

The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole Grants Director

Grant Recipient Details

Your name	Dr Hamish Campbell
Project title	Using <i>Caiman crocodylus yacare</i> as a sentinel species to monitor the environmental degradation of the Pantanal wetlands
RSG reference	59.05.08
Reporting period	September 2008 – September 2009
Amount of grant	£5956
Your email address	Dr.hamish.campbell@gmail.com
Date of this report	28/09/2009

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
The primary aim of this second project phase was to trial methodology – established in Phase 1 – upon caiman inhabiting environmentally degraded areas within the Pantanal wetlands.			X	The study concluded that caiman are an ideal sentinel species to monitor environmental degradation within the Pantanal, because they persist throughout the degradation gradient and show physiological effects which correlate with pollutant load.
Examine heavy metal load in caiman along gradient from point source			X	The caiman inhabiting these areas were found to contain higher levels of trace metals compared to caiman from unpolluted habitat. The increased toxicant load was observed in caiman captured up to 70 km from the contaminate point source
Examine anthropogenic organic compounds in caiman tissue		X		In this phase of the project we only had enough funds to examine heavy metal load within the tissue of caiman. The collected tissue has been safely stored and will be analysed when we have sufficient funds.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

The land upon which Phase 1 of this project was developed has been sold to new landowners. The new landowners are to change the land from seasonal grazing pasture to agriculture and have not permitted us to go onto their land to continue our monitoring work. This change of farming practice is a serious problem occurring throughout the Pantanal region.

We have taken the initiative to use this event to our advantage and we will directly quantify changes in the habitat quality of the area surrounding the farmland. Rather than being an inconvenience I see this as a timely opportunity to directly assess the effects of intensive agriculture upon the wetland inhabiting caiman.

3. Briefly describe the three most important outcomes of your project.

i/ As hypothesised, the study results found that caiman inhabiting rivers downstream from urban areas had higher levels of the heavy metals, copper, zinc, mercury, and cadmium stored within their fat, compared with caiman inhabiting unpolluted environments. The high toxic load was probably

acquired from ingested prey or carrion. Although the heavy metals had been sequestered by the caiman in stored fats, during periods of drought this fat with the heavy metal load would become mobilised. This may explain the large number of dead caiman found along polluted river systems towards the end of the dry season.

ii/ Caiman from polluted river systems also had higher levels of corticosterone in the blood compared with caiman captured from non-polluted areas, suggesting that these animals were in a state of increased physiological stress. Caiman from polluted river systems also had a lower body mass index compared to caiman from non-polluted sites, supporting a theory of reduced physiological health. This may be directly related to the heavy metal load but could also be due to other biological stressors such as pesticides, detergents and organic compounds. These were not measured during this study, but present an interesting avenue for future research.

iii/. A negative correlation existed between caiman heavy metal and the distance they were captured downriver from the town. Those animals captured within 10 km downstream had a 5-fold greater heavy metal load compared with caiman captured 60 km to 70 km downstream. Caiman 70 km downriver from the town did, however, still show levels of heavy metals within their fat which was higher than animals from unpolluted rivers. This result is important as shows that the run-off from urban development has the potential to cause detrimental effects on wildlife up to 80 km from the point source.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Local community members were hired for all of the field work, providing employment, albeit short-term. The study and its results have also been printed in the local language and posted around the community.

The study results revealed high levels of heavy metals within the Pantanal food web. Many of the locals feed on fish caught from within the river, and therefore the study has highlighted the need for water treatment facilities in the local area. It has also revealed that fish should only be captured at least 80 km from the pollutant point source or upriver of the town.

5. Are there any plans to continue this work?

Yes, this project has been successful in the development of low cost field methodology to assess the health and physiological condition of wild animal populations. We will continue to refine these methods.

The project has revealed the environmental degradation that is spreading into the Pantanal from a single urban development. There are a number of urban developments within the Pantanal, and the effects of these on the local environment require study. We also aim to examine the effects of agricultural run-off (herbicides and pesticides) on caiman health.

6. How do you plan to share the results of your work with others?

The environmental degradation problem within the Pantanal wetlands has been revealed to the scientific and conservation biology community through talks at international conferences (Society

for Experimental Biology, Conservation Physiology, Glasgow, UK, 2009) and peer reviewed publications related to this project. At the national level within Brazil we have shared the results from this study with the relative environmental and water authorities within Brazil (EMBRAPA). We have also made a number of publications in internationally peered review journals on the findings of this study. These are:

Campbell, H.A. (2009) A cheap and simple method for assessing the physical condition of a reptile population at remote field locations. *Comparative Biochemistry and Physiology, A* **153**, 60.

Franklin, C.E., Read, M.A., Kraft, P.G., Liebsch, N., Irwin, S.R. & Campbell, H.A. (2009) Remote monitoring of crocodylians: implantation, attachment and release methods for transmitters and data-loggers. *Marine and Freshwater Research* **60**, 284-292.

Campbell, H.A., Micheli, M.A. & Abe, A. (2008) A seasonally dependent change in the distribution and physiological condition of *Caiman crocodilus yacare* in the Paraguay River Basin. *Wildlife Research* **35**, 150-157

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

The RSG was used to fund three separate field trips which were undertaken throughout one year. The funds were sufficient to fund these trips and the project was completed within the allotted 12 month time span.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Travel	836	1140	+304	Required additional flight, made up from other budget
Subsistence	2400	2800	+400	Increase in food costs, made up with own budget
Hire of local guides	1460	1460		Determined before application
Equipment	700	950		Determined before application
Biochemical analysis	590	750	+160	Required some reagents not accounted for, made up from other budget
TOTAL				

9. Looking ahead, what do you feel are the important next steps?

I propose three main areas of project development. These are:

1/. Identification of anthropogenic organic compounds which may be impacting on caiman health. A 2003 biochemical analysis of sediment samples along rivers within the Pantanal recorded the following anthropogenic pesticides and herbicides; alachlor, sulphate endosulfan β -endosulfan,

trifluralin, metolachlor, metoxichlor, metribuzine, simazine, chlorpyrifos, p,p'DDE, p,p'DDT, ametryn, terbutilazine (Cunha, 2003). The use of these compounds is banned within Brazil but the lack of stringent regulation has allowed their continued use. By identifying the extent by which these compounds have bio-accumulated within the Pantanal food web – including human food sources- it is anticipated that greater control will be observed at the national level.

2/. Development of cheaper, more rapid, and simpler methodology and techniques for identifying the physiological status of individual animals and the overall health of discrete animal populations. These will enable non-scientists, including NGO volunteers to evaluate the health of local animal populations on very limited budgets.

3/. Engaging people at the local and national level to understand the problems of anthropogenic water contamination and the necessity of grey water treatment.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

The RSGF logo was used in slides for all talks delivered about the project. Acknowledgement of the Rufford Small Grants Foundation for supporting the project has been listed in the appropriate section of all publications.

11. Any other comments?

I would like to thank RSGF for their support, and for providing a platform for me to publish the study findings. Recently, I have been in talks with other RSGF awardees within South American about possible future collaboration. This would not have been possible without the great website that RSGF provides.