2008

Wildlife Survey Program
Status of Mammals in Wakhan Afghanistan

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January, 2008

Wildlife Conservation Society, New York

Cover Photograph: Group of adult male Marco Polo Sheep from Waghjir Valley, Photographed on 22.07.2007
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EXECUTIVE SUMMARY

The Wildlife Survey Program Team carried out two surveys in the Wakhan in 2007. Post Winter Conflict Assessment during the month of April and summer survey during the months of June – August. The first survey was aimed to collect the data on the loss of the livestock during the recent winter and the summer survey was carried to evaluate the status of mammals in Proposed Big Pamir Wildlife Reserve (PBPWR) and Waghjir Valley.

The overall loss of livestock to the predators during the winter is far less than the loss by the extreme conditions of the weather. The loss by predators was just 0.65% as compared to the loss by the extreme conditions of weather which was 8.85%.

Sighting of Urial sheep and Otter from the Wakhan valley during the survey period helped to map the distribution of the species within the country. Both the species were first time reported from the Wakhan.

The summer 2007 survey of the proposed BPWR and Waghjir valley of the Wakhan region reported the presence of higher number of Marco Polo sheep following three decades of the war. Based on the conservative estimate 116 animals were counted from PBPWR and 106 animals from the Waghjir valley. 106 animals are the highest number of Marco Polo reported from the Waghjir.

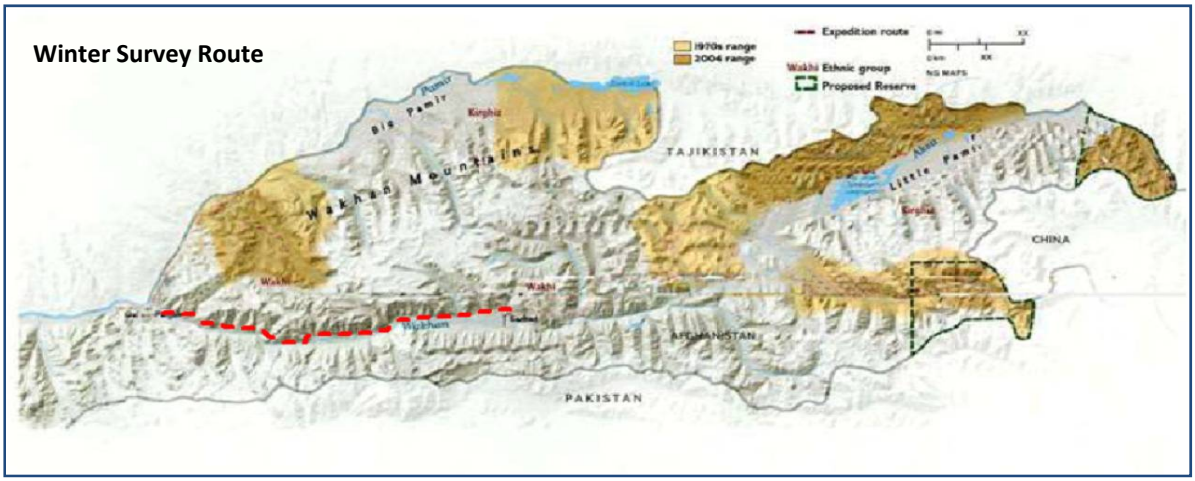
Based on the analysis of the scats collected from the Wakhan during the year 2006 and 2007, Marco Polo contributed 33% to the diet of the snow leopard followed by Marmots (21%) and Ibex (18.4%) and the livestock just contributed 9.6%, whereas Ibex contributed maximum 23.9% followed by Marmot (18.2%) and Marco Polo (18.2%) to the diet of Wolves. Livestock contributed 33% to the diet of the wolves. Red Fox is entirely dependent on the smaller mammals in the Wakhan.

All the three predators Snow Leopard, Wolf and Red Fox separate themselves on ecological niche axis based on their food habits.

POST WINTER CONFLICT ASSESSMENT (APRIL 2007)

Post winter conflict assessment for the loss of live stock to the predators (Snow Leopard and Wolf) was carried in the month of April 2007. 20 days in the month of April were spent in the main Wakhan Valley and all the 53 villages in the main Wakhan Valley were surveyed. The main objective of the survey was to assess the magnitude of the loss during the immediate winter and to estimate the number of livestock within the Pamir's during the winter season (Livestock which stay back and not return to main Wakhan valley).

A well defined data sheet was designed to carry the survey. Data sheet was translated into local language for the ease of interview. The specific questions which have impact on the final out of the results were asked many times during the interview in different ways.



During the survey period information on the wild species presence around the villages was also recorded. Snow leopard attacks near the Sargez village lead to the death of one Yak and injured a couple of them. Snow Leopard was continuously sighted around the villages namely Kret, Kugzet, Sargez, Qila-e-Wust, Shelk, Kipkut, Wuzed and Pakuy. One snow leopard was killed by villagers in Qila-e-Wust. Villagers reported the killing of the Snow Leopard by stones but the Leopard had the clear shot of the bullet at its neck. Probably an AK-47 might have been used to shot the leopard. Presence of Snow leopard is always confirmed around the mountains of the Qila-e-Wust village.

The overall loss of livestock to Predators during the winter is only 0.65% of total stock mortality, whereas the loss due to extreme weather is 8.85%.

Of interest is the evidence that Snow Leopards only killed 22 goats and sheep as opposed to 27 Yaks. Yaks are high altitude animals and this suggests that this predation is accidental when Yaks are left out untended. By

comparison wolves killed 38 Yaks and 137 sheep and goats. Table 1 below gives the details of the loss of livestock in the Wakhan.

Table 1: Details of Livestock Loss in Wakhan Corridor during the winter 2006

Animal	Total Number of domestic animals	Loss to Snow Leopard	Loss to Wolves	Loss to Extreme Weather
Goats/Sheep	32,206	22	137	2784
Yaks	1,689	26	38	130
Horses	638	01	10	49
Cows	4,327	07	09	443
Donkeys	2,029	00	16	261
Camels	105	00	02	00
Total	**40,994**	**56**	**212**	**3631**

Concerns on pasture usage change detected during the Post Winter Survey in Wakhan

Pastoralists, who used to move away in winter, now stay in the area throughout the year. This is a matter for concern as it has impact on grazing. This continuous camping of the people in the main Pamir valleys during the winter results in the overgrazing of the middle altitude pastures and these are important for Marco Polo sheep. 25 – 30 % of the total livestock is not taken out of the Pamir's during the winter season. There are few valleys which are used on rotational basis; Nakchirshitk is used during the summer where as Aba Khan Valley is used during the winter season. This pattern of pasture use needs to be evaluated for its impact on Marco Polo sheep.

Thought to Review

Overall, the loss of livestock to the predators in Wakhan is not the issue at present, the death of the livestock by the extreme weather is far more as compared by the predator loss. WCS is already working on the issues of disease transmission and the parasite load in the livestock and hope that some solid findings will be out to determine the causes of loss during winter, whether it is by diseases or by extreme weather conditions. If weather is responsible for maximum loss, then some strategies should be put into action.

The continued use of high altitude pastures during the winter season is of high concern for the survival of the Marco Polo Sheep. People have now adapted to keep their live stock in the main Pamir's during the winter also. There should be some incentive packages for the local people so that they bring their livestock out of the Pamir's during the winter season.

DISTRIBUTION MAPPING

During the post winter conflict survey we had sightings of some animal species which were not record from the Wakhan earlier. These sightings helped us to modify the already existing distribution maps given in Habibi 2003. Other than distribution we were able to put Snow Leopard and Himalayan Lynx potential conservation areas within the Wakhan Corridor.

Urial sheep (*Ovis orientalis*) was not shown within the limits of the Wakhan by Habibi 2003, but the species has been reported by the local people mainly from Hindukush Mountains. During the winter survey we had the sightings of the species from the main Wakhan valley. Based on these winter sightings I was able to modify the already existing distribution map. Both Habibi 2003 and present distribution maps of the Urial are given in figure 1.

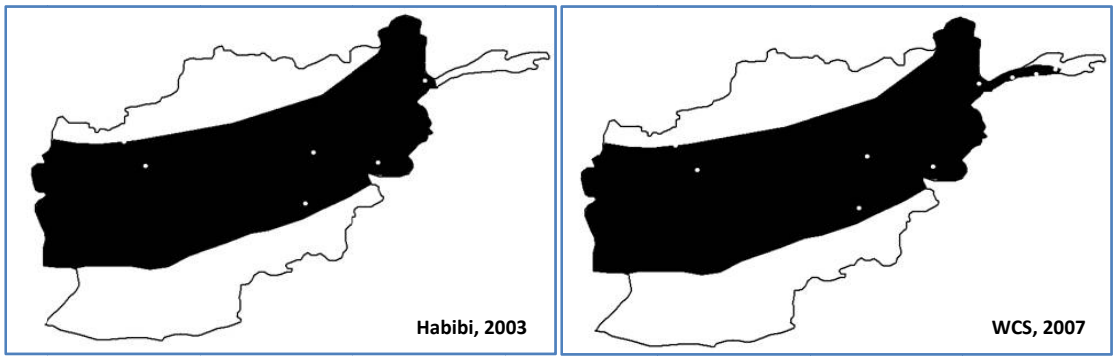


Figure 1: Distribution maps for Urial (*Ovis orientalis*)

The black color in the map represents the distribution range within Afghanistan where as white dots show the confirmed records. During the winter survey we had sighting of three groups of the Urial from the main Wakhan valley.

There have been no confirmed records of the Otter (*Lutra lutra*) from the main waters of Panj River and Oxus River. During the present survey we got the confirmed records of the presence of the species near Sargez and Goz Khun. Based on present confirmed records the distribution map for the species has been modified. Both Habibi 2003 and present distribution maps of Otter are given in figure 2.

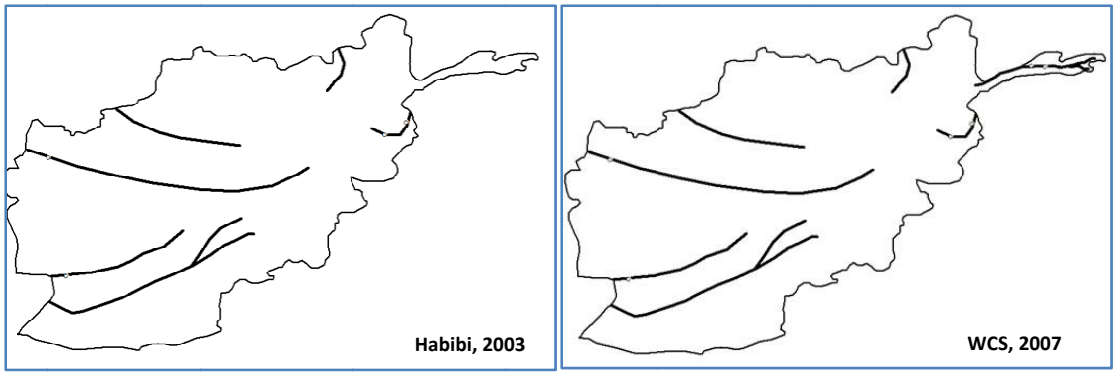


Figure 2: Distribution maps for Otter (*Lutra lutra*)

Other than patterns of the distribution mapping, I was also able to map the hot spots for Snow Leopard and Himalayan Lynx. These hot spots will serve as priority conservation areas for these two species. Himalayan Lynx has not been reported from the Pamir's except by Petocz (1978). The local people rarely reported the presence of the species from the Pamir's. But during the post winter we got the confirmed records of the species from the Hindukush Mountains especially areas around the villages such as Kret, Sargez and Qila-e Wust. Based on the confirmed records the high priority areas were mapped for the species. Figure 3 shows the high priority area for Himalayan Lynx and Figure 4 for the Snow Leopard.

Figure 3: Priority areas for conservation of Himalayan Lynx

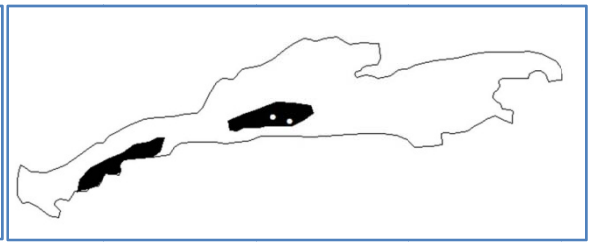


Figure 4: Priority areas for conservation of Snow Leopard

As pointed by many workers the high density area for the Snow Leopard is the Hindukush Mountains and not the Pamir's from the Wakhan. Based the occurrence of sightings and records of the conflict from the main Wakhan valley I was able to map the high priority areas for the conservation of the Snow Leopard. The high priority area for the Snow Leopard is the lower portion of the upper Wakhan and middle portion of the lower Wakhan. The areas around the villages namely Kret, Kugzet, Sargez, Qila-e-Wust, Shelk, Kipkut, Wuzed, Pakuy and Khandud are considered to be the potential snow leopard areas.

During the post winter survey, mammal team also added 10 new bird species to the already existing species checklist of the Wakhan. The details of the birds are mentioned in field report 7 (Habib, 2007).

Other than the sighting of the mammals and birds, mammal team also reported the presence of the Himalayan Pit Viper (*Gloydius himalayanus*) from Wakhan Afghanistan. The snake is characterized by the presence of large Shields instead of uniform small scales on head. Occurs between 2133 – 3048 meters ASL, but also recorded at 4876 meters from Western Himalayas of Nepal. It is venomous snake. The snake was reported from the area around Goz Khun.

SUMMER 2007 SURVEY

The summer 2007 survey of the proposed Big Pamir Wildlife Reserve and Waghjir Valley of the Wakhan region reported the presence of higher numbers of Marco polo Sheep following almost 3 decades of war. More than 50 days were spent for monitoring the high altitude sheep which is always seen at an altitude above 4500 m/sea level. During the present survey mammal team reported the presence of 116 MP Sheep (Females 39, Young 29, Adult males 24, Sub-adult males 24) in the Proposed Big Pamir Wildlife Reserve. The area was reported to have 192 animals in 1973 (Petocz, 1978) and 106 (64 Adult and 42 Sub-adult) males in the Waghjir valley. The Waghir area was reported to have more than 100 animals during 1970's as reported by Petocz 1978. The other survey of the Waghjir (Schaller, 2004) reported the presence of only 4 animals in the valley.

Summer 2007 Survey Route

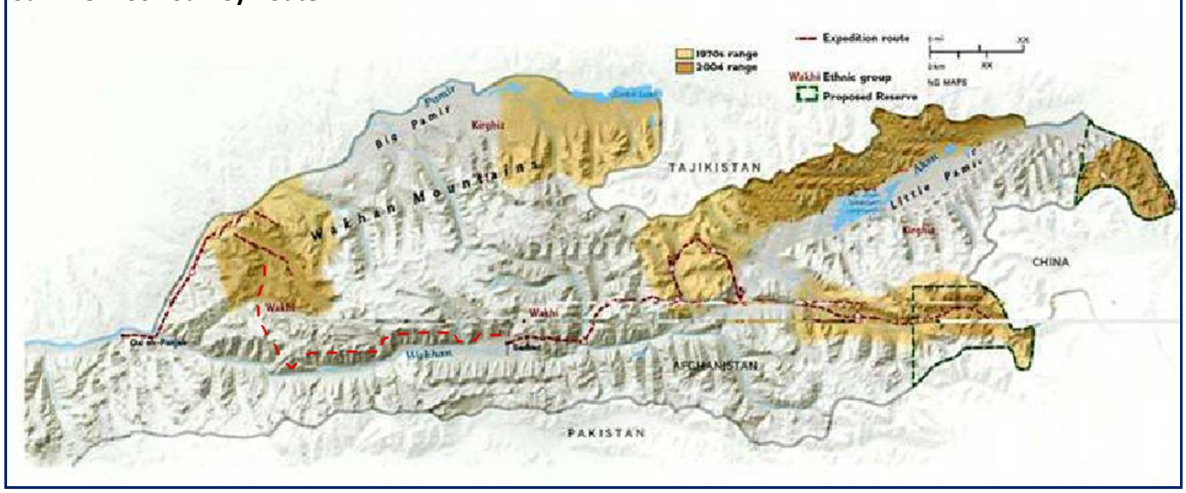


Table 2 below shows the total number of Marco Polo (*Ovis ammon poli*) seen with a conservative estimate of the actual numbers of animals present in the two areas of the Afghan Pamir's.

Table 2: Number of Marco Polo seen during summer 2007 in PBPWR and Waghjir Valley

MP Sheep Observed	Proposed Big Pamir Wildlife Reserve		Waghjir Valley	
	Total Observed	Conservative Estimate	Total Observed	Conservative Estimate
Adult Males	31	24	120	64
Sub-adult Males	40	24	71	42
Females	85	39	0	0
Young	54	29	0	0
Total	**210**	**116**	**191**	**106**

During this survey Mammal Team reported the presence (in the Pamirs) of all the large mammal species as reported by Petocz (1978a, b) except Himalayan Lynx. But the team reported evidence of this species in the Hindukush Mountains of Wakhan, Afghanistan. During the survey period mammal team sighted

six brown bears from the Proposed Big Pamir Wildlife Reserve. One Sighting was that of the Female with two young ones where as other sighting was again of the female but with older young ones. First sighting was from the Abakan Valley where as the second sighting was from Shikargah valley.

Table 3 below gives the details of various species of animals reported from Proposed Big Pamir Wildlife Reserve and Waghjir Valley during summer 2007.

Table 3: Mammalian species of Proposed Big Pamir Wildlife Reserve and Waghjir Valley Afghanistan with number or evidences recorded during Summer 2007

Mammalian Species	**Number seen/evidences recorded**	
	Propose BPWR	**Waghjir Valley**
Snow leopard *Uncia uncia*	Scats, tracks	Scats
Brown bear *Ursus arctos*	06, Scats, tracks, Diggings	Diggings
Wolf *Canis lupus*	scats, tracks	1 Dead Wolf, Scats
Red fox *Vulpes vulpes*	scats, tracks	Scats
Marco Polo sheep *Ovis ammon polii*	210	191
Ibex *Capra (ibex) siberica*	112	0
Long tailed marmot *Marmota caudata*	288	155
Cape hare *Lepus capensis*	08	12
Himalayan stoat (Ermine) *Mustela erminea*	05	0
Altai Weasel *Mustela altaica*	02	0

Marco Polo Sheep from Waghjir Valley

Table 4: Records of Marco polo during summer 2007 field season from Proposed Big Pamir Wildlife Reserve

Date	Adult Male	Sub-adult Male	Females	Young	Total	Conservative Estimate
28.06.2007	0	4	0	0	**04**	**00**
28.06.2004	0	0	2	0	**02**	**00**
30.06.2007	0	0	16	7	**23**	**00**
30.06.2007	0	9	0	0	**09**	**09**
30.06.2007	0	0	4	3	**07**	**07**
30.06.2007	0	0	6	6	**12**	**00**
01.07.2007	0	0	6	6	**12**	**12**
01.07.2007	0	0	6	6	**12**	**12**
01.07.2007	0	0	23	14	**37**	**37**
03.07.2007	0	0	6	5	**11**	**00**
03.07.2007	0	0	6	5	**11**	**00**
03.07.2007	0	0	10	2	**12**	**00**
04.07.2007	4	0	0	0	**04**	**04**
05.07.2007	7	0	0	0	**07**	**00**
05.07.2007	0	6	0	0	**06**	**06**
05.07.2007	0	4	0	0	**04**	**04**
05.07.2007	8	1	0	0	**09**	**09**
06.07.2007	12	0	0	0	**12**	**12**
07.07.2007	0	4	0	0	**04**	**00**
08.07.2007	0	8	0	0	**08**	**04**
09.07.2007	0	4	0	0	**04**	**00**
	31	**40**	**85**	**54**	**210**	**116**

Table 5: Records of Marco polo during summer 2007 field season from Waghjir Valley

Date	Adult Male	Sub-adult Male	Yearling Male	Total	Conservative Estimate
20.07.2007	0	4	9	**13**	**0**
21.07.2007	0	6	9	**15**	**15**
21.07.2007	0	3	0	**3**	**3**
22.07.2007	25	0	0	**25**	**25**
22.07.2007	8	4	0	**12**	**12**
22.07.2007	0	6	0	**6**	**6**
22.07.2007	4	0	0	**4**	**4**
22.07.2007	0	2	1	**3**	**3**
23.07.2007	25	0	0	**25**	**0**
24.07.2007	9	0	0	**9**	**0**
24.07.2007	0	0	2	**2**	**2**
24.07.2007	6	0	0	**6**	**6**
24.07.2007	1	0	0	**1**	**0**
24.07.2007	6	0	0	**6**	**0**
25.07.2007	30	0	0	**30**	**21**
26.07.2007	6	0	0	**6**	**0**
26.07.2007	0	0	7	**7**	**7**
26.07.2007	0	0	11	**11**	**2**
27.07.2007	0	0	7	**7**	**0**
	120	**25**	**46**	**191**	**106**

Analysis of the field data revealed excellent birth rate in the population of Marco Polo of the Big Pamir Biosphere Reserve. Presence of 29 young ones with 39 females in the population is the indication of good fawning season. 74.35% of the females we observed where with their young ones. Table 4 & 5 below gives the details of Marco Polo Sightings from the Proposed Big Pamir Wildlife Reserve and Waghjir respectively.

The most striking question after surveying the Waghjir was where the females are. Pectoz earlier reported presence of 100 Marco Polo from the valley where as Schaller and Mock during their visits reported not more than 10 individuals from the valley.

During the summer 2007 field session we made independent observation of 19 groups of Marco Polo counting 106 – 191 individuals. The most striking about the Waghjir was the absence of females from the area. All the animals encountered were males only. I tried to check both the passes namely Dilsang which leads to Pakistan and Waghjir which leads to China to see the possibility of any females in the area. The Dilsang on the higher reaches is not the good habitat for the Marco Polo, further down towards the Pakistan it may be an ideal Marco Polo habitat. Close to Waghjir Pass towards China, the habitat is good for Marco Polo Sheep. Pellets can be seen on the other side of the fence.

The Waghjir population if connected to China or Pakistan will be considered as one of the important populations of the Marco polo in the Pamir's which may sustain a surviving gene pool in the long run. We have already collected 35 samples from the Waghjir for the genetic analysis and hope if Dr. Rich Harris (Marco Polo Team) will be able to get some samples from the other side close to the Waghjir then it will be easy to link the male population of the Waghjir to its source population.

Other striking feature of the Waghjir is total absence of livestock during summer and human from the area. But the area where we counted 106 – 191 male Marco polo will hold more than 500 unattended yaks during the winter season, where the Marco Polo will go at that time needs further evaluation.

Higher reaches of Waghjir is not a suitable snow leopard habitat, but the middle portion of the valley is good where we found moderate evidences. Ibex is rare in the valley where as bears and wolves frequent the area.

The sign survey carried in the Waghjir valley gave 4.2 Signs per Sq. Kilometer which gives the conservative estimate of 1 – 2 Snow Leopards per 100 Sq. Km in the Waghjir Area.

Issue about the Proposed Boundary for the Waghjir Area

The proposed boundary for the reserve needs further evaluation. As per my understanding of the area we should put the boundary on map in such a manner so that it includes Dilsang Pass within the limits of protected area. The present boundary of the reserve does not cover the area from which the Marco Polo were seen during the summer season.

Issue of Disease Transmission

During the present survey we found one marmot on the way while going from Sarhad to Little Pamir having some lesions on its body. I was unable to know the reason behind or the probable disease. I was able to photograph the animal. The animal was quiet lazy and was standing on its burrow. The

occurrence of disease needs to be evaluated. WCS ecosystem health team is working on the issue of disease transmission in the Wakhan.

FOOD HABITS OF CARNIVORES

This report gives the account of food habits of three species of carnivores namely Snow Leopard, Wolf and Red Fox from the Wakhan Corridor. During the field surveys from 2006 to 2007 in the Wakhan Corridor especially in Proposed Big Pamir Wildlife Reserve and Waghjir Valley, scats were collected. Overall mammal team collected 94 Snow Leopard Scats, 84 Wolf Scats and 13 Red Fox Scats. Knowledge of feeding ecology of carnivores is critical not only in an ecological context but also in terms of economics and conservation (Ciucci *et al.,* 1997), particularly in the light of increasing human animal conflict across the globe. Using scat analysis most information regarding the diets of carnivores has been based on frequency of occurrence of prey species, biomass of ingested prey and relative frequency of prey found in proportion to prey consumed (Floyd *et al.,* 1978; Corbett, 1989). To overcome the problem of small prey being over represented in mass and underrepresented in number (Mech, 1970), Floyd *et al.* (1978), Ackerman *et al.* (1984) and Weaver (1993) derived linear regression models to convert scat data to relative biomass and relative number of prey consumed.

Scat analysis is indirect, non-invasive and unbiased technique for recording frequency of occurrence of different prey species in the scats of carnivores and hence it is most widely used (Shahi, 1982; Johnson *et al.,* 1983; Leopold and Krausman, 1986; Jhala, 1993; Mukherjee *et al.,* 1994a, b; Jethva *et al.,* 1997; Spaulding *et al.,* 1997; Jhala, 2001; Jethva, 2002; Habib, 2007).

Identification of Scats

Carnivore scats are often identified by size, shape, odor, color and signs associated with scats such as scrapes and footprints (Quinn and Jackman, 1994). Combinations of characteristics like associated signs, odor is important to identify scats. Scats of ambiguous identity were discarded from further analysis.

Collection and Preservation of Scats

Scats were collected in frequently traveled areas during the survey period. The scats were collected in polythene bags, labeled and sun-dried in the field. Information on habitat, substratum where scat was found and its GPS location were also recorded.

Identification of Prey Remains from Scats

Standard methods for scat analysis from time to time were followed which have been used by various workers (Koppiker and Sabnis, 1976, 1977; Korschgen, 1980; Johnson *et al.,* 1983; Leopold and Krausman, 1986; Reynolds and Aebischer, 1991; Mukherjee *et al.,* 1994a, b; John *et al.,* 1996; Spaulding *et al.,* 1997; Habib, 2007; Habib *et al.,* 2007).

1. Scats were crushed and carefully observed for the presence of indigestible macro components such as bones, claws, feathers, beaks, scales, hooves and other indigestible vegetable matter.

2. After identification of macro components the hair remains were washed in warm water over a sieve to remove soil and calcium present in the scat.

3. The washed scats were dried for further collection of hair and their microscopic examination to identify prey species.

4. Hairs were thoroughly mixed and randomly picked for slide preparation. Before slide preparation hairs were also treated with Xylol (50 % Ethyl Alcohol and 50 % Xylene).

5. Reference slides for cuticular pattern and medulla were prepared for all potential prey species occurring in the study area.

6. The combination of hair characteristics such as medullary and cuticular pattern, were primarily used for identification of most of the mammalian species from scats. However, occasionally medulla to hair width ratio was also used to identify prey species represented in scats.

Slides of hair picked up randomly from scats were prepared in DPX medium for examining cuticular and medullary patterns. All these characteristics were compared with permanent slides to identify different prey species (Keogh, 1983).

Occurrence of Prey Items in Carnivore Scats

In case of Snow Leopard maximum scats (n = 85) contained prey remains of only one species (90 %) whereas remaining 9.6 % (n = 9) contained remains of two prey species. In case of Wolf maximum scats (n = 80) contained prey remains of only one species (95 %) where as remaining 5% (n = 4) contained remains of two prey species. In case of Red Fox all the scats contained only remains of single prey species (Figure 5).

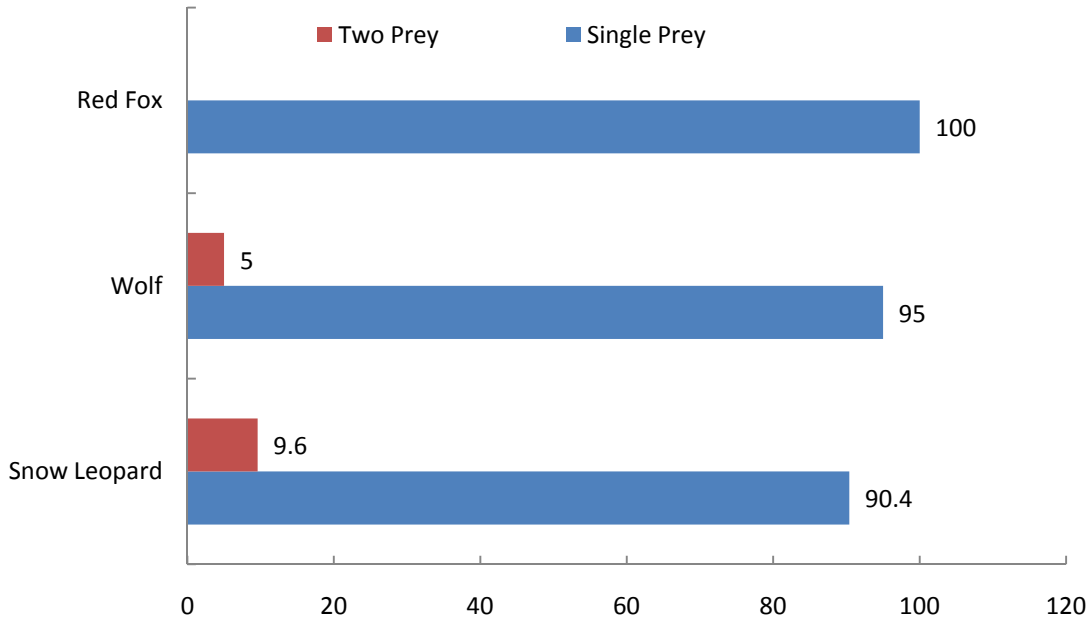


Figure 5: Percentage of prey items detected in carnivore scats (n = 191) between 2006-2007

Food Habits of Snow Leopard

Percent occurrence of different prey items in the Snow Leopard scats from Wakhan suggested that the leopards are largely dependent on natural prey, which constituted 89.3% of its diet whereas only 10.7 % of its diet was represented by livestock. Among natural prey Marco Polo sheep constituted major portion (33 %) of the diet followed by Marmots (29.1 %) and Ibex (18.4 %) where as among livestock category the maximum contribution was by goat and sheep which accounted for 2.9 % each. The percent occurrence of different prey species along with 95% Bootstrap confidence intervals is given in Table 6.

Table 6: Percent Occurrence of Different Prey Species and 95% Bootstrap Confidence Intervals for Snow Leopard Scats from Wakhan Afghanistan (N = 94)

Prey Item	Frequency of Occurrence	Percent Frequency of Occurrence	95 % Bootstrap Confidence Limits
Marco Polo	34	33.0	0.266 – 0.468
Ibex	19	18.4	0.14 – 0.296
Cape Hare	7	6.8	0.021 – 0.138
Marmot	30	29.1	0.223 – 0.426
Rodent	2	1.9	0 – 0.053
Yak	2	1.9	0 – 0.053
Goat	3	2.9	0 – 0.074
Sheep	3	2.9	0 – 0.074
Cattle	2	1.9	0 – 0.053
Unidentified	1	1.0	0 – 0.032

Biomass Assessment (Reconstruction of Diet) for Snow Leopard

Estimation of relative biomass contributed by different prey species to Snow Leopard diet by using the equation developed by Ackerman *et al.,* (1984) gave a better assessment of the prey species used than results obtained by frequency of occurrence. In terms of frequency of occurrence and percent biomass consumed per 100 scats Marco Polo dominated the list of prey species for the snow leopard. Marmot dominated in terms of frequency of occurrence where as Ibex dominated in terms of biomass consumption per 100 scats. The biomass contribution by different prey species to the diet of the Snow Leopard in the Wakhan Corridor is given in Table 7.

Food Habits of Wolves

Percent occurrence of different prey items in the Wolf scats of Wakhan suggested that Wolves too are largely dependent on natural prey, which constituted 65.9 % of its diet whereas 34.1 % of its diet was represented by livestock. Among natural prey Ibex constituted major portion (23.9 %) of the diet followed by Marmot and Marco Polo (18.2 % each) where as among livestock category the maximum contribution was by sheep which accounted for 12.5 % followed by Yak 9.1 % and Cattle 8 %. The percent occurrence of different prey species along with 95% Bootstrap confidence intervals is given in Table 8.

Table 7: Prey represented in 94 Snow Leopard Scats from Wakhan Afghanistan from 2006 – 2007, together with estimated biomass and numbers of prey consumed

Prey Item	Body Wt. (Kg)	% Relative estimated bulk	No. of collectable Scats per Kill*	Biomass eaten/100 Scats (Kg)	Percent Biomass Eaten	No. of Individuals eaten / 100 Scats	Ratio of number of individuals eaten
Marco Polo	70	33.1	15.80	146.23	42.44	2.09	1.67
Ibex	60	18.45	14.71	75.26	21.84	1.25	1.00
Cape Hare	2.5	6.80	1.21	14.05	4.08	5.62	4.50
Marmot	6	29.13	2.74	63.79	18.51	10.63	8.50
Rodent	0.25	1.94	0.13	3.86	1.12	15.45	12.36
Yak	120	1.94	19.42	12	3.84	0.10	0.08
Goat	20	2.91	7.46	7.89	2.27	0.39	0.31
Sheep	30	2.91	9.90	8.83	2.56	0.29	0.24
Cattle	100	1.94	18.25	10.64	3.09	0.11	0.09
Unidentified	5	0.97	2.32	2.09	0.61	0.42	0.33

*** Calculations based on the equation Y = 0.035 x + 1.980 developed by Ackerman *et al.,* (1984) for Cougars**

Table 8: Percent Occurrence of Different Prey Species and 95% Bootstrap Confidence Intervals for Wolf Scats from Wakhan Afghanistan (N = 84)

Prey Item	Frequency of Occurrence	Percent Frequency of Occurrence	95% Bootstrap Confidence Limits
Marco Polo	16	18.2	0.119 – 0.274
Ibex	21	23.9	0.155 – 0.339
Cape Hare	4	4.5	0.012 – 0.095
Marmot	16	18.2	0.113 – 0.274
Rodent	1	1.1	0 – 0.036
Yak	8	9.1	0.036 – 0.155
Goat	3	3.4	0 – 0.083
Sheep	11	12.5	0.06 – 0.208
Cattle	7	8.0	0.036 – 0.155
Unidentified	1	1.1	0 – 0.036

Biomass Assessment (Reconstruction of Diet) for Wolves

Estimation of relative biomass contributed by different prey species to Wolf diet by using the equation developed by Floyd *et al.,* (1978) Y = 0.02x + 0.38 and Jethva and Jhala (2004) Y = 0.0148x + 0.135 gave a better assessment of the prey species use than results obtained by frequency of occurrence. In terms of frequency of occurrence and percent biomass consumed per 100 scats Ibex dominated the list of prey species for Wolves. Marmot and Marco Polo sheep contributed equally in terms of percent frequency of occurrence where as Marco Polo dominated in terms of biomass contribution per 100 scats. The biomass contribution by different prey species to the diet of the Snow Leopard in the Wakhan Corridor is given in Table 9.

Table 9: Prey represented in 84 Wolf Scats from Wakhan Afghanistan from 2006 – 2007, together with estimated biomass and numbers of prey consumed

Prey Item	Body Wt. (Kg)	% Relative estimated bulk	No. of collectable Scats per Kill*	Biomass eaten/100 Scats (Kg)	Percent Biomass Eaten	No. of Individuals eaten / 100 Scats	Ratio of number of individuals eaten
Marco Polo	70	18.18	46.95	27.11	23.45	0.39	1.00
Ibex	60	23.86	45.84	31.24	27.02	0.52	1.33
Cape Hare	2.5	4.55	9.52	1.19	1.03	0.48	1.22
Marmot	6	18.18	18.39	5.93	5.13	0.99	2.53
Rodent	0.25	1.14	1.13	0.25	0.22	1.01	2.58
Yak	120	9.09	49.98	21.83	18.18	0.18	0.47
Goat	20	3.41	34.42	1.98	1.71	0.10	0.25
Sheep	30	12.50	39.32	9.54	8.25	0.32	0.82
Cattle	100	7.95	49.09	16.20	14.01	0.16	0.42
Unidentified	5	1.14	16.23	0.35	0.30	0.07	0.18

*** Calculations based on the equation Y = 0.0182x + 0.217 derived by averaging the equations developed by:**

- **Floyd *et al.,* (1978) Y = 0.02x + 0.38 and**
- **Jethva and Jhala (2004) Y = 0.0148x + 0.135**

Food Habits of Red Fox

Percent occurrence of different prey items in the Red Fox scats of Wakhan suggested that R totally dependent on small mammals such as Rodents and Marmots. Rodents contributed 61.5 % and Marmots contributed 23.1 %. The occurrence of the Yak may be the rare case of scavenging. Too small sample size in case of red fox scats does not provide any solid inference. The percent occurrence of different prey species along with 95% Bootstrap confidence intervals is given in Table 10.

Table 10: Percent Occurrence of Different Prey Species and 95% Bootstrap Confidence Intervals for Red Fox Scats from Wakhan Afghanistan (N = 13)

Prey Item	Frequency of Occurrence	Percent Frequency of Occurrence	95% Bootstrap Confidence Limits
Marmot	3	23.1	0 – 0.462
Rodent	8	61.5	0.308 – 0.846
Yak	1	7.7	0 – 0.231
Grass	1	7.7	0 – 0.231

DISCUSSION

The analysis of carnivore scats from the Wakhan Afghanistan revealed the exact picture of food habits of three carnivore species namely Snow Leopard, Wolf and Red Fox. The two major species namely Snow Leopard and Wolf are mostly dependent on the large mammalian prey where as Red Fox is entirely dependent on the smaller mammals especially rodents. In terms of percent occurrence, Marco Polo sheep contributed 25.6% followed by Marmot 23.7% and Ibex 21.05% to the diet of the Snow Leopard and Wolf. The livestock just contributed 21.3 % to the overall diet of these two species. To the snow leopard diet the contribution of livestock was just 9.6% where as to wolf diet it contributed 33%. The results are in accordance to the post winter conflict survey. According to the survey the number of

livestock killed by the wolf is 212 heads where is by snow leopard it is just 56 heads out of the total livestock 40994 heads in the Wakhan. The results of the scats analysis and winter survey are in accordance and confirms minimum conflict in the Wakhan Corridor of the Afghanistan.

In terms of biomass contribution Marco Polo Sheep dominated for Snow Leopard and attributed 42.44 % per 100 scats followed by ibex 21.84 % and Marmot 18.51 %. Wild Prey contributed 88.6% of the biomass where as livestock just contributed 11.4 % of the biomass per 100 scats for the snow leopard. In Wakhan wild prey is still the major food item of the snow leopard.

Considering the defecation rate of Snow Leopard to be equal to 1 scat per day (It may be higher or lower depending upon different field conditions like availability of prey base, etc) to be the conservative estimate, I tried to estimate the number of animals of different prey species killed by one snow leopard on annual basis. The estimated scat production rate gives the estimate of 365 scats per year for one cat. Based on the estimate of requirements per 100 scats derived by using the equation developed by Ackerman *et al.,* (1984) given in Table 2, the estimated number of animals killed by one cat for the year is given in Table 11.

Table 11: Annual estimate of number of animals of different prey species killed by Snow Leopard

Prey Items	No. of Individuals eaten/100 scats (Table 7)	Estimated Scats per Year (Based on conservative estimate 1 scat/leopard/day)	Number of Animals killed Per Year /Cat
Marco Polo	2.09	365 Scats /Year/Cat	7.63
Ibex	1.25		4.56
Cape Hare	5.62		20.51
Marmot	10.63		38.80
Rodent	15.45		56.39
Yak	0.10		0.37
Goat	0.39		1.42
Sheep	0.29		1.06
Cattle	0.11		0.40
Unidentified	0.42		1.53

Considering the number of animals killed per year by one cat again proves minimum dependence on livestock by the cat.

Table 12: Annual estimate of number of animals of different prey species killed by Wolf

Prey Items	No. of Individuals eaten/100 scats (Table 9)	Estimated Scats per Year (Based on conservative estimate 1 scat/wolf/day)	Number of Animals killed Per Year /Wolf
Marco Polo	0.39	365 Scats /Year/Wolf	1.42
Ibex	0.52		1.90
Cape Hare	0.48		1.75
Marmot	0.99		3.61
Rodent	1.01		3.69
Yak	0.18		0.66
Goat	0.10		0.37
Sheep	0.32		1.17
Cattle	0.16		0.58
Unidentified	0.07		0.26

Similarly using the conservative estimate of 1 scat per wolf per day and using the regression equation developed for wolves, the conservation estimate of number of animals of different prey species killed by wolf is given in Table 12.

The analysis confirms less dependence on livestock and differential use of the available prey species by Snow Leopard and wolf from the Wakhan, Afghanistan. Total use of smaller mammals by the red fox further confirms ecological separation at all the levels of prey use in the Wakhan corridor.

BIRDS

During summer 2007 mammal team spent most of time at higher altitudes from 4000 – 5000 meters. Occasional bird watching was carried during the field season. Mammal team was able to list 28 bird species during the survey bird. The species checklist adds three new species namely Tibetan Sand grouse, Rufous backed long tailed shrike and White winged snow finch to the already existing species checklist of the Wakhan. The list of the bird species reported by the team is given below:

S. No.	Common Name	Scientific Name
1	Golden Eagle	*Aquilla chrysaetos*
2	Himalayan Vulture	*Gyps himalayensis*
3	Himalayan Snowcock	*Tetraogallus himalayensis*
4	Common Redshank	*Tringa totanus*
5	Tibetan Sandgrouse	*Syrrhaptes tibetanus*
6	Hill Pigeon	*Columba rupestris*
7	Snow Pigeon	*Columba leuconota*
8	Common Hoopoe	*Upupa e. epops*
9	Oriental Skylark	*Alauda gulgula*
10	Horned Lark	*Eremophila alpestris*
11	Citrine Wagtail	*Motacilla c. citreola*
12	White Wagtail	*Motacilla alba personata*
13	Rufous backed Long-tailed Shrike	*Lanius schach erythronotus*
14	Black Redstart	*Phoenicurus ochruros phoenicuroides*
15	Common Redstart	*Phoenicurus p. samamisicus*
16	White Winged Redstart	*Phoenicurus erythrogastrus*
17	Isabelline Wheatear	*Oenanthe isabellina*
18	Red Tailed Wheatear	*Oenanthe chrysopygia*
19	Common Stonechat	*Saxicola torquatus indicus*
20	Alpine Accentor	*Prunella collaris*
21	Grey Necked Bunting	*Emberiza buchanani*
22	Brandt's Mountain Finch	*Leucosticte brandti*
23	White Winged Snowfinch	*Montifringilla nivalis*
24	Twite	*Acanthis flavirostris*
25	Common Rosefinch	*Carpodacus e. erythrinus*
26	Red Billed Chough	*Pyrrhocorax pyrrhocorax*
27	Alpine Chough	*Pyrrhocorax graculuc*
28	Eurasian Magpie	*Pica pica*

Composition of Teams

The Wildlife Survey Program team which carried post winter conflict survey was composed of:

- Dr. Bilal Habib, team leader/WCS Wildlife Survey Program Manager
- Mr. Assadullah Khairzad, Govt. counterpart. Ministry of Agriculture, Afghanistan
- Mr. Syed Naqibullah, recent graduate from Kabul University
- Mr. Sabir, local wildlife guide/cook from Khandud village
- Mr. Ghuam Sediq,WCS driver

Summer Survey was carried in two phases. First phase was carried in Big Pamir and the second phase in Waghjir valley. The composition of teams for first and second phase was different. The Big Pamir team was composed of:

- Dr. Rich Harris, WCS Marco Polo Sheep Program Manager
- Dr. Bilal Habib, WCS Wildlife Survey Program Manager
- Zalmai Moheb, Research Assistant, WCS Afghanistan
- Mr. Sabir, local wildlife guide from Khandud village
- Mr. Safdar, cook trained by AKF from Sargez Village

Team which carried survey in Waghjir valley was composed of:

- Dr. Bilal Habib, team leader/WCS Wildlife Survey Program Manager
- Zalmai Moheb, Research Assistant, WCS Afghanistan
- Mr. Sabir, local wildlife guide from Khandud village
- Mr. Safdar, cook trained by AKF from Sargez Village
- Mr. Mousa, local guide from Kyrgyz area

Acknowledgements

I thank all WCS staff at Kabul for logistical support throughout the missions, and particularly Mr. Inayatullah who carried out all local arrangements and resupplied the teams at the time of need. I value the help rendered by Zalmai Moheb and other members of the team Sabir and Safdar. Thanks are due to all the inhabitants of Wakhan and Waghjir valley for their hospitality.

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