

CROP PROTECTION PROGRAMME

Technology transfer and promotion of ecologically-based and sustainable rodent control strategies in South Africa

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FINAL TECHNICAL REPORT

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Executive Summary

Rodents are a long-standing problem throughout the world which disproportionately affect the rural poor through consuming and contaminating stored food, damaging field crops, transmitting diseases and degrading the built environment. In Africa, rodents are by far the greatest vertebrate pest problem.

This research project was based on developing sustainable strategies for rodent management in rural communities of South Africa. By working with target communities as well as the traditional rodent management service providers (Environmental Health Officers, Agricultural Extensionists, and the commercial pest control industry), the project developed novel methods and strategies that were researched and evaluated for their cost-benefits and ability to effectively deal with rodent pest problems as experienced by rural agricultural communities. This research was done in collaboration between UK and South African scientists as well as the key stakeholders (end users and service providers). Many of the activities presented in this report are novel, with all data presented having been collected by project-funded staff. The project worked in close collaboration with the EC-funded RATZOOMAN project, which focused upon rodent zoonosis impacts and risk reduction in southern African countries.

The project activities were focussed on generating new knowledge with regard to understanding the impact of rodents on rural agricultural communities, trialling potential rodent management techniques, working with stakeholders to improve the relevance of rodent management services, and recommending policies that would help reduce long term trends of increasing rodent pest problems.

The research findings showed that rodents have multiple impacts on the livelihood of rural communities, which include biting people, damage to property, and damage to crops in fields and in storage. Although farmers had a general awareness about rodent control tools such as rodenticides and traps, knowledge on the correct and effective use thereof was lacking.

The management strategies tested were to reduce rodent populations through intensive trapping. Trap success from break back traps in and around 80 households and 4 crop fields over a continues period of 18 months has demonstrated to the communities and government agricultural extension the effectiveness of trapping as rodent control management tool, as well as the efficacy of the break back trap. Severe drought conditions during the assessment period prevented reliable results of rodent damage to crops in storage. Damage to maize in crop field without trapping however ranged from 10% to 28%.

Results from a market survey indicate that most known rodenticide brands were available from retailers, but that neither the retailer nor the villagers had knowledge in their effective application. The anthropological and socio-economic studies indicate that regular contact between rodents and villagers increases the risk of zoonotic diseases transmission.

The results of the project were discussed with the stakeholders and major role players such as the Department of Agriculture and the Pest Control Services Industries Board respectively. An invitation by the latter to revise the current rodent control curriculum demonstrates their willingness to improve present rodent control training.

Of appreciable scientific value was the discovery of the oriental rat, *Rattus tanezumi*, a first recording of the species in Africa, and the grooved-toothed mouse, *Pelomys fallax*, a first recording in South Africa.

Project results were presented as oral papers at workshops with stakeholders in the industry as well as at scientific symposia.

Background

In Africa, rodents are by far the greatest vertebrate pest problem (Makundi et al., 1999). The management of rodents has focused on conventional methods, mainly the use of rodenticides as a symptomatic treatment approach. These methods are supported by government, especially to contain outbreaks. However, conventional control methods have remained largely ineffective (Van den Oever & Segeren, 1997; Shangula, 1998). Recent studies on rodent ecology in East Africa have enabled the development of models to forecast outbreaks. These, when incorporated in development and implementation of control activities, may assist in alleviating the damage and losses due to rodents in the future (Leirs et al., 1996; Leirs, 1999). Research on the ecology of the main field rodent species found in Africa, the multi-mammate rat *Mastomys natalensis*, is well-known, particularly in Tanzania, and its role in crop damage and plague transmission (Makundi & Kilonzo, 1994; Christensen, 1996; Leirs et al., 1996). Beyond the work in Tanzania, there are few studies which have attempted to develop rodent management strategies for field rodent pests.

In a Participatory Rural Appraisal (PRA) needs assessment conducted with subsistence and small-scale farmers in the Limpopo Province, damage by rodents was listed as an agricultural constraint (Von Maltitz *et al.*, 2001). The PRA survey was conducted in six villages during the out of season period after harvesting. The six villages were randomly selected from the three districts of the province with the highest populations of small-scale or resource-poor farmers. Each community was asked to list their agricultural constraints, which were then ranked separately by men and women in the community. In the survey on crop post-harvest constraints, maize and sorghum farmers ranked rodents after insect pests in storage as the biggest problem. Rodent damage to stored millet, groundnuts and legumes was also ranked as the first or second most important problem. Farmers of the Nkomo-B village in the Mopani district specifically ranked rodents as their major post-harvest constraint.

Household questionnaire surveys that specifically dealt with rodent problems indicated that 40% of respondents used a preventative method against rodent damage. The most common method was the occasional single-dose use of a chronic rodenticide in and around the house and food store.

In November 2001, Dr Steve Belmain (NRI), who was then completing a research study in Mozambique (DFID project R7372, ZB0146) on the impact of rodents on food security there, was invited by PPRI to make an initial assessments on the rodent problem and make recommendations as how future rodent pest control strategies could be developed and tested, while on a visit to four villages surveyed in the PRA (Von Maltitz *et al.*, 2002).

A questionnaire survey on rodent activity was conducted with households in Nkomo-B village in November 2001. The main rodent problem mentioned was storage losses, farmers estimating crop losses to be about 50kg of stored maize per month. Rodents were also noted to feed on the crop in the field (maize and bananas), cause damage to buildings, granaries, furniture and household belongings.

Rodents also bite people at night in their sleep. However, in comparison to research in Zambézia Province, Mozambique, the incidence of rodents biting people appeared to be relatively lower in Limpopo Province (Belmain, 2002). Farmers knew little about the source of these rodents and how to control them. Post-harvest hygiene and waste management was a problem and agricultural waste was often left in the yard, providing shelter for rodents. The control of rubbish needed to be approached at community level for it to have sustained impact on rodent numbers. Open structure granaries used for maize storage were raised less than one meter from the ground, allowing rodents free access. Existing structures would be difficult to rodent-proof without major design changes. However the outputs from a DFID project (R6685) on improved storage structures in Zimbabwe was utilised. Mr Chigariro from the Institute of Agricultural Engineering in Harare, Zimbabwe, was invited to demonstrate the construction of such a 'rodent-proof' granary platform with the use of concrete-filled PVC posts, at a

farmer's day arranged for this in Nkomo-B (Von Maltitz *et al.*, 2002; 2003). Trapping results from a short period three-night trial in four villages and followed by a pilot trial conducted for three weeks in 2002 in the village of Nkomo-B surprised villagers and local extension personnel alike on the high rodent population present.

The objective of the project was to create market-led promotion of cost-beneficial strategies that are to be sustainably implemented by resource-poor farmers. By assessing the impact which rodents have upon sustainable rural livelihoods, control strategies can be devised a/or adapted and applied in a sustainable manner. By analysing collected information and data, the economic aspects of damage and control was determined. Information benefited the research component of the collaborating Institutes and Universities. Results are incorporated in the training of extension services and are taken up in the curricula of the Universities involved. Project outputs are also to the benefit of the Department of Health. Rodent control as a part of crop-protection expanded the potential of the ARC-PPRI leading in this pest control field in South Africa.

Project Purpose

The Limpopo Province has been identified as one of the poorest of the South African Provinces where food security is a major issue. This project addresses many of the Presidential imperatives (Agricultural Research Council, 2001) such as rural development, job creation and urban renewal. Further, by applying the outputs of previous research in Mozambique (R7372), this project contributes towards regional integration aiming at developing an equitable, balanced region within the Southern African Development Community (SADC) States. The purpose of this project was, therefore, to develop and promote strategies to minimise the impacts of rodent pests, in a sustainable and environmentally benign manner, for the benefit of rural poor households and farming communities.

To fulfil the project objectives, five major project activities were conducted to:

1. Assess the impact of rodents on rural communities' sustainable livelihoods in 3 districts in the Limpopo Province.
2. Assess impact of rodent management strategies on these rural communities.
3. Market surveys and socio-economic assessments.
4. Disseminate results of assessments through a publicity campaign on management strategies.
5. Development of policy framework for supplying rodent control programmes.

Research activities

Criteria on rodent impact and rodent management impact studies were set up after a preliminary short trapping trial was conducted in four villages in the south and east of the Limpopo Province, and a follow-up pilot trial in the village of Nkomo-B in 2002. The criteria were:

- Conduct intensive trapping in households for a continual period of at least one year
- Compare households with intensive trapping with a group of households with a three-day trapping period as the control.
- Conduct trapping in crop fields for at least a one year period
- Impact assessment of rodents on crops in storage.
- Standardise trapping to 10 traps per household.
- Train village trappers (field staff) to execute trapping and record data.
- Involve and train government extension staff linked to the survey villages on the tasks assigned to village trappers, to be abreast of activities and to convey progress to other areas.
- Record range of data to include, for species identification, the collection and preparation of material.
- Rodent control trials to be household/community managed with regular feedback to community.
- Conduct market survey to determine rodent management tools available
- Select at least three villages to represent the survey area, where it was possible to conduct and to demonstrate trapping, with the participation of households/community, based on
 - rodent activity noticed in the pilot trapping trials,
 - location in geographical and vegetation veld type (arid, sub-tropical, mountainous, grassveld, bushveld) and proximity to urban areas (rural, peri-urban).
 - Staple crop production (maize and sorghum).

The villages selected were Mapate (Vhembe district), Nkomo-B (Mopani district), GaPhaahla and Bloublommetjieskloof (both Greater Sekhukhuni district).

The five major project activities conducted to achieve the outputs for the project are:

- Assess the impact of rodents on rural communities' sustainable livelihoods in 3 districts in the Limpopo Province.
- Assess impact of rodent management strategies on these rural communities.
- Market surveys and socio-economic assessments.
- Publicity campaign to disseminate results of assessments on management strategies.
- Development of policy framework for supplying rodent control programmes.

1 Assessing the impact of rodents on rural communities' sustainable livelihoods.

Introduction

Issues researched should be relevant to the needs of the community. For communities to understand and partake in a research project, it is necessarily for the researchers to understand the community's needs, knowledge, attitudes and practices relevant to the project. For pest management to be sustainable in an agricultural community, it must be informed by farmer knowledge, attitudes and practices (KAP) that are relevant to the pest. Improving or adapting an existing management system may be more effective than introducing a foreign strategy.

At the start of the project in 2002, meetings with the communities of the selected villages were held to explain and discuss the proposed rodent research activities and surveys. Project staff were introduced and visiting collaborators were also introduced to the communities at later meetings arranged for this purpose. Community response was keen and their general perception of the proposal was that the project was a follow-up of the previously conducted PRA survey and projects (DFID R7777 and ZB0242).

Material and methods

In each village twenty volunteer households were randomly selected to represent the variety of aspects in a village concerning household structure, storage practices, crop production systems and social and economic status. Village volunteers and/or nominated candidates were selected to actively participate in the assessment of the impact studies and to commit to for the duration of the project. The candidates to serve as project field staff were trained in the skills needed for the execution of the trapping trial as described in chapter 2.

The impact of rodents on the livelihoods of households and farmer knowledge was assessed by a household questionnaire survey with the twenty households in each of the four villages in August and September of 2002 (Figure 1.1).

Results

Farmers and homeowners indicated that rodents were in general a problem for everyone. It was stated "rats eat food, eat clothes and bite people". The results are summarised as a list of rodent induced problems in Table 1.1 and are further discussed under the headings of rodent impact on food storage, field crops, human health and other damages and rodent control options.

Rodent damage to food storage

The biggest problem mentioned by respondents was the damage rodents caused to stored grain (Plate 1.1). Farmers who store grain in bags estimated a loss of about 20kg to even 80kg per season. However farmers storing maize on the cob in granaries could not quantify losses, except saying that it was "a lot", as they could also not quantify loss due to spillage and chickens or normal consumption. At the time of the survey, most farmers had very little maize in their granaries due to a poor harvest during the previous season. Few farmers used granaries and at Nkomo the little maize yield was more often stored in bags in the house than in the granaries by those that had granaries.

Table 1.1 Damage caused by rodents listed by the number of households from the different villages surveyed in the Limpopo Province.

Rodent damage to:	Nkomo-B	GaPhaahla	BBKloof	Total %
Clothes / shoes	13	18	15	76
Bedding	-	-	12	11
Furniture	3	6	-	20
Electrical /vehicle wiring	2	-	2	8
Structures/houses	4	12	11	42
Crops in storage: grain	10	20	20	77
Maize	7	-	-	
Groundnuts	3	-	-	
Sorghum	0	16	-	
Millet	0	14	-	
Crops in field	5	11	12	47
Eat /spoil food	18	6	15	65
Chicken feed	2	-	-	4
Contaminate water	-	6	9	15
Damage by contamination	-	-	12	12
Bite people	16	10	13	69
Bite chicks	2	4	-	12

Rodent damage to field crops

While 77% of respondents indicated rodent damage to crops in storage (specifically maize, sorghum, millet and groundnuts), only a half of the respondents mentioned rodent damage to crops in the field. More farmers from the villages in the arid south producing sorghum and millet indicated incidences of rodent field damage than maize farmers from the northern and eastern regions. Rodent activity and damage around the homestead is more obvious than out in the fields, thus farmer communities perceive rodents as a household pest. Although farmers could not estimate what field crop losses were due to rodents, one farmer suggested a loss of 100kg maize a year. No farmers however took any action in combating rodents in fields. At Mapate, losses were indicated to be at planting, rodents digging up maize seeds, and again later at the heading stage when cobs were damaged (Plate 1.2). Farmers further indicated sporadic damage by rats to vegetables and fruit in gardens around the house.

Rodent effect on human health

A high proportion of respondents (69%) mentioned that "rats bite people" at night in their sleep. The numbers varied from one to three times a year to even four incidences a month, but it was not determined if the incidences were in the household or if it was generalised. In the socio-economic survey conducted in Mapate village (see chapter 3), five percent of the respondents indicated that their family members have been bitten by rodents, which may be a fair reflection. Most bite marks were indicated to be on the tips of toes, fingers or soles of the feet. Some mentioned that rodents regularly nibble on human fingernails and toenails.

Rodents as carriers of diseases transmitted to humans are responsible for considerable economic loss in terms of decreased worker productivity and health care-cost (Mills, 1999). A review published in 1995 described about 60 zoonotic diseases for which rodents serve as hosts for the etiologic agent (Hugh-Jones et al., 1995). The magnitude of the potential for human disease involving rodent-borne agents is largely unknown (Mills, 1999). In the preliminary results from more than 200 rodent sera collected from households in Mapate during 2003-2004 and analysed for antibodies to zoonotic

diseases in the INCO-DEV Ratzooman project, 6.74 % tested positive to Leptospirosis and 18.4 % were positive to Toxoplasmosis (Belmain, 2004).

About two thirds of respondents indicated that rodents ate food in the house or kitchen. Although most households daily prepare cooked meals (more households cooked over a fire than with electricity or other fuel), food such as porridge and cooked vegetables are often left uncovered in the kitchen for the next morning (Plate 1.3). Some households indicated seeing signs of rodent activity, such as hair and faeces, near food.

Respondents from the village of GaPhaahla collected their household water from fountains or the river and two households bought water in containers. Respondents from the other three villages all stated having access to tap water either through standpipes at key points in streets or in the yard. Some houses at Bloublommetjieskloof pumped water from bore holes. Most stored water in plastic containers or clay pots either inside or outside the house. The majority of those with access to tap water washed clothes at home, while most households in GaPhaahla washed clothes in the river. Of the households that stored water, 15 % mentioned that water was sometimes spoiled by rodent hair.

Agricultural waste and household waste was usually dumped in the yard, either in a pit or open areas where it would sometimes be burned (Plate 1.4). The few farmers who owned cattle kept them overnight in enclosed areas in the yard.

Other rodent damage

Rodents were further implicated as to damaging and urinating on clothes, blankets and bedding (± 76 % of respondents) and furniture (23% of respondents) while 42% of respondents pointed out structural damage such as rodent entrance holes and tunnels in their houses.

Rodents were also stated to bite chicks and cause damage to the wiring of vehicles. A number of respondents indicated contamination through rodent droppings and hair in water, food and in containers, as well as rodents urinating down walls and on household articles.

The majority of respondents indicated that rodents eat anything and the reason why households should try to control them is because "rats damage household properties and it is not healthy to live with rats in the house". A few respondents also indicated their fear of rodents and some suggested rodents may even cause or transmit diseases.

Rodent control

A third of the farmers perceived that rodents mostly lived in holes in the houses, a third indicated rodents to be in the kitchen, storerooms, old cars and in the roofs while a third did not know where the rodents were. Households mostly noticed rodents at night or after sunset, while some stated that rats are seen during night and day. Most homeowners positively identified rats (*Rattus* sp) as the type of rodent visible in and around homesteads, while villagers in Mapate also mentioned seeing striped-mice (*Rhabdomys* sp) in the bush during the day. Respondents indicated that rodents came from the hills or bush to the houses during harvest. Most households did not differentiate between rats and mice except for size.

Rodent control was only applied in or around the homestead. Of the respondents, 62% stated the use of "rattex", and two thirds of those using "rattex" also stated that it was ineffective. The trade name Rattex® has been on the market for a long time. The ready to use bait in pellet format is a difethialone based rodenticide. When the active ingredient was changed from brodifacoum in the 1990's, the trade name was kept. Most households refer to rodenticides as rattex (see Market survey, chapter 3.). A few

households expressed a fear of rodenticides as small children could mistake the colour of the pellet bait (bright pink) for sweets.

Three households stated the use of a cat as a rodent controller while 20% of respondents said they were unable to control or did not apply any rodent control. On the question of what households did with rodents caught, 62% replied that they buried the bodies, 23% threw the bodies away, either over the fence or down the pit latrine, those with cats fed them to the cats and one household stated burning the bodies. None indicated that rodents were eaten and when they were asked if they ate rats, most were disgusted and some even surprised that there could be people that ate rats. Some indicated that certain "rodents were known to be edible", such as the greater cane-rat *Thryonomys swinderianus* (family Thryonomyidae), but they perceived those animals very different to "rodent pests of households".

When households were asked for recommendations on how to control rodents, 77% of respondents stated they had no idea, but three respondents suggested the combined use of rodenticides and trapping.

Discussion

Rodents and their effect on the livelihoods of Limpopo subsistence agricultural communities is a reality. The impact of rodents on the livelihood was summarised as that rats eat food, eat clothes and bite people. However for many individuals the rodent problem has been there for so long that many have become used to living with rodents. Although commensal rodent species were recognised it was perceived that rodents were living in the natural vegetation and came in with the harvest. There is a general awareness about rodent control tools such as rodenticides and traps, but the knowledge on the correct and effective uses thereof is lacking. Rodent control practices applied are only curative, when the damage has already been done. Where a chemical treatment has failed, it is dismissed with the statement that the chemical is "not effective" or when the trap is bare it is agreed that rodents are very clever.

The challenge of this project was not to introduce new rodent management tools, but the demonstration of the correct and sustained application of existing methods.

Figure 1.1 Questionnaire survey of rodent impacts and farmer knowledge

1. Gender and age group of interviewed person(s)
- assign number to household
2. Gender and profession of head of household
3. Number of people living in the building(s) to be assessed
4. Land cultivation
5. Do you have problems with rodents?
- List sort of problems
6. Farmer estimate of losses caused by rodents
7. Farmer control options used and impact on rodents
8. What sort of rats, where do they live, when are they seen?
9. What do they do with rats caught?
10. Water:- source, storage, cooking, wash of clothes
11. Waste:- where is agricultural waste, food waste, human/animal waste?
12. Farmer's recommendations on how to solve rodent problems



Plate 1.1. Rodent damage to food storage; entry holes in the base of a dulu granary



Plate 1.2. Rodent damage to field crop; damaged maize cob at heading stage.



Plate 1.3. Food preparation in a closed kitchen. Rodents contaminate food left overnight in the kitchen



Plate 1.4. Household waste is often dumped in open areas

2. Assessing the impact of rodent management strategies on rural communities sustainable livelihoods

2.1 Baseline data

Introduction

A number of trials and activities were undertaken to obtain scientific baseline data on rodents and to understand the effect of rodent control on the livelihoods of communities. Rodent trapping was done to collect data on rodent taxonomy, monitor prevalence and breeding in different habitats in and around rural villages. Trapping also determined the effectiveness of the break back traps and demonstrated the effectiveness of intensive trapping to communities. Rodent damage to food crops in the field and losses of food in storage were assessed, and an ecological study of rodent populations in crop fields was conducted over a two-year period.

Material and methods

Village volunteers, students (project field staff) and government extension officials allocated to the survey villages, underwent a training course in August 2002 in Pretoria (Plate 2.1). The course covered theoretical and practical aspects of rodent biology, ecology, identification, rodent zoonosis, dissections, data recording, handling of trapping equipment and human safety aspects.

A second training course was presented to field staff members, responsible for the execution of the trapping in the villages, in February 2003. This course focussed on dissections in line with the INCO-DEV Ratzooman project (Plate 2.2). Research activities for the Ratzooman project were conducted in one of the villages in Limpopo.

Project staff maintained regular contact with the field staff as a means of monitoring the accuracy of data and to be aware of trends or developments. Collected data was also discussed with field staff enabling them to share information between the village communities and project staff. Random inspection of traps, trapping location and trapping procedure, as well as other equipment was undertaken. Broken or missing traps and equipment were repaired and/or replaced.

Trapping was done in four villages from three districts in the Limpopo Province; Mapate village in Vhembe district, Nkomo-B in Mopani district, GaPhaahla village and the Bloublommetjieskloof community in the Greater Sekhukhune district. Baseline population data of rodents inside houses and from field crops were obtained from August 2002 to March 2004. Rodent zoonosis baseline data for the INCO-DEV Ratzooman project was collected from August 2003 to November 2004 in Mapate, while a two-year rodent ecology trial in crop fields near Mapate is to continue to September 2005 (Map).

Baseline population data

Twenty households and one crop field from each of the four villages were randomly selected (as described in chapter 1). In collaboration with home-owners, premises and structures of the homestead were inspected for signs of rodent activity and for sites for best possible placement of traps. In each of the twenty households, ten break back traps (big snap-E® trap, Kness Manufacturing Ltd., USA) were placed at these indicated sites such as along interior walls and places where food was stored. The home-owner or a person in the household designated to manage the traps was given training on the correct setting of the traps and instructions to activate them each evening (Plates 2.6 and 2.7). Homesteads were randomly assigned to either the treated or untreated (control) group. Homesteads in the treated group continued to trap with ten traps every evening for the duration of the trial. In the untreated (control) group trapping was done once a month for three consecutive nights for the duration of the

trial. For this group all the traps were removed from the households after a trapping session. Traps in households were baited with material available at the trapping site such as maize kernels, pumpkin-seed or left-over porridge.

Baseline population data of rodents in crop fields were obtained for a period of three consecutive trapping nights every month. Trapping was conducted in the same crop field each month without interfering with the normal local small-scale cultivation practices. A grid arrangement of three trapping lines with 15 trapping stations each was used, with a distance of 10 m between the lines and rows of the grid. Three traps were placed per trapping station for a total of 120 break back traps in each field. Traps were baited with peanut butter and maize or pumpkin-seed.

Homesteads and fields were visited each morning after a trapping night, to record the number of rodents, sex, reproductive condition, weight, body length, species of rodents caught and location of trap (Plates 2.3 to 2.5). All mammals trapped were tagged and collected for identification. The skulls were detached and prepared as study material and sent to the Transvaal Museum for cleaning and curating. Specimens of the genera *Mastomys*, *Aethomys*, juveniles and rodents that could not easily be identified in the field, were further dissected for organ tissue. The organ tissues (hearts, kidney and livers) were preserved within 95% ethanol in vials. Representative organ tissue samples of the two medically and agriculturally important cryptic species of *Mastomys* were sent to the Zoology Department of the University of Pretoria where the nucleotide sequence of the cytochrome-B gene, was determined. Organ tissue of the morphologically indistinguishable *Aethomys chrysophilus* and its newly recognised sibling species *A. ineptus*, (Linzey et al., 2003) where possible, were also collected for cytogenetic analysis.

Damage to newly planted maize fields

Maize fields were additionally inspected for rodent damage to crops. Maize that is to be harvested as green maize, is planted weekly in a succession of rows. Short rows of 5 to 8m were planted weekly in September 2004, in normal local cultivation practice by the farmer and were inspected for signs of rodent activity. In an once-off trapping trail, baited break back traps were set in the rows in the evening and collected the next morning to determine species active.

Damage to mature maize fields

Data of rodent damage in mature crop fields was obtained through transectal monitoring of maize fields at the heading stage. Transect walks counting rodent damage to cobs was done in five farmer's maize fields around Mapate in April 2004. Rodent damaged maize cobs were counted within the first 100 successive maize cobs.

Damage to stored grain

Rodent damage to stored grain was determined with a sub-sample of households. Five randomly chosen households in each of the four villages were selected to store 5 kg of their own shelled maize in open-topped bags during the winter period following harvest in 2002/2003. Woven bags, of the same type farmers use to store grain, were provided for the trial. Forty bags were filled with maize to a total weight of 5,0 kg. The open-top of the bags were folded down to a point level with its content. Control bags were similarly designed with the addition of two layers of chicken wire mesh, to prevent feeding by rodents, but to allow for normal insect damage. The two bags, one treatment and one control, were placed together in the same facilities used by households for their storage of shelled maize. The bags were inspected monthly and weighed to assess loss.

Cross cutting studies; INCO-DEV Ratzooman project

Rodent ecology studies were conducted monthly as part of the INCO-DEV RatZooMan project at Mapate for a continuous duration of two years. A replicated Capture-Mark-Recapture study (CMR) was set up in two fields. In each field, an one-hectare site consisting of even components of maize crop and fallow/natural vegetation, was laid out in a square study grid with 10m between the lines and rows of the grid. The crop fields were managed by the farmers using normal local small-scale

cultivation practices. Animals were live-trapped on three consecutive nights each month with 100 trapping stations, using Sherman type live traps baited with peanut butter. Captured rodents were marked, sexed, weighed, and their reproductive condition recorded. Each rodent was then released at its exact capture station.



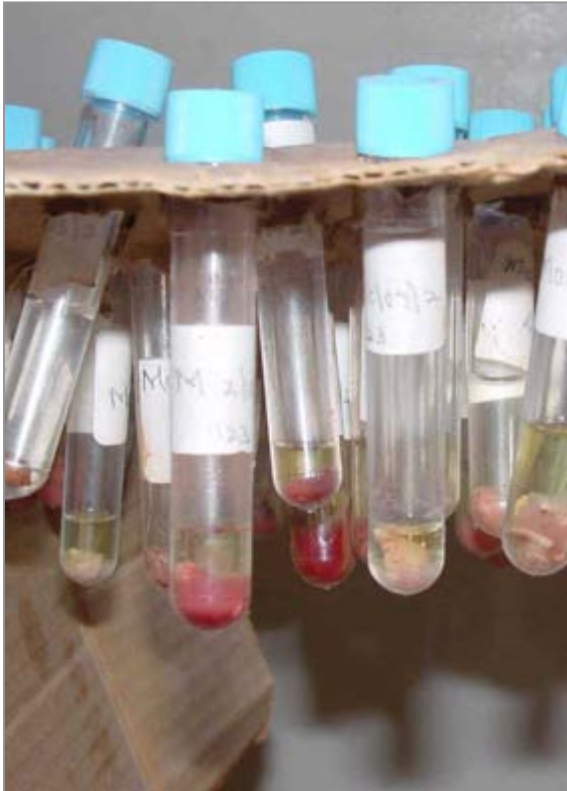
Plate 2.1. Field staff underwent training on the dissection of rodents in Pretoria



Plate 2.2. Extracting rodent serum in the INCO-DEV rodent zoonosis project



Plates 2.3-2.5. Rodents were weighed, measured, sexed and dissected for organ tissue (above). The skulls were detached and prepared as study material (below left) and the hearts, kidneys and livers were preserved in ethanol (below right)



Results

Intensive trapping in households

Trap success

Trapping results are presented in terms of trap success, the number of traps used multiplied by the number of trapping nights. The effects of intensive trapping in the treated households are compared to the three-consecutive trap nights per month of the untreated households. It is suspected that, as number of captures declined, some households did not set all the traps every night and some did not set traps every night. This suspicion was to some extent confirmed in the post-trapping period when field staff recorded rodent management activities for households (section farmer diaries) and many households stated that they did not trap as they did not see rodents. Capture results thus might be an underestimation of the true value of trap success.

In all four villages trap success declined soon after intensive trapping was started in September - October of 2002. This sustained decline in capture rates is compared with the trap success trend of the untreated households per village in Figures 2.1 to 2.5.

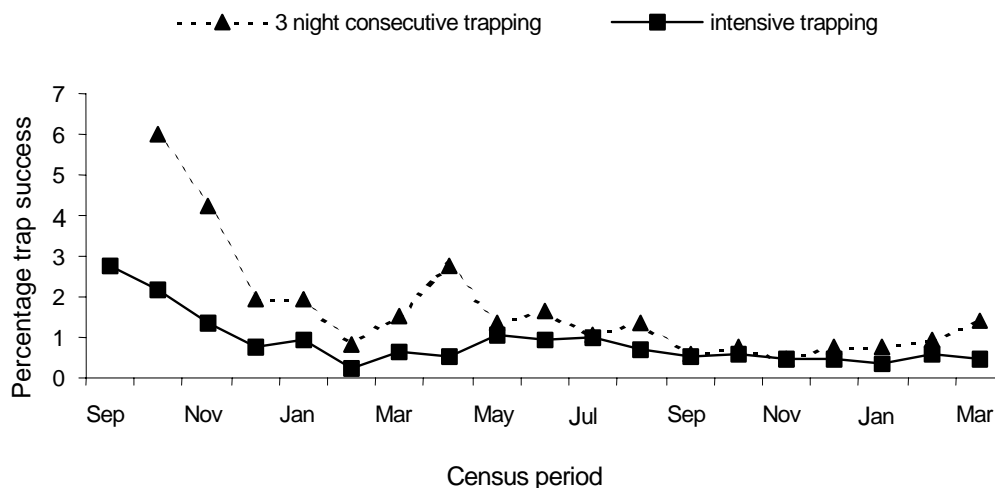


Figure 2.1 Trap success of all animals caught in households in four villages in Limpopo Province

Trap success at the onset was three to four percent for the month (September/October) and remained below two percent for the remainder of the census period of 18 months. Even the autumn harvest and storage period, when an increase of rodents into the households was expected, trap success did not rise to the level it was at onset of trapping.

Trap success in the untreated households also declined from the onset, and although numbers increased and peaked at the start of autumn, it was not as high as at the onset.

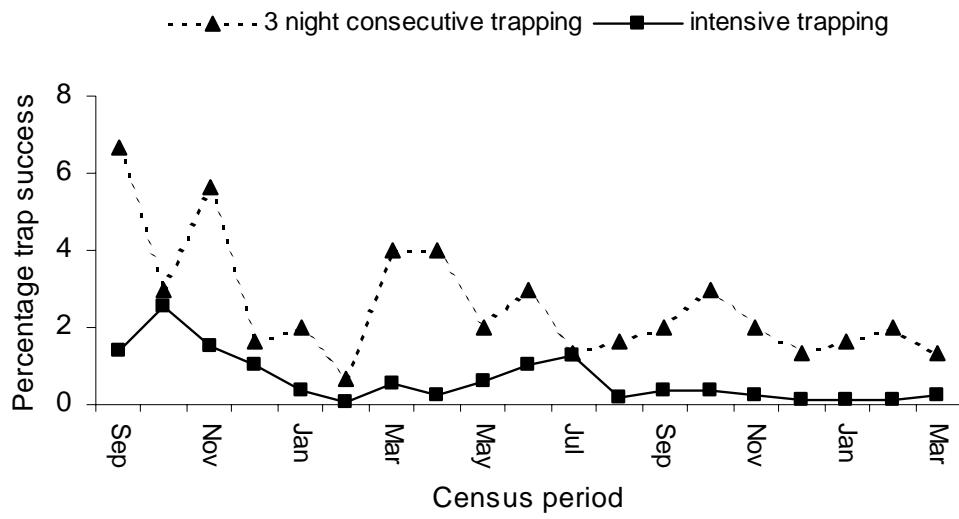


Figure 2.2 Trap success of all animals caught in households in the Bloublommetjieskloof community.

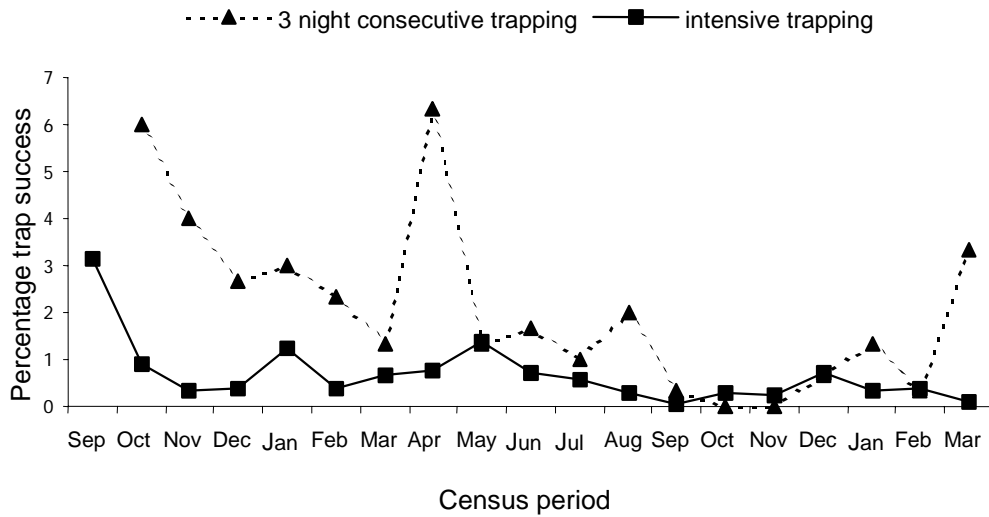


Figure 2.3 Trap success of all animals caught in households in the village of GaPhaahla

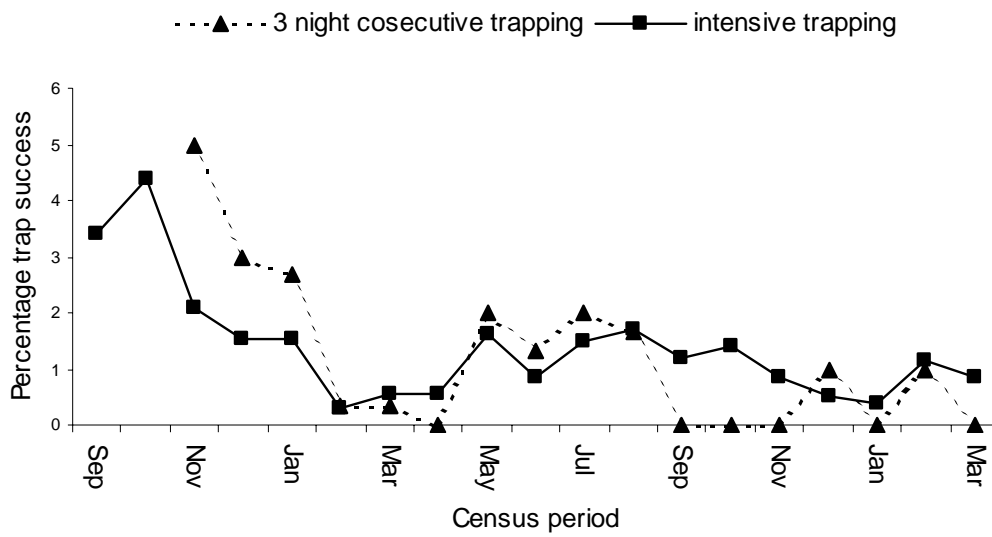


Figure 2.4 Trap success of all animals caught in households in the village of Mapate.

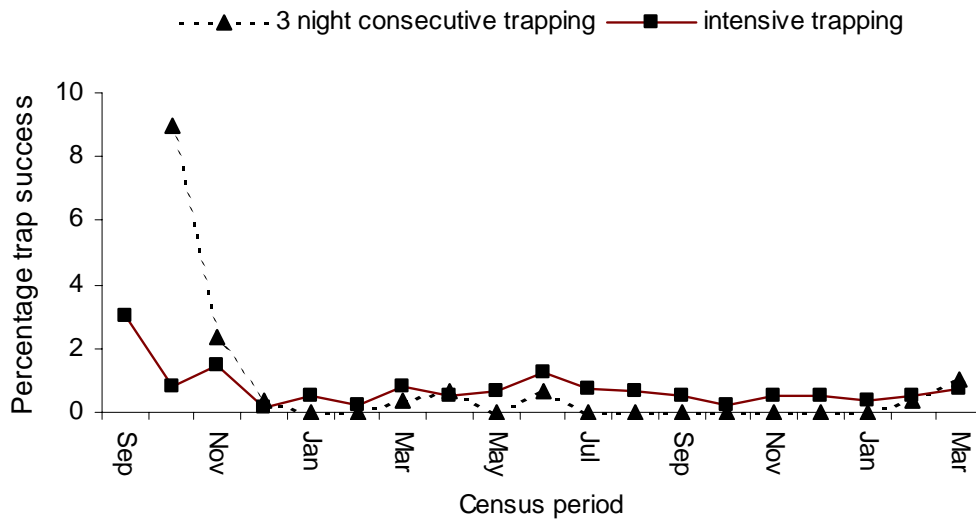


Figure 2.5 Trap success of all animals caught in households in the village of Nkomo-B.

The number of rodents trapped in and around the homesteads was higher than in the crop fields. This may indicate a true reflection of the rodent population dynamics as commensal rodents made up a high proportion of the rodent species composition, but trapping at houses was intensive and continuous each month, while field trapping was done for three consecutive nights each month only. The enclosed homestead area further may make it easier to trap rodents than the open environment of crop fields. However the lower than normal rainfall experienced in the census period would have had a bigger influence on rodent numbers in the crop fields

Species composition

The dominant rodent species trapped in the villages in the arid southern and eastern regions of Limpopo Province was the black rat or house rat *Rattus rattus* (Figure 2.6). Approximately 57% of catches in GaPhaahla and 69% of catches at Nkomo and Bloublommetjieskloof was of the commensal pest. The *Aethomys* species group, comprising of *Aethomys chrysophilus*, *A. namaquensis* and *A. ineptus*, contributed 23% at GaPhaahla, 12% at Nkomo and 10% at Bloublommetjieskloof to the species composition of the surveyed villages.

In Mapate households, the dominant rodent species was the multi-mammate rat *Mastomys natalensis* and about 66% of all catches made in the village was of this rodent. *Mastomys* species made up 16% of total catches at Bloublommetjieskloof and 7% of catches at Nkomo, but only 1,5% of catches at GaPhaahla.

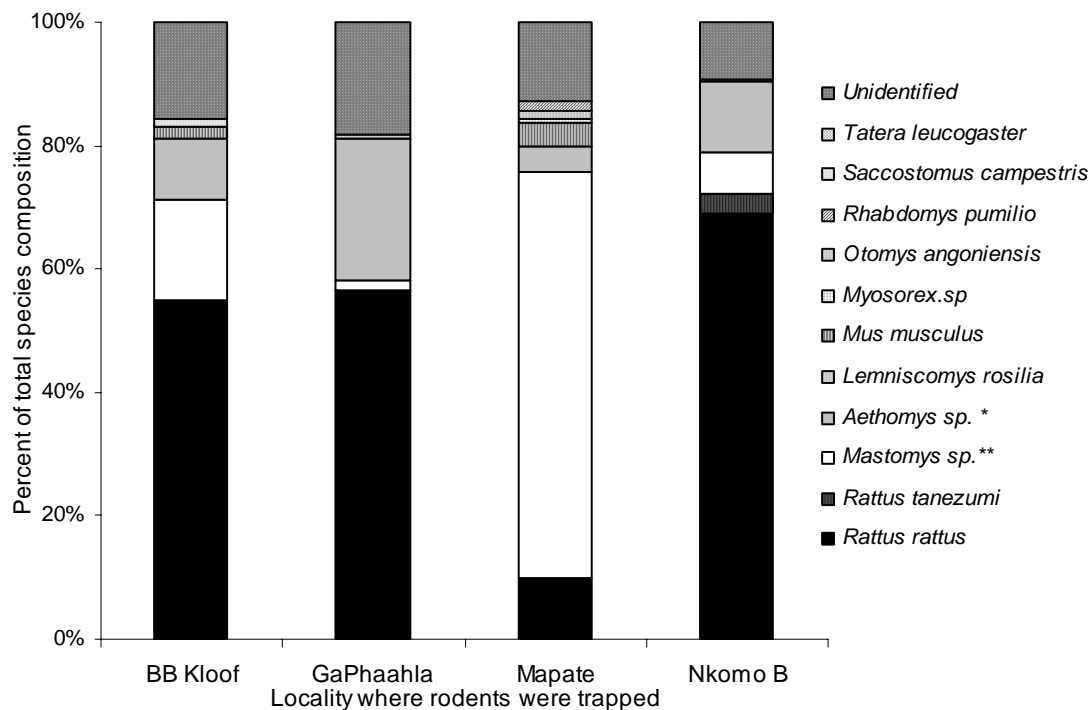


Figure 2.6. Species composition of rodents caught through intensive trapping in households of four villages in Limpopo Province. Three **Aethomys* species (*A. chrysophilus*, *A. namaquensis* and *A. ineptus*) and two ***Mastomys* species (*M. natalensis* and *M. coucha*) were collected, but not all specimens were identified to the species level.

Both the two cryptic *Mastomys* species were trapped in crop fields and/or in households in the villages of Bloublommetjieskloof and Nkomo-B, while only *M. natalensis* was trapped in Mapate and only *M. coucha* was trapped in GaPhaahla. The red veld rat *Aethomys chrysophilus* was trapped in all four villages while its sibling species *A. ineptus* was confirmed for Mapate and GaPhaahla homesteads. The namaqua rock mouse *A. namaquensis* was collected in the crop fields and homesteads of Bloublommetjieskloof and in homesteads in GaPhaahla.

At Mapate *Rattus rattus* made up 10% of the total rodent species composition trapped in households. The commensal house mouse *Mus musculus* was found in Mapate households (3,7 % of total catches) and in Bloublommejieskloof (1,9% of total catches)

Table 2.1. List of all animal species trapped in and around households and in crop fields in four villages in Limpopo Province, as well as in other habitats at Mapate for the INCO-DEV project, in the period of September 2002 to November 2004.

Species	BBKloof		GaPhaahla		Nkomo		Mapate		
	Home	field	home	field	home	Field	home	field	other
<i>Aethomys chrysophilus</i>	X	X	X		X		X	X	X
<i>Aethomys ineptus</i>			X				X		
<i>Aethomys namaquensis</i>	X	X	X						
<i>Dasymys incomtus</i>									X
<i>Lemniscomys rosalia</i>				X			X	X	X
<i>Mastomys coucha</i>	X	X		X	X	X			
<i>Mastomys natalensis</i>	X				X		X	X	X
<i>Mus musculus</i>	X	X		X			X	X	X
<i>Mus minutoides</i>									X
<i>Otomys angoniensis</i>			X				X	X	X
<i>Pelomys fallax</i>									X
<i>Rattus rattus</i>	X	X	X		X		X	X	X
<i>Rattus tanezumi</i>					X				
<i>Rhabdomys pumilio</i>							X		X
<i>Saccostomus campestris</i>	X			X		X			X
<i>Steatomys</i> sp.						X			X
<i>Tatera brantsii</i>									X
<i>Tatera leucogaster</i>		X		X	X	X			
<i>Elephantulus</i> sp.		X							
<i>Myosorex</i> sp.							X		

In three households at Nkomo-B, specimens of the oriental rat *Rattus tanezumi* were collected which is a first recording of this species in Africa. Morphologically these rodents are similar to *Rattus rattus*. At Mapate a specimen of *Pellomys fallax* was collected in an irrigated crop field, which is a first recording of the species in South Africa.

A total of eighteen different rodent species of the order Rodentia, one shrew species (order Insectivora) and one elephant shrew species (order Macroscelidea) were collected in households and crop fields in the four villages, as well as in natural vegetation at Mapate, in the combined projects from September 2002 to November 2004 (Table 2.1.)

Unfortunately a large number of captured rodents were or could not be identified due to skulls tags becoming detached from the specimens, damaged skulls unsuitable for identification or samples being lost. Not all specimens of the two cryptic *Mastomys* species and the two *Aethomys* sibling species were cytogenetically analysed due to the high financial cost of the nucleotide sequencing process, but representative sampling could with certainty indicate which species occurred in what areas. Most of the specimens collected of these two genera are thus only identified as *Aethomys* and *Mastomys* spp.

The localities (habitats) in and around the homestead where the different rodent species were trapped are indicated in figures 2.7 to 2.10. At Mapate the multimammate-rat was again the dominant species in all the localities, while the black rat was the dominant species in all the localities in all the other villages.

The kitchen and storage rooms had the largest diversity of rodent species as well as the highest number of captures of all the localities. At Nkomo more rodents were caught in storeroom followed by catches in kitchens, while at Mapate bedrooms had as many captures as in storerooms. The criterion for localities is however loosely based as some households stored grain in bedrooms. In most of the “traditional” households the different localities (rooms) were each a separate structure as part of a

complex of structures, while in most of the “modern” brick homes only the kitchen and store-rooms were separate structures.

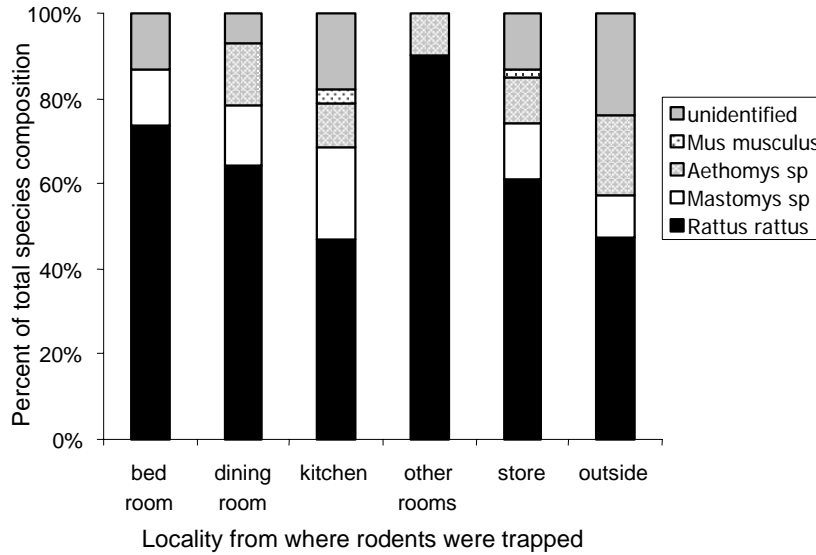


Figure 2.7. Rodent community structure in different habitats found in households of Bloublommetjieskloof community based on habitat trapping conducted over the census period from September 2002 to March 2004

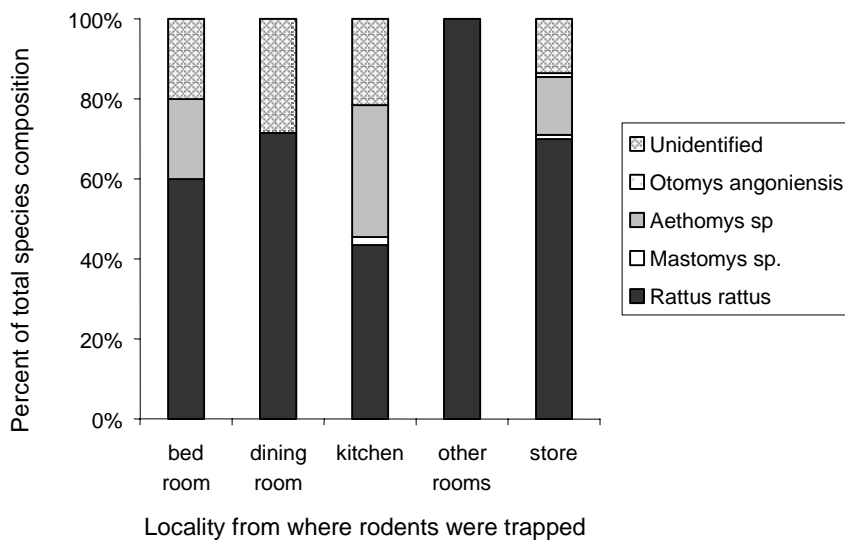


Figure 2.8. Rodent community structure in different habitats found in households of GaPhaahla village based on habitat trapping conducted over the census period from September 2002 to March 2004

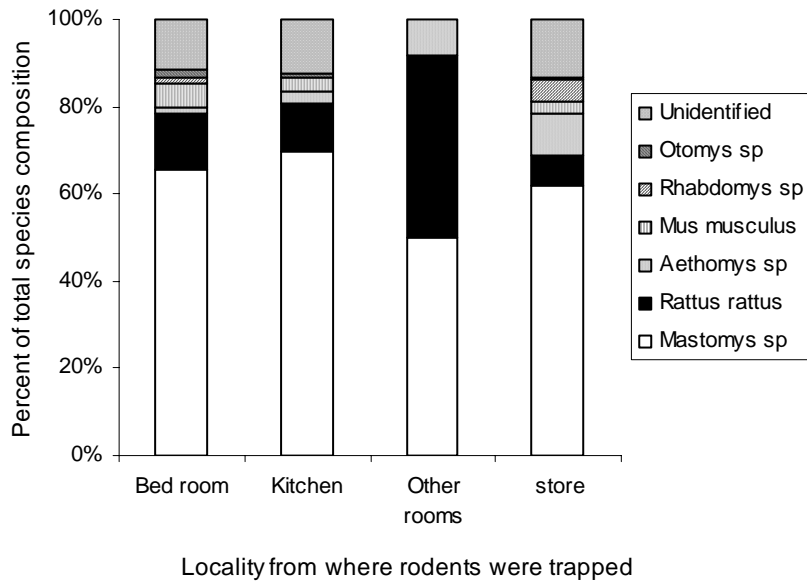


Figure 2.9. Rodent community structure in different habitats found in households of Mapate village based on habitat trapping conducted over the census period from September 2002 to March 2004

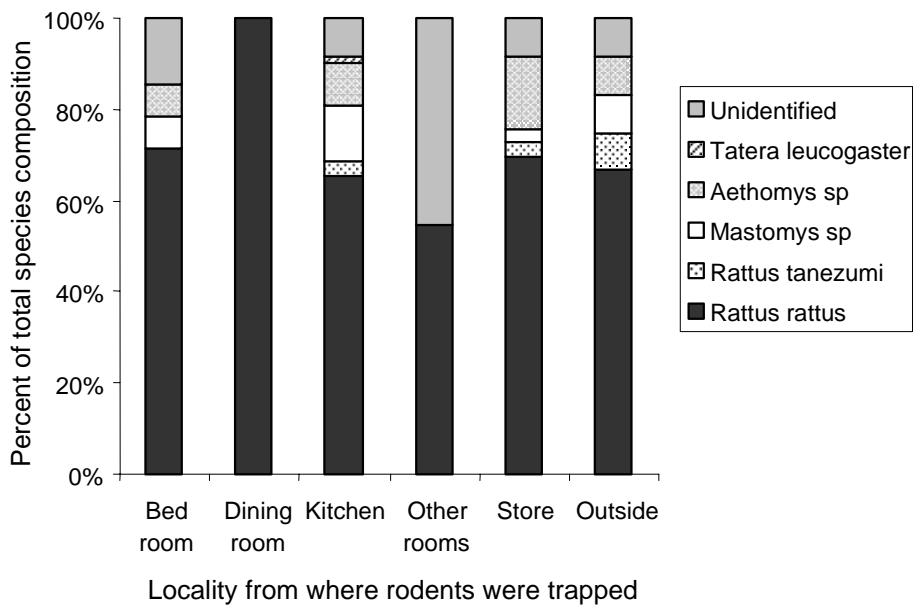


Figure 2.10. Rodent community structure in different habitats found in households of Nkomo-B village based on habitat trapping conducted over the census period from September 2002 to March 2004



Plate 2.6. Explaining the setting of a break back trap.
Plate 2.7. Inspecting store room for placing of rodent traps.



Plate 2.8. The commensal ship rat *Rattus rattus* was the dominant rodent species trapped in households in three villages in the arid regions of Limpopo Province.

Species competition

The capture numbers of the dominant rodent species caught in village households during the census period are compared in Figures 2.11 to 2.14. A dominant rodent species in all the villages was *Rattus rattus*, while *Mastomys* sp. was dominant in Mapate and Bloublommetjieskloof only. The *Aethomys* spp. group was dominant in three villages only and was replaced with *Mus musculus* in Mapate. In comparing the rodent numbers captured of *Rattus rattus* with the other dominant rodent species captured, it appears that *Mastomys* sp. population growth has an influence on that of *Rattus rattus*.

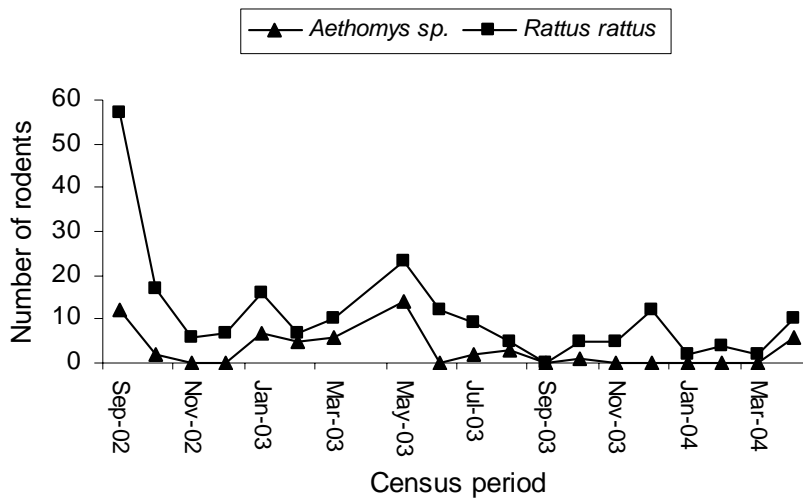


Figure 2.11. Numbers of the two dominant rodent species caught in households of GaPhaahla village

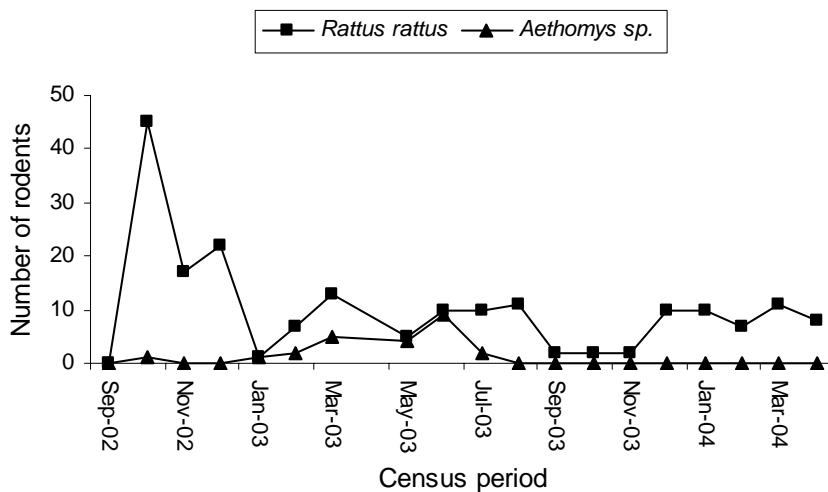


Figure 2.12. Numbers of the two dominant rodent species caught in households at Nkomo-B.

In the absence of *Mastomys* as in GaPhaahla, or where species diversity was relatively low such as at Nkomo, *R. rattus* population peaked earlier after the rain season. The peaks were during April/May at

GaPhaahla (Figure 2.11) and already in March at Nkomo (Figure 2.12), but only in July/August in the two villages were *Mastomys* occur as the dominant species. At Bloublommetjieskloof (figure 2.13) and Mapate (Figure 2.14), *Mastomys* sp peaked in May/June. Although not conclusive, it would appear that *Mastomys* is able to suppress *Rattus* populations if conditions are favourable The *Aethomys* populations trapped peaked in May, regardless of the absence of *Mastomys* as at GaPhaahla and Nkomo, or the presence of *Mastomys* as a dominant species such as in Bloublommetjieskloof (Figure 2.13.).

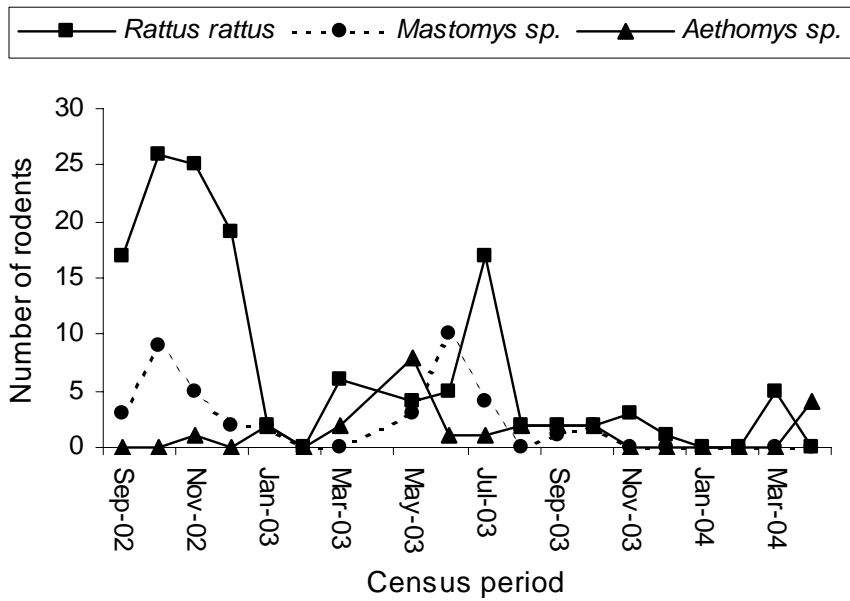


Figure 2.13. Numbers of the three dominant rodent species caught in homesteads at Bloublommetjieskloof

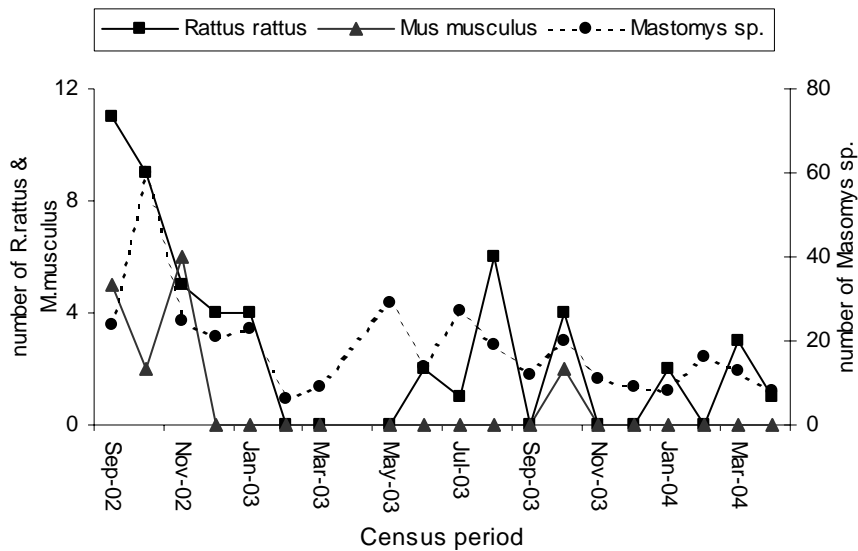


Figure 2.14. Numbers of the three dominant rodent species caught in homesteads at Mapate

Field trapping

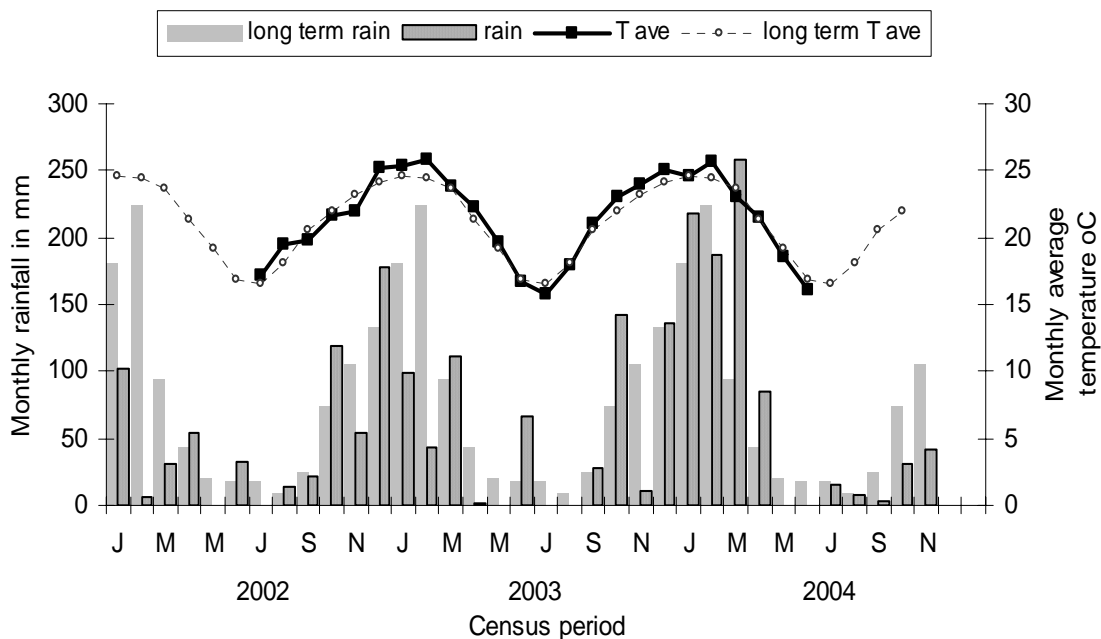


Figure 2.15. Long term average weather data compared to weather data at Mapate during the rodent census period from October 2002 to March 2004.

Comparing the monthly rainfall and temperature (monthly average) of the census period with the long term average at Mapate (Fig. 2.15), indicates that the 2002/2003 season had a lower than normal rainfall but higher than normal average temperatures. The following rain season started well with high rainfall recorded in October, and dry-land crop farmers started planting, but with very little rain in November, crops either did not germinate or those that did received no follow-up watering and perished. The end of the rain season had above average rainfall, which again affected crop farmers at weeding and harvesting

Figures 2.16 to 2.18 compare monthly rodent catches in maize crop fields with the monthly rainfall recorded during the census period. Reliable weather data was however not available for all the trial sites. The closest weather-station to GaPhaahla is approximately 75 km due east, while the weather station closest to Nkomo village (approximately 35 km direction north-west) did not record weather data from July to November 2003.

Rodent catches were clumped and varied monthly with no reliable pattern. Trap success was relatively low, never more than 15% per trap station per day (or 5% per trap per day). This is due to low populations of rodents in the failed crop fields, likewise trap success in and around households was as low. The numbers of rodents trapped in the four crop fields however declined during the census period of 18 months as indicated with the trend line in Figure 2.20.

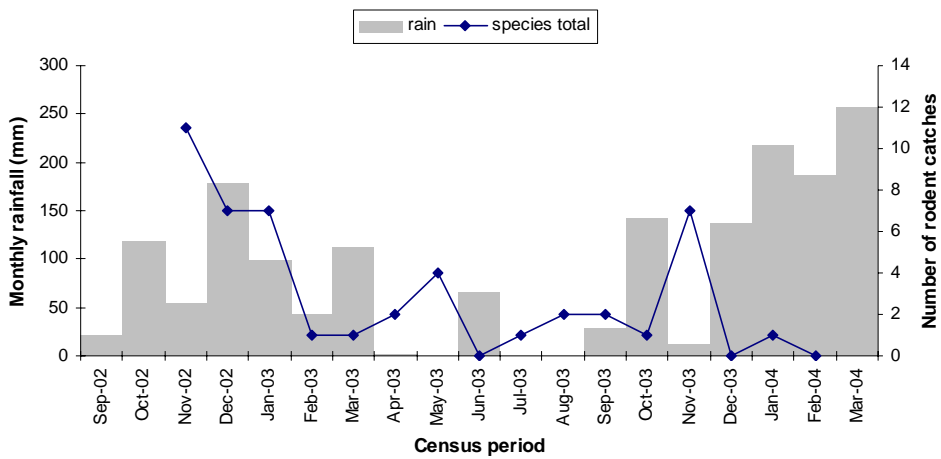


Figure 2.16 Monthly three-night rodent catches in a maize field at Mapate compared to the monthly rainfall in the period October 2002 to March 2004

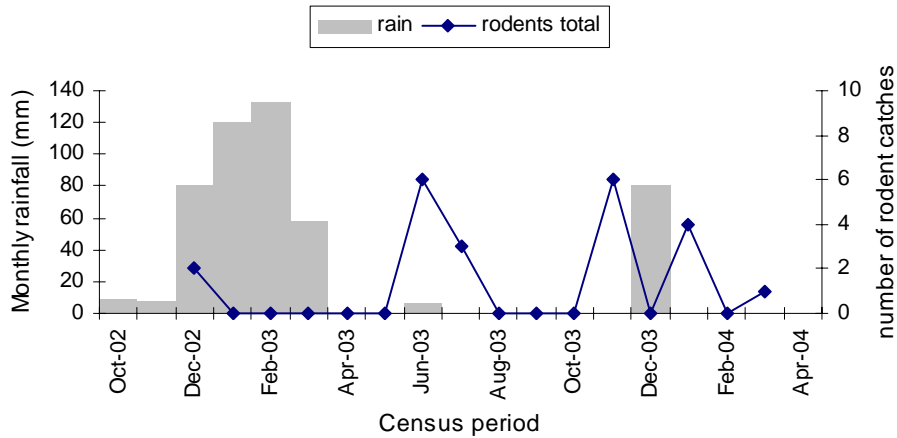


Figure 2.17 Monthly three-night rodent catches in a maize field at Nkomo compared to the monthly rainfall in the period October 2002 to March 2004. The weather station did not record data during July to November 2003. No rainfall data from January 2004

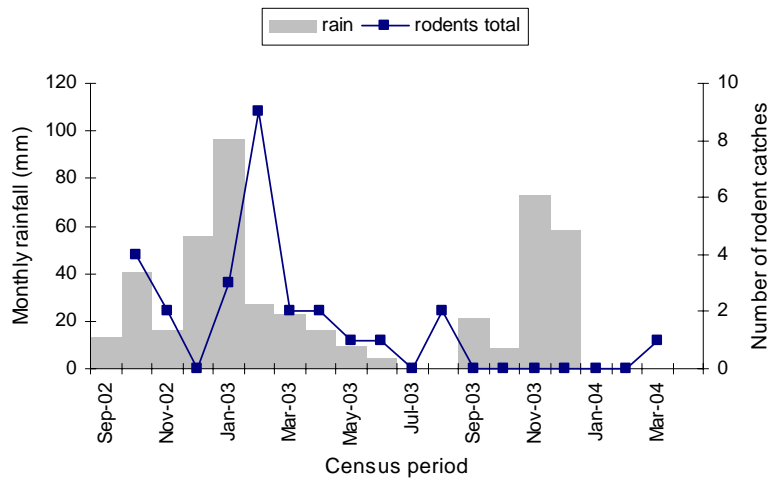


Figure 2.18 Monthly three-night rodent catches in a sorghum maize field at GaPhaahla compared to the monthly rainfall in the period October 2002 to March 2004. No rainfall data from January 2004

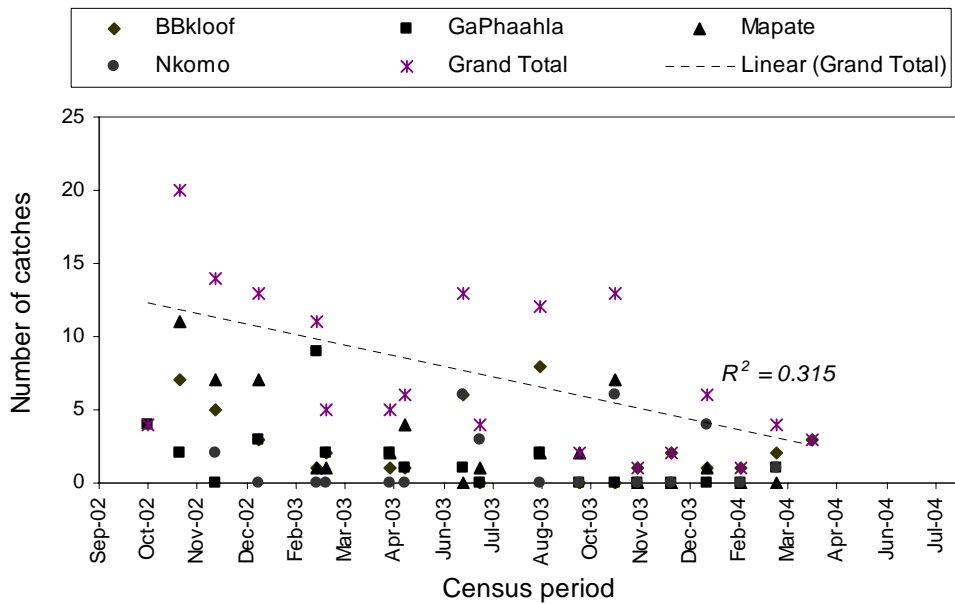


Figure 2.19. Regression of number of rodent catches in four crop fields in the census period.

The rodent species composition of field captures was different to the captures in households of the same villages (Table 2.2.). The indigenous multimammate rats *Mastomys* spp were the dominant species in all four fields (Figures 2.20 to 2.23). At Mapate the numbers of *Mastomys* trapped in the maize field was far higher than that of the other rodent species captured. In the maize field at Bloublommetjies, even numbers of *Mastomys* sp. and *Aethomys namaquensis* were trapped, with the former dominating the species composition in the late summer season while the latter dominated the species composition in autumn and winter. In the sorghum field at GaPhaahla species composition was about even between the four species trapped there. Only in the arid field at Nkomo were captures of the gerbil *Tatera leucogaster* higher than that of the multimammate rats. The commensal *Rattus rattus* was trapped in relative high numbers in the maize field at Mapate and only once at Bloublommetjieskloof, but not in the crop fields of the other villages. The crop fields where *Rattus rattus* were trapped are relatively close to the respective villages.

Table 2.2 . Number of rodent species captured in four crop fields in Limpopo

Species	Village				Total
	BBkloof	Gaphaahla	Mapate	Nkomo	
<i>Rattus rattus</i>	1		7		8
<i>Mastomys</i> spp ²	16	8	24	5	53
<i>Aethomys</i> spp	15		2		17
<i>Mus musculus</i>	1	3	1		5
<i>Otomys angoniensis</i>			2		2
<i>Lemniscomys rosalia</i>			1		1
<i>Tatera leucogaster</i>	1	5		10	16
<i>Saccostomus campestris</i>		4		1	5
<i>Steatomys</i>				1	1
<i>Elephantulus sp</i>	2				2
Not identified	7	7	10	5	29
Total	43	27	47	22	139

² The two cryptic species of *Mastomys* (*M. coucha* and *M. natalensis*) were recorded as *Mastomys* spp. The three *Aethomys* species (*A. chrysophilus*, *A. namaquensis* and *A. ineptus*) were recorded as *Aethomys* spp.

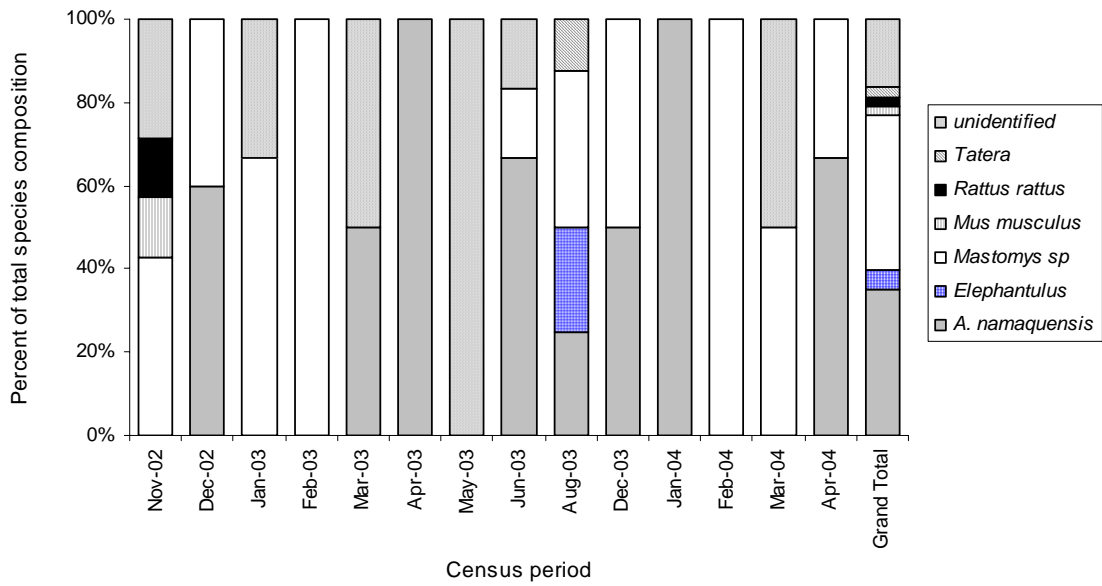


Figure 2.20. Monthly small mammal species structure in a maize crop field at Bloublommetjieskloof.

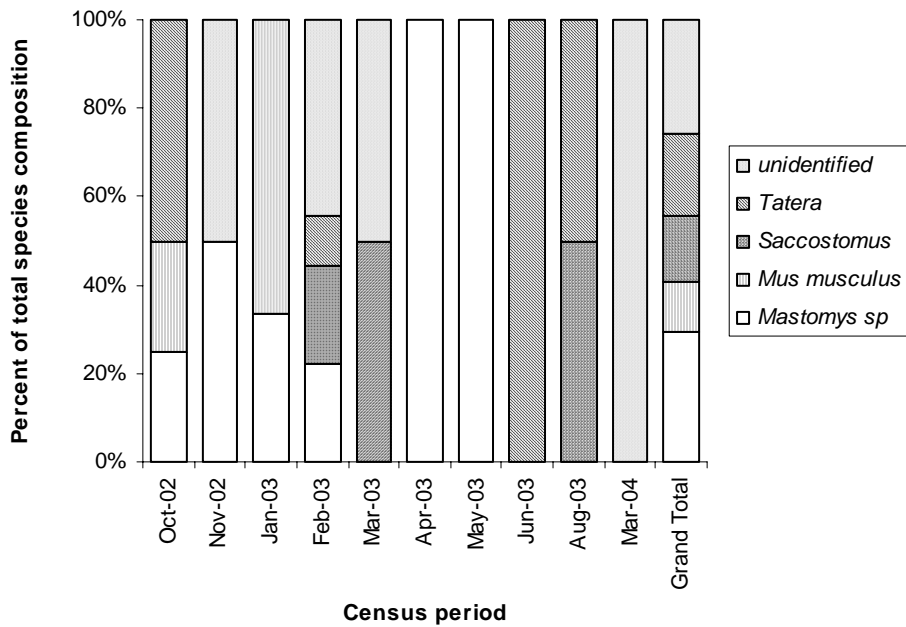


Figure 2.21. Monthly rodent species structure in a sorghum crop field at GaPhaahla.

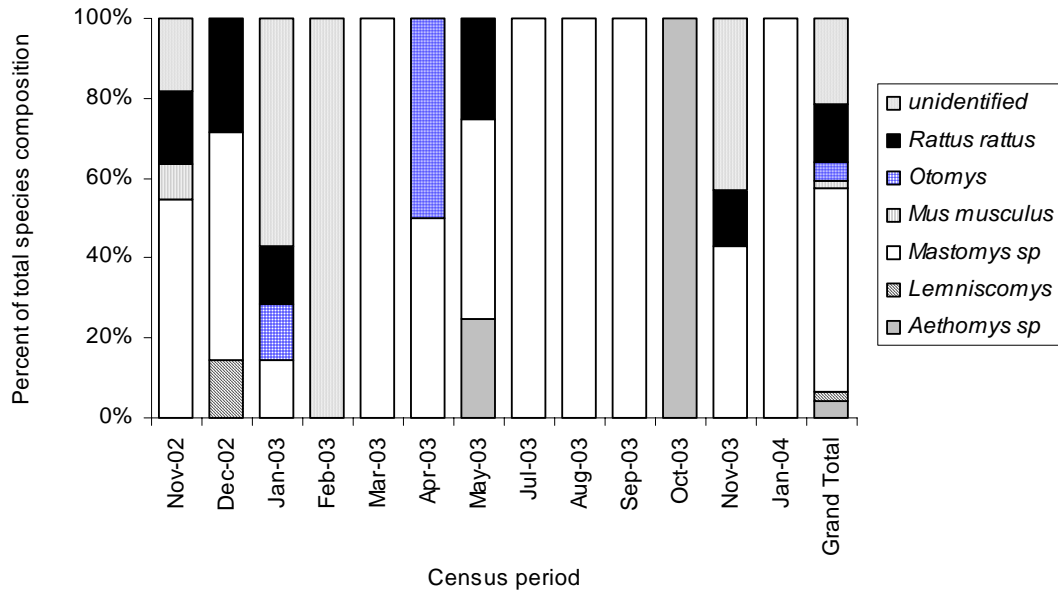


Figure 2.22. Monthly rodent species structure in a maize crop field at Mapate.

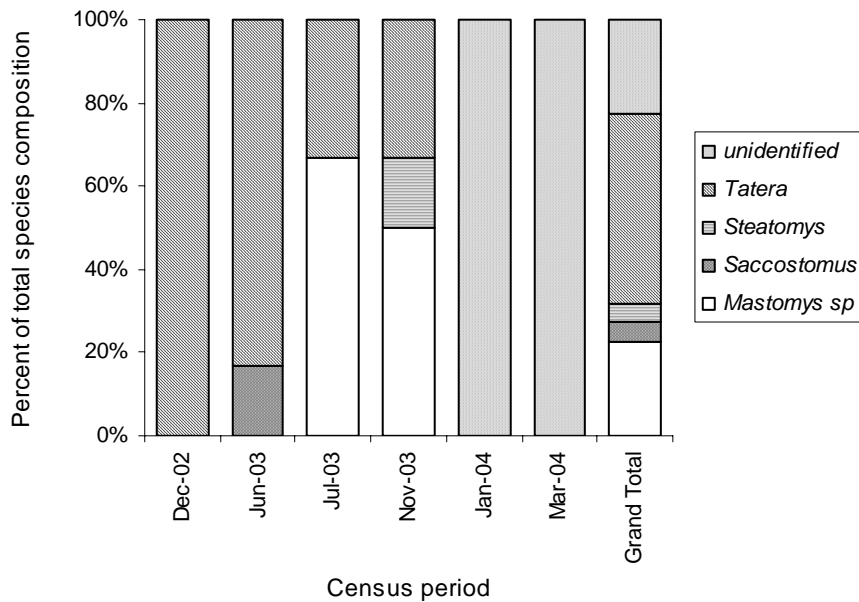


Figure 2.23. Monthly rodent species structure in a maize crop field at Nkomo-B



Plate 2.9. Inspecting the ploughed crop field at Bloublommetjieskloof



Plate 2.10. The sorghum crop field where rodents were trapped at GaPhaahla.



Plate 2.11. The maize crop field at Mapate in the mountainous Vhembe district.



Plate 2.12. Inspecting the crop field at Nkomo for rodent trapping layout

Damage to newly planted maize fields

Rodents damage maize crops in the field already at planting. This was demonstrated at Mapate in flood-irrigated 'green maize' fields. An early morning inspection of the previous day's planted rows had indications of rodent activity. Eight holes of 3 cm deep and at 50 to 100cm intervals had been dug in planting rows. Over a period of two consecutive night trapping events, seven *Mastomys* rats were caught in six break back traps placed in the planting rows.

Damage to mature maize fields.

The number of cobs with rodent damage varied from 10% to 28% in the seven transects (Table 2.3). Damage in the planting rows had a clumped distribution, typical of rodent activity. Maize cobs damaged by rodent feeding at the earlier and ripening stages of cob development are prone to secondary fungal infection and maize ear rot caused by *Diplodia* and *Fusarium* infections were evident in the surveyed fields.

Table 2.3. Rodent damage to maize cobs in Mapate crop fields

Maize field	Number of rodent-damaged cobs	Total
Teacher's field	11	100
Teacher's field	10	100
Walter's field	13	100
Walter's field	28	100
Dream's field	16	100
Gracie's field	17	100
Magnetic's field	20	100

Due to the late onset of spring rain farmers were forced to delay planting to late in the growth season. The follow-up summer rains were also late and below normal, and combined with poor weeding, resulted in a very poor maize yield.



Plate 2.13 The gerbil *Tatera leucogaster* was the dominant rodent species trapped in the arid fields of Nkomo.

Damage to stored grain

Due to the effects of drought resulting in a very low maize yield for farmers, few farmers volunteered to participate in an activity which they indicated would further restrict their meagre food security. To compensate farmers for the use of the farmer's maize in these studies, similar quantities of maize were provided to the participating households.

In Mapate, despite high numbers of rodents trapped in the survey, no rodent damage was evident from the stored crop trial. At Nkomo and GaPhaahla, unnatural damage was evident in a number of households; losses due to chickens and also due to human interference occurred. In some households the owners had moved the bags away from exterior interference to a place of safety such as locked in a cupboard. In these households the trials were started anew, but after repeated interference, the trial was delayed to the next season.

Trials were to be repeated after the 2003/04 harvest, but with even less and later rains in 2003, many farmers did not even plant and the trial was cancelled.

Weight loss to the standard (5kg) open-top bags of maize kernels was attributed to both rodent and insect damage (Table 2.4). While insects infest maize kernels internally, rodents clearly removed kernels from the containers.

Weight loss due to rodents was calculated after a month to be as high as 37%. Observed losses in the bags could be an overestimate of food store losses due to rodents, as trial bags were either placed on the floor next to bags used for normal storage or on top of closed bags, where it could have been more readily accessible to rodents.

The predominant insect pests found in the stored maize were the maize weevil *Sitophilus zeamais*, flour beetle *Tribolium castaneum* and the warehouse moth *Ephestia cautella*.

Table 2.4. Comparison between the cumulative weight loss and percent damage to 5kg of shelled maize kernels stored in open bags over two months inside houses in the four survey villages in Limpopo Province.

Assessment period	Percent weight loss (mean±sem)	Percent rodent damage (mean±sem)	Percent insect damage (mean±sem)
Bloublommetjieskloof n=4			
May	0	0	0
June	43,62±33,4	35,635±32,808	7,99±0,705
Mapate n=5			
May	0	0	0
June b	5,16±6,118	1,16±2,031	4,0±4,311
Nkomo n=2			
May	0	0	0
June b	45,6±6,364	33,7±4,808	11,9±11,172
GaPhaahla n=2			
May	0	0	0
June b	42,2±58,266	37,3±52,185	4,9±6,081



Plates 2.14 and 2.15. Rodent damage to maize cobs in the field (left) and in storage (right)



Plate 2.16. Grain storage in a dulu granary at Nkomo in the Mopani district.

Plate 2.17. Grain storage in bags in a homestead at GaPhaahla, Greater Sekhukhuni district.

Cross-cutting studies – INCO-DEV Ratzooman project

Live-trapping over 8200 trap-nights, from September 2003 till November 2004, resulted in 1122 captures of 937 individuals from eight rodents species at the two sites. The dominant species was the multi-mammate rat *Mastomys natalensis*, contributing approximately 85 % and 92 % of total captures in each field. The striped-mouse *Rhabdomys pumilio* captures were 8% of the total captures in the first field while *Aethomys* spp captures were 3% and 6% of the total at the two sites.

Preliminary results for the first year indicates that the population dynamics of *Mastomys natalensis* fluctuated seasonally. The population increased sharply from April-May to peak in July-August, and then declined to October (Figure 2.25). Accelerated population increases follows on the end of the "long wet season" of the late summer rainfall pattern that started in October, dipped in November and again in February, and peaked in March. The *M. natalensis* population rises during the long dry season following the wet season which corresponds to the scenario formulated for Tanzania (Leirs, *et al.* 1996) and was similar to CMR results repeated at the RatZooMan site in Morogoro, Tanzania (Belmain, 2004). The breeding of the multi-mammate rat started a few months before the population rise and continued during the population peak and its decline period (Figure 2.26). It appears that breeding does not occur in the months of early summer, but the data as yet is insufficient to conclude a pattern.

The population size of *Rhabdomys pumilio* was much smaller than that of *M. natalensis*. Its population numbers peaked twice, during February and again in late August, but with little to nil captures before the February peak, and a steady size in the period between the peaks (Figure 2.27). Breeding seems to be seasonal, with a start in January and ends in September (Figure 2.28). Interspecific competition between the two rodent species is possible as the *Mastomys* population increased and peaked in the period between the *Rhabdomys* population peaks. The presence of the former species is possibly a factor in shaping the population dynamics of the latter species.



Plate 2.18. Live-trapping for rodents at Mapate in the capture-mark-recapture trial.

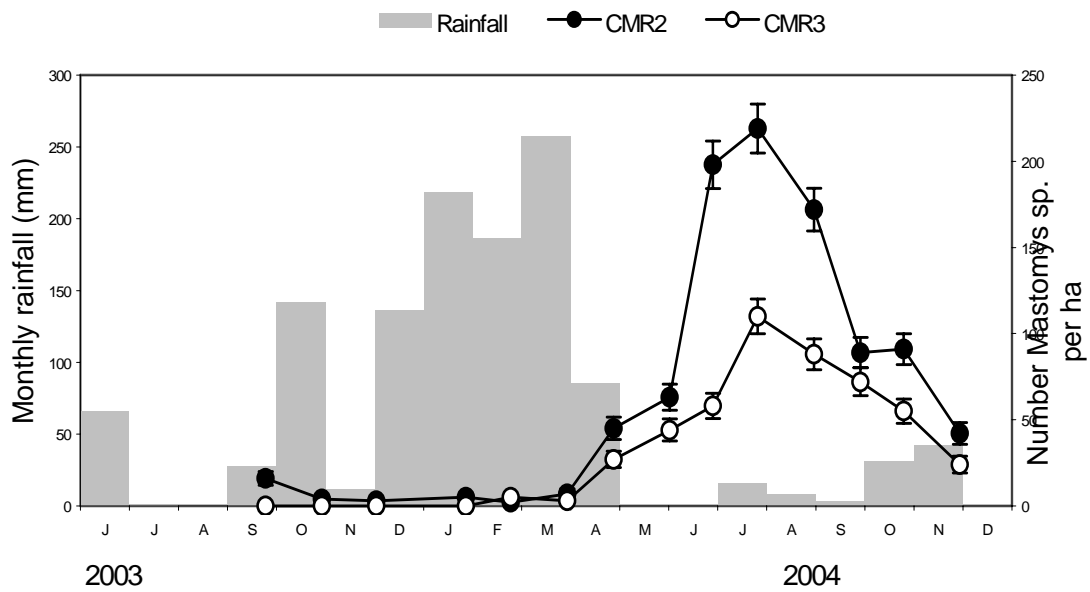


Figure 2.25. Population dynamics of *Mastomys natalensis* in two capture-mark-recapture trial sites at Mapate.

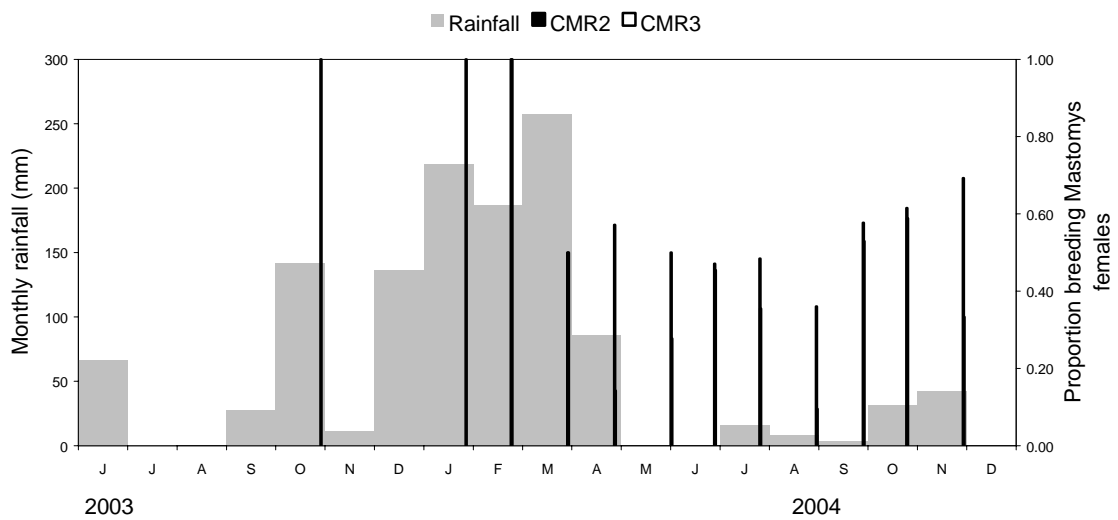


Figure 2.26 Breeding of *Mastomys natalensis* females in two capture-mark-recapture crop field sites at Mapate.

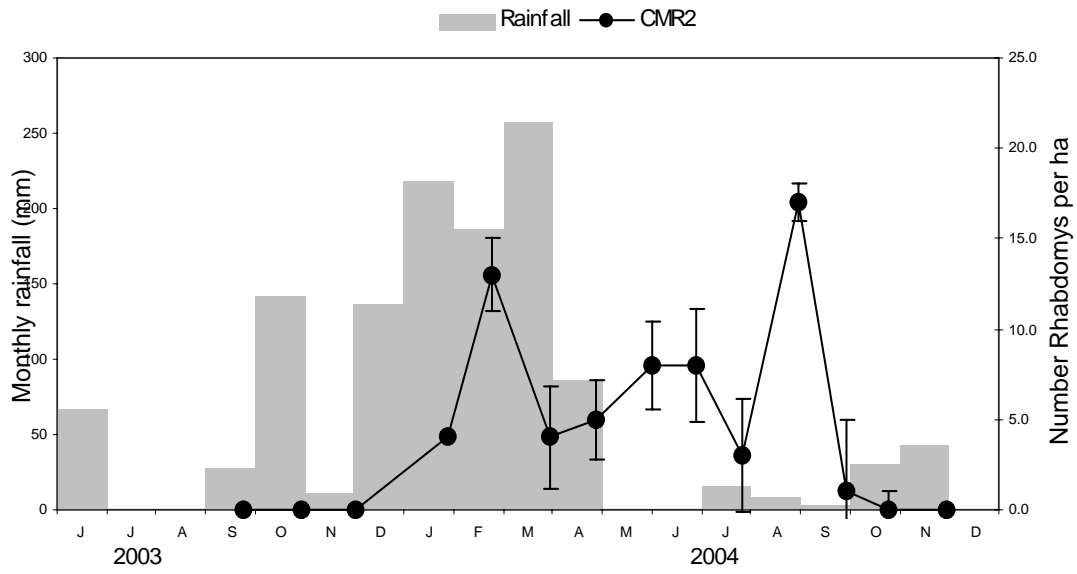


Figure 2.27. Population dynamics of *Rhabdomys pumilio* in a capture-mark-recapture site at Mapate.

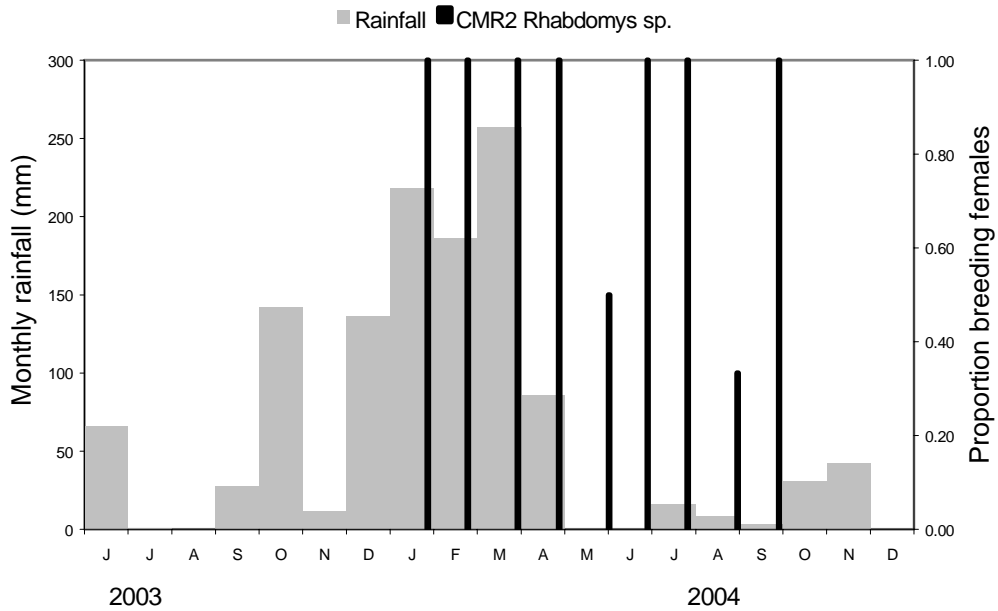


Figure 2.28. Breeding in *Rhabdomys pumilio* females in a capture-mark-recapture crop field site at Mapate.

Discussion

Trapping for rodents with break back traps in and around households and in crop fields over a continuous period of 18 months has demonstrated to the communities and government agricultural extension the effectiveness of trapping as rodent control management tool as well as the effectiveness of the break back trap. Trapping results were presented in terms of trap success, which does not appear to be high, but from the onset of intensive trapping, the number of rodents have declined. Capture results however may be an underestimation of the true value of trap success, as some households did not set all the traps every night. Rodents were caught every month indicating that rodents are a year-round problem. Although rodent numbers increased after the rain season as was expected, it never reached the high it was at as at the onset of trapping. The lower than normal rainfall would also have an effect on rodent population growth

The dominant rodent species in households in the villages in the arid regions was the commensal house rat, while the indigenous multimammate-rat was the dominant rodent species in the village in the sub-tropical and mountainous region. The multimammate rat was also a dominant species in field crops of all the surveyed villages. Rodents were further caught in all the localities in the households. While high numbers may be expected in localities where staple crops are stored, food is prepared or food waste is left, relatively high numbers were also caught in bedrooms. As both dominant species are medically important in the transmitting of rodent zoonosis, the close proximity between the carriers of diseases and human victims, especially children, is of great concern. Incidences of humans being bitten in their sleep and the wounds are left untreated, further confirms the case.

Rodent damage to crops in the field at different growth stages, localities where farmers have not applied rodent control, and rodent damage of crops in storage, were also demonstrated. The trial to determine losses due to rodents in the storage of staple crops however failed to due to external interference and due to too low yields to execute the trials confidently. Although losses were noted, no conclusions were made

Of scientific value was the discovery of the oriental rat, a first recording of the species in Africa, and the grooved-toothed mouse, a first recording in South Africa. A taxonomic article on this discovery is soon to be published. Catches of rodents in the genera *Mastomys* and *Aethomys* has also added to the national data bank on the geographical distribution of cryptic and sibling species in these genera. The respective geographical distributions of the two cryptic *Mastomys* species in South Africa is uncertain and populations of the two species in sympatry have as yet only been recorded at four localities in the country of which one is in the Limpopo province (Venturi et al., 2003). In the project trappings with households, both cryptic species were collected in two of the survey villages.

2.2 Farmer diaries

Introduction

An issue identified nearing commencement of the baseline trapping was that households relied on the project field staff to "manage their rodent control programme". In households where intensive trapping appeared to have eradicated rodents or reduced rodent populations to a very low level, community feeling was that trapping had solved the rodent problem and that further trapping was a "waste of time". Feedback from community meetings indicated rumours from some households, which were not directly involved in the assessment, expecting the field staff (trappers) to come to their houses to apply rodent control. Getting the farmers to maintain awareness of the pest problem was a challenge. The exit strategy of "handing over" the continuation of pest management to the community empowered with knowledge and tools on sustainable rodent management might also not realise successfully. In a similar rodent management project with rice-farmers in Bangladesh, the use of a personal diary to record relevant activities and quantifying rodent damage was implemented with potentially positive results (Belmain, personal communication)

Feedback from a community meeting indicated that farmers doubted the significance for them of recording on paper if they also not do so for other more important activities such as the recording of crop yields and losses. Although many villagers have learned to write, few do so regularly. It was thus decided to employ the field staff to maintain diaries recording rodent management activities for the participating households.

Material and methods

At the commencement of the formal trapping trials for the baseline data on impact of rodents on rural communities in March 2004, each participating household was presented with five break back traps as a gift. The project field staff were asked to conduct weekly to monthly follow-up visits with these households and record their rodent control activities in a diary. A questionnaire format was provided which was also adapted by the field staff depending on the reply and on the period of survey (Figure 2.2.1). Field staff were to inquire what farmers were doing with the traps, their rodent management activities, successes as well as failures and also to probe villager's opinion as to the value of the traps in terms of ease of use and financial cost. By recording the number of rodent catches, changes in rodent population could be estimated.

Results

The diary survey in the villages of GaPhaahla and Nkomo was conducted weekly for a period of two and three months respectively, while at Bloublommestjieskloof the survey was done weekly for the first two months and then monthly for a further two months. Only 40 of the 60 households participated to the end of the period. Of these 40 households, one had lent all the traps to family in the village and one household had moved away during this period. Of the remaining households, it was found that most households (67%) continued with daily trapping using two to five traps, two households set all the traps twice a week, while the remainder stated they no longer had rodents, or would set traps when they noticed rodent activity.

At GaPhaahla households setting traps indicated weekly catches of nil to three rats in the first month (April) for an average 0,05 rats per household per week, and nil to six rats during the second month (May, average of 1,03 rats per household per week). Bloublommestjieskloof households claimed catches of nil to 12 per month (average of 2,4 rats per household per month). At Nkomo no rodents were caught in the first two months, but in the third month catches were between one to seven for a household average of three rodents.

At Mapate the survey continued for a period of six months with twenty households (Table 2.2.1). However, during this period, three of the households moved away or were often away. In the first two weeks, more than half the households continued to set traps daily. The other half stated that the trapping project had cleared their homes of rodents and they would only set traps when they noticed rodent activity. Rodent catches in this period were from nil to five with a weekly average of 0,8 rats per household.

- By the second month, only four households set traps daily, seven households set traps when they noticed rodent activity (which appeared to be weekly), and six households stated they still had no rats and thus did not set traps. The 11 households had catches from nil to ten rats per month (average of 1,4 rats per household per month).
- By June, two households continued daily trapping with three traps while 13 households only used two to all traps when they noticed activity. The fifteen households recorded nil to ten catches, but had an increase in the monthly average of 3,07 rats per household.
- The average catches per household increased in July to 4,8 with catches ranging from nil to eleven in the fifteen houses now trapping on a more regular base.
- In August, all seventeen households recorded catches, but only eleven set traps daily. The six homeowners stated that they "relied on their hearing sense at night to know when to set traps". The average number of rat catches per household had increased to 8,8, with two houses trapping twenty rats. In September, all houses were trapping and the number of catches for the month decreased to an average of 5,18 per household.

Table 2.2.1. Households in Mapate trapping for rodents monthly

Month	April	May	June	July	August	Sept.
No. households	18	17	18	17	17	17
Households setting traps daily	10	4	2	5	11	10
Households setting traps	11	11	15	15	17	17
Min. rodent catches	0	0	0	0	2	0
Max. rodent catches	5	10	10	11	20	14
Average catches/household	0,8	1,40	3,07	4,80	8,80	5,18

In the survey all 40 households indicated that they found the "American" break back trap very effective and as it is easy to operate, made it much more "user-friendly" than the kill trap available locally.

Households also stated that they considered trapping as the best form of rodent control. However, with the increase in rodent catches in August and September at Mapate, some homeowners stated also using a rodenticide as added rodent control measure together with trapping.

Only one farmer had sold some traps, for R5.00 each he had sold three traps to his neighbour. Most of the other participants stated that the traps were of high value and they would not sell it. Some households however lent one or more traps to neighbours or family in the village. As no further households sold traps, they were asked to indicate a price considered to be fair for the break back trap and which they would be willing to pay. Farmers at Mapate suggested prices from R5 to R20 (average of R10.00) explaining that all should be able to afford traps, but further that all should be using these traps. A price of R10 to R50 (average of R22.00) was suggested in the more affluent village of GaPhaahla.

Discussion

The farmer diaries were a successful method for monitoring people's attitudes towards the use of trapping as a rodent management strategy, and confirmed the likelihood that trapping could be a

sustainable and cost-effective method of control for rural households in Limpopo Province. However the low rodent capture rate due to a normal low in rodent populations and also due to the success of intensive trapping over a long period seemed to put participating households under the impression that the rodent problem was solved. The continued monitoring by the field staff, especially at Mapate proved valuable as it provided raw data of the expected increase of the rodent population due to breeding, but also indicated householders awareness and their reaction to the rise in rodent numbers. Households that had continued preventative trapping were better informed on changes in rodent activity than households that only applied curative control.

Effective rodent management is based on effective monitoring. Although it is unlikely that farmers will keep written records, the staff-managed diary exercise suggested that many farmers were mentally monitoring their rodent pest problem and taking action. Through the exercise, farmers may also have been made aware of mental monitoring for more signs of rodent activities than only the damage caused by gnawing rats.

Figure 2.2.1. Diary survey questions to record villagers' activities related to rodent management.

1. Farmer name/household number
2. Date
3. What have you done with the traps (e.g. used for trapping, stored, sold)
4. If trapping continued;
 - How often are traps set?
 - How many traps set?
 - What and how many trapped?
 - What have you done with trapped rodents?
5. If sold, for what price?
 - What are you willing to pay for a new trap?
6. Has trapping been effective (are these specific traps effective, other rodent control options used)?



Plate 2.18. One night's rodent trapping success in GaPhaahla households

3. Market Surveys and Socio-economic Assessments

3.1 Market surveys

Introduction

Results from a Participatory Rural Appraisal (PRA) conducted in three districts in the Limpopo Province in 2001, showed that only 40% farmers and households who identified rodents as a major agricultural constraint of stored crops, applied or had used a form of rodent control. The majority stated the use of rattex³, some relied on their cats to control rodents and only 6% made use of traps. Except for a water trap and the sealing of entry holes, no farmers considered preventative measures to minimise a problem of almost daily occurrence. The use of chemical control, although the majority of users claimed it to be ineffective, far out numbered mechanical or other forms of control.

More than 70 rodenticide brand names, from eleven chemical groups according to their active ingredient, are registered by the Registrar: Act No. 36 of 1947 of the Department of Agriculture (Nel et al., 2000, 2004). Of these, alpha-cellulose is a recent addition to the market, and only registered pest control operators (PCO's) may use zinc phosphide (Table 3.1). A number of formulations are also for use by PCO's only.

Table 3.1. Summary of rodenticides registered by the Department of Agriculture.

Active ingredient; Common name	Number of Trade names	Formulation
Alpha cellulose	4	RB
Brodifacoum	26	BB, CB, RB
Bromadiolone	3	DP, GB, RB
Chlorophacinose	1	CB
Coumatetralyl	5	CB, RB
Difenacoum	7	BB, CB, RB
Difethialone	12	CB, GB, RB, RB(paste), RB(gel)
Diphacinone	4	BB, RB
Flocoumafen	3	RB
Warfarin	1	RB
Zinc phosphide	1 (PCO only)	Gel

Legend: BB Bait block; CB Bait concentrate; DP Dusting powder;
GB Granular bait; RB Bait - ready for use

Material and methods

To determine the relative use of rodent control products, an informal survey was conducted with households and retailers of rodent control products to determine

- what rodent control products are available
- what do farmers use
- what are the costs involved
- the frequency of use

³ Rattex® is the trade name for a rodenticide with difethialone as its active ingredient. In the early 1990's the active ingredient was changed from bromadiolone, however the brand name was retained. The trade name is so well known that almost all the respondents in the survey referred to rodenticides as rattex. For households, in the survey, the original packaging of the rodenticide or a description of the rodenticide was used to identify the product

In an informal survey conducted in August 2004 with households in the rodent trapping villages in Limpopo Province, respondents were questioned on their rodent control practices, the cost thereof and the period of use. In two districts, where households indicated the purchase of rodent control products, the retail route of the products was, as far as possible, traced back to its origin in the district. The retailers (formal and informal) were questioned on their range of rodent control products, popular brands, cost there-of and number of sales.

Results

Householder survey

In the survey, 75 households of six villages in the rodent trapping area were questioned on their rodent control practices. The rodent control products, the cost of purchased products and the period of use are summarised in Table 3.2.

Table 3.2. Rodent control methods used by households in three survey areas in Limpopo Province

Product	Number of households	Cost of product	Period of use
Rattex®	10	R6.50 - 15.00/100g	Present
Rattex®	11	R6.50 - 15.00/100g	When rodents active
Rattex®	20	±R5.00 - 12.00/100g	> 5 months ago
Other rodenticide brand names	5	± R16.00/85g R86/200ml	When rodents active
Unknown "chemical"	2	-	> 5 months ago
Kill traps	14	R7.00 - 15.00 each	When rodents active
Glue trap	1	R3.00 - 10 each	Regularly
"Black poison"	4	R2.00 - 10.00/±1g	-
Cats	6	-	Present
None	15	-	-

The survey in the Vhembe district was conducted with 50 households from Mapate and its three neighbouring villages on a route to Thohoyando, the largest town in the district. The three villages were Lwamondo, Tshakuma and Phiphidi. Of the households surveyed that applied a form of rodent control, 76% used a difethialone (Rattex®) in a ready to use bait (RB) format. The rodenticide is purchased in single units of 100g sachets, mostly from local shops. It is mixed with grain or left-over food from the kitchen and set out in the evenings. A further 8% of households used a second difethialone product, either as a baited block (BB) or in liquid format (CB). Most of the respondents however stated that they only purchased rodenticides when they perceived rodents to be a problem, and for most it was "long-ago" (five or more months ast). Five households stated the use of a kill trap (Plate 3.1) while one respondent had used "black poison" (aldicarb)⁴. The "black poison" was purchased from an informal trader at the pension pay point (Plate 3.2). This poison she had mixed with meat, but it killed her dog and now she uses a kill trap.

⁴ Aldicarb is a nematicide carbamoyloxime, in a granular formulation. It is registered for use against nematodes, the application direct into the soil at planting with a specified applicator on certain crops only. In South Africa two companies produce it and the sale of the product is controlled by law to registered commercial farmers only. In the survey area, aldicarb as a rodenticide was commonly referred to as 'black poison', 'gale pherimi' (meaning you won't see the sunset), 'two-step' or generally just 'rat poison' as opposed to "rattex".

At Nkomo, 15 households, that were not part of the trapping trial, were consulted on their rodent control activities. In three of the 15 houses, kill traps together with rodenticides were used while four households used traps only. In four of the seven houses using traps, the break-back traps were those that had been used during the trapping trial. All four remarked on the effectiveness of the break-back trap they had borrowed. Seven respondents bought their rodenticides and or kill traps in the nearest town of Giyani, while three bought rodent control products either at local shops or at the pension pay point. A tuckshop (spaza) owner in Nkomo applied the use of both kill traps and Rattex® in his home and shop. He stated selling about 50 sachets (100g) of Rattex® a month.

Only one household stated using or having used "black poison", which was bought from traders at the pension pay-point, to control rodents. One further respondent feared the use of "black poison" (aldicarb) as "it also kills dogs".

In GaPhaahla, six of ten households visited stated the application of rodent control measures and most used more than one method of control. Two applied rodent control regularly (also at present), two apply measures when they notice rodent activity, but two had recently given up on rodent control "as being useless". The other four households regarded rodenticides as ineffective and not worth the input.

Rattex® was again the most used rodenticide (five respondents) while two households had used "black poison" or "gale phirimi" as it was called here. Two households had a cat for rodent control, and one each used glue boards, kill traps and grain-mixed granular rodenticide.

Four of the respondents bought their rodent control measures from shops in the village and two went to the nearest big town of Jane Furse. The "gale phirimi" was obtained from traders at the monthly pension pay-points.

Retail survey

Ten shops in the four villages, mentioned by the households in and around Mapate, were visited. All ten shops sold Rattex®; seven had Rattex® only while the other had either a second brand name or kill traps. The shops purchased these products from wholesalers or larger shops in town. Shop owners estimated monthly sales from six to 20 sachets of Rattex® in the 100g format, clients buying one sachet at a time. In general, shops did not stock more units of rodenticides than what was sold in a month. The shop trading in kill traps was out of stock and the owner mentioned that it was hard to get hold of kill traps.

In the larger towns of Shayandima, Sibasa and Thohoyandou, the wholesalers, co-operative depots and franchised supermarkets, mentioned by households and village traders in the village survey, were surveyed. A further four general dealers and three pharmacies were included.

- The wholesalers and co-operative carried eleven rodent control products. These were ready to use baits (RB), bait blocks (BB), liquid concentrates formulation and traps. The rodenticides represented products from five different manufacturers. Except for bulk sales to shopkeepers, clients purchased the smallest unit one at a time. Sales staff calculated sales of rodenticides at six to twelve units a week, and two to five units per week for the newer or "unknown" brand names and products in a larger packaging (bulk). Sales of kill traps were stated to be high at 150 units in the past two weeks.
- The six large franchised shops together had ten different products for rodent control. The rodenticides were all in ready to use bait format (pellet, wax block or granular formulation), representing brand names of five different manufacturers. The weekly trade in rodenticides varied from three to eleven units for the lesser-known brands to 23 units of 100g Rattex®.
- Three of the four shops sold Rattex and another rodenticide while the fourth shop had Rattex only. Two pharmacies sold Rattex® as the only rodenticide, while the third carried Rattex® and three

other products, including glue traps. The shops and pharmacies estimated sales of their rodenticides ranging from 12 to 20 units a month, while the glue traps was a slow seller.

Giyani, the nearest big town to Nkomo, is approximately 20km away. Two franchised supermarkets, two shops and a pharmacy in Giyani was surveyed. Three of the shops sold Rattex®, while one franchised shop also sold a second difethialone rodenticide in bait block formulation. The second shop claimed to also sell a brodifacoum rodenticide, but had none in stock. The third shop further carried glue boards with sales of one to two packets of 10 per month depending on the season. The pharmacy's three rodenticides included grain bait, pellets (RB) and bait blocks, each with a different active ingredient.

It was also mentioned that some farmers illegally use Weeviltox GE for rodent control. The pellets are grounded and mixed with food as rodent bait. The gas generating formulation of aluminium phosphide is registered as an insecticide in stored grain. However no households in the survey indicated the use of this product against rodents.

Informal trade

At Mapate, two informal traders were found who stated selling "black poison" at pension pay points on pension pay-out days. They claimed buying the substance in units of up to 20 from Zimbabweans⁵ at a cost of R1.00 to R1.50 each. They then sell it for R2.00 and are able to sell three or four units monthly per pension pay point.

At the market in Thohoyandou, three, and at the taxi rank, a further two informal traders were found selling rodenticides. Four of the traders sold "black poison" at R5.00 per unit (0,23 grams) (Figure 3.1), but they stated that they only manage to sell three to five units per month. One trader mixed the granules with "food" and sold it as a 'ready to use bait'. All four traders stated that the origin of the product was Zimbabwe. Two of the traders also sold glue-board traps, bought from wholesalers in packs of ten boards which are then sold as single units. A further two traders repacked block bait rodenticides, bought from franchised retailers, and sold it as single blocks. One trader mixed granular rodenticides with grain and sold it as a 'ready to use bait'.

Discussion

In the market survey compiled in the two survey regions in Limpopo Province, eighteen registered rodenticides (trade names) from six of the active ingredients (common names) list were found (Table 3.3). These were brodifacoum, bromadiolone, coumatetralyl, difethialone, flocoumafen and warfarin. However in the shops closest to households surveyed, only two to three rodenticides, and only with the active ingredient difethialone, was seen, and with some exceptions, Rattex® in its granular baited formulation, was not only the only rodenticide, but also the only rodent control product, available.

Except for the rodenticides, kill traps (steel and wood base) and glue boards were also available. It was found that there was an increase in the demand for kill traps since the trapping trials. It was remarked that kill traps available locally were difficult to use and also that it was "not strong". In the survey it was found that some retailers of traps were out of stock and could not get hold of traps fast enough.

Prices for the same products were a little higher in the survey area of Giyani/ Nkomo and at GaPhaahla, than in the area around Mapate.

⁵ Zimbabweans are often implicated in crime in the Limpopo Province. Blaming them has become a habit when suspicious activities arise.

Table 3.3. Retail rodent control products available in the survey area in Limpopo

Common name and formulation	Price in village shop	Price in town
Brodifacoum BB	n/a	R2.69 - 3.35/20g R32.28/240g
Brodifacoum BB	n/a	R21.25/120g
Brodifacoum RB	n/a	R2.99 - 3.39/20g R14.95/100g
Brodifacoum RB	n/a	R7.15-8.27/80g
Brodifacoum RB	n/a	R8.99/50g
Brodifacoum RB	n/a	No price available
Brodifacoum CB	n/a	Out of stock
Bromadiolone RB	n/a	R13.68/100g R40.40/500g
Coumatetralyl BB	n/a	R14.99/240g
Coumatetralyl RB	n/a	R8.99- 9.99/125g
Difethialone BB	n/a	R8.29/15g x5 R55.27/100g
Difethialone BB	R18.00 / 85g	R15.99/85g R18.81/100g
Difethialone CB	n/a	R96.35/200ml x30
Difethialone RB	9.70- 10.50 /50g	R3.35 - 7.49/50g R14.98/100g R53.95/500g
Difethialone RB	5.95 - 11.00 /100g	R5.89 - 8.99/100g R16.00/100g
Difethialone RB	n/a	No price available
Flocoumafen BB	n/a	R12.80
Flocoumafen RB	n/a	R64.00/500g
Warfarin RB	n/a	R8.80/100g
Kill traps	R4.50 small R7.50 - 15.00large	R7.00 large
Glue boards 1	R2.00-3.00/each	R8.00 - 9.99 / 10
Glue Boards 2	-	R6.95
Loaf white bread *	R4.00 - R4.80 /700g	
Popular soft drink	R6.50 - 7.90 / 1250ml	

N/a: product was not available in the village shop

*For comparison, the price of two popular commodities, as noted during the survey in the villages, is given. These were a loaf of white bread with a government weight and price regulation, and a popular carbonated soft drink.

From the comments made by respondents in the household and retail survey:

- most rural households knew very little about the correct use of rodenticides,
- most rural households did not know what rodenticides were available,
- most households were slow in changing from a known brand name.
- most households only bought the smallest single rodenticide unit available.
- most households bought Rattex® because it was the only product available in the local shop when it was needed
- Many village shops stock Rattex® as the only rodenticide due to customer demand
- A large number of respondents believed that (chronic) rodenticides were not effective as they note that either rodents had not eaten it or that no dead rodent bodies were seen.
- A number of respondents no longer used rodenticides as they "had rodent problems with or without rodent control".
- some households stated a fear of using poison (rodenticides) in and around the house

- the demand for rodent control products is higher in summer
- Although villagers may often travel to town for various reasons, it is very seldom for the purpose of buying rodent control products.
- Some retailers asked for information on new products

Most households using rodenticides and also those in earlier surveys that had used rodenticides, stated that the product was "ineffective". However many households did not know of other products on the market and would probably buy the same again. It was noted that most households, when using rodenticides, did so in a once-off application and without much planning on correct positioning of the bait. "Ineffective" also meant that they did not see dead rats after application of rodenticides. It is possible that for this reason the illegal use of aldicarb for rodent control has become popular. Households stated that they wanted to see rodent bodies as evidence of effectiveness.

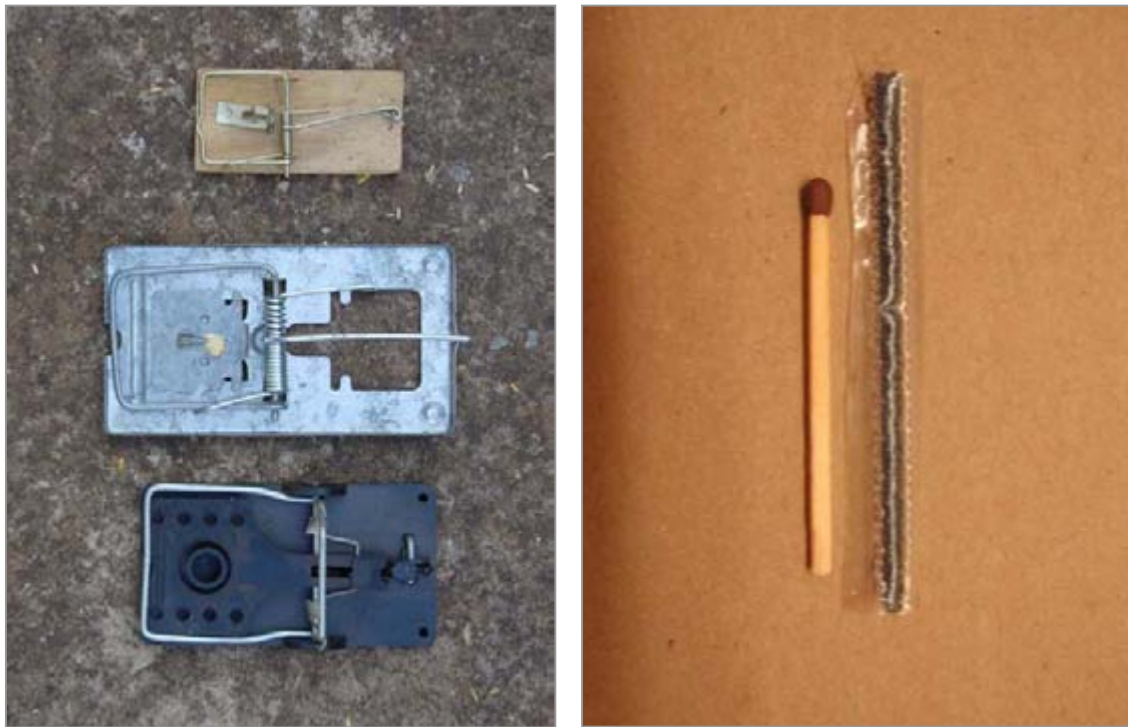


Plate 3.1. Three snap traps: The top two were used with limited success in the survey area, the break back trap at the bottom was demonstrated through intensive trapping to be effective in the controlling of rodents.

Plate 3.2. The nematocidal aldicarb sealed in plastic strips and illegally traded as “rat poison” in informal markets in Limpopo Province.

3.2 Socio-economic and anthropogenic assessments

Introduction

Social anthropological and socio-economic studies, in collaboration with the INCO-DEV RatZooMan project in the Limpopo Province, were conducted in 2004 in the village of Mapate. The socio-economical study was compiled to compare differences between rural and urban situations and between areas without records of rodent zoonosis. The analysis of the survey data is of key socio-economic factors potentially influencing zoonosis transmission.

Material and methods

The study by an anthropologist was based on three visits to each of ten households selected for the study. Interviews were unstructured and observations by the surveyor were also noted. It was explained to participants that the reason for the study was to find out their attitudes and perceptions of rodents and that rodents can carry certain diseases.

The socio-economic questionnaire survey was conducted separately from the above survey with 120 households in Mapate.

Results

Although the anthropological study (Appendix 1) and the household questionnaire were conducted separately, their results are combined under the following headings: Socio-economic status and Human behaviour.

Socio-economic status

The survey with Mapate heads of households indicated that 64% were unemployed, 25% employed and 10% were pensioners and of these 10% did not stay at home. However most heads of households are involved in agriculture and many do not consider farming as "employment" as they do not work for a salary. The heads of the household were indicated as male in only 56% of respondents.

The production of crops were important with maize the most important crop. Vegetables were also important, mostly for women, and almost each household has one or more fruit trees. Few households keep animals (cattle, goats and pigs) and this is due to a lack of grazing area and space for keeping cattle at night. The suggestion that cattle are a sign of economic well-being may be so for the older heads of households, but it is no longer seen as such by younger generations. Households keeping cattle were more likely also to keep goats, dog and cats.

Housing was used as an indication of economic status. The surveyor sorted housing into the categories of traditional, improved and brick (modern). Of the interviewees, 44% lived in brick and tile/metal sheet roofed houses (with more than one room in the building) (Plate 3.3.) and 13% in traditional (mud brick and thatched roof) houses (Plates 3.5 and 3.6). Improved (42%) may be a combination of both as most households consist of more than one building, the living rooms mostly brick and metal sheet while the kitchen and some rooms are traditional (Plate 3.4). The type of building may have an influence on rodent activity as the use of improved materials may reduce rodent access. However for many households the improved housing was in a process of construction which takes a long period of time.

Buildings and homesteads were assessed for rodent-proofing (Plate 3.3 to 3.6). The three aspects observed were the ease of access for rodents to enter buildings, internal harbourage for rodents, and external harbourage for rodents. It was concluded that the rodent proofing varied between the categories of 'easy access for rodents' to 'limited access for rodents', with some cover for rodent harbourage inside buildings and more than average cover outside in the yard.

Human behaviour

Hygiene

All households in the community have access to piped water, through standpipes at key points in the village (Plate 3.7). However water availability is rotated between the points and sometimes run dry. Storage is common for both drinking water and washing water (Plate 3.8). Stored water for drinking is mostly covered while washing water is not. A few households have tapped water in the house or yard. The rivers are often used for washing and bathing and also by children for swimming. Rodent contact with water used by humans is a transmission pathway of rodent transmitted diseases.

The anthropological survey classed eight of the ten households surveyed as having average levels of hygiene, and two were classed as having good hygiene. This was relative to the standards of the town of Thohoyandou and to local notions of hygiene. It was also indicated that those with high income do not necessarily have better hygienic practices than those on low incomes, but depended on individuals. Perceptions of hygiene varied according to age of respondents. Older respondents perceived hygiene as a neat kitchen while for the younger generation hygiene means washing hands before eating. Recent exposure to school education, where for example the young were taught how to use the toilet, was considered a factor in defining hygiene. A high proportion of households in the survey have their own toilets, the majority having an 'improved' or brick building and some households have two toilets.

Method of waste disposal was indicated to be mostly through burning, by disposal in covered or uncovered pit, while some indicated 'thrown anywhere'. Disposal by the majority is however through ways such that it could remain a food source for rodents. Food waste is normally disposed in a pit.

Storage of crops was within the household premises, usually bags of maize put in the corner of a room, but less than half the respondents indicated that it was in the same room used for sleeping. Some respondents believed that households with separate storage structures for maize have the biggest rodent problems, as nobody could chase them away at night. This was also indicated in the PRA survey conducted in the Sekhukhuni district where it was stated that bags of sorghum were often stored in the bedroom where the owner could be alerted to rodents at night. (Von Maltitz *et al.*, 2001)

Rodent perceptions and activities.

The survey questions were formulated to be relevant regarding risks for rodent transmitted diseases. Almost all respondents (91%) in the survey had seen rodents in the house or in the bush and most stated they had seen rodents as frequent as once a month, but few had seen them in the crop fields. Rodents were considered to be a problem but less than half the respondents considered that rodents carried diseases. Most households suggested that rodents that come to houses came from the bush or fields and do not have nests in the houses. From the anthropological survey it was concluded that having rats in your house was seen as a mark of not being a "good housewife" thus there may be a higher incidence of rats and rats nesting in houses than respondents say. More rodents are noticed from October to January (summer) when maize is growing in the field. It was however stated by households participating in the trapping activities that the rodents come to the houses when the maize is harvested.

Rodents were disliked because they damaged personal possessions and crops. The majority of households (74% of respondents) indicated that they undertook rodent control. The most important were chemical, followed by mechanical and biological. A positive correlation was found between

thinking rodents are a problem with thinking rodents carry diseases, family members being bitten and undertaking rodent control. Five percent of households have members that had been bitten by rodents. Wounds are however left to heal by themselves.

A number of people consider rats as disgusting. In the questionnaire survey, 43% of respondents believe that rodents could carry diseases. While some denied this, others said that rats carry a mental illness sent by witches while others believed that rodents could be used to bewitch people.

In the anthropological survey it was mentioned that people in the community regularly eat wild (bush) meat, either hunted by male members of the household or by neighbours or relatives. The animal most often hunted, particularly in summer, was said to be an animal locally called 'tshedzi'. A second "less hunted" unidentified mammal was called 'ndovhi'. The survey however could not identify the two animals by their scientific names so as to tell whether any of them were rodents. In a follow-up query with the trapping staff and students, it was concluded that the tshedzi is the Greater Canerat *Thryonomys swinderianus*, an agricultural pest near its habitat but also due to its size a valuable source of meat. The ndovhi is probably the Giant rat *Cricetomys gambianus*. While occasionally a pest of orchards, it has in South Africa a very small home range in the Soutpansberg mountains only and is listed as vulnerable in the South African Red Data book (Apps, 1996). Both animals are Rodentia and predated by man (De Graaff, 1981). It was mentioned that cattle herd boys of a previous generation had often hunted cane rat along waterways, but as few cattle are kept now due to restricted grazing areas, this activity is now as rare as hunting for the Giant rat was for them when they were younger. While a number of respondents could identify the tshedzi, only a few had heard of the name ndovhi stating, "they knew the name but had not seen the animal".

Contact with cats.

Toxoplasmosis is normally associated with the presence of cats that are the primary host of this protozoal disease. The disease agent is normally picked up from faecal material, however rodents are a reservoir for the protozoa. Cats were kept to control rodents by some households in Mapate, but were also treated as pets. It was observed that especially smaller children cuddled cats and did not wash their hands afterwards. Some respondents in the survey did not believe it was needed to wash hands that had been in contact with cat faeces. Cats could also move freely around homesteads.

Discussion

The studies show that there is regular contact between villagers and rodents, which increases the risk of zoonotic transmission. Levels of personal hygiene vary and as most villagers are not aware of zoonotic diseases, they thus do not take specific measures to prevent transmission. There is a general dislike of rodents, but rodents are often more seen as being a nuisance and disgusting than a threat to human health, although some households believe that the ability of rodents to transmit diseases is due to witchcraft.

The types of housing structures have an influence on rodent access and activity. Although the use of improved building materials and methods may limit rodent access, the construction of improved housing takes a long time and therefor access for rodents is not reduced. Improvement to the infrastructure by local government may reduce rodent populations and the risk of zoonotic transmission.



Plate 3.3. Brick and tile roofed (modern) house with garden in Mapate with reduced access to rodents



Plate 3.4. Brick and tile roofed (improved) house in Mapate with reduced access to rodents. The open kitchen however provides ease of access for rodents to food preparation areas. In the foreground maize cobs are dried in the sun.



Plates 3.5 (above) and 3.6 (below). Two examples of the “traditional housing” category in Mapate. The building below provides easier access and harbourage for rodents compared to the neat appearance of the homestead above.





Plate 3.7. Women waiting at the standpipe for drinking water in Nkomo-B.



Plate 3.8. Storage of water in containers in the arid Mopani district
Plate 3.9. Cooking area under a raised granary in the Mopani district.

4. Publicity campaign to disseminate results of assessments on management strategies.

Introduction

Two valuable lessons learnt from conducting research and development projects in South African subsistence rural communities are the following of the correct communication channels of the community and the feedback of research activities and results. Through continuity mutual trust and respect develops.

During the PRA conducted in Limpopo Province in 2000-2001, a Venn-diagram technique was used in community group exercises to determine the sources of agricultural information to which villagers have access. The direction of information flow and the importance attached to the information was determined in exercises with male and female groups separately. The sources mentioned were as numerous as the types of information and varied from gossip to printed media. The sources most often listed were seen as more important and are also more readily available to “outsiders” for the dissemination of research outputs. These are agricultural extension service, radio and the tribal authority. These were specifically targeted for formal dissemination while other available sources were accessed as opportunity arose during the execution of the project assessments in the communities.

Material and methods

The three major information sources identified by communities were utilised in the following ways;

- Agricultural extension service through the involvement of the Provincial Department of Agriculture in all aspects of the project as well as presenting training workshops for extension personnel specifically.
- Attending and arranging community meetings through and with the tribal authorities.
- Preparing and presenting material for radio broadcast.

Other dissemination systems to reach a broader audience and involve stakeholders in the industry were also utilised through publications, presenting of papers at scientific congresses and hosting workshops.

Results

Rural communities information sources

Meetings with the Communities were held from the initiation of the project with follow-up meetings during the assessments period with the objective to provide feed-back (Plates 4.1 to 4.5). All meetings were set up through the tribal authority via the agricultural extension officer assigned to the village, and always had at least a representative of the community council in attendance. The execution of assessments in the villages and with the community had the blessing of the respective tribal chiefs. Through this system informal discussions to transfer research results or give advice on rodent control had value. Attendance at meetings varied from twelve to 100 people, depending on the occasion or time.

Extension personnel and officials from the Limpopo Department of Agriculture and Environment allocated to the rural communities selected for the execution of the project were delegated to attend the training course together with the project field staff in Pretoria in August 2002. These extension officers served as back-up to the field staff as well as communicating progress to their communities and offices.

A two-day training workshop on rodent control specifically for agricultural extension and environmental health personnel was presented in February 2004. Twenty representatives of the two

government departments attended the workshop at Thohoyandou (Plate 4.6). Training was presented by international rodent experts Dr. S.R. Belmain (NRI, UK) and Adrian Meyer (NRI associate, UK), a local professional pest control operator (Scientific Pest Control Services) and a local manufacturer and distributor of rodent control products (Coopers Environmental Science (Pty) Ltd). The theoretical training was substantiated with practical demonstrations in households of a farming community nearby and at a hospital.

Two radio talks were prepared for regional radio on the importance of rodent control regarding human health and food security. A talk in SePedi was broadcast by Radio Thobela FM on 27 January 2003, while a talk in Afrikaans was prepared by the National Department of Agriculture's media office for broadcasting on Radio Sonder Grense on 7 March 2003. Further use of radio as media output with a specific format is planned for 2005 with material for broadcasting in the process of preparation.

Workshops

A Crop post-harvest workshop was organised with relevant stakeholders in the industry in Pretoria on 24 October 2002. A paper on the DFID outputs in the Limpopo province providing solutions to rodent constraint was presented.

A workshop was held on 6 February 2004 in Pretoria with stakeholders in the rodent control industry. At this meeting a review was given on international and local rodent research and rodent control trends. One output of the workshop was the setting up of an interim committee representing rodent control operators, manufacturers of rodent control products and research (see chapter 5).

Publications

For dissemination to a wider audience and for scientific purposes, articles and papers were also presented in text. Articles were submitted in two popular publications, *i.e.* Plant Protection News (Pretoria) of March 2003 and Rodent Research Newsletter (Canberra) of April 2005. A refereed article was published in the ACIAR Monograph of 2003 and abstracts of papers presented were published in the proceedings of the respective organisers.

Scientific papers were presented at the International Conference on Rodent Biology and Management held in Canberra, Australia, 10-14 February 2003 and the African Small Mammal Symposium held in Morogoro, Tanzania, 14-18 July 2003.

To serve as visual feedback on project progress, a newsletter illustrating the rodent species and number of each species caught in the villages was written for and distributed by the field staff. The newsletter was also used by extension in the compiling of reports for their respective offices.

Discussion

The mutual understanding and respect that was developed between research, extension and farmer (communities) in the Limpopo Province rural community area through the successes of previous development projects paved the way for the rodent control project. This in turn eased the implementation of the INCO-DEV project on rodent zoonosis.

The continuity and the combination of the CPP rodent project with the Ratzooman project further contributed to the success of each project. Dissemination of results through the key information sources not only presented information to the participating rural communities, but also to other communities in the province and to interest groups further away.



Plate 4.1. Meeting with the community of GaPhaahla in the community hall.



Plate 4.2. Meeting with the community at Bloublommetjieskloof service centre.



Plate 4.3. Meeting with council members and community members of Mapate in February 2003 to explain project activities.



Plate 4.4 Meeting with the community of Mapate in February 2004 to present feedback on project activities and to reward project field staff with skills development certificates.



Plate 4.5. Meeting with the communities of Nkomo in the community centre.



Plate 4.6. Training workshop on rodent biology and control with government agricultural extension and environmental health officials at Thohoyandou.

5 Development of policy framework for supplying rodent control programmes

Introduction

The policy on good pest control service industry in South Africa is in place. This is regulated by the Pest Control Service Industries Board (PCSIB) established in 1997. The board consists of representation by the National Departments of Agriculture, of Health, of Labour and of Environmental Affairs, Pest Control Association (SAPCA), Crop Protection and Animal Health Association (AVCASA) and the Tshwane University of Technology (TUT). It incorporates eight Acts of Parliament and has set up 14 objectives of which the most important are:

- To review the regulatory mechanisms of the Pest Control Service Industry, make recommendations for the improvement of these mechanisms.
- To monitor, inspect and regulate the activities of Pest Control Service Providers, Pest Control Operators and their assistants to ensure they meet the standards required by the Board.
- To set policy and administer all aspects of the Pest Control Service Industry not covered by the Act.

It also promotes science and operates in close co-operation with SAPCA, Registrar of Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act and any organisation to further the interest of the board.

The Board in partnership with TUT and SAPCA is responsible for developing Pest Control Operators (PCO's) training courses and curricula.

Some of the problems identified by the Board are "fly-by-night" PCO's, lack of training, the unethical use of pesticides and unregistered applications by PCO's.

Material and Methods

A one-day workshop was organised with stakeholders and roleplayers in the rodent control industry in Pretoria on 6 February 2004. As an introduction DFID and EC funded rodent projects operating in southern Africa (South Africa) and the UK perspective on training and regulation, were presented. The challenge posed to the participants was resolve the shortcomings of the local pest control industry as experienced by end-users

Results and Discussion

Policy frame work

From the open discussion and the group session three major shortcomings were identified:

- Training, not only PCO certificate training, but lack of practical training and specialised training on rodent control.
- The need for an independent body to examine trainees.
- Better enforcement of Act 36 of 1947 by the National Department of Agriculture.

From the workshop an interim committee was appointed, with one representative each from research (PPRI), manufacturers, pest control operators and SAPCA.

The committee had a meeting on 16 March 2004 at Kempton Park to draw up a proposal on changes to the PCO training that was tabled by PPRI, as an independent outsider to the industry. The proposals were tabled, by invitation, to the PCSIB meeting on 10 May 2004.

The recommendations to the industry were:

- Upgrade the existing pest control course to include rodent control as subject divided into components for industrial and domestic rodent control. The content of the course needs to be refereed by industry.
- Practical training essential to the course.
- Annual registration should include attendance of a workshop to update on new technology and trends.
- National and local government personnel responsible for rodent control should also complete the rodent control component of the PCO course.

TUT acknowledged the fact that their rodent control course is inadequate and has given the project an 'open hand' in revising the introductory course as well as writing the advanced rodent control course if the latter is approved by PCSIB. On the strength of the projects involvement in rodent control training PCSIB invited the project to participate in setting unit standards for rodent control for approval by South African Qualifications Authority (SAQA).

Resistance to policy changes by some role players will take time to overcome, but a major step towards changes was made by giving an independent institution (PPRI) the opportunity to revise the existing curriculum in cooperation with the leading training institution in the industry.

Public/private partnership

A partnership between government, research (represented by PPRI and NRI), manufacturers of rodent management tools and pest control industry was established to present training to agricultural extension, environmental health officials and pest control operators and municipalities. Due to the importance of maintaining a high standard of training for the extension of the project to the end of 2005, NRI and its associate were made the leading collaborators. The initial training with extension and environmental health in the Limpopo Province was successful and has already been extended to KwaZulu-Natal in March 2005.

A South African rodenticide manufacturer has agreed to modify and manufacture break back traps similar to those from an US based company, which were successfully used in Mozambique (DFID project R7372) and in this project. These traps are sufficiently sensitive and cost-effective (based on the number of rodents caught per trap) when compared to alternatives such as rodenticides. The engagement of a local manufacturer also ensures sustainability and a pricing structure independent of the Rand – US Dollar exchange rate.

Outputs

The project had five main objectives for which the results are summarised below.

Assess the impact of rodents on rural communities' sustainable livelihoods

A questionnaire survey with households representing the variety of standards in the community indicated that rodents were a problem to all. The impact of rodents on the livelihood was summarised as that rats eat food, eat clothes and bite people. Although farmers noticed damage to field crops, it could not be quantified. Rodent damage was more visible in stored crops and in and around the homestead and thus rodents were perceived as a household pest. For many rodents had become a part of the daily life and were often only noticed when populations increased during harvest time. There was a general awareness about rodent control tools such as rodenticides and traps, but the knowledge on the correct and effective uses thereof was lacking.

Assess impact of rodent management strategies on rural communities

A number of trials were conducted in the four identified communities in the Limpopo province. Project field staff to manage the daily maintenance of trapping trials were trained on rodent biology, ecology and identification to be skilled to execute dissections, data recording and handling of material. Trapping trials were conducted with 80 households in four villages and in four crop fields for a period of 18 months. Intensive trapping reduced the rodent population, in the households and in crop fields, by at least two thirds and sustained trapping constrained population growth in the following season favourable for population growth. The effectiveness of intensive trapping on the reduction in rodent population numbers and the effectiveness of the break back trap as a rodent management tool was favourably demonstrated to communities. The effects of subnormal rainfall however also had an impact on rodent breeding. Monitoring the rodent influence in post-harvest losses did not proceed as desired due to external interference with the trials and no satisfactory conclusion could be made. Trap success in crop fields, localities where farmers have not applied rodent control, was similar to that in the households, although number of rodents trapped in the households far exceeded the number trapped in the field. Rodent damage to crops in the field at different growth stages was also calculated.

Project field staff continued to assist and monitor the participating communities for a period after the formal baseline assessments on rodent impacts on households were completed. Through the keeping of 'farmer's diaries' on behalf of the households, a "post-trapping survey" monitoring the continuity of rodent control in the villages.

Market surveys and socio-economic assessments

A survey with households and with retailers of rodent management tools was conducted to determine what products were available to communities. Farmers indicated that they could only purchase the rodenticide that retailers offered, even though they dismissed the effectiveness of the product, while retailers closest to the rural communities only stocked what customers demanded. Rural households often did not know what other rodenticides were available, but were slow in changing from a known brand. Rodenticides were used as a once-off single dosage that rendered them to be ineffective. This had stimulated the informal trade in acute chemicals as illegal rodenticides

The anthropogenic and socio-economical studies revealed that villagers risked contact with rodents on a regular basis. Structures not only provided rodents with relative ease of access, but also harbourage in most homesteads. Crops in storage, food preparation and water stored in containers could be

exposed to contamination. Perceptions on hygiene varied and although rodents were considered disgusting, few perceived that rodents could transmit diseases.

Disseminate results of assessments

Results from the assessments as well as information regarding rodent control were transferred to communities via the three major information channels identified by communities to be to their advantage. Meetings were held with communities and their local tribal authorities to disseminate progress and results of the project. Government agricultural extension personnel assigned to the participating communities were involved at all stages of the assessments and dissemination of results. Training on rodent control was presented to representatives of government departments of agriculture and of environmental health in the province at workshops held for this purpose. Project activities and results were presented for regional radio broadcast in two languages. Further material for broadcasting on radio is being prepared for 2005.

Results from the assessments were presented as oral papers at workshops with stakeholders in the industry as well as at scientific symposia. Results were also published in semi-scientific literature and in conference proceedings.

Develop policy framework for supplying rodent control programmes

A workshop was held with stakeholders involved in rodent control to reveal the impacts that rodents have on sustainable livelihoods and to discuss the potential strategies, which can be used to disseminate information. An interim committee appointed by the workshop tabled changes to pest control operator's training regarding rodent control as well as policy changes regarding training of government and municipal health and environmental health personnel to the Registrar: Agricultural remedies and Stock remedies (Act 36 of 1947) and to the Pest Control Service Industries Board (PCSIB). The official trainers acknowledged deficiencies and suggested revising the present introductory course as well as drafts for specialist courses. Although a measure of resistance to policy changes exists within the Board, the importance of improving rodent control is recognised and it has asked for proposed changes to be submitted. On the strength of the project's involvement in rodent control training, PCSIB invited the project to participate in setting unit standards for rodent control for approval by South African Qualifications Authority (SAQA). A training workshop on rodent control is prepared for attendance by commercial pest control operators and city municipal environmental health personnel in an effort to improve the standard of practical rodent control training.

Contribution of Outputs to developmental impact

The outputs have been achieved. The major objective of demonstrating to poor rural communities in the Limpopo Province that rodent pests can be sustainably managed without the use of poisons has been achieved. The impact of rodents on the livelihoods of subsistence communities can be reduced without large financial expenditure of households, communities or of governmental departments. Market surveys has shown that rodent management tools are available, but that the knowledge on the effective use of products is lacking. A South African pest control company has started manufacturing a modified version of the imported break back traps used effectively in the project trials while a second company directly imports the tool for local retail. Availability of improved break back traps will ensure cost stability affected by changes in local monetary value. This will add to the sustainability of rodent management in urban communities, however links between manufacturer and remote rural retailers need to be improved. Project activities and results has been disseminated to communities by means of information transfer via government extension and limited use of radio, however further dissemination of project results as well as rodent management technology by means of radio and other media tools will also be addressed.

South Africa is in a transitional phase, which adds another dimension to policy change within the public sector and acceptance of changes by some role-players especially within the private sector. A major opportunity was given to the project to assist in setting the unit standards and revision of existing national rodent control training material.

The sustainability of the project was strengthened by training trainers in rodent pest management in the agricultural extension services, department of health and local government environmental health services.

List of publications produced from the project

BASTOS, A.D.S., C.T. CHIMIMBA, E. VON MALTITZ, F. KIRSTEN & S.R. BELMAIN, 2005. Identification of rodent species that play a role in disease transmission to humans in South Africa. 5th Annual Conference of the Southern African Society for Veterinary Epidemiology and Preventive Medicine. Centurion, South Africa, 11-12 August 2005. [paper to be published in conference proceedings]

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Biometricians Signature

I confirm that the biometric issues have been adequately addressed in the Final Technical Report:

Signature:

Name: Mrs. M. Smith
Position: Senior Biometrician to the ARC
Date: 30 June 2005

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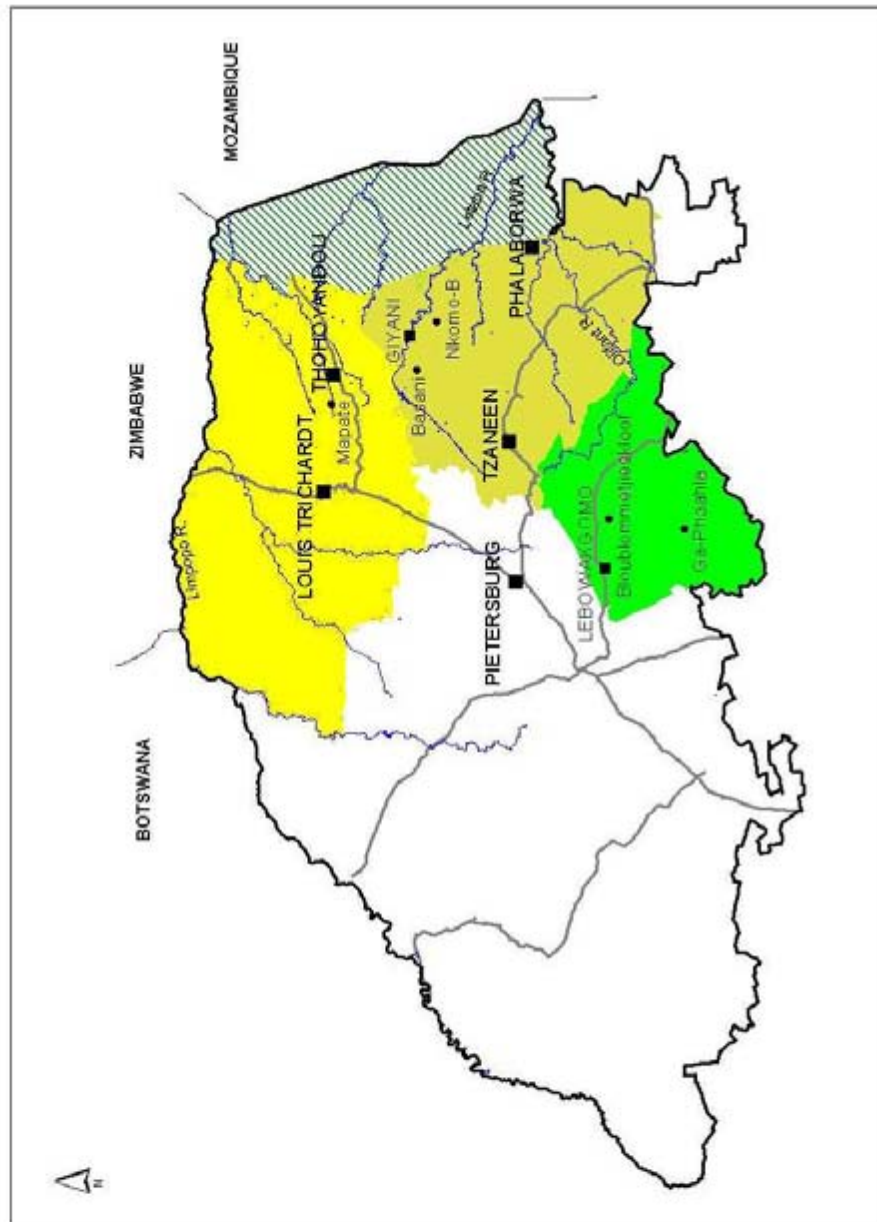
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Appendix 1: Map of research locations.

SOUTH AFRICA
Limpopo Province



	<p> Vhembe District Mopani District Greater Sekhukhuni Kruger National Park </p>	<p> PPRI P/Bag X 134, Pretoria 0001 Drawn by: ME Kleser GIS Unit February 2001 </p>
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Appendix 2: Report on social anthropological study.

"Practices that are considered to be of a good wife are when a woman is able to keep her own household clean"

The Ratzooman Project
“ Prevention of Sanitary Risks Associated with Rodents at the Rural/Periurban Interface”
Report on Social Anthropological Study: Identification of perceptions and practices likely to be relevant to the transmission of plague, leptospirosis and toxoplasmosis.

Field site: Mapate, Thohoyandou, Limpopo Province, South Africa

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Based on fieldwork carried out by
Pfarelo Matshidze and Josephine Mudau of the University of Venda.

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SELECTION OF FIELD SITE

Mapate was chosen as a field site for the RATZOOMAN project because work had already been done there, and was still ongoing at the time of this study, in relation to another project focusing on ways of controlling rats. In conjunction with the anthropological study, which has provided the basis for this report, a linked socio-economic questionnaire survey was carried out at around the same time. Some of the figures from this are included here. Mapate is a rural area consisting of a number of smaller hamlets, within two miles of the town of Thohoyandou in Limpopo province. It is within the peri-urban area surrounding the town, and there are regular buses connecting the village and the town. This is an area which was a homeland under the apartheid era. There is the expectation historically that many of the men will go away to work in white-farmed areas, in white-dominated towns or in white-owned mines. Much of this work has now dried up. This has left the men with a sense that they have no proper occupation, since they had, for many decades, left agriculture to their womenfolk. They now consider themselves to be unemployed, even if their households have land, and most do not involve themselves much in cultivation of the fields. In the socio-economic survey, 64% of households reported their male heads as being unemployed. Poverty, measured by numbers of animals owned, is high: very few households reported owning poultry, goats, pigs or cattle. Maize is the staple crop, with almost all questionnaire survey households reporting that they grow it. 83% of households also reported growing fruit. Only 39% of households reported growing vegetables, which may be related to the proximity of Venda and the possibility of buying vegetables there.

METHODOLOGY

The fieldwork for this study was carried out by Ms. Pfarelo Matshidze and Ms. Josephine Mudau, both of the University of Venda. Ten households were chosen as key informant households for the study, with the assistance of Lacton Mudau, the civic association chairperson for Mapate. These were chosen to be representative of the community both in terms of income levels and in relation to factors which might affect their exposure to leptospirosis, toxoplasmosis and plague (different sources of water, different types of house structure, relative proximity to bush land, types of storage structure for crops and for water, presence of cats in the household, relative levels of hygiene [according to local perception]). A list of the key informant households is included as an appendix at the end of the report. A qualitative method of data collection was adopted, using participant observation methods as well as direct interviews.

Each household was visited three times. The interviews were unstructured, with the researcher introducing the theme and encouraging informants to participate spontaneously. In each household both parents were interviewed as well as their children. What informants actually did in relation to relevant activities was also observed during visits, and their practices were documented. The interviews were conducted in Tshivenda, and they were then translated to English. The main researcher, Pfarelo Matshidze, is a Tshivenda speaker, so no interpreter was needed. This also made participant observation straightforward. Pfarelo Matshidze began the first visit by explaining to the informants the aim of the study, which is to find out about the presence of rats in their community, as well as the informants attitudes and perceptions of rats. The fact that rats can carry certain diseases was explained as the reason for the study. It was also explained to informants that their identity would be concealed, and they were told that they had the choice of not participating in the research.

Because in Mapate there is no history of plague, the focus within this study has been on practices and perceptions which are relevant to the transmission of leptospirosis and toxoplasmosis. However, practices relating to the consumption of meat, and attitudes to rats, are potentially relevant to the transmission of plague.

FINDINGS

General hygiene: practices and perceptions

Hygiene practices in the kitchen relate to the likelihood that there will be food to attract rats and therefore the possibility of transmission of leptospirosis. Personal hygiene relates to the possibility that toxoplasmosis could be transmitted either through cat faeces or through handling contaminated meat and failing to wash one's hands afterwards; this latter also relates, potentially, to the transmission of plague. It also relates to the transmission of leptospirosis through rats being attracted to unwashed hands during the night. Eight of the households were classed as having average levels of hygiene by the researcher, and two were classed as having good hygiene. This is relative to standards in the town of Thohoyandou as well as to local notions of hygiene, and these are not the same, although they do overlap with, standards of hygiene which would protect from transmission of disease. It should be noted that many informants said that those with a high income do not necessarily have better hygienic practices than those on low incomes. It depends, they said, on individuals. They said that women in some households that have low incomes keep a much cleaner household than other women in households with higher incomes. Perceptions of hygiene vary according to the age of informants. While for older informants to be hygienic means to keep one's kitchen tidy and in good order, for the younger generation to be hygienic means washing one's body everyday and washing one's hands before one eats food. This probably relates both to the fact that young people are not yet focused on keeping a household themselves and to recent exposure to education. At school young people are taught to use the toilet and to use water that has been treated with bleach. In relation to cleaning practices, nowadays the ideal, particularly among the young, is to buy and use chemical detergents such as Handy-Andy and Bleach to use as multi-purpose cleaners, and to use commercial polishes for the floor rather than using cow dung as is traditional.

Those who have the money to buy these do so, according to informants and according to what was observed. However, informants pointed out that those with low incomes are unable to use these because they cannot afford them. A relatively high proportion of households have toilets. Those which do not tend, according to informants, to be recent arrivals. Some informants said that younger members of households without toilets use the bush, while older people will often ask to use a neighbour toilet. However, some informants told us that certain elderly people prefer to use the bush even if their household has a toilet. One female informant said that men have a tendency to urinate just anywhere rather than use the toilet. Not everyone washes their hands after going to the toilet; although a number of informants said that they did, and a few said that they knew that there were illnesses which could be transmitted if they did not. However, it was observed that informants often did not in fact wash their hands. Children in particular are very likely not to wash their hands. Toilets are sometimes used as bathrooms as well. Some old women, however, were observed to wash behind the kitchen (tsitanga) after dark or very early in the morning around 4 a.m., to prevent people from seeing them. Opinion was divided among informants as to whether water can carry disease. Some informants believed that it does, others said that it does not. It seems likely that government health campaigns may have had some impact in increasing awareness among some informants of the potential for water-borne diseases. Some informants said that running, river water cannot carry disease because it is indigenous, implying perhaps that it is not contaminated by outside pollutants. Water is normally drunk as it is, without treatment or boiling. Some informants were explicit about their belief that there is no need to boil water "that people in Mapate had been using water as it is for many years and it hasn't harmed them. However, one informant said these days it is better to boil water because there is enough rain, and when it rains water could carry diseases.

Another informant said that she knows that water from the river should be boiled before drinking. Some informants said that bleach is poured into drinking water if there is an outbreak of disease. Waste, particularly food waste can potentially attract rodents. Waste was found in the socio-economic survey to be disposed of through burning by half the households surveyed. The other half put rubbish in pits, often uncovered, near the house. It is likely that food waste is normally disposed of in this way by all households since it is not easy to burn wet waste.

Rats: practices and perceptions

Rats were said by most informants to be common in the village, although informants said that there are more rats in the fields than in houses. In the socio-economic questionnaire survey, 91% of respondents had seen rats in the house or in the bush, though much fewer had seen rats in their fields. 15% of those who said they had seen rats had seen them once a day. There are apparently more rats in October to January when maize is growing in the fields. Despite the fact that most respondents to the questionnaire survey said that they had not seen rats in their own fields, most people questioned through the anthropological survey said that rats which come into houses come from the fields; they do not, respondents said, have nests in the houses themselves. It seems likely that not having rats in your house is seen as a mark of not being a "good housewife"; some of the women asserted that they did not have any in their houses. Thus there may be a higher incidence of rats in houses, and even of rat nests, than people say.

Rats are disliked because they damage crops and, if they come into the house, personal possessions. They also bite people, especially at night. In the questionnaire survey, 84% of households said that they consider rats to be a problem. Informants were divided as to whether they believe that rats can carry disease (in the questionnaire survey 43% of respondents said that rats could carry disease). Some informants in the anthropological study denied that this was the case, while others said that they carry diseases such as what is locally called thuri (a mental illness which is sent by witches). Because of this rats are considered disgusting. A number of informants said that they believe that rats can be used to bewitch others. Rats are very fast, and they are thought to use their speed to move from the perpetrator (the witch) to the victim. People are, they said, often bitten by rats while they are asleep, particularly on the toes or fingers. One informant pointed out that it is generally those who have not washed their hands after eating maize porridge who get bitten on the hands. If the wound goes septic, informants said that they consult a traditional healer. Generally, though, rat bites are left, as are other wounds, to heal by themselves. They are not covered, meant that they are potentially open to leptospirosis via water.

Attempts are made by some households to control rats by using chemicals such as rattex and rat traps locally called zwilibana. Households are, according to informants, more likely to use rat poison if they have a separate storage hut. This is probably because it is believed that separate storage huts mean more rats (see below). Households in Mapate almost always have more than one building, and may have a mix of thatched (round, one-room) and "modern" (zinc or tile roofed, often containing more than one room) constructions. In terms of access by rats, thatched houses are not necessarily easier than modern houses. If a modern house is in the process of construction, which it may be for a period of time, it was observed that there are many potential entrances for rats. However, once a modern house is finished and if it is well-made with a well-fitting door and no gaps at the top of the walls under the eaves, it will be harder for rats to gain access to than a thatched house.

Households normally have separate buildings for use as sleeping huts and as kitchens. Grain is often stored in the same room in which people sleep. In the socio-economic survey, it was found that 42% of households store their maize in their sleeping room, normally in a bag in the corner of the room. Very few households have separate storage structures for grain, and they do not successfully protect stored grain from rats. Some informants said that it is households which have separate storage structures for their maize that have the biggest rat problem (perhaps because there are no people to shoo them away at night), and this may be one reason for the fact that households do not normally build these but store their maize in their sleeping huts. If there is too much meat from kills of wild animals to be eaten immediately, informants said that it is made into biltong. This is stored in the kitchen, and is likely to be attractive to rats.

Leptospirosis: risky activities

Contact with river and pond water

All households in the community have access to piped water, through standpipes situated at key points in the village; however, informants said that these sometimes run dry and everyone then has to use river water. There are rivers on both the eastern and western sides of the village of Mapate. Of the ten households involved in the study, four said that they normally use piped water for all purposes. Five households said that they use both piped water and the river, and one household had a tank to store water itself. A common pattern would be to use water from standpipes for drinking water and to wash dishes, to bathe and wash clothes in the river. Thus, the minimum amount of water has to be carried to the house. Members of households near standpipes are more likely to use water from them for washing and bathing. However all households would use the river when the standpipes run dry.

Apart from the two rivers, there are also small ponds where children go to play occasionally. Teenagers and small children go to the river to swim, particularly at weekends and after school. The rivers are near the bushes and mealie-fields where there are rats. Rats may urinate or defecate in the water. It is quite likely that when young girls and boys swim, they have wounds or cuts. The community is poor so most people do not go to hospitals or clinics unless they suspect that they have a serious illness. Those with higher incomes may take their children to the doctor or clinic if they are wounded, in order to get medication. However, those who are from a low income bracket often do not go for treatment, and their sores may take a long time to heal. Thus the poorer members of the community are probably more likely to be exposed to the transmission of leptospirosis through untreated wounds being exposed to river margins where rats may have urinated.

Households which are situated at a distance from a standpipe, or are near the river, are more likely to make use of the river for washing clothes, dishes and for bathing. Thus it is likely that they will be more exposed to the danger of catching leptospirosis. In a general sense, children and teenagers are much more likely to swim in the river or in ponds, as a recreational activity, and are therefore more likely to be exposed to leptospirosis. Most women go two or three times a week to wash clothes in the river, according to informants. Because this activity is at the margin of the river, it is a risky activity, particularly if women have cuts or sores.

Water storage

Informants said that water is usually collected for household use (mainly for drinking and cooking) three times a day. It is normally either women or children who collect water. Only one of the households had a separate storage structure for water (a tank). Normally, water is stored within the household or under a tree nearby to keep it cold, either in plastic containers or in big clay pots. These are emptied and refilled every two or three days. One informant said that it was important to empty and refill water containers to avoid the water smelling bad. Containers are sometimes, but not always, washed with bleach or soap before they are refilled. Usually, they are simply rinsed out with water and may be scrubbed. Although some informants said that they knew that they should cover water containers to stop rats and cockroaches falling into the water, sometimes the containers were observed not to have lids or to have ill-fitting lids, and rats could therefore urinate in the water. Since water is not normally boiled before drinking, this means that drinking water could be contaminated with leptospirosis.

Food preparation and storage

Local practices in relation to the storage of raw food and to the preparation and storage of cooked food present risks in relation to leptospirosis. Because grain is often stored in sleeping huts, people are exposed to rats which wander around during the night while they are sleeping and may lick their fingers if there are traces of food on them and even urinate on them, thus exposing them to the danger

of leptospirosis. Some fruit is eaten raw but vegetables are cooked before they are eaten. Fruit (except wild fruit picked from trees and bushes nearby) and vegetables were said by most informants to be washed before they are eaten by most informants, although one said that she did not always do so and another said that she believed that even if fruit and vegetables are not washed there is no problem. The water which is used for washing fruit and vegetables is untreated and may have been contaminated with rat urine.

Meat is often left out in the open by most households since only a few well-off households have refrigerators, and rats may therefore have been in contact with it and urinated on it or near it. Cooked food in most households is stored in the kitchen where it is prepared. Food such as vhuswa (porridge), vegetables (muroho) and meat are left out on a daily basis because some people regularly eat porridge for breakfast. Although some informants said that they knew they should cover leftover cooked food to avoid rats and cats eating it, food was in fact not infrequently left uncovered, according to informants and according to what researchers observed, and rats may walk on top of the food and may potentially urinate on it or near it. Some informants said that they had seen rat faeces on food, demonstrating that rats have been in contact with it.

Food is often shared with neighbours and relatives, particularly special dishes such as tshidzimba (a mixture of samp and beans and thophi). When one family does not have enough to eat, relatives or friends may assist with food in order to provide for the family. During feasts and weddings food may be shared among family members and relatives. If there are visitors food may be taken to their hosts households. There is the potential that if the food has been left out and rats have urinated on or near it, leptospirosis could be passed to members of other households in this way.

Toxoplasmosis: risky activities

Consumption of potentially contaminated meat

Most households rarely buy meat. The very well-off may buy meat twice a week, but the least well-off would buy meat once every couple of weeks or less often than that. Meat is most often bought on pay-day, for those who are employed. Beef is infrequently bought; most households buy chicken, which is cheaper. However, wild meat appears to be regularly consumed. Although only two of the ten households studied are classed as living close to the bush, all households are relatively close. Eight of the ten households in the study mentioned the fact that people in the community regularly eat wild meat, either hunted by a male household member or by neighbours or relatives and given to other households, although it was not possible to ascertain definitely how many of the households studied regularly eat wild meat themselves. Hunting appears to be common, and hunters go out from the village almost every day, according to some informants. It probably provides a significant proportion of the meat eaten in the village by most households, particularly the majority which are not well-off enough to buy meat often. It is possible that eating wild meat may be seen as a marker of poverty, although this was not ascertained definitely, and this may veil the actual incidence of consumption of wild meat. The animal most often hunted was said by informants to be an animal locally called tshedzi, a pole-cat like animal, which was said to be found particularly in the summer when it comes to eat the crops. Another prey animal which was mentioned by one informant is called ndovhi locally. It was not possible to identify these species by their scientific names, so as to be able to tell whether any of the animals hunted are rodents.

Informants said that meat is sometimes (possibly even quite regularly) cooked directly over the fire rather than boiled. Although informants said that it is thoroughly cooked, it was not possible to verify whether meat is cooked until there is no blood present, and therefore whether there is a risk of transmission of toxoplasmosis. As already mentioned, special dishes “ particularly meat” may be shared with neighbours and relatives, so toxoplasmosis may be passed to members of other households. It is not known whether excess hunted meat made into biltong could carry toxoplasmosis.

Contact with cats

Cats are found in many households, although of the key informant households studied only two owned cats. It is extremely likely that cats do not restrict themselves to the household which technically owns them, and that their presence in other households will be welcomed because they control rats. Cats were said by some informants to be kept specifically to control rats, but they were also said by many households to be treated as pets. In this context, there are various means via which people may come into contact with cat faeces and hence with toxoplasmosis, either directly or on cats coats. Firstly, since cats are treated as pets they are petted and cuddled by their owners, and particularly by children. It was observed to be unusual for people to wash their hands after they have handled such pets, although some informants said that they did wash their hands. Some informants specifically said that they did not believe that you needed to wash your hands after you have come in contact with cat faeces. Secondly, cats may sometimes defecate near food, although cat faeces are removed by adults if they see them inside the house. It is possible that even if there is no cat in the household, cats from other households may come, attracted by meat, and walk over it if it is not covered properly, and they could have traces of their own faces on their paws which would then be passed to the meat.

CONCLUSIONS

There is no plague in Mapate. Leptospirosis and toxoplasmosis are not diseases of which villagers are aware. While they or members of their families may have had one or the other, they would not know this. Since they do not know of the diseases, they also do not know how they are transmitted. They cannot, therefore, specifically take measures to prevent transmission. However, there are local views and beliefs about good hygiene and disease in general which are relevant to the transmission of the two diseases, and a look at human habits, in particular food preparation, reveals various practices which could facilitate transmission. This report has focused on examining these views, beliefs and habits. Although there is a general dislike for rats only about half of the people questioned believed that they carry disease. They are seen more as a nuisance, and as disgusting, than a threat to health in themselves. There is a belief that they are used by witches to bewitch people, and their ability to transmit disease is to a large extent believed to be related to this. They are also seen as more or less impossible to eradicate; given current house-building practices in Mapate, which rarely keep out rats effectively, this is probably accurate at the moment. Efforts are made to trap rats by some households but generally rats are seen as something you have to live with. Although government health campaigns and education have had an impact on perceptions of hygiene and on practices which relate to susceptibility to the transmission of rat-borne diseases, they do not seem to be fully effective. Thus, for example, perceptions of the potential for water to carry disease are confused and many people believe that it is polluted water that carries disease, and do not realise that local water sources can carry disease of other kinds. Therefore, local water is not normally boiled.

Outline of risky behaviour in relation to leptospirosis and toxoplasmosis in Mapate.

Leptospirosis

Potential exposure to leptospirosis in Mapate is likely via the following routes:

- Drinking water from rivers without boiling
- Exposure to river water through washing clothes (women) and through swimming (young people and children)
- Drinking or using for food preparation river or well water which has been stored not fully covered, accessible to rats
- Leaving raw and cooked food in the open, uncovered, accessible to rats
- Having ones hands bitten and/or licked by rats while sleeping, due to storage of grain in sleeping huts and the fact that people do not always wash their hands after eating

- Sharing food which may be contaminated with other households

Toxoplasmosis

Potential exposure to toxoplasmosis is via the following routes;

- Eating meat from wild animals which is cooked over a fire and may not be thoroughly cooked
- Handling and cuddling cats
- Leaving raw or cooked meat in the open, uncovered, accessible to cats and in potential contact with cat faeces either directly or via cats paws

DETAILS OF KEY INFORMANT HOUSEHOLDS

N.B. Standard of hygiene and income level are as assessed by the researchers.

Household 1

Members of household: Husband and wife (36 and 32) and 4 children Employment details: Unemployed. Where born : Duthuni. Crops planted : Maize, vegetables. Storage structure for maize: None. Storage structure for water : None. Sources of water : Standpipe, river. Relative proximity to bush areas: Far away from bush. Type of house structure : Thatched (4 buildings). Cats: No cats. Standard of hygiene : Average. Income level : Low.

Household 2

Household members: Husband and wife (32 and 36) and 3 children Employment details : Unemployed Where born : Mapate Crops planted : Maize meal, vegetables Storage structure for maize: None Storage structure for water : None Sources of water : Standpipe, river Relative proximity to bush areas: Near the bush Type of house structure : Thatched Cats : Cats owned Standard of hygiene : Average Income level : Low

Household 3

Household members : Husband and wife (26 and 24) and 2 children Employment details : Employed Where born : Tshisahulu Crops planted : Maize meal, vegetables Storage structure for maize : None Storage structure for water : None Sources of water : Tank, standpipe, river Relative proximity to bush areas: Far away from the bush Type of house structure : Modern house Cats : No cats owned Standard of hygiene : Good Income level : High

Household 4

Household members : Husband and wife (31 and 25) and 4 children Employment details : Employed Where born : Mapate Crops planted : Maize, vegetables Storage structure for maize : None Storage structure for water : None Sources of water : Standpipe, river Relative proximity to bush areas: Near the bush Type of house structure : Thatched Cats : Cats owned Standard of hygiene : Average Income level : Medium

Household 5

Household members : Husband and wife (60 and 64) and 4 children Employment details : Employed Where born : Tshakhuma. Crops planted : Maize, vegetables Storage structure for maize : None Storage structure for water : None Sources of water : Standpipe, river Relative proximity to bush areas: Far away from the bush Type of house structure : Modern Cats : No cats owned Standard of hygiene : Good Income level : High

Household 6

Household members : Husband and wife (40 and 32) and 4 children Employment details : Self employed Where born : Mapate Crops planted : Maize, groundnuts Storage structure for maize : None

Storage structure for water : None Sources of water : Standpipe Relative proximity to bush areas: Far away from bush Type of house structure : Modern With and without cats : No cats owned Standard of hygiene : Average Income level : Low

Household 7

Household members : Husband and wife (39 and 30) and 5 children Employment details : Unemployed Where born : Lwamondo Crops planted : Maize, groundnuts Storage structure for maize : None Storage structure for water : None Sources of water : Standpipe Proximity to bush areas : Far away from the bush Type of house structure : Thatched houses. Cats : No cats owned Standard of hygiene : Average Income level : Low

Household 8

Household members : Husband and wife (38 and 34) and 3 children Employment details: Self-employed Where born : Mapate Crops planted : Maize, fruits and groundnuts Storage structure for maize : None Storage structure for water : None Sources of water : Standpipe Proximity to bush areas : Far away from the bush Type of house structure : Thatched Cats : No cats owned Standard of hygiene : Average Income level : Low.

Household 9

Household members: Husband and wife (37 and 33) and 4 children Employment details: Unemployment Where born : Mapate Crops planted : Maize Storage structure for maize : None Storage structure for water : None Sources of water : Standpipe Proximity to bush areas : Far away from the bush Type of house structure : Thatched and modern Cats : No cats owned Standard of hygiene : Average Income level : Low.

Household 10

Household members: Husband and wife (36 and 29) and 4 children. Employment details: Unemployed. Where born: Mapate. Crops planted: Maize. Storage structure for maize: None. Storage structure for water: None. Sources of water : Standpipe. Proximity to bush areas : Far away from the bush. Type of house structure : Modern. With and without cats : No cats owned. Standard of hygiene : Average. Income level : Low.

Appendix 3. Minutes of the stakeholder meeting on the rodent control industry.

Minutes

"Stakeholder meeting on the rodent control industry in South Africa: Improving service provision and public perceptions through regular professional training and independent regulation"

**Held at the Central Office of
the Agricultural Research Council (ARC)
Hatfield, Pretoria, on Friday, 6 February 2004**

1. Introduction

Dr. E Sandmann (ARC-Plant Protection Research Institute (ARC-PPRI)) officially opened the workshop and welcomed everyone present, with a special welcome to the guest speakers from the United Kingdom (UK).

2. The DFID and EC rodent projects operating in South Africa - Dr Steve Belmain (Natural Resources Institute, UK).

Dr. Belmain gave an overview on the rodent projects done by the NRI and ARC-PPRI.

RatZooMan: European Commission funded – Prevention of sanitary risks linked to rodents at the rural/peri-urban interface; projects in South Africa, Tanzania, Zimbabwe and Mozambique on rodent transmitted diseases, with a number of European partners.

Ecology-based rodent management in the Limpopo Province (based on the Mozambique rural households project which has been completed).

STAPLERAT: Protecting staple crops in eastern Africa, integrated approaches for ecologically based field rodent pest management.

The objectives of the projects are to assess the impact of rodents on people's lives, to assess local knowledge, attitudes as well as practice of control and then finally to design and test strategies to work under these circumstances. "Ecologically based rodent control" is a common theme within all the projects.

From meetings with resource-poor farmers and village communities in the Limpopo Province, the impact on food, people being bitten and other problems as diseases such as plague. A great concern is the re-emergence of zoonotic diseases. Climatic changes, urbanisation, rural expansion and increased population have an important impact on rodent management. The project "Ratzooman" looks holistically at all important factors; see website: <http://www.nri.org/ratzooman/>

3. Reasons for this meeting: Dr. Steve Belmain(NRI)

Dr. Steve Belmain stipulated a few concerns as experienced in the United Kingdom:

Customer dissatisfaction

Lack of public trust and poor pest control operator (PCO) image

Increasing and changing pest problem

Inappropriate use of pesticides

Changing international regulations

Changing customer demands and pest control options

To solve these concerns the issues were discussed with pest control companies in general as well as environmental health and hospitals. It is important that complaints of the end-users are channelled to the right authority. They noted that problems had different perspectives, there were public

misconceptions and these customer misconceptions had to be rectified. They experienced problems with training and re-fresher courses/training which were not easy to follow up.

4. Shortcomings of the South African pest control industry

Chaired by Dr. E. Sandmann (ARC - PPRI)

The workshop participants were asked to discuss the shortcomings of the South African Pest Control Industry in relation to training as well as customer relations.

From the open discussion (see appendix A) the following shortcomings were identified:

Training:

The current training material as supplied by the Tshwane University of Technology (TUT) is inadequate.

Training material has to be up-dated, refined to cover rodent control in different areas such as rural communities, central business districts in cities, food manufacturing etc.

Training material should be available in other languages and not only English.

A practical training component should be included in the any course work.

Some of the participants raised concerns that untrained labourers were doing the actual control and that they as well as the general public and rural clientele need training.

TUT maintained that they have the manpower and infrastructure to compile and present rodent courses.

It was suggested that a rodent course was to be compiled by the necessary role players, which included the industry, the ARC, Crop Life SA (was AVCASA), the National Department of Agriculture, the SA Pest Control Association (SAPCA) and chemical companies.

It was agreed that all courses must be approved by the registrar and this should be done in collaboration with the various role players.

Customer relations:

There are a number of steps a client can take to indicate his/her dissatisfaction with the particular service rendered, e.g. using the press, changing the pesticide company and /or pesticide and most importantly, lay a complaint at the Registrar (Act 36 of 1947).

It became clear that the public was unaware that uncertified, unqualified and unprofessional Pest Control Operators could be reported to the Registrar.

The participants at the workshop were in accord that the public and pest control clients need training in legislation and regulations.

Open discussion:

See appendix A

5. The UK perspective on training and regulation: Mr. Adrian Meyer (Acheta: Independent training & consultancy for pest control, Berkshire, UK)

Prevention of Damage by Pests Act

Local authorities have to control rodents in their areas, but there is no indication as to how effectively they have to do this.

Householders should report when they have rats and mice on their land "in substantial numbers".

In practice, all local authorities provide a rodent control service in some form.

Food legislation and pests.

It is an offence to sell food that is not "safe" and to sell food that is not as the consumer had a right to expect.

Food businesses must have a pest control strategy in place

Pesticide legislation

Only approved pesticides may be used

Pesticides may only be used in the way and against species or pest groups identified on the label. Before any pesticide is used, an assessment must be undertaken justifying its use and identifying how it should be used safely.

In the UK, the user as well as the seller of phosphine have to be trained. All pesticides must be registered. Rodent control is done by the local authorities (domestic and high risk) and contractors (to food industry and commercially). Pest Control Operators in the UK do not have to be registered, but undergo voluntary training. The training courses and price of courses are a very competitive business and a number of courses are available which have been compiled by consultants, industry and the Pest Control Association. The British Pest Control Association price these courses and present them through the Pest Control Association to compete with others and thus seems to work very well. An independent examiner monitors the examinations. Not competing certification - BPCA diploma part 1, Royal Society of Health Certificate in Pest Control, and BPCA diploma part 2. Presently about 90% of pest controllers are qualified in the first stage exams and customer increasingly demand pest control operators who are qualified to work on their sites.

6. How do we improve the South African pest control industry?

The participants were divided into three discussion groups:

- 6.1 Pest Control Operators
- 6.2 Manufacturers of pesticides
- 6.3 End-users and health

Report back:

6.1 Pest Control Operators (PCO's): presented by Mr. Dominique Sauvage

Training:

Determine what level of training is needed; pest control industry, industrial, rural, urban, etc. PCO's serve domestically and locally.

Determine who will do the work out there and if they are trained.

Regulation:

PCO's are governed under Act 36 (1947), which is under-staffed with particular reference to inspectors.

Maintained and governed by client, e.g. export, 'specific single feed' application.

Client should be 'educated', but not too much, not to destroy the PCO industry.

SAPCA needs to bring the PCO together.

Government / Policy: e.g. UK specification's box.

If done in a regulated way, prosecute!

If product is for PCO-only, it must be followed up. There are too many non-PCO's using these products.

South Africa only looks into problems once a death occurs.

Are we reputable?

6.2 Manufacturers: presented by Mr. Louwis Venter

Product training:

Need training on products for general public, at co-ops etc, in advertisements.

Need support from local authorities.

Make authorities aware of the advantages to follow through to end-users, e.g. rural, home-owners, give a choice of products.

Awareness programmes, to illiterate people, educate school children, e.g. on diseases, rodent loss, etc.

Penetrate rural areas – health clinics and primary health care officials who have contact with rural communities.

Technical information training programmes, make industry in-house training information available.

TUT make rodent control a subject. Rodent control modules i.e. industrial, rural, ship, agric. and domestic - treat subject to do rodent control as such.

Regulation:

Act 36 (1947) legal requirements.

Above legal requirements need clarity on use of pesticides from government. Dept. Health authorities withdrew certain products from co-ops, but not at supermarkets etc. The same standard should apply where products are sold.

Need the industry's view, to what extent does regulation need the industry's help. e.g. re-packaging or diluting of products?

Customer relations:

Need to identify shortcomings of the control body SAPCA. SAPCA should represent pest industry in totality; bring in other companies and groups.

Get representative body- improve credibility.

Government Policy:

Government needs more muscle to fine or close down illegal operations.

Many departments in local / municipalities involved with e.g. rodent control, have disappeared. This issue must be strongly emphasised everywhere and funds made available.

6.3 End-users: presented by Dr. Eric Sandmann

Regulations are in place, but not their implementation.

Training is very important, with it public awareness.

Many PCO's are 'fly-by-night' individuals.

Impression that currently there is not much confidence in SAPCA, that it is not effective through its communication, or not as effective as it should be. This affects all stakeholders.

Form a new committee of necessary stakeholders (national committee) also from government,

Department of Health and Department of Agriculture and DEAT, local government, SALGA.

Who takes the responsibility? And who takes initiative?

Communication at national level to be established e.g. National Rodent Assoc. such as CropLife (parallel). What you put in, you will receive. Together the benefits are greater.

Need a committee, involve people such as Mr. Gerhard Verdoorn (Zoological Garden), and local and municipal councils.

Who should take action - e.g. Dept. Health?

7. Where to now?

Pest Control Operators would like to set a follow-up meeting. Encourage SAPCA and other (non-members) to attend the meeting. Determine where to enrol or register for rodent courses. Share the information with the Pest Control Operators.

During the open session discussion (appendix B) a temporary committee was chosen to organise the follow-up meeting. The committee should meet with in three months from the workshop.

Proposed temporary committee:

Rodenticide industry	:	Mr. Louwis Venter
PCO	:	Mr. Dominique Sauvage
SAPCA	:	Mr. Nick Grobler
PPRI	:	Mr. Emil von Maltitz

7.1 Open discussion:

See appendix B for the open discussion for this session.

APPENDIX A

Open discussion on: Shortcomings of the South African pest control industry - Chaired by Dr. E. Sandmann (ARC - PPRI)

Training:

Mr. Louis Venter (Coopers Environmental Science): They visited a number of rural areas and found that the language, literacy and transport seemed to be a problem when it came to training people.

Me. Carol Macdonald (Design Hygiene): A huge problem for them was the lack of local training material like videos - they had to get their training material from abroad.

Mr. Barry Hyman (Novartis) asked Dr. Steven Belmain what training was done in the UK apart from PCO certification? Dr. Belmain explained that PCO's in the UK could receive training at different institutions and asked the PCO's present at the Workshop to say what training they received in South Africa?

Mr. Dominique Sauvage (Scientific Pest Control) said that the training material from the Tswane University for Technology (TUT) (formerly Pretoria Technikon) was insufficient and that students needed technical training as well. Pest Control Operators from Scientific Pest Control received additional pest control information from the USA and UK.

Mr. Robin Sauvage (Scientific Pest Control) informed the workshop that they trained their own staff and that their in-house training was not necessarily open to the public.

Me. Mareli Krause (Act 36, 1947) wanted to know how SAPCA fits in and if SAPCA could take the initiative to look at the course and or new courses? At the moment a PCO's must complete the course at TUT to receive a certificate, which must be renewed every year. The certificate states the fields of "expertise"/courses passed.

Mr. Adrian Meyer (NRI) pointed out that PCO's in the UK did not have to be certified, but undergo voluntary training. The training courses and price of courses are a very competitive business and a number of courses, compiled by which consultants, industry and the Pest Control Association, are available. The British Pest Control Association price and present these courses through the Pest Control Association to compete with others and this seems to work very well.

Mr. Robin Sauvage (Scientific Pest Control): When a student wants to become a PCO and therefore study at the TUT he first needs a registration number from SAPCA. Mr. Sauvage feels that anybody must be able to go and study such a course even without a registration number. The course material is only available in English and he feels this must be translated into other languages as well, Mr. Sauvage feels SAPCA lacks credibility. He feels that SAPCA has no right to rap someone over the knuckles and decide what's right for one's company and what is not right for the industry. He insists that the Registrar should investigate all suspicious cases, but knows that there are not enough inspectors available.

Dr. Steve Belmain wanted to know if perhaps the training should be updated?

Dr. Jim Findlay (SA Association of Pesticide Consultants): Dr. Findlay thought it was a wonderful opportunity for an independent organization (if the need is warranted) to come up with a new training course or upgrade the current course.

Mr. Robin Sauvage felt that the Registrar would have to approve new training material, and it would be of great value if the course could be for a specific industry, farms, food manufacturers etc. seeing that for example fumigation in storage structures differs from fumigation on ships.

Mr. Nic Grobler (The Specialists – WestRand): mentioned that the suppliers/distributors of rodenticides/chemicals are willing to give training in the use of the products.

Mr. Corrie Bezuidenhout (JHB Municipality): said that most of the labourers do the actual control and that most of them will not pass the difficult courses. He wanted to know if the rodent control training will focus on buildings only, and if inner-city will be included, because rodents are a major problem in the inner-cities. He felt that industry could not regulate industry – a more official body was needed to regulate or inspect pest control.

Mr. Etienne Wolmarans (KEW regulatory Advice and services): stipulated the "doings" of the registrar and the courses etc. The Act can decide that it is time to up-grade rodent control training at the TUT, the course can be refined to rural, city, food manufacturing requirements etc. These courses

can be up-graded by role players such as ARC, industry etc., but the end product will have to be approved by the Registrar. One definite inclusion must be practical training.

Dr. Steven Belmain wanted to know how the Registrar will know if the courses have sufficient training material? Mr. Wolmarans informed Dr. Belmain that the Registrar has meetings, contact, liaison with role players such as Crop Life SA (was AVCASA), the pest control industry, SAPCA (who represents the pest control industry) and the ARC to determine if the courses are complete.

Mr. Barry Hyman: believes that through SAPCA something wonderful can happen. At the moment, SAPCA does not have courses on rodents, but if 10 minds from pest control companies are put together a great course can be compiled.

Mr. Pieter Fourie (Bayer): mentioned that competition is very healthy, chemical companies have privileged information, which cannot be shared with their competition.

Mr. Robin Sauvage suggested that Crop Life SA (was AVCASA) is the “independent organization” – SAPCA is testing their own members and therefore feels that is not justified.

Mr. Manie de Lange (TUT): informed the workshop that the “Technicon” would be more than happy to give rodent / rodent control training courses, as they have the infrastructure and manpower to assist with the compilation of courses.

Mr. David Faber: (Coopers Environmental Science): said that chemical companies also do training and was wondering if this training reached the end-user.

Mr. Nic Grobler: said that SAPCA could not there and then decide on extra time for course etc. but could organize a meeting and asked the members to attend to decide such matters.

Mr. Louis Venter: wanted to know if it was for rodent control in general?

Dr. Jim Findlay: noticed that here was a lot of information, a lot of material, and that all role players need to meet to plan this course and not to forget the rural communities, which had a huge clientele to be trained.

Ms. Mareli Krause: came to the conclusion that everyone agreed that a rodent course was necessary, but said they had to decide how many courses and who was going to provide such courses.

Dr. Eric Sandmann reminded the workshop that the rural communities were very important and wondered who was going to train them. Most of the rural communities could not afford qualified pest control officers to control their rodents.

Mr. Copper Ludick: (Novartis) said that the training had to include the extension officers. Training had to reach rural people at rural “clinics” and it was up to the companies who distribute products at these “clinics” to make sure they give the adequate training.

Mr. Pieter Fourie (Bayer): again confirmed that everyone present at the workshop knows what is needed and that they should come together, use the existing industry data base and as a unification between the ARC, the NDA and chemical companies come up with solutions.

Customer relation:

Dr. Steve Belmain (NRI) wanted to know what official channels a dissatisfied client could use for filing complaints?

Mr. Louwis Venter: A dissatisfied client can send in complaints to SAPCA, via the press, or to the Registrar. He could make use of someone else (chemical company)/the competition or could make use of another pesticide/competition.

Me. Marli Krause confirmed that all complaints can be directed to the Registrar.

Mr. Dominique Sauvage said most of the public were not aware of this and did not know who the Registrar even was – therefore, many of the problems were not reported.

Mr. Robin Sauvage agreed that the public did not know they can use registered Pest Control Operators, and not even that the pesticide must be registered. The public/customers must be more informed/trained. Scientific Pest Control has files with the registration of their employers etc. for their clientele to see.

Mr. Rodney Mangaka (Act 36, 1947) said that a PCO must educate their clients.

Mr. Lee Ashford (Scientific Pest Control): informed the workshop that they have been active in the “townships”, but did not receive any support from the Government. – It seems that everything at the Government departments came to a stand still and that the lower income market did not want to spend money, but rely on the Government for support.

It was decided that the participants would decide later who would take responsibility to take further the above-mentioned concerns, considerations and suggestions.

APPENDIX B

Open discussion on: Where to now ?

Mr. Rodney Mangaka suggested that a committee be appointed from this group present at the workshop.

Mr. Bill Smith (Efekto) suggested the reps to come back with proposals.

Mr. Nic Grobler – wanted to get more people from PCO industry to be involved, only 4-5 represented at the workshop from about 50 (Gauteng).

Mr. Louis Venter – wanted to know what action could be achieved in the short term/long term? A Pesticide buzz-meeting is to be held in August (non-SAPCA pest activity, re. training, etc - use that as a forum to select a committee - what do we want to achieve?

Dr. Jim Findlay raised two issues, the actual Industry association and a working group to address rodent problems. The Industry has to get their act together, legitimate voice - one voice, to speak on behalf of industry to the Dept. Health and Dept. Agriculture. Regarding training programmes at the TUT, the industry should be unanimous in meeting and deciding who takes the decisions.

Mr. L. Venter suggested all rodenticide suppliers should be contacted as not all were represented at the workshop.

Mr Richard Olivier (Specialist) suggested another meeting in three months' time.

Dr. J. Findlay suggested a meeting for Pest Control Operators only and not for international companies.

Mr. Rodney Mangaka was worried that the Dept. of Agriculture might not be able to attend in three months' time and suggested that a temporary committee be elected now to facilitate that forthcoming meeting.

Mr. R. Sauvage's concern was how to get SAPCA members involved, to become dedicated members.

Mr. Adrian Meyer offered to help with training courses.