



FIELD REPORT

Marketing title

Meerkats of the Kalahari

PI name

Professor Tim Clutton-Brock

Research site/ region

Kuruman River Reserve, Northern Cape

Country

South Africa

Research site latitude/ longitude

26°59'S, 21°50'E

Protected area status

Kuruman River Reserve - the site is privately owned and managed by the Kalahari Research Trust

18 February 2010

Period covered by this report.

From:

March 2009

To:

October 2009

Report completed by

Melissa Kotze, Megan Price, Tim Clutton-Brock.

Dear all

It feels like only yesterday that the first team of volunteers arrived at the KRR, yet here we are a successful and exciting couple of years later! Clearly, time flies when you're having fun!

Many thanks for your dedication to our research objectives: your many hours in the field and your many lines of data. But thank you too for all of your ideas, enthusiasm and encouragement. It is always a special and humbling experience to share the magic of meerkats with an eager new apprentice, and our team has had that honour 32 times this year!

It has been an immensely rewarding and productive experience to host Earthwatch teams at the Kuruman River Reserve, and we sincerely hope you all took with you as much insight and as many fond memories as we did by having you join us.

Yours sincerely

Tim Clutton-Brock, Marta Manser, Megan Price and Melissa Kotze

SECTION ONE

Top highlight

Our work has emphasised the extent to which the dominant female in each group controls the behaviour, development and reproduction of other group members. This year saw the publication of a general review of the evolutionary consequences of intrasexual competition between females (1). Other highlights included the publication of work on begging and its effects on helpers and breeders (2-4), the distribution of bovine tuberculosis (TB) in the population (5, 6) and the maintenance of cultural traditions (7, 8) as well as general reviews of the evolution of mammalian societies (9, 10) of cooperation between non-kin in animals (11) and female mate choice in mammals (12).

References:

1. T. H. Clutton-Brock, *Animal Behaviour* 77, 3 (2009)
2. J. R. Madden, H.-J. P. Kunc, S. English, M. B. Manser, T. H. Clutton-Brock, *Behavioral Ecology and Sociobiology* 63, 1259 (2009)
3. J. R. Madden, H.-J. Kunc, S. English, M. B. Manser, T. H. Clutton-Brock, *Proceedings of the Royal Society B* 276, 1255 (2009)
4. J. R. Madden, H.-J. P. Kunc, S. English, T. H. Clutton-Brock, *Animal Behaviour* 78, 85 (2009)
5. J. A. Drewe, G. S. Dean, A. L. Michel, G. P. Pearce, *Journal of Veterinary Diagnostic Investigation* 21, 31 (2009)
6. J. A. Drewe, A. K. Foot, R. L. Sutcliffe, G. P. Pearce, *Journal of Comparative Pathology* 140, 12 (2009)
7. A. Thornton, A. Malapert, *Proceedings of the Royal Society B* 276, 1269 (2009)
8. A. Thornton, A. Malapert, *Animal Behaviour* 78, 255 (2009)
9. T. Clutton-Brock, S. West, F. Ratnieks, R. Foley, *Philosophical Transactions of the Royal Society* 364, 3127 (2009)
10. T. Clutton-Brock, *Philosophical Transactions of the Royal Society* 364, 3229 (2009)
11. T. Clutton-Brock, *Nature* 462, 51 (2009)
12. T. H. Clutton-Brock, K. McAuliffe, *Quarterly Review of Biology* 84, 3 (2009)



Figure 1: Country map

Non-technical overview of results

Fieldwork at the Kuruman River Reserve (Fig. 2) has continued to monitor the growth, breeding success and survival of all individuals in seventeen distinct, habituated groups of meerkats (*Suricata suricatta*). In the two previous years, a number of our study groups became extinct or unhabituated and work in the past year has concentrated on increasing the number of groups we work with, which is now back to 2005 levels.

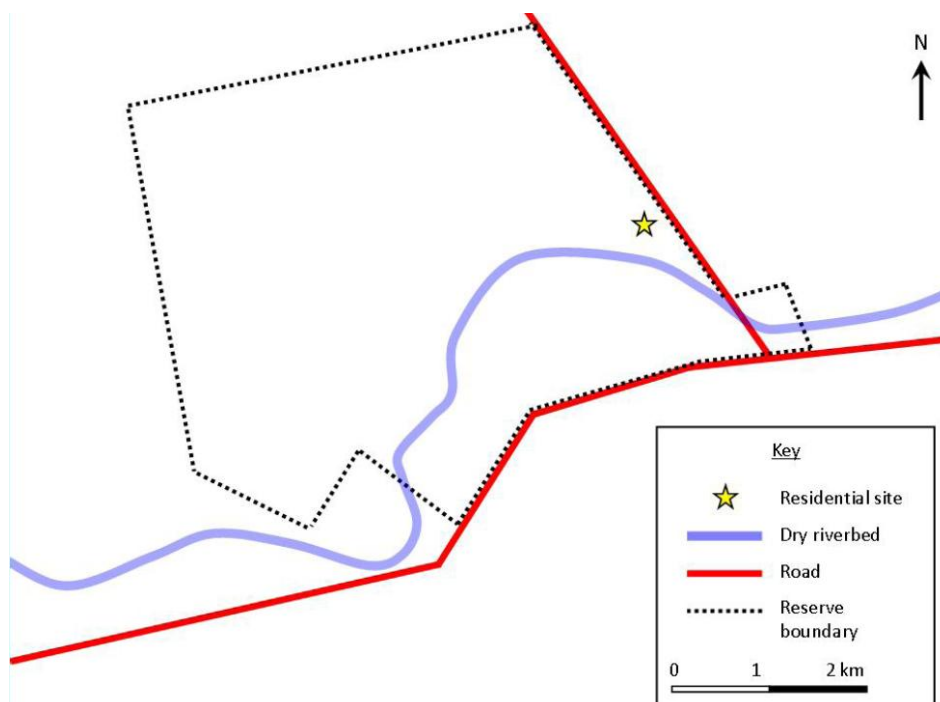


Figure 2: Research area map

Our research has continued to investigate the evolutionary causes and ecological consequences of animal societies, focussing in particular on the evolution of cooperative behaviour, using meerkats as a model. This year has seen the publication of several general reviews that set the results of our work in the context of other animal societies and derive general conclusions concerning their evolution and ecology. In particular, we have reviewed the evolution of cooperation between non-kin in animals and argued that it is maintained principally by mutualism (1). In addition, we have assessed the selection pressures operating on females through intrasexual competition and suggested that there are close parallels with the operation of sexual selection in males (2). Our work on begging has shown that begging rates reflect the hunger of pups and are used by helpers to adjust the frequency with which they feed them (3-5). Our ecological work has continued to explore the way in which population density is regulated and we have begun to structure the first quantitative models of the dynamics of the population. Finally, we have developed diagnostic tests for bovine TB in meerkats and other mongooses (6, 7) and used network analysis to investigate its transmission within and between groups (8).

References:

1. T. Clutton-Brock, *Nature* 462, 51 (2009)
2. T. H. Clutton-Brock, *Animal Behaviour* 77, 3 (2009)
3. J. R. Madden, H.-J. P. Kunc, S. English, M. B. Manser, T. H. Clutton-Brock, *Behavioral Ecology and Sociobiology* 63, 1259 (2009)
4. J. R. Madden, H.-J. Kunc, S. English, M. B. Manser, T. H. Clutton-Brock, *Proceedings of the Royal Society B* 276, 1255 (2009)
5. J. R. Madden, H.-J. P. Kunc, S. English, T. H. Clutton-Brock, *Animal Behaviour* 78, 85 (2009)
6. J. A. Drewe, G. S. Dean, A. L. Michel, G. P. Pearce, *Journal of Veterinary Diagnostic Investigation* 21, 31 (2009)
7. J. A. Drewe, A. K. Foot, R. L. Sutcliffe, G. P. Pearce, *Journal of Comparative Pathology* 140, 12 (2009)
8. J. A. Drewe, PhD thesis, University of Cambridge (2009)

Acknowledgements

The Kalahari Meerkat Project is supported by the University of Cambridge and collaborates with the Universities of Zurich, Pretoria and Cape Town. We are also grateful to staff from the University of Edinburgh for their contributions to genetic analyses and to members of the Smithsonian Institute, Front Royal, for their contribution to hormone assays. We express gratitude to local landowners J Kotze, P Kotze and F de Bruin for access to their land when our meerkats roam outside our Reserve boundaries.

Thanks must also go to the Van Zylsrus Intermediate School, library and women's needlework group for granting us opportunities to interact with their learners.

SECTION TWO - TECHNICAL RESULTS

1. REPORTING ON RESEARCH OBJECTIVES

Objective 1

How is population density regulated?

Progress towards/against objective 1

We have continued to monitor the growth, breeding success and survival of all members of seventeen different groups. Our work on the regulation of density is at two main levels: the regulation of group size and the regulation of population density. Our recent work on group size indicates that the frequency of eviction is the immediate factor limiting group size and that this increases once groups exceed 20-25 animals (1). As group size rises, dominant females appear to target less closely related animals and evict them at an earlier age than more distant relatives. Our current work is investigating how the frequency of establishment of new groups and the rate of extinction of existing groups changes with population density and we anticipate that this will show that changes in emigration rates (rather than changes in fecundity or survival) are the principal factor limiting local density and that density-dependent changes in the rate at which new groups are established also play an important role.

Reference:

1. T. H. Clutton-Brock, S. J. Hodge, T. P. Flower, *Animal Behaviour* 76, 689 (2008)

Objective 2

What effects does climatic variation have on recruitment and survival?

Progress towards/against objective 2

The last three years have been relatively wet, food density has increased and this has led to increases in the duration of the breeding season and the number of litters produced per year. Our long term monitoring of breeding success, growth (Fig. 3) and survival will provide the basis for an assessment of the effects of changes in rainfall on each demographic parameter and the effects of climatic change will be incorporated into an overall model of the dynamics of the population. While it is clear that rainfall has an important influence on reproduction, group size and population density, we have not yet investigated how the effects of climate and population density interact though we plan to do so in the course of the next year.



Fig. 3: Weighing meerkats (S.English)

Objective 3

How commonly does (a) human and (b) bovine TB occur in the meerkat population? Which categories of animals are most likely to be affected? What is the likely source of the infection?

Progress towards/against objective 3

Our work over the past two years has shown that all observed cases of TB in the population are of bovine not human TB and suggests that previous identification of TB from other mongoose populations may have been mistaken. We have developed and improved diagnostic tests (1, 2) for the disease and begun to investigate its transmission between groups (3, 4). Our work suggests that TB is probably caught from cattle and spread through the meerkat population by the movements of dispersing males. Its incidence does not appear to be density or group size dependent but increases at times (and in years) when food availability is low. We are currently assessing the relative frequency with which different age and sex categories are affected.

References:

1. J. A. Drewe, G. S. Dean, A. L. Michel, G. P. Pearce, *Journal of Veterinary Diagnostic Investigation* 21, 31 (2009)
2. J. A. Drewe, A. K. Foot, R. L. Sutcliffe, G. P. Pearce, *Journal of Comparative Pathology* 140, 12 (2009)
3. J. A. Drewe, J. R. Madden, G. P. Pearce, *Behavioral Ecology and Sociobiology* 63, 1295 (2009)
4. J. A. Drewe, PhD, University of Cambridge (2009)

Objective 4

To restore a degraded Kalahari cattle ranch so as to maximise biological diversity and to remove alien species

Progress towards/against objective 4

In collaboration with the 'Working in Water' programme established by the South African government, we have now removed mesquite (*Prosopis*) almost totally from the bed of the Kuruman River and have begun to clear the flats on either side. Our monitoring programme shows that *Prosopis* bushes with a trunk diameter of over 10cm commonly regenerate and require a second treatment within three years. We are also examining the effects of mesquite clearance on the growth and distribution of native trees (especially *Acacia erioloba*) but it is still too early to tell whether these are measurable. Other aspects of our ecological monitoring continue to measure the size and distribution of colonies of social weavers and the impact of climatic variation on colony size and number.

Objective 5

To generate a regular income from research and film making and to use part of this to employ and support the local community

Progress towards/against objective 5

We have removed domestic stock from 85% of the Reserve and replaced them with indigenous ungulates (eland (*Taurotragus oryx*), gemsbok (*Oryx gazella*), red hartebeest (*Alcelaphus caama*), blue wildebeest (*Connochaetes taurinus*) and springbok (*Antidorcas marsupialis*)). Working with a local culling company, we have established a regular off-take of all five species providing a supply of meat for ourselves and for the three families that we employ. The sale of meat also provides a small income for the Reserve.

We have also hosted film teams from South Africa, America and the UK for short periods. No major filming occurred this year but we are currently in discussion with Oxford Scientific Films regarding a new series and a possible 3D meerkat film for National Geographic.

We continue to employ all three families resident on the Reserve, providing jobs for six people. In the course of the year we have installed solar powered water heating in their houses and have continued to contribute to the education of their children.

Objective 6

To inform the broader community in the region of the Reserve with the results of our work and to discuss environmental issues with them

Progress towards/against objective 6

Our educational programme operates at three levels. First, we continue to maintain and expand our interaction with the Van Zyls Rus school through regular visits as well as through financial support. Second, we train 8-10 interns per year from Europe and Africa in field research techniques, analysis and project management. Third, we maintain an active web site (<http://friends.kalahari-meerkats.com>) that provides regular information on the movements, breeding success and survival of all individuals in the population. Over 200 subscribers pay a small annual fee for access and are then able to track individual meerkats throughout their lives. The information is used by a wide variety of individuals, including several schools. Finally, the television programmes and films we contribute to provide an understanding of the evolution and ecology of animal societies to a large audience. Meerkat Manor IV was shown in the UK this year to a regular audience of over one million viewers.

2. PARTNERSHIPS

We continue to collaborate with staff from the Universities of Pretoria, Stellenbosch and Cape Town as well as with staff members from the Universities of Zurich, Edinburgh and Exeter and the Smithsonian Institute. Professor N Bennett (Pretoria) processes blood samples for hormonal analysis; Dr S Monfort (Smithsonian) supervises the analyses of faecal samples for hormone metabolites; and Professor J Pemberton (Edinburgh) supervises the analysis of blood and skin samples to check paternities. We maintain less regular links with Northern Cape Nature Conservation; Northern Cape Raptor Conservation Group, the Kuruman Raptor Centre; the Tswalu Desert Reserve; and the Northern Cape Economic Empowerment Company.

3. PROJECT DEVELOPMENT

The main objectives of the project remain unchanged.

4. DISSEMINATION

Printed:

Drewe, J.A., Foot, A.K., Sutcliffe, R.L. and Pearce, G.P. (2009) Pathology of *Mycobacterium bovis* infection in wild meerkats (*Suricata suricatta*) *Journal of Comparative Pathology* 140: 12-24.

Cross, P.C., Drewe, J., Patrek, V., Pearce, G., Samuel, M.D. and Delahay, R.J. (2009) Wildlife population structure and parasite transmission: Implications for disease management. In *Management of Disease in Wild Mammals* (Ed R.J. Delahay) pp.9-29. Japan: Springer

Clutton-Brock, T.H. (2009) Sexual selection in females. *Animal Behaviour* 77: 3-11.

Madden, J.R. and Clutton-Brock, T.H. (2009) Manipulating grooming by decreasing parasite load causes unpredicted changes in antagonism. *Proceedings of the Royal Society B* 276: 1263-1268.

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Drewe, J.A., Madden, J.R. and Pearce, G.P. (2009) The social network structure of a wild meerkat population: 1. Inter-group interactions. *Behavioural Ecology and Sociobiology* 63: 1295-1306.

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Madden, J.R., Kunc, H-J.P., English, S., Manser, M.B. and Clutton-Brock, T.H. (2009) Do meerkat (*Suricata suricatta*) pups exhibit strategic begging behaviour and so exploit adults that feed at relatively high rates? *Behavioural Ecology and Sociobiology* 63: 1259-1268.

Madden, J.R., Kunc, H-J.P. Kunc., English, S. and Clutton-Brock, T.H. (2009) Why do meerkat pups stop begging? *Animals Behaviour*: 78: 85-89.

Thornton, A. and Malapert, A. (2009) The rise and fall of an arbitrary tradition: an experiment with wild meerkats. *Proceedings of the Royal Society B* 276:1269-1276.

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Drewe, J.A. (2009) Social networks and infectious disease transmission: Epidemiology of tuberculosis in wild meerkats. PhD thesis: University of Cambridge.

Madden, J.R., Drewe, J.A., Pearce, G.P. and Clutton-Brock, T.H. (2009) The social network structure of a wild meerkat population: 2. Intra-group interactions. *Behavioral Ecology and Sociobiology*. Advance online publication, doi: 10.1007/s00265-009-0820-8 <<http://dx.doi.org/10.1007/s00265-009-0820-8>>

Manser, M.B. (2009) The generation of functionally and motivational vocal signals in mammals. In *Handbook of Mammalian Vocalization*(Ed S.M. Brudzynski) pp. 477-486. Oxford: Academic Press.

Manser, M.B. (2009) What do functionally referential alarm calls refer to? In *Cognitive Ecology* (Ed R. Dukas and J.M. Ratcliffe) University of Chicago Press, Chicago pp. 229-248.

Clutton-Brock, T.H. (2009) Structure and function in mammalian societies. *Philosophical Transactions of the Royal Society B* 364: 3229-3242.

Madden, J.R. and Clutton-Brock, T.H. (2009) Calling in the gap: competition or cooperation in littermates' begging behaviour. *Proceedings of the Royal Society B* 276: 1255-1262.

Hodge, S. J., Thornton, A., Flower, T. P. & Clutton-Brock, T. H. (2009) Food limitation increases aggression in juvenile meerkats. *Behavioral Ecology*.

Clutton-Brock, T.H. (2009) Cooperation between non-kin in animal societies. *Nature* 462:51-57.

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Visual

Our website provides displays of recent photographs: <http://friends.kalahari-meerkats.com>

Digital

We maintain a fifteen-year database incorporating all individuals that have passed through the population which we share with collaborators.

Meerkat Manor IV was showing in the UK to a regular audience of over a million. Series I-III are regularly shown in other parts of the world. Our popular book (Meerkat Manor: Flower of the Kalahari) has now sold over 50,000 copies.

Meetings and conferences

Professor Clutton-Brock has presented plenary lectures based on our work at international conferences in the UK (Royal Society) and Zurich (Latsis Foundation) as well as national meetings (ASAB, Society for the Study of Social Insects). Professor Manser has also presented papers based on her work at four meetings within Europe, while students and post-docs working with us have presented a further twelve talks at a range of national and international meetings.

Educational resources

We have helped to provide teaching material to the Van Zyls Rus school and our website is used for projects by several schools in Europe and the US. In addition, we are collaborating with the Tropical Biology Association to develop teaching packs for field courses throughout sub-Saharan Africa.

5. CAPACITY DEVELOPMENT AND EDUCATION

Three local families reside and work on the Reserve. Their children are partially sponsored to attend school and higher education and are encouraged to pursue either a tertiary education or further educational training. Employees on the Reserve often attend training courses, including mechanic, first aid and fire fighting, to help them with their specific roles on the Reserve and to further their personal development. A working knowledge of car mechanics is also critical in a remote area where cars are exposed to extreme heat, corrosive sand and generally bad public roads. Nine interns have worked with us for at least twelve months each over the course of the past year. We have now trained over 100 in the course of the project. Around 30% of these have gone into full time research, 40% into conservation-related activities and 30% into other fields.

6.1. CONTRIBUTIONS TO INTERNATIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Our research has contributed to our general understanding of the ecology and conservation of cooperative breeders and other species where breeding success increases with group size (1).

Reference:

(1) F. Courchamp, J. Gascogne, L. Berek. 2008. Allee effects in ecology and conservation. Oxford University Press. 264p (2008)

6.2. CONTRIBUTIONS TO LOCAL, NATIONAL AND REGIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Our research contributes to the management of the Kuruman River Reserve but has not yet been used directly at a national level.

7. ACTIONS OR ACTIVITIES THAT ENHANCE NATURAL AND SOCIAL CAPITAL

The removal of mesquite (*Prosopis grandulosa*) contributes to water conservation; species management (cf *Acacia erioloba*) and the range of birds and mammals that depend on camel thorn trees and their fruit. Our outreach programmes to the local community have contributed to local awareness while our films and books have reached a worldwide audience. Our research provides a basis for understanding the population dynamics of cooperative breeders and planning feasible conservation strategies.

8. LONG TERM IMPACT OF PROJECT

Taxa of conservation significance enhanced, restored or maintained

- (1) Kalahari meerkat: ecologically significant; improved understanding of population dynamics and incidence of bovine TB.
- (2) Yellow mongoose: ecologically significant; improved understanding of population dynamics and incidence of bovine TB.
- (3) Slender mongoose: ecologically significant; improved understanding of population dynamics and incidence of bovine TB.
- (4) South African ground squirrel: ecologically significant; improved understanding of population dynamics and incidence of bovine TB.
- (5) Pangolin: vulnerable; monitoring of sightings.
- (6) Social weavers: ecologically significant; improved understanding of population dynamics.
- (7) Camel thorn: ecologically significant; monitoring growth and distribution.

Habitats enhanced, restored or maintained

Much of the Kalahari has been degraded by over-farming and the invasion of alien species. Within the local area, the Kuruman River Reserve is the only area of protected land and is surrounded by farmland on all sides. The rehabilitation of farmland to natural semi-desert status is a process set in motion by the creation of this Reserve and can serve as an accurate documentation of the natural restoration process. Our work has involved the regular removal of invasive alien plants, reducing over-grazing and re-introducing native ungulate species.

Ecosystem services enhanced, restored or maintained

We have restored indigenous populations of ungulates and used them to provide a regular meat supply for local people. In the long run, our restriction of fire and the clearance of mesquite will contribute to the density of *Acacia erioloba* woodland and thus to carbon sequestration by indigenous species.

Cultural heritage enhanced, restored or maintained

We have protected and maintained grave sites from the colonial and pre-colonial periods.

Livelihoods enhanced, restored or maintained

Five people from three families reside on the Reserve and are employed long-term, with other family members occasionally assisting in these roles or fulfilling other roles. Employees and their children and grand-children have access to better education and training than they otherwise would have done if the project was not conducted on the Reserve.

Photos:



Meerkat (*Suricata suricatta*) group (S.English)



Rondavel accommodation on the Reserve (S.English)



Sunset in the Kalahari (S.English)