



Investigate Human-leopard Conflict in Galliat and Contiguous to Abbottabad and Margalla

Scientific Committee Project, WWF-Pakistan

Preliminary study to know leopard population in and around Ayubia National Park)

(October, 2005 to August 2007)



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Summary

The present document is an outcome of a two year study, aimed to estimate the leopard population in and around the Ayubia National Park (ANP). Spread over an area 3,312ha, the park supports a variety of wildlife, including Common leopard. To know about its current status and the environment that it lives in, scientific studies are needed. Due to technical and financial constraints, however, no such studies could be so far. The present study is the first of its kind to estimate the population of common leopard. Two different methodologies were used to do so: (i) sighting record information documentation from villages; and (ii) pugmark survey.

Leopards were sighted in 175 locations over an area of 115.27km². Sighting records remained higher from May to August. Similarly, sighting in villages were higher than in the forest. Bulk of the sighting was recorded in morning and evening and fewer in the afternoon. In 2006, cubs with mother were sighted at four different locations in the study area.

Ten fixed monitoring tracks (covering 151.5km) were surveyed twice to get the *mean encounter rate* for leopard scats, footprints, livestock and people seen in the area. Analysis revealed that all the tracks were frequently used during April-May. As such, more than 40 tracks were traced. After data analysis, only eleven (11) tracks were identified as individual leopards. Species occupancy rate will be calculated with the help of PRESENCE software once the third survey results are available. During the last two years, four leopards were reported to have been killed by the local communities.

1. INTRODUCTION

There are 36 species of cats extant in the world. Pakistan has 11 of them, including three of the large sized cats; Snow leopard (*Uncia uncia*), Common leopard (*Panthera pardus*), and Cheetah (approximately extinct).

Common leopard is the most widely distributed of all the wild cats in the world (Nowell and Jackson 1996). It is found almost in every kind of habitat: from rainforests to the tropics to desert and to temperate regions (Kitchener 1991). Fossil evidence, some as old as 1.5 to 2.0 million years (Hemmer 1976, Brain 1981), suggests that leopards were once more widely distributed than today. The geographical distribution of leopard extends throughout Africa, central Asia, south-east Asia and north Amur valley in Russia. Leopard is found through the Indian sub-continent with the exception of deserts, the Sundarban mangroves, and densely settled areas (Khan 1986, Jhonsingh *et al.* 1991). Myres (1976) recommends that it remains in Appendix 1 of CITES because its extensive hunting had depressed its population in several parts of Africa. It is classified as a threatened species in the IUCN Red list data book. According to the Global Cat species Vulnerability Ranking, common leopard is categorized as 5(a), while regionally placed in category 4(a).

Leopards shows considerable variation in its physical appearance, having a coat of any color: from pale yellow to deep gold, patterned with black rosettes. It has an elongated body and limbs of moderate length. The paws are broad, rounded, the ears are short, the tail, longer in comparison to its body or that of Tiger (*Panthera tigris*), assisting its quick manoeuvres. Throat, chest, belly, and insides of the limbs are white. The backs of the ears are black with a white central spot. The skull is relatively elongate but flat on the upper surface. There are, however, various aberrant coat patterns: one of the most striking is *melanism*, the leopard being totally black. It is caused by a recessive gene. Average adult male weighs 50-70kg and female, 29-54kg (Nowell and Jackson 1996).

Over most of their range, leopards have no particular breeding season. Females are sexually receptive at 3 – 7 week intervals lasting just a few days. Sexual maturity is achieved at about 2.5 years. Leopard in Africa and India mate at any time of the year, the gestation period is an average of 96 days (90-112) with 2-3 cubs being borne. The young weights 400-700 gm at the time of birth and opens its eyes after 7-9 days (Ewer 1973, Hemmer 1976). It has now been proposed on the basis of molecular studies to lump the 27 races of leopards, found across its range from Africa to Asia into eight races (Miththapala *et.al* 1996). They have suggested that three races are found in the Indian sub-continent, the Nepal leopard (*Panthera pardus pernigra*), Kashmir leopard (*P.p millardi*) and the India leopard (*P.p fusca*) be lumped into *P.p fusca*.

1.2 Status and distribution of Common leopard in Pakistan

Leopards in Pakistan are mainly found in the high lands of Balochistan (TobaKakar, Mekran and Sulaiman range), Sindh (Kirthar mountain ranges), the mountain forests of Punjab (Margalla and Murree hills), NWFP (Swat Kohistan, Dir, Chitral, Abbottabad, Kaghan valley), Azad Kashmir (hill ranges of the Muzafarabad and the Neelum valley), and lower Gilgit. Its survival in the Salt Ranges in Punjab is not clear (website source).

Though widely distributed in Pakistan, Common leopard is quite unique in most of its habitats. Except a few places in NWFP, where a reasonable degree of protection has helped this species to grow in numbers, it is decreasing in other parts where it has lives. The total population of leopards in Pakistan is not exactly known and very limited literature is available at the national level. To estimate its population, a study was conducted about its distribution pattern, and habitat preference in 1998-99 in Rawalpindi District by M. Anwar Maan & A. Aleem Ch. (Tiger Paper; vol.27 October-December, 2000). The overall population estimates within a 281km² habitat was 5.058+-4.496, indicating that 1-9 leopards survive in its distribution range. Observation of the study conclude that the population of leopard was randomly distributed, showing no preference for a particular habitat. The NWFP Wildlife Department carried out a census in the province in 1997 and has put the number of leopards at 76 of which, 24 were said to be Abbottabad District (Study area).

Panthers kill a variety of pray and do not spurn even snakes, lizards, and small rodents. In Pakistan, their preferred food varies according to locality. In Balochistan, they prey on female and sub-adult Sindh Ibex and Markhor. In Kala Chitta Hills, they prey on Urial, and in the forest of Himalayas, Rhesus monkey and domestic dogs, are their main prey. In regions where natural game is limited, panthers are notorious for attacking domestic livestock. In Pakistan, they have been known to kill adult cows, besides calves, donkeys, ponies, goats and sheep (Robert, T.J., 1977).

1.3 STUDY AREA

I. Location

Ayubia National Park (ANP) lies between the 34°:1' to 34°:3. 8' N latitude and 73°:22.8' to 73°:27.1' E longitude. It is located at a 3-hour drive north of Islamabad in the Galliat Hills (North West Frontier Province) of Pakistan. It was declared as a national park in 1984 with the aims of preserving its beautiful landscapes, forests and biodiversity for scientific research, education and recreational purposes. Its elevation ranges between 1,050m to 3,027m¹.

II. Climate

Climate of the Park is temperate in summer with the influence of monsoons. In winter, it is severe cold. The snow season prevails from mid December to mid March. Mean annual rainfall is well above 1500mm in addition to precipitation received in the form of deep snow in winter¹.

III. Geology

Mountains of the ANP are 40 to 170 million years old. The rocks are sedimentary of varied variety; mostly limestone but also alternating shale and sandstones. Where

these rocks are exposed, heavy folding and faults are visible, with various colored clay due to inter phase. The soil is mainly clayey, but also mixed with gravel and sand at places².

IV. Ethnic Groups

Twelve major villages and three small towns (Nathiagali, Ayubia and Khanspur) surround the Park. The two main ethnic groups are Karlal and Abbasi. Karlal are dominant to the north side and Abbasi, to the southern side of the Park².

V. Ecosystems of the Park

The Park supports three type of forest ecozone;

- Sub tropical Chir pine forest (1050m asl)
Pinus Roxburgii, *Quercus incana* and *Rhododandron arboreum* are the dominant species and include area around Lahoor Kas forest compartment.
- Moist temperate coniferous forest (2000m asl)
Trees are *Pinus wallichiana*, *Taxus wallichiana*, *Abies pindrow*, *Cedrus deodara*, *Aesculus indica*, *Poplus ciliate*, *Acer ceasium*, *Ulmus wallichiana*, *Quercus leucotrichophora*, *Q. glauca* and *Q. floribunda*.

Shrubs and herbs include; *Rubus paniculata*, *Vibernum nervosum*, *Lonicera purpurascens*, *Rosa macrophylla*, *Skimia laureola*, *Indigofera heterantha*, *impatiens edgworthii*, *Viola biflora*, *Fragaria nubicola*, *Arisaema jacquemontii* and many more.

- Sub alpine meadows (3000m asl)
This zone is representing on a very short area, o the relatively broader peaks of two mounts, which are Merranjani and Mukshpuri of the Park. Poa grass cover the ground and herbs like *Polygonum*, *saxifrage*, *Euphorbia* etc.

VI. Biodiversity of the Park

In Pakistan, it is one of the rich areas in species diversity. Species recorded include 757 plant species, 650 insects, 203 birds, 31 mammals, 19 reptiles, and 3 amphibians.

1.4 Study objectives

To estimate the leopard population in and around the Ayubia National Park, District Abbottabad

2. METHODOLOGY

Two different methodologies were used to ascertain the leopard population: one was sighting record information documentation and the second was pugmark census. Both were used simultaneously and covered an area of 115.27km².

I. Sighting Record Information Collection

Initially, a questionnaire was developed and information collected on the size of the leopard, sighting date and time, habitat condition, geographical location of the sighting and other evidences of the presence of leopard in the area. Sighting records were plotted on the GIS based maps. Based on the sighting records, surveys were conducted to confirm the claims and reports (Questionnaire as Annex-1).

II. Pugmark Survey

10-fixed trails were selected to be monitored on regular basis. Trails were selected based on previous year data and local people's observations regarding leopard's presence. Specific data sheet was designed to collect information from the tracks, including footprints, scats, and animal sign related information (Data sheet is attached as Annex-2). Pugmark tracing technique was also used to get suitable pugmark impressions in order to get information about the leopard's movement in the study area. Tracing mirror and plaster casts were used to get paw impressions. Tracing from the mirror was then transferred to the tracing paper, rewarding the outlines of pugmark by keeping the tracer against the light. Different variables were noted down including leopard's gait and the field conditions, with date, time, and place.

Encounter rate and mean encounter rate of scats and pugmarks were calculated and the traced footprints were analyzed with the help of already developed standards to make the population estimates.

3. RESULTS AND DISCUSSIONS

3.1 Sighting Record Information Collection

In 2005, 2006 and up to June 2007, leopards have been sighted in 175 places. The geographical coordinates of all the sighting places were recorded and plotted on the GIS for the year 2005 and 2006 (maps are attached as Annex 3 & 4).

The sighting results of the Y2005, Y2006 and Y2007 up to June with respect to the months are provided in the Table.1 as annex. Results of the sighting records are summarized below:

- In 2005, leopards have been sighted in 31 places, in 2006, in 94 and in 2007 (up to June), in 50 different places.
- Sightings were higher in May (30), June (27), July (12) and August (14) as compared to the rest of the year.
- Sightings inside the villages (97) were higher than inside the forests (78).
- About 30% sightings happened near the water sources.
- Of total sightings, 43% were recorded in morning, 18% in the afternoon, and 39%, in the evening.
- About 69% sighting were through the local women, who usually visit the forest area daily for the fuelwood and fodder collection.
- In 2005, one cub was sighted without mother at Ratti Mitti. In 2006, two cubs at four different locations (Kalabagh, Namlimera, Jandarpara, Bagnakkar). In 2007, only once a leopard with cubs was sighted near the green spot area of the union council Nathiagali. (GPS locations of the cubs sighting are provided as table.3 in the annex.)

Discussion

Leopard sighting in the villages particularly at day time have increased manifold now than in the past. This could be attributed to two reasons. One, that the leopard population has increased and two, it implies that its prey species population in its core habitat has decreased considerably forcing it to come down to villages in search of food.

Another worth mentioning factor is the increase human population, and higher level of disturbance in the leopard habitat. The leopard habitat is under use constantly for the local fuelwood and fodder requirements. Due to frequent interaction, leopards are no more shy of human beings.

It is evident from the sighting records that leopards population in and around the park peripheries is randomly distributed while the park provides protection for the survival of the species in its historic range.

4 Pugmark Survey

Project team identified and mapped 10 leopard tracks showing their territorial markings in the study area. Maps of all the tracks were monitored on regular basis. A specific datasheet was designed to collect the relevant information from the tracks, containing footprints, scats, and other related information (data sheet is available as annex). Mean encounter rate of the scats and footprints was calculated (See table.5, 6, 7, & 8. provided at the end). The detail of the monitoring tracks is given below;

Table.4 Details of the Monitoring Tracks

A	Track Code	Track Name (Distance covered during the monitoring)
	T1.	Pipeline Track, (12Km)
	T2.	Chakhanapani Track, (08Km)
	T3.	Darwazakus Track, (11.5Km)
	T4.	Mallach&Pasalla village Track, (15Km)
	T5.	Diar Sari Track, (08Km)
	T6.	Ratri Track, (32Km)
	T7.	GH, Lissan, Kalapani Track, (08Km)
	T8.	Lahurkus& Gulbaba Ziarat Track, (13Km)
	T9.	Sajangali Track, (34Km)
	T10.	Lalazar Track, (10Km)

Encounter rates of the footprints, scats, livestock and people was calculated

To develop base line information, two surveys were conducted to get the mean encounter rate for the leopard scats, footprints, livestock and people seen in the area. First survey was conducted in August- September, 2006 and second in April-May, 2007. The calculated mean encounter rate will be used as (indices) baseline in future to assess the trend of using the habitat by the leopard, livestock and people. Mean encounter rate calculated for the leopard footprints was 0.0972, for scat 0.0657, for livestock 1.7581, and for people, it was 2.5143 in August-September, 2006. In 2007, the survey was conducted in April-May, and a great variation in the results was observed. Mean encounter rate for the footprints was 1.133, for scat 0.111, for livestock was 1.7925, and for people, it was 3.15946. The comparison of results of both the surveys shows that all the tracks are most frequently used in April-May, compared to August-September by all the four parameters. Therefore it is recommended that, April-May months of the year are better for the surveys, compared to August-September. Regular monitoring is required to understand the whole year use of the tracks by the leopards (for detailed results see Tables 5 & 6).

Pugmark tracing technique was used to estimate the leopard population

Pugmark tracing mirror was used. It consists of a transparent rectangular glass plate, of size 30cmX30cmX3mm. Pugmarks of the individual leopards can be distinguished from others. Even when the broad layout of different pugmarks appears similar; distinctions can be inferred through minute examination. To enable such comparative examination, accurate tracing of pugmarks is required on a glass plate and later, transferred to the paper.

All the leopard trails pass through forests or grassy areas, where it is impossible to get a suitable pugmark impression. To gain in-depth understanding with regards to the movement of the leopards at such places and to be able to record pugmark tracing or make a plaster cast, Paw Impression Pads (PIP's) with soft soil were required. PIP's of 3m length and 1m width were placed along the identified leopard trails with due regard to the overall topography of the study area.

During the reporting period, more than 40 tracks were traced and after careful analysis of the data, only 11 tracks were identified as individual leopards. Standard method was used to analyze the traced pugmarks for which experts were consulted. The individual leopards were distinguished from each other and their localities were monitored regularly to gain some useful information about the leopard's behavior. Places for camera trap installation were also identified as well sites for regular monitoring.

Table.9 Details of the identified individual leopards

Track Code	Length (cm)	Width (cm)	Sex	Foot
T1	10.1	8.6	Female	HF
	9.3	8.9	Male	HF
T2	9.3	9.7	Male	HF
T3	11.0	9.0	Female	HF
T4	9.0	7.9	Female	FF
T5	9.9	9.9	Male	HF
T6	8.4	8.4	Male	HF
T7	8.4	8.4	Male	HF
T8	8.5	7.9	Female	FF
T9	8.4	7.2	Female	FF
	9.3	7.9	Female	FF
T10	We couldn't traced its paw due to non availability of good substrata			
Total	06Females & 05Males			

It could be argued that the study area has a minimum 11 leopards over an area of 115.27km². During the last two years, four leopards were killed by local community, three females were killed, one from Khunkalan and two from Lahurkus, while one adult was killed in Kundla, whose status was not known.

Preservation of tracks (footprints)

Preservation of tracks (footprints) is a useful technique for keeping field record for measurements and comparison with other tracks, as well as for the exhibition and educational purposes. This technique was also used additionally to get more useful information about the leopard population and other relevant aspects with the sighting record collection & pugmark tracing techniques in 2006. Eleven pugmarks were preserved during the reporting period for which, Plaster of Paris was used. This method is more costly, compared to the pugmark tracing. The results are also not useful for further analysis to reach population estimates.

GIS based Habitat modeling of leopard land cover study;

During the reporting period, a study for the GIS based habitat modeling of leopard land cover was started. Study is attached as annex.

5. Conclusion

Though widely distributed in Pakistan, Common leopard is unique in most of its habitats. Except a few places in NWFP, where a reasonable degree of protection has helped this species grow in numbers, it is decreasing in other parts of the country. The

total population of leopards in Pakistan is not exactly known and a very limited literature is available on the species population at national level. The present study tried to identify different techniques that suit the area for population census and established baseline for the sighting information, population, etc.

This study revealed that a minimum of 11 leopards occupied 115.27km². Mean encounter rate calculated for the leopard footprints was 0.0972, for scat 0.0657, for livestock 1.7581, and for people was 2.5143 in August-September, 2006. In 2007, the survey was conducted in April-May, and a great variation in the results was observed. Mean encounter rate for the leopard footprints was 1.133, for scat 0.111, for livestock was 1.7925, and for people was 3.15946. The comparison of results of both the surveys shows that all the tracks were more used in the month of April-May as compared to the August-September by all the four parameters. Same study will also be conducted in Murree, Qalandarabad game reserve, Margalla, and Thandiani.

6. Recommendation

- Conduct such a survey in other parts as well
- To evaluate the performance of both the techniques, compare pugmark-photographs with the tracing pugmarks
- Calculate leopard population density by using capture-recapture method through camera trap technique

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ANNEXES

Table.1 Leopard Sighting Record on Monthly Basis

Months	Year		
	2005	2006	2007
January	0	03	06
February	0	06	07
March	0	10	05
April	0	15	02
May	0	11	19
June	02	14	11
July	04	08	
August	02	12	
September	02	07	
October	05	06	
November	05	02	
December	11	Data was not collected due to severe cold	
Total	31	94	50

Table.2 Leopard sighting information with respect to time and location

Year	Location		Timings		
	Inside forest area	Inside village Or at any other place	0400hrs-1200hrs	1200hrs-1600hrs	1600hrs-2000hrs
2005	13	18	18	05	08
2006	42	52	35	19	40
2007	23	27	22	07	21
Total	78	97	75	31	69

Table.3 Leopard cubs sighting information

Year	Month	No. of Cubs	Location Name	GPS reading	
				N	E
2005	August	01 (without mother)	Ratti Mitti	34.04.065	73.22.224
2006	February & March	02 (with mother)	Bagnakkar	34.04.204	73.22.412
2006	May	02 (without mother)	Namlimera	34.06.047	73.22.196
2006	July	02 (with mother)	Kalabagh	34.02.146	73.23.455
2006	September	02(with mother)	Jandarpara	34.03.227	73.23.100
2007	May	02(with mother)	Green spot	34.04.432	73.22.419

Table.4 August-September, 2006 Survey results (0630hrs-0830hrs)

Track Code	Km walked	Leopard Footprints (ER)	Scat (ER)	livestock (ER)	People (ER)
T1.	12Km	01 (0.08)	01 (0.08)	13 (1.08)	26(2.166)
T2.	08Km	01 (0.125)	0 (0)	17 (2.125)	13(1.627)
T3.	11.5Km	0 (0)	0 (0)	02 (0.173)	06(0.521)
T4.	15Km	02 (0.133)	0 (0)	34(2.266)	101(6.733)
T5.	08Km	01 (0.125)	01 (0.125)	08(1.0)	23(2.875)
T6.	32Km	01 (0.031)	03 (0.0937)	57(1.781)	55(1.718)
T7.	08Km	01 (0.125)	01 (0.125)	31(3.875)	12(1.5)
T8.	13Km	02 (0.153)	01 (0.076)	53(4.076)	61(4.692)
T9.	34Km	0 (0)	02 (0.058)	41(1.205)	99(2.911)
T10.	10Km	02 (0.2)	01 (0.1)	0 (0.000)	04(0.4)

Table.5 April-May, 2007 Survey results (0630hrs-0830hrs)

Track Code	Km walked	Leopard Footprints (ER)	Scat (ER)	livestock (ER)	People (ER)
T1.	12Km	02 (0.166)	02 (0.166)	05 (0.416)	11(0.9166)
T2.	08Km	01 (0.125)	01 (0.125)	21 (2.625)	27(3.375)
T3.	11.5Km	01 (0.086)	01 (0.0869)	09 (0.782)	31(2.695)
T4.	15Km	02 (0.133)	0 (0)	31(2.066)	61(4.066)
T5.	08Km	01 (0.125)	02 (0.25)	09(1.125)	19(2.375)
T6.	32Km	02 (0.0625)	04 (0.125)	63(1.968)	117(3.656)
T7.	08Km	01 (0.125)	01 (0.125)	37(4.625)	37(4.625)
T8.	13Km	02 (0.153)	03 (0.230)	42(3.230)	57(4.384)
T9.	34Km	02 (0.0588)	01 (0.0294)	37(1.088)	124(3.647)
T10.	10Km	01 (0.1)	01 (0.1)	0 (0.00)	19(1.9)

Table. 6 Details of the Retaliatory killing sites of the leopards in District Abbottabad

S. No	Sex	Date of incident	Killed by(Poisoned (P), Shoot (S))	Village (Union Council)
1.	Male	11 July, 2005	Wildlife Department (S)	Singal Kot (Bakot)
2.	Male	17 July, 2005	Wildlife Department(S)	Aliabad (Bakot)
3.	Female	10 April, 2006	Local community(S)	Lahurkus (Berot)
4.	Female	28 May, 2006	Local community (S)	Khunkalan (Bakot)
5.	Male	30 August, 2006	Local community(S)	Turnai (Qalandarabad)
6.	Male	27 October, 2006	Local community(S)	Dhaki Kheter (Namli Mera)
7.	Female	10 November, 2006	Local community(P)	Lahurkus (Berot)
8.	Cub	01 January, 2007	Unknown	Darwaza Changla (Palak)
9.	Unknown	24 April, 2007	Local community(P)	Kundla (Nathiagali)
10.	Male	24 May, 2007	Local community(P)	Ziaratmasoon (Seer)
11.	Male	07 June, 2007	Local community(P)	Kalsura (Seer)
12.	Female	16 May, 2007	Local community(P)	Jafran (Barmigali)