Activities of the Ecosystem Health Component in 2011 in Wakhan District, Afghanistan

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February 2012

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Table of contents

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General introduction

In 2011 the team worked on a wide variety of projects, including organization of two mass vaccination campaigns against foot-and-mouth disease in cattle and domestic yak (*Bos grunniens*) in Wakhan Valley, the first bovine tuberculosis screening in cattle in Lower Wakhan, a large-scale livestock blood-sampling operation and serological screening for brucellosis and contagious caprine pleuropneumonia, a longitudinal urial sheep (*Ovis vignei*) / Himalayan ibex (*Capra sibirica*) survey of the Hindu Kush mountain range, and the organization and implementation of livestock census in western Big Pamir. The team has also provided upon demand help and expertise to all requests originating from other components of the WCS project in Wakhan. This help was provided enthusiastically either through physical involvement or technical support.

During past involvements the WCS veterinary team in Wakhan provided a separate report after each mission. Because of the numerous long-duration missions carried out in Wakhan in 2011 (3) and the variety of works and duties, we decided to compile our activities and their results in a single report at the end of the calendar year, major activities being detailed in eight different parts, a ninth one compiling nine appendices. Appendices have been made as detailed as possible to allow for future monitoring or evaluations by people foreign to the project.

Among the most conspicuous quantitative achievements 5,976 cattle and yak were vaccinated against foot-and-mouth disease, or almost two times the number targeted at the beginning of the year. In addition, as part of an unprecedent effort to decipher the impact of contagious diseases in Wakhan, 1,584 blood samples were collected from 231 cattle, 102 yak, 799 sheep and 452 goats, and analyzed for brucellosis. We also tested 153 cattle for bovine tuberculosis.

The work of WCS ecosystem health team in Wakhan was made possible by the generous support of the American people through the United States Agency for International Development (USAID). The content of the report is the responsibility of the Wildlife Conservation Society, and does not necessarily reflect the views of USAID or the United States Government.

Commitments and achievements of the ecosystem health team would not have been possible without the enthusiastic support of D. Lawson, WCS country director, P. Bowles, WCS deputy country director and Shafiq Nickzad, WCS country manager. We also thank all WCS staff in Afghanistan and New York, and community members in Wakhan who facilitated, supported and helped our work. What we have achieved in Wakhan would not have been possible without their dedication and efficient collaboration.

Background

This document is written in the continuity of six reports on missions we have carried out in this region of Afghanistan[1][2][3][4][5][6]. To summarize our accomplishements in Wakhan and Pamirs of Afghanistan since 2006, we have studied Wakhi livestock herds in Wakhan Valley, Big Pamir and western Little Pamir, recording their species composition, numbers, ownership, range use, and transhumance patterns. We have also assessed their health status based on clinical examinations and questionnaire investigations. After analyzing the data collected during our earlier missions, we decided that we needed to further investigate the occurrence of foot-and-mouth disease (FMD) in the area, assess its epidemiological status and quantify its prevalence in livestock. This information was essential to understand the risk of cross-species dissemination of FMD virus between livestock and wild ungulates and a prerequisite to develop FMD control programs in the area. Since 2009 we have been implementing with the help of two local paravets mass vaccination campaigns of cattle and yak against FMD and have progressively built the capacity of local people at organizing such operations by themselves. In the meantime we have also assessed the geographical risk of disease spillover from livestock to Marco Polo sheep (*Ovis ammon polii*) in the area proposed for official protection in western Big Pamir. Part of this risk assessment included a surveillance effort in livestock of infectious diseases potentially dangerous to wildlife. In 2010 we initiated the screening of cattle for bovine tuberculosis, and of all domestic hoofstock species present in

[1] Ostrowski, S. (2006). Wakhi livestock in Big Pamir in 2006. Unpublished report, WCS, New York, USA, 60 pp.

[2] Ostrowski, S., Rajabi, A. M. and H. Noori. (2007). Kirghiz and Wakhi livestock in Afghan Pamirs in 2007. Unpublished report, WCS, New York, USA, 91 pp.

[3] Ostrowski, S., Rajabi, A. M. and H. Noori. (2009). Livestock and Marco Polo sheep: assessing the risk of health conflicts in Big Pamir, Asia. Unpublished report, WCS, New York, USA, 54 pp.

[4] Ostrowski, S., Moori, H. and A. M. Rajabi (2010). Foot-and-mouth disease in Wakhan District, Afghanistan. Unpublished report, WCS, New York, USA, 24 pp.

[5] Rajabi, A. M., Noori, H. and S. Ostrowski (2010). Foot-and-mouth disease vaccination campaign, Wakhan District, Badakhshan Province, Afghanistan. Unpublishd report, WCS, New York, USA, 13 pp.

[6] Noori, H. and A. M. Rajabi (2010). Activity report of the Ecostsystem Health Team in Wakhan, Afghanistan – September to November 2010. Unpublished report, WCS, New York, USA, 23 pp.

the area, for brucellosis. These diseases have been shown to infect wildlife in North America, Europe, and South-Africa, and pose significant risk to the health of livestock and human beings.

The work carried out since 2006 improves the understanding of livestock health in the Afghan Pamir and brings insights into the risk of disease spillover between domestic and wild ungulates in this remote ecosystem.

Part I. Mass vaccination campaigns for foot-and-mouth disease in Wakhan District (by Ali Madad Rajabi)

Introduction

Foot-and-mouth disease (FMD) is a very contagious viral disease of domestic and wild cloven-hoofed animals. There are seven immunologically distinct serotypes and over 60 subtypes of FMD virus (family Picornaviridae). It is endemic in most of Asia, including in Afghanistan where it occurs as regular epizootics. A new serotype (Asia 1) was identified in the country in March 2001 (S. Yingst / CVL–Kabul, pers.comm.), bringing the total of known serotypes to three for the country (A, O and Asia 1). The disease has a direct effect on food security as it drastically reduces milk production in cows and domestic yak, reduces their fertility rate, and incapacitates breeding bulls and oxen. The virus is very stable at low temperatures and can survive in frozen tissues. It may persist for days to weeks in organic matter under moist and cool temperatures. It is however inactivated on dry surfaces and by UV radiation (sunlight).Transmission primarily occurs by respiratory aerosols and direct or indirect contact with infected animals. Sheep and goats are occasionally considered maintenance hosts, and sometime present very mild signs. Cattle and yak are generally the first species to manifest signs of FMD and are therefore considered 'indicators' of the presence of this disease. Recovered or vaccinated cattle and yak exposed to diseased animals can be healthy carriers for 6 to 24 months; sheep can be carriers for 4 to 6 months.

In the Wakhan District results of serological investigations carried out by WCS in 2008 and 2009 confirmed that around 50% and 70% of tested sheep and cattle, respectively, were positive to the infectious agent. Also we found antibodies against serotype Asia 1 in clinically sick yak in Big Pamir in 2008 and in recovered cattle and sheep in April 2009. We also found antibodies against serotype O in sheep in April 2008[7]. The high serological prevalence recorded over the two years of WCS serological investigations associated to low mortality support that FMD is endemic in the area.

[7] Ostrowski, S. et al. (2010) Foot-and-mouth disease in Wakhan District, Afghanistan. WCS unpub report, New York, 24 pp.

The disease may also pose a threat to the rich fauna of mountain ungulates present in Wakhan; the Marco Polo sheep, the Himalayan ibex and the urial sheep. A vaccination campaign would therefore protect cattle and yak, and secure the dairy food resource which is crucial to local communities, but also reduce the risk of clinically sick livestock transmitting the disease to wild ungulates.

Since 2007 WCS has selected, built the capacity, and supported in part the activity of two paraveterinarians (Mr. Mohammad Gul and Mr. Sarwar based in Avgarch and Kandkhun villages, respectively) in the Wakhi community. In 2007 WCS sent the two paravet candidates to attend a six-month training course offered by the Dutch Committee for Afghanistan (DCA). Subsequently WCS set up two veterinary field units for them, supplied them with veterinary equipment and continued building their technical capacity. For example in 2009 both paravets were offered a refresher-training course by DCA in Mazar-e Sharif. In 2009 and 2010 WCS gave them an increasing autonomy to organize and implement mass vaccination campaigns. In 2011, for the first time, aside of vaccine provision, the vaccination campaigns against FMD were organized and implemented by the two paravets without direct supervision from WCS. Here we report on the results of cattle and yak FMD vaccination carried out in Wakhan in 2011.

Methods

In 2011 we purchased from DCA 8,000 doses of a liquid inactivated sorbed foot and mouth disease vaccine (virus grown in BHK-21 cells) against A Iran-05, O PanAsia-2 and Asia 1 types, produced by the Federal Centre for Animal Health, 600901, Yur'evets, Vladimir, Russia. At DCA headquarter in Kabul the vaccine was stored at +1°C–+8°C according to manufacturer's recommendations and monitored throughout transportations by a temperature range indicator. After purchasing vaccines we stored them within the same temperature range at WCS headquarters in Kabul, air-shipped them to Feyzabad, the provincial capital of Badakhshan, and transported them by car to Upper[8] Wakhan in cool boxes with ice packs. Eventually they were stored in a solar-powered refrigerator in Kandkhun field veterinary unit. At the beginning of each campaign vaccines were shared between the two paravets and their assistants according to the number of vaccinations expected to be performed. During operations they were transported in cool boxes on horse-back.

Cattle and yak older than 3 months were vaccinated with 3 ml of the vaccine administered subcutaneously in the middle of neck. Before vaccinations, team members always met with

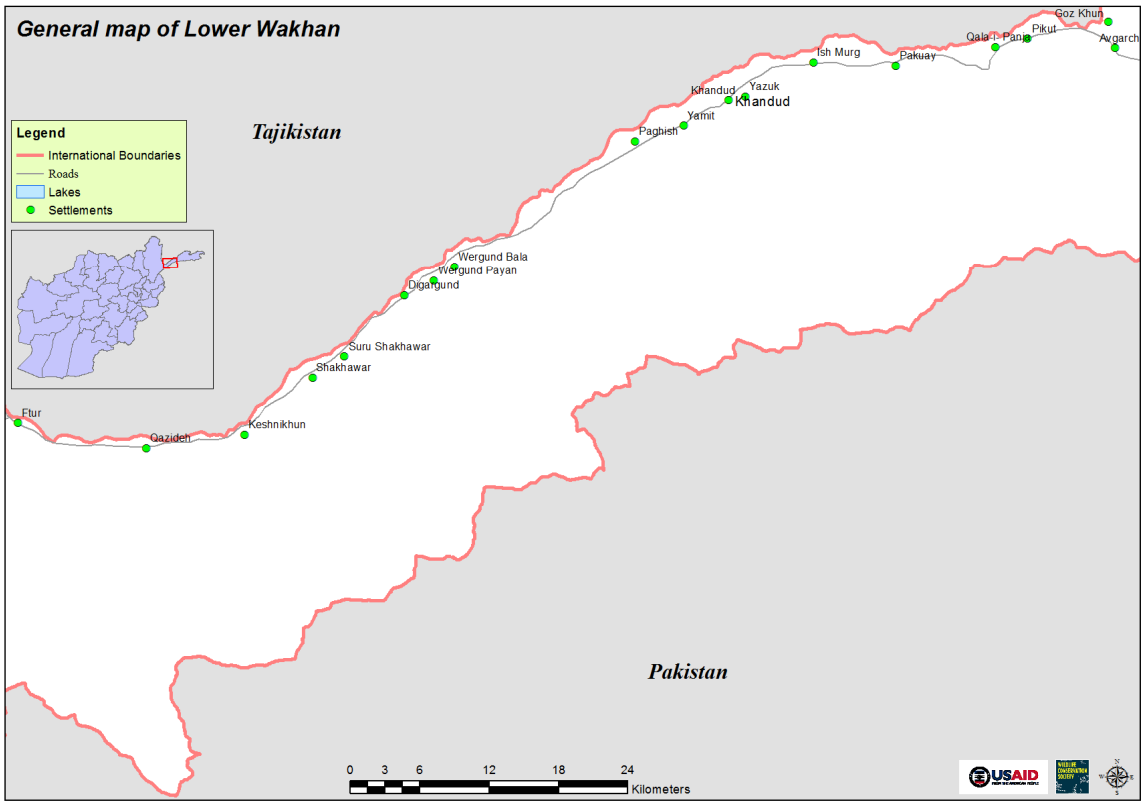
[8] We arbitrarily divided the c. 150-km-long Wakhan Valley into the Lower Wakhan from the village of Fitr in the west, at the entrance of the corridor, to the village of Qila-e Panja (excluded) in the east, and the Upper Wakhan from the village of Qila-e Panja in the west to Sarhad-e Broghil in the east (Maps 1 & 2).

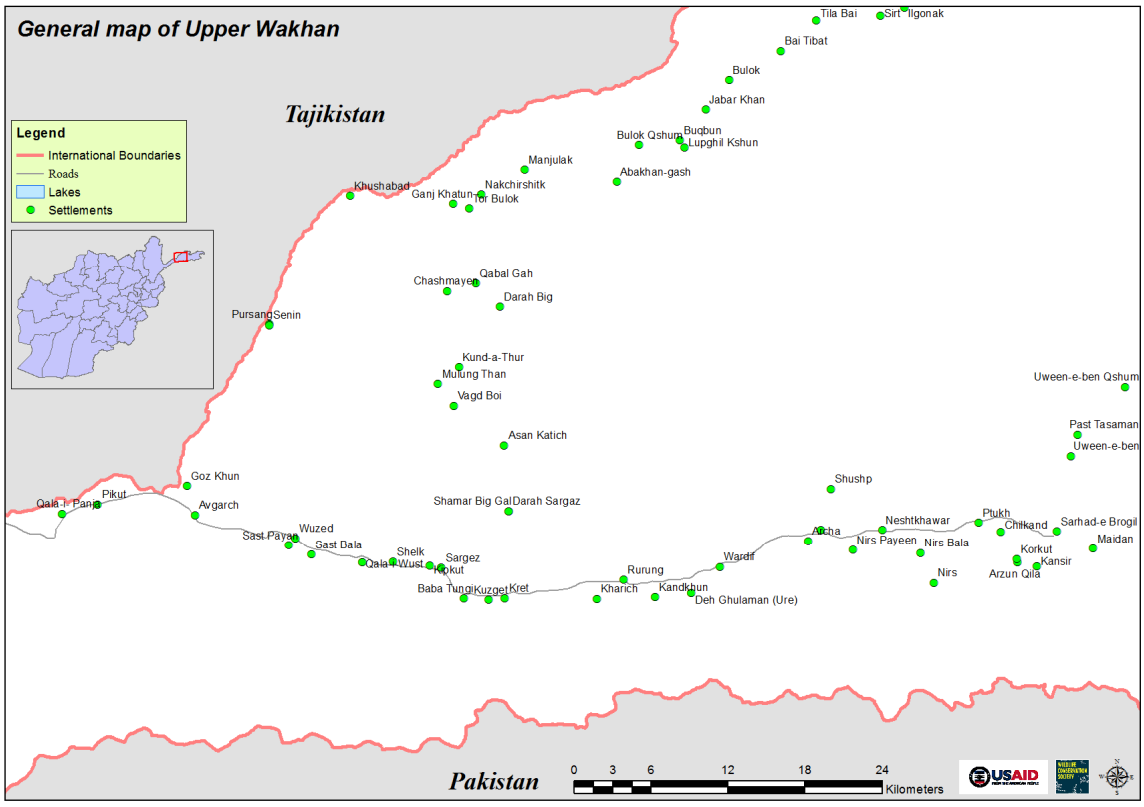
the elders (head of shora) in every village and camp they visited, and explained to them the program and the benefits of vaccination. Because vaccination targeted large-size, untied livestock species, the collaboration of local people was essential to capture, gather and restrain often uncooperative or semi-wild animals, particularly among yak. In each village or camp animals were usually gathered communally in one large herd which was confined to barns and corrals.

Results and discussions

Paravets and their assistants achieved two mass vaccination campaigns in 2011. The first operation took place between April 13th and May 10th, targeting cattle and yak present in mid and upper Wakhan Valley, and the second was organized between September 22nd and October 14th on cattle and yak in western pastures of Little and Big Pamirs, and again in the mid and upper Wakhan Valley (Plate 1). During the first campaign the two paravet teams vaccinated 3,661 animals, including 2,674 cattle and 987 yak, and 4,314 animals during the second campaign, including 1,956 cattle and 2,358 yak. In total they performed 7,975 FMD vaccinations. It is not possible to know the exact number of animals vaccinated because they were not identified individually.

Plate 1. A Wakhi paraveterinarian assisted by two herders vaccinates a large male domestic yak against foot-and-mouth disease, October 2011, Wakhan District, Badakhshan Province, Afghanistan.





Maps 1 & 2. General maps of Lower and Upper Wakhan We arbitrarily divided the c. 150-km-long Wakhan Valley into the Lower Wakhan from the village of Fitr in the west, at the entrance of the corridor, to the village of Qila-e Panja (excluded) in the east, and the Upper Wakhan from the village of Qila-e Panja in the west to Sarhad-e Broghil in the east.

However, assuming (according to previous post-vaccination questionnaires) that about 60% and 40% of the cattle and yak, respectively, vaccinated during the spring campaign received a second (booster) injection during the autumn campaign, we estimate that 5,976 different animals, including 3,026 cattle and 2,950 yak, were vaccinated one or two times in 2011. We estimate that respectively 53% and 13% of vaccinated cattle and yak owned in Wakhan received two injections. During both campaigns livestock owners in the vaccination area were also questioned on the number of animals not vaccinated. Results varied between 21% and 24% of non-vaccinated cattle, and 16% and 32% of non-vaccinated yak. Based on the rate of double vaccination, we estimate that >85% of the cattle and yak populations in the targeted area received at least one vaccination shot against FMD in 2011. Details of vaccination campaigns are provided in Appendices 1 & 2.

The participation of local communities in mass vaccination campaigns was deemed very satisfactory. During previous campaigns, we observed different levels of acceptance of the vaccination for yak. For example in Big Pamir large numbers of yak could not be vaccinated in autumn because owners believed that vaccination combined with cold weather conditions could be detrimental to their animals. This was not the case in Wakhan Valley where the vast majority of people accepted enthusiastically the vaccination of their cattle and yak. In 2011 it appeared that people in Pamirs were less reticent at having their yak vaccinated. It is likely that the misconception linked to the alleged vaccination risk will progressively wane with more yak being efficiently protected thanks to vaccination. No deaths or injuries related to the capture and handling of livestock occurred during the vaccination campaigns.

Compared to 2009 and 2010, paravets were given full responsibility and autonomy to organize and implement both mass vaccination operations. Previous post-operation controls have shown that the FMD vaccine used in Wakhan is efficient at protecting yak and cattle against the serotypes circulating in the area. Also in 2009 and 2010 we have shown that there was a highly significant relationship between being vaccinated and not developing the disease within 6-8 months following the vaccination. Based on these observations we plan to carry out a questionnaire survey in April 2012 to compare the occurrence of the disease in vaccinated and non-vaccinated cattle and yak, and also to compare the level of protection in populations vaccinated in 2010 versus 2011 (with and without WCS supervision). This monitoring will determine the quality of the work achieved autonomously by paravets.

The future is evidently to progressively increase the share of the community in the cost of vaccines. Yet this will take time for two reasons. One is that Wakhis were until the 2009 vaccination campaign absolutely not convinced that vaccination was something beneficial for their animals. The second reason is that the cash economy is still relatively undeveloped in the area, meaning that paravets who are often paid by trade of other material have trouble resupplying from drug retailers. FMD vaccination is relatively expensive (1.5-2$/cattle or

yak/year for a double shot), yet given that Wakhi and Kyrgyz survival relies crucially on pastoral incomes (100% for Kyrgyz) it justifies a higher level of investment in prophylaxis. The communities are in the process of understanding that. Paravets also offer other vaccinations and health services to their communities but for the reasons mentioned above they have not been very successful so far. The efficiency of FMD vaccination will hopefully push local communities into investing in the future in mass vaccination campaigns against this disease. We need to pursue these efforts, an example of human development activity conflicting only marginally with wildlife. We intend to measure for another year whether this initiative is sustainable from an ecosystem conservation point of view by monitoring concomitantly vaccination success and livestock productivity.

In 2012 vaccination of yak will be combined with a compulsory identification of vaccinated animals with metal ear-tags, a preliminary step towards the management of yak at landscape level.

Summary 1 — Two paravets and their assistants achieved two mass vaccination campaigns against foot-and-mouth disease in Wakhan District in spring and autumn 2011. For the first time, aside of vaccine provision, the vaccination campaigns were organized and implemented without direct supervision from WCS. We estimate that 5,976 different animals, including 3,026 cattle and 2,950 yak, were vaccinated one or two times, or >85% of the cattle and yak populations in the targeted areas. We plan to carry out a questionnaire survey in April 2012 to compare the occurrence of the disease in vaccinated and non-vaccinated cattle, and also the level of protection in populations vaccinated in 2010 versus 2011 (with and without WCS supervision).

Part II. Bovine tuberculosis detection in cattle in Wakhan District (by Hafizullah Noori)

Introduction

Bovine tuberculosis (TB) is a disease of cattle that can affect occasionally other animal species including wild ungulates. It is caused by *Mycobacterium bovis* a bacterium species of the *Mycobacterium tuberculosis* complex. It is a significant zoonosis transmitted to humans via aerosols or unpasteurized milk. The disease tends to be very rare in human communities with generalized milk pasteurization practices. Between animals the disease is transmitted via close contacts or environmental contamination.

It is crucial to evaluate the prevalence of this infection in cattle of Wakhan where non-pasteurized dairy products are consumed by local inhabitants almost daily and throughout their lifes. Another important reason for better understanding the prevalence of bovine

tuberculosis in cattle populations in Wakhan is because this area still supports a relatively large population of wild urials, sometimes seen foraging at relatively close distances to cattle when those are left unattended during summer in side valleys of the Hindu Kush mountain range. The first ever TB testing campaign in the district was carried out on cattle in Upper Wakhan in 2010. We report here on the results of the second campaign, in Lower Wakhan. Both campaigns have been organized and implemented by WCS.

Methods

We used as reactive antigen a purified protein derivate of *Mycobacterium bovis* prepared from strain AN 5 (Bovituber PPD, Synbiotics Europe, France). Antigens were kept refrigerated at +4 to +8 °C in cool boxes with icepacks. We started the work at Wergund Bala, then continued in Wergund Payan, Digargund, Sar Shkhawar, Shkhawar, Keshnikhun, Wark, and ended in Qazideh. In each village before implementing testings we met with the head of shora and explained the objectives. On each animal we cut a patch of hair in the middle of a lateral side of the neck, measured the skin fold thickness, and injected 0.1 ml (2000 UCT) in the skin with a calibrated injector. After 72 hours we revisited the tested specimens and measured again the thickness of the skin fold at injection site. No change or an increase of skin fold thickness by less than 2 mm was interpreted as a negative reaction, between 2 mm and 4 mm as a doubtful reaction, and by more than 4 mm as a positive reaction.

Results and discussion

We did tuberculin skin test in October 2011 on 153 cattle; 20 in Wergund Bala, 15 in Wergund Payan, 23 in Digargund, 23 in Sar Shkhawar, 14 in Shkhawar, 25 in Keshnikhun, 22 in Wark and 11 in Qazideh villages (Plate 2). All tested cattle were negative to the tuberculin skin test.

Because groups of cattle in Wakhan form independent herds interacting infrequently, it is meaningful to combine the results of this survey with those retrieved from similar investigations carried out in October 2010 in Upper Wakhan Valley. This approach allows drawing a more precise estimate of TB prevalence in the area.

Only one out of the 281 cattle tested in 2010 and 2011 had a doubtful reaction (+2.6 mm increase) to the test. No positive reactions were observed. These preliminary investigations suggest that bovine tuberculosis is of low prevalence in the cattle population in Wakhan District, likely <1.3% (upper limit of the 95% Confidence Interval of the frequency).

There are several possible reasons for a low prevalence of TB in Wakhan. The most evident is that TB is effectively of rare occurrence or even absent in the Wakhan Valley or possibly throughout Wakhan District, including Pamirs, or even at the scale of the mountainous ranges of Pamir and eastern Hindu Kush.

Plate 2. Using tuberculin skin test WCS veterinary team searches for the presence of cattle reactive to bovine tuberculosis, October 2011, Wakhan District, Badakhshan Province, Afghanistan.

Only a landscape-scale survey would clarify that. It is indeed possible that the harsh climatic conditions prevailing in this high altitude ecosystem reduce the prevalence of infectious agents, including TB, in livestock populations. We have documented that in Wakhan climate and harsh weather conditions play a key role in livestock survival. Extreme coldness and poor nutrition, as prevailing during winters, are responsible of more than 50% of livestock mortality every year, exceeding diseases (15%) and other causes. It is likely that animals affected by a debilitating disease, such as tuberculosis, are less likely to survive winter conditions compared to healthy ones. Also, the infectious agent may expose its sick host to a higher level of predation, such as from the gray wolf (*Canis lupus*) still common in this part of Afghanistan. Another possibility for the low prevalence of the disease could also be that in the epidemiological context of Wakhan the test may lack sensitivity to detect efficiently animals infected with *M. bovis* (false negative). This has been documented to occur in populations with very high level of TB endemicity. However, such situation does not seem to occur in Wakhan Valley as routine necropsies of cattle have not detected the presence of the disease and the cattle population is not known to express common clinical syndromes compatible with tuberculosis.

Although of a lesser extent than for sheep and goats, socio-economical conditions could also contribute to the low prevalence of tuberculosis in the cattle population. In Wakhan, such as in many areas of this corner of the Asian highlands, livestock foreign to the area, and their associated pathogens, are rarely imported, instead animals raised and fattened in the area are massively exported from the area in autumn as the main economic resource for locals. The pattern of circulation of potential infectious agents is therefore largely centrifugal to the area.

Detailed skin fold measurements of the 153 tested cattle are shown in Appendix 3.

Summary 2 — In October 2011 the WCS veterinary team did tuberculin skin tests on 153 cattle in Lower Wakhan. All tested cattle responded negatively to the test. Results of these preliminary investigations combined to those collected in October 2010 from 128 cattle tested in Upper Wakhan suggest that bovine tuberculosis is of low prevalence in the cattle population in Wakhan District, likely <1.3% (upper limit of the 95% Confidence Interval of the frequency). Possible explanations for this observed low prevalence are discussed.

Part III. Seroprevalence of brucellosis in livestock of Wakhan District (by Hafizullah Noori & Stephane Ostrowski)

Introduction

Brucellosis is caused by *Brucella* sp. a Gram negative coccobacillus which is a facultative intracellular pathogen. In sheep and goats brucellosis is mainly caused by *Brucella melitensis*, while *Brucella abortus* is more frequent in cattle. Infection in livestock can also spill over into wild ruminants and vice versa; *B. melitensis* infections have been reported in Alpine ibex (*Capra ibex*) in Italy and in chamois (*Rupricapra rupricapra*) in the French Alps as result of contacts with infected livestock. However, there is no evidence that these wild species served as reservoir hosts for domesticated sheep and goats. The predominant symptoms in naturally infected sheep and goats are abortions, stillbirths and the birth of weak offspring. In wild chamois, this organism has been linked to orchitis, polyarthritis, blindness and neurological signs, but not abortion. *B. melitensis* is very contagious to humans and is transmitted from animals to humans by contact with the placenta, fetus, fetal fluids and vaginal discharges from infected animals and via consumption of unpasteurized dairy products. In humans the disease is extremely debilitating, responsible for relapsing fevers, arthritis and reproduction defects such as abortions and orchitis.

Because of the widespread consumption of unpasteurized dairy products in Wakhan, the pivotal importance of livestock production in the local economy and the risk posed to

valuable wildlife resources, WCS selected brucellosis as a priority disease for surveillance in Wakhan.

Methods

In June-July 2010, September-October 2010, June-July 2011 and September-October 2011 we collected blood samples from healthy adult sheep, goats, cattle and yak in western Big Pamir, western Little Pamir and across Wakhan Valley (between the villages of Qasideh in the west and of Sarhad-e Broghil in the east) to investigate the serological prevalence to brucellosis. Samples were collected from animals gathered in corrals or barns, and sometimes, such as for domestic yak, in open fields with the help of community herders. For each animal we took 5-8 ml of blood in vacutainer vials (Terumo, USA) via jugular vein puncture. Blood samples were kept between 15-22°C for 3-4 hours to allow for clotting. We extracted two to three ml of serum with a micropipette or plastic 'one-use' pipette after clotting and centrifugation for 5-10 minutes (Manual centrifuge, (Hettich, Germany) (Plate 3). Sera were transferred into labeled cryovials (date, location, access number) and stored in liquid nitrogen dry shippers when collected in Pamirs or directly in a liquid nitrogen container (at -196°C) in Wakhan Valley. All samples were eventually transferred in the liquid nitrogen container and shipped by car to WCS office in Kabul where they were stored in a freezer (-20°C) pending analyses.

At WCS headquarters in Kabul we used the Rose Bengal (RB) test, which is a well-established buffered *Brucella* antigen test. It is a rapid agglutination test lasting 4 minutes done on a glass plate with the help of an acidic-buffered antigen. This test has been introduced in many countries as the standard screening test because it is very simple and sensitive. Samples positive or doubtful with RB test were re-tested at the Central Veterinary Institute in Lelystad, The Netherlands, with competitive ELISA (cELISA) and Complement Fixation (CF) tests. The World Organization for Animal Health (Office International des Epizooties, OIE) considers these three tests "prescribed tests for trade".

Results and discussion

In June and July 2010 we collected 281 samples from 95 sheep, 65 goats, 91 cattle and 30 yak in Big Pamir and different villages of mid Wakhan Valley between Sarkand, Qila-e Panja, Pikut, Avgarch and Sast villages. In September and October 2010 we sampled 384 animals including 286 sheep, 12 goats, 48 cattle and 38 yaks from Big Pamir and Wakhan Valley between Sarhad-e Broghil and Qila-e Panja villages. In June and July 2011 we collected 793 samples from 375 goats and 418 sheep in western Little Pamir and across Wakhan Valley. Eventually in September and October 2011 we collected 126 samples from 92 cattle and 34 yak in Big Pamir and different villages of Lower Wakhan Valley between Wergund Bala and

Shkhawar villages. Overall between June 2010 and October 2011 we collected 1,584 blood samples from 231 cattle, 102 yak, 799 sheep and 452 goats.

In Big Pamir due to coldness and relatively poor weather conditions people were usually unwilling to have their livestock sampled, fearing that removing blood from their animals could harm them and jeopardize their survival in winter.

Plate 3. WCS veterinary team members process blood samples collected on sheep and goats for serological detection of exposure to brucellosis, July 2011, Wakhan District, Badakhshan Province, Afghanistan.

Consequently we could only sample 34 yaks in this area. On the contrary, in villages communities agreed to have their animals bled because this operation was perceived as minimally invasive by people and they were also more sensitized on the importance of detecting brucellosis and the risk that the disease could pose to them and their animals. During blood sampling campaigns opportunities were taken to explain what brucellosis is and sensitize the population to the fact that the agent is mainly transmitted through the consumption of raw milk, uncooked dairy products and through contacts with aborted fetuses and placental membranes.

Because samples collected in June and July 2011 were tested by the Central Veterinary Diagnostic and Research Laboratory in Kabul (CVDRL), results pertaining to these samples will be reported elsewhere. Out of the 791 samples tested at WCS headquarters in Kabul,

two sera of cattle and one serum of sheep were positive and two sera of sheep were doubtful with the RB test (Table 1). All sera of yak and goats tested negative.

Only one of the two reactive cattle samples was confirmed positive with cELISA and CF test (titre ≥20 EU/ml), the other cattle sample was negative to both confirmatory tests. The positive sheep sample was also found negative to cELISA and CF tests, whereas the two sheep samples doubtful with RB were both positive to cELISA but negative to CF test (Table 1).

Table 1. Summary of positive and doubtful serological results of brucellosis in livestock from Wakhan, Afghanistan.

Species	Sex	Age (yr)	Date of collection	Locality	RB[1]	cELISA[2]	CFT[3]	Final status
Cow	F	3	29 June 2010	Avgarch	Positive	Positive	Positive	Confirmed exposure
Cow	F	5	24 June 2010	Qila-e Panja	Positive	Negative	Negative	Unconfirmed exposure
Sheep	F	3	30 June 2010	Sast	Doubtful	Positive	Negative	Possible exposure
Sheep	M	5	19 October 2010	Neshtkhawar	Positive	Negative	Negative	Unconfirmed exposure
Sheep	F	3	19 October 2010	Nirs Payan	Doubtful	Positive	Negative	Possible exposure

[1]Rose Bengal buffered *Brucella* antigen agglutination test

[2]Competitive ELISA test (cut-off value is 30% inhibition)

[3]Complement fixation test (threshold of positivity ≥20 EU/ml)

According to some literature the RB test is highly sensitive but sometimes lacks specificity (occurrence of false positive results), whereas the CF test has high specificity but lacks sensitivity (occurrence of false negative results)[9].The cELISA is said to combine the highest specificity and sensitivity of the three tests. Based on these assumptions we considered that the two animals positive and doubtful with RB test and negative for cELISA and CFT were negative to brucellosis ("unconfirmed exposure"). The cattle sample positive to the three tests was considered positive to brucellosis and the two samples doubtful to RB, but positive to cELISA and negative to CFT remain doubtful ("possible exposure"). Based on these results and on more or less conservative interpretations of serological results, exposure level to *Brucella* sp. in livestock of Wakhan District varied between 0.13% and 0.38% (the upper

[9] Godfroid, J. et al. (2010). Diagnosis of brucellosis in livestock and wildlife. Croatian Medical Journal 51:296-305.

limit of the 95% confidence interval for the livestock population varied between 0.7 and 1.1%).

Serological exposure to *Brucella* sp. is only an indirect test of the prevalence of brucellosis and should ideally be combined with isolation attempts of the bacteria. Serological diagnosis of brucellosis is known to underestimate the real prevalence. However, despite this caveat our results support that prevalence to brucellosis infection in livestock is low in the area.

The results from Wakhan contrast with those of serological investigations carried out during the last decade in the macro-region. Cross-sectional serological surveys carried out in 2003 in Khatlon Province and in the Region of Republican Subordination, Tajikistan, on 13,625 ruminants and three years later in Kyrgyzstan on 4,936 livestock revealed higher exposure levels to brucellosis than in Wakhan (Table 2). The reasons for a low prevalence of this debilitating disease in Wakhan stem from the same hypothesis discussed for bovine tuberculosis (see Part II).

Table 2. Comparative seroprevalence of brucellosis in livestock from Tajikistan, Kyrgyzstan and Wakhan, Afghanistan.

	Tajikistan (2003)[10]		Kyrgyzstan (2006)[11]		Wakhan (2010-2011)	
Livestock species	Prevalence (*N*)	95%CI	Prevalence (*N*)	95%CI	Prevalence (*N*)	95%CI
Cattle	2.1% (620)	[1.0-3.2]	2.8% (1,813)	[1.6-4.9]	0.4% (231)	[0.01-2.4]
Sheep	5.8% (6,238)	[5.2-6.4]	3.3% (2,076)	[1.5-6.9]	0.5% (381)	[0.06-1.9]
Goats	5.5% (6,767)	[5.0-6.0]	2.5% (1,286)	[1.4-4.5]	0.0% (77)	[0.0-4.7]
Yak	-	-	-	-	0.0% (102)	[0.0-3.5]

Summary 3 — Based on the analysis of 791 samples collected in Wakhan and Pamirs between June 2010 and October 2011, the average seroprevalence of brucellosis was estimated at 0.4% in cattle, 0.5% in sheep, and 0.0% in goats and yak. Results of serological investigations carried out during the last decade in Tajikistan and Kyrgyzstan suggest that the seroprevalence of brucellosis in Wakhan is low, on average six to seven-times lower than in neighboring countries.

[10] Jackson, R. et al. (2007). Survey of seroprevalence of brucellosis in ruminants in Tajikistan. Veterinary Record 161:476-482.

[11] Bonfoh, B. et al. (2011). Representative seroprevalences of brucellosis in humans and livestock in Kyrgyzstan. Ecohealth, Dec 6.

Part IV. Seroprevalence of caprine contagious pleuropneumonia in Wakhan District (by Hafizullah Noori)

Introduction

Contagious caprine pleuropneumonia (CCPP) is a highly fatal disease caused by *Mycoplasma capricolum* subsp. *capripneumoniae* (*Mccp*), a mycoplasma species notoriously fastidious to isolate and cultivate, that affects populations of domestic goats in Africa and Asia. The disease is extremely contagious with very high morbidity and mortality rates, causing an interstitial fibrinous pleuropneumonia in infected goats. Infection is spread by close-contact aerosol, therefore overcrowding and confinement increase disease incidence. Stress factors such as malnutrition can also predispose animals to the disease. *Mccp* has rarely been found in species of ruminants other than domestic goat. There is no age predilection, but clinical signs are often worse in younger animals.

There are reports of lethal respiratory diseases affecting domestic goats in Badakhshan Province including in Wakhan District. However, there have been few successful attempts to isolate causative agents. To our knowledge *Mccp* has never been confirmed in Wakhan District, but it was identified for the first time in Tajikistan in 2009[12], in areas adjacent to the Badakhshan Province of Afghanistan.

A pneumonia outbreak caused by a close subspecies, *M. capricolum* subsp. *capricolum*, has recently reduced the numbers of a wild population of endangered markhors (*Capra falconeri*) in Tajikistan[13]. *Mccp* has also affected non-domestic ruminants, such as Nubian ibex (*Capra ibex nubiana*) and wild goats (*Capra aegagrus*) in the Middle East[14]. If *Mccp* occurs in domestic goats in Wakhan it could therefore pose a risk, through cross-species spillover, to wild herbivore and particularly to the still abundant populations of Himalayan ibexes. It is therefore important to evaluate whether this infectious agent circulates in the area. Here, we report on preliminary results of CCPP seroprevalence in domestic goats in Wakhan District.

Methods

We collected 452 samples from healthy adult domestic goats in Wakhan District in June-July 2010 and 2011, and in September-October 2010. For each animal we took 5-8 ml of blood in vacutainer vials (Terumo, USA) via jugular vein puncture. Blood samples were kept

[12] Office International des Epizooties. Contagious caprine pleuropneumonia, Tajikistan. 2009 May 15 [Cited 2009 Nov 3]. http://web.oie.int/wahis/public.php?page=event_summary&reportid=8610

[13] Ostrowski, S. et al. (2011). A fatal outbreak of *Mycoplasma capricolum* pneumonia in endangered markhors. Emerging Infectious Diseases 17(12):2338-2341.

[14] Arif, A. et al. (2007). Contagious caprine pleuropneumonia outbreak in captive wild ungulates at Al Wabra Wildlife Preservation, State of Qatar. Journal of Zoo and Wildlife Medicine 38(1):93-96.

between 15-22°C for 3-4 hours to allow for clotting. We extracted 2-3 ml of serum with a micropipette or plastic 'one-use' pipette after clotting and centrifugation for 5-10 minutes (Manual centrifuge, (Hettich, Germany). Sera were transferred into labeled cryovials (date, location, access number) and stored in a liquid nitrogen container (at -196°C) in Wakhan Valley. All samples were eventually shipped by car to the WCS office in Kabul where they were stored in a freezer (-20°C) pending analyses.

The samples were tested with a latex agglutination test (Caprilat, Veterinary Laboratories Agency, England). The test is used on blood or serum for the rapid detection of antibodies against *Mccp*. Positive and negative controls were supplied freeze-dried, and were reconstituted with sterile distilled water at least 20 minutes before use. A strong clumping of latex beds appearing within two minutes signified a highly positive reaction (+++), while a clear agglutination of latex beds within two minutes was a positive reaction (++) and a fine agglutination between two and three minutes was a weak positive reaction. When there was no agglutination within three minutes the reaction was considered negative (Figure 1).

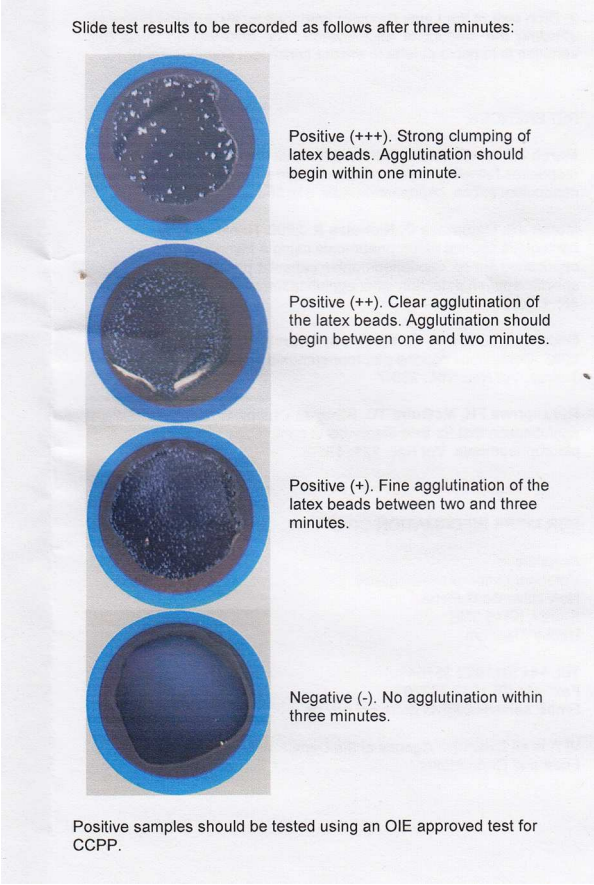


Figure 1. Recording and interpretation of results of the latex immunoagglutination test (CapriLAT, VLA, UK) for the detection of antibodies against *Mycoplama capricolum* subspecies *capripneumoniae*, the causative agent of contagious caprine pleuropneumonia (CCPP).

Results and discussions

Positive and negative controls were ran at the beginning and end of the procedure and worked well. Only 66 samples were tested at the WCS office in Kabul whereas the 375 samples collected in June-July 2011 were tested by CVDRL Kabul.

Results of investigations carried out in this laboratory will be reported separately. We detected no positive samples among the 66 tested at the WCS office (see Appendix 4).

These results should be interpreted with caution because they originate from a small number of goats sampled in a relatively localized area in mid Wakhan Valley. Besides, the latex agglutination test detects antibodies produced against a capsular polysaccharide produced by *Mccp* during the early stage of infection. Because the resilience of these antibodies is not known, there is a possibility that the test can only detect relatively recent infections. None of the 66 sampled animals displayed symptoms of respiratory tract infection.

The « Centre de Coopération Internationale en Recherche Agronomique pour le Développement » (CIRAD), Montpellier, France, which is an OIE-accredited reference laboratory for CCPP has developed a competitive ELISA test that should be commercialized in 2012. As part of a cooperative agreement between WCS and the Animal Husbandry and Production Department of the Ministry of Agriculture of Afghanistan, CIRAD will analyze the 375 goat samples tested at CVDRL with the new cELISA kit. Combined serological results will provide us a more accurate understanding of the status of CCPP in Wakhan District.

Summary 4 —Seroprevalence of contagious caprine pleuropneumonia in domestic goats, one of the deadliest diseases to caprine species, known to occur in southern Tajikistan and northern Pakistan, has been evaluated for the first time in Wakhan District. None of the 66 goat samples tested positive with a latex agglutination test. Pending analysis on a larger sample size of 375 blood samples collected in June-July 2011 will further clarify the status of this disease in Wakhan.

Part V. A preliminary assessment of disease spillover risk from livestock to wildlife in the Hindu Kush of Wakhan (By Ali Madad Rajabi & Hafizullah Noori)

Introduction

In April and May 2011 five teams from the WCS project in Wakhan associated with local rangers conducted a longitudinal west-to-east survey of urial sheep and Himalayan ibex in the southern slopes of the Hindu Kush mountain range, between Fitr at the entrance of the

Wakhan corridor, and Sarhad-e Broghil. The WCS veterinary team was asked to participate in this large-scale survey. In addition to documenting numbers and distribution of large wildlife species, the vets took the opportunity of this longitudinal large-scale investigation to record the presence of livestock in surveyed habitats. Livestock pose a risk of disease transmission to wild herbivores through direct contacts, and their presence in Wakhan is considered a risk factor to wild ungulates.

The transmission of infectious agents between wildlife and livestock occurs either through direct or indirect contacts with a contaminated environment, or via living vectors such as insects and other ectoparasites. In mountainous areas in Wakhan, the abundance of domestic herds increases the risk of disease transmission to wild ungulates. Also, in Afghan Pamirs, domestic and wild-living ungulates are competitors for food, which results in pasture sharing and possible transmission of infectious agents[15].

The present report offers a preliminary assessment of the risk of pathogen transmission through direct contacts between livestock and urials, in the Hindu Kush range of Wakhan.

Methods

The two ranger teams led by WCS vets traveled by car from Qila-e Panja to Fitr villages located at the entrance of the Wakhan corridor. Their surveys started on April 15th and ended on May 3rd. Each team had a pre-determined number of valleys and mountain ranges to investigate during this period of time.

The methodology of the survey will be described in greater details in another report (Zalmai Moheb *et al.*, in prep.) and we provide here only a brief overview of it. Surveys were carried out on foot, starting every day in the early morning and ending at sunset (Plate 4). Valley slopes were thoroughly scanned with binoculars and spotting scope from vantage points.

Observations of wild ungulates were recorded on standardized data sheets, including group size and composition, behavior, habitat and vegetation coverage, spotting location, and compass bearing combined with map plotting.

The presence of livestock was assessed based on visual contacts, on the occurrence of fecal material or footprints, on the presence of occupied or unoccupied settlements, and according to interviews of local inhabitants.

The team led by Ali Madad "Rajabi" surveyed in Lower Wakhan Fitr and Wergund Payan valleys, part of Regijurm barren area, mountains between Paghish and Yamit villages, and mountains around Khandud, Yazuk, and Pak villages.

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[15] Ostrowski, S. et al. (2009). Livestock and Marco Polo sheep: assessing the risk of health conflicts in Afghan Big Pamir, Asia. WCS unpub report, New York, 54 pp.

Plate 4. The ungulate survey team led by Dr. Ali Madad "Rajabi" at work in the Hindu Kush, April 2011, Wakhan District, Badakhshan Province, Afghanistan.

In Upper Wakhan this team surveyed Hindu Kush drainage valleys ending in Pikut, Sast, Kret, and Deghulaman villages, and mountains between Sast and Qila-e Wust villages and around Nirs Payan Village. The team led by Hafizullah "Noori" surveyed in Lower Wakhan Ojdaragh, the mountains between Fitr and Qazideh villages, the valley ending at Shkhawar Village, the mountains around Wergund Payan and Wergund Bala villages, part of the barren area of Regijurm, and mountains around Pakuy Village. Then in Upper Wakhan it surveyed the west side of Pikut Village valley, mountains between Sast and Avgarch villages, the valleys of Kuzget and Kandkhun villages, and mountains around Korkut and Suikunj villages.

Results and discussion

Cumulated observations of large wildlife species near livestock settlements totalized 403 animals, including 362 Himalayan ibexes, and 41 urial sheep (Plate 5). These observations were incorporated into the dataset of global survey results for the vet teams (Appendices 5, 6 & 7). Whereas Himalayan ibexes were present in 11 out of the 16 surveyed areas, urials were seen only in five of these localities (Table 3). Except in Shkhawar (Lakhsh), areas with urials also had ibexes.

Plate 5. A large herd of Himalayan ibexes on the southern slopes of the Hindu Kush mountain range, April 2011, Wakhan District, Badakhshan Province, Afghanistan.

However, the habitat used by ibexes and urials differed markedly. While ibexes used steep rocky habitat, in general difficult to access for livestock, urials used "smoother" hilly landscapes, and were often observed in rolling hills surrounding those relatively flat areas favored by livestock.This habitat preference renders urials potentially more exposed to direct contacts with livestock and their pathogens than ibexes. We therefore focused on the urial distribution to determine areas of highest risk of disease spill-over from livestock.

Except in Wergund Payan and Avgarch the only livestock species observed during the survey was the domestic yak, as also confirmed by interview reports. Yak were seen in Ish Murg, Avgarch, Kuzget, Korkut and Suikunj areas. It is not known, as it is the case for Marco Polo sheep in Pamirs, whether domestic yak intermingle with urial sheep in pastures of the Hindu Kush.If it is the case it would render virtually all the Hindu Kush range, which is extensively used by yak in winter, an area of potential disease spillover to urials. In Wakhan, yak are known to host contagious diseases potentially dangerous to wildlife such as foot-and-mouth disease. However, domestic sheep and goats, as the closest domestic relatives to urials and ibexes, respectively, may pose a far greater risk of disease transmission to wild ungulates than free-ranging domestic yak.

Table 3. List of livestock settlements visited by WCS veterinary teams during the wild ungulate survey with information on livestock/wildlife concomitant presence. In bold the area with concomitant presence of sheep/goats and urial in April, Wakhan District, Badakhshan Province, Afghanistan.

Date	Settlement name	Evidence of livestock presence	Livestock in spring	Livestock in summer	Ibex observed	Urial observed
15/04/2011	Qazideh	Foot prints and feces	(Yak?)	Sheep, goats & cattle	29	2
15/04/2011	Fitr Valley (Wenkharaw)	Foot prints and feces	(Yak?)	Cattle	40	0
16/04/2011	Fitr Valley (Khan Sang)	Foot prints and feces	(Yak?)	Catlle	25	0
16/04/2011	Shkhawar (Lakhsh)	No	(Yak?)	Sheep, goats & cattle	0	7
17/04/2011	Shkhawar Valley	Foot prints and feces	(Yak?)	Cattle & yak	22	0
18/04/2011	**Wergund Payan (Sabzposh)**	**Sheep and goats present**	**Sheep & goats**	**Sheep, goats & cattle**	**82**	**27**
22/04/2011	Pagish Valley	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	39	0
25/04/2011	Pakuy 2	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	7	0
25/04/2011	Pakuy 1	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	0	0
25/04/2011	Ish Murg	Yak present	Yak			
27/04/2011	Pikut Valley (new)	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	37	4
27/04/2011	Pikut Valley (old)	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	41	1
29/04/2011	Sast	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	32	0
29/04/2011	Avgarch	Foot prints and feces	Sheep, goats, yak	Sheep, goats, cattle & yak	0	0
01/05/2011	Kuzget	Yak present	Yak	Sheep, goats, cattle & yak	8	0
04/05/2011	Suikunj	Foot prints and feces	(Yak?)	Sheep, goats, cattle & yak	0	0
04/05/2011	Korkut and Suikunj	Yak present	Yak	Sheep, goats, cattle & yak	0	0

Although in Pamirs sheep and goats come very rarely into contact with Marco Polo sheep[16], this situation seems to differ in the Hindu Kush where domestic sheep have been seen at relatively close distances from urials (Stefan Michel, pers. comm.). We therefore considered the presence of domestic sheep in areas used by urials indicative of a high level of disease transmission risk.

[16] Ostrowski, S. et al. (2009). Livestock and Marco Polo sheep: assessing the risk of health conflicts in Afghan Big Pamir, Asia. WCS unpub report, New York, 54 pp.

Based on these assumptions, we have determined Wergund Payan as an area of high risk of disease spill-over to urials in April. Should we consider yak a health risk to urials, then the area of Pikut would also qualify as an area of spring disease risk.

Our approach is evidently constrained by several limitations. First the two teams surveyed less than 40% of the urial spring habitat in Wakhan Valley and results of the three other teams have not been compiled in the present report. For example the area of Dehqankhana / Sarhad-e Boroghil in Upper Wakhan, not surveyed by the vets, hosts large numbers of livestock in winter and spring, including sheep, cohabiting with urials (Zalmai Moheb pers.comm.). Also, because urials are gregarious and highly mobile species, the fact that they were not observed during the survey in areas that hosted domestic sheep, such as in Avgarch area, does not mean that they never use the area in spring. Also there are reports of urials coming in winter and spring within a distance of less than a kilometer from villages in Lower Wakhan Valley, a behavior that could expose them to a higher risk of disease transmission from livestock. Finally although the results of this preliminary assessment could probably be extrapolated to the range utilization situation in late autumn and winter, they say nothing about the risk of disease spill-over during summer, when almost all the Hindu Kush range hosts large numbers of livestock of different species, and the distribution of urials is unknown.

Summary 5 — In April and May 2011 WCS vets led two of the five ranger teams in a large-scale longitudinal west-to-east survey of urial sheep and Himalayan ibex in the southern slopes of the Hindu Kush mountain range of Wakhan. They surveyed 16 pre-determined areas and counted 362 ibexes, 41 urials, one snow leopard and one gray wolf. They took the opportunity of this survey to record the presence of livestock in surveyed habitats and produced a preliminary assessment on the risk of disease spillover between domestic and wild sheep during spring.

Part VI. Results of livestock census in western Big Pamir in autumn 2011 (by Stephane Ostrowski)

Introduction

Livestock production is the principal economic resource in Wakhan District. Limited surfaces of arable lands offer few other options but rearing livestock as a sustainable livelihood activity. In summer the Pamirs provide abundant high-quality pastures and favorable weather conditions to raise and fatten livestock. Resident Kirghiz tend livestock

herds all-year-round in the east of this mountain range, whereas livestock of Wakhis, who inhabit the Wakhan Valley, graze the western part of Afghan Pamirs and for the majority of them only between May and October.

The Pamirs are home to a rich wildlife including the endemic Marco Polo sheep, a charismatic subspecies of wild sheep, which is found notably in western Big Pamir, an area proposed for protection. The cohabitation between livestock and wild sheep is a source of conflicts because both compete for the same food resource. Scientists at WCS believe that fluctuations of livestock numbers influence the productivity and survival of wild sheep and perhaps also the risk of disease propagation. An increase in livestock numbers in summer would decrease the food biomass available to Marco Polo sheep, particularly in the following spring and summer, when the energetic requirement of milking females is maximal. This forced cohabitation with a high number of livestock may also increase the frequency of interspecific contacts; potentiating the risk of emergence of newly reported infectious diseases in herbivores sharing the same habitat.

Livestock numbers at the end of the grazing season provide a good proxy of the range condition at that time, and in turn, of the level of competition with Marco Polo sheep in western Big Pamirs. Here we report about the results of livestock counts carried out in September 2011 and compare them with counts made in September 2010.

Methods

Similarly to the census in 2010, the mission in 2011 was organized and implemented by Hafizullah "Noori" and Ali Madad "Rajabi", the two Afghan veterinarians of WCS. They were assisted by four community rangers who they trained for two consecutive days prior to the mission. All known Wakhi ayloqs in western Big Pamir were visited on foot between September 23 and September 30 and livestock counted visually with hand tally counters, either when entering corrals or more conveniently when in pastures. Counts were repeated up to three times for each livestock species and in each ayloq, and averages provided as final results. Inter-annual variations between 2010 and 2011 were analyzed descriptively. We expect to carry out more in-depth and meaningful statistical examinations after three years of consecutive counts (at the end of 2012).

Results and discussion

The survey teams visited the 20 ayloqs occupied in western Big Pamir in September 2011 (Appendix 8) and counted 15,760 livestock, including 10,672 animals older than one year and 5,088 younger than one year. Results discriminated according to species (sheep, goat, yak, and cattle), age and locations are presented in Table 4. Compared to 2010 the number of livestock in western Big Pamir has increased by a remarkable 38.9% (Table 5), due in part to newly occupied ayloqs and grazing areas.

Table 4. Results of livestock counts in western Big Pamir in September 2011, Wakhan District, Badakhshan Province, Afghanistan.

Location		Sheep		Goat		Yak		Catlle		
Grazing area	Ayloq name	> 1yr	< 1yr	> 1yr	< 1yr	> 1yr	<1yr	> 1yr	< 1yr	Totals
	Kund-a-Thur	207	82	125	57	30	6	0	0	507
	Mulung Than	345	178	149	76	72	20	0	0	840
	Asan Katich	493	142	297	145	122	35	0	0	1,234
Shikargah	Khushabad	476	223	290	124	97	18	0	0	1,228
	Darah Big	316	160	100	86	20	11	0	0	693
	Qabal Gah	540	220	480	250	56	18	0	0	1,564
	Chashmayeen	160	50	80	45	28	7	0	0	370
	Ganj Khatun	250	120	180	60	45	10	0	0	665
Manjulak	Manjulak	350	310	150	120	50	27	0	0	1,007
	Nakchirshitk	380	170	210	50	60	12	0	0	882
	Jabar Khan	320	110	160	100	55	18	0	0	763
	Buqbun	360	190	200	80	20	5	0	0	855
Jermasirt	Bulok	442	240	160	90	28	9	0	0	969
	Lupghil Kshun	200	100	60	25	30	22	0	0	437
	Saraghil	150	60	70	35	12	6	0	0	333
	Senin	165	90	130	35	30	4	0	0	454
Senin	Pursan	77	35	72	36	1	0	0	0	221
	Yup Goz	94	35	146	65	0	0	0	0	340
Wuzed	Darya Wuzed	250	195	195	117	48	10	25	4	844
Sargez	Darya Sargez	595	230	330	270	89	40	0	0	1,554
Total		6,170	2,940	3,584	1,866	893	278	25	4	**15,760**

Table 5. Variations in number of livestock in western Big Pamir between September 2010 and September 2011, Wakhan District, Badakhshan Province, Afghanistan.

Location		Sheep		Goat		Yak		Catlle		
Grazing area	Ayloq name	> 1yr	< 1yr	> 1yr	< 1yr	> 1yr	< 1yr	> 1yr	< 1 yr	Totals
	Kund-a-Thur	-35.3%	+36.7%	-41.8%	-36.7%	-25.0%	-40.0%	-	-	-31.0%
	Mulung Than	+23.2%	+27.1%	+86.2%	+31.0%	+5.9%	+33.3%	-	-	+31.0%
	Asan Katich	+54.1%	+57.8%	+78.9%	+190%	+10.9%	+150%	-	-	+64.5%
Shikargah	Khushabad	+70.0%	+71.5	+346.1%	+90.7	+49.2%	+20.0%	-	-	+98.1%
	Darah Big	+23.9%	-20.0%	+5.3%	+72.0	-50.5%	+37.5%	-	-	+6.9%
	Qabal Gah	+35.0%	+22.2%	+140%	+308.3	-30.9%	+80.0%	-	-	+58.0%
	Chashmayeen	-20.0%	-43.2%	+23.1%	-	+12.0%	+133.3%	-	-	-2.9%
	Ganj Khatun	-16.7%	+33.3%	-10.0%	-29.4%	+136.8%	+100.0%	-	-	-4.9%
Manjulak	Manjulak	-17.6%	+106.7%	-9.1%	-55.8%	-16.7%	+125.0%	-	-	+13.3%
	Nakchirshitk	+4.4%	-10.5%	+5.0%	-44.4%	+33.3%	-14.3%	-	-	-2.3%
	Jabar Khan	-50.8%	-8.3%	+14.3%	+21.9%	-19.1%	+20.0%	-	-	-29.0%
	Buqbun	+16.1%	+100%	+42.8%	+29.0%	+33.3%	0%	-	-	+36.8%
Jermasirt	Bulok	+145.5%	+135.3%	+128.6%	+260.0%	+180.0%	+80.0%	-	-	+147.2%
	Lupghil Kshun	-49.6%	-65.5%	-73.3%	-72.2%	-28.6%	340.0%	-	-	-55.1%
	Saraghil	-	-	-	-	-	-	-	-	-
	Senin	-32.4%	-10.9%	-10.3%	-200%	+30.4%	-20.0%	-	-	-27.1%
Senin	Pursan	-	-	-	-	-	-	-	-	-
	Yup Goz	-	-	-	-	-	-	-	-	-
Wuzed	Darya Wuzed	-	-	-	-	-	-	-	-	-
Sargez	Darya Sargez	+230.5%	+280.3%	+262.6%	+419.2%	+81.6%	+700%	-	-	+255.6%
Total		+20.9%	+40.9%	+64.3%	+69.5%	+17.6%	+90.4%	-	-	**+38.9%**

In contrast to 2010, Pursan and Yup Goz in Senin, Saraghil in Jermasirt, and Darya Wuzed were newly occupied ayloqs in September 2011. With 1,738 animals, occupation of these newly reported sites explained almost 40% of the livestock increase observed in 2011.

This inflation was also due in part to larger herd sizes mainly in Shikargah and Darya Sargez areas. When comparing inter-annual counts in Shikargah, Jermasirt and Manjulak, the three grazing areas hosting c. 80% of livestock in western Big Pamir, the increase was relatively modest in Jermasirt and Manjulak (+9.4% and +2.5%, respectively), even when considering the newly reported ayloq of Saraghil in Jermasirt, but more significant in Shikargah (+35.1%). Even more noticeable was the 3.5-fold inter-annual increase of livestock in Darya Sargez (an area at the outskirt of the western Big Pamirs), corresponding to 25.5% of the total livestock increase observed in 2011.

When comparing variations of different livestock species, the increase was 24.8%, 29.4% and 65.7% for sheep, yak and goats, respectively. The magnitude of the increase in goat numbers was remarkable, particularly in Qabal Gah, Khushabad, and Darya Sargez (all >150%).

With almost 4,500 additional animals compared to last year, the western Big Pamir might have suffered overstocking during summer 2011. Although it is possible that the massive increase observed in Darya Sargez (an area of transit for livestock returning to the Wakhan Valley) is biased and corresponds to a delayed departure of livestock from highlands that we failed to observe in 2010, disregarding counts made in this area would still translate into a net increase of 3,383 livestock heads compared to 2010, or nearly 30%. One has also to bear in mind that at least 1,048 sheep and goats died of an outbreak of infectious disease (possibly Peste des Petits Ruminants) in western Big Pamir during summer 2011 (Ali Madad "Rajabi" and Hfizullah "Noori", pers obs, September 2011), which would have rendered the inter-annual increase even more dramatic had it not happened.

Although comparison of the two livestock counts made in 2010 and 2011 gives an alarming signal in term of stocking rates in western Big Parmir, it could also reflect to some extent a high inter-annual variability due for example to a relatively low stocking rate in 2010. For this reason comparison of livestock estimates over a longer period is essential to better evaluate the long-term demography of this population. In this respect we compared livestock estimates made in July 2006[17] and September 2011 in the 11 major ayloqs of Big Pamir (Kund-a-Thur, Mulung Than, Darah Big, Qabal gah, Ganj Khatun, Manjulak, Nakchirshitk, Jabar Khan, Buqbun, Lupghil Kshun, Buloq) and found a less spectacular, but still

[17] Ostrowski, S. *et al.* (2007). Kirghiz and Wakhi livestock in Afghan Pamirs in 2007. WCS Unpublished report, New York, 91 pp.

noticeable 14% increase in the cumulated number of sheep, goats and yak. It provides a solid evidence of livestock increase in these traditional ayloqs, over the last 7 years.

More livestock grazing Big Pamir implies less forage biomass available to wild herbivores, a threatening situation for species also exposed to hunting. Both wild ungulate species present in Big Pamir are coming under threat of food resource depletion. The largest livestock increase occurred in Shikargah, which is the heart of Marco Polo sheep territory in Big Pamir, whereas the increase in number of the domestic goat would presumably affect the situation of its wild relative, the ibex.

In view of the significant livestock increase in western Big Pamir in 2011 compared to 2010, we think it is of prime importance:

1. to repeat a livestock census in western Big Pamir in September 2012,
2. to investigate the origin of livestock using newly reported ayloqs,
3. to investigate the reasons of the massive livestock increases in Qabal gah, Khushabad, an Darya Sargez in 2011,
4. to approach communities and discuss the current trend of livestock increase in Big Pamir.

Summary 6 — Two ranger teams led by WCS veterinarians performed a census of livestock present in western Big Pamirs in September 2011. They counted in 20 occupied ayloqs 15,760 livestock, including 10,672 animals older than one year and 5,088 younger than one year. Compared to September 2010 the number of livestock in the surveyed area has increased by a remarkable 38.9%, due to newly occupied ayloqs and grazing areas, and larger herd sizes mainly in Shikargah and Darya Sargez areas. However, comparison of counts made in 11 major ayloqs in September 2011 with those made in July 2006 found a less dramatic but still significant 14% increase in the cumulated number of sheep, goats and yak. This last comparison provides good evidence that livestock have increased, at least in these major ayloqs, over the last 7 years. Increase in stocking rate may ultimately jeopardize the food security of livestock and cohabiting wild ungulates, and affect detrimentaly the ecosystem.

Part VII. Capacity building and training (by Ali Madad Rajabi)

Introduction

In compliance with the work mandate of WCS in Wakhan District, a significant amount of time was devoted to raise the technical capacity of local project partners. In contrast to previous years, the veterinary team also allocated time at improving the technical capacity of

community rangers in the field of wildlife monitoring. WCS veterinarians took the opportunity of this training to discuss extensively with local trainees about the risk of disease transmission at the livestock/wildlife interface, taught people to consider wildlife present in the area as rare and vulnerable, and emphasized the importance of disease surveillance in livestock coming into contact with valuable wildlife resource. The team committed also into more "classical" involvements comprising technical training in livestock census techniques and in field epidemiology. In the present chapter we summarize the scope and achievements of the WCS veterinary team in capacity building in Wakhan District. Names and affiliation of the people trained by the team in 2011 are provided in Appendix 9.

Continuing education of rangers in wildlife monitoring

In April and May 2011 the WCS team in Wakhan conducted a transect survey of urial sheep and Himalayan ibex in the southern slopes of the Hindu Kush mountain range between Fitr Village at the entrance of the Wakhan corridor and Sarhad-e Broghil in the east, where rugged mountains of Little Pamir abruptly end the vehicular crossing. Two of the five teams involved were led by WCS veterinarians. One team was composed of Dr. Ali Madad "Rajabi", Mr. Ali Mohammad a community ranger from the village of Wergund Bala in Lower Wakhan, and Mr. Saeed Kazim, a community ranger from Sargez Village in Upper Wakhan. The second team was composed of Dr. Hafizullah "Noori", and Mr. Khalam Big and Mr. Hadina Big, community rangers from Suikunj and Kuzget villages, respectively, in Upper Wakhan.

During the three week survey, community rangers were taught daily on theoretical and practical aspects of: 1/data recording and data sheet filling, 2/principles of compass reading including recording of accurate bearings, 3/use of hand-held gps units, including recording waypoints and practicing "go to" function, 4/map-reading including interpretation of topographic details (water, contour lines, roads, etc), orientation of a map using a compass, and plotting of waypoints on a map, 5/trekking organization, including cooking skills, basic rules of hygiene and logistical organization.

Continuing education of rangers in livestock monitoring

In September and October 2011 the WCS team in Wakhan organized for 10 days a livestock census operation in western Big Pamir. This mission was considered of great importance because it intended to document the current trend in livestock numbers in an area proposed for formal protection and controlled livestock grazing.

The mission was led by Drs. Hafizullah "Noori" and Ali Madad "Rajabi" the two WCS veterinarians assisted by four community rangers; Mr. Erkan, Mr. Lala Jan, and Mr. Ayob, respectively from Goz Khun, Sast and from Qila-e Panja in Upper Wakhan and Mr. Ghulam Husain from Pak in Lower Wakhan. Prior to the mission the four rangers received a short

refresher course on how to use hand-held gps units and were then taught livestock census methods. Particular emphasize was given to the timing and location of counts, accurate discrimination between animals older or younger than one year, averaging of multiple consecutive counts and best estimation methods when an individual count is not achievable. The four rangers were divided into two teams of two and were satisfactorily evaluated prior to their deployment in the field.

As an additional evaluation of the quality of their work it was decided to organize duplicate counts in seven of the 20 visited settlements and a triplicate count in one settlement. The triplicate count (consecutive counts made by the team of trainers and the two ranger teams) and four of the duplicate counts (consecutive counts made by the trainer team and one of the two ranger teams) gave good results, with count results differing by less than 10%. However, for the three duplicate counts without trainer team supervision, differences were rarely within 10% but closer to 30% (on average) and sometimes exceeding 50%. When questioned after the survey by the trainers about these discrepancies, rangers explained that in these three settlements herders viewed the census operation of their livestock as an intrusion and intimidated them, asking them not to do any count. In such circumstances they had to estimate "from far away" livestock numbers. When questioned again several months later by one of their community leaders, one of the rangers denied that they received intimidations (Salahudin pers. obs.).

Trainees responded well to training as recognized by the good evaluations they received when tested directly by the trainers. However, for reasons that would certainly need to be elucidated the results of the counts they made without supervision of trainers is vitiated by possible errors and must therefore be used with caution. Given the importance of these census results and the implications they could have in the management plan of the future Big Pamir protected area, we recommend to organize future livestock census operations in western Big Pamir with the help of a transparent and rigorous expertise foreign to the community.

Continuing education in animal health

In July 2011 the veterinary team conducted a large-scale mission in the Wakhan District aimed at collecting c. 800 blood samples from sheep and goats, as part of a collaborative disease surveillance operation organized by WCS and the animal health and husbandry department at the Ministry of Agriculture in Kabul. Mr. Fahim affiliated to the veterinary department at the local office of the Ministry of Agriculture in Feyzabad participated actively in the survey. He was given the opportunity to be involved in all aspects of the operation, including in the preparation phase, in the organization of logistical aspects, in understanding and rigorously applying "cold chain" principles in the field, in blood sampling with the vacutainer system, and sample processing and storage (Plate 6). More importantly Mr. Fahim

could meet with leaders of Wakhi and Kyrgyz communities and understand the animal health challenges in this remote district of Badakhshan Province.

During his one month training in Wakhan Mr Fahim met and discussed with Mr Sarwar and Mohammad Gul, the WCS-sponsored paraveterinarians based in Upper Wakhan, in Kandkhun and Avgarch, respectively. In 2011 both paravets were offered for the first time to organize and implement two mass vaccination campaigns. Before these new professional challenges they were provided the theoretical background by WCS veterinarians. In the course of disease surveillance activities, they were also refreshed on blood sampling techniques, sample processing and storage procedures.

One main constraint to an organic expansion of their animal health activities in Wakhan is the difficulty they face to be remunerated for the services they provide. It is a main issue that has been tackled very progressively since their installation in the area in 2008. It is however essential to secure the sustainability of their activities. WCS veterinarians have repeatedly discussed this matter with local communities. Receptiveness to the idea that paravets should be paid for the service they provide is in general good but implementation usually deceptive. Considerable work needs to be done to change mentalities and behaviors.

Plate 6. Drs Ali Madad and Hafizullah teach Mr Fahim field techniques for sample processing and discuss health issues with local herders, July 2011, Wakhan District, Badakhshan Province, Afghanistan.

Other trainings

During WCS animal health missions in Wakhan in 2011, Mr. Juma Gul from Goz Khun and Mr. Inayat from Qila-e Panja were employed as camp managers and cooks. Both were taught basics in cooking practice, hygiene rules in meal preparation and washing-up, preparation of a variety of dishes, and trekking camp management. They will be able to use these skills in trekking activities for tourists.

Summary 7 — In the present chapter we summarize the scopes and achievements of WCS veterinary team in training and capacity building activities in Wakhan District during 2011. Overall the team trained 14 people, including 4, 4, 3, 2, and 1 in the fields of wildlife monitoring, livestock monitoring, animal health, trekking expertise, and small carnivore trapping, respectively.

Part VIII. Other activities (by Hafizullah Noori)

Bird mist netting in the riparian habitat near Goz Khun Village

Between September 30 and October 4, 2011 the ecosystem health team performed five days of bird mist netting in the riparian vegetation near Goz Khun Village, at the exact same locations where it re-discovered the little known large-billed reed warbler (*Acrocephalus orinus*) in June 2009[18]. The operation intended to evaluate whether individuals of this elusive bird species could still be present in the area in mid autumn.

The team erected two 6-m-long mist nets in the riparian habitat, changing their locations every day. Trapping attempts were mostly undertaken during windless mornings, rarely after noon (Plate 7). No *Acrocephalus* species were seen or captured. Four relatively common species were captured on several occasions and safely released: the white-winged redstart *Phoenicurus erythrogastrus*, the Siberian chiffchaff *Phylloscopus tristis*, the black redstart *Phoenicurus ochruros* and the bluethroat *Luscinia svecica*. Overall there were few bird species present in the area, possibly because most summer visitors had already left the area.

It is not possible to conclude from this limited trapping effort that *A. orinus*, a species which very likely breeds in Wakhan, had already entirely left the area by early October. However, these results plead in favor of another trapping effort at the same location earlier after breeding time, possibly in late August to early September.

[18] Timmins, RJ. et al. (2009). The discovery of large-billed reed warblers *Acrocephalus orinus* in north-eastern Afghanistan. BirdingASIA 12:42-45.

Plate 7. Dr Hafizullah retrieves a white-winged redstart from a mistnet erected in the riparian vegetation near Goz Khun Village, October 2011, Wakhan District, Badakhshan Province, Afghanistan.

Small carnivore trapping in the riparian habitat near Goz Khun Village

Simultaneously to the bird mist netting operation it was decided to deploy medium-size double-collapsible-door traps (Tomahawk, USA) in the area to assess the presence of small carnivores, including possible predators to the avifauna. With the help of Mr. Sangin Mohammad, a Wakhi assistant hired in Goz Khun, the team set-up 15 traps at different locations of the riparian habitat at the confluence of Wakhan and Pamir rivers (Plate 8). Trap locations were recorded with a gps. Traps were baited with raw chicken meat and tuna fish, and opened for six consecutive nights between September 29 and October 5. They were checked every morning.

The team failed to trap any wild carnivore. Occasionally foot-prints of canids, probably of red foxes (*Vulpes vulpes*), were recorded in the immediate vicinity of the traps. On 5th October the team captured an adult domestic cat (*Felis silvestris catus*) which they saw in the area during previous days. People in Goz Khun mentioned that wild carnivores are more likely to visit lowland areas, including the riparian habitat around Goz Khun, after first snow falls in the surrounding mountains, typically in December. These winter visitors are said to return to their summer mountainous strongholds in April. One trap was stolen during the operation and we had to inform the head of the Shora in Goz Khun and Mr Salahudin in Qila-e Panja about this incident. They will try to recover it.

Plate 8. Dr. Hafizullah installs a cage trap for small carnivores in the riparian vegetation near Goz Khun Village, October 2011, Wakhan District, Badakhshan Province, Afghanistan.

Summary 8 — Bird mist netting and carnivore trapping attempts in October 2011 in the riparian habitat near Goz Khun Village failed to capture specimens of large-billed reed warblers (*Acrocephalus orinus*) and of wild carnivores. Several specimens of bird species common in the area and one feral dometic cat (*Felis silvestris catus*) were captured.

Part IX. Appendices

Appendix 1

Date, location and number of adult and young cattle and yak vaccinated against foot-and-mouth disease in April 2011, Wakhan District, Badakhshan Province, Afghanistan

Date	Location	Leading paravet	Adult cattle	Young cattle	Adult yak	Young yak
13 April	Nirs	Sarwar	45	11	14	4
14 April	Qila-e Wust	Mohammad Gul	65	10	10	8
14 April	Suikunj	Sarwar	25	7	18	4
15 April	Shelk	Mohammad Gul	0	0	20	6
15 April	Korkut	Sarwar	15	7	44	14

16 April	Sargez	Mohammad Gul	25	5	15	10
16 April	Kret	Mohammad Gul	80	30	0	0
16 April	Baba Tungi	Mohammad Gul	20	5	0	0
16 April	Dehqan Khane	Sarwar	0	0	348	90
17 April	Sast	Mohammad Gul	220	40	0	0
17 April	Sarhad-e Broghil	Sarwar	175	40	0	0
18 April	Sarhad-e Broghil	Sarwar	0	0	29	25
18 April	Wuzed	Mohammad Gul	40	10	0	0
18 April	Chilkand	Sarwar	32	13	0	0
19 April	Goz Khun	Mohammad Gul	40	15	0	0
19 April	Ptukh	Sarwar	58	21	0	0
19 April	Neshtkhawar	Sarwar	77	28	0	0
20 April	Sast	Mohammad Gul	0	0	25	2
20 April	Archa	Sarwar	23	9	0	0
20 April	Rochun	Sarwar	30	11	0	0
21 April	Sast	Mohammad Gul	0	0	15	2
21 April	Dehghulaman	Sarwar	90	32	21	12
21 April	Kandkhun	Sarwar	50	17	0	0
22 April	Rorung	Sarwar	120	33	24	11
22 April	Avgarch	Mohammad Gul	220	42	50	10
23 April	Karich	Sarwar	55	21	35	13
24 April	Avgarch	Mohammad Gul	0	0	60	10
25 April	Qila-e Panja	Mohammad Gul	120	20	0	0
26 April	Sarkand	Mohammad Gul	65	10	0	0
26 April	Qila-e Panja	Mohammad Gul	200	6	0	0
26 April	Pikut	Mohammad Gul	0	0	5	0
27 April	Pikut	Mohammad Gul	91	20	0	0
28 April	Avgarch	Mohammad Gul	0	0	10	2
29 April	Avgarch	Mohammad Gul	0	0	5	1
30 April	Avgarch	Mohammad Gul	10	3	15	2
8 May	Pak	Mohammad Gul	89	10	0	0
9 May	Pakuy	Mohammad Gul	98	20	0	0
Totals			**2178**	**496**	**763**	**224**

Appendix 2

Date, location and number of adult and young cattle and yak vaccinated against foot-and-mouth disease in September and October 2011, Wakhan District, Badakhshan Province, Afghanistan

Date	Location	Leading paravet	Adult cattle	Young cattle	Adult yak	Young yak
22 September	Wuzed Valley	Mohammad Gul	0	0	47	10
23 September	Vagd Boi	Mohammad Gul	0	0	82	20
24 September	Sargez Valley	Mohammad Gul	0	0	25	10
24 September	Daliz Pass (down)	Sarwar	0	0	32	13
24 September	Saq Big	Sarwar	0	0	64	18
25 September	Sargez Valley	Mohammad Gul	0	0	35	10
25 September	Ruun	Sarwar	0	0	145	47
26 September	Asan Katich	Mohammad Gul	0	0	100	45
26 September	Wuzirm	Sarwar	0	0	61	13
26 September	Spanderbok	Mohammad Gul	0	0	30	5
27 September	Mulung Than	Mohammad Gul	0	0	55	15
27 September	Kund-a-Thur	Mohammad Gul	0	0	25	5
27 September	Nasir Karaw	Sarwar	0	0	120	27
28 September	Ganj Khatun	Mohamamd Gul	0	0	21	4
28 September	Nawabad Warm	Sarwar	0	0	144	40
29 September	Nakchirshitk	Mohammad Gul	0	0	40	18
29 September	Bajqir	Sarwar	0	0	100	34
29 September	Manjulak	Mohammad Gul	0	0	0	21
30 September	Bulok	Mohammad Gul	0	0	47	20
30 September	Wuch Raowen	Sarwar	0	0	80	15
30 September	Buqbun	Mohammad Gul	0	0	6	5
1 October	Qabal Gah	Mohammad Gul	0	0	70	15
1 October	Darah Big	Mohammad Gul	0	0	32	13
1 October	Ghareen Warm	Sarwar	0	0	48	23
2 October	Ghareen Shpodkis	Sarwar	0	0	180	52
2 October	Senin	Mohammad Gul	0	0	0	6
2 October	Sot Vijeetk	Sarwar	0	0	32	7
3 October	Sang Nevishta	Sarwar	0	0	52	11
3 October	Limil	Sarwar	0	0	46	14
5 October	Sarah-e Broghil	Sarwar	180	64	20	0
5 October	Goz Khun	Mohammad Gul	40	10	0	0
5 October	Chilkand	Sarwar	100	37	0	0
6 October	Sast	Mohammad Gul	40	5	0	0
6 October	Ptukh	Sarwar	25	11	0	0
6 October	Korkut	Sarwar	28	8	0	0
7 October	Kandsir	Sarwar	0	0	65	18
7 October	Suikunj	Sarwar	37	13	0	0

7 October	Qila-e Wust	Mohammad Gul	50	10	0	0
7 October	Kret	Mohammad Gul	15	5	0	0
7 October	Nirs	Sarwar	40	15	0	0
8 October	Baba Tungi	Mohammad Gul	25	5	0	0
8 October	Sargez	Mohammad Gul	35	5	0	0
8 October	Archa	Sarwar	26	8	0	0
9 October	Kipkut	Mohammad Gul	20	5	0	0
9 October	Neshtkhawar	Sarwar	60	21	0	0
10 October	Shelk	Mohammad Gul	25	5	0	0
10 October	Rochun	Sarwar	33	7	0	0
11 October	Wuzed	Mohammad Gul	130	5	0	0
11 October	Dehghulaman	Sarwar	85	23	0	0
12 October	Kandkhun	Sarwar	34	8	0	0
12 October	Sast	Mohammad Gul	14	6	0	0
13 October	Karich	Sarwar	30	11	0	0
13 October	Avgarch	Mohammad Gul	130	20	0	0
14 October	Rorung	Sarwar	64	25	0	0
14 October	Pikut	Mohammad Gul	25	5	0	0
14 October	Qila-e Panja	Mohammad Gul	150	55	0	0
16 October	Sarkand	Mohammad Gul	109	14	0	0
Totals			**1550**	**406**	**1804**	**554**

Appendix 3

Result of tuberculin skin tests for detection of bovine tuberculosis in cattle of Lower Wakhan, Wakhan District, Badakhshan Province, Afghanistan

Location	Sex	Age (yr)	Date (initial)	Skin fold initial (mm)	Skin fold final (mm)	Difference (mm)	Interpretation
Wergund Bala	F	8	09-10-2011	6	6	0	Negative
Wergund Bala	F	5	09-10-2011	6	6	0	Negative
Wergund Bala	F	10	09-10-2011	5.5	5.7	+ 0.2	Negative
Wergund Bala	F	5	09-10-2011	6.1	6.1	0	Negative
Wergund Bala	F	10	09-10-2011	4.5	4.6	+ 0.1	Negative
Wergund Bala	F	12	09-10-2011	6.5	6.5	0	Negative
Wergund Bala	F	6	09-10-2011	6	6	0	Negative
Wergund Bala	F	8	09-10-2011	5.5	5.8	+ 0.3	Negative
Wergund Bala	F	6	09-10-2011	5.5	7	+ 1.5	Negative
Wergund Bala	F	8	09-10-2011	6.2	6.5	+ 0.3	Negative
Wergund Bala	M	7	09-10-2011	6	6.9	+ 0.9	Negative
Wergund Bala	F	5	09-10-2011	5.1	5.4	+ 0.3	Negative
Wergund Bala	F	5	09-10-2011	5.2	5.2	0	Negative

Wergund Bala	F	10	09-10-2011	5	5	0	Negative
Wergund Bala	F	3	09-10-2011	6	6.7	+ 0.7	Negative
Wergund Bala	F	6	09-10-2011	5.4	5.9	+ 0.4	Negative
Wergund Bala	F	9	09-10-2011	6.7	6.7	0	Negative
Wergund Bala	F	10	09-10-2011	5.8	6	+ 0.2	Negative
Wergund Bala	F	3	09-10-2011	6.7	6.7	0	Negative
Wergund Bala	F	8	09-10-2011	5	5	0	Negative
Wergund Payan	F	6	09-10-2011	5.7	5.8	+ 0.1	Negative
Wergund Payan	F	1	09-10-2011	6.3	6.3	0	Negative
Wergund Payan	F	1	09-10-2011	8.2	8.8	+ 0.6	Negative
Wergund Payan	F	6	09-10-2011	6	6.4	+ 0.4	Negative
Wergund Payan	F	2	09-10-2011	5.8	5.8	0	Negative
Wergund Payan	F	2	09-10-2011	5	5.5	0	Negative
Wergund Payan	F	1	09-10-2011	5.5.	6.5	+ 1.0	Negative
Wergund Payan	M	3	09-10-2011	8	8	0	Negative
Wergund Payan	F	5	09-10-2011	6.3	6.3	0	Negative
Wergund Payan	M	1	09-10-2011	7.4	7.5	+ 0.1	Negative
Wergund Payan	F	6	09-10-2011	6.3	6.3	0	Negative
Wergund Payan	M	1	09-10-2011	6.2	6.2	0	Negative
Wergund Payan	F	1	09-10-2011	6.2	6.2	0	Negative
Wergund Payan	F	0.5	09-10-2011	5.1	5.1	0	Negative
Wergund Payan	F	5	09-10-2011	4.8	5	+ 0.2	Negative
Digargund	F	5	10-10-2011	5	5	0	Negative
Digargund	F	2	10-10-2011	5.8	5.8	0	Negative
Digargund	M	1	10-10-2011	5.2	5.2	0	Negative
Digargund	M	4	10-10-2011	7	7	0	Negative
Digargund	M	2	10-10-2011	7	7	0	Negative
Digargund	F	6	10-10-2011	5.3	5.6	+ 0.3	Negative
Digargund	F	8	10-10-2011	4.9	5	+ 0.1	Negative
Digargund	F	9	10-10-2011	5	5.8	+ 0.8	Negative
Digargund	F	8	10-10-2011	5.7	6.2	+ 0.5	Negative
Digargund	F	8	10-10-2011	6.5	6.5	0	Negative
Digargund	M	0.5	10-10-2011	5	5	0	Negative
Digargund	M	1	10-10-2011	6	6	0	Negative
Digargund	M	1	10-10-2011	5	6	+ 1.0	Negative
Digargund	F	0.5	10-10-2011	5.4	6.2	+ 0.8	Negative
Digargund	F	0.5	10-10-2011	5.6	5.6	0	Negative
Digargund	F	3	10-10-2011	6.3	6.3	0	Negative
Digargund	F	4	10-10-2011	5.9	5.9	+ 0.2	Negative
Digargund	F	5	10-10-2011	6.9	6.9	+ 0.1	Negative
Digargund	M	0.5	10-10-2011	4.9	6.1	+ 1.2	Negative

Digargund	F	0.5	10-10-2011	5.5	5.5	0	Negative
Digargund	F	10	10-10-2011	5.6	5.6	0	Negative
Digargund	F	5	10-10-2011	8	8.6	+ 0.6	Negative
Digargund	M	0.5	10-10-2011	5.8	5.8	0	Negative
Sar Shkhawar	F	1	10-10-2011	5.5	5.5	0	Negative
Sar Shkhawar	F	3	10-10-2011	5	5	0	Negative
Sar Shkhawar	F	3	10-10-2011	5.5	5.5	0	Negative
Sar Shkhawar	F	4	10-10-2011	4.9	4.9	0	Negative
Sar Shkhawar	F	2	10-10-2011	6.5	6.5	0	Negative
Sar Shkhawar	F	2	10-10-2011	5.3	5.3	0	Negative
Sar Shkhawar	F	4	10-10-2011	5	5.5	+ 0.5	Negative
Sar Shkhawar	F	3	10-10-2011	7	7	0	Negative
Sar Shkhawar	F	6	10-10-2011	5	5	0	Negative
Sar Shkhawar	M	4	10-10-2011	7	7	0	Negative
Sar Shkhawar	M	10	10-10-2011	7.2	7.6	+ 0.4	Negative
Sar Shkhawar	M	11	10-10-2011	6.9	6.9	0	Negative
Sar Shkhawar	F	1	10-10-2011	6.8	6.8	0	Negative
Sar Shkhawar	F	6	10-10-2011	6.8	6.8	0	Negative
Sar Shkhawar	M	12	10-10-2011	9.5	9.5	0	Negative
Sar Shkhawar	M	10	10-10-2011	9.2	9.5	+ 0.3	Negative
Sar Shkhawar	M	4	10-10-2011	9.2	9.2	0	Negative
Sar Shkhawar	M	8	10-10-2011	9.5	10	+ 0.5	Negative
Sar Shkhawar	M	1	10-10-2011	9.3	9.4	+ 0.1	Negative
Sar Shkhawar	M	1	10-10-2011	8.7	8.8	+ 0.1	Negative
Sar Shkhawar	M	8	10-10-2011	7.5	9	+ 1.5	Negative
Sar Shkhawar	M	4	10-10-2011	9.4	9.4	0	Negative
Sar Shkhawar	M	6	10-10-2011	8	8	0	Negative
Shkhawar	M	1	10-10-2011	5.2	5.2	0	Negative
Shkhawar	M	2	10-10-2011	6.5	6.7	+ 0.1	Negative
Shkhawar	M	2	10-10-2011	6.8	7.3	+ 0.5	Negative
Shkhawar	F	5	10-10-2011	5.7	5.7	0	Negative
Shkhawar	F	6	10-10-2011	6.1	6.2	+ 0.1	Negative
Shkhawar	F	2	10-10-2011	7	7	0	Negative
Shkhawar	F	2	10-10-2011	5.5	5.5	0	Negative
Shkhawar	F	2	10-10-2011	7	7	0	Negative
Shkhawar	M	2	10-10-2011	6.1	6.1	0	Negative
Shkhawar	F	5	10-10-2011	5.2	5.2	0	Negative
Shkhawar	F	6	10-10-2011	5.8	5.8	0	Negative
Shkhawar	M	2	10-10-2011	8	8.4	+ 0.4	Negative
Shkhawar	M	2	10-10-2011	5.5	6.1	+ 0.6	Negative
Shkhawar	F	1	10-10-2011	6.6	6.6	0	Negative

Keshnikhun	F	6	11-10-2011	5.5	5.6	+ 0.1	Negative
Keshnikhun	F	9	11-10-2011	5.6	5.3	- 0.3	Negative
Keshnikhun	M	2	11-10-2011	6.8	7.3	+ 0.5	Negative
Keshnikhun	F	8	11-10-2011	5.6	6.4	+ 0.8	Negative
Keshnikhun	M	7	11-10-2011	6.8	7.4	+ 0.6	Negative
Keshnikhun	M	2	11-10-2011	8.8	8.8	0	Negative
Keshnikhun	F	1	11-10-2011	6	6	0	Negative
Keshnikhun	F	4	11-10-2011	6.1	6.6	+ 0.5	Negative
Keshnikhun	F	5	11-10-2011	5.6	5.8	+ 0.2	Negative
Keshnikhun	M	3	11-10-2011	8.7	8.7	0	Negative
Keshnikhun	M	5	11-10-2011	11.6	11.8	+ 0.2	Negative
Keshnikhun	F	12	11-10-2011	5.7	5.7	0	Negative
Keshnikhun	M	9	11-10-2011	6.9	6.9	0	Negative
Keshnikhun	M	8	11-10-2011	10	10	0	Negative
Keshnikhun	F	4	11-10-2011	5.4	5.7	+ 0.3	Negative
Keshnikhun	M	2	11-10-2011	5.8	5.8	0	Negative
Keshnikhun	F	4	11-10-2011	6	6.4	+ 0.4	Negative
Keshnikhun	M	7	11-10-2011	6.8	6.9	+ 0.1	Negative
Keshnikhun	F	6	11-10-2011	5.5	5.5	0	Negative
Keshnikhun	F	8	11-10-2011	6.9	6.9	0	Negative
Keshnikhun	F	8	11-10-2011	9.4	9.5	+ 0.1	Negative
Keshnikhun	F	1	11-10-2011	6.7	6.8	+ 0.1	Negative
Keshnikhun	F	8	11-10-2011	4.5	6	+ 1.5	Negative
Keshnikhun	F	8	11-10-2011	5	5	0	Negative
Keshnikhun	F	8	11-10-2011	6.5	6.9	+ 0.4	Negative
Wark	M	6	11-10-2011	9.2	9.2	0	Negative
Wark	M	5	11-10-2011	7.3	7.8	+ 0.5	Negative
Wark	M	4	11-10-2011	8.4	9.7	+ 1.3	Negative
Wark	M	4	11-10-2011	7.2	8.9	+ 1.7	Negative
Wark	M	4	11-10-2011	7.1	7.5	+ 0.4	Negative
Wark	M	9	11-10-2011	5.5	7	+ 1.5	Negative
Wark	M	7	11-10-2011	6.2	6.9	+ 0.7	Negative
Wark	M	9	11-10-2011	6	7.9	+ 1.9	Negative
Wark	M	5	11-10-2011	10	10.2	+ 0.2	Negative
Wark	F	1	11-10-2011	4.7	4.7	0	Negative
Wark	F	1	11-10-2011	4.5	5.5	+ 1.0	Negative
Wark	M	1	11-10-2011	5.7	5.9	+ 0.2	Negative
Wark	M	9	11-10-2011	5.6	5.8	+ 0.2	Negative
Wark	M	4	11-10-2011	10	10	0	Negative
Wark	F	8	11-10-2011	4.2	4.4	+ 0.2	Negative
Wark	F	9	11-10-2011	6.1	6.6	+ 0.5	Negative

Wark	F	7	11-10-2011	5.4	6.1	+ 0.7	Negative
Wark	F	4	11-10-2011	4.1	5.3	+ 1.2	Negative
Wark	F	1	11-10-2011	4.6	4.6	0	Negative
Wark	M	1	11-10-2011	3.8	3.8	0	Negative
Wark	F	1	11-10-2011	5	5.2	+ 0.2	Negative
Wark	M	2	11-10-2011	8	8	0	Negative
Qazideh	M	7	11-10-2011	9.2	9.2	0	Negative
Qazideh	M	8	11-10-2011	7.1	7.7	+ 0.6	Negative
Qazideh	M	10	11-10-2011	8.8	9.2	+ 0.4	Negative
Qazideh	M	5	11-10-2011	5.9	7.4	+ 1.5	Negative
Qazideh	F	10	11-10-2011	5	5.5	+ 0.5	Negative
Qazideh	F	9	11-10-2011	5.3	5.1	- 0.2	Negative
Qazideh	F	5	11-10-2011	7.2	7.2	0	Negative
Qazideh	F	7	11-10-2011	7.5	7.5	0	Negative
Qazideh	F	1	11-10-2011	6.7	6.9	+ 0.2	Negative
Qazideh	F	4	11-10-2011	4.5	4.5	0	Negative
Qazideh	F	4	11-10-2011	5.7	5.7	0	Negative

Appendix 4

Results of latex agglutination tests for detection of seroprevalence to contagious caprine pleuropneumoniae in 66 domestic goats, Wakhan District, Badakhshan Province, Afghanistan

Date	Location	Age (yr)	Sex	Health status	Test result[1]
22-June	Sarkand	2	Female	Healthy	Negative
22-June	Sarkand	3	Male	Healthy	Negative
22-June	Sarkand	2	Female	Healthy	Negative
22-June	Sarkand	3	Female	Healthy	Negative
22-June	Sarkand	3	Female	Healthy	Negative
22-June	Sarkand	2	Female	Healthy	Negative
22-June	Sarkand	2	Female	Healthy	Negative
22-June	Sarkand	3	Female	Healthy	Negative
23-June	Qila-e Panja	3	Female	Healthy	Negative
23-June	Qila-e Panja	3	Female	Healthy	Negative
23-June	Qila-e Panja	2	Female	Healthy	Negative
23-June	Qila-e Panja	4	Female	Healthy	Negative
23-June	Qila-e Panja	4	Female	Healthy	Negative
23-June	Qila-e Panja	4	Female	Healthy	Negative
23-June	Qila-e Panja	1	Female	Healthy	Negative
23-June	Qila-e Panja	4	Female	Healthy	Negative
24-June	Qila-e Panja	2	Female	Healthy	Negative

24-June	Qila-e Panja	2	Female	Healthy	Negative
24-June	Qila-e Panja	2	Female	Healthy	Negative
24-June	Qila-e Panja	3	Male	Healthy	Negative
24-June	Qila-e Panja	3	Male	Healthy	Negative
24-June	Qila-e Panja	4	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	5	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	4	Female	Healthy	Negative
25-June	Pikut	2	Female	Healthy	Negative
25-June	Pikut	2	Female	Healthy	Negative
25-June	Pikut	2	Female	Healthy	Negative
25-June	Pikut	2	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
25-June	Pikut	3	Female	Healthy	Negative
29-June	Pikut	4	Female	Healthy	Negative
25-June	Avgarch	4	Female	Healthy	Negative
29-June	Avgarch	5	Female	Healthy	Negative
29-June	Avgarch	3	Female	Healthy	Negative
29-June	Avgarch	3	Female	Healthy	Negative
29-June	Avgarch	3	Female	Healthy	Negative
29-June	Avgarch	4	Female	Healthy	Negative
29-June	Avgarch	4	Female	Healthy	Negative
29-June	Avgarch	4	Female	Healthy	Negative
29-June	Avgarch	2	Female	Healthy	Negative
29-June	Avgarch	2	Female	Healthy	Negative
29-June	Avgarch	3	Female	Healthy	Negative
29-June	Avgarch	5	Female	Healthu	Negative
30-Jun	Sast	3	Female	Healthy	Negative
30-Jun	Sast	5	Female	Healthy	Negative
30-Jun	Sast	3	Female	Healthy	Negative
30-Jun	Sast	5	Female	Healthy	Negative

30-Jun	Sast	2	Female	Healthy	Negative
30-Jun	Sast	3	Female	Healthy	Negative
30-Jun	Sast	4	Female	Healthy	Negative
30-Jun	Sast	4	Female	Healthy	Negative
30-Jun	Sast	3	Female	Healthy	Negative
10-July	Dan Abakhan	4	Female	Healthy	Negative
10-July	Dan Abakhan	5	Female	Healthy	Negative
14-July	Zarnaw	7	Male	Healthy	Negative

[1]Latex Agglutination Test, Caprilat™, Veterinary Laboratories Agency, UK

Appendix 5

Details of urial sheep (*Ovis vignei*) observations made by the two teams led by WCS veterinarians during the April-May 2011 wild ungulate survey, Wakhan District, Badakhshan Province, Afghanistan

Date	Team[1]	Group size	Location	Longitude[2]	Latitude	Altitude (m asl)
15-Apr-11	2	2	Qazideh	742310	4058771	3665
16-Apr-11	2	7	Shkhawar	760744	4069220	2770
19-Apr-11	2	13	Wergund Payan	236789	4077141	3104
20-Apr-11	2	14	Shkhawr	235871	4077879	-
21-Apr-11	1	2	Regijurm	243160	4080419	3201
21-Apr-11	1	1	Regijurm	242595	4079324	3533
21-Apr-11	1	4	Regijurm	242446	4079492	3426
21-Apr-11	2	9	Regijurm	244037	4080724	3394
24-Apr-11	1	3	Kandud	263318	4091489	3319
24-Apr-11	2	5	Ezag	264238	4092142	3825
27-Apr-11	2	1	Pikut	290229	4095721	3425
27-Apr-11	2	3	Pikut	290135	4095756	3478

[1]Team "1" was led by Ali Madad Rajabi and Team "2" by Hafizullah Noori.
[2]UTM Zone 42 or 43, WGS84,

Appendix 6

Details of Himalayan ibex (*Capra sibirica*) observations made by the two teams led by WCS veterinarians during the April-May 2011 wild ungulate survey, Wakhan District, Badakhshan Province, Afghanistan

Date	Team[1]	Group size	Location	Longitude[2]	Latitude	Altitude (m asl)
15-April	1	2	Fitr	736485	4058357	3117
15-April	1	3	Fitr	736792	4057311	3164
15-April	1	35	Fitr	737802	4057233	3312
15-April	2	10	Wuzhdagh	741292	4059714	3264
15-April	2	6	Wuzhdagh	745526	4059119	3776

16-April	1	12	Fitr	736365	4057585	3365
16-April	1	10	Fitr	736159	4057332	3401
16-April	1	3	Fitr	735977	4056736	3580
17-April	2	13	Wuzhdagh	764313	4060196	3457
17-April	2	13	Shkhawar	767423	4058796	3457
17-April	2	46	Wergund Payan	238268	4076455	3592
18-April	2	9	Shkhawar	764172	4061128	3326
18-April	1	16	Wergund Payan	235717	4074889	3227
18-April	1	27	Wergund Payan	235896	4074481	3253
18-April	1	17	Wergund Payan	236826	4073134	3363
18-April	1	15	Wergund Payan	237268	4073545	3469
19-April	2	9	Wergund Payan	231967	4077017	3829
19-April	1	7	Wergund Payan	236153	4077031	3018
21-April	1	7	Regijurm	242399	4079320	3351
21-April	2	2	Regijurm	243631	4080005	3526
21-April	2	4	Regijurm	244233	4080063	3693
22-April	2	6	Regijurm	255067	4080132	3833
22-April	2	18	Pagish	253607	4085622	3193
22-April	2	12	Pagish	255068	4080131	3831
22-April	2	7	Pagish	255069	4080134	3832
22-April	2	2	Pagish	253677	4085155	3253
22-April	1	23	Yamit	257149	4089068	3378
22-April	1	3	Pagish	255528	4088127	3553
23-April	1	7	Yamit	258185	4089871	3126
23-April	1	62	Yamit	259701	4089992	3641
24-April	1	32	Khandud	262927	4091912	3498
24-April	2	5	Ezag	264238	4092142	3825
25-April	2	7	Pakuy	274587	4093676	4107
25-April	1	87	Pak	280491	4094323	3877
27-April	1	19	Pikut	291125	4094866	3319
27-April	1	4	Pikut	291178	4094775	3229
27-April	1	3	Pikut	292969	4091038	3323
27-April	1	15	Pikut	290511	4096594	3689
27-April	2	15	Pikut	290625	4096010	3193
27-April	2	2	Pikut	289480	4095138	3609
27-April	2	12	Pikut	388771	4093388	3884
27-April	2	8	Pikut	288770	4093389	3887
29-April	1	13	Sast	304613	4092805	3102
29-April	1	9	Sast	304581	4092528	3074
29-April	1	10	Sast	304522	4091181	3078
30-April	1	18	Sast	305761	4093169	3480

30-April	2	8	Kuzget	317561	4091155	3080
2-May	2	7	Kandkhun	330914	4091151	3374
2-May	1	7	Dehghulaman	336107	4090307	3563
3-May	2	6	Kandkhun	330195	4091173	3311
3-May	2	6	Kandkhun	330978	4091035	3405

[1]Team "1" was led by Ali Madad Rajabi and Team "2" by Hafizullah Noori.
[2]UTM Zone 42 or 43, WGS84,

Appendix 7

Details of wild carnivore species recorded by the two teams led by WCS veterinarians during the April-May 2011 wild ungulate survey, Wakhan District, Badakhshan Province, Afghanistan

Date	Team[1]	Species	Group size	Location	Longitude[2]	Latitude	Altitude (m asl)
30 April	1	Snow leopard	1	Sast	306561	4093003	3662
4 May	2	Gray wolf	1	Suikunj	357794	4093062	3830

[1]Team "1" was led by Ali Madad Rajabi and Team "2" by Hafizullah Noori.
[2]UTM Zone 42 or 43, WGS84,

Appendix 8

List and location of the 20 ayloqs and grazing areas occupied by livestock in western Big Pamir in September 2011, Wakhan District, Badakhshan Province, Afghanistan.

No	Name	Grazing area	Longitude[2]	Latitude	Altitude (m asl)
1	Saraghil[1]	Manjulak	NR	NR	NR
2	Ganj Khatun	Manjulak	314933	4121871	4096
3	Nakchirshitk	Manjulak	316594	4123156	4001
4	Chashmayeen	Manjulak	314465	4115028	4034
5	Manjulak	Manjulak	321123	4123885	4084
6	Buqbun	Jermasirt	332239	4127424	4186
7	Bulok	Jermasirt	329381	4126507	4373
8	Lupghil Khshun	Jermasirt	332989	4126304	4335
9	Jabar Khan	Jermasirt	334645	4129140	4278
10	Senin	Senin	302638	4114015	3466
11	Pursang	Senin	300860	4112544	3237
12	Yop Goz[3]	Senin	NR	NR	NR
13	Khushabad	Shikargah	316226	4104633	4269
14	Asan Katich	Shikargah	314472	4105904	4237
15	Kund-a-Thur	Shikargah	315380	4109151	4219
16	Mulung Than	Sikargah	313734	4107799	NR
17	Qabal Gah	Shikargah	311535	4117933	3811

18	Darah Big	Shikargah	318620	4113248	4115
19	Wuzed Valley	Wuzed	305560	4101368	4060
20	Sargez Valley	Sargez	319213	4097911	4458

[1]Only the approximate location is available; 321123 4123885, alt 4084 m asl

[2]UTM Zone 43, WGS84

[3]No geolocation is available. The settlement is located in western Big Pamir, about 2 km south-east of the Pamir River between Goz Khun Village and Brikharv locality.

Appendix 9

List of people trained by the WCS Ecosystem Health Team in 2011, Wakhan District, Badakhshan Province, Afghanistan.

No.	Name	Address	Gender	Training topic	Training period
1	Ali Mohammad	Wergund Bala	Male	Wildlife monitoring	3 weeks / April-May
2	Sayeed Kazim	Sargez	Male	Wildlife Monitoring	3 weeks / April-May
3	Khalam Big	Suikunj	Male	Wildlife Monitoring	3 weeks / April-May
4	Hadina Big	Kuzget	Male	Wildlife Monitoring	3 weeks / April-May
5	Ayob	Qila-e Panja	Male	Livestock Monitoring	10 days / September
6	Erkan	Goz Khun	Male	Livestock Monitoring	10 days / September
7	Lala Jan	Sast	Male	Livestock Monitoring	10 days / September
8	Ghulam Husain	Pak	Male	Livestock Monitoring	10 days / September
9	Fahim	Feyzabad	Male	Animal health	1 month / June-July
10	Inayat	Qila-e Panja	Male	Trekking organization	2 weeks / September-October
11	Juma Gul	Goz Khun	Male	Trekking organization	1 month / June-July
12	Sangin Mohammad	Goz Khun	Male	Small carnivore trapping	2 days / October
13	Mohammad Gul	Avgarch	Male	Animal health	Continuing / Year round
14	Sarwar	Khandkhun	Male	Animal health	Continuing / Year round