



Preliminary data on human - carnivore conflict in Niassa National Reserve, Mozambique, particularly fatalities due to lion, spotted hyaena and crocodile



Fig. 1: Adult crocodile killed by Niassa fisherman during the wet season of 2006. The crocodile was caught in a gill net, pulled the fisherman into the water and was killed during the struggle

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Summary

Wildlife can cause significant loss of human lives and livelihoods and if not responded to human-wildlife conflict can lead to a critical erosion of support for conservation initiatives. Niassa National Reserve, in northern Mozambique supports viable populations of lion, leopard, spotted hyaena and crocodile as well as approximately 25 000 people. The objectives of this report are to provide a preliminary assessment of the scale and distribution of large carnivore attacks on Niassa residents, with particular emphasis on lions and crocodiles and to provide a baseline against which the level of future conflict can be compared. Data were collated from monthly reports of MOMS community scouts, NNR records, opportunistic conversations with local residents, concession operators and Reserve staff as well as from targeted questionnaire surveys for crocodiles and lions.

Since 1974, there have been at least 73 lion attacks in NNR. A minimum of 34 people has been killed and 37 injured with 11 people killed and 17 injured in the last six years alone with recent attacks concentrated in the north eastern region of NNR. Leopard attacks are rare ($n=2$) however at least nine people have been injured and four people killed by spotted hyaenas in NNR in the last 14 years. In these attacks sleeping in the open is the risk factor. At least 57 people have been killed by crocodiles in NNR in the past 30 years with more than 40 people killed in the last seven years alone. A large portion of the Ruvuma River within NNR has not yet been surveyed so this is likely to be an underestimate. High-risk activities are repetitive behaviour such as bathing at communal sites and wading at regular crossing points as well as Chingundenje net fishing. The results show the need for further investigation into human-carnivore conflict, particularly with respect to lions and crocodiles. We strongly believe that providing locally derived, practical solutions to this conflict before it escalates any further provides the best opportunity for successful long-term conservation of the large carnivores in NNR.

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1.0 Introduction and Background

Wildlife can cause significant loss of human lives and livelihoods and if not responded to human-wildlife conflict can lead to a critical erosion of support for conservation initiatives. While livestock depredation is probably the most common cause of human-carnivore conflict in Africa, one of the most serious causes of conflict is the fear of being killed or injured by a large carnivore. The death or injury of a person due to a large carnivore causes considerable trauma to the family and community, and may impact severely on the welfare of the surviving family (Anderson 2005). Retributive killing of the species of animal responsible (not necessarily the problem individual) can also cause serious population declines (Thirgood, Woodroffe and Rabinowitz, 2005).

Niassa National Reserve (NNR) is unusual as it is a protected area that supports viable populations of the large carnivores (lion, spotted hyaena, leopard, crocodile) as well as approximately 25 000 people spread across 40 villages. In NNR livestock depredation by large carnivores is not a major problem at present as there are relatively few domestic livestock (mainly goats and chickens) and cattle are absent. However, loss of human life and injury do occur particularly due to lions and crocodiles, but up until now the extent of the conflict has been unknown. We strongly believe that providing solutions to this conflict before it escalates any further provides the best opportunity for successful long-term conservation of the large carnivores in NNR. The objectives of this report are therefore to provide a preliminary assessment of the scale and distribution of carnivore attacks on Niassa residents, with particular emphasis on lions and crocodiles and to provide a baseline against which the level of future conflict can be compared.

It is not the intention of this report to provide solutions or recommendations at this early stage but simply to present the extent of the problem and encourage further investigation. Collaboration with the NNR communities is recognized as being central to achieving the long-term conservation goals for the protected area (SRN Management Plan, Community Policy, 2006). It is therefore imperative that SRN investigates and implements locally derived, pragmatic methods to mitigate against further attacks as soon as possible. This is important both from a human welfare and a conservation perspective.

2.0. Data Sources and Methods

- All opportunistic records from concession operators, reserve staff, Niassa residents were collated.
- In 2006, SRN initiated the Management Orientated Monitoring System (MOMS) in NNR (Stuart-Hill *et al.* 2005). This system is still in its infancy in NNR however traditional leaders from four villages were identified and trained in 2006 and one of the modules identified for data collection was “problem animals”. Since August 2006, the five MOMS community scouts have been collecting specific data on “problem animals” from four villages (Nkuti, Mbamba, Macalange, Mecula, Cuchilanga) co-ordinated by M. Marufo, A. Jorge and O. Muemedi. The aim is to extend this system to the majority of villages within NNR and thereby provide a robust, sustainable system for monitoring attacks that is not researcher driven (Begg & Begg 2007).
- Details (names, ages and year) of residents attacked by lions in the Negomano village complex (Block A) were collected by Derek Littleton and Luwire scouts.
- Similarly, a list of crocodile attacks was collected by D. Littleton in Block C and Block A by Luwire scouts.
- The Selous-Niassa Wildlife Corridor team collected information on crocodile attacks on the northeastern section of the Ruvuma River during the river survey conducted in November 2006 (Begg *et al.* 2007).

In addition two specific surveys were conducted:

- A questionnaire survey of 20 villages within NNR was completed in 2006 to assess the number of people killed or injured by lions and spotted hyaenas within the last 30 years (Fig.2). During the survey 210 Niassa residents were interviewed representing 3083 resident years in the villages of NNR. Anecdotal information on deaths and injuries by baboons, elephant, buffalo, hippo and snakes was also collected but is not discussed in this report.
- For crocodiles a similar questionnaire survey was conducted during the Lugenda River Survey (canoe survey, 345km) in August 2006. 102 Fishermen representing more than 1100 fishing years on the Lugenda River were interviewed randomly but consistently along the entire length of the river transect with at least one fishermen interviewed from each active fishing camp (Fig. 3).

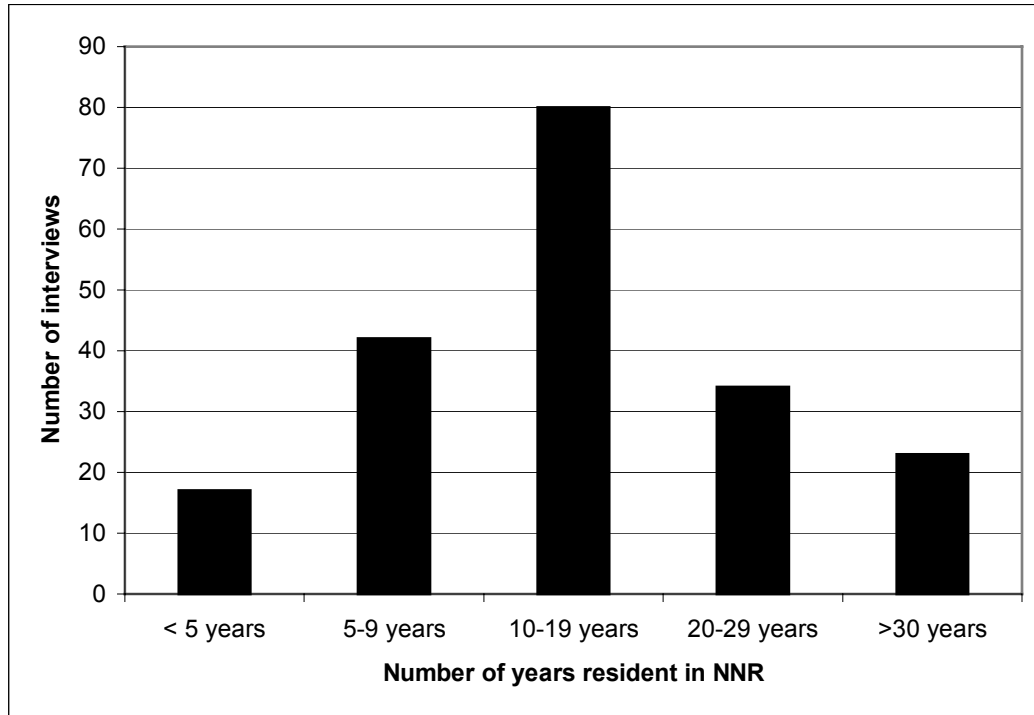


Fig. 2: Sample of NNR residents interviewed during 2006 to assess lion, leopard and spotted hyaena attacks

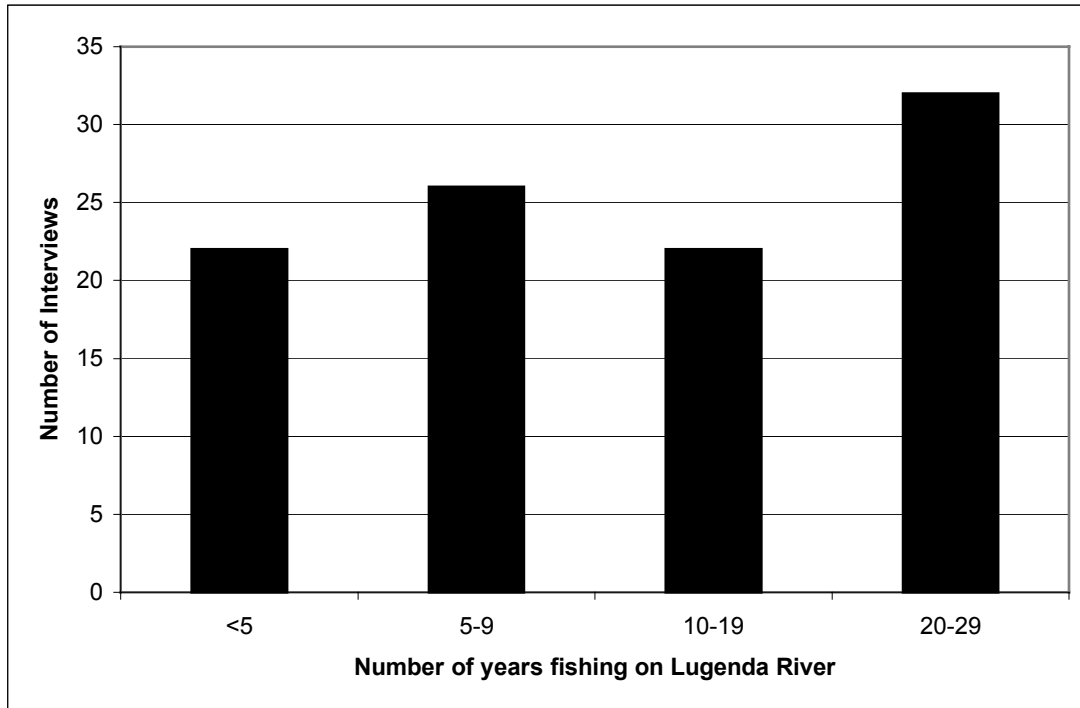


Fig. 3: Sample of NNR fishermen interviewed on the Lugenda River in 2006 to assess crocodile attacks.

3.0. Results

3.1. Lion

In certain areas, particularly southern and eastern Tanzania, lion attacks have become increasingly common in recent years with more than 500 attacks since 1990 (Packer et al. 2005). There are indications that a similar escalation in lion attacks has been experienced in northeastern Mozambique in Cabo Delgado Province particularly on the Mueda plateau. Recent reports suggests that 46 people were killed between 2002-2003 in Muidimbe rural district on the Makonde plateau (P. Israel, pers. com.; H. West pers. com)) with 70 people killed between 2000 and 2001 by lions in Cabo Delgado Province (Anderson 2005).

3.1.1 Number of attacks

- Since 1974, there have been at least 73 lion attacks in NNR. A minimum of 34 people has been killed and 37 injured with 11 people killed and 17 injured in the last six years alone (Fig. 4).
- A total of 49 lion attacks representing 28 individual victims were reported during the questionnaire survey. Additional reports of 19 deaths and 22 injuries were provided from other sources, with 13 people injured and 9 killed in the northeastern section of NNR (Block A – Negomano village complex, Gomba).
- This is believed to be in the right order of magnitude since details of lion attacks (victim names, circumstances and year of attack) are remembered long after the event due to the trauma of the attack.
- However, Mavago –Msawize village complex has not been comprehensively surveyed and several more attacks may remain unreported.
- In addition conversations with Niassa residents do suggest that lion attacks in the 1980s may have been underestimated as some were believed to be the work of witchcraft and “spirit” lions not bush lions and details of these attacks are not easily collected. The work of “spirit lions” appears to have declined in the 1990s due to the death of the powerful traditional healer who lived in Mecula. Further investigation into the cultural significance of lions and lion attacks in Niassa is warranted as this may have an effect on future mitigation strategies and conservation initiatives. (H. West pers. com)

3.1.2 Victims and circumstances of attacks

- The vast majority of the victims have been adult men (76%), with 16% of attacks on children and 9% on women (Fig. 5). However, while men are more likely to be injured (68%) than killed by a lion attack, children and women are more likely to be killed. For

- records where the specific ages of the victims are known (n = 32 records), the majority of victims have been adults older than 50 years of age (Fig. 6).
- Little information is currently available on the exact circumstances of the lion attacks. However for records where some details are provided (n = 38), 50% of the attacks have occurred in the village with the lions entering the living areas and on four occasions pulling people out of huts, 34% have occurred in the mashambas and only 18% have occurred out in the woodlands.
 - Too little information on the activities of the victims before the attacks has been collected to determine the risk factors at this stage, however many of the attacks have occurred at night, as expected. Seven attacks occurring while people were sleeping in the open either outside their huts or in the mashambas. On one occasion, lions appear to have been attracted into the village due to meat from the community quota being stored there. On several occasions it appears that men have been killed or injured trying to chase the lions out of the village or mashambas at night or protect their family members.

3.1.3 Responses to attacks

- In recent years, no “problem lions” have been killed by Agriculture or NNR staff in response to the attacks and lions are rarely killed in direct retaliation by the communities themselves but are chased off where possible. In 2001, a lion entered through the roof of a hut in Manyuri and was killed with a spear, while in 2000 a lion was killed after dragging a man from his hut in the old Kambako hunting camp.
- During the 1980’s records of at least 10 lions killed by the Frelimo Militia and/or communities in response to lion attacks have been collected. Note that in many cases it appears that the lion killed after an attack was not necessarily the culprit.
- During a period of lion attacks in Mecula (1982-1984) a traditional healer was called in to solve the problem as these attacks were believed to be the work of sorcery.

3.1.4 Distribution of Attacks

- The distribution of the all known attacks is shown in Fig. 7 with reports of attacks throughout NNR, but particularly in the bigger villages of Negomano, Mecula and Mbamba.
- Recently (2000-2007), the majority of attacks have occurred in the northeastern section of the Reserve around Negomano and surrounding villages (Fig 8).
- While it is likely that the spate of attacks in the Negomano area are exacerbated by low prey densities and heavy poaching pressure, spates of lion attacks on the Mueda plateau

are not a new phenomenon but have been occurring in this region since the 1950s (H. West. pers. com).

- Interestingly, no reports of lion attacks in Mbamba and /Mecula have been recorded in the last ten years, despite previous attacks in these villages and regular sightings of lions in the mashambas of Mbamba and Ncuti.

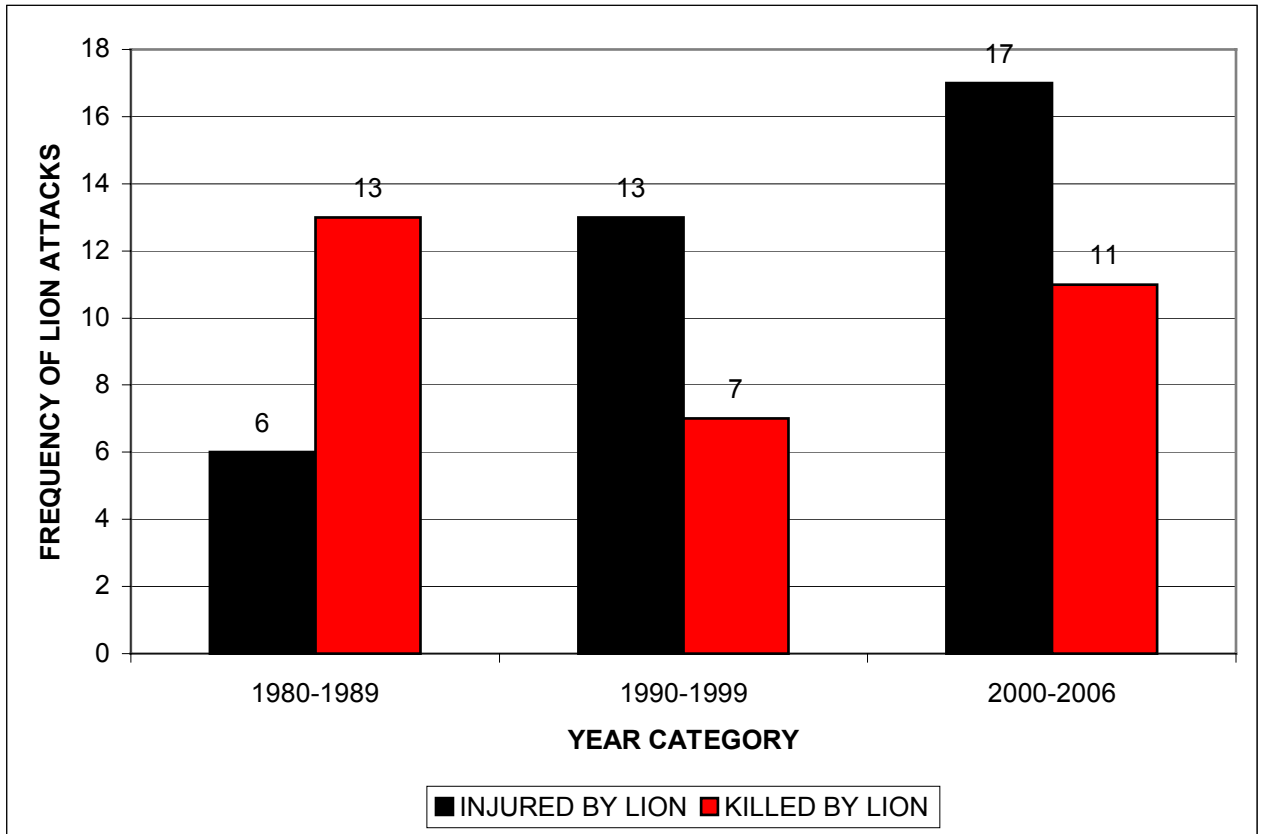


Fig. 4: Number of people killed and injured by lions in NNR since 1980.

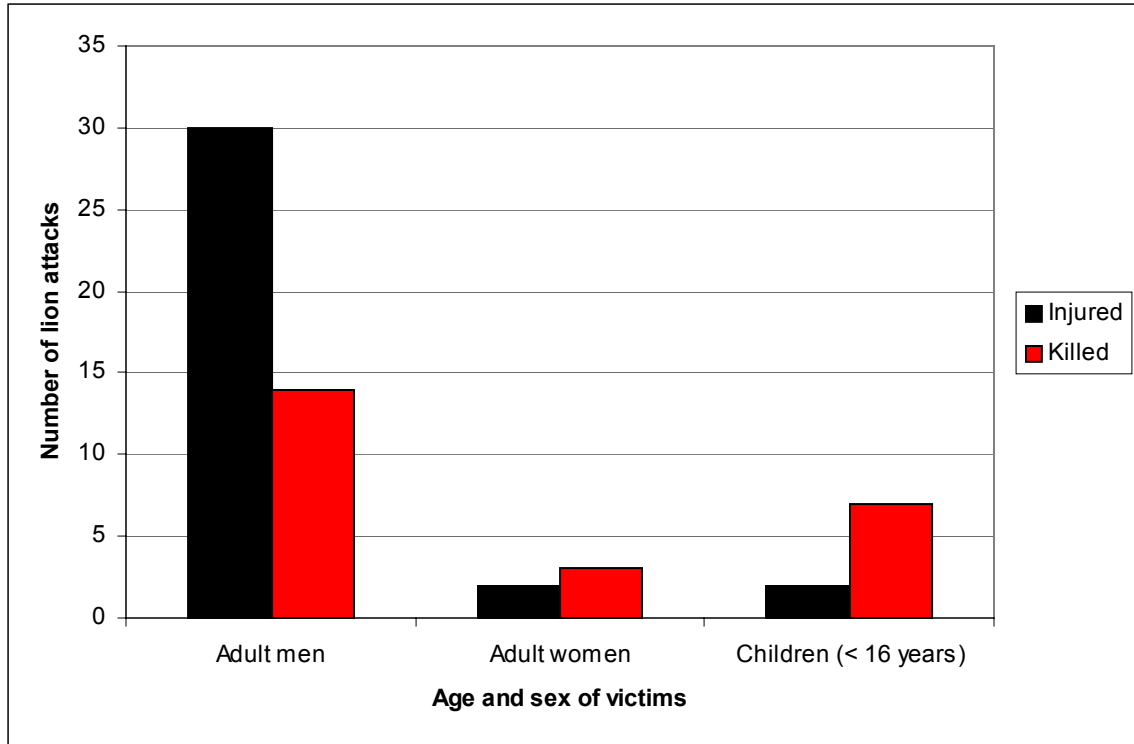


Fig. 5: Age and sex of victims of lion attacks where this data is available

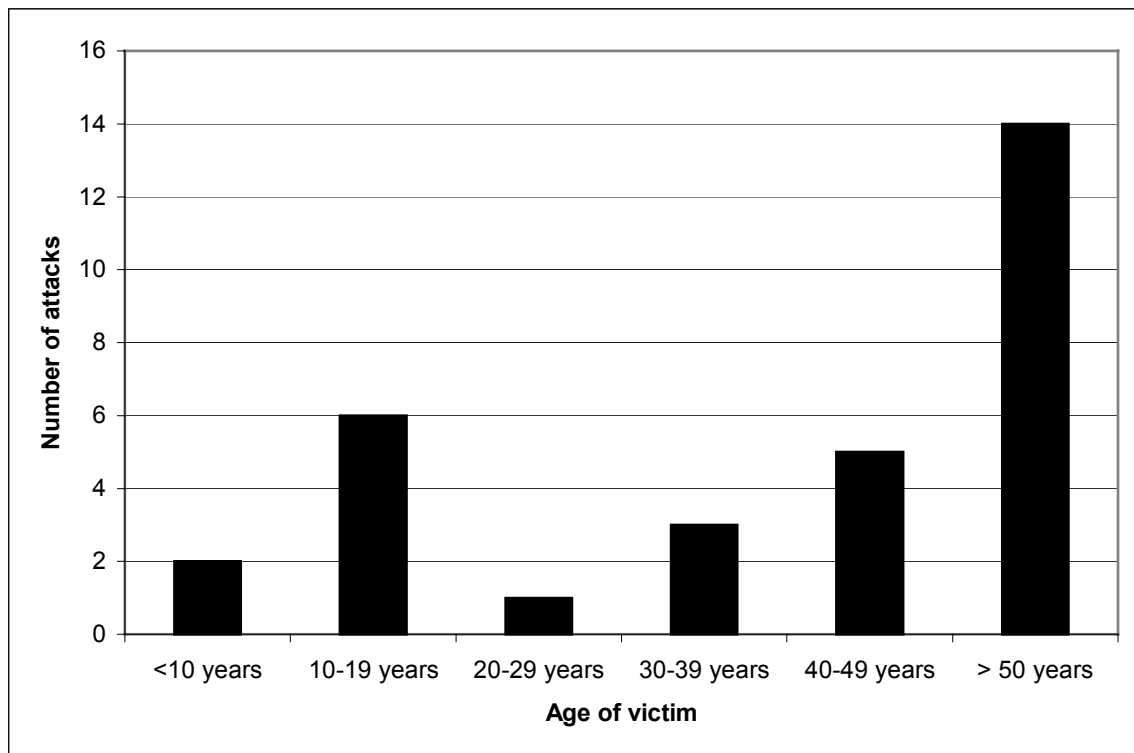


Fig. 6: Age of victims of lion attacks in NNR

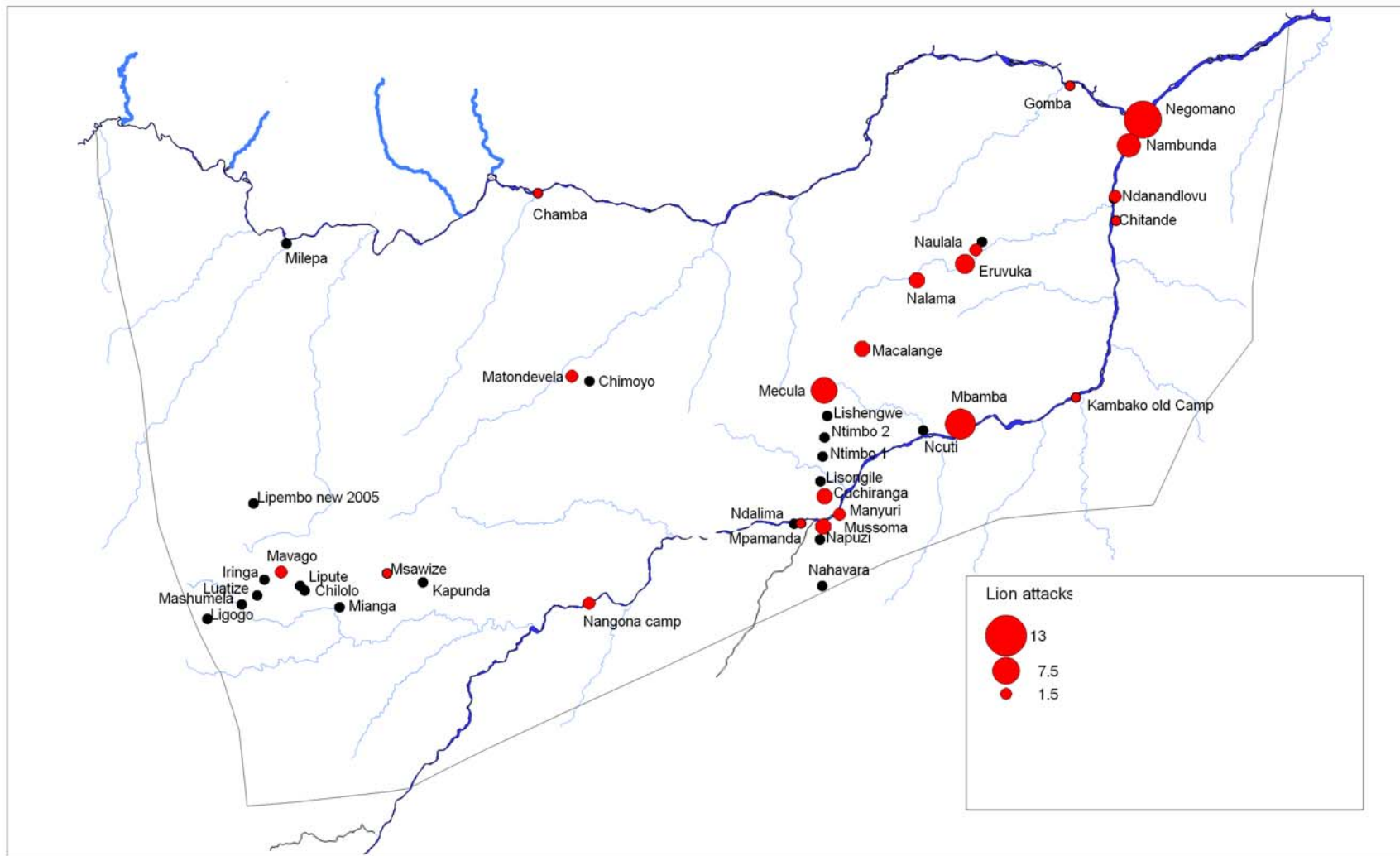


Fig. 7: Distribution of known lion attacks that caused injury or death to Niassa residents between 1970 and 2006

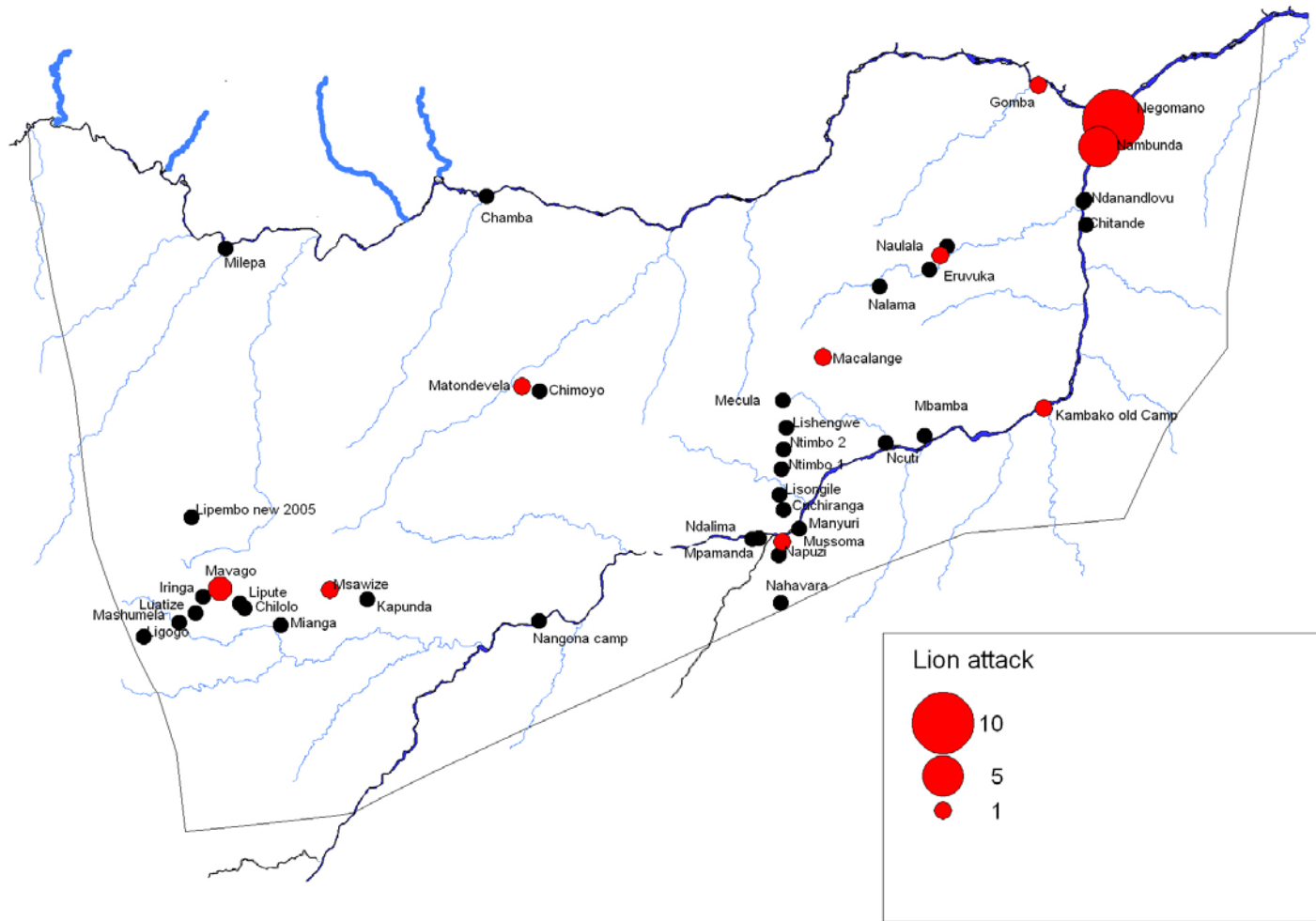


Fig. 8. Distribution of lion attacks in NNR villages between 2000-2006 showing the recent spate of attacks in the Negomano region.

3.4. Spotted Hyaena

- Attacks on humans by spotted hyaenas are likely to be underreported, however there are accounts of man-eating developing in spotted hyaenas in certain areas. An anecdotal news report (World Wide Fund for Nature 2004) indicates that there were 52 hyena attacks resulting in 35 deaths in a 12 month period in Mozambique along a 20km stretch of road near the Tanzanian border. Anderson (2005) suggests that the only hyaena problems that have been reported are from the northwestern region of Niassa province and at Goba in Maputo province.
- In NNR, at least nine people have been injured and four people killed by spotted hyaenas in NNR in the last 14 years (Fig. 9).
- Sample sizes are small (n=10) however it seems that the majority of attacks have been on adults older than 40 (80%) with only two children attacked. Seven of the 13 attacks occurred when people were sleeping in the open, either in the mashambas or on the veranda of a house in the village. The circumstances of six of the attacks are not known.
- On five occasions the hyaenas were claimed to have been killed after the attack.
- It is of interest that nine of 13 attacks have occurred in the same area (Naulala- Nalama; Fig 9) in the last ten years. This may suggest that a particular clan of hyaenas is to blame in this area and simply removing these hyaenas could solve the problem, however more details are needed on these attacks.
- Hyaenas have been recorded to kill goats and chickens on four occasions, all in 2005 and three of these incidents occurred in Mecula.
-

3.5. Leopard

- Conflict with leopard appears to be minimal despite the fact that leopards are frequently seen within the villages at night.
- Leopards have injured two people in the last year (Fig 9). No reports of attacks prior to this have been collected.
- Outside NNR on the Mueda Plateau, leopard attacks are also frequently associated with sorcery (“spirit leopards”; H. West pers. com) however at this stage no evidence of this has been found in NNR, perhaps due to the low incidence of attacks.
- In 2005, leopards were reported to be catching chickens at Chamba Posto. They are also likely to be attracted into villages by the presence of domestic dogs as has been found in other areas.

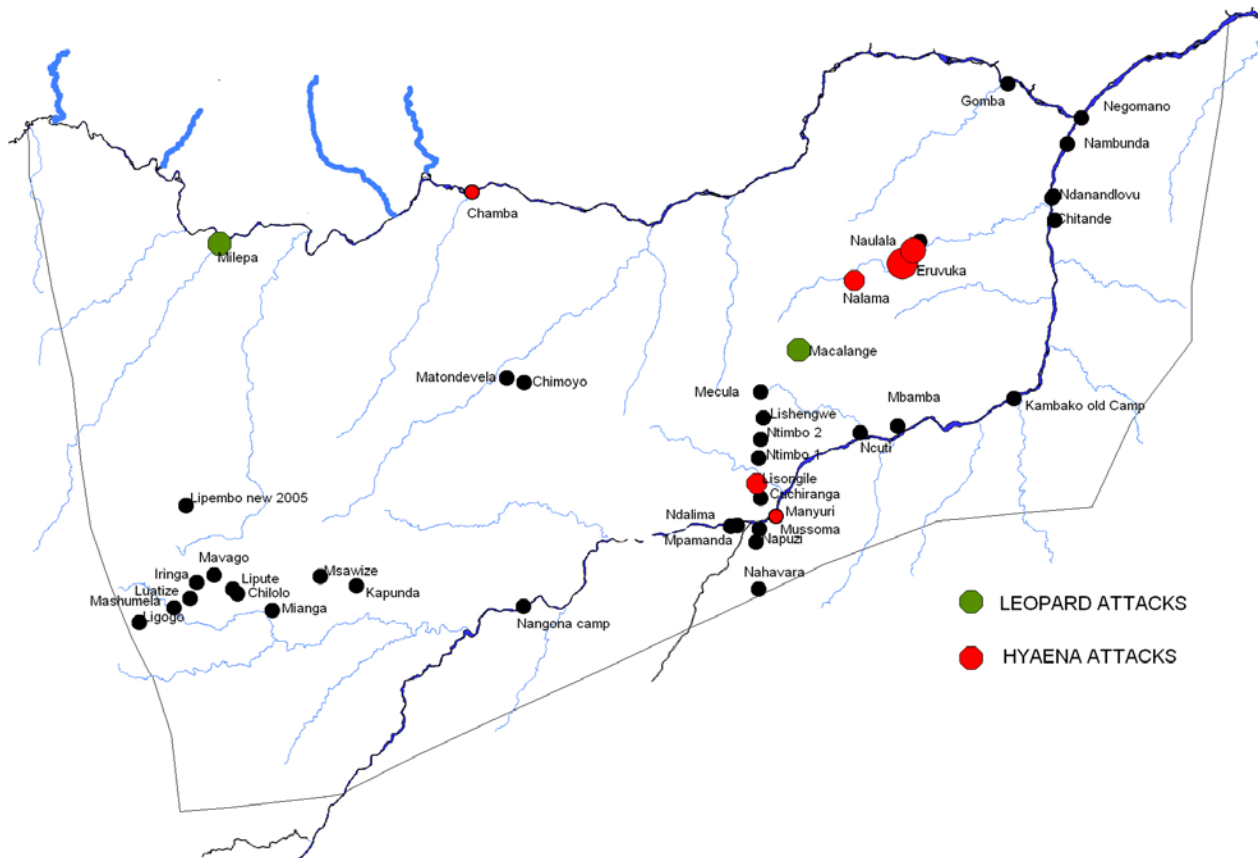


Fig. 9: Distribution of spotted hyaena and leopard attacks in NNR. Only two leopard attacks have been reported, both in 2006, whilst 13 hyaena attacks have been recorded in the last 14 years, primarily in the Nalama-Naulala area.

3.4. Crocodile

3.4.1. General

- Between 1997 and 1998, crocodiles killed 17 people on the Ruvuma River with 59 incidents since 1985. As a result at least 123 crocodiles were killed between 1989-1999 in the Ruvuma region and the majority of these were on the Ruvuma River (Games & Severre 1999).
- Subsequent surveys carried out on the Ruvuma River suggest that crocodile densities are low (Games & Severre, 1999b; Begg *et al.* 2007). An aerial census in 1999 of approximately 150 km of the Ruvuma upstream of Negomano (confluence of the Lugenda and Ruvuma Rivers) calculated a density of 0.05 adult crocs / km (Games & Severre, 1999b); while spotlight counts over 10 km of the Ruvuma River with the Selous Niassa Wildlife Corridor estimated a density of 0.6 adult crocs / km.
- On the Lugenda River preliminary spotlight counts revealed a density of 13.4 crocodiles / km (Begg *et a.* 2005), this count included juveniles as well as adult crocodiles.

3.4.2. Crocodile attacks in NNR

- At least 57 people have been killed by crocodiles in NNR in the past 30 years, with 46 people injured. Of these 45 of the deaths have occurred on the Lugenda River and 7 on the Ruvuma River.
- This is likely to be an underestimate, as it does not include mortalities along the Ruvuma outside of the Selous Niassa Wildlife Corridor.
- The data show a sharp and worrying increase in deaths due to crocodiles since 1970 with more than 40 people killed in the last seven years alone (Fig. 10).
- Given that a significant portion of the fishermen interviewed have been fishing on the Lugenda for more than 10 years, it is unlikely that this is simply due to sampling error (Fig 3). Like lion attacks the circumstances of crocodile attacks are remembered long after the event. At this stage it is impossible to determine whether this increase in attacks is due to an increase in the crocodile population as it recovers from past commercial hunting pressure (B. Chande pers. com) , an increase in the human population utilising the river, or a combination of both (most likely).
- A survey of the Ruvuma River bordering the SNWC showed that crocodiles have killed at least three people and injured five in the last 6 years (Begg *et al.* 2007) and these attacks are happening in only two areas: near Milepa Village at the major commuter crossing point and near the Lusanyando River crossing point (Fig. 11).
- No accurate estimation of the number of people injured by crocodiles has been obtained as injuries are frequently not reported and many are relatively minor. In most cases serious injuries

- result in death from infection at a later date. Data from health clinics might be useful to investigate the number of serious injuries due to crocodiles (and other wildlife).
- The activities of victims prior to the attacks are known for 51 records (Fig 11). The two most dangerous activities on the river are Chingundenje net fishing (21% of attacks) and bathing at regular bathing sites (19%) with wading across the river at regular crossing points accounting for 14% of the attacks.
 - Repetitive behaviour such as bathing and wading at regular crossing points are therefore high-risk activities. In terms of bathing, attacks occur at the Mussoma, Mbamba (Msosa) and Negomano bathing areas where people and children consistently splash and enter the water at the same spot.
 - Chingundenje fishing involves a team of 3-4 fishermen wading waist high through deep pools, swimming and diving to flush fish from their hiding places while gradually pulling the net closed. Large crocodiles are frequently cornered in the nets and it is known to be the most dangerous fishing technique. All the fishermen carry knives to protect themselves when employing this fishing technique and many fishermen have been injured.
 - Due to the danger crocodiles pose to human life, and the damage they cause to fishing nets crocodiles are opportunistically killed by NNR residents whenever they are encountered (retributive killing) and nests are destroyed.
 - Problem crocodiles in deep pools that are prime fishing areas have been trapped and killed by fishermen when necessary. However in some case prime fishing areas have been abandoned due to regular attacks i.e. Natemanda Pool. Small crocodiles are regularly caught in gill nets and killed rather than released (Begg *et al.* 2004). There is also some evidence for a trade in crocodile skins however the extent of this is unknown.

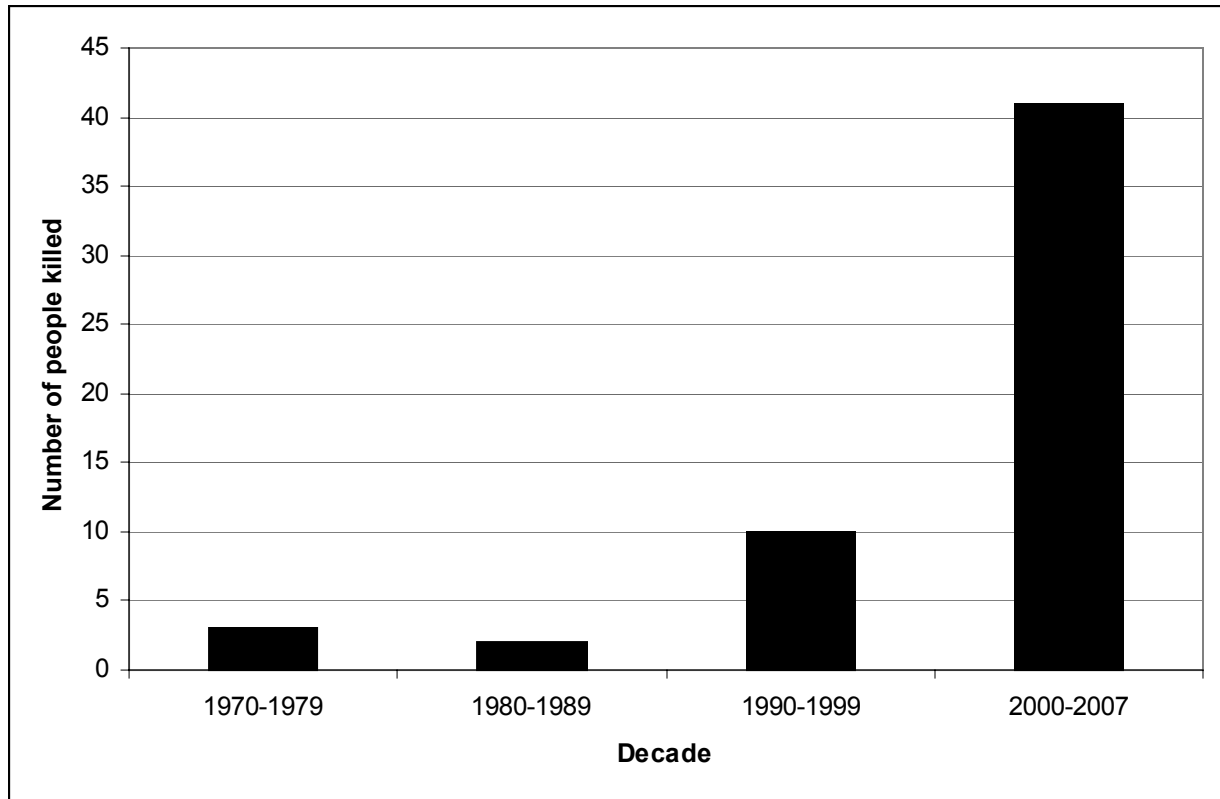


Fig. 10: Frequency of crocodile attacks in NNR over the last 30 years.

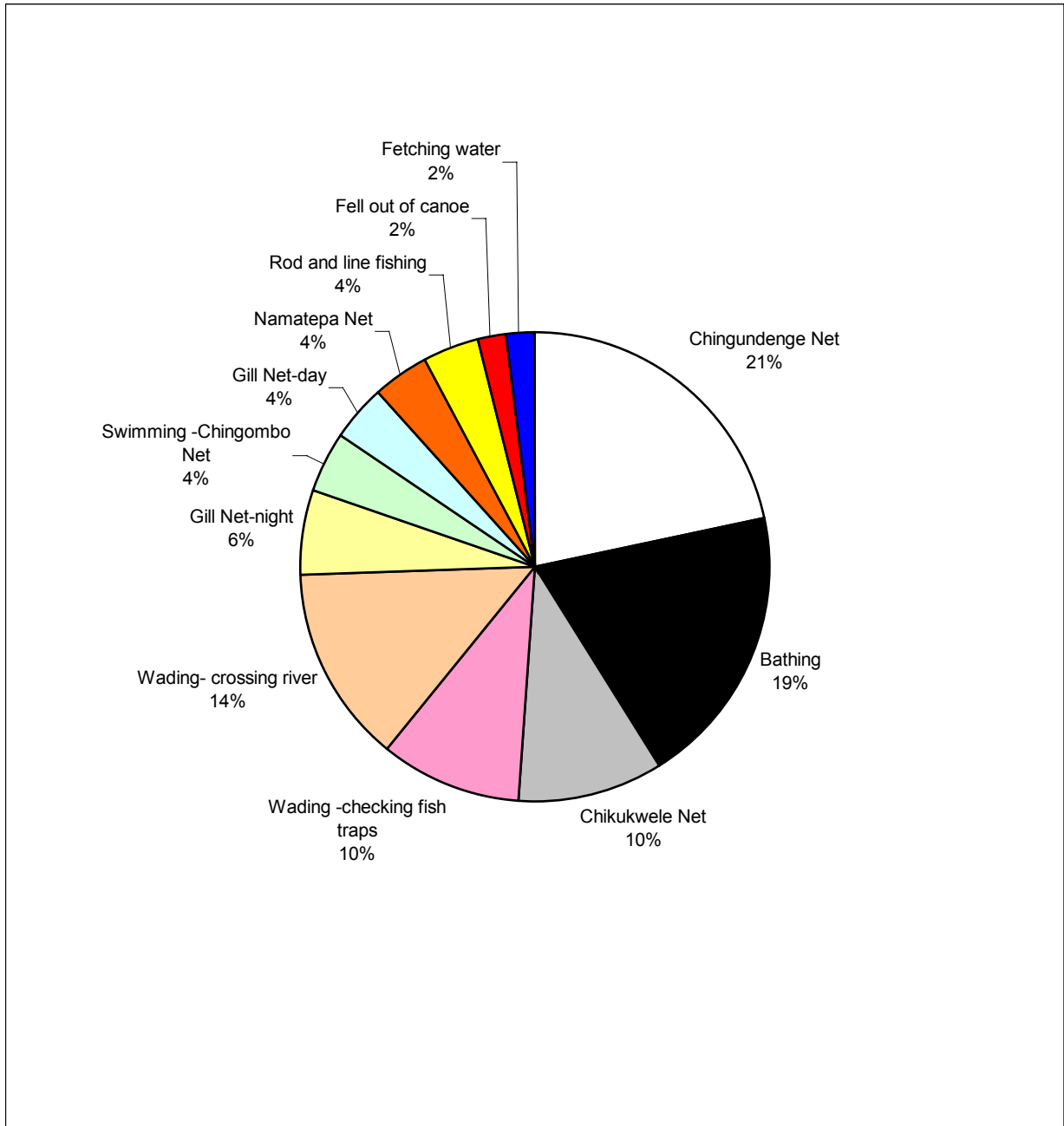


Fig. 11: Pie chart illustrating the activities of victims prior to crocodile attacks in NNR (n = 51). Chingundenje, Chikukwele and Namatepa are types of net fishing where nets are pulled through the water (see Begg *et al.* 2007 for detailed descriptions of fishing techniques).

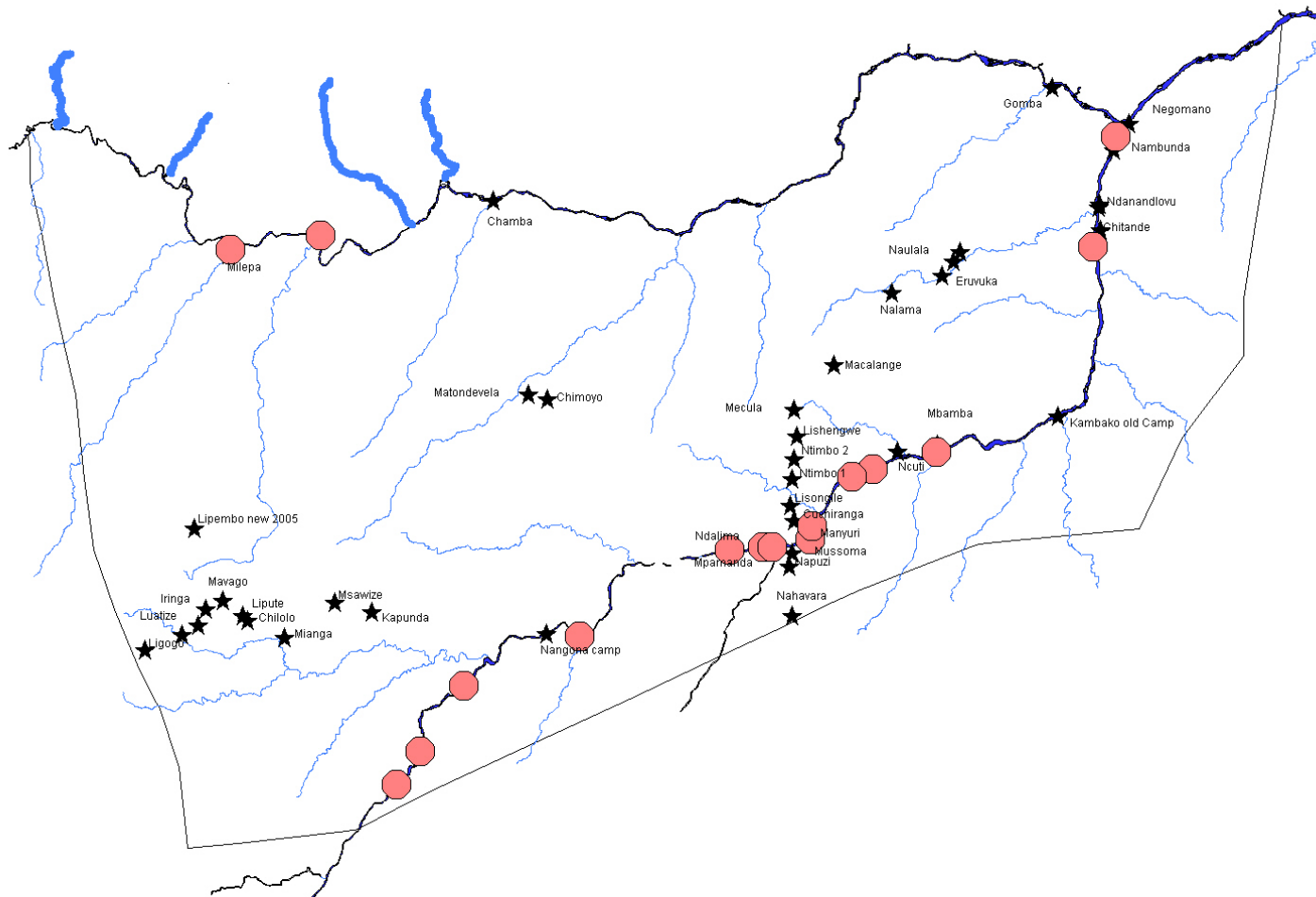


Fig. 12: Distribution of known fatalities due to crocodile attacks in NNR during the last 30 years

. Note that no surveys have been conducted on the Ruvuma east of Chamba village.

5.0 Literature Cited

- Anderson, J. 2005. *Human-Wildlife Conflict in Mozambique*. Unpublished Report Begg, C.M., Begg, K.S., Begg, G.W. & Muemedi, O.I. 2005. Ecological observations from a portion of the Lugenda Valley, Niassa Reserve: resource utilization and densities of key animal species. Unpublished report prepared for SRN, Maputo.
- Begg, C.M., Begg, K.S., Begg, G.W. & Muemedi, O.I. 2005. *Ecological observations from a portion of the Lugenda Valley, Niassa Reserve: resource utilization and densities of key animal species*. Unpublished report prepared for SRN, Maputo.
- Begg, C.M & Begg, K.S. 2007. *Niassa Wild Dog Project: Status and Conservation 2004-2006*. Unpublished report prepared for SRN, Maputo.
- Begg, C.M., Hahn, R., & Madatta, N. 2007. *Ecological and socio-ecological survey of the Ruvuma River contained within Selous Niassa Wildlife Corridor, Tanzania and Niassa National Reserve, Mozambique*. Unpublished Report for Ministry of Natural Resources and Tourism: Wildlife Division, Tanzania.
- Games, I. & Severre, E.L. M. 1999a. *Tanzanian Crocodile Survey*: Appendix 2: problem Crocodile Report. An unpublished report to the Director of Wildlife.
- Games, I. & Severre, E.L. M. 1999b. *Tanzanian Crocodile Survey*: October 1999. An unpublished report to the Director of Wildlife.
- Packer, C., Ikanda, D., Kissul, B. & Kushnir, H. 2005. Lion Attacks on humans in Tanzania. *Nature* **436**: 937-938.
- Stuart-Hill, G., Diggle., R., Munali, B., Tagg, J. & Ward, D. 2005. The Event Book System: a community-based natural resource monitoring system from Namibia. *Biodiversity & Conservation* **14**:2611-2631.
- Woodroffe, R., Thirgood, S. & Rabinowitz, A. 2005. The impact of human-wildlife conflict on natural systems. In: *People and Wildlife: Conflict or Coexistence*. Ed: R. Woodroffe, Thirgood, S. & Rabinowitz, A. Conservation Biology 9, Cambridge University Press.