Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt

Annual Report April 2003

Dr A. J. Lawrence

Department of Biological Sciences
University of Hull
Hull, HU6 7RX

Darwin Initiative for the Survival of Species

Annual Report

1. Darwin Project Information

Project title	*Darwin Initiative for the Sustainable use of Sea Cucumber in Egypt*
Country(ies)	*Egypt*
Contractor	*Department of Biological Sciences, University of Hull*
Project Reference No.	*162/10/027*
Grant Value	*£160, 700*
Start/Finishing dates	*October 2001 – October 2004*
Reporting period	*October 2001 – April 2002*

2. Project Background

The commercial exploitation of marine invertebrates is currently receiving increased attention. Part of this expanding sector includes the sea cucumber fishery. Unfortunately, this fishery, known as Beche-de-mer or Trepang, has a history of over-exploitation and collapse. The pattern of the fishery is to mine out an area in a few years and then move on leaving behind a disrupted and impoverished environment. The fishery has collapsed throughout the Indo Pacific with many species now commercially extinct. Several countries have recently opened sea cucumber fisheries and experienced a 2 year cycle of expansion followed by rapid decline in export volume through over-fishing, highlighting the need for management of the fishery.

Egypt had opened a sea cucumber fishery in 1996. However, during the preparation of the proposal for this Darwin Initiative project, The Red Sea Governorate placed a ban on sea cucumber fishing in April 2000 until the stock assessment and management plan could be prepared. Unfortunately, large numbers of animals have continued to be taken illegally and political pressure resulted in the re-opening of the fishery in early 2002. The aim of this Darwin Initiative project was to develop the fishery in a sustainable manner. The project incorporates the whole of the Red Sea coastline of Egypt. In addition to developing a sustainable fishery, the project will provide data to Egypt's National Biodiversity Unit for inclusion in its National Biodiversity Strategy.

3. Project Objectives

The aim of this project is to develop a sustainable sea cucumber fishery along the Egyptian Red Sea coast. This will be achieved through the successful completion of 4 principal objectives:

- First, to complete a fishery stock assessment, including baseline data on sea cucumber population dynamics and prepare a fishery management plan.
- Second, to develop a pilot mariculture system for sea cucumber in the Red Sea, to restock depleted reef areas and evaluate the feasibility of the process as a direct source of sea cucumber/ income generation for small community based mariculture systems
- Third, to examine the potential of the main species of farmed sea cucumber as a source of bioactive substances of potential medical benefit

- Fourth, to develop and run training courses in stock assessment and mariculture to build capacity in Egypt to continue the work beyond the period of funding.

The full list of objectives, including outputs, activities and measurable indicators are shown in the project logical framework (Appendix 1).

The objectives of the project have not changed over the last year. However, due to initial problems, and the delays caused by these there has been a slight modification to the operational plan. These changes have been discussed and approved by the Darwin Secretariat.

4. Progress

4.1 Brief History of the Project to April 2002

The start of the project was initially delayed by a combination of late signing of the contract (September '01) followed by significant changes within the partnership which occurred as a consequence of September 11. As a result there was little to report by April 02, other than changes in personnel and lead contacts within the Egyptian partners. Further delays were then encountered whilst financial system were set up in Egypt for transfer of grant funds. Thus, at the time of the first report, few measurable indicators highlighted in the Logical Framework (Appendix 1), project outputs highlighted in Table C of the project schedule and Key milestones highlighted in Table D or the project schedule were met and in real terms, the project was effectively a year behind schedule. However, following the meeting of partners in April 02, the project schedule was modified to try to catch up some of the lost time.

4.2 Progress against the Agreed Timetable

The following progress has been made during the reporting period and is considered against the outline timetable provided in the original application, the Logical Framework and deliverables identified in Tables C and D. All major equipment has been purchased and fieldwork began in July 2002, following purchase and delivery of truck and boat from the UK. Many of the large equipment purchases were made in the UK because of the high tax on imported goods in Egypt.

4.2.1.1. Sea Cucumber Stock Assessment

Field surveys have been undertaken continuously since July '02. Over 60 different sites have been surveyed as part of the Area Survey from Taba in the north to Shalateen in the south (see Maps 1-4, Appendix 2). Due to the high level of illegal fishing, methods have had to be modified to include both line transect and CPUE measures, depending on animal densities at each site. In addition, to better fit in with the EEAA remit, a number of sites (including offshore islands and very remote areas in the south) were selected to specifically examine and assess the impact of over-fishing rather than to simply perform a stock assessment. In some instances, this required the hire of a liveaboard boat which was not originally budgeted for. In addition to the field surveys, the state of the fishery has also been examined through a semi-open questionnaire survey during meetings with several of the sea cucumber fishermen and traders. Based on information from this Area Survey, four sites have been selected for monthly and seasonal surveys. These surveys began in January '03.

Over 20 species of Holothuria have currently been identified and a species list developed (Appendix 3). In addition, two reference collections have been developed, the first based in the Department of Marine Sciences, Suez Canal University and the second in the Department of Biological Sciences, University of Hull. Furthermore, a draft field guide to the Sea Cucumber of the Egyptian Red Sea has been developed. This includes a key for the identification of each species, a description of each species including its distribution along the Egyptian Red Sea coast, a photograph of each species taken *in-situ* and Scanning Electron Micrographs (SEM) of calcareous spicules, (microscopic spines present in the skin that need to be examined and identified to confirm the ID of some species). A preliminary assessment of the distribution and abundance of sea cucumbers in Egypt has been made based on the data generated to date.

4.2.1.2 Stock Assessment Progress against Agreed Deliverables

In relation to the deliverables identified in the original application, Tables C and D and the Logical Framework, the project is now making very good progress. Species check list, draft field guide and area survey are now prepared. Given the original slippage, therefore, progress is good. However, based on the original proposal some elements are yet to be prepared. For example, the MSc thesis is not prepared or submitted although work is progressing on this. In addition, the fishery management plan is not yet prepared, although preliminary recommendations have been submitted to the EEAA.

4.2.1.3 Stock Assessment Additional Outputs

A number additional outputs and activities have been achieved during the last year. For example, two reference collections have been developed (as opposed to the 1 identified in Logical Framework and Tables C & D). In addition, a number of sites have been surveyed specifically to determine the impact of over-fishing on sea cucumber population structure. This was undertaken at the specific request of EEAA and not part of the original proposal. Furthermore, in addition to the proposed stock assessment methodology, interview surveys have been conducted with fishermen and traders to provide an additional assessment of the fishery. Finally, the identification of species has gone into much more detail than originally anticipated to include spicule isolation and identification and preparation of SEMs of these.

4.2.2.1 Identification of Bioactive Substances

Extracts from 11 of the species (14 samples) currently found in the stock survey were collected during the first field surveys in July - August ’02 for extraction of bioactive substances. Preliminary extractions of bioactive compounds were performed in Dr Khalifa’s laboratory, Department of Pharmacy, in Suez Canal University. Freeze dried extracts from all 11 species, together with frozen samples from each species were then brought to the UK for preliminary screening.

To data, over 150 bioassays have been performed using the extracts from each of the 11 species. Assays have been used to test for bioactivity against bacteria, fungi, Leishmania and a colon cancer cell line. These bioassays have been repeated at various concentrations of each extract first in range finding tests and second, in a series of more precise, or definitive, assays for the active component and measured as LC50 and MIC (mean inhibition concentration).

4.2.2.2 Progress of Bioactivity Work Against Agreed Deliverables

In relation to the deliverables identified in the original application, Tables C and D and the Logical Framework, this aspect of the project is now also making very good progress. However, given the initial slippage of the project in the first year it is still behind schedule. For example, whilst preliminary screening against bacteria and fungi is at an advanced stage only one selected protozoan parasites has been tested and cancer tissue culture methods are still being optimised. In addition, secondary purification of the bioactive isolates is yet to be performed with further testing of each of these isolates against the appropriate assays. Finally the isolates are yet to be identified.

4.2.2.3 Additional Outputs from the Bioactivity Study

The most important additional output from the bioactivity study concerns the number of species being screened. In the original proposal it was anticipated that the project would focus only on those 2-4 species that were either commercially exploited or likely to succeed in mariculture. However, given the timeliness of this aspect of the project, together with its potential benefits, the work has been significantly expanded to include 11 of the 21 species currently identified from the field surveys. Given the intensive nature of the assay procedures, this has exponentially increased the workload. Despite this, very good progress is being made, and interesting data generated.

In addition, the data indicate differences in activity within a single species taken from different parts of its range. This is of fundamental interest at the level of chemical diversity and speciation and will continue to be analysed during the lifetime of the project.

4.2.3.1 Sea Cucumber Mariculture Study

The mariculture aspect of the project began in August 2002 and was consequently initiated slightly ahead of time. At the time of the last report the Darwin Secretariat had agreed that a Post-Doctoral Research Assistant, Dr Ashraf Ahmed, could be employed to develop this study. Unfortunately, Dr Ahmed has found it impossible

to commit the necessary time to the project. Consequently, we will to return to the original proposal and register a research student for the study. Whilst the student is being identified Dr Ahmed and Dr Gabr continue to oversee and undertake the majority of this work.

In addition, and in recognition of the considerable support given to the project by Dr Hanafy and his colleagues at the EEAA, The University of Hull has agreed to pay the tuition fees for a EEAA Ranger to be registered in Hull to undertake a research MSc, again focussing on mariculture of sea cucumber for stock replenishment and reef rehabilitation.

It was initially proposed that the mariculture study would be based at the EEAA wet laboratory in Ras Mohammed National Park. However, given the distance of this site from Ismailia and Hurgada, together with the lack of aquaculture specific facilities and the potential risk of mariculture related pollution within the park, a number of alternative and more suitable sites were investigated. Of these, a current mariculture facility based at the lower end of the Suez Canal was selected. The Haraz Hatchery is a small venture constructed in 1999 mainly for shrimp, sea bass and sole. The site contains all necessary facilities including 5 spawning tanks, 20 nursery tanks and 4 grow–out ponds. There is a separate unit for algal production and zooplankton production. So far, three tanks have been separated from the hatchery specifically for the sea cucumber study (see plates 1-3, Appendix 4).

There is a rental charge for the use of the facilities which again was not originally in the budget but, these are offset by the costs of equipment that would have had to be purchased if alternative sites had been used. In addition, the use of this hatchery benefits the study in that professional staff are on-site 24 hours a day to oversee any problems.

Preliminary studies are currently being undertaken to determine the reproductive cycle, to attempt to induce spawning and to examine the feasibility of increasing the stock using asexual reproductive methods. These are ongoing. However, the study is currently being expanded to include a second commercial species, *Holothuria scabra* if enough broodstock can be found.

4.2.3.2.Progress of Mariculture Against Agreed Deliverables

Some progress has been made in the culture of sea cucumber. In relation to the Logical Framework, it is on schedule. However, work will hopefully begin to progress more quickly now.

4.2.3.3. Additional Outputs from the Mariculture Study

The only additional output from the mariculture study at this time is the additional training and submission of an MSc thesis by one of the EEAA Park Rangers.

4.3.1 Project Research and Training in Stock Assessment

4.3.1.1 Selection Criteria for MPhil Student

Mr Mohammed Ismail Ahmed was registered at Hull University in 2002 to complete an Mphil on the distribution and structure of sea cucumber in Egypt. He was selected based on his previous ecological field experience and because he graduated with the top mark in his year. In addition, he is at the stage of his career where research training through the completion of a research MPhil will provide the experiential skills and qualifications necessary to develop his academic career in Egypt.

4.3.1.2 Project Research in Stock Assessment

Field survey methods have included both line transect and CPUE methods. Where line transect methods were used a 100m line transect was laid by two divers first at approximately 20m then 10m and finally 5m. The two divers then swam the length of the transect, searching an area of sea-bed equivalent to 2.5m each side of the line. Each sea cucumber found was either identified *in-situ*, photographed as necessary and, if one of the 4 main commercial species, its length measured. If the species could not be identified in the field it was collected and retained in a labelled plastic bag for later identification. At sites in which numbers of animals were very low, a CPUE method was followed. At each depth, 20, 10 and 5m, the two divers would perform a random search for a period of 20 minutes. This provided final numbers as numbers per diver per dive hour. In addition to the dive survey, surveys were also conducted of the reef flat area.

4.3.1.3. Training delivered as part of the Stock Assessment

Training in the field survey methodology was given by A. Lawrence during initial field surveys in Ras Mohammed National Park and Hurgada (June - July 2002). In addition, training was provided on identification of Holothuria using a key, developed in the Department of Biological Sciences at the University of Hull and a CD-Rom based key developed by the ETI.

Additional training and support in the identification of some species was provided during a week spent at the Natural History Museum under the guidance of Andrew Cabrinovik (NHM Invertebrate Collection) and examination of the NHM Indo Pacific collection. Spicule preparation and identification including preparation of slides for Scanning Electron Microscopy (SEM) was provided by A Lawence, Nigel Proctor (Hull University, IECS) and Jan Halder (Biological Sciences, EM suite Technician).

In addition to project specific training, The University of Hull was one of the first in the country to develop a Postgraduate Training Scheme (PTS) for students undertaking research degrees. The scheme requires that a student gains 20 credits per year on courses (taught/ practical modules, experiential training, transferable skills) leading to the award of a Certificate in Postgraduate Training. This is a pre-requesite to qualifying with the appropriate research degree. As part of this scheme, Mohammed has gained training in four modules relevant to his research:

i) Safety training and preparation of risk assessments for field work delivered by the Safety Office (5 Credit Module). Assessed through the production of a risk assessment for field work.

ii) Concepts and Threats to Marine Biodiversity (15 credit taught module) by A Lawrence. Examined by submission of an essay.

iii) Numerical Methods and Statistical Analysis (including the use of SPSS) (10 credit module) by Dr Mike Elliott (Biological Sciences). Assessed by completion of extensive, problem based worksheets both by hand and using SPSS.

iv) English for Academic Purposes (10 credit taught module) Hull Languages Department and assessed through submission of an essay and oral presentation.

Additional statistical training and support (not credited) has been provided by Dr Jim Allen (IECS) in multi-variate community statistics and the use of MVSP, and in FiSAT by Dr I. Cowx (HIFI).

In addition, Mohammed Ismail has himself trained 5 EEAA Rangers in the identification of the commercial species of sea cucumber. Training took place over a 4 day period for each Ranger and involved comparison of photographs of each species, identification of animals in the field, testing of ID skills followed by further training for those who required it. It also involved training in transect and CPUE methods and measurement of animals underwater. We are currently in the process of formalising this training with the EEAA so that it provides credits to the Rangers which can be used in promotion.

4.3.1.4.Results of the Area Survey

To date, 20 species of Holothurian have been identified along the coastline of Egypt. Of these, six species are known to be commercial species (see Appendix 3). In addition, at least 5 of the species are described for the first time in Egyptian waters.

One of the most important results to come from this survey is that, through a combination of illegal fishing of sea cucumber within the Red Sea Governerate jurisdictional waters, and extensive fishing outside of these areas, many of the commercial species stocks have become significantly depleted along the whole of the Red Sea coastline of Egypt. Furthermore, it has been very difficult to find any sites which have not been fished and that can be used for the monthly survey.

Species distribution has been examined in relation to habitat type, depth and location along the coastline. Briefly, these show that the majority of animals prefer a sediment / seagrass habitat although some species are found within the coral itself. Different species appear to have different preferred depths and some species do not occur along the whole of the coastline but have a more northern or southern distribution.

4.3.2. Project Research and Training in Bioactivity Study

4.3.2.1 Selection Criteria of Mphil Student

The student selected for this aspect of the module is Mr Rafat Afifi. Mr Afifi was selected based on his previous research experience particularly in the use of biochemical and chemical separation techniques in the examination of pollution impacts in marine organisms.

4.2.2.2 Project Research in Bioactivity Study

Fourteen Crude extracts from 11 species of sea cucumber have been tested against bacteria, fungi, a protozoan parasite and colon cancer cell line. Preliminary extraction (x4) of the tissue was in dichloromethane: methanol. These were freeze dried then frozen and brought to the UK where bioassays are being developed and optimised.

Specifically, the extracts have been tested against two strains of each of three species of bacteria *Staphyllococus aereus, Pseudomonas aeroginosa* and *Escherichia coli*. The crude extracts have also been tested against three isolates of the fungi *Candida* (580(1), 581(2) and ME047228 (isolated from different patients in Hull Hospital). Bioassays against *Candida* were repeated using different strains because of the significant activity found against this fungi. In addition, assays for bioactivity have been tested against *Leishmania* (Protozoan parasite) and a colon cancer cell line.

The test were performed in 96-well microtitre plates. Assessment of activity was measured using optical density of the culture. Viability is determined either by change in absorbance or by dye exclusion. Densities 50% or more below control densities were considered to be active.

4.3.2.3. Training delivered as part of the Stock Assessment

Preliminary extraction of bioactive compounds from each of the 11 species of seacucumber occurred in Egypt under the supervision of Prof. Khalifa and direction of Dr Tim Paget (Hull). All procedures were taught and confirmed during Dr Paget's visit to Egypt in April 2002.

In the UK, Rafat has acquired practical training both in the preparation and assessment of the microplate bioassay technique. Training has been delivered by Drs T. Paget and A. Lawrence. Additional training in tissue culture methods has been provided by Dr Katherine Tapping and Dr Leigh Madden (Medical Research Laboratory, Hull University).

As part of the Postgraduate Training Scheme, Rafat has attended a number of training modules, selected to meet his specific requirements:

i) Safety Training Module (5 credits) delivered by the Safety Office and including COSHH (Control of Substances Hazardous to Health) procedures. Assessment was by preparation of a risk assessment and relevant COSHH forms. Further safety training in the use of biological hazards was provided by Dr Paget.

ii) Introduction to Analytical Spectroscopy and Advanced Spectroscopy (20 credits) delivered by Dr Paul Fletcher (Department of Chemistry). Assessment by completion of a detailed, problem based worksheet.

iii) English for Academic Purposes, taught through the Languages Department (10 credits). Assessed through the submission of an essay and oral presentation.

4.2.3.4. Results from the Bioactivity Study

To date, over 150 biassays have been performed. Briefly, the results from these have shown:

First, that there is no activity in any of the species tested against any of the strains of bacteria tested.

Second, variable activity has been found against the three isolates of Candida. The minimum inhibition concentration has ranged between 50-500 ug/ml, depending on species and the LC50 between 50 and 400 ug/ml. Only two species showed no activity against any of the strains of Candida.

Third, in an anti-protozoal bioassay, we have found significant activity against Leishmania.

Each of these sets of results is significant because both Candida and Leishmania cause significant health problems globally. Leishmania affects over 12 million people worldwide and has a high mortality rate. It is listed by WHO as one of the most important pathogens. Fungal infections are increasingly important in hospitals particularly among patients with immune deficiency. The lack of activity against bacteria shows some specificity in the activity of the compounds.

Tissue culture assays have also been developed but are currently still being optimised. Consequently, we do not have any clear data from these assays at this time.

4.2.3 Project Research and Training in Mariculture

4.2.3.1. Selection of Student

Given the personnel changes in Ismailia, the research student is yet to be confirmed. The work is currently being overseen by Drs Ibrahim and Gabr.

4.2.3.2. Research Methodology.

Actinopyga mauritiana were collected from Hurgada and transferred to the mariculture facility. Initial experiments simply monitored survival and health. Following this, total length, body wall wet weight and gonad weight has been measured. Gametogenesis is being monitored through microscopic measurement of gonad tubule length and width and oocyte diameter.

Initial experiments have been performed to try to induce spawning. At the hatchery animals were placed in a 4000 l fibreglass tank with running seawater. Animals are given 3 weeks to acclimatise. Five spawning trials have been performed with batches of 6 animals given a thermal shock of 3-5 C above ambient. In addition, the possibly use of asexual propagation techniques have been investigated with animals maintained in a tank. Each animal was fitted with a rubber band (mid-body) to force division.

4.2.3.3. Training Component.

Other than in basic microscopic techniques, there has not been any specific training of a mariculture student at this stage.

4.2.3.4. Results from the Mariculture Study

Initial observations showed that the animals were able to survive and remain healthy in the hatchery, despite changes in water temperature and salinity. Histological analyses of gonad tissue over the first 6 months have not indicated any change in condition. *Actinopyga mauritiana* may, therefore, only have an annual cycle of two phases (resting and active) as has been reported elsewhere.

Preliminary spawning assays using thermal shock failed to cause any animals to spawn. This may have been due to the gonad not being in an active phase at the time of the initial trials. Approximately 70% of animals had divided asexually within three weeks of having an elastic band placed around them. However, there was a high mortality within these divided individuals by the end of the experiment. Mortality was high particularly in the anterior halves of the original animals.

4.3. Significant Difficulties

The biggest problem that the project has faced has been the impact of fishing of sea cucumber populations in Egypt, both legally and illegally. Sea cucumber fishing began in Egypt in 1996. Despite an original ban large numbers of animals continued to be taken for a variety of reasons including the establishment of an illegal fishery. Pressure was put on the Red Sea Governorate to re-open the fishery which it did in early 2002. However, following the preliminary findings of the current study, in March 2003 a new ban was established by the Red Sea and South Sinai Governorates with the support of the General Authority for Fisheries Resources (GAFR). The current ban is in place until the end of the year and will be reconsidered based on the outcome and recommendations of this project.

The implications for the project are that there are very few areas or populations that have not been severely impacted by fishing. Many of the commercial species and notably *Holothuria scabra* are almost fished out. This makes the development of a fisheries management plan based on models of sustainable yields very difficult. However, a few sites at which impacts have been negligible which we will use for monthly survey purposes. Other management options will be developed based on best available information and approaches employed in other parts of the world.

4.4 Enhancement in the Design of the Project

Field methods have been modified to suite the local situation. In addition, the identification of species has been undertaken in far more detail than anticipated. Furthermore, the number of species examined in the bioactivity study is much higher than anticipated and finally, through the use of a commercial hatchery, aspects of the mariculture of sea cucumber can be studied in far greater detail.

Table 1. Work plan for the period April 2002 to October 2002

	May	June	July	August	September	October
Monthly survey of fished and unfished sites						
Histological examination of gamete development						
Field survey with A. Lawrence to include impact of removal of animals on ecosystem health						
Completion of preliminary bioassays						
Further purification of extracts to find bioactive components						
Targeted bioassays as part of purification process						
Continued analysis of reproductive cycle of A. mauritiana and H. scabra						
Induction of spawning in A. mauritiana and H. scabra						
Annual meeting of Scientific Committee						
Darwin Exhibition/ China conference						
Reporting to Darwin Initiative						

5. Partnerships

Following the initial changes and delays within the project the partnership is now mostly functioning well. One problem has related to how the grant is managed. This reflects the cultural differences between the two countries. For example, the Darwin Initiative, requires money to be paid on receipt of quarterly claims, in arrears. However, the Egyptian partners could not afford to complete the work without receiving money in advance. This has now been overcome with the Darwin Initiative approval. Added to this, it is very difficult to press upon the partners, the need to collect receipts for all expenses, particularly given that Egypt is mostly a cash based society. Furthermore, it is very difficult to then get paperwork or cash claims in on time. In particular, it is proving impossible to ask partners to record all “in kind” support.

Of particular value has been the support provided by the EEAA, through the provision of equipment, manpower, transport, laboratory space and computer facilities at their Hurgada office. Consequently, the degree of their involvement, and “in kind” contribution, has been far greater than originally anticipated. The support of the EEAA has been recognised by the University of Hull’s agreement to pay the tuition fee for a Ranger who will begin a research MSc in September 2003. The study will relate to an aspect of the mariculture of sea cucumber and thus further build on the Darwin Initiative project.

The partnership is further strengthened by the support from the Red Sea Governorate. In particular, the Governor has supported the project at a political level, often against extreme pressure from other agencies. This has resulted in the most recent ban being issued in March 2003.

The project has been contacted by a number of groups around the world who are hoping to develop collaborations/ exchange information. Of particular note, we have been contacted by the UN FAO to attend a workshop in China, October 2003, to present papers on our experiences of the state of the sea cucumber fishery in The Red Sea, and developments in mariculture techniques in the Red Sea. Through this we have had contact with other organisations involved in mariculture from the Philippines, New Zealand and Brazil. In addition, we have been contacted by a group in Australia who are interested to know how our project is progressing because they are trying to set up a similar, community based, mariculture approach in Australia.

6. Impact and Sustainability

There has been increasing interest in the project since work began, particularly in the local and national media in Egypt. This interest stems mostly from a combination of the significant over-fishing that has occurred, the level of illegal fishing, the number of fishermen who have died whilst fishing for sea cucumber and the instigation of a new ban along the whole Egyptian Red Sea coast until the result of the findings of our surveys are provided.

The agreement between Hull and EEAA to sponsor a Ranger to complete a research MSc highlights the fundamental desire on the part of EEAA to train its staff in biodiversity related issues. This is further highlighted by the sponsorship of a Senior Ranger to complete an Mphil by Research under the supervision of Dr A. Lawrence. Funded by the Ford Foundation (£27, 500) and administered through the British Council, the project will examine the impact of tourism, development and fisheries on the health of coral reefs in the Hurgada area. This will include impacts of over-fishing of sea cucumber and again builds on the Darwin Initiative project.

Exit strategies are continuing to be developed. Both MSc students will continue to be employed in the Department of Marine Sciences at Suez Canal University. In relation to technology transfer and sustainable development, the Department clearly sees its expansion into the field of bioactive substances and mariculture of sea cucumber as fundamentally important to its future.

7. Post-Project Follow up Activities

These are currently being reviewed and discussed.

8. Outputs, Outcomes and Dissemination

Table 2. Project Outputs (According to Standard Output Measures)

Code No.	Quantity	Description
2	2 (Additional)	Two additional Egyptians (EEAA Rangers) to register for research degrees (1 Mphil and 1 MSc)
6A/B	5	5 EEAA Rangers received 1 week equivalent training in sea cucumber ID and stock survey
8	2	Two UK staff provided 2 weeks (equivalent) training to Egyptian partners in survey methods, species ID
8	1	One UK staff provided 4 weeks training and support in survey methods and species ID
13A	2	Two species reference collections set up.
14B	2	Conferences attended in Vancouver and Cambridge and posters presented at both
15A	2	Local press releases in Egypt
15 B	2	National press releases in Egypt.
20		Truck, boat, underwater camera and housing, computer, 2 sets of dive equipment,

In comparison with Table C the project is mostly meeting its projected outputs. The main differences are: No Egyptian has received training in GIS (code 6A/B), the field guide to Holothuria is currently only in draft form (Code 10) no papers have currently been submitted to peer review journals (code 11A/B) and no press releases have been sent out in the UK recently (code 15C/D).

However, the project has been central to the establishment of two additional research studentships for EEAA Rangers (code 2), it has trained 5 Rangers in sea cucumber identification and stock survey methods ahead of time (code 6A/B), it has prepared an additional reference collection (code 13A) and presented findings from the project as posters at two conferences (code 14B).

Table 3: Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (e.g. contact address, website)	Cost £
None	Published	To	Date	

No scientific papers have currently been published although three are in preparation. Two additional papers are being prepared for a workshop in China (October, 03) which will be published by the FAO. Two posters have been presented at conferences.

In addition to the number of newspaper articles in Egypt regarding the project, additional dissemination activities have included two scientific presentations. The first was a paper by Dr H. Gabr (December ‘02) at a workshop on Marine Natural Products sponsored by the Joint Science and Technology Fund of the US – Egypt Partnership for Economic Growth and Development. The second was a paper by Dr M. Hanafy (March ’03) titled Status, importance and need for management of sea cucumber fisheries in the Red Sea. This was presented at an EEAA workshop in Cairo, considering the need for a ban of sea cucumber fisheries.

9. Project Expenditure

Table 4: Project expenditure during the reporting period

Item	Budget	Expenditure

Project spend is still behind schedule as a consequence of the initial delays described previously.

10. Monitoring, Evaluation and Lessons

The Merlin web based communications system continues to be used by the project participants, and Management Committee, to share and disseminate information, provide training and monitor progress against predetermined milestones and the Logical Framework. Through the system, the project coordinators keep regular contact and discuss progress, and research students submit progress reports.

Progress, against agreed deliverables and milestones is also considered during meetings of the Project Coordinators and the Scientific Committee.

11. Author(s) / Date

Dr Andrew Lawrence 1 May 2003

Project Coordinator