete his study and submit a PhD thesis. It is also providing the part-time tuition fees for Mr Khabana so that he, too is registered for a PhD.

The National Institute of Oceanography has provided facilities and some man-power to support the research undertaken by Mr Khabana. The relationship between NIOF and Hull University is something that is expected to develop beyond the period of Darwin funding, with a new sea cucumber mariculture project likely to begin in the near future.

The Red Sea Governorate, GAFR and EEAA have all supported the project by maintaining and expanding the original ban on the fishery.

5.5 Social Impact from the Project

The project has had positive and negative impacts on individuals and the local community. It has clearly helped a number of individuals in their personal careers, notably Mr Ahmed, Mr Khabana and Dr Khattab. It has also, undoubtedly helped Dr Lawrence gain the offer of a Professorship at the University of West Indies.

The project has also increased the profile of Dr Lawrence and Hull University in Egypt. This has resulted in one additional project being developed with a research students from EEAA. The project is an examination of the conservation status of shark populations in the Egyptian Red Sea.

The continued ban on the fishery has arguably had mixed impacts. It will certainly have resulted in a loss of revenue to many within the local fishing communities. However, this “perceived” negative impact will have occurred despite the project, through the collapse of the fishery. Furthermore, the ban should have also resulted in a reduction in the number of diving accidents associated with the fishery.

6. Project Outputs

The main outputs from the project are shown in Appendix II. Of these, those not achieved were the two regional workshops originally planned as part of the project. In conjunction with these, the Regional Species Status Report was not produced. Several press releases were prepared, both in the UK and Egypt, but fewer of these were taken up by the local or national media in Egypt. There was some local coverage in the Egyptian media regarding the ban when it was extended to the whole of the Egyptian coastline.

However, a number of outputs produced by the project were additional to those of the original proposal. These included: The registration and training of a second PhD student (with 24 weeks of training in molecular techniques), the training of undergraduate and postgraduate students in Egypt by the Darwin Fellow, and the development of the new biotechnology laboratory in Egypt with an estimated £30, 000 worth of equipment.

All current publications are listed in Appendix III. It is hoped that additional material will become available as and when a project website can be developed. In addition, four presentations on the outcomes of the project have been given at universities in the UK and one at a conference in Egypt. Dissemination will continue after the project. A number of scientific publications are in preparation and will, hopefully, be submitted shortly. A website will be created, probably at the expense of the PI. In addition, further grant applications are currently being prepared which will allow further future dissemination.

7. Project Expenditure

Grant expenditure is shown in Appendix 9 This shows the actual project expenditure against the originally proposed budget and the modified budget approved by the Darwin Initiative following the first meeting of the Scientific Committee.

The salary to the GTA and the stipend to the Darwin Fellow were slightly higher than anticipated due to cost of living rises to salary scales adopted by the University.

Most other expenses are lower than anticipated (eg no funding was spent on conferences, travel costs were reduced substantially etc due to the loss of £20,000 from our original Darwin Budget. This occurred because a (former) member of staff from The University of Hull's Post Project Funding Department had not been completing and submitting quarterly cost statements as agreed between the University and the Darwin Initiative and assumed by the PI. This only came to light half way through the second year of the project when it was too late to recoup the funds.

Consequently, some significant changes were made to the final stages of the project in order to work within the remaining budget. Aspects of the biotechnology work were reduced so that only assays using Candida were performed as part of the chemical isolation and characterisation project. Internal office costs were absorbed by the partner institutions, the Regional Workshop was cancelled and the work on development of a website was postponed. These changes were again discussed with the Darwin Initiative Secretariat and accepted as necessary.

8. Project Operation and Partnerships

8.1 Project Partners

There were 6 initial main partners in the project. These were The Department of Marine Science, Suez Canal University; The Egyptian Environmental Affairs Agency (EEAA); The Red Sea Governorate; The General Authority for Fish Resources Development (GAFR); The Gulf of Aquaba Governorate and The Fishermen's Society. These were later joined by the National Institute of Oceanography (NIOF). Of these, the most active partners were The Department of Marine Science, EEAA and NIOF. The main roles of these partners in biodiversity link to education, scientific research, monitoring and training, fishery management and mariculture. In addition, EEAA, as a government agency with responsibility for CBD implementation in Egypt, continued to represent the project in Egypt at a political level. The other partners, whilst less directly involved, were kept informed of the project. In addition, these were the partners who had the authority to implement any decisions at a political level.

The Egyptian Partners met early during the project and agreed to continue and expand the original ban on the fishery during the second project. In addition, each partner was invited to participate in the meetings of the Project Scientific Committee. Of the partners, it was the most active partners who attended these meetings.

The EEAA and Suez Canal University were closely involved in the original project plan. In addition, during the first meeting of the Scientific Committee, the EEAA were the primary partner pushing for the development of the Biotechnology Laboratory. Furthermore, the EEAA introduced the project leaders to NIOF and were very instrumental in gaining the Institute's involvement in the project. Consequently, the original project plans were significantly modified following local consultation.

8.2 Collaboration with Similar Projects in Egypt

Collaboration has continued between this Darwin Initiative project and a USAID Life Red Sea Project. However, changes in the scope of the USAID project, together with the management team in Hurghada, resulted less direct collaboration than had previously been enjoyed. There was no direct consultation with Egypt's Biodiversity Strategy Office. However, Dr Fouda (CBD Focal Point) has been kept informed of the project outputs during the project.

8.3 International Participants in the Project

Internationally, links have been maintained with a number of colleagues on various aspects of the project. For example, Dr Yves Samyn (CBD National Focal Point, The Royal Institute of Natural Science of Belgium) offered further advice of some species identifications.

Dr Sven Ulthike, from The Australian Institute of Marine Sciences (AIMS) has offered further advice on some species as well as on the molecular genetic techniques being developed by his laboratory.

In addition, material has been offered by Professor Chantal Conand, Editor of Beche de Mer, Universite de la Reunion, France, for our current population genetic analysis. It is anticipated that these relationships will continue to develop.

8.4 Post Project Local Partner Activity

Several of the local partners are continuing with aspects of the project at this time. Indeed, we are in the process of submitting two grant applications for further funding to support aspects of the project. In addition, Dr Khattab, the Darwin Fellow, is continuing to develop the work of the Biotechnology Laboratory. It is also anticipated that whilst the period of Darwin funding has ended, the most active partners will continue to liaise to complete aspects of the work. For example, a number of scientific papers are in preparation and will hopefully be completed and submitted over the coming months.

A future study on sea cucumber mariculture is planned, with Dr Lawrence acting as a supervisor. It is anticipated that the project will be based at NIOF in Alexandria and work on a Mediterranean species.

It is not currently known whether the monitoring programme initiated during this project will continue. In addition, whilst documents have been made available to the CBD focal point, it is not known if, or for how long, the current ban will continue. Without clear funding set aside for future monitoring, it is not clear whether the Egyptian government see this as a priority at this time. More local participation would be welcome but the political structures within Egypt do not currently encourage this. There is no obvious role for the private sector at this time**.**

9. Monitoring and Evaluation, Lesson learning

9.1 Monitoring, Evaluation and Indicators of Achievement

Monitoring and management of the project was primarily via Merlin (an internet system) which allows all of the named participants in the project to correspond and communicate on a regular basis). The project participants, and Management Committee, were able to share and disseminate information, provide training and monitor progress against predetermined milestones and the logistic framework via the system. In addition, there were regular meetings between the Project Coordinators in Egypt and the UK.

Information collected in the study is highlighted in Section 3. Indicators of achievement and project milestones included progress reports submitted by project student and fellow for each of the topic areas of the project, The future submission of two PhD theses and further scientific publications are all indicators of achievement as are the submission of the Management Plan and use of the Field Guide.

An indicator of the fact that the outputs contributed to the project purpose is highlighted by the establishment and re-instigation of a fishery ban during in 2005 whilst any evidence of stock recovery was determined.

9.2 What were the Main Problems

The main problem for the project related to its financial management. Unfortunately, a (now former) member of staff within the University of Hull Post Project Funding Department, was found to not have been submitting quarterly financial statements to the Darwin Secretariat as had been agreed as assumed. As a consequence, the project lost £20, 000 from its budget and this had a significant impact on the final scope of the project.

9.3 Internal and External Evaluation of the Project

There has been internal and external evaluation of the project throughout its time frame. For example, aspects of the scientific elements of the project were monitored by the Scientific Committee at regular intervals. The PhD student had to submit first year report to the Department of Biological Sciences. This was examined by viva by two internal members of the department not involved in the project work.

In addition, the outcome of the stock assessment study has been subject to peer review and published and further work on the diversity and distribution of species is currently under review.

9.4 Key Lessons learned

The key lessons learned from the project have been that good regular communications are fundamental to the success of a project. Good systems need to be in place for this between countries and individuals in a way which keeps everyone informed of the progress of the work. The Merlin system used in this project could have been more effective in this if all partners had regularly used it.

A second lesson learned was that most elements of work, particularly overseas and in remote areas and developing countries take longer than anticipated. Work programmes and timetables should probably reflect this but might be less likely to be successful at the proposal stage if they did so.

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

No specific issues have been raised as a result of the annual report. However, the comment raised by a previous referee has proven very relevant regarding the possibility of genotypic separation of populations and the implications of this for species conservation. These comments were taken on board at the time. However, the genetic separation of populations, identified in the current study, have highlighted the importance of this issue.

11. Darwin Identity

Every effort was made to publicise the Darwin Initiative throughout the project. The Darwin Logo continues to be used on the truck purchased for fieldwork. The new Biotechnology Laboratory in Suez Canal University is labelled the Darwin Initiative Laboratory and every piece of equipment within the laboratory includes the Darwin Initiative logo. In addition, the support of the Darwin Initiative was written into every press release and highlighted in every presentation given by project partners.

Whilst collaborating with similar projects and working with individuals involved in wider biodiversity and conservation issues, the project has mostly been considered as a distinct project with a clear identity.

12. Leverage

Additional funds to the project were provided by the University of Hull to cover the additional scholarship fee for the PhD student. Additional tuition fees have also been made available to a second student by the University of Hull. The work of this student is also being supported in Egypt by the EEAA and NIOF. NIOF have also gained funding to support a future project on mariculture which will be co-supervised by Dr Lawrence. Furthermore, money diverted for partner salaries to the establishment of a biotechnology laboratory was used to gain an additional £11, 000 worth of equipment from the company gaining the contract to supply the laboratory. In addition, elements of monitoring work were supported by the EEAA “in kind”.

13. Sustainability and Legacy

At the current time the capacity building, through training of research students, Darwin Fellow and EEAA Rangers will endure and be built upon. Furthermore, resources provided by the project will continue to be used by some of the Egyptian partners, notably those physical resources left with the Department of Marine Sciences, Suez Canal University. Indeed, the new laboratory is already being used to train additional students in aspects of biotechnology.

Mr M Ahmed will continue work on holothurian taxonomy and molecular biology for the immediate future. His employment as a lecturer in the Department of Marine Sciences will ensure that these skills are passed on to others..

The work of the natural products group will certainly continue through the employment of Dr R. Khattab as a lecturer in Suez Canal University. This is clearly an aspect of the work that the Egyptian partners are keen to progress. Dr Khattab has begun training undergraduates in some of the extraction and assay techniques, developed during the project and it is anticipated that this will continue and expand in the future.

It is also clear that both Dr Khattab and Mr Ahmed, as well as some of the other partners, will undoubtedly stay in contact beyond the period of the project will seek funding for future collaborations. Very good partnerships have been developed between these staff and the UK partner.

14. Value for money

Overall, the majority of outputs have been achieved either completely or partially. Furthermore, where outputs were not achieved, alternative work and studies were undertaken which have provided valuable information to the EEAA and other agencies. Consequently, overall, the projects has mostly met its goals and purpose, producing the outputs and indicators of achievement that were originally proposed.

Furthermore, the project has clearly begun to leave a lasting legacy in Egypt through the employment of trained personnel and their roles in educational and governmental institutions. These people will continue to train others in aspects of the original work. In addition, it has attracted some additional funding from the partners which expanded the scope of some of the work beyond that anticipated.

Consequently, on reflection, we feel that the project has been extremely cost effective and represents very good value for money.

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

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	**Project %**	**Article Description**
6. General Measures for Conservation & Sustainable Use		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	50%	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.
8. In-situ Conservation		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.
9. Ex-situ Conservation	10%	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.
10. Sustainable Use of Components of Biological Diversity		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.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	25%	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).
13. Public Education and Awareness		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.

14. Impact Assessment and Minimizing Adverse Impacts		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.
15. Access to Genetic Resources		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.
16. Access to and Transfer of Technology	5%	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.
17. Exchange of Information	5%	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		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.
Total %	**100%**	**Check % = total 100**

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)
Training Outputs		
1a	Number of people to submit PhD thesis	2 (1 is additional)
1b	Number of PhD qualifications obtained	2 (1 is additional)
2	Number of Masters qualifications obtained	
3	Number of other qualifications obtained	
4a	Number of undergraduate students receiving training	2 additional (Rafats lab?)
4b	Number of training weeks provided to undergraduate students	
4c	Number of postgraduate students receiving training (not 1-3 above)	2 additional post-graduates in the new Biotechnology lab
4d	Number of training weeks for postgraduate students	1st student 28 weeks 2nd student 24 weeks (additional output)
5	Number of people receiving other forms of **long-term** (>1yr) training not leading to formal qualification(i.e not categories 1-4 above)	The Darwin Fellow has received continued training throughout the project
6a	Number of people receiving other forms of **short-term** education/training (i.e not categories 1-5 above)	Rangers trained in survey methods
6b	Number of training weeks not leading to formal qualification	
7	Number of types of training materials produced for use by host country(s)	1 – updated Field Guide
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	4 weeks spent by 2 staff 7 additional weeks by 1 staff
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1 updated monitoring & management plan, 2 final reports (no regional report)
10	Number of formal documents produced to assist work related to species identification, classification and recording.	1
11a	Number of papers published or accepted for publication in peer reviewed journals	2
11b	Number of papers published or accepted for publication elsewhere	0
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	0
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	1
13a	Number of species reference collections established and handed over to host country(s)	0
13b	Number of species reference collections enhanced and handed over to host country(s)	1 updated reference collection based at Suez Canal University

Dissemination Outputs		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	0 (2 regional workshops originally planned)
14b	Number of conferences/seminars/ workshops **attended** at which findings from Darwin project work will be presented/ disseminated.	Rafat? Mo?, AJL done 4
15a	Number of national press releases or publicity articles in host country(s)	1
15b	Number of local press releases or publicity articles in host country(s)	2
15c	Number of national press releases or publicity articles in UK	0
15d	Number of local press releases or publicity articles in UK	1
16a	Number of issues of newsletters produced in the host country(s)	0
16b	Estimated circulation of each newsletter in the host country(s)	NA
16c	Estimated circulation of each newsletter in the UK	NA
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	1 through the project partners
18a	Number of national TV programmes/features in host country(s)	0
18b	Number of national TV programme/features in the UK	0
18c	Number of local TV programme/features in host country	0
18d	Number of local TV programme features in the UK	0
19a	Number of national radio interviews/features in host country(s)	0
19b	Number of national radio interviews/features in the UK	0
19c	Number of local radio interviews/features in host country (s)	0
19d	Number of local radio interviews/features in the UK	0
Physical Outputs		
20	Estimated value (£s) of physical assets handed over to host country(s)	£30, 000
21	Number of permanent educational/training/research facilities or organisation established	1
22	Number of permanent field plots established	0
23	Value of additional resources raised for project	£11,000 worth of equipment, £38, 800 in tuition fees by Hull University

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

Type * (e.g. journals, manual, CDs)	**Detail** (title, author, year)	**Publishers** (name, city)	**Available from** (e.g. contact address, website)	**Cost £**
Beche-de-Mer Information Bulletin	* The Status of Commercial Sea Cucumbers from Egypt's northern Red Sea Coast. M.I. Ahmed & A.J. Lawrence (2007) Issue 26, pgs 14-18	Secretariat of the Pacific Community, New Caledonia	http://www.spc.int/coastfish/News/BDM/bdm.htm	Free

18. Appendix IV: Darwin Contacts

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

Project Title	Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt and the Red Sea
Ref. No.	EIDPO8/10-027
UK Leader Details	
Name	**Dr Andrew J Lawrence**
Role within Darwin Project	Overall project management, supervised the monitoring work, taxonomy/ molecular biology and biotechnology work
Address	Department of Biological Sciences, University of Hull, Hull, HU6 7RX
Phone	
Fax	
Email	
Other UK Contact (if relevant)	
Name	Dr Tim Paget
Role within Darwin Project	Supervising both the Darwin Fellow and PhD student
Address	Medway School of Pharmacy, University of Kent at Medway, Chatham, Kent, ME4 4TB
Phone	
Fax	
Email	
Partner 1	
Name	Dr Rafat Khattab
Organisation	Suez Canal University
Role within Darwin Project	Darwin Fellow, leading the Bioactive Study
Address	Department of Marine Science, Suez Canal University, Ismailia, Egypt
Fax	
Email	
Partner 2 (if relevant)	
Name	Mr Mohammed Ismail Ahmed
Organisation	Suez Canal University
Role within Darwin Project	PhD student further clarifying the taxonomy of Red Sea holothuria using traditional and molecular biology methods
Address	Department of Marine Science, Suez Canal University, Ismailia, Egypt
Fax	
Email	

Appendix 5
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 monitor recovery of sea cucumber stocks in Egypt and move towards a sustainable fishery in Egypt and Regionally in the Red Sea and East coast of Africa	• *Updated Species List and GIS Database* • *Updated Species Reference Collection* • *Darwin Project 6 month, Annual & Final Report.* • *Stock Monitoring Final Report* • *GTA Final Report* • *Research Fellow Final Report* • *Regional Workshop Reports* • *Production of Project Website*	• *Additional information included in NBUs NBS* • *Updated Fieldguide to Holothuria of the Red Sea Region* • *Updated Computer database and GIS system* • *Final Report of project Scientific Committee* • *Final Reports from the Monitoring, Bioactive Substances & Regional Workshop groups* • *Publications in scientific literature* • *Minutes and reports of all progress meetings*	• *Recommendations from the original Management Plan are adopted in part or in full by the relevant agencies in Egypt* • *That stock recovery is detectable with a 2 year period* • *That Agencies in neighbouring countries show a commitment to the project* • *That enough additional funding can be found to support the attendance at workshops of those with insufficient funding to cover own expenses.*
Outputs • *Stock Monitoring Final Report & Modified Management Plan* • *Field Guide to the Holothuria of the Red Sea and East African Region* • *GTA Species Diversity & Population Genetics Final Report* • *Research Fellow Final Report on Bioactive Substances* • *Publication of a Status Reports and Proposed Strategic Plan for Sustanable Use and Conservation of Sea Cucumber in the Red Sea/ East African Region* • *Production of a project website* • *Further training of EEAA Rangers in Stock Monitoring.* • *GTA trained in appropriate Molecular Genetic Methods*	• *Annual and Final report from the monitoring Team* • *GTA project report and a minimum of two Scientific papers* • *GTA research report on species diversity and population genetic structuring* • *Research Fellow report and publication of a minimum of 4 scientific papers* • *Workshop reports* • *Workshop final report and recommendations* • *Strategic Plan for Regional Cooperation in the Sustainble Use and Conservation of Sea Cucumber*	• *Final Reports from the Monitoring, Bioactive Substances & Regional Workshop groups* • *Publications in scientific literature* • *Minutes and reports of all progress meetings* • *Final report of project scientific committee* • *Press releases/ newsletter articles* • *A Representative from the Darwin Initiative Secretariat and/or Monitoring Team given access to the Merlin internet management system* • *Copies of all Publications sent to Darwin Initiative*	• *That a publisher for the modified field guide can be found* • *That a publisher for the Regional Status Report and Strategic Plan can be found.* • *That publishable data can be generated quickly enough to allow publication of scientific papers within the time-frame of the project* • *That Agencies in neighbouring countries show a commitment to the project* • *That, if required, enough additional funding can be found to allow participants from other countries to collect or provide a level of baseline information or samples from their countries.*

Activities

- *To initiate and embed a monitoring programme for sea cucumber in Egypt*
- *To elucidate the genetic/ environmental drivers of modified metabolite production between species populations*
- *To run regional workshops and move toward a Red Sea/ East African Regional Strategy for the Sustainable use of Sea Cucumber*
- *To train additional EEAA Rangers in sea cucumber monitoring and embed these skills into the individuals through an on-going monitoring programme*
- *To train the GTA in molecular genetic techniques and for the Darwin Research Fellow to pass on current training to others in Egypt*
- *To update the Merlin system and develop a Project Website*

Activity Milestones (Summary of Project Implementation Timetable)

	Year 1				Year 2			
Yr Quarters from May	1	2	3	4	1	2	3	4
Scientific Cttee Meets	■			■		■		■
Monitoring Project	■	■	■	■	■	■	■	■
Genetic Study	■	■	■	■	■	■	■	■
Bioactivity study	■	■	■	■	■	■	■	■
Project Progress Repts		■		■		■		■
Website launched			■					
Regional Workshops				■				■
Draft & Final reports				■				■
GIS/ collection update			■	■	■	■	■	■
Scientific submissions								■
Darwin Reports		■		■		■		■