Darwin Initiative for the Survival of Species

Final Report

River Invertebrate Biodiversity and Water Quality in the Dominican Republic

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1. Darwin Project Information

Project title	River Invertebrate Biodiversity and Water Quality in the Dominican Republic
Country	Dominican Republic
Contractor	School of Biological Sciences Royal Holloway University of London
Project Reference No.	08/144
Grant Value	£95598.00
Staring/Finishing dates	1 September 1999 - 31 December 2001

2. Project Background/Rationale

This project was located in the Dominican Republic, which occupies the eastern two-thirds of the island of Hispaniola, the second largest island in the Caribbean. With a land area of 48500 km^2, the Dominican Republic is a country of limnological superlatives. Lago Enriquillo is the largest lake in the Caribbean, and Pico Duarte (3067 m) boasts the highest mountain streams. The climate also varies considerably across the island, with tropical forests in the North and East giving way to sparse desert vegetation in the West.

Size, and the diversity of island ecotones and habitats, has produced a diversity of endemic species. The International Council for Bird Preservation classifies Hispaniola as a Critical Priority 1 area for conservation, with 34 endemic birds, 47 endemic herpetofauna and 1800 endemic plants. While much is known about the vertebrate species of Hispaniola, and there is some information on marine and terrestrial plants and invertebrates, there has been little work on the invertebrates that inhabit the 2500 km of rivers in the Dominican Republic.

A structured investigation into the benthic invertebrate life in the rivers of the Dominican Republic was considered important because these organisms are under intense pressure. The human population currently stands at 7.5 million and is growing at a rate of 2.4% per annum. Deforestation, the construction of dams and the abstraction of water for irrigation have already led to the disappearance of many km of rivers. A rapidly growing population and increasing industrialisation are leading to the contamination of many remaining rivers through the discharge of sewage and toxic industrial chemicals, and pesticide run-off from rice paddies and other agricultural activities. The Dominican Republic is also proving an increasingly popular destination for tourists, including many from the UK. The tourist industry, while interested in maintaining the natural attractions of the country for ecotourism, also places pressure on water resources in many areas, leading to increased abstraction and sewage discharge.

The need for this project was identified by Mark Crane (then a senior lecture at the University of London and now an independent environmental consultant), Albania Grosso (then a risk assessor at W.S. Atkins, now a risk assessor for the Environment Agency of England and Wales, and originally a Dominican national), after discussion with Dominican colleagues in the National Parks department and the University of Santo Domingo.

3. Project Summary

The overall aim of this project was to use simple sampling and chromosomal taxonomy techniques to produce an inventory and key for lotic invertebrates in the Dominican Republic, and to use information on invertebrate distributions to monitor the quality of Dominican streams and rivers.

The original specific objectives of the project were,

- to produce an inventory of freshwater benthic invertebrate species in the Dominican Republic so that the level of biodiversity and endemism can be determined;

- to produce a key to these invertebrates suitable for use by local water pollution biologists;

- to use an artificial intelligence model to classify and identify the major anthropogenic sources of impact in Dominican rivers, and aid local environmental regulators in producing catchment management plans for preventing further deterioration, thereby helping to safeguard freshwater biodiversity;

- to train local workers in the Dominican Republic and other Caribbean countries in practical techniques for monitoring and protecting rivers.

Article 7 of the Convention on Biological Diversity best describes the project: *Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities which have adverse effects; maintain and organise relevant data.*

The original objectives were not modified significantly, but the means used to achieve them did change during the course of the project. The sheer number of organisms collected led us to concentrate on classifying them to family rather than species level, so that a broad picture of biodiversity could be established. In contrast to this abundance of individual organisms, the number of sites that could be sampled was lower than originally anticipated. This meant that traditional metric and multivariate approaches to data analysis had to be used, rather than the more data-hungry artificial intelligence techniques originally proposed. Finally, a change in governing party towards the end of the project, which unfortunately also led to a change in the civil service personnel with whom we were dealing, meant that catchment management plans could not be produced.

Positive results from the project were that an inventory of benthic invertebrate families was compiled for the first time, and a reference collection established in the national natural history museum. A simple key to these organisms was produced that is currently being used by National Park staff. Data have been analysed to reveal patterns in environmental factors that are associated with patterns in diversity. Finally, a training workshop was held and an information video produced and disseminated widely in the Dominican Republic.

4. Scientific, Training, and Technical Assessment

UK staff were involved in this project in the following ways:

Mark Crane: Project leader, set up project during initial one month visit to the Dominican Republic and assisted in production of outputs.

Albania Grosso: Assisted in setting up of project during initial one month visit to the

Dominican Republic.

Ian Stephen: Research assistant in the Dominican Republic for eighteen months. Responsible for co-ordination and performance of all aspects of data collection, training, and production of information video

Nishan Hindes: Provided film production expertise during two two-week visits to the Dominican Republic, and technical editing assistance in the UK.

Robert Angus: Provided entomological expertise and audited the reference collection during two-week visit to the Dominican Republic.

Michael Soldner: Provided sampling, identification and data analysis assistance during three month visit to the Dominican Republic

Claire Wells: Analysed data set using multivariate techniques.

Dominican staff were involved in the project in the following ways:

Gladis Rosado: provided initial facilities at the University of Santo Domingo

Valentin Rosado: provided initial facilities at the University of Santo Domingo

Kennida Polanco: First trainee and research assistant

Litay Ramos: Second trainee and research assistant

Macroinvertebrate samples were collected from 104 river sites across the Dominican Republic, with a further 40 sites visited but found to be dry. Environmental data on geographical, physical and chemical variables were also collected from each site. The Biological Monitoring Working Party score and total numbers of Ephemeroptera and

Trichoptera were calculated for macroinvertebrate samples collected from the sampled sites. Physico-chemical and biological data sets were ordinated by principal components analysis and non-parametric Multi-Dimensional Scaling, and the biotic and abiotic data sets were correlated to determine the most influential factors determining site similarities. A clear pattern emerged, indicating changes in macroinvertebrate assemblage structure with declining altitude and water quality. These findings have been reported in a paper submitted to the peer-reviewed journal *Water Research* and will be expanded upon in a paper currently in preparation.

The main training undertaken during the project comprised,

- training of two research assistants: Kennida Polanco and Litay Ramos; and
- a training workshop for natural history museum and other relevant staff.

5. Project Impacts

The project's contribution to measures for biodiversity conservation, as defined in the CBD articles is shown in the Appendix I Table. The project has had a beneficial impact, although the extent of this was reduced by changes in government personnel after a general election. As a result of this change in staff, production of catchment management plans in collaboration with Dominican staff become impossible. However, the project succeeded in establishing benthic macroinvertebrates as useful indicators of aquatic biodiversity. It also showed that this biodiversity was greatest in the mountainous National Parks, where conservation efforts should be concentrated. Since the project ended, Litay Ramos, one of the trained local research assistants has been employed on a US-funded project to examine Dominican montane aquatic biodiversity further, and she has used the key that was produced as part of the Darwin project to help her in this task.

To summarise the impacts briefly: the scientific objectives of the project were largely met, but the linkage of these useful outcomes to management of freshwater resources was frustrated by local politics. There remains the hope that the continuing work by Litay Ramos will lead to acceptance of the need for catchment management plans, at least for National Parks.

6. Project Outputs

Project outputs are shown in the Appendix II Table. The only discrepancies between predicted and realised outputs are:

- Catchment management plans have not been produced, for reasons described above.

- Publication of three peer-reviewed papers was predicted, but it is likely that there is only sufficient information for two papers (one has been submitted and one is nearing completion).

- A radio interview/feature in the host country did not occur despite a Press Release sent to local radio stations. However, a national TV feature did take place as a result of this Press Release, as predicted.

- The original intention was to train workers from other Caribbean countries at the final workshop. However, enquiries quickly revealed that without the ability to fund travel for participants, which was not available from the project budget, none would attend. We therefore concentrated on training only local Dominican staff.

7. Project Expenditure

Grant expenditure was as originally tabulated.

8. Project Operation and Partnerships:

The main local partner in the Dominican Republic was originally CIBIMA, a research unit in the University of Santo Domingo. Unfortunately, the relationship with them deteriorated because of their lack of interest in the project objectives, and their refusal to deliver the agreed resources. The project base was subsequently moved to the National Museum of Natural History, where it operated successfully for several months. However, a change of government, and the resulting change in the museum's leadership along with all other middle-ranking and senior civil servants, led to a reduced interest in the project objectives by museum management in the final six months.

Efforts were made to collaborate with a German-funded project on river water chemistry based at the Hydrological Institute. However, this project suffered from a problem that we gradually came to realise plague many such initiatives in the Dominican Republic: despite funding for a year, fewer than ten sites were visited and sampled - the bulk of the project resources seemed to be consumed in meetings and publicity, rather than in meeting practical objectives.

If we could turn back the clock and run this project again, the UK participants would focus their efforts on community participation, probably through schools and Colleges, rather than attempts to gain buy-in from government departments or quasi-governmental research institutes such as CIBIMA and the museum. These attempts were, at best, only partially successful and depended upon individuals who could lose their jobs at the next election. Gaining institutional buy-in was a problem that we were unable to solve.

9. Monitoring and Evaluation, Lesson learning

The accuracy of invertebrate identification by the team was assessed by Dr Robert Angus when he visited the Dominican Republic. He found very few identification errors, which demonstrates that the scientific value of the data and reference collection are high.

There has been no external evaluation of the project, and there are no plans for this now that the project has ended and the primary UK staff are no longer employed by the University of London.

The key lesson that we drew from this project was the extreme difficulty of mounting what we had assumed would be a fairly routine monitoring exercise in a country with limited infrastructure and resources, with inappropriate partners, and with complex but opaque politics determining government decision-making. The logistics were a considerable struggle, with tediously regular power cuts and immense wastage of time on bureaucratic processes and discussions that added nothing to the project's value. The project leader has experience of party politics in the UK, and Albania Grosso, a Dominican, was fully aware of the casual corruption and self-interest that sadly characterises interactions between some Dominicans and foreigners, so we did not begin this project in an entirely naïve frame of mind. However, we were both surprised at the extent to which the project was afflicted by these problems. Only the presence of an immensely capable research assistant (Ian Stephen), with several years of relevant experience from working in Columbia allowed the project to succeed to the extent that it did.

One broad lesson that we feel could usefully be taken forward is to integrate local British Embassy staff more effectively into the planning and management of projects from the start (ideally before a proposal is submitted to the Darwin Initiative). Staff at the embassy in Santo Domingo were very friendly and helpful, but they and we could have benefited from more guidance from DEFRA on their role and the UK's expectations from the host country government.

10. Darwin Identity

The Darwin logo was used on all literature and the Darwin Initiative name was mentioned to all Dominican contacts. However, we remain fairly confident that this was of little interest to them and that they will have forgotten what they were told rather

quickly.

The project was a stand alone contribution to biodiversity conservation in the Dominican Republic and did not form part of a larger programme of work.

11. Leverage

Attempts were made by the project team and the British Embassy during the lifetime of the project to obtain additional funds from BP and Thompson Holidays. We were listened to respectfully, but no offers emerged.

12. Sustainability and Legacy

The project outputs that are most likely to endure are i) analyses and interpretation of the data, and ii) training of Litay Ramos and her continuing work in the field. The partners are unlikely to remain in touch, and there is no intention to seek additional funds for continuation of the work, as the UK personnel most intimately involved in the project have moved on to other areas of work.

The project's conclusions and legacy are being applied by Litay Ramos, and we must hope that success for her in establishing the usefulness of this approach in National Parks might be taken up elsewhere in the Dominican Republic. The legacy could have been improved by focusing greater attention on schools and Colleges, i.e., adopting a bottom-up rather than a top-down approach as we did. We have attempted to remedy this problem at least partially by distributing over 100 copies of the information video, in Spanish, to selected schools and Colleges in the Dominican Republic. We have also distributed the key on CD.

13. Value for money

Overall we believe that the project provided good value for money from a scientific point of view, but rather poor value for money from a Darwin Initiative and biodiversity conservation point of view. We believe that the data on invertebrates collected for the first time from the Dominican Republic could not have been obtained as cost-effectively in any other way, particularly with the logistical obstacles that confront one when working in that country. However, we remain frustrated that the governmental structure in the Dominican Republic has prevented us from turning scientific results into more practical tools for biodiversity conservation.

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

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

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	**Project %**	**Article Description**
6. General Measures for Conservation & Sustainable Use	0	Develop national strategies which integrate conservation and sustainable use.
7. Identification and Monitoring	50	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities which have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	0	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.

9. Ex-situ Conservation	0	Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity	0	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures	0	Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	10	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts	10	Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources	0	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

16. Access to and Transfer of Technology	5	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information	20	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol	0	Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Total %	**100%**	**Check % = total 100**

15. Appendix II Outputs

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

Code	Total to date	Detail
Training Outputs		
1a	Number of people to submit PhD thesis	0
1b	Number of PhD qualifications obtained	0
2	Number of Masters qualifications obtained	1
3	Number of other qualifications obtained	0
4a	Number of undergraduate students receiving training	0
4b	Number of training weeks provided to undergraduate students	0
4c	Number of postgraduate students receiving training (not 1-3 above)	0
4d	Number of training weeks for postgraduate students	0
5	Number of people receiving other forms of **long-term** (>1yr) training not leading to formal qualification(i.e not categories 1-4 above)	0

Code	Total to date	Detail
6a	Number of people receiving other forms of **short-term** education/training (i.e not categories 1-5 above)	20
6b	Number of training weeks not leading to formal qualification	1
7	Number of types of training materials produced for use by host country(s)	1
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	100
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	0
10	Number of formal documents produced to assist work related to species identification, classification and recording.	1
11a	Number of papers published or accepted for publication in peer reviewed journals	1
11b	Number of papers published or accepted for publication elsewhere	0

Code	Total to date	Detail
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	0
13a	Number of species reference collections established and handed over to host country(s)	1
13b	Number of species reference collections enhanced and handed over to host country(s)	0

Dissemination Outputs		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	1
14b	Number of conferences/seminars/ workshops **attended** at which findings from Darwin project work will be presented/ disseminated.	2
15a	Number of national press releases or publicity articles in host country(s)	1
15b	Number of local press releases or publicity articles in host country(s)	0
15c	Number of national press releases or publicity articles in UK	0
15d	Number of local press releases or publicity articles in UK	0
16a	Number of issues of newsletters produced in the host country(s)	0
16b	Estimated circulation of each newsletter in the host country(s)	0
16c	Estimated circulation of each newsletter in the UK	0
17a	Number of dissemination networks established	0
17b	Number of dissemination networks enhanced or extended	0
18a	Number of national TV programmes/features in host country(s)	1
18b	Number of national TV programme/features in the UK	0
18c	Number of local TV programme/features in host country	0

18d	Number of local TV programme features in the UK	0
19a	Number of national radio interviews/features in host country(s)	0
19b	Number of national radio interviews/features in the UK	0
19c	Number of local radio interviews/features in host country (s)	0
19d	Number of local radio interviews/features in the UK	0
Physical Outputs		
20	Estimated value (£s) of physical assets handed over to host country(s)	5000.00
21	Number of permanent educational/training/research facilities or organisation established	0
22	Number of permanent field plots established	0
23	Value of additional resources raised for project	0

16. Appendix III: Publications

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

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

Type * (e.g. journals, manual, CDs)	**Detail** (title, author, year)	**Publishers** (name, city)	**Available from** (e.g. contact address, website)	**Cost £**
Video	River Invertebrate Biodiversity in the Dominican Republic, Ian Stephen, 2002.	Royal Holloway, University of London, Egham, Surrey, UK.	Ms Cathy Barlow (C.Barlow@rhul.ac.uk)	£10.00
Identification key (CD)	A key to the aquatic insects of the Dominican Republic, Ian Stephen, 2002.			£5.00
Journal paper	Relationship between macroinvertebrate fauna and environmental variables in small streams of the Dominican Republic, Soldner et al., *Water Research* (in review, 2002)	*Water Research*	Dr Mark Crane (craneconsultants@aol.com)	-

17. Appendix IV: Darwin Contacts

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

Project Title	River Invertebrate Biodiversity and Water Quality in the Dominican Republic
Ref. No.	**08/144**
UK Leader Details	
Name	Mark Crane
Role within Darwin Project	Project leader
Address	*Crane Consultants*, Chancel Cottage, 23 London Street, Faringdon, Oxon. SN7 7AG
Phone	
Fax	
Email	
Partner 1	
Name	Ms Litay Ramos
Organisation	Museum of Natural History
Role within Darwin Project	Trainee
Address	Plaza de la Cultura, Santo Domingo, Dominican Republic.
Fax	None
Email	None