

Darwin Initiative for the Survival of Species

Annual Report, 2002/2003

1. Darwin Project Information

Project title	Developing local capacity for biodiversity surveys in Papua New Guinea
Country(ies)	U. K. and Papua New Guinea
Contractor	University of Sussex
Project Reference No.	162/10/030
Grant Value	£ 162,489.00
Start/Finishing dates	September 2001 / August 2004
Reporting period	Annually

2. Project Background

The project is led by Alan Stewart (University of Sussex (UoS), UK) in collaboration with Vojtech Novotny (Institute of Entomology, Czech Republic) and Mike Wilson (National Museum of Wales, Cardiff, UK). The primary aim of the project is to train a team of 'parataxonomists' (research technicians) based at the Parataxonomist Training Center (PTC) in Madang, Papua New Guinea (PNG), so that they will become a source of expertise for carrying out local biodiversity surveys, producing data for national and international nature conservation and sustainable forest use projects and material for national taxonomic collections.

3. Project Objectives

A team of parataxonomists in Papua New Guinea is being trained to (1) design and implement biodiversity surveys, (2) process and evaluate plant and insect samples, (3) produce high quality biological specimens, (4) document the specimens by digital photography, and (5) summarise the information in electronic databases, field guides, technical reports, education leaflets for grassroots landowners and www pages.

The project objectives have not been modified, although some minor changes to the timing of visits by the UK scientists have been an unavoidable consequence of delays in obtaining visas.

4. Progress

Brief history of project: The project started in September 2001, so is currently just over half way through. Prior to the year being reported upon, the main activities were: (i) setting up the parataxonomist team, recruiting individuals from local village communities, and training them in field and laboratory research techniques, (ii) purchase and installation of the computer, microscope and other scientific equipment, (iii) completion of two biodiversity surveys, (iv) development of environmental awareness literature (leaflets etc.), (v) giving environmental awareness presentations to three village communities (combined audience of 150 people), (vi) participation by parataxonomists in national scientific conference.

Progress over the last year: The main progress milestones of this reporting year were: (i) continued training of parataxonomists (the project's main objective) as planned, further developing the parataxonomist team established in the previous year, (ii) initiation of parataxonomist training in the UK: two parataxonomists were trained at three UK institutions and also visited research institutions in three other countries, (iii) initiation of MSc. research

training for a PNG student from University of Technology who is now resident at PTC, (iv) completion of two biodiversity surveys, as planned, (v) attendance by parataxonomists at one national and one international conference, giving oral presentations and posters, (vi) completion of two projects assisting villagers in developing ecotourist projects in their locally-established forest conservation areas, (vii) advancement of the public image of PTC by completing and distributing a number of publications, leaflets etc., partaking in radio and TV broadcasts, newspaper articles and launching a new www site, (viii) purchase of new 4WD vehicle and other equipment for use in survey work. Details on each of these are provided below:

(i) Training and development of the parataxonomist team

We recruited two new parataxonomists to the team. Our selection criteria for such positions remains unchanged, namely: interest in biology, understanding of the environment, relevant skills demonstrated, enthusiasm and ability to learn, and an ability to work in a team (little emphasis was placed on the extent of formal education since access to it is limited in PNG). There are now 13 parataxonomists, two of whom have been promoted to team leaders in the last year.

Training of the parataxonomist team continued at PTC, with the project team scientists leading the training as follows during their stays in PNG: Vojtech Novotny: July - December 2002; Alan Stewart: November 2002 and February 2003; Michael Wilson: February 2003. The training of parataxonomists also benefited from long-term stays by overseas and PNG M.Sc. students (Jiri Hulcr, Milan Janda, Darren Bito) and visits by overseas and PNG researchers (George Weiblen, Jan Leps, Lawong Balun, Lisa Dabek) who helped to create an intellectually stimulating environment at PTC.

(ii) Overseas training of parataxonomists

The first of the three planned overseas training visits was successfully completed. Two senior parataxonomists, Kenneth Molem and William Boen visited three academic institutions in the UK:

- University of Sussex, hosted by Dr Alan Stewart. The parataxonomists were introduced to a variety of field ecological techniques and UK habitats, including temperate deciduous forest as a comparison to tropical forest. Day visits were made to the Royal Entomological Society library and the Natural History Museum in London where they were able to see and discuss the work done by insect taxonomists specialising in Lepidoptera and Coleoptera. At Sussex University, they were given training in various laboratory techniques including examination of specimens using a Scanning Electron Microscope.
- National Museums & Galleries of Wales, Cardiff, hosted by Dr Mike Wilson. The parataxonomists were given an introduction to the museum's insect collections and taxonomic facilities (including photomicroscopy, freeze drying). They were also given training in taxonomic and curatorial techniques and were able to see how a major national museum operates. They visited a number of local habitat types, including montane environments, and were able to see a variety of agricultural systems.
- Royal Botanic Garden and Herbarium, Kew, hosted by Dr William Baker. The parataxonomists were given an introduction to the systematics and phylogeny of key plant groups and training in botanical curation techniques. They were shown the experimental work done by Kew and given the opportunity to discuss issues associated with particular plant taxa found in PNG. They were accommodated by Dr Robert Johns who has worked for many years in PNG and Irian Jaya and who speaks fluent pidgin.

Furthermore, other overseas collaborators with PTC invited the two trainees to visit their institutions where they obtained additional training. These visits, funded from non-Darwin sources, represent significant added value to the Darwin-sponsored training in the UK as they were made possible by the Darwin programme. These additional stays included:

- Smithsonian Training Institute, Panama, hosted by Dr Yves Basset. The parataxonomists visited the canopy crane facility at Port Sherman and were taught insect collecting methods using the crane. Furthermore, this was their first experience of tropical environments outside New Guinea and it provided an opportunity to visit a Neotropical forest.
- Department of Plant Biology and the Bell Museum of Natural History at the University of Minnesota, St. Paul, USA, hosted by Dr. George Weiblen. The parataxonomists visited plant collections and molecular biology laboratories, where they sequenced plant material collected previously by them at PTC and were taught the general rationale of phylogenetic studies using molecular data.
- Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, Washington DC, USA, hosted by Dr Scott Miller and Karie Darrow. The parataxonomists visited insect collections, including material they had collected as a part of the Darwin light trapping programme and received brief training in insect dissections and digital photography, using the advanced facilities available at the museum.
- Institute of Entomology of the Czech Academy of Sciences and the University of South Bohemia, Ceske Budejovice, Czech Republic, hosted by Lukas Cizek and Milan Janda. The parataxonomists visited several nature reserves demonstrating Central-European ecosystems. Also, visits to several farms informed them about European agricultural methods.

Both trainees were very pleased with their visits and felt that they had significantly expanded their knowledge and experience. This was a significant factor in their subsequent promotion on return to PTC (Kenneth Molem to deputy director and William Boen to team leader).

(iii) Student training

Mr. Rapo Pokon, a graduate student from the University of Technology, Lae, PNG, started his research M.Sc. study based at PTC as a Darwin-sponsored in-house student; Lawong Balun and Vojtech Novotny serve as his co-supervisors, and John Mukiui is the principal supervisor. His research topic is: *Host specificity and species richness of beetle larvae (Coleoptera) feeding on the roots of trees in a lowland rainforest in Madang (Papua New Guinea)*. Mr. Pokon started his studies at PTC in September 2002 and the project is progressing successfully.

Mr. Chris Dal, an undergraduate student of biology at University of PNG, received 6 weeks of training in December 2002 - January 2003 at PTC, during which time he also took part in the field and laboratory entomological research activities lead by PTC staff.

Responding to a request by our local collaborator, the National Agriculture Research Institute (NARI) in Port Moresby (PNG), we provided one month of training at PTC for Mr. Mark Ero, who is currently the Deputy Curator of the National Insect Collection and is being trained to take over as Chief Curator of the collection. He is a recent MSc graduate in entomology from the University of Papua New Guinea. During his stay at PTC from 30 June to 25 July, he received training in the curation of insect collections, field entomological research and sampling techniques, as well as data management and digital imaging. We were keen to undertake this training as it further consolidates the good collaboration with NARI that we developed in the first year of the project.

(iv) Biological surveys

Our programme of light-trap surveys continued with two surveys: one on Misima Island in PNG, and one near Bonkimant Village in the Finisterre Mountains. (the latter was a second survey in this area, following last year's survey at Keweng Village). These two surveys together produced over 8,000 specimens, which increased our total data set to 13,300 specimens from at least 1,550 species. The Misima survey targeted specific differences between undisturbed primary forest and re-vegetated areas after gold mining. The results so far are very promising and we expect to write a research paper on this specific topic during the next 12 months. The Finisterre survey, in

combination with our first survey in this area in 2002, will provide excellent possibilities for analysis of altitudinal variation in moth communities from 200 to 2,400 metres above sea-level.

(v) Scientific conferences

- **4th New Guinea Biological Conference, Cenderwasih University, Jayapura, Indonesia, August 2002:** Four parataxonomists participated: Joseph Kua, Borenke Kaupa, Richard Kutil and Brus Isua. In addition to the opportunity to learn about the activities of their counterparts on the Indonesian side of the island, this was also the first overseas visit for all of them. They also presented their own research in the form of two oral presentations and one poster:
 - Isua, B & Auga, J. (2002) Host specificity and species richness of long horn beetles (Cerambycidae) reared from rainforest trees in Papua New Guinea. Poster.
 - Kua, J., Kaupa, B., Eresula, L. & Sinebare, D. (2002) Caterpillars feeding on *Ficus* trees in Chimbu mountains (Papua New Guinea). Oral presentation.
 - Kutil, R, Hiuk, S., & Damag, M. (2002) Host specificity and species richness of fruit flies feeding on fruits in a Papua New Guinean rainforest. Oral presentation.
- **3rd International Canopy Conference, Cairns, Australia, June 2002:** Two parataxonomists (William Boen and Kenneth Molem) and one researcher (Vojtech Novotny) participated, presenting:
 - Boen, W. & Molem, K. (2002) Parataxonomists: a new approach to ecological research. Poster.
 - Novotny, V. (2002) Simple and predictable: communities of caterpillars in Papua New Guinea. Oral presentation.
- **Association for Tropical Biology, 2002 Annual Meeting, Panama City, Panama, July 29-Aug 2:** Two parataxonomists (William Boen and Kenneth Molem) visited the Smithsonian Tropical Research Institute in Panama and contributed a poster to be displayed at the Association of Tropical Biology meeting organised shortly after their departure:
 - Molem K., Boen, W., Auga, J., Damag, M., Hiuk, S., Isua, B., Kutil, R., Manaono, M., Manumbor, M., Mogia, M., Tamtiai, E., Hulcr, J., Janda, M., Novotny, V., Cizek, L., & Basset, Y. (2002) Parataxonomists: a new approach to ecological research.

(vi) Educational and conservation activities in local villages

We have initiated two eco-tourism projects with local village communities, respectively in Ohu and Baitabag villages. In Ohu village, we advised the villagers on developing a tourist track to local waterfalls, and designed and printed information leaflets advertising this attraction. We also assisted Baitabag village with exhibits and displays to complement a nature track through their rainforest protected area. These two projects were pursued *in lieu* of the originally planned village environmental awareness training courses, as the villagers preferred our assistance with these practical projects.

(vii) Media coverage of the project

The training visit to the UK by parataxonomists Kenneth Molem and William Boen resulted in one radio interview with local Radio Madang (PNG) and a news item in one of the two most important newspapers in PNG, The National. Also, the parataxonomists were interviewed for a local cable TV station in the Czech Republic:

- Radio Madang, programme about the Parataxonomist Training Center, October 2002
- Researchers return. By Lucy Kapi. The National, 19 September 2002, p. 7
- Moravia Cable TV, Czech Republic, interview with K. Molem and W. Boen, August 2002.

Parataxonomist programmes at PTC continued to attract media attention. In particular, extensive articles describing these programmes were published in PNG in *Paradise Magazine* (the in-flight magazine of the national airline, Air Niugini) and in *Post Courier*, one of the two most important newspapers in the country:

- Hulcr, J. & Janda, M. (2002) Science enters the village. *Paradise Magazine* No. 153, 3-4. Also on-line at Papua New Guinea Tourism and Business Directory: <http://www.pngbd.com/forum/showthread.php?s=&postid=18999#post18999>
- Mack, A. (2002) Understanding tropical ecosystems: Study of PNG insects and plants improves knowledge of tropical biology across the world. *Post Courier*, July 12-14, 2002, p. 29.

Parataxonomist John Auga wrote one newspaper article in Tok Pisin language on parataxonomist research activities:

- Auga, J. (2002) PNG Entomologist i wok long Wes Papua sevei. *Wantok* 13 July 2002, p. 4.

The parataxonomists also produced 14 new education leaflets (see list of publications, below).

The PTC www page was completely redesigned and expanded so that it became an information resource with education leaflets and research publications available as pdf files. Address: <http://www.entu.cas.cz/png/index.html>

(viii) Equipment

We purchased the new four-wheel-drive vehicle for accessing the field sites where our biodiversity surveys will be done. We also purchased solar power-generation equipment for use in remote locations, to power light traps, lap-top computers etc.

Workplan for financial year 2003/2004: The project design has not been modified. Likewise, we do not propose any significant changes in the workplan for the next year, which is as follows:

July 2003	6A/B	Specialist training of 2 parataxonomists for 4 weeks in UK (10 days spent at Univ. Sussex, 10 days spent at Cardiff Museum, 1 week at Kew)
	14B	2 parataxonomists attend and present poster at Tropical Biology Association conference in Aberdeen, UK.
	14B	2 parataxonomists attend and present poster at Royal Entomological Society conference in Reading, UK.
Aug 2003		Completion of 5 th biodiversity survey and processing of the material (Chimbu Prov., Mu Village, montane rain forest)
Aug 2003		5 parataxonomists attend New Guinea Biological Society Conference in Goroka, PNG with poster and oral presentations
Oct 2003		UK collaborator (MRW) visits PNG for training parataxonomists in taxonomy and curation techniques
Nov 2003	4C	1 MSc student (Rapo Pokon) completes 12 months of research studies at PTC
		Completion of 6 th biodiversity survey and processing of the material (Sepik Province, lowland rain forest)
		Project Leader (AJAS) visits PNG for training, planning etc.
		Annual Planning meeting, PNG, involving VN, AJAS, & parataxonomists
Jan 2004	4A	1 undergraduate student (Chris Dal) completes 6 weeks training at PTC
Feb 2004		Project Leader (AJAS) visits PNG for training, planning etc.

5. Partnerships

Collaboration between UK and host country: Linkages between the UK institutions and PTC continue to develop well. Visits to PNG by the Project Leader (three so far) and Dr Wilson (collaborator on taxonomic aspects of the project; one visit) have enabled the UK participants to appreciate the challenges and constraints of conducting this kind of work in PNG. Collective experiences with training parataxonomists has resulted in a joint publication (see below) that explores the opportunities that such an approach provides.

Collaboration within the host country: The project continues to enjoy the collaborative support of:

- The National Agriculture Research Institute (Port Moresby): we signed a Memorandum of Understanding with the Institute and started collaboration, which will contribute specimens from our studies to their National Insect Collection.
- University of Papua New Guinea (Port Moresby): two students from the Biology Department have received training at PTC, one of which has now progressed on to a Masters research programme (resident at PTC).
- University of Technology (Lae): one M.Sc. student is resident at PTC, where he is receiving training and assistance with his M.Sc. research as a part of the Darwin project.

We continue to have informal collaboration and active contact with the following conservation NGOs based in PNG:

- Tree Kangaroo Conservation Project (administered in collaboration with Roger Williams Park Zoo, Rhode Island, USA)
- Sangamanga Conservation and Environment Preservation Group
- Bismarck-Ramu Group
- WWF

6. Impact and Sustainability

The collaborations listed above indicate that the project is becoming known in the NGO community as well as the academic research community in PNG. We are also attracting significant media attention for our work and have actively encouraged this by getting directly involved in working with the media. Our project has been featured in both major national newspapers (Post Courier and National), the only Tok Pisin national newspaper (Wantok), as well as in the in-flight magazine of the national airline carrier Air Niugini (Paradise Magazine) and by the provincial radio station Radio Madang (see details in Section 4 (vii) above).

A major component of the project exit strategy is the successful development of a parataxonomist team that is financially self-sustaining, funded through conducting biodiversity contract surveys. Evidence that we are making good progress towards this objective is given by the new contracts which PTC has been able to attract during this second year:

- A survey in Tanggugh (lowland forest in Indonesian part of New Guinea) was commissioned by British Petroleum, to help assess the environmental impact of gas extraction.
- We completed a survey for the Misima Mine to study differences between undisturbed primary forest and re-vegetated areas after gold mining and to assess the success of their mine re-vegetation programme.

These contracts, as well as the enhanced media attention, demonstrate the excellent profile that PTC is developing within PNG and give us confidence that PTC is rapidly becoming known as the principal source of expertise on PNG biodiversity.

7. Post-Project Follow up Activities

The present Darwin project has opened a new, and in our opinion very exciting, opportunity to develop further our educational and training activities in PNG, which could be eminently suitable for Darwin Post-Project funding. Our experience from having two resident MSc students based at PTC to do research for their dissertations is proving to be very successful.

Only a very low proportion of the PNG population can study at university, particularly for MSc and PhD degrees. The constraints are financial, as well as the lack of research facilities and expertise; most university staff are heavily involved in teaching and have neither the time nor the resources to pursue an active research programme.

PTC is ideally suited to assist local MSc and PhD students in their dissertation research. It provides one of the best laboratory facilities and information resources for ecological research in the country and, more importantly, research expertise and active research programmes which could be joined by students. The combination of Darwin-trained parataxonomists and students has proved to be particularly fruitful as their respective skills are complementary: the parataxonomists have good practical research skills while the students have a deeper theoretical understanding of research. Also, the local and overseas scientists associated with PTC provide an excellent research environment in which the students can acquire new research skills. PTC provides dormitory-style accommodation for parataxonomists, students and researchers alike, thus creating a supportive environment for research.

Biology departments at both major PNG universities, the University of Technology and the University of PNG, have recognised the potential of PTC; evidence of their support is documented by letters of interest from these institutions, but, more importantly, is shown by their very active involvement in the project so far. Both institutions are very interested in collaborations over further expansion of our student training. Any such project however is dependent upon external funding as university budgets are extremely limited. We envisage PTC becoming a centre for research training in ecology for local students, providing them with an opportunity to pursue MSc and PhD degrees. The optimum PTC capacity is approximately 5 resident students, allowing 15 MSc or 5 PhD students (or, more likely, some combination of both) to complete their degrees in the course of a 3-year project.

8. Outputs, Outcomes and Dissemination

Table 1. Project Outputs

Code No.	Quantity	Description
4A	3	1 PNG BSc student completes 6 weeks training, 1 PNG MSc student trained for 8 months at PTC, working on his thesis, 1 PNG MSc graduate completes 4 weeks of training
6A/B	2	Specialist training of 2 parataxonomists for 4 weeks in UK (Univ. Sussex, Cardiff Museum & Kew)
6A/B		30 landowners from 2 villages assisted with their ecotourist projects throughout the year
7	14	Education leaflets on biodiversity conservation and other environmental topics
8	2	UK collaborator (MRW) visits PNG for training parataxonomists in taxonomy and curation techniques
8	6	Project Leader (AJAS) visits PNG for training, planning etc.
11A	3	Scientific papers in peer-reviewed journals
14B	1	2 parataxonomists attend and present poster at Rainforest Canopy conference in Cairns, Australia.
14B	1	4 parataxonomists present Darwin results at New Guinea Biological Society conference in Jayapura

15A	4	National press coverage/release in host country
15C	1	Local press coverage/release in UK
15D	1	National press coverage/release in UK
		Completion of 3 rd biodiversity survey and processing of the material (Misima, Milne Bay Province, coastal rainforest)
		Completion of 4 th biodiversity survey and processing of the material (Finnisterre Mountains, Morobe Prov., montane rain forest)
		Annual Planning meeting, PNG, involving VN, AJAS, & parataxonomists

The following Project Output scheduled for the first year has not been achieved:

- 8: one visit by Dr Mike Wilson to PNG, due to delay in obtaining visa until January 2003; this has been rescheduled for the 3rd year of the project

The following Project Outputs have been modified:

- 6A and 6B: The environmental awareness training courses planned in two villages were replaced by an eco-tourism project in each community. In Ohu village, we advised the villagers on developing a tourist track to local waterfalls, and designed and printed information leaflets advertising this attraction. In Baitabag village, we assisted with exhibits and displays to complement a nature track through their rainforest protected area. These changes were made because the occupants of the villages preferred our assistance with these more practical projects.
- 7: We have posted preliminary results and analyses from biodiversity surveys on the PTC website in the form of educational leaflets and published papers. However, detailed results will be made available towards the end of the project, when the data become more extensive and suitable for analysis.

The following Project Outputs are additional or ahead of schedule:

- 6A/B: In addition to their training in the UK, two parataxonomists visited the institutions of other collaborators with PTC where they were given additional (up to 2 weeks) training in relevant techniques: Smithsonian Training Institute, Panama; Department of Plant Biology, University of Minnesota, USA; National Museum of Natural History, Smithsonian Institution, Washington DC, USA; and Institute of Entomology of the Czech Academy of Sciences, Czech Republic.
- 6A/B: An additional field data set was obtained and extra parataxonomist training was achieved due to an invitation by the Indo-Pacific Conservation Alliance to conduct a biodiversity survey in Tanggugh lowland forest in the Indonesian part of New Guinea. This was an additional survey, commissioned by British Petroleum to provide baseline biological data which could be used to study the environmental impact of gas extraction planned in the area. This survey was not a Darwin survey, but it was completed using Darwin-trained parataxonomists and provided data on moth communities which will be analysed in combination with Darwin data.
- 14B: Poster presentation by 2 parataxonomists *in absentia* at a Tropical Biology Association conference, Panama.

Table 2: Publications

Senior scientists associated with PTC published a report in *Nature* (Research Paper #1) on work that was, in part, supported by Darwin Initiative funds and for which the parataxonomists were pivotal in generating the raw data. Our experiences in training parataxonomists have been summarised in a review paper, accepted by the *Journal of Applied Ecology* (Research Paper #2, below). Research Paper #3 below was co-authored by Darwin-trained parataxonomists who used their expertise during the research; the paper is therefore indirectly also a product of the Darwin work, although it is on a topic that is less closely related to this project.

Copies of all publications can be obtained from the Project Leader or PTC.

Type	Detail
Research Paper #1	Novotny, V., Basset, Y., Miller, S.E., Weiblen, G.D., Bremer, B., Cizek, L. & Drozd, P. (2002) Low host specificity of herbivorous insects in a tropical forest. <i>Nature</i> 416 , 841-844.
Research Paper #2	Basset, Y., Novotny, V., Miller, S.E., Weiblen, G.D., Missa, O. & Stewart, A.J.A. (in press) Conservation and biological monitoring of tropical forests: the role of parataxonomists. <i>Journal of Applied Ecology</i> .
Research Paper #3	Leps J., Novotny, V., Cizek, L., Molem, K., Isua, B., Boen, W., Kutil, R., Auga, J., Kasbal, M., Manumbor, M. & Hiuk, S. (2002) The habitat preferences of <i>Piper aduncum</i> , an invasive species in Papua New Guinean rainforests. <i>Applied Vegetation Science</i> 5 , 255-267
Leaflet	Boen, W. (2003) <i>Pometia pinnata</i> - the richest host plant for herbivorous insects
Leaflet	Boen, W. (2003) <i>Ficus</i> trees - the special plants for insects
Leaflet	Boen, W. (2003) <i>Macaranga</i> trees and the moths feeding on them
Leaflet	Boen, W. (2003) <i>Bikpela bataplai bilong nait</i> (Hercules moths and their host plants)
Leaflet	Boen, W. (2003) Butterflies of <i>Ficus</i> trees
Leaflet	Boen, W. (2003) Spingidae moths and their host plants
Leaflet	Boen, W. (2003) Rainforest plants and their moths
Leaflet	Boen, W. (2003) Wanem kain development? (What kind of development?)
Leaflet	Boen, W. (2003) Plants and animals of developed countries facing extinction - why and how?
Leaflet	Boen, W. (2003) Comparison between PNG's and European forests
Leaflet	Boen, W. (2003) Comparison of plants from the grassland of PNG and the European countries
Leaflet	Boen, W. (2003) Comparison of insects feeding in the canopy and bellow the canopy in a South American forest, Panama
Leaflet	Mogia, M. (2002) Bark beetles as the enemies of our forest trees
Leaflet	PTC parataxonomists (2002) Ohu Village waterfalls - an ecotourist guide
Leaflet	Boen, W. (2003) Kau Wildlife Protected Area - its biological richness.

- Dissemination activities in the host country.

The main mechanisms for dissemination of this project are (i) the production of leaflets, as in Table 2 above, (ii) organisation of training and collaborative environmental projects in local villages (e.g. development of eco-tourism), (iii) the further development of web-pages, and (iv) further work with the media. These activities are considered to be core elements of the PTC's work and an important part of maintaining its profile and its ability to attract funding within PNG. Consequently, they will be continued after the Darwin project finishes, funded by locally- and internationally-derived contract work.

9. Project Expenditure

Table 3: Project expenditure during the reporting period

Item	Budget	Expenditure

* PTC staff: Vojtech Novotny (partner in host country and Director of PTC); 13 current parataxonomists (John Auga, William Boen, Borenke Kaupa, Joseph Kua, Richard Kutil, Roll Lilip, Max Manaono, Markus Manumbor, Martin Mogia, Kua Nimai, Brus Isua, Kenneth Molem, Elvis Tamtiai).

Agreed changes to the budget

- We made a significant saving on the purchase of the 4WD vehicle (£21,882 instead of £25,000). We have transferred the saving to a separate budgetary item entitled 'vehicle running costs', which we will use to cover regular servicing, maintenance costs etc.
- We over-budgeted on the costs of printing, partly due to using a locally-based and cheaper printing firm for production of leaflets etc. and partly due to changes in the international exchange rate. The underspend was transferred to salaries for PNG staff.
- Staff costs were overspent by £804 and Office costs by £606, both of which were vired from other headings (in each case, the amount vired was less than 10% of the total for that budgetary category and was agreed by the Darwin Secretariat).
- We requested to carry forward a total of £1,573.00 to the next financial year

10. Monitoring, Evaluation and Lessons

Methods employed to monitor and evaluate the project

The outputs from this project will be multifaceted and therefore need to be evaluated in several ways. The following list outlines some of the indicators of achievement that will be used to measure the extent to which the project has been successful in meeting its objectives:

- Training: the number of parataxonomists attending and making presentations at national and international conferences (such as in Cairns last year) indicate the extent to which training is instilling both the skills and the confidence that is required to contribute to such events. The extent to which each pair of parataxonomists that visit the UK each year can apply the skills that they have learnt (e.g. advanced microscopic dissection techniques) on return to PTC and pass them on to other parataxonomists will be used to evaluate the success of their overseas training. We firmly believe that training locally-recruited parataxonomists to generate high quality scientific data is an excellent way to cultivate a new generation of environmentally-literate people at the same time as generating data that can be used to tackle major ecological questions that have wide applicability beyond PNG.
- Environmental education and awareness: the degree of involvement by local villagers in community-based environmental projects that have been initiated or guided by PTC will show the extent to which grassroots people have developed awareness of, and concern about, environmental issues.
- Awareness of PTC: the number and quality (both high) of applicants for parataxonomist jobs indicates the level of awareness of PTC and its work and the fact that it is perceived as an appropriate training centre for an environmental career in PNG. We will be monitoring the number of 'hits' on the website, as an indication of the extent to which PTC is made aware to a wider audience. The number of newspaper articles and other types of media interest indicates the extent to which PTC is regarded as a respected source of information on biodiversity on PNG.
- Research: whilst the completion of survey fieldwork and the processing of the material is the immediate measure of progress, publications in peer-reviewed journals are a better long-term measure of the quality and impact of the research done. Thus, the papers in *Nature* (on work that was, in part, supported by Darwin Initiative funds) and *Journal of Applied Ecology* (in press) indicate the capacity of the team (parataxonomists, under the guidance of international scientists) to generate the very highest quality scientific research output.
- Exit strategy: the principal aim of the project (as defined in the original project application) is "to transform biodiversity surveys from an overseas-driven to a local activity, relying on

local experts with access to national biological collections who can establish rapport with both local grassroots landowners and international research communities". The success of the exit strategy will be measured as the ability of PTC to attract work in the following areas:

- full-economic-cost contracts to do biodiversity survey work (e.g. for environmental organisations, post-industrial restoration projects)
- collaborative projects with PNG-based conservation NGOs
- scientific research directed by PNG-based and overseas universities
- training of PNG MSc. and PhD. students, particularly assisting their dissertation research projects.

We successfully collaborated with Misima Mines Ltd. on biodiversity surveys to assess the environmental impact of their activities and the success of their landscape restoration and revegetation programmes. This represents an early indication that our strategy of building a parataxonomist team to undertake such work has been successful. Similar environmental impact assessments are now required by PNG law, so we can expect other mining and logging companies operating in PNG to require these services. The Darwin project is enabling PTC to consolidate and enhance its position so that it can successfully compete for these projects in future.

Lessons from this years work

The Darwin project made it possible, for the first time in the history of PTC, to send parataxonomists overseas for training. Their experience was exceedingly positive: the training not only brought technical skills and knowledge, but also their experience of overseas academic institutions and temperate zone ecosystems broadened their intellectual horizons so that they now have a much better understanding of research and particularly of conservation issues. Furthermore, the presence of the Darwin-sponsored MSc student at PTC has demonstrated that collaboration between parataxonomists and local students is exceedingly fruitful, as their skills are complementary; the parataxonomists have more practical research skills while the university students have a broader and deeper theoretical understanding of the research issues.

Otherwise, there have been no major issues arising from the day-to-day running of the project which require any substantial revision of the programme or the way in which it is to be carried out in future.

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Date: 29 April 2003

Appendix 1: Logical framework for Project 162/10/030.

<i>Project summary</i>	<i>Measurable indicators</i>	<i>Means of verification</i>	<i>Important assumptions</i>
<p><i>Goal</i> Increase the intensity of biodiversity surveys in unexplored rain forests of Papua New Guinea which are threatened by logging and increase the relevance of these surveys for conservation decisions, particularly the decisions made by local village landowners, who own a majority of PNG forests.</p>	<p>The extent and detail of biodiversity information on species-rich plant and animal taxa available for main forest areas in PNG; conservation vs. logging decisions by local communities exposed to environmental education and similar decisions by government bodies for areas with known biodiversity information.</p>	<p>Biodiversity maps and research publications; case studies, field reports and published information on conservation decisions by local communities; national statistics on logging concessions and information on governmental policies and laws on logging in biodiversity hotspots; reports by environmental organisations</p>	<p>Biodiversity information and environmental education can influence conservation decisions by local communities and the government; sustainable forest use can, at least under certain circumstances and in certain social situations, compete with industrial logging in satisfying the development aspirations of the local communities</p>
<p><i>Purpose</i> Transform biodiversity surveys from an overseas-driven to a local activity, relying on local teams with sufficient expertise, equipment and access to biological collections, which can establish rapport with both local grassroots landowner and international research communities</p>	<p>The intensity of biodiversity surveys in various parts of PNG and the role and share of local experts in the planning and implementation of these surveys; the flow of biological specimens to national vs. overseas collections; the role of local experts in data reporting, evaluation and interpretation.</p>	<p>Survey reports and research publications; statistics on research activities by the National Research Institute; statistics on holdings in the national biological collections; publications on biodiversity issues authored by local experts and their activity in environmental discussions (in the press, on the internet, etc.).</p>	<p>Local experts are more sensitive to country needs and have a better understanding of the local social, economic and environmental situation so that they can collect and use biodiversity information for conservation more efficiently than overseas experts. Local experts can attain a sufficient level of expertise in research.</p>
<p><i>Outputs</i> Establish a fully equipped team of parataxonomists, trained for and experienced in biodiversity surveys including building of biological collections and data analysis, which can collaborate with researchers as well as with local villagers, thus capable of providing survey data both to the scientific community and resource owners.</p>	<p>Biodiversity surveys accomplished by the parataxonomist team; biological specimens and research information generated by these surveys; flow of specimens to national collections resulting from these surveys; village educational programmes successfully completed by the parataxonomists.</p>	<p>Products created by the parataxonomists: museum-quality biological specimens, electronic specimen databases, internet pages, biodiversity reports, papers, posters and oral presentations, educational leaflets, radio features, environmental lectures to the public and schools.</p>	<p>Parataxonomists are better biodiversity surveyors than university graduates who tend to pursue administrative careers in towns and are thus unavailable for fieldwork and also become too removed from concerns of village landowners. There is a sufficient demand for biodiversity surveys to sustain a parataxonomist team.</p>
<p><i>Activities</i> Recruit and train parataxonomists in computer use, field survey methods and logistics, curation and databasing of biological specimens, data analysis and creation of educational materials; provide them with field experience; expose them to researchers; provide with baseline databases, collections, and equipment.</p>	<p>Every senior parataxonomist is able to: train others to his level of expertise; organise and lead a survey team; organise complex logistics and solve various emergencies in remote areas; interact with local landowners as well as with overseas researchers; communicate survey results to both these communities. All 6 planned surveys are successfully completed.</p>	<p>Reports on the progress of individual parataxonomists and the whole team during the training sessions in PNG and UK and during the biodiversity surveys no. 1-6.</p>	<p>There is a pool of highly dedicated and capable school leavers in PNG villages with extensive traditional knowledge of the natural world, who could be trained as fully qualified biodiversity surveyors (parataxonomists); the DI senior personnel are able to accomplish such training.</p>