Recommendations for rodent management interventions in Mozambique

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Three habitations in three different Provinces were investigated with respect to socio-economic, rodent prevalence (not yet available in details), prevalence of the three diseases in rodents (not available) and an anthropological study of the rural habitation Morrumbala in the Zambezia Province.

Mozambique has a history of plague (references) but also the diseases leptospirosis and toxoplasmosis have been found to occur at high level in rodents (preliminary reports on tested rodents).

The most striking differences in Mozambique compared to the other study countries are the fact that rodents here are eaten and in some areas constitute a large proportion of the protein source. Eating rodents and other wild animals are well known sources for transmission of toxoplasma and plague to human.

Three Mozambican locations were chosen for this study; Tsalala a peri-urban area in Maputo Province, Mutarara and Morrumbala rural habitations in the Tete and Zambezia province, respectively. The socio-economic report (Malcolm Iles NRI Report: 2782, 2006) is based on 33 households in Tsalala, 30 households in Mutarara and 31 in Morrumbala.
The three locations are shortly described separately with respect to type of location, type and quality of housing, resources as water and food.

Tsalala, Mozambique

Tsalala is a peri-urban town. Housing quality is generally very poor as half of the interviewed households are characterized as worse than average and the other half better than average. Housing provides good cover and conditions for harbourage of rodents.

The most common crops grown here are cassava, maize, vegetables and fruit.

Staples and food

Staples are in more stored in 76 % of the households. Staples are typically stored on the floor (58 % of the households) in sacks (30 %) or in the traditional drums and tins (27 %).
In most households staples are stored within the house (64 %), but only in one third of the households do people sleep in the same room.

Water

Drinking and washing water is available from stands, other open sources like e.g. river and steam water are typically used (58 %). Though piped water is available, all interviewed households store water. In Tsalala water for both drinking and washing are normally covered, but not necessarily all the time. Water is not treated or boiled before used.

Waste

The most common way of getting rid of waste is by burning (64 %), but covered pits are also used (27 % of the households).

Animal keeping

Animal keeping is not very common in Tsalala but few households have a few goats and pigs. Dogs and cats are not numerous, but are allowed indoor also for sleeping, this is particular valid for cats (55 % of the households).

Rodent species in Maputo

Mus sp. was the dominating species found and trapped in Maputo (Tsalala) the other commensally *Rattus* species like the brown rat was also common. The list below shows species and numbers caught and identified.

Species	**Number**
Lemniscomys	13
Mastomys sp.	27
Mus sp.	193
Nannomys	4
Rattus norvegicus	44
Rattus rattus	7
Rattus sp.	5
Tatera sp.	3

Perception and control of rodents

Rats are seen by most households on daily basis and often more than once a day. When asked in the house is the most common place to meet the rats, but in the fields and bush also the place to see them. Rats are considered a problem, though it is well known (76 % of the households) in the community that rodents can carry disease, disease is not the main concern as the destroying of food and clothes are seen as the largest nuisance.

People are trying to control the rats and 70 % of the households have had some kind of rodent control using either one or more methods as mechanical (27 %), chemical means (27 %) and biological means (18 %).

Recommendations for preventive measures to avoid transmission of rodent-born diseases

The suggestions made beneath, which may influence disease transmission between rodents and man, are based on knowledge collected on general socio-economic aspects in Mozambique and more detailed observations made in the peri-urban habitation Tsalala, Maputo.

Individual level	Community level	Governmental level
Preventative measures in rodent control		
Increase rodent proofing, ease of rodent access to minimum category 3 level (52 % are at present at cat. 2 level)	Education/information on how to improve housing quality/rodent proofing	
Clean up around and inside houses (minimise hiding condition for rodents). Minimum category 3 level	Education/information on features that may be attractive to rodents; food, staples, water, animal keeping, covers	
Keep areas around houses, toilets and storage free of vegetation (minimum 3 metres).		
Around houses (living, storage, toilets) a 0.5 meter boarder made of larger gravel stones		
Staples; storing in separate houses (avoid sleeping together with staples, approx. one third sleep in the same room)	Education of good waste handling. Why it is important	Education of good waste handling. Why it is important
Avoid storing in sacks, instead storing in *e.g.* closed plastic containers		
Minimize spillage around area of staple storing		
Avoid animal keeping in same house as man		
Burning is practised and should continue. Use of pits should always be covered	Before carrying out rodent control, insecticide control should be done.	
Proper storing of food & water; safe containers keep off floor	Rodent control, chemically or mechanically, carried out as a united effort in community.	Education and training of people in rodent control, preventative measures and chemical and mechanical control

Individual level	Community level	Governmental level
Measures to avoid rodent-born disease transmission to man		
Treat water when other sources than piped water is used; boiling, filtering or bleach	Teaching in rodents and disease transmission.	Teaching/information on rodents and disease transmission
Keep stored water covered except when in use	Teaching in basic hygienic principle; personal, food preparation	Teaching in basic hygienic principle; personal, food preparation
Personal Hygiene; washing hands before eating, handling of animals/pets.	Tap water; clean, good drainage around stands. Proper area for washing and getting rid of waste water	Provide economic basis for establishment of safe water supply, more water stands.
Sufficient cooking of especially meat, wild animals like rodents		Drainage system around water stands and washing/laundry areas
		Monitoring prevalence of plague, toxoplasmosis and leptospirosis in rodents.
		Warning system when plague is monitored. Information on risk of getting toxoplasmosis and leptospirosis

Mutarara, Mozambique

Mutarara is situated in the rural area. Few households were of good quality, with limited access for rodents. The majority, however, is very poor and leave good conditions for harbourage for rodents, as access and covers are plenty.

Staples and food

Staples are in more than 97 % of the households stored either in traditional granaries (50 %) or in sacks (50 %). Storing is generally off the floor but in the same house but in separate room (kitchen?).

Water

The most common water source is open like river and steam water. Piped water are present but are only used as source for drinking water in one third of the households and for washing river water are used (only 7 % are from piped water). Both drinking and washing water are stored, but there is only awareness of covering drinking water (100 %) and not washing water (10 %). Water is not treated or boiled before use.

Waste

Getting rid of waste is a matter of the individual household this means that waste is thrown anywhere or reused for *e.g.* manure. Disposal of waste into pits are practised but only 13 % of the households covers the pits whereas 27 % of the households have open pits.

Animal keeping

Animal keeping is common in Mutarara, dominated by cattle, goats and pigs. There is no information on whether animals are kept in the same house as where man lives.

Dogs and cats are not numerous. Cats are allowed into the houses and in some households also sleeps indoor, but the majority (73 %) do not allow cats sleeping indoor.

Rodent species caught in Mutarara

Rattus rattus, the black rat, was the dominating species found and trapped in Mutarara. The list below shows species and numbers caught and identified.

Species	Number
Acomys	1
Aethomys	1
Mastomys sp.	1
Rattus rattus	39
Rattus sp.	15

Perception and control of rodents

Rats are seen by most households on daily basis and often more than once a day. When asked in the house is the most common place to meet the rats, but in the fields and bush also the place to see them. Rats are considered a problem, though it is well known (67 % of the households) in the community that rodents can carry disease, disease is not the main concern as the destroying of food and clothes are seen as the largest nuisance.

People are trying to control the rats, but mechanical (20 %) and chemical (17 %) means are only used in few cases leaving biological control (40 %) as the most used method (cats?).

Recommendations for preventive measures to avoid transmission of rodent-born diseases

The suggestions made beneath, which may influence disease transmission between rodents and man, are based on knowledge collected on general socio-economic aspects in Mozambique and more detailed observations made in the rural habitation Mutarara, Teté Province.

Individual level	Community level	Governmental level
Preventative measures in rodent control		
Increase rodent proofing, ease of rodent access to minimum category 3 level (53 % are at present at cat. 2 level)	Education/information on how to improve housing quality/rodent proofing	
Clean up around and inside houses (minimise hiding condition for rodents). Minimum category 3 level	Education/information on features that may be attractive to rodents; food, staples, water, animal keeping, covers	
Keep areas around houses, toilets and storage free of vegetation (minimum 3 metres).		
Around houses (living, storage, toilets) a 0.5 meter boarder made of larger gravel stones		
Storing of staples in separate houses		
Avoid storing in sacks and ideally the traditional granaries, instead storing in *e.g.* closed plastic containers		
Minimize spillage around area of staple storing		
Avoid animal keeping in same house as man	Education of good waste handling. Why it is important	
Proper waste handling. Burning should be practised. Use of pits with cover	Insecticide control before or combined with rodent control	Education of good waste handling. Why it is important
Proper storing of food & water; safe containers keep off floor	Rodent control, chemically or mechanically, carried out as a united effort in community	Education and training of people in rodent control, preventative measures and chemical and mechanical control

Individual level	Community level	Governmental level
Measures to avoid rodent-born disease transmission to man		
Treat water before use; boiling, filtering or bleach	Teaching in rodents and disease transmission.	Teaching/information on rodents and disease transmission
Keep stored water covered except when in use	Teaching in basic hygienic principle; personal, food preparation	Teaching in basic hygienic principle; personal, food preparation
Personal Hygiene; washing hands before eating, handling of animals/pets.		Provide economic basis for establishment of safe water supply, more water stands.
Sufficient cooking of especially meat, wild animals like rodents		Drainage system around water stands and washing/laundry areas
		Monitoring prevalence of plague, toxoplasmosis and leptospirosis in rodents.
		Warning system when plague is monitored. Information on risk of getting toxoplasmosis and leptospirosis

Morrumbala, Mozambique

Morrumbala is situated in the rural area. Poverty is high and the community strongly relies on agriculture and hunting, with the main agricultural crops being cassava, maize, beans and sorghum, known to be attractive to many rodent species. Fishery has been an important source for food, but draught during the last couple of years has minimized this contribution. Information on the educational level is not given, *(but assumed to average 3-4 years of education)*. Rodents, in particular, serve as one of the most important protein sources and are furthermore considered a delicacy. Hunting and eating are one of the main issues to focus on when identifying key problems in disease transmission.

There is no clear separation of living, agricultural and animal keeping areas in Morrumbala. This may indicate small distances between fields and houses.

A household normally consists of more houses, which all are within a limited distance from each other (e.g. toilets no more than 15 metres away). Generally the quality of the houses are bad and rodents have easy access and plenty opportunities for hiding in and around the houses. The majority of the interviewed households are described as poor, and worse than average and only one third better than average (Malcolm Iles NRI Report: 2782, 2006).

Staples and food
Staples are in more than 70 % of the households stored in traditional granaries and in most cases (87 %) in close association with or within the main house.
Electricity is not common in households in Morrumbala, why food and leftovers are stored outside and leaving it available for rodents and cats.

Water
Drinking water is available from five boreholes, but with no information on the quality of the water (treated?) other sources would be river water. Water used for washing is mostly from the open sources (river water). Water for domestic use has to be transported to the different households and is stored in most households (97 %). People in Morrumbala are aware of the importance of protecting stored water meant for drinking, but covering in many cases not adequately, whereas water for washing purpose are seldom covered. It is unknown whether the people in Morrumbala treat water before drinking and use.

Waste
Pits in the garden are a common way of getting rid of waste (68 % of the households) of which 80 % of them are said to be covered. Approx. one third are reused as either manure in e.g. gardens or thrown anywhere.

Animal keeping
There is some animal keeping in Morrumbala, dominated by goats and pigs. It is noted that people having goats normally keep the animals in the same house when sleeping.
Dogs and cats are seen and are also accepted in door.

Rodent species in Morrumbala

Species	Number
Acomys	1
Crocidura	1
Mastomys sp.	14
Mus sp.	5
Rattus rattus	9
Rattus sp.	4
Tatera valida	3
Tatera sp.	10

Perception and control of rodents

There is a general knowledge of rodents as disease transmitter in Morrumbala. But as a practical daily problem transmission of diseases from rodents have low priority, where the destruction of especially food and clothes are considered the largest nuisance of the rodents.
One reason for diseases caused by rodents is not a big issue, could be that many of the symptoms of *e.g.* leptospirosis resemble diarrhoea and flu and therefore not necessarily connected to a possibly rodent related disease.

However, diseases caused by rodents are the main reason to the restriction of the intensive hunting season in Morrumbala, the intensive hunting season being restricted to a few months (May until July). There is also a separation of rodents which are more typical of causing diseases and thus avoided when hunting.

The percentage of households undertaking rat control is high (68 %) where mechanical means are dominating, chemical control are also carried out in approximately 20 % of the households and biological control even less. When asked, quite a lot of households had no suggestions on how to reduce the rat problem or simply meant nothing could be done.

Prevalence of rodent-born diseases

Data not available

However plague has been recorded within the Morrumbala habitation, with the first registered cases in 1997, how prevalent *Yersinia pestis* occurs in the wild rodents is unknown like in which species the bacteria typically prevail.

Lepto and toxo – with references to paper by Thompson et al. (2002) and Lepto data from Mirijam Engelberts at KIT.

Recommendations for preventive measures to avoid transmission of rodent-born diseases

The suggestions made beneath, which may influence disease transmission between rodents and man, are based on knowledge collected on general socio-economic aspects in Mozambique and more detailed observations made in the rural habitation; Morrumbala.

Individual level	Community level	Governmental level
Preventative measures in rodent control		
Improve housing quality at minimum category 3 level with respect to rodent access (58 % is category 2 or less)	Education/information on how to improve housing quality/rodent proofing	
Clean up around and inside houses (minimise hiding condition for rodents). Minimum category 3 level	Education/information on features that may be attractive to rodents; food, staples, water, animal keeping, covers	
Keep areas around houses, toilets and storage free of vegetation (minimum 3 metres). This includes trees and bushes	Education/information on the importance of good renovation and daily waste handling	Education of good waste handling. Why it is important
Around houses (living, storage, toilets) a 0.5 meter boarder made of larger gravel stones		
Storing of staples are mainly in traditional granaries, should be in separate houses. Ideally storing should be kept in close containers (*e.g.* made of hard plastic)		
Minimize spillage around area of staple storing	Establishment of an official place/station for collection of garbage like wood, plastic, furniture etc.	Establishment of an official place for garbage.
Avoid animal keeping in same house as man	Separation of garbage into burning and non-burning garbage.	Collection of garbage from a official garbage station. Garbage like e.g. furniture, tires, plastic and other non-recycle garbage.
Separation of waste Handling propositions; Burning Covered pits		
Avoid cooked kitchen waste thrown in e.g. garden or anywhere. Should be thrown into covered pits	Insecticide control important to be done before handling trapped rodents. When meant for consumption trapping may involve pits in pits in the ground. Should contain some insecticide to kill *e.g.* fleas while in the trap.	

Proper storing of food & water; safe containers keep off floor	Rodent control, chemically or mechanically, carried out as a united effort in community	Education and training of people in rodent control, preventative measures and chemical and mechanical control
Proper storing of food and leftovers		
Measures to avoid rodent-born disease transmission to man		
Personal Hygiene; washing hands before eating, handling of animals/pets. Good hygiene practise when cooking; keep meat separate from vegetables. use treated water.	Teaching in rodents and disease transmission.	Teaching in basic hygienic principle; personal, food preparation
	Teaching in basic hygienic principle; personal, food preparation	Teaching/information on rodents and disease transmission
Sufficient cooking of especially meat, wild animals like rodents	Tap water; clean, good drainage around stands. Proper area for washing and getting rid of waste water	Provide economic basis for establishment of safe water supply, more water stands.
Hunting & eating rodents; avoid trapping and handling of rodents in nest (fleas mostly in nests).		Drainage system around water stands
		Monitoring prevalence of plague, toxoplasmosis and leptospirosis in rodents.
		Warning system when plague is monitored. Information on risk of getting toxoplasmosis and leptospirosis