Darwin Initiative for the survival of species

FINAL REPORT

RIVER DOLPHIN CONSERVATION IN BRAZIL

(Project Reference No. 162/07/035)

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Final Report

1. Darwin Project Information

Project title	**River Dolphin Conservation in Brazil**
Country	**Brazil**
Contractor	**Sea Mammal Research Unit, Univ. of St Andrews**
Project Reference No.	**162/07/035**
Grant Value	**£69,500**
Starting/Finishing dates	**1 December 1998 – 1 December 2001**

2. Project Background/Rationale

This project was located in and around the Mamirauá Sustainable Development Reserve, which lies at 3^{O} S, 64^{O} W in the Northwest of the Brazilian Amazon and bounded by the major rivers Solimões and Japurá. Mamirauá was the first of three contiguous reserves to be designated by the Federal and State Governments in what has become known as the Amazon Corridor (the other Reserves are Amanã and Jaú). Mamirauá is a huge floodplain Reserve, comprising a mosaic of habitats known as *Várzea*. Much of the area is heavily forested, and the whole Reserve is flooded for some 6-8 months of the year. The Mamirauá Reserve was set up as an experiment to establish whether floodplain biodiversity could be conserved without the need to evict the people who live there. The aim was to ban industrial exploitation of resources such as timber and fish, and to empower local communities to both police the area and make a decent living without over-exploiting any resource. The concept has been a qualified success to date, especially in so far as several fish species, and caimans, have recovered their earlier abundance. Ironically, they may now be competing with dolphins for the same resources of smaller fish.

The problem that the project was aimed to address was the highly probable demise of dolphins in the Amazon unless more was known about how human activities are destroying river dolphin populations both here and worldwide. This involved improving knowledge of the biology and ecology of the animals themselves, and also establishing how elements of managing floodplain habitat (a major feature of the Amazon basin, and we now know to be important habitat for dolphin reproduction – see below) might be either a cost or benefit to dolphins living there. Two contrasting dolphin taxa are endemic to the Amazon, and both occur in Mamirauá. The first – the boto, or Amazon river dolphin *Inia geoffrensis*, is a relict species that has evolved over millions of years to life in turbid freshwater. It has small eyes, extraordinary acoustic abilities, and is pink in adulthood. This unique species was the

primary focus of the Darwin Initiative sponsored work. The second animal – the riverine form of the tucuxi *Sotalia fluviatilis* is a diminutive Delphinid dolphin. This taxon is confined to freshwater, but a sister form – possibly distinct at the sub-specific level – occurs in coastal eastern South America. Data on tucuxis were collected throughout the Project, are as valuable as those for botos, and have been (and are being) analysed and published. Priority has always been given to the former species, however, because of its similarity to the critically endangered river dolphins of Asia, and the expectation that discoveries for the one species could be applicable to the others.

The need for a project of this type had been identified by many individuals, institutions and agencies over several decades, including the IUCN Species Survival Commission, the Scientific Committee of the International Whaling Commission (the main international body providing advice on cetacean status and conservation priorities to range states) and the Brazilian National Institute for Amazonian Research. River dolphins are collectively the most endangered of all cetaceans, and among the least known. Those in Asia are in catastrophic decline due to destruction of river habitats and ignorance of their critical needs. The same fate is already facing the two South American species (boto *Inia geoffrensis* and tucuxi *Sotalia fluviatilis*) in parts of the Amazon where dams are being, or have been, built and where resource exploitation or the pressure of human habitation has resulted in unsustainable habitat damage.

The commitment from the local partner (National Institute for Amazonian Research – INPA) in undertaking this work was unequivocal before and throughout the project. INPA staff were enthusiastic and dedicated, and the Directorate was equally committed and supportive. I cannot imagine that the working relationship between Project Leader and host country partner could have been any better.

3. Project Summary

The original objectives and operational plan remained unchanged throughout the project. The purpose and primary objective of the work was to bring about improved prospects for the conservation of river dolphins in Amazonian flooded forest by improving knowledge of the animal and its ecology, by developing management advice based on high quality applied research, and by assisting the host country to meet its obligations under the Convention on Biodiversity . A second objective was to enhance the capacity of Brazil and other South American states to carry out similar research on small cetaceans and other rainforest animals by training bright young scientists.

This project addressed a number of Articles under the Convention on Biological Diversity, particularly 12 (Research and Training) and 8 (In-situ Conservation). Full details are given in Appendix I.

It is with great pleasure and pride that I can report the project to have been entirely successful in meeting its objectives; indeed such was the rate of progress with the research that the study has transformed understanding of the biology and ecology of this river dolphin (and, by analogy, that of other river dolphins too). One lasting legacy is a well-found laboratory for the continuation of the river dolphin research work in Mamirauá. The Darwin Initiative money acted as a catalyst to allow the setting up of a World-class research

project in the Reserve, and that project continues strongly at the end of 2003, complete with a floating lab/house, boats, engine, staff and students.

4. Scientific, Training, and Technical Assessment

Staff. The Project Leader (PL - Martin) and Host Country Partner Representative (HCPR - da Silva) acted as research leaders, and they received assistance from specialist staff in both Institutions (SMRU/St Andrews and INPA) as necessary. Field research was carried out by intern students on 6-month revolving placements and the permanent local staff member (Edinho Martins).

Methodology. The research comprised four main elements – capture/marking, observation, radio telemetry and abundance estimation. A summary is given here, but further details are given in da Silva and Martin (2000). Most of the work was dependent on the ability to recognise individual dolphins, and a capture/marking programme was carried out to achieve this, as well as to collect measurements and samples that would yield information on such topics as growth, body condition, diet, reproduction, genetics and social structure. Capture was by means of a seining process, and marking was accomplished with freeze-branding, using techniques and equipment employed on horses and cattle in the UK. Daily observational work was carried out year-round from small aluminium skiffs equipped with 15HP outboard engines, with an average of 130 hours of effort per month. Observers searched for dolphins and, when a group was encountered, recorded location, group size and structure, the identity of marked animals, presence of calves with known females, and behaviour. All data were entered into a MS Access relational database at the end of each day, backed up to ZIP drive twice weekly, and sent by e-mail to both PL and HCPR at the end of each month.

Many dolphins were tracked using a VHF transmitter temporarily attached to their dorsal fin. Automatic scanning/logging receivers were mounted atop towers and trees at key points in the study area, and hand-held receivers were carried by boat-based observers to allow the detection of transmitters in groups of dolphins encountered during observational work. Further details are given in Martin and da Silva (1998).

Abundance estimation was carried out in two ways, according to the size of the waterway. On rivers and large lakes we used line- and strip-transect techniques (Thomas et al 2002) from a 20m riverboat with a purpose-made viewing platform above the wheelhouse. Analysis of the line-transect data was carried out using program DISTANCE (Thomas et al 2002). Smaller lakes and channels (<200m across) were counted from a skiff using 4 personnel and a standardised protocol. Counts along a particular 30km waterway in the rainforest were conducted at least twice per month throughout the duration of the project to allow detection of abundance or distribution changes.

Analysis and write-up of the Project's results in a broad range of research areas will continue for some years, such is the amount of data collected and the number of inter-related questions that they can be used to answer. All results have been, and will continue to be, published in international peer-reviewed journals. Papers to date:

1. *da Silva, V.M.F. & Martin, A.R. (2000). A study of the boto, or Amazon river dolphin*

(Inia geoffrensis), in the Mamirauá Reserve, Brazil: operation and techniques. Biology and Conservation of freshwater cetaceans in Asia. (Eds R.R.Reeves, B.D.Smith & T.Kasuya), pp121-131. Occasional paper of the IUCN Species Survival Commission no. 23. IUCN, Gland, Switzerland.

This paper presented and discussed the research technique developments that were made during the project. The paper was published in an edited volume that would be easily available to scientists in S.E. Asia, where scientific progress and rigour are low, and conservation of river dolphins is most urgently required.

2. *Martin, A.R. and da Silva, V.M.F. (In Press). River dolphins and flooded forest: seasonal habitat use and sexual segregation of botos (*Inia geoffrensis*) in an extreme cetacean environment. Journal of Zoology.*

This was our first data paper, and will be published in April 2004. It shows how botos have adapted very successfully to forested floodplain habitats, and how reproduction is intimately tied to the seasonal inundation of várzea. The extent and health of floodplains probably dictate the distribution and density of this species throughout its range.

3. *Martin, A.R., da Silva, V.M.F. and Salmon, D.L. (In Press). Riverine habitat preferences of botos (*Inia geoffrensis*) and tucuxis (*Sotalia fluviatilis*) in the central Amazon. Marine Mammal Science.*

This paper quantifies for the first time the use of riverine habitats by both botos and tucuxis. It shows that both species differentially prefer river edges and areas of low current, especially where waterways meet. It demonstrates that dolphins and fishers have the same habitat preferences, and thus explains why gillnet entanglements are probably the greatest threat to these dolphins throughout their range.

4. *Martin, A.R. and da Silva, V.M.F. (Submitted). Adornment in an aquatic mammal. Nature.*

Here, we show that botos share with humans and chimpanzees, but very few other animals, the use of objects for sexual display. We discuss how this fits with the species' mating system and what it tells us about the culture and evolution of this dolphin.

5. *Martin, A.R. and da Silva, V.M.F. (Submitted). Number, seasonal movements and residency characteristics of river dolphins using an Amazonian floodplain lake system. Canadian Journal of Zoology.*

This is a broad-ranging analysis of how many dolphins use the Mamirauá lake system, and to what extent, during a typical year. It also provides an estimate of how many botos (13,000) likely live in the entire Mamirauá Sustainable Development Reserve.

We currently have 10 further papers in various stages of analysis or write-up, on subjects ranging from growth, reproduction and genetic diversity to mortality rates, causes of mortality, diet, population dynamics, communication and health.

The training element of the project centred around the 'interns' that joined us for 6-month periods and the two Masters students. Selection for the interns was based on suitable education qualifications (1st degree minimum), nationality (priority given to Brazilians, and then to residents of other South American states), references and finally an interview. The

training itself included boat handling, engine maintenance, field safety, observation and recording techniques, database design and basic analysis techniques. A formal assessment of each individual was carried out by HCPR and PL at 3 months and again at the completion of the 6-month internship.

5. Project Impacts

Most of the achievements of this project will necessarily be seen in the longer term, because the designation of Reserves and the development of Management Plans occur over scales of decades rather than years. That said, the results of this work have already been taken into account in the management of the vast Mamirauá Reserve, and have been promulgated to State and National agencies through written and verbal reports. The key discovery – that flooded forest habitat (Várzea) serves as a nursery area for Amazon river dolphins and is probably critical habitat in the life history of the species – enormously strengthens the case for formal protection of these areas throughout the Amazon. Botos are large, charismatic and very obvious representatives of the diverse animal community which is dependent on Várzea, and largely unseen. This is very much a flagship species that can be used to represent the whole várzea biotic community. If you have pink dolphins, your environment is probably healthy. If they diminish or disappear, something is going wrong, seen or unseen.

Publication and assimilation of research results should also be looked at in the medium-long term. The period between submission and publication in most peer-reviewed journals is typically over a year in this field, and the time taken to analyse and write up any topic can easily consume two years. Thus, 3 – 4 years is a reasonable expectation of time between picking up a topic and seeing it published. Given the number and diversity of potential papers generated by this Darwin Project, and the rate at which they can be completed (average 3 per year expected), it will be another 5 years before the scientific legacy of this Project has been completely put in to the public domain.

On a broader scale, the discoveries made by the project offer the first real understanding of what makes a river dolphin population 'tick'. What elements of a large river and its diverse environment are necessary to permit endemic cetaceans to survive and thrive? Which anthropogenic activities impact these populations and how can human populations exist alongside those of dolphins with minimal negative consequences to both? What sustainable benefits can human communities gain from their close proximity to dolphins? As such, the project assisted, and continues to assist, the host country in meeting its obligations under articles 6, 7, 8, 10, 11, 12 and 14 of the CBD. The training and education elements of the project addressed the requirements under articles 12 and 13.

Trainees demonstrated varying levels of dedication to a scientific career. At one extreme, roughly a third discovered that rigorous cetacean and biodiversity research was harder and less romantic than they had perhaps imagined, and will probably not put their new-found expertise to any specific use. At the other end of the spectrum were a similar number of outstanding graduates who used their time with us as a stepping stone to what promise to be long and fruitful careers in this or a similar field. One is now undertaking a PhD, three are on a Masters course, and another (a veterinarian) is about to start a Masters

on dolphins in Mamirauá. In between are people who have benefited from what is often a life-changing experience for them, will likely stay in science or animal work, and may or may not decide to return to dolphin or conservation projects. In terms of capacity-building, these numbers are small on a National or Regional scale, but the continuing existence of a cetacean research project of recognised international quality within Brazil is itself a significant enhancement of capacity. We hope and expect that the standards of excellence established here will be maintained, and will positively influence the many students likely to pass through the project in years to come.

There is no doubt at all that the Darwin Initiative support has resulted in greatly improved collaboration between the two institutions directly involved in this project, and this has spawned other links between UK and Brazilian institutions and individuals. Within Brazil, collaborations were built between the Darwin project and the Universities of Sao Paulo, Manaus, Goiãna and Rio Grande do Sul. On a more local level, the considerable interest generated by this Project brought in people from many diverse groups and institutions ranging from schools to local government, and they were often involved when national political figures (such as the State Governor and Federal President) visited, so I think it's fair to say that this Darwin Project did bring people from many different backgrounds and perspectives together, and hopefully facilitated improved understanding and collaboration.

The success of the whole Mamirauá project – the sustainable management of a floodplain reserve with local human population remaining in place – has a huge social impact on these people, and the dolphin work forms an integral part of that. The most obvious and direct contributions have been employment (research field staff, cooks, caretakers, boat drivers) and the important part our work has played in the success of the eco-tourism operation that is intended to provide the long-term financial underpinning of the entire Reserve. The dolphin project has yielded a protocol for tourist boats observing dolphins without adversely affecting them and contributions to information and publicity leaflets. The team routinely provided advice on where to go to reliably find animals, and gave talks to the guests about botos, their conservation, and the work done in Mamirauá with the support of the Darwin Initiative.

But it would be misleading to give the impression that the delivery of a Darwin Initiative Project to a remote, simple human community is entirely beneficial. I was, and still am to some extent, personally worried about the cultural impact that bringing money to an essentially non-cash economy can have. I have seen the destructive influence of western culture in Inuit communities in the arctic, and did not want to be responsible for diminishing the contentedness of the wonderful caboclo people in Mamirauá. Of course, change is inevitable and not necessarily a bad thing, but the rate of change can be corrosive. On the whole, I think that we did manage this issue sensitively, and I trust that the caboclos would agree, but I'm not sure that wealth necessarily equates to increased happiness in this (or perhaps any) culture. It is difficult to escape the reality of the cultural gulf between locals and incomers like myself, and the uncomfortable feeling that to succeed in a Project such as this is to impose some measure of cultural imperialism on people, even if they do welcome it.

In the case of Mamirauá Reserve, the Darwin Initiative finance was tiny in proportion

to the millions that had been attracted to the Sustainable Development programme as a whole, and the consequences of imported money would have occurred with or without the dolphin work. Furthermore, I am in no doubt that the conservation work undertaken there (including the dolphin study) is important and essential. Without it, the caboclo communities would not be able to sustain their way of life indefinitely, and the forest and its rich biota would be irretrievably damaged. Ultimately, Mamirauá is probably as successful an environmental programme as could be achieved, and does genuinely have the support of the local people. As an attempted resolution of the eternal Man v Environment conflict, it does appear to be succeeding.

6. Project Outputs

The results of the Darwin work have been disseminated in several ways. At local level, we had input to the Mamirauá newsletter which was circulated to all communities and researchers within the Reserve. At National level our work was the focus of a major TV documentary (Globo Reporter), and the HCPR sits on the committees of numerous Government agencies dealing with wildlife and environmental management. At international level, our results have been, and will continue to be, both published in the scientific literature and disseminated through talks at conferences for several years to come. The responsibility for continuing the dissemination of these results lies with the PL and HCPR, both of whom intend to continue with this work and seek further funding to allow this to happen.

7. Project Expenditure

	Staff	Rent/rates	Postage etc	Travel	Conferences	Equipment	Other	Total
Award								
Actual								
Diff								

Differences between the amount allocated to each financial category in the original award and that spent were minor (3% of the budget). They were due to lower overheads than expected, and the money saved was used to partially deal with slightly higher than expected salaries and miscellaneous other expenditure.

8. Project Operation and Partnerships

The main local partner throughout was the National Institute of Amazonian Research (INPA). During the period of the work, the Mamirauá Institute was formally founded and it provided both invaluable logistical support and some matching funds. Both of these Institutions play a key role in biodiversity issues in Amazonia and, because of the importance of the Amazon, in Brazil as a whole. INPA is a large multi-disciplinary research

laboratory based in Manaus. Its Director is appointed by the Federal Government in Brasilia, and the lab is seen as the primary source of research and advice on biodiversity and exploitation issues in the Amazonian region. This laboratory, through the efforts particularly of its Head of Aquatic Mammals Section (Dr Vera da Silva) and her staff, was a strong and active partner throughout the Darwin project. Indeed, the work would not have reached its successful conclusion, nor have been carried out as efficiently, without the daily input of this lab. The planning and execution of the entire project were carried out jointly by the PL and Dr da Silva, and almost daily e-mail or phone contact ensured that any problems were quickly identified and dealt with. In Brazil, and I suspect in most or all other South American countries, it would simply not be possible to carry out a project of this size and complexity without a strong and active local partner. The bureaucratic hurdles continuously thrown up by Government Departments, agencies, banks, insurance companies, couriers etc could only be overcome with experienced local people and usually with institutional backing.

One unforeseen boost for our work occurred when the Brazilian political landscape changed in 2002. A new President was elected, and chose as head of his environmental agency (IBAMA) the then Director of INPA, who had been a strong supporter of our boto work and the involvement of the Darwin Initiative.

There were no similar projects elsewhere in the host country, but we did collaborate with the University of Goiãna which had an interest in setting up similar work by inviting two of its graduate students to join the project as interns and learn how to do the work. This was very effective, and the two are now carrying out their own studies on the Araguia river in SE Amazonia.

Apart from the Host Country Partner, and my lab/University, the main international collaborators in this work were scientists in research fields not covered by Dr da Silva or myself. They included staff of the U.S. National Marine Fisheries laboratory and the University of Berkely, California.

The continuation of the Project work after the cessation of Darwin Initiative money has ensured that all stakeholders in the work have remained active and interested in its objectives. Key to this process is the continuing management of the Mamirauá Reserve itself, and the Institute of the same name that now oversees all research and implementation of management policies.

9. Monitoring and Evaluation, Lesson learning

The main strategy for monitoring and evaluation (M&E) of this project was the series of formal, frequent meetings (at least 3 times annually) between the PL and HCPR, at which every element of the project was analysed and discussed. At these meetings, progress was measured against 6-monthly targets, and a list of actions prepared for each member of the team. The M&E process was continuous between meetings, so problems could be identified and dealt with quickly.

Independent, informal, assessments were carried out by suitably qualified visitors to the project, who were asked to give an evaluation of areas within their realm of expertise

and appraise the PL or HCPR of, especially, any deficiencies they could see. The close association between this project and the scientific activities being carried out by the Mamirauá Institute resulted in frequent opportunities for assessments of this kind.

There was little formal evaluation of the work from within Brazil. I believe that the PL and HCPR maintained continuous and rigorous evaluation throughout, and the quality of the science was, and continues to be, evaluated in the international arena through publication and oral presentations.

One of the key lessons to be drawn from this project are that numerous pitfalls and frustrations lie in wait for those carrying out an operation of this size and complexity, and that success was achieved due to having (a) a strong, active and experienced HCPR, and (b) frequent (preferably daily) contact between the PL and HCPR by e-mail and/or telephone. The only times that problems became a threat to the proper development and success of the project were when communications were poor, such as when one or other of us was uncontactable for more than a week or e-mail links were down. Another important lesson for the PL was how to manage and lead a project in a developing country when that project was being judged, in terms of quality, productivity and value, by standards that are literally foreign to most people working within the project. This was an unrelenting issue, and the one which was responsible for most stress and tension between the partners and between the senior and junior members of the team. Without great care and sensitivity, this matter can quickly lead to destructive frustration on the part of the PL, and equally destructive feelings of cultural imperialism and being unvalued on the part of the host country participants. We overcame these difficulties by an often painful process of trial and error, especially in the early days, but here again frequent communication is essential. Small misunderstandings can grow into huge, long-term problems if they are not tackled very quickly. A successful PL must be a good and productive scientist, an organiser, a motivator, a communicator and a skilled and sensitive diplomat all rolled in to one. Such qualities are rarely found in equal measure in anyone, least of all this PL.

10. Darwin Identity

Publicity for the Darwin Initiative was given whenever the PL or any member of the team gave talks on our work (at anything from local level to international conferences), when the project was involved with the media (usually TV documentaries), and in publications arising from the work. I think it's fair to say that most or all of the people who came in to contact with the dolphin project were aware than it was receiving support from Darwin. Certainly, visitors to our field site would have been left in no doubt because the Darwin logo and name was prominently displayed on the front of our laboratory/accommodation raft.

Awareness of the Darwin Initiative in Brazil was and is poor. On hearing about our Darwin support, almost everyone in Mamirauá expressed no previous knowledge of the scheme. In contrast, the President of Brazil, who came to our raft during two visits to Mamirauá (one formal, and the second informal with his family), knew of the existence and objectives of the Darwin Initiative. Brazil is a huge country, and most people in the lower echelons of society know little outside their small sphere of experience. More senior people

generally have a much wider purview, and may therefore have come across the Darwin Initiative name in more than one geographical or policy area, so remember it.

The dolphin project was both an entity in its own right, with clear delineations and objectives, and also part of a much larger whole – the research team of the flagship Mamirauá Reserve. Being associated with the Mamirauá 'brand' was an enormous help in many ways. It generated extra financial support, publicity for our work, objectives and results, and an elevated platform from which to preach the merits of floodplain conservation and its importance for dolphins. The ability to talk to both the President of Brazil and the Governor of the State of Amazonas, and other high-level government officials, would not have come about without us being under the Mamirauá umbrella. That said, the dolphin project was thankfully semi-autonomous because of independent funding, was subsequently less hampered by petty bureaucracy and internal politics, and had a very distinct identity. Because of the high public profile of dolphins, our work became perhaps the best-known element of all Mamirauá science, with an image that benefited the entire enterprise.

11. Leverage

During the lifetime of this project, some additional funding was made available to expand the work by the HCPR, using both her own core budget from INPA and diverse other small sources over which she had control. Further support in kind came from INPA in the form of staff who were seconded to dolphin work for various periods.

The PL worked with the HCPR to solicit future funding for this project from several sources, and this process is ongoing. The HCPR had previously failed in several bids for research money from both national and international sources because of her poor publication record; the expectation of primary publications from senior scientists is far less in Brazil than the UK, and the pressure to publish is weaker. This is a problem when likely donors are mostly from rich, western nations with higher expectations of publication output to justify funding. As a result of the Darwin-sponsored collaboration, the PL and HCPR have jointly produced (and will continue over the next several years to produce) a number of papers in high quality, international peer-reviewed scientific journals, so prospects of future funding for the HCPR are now greatly improved.

During the course of this project, very considerable funds (> 1million USD) were successfully sought to support the overall running of the Mamirauá Sustainable Development Reserve and its biodiversity work, including the dolphin project. Among the various research projects carried out under the Mamirauá umbrella, the standard of excellence and productivity of the dolphin work was second to none, and this was acknowledged by the funding agencies.

12. Sustainability and Legacy

The scientific achievements of this project, the core of the work, should last for decades or centuries because they are incontrovertible discoveries that have become part of the biological and ecological description of the animals and the ecosystem. The management advice we have formulated should similarly stand the test of time, and we are

confident that it will result in real, practical differences in the way that Amazonian flooded forest is viewed and cared for in future decades at least. One of the reasons for this optimism is that dolphins are universally popular, high profile animals that provide a useful focus for conservation and sustainable management initiatives. Conversations with high-ranking policy makers, including the Brazilian President and the State Governor, indicated that a pink dolphin held in awe by Amazonian peoples is an easier 'peg' on which to hang perhaps unpopular management legislation than would be, say, fish or birds or terrestrial mammals. It gives the concept of Sustainable Development, the cornerstone of Brazil's Amazonian conservation policy, a recognisable and popular face.

The PL and HCPR have firm plans to continue the project after the end of Darwin support, so the staff and resources put together during this 3 year period should remain in place and continue to contribute both primary research and enhanced management advice to policy makers at all levels over the next few years. We have together developed a World-class project and team, and feel that it would be a terrible waste of investment, hard work and hopes if it were to close now.

As discussed above, the conclusions and consequences of this Darwin project are not short-term. The scientific discoveries have been, and will continue to be, published. But the practical application of the work – the building of our results and advice into Management Plans for floodplain habitats throughout the Amazon (and hopefully also in Asia) will we hope continue for decades at least. The legacy of the Darwin funding is therefore likely to be long-term and far-reaching.

The PL and HCPR began to search for funding to continue this research and conservation work from a variety of sources before the end of the Darwin Initiative support, and the effort continues. To date we have secured some financial support from Instituto Mamirauá, sufficient to cover the salary of the local people we employ and food for all field staff, but there is a shortfall of some 50% of the minimum amount required to keep the project running at its current level. The PL will cover the shortfall from his own pocket for 24 months, or until other support is found, whichever is the sooner. We feel that it would be a tragic waste to have to abandon this ground-breaking work after the huge investment of effort and resources that have built it into today's world-class project.

13. Post-Project Follow up Activities

We believe that the continuing output of scientific discovery and enhanced understanding of these dolphins greatly increases the legacy of the Darwin investment. Every day we build a more complete picture of the life of these populations – births and deaths, causes of mortality, effects of increased boating traffic and tourist activity, changing diet as fish populations rise and fall in response to management policies, use of dolphins as indicators of ecological change, and much more. Having established the infrastructure – a purpose-made accommodation raft with boats and engines, over 300 marked animals and several years of knowledge of their lives, a experienced team – we can continue to operate with about 35% of the money needed to set the project up in the first few years. We believe that this would represent outstanding value for money for the Darwin Initiative, allow it to reap further substantial dividends from its initial investment, and enhance its profile as a key contributor to the internationally renowned Mamirauá Reserve.

It is clear that the host country partner – INPA – has the capacity and intent to play a fundamental role in the project's continuation. INPA continues to support the work by providing salary to the HCPR (Dr da Silva) and some of her staff to work on the project, and by helping with field costs. With scientific publications now flowing, INPA has greater reason to remain involved and benefit from the international credibility that the work is generating. Recently, INPA signed an agreement with the Mamirauá Institute to formalise its continued involvement in the Mamirauá dolphin work. This is excellent news, because INPA is a Government lab with permanent representation on all the decision-making bodies that manage wildlife and environment in the Amazon, so the results of the work will reach the people who can make a difference.

14. Value for money

I have worked in projects large and small in collaboration with overseas scientists for 25 years, and I genuinely believe that the work carried out under this Darwin Initiative grant has represented the best value for money of all over this time. A crucial factor, of course, is that the exchange rate is favourable, so a pound sterling buys a lot more in Brazil than in the UK. A second factor is that the ratio of salaries to purchased goods is relatively low in Brazil, so a labour-intensive project such as this costs even less than it would in Europe, where salaries are relatively high. The third factor, and at least as significant as the first two, was management. This enterprise was carefully planned, efficiently organised on a day-to-day basis, and continuously monitored to detect and resolve problems before they could become damaging. The evidence for these strong assertions are in the outstanding research results to date, the legacy of a World-class ongoing study and 15 trained young scientists, the high profile gained for the study and the Darwin Initiative during this period, and the knowledge that the management advice developed is not only being put to practical use now in the vast tracts of rainforest covered by Mamirauá, Amanã and Jaú, but will likely continue to influence key policy decisions in the conservation of the Amazon for decades to come.

Author(s) / Date

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21 Dec 2003

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

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	**Project %**	**Article Description**
6. General Measures for Conservation & Sustainable Use	3	Develop national strategies which integrate conservation and sustainable use.
7. Identification and Monitoring	7	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	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.
9. Ex-situ Conservation		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		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	3	Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	60	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	3	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	3	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		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	3	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	3	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		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**	

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 (reduce box)	Detail (←expand box)
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	5
4a	Number of undergraduate students receiving training	6
4b	Number of training weeks provided to undergraduate students	150
4c	Number of postgraduate students receiving training (not 1-3 above)	10
4d	Number of training weeks for postgraduate students	250
5	Number of people receiving other forms of **long-term** (>1yr) training not leading to formal qualification(i.e not categories 1-4 above)	
6a	Number of people receiving other forms of **short-term** education/training (i.e not categories 1-5 above)	
6b	Number of training weeks not leading to formal qualification	
7	Number of types of training materials produced for use by host country(s)	
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	30
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	2
10	Number of formal documents produced to assist work related to species identification, classification and recording.	0
11a	Number of papers published or accepted for publication in peer reviewed journals	3
11b	Number of papers published or accepted for publication elsewhere	4
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)	0
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	0
14b	Number of conferences/seminars/ workshops **attended** at which findings from Darwin project work will be presented/ disseminated.	8
15a	Number of national press releases or publicity articles in host country(s)	4
15b	Number of local press releases or publicity articles in host country(s)	10
15c	Number of national press releases or publicity articles in UK	1
15d	Number of local press releases or publicity articles in UK	0
16a	Number of issues of newsletters produced in the host country(s)	4
16b	Estimated circulation of each newsletter in the host country(s)	2000
16c	Estimated circulation of each newsletter in the UK	
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)	3
18b	Number of national TV programme/features in the UK	1
18c	Number of local TV programme/features in host country	6
18d	Number of local TV programme features in the UK	0
19a	Number of national radio interviews/features in host country(s)	2
19b	Number of national radio interviews/features in the UK	0
19c	Number of local radio interviews/features in host country (s)	4
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)	7
21	Number of permanent educational/training/research facilities or organisation established	1
22	Number of permanent field plots established	1
23	Value of additional resources raised for project	60,000 UKP

Appendix III: Publications

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

*da Silva, V.M.F. & Martin, A.R. (2000). A study of the boto, or Amazon river dolphin (Inia geoffrensis), in the Mamirauá Reserve, Brazil: operation and techniques. Biology and Conservation of freshwater cetaceans in Asia. (Eds R.R.Reeves, B.D.Smith & T.Kasuya), pp121-131. Occasional paper of the IUCN Species Survival Commission no. 23. IUCN, Gland, Switzerland.

*Martin, A.R. and da Silva, V.M.F. (In Press). River dolphins and flooded forest: seasonal habitat use and sexual segregation of botos (*Inia geoffrensis*) in an extreme cetacean environment. Journal of Zoology.

*Martin, A.R., da Silva, V.M.F. and Salmon, D.L. (In Press). Riverine habitat preferences of botos (*Inia geoffrensis*) and tucuxis (*Sotalia fluviatilis*) in the central Amazon. Marine Mammal Science.

*Martin, A.R. and da Silva, V.M.F. (Submitted). Adornment in an aquatic mammal. Nature.

*Martin, A.R. and da Silva, V.M.F. (Submitted). Number, seasonal movements and residency characteristics of river dolphins using an Amazonian floodplain lake system. Canadian Journal of Zoology.

Appendix IV: Darwin Contacts

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

Project Title	**River Dolphin Conservation in Brazil**
Ref. No.	*162/07/035*
UK Leader Details	
Name	Dr Anthony R Martin
Role within Darwin Project	Project leader
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Fax	
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Role within Darwin Project	
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Partner 1	
Name	Dr Vera M F da Silva
Organisation	Instituto Nacional de Pesquisas Amazonas
Role within Darwin Project	Host Country Partner representative
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Partner 2 (if relevant)	
Name	
Organisation	
Role within Darwin Project	
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Fax	
Email	