

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. The Final Report must be sent in **word format** and not PDF format or any other format. 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. Please note that the information may be edited for clarity. 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	Wilbert T. Kadye
Project title	Distribution patterns of non-native sharptooth catfish and threatened indigenous fishes: implications for species conserv in the Great Fish and Sundays Rivers, Eastern Cape, South Africa
RSG reference	45.08.09
Reporting period	January 2010 to December 2011
Amount of grant	£5844
Your email address	kadyew@yahoo.com
Date of this report	21st December 2011

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
To assess the distribution and abundance of non-native catfish and native ichthyofauna within the Great Fish and Sundays Rivers, Eastern Cape, South Africa			Fully achieved	Patterns in catfish distribution and abundance revealed an upstream to downstream gradient that was associated with spatial distribution of most species within the mainstream, and a mainstream to tributary gradient that was associated with the spatial distribution of native minnows. Catfish occurred widely within the mainstream habitats and decreased progressively along the mainstream to tributary gradient. The results suggest the proliferation of catfish and its probable impact within flow-altered mainstream habitats where invasion resistance was possibly reduced. There is also a likelihood and potential invasion risk from these mainstream habitats into headwater tributaries that are inhabited by native species such as chubbyhead minnow <i>Barbus anoplus</i> , and the endangered redbfin minnow <i>Pseudobarbus afer</i> within the headwaters of the Great Fish River and Sundays River, respectively.
To assess the critical habitats for threatened native species			Fully achieved	The population dynamics and size structuring of two native cyprinid minnows <i>Pseudobarbus afer</i> and <i>Barbus anoplus</i> , threatened by catfish, were examined within uninvaded headwater streams in relation to their proximate physical habitats. Their habitats were characterised by seasonal variation in physico-chemical conditions and a spatial variation in substrata compositions. There were no seasonal differences in density and capture probability for either species. The population size and density for <i>P. afer</i> was found to increase with increasing proportion of boulders. By comparison, <i>B. anoplus</i> population size and probability of capture increased with increasing proportion of bedrock and

				bank vegetation, respectively. Size structuring was explained predominantly by seasonality and habitat variables for <i>P. afer</i> and <i>B. anoplus</i> , respectively. These two species need to be continuously monitored and to be protected from catfish invasions.
To determine the feeding habits of non-native catfish within its invaded range			Fully achieved	Catfish feeding was determined and quantified using both traditional stomach content analysis and contemporary stable isotope analysis. The outcome of this study has been published in the journal <i>Biological Invasions</i> and the article is currently in press.
To determine the movement pattern and habitat selection by non-native catfish			Fully achieved	A study on acoustic telemetry was successfully implemented to determine patterns in movement and habitat utilisation by the non-native catfish within an invaded impoundment. Although catfish is a ubiquitous species, this study provided evidence that its habitat use was non-random. Catfish preferred shallow and structured river mouth habitat that was probably the most ideal for its breeding and feeding. This inferred potential overlap with native species such as moggel <i>Labeo umbratus</i> and suggested the risk of predation and competitive interference.

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

There was a slight delay in the implementation of the telemetry study. Since this was a crucial and costly component of this study, there was need to ascertain both its feasibility and practicality. This was achieved by participating in a number of telemetry studies with experienced researchers in the field. A small-scale pilot study was also conducted with the study species to determine its response and any adverse effect on behaviour and feeding following surgical implantation of acoustic study. All these studies became relevant during the implementation of the final study.

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

1) The acoustic telemetry study was, to my knowledge, the first for sharptooth catfish outside its native range. Such a study is essential in providing information about catfish's habitat use and, where possible, in mitigating its impact.

2) This study provided relevant information of the distribution and abundance of both non-native catfish and that of the native ichthyofauna. Assessing catfish feeding within its invaded range

provided information on its potential to homogenise biota as it is a generalised predator. As a result of this study, six manuscripts have been prepared for submission in peer reviewed journals. Of these, one has been published (see attachment), three have been submitted and the remaining two will be submitted before the end of the year.

3) This research forms part of my PhD study that commenced in February 2009 under the supervision of Professor Anthony J. Booth. The thesis was submitted on 13 December 2011.

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

This study engaged with several conservation agencies such as SANParks and the Eastern Cape Parks Board. The outcome of this research has and will continue to be availed to these agencies that are the custodians of this biodiversity through technical reports, workshops and peer reviewed publications. Various private landholders granted permission for this study, and every effort was taken to increase awareness on the need to conserve the fragile headwater tributaries where the native and endangered minnows occur.

5. Are there any plans to continue this work?

Yes. There is need to conserve the critical headwater habitats where native ichthyofauna occurs. There is also need to continuously monitor and eradicate catfish in certain habitats and monitor recovery patterns. The present study also showed that catfish appears to facilitate the establishment of multiple invaders within the study system and this hypothesis needs to be tested in order to conserve and manage future introductions.

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

The outcome of this study will be disseminated through workshops, seminars, technical reports and peer reviewed articles.

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

This study was conducted over a 3-year period (January 2009 to December 2011). The RSG grant was used for period of 18 months (February 2010 to July 2011). Additional funding was obtained from the National Research Foundation of South Africa.

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
Fuel and mileage	444	500	-56	More field trips had to be undertaken
Accommodation	900	1000	-100	
Mileage	900	1000	-100	
Telemetry study	3600	3340	260	
Total	5844	5840	4	

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

The endangered native minnows occur mostly within the headwater streams of the Study Rivers. Presently, there are no barriers to the upstream movement and potential invasion of these headwater streams. The next step therefore requires a proper management plan to protect these headwaters habitats. Construction of in-stream barriers has been recommended as an option to counter the movement of catfish into these habitats. Stakeholder participation is essential especially among the private land holders to increase awareness on the dangers of deliberate catfish introductions outside their range, which is becoming a common problem with anglers. Within the already invaded mainstream sections, effort needs to be taken to eradicate catfish where possible using non-destructive methods such as fyke nets and by using selective sampling gear such as long-lines to target catfish. More studies also need to be carried on the ecosystem impacts, especially from a trophic perspective within the invaded habitats.

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?

Yes, the RSG logo has been used in all presentations and workshops. Funding from RSG has been and will continue to be acknowledged in all publications arising from this work.

11. Any other comments?

RSG grant was not only crucial in the successful completion of this study but also provided an opportunity to implement a multifaceted approach and novel study techniques such as acoustic telemetry in the context of invasion biology in South Africa. These approaches are essential in understanding both invasion impacts and conservation of endangered native ichthyofauna. I therefore would like to express my sincere gratitude for such funding and hope that your continued support will make a difference towards the conservation of the fragile and endemic freshwater ichthyofauna of this region.

Update on publications in peer reviewed journals

Kadye W.T. & Booth A.J. (2012) Integrating stomach content and stable isotope analyses to elucidate the feeding habits of non-native sharptooth catfish *Clarias gariepinus*. *Biological Invasions*, **14**: 779-795.

Kadye W.T. & Booth A.J. (2012) Detecting impacts of invasive non-native sharptooth catfish, *Clarias gariepinus*, within invaded and non-invaded rivers. *Biodiversity and Conservation*, **21**: 1997-2015.

Kadye W.T. & Booth A.J. (2012) Movement patterns and habitat selection of invasive African sharptooth catfish. *Journal of Zoology*, (in press)

Kadye W.T. & Booth A.J. (2012) An invader within an altered landscape: one catfish, two rivers and an inter-basin water transfer scheme. *River Research and Applications*, DOI: 10.1002/rra.2599.

Kadye W.T. & Booth A.J. (2012) Inter-seasonal persistence and size-structuring of two minnow species within headwater streams in the Eastern Cape, South Africa. *Journal of Applied Ichthyology*, DOI: 10.1111/j.1439-0426.2012. 02027.x