



***Darwin Initiative for the Survival of Species***  
***Final Report***

**Project Reference Number 162/12/021**

**Marine biodiversity assessment and  
development in Perlas Archipelago,  
Panama**

**April 2003 - March 2006**

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# ***Darwin Initiative***

## ***Final Report***

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

|                          |   |
|--------------------------|---|
| Project Reference No.    | 162/12/021  |
| Project title            | Marine biodiversity assessment and development in Perlas Archipelago, Panama                  |
| Country                  | Panama  |
| UK Contractor            | Heriot-Watt University  |
| Partner Organisation (s) | Smithsonian Tropical Research Institute, Panama   |
| Darwin Grant Value       | £168,154  |
| Start/End date           | April 2003 – March 2006   |
| Project website          | <a href="http://striweb.si.edu/darwin_initiative">http://striweb.si.edu/darwin_initiative</a> |
| Author(s), date          | James Mair (UK) Hector Guzman (Panama) 30 June 2006   |

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

The main purpose of this Darwin Project was to build up research and habitat information about the marine and coastal environment of Las Perlas Archipelago, located in the Gulf of Panama, to properly enable the archipelago (or an appropriate area of it) to be designated by Panamanian authorities as a National Park. During early discussions (2002), after a collaborative student exchange programme, the host country co-ordinator (Dr Guzman) highlighted to the UK Leader (Dr Mair) the importance of this archipelago to Panama and the need for biological information and understanding of the issues before conservation management plans could be developed. Although it was acknowledged generally that the area was an ideal candidate for conservation management, there was a scarcity of reliable scientific data on the habitats of the Archipelago. Dr Guzman had previously been involved in advising Panamanian authorities on other marine protected areas, e.g. Coiba Marine National Park, and so he was ideally suited to translate into practicalities the general political desire to ensure that the natural resources of Las Perlas Archipelago should be protected and sustainably managed.

### 3. Project Summary

A copy of the original (unchanged) Project Logical Framework is given below in Section 15 (Appendix I).

The purpose and objectives of the Darwin project proposal (that developed from discussions between Dr Guzman and Dr Mair and given in the logframe) were in general to provide the Panamanian authorities with sufficient high-quality information in order to design appropriate legislation to enable protected status to be designated for the marine environment of Las Perlas Archipelago. This was to be achieved in the Darwin Project by:

1. *Establishing a research group dedicated to the survey and assessment of the area's littoral and sub-littoral habitats and identifying the potential threats from land and marine based activities;*
2. *Providing advanced training for three Panamanian Darwin Fellows so that each could specialise in different aspects of the study. These three would form the core of this research group, during the Darwin Initiative project lifetime and afterwards, and who would subsequently be able to contribute to monitoring and advice on park management;*
3. *Increasing awareness (through, a. - school and community educational information material, and b. - scientific publications and conferences) to promote the designation of the Park so that the Archipelago's important marine natural and commercial resources could be protected and sustainably managed;*
4. *Establishing an active Darwin Project network for the exchange of information and experiences relevant to the project.*

It was not necessary to modify any of the main original objectives, outputs and proposed operational plan of the project - apart from bringing forward, into Year 2, Darwin Fellow 3 training which was discussed with, and prior approved by, Darwin Secretariat (see Year 2 Annual Report).

It is considered that the project contributed significantly to seven of the CBD Articles (see percentage contribution indicated below in Section 16, Appendix II). The project achieved the main objectives in assisting Panama in the particular Articles as set out in the original proposal. On reflection, in terms of what resulted, the proportional contribution varied slightly from the original intention and there were important contributions also to Articles 8 (In-situ Conservation) and 10 (Sustainable Use of Components of Biological Diversity). It is considered by the UK and host-country project co-ordinators that the main objectives were successfully met throughout the term of the project. By meeting all of the main objectives that were set out, in a timely manner, the project has therefore also been regarded in Panama by the relevant authorities as being a major contributing factor to the process of 'Special Management Zone' status designation for the marine areas of Las Perlas Archipelago. Apart from the research and training components of the project, the main achievement considered to be important has been the ability of STRI and the host-country co-ordinator, Dr Guzman, to play a central role in formulating and influencing the process leading up to the designation of the Las Perlas marine protected area. This has required a huge amount of work to meet set government deadlines and also to ensure that the various biodiversity/conservation aspects were fully integrated and not overlooked or watered-down by administrators. This effort also included Dr Guzman giving a total of 15 private and public talks to promote the creation of the "Zona Especial de Manejo".

Another achievement has been the active involvement of other groups in the developing Darwin Network component of this project's objectives. In addition to collaboration of Ecuadorian and Costa Rican taxonomists described elsewhere, a Spanish postgraduate student at the University of Wales, Bangor, carried out a MSc dissertation on the study of primary productivity in coastal waters with guidance from Dr Guzman and this has resulted in him continuing to carry out this important research to PhD level (in the Post-project phase – started in May 2006) Dr Guzman applied for \$25,000 to the AVINA foundation (which was granted) to study whales, prepare educational material for whale watching, and organize four workshops to train local fishermen to guide tours and reduce pressure on fisheries ([www.avina.com](http://www.avina.com)).

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

Research: The main staff members involved in project-related research were Dr Hector Guzman from the Smithsonian Tropical Research Institute, Panama (Host-Country Co-ordinator - [www.stri.org/english/scientific\\_staff/staff\\_scientist/scientist.php?id=13](http://www.stri.org/english/scientific_staff/staff_scientist/scientist.php?id=13) ) and Dr James Mair (UK Project Leader - [www.sls.hw.ac.uk/Staff/Mair.htm](http://www.sls.hw.ac.uk/Staff/Mair.htm) ). Other project staff named in the project proposal were Dr Jimmy Young (also of Heriot-Watt University) Geomatics Unit, who supervised/guided the satellite imagery interpretation and GIS components for the research carried out by Darwin Fellow 2 (Jose Miguel Guevara) and the UK PhD student (Sarah Benfield). Ms Susan Chambers (Curator of Marine Invertebrates, National Museums of Scotland – [www.nms.ac.uk](http://www.nms.ac.uk) ) was involved in Year 2 survey fieldwork and extensively on advising on the laboratory research directed at the identification and taxonomy of samples collected. Also listed on the Project proposal was Ms Sarah Benfield who, throughout the period of the Darwin project, was an EPSRC-funded, Heriot-Watt University registered PhD student. She was actively involved in Year 1 and 2 fieldwork surveys. All staff were experienced researchers and applied scientific methodology to the project work. These staff supervised the postgraduate students (mentioned above) but also directed other student research to maximise the research benefit of fieldwork carried out on the project. The titles of these individual pieces of research are given on the Darwin project website ([http://striweb.si.edu/darwin\\_initiative/index.html](http://striweb.si.edu/darwin_initiative/index.html) - under pages 'People' and 'Research'. See also [http://www.darwin.gov.uk/news/projects/las\\_perlas.html](http://www.darwin.gov.uk/news/projects/las_perlas.html)). Two Colombian PhD students (funded through EU Alban and HWU Scholarships) also contributed significantly to the research in Panama (theses about to be submitted in late 2006 and 2007 respectively). Much of the research has been submitted for peer-review with more work in preparation and about to be submitted later in 2006. So far, two journal publications from collaborative studies have resulted from the work in Panama, and one is "In Press" (to appear in December 2006). Another manuscript has passed through peer-review and is to be accepted subject to a final revision (to satisfy referee comments) which has now been sent to the journal editor. One of the Heriot-Watt University UK MSc students who carried out her dissertation research in Panama had her MSc dissertation submitted to the Society of Underwater Technology's Fugro-GEOS prize competition. After review and short-listed interview, her dissertation was awarded the prize of best UK MSc dissertation in Marine Science in 2005 (see: [www.sut.org.uk](http://www.sut.org.uk) ).

Training and capacity building activities: The main training component designed within this project was the Masters degree studies provided for each of the three Darwin Fellows. The MSc degree course offered was that run at Heriot-Watt University (Course Director – Dr James Mair) entitled “*Marine Resource Development and Protection*” ([www.sls.hw.ac.uk/courses/msc\\_marine\\_resource\\_development.htm](http://www.sls.hw.ac.uk/courses/msc_marine_resource_development.htm) ). The Host-country co-ordinator selected suitable graduates with potential to contribute as Darwin Fellows to the project and the UK co-ordinator confirmed that these candidates were also suitable for admittance to the MSc Course. The MSc course has been in operation since 1986 and so is well established with over 500 graduates. The course is accredited in the sense that the UK’s NERC ([www.nerc.ac.uk](http://www.nerc.ac.uk)) recognises the course and awards it a quota of NERC Advance Course Studentships each year (since 1989). The British Council has also funded numerous studentships (Chevening, etc.) to enable overseas students to attend. All students on the course are assessed under normal internal (University) and external (Scottish Credit and Qualifications Framework – [www.scf.org.uk](http://www.scf.org.uk)) procedures. The content of the taught modules is ideally suited for students proceeding towards research or management posts in marine resource issues. The Darwin project plan had the Darwin Fellows attend the taught module component of the MSc course in Edinburgh over the period October to April and then to return to Panama to carry out relevant Darwin Project research which would also be suitable for presentation as the MSc dissertation component of the degree. Panamanian Darwin Fellow 1 (Beatriz Medina) successfully completed the course and graduated in the academic year 2003-2004. Panamanian Darwin Fellows 2 & 3 (Jose Miguel Guevara and Inez Campbell) successfully graduated in the year 2004-2005. The Darwin project benefited from the activities of other MSc students (classmates of the Darwin Fellows) who also carried out MSc dissertation work in Las Perlas but were externally funded (e.g. through HWU Alumni Travel Grant funding and in some cases through NERC studentship funding). The MSc training and subsequent involvement in the Darwin project by the three Panamanian Darwin Fellows was seen as the major longer-term capacity building component of the project.

## **5. Project Impacts**

The information on the marine environment of Las Perlas Archipelago gathered by the 12/021 Darwin Project, and the consultative advice given by Dr Hector Guzman to Panamanian Authorities, has led to legislation for “Special Management Zone” status of the Las Perlas marine area going through the Panamanian Congress. This has resulted in a high profile for the Darwin Project in Panama with it being intimately associated with, and being one of the driving forces for, the designation process. In late 2005, the Panamanian Maritime Authority ([www.amp.gob.pa](http://www.amp.gob.pa)) provided an enthusiastic letter of support for the application by Drs Mair and Guzman for Post-project Darwin funding (May 2006-March 2008, subsequently approved). This Post-project stage is aimed at further advising the Panamanian Authorities with appropriate scientific advice in order to develop specific and detailed management plans for high-priority targeted areas within the designated ‘Special Management Zone’.

It is therefore considered that the project has successfully achieved its purpose of assisting Panama in meeting its CBD obligations (see also Section 16 Appendix II below), and, through its legacy (and with continued input from the new Post-project phase), should continue to do so in the future.

It was envisaged in the project proposal that the three Panamanian Darwin Fellows would provide the focus for local capacity building for future biodiversity work. As reported in the project's Year 2 Annual Report, Darwin Fellow 1 (Beatriz Medina) left the project to pursue other studies, but returned to give a presentation of her MSc dissertation research on the Las Perlas scallop fishery (now also "in press" in Journal of Shellfish Research) at the Darwin Project Conference held in March 2006. Darwin Fellow 2 (Jose Miguel Guevara) has, since the project was completed in March 2006, obtained short-term contract work using his GIS skills with Panama's Environmental Authority ([www.anam.gob.pa](http://www.anam.gob.pa)). He is currently seeking a permanent post but his skills may be employed in some Post-project Darwin work as appropriate. Darwin Fellow 3 (Inez Campbell) was included in the Post-project Darwin proposal and is now working (as Darwin Fellow B) part-time on the continuing Darwin work but also established in her post in the Smithsonian Tropical Research Institute's Marine Education Center in Punta Culebra ([http://stri.org/english/visit\\_us/culebra/history.php](http://stri.org/english/visit_us/culebra/history.php)). Ms Campbell has also, as part of the Darwin Post-project, registered for a PhD research degree (off-campus, part-time) at Heriot-Watt University with the aim of her Las Perlas research contributing to the overall longer-term aims of the Darwin Project and Post-project.

The project has enabled more collaboration than originally envisaged between the two partners. Each year since 2003 (including May/June of 2006), STRI has hosted several Heriot-Watt University MSc and PhD students to collaborate on the research ongoing through the Darwin Project in Las Perlas. Two collaborative research proposals have been prepared and submitted to NERC for research arising from Darwin project work. One of these applications (Vermetid mollusc use as a proxy to monitor long-term environmental variables from the Tropical Eastern Pacific) was unsuccessful. Another (to integrate the remote sensing research of former HWU PhD students Evanthia Karpouzli who worked on Darwin project 07/147 and Sarah Benfield's work in Las Perlas) is being revised and will be submitted to NERC later in 2006. Longer-term future collaboration was also discussed at the Darwin Conference in March 2006 and plans are underway for collaborative research between Heriot-Watt University and STRI, as well as with other partners in the Network (e.g. co-ordinators in Darwin project 14/048). Throughout the Darwin project (2003-2006) Dr Guzman had, and continues to have, close links with Panamanian government authorities and Congress members and the local communities in Las Perlas (through information/training workshops).

It is considered that the project has had a positive social impact on the communities in Las Perlas since they have been kept informed through Workshops and have been actively consulted on the plans as they were developed for the 'Special Management Zone'. The Las Perlas Archipelago is located within the main fishery area of the country: the Gulf of Panama. In 1990, it was estimated that about 10,000 people worked in the fishing activity, of which about 65% were subsistence fishers. The mangrove forests along the mouths of rivers in some of the islands constitute important reproduction sites for aquatic species as well as a source of food for fish and shrimp larvae of commercial interest. The project work took into account land and marine usage (agriculture, fishing, tourism, etc.) in the Archipelago and considered both conservation and sustainable development issues. An overall aim was therefore to help local fishers potentially avoid fishery collapses (which have happened in the past due to over-fishing and lack of understanding of species life-cycles and habitats) and to assist them in alternative livelihood opportunities such as well-managed ecotourism (e.g. potential for whale-watching, diving guides). Information from the project fed into educational material for target groups and school-leavers in Las Perlas some of whom might then remain in economically and environmentally sustainable local employment.

## 6. Project Outputs

Project Outputs are quantified and described below in Section 17, Appendix III. Details of publications and publicly accessible material are listed in Section 18, Appendix IV (and paper copies, etc., are provided in the Annex to this report). It is considered by the project co-ordinators that all of the main Outputs originally in the agreed schedule essentially have been met.

In terms of Training outputs, the main objective was to train three Panamanian graduates to MSc level with direct support through funding by the Darwin project. No funding for PhD training was requested. However, the opportunity was taken to enhance the research of the main Darwin Project objectives by enabling PhD students to contribute to, and be associated with, the project. In the original proposal plan, the main component of this was the inclusion of Ms Sarah Benfield (UK student, fully funded by a ESPRC grant) whose work played an important part in mapping the Las Perlas Archipelago and studying reef fish communities. In anticipation of the Darwin project, a Colombian biologist (Lina Barrios) was selected to be put forward for an EU Alban training grant ([www.programalban.org](http://www.programalban.org)). When this was awarded (with partial funding from a Heriot-Watt University Scholarship) she also began a major contribution to the Darwin project: research into the ecology and distribution of vermetid molluscs and sabellaridae polychaetes in the Las Perlas Archipelago. The following year, another Colombian graduate registered for a PhD degree at Heriot-Watt University (again with EU Alban funding) and she is currently comparing some of the data obtained from the Las Perlas case study with similar studies of protected area management in Colombia. Whilst no Darwin funding has been used to directly fund PhD studies (Output 1), the project has enabled good PhD research to be carried out (of benefit to all) and has also raised interest in Panama and Colombia for more such collaborative PhD research training in the future.

In a similar manner, the Darwin project has enabled and provided logistical support for numerous separately-funded MSc students (in addition to the 3 Darwin Fellows) from UK and EU to contribute to project work and to personally benefit by such an association. Although not a major objective of the Darwin project, through contacts with the University of Panama, Dr Guzman was able to provide some informal training and work experience for undergraduate students on project work (Output 4). In late 2005, two STRI interns (PG students) were also able to be involved in related work in Las Perlas – studies of whale shark occurrence and ecology of lobsters.

The planned Darwin “Information and Experience Exchange” Network (Output 17) was established and operated well. Darwin Fellows from old projects in Ecuador and Colombia (06/029 and 07/147) spent time in Panama in Year 2 (plus attended the final Darwin conference in March 2006) and contributed greatly to the project work, particularly on the taxonomy and identification of the large benthic invertebrate sample collection (for a detailed description, please see Powerpoint presentation included in CD attached to the Annex of this report). Two biologists from Costa Rica also became closely associated with this work. During Year 2 of the project when it was announced that another Darwin project in Galapagos (14/048) had been approved, links were made with the UK (Edinburgh University) co-ordinator and the host-country co-ordinator in Ecuador. This host-country co-ordinator was able to attend the March 2006 Panama project conference and to contribute greatly to it, resulting in continuing discussions about future collaboration.

The target of 'at least six papers submitted and published in peer reviewed journals' (Output 11a) has not quite been met on time. There have been two papers published (see Annex for copies and Section 18, Appendix IV for details) resulting from the collaborative work in Panama, another "in press" (due in-print in December 2006) and another accepted subject to slight amendments (done and awaiting final notification). Six other manuscripts are nearing final agreed versions for submission within the next few months and so it is considered that the original target will eventually be met. It is in the interests of both co-ordinators (and the associated research students) that these manuscripts are 'in print' by next year.

The scientific papers described above are targeted at the wider scientific audience and so information is disseminated in the normal way. Other material (newsletters, etc.) maintained the profile of the project work and its objectives both for in host-country consumption (STRI community and Panamanian stakeholders) and also more widely through the Darwin Initiative community. For example, regular Darwin project articles were submitted and appeared in STRI and Darwin Newsletters (see paper copies attached to report in Annex). With the work in Las Perlas benefiting from a further 23 months of Post-project Darwin funding, the intention is to continue the dissemination of project work and progress through all appropriate channels.

## 7. Project Expenditure

The Table below provides a summary of grant expenditure for the Panama Darwin Project (12/021) using the categories in the original application/schedule. A more detailed breakdown of costs is available. In Years 1 & 2 of the project there were some instances where permission for virement (above the +/- 10% limit) between categories was requested and given. In addition, the Darwin Secretariat approved a request to transfer £6,000 from Year 3 into Year 2 in order to bring forward the MSc training for Darwin Fellow 3 (described in Section 4 above). These changes however did not result in any alteration of the overall project total and, at the end, the overall 3-year project budget of £168,154 was balanced (i.e. no overspend/no underspend). Some savings were made in overall Salary costs with the retiral of Dr Jimmy Young (Heriot-Watt University) halfway through Year 3. With this being anticipated in advance, he completed his contribution to the project before his retiral (i.e. advice and guidance on the satellite remote sensing and GIS work for PhD student Sarah Benfield). Darwin Fellow 3 (Inez Campbell), after completion of her MSc training in Edinburgh, moved onto part-time Darwin Fellowship payments to enable her to re-integrate into a salaried post within STRI (Marine Education) following completion of the Darwin project. As Year 3 of the project commenced, both these anticipated salary savings enabled additional spend, as deemed appropriate by the project co-ordinators, in other areas of the project.

| <b>Original<br/>Total Budget</b> | <b>Actual<br/>Total Spend</b> | <b>Balance</b> |
|----------------------------------|-------------------------------|----------------|
|----------------------------------|-------------------------------|----------------|

*# Variations greater than +/- 10% for sub-budgets. Requests had been made to Darwin Secretariat to consider allocation of extra external money to enable Darwin workers from other projects to attend the final Darwin Project Conference in Panama. This was considered a positive idea (and perhaps to be a feature of future Darwin funding) but in the present round funding was unavailable. The Project co-ordinators decided to subsidise attendance of some 'Network' partners from Darwin projects in Colombia and Ecuador (06/029 and 07/147) and they contributed significantly to the March 2006 Darwin conference. This resulted in an overall 14% overspend in the final T&S budget. There was a 16.6% underspend in printing (of leaflets) since in Year 3 some subsidy of printing costs was obtained. An overspend in capital items resulted from the decision to obtain more satellite imagery of the islands than originally anticipated – again deemed important to the scientific work and interpretation by both UK and host-country co-ordinators (images were used in studies of the marine shallow water areas but are now also available for future work on terrestrial studies of the islands).*

## **8. Project Operation and Partnerships**

The Smithsonian Tropical Research Institute ([www.stri.org](http://www.stri.org)) was the main local partner as was initially planned. In Panama, STRI also plays a major role in advising the appropriate government authorities on environmental and biodiversity issues. Dr Guzman (Darwin host-country co-ordinator), with his experience as scientific advisor in the establishment of the Coiba Marine National Park, had the lead role in similar activities for the Las Perlas Archipelago. He advised government departments ([www.anam.gob.pa](http://www.anam.gob.pa), [www.amp.gob.pa](http://www.amp.gob.pa), [www.ipat.gob.pa](http://www.ipat.gob.pa) – Environment, Maritime, Tourism) as well as being a major link with the major fishery and tourism industry sector, local island communities and other stakeholders. Plans for the designation of the Las Perlas “Special Management Zone” were modified and evolved through various stages during the extensive consultation period. There had been no other Darwin projects exclusively focused on Panama although links were made with personnel in ANAM (CBD National Focal Points) who had been involved in a previous regional project (10/023 – “Enhanced biodiversity conservation through capacity building in Central America”).

International partners who actively participated (i.e. took part in project research or attended the March 2006 Darwin Conference and Workshop) represented the following organisations: Coralina, Colombia ([www.coralina.gov.co](http://www.coralina.gov.co)) - former 07/147 Darwin partner; University of Guayaquil, Ecuador ([www.ug.edu.ec](http://www.ug.edu.ec)) - former 06/029 Darwin partner; Conservation International ([www.conservation.org](http://www.conservation.org)) – associated with current Darwin Project 14/048; plus staff from University of Costa Rica; INOCAR, Ecuador (Navy Oceanographic Institute – [www.inocar.mil.ec](http://www.inocar.mil.ec)); and INP, Ecuador (Government Fisheries Institute – [www.inp.gov.ec](http://www.inp.gov.ec)).

All international and local partnerships established during the project are continuing (and will obviously be further assisted by the current Post-project involvement). The project co-ordinators understand the importance of full involvement of the private sector, government and community participation in developing the fine detail of the individual and specific action plans envisaged within the “Special Management Zone” of Las Perlas.

## **9. Monitoring and Evaluation, Lesson Learning**

Both the UK and the Panama project co-ordinators took an active role in all aspects of the project and regularly communicated in order to monitor and evaluate progress. Achievement indicators were reasonably easy to measure (e.g. assessment marks on MSc course training, field plots being surveyed, etc.) and both co-ordinators were satisfied with project progress. No major problems arose. Both co-ordinators were able to inform each other of opportunities arising for additional funding/related research potential and ideas were exchanged to enable targeting of future potential opportunities (e.g. EU Alban funding for further postgraduate training and research, and other PhD projects being diverted to work on issues related to the Darwin Project).

The key lessons learned were: to have clear, regular and frank communications between project co-ordinators (this assisted smooth management of the project); and the importance of networking with other organisations with similar aims. On this last point, it had been considered important to involve 'Network' partners in the final Darwin Project Conference. During the Workshop sessions in March 2006, it was greatly appreciated by all that the exchange of experiences of similar activities (setting up, managing and monitoring marine protected areas) was invaluable. All Darwin Network partners plan to meet up again in the future. A separate fund within the Darwin Initiative to promote such Networking links and meetings would be very useful generally (not only for this specific marine Network).

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

There were no requests or need to take any actions in response to Year 1 and 2 Annual Report Reviews.

#### **11. Darwin Identity**

The Darwin logo was used on all appropriate material and websites produced during the project (see some examples in Annex to this report). The participants at the Darwin Project Conference were given certificates with the project and Darwin logos, as were the visiting biologists from Ecuador, Colombia and Costa Rica who actively participated in project research in Panama and STRI laboratories. Through the Darwin Project network, there is now increased awareness of the potential for future Darwin (and other) funding opportunities for related and collaborative projects. These ideas are regularly circulated by email amongst Network partners.

The development of the plans and designation for the "Special Management Zone" for Las Perlas has been intimately associated with the "Darwin Project". STRI and the host-country co-ordinator (Dr Guzman) have taken every opportunity to associate the Darwin project with the consultation process with all stakeholders. The plenary session of the Darwin Project Conference in March 2006 was the best opportunity to date for the aims of the Darwin Initiative in general (and this project in particular) to be explained to a large audience. Drs Mair and Guzman held regular meetings with staff at the British Embassy and this also helped greatly in the wider explanation of Darwin Initiative and Darwin project aims within Panama.

In the general context of biodiversity conservation in Panama, this particular Darwin project was closely associated with the Las Perlas situation and so was readily regarded as a distinct project with a clear identity. The achievements of the Project, in providing sound scientific guidance to managers in this case, will undoubtedly be seen as a model for larger programmes.

## **12. Leverage**

The matching funds described in the project proposal were met. During the lifetime of the project a further \$25,000 from the AVINA foundation was obtained for associated work in Las Perlas (to study whales, prepare educational material for whale watching, and organize 4 workshops to train local fishermen to guide tours and reduce pressure on fisheries). With designation of "Special Management Zone" status, other funding sources for continued work on the Las Perlas case should be available (more for outreach activities) and Dr Guzman has prepared bids for GEF funding to this effect. The additional funding from the Darwin Initiative (Post-project funding, May 2006-March 2008) is aimed mainly at continuing the collection of reliable scientific information to feed into management plans.

There was no real need for UK project staff to attempt to strengthen the capacity of partners in the host-country since STRI is a well-established organisation with an impressive track record of attracting national and international funding. In this particular case, there tended to be more of an exchange of information between project partners to alert each other to potential funding opportunities especially where this had the potential for aiding continued future collaboration.

## **13. Sustainability and Legacy**

As described in previous sections, Capital items (mainly satellite imagery) purchased during the project have been left with the host-organisation and these are, and will be, being used for continued work not only on the marine environment around the Archipelago but also to extract useful terrestrial data from the islands. Most of the original Darwin project staff members have major roles in the Post-project. The sustainability of the original Darwin project has therefore been demonstrated. Legacy will be built on during, and after, the Post-project phase.

## **14. Value for money**

The Project co-ordinators consider that there have been many benefits brought about by the project and at relatively low costs. The main objectives of the project from the outset have been achieved within budget. Perhaps more scientific work than was expected was achieved, mainly due to the opportunities taken by encouraging Heriot-Watt University research students (funded from elsewhere) to contribute to the overall aims. Similarly, the reliance on Dr Guzman by various stakeholders for advice and support in the protected area status of the Archipelago has also enabled the process to proceed much faster than expected.

## 15. Appendix I: Project Logical Framework

| Project summary   | Measurable indicators   | Means of verification   | Important assumptions  |
|---|---|---|--|
| <p><b>Goal:</b> To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve</p> <ul style="list-style-type: none"> <li>• the conservation of biological diversity,</li> <li>• the sustainable use of its components, and</li> <li>• the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</li> </ul> |   |   |  |
| <p><b>Purpose</b></p> <p>To build up research expertise in a team dedicated to obtaining habitat information and to producing management plans for the marine and coastal environment of Las Perlas (Gulf of Panama) in order to enable the designation of a Marine National Park within the Archipelago's boundaries</p>   | <p>Information obtained during surveying and research from project used in formulation of action plans for protected area management during discussions with ANAM (Panamanian National Environmental Authority)</p>   | <p>ANAM endorsement of final reports produced by Darwin project team</p>  | <p>Panamanian authorities accept the information obtained and advice/recommendations made during the project and pass appropriate legislation, policy and funding schemes to set up and manage the Park</p>                                  |
| <p><b>Outputs</b></p> <p>3 Panamanian Darwin Fellows with MSc level degrees and experience in applied field research</p> <p>Field plots and action plans produced</p> <p>Results disseminated through conference, scientific papers, etc</p> <p>Information and experience exchange network of Darwin workers established</p>   | <p>Continuous assessment during taught modules and research dissertation</p> <p style="text-align: right;">Plot</p> <p>sites geographically defined and Action Plan draft report presented</p> <p>Papers being peer-reviewed, Conference arrangements and attendance confirmed</p> <p>Numbers of groups participating and numbers of communications</p>   | <p>Degree certificates awarded by Heriot-Watt University</p> <p>Feedback and final Action Plan report endorsed</p> <p>Scientific papers appearing in journals</p> <p>Network aims and details of active partners appear on websites</p> | <p>Darwin Fellows pass all academic requirements of HWU's MSc Course</p> <p>ANAM agrees on proposed Action Plan</p> <p>Manuscripts submitted to peer-reviewed journals are accepted</p> <p>Other partners maintain commitment to Network</p> |
| <p><b>Activities</b></p> <p>Provision of training</p> <p>Survey and habitat mapping</p> <p>Results dissemination and consultations</p> <p>Production of educational material</p> <p>Networking</p>  | <p><b>Activity Milestones (Summary of Project Implementation Timetable)</b></p> <p>In each of the 3 Years, one Darwin Fellow selected in April, starts MSc taught course training in UK in October and completes degree with dissertation in Panama by following September. Main UK staff-run training courses held in Panama in July/August 2004.</p> <p>Survey programme planning finalised by June 2003. Main field survey work carried out in July/August of each year jointly by UK and Panamanian team with additional survey work carried out locally throughout study period. Field plots, databases &amp; reference collections consolidated by August 2005.</p> <p>Peer-reviewed scientific journal papers starting to be prepared after collation of initial survey results and being produced regularly in Years 2, 3 and afterwards. Project Conference held August 2005. Continuous discussions/liaison with ANAM personnel.</p> <p>Design of school and community education leaflets started September 2004 and printed ready for distribution in August 2005.</p> <p>Immediate "information and experience exchange" network initiated (May 2003) with core of other Darwin project personnel. Expanded throughout project.</p> |   |  |

**16. Appendix II: Project Contribution to Articles under the Convention on Biological Diversity (CBD)**

| <b>Project Contribution to Articles under the Convention on Biological Diversity</b> |                  |   |
|--|------------------|---|
| <b>Article No./Title</b>   | <b>Project %</b> | <b>Article Description</b>  |
| <b>6. General Measures for Conservation &amp; Sustainable Use</b>                    | 5                | Develop national strategies that integrate conservation and sustainable use.  |
| <b>7. Identification and Monitoring</b>  | 20               | Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.  |
| <b>8. In-situ Conservation</b>   | 15               | Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources. |
| <b>10. Sustainable Use of Components of Biological Diversity</b>                     | 10               | Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.   |
| <b>12. Research and Training</b>   | 30               | Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).  |
| <b>13. Public Education and Awareness</b>  | 10               | Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.  |
| <b>17. Exchange of Information</b>   | 10               | Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge   |
| <b>Total %</b>   | <b>100%</b>      | <b>Check % = total 100</b>  |

## 17. Appendix III: Outputs

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

| Code                    | Total to date (reduce box)   | Detail (←expand box)  |
|-------------------------|--|---|
| <b>Training Outputs</b> |  |   |
| 1a                      | Number of people to submit PhD thesis  | This was not an original objective but two Colombian PhD (independently funded) students will submit theses in 2006 and 2007)                             |
| 1b                      | Number of PhD qualifications obtained  | Sarah Benfield (UK project team - independently funded)   |
| 2                       | Number of Masters qualifications obtained  | 3 Darwin Fellows – plus others  |
| 3                       |  | n/a   |
| 4a                      | Number of undergraduate students receiving training  | 2   |
| 4b                      | No. of training weeks provided to UG students  | 10  |
| 4c                      | No. of PG students receiving training (not 1-3 above)  | 2   |
| 4d                      | Number of training weeks for postgraduate students   | 10  |
| 5                       |  | n/a   |
| 6a                      |  | n/a   |
| 6b                      |  | n/a   |
| 7                       | No. of training materials produced for host country(s)   | 3 leaflets (samples attached)   |
| <b>Research Outputs</b> |  |   |
| 8                       | No. of weeks spent by UK staff work in host country  | 36  |
| 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 – the main plan provided as guidance for Panamanian authorities to design the “Special Management Zone”   |
| 10                      | Number of formal documents produced to assist work related to species identification, classification and recording.  | None produced on this project since the two manuals produced for project 06/029 were used by Network taxonomists and left at STRI                         |
| 11a                     | Number of papers published or accepted for publication in peer reviewed journals   | 4 so far (6 was target) but several more are currently about to be submitted  |
| 11b                     | No. of papers published/accepted elsewhere   | 2   |
| 12a                     |  | n/a   |
| 12b                     | Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country   | 1 – database of benthic marine organisms (to family level) enhances country records – with associated GIS   |
| 13a                     |  | n/a   |
| 13b                     | Number of species reference collections enhanced and handed over to host country(s)  | 1 – comprehensive benthic organism collection, currently being catalogued/curated in NMS, Edinburgh before return to Panama. Other samples remain at STRI |

### 17. Appendix III: Outputs (Continued)

| <b>Dissemination Outputs</b> |   |   |
|------------------------------|---|---|
| 14a                          | Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work                           | 1 major Darwin Project Conference held in March 2006  |
| 14b                          | Number of conferences/seminars/ workshops <b>attended</b> at which findings from Darwin project work will be presented/ disseminated. | Several (4) varied level seminars/workshops attended by host-country co-ordinator   |
| 15a                          | No. of national press releases/articles in host country   | 3*  |
| 15b                          | No. of local press releases/articles in host country  | 5*  |
| 15c                          | No. of national press releases/articles in UK   | 0   |
| 15d                          | No. of local press releases/articles in UK  | 1*  |
| 16a                          | No. of issues of newsletters in the host country  | 3* (STRI Newsletters)   |
| 16b                          | Estimated circulation in the host country   | 1,000*  |
| 16c                          | Estimated circulation of each newsletter in the UK  | 10*   |
| 17a                          | Number of dissemination networks established  | 1 – Darwin Project Network – continuing and developing in Post-project phase  |
| 17b                          | No. of dissemination networks enhanced or extended  | 1 – STRI's own network  |
| 18a                          | No. of national TV features in host country   | 1*  |
| 18b                          | Number of national TV features in the UK  | 0   |
| 18c                          | Number of local TV features in host country   | 1*  |
| 18d                          | Number of local TV programme features in the UK   | 0   |
| 19a                          | No. of national radio interviews in host country  | 0   |
| 19b                          | No. of national radio interviews in UK  | 0   |
| 19c                          | No. of local radio interviews in host country   | 3*  |
| 19d                          | No. of local radio interviews in UK   | 0   |
| <b>Physical Outputs</b>      |   |   |
| 20                           | Estimated value (£s) of physical assets handed over to host country(s)  | £6,398 (Capital items) – mainly purchased satellite imagery   |
| 21                           |   | n/a   |
| 22                           | Number of permanent field plots established   | 6 – the base for monitoring for in the Post-project phase   |
| 23                           | Value of additional resources raised for project  | The £167,116 identified in the original proposal can be confirmed plus additional diffuse funding (difficult to quantify) |

\* In the original Project proposal (for Outputs 15, 16, 18, and 19) it was stated that “News of Darwin project work to be broadcast on radio and TV, newsletters and press releases will be attempted and encouraged as appropriate”. The numbers listed above are estimates provided by the host-country co-ordinator who was interviewed on radio and TV at the time of the Darwin Project Conference in March 2006 (not all have recordings available). Some paper copies (where available) of newspaper and other press releases are appended to this report.

## 18. Appendix IV: Publications

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

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

| <b>Type *</b><br>(e.g. journals, manual, CDs)        | <b>Detail</b><br>(title, author, year)   | <b>Publishers</b><br>(name, city)   | <b>Available from</b><br>(e.g. contact address, website)                             | <b>Cost</b><br>£ |
|--|--|-------------------------------------|--|------------------|
| * Journal - Marine Pollution Bulletin<br>Vol: 50 (5) | <i>"An assessment of metal contamination in mangrove sediments and leaves from Punta Mala Bay, Pacific Panama"</i><br>L. H. Defew, J. M. Mair, H. M. Guzman 2005   | Elsevier                            | www.elsevier.com/locate/marpolbul  | n/a              |
| * Journal of Environmental Management<br>Vol: 76     | <i>"An assessment of mangrove forest structure and development after human reclamation in Panama City, Panama"</i><br>Benfield S, Guzman H & Mair J 2005   | Elsevier                            | www.elsevier.com/wps/find/journaldescription.cws_home/622871/description#description | n/a              |
| * Journal of Shellfish research                      | <i>"Failed recovery of a collapsed scallop (Argopecten ventricosus) fishery in Las Perlas Archipelago, Panama"</i><br>Medina, B., Guzman, H. & Mair, J.M. (2006 in press)  | National Shellfisheries Association | http://shellfish.org/pubs/jsr.htm  | n/a              |
| Journal -- International Journal of Remote Sensing   | <i>"Mapping the distribution of coral reefs and associated sublittoral habitats in Pacific Panama: a comparison of optical satellite sensors and classification methodologies"</i><br>Benfield S, Guzman H, Mair J & Young J (2006 accepted) | Taylor and Francis Journals         | http://mc.manuscriptcentral.com/tres   | n/a              |
|  |  |                                     |  |                  |

Below is a selected list of working titles of various multi-authored manuscripts in final preparation for submission to peer-reviewed journals (anticipated before end of 2006 with publication possibly in 2007). The summer of 2006 is being devoted to readying further studies to manuscript stage. Other non-peered review material is detailed, and copies supplied, in the Annex to this report.

- *"The seasonal upwelling and primary production of the Gulf of Panama: ENSO implications", about to be submitted to Journal of Deep Sea Research*
- *"Taxonomy and PCR-RAPD's analysis as tools for population analysis and geographic distribution of Idanthyrsus cretus (Sabellaridae: Polychaeta) in the Tropical Eastern Pacific"*
- *"A comparison of environmental variables affecting reef-fish communities in Las Perlas Archipelago, Panama"*
- *The biology of Red Snappers and associated fisheries pressures in Las Perlas Archipelago, Panama"*

## 19. Appendix V: Darwin Contacts

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

|                                       |  |
|---------------------------------------|--|
| <b>Project Title</b>                  | Marine biodiversity assessment and development in Perlas Archipelago, Panama |
| <b>Ref. No.</b>                       | <b>162/12/021</b>  |
| <b>UK Leader Details</b>              |  |
| Name                                  | Dr James Mair  |
| Role within Darwin Project            | UK Leader – Project Co-ordinator   |
| Address                               | School of Life Sciences, Heriot-Watt University, EDINBURGH, EH14 4AS         |
| Phone                                 |  |
| Fax                                   |  |
| Email                                 |  |
| <b>Other UK Contact (if relevant)</b> |  |
| Name                                  |  |
| Role within Darwin Project            |  |
| Address                               |  |
| Phone                                 |  |
| Fax                                   |  |
| Email                                 |  |
| <b>Partner 1</b>                      |  |
| Name                                  | Dr Hector Guzman   |
| Organisation                          | Smithsonian Tropical Research Institute                                      |
| Role within Darwin Project            | Host Country Project Co-ordinator  |
| Address                               | Apartado 0843-03092 Balboa, Republica de Panama                              |
| Fax                                   |  |
| Email                                 |  |
| <b>Partner 2 (if relevant)</b>        |  |
| Name                                  |  |
| Organisation                          |  |
| Role within Darwin Project            |  |
| Address                               |  |
| Fax                                   |  |
| Email                                 |  |

## **ANNEX**

List of separately attached paper documents or electronic files

\* Paper format

† On web pages

- CD produced for distribution to all Darwin Project Workshop participants (March 2006) – containing Powerpoint presentations at the Workshop and describing in detail the work of the project (and other Darwin projects in the Network)
- \* Journal papers listed above in Section 18, Appendix IV
- \* 3 leaflets produced for educational/awareness purposes (on whales, fisheries and the new “Special Management Zone”) for Las Perlas stakeholders
- \* Panamanian newspaper article published to coincide with the March 2006 Darwin Project Conference
- \* Selection of news items on the project appearing in Heriot-Watt Newsletters and Annual Review
- \* Selection of news items on the project appearing in STRI Newsletters (May 2003 – March 2006)
- \* Selection of Project News items appearing in Darwin News (Issues 3, 5 and 6)
- \* Darwin Project Conference/Workshop programme, March 2006

### **Material already supplied: Annexed to Year 2 Annual report (April 2005)**

- \* Map of benthic sample stations from 2003/2004 surveys around Las Perlas Archipelago and final zoning area
- \* Leaflet describing the MSc Course taken by the 3 Panamanian Darwin Fellows
- \* Example of one of the draft leaflets prepared for printing in Panama and soon to be distributed once final zoning agreed, translated into Spanish, final corrections and logos included. Other leaflets are designed to cover fishing, tourism, pollution and special packs for schools.
- \* STRI Newsletter and Darwin Project article (August 2004)
- † Journal articles by Defew et al., 2005, Benfield et al., 2005
- \* Information on Las Perlas MSc dissertation nominated for 2005 Fugro-GEOS award
- \* Summary of MSc dissertation undertaken by another student at University of Wales, Bangor
- \* Final Draft of Executive Decree creating the “*Zona Especial de Manejo del Archipiélago de las Perlas*” (*Special Management Zone of the Las Perlas Archipelago*)
- \* SMG poster - presentation given by Sarah Benfield on PhD research work on Las Perlas at Scottish Marine Group meeting