

# **Darwin Initiative for the Sustainable Use of Sea Cucumber in Egypt**

Annual Report April 2002

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

## ***Annual Report***

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

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

### **2. Project Background**

The commercial exploitation of marine invertebrates is currently receiving increasing 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 1999. However, due to the support of the Darwin Initiative through this project, The Red Sea Governorate placed a ban on sea cucumber fishing until a stock assessment and management plan could be prepared. The aim of this was to try 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 (see Section 4) there has been a slight modification to the operational plan. These changes have been discussed and approved by the Darwin Secretariat.

#### **4. Progress**

This is the first annual report for the project and represents the first 6 months of the project. Consequently, there is no history to the project prior to this reporting period.

The project was initially delayed and slow to begin, due to the problems highlighted below. However, two meetings have now taken place between the partners, plans have been modified and the project should now make good progress.

In addition, because the reporting period in effect only covers a six month period to April 2002, measurable indicators highlighted in the logical framework, project outputs highlighted in Table C of the project schedule and Key milestones highlighted in Table D or the project schedule, are yet to be met. However, following the meeting of partners in April, the project schedule has been modified to try to catch up some of the lost time. In relation to project outputs:

- A number of local and national press releases have been released in the UK and in Egypt where the project has gained a great deal of attention.

Due to the short reporting period, little research and training has taken place. However, following the April meeting of the partners, research groups have been established which will focus on the three main aspects of the project. This is highlighted in Tables 1,2 and 3.

Mr Mohammed Ismail Ahmed has been selected to register in Hull as the MSc student for this aspect of the project work. He has been selected based on his previous ecological field experience. In addition, he is at the stage of his career in which research training through the completion of a research MSc will provide the experiential skills necessary to develop an academic career.

A number of species of sea cucumber have been collected on a preliminary short visit to Sharm El-Sheikh. Preliminary training has been provided on identification of Holothuria and an identification key, developed in the Department of Biological Sciences at the University of Hull is being used to identify these. This is being used in conjunction with a CD-Rom based key to the Holothuria of the Indo-Pacific developed by the ETI. Where species can be identified using this key and photographic index they are. Where this is not possible, spicules are being prepared and the Hull key used.

**Table 1. Role of Egyptian Participants in the Project – Fishery Stock Assessment**

<i>Name</i>	<i>Affiliation</i>	<i>Role</i>
<i>Prof. Dr: Salah El Etreby.</i>	<i>Head of the Dept. of Marine Science</i>	<i>To jointly head the fishery group/ examination of reproductive cycle of animals, local supervisor to MSc student</i>
<i>Ass. Prof. Mahmoud Hanafy.</i>	<i>Dept. of Marine Science Chief Consultant to EEAA</i>	<i>To jointly head the fishery group/ arrange EEAA logistic support in the field, local supervisor to MSc student</i>
<i>Ass. Prof. Ali A. Gab-Alla</i>	<i>Assistant Prof. In the Dept. of Marine Science</i>	<i>To lead and provide safety cover in the field.</i>
<i>Dr Howida R. Gabr</i>	<i>Lecturer -Dept.Mar. Sci.</i>	<i>Egyptian Project Coordinator/ study reproductive cycle of animals</i>
<i>Dr Ashraf I. Ahmed</i>	<i>Lecturer Dept.Mar. Sci</i>	<i>Egyptian Project Coordinantor/ lead field work/ safety cover</i>
<i>Mr Maher A. Amer</i>	<i>Assistant Lecturer- Dept. Mar. Sci.</i>	<i>Dive surveyor (buddy) in field survey</i>
<i>Mr Tarek A. temraz</i>	<i>Assistant Lecturer - Dept. Mar. Sci.</i>	<i>Dive surveyor (buddy) in field survey</i>
<i>Mr Mohammed I. Ahmed</i>	<i>Demonstrator in the Dept. of Marine Science</i>	<i>Principal researcher (MSc student) for stock assessment work</i>

The work is being overseen by partners from Hull University, lead by Dr A. Lawrence.

Mohammed Diaa has been selected to undertake the MSc in the bioactive substances aspect of the project based on his position in the Department of Marine Science and some previous experience in extraction of secondary compounds from soft coral. However, whilst in Egypt, the work will mainly take place in the Department of Pharmacy at Suez Canal University under the local supervision of Dr Khalifa.

**Table 2. Role of Egyptian Participants in the Project – Bioactive Substances Group**

<i>Dr Sherief Khalifa</i>	<i>Lecture in faculty of pharmacy</i>	<i>Egyptian Coordinator for bioactive study in Egypt, local MSc project supervisor</i>
<i>Mr Osama Melika</i>	<i>Technician</i>	<i>To provide technical support to the study</i>
<i>Mr Mohammed Diaa</i>	<i>Demonstrator in the Dept. of Marine Science</i>	<i>Principal researcher (MSc student) for bioactive substances work</i>

Following the April meeting of partners in Ismailia, a protocol and timetable for the work has been agreed. Preliminary extraction of materials will be performed in Egypt under the supervision of Dr Khalifa. Material will then be brought to Hull to perform the initial set of bioassays. Based on activity of materials, a second set of more detailed extractions will be performed. Later, some of the bioassay methods will be developed in the Egyptian laboratory based on the training received in Hull. These tests will depend on what materials can be exported to Egypt.

The MSc student will be supervised in the UK by Dr T. Paget and Dr A. Lawrence. Further technical support and training in extraction methods will be provided by Dr J. Hardege.

**Table 3. Role of Egyptian Participants in the Project – Mariculture Group**

<i>Dr Howida R. Gabr</i>	<i>Lecture in the Dept. of Marine Science</i>	<i>Performing reproductive development experiments</i>
<i>Dr Ashraf I. Ahmed</i>	<i>Lecture in the Dept. of Marine Science</i>	<i>Post-doctoral research assistant performing feeding and growth experiments</i>

During the April meeting at Suez Canal University, the possibility of modifying the third stage of the project was discussed. In particular, the Egyptian partners requested that a Post-Doctoral Research Assistant be employed rather than a third MSc student. This issue has been raised with the Darwin Initiative Secretariat and agreed, if the budget can be modified to accommodate this. Consequently, it has been agreed that Mr Ashraf Ahmed will be employed as a PDRA on this aspect of the project. In addition, contact has been made with an aquaculture operator on the Suez Canal who might be able to offer facilities for culture of sea cucumber. This is currently being determined.

The project has experienced significant delays since beginning. This was primarily due to administrative problems caused as a consequence of the September 11 bombings in America. This resulted in the movement of several key Egyptian participants, most notably the original Egyptian Coordinator (Dr R. Kilada) and his contact in the Egyptian Environmental Affairs Agency. Consequently, most of the first 6 months of the project have been spent re-establishing contacts, agreeing the new Egyptian Coordinators and most importantly, re-establishing links with the EEAA and Red Sea Governorate.

Following a long and detailed series of meetings in Egypt in April, a new group of participants has been established. Importantly, both the EEAA and Red Sea Governorate are fully involved in the project. Dr Mahmoud Hanafy has proven a vital link in the re-establishment of these partnerships. In addition, the specific role of each Egyptian partner has been agreed.

The work programme has been agreed, and the principal aims, objectives and work plan of the original proposal re-confirmed. However, the point has been made, by Dr Hanafy on behalf of the EEAA, that the original goal of the stock assessment was not broad enough. The EEAA is particularly concerned with the impact of fishing of sea cucumber on the environment. They did not feel that the original scope of the field work would enable an assessment of this. This is particularly important because a significant illegal fishery has now developed along the coastline of the Red Sea Governorate with some areas becoming highly degraded as a result of the complete removal of sea cucumber.

As a consequence of the issues raised by Dr Hanafy, the scope of the field work has been expanded to try to assess the level of impact of over-fishing of sea cucumber. In addition to the original work it is now felt that additional sites should be examined and numbers of sea cucumber determined. This will include a number of offshore islands and areas south of Hurgada that will require several cruises. This again has implications for the budget which has been modified to accommodate some of the additional cost. However, some of the additional costs for this work will be covered by the EEAA and some, it is hoped, by individual dive companies.

The work plan for the next six months is shown below in Table 4. Due to the very high cost of purchasing equipment in Egypt, the truck, boat, underwater camera and sets of diving equipment will be purchased in the UK and shipped to Egypt.

Importantly, the full field survey will begin. The first series of sites will be based north and south of Hurgada and will include several of the offshore islands. This work will be conducted by Mr Mohammed Ismail Ahmed in collaboration with colleagues from the EEAA offices in Hurgada. The EEAA will provide accommodation, boat and dive equipment and support to Mr Ismail Ahmed. Following this, a second series of surveys will be performed through June and July. These will take place in Ras Mohammed National Park and North of Hurgada by Mr Mohammed Ismail and Dr Andrew Lawrence with support from EEAA staff. A third series of surveys will then be performed in late summer (August & September) in the Gulf of Aquaba, north of Sharm El-Sheikh and up to the border with Israel.

The survey methodology has been slightly modified to take account of logistic limitations in the field. Consequently, the dive surveys will now be performed at 20, 10 and 5m depths using a belt transect methodology. This will allow the survey team to complete the survey at any site on a single tank of air. In addition to identifying and counting animals in each transect, each will have length and width measurements taken *in-situ*. Approximately 20 of each of the commercial species will be collected to determine gonad index, reproductive state and sex ratio. In addition, snorkel surveys will be performed of reef flat areas both during the day and at night.

Due to changes in the budgeting for the project, and because of the potentially destructive nature of the work, the video transect survey will not now be developed and the equipment not purchased. Video transect survey of this type usually involves towing the underwater video on some form of sledge. In coral reef and mixed reef/sediment habitats this could cause significant damage to coral. In addition, it could stir sediments causing water turbidity problems, again damaging coral. However, an underwater digital camera will be purchased to develop the photo-identification key to species of holothurian in the Red Sea.

Preliminary extraction of bioactive substances will begin in August when the first series of field samples will be returned to Suez Canal University.. A number of Holothurian species will be obtained in July and preliminary extraction performed. Briefly small samples of tissue (various sites) will be taken and then placed into methanol/ dichloromethane (1 :1). After prolonged extraction the solvent is removed and evaporated off leaving a dry extract. The extract will then be dissolved in an appropriate solvent. Preliminary fractionation of this extract is being performed using 2D TLC.

The Biological Assays have been developed as part of a taught MSc project (May-August 2002) and an ongoing Undergraduate project. To date a simple tube based preliminary screen has been developed using six bacteria and two fungi. This assay was derived for a microwell plate based system which we found to be prone to contamination. Two species of parasite are also used in this screening process and

these are assayed using a microwell culture system. Viability is determined either by change in absorbance or by dye exclusion.

Key species of economic interest will be identified and mariculture of one of these will begin in August/ September. This will put the mariculture element of the project ahead of schedule.

**Table 4. Work plan for the period April 2002 to October 2002**

	May	June	July	August	September	October
Dive Training of M. Ismail						
Purchase & shipping of truck, boat, camera & dive equipment						
Field Survey						
Field survey with A. Lawrence						
Prelim. Extraction of Bioactive						
Set up of Mariculture						
Conference Presentations						
UK Meeting of Coordinators						
Reporting to Darwin Initiative						

The most significant change to have taken place as a result of the April meeting is the expansion of the field work to include sites that are known to have been affected by over-fishing. As already noted, this is change has been agreed by the partners specifically to make the project more appropriate to the needs of the EEAA.

## 5. Partnerships

Following the initial problems relating to changes of personnel, particularly with the loss of the Egyptian Coordinator, the partnership is now beginning to function well. The principal Egyptian Partner, Suez Canal University, has allocated two new Coordinators to the project. Dr Howaida Gabr is a molluscan physiologist and aquaculturist. She is particularly adept at identifying and resolving issues relating to the scientific detail of the project. Dr Ashraf Ibrahim Ahmed is a fisheries biologist. He is particularly well versed in the political and bureaucratic aspects of project management in Egypt. Together they are proving very adept at getting the work moving forward.

One problem for the partnership, which has lead to further delays in the initiation of the project, has been the level of bureaucracy in Egypt. However, a number of key players in the partnership are now actively supporting the work and moving it forward. Professor Salah El Etreby is endorsing and providing the full backing of the Department of Marine Sciences at Suez Canal University to the Project. The project leaders are particularly grateful for this support and the support of all of the staff in the Department of Marine Sciences.

Dr Sherief Khalifa, rather than simply provide technical advice on the isolation of bioactive substances to the student (whilst in Egypt) has taken on a far more prominent role. He has provided the facilities of his laboratory in the Department of Pharmacy and the support of some of his technical staff to the project. The student

undertaking this work, whilst from the Department of Marine Sciences, is now based in the Department of Pharmacy for the project.

The participation of Dr Mahmoud Hanafy, as Chief consultant to the Egyptian Environmental Affairs Agency and the Red Sea Governorate, has proven critical. It is through Dr Hanafy's support of the project and his close liaison with the Governor of the Red Sea and Director of Conservation in the EEAA that the support of these two institutions has been re-affirmed. The EEAA in particular will provide a great deal of logistic support to the fieldwork in the form of equipment, manpower, use of office and computer facilities and accommodation. In addition, Dr Hanafy has a great deal of knowledge about the region and the problems that it is currently facing and is able to offer advice on potential survey sites.

The Governor of the Red Sea has been particularly supportive of the project, instituting an initial ban on the fishery whilst the stock assessment is performed. This is in the face of growing political pressure from other organisations and institutions in Egypt.

The project has not had time, at this stage to develop additional relationships with other local, national or international institutions in Egypt. However, through liaison with the EEAA, there are a number of other significant problems facing the reef systems in Egypt which are of particular concern. It is hoped that as the project proceeds these issues might be developed as themes for future collaboration.

## **6. Impact and Sustainability**

Given that the project has been running for six months there has been some significant interest in the work. For example, when the Darwin Initiative support for the project was first confirmed, it was stated by staff at the British Council in Cairo that the project had come up in conversation between the UK Ambassador to Egypt and the Egyptian Secretary of State for the Environment. In addition, a number of press releases have been sent out in Egypt relating to the problems of the illegal fishery developing off of the coast particularly south of Hurgada. It is to be seen what impact these have.

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. The degree to which other partners and institutions will continue with the work of the project is yet to be confirmed.



## 7. Outputs, Outcomes and Dissemination

**Table 5. Project Outputs (According to Standard Output Measures)**

Code No.	Quantity	Description
8	2	Two UK staff provided 2 weeks (equivalent) training to Egyptian partners
15C	1	Local press release in the UK published in the Hull Daily Mail, Yorkshire Post. Project mentioned on BBC Look North and on CEFAX local news pages
15 D	1	National press release in UK published in the Daily Express, The Times HES and the Sunday Times Business Section. Internationally published in The Echinoderm Newsletter of the Smithsonian Institute
17 A	1	One dissemination network created through the establishment of the Scientific Committee.
19 B	1	One radio interview given for BBC World Services news programme “The World Today”
19C	1	One interview given for BBC Radio Humberside morning news programme

Despite the delays highlighted in Section 4, the majority of the project outputs listed in Table C of the Project Schedule have been accomplished. The only output not completed was 6A/B one months training is GIS for Dr Raouf Kilada. This was due to the departure of Dr Kilada from the project. GIS training of an alternative partner is currently being considered.

Significant additional project outputs not listed in the schedule include the local and national/ international radio interviews given to the BBC. This would support the belief of the partners that the project is both extremely relevant and timely and, consequently, newsworthy.

**Table 6: Publications**

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

There have been no publications produced by the project during the first 6 months of the project. In addition, Given the early stage of the project, there has been no dissemination activities in Egypt during the current reporting period.

## 8. Project Expenditure

**Table 7: Project expenditure during the reporting period**

Item	Budget	Expenditure
Salaries (specify)		
Rent ,rates heating lighting etc		
Office administration costs		
Capital items/equipment		
Others		
Travel		
Total		

Table 7 includes real expenditure against Darwin Initiative funding to the end of April 2002. Clearly very little has been spent against the budget. This is a simple consequence of the delay in the starting of the project.

There have been some changes to the budget, agreed between the partners at their meeting in April 2002. These are summarised in Table 8. Note that whilst there has been a slight rise in the overall cost of salaries to Egyptian participants, this has been offset by the reduction in tuition fees. This reduction in tuition fees for the MSc students is the most significant saving and has been agreed by the University of Hull. This saving also releases additional funds for the anticipated extended field survey required by EEAA and costs for use of mariculture facilities. Administratively, it will also be used to pay for the annual audits of the project accounts required by the Darwin Initiative.

**Table 8. Overall Changes to Proposed Budget for 3 year period of project**

ITEM	NEW / MODIFIED PURCHASE	CANCELLED (Saving)	BALANCE
<b>Salaries (original)</b>			
Gabr, Ibrahim Ahmed, El-Etreby, Hanafy, Gaballa and Khalifa to receive £XXX per year			
Project accountant and driver employed in Egypt (£XXX per year)			
Maha and Temraz Not salaried but receive per diem			
Kilada,			

Mohammed Helmy, Rahman, Samir and Salem no longer involved			
MSc students 1 and 2 now Mphil, pay half tuition fee			
MSc student 3 now a PDRA £XXX per year			
Salaries (New)			
<b>A) Overall Saving on salaries</b>			
Other Costs			
2 new sets of dive kit			
Digitiser			
Video			
<b>B) Overall Saving on capital items</b>			
<b>Additional funds for fieldwork, mariculture, audits of accounts etc (A + B)</b>			

## 9. Monitoring, Evaluation and Lessons

It is difficult at this early stage of the project to demonstrate how the current outputs of the project contribute to the project purpose. However, in terms of monitoring the project an internet system has been set up which allows all of the named participants in the project to correspond and communicate on a regular basis. The system, named Merlin, was originally developed by the University of Hull for the delivery of e-courses. However, in this context, it is being used by the project participants, and Management Committee, to share and disseminate information, provide training and monitor progress against predetermined milestones and the logistic framework. Through the system, the project coordinators keep regular contact and discuss progress, and research students submit progress reports.

The main lesson learned during the current period is that it takes longer than expected to initiate a project of this type. An important point, not considered in the timetabling of the project, was the amount of time needed to secure all of the necessary support, at various institutional levels, for the project to proceed in Egypt.

## 10. Author(s) / Date

Dr Andrew Lawrence  
Project Coordinator

19 November 2002

## Appendix 1 – Logistic Framework for Project 162/10/027

Project summary	Measurable indicators	Means of verification	Important assumptions
<p>Goal</p> <p>To help Egypt, a country rich in biodiversity but poor in resources, meet its obligations under the Biodiversity Convention.</p>	<ul style="list-style-type: none"> <li>• After 12 months provide checklist of holothuria.</li> <li>• From 1-24 months, one species reference collection</li> <li>• After 24 months provide recommendations for sustainable fishery and biomedical properties</li> <li>• After 36 months, 10 EEAA rangers and 30 locals trained in stock assessment/ mariculture</li> </ul>	<ul style="list-style-type: none"> <li>• Information included in NBUs NBS</li> <li>• Fieldguide to Holothuria of the Red Sea</li> <li>• Computer database and GIS system</li> <li>• Final Report of project Scientific Committee</li> <li>• 3 MSc theses</li> <li>• Publications in scientific literature</li> <li>• Minutes and reports of all progress meetings</li> </ul>	<ul style="list-style-type: none"> <li>• EEAA to continue monitoring beyond Darwin funding</li> <li>• Mariculture not only to prove viable but local communities to develop and operate their own systems based on training</li> <li>• Additional funding/ sponsor found to support work on bioactive substances</li> </ul>
<p>Purpose</p> <p>To develop the first example of a sustainable sea cucumber fishery along the Red Sea coast of Egypt</p>	<ul style="list-style-type: none"> <li>• After 24 months, fishery management plan</li> <li>• After 24 months, primary analysis of biomedical benefits completed</li> <li>• After 36 months, pilot mariculture system in operation/ feasibility study completed</li> <li>• After 36 months, trained rangers and fishermen</li> </ul>	<ul style="list-style-type: none"> <li>• Sea cucumber management plan</li> <li>• 3 MSc theses related to the fishery resource, mariculture and biomedical compounds</li> <li>• Publications in the scientific literature</li> <li>• Final report of project scientific committee</li> <li>• Press releases/ newsletter articles</li> </ul>	<ul style="list-style-type: none"> <li>• Recommendations are accepted and incorporated into policy</li> <li>• Information generated ie: species, economic value, rational use accepted and incorporated into NBU's NBS</li> <li>• Mariculture to offer a viable alternative to fishing for local communities</li> </ul>
<p>Outputs</p> <ul style="list-style-type: none"> <li>• Produce a fishery management plan for sea cucumbers</li> <li>• Produce a pilot mariculture system</li> <li>• Identify secondary compounds of potential biomedical value</li> <li>• Train EEAA rangers and local fishermen in stock assessment and mariculture respectively</li> </ul>	<ul style="list-style-type: none"> <li>• After 12 months species list and reference collection established</li> <li>• After 24 months stock assessment, database and GIS system established</li> <li>• After 24 months bioactive compounds and their activity identified</li> <li>• After 36 months, pilot mariculture system operating</li> </ul>	<ul style="list-style-type: none"> <li>• 3 MSc theses</li> <li>• Field guide to Holothuria of Red Sea</li> <li>• Papers published in scientific literature</li> <li>• Final report of Scientific Committee</li> <li>• Minutes and reports of all progress meetings</li> <li>• Press releases/ newsletter articles</li> </ul>	<ul style="list-style-type: none"> <li>• Recommendations of the management plan accepted/ incorporated into policy</li> <li>• EEAA to continue monitoring beyond Darwin funding</li> <li>• Mariculture to prove economical and therefore expanded by the trained fishermen</li> </ul>

<p>Activities</p> <ul style="list-style-type: none"> <li>• Stock assessment for Holothuria along Red Sea</li> <li>• Development of mariculture system for sea cucumbers</li> <li>• Isolation of bioactive compounds and their specific activity</li> <li>• Training of Egyptian scientists, EEAA rangers and local fishermen</li> </ul>	<ul style="list-style-type: none"> <li>• £160, 700 requested from Darwin Initiative</li> <li>• £170, 308 donated by partner institutions</li> <li>• species list and collection established</li> <li>• After 24 months database and GIS system established</li> <li>• After 24 months bioactive compounds and activity identified</li> <li>• After 36 months, pilot mariculture system operating</li> </ul>	<ul style="list-style-type: none"> <li>• Cost statement for grant will be available from Hull University Research Office</li> <li>• Minutes and reports of all progress meetings</li> <li>• Press releases/ newsletter articles</li> <li>• Final report of Scientific Committee</li> <li>• Papers published in scientific literature</li> </ul>	<ul style="list-style-type: none"> <li>• Secondary compounds with potentially useful bioactivity are found</li> <li>• In vitro fertilisation and culture of plankton stages proves successful in mariculture</li> </ul>
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