Athreya, V.R[1]. & A.V. Belsare[2]. 2006. Providing the Maharashtra Forest Department technical and veterinary support to better deal with wild animals that require human intervention. Technical report submitted to Wildlife Trust of India, New Delhi and the Office of the Chief Wildlife Warden, Maharashtra.

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CONTENTS

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Summary

This project aimed to provide technical and veterinary support to wild caught carnivores that had to be cared by the Maharashtra Forest Department. In the case of carnivores (mainly leopards), we inserted microchips (or PIT tags) so that they could be identified in case of recapture following translocation. Most of our visits were to the Nashik and Ahmadnagar Forest Divisions. As part of our work we also provided recommendations to the field staff and senior officers for better managing human-leopard conflict.

We also used the opportunity to obtain measurements of leopards and this is the first time such information is available for the commonest of the large cats in India. The most important result of this work is the documentation that leopards can live in high density human inhabitations without any attacks on people. Therefore, it is important that management in India acknowledges this and appropriate proactive management strategies are set in place to prevent escalation of human leopard conflict in human dominated areas.

We recommend that

1. The conservation and managerial community acknowledge that the leopard is a highly adaptable species that can live even amidst human inhabitations without attacks on people if appropriate proactive management strategies are put into place.

2. Proactive management actions addressing human leopard conflict be science based, taking into consideration the ecology of the species.

We would like to acknowledge the fact that our recommendations have been received positively by the Maharashtra Forest Department, at all levels. Serious levels of human leopard conflict can be completely controlled if the biologically unsound method of capture and translocation is stopped.

Introduction

Human-leopard conflict is a problem faced by many Indian states. The most common perception among the conservation and managerial community towards the presence of leopards outside natural forests is that they are straying individuals. This is not based on any scientific information and does not acknowledge the fact that leopards can live outside natural forests (see Seidensticker et al. 1990). The most common reaction to such animals even in the absence of serious conflict (attacks on people) is that they need to be trapped and sent back into a natural forest.

This response does not consider the biology of highly territorial species nor their homing instincts. All high human leopard conflict sites in India for which data is available are in the vicinity of forests where leopards have been released over the past decade (Athreya et al. *In Press*). Information from leopards that have been translocated in Africa indicates that they can move large distances (hundreds of km), leave the site of release and face increased mortality following translocation (Hamilton 1981). Our work on microchipped leopards also indicates that they move large distances (tens of km) following translocation and can transfer serious conflict to areas without a history of conflict (Belsare & Athreya *In Prep)*.

We have worked with the Maharashtra Forest Department to bring about changes in pre and post capture management of leopards. It is important that the experience of this state be shared with other states facing the same problems.

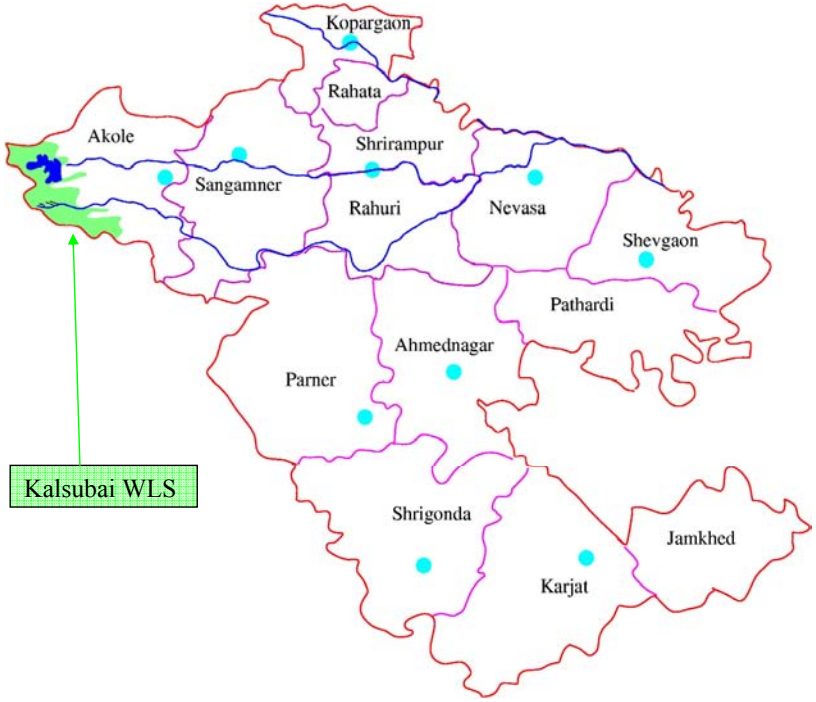
Study Area

The areas covered in this project lie on the eastern flanks of the Western Ghats, in the Ahmadnagar Forest Division (Ahmadnagar district) and the Nashik Forest Division (Nashik district). The territorial wing of the Forest Department administers a 1717 km^2

area in the Ahmadnagar Forest Division and a 3460 km^2 are in the Nashik Forest Division. The region used to support dry deciduous forests which have changed to lush croplands following numerous irrigation projects. Cash crops such as sugarcane, maize, fruit plantations and vegetables are grown in the area. The Pravara River, a tributary of the Godavari originates in the Kalsubai WLS in the Western Ghats adjoining the Ahmadnagar Forest Division and the Godavari originates in the Western Ghat forests adjoining the Nashik Forest Division. The leopards occur in the irrigated valleys of the two rivers. The density of people in this landscape is greater than 258 km^{-2} (http://Ahmadnagar.nic.in and http://Nashik.nic.in). The landscape consists mainly of rural inhabitations and crop fields. Large number of feral dogs are present in the villages, as well as feral cattle and pigs.

Figure 1: Map of Maharashtra

Figure 2: Map of the Ahmadnagar Forest Division



Methods

We provided veterinary support and/or assistance with human leopard conflict management recommendations when required by the Maharashtra Forest Department. In cases when microchips (or PIT tags) had to be inserted in the leopards, details of the trapping site, date, reasons for trapping were noted. A report of the entire procedure and recommendations were provided on the spot to the officer in-charge. The animals were tranquilised as per the details provided in Athreya & Belsare (2005).

Morphometry of leopards

When possible measurements of the animals were taken. The body length (top of nose to where body meets the tail), tail length (where

body meets tail to tip of tail), hind leg length (from the join of the hip bone to the end of the paw) and fore leg length (same method as hind leg) were measured with a tape.

The status of their dentition was noted to estimate age as per Bailey (1993). Pictures are provided below.

Old Adults: Teeth yellow, canines and incisors usually well worn and sometimes missing.

Figure 3: Dental characteristics of old individuals

Prime Adults: Teeth yellowish, incisors and canines slightly worn.

Figure 4: Dental characteristics of prime adults

Young Adults/subadults: It is not possible to distinguish the transition age between prime adults and young adults. However, we have considered all individuals with whitish perfect set of teeth as young adults.

Figure 5: Dental characteristics of young adults

Large cubs: with deciduous canines and incisors.

Figure 6: Dental characteristics of large cubs

Tranquilised leopards were weighed in a hammock to obtain their weights.

Low levels of conflict despite the presence of leopards

Although age related information is presented from leopards trapped in both, the Ahmadnagar and Nashik Forest Divisions, conflict related information is provided only from Ahmadnagar Forest Division. Following our Junnar study in 2004 (Athreya et al. 2004) we recommended to the Office of the Chief Wildlife Warden, Maharashtra that translocation of leopards be stopped in the

Western Ghat forests adjoining Ahmadnagar Forest Division since it was likely to exacerbate conflict in the human dominated valleys downstream of the release sites. From July 2004 releases of leopards were halted in the forests adjoining Ahmadnagar Division except for one animal in 2005. However, a few translocations continued into the forests adjoining Nashik Division till recently.

We have used Forest Department records on trapping and reasons for the same to assess the levels of conflict in the Ahmadnagar Forest Division. Based on the results we provide management recommendations to better manage human leopard conflict in human dominated areas.

Results and Discussion

Morphometry of leopards

The various morphometric values of the leopards from Maharashtra are no different from those obtained from a similar sample size of the leopards from Kruger National Park, South Africa (Bailey 1993).

Table 1: The weight of leopards

Age	Sex	Weight (kg) ± std	n	min	max
Prime adult	Male	63 ± 13	3	50	75
	Female	40 ± 6	3	33	45
Subadult	Male	38 ± 6	8	33	49
	Female	31 ± 5	7	24.5	40

Table2: The body length of leopards

Age	Sex	Body length (cm) ± std	n	min	max
Prime adult	Male	132.1	2[1]	109.2	154.9
	Female	123.2	2	116.8	129.5
Subadult	Male	125.9 ± 7.7	8	119.4	139.7
	Female	117 ± 9.6	7	104.1	129.5

Table 3: The total body length (including tail) of leopards

Age	Sex	Total body length (cm) ± std	n	min	max
Prime adult	Male	229.9	2	208.3	251.5
	Female	205.7	2	195.6	215.9
Subadult	Male	210.8 ± 11.2	8	200.7	229.9
	Female	198.7 ± 13.9	7	180.3	210.8

Table 4: The length of hind leg of leopards

Age	Sex	Hind leg (cm) ± std	n	min	max
Prime adult	Male	75.6	2	71.1	80
	Female	62.9	2	61	64.8
Subadult	Male	65.7 ± 5.1	7	58.4	71.1
	Female	63 ± 5.5	7	55.9	68.6

[1] Only a minimum amount of anaesthesia was given to allow insertion of the PIT tag and/or to treat the animals. Therefore in some cases it was not possible to remove the animal outside the cage for obtaining its weight and body size measurements.

Table 5: The length of fore leg of leopards

Age	Sex	Shoulder (cm) ± std	n	min	Max
Prime adult	Male	Not available			
	Female	61.0	1		
Subadult	Male	65.3 ± 3.2	7	61.0	68.6
	Female	62.1 ± 6	6	53.3	67.3

Three male leopards hunted in the Vidarbha region of Maharashtra in 1911 were on average 7.1 feet in length and two females were 6.2 feet (Pocock 1939). The adults in our sample were on average 7.5 feet for the males and 6.7 in the case of females.

Low levels of conflict despite the presence of leopards

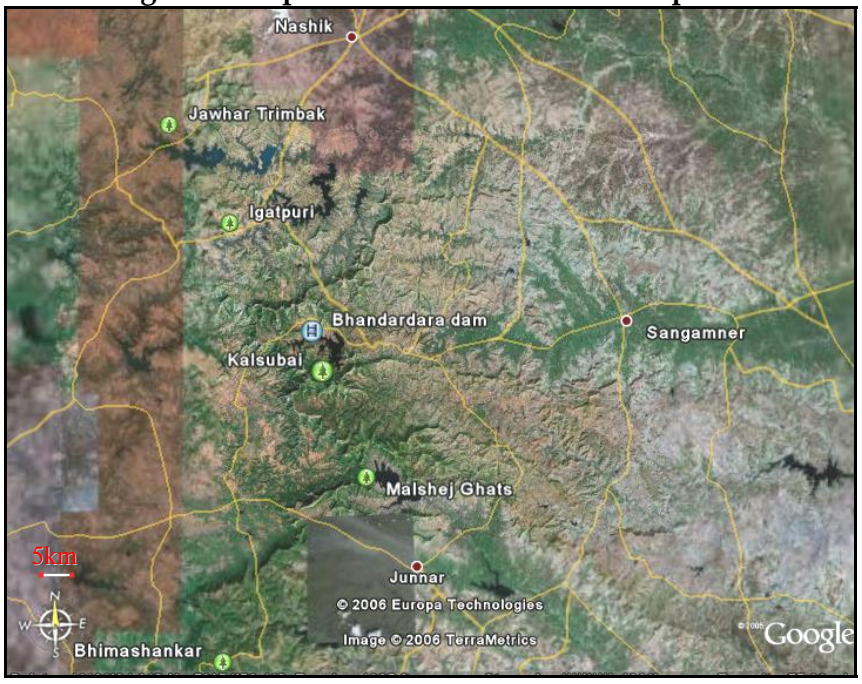
Nineteen leopards were trapped between 9 October 2004 and 28 May 2006 in the agricultural fields of Ahmadnagar Forest Division. Twelve were from the Sangamner Taluka, three from Akole Taluka, two from Kopargaon Taluka, one from Nevasa Taluka and one from Shrirampur Taluka. Of these, eight were prime adults (at least 3 years old) and 11 were young adults (at least two years old) based on their dentition. None of the nineteen individuals were involved in attacks on people. Twelve were trapped following complaints of livestock attacks, four individuals had fallen in open wells in the croplands, one was trapped in a snare, one used to enter a village for pigs and dogs and we do not have precise information on reason for trapping of the last, but it was not due to attacks on people. There were three more leopard incidents in the region in the same period – on 25th February 2005 a leopard fell into a well and escaped in the night via a ladder, on 19th September 2005 a leopard was seen in a chicken coop but escaped in the morning and on 29th December 2005 a dead leopard was found in a well.

For the past decade (data available since 1999), leopards trapped in the entire Ahmadnagar Forest Division were released in the forests adjoining the division (Table 6 and Figure 2,3).

Table 6: Number of leopards trapped in the Ahmednagar Forest Division and released in nearby forests (see Image below for location of sites).

	Kalsubai	Malshej Ghats	Igatpuri	Jawhar Trimbak	Other sites in adjoining W. Ghat forests	Total trapped
1999	4					4
2000	5					5
2001	4	5				10
2002	2	3				10
2003						15
2004		2	2	5	3	18
2005					1	13
2006 (until Oct 07)						7

Figure 3 :Map with release sites of the leopards



Leopards were also released in the Western Ghat forests adjoining Junnar Forest Division and Nashik Forest Division (Table 6). The last of the releases occurred in 2005. 15 leopards trapped in the Ahmadnagar Forest Division were released in Kalsubai WLS between 1999 and 2002. The Pravara river that originates in the Sanctuary runs through the Ahmadnagar Forest Division, passing through the town of Sangamner and joins the Godavari to the east (Figure 2).

The last leopard attack on a person in the Ahmednagar Forest Division occurred in late 2004 (exact date is not available). The last release in 2004 in forests adjoining the Division was in July 2004.

Leopards are strongly territorial species and have phenomenal homing skills (Hamilton 1981, Bailey 1993). Radio telemetry studies of translocated leopards in Kenya have shown that the animals move a distance of at least 25 km from the site of release (Hamilton 1981). Large post release movements out of forests in a country like India would mean displaced leopards in human dominated landscapes thereby increasing the potential for conflict.

Large carnivore scientists have often commented on the fact that large cats, especially leopards, do live close to humans without causing serious conflict (IUCN-Cat Specialist Group 1992, McDougal 1991, Seidensticker 1990). The results of our work provide strong evidence for the same. All the 22 leopards, each of them at least 2 years old and eight at least three years old were living in a high human density area (258 people km^{-2}) without any attacks on people reported in the 1717 km^2 area prior to their trapping. Among those that were trapped, a 75 kg male escaped from the trap cage after two weeks in captivity in the Forest Department nursery located at the edge of the town of Sangamner. No attacks on people were reported following his escape.

The same region reported more than 70 attacks on people between 2001 and 2004. In the same period, 28 leopards trapped in different parts of Ahmadnagar Forest Division were released in the Western Ghat forests adjoining the Division. Our study in Junnar Forest Division also indicated that serious conflict was seen in adjoining human dominated areas following translocations of leopards in nearby forests (upto 60 km away).

Many Indian states report severe human leopard conflict but it is only in Maharashtra that conflict levels have declined drastically. More than 200 people were attacked in various parts of W. Maharashtra between 2001 and 2004 and at least 250 leopards were translocated in the same period. Following 2004 only a few people have been attacked each year in the state.

The reduction of conflict was initially attributed to the removal of a large number of leopards (more than 65 were removed from Junnar and about 30 from Sanjay Gandhi National park, Mumbai). Following our work in Junnar we recommended that releases be stopped. Therefore the other two practical options were to maintain the trapped leopards in permanent captivity or manage them in-situ with low levels of conflict. Since our Junnar work also indicated that the leopards were living in the region without any attacks on people for an entire year prior to the large scale trapping and release exercise (more than 100 trappings of leopards from the Junnar Division and more than 30 releases in the adjoining forests of Malshej Ghats and Bhimashankar WLS – *See* Figure 2) we recommended to the managers that

1. each conflict incident be monitored before traps were set
2. trapping be discouraged if the animal was involved only in livestock attacks (danger to property not included in Section 11 of Wildlife Protection Act) and/or following only a sighting of a leopard.

Trapping has declined in Ahmednagar. Seven leopards were trapped from January to October 2007. The census figures report greater than 50 leopards in the region and each day a couple of livestock attacks are reported (pers. Comm. FD personnel).

Our work in Maharashtra allows us to understand how conflict can be effectively managed using inputs from the biology of the species. It is important that this experience is also shared with the other severely affected conflict states where the same management strategy is in place – that of capture and release.

Recommendations

1. The conservation and managerial community acknowledge that the leopard is a highly adaptable species that can live even amidst human inhabitations without attacks on people if appropriate proactive management strategies are put into place.

2. Proactive management actions addressing human leopard conflict be science based, taking into consideration the ecology of the species.

We would like to acknowledge the fact that our recommendations have been received positively by the Maharashtra Forest Department, at all levels. Serious levels of human leopard conflict can be completely controlled if the biologically unsound method of capture and translocation is stopped.

Table 1: Summary of information on all activities carried out in the Wild-Aid RAP 2005 - 2006.

Date	Place	Species	Chip #	Sex	Age class	Fate	Action
14 Nov 05	Nashik	*P.pardus*	00-065D-B184	M	Adult	Captivity	Treatment and chipping
14 Nov 05	Nashik		00-065D-B719	F	Adult	?	Treatment and chipping
14 Nov 05	Nashik		00-0658-B8D0	F	Adult	?	Treatment and chipping
14 Nov 05	Nashik		00-065E-A10A	M	Adult	?	Treatment and chipping
14 Nov 05	Sangamner		00-0658-D1AA	M	Adult	Escaped from trap cage	Chipping
26 Nov 05	Junnar Rescue Centre			M			Treatment
5 Dec 05	Nashik			F	Cub	Died after few months	Treatment
8 Dec 05	Nashik	*Hyaena*				Died	Treatment
18 Dec 05	Chalisgaon		00-065D-9987	M	Adult	Released in wild	Chipping
19 Jan 06	SGNP, Mumbai	To meet FD officials					
11 Apr 06	Sangamner		00-065D-6D87	F	Adult	Died	Treatment – was unwell
11 Apr 06	Sugaon		00-0658-BB97	F	Adult	Released in wild	Treatment and chipping
11 Apr 06	Sugaon		00-065D-F027	M	Adult	Released in wild	Treatment and chipping
15 Apr 06	Nashik	Meeting with CWW, CCF (T), DCF (T) and RFO's to discuss leopard problem management					
25 May 06	Ahmadnagar		00-065D-847A	M	Adult	Not known	Chipping
5 June 06	Ahmadnagar district	Visit to Mahalsakore and Bhorkhind to hold workshops with gram sabhas to discuss complexities of leopard problem and to provide information on precautions to be taken in a leopard area.					

Appendix 1

Summary of our visits

1. 14th November 2005

Place: Pandavlini Forest Nursery, Nashik Division, Maharashtra.

Chip #	00-065D-B184	00-065D-B719	00-0658-B8D0	00-065E-A10A
Sex	Male	Female	Female	Male
Place of capture	Lahavit	Tarukhedle	Mahalsakore, Sinnar Range, TQ Niphad.	Pahuchibari
Trapped on	13.11.05	22.10.05	29.10.05	9.11.05
Reason	A girl was attacked at Wanjarwadi		9 year old girl taken and eaten.	He got inside a house
Condition	Normal	Normal	Fat	To be observed
Treatment	None	Dectomax + LAP	None	Dectomax, dressing done.
Notes		Old head and body scars present UL canine chipped	Old head wounds	Head wounds, flies present,

2. 14th November 2005
Place: Nimbala Nursery, Ahmadnagar Forest Division, Maharastrha.

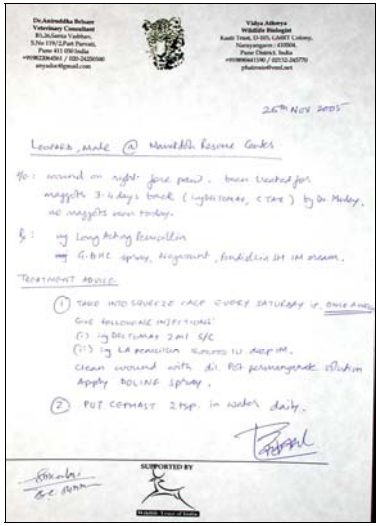
Two leopards were present, one was chipped and the other could not be tranquilised because two syringes bounced off and we ran out of drugs.

Chip #	00-0658-D1AA	Not put
Sex	Male	Female
Place of capture	Ashvi Khurd, TQ Sangamner	Not taken
Age	Adult	Adult
Trapped on	28.10.05	
Reason	Livestock attacks	
Condition	Normal	Normal
Treatment	None	Dectomax + LAP
Notes		Old head and body scars present

3. 26th November 2005
Place: Junnar rescue centre, Junnar Division, Maharashtra.

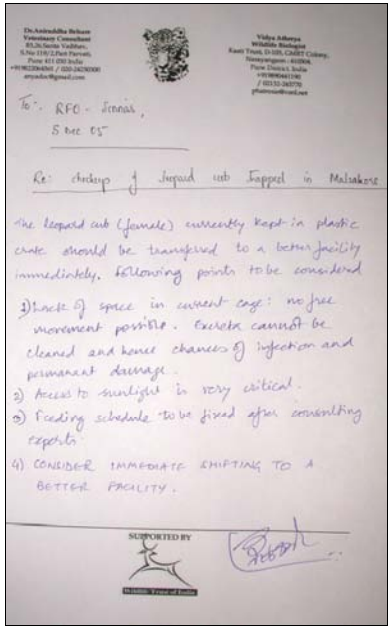
Male leopard at rescue center had wound in RF paw. It was treated.

A copy of the report provided



4. 5th December 2005
Place: Pandavlini Forest Nursery, Nashik Division, Maharashtra.

Two leopard cubs were found in a sugarcane field in Malsake, Sinnar Range, Tal Niphad. One survived. A female, about 2 – 2.5 months. It was recommended to the RFO that better holding facility be made, the animal should receive sunlight.



To. RFO - Sinnar,
5 Dec 05

Re: checkup of leopard cub Trapped in Malsake

The leopard cub (female) currently kept in plastic crate should be transferred to a better facility immediately. following points to be considered

1) Lack of space in current cage: no free movement possible. Excreta cannot be cleaned and hence chances of infection and permanent damage.
2) Access to sunlight is very critical.
3) Feeding schedule to be fixed after consulting experts.
4) CONSIDER IMMEDIATE SHIFTING TO A BETTER FACILITY.

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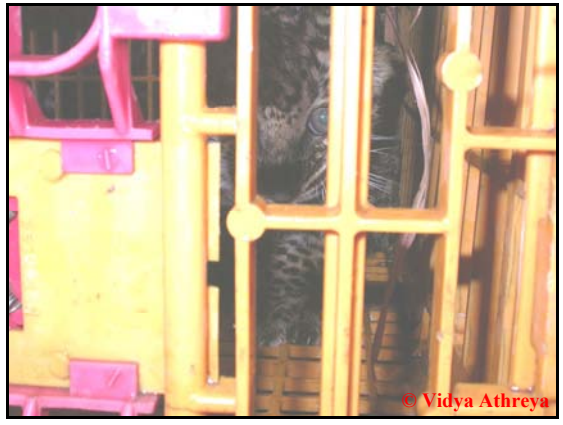


5. 8th December 2005
Place: Pandavlini Forest Nursery, Nashik Division, Maharashtra.

Treatment and checkup of hyaena injured in a motor vehicle accident at Nandur Shingote on National Highway. It had suffered serious skull injuries and skull was fractured, the animal was ataxic. Left eye ball was out of the socket and R eyeball had gone inside the cavity. It was euthanized.

6. 18 December 2005
Place: Patnadevi WLS, Chalisgaon, Auragabad Division.

Leopard trapped in Village Padali, Tal Shirur, Bhid Zilla. Trapped on banks of river Uthala which is about 100 km from Mazalgain area. Area never had leopards for at least 10 – 15 years and 10 days before 17th December 05, attacks started on livestock. Wolves and hyaenas also found in area and livestock is killed by wolves. People saw the leopard and called it a tiger. Godavari is about 10 – 15 km from problem area. Trap cage was set in cotton fields on 12 Dec 05. The range has about 2 trap cages.

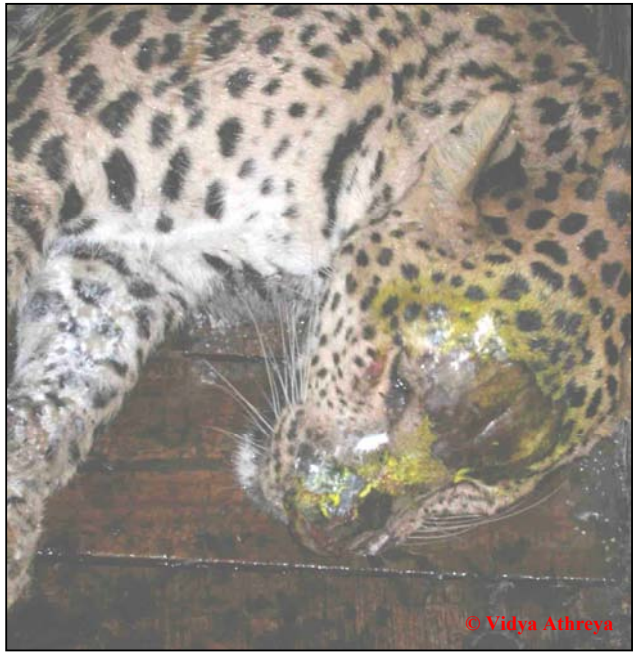
Chip number 00– 065D-9987 was inserted. The animal was released in the Patnadevi WLS.

7. 19 January 2006
Place: Sanjay Gandhi National Park, Mumbai.

A visit was made to the Sanjay Gandhi National Park to meet the Park Director for offering our help to the rescue centre there.

8. 11 Apr 2006
Place: Nimbala Nursery, Sangamner, Ahmadnagar Forest Division.
A trapped female leopardess appeared to be unwell. No obvious external injuries were seen except for an old head wound but her overall body condition was not good and a blood report also indicated that she was unwell. She died the same evening.

chip number	00-065D-6D87
date chipped	11-Apr-06
Division	Ahmadnagar
place trapped	Hanumanthgaon, Nagar F.D.
Date trapped	04-Apr-06
released	Died the same evening
date released	
sex	f



9. 11 Apr 2006
Place: Sugaon Nursery, Akole,, Ahmadnagar Forest Division.

Chip #	00-0658-BB97	00-065D-F027 (picture below)
Sex	Female	Male
Place of capture	Akole	Not taken
Age	Adult	Young male
Trapped on	26.12.05	10.01.06
Reason	Livestock attacks	Fell in well
Condition	Normal	Normal
Treatment	None	None
Notes	Released in Yaval WLS in first week of August.	

10. 25 May 06
Place: Bhingar Nursery, Ahmadnagar, Ahmadnagar Forest Division.

Place where chipped	Bhingar Nursery
chip number	00-065D-847A
date chipped	25 May 06
place trapped	Nevasa
Date trapped	21 May 06
released	
date released	
sex	m

11. 25 May 06
Place: Mahalsakore and Bhorkhind villages, Nashik Forest Division. Meeting with local people.

References

Athreya, V.R. & A.V. Belsare. 2005. Helping the Maharashtra Forest Department rescue or treat endangered wild carnivores. Submitted to the Wildlife Trust of India, New Delhi and the Office of the Chief Wildlife Warden, Maharashtra.

Athreya, V.R., Thakur, S.S., Chaudhuri, S. & A.V. Belsare. 2004. A study of the man-leopard conflict in the Junnar Forest Division, Pune District, Maharashtra. Submitted to the Office of the Chief Wildlife Warden, Maharashtra and the Wildlife Protection Society of India, New Delhi. http://carnivorelibrary2.free.fr/junnarleopards.

Athreya, V.R., Thakur, S.S., Chaudhuri, S. & A.V. Belsare. In Press. Leopards in human-dominated areas: A spillover from sustained translocations into nearby forests? Accepted in the Journal of Bombay Natural History Society.

Bailey, T.N. 1993. The African leopard: a study of the ecology and behaviour of a solitary felid. Columbia University Press. NY.

IUCN-CSG. 1992. Management of Big Cats near human settlements and activities. First draft of the Cat Action plan. IUCN Cat Specialist Group.

McDougal, C. 1991. Man-eaters. *In* Great Cats. Majestic creatures of the wild. Eds. J. Seidensticker & S.Lumpkin. Pp 240. Pennsylvania Rodale Press, Inc.

Pocock. 1939. Felidae of British India.

Seidensticker, J., Sunquist, M.E. & C.McDougal. **1990.** Leopards living at the edge of the Royal Chitwan National Park, Nepal. In. Conservation in developing countries: problems and prospects. Eds. J.C.Daniel and J.S.Serrao. 415- 423. Bombay Natural History Society and Oxford University Press.