TREWEEK
ENVIRONMENTAL CONSULTANTS

Survey of Brown Bear *Ursus arctos* at Amulsar (Armenia)

Interim Report

October 2015

TREWEEK
ENVIRONMENTAL CONSULTANTS

CONTENTS

EXECUTIVE SUMMARY

A baseline assessment of Brown Bear (*Ursus arctos)* was carried out by Treweek Environmental Consultants (TEC), Alberta Innovates (AI) and the Institute of Zoology (IoZ) of the Armenian National Academy of Science (NAS) from April to October 2015 to assess the potential impact of the proposed gold mining project at Amulsar, Armenia ("the Project"), on the species.

Brown Bear is a species of national conservation concern in Armenia and the Project area is critical habitat for the species in relation to Performance Requirement 6 (PR6) of the European Bank for Reconstruction and Development (EBRD). The main objective of the survey was to provide baseline information on the population of Brown Bear affected by the proposed Amulsar mine, so that the importance of the Project-affected area and the significance of Project impacts on the population could be interpreted and mitigation measures (including offsets if needed) could be identified for significant adverse effects.

A study area of 733 km² was divided into 34 squares of 5x5 km and a camera trap was placed in each of these squares, positioned to photograph a “hair trap” used for non-invasive genetic tagging (NGT). The results will be analysed to identify the different individuals present and to support estimates of population size. At the time of writing the interim report (October 2015), all of the genetic testing remains to be done, so this analysis is not yet possible. It is therefore impossible to draw firm conclusions about the population size and density of Brown Bears in the survey area. However, data from the camera traps already provide some insight into presence/absence of bears in a particular square, which parts of the survey area are used by the species and the suitability of different areas as bear habitat.

From mid May to the end of September 2015 the camera traps captured a total of 2,422 pictures of Brown Bears. Of the 34 camera sites, 28 were visited by at least one bear, 23 more than once, and 15 by more than one bear. Females with cubs were photographed at 9 sites; however, this does not include square 15, where a mother with cubs was seen in late April.

Activity of bears throughout the study area is presented in the report as the number of “bear days” for each square, i.e. the number of days on which the camera took photographs of a bear. While this method of presentation is not flawless since, for example, it does not distinguish between three consecutive days (a short visit) and three days spread over a period of several months (indicating

continued presence of bears in the square), it does give an idea of the parts of the study area where bear activity was concentrated.

From our data it is clear that repeated bear activity was mainly found in the following areas (in order of importance):

- Herher State Sanctuary (squares 16-17, with 39 “bear days” in the latter).
- southern slopes of Amulsar (Arshak set-aside, square 23, with 24 “bear days”).
- woodlands between Amulsar and Saravan (square 22, with 17 “bear days”).

To a lesser extent, bear activity was also notable in:

- the wooded valley west of Kechut lake (squares 8 and 12, with 8 “bear days” in the latter).
- the Arpa river valley in Jermuk Hydrological State Park (square 5, with 6 “bear days”).
- the wooded valley along Artavan Road, and the mountains southeast of Artavan village (squares 24 and 30, with 5 “bear days” in the latter).

The data analysis will reveal the number and identity of bears photographed in these locations. Bears move large distances so the photographs (and “bear days”) could be of the same individuals in different locations. The preliminary data do confirm that bears use habitat in the wider landscape and are not just confined to habitat on Amulsar. The results also confirm the likely suitability of the proposed Jermuk National Park to provide offsets for residual impacts of the mining project on Brown Bear.

Between early June and 1 October 2015, a total of 203 hair samples were collected from 23 squares. This means that in some squares (9 to be precise) bears were photographed but did not leave any hairs. Most samples were encountered in the wooded valley west of Kechut Lake (especially at the southern edge of square 8), in the woodland between Amulsar and Saravan, in Herher State Park, and on the southern slopes of Amulsar (Arshak set-aside). Not surprisingly, these are also the same areas that show a lot of bear activity in terms of “bear days”, but one difference is that quite a lot of samples were found in the woodlands east of Jermuk/Kechut (e.g. 13 samples in square 14). It could be argued that a large number of hair samples in a square is a sign of territorial behaviour and therefore continued presence of bears, which would indicate that these woodlands are also an important area for the species. Likewise, the area around Shaghat village (square 38) may be more important than suggested by the camera trap results. However, at this stage it cannot yet be

excluded that a large number of hairs may simply have been the result of one or a few visits by a heavily moulting bear.

Although analysis of the data is needed to confirm the population size, density and habitat use in the study area, wide use of the landscape by Brown Bear can be confirmed on the basis of this survey. Numerous observations and photographs confirm that the southern slopes of Amulsar are critical habitat for the species, with frequent records and use for breeding.

Cameras also confirm presence of other threatened mammals like Bezoar Goat and Eurasian Lynx in the Arshak Set-Aside area. However other areas are also frequently used at least for foraging and there were sufficient observations of mothers with cubs elsewhere in the Study Area to confirm that Amulsar is not the only breeding habitat in the landscape. Other areas that appear to be important habitat for bears include the woodland between Amulsar and Saravan and Herher State Sanctuary.

Disturbance during construction and operation, Project footprint and activities and barrier effects (such as the planned conveyor corridor) are all likely to have an impact on the local bear population, reducing feeding habitat and availability of undisturbed breeding habitat. Altered distributions and behaviour patterns are likely. The conveyor corridor will include a lot of mining infrastructure (earth platforms, service roads, ponds) and will be noisy, with frequent vehicle movements and lighting. Bears will try to avoid the entire corridor, but may need crossings if other options are closed off due to human activity.

The Project's mitigation strategy is to preserve the Arshak area as set-aside and to respect a buffer zone between the closest open pit area (Tigranes – Artavzdes) and this set-aside. Depending on the responses of bears to levels of disturbance, they may be displaced. Continued monitoring will therefore take place through the Project's Biodiversity Monitoring and Evaluation Plan. Monitoring will take place initially in the Amulsar – Gndevaz – Saravan region (Lydian license area) so that the residual impact can be confirmed and specific offset activities designed accordingly, but the monitoring programme will have to be refined when data analysis is complete.

Safe passage of bears westward from the set-aside area through the woodlands near Ughedzor and Saravan (squares 22 and 26) is important and needs to be discussed with communities to ensure safety for people and wildlife. This will be reflected in the Species Action Plan. In addition, the need for crossings over the planned conveyor corridor is being reviewed. However use of crossings is difficult to confirm. Continued long-term use of Amulsar for breeding cannot be assured and

therefore an offset will likely be needed for residual impact on Amulsar bears and other species such as Eurasian Lynx (listed as 'Endangered' at European level by IUCN), Grey Wolf and Bezoar Goat (the latter included in Annex II and IV of the European Habitat Directive and also listed in the Armenian Red Book). The preliminary results of this baseline survey suggest that the proposed Jermuk National Park / Natural Habitat Offset can provide a suitable offset for impacts on these species, as small numbers of them already appear to be present in this area and they all have suitable habitat present, but are adversely affected by hunting, over-grazing and road-construction. Through targeted interventions to control these threats and pressures within the proposed National Park, it should be possible to increase the potential of this area for these species and demonstrate a net positive impact. The required gain will be quantified and proposals for positive outcome finalised in summer 2016, when all survey data including the results of genetic testing are analysed.

1 INTRODUCTION

Lydian International (Lydian) and Geoteam CJSC (Geoteam) requested Treweek Environmental Consultants (TEC), Alberta Innovates (AI) and the Institute of Zoology (IoZ) of the National Academy of Science (NAS) of the Republic of Armenia to undertake a baseline assessment of Brown Bear (*Ursus arctos)* potentially affected by its proposed gold mining project at Amulsar, Armenia ("the Project"). This report presents the interim findings and observations from surveys undertaken in 2015, prior to final analysis of data (see 3.4).

1.1 Background

Ursus arctos is a priority species due to its conservation status in the country and within the region (see below). Regular use of Amulsar Mountain by breeding bears was confirmed during ecological baseline surveys carried out for the Project Environmental and Social Impact Assessment (ESIA, Lydian International Ltd., 2014). The Project will cause loss of habitat, disturbance and barrier effects, the significance of which could not be interpreted without more detailed baseline information. The IFC and EBRD therefore required a baseline survey to confirm the number of Brown Bears affected by the Project and to establish their level of dependence on the Project-affected area for survival. The survey needed to cover parts of the surrounding landscape so that the significance of impacts could be assessed and so that consequences of displacing bears to alternative habitat could be determined and suitable offsets identified.

1.1.1 Conservation Status of Brown Bear

- The Brown Bear *Ursus arctos* is protected in Armenia and is included in the national Red Data Book with a status of Vulnerable (Margarian 1987). Hunting of this species is illegal in the country. The species is protected by the Law on Fauna[1], which states that "*The users of natural resources, who harm the species mentioned in the Red Book of the Republic of Armenia during economic or other activities, must undertake measures for their protection. Any activity that will result in decrease of the quantity of animal species registered in the Red Book of the Republic of Armenia or will spoil their habitat is prohibited*" (Article 18).

[1] Available at http://faolex.fao.org/docs/texts/arm50257E.doc

- The Armenian population of *Ursus arctos* is of regional conservation concern and is targeted for action in this part of Armenia in the Conservation Plan for the Caucasus Ecoregion (WWF 2012)[2].
- The Project area is critical habitat for Brown Bear in relation to EBRD's Performance Requirement 6 (PR6). EBRD expects clients to follow the spirit of the EU Habitats Directive and Article 12/ Annex II and IV prohibits degradation of habitat for species such as Brown Bear, which is listed on both Annexes.
- As a top predator, Brown Bear is also an important feature of the natural habitat affected by the Project, for which the Project has committed to achieve No Net Loss in accordance with the requirements of IFC's Performance Standard 6 (PS6).

1.2 Objective of the Survey

The main objective of the survey was to provide baseline information on the population of Brown Bear affected by the Amulsar Mine, so that the importance of the Project-affected area and the significance of Project impacts on the population could be interpreted and mitigation measures (including offsets) could be identified for significant adverse effects.

The results of this study will be used to finalise a Species Action Plan for Brown Bear (part of a Biodiversity Action Plan produced to ensure that the Project meets lender requirements relating to biodiversity and ecosystems). They will be used to identify any mitigation or management measures that need to be included in the Project BMP and to identify any further actions needed through the Project's Biodiversity Offset Strategy and Biodiversity Offset Management Plan, as needed.

2 Summary of available information

2.1 National data

A review of available scientific literature carried out for the Environmental and Social Impact Assessment (version 9f; Wardell Armstrong International 2015; Treweek Environmental Consultants 2015) provided limited specific information on bear populations in the region. Reports from the

[2] Available at: http://69.195.124.72/~caucasu1/wp-content/uploads/2012/11/ECP_Ecoregion_Conservation_Plan_Caucasus_2012.pdf

WWF Armenian Office were also reviewed, along with the 2012 revised and amended Ecoregion Conservation Plan for the Caucasus[3].

Few surveys of bears have been carried out in Armenia, or in the South Caucasus Region. According to the Wildlife Data Bank of the Caucasus (NACRES 2003), the bear population in Armenia is unknown. Brown Bear distribution in the South Caucasus region is reported to have contracted significantly since historical times, due to increasing human activity and associated loss of forest cover. Bear numbers have been low in the Lesser Caucasus Mountains, including Armenia, since the middle of the 20th century (Vereshchagin 1958) and the present range is significantly smaller than the historical range (Lortkipanidze, 2010). They are expected to decline further due to ongoing intensification of farming and high levels of hunting, despite protection in law.

The Armenian population was estimated to be 292 bears in the 1970s (Vereshchagin 1972) and only 150 bears in the 1980's (Margarian 1987). In the 1980s, data from governmental hunting districts suggested an increase in population to 600 (Kudaktin and Chestin 1993 in Lortkipanidze, 2010), but without systematic survey these data are difficult to interpret. Discrepancies in the data and the limited extent of surveys (Chestin *et al*. 1992) made it impossible to determine the abundance and trends of bear populations in the Project area, or to evaluate the significance of mining impacts at Amulsar.

2.2 Summary of earlier surveys and results for Amulsar

Observations of bears were noted in baseline surveys of Amulsar dating from 2008. In autumn 2011, more detailed observations were made along 5-7km long linear routes or transects designed to include all biotopes considered to form suitable habitat for both large and medium sized animals in the Project-affected area. Presence of Brown Bear was noted in all these surveys, but the specialists reported that bears were visiting the site, rather than being resident, and that very small numbers were involved.

Further surveys were undertaken by the Armenian Institute of Zoology during 2013 and 2014 and observations were also made by ecological survey teams on Amulsar during ornithological surveys. In

[3] Available at: http://69.195.124.72/~caucasu1/wp-content/uploads/2012/11/ECP_Ecoregion_Conservation_Plan_Caucasus_2012.pdf

2013 and 2014, numerous sightings and signs of Brown Bear were recorded. A number of dens were identified (Plate 1) and numerous footprints could be seen all over the Amulsar mountain tops in spring and summer. Key areas appeared to be the southern side of the mountain, but many tracks and faeces were also found on the western slopes and further west up to Gndevaz village and towards the Arpa gorge. In late May 2014, a female with two cubs was seen southeast of Gndevaz in areas where the mine Heap Leach Facility is proposed, and another female with two cubs was photographed on the southern slopes of Amulsar. These observations caused specialists to revise their opinion and confirm the presence of a breeding population using Amulsar.

Although bear tracks had been seen along the Vorotan Valley (east of Amulsar) in 2011, none were seen in 2013 or 2014, and in focus group surveys for ecosystem services review, herders reported that increasing levels of disturbance in the valley have caused bears to move. Further away from Amulsar Mountain, a male bear was observed east of Jermuk in late April 2013, and footprints were found on the muddy shores of Spandaryan reservoir. This reinforces anecdotal information suggesting that bears are also present in the wider landscape, though no systematic surveys have been done there.

Plate 1. Bear resting in small den in Arshak set-aside, May 2013

3 Approach and Methods

3.1 Survey Area

Because of their intrinsic characteristics (huge territories, low densities, solitary lifestyle), large mammals such as Brown Bear must be monitored over very large areas. They may wander over long distances in search of food, and their feeding range can shift seasonally. As well as being designed to "capture" areas most likely to be affected by the mine, the spatial scope of the baseline survey was designed to incorporate as much of the area proposed for a new Jermuk National Park as possible. Lydian's proposed natural habitat offset focuses on this area and therefore it was important to determine whether it could be expected to provide offsets for any residual impacts on Brown Bear populations in the region.

Figure 1 shows the study area. In addition to Amulsar Mountain (squares 18-23), the Arpa gorge (squares 13, 17-18, 20-21 and 24) and around the Spandaryan reservoir (squares 28-29, 32-33), it included three other large areas that looked promising for Brown Bear based on preliminary field visits:

- The mountain range south of Spandaryan reservoir and south of the towns of Gorayk and Ughedzor (squares 25-38);
- Herher state sanctuary, within the proposed Jermuk National Park, which offers a large expanse of wooded habitat (squares 11-12, 16-17, 20);
- Jermuk hydrological state sanctuary, another area within the proposed Jermuk National Park offering wooded valleys of the type affected by the mining project (squares 1-2, 4-6, 9-10).

The provisional spatial scope for baseline survey intersected 39 grid squares of 5x5 km. However, squares 35-37 were in a military conflict zone along the Armenian – Nakhchivan border and therefore had to be discarded for safety and security reasons. In addition, squares 7 and 29 were almost completely outside the proposed National Park area and were discarded. In practice, the survey was conducted in 34 grid squares.

The area was 733 km² in size and included many different habitats in microclimate zones ranging from semi-arid to alpine and at altitudes ranging from 1,400 to 3,200 m. Settlements within the survey area were the towns of Jermuk, Kechut, Gndevaz, Herher, Artavan, Saravan, Saralanj and Gorayk, while the villages of Tsghuk, Sarnakunk, Spandaryan, Angeghakot and Shaghat were located along its southeastern border. Human presence was not just confined to the villages though; at higher altitudes (above 2,000 m) many herder camps with free ranging livestock are found, and in wooded areas at lower altitudes herb picking is popular. Hunting is prevalent. Other human activities are fishing, tourism, and limited drilling and construction works in the Gndevaz – Amulsar area.

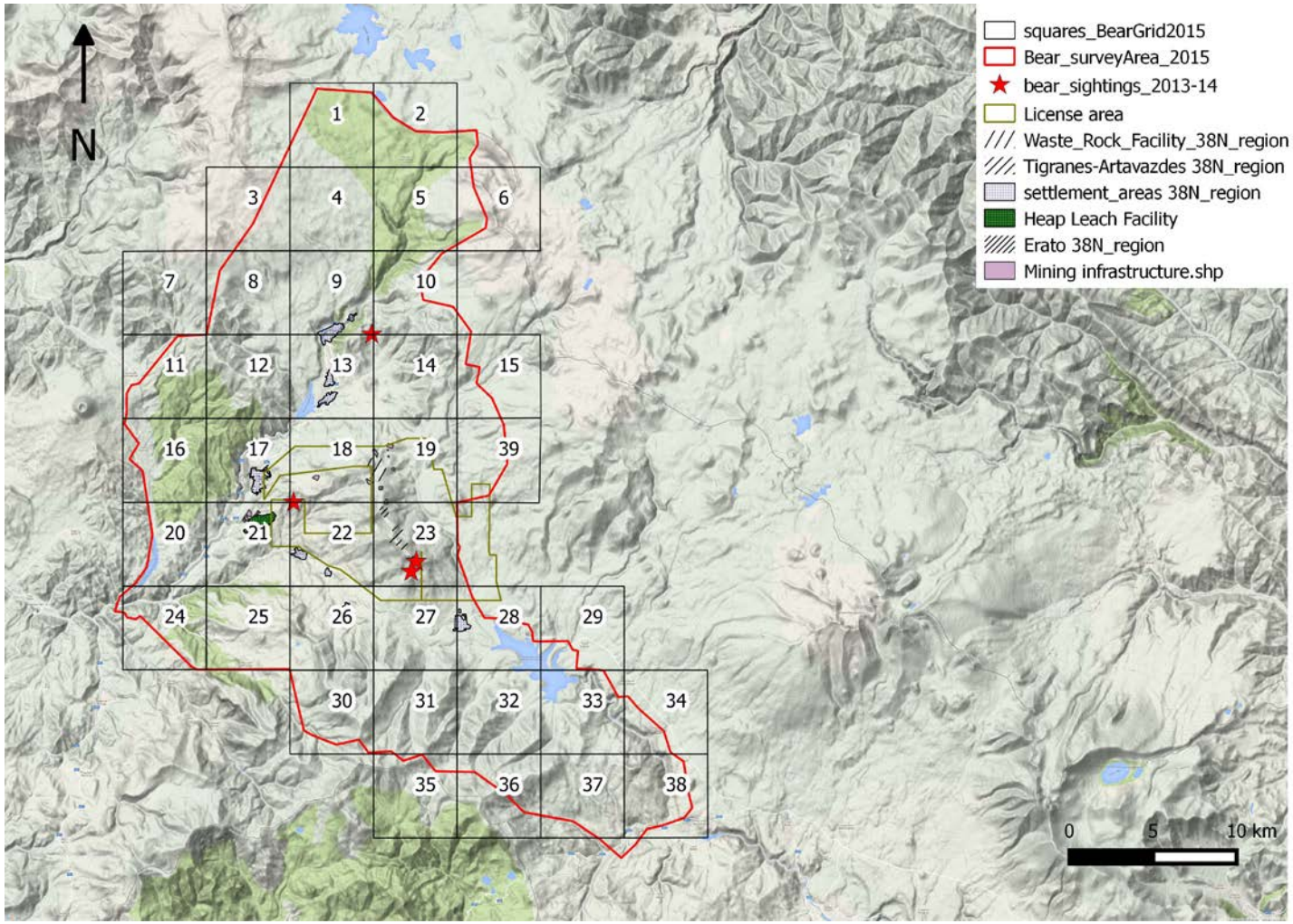

Figure 1. Outline (red) of survey area for Brown Bear, with locations of observations in 2013-14

3.2 Methods for surveying bear numbers and distribution

Two principle non-invasive methods for ascertaining Brown Bear populations exist: non-invasive genetic tagging (NGT) and the systematic use of camera traps. NGT (see De Barba *et al,* 2010) is used to obtain trapped hair follicles to yield DNA samples, which can be amplified and identified to species by mitochondrial analysis. This technique has been used frequently in conservation planning in Canada (e.g. Alberta Grizzly Bear Recovery Plan 2008-2013) as it provides low-cost and high-yield data on species' occurrence and is ideal as an initial step to establish the numbers of different bears in the study area and their genetic inter-relationships.

This technique can carry some error, however; interpretation of false absences is a particular challenge. When a species is not detected at a site, it is not possible to be certain whether a species is truly absent, or is present but has not been detected (MacKenzie *et al*., 2002; MacKenzie, 2005). This error can be corrected for by simultaneously using a second-survey method such as camera trapping.

The use of automatic devices such as infra-red cameras has proved to be an effective method for assessing population numbers and density of Brown Bear (e.g. Nicolini *et al.,* 1997; Fisher *et al*., 2014). Combined with NGT sampling this method is extremely powerful at surveying carnivore populations (Nichols et al., 2007; Fisher & Bradbury, 2014).

A combination of these two techniques was used to assess Brown Bear density, movement and speciation. Use of the two techniques together aids interpretation of results, as it makes false negatives less likely.

Figure 2 shows how the two techniques were combined to give more reliable results: genetic analysis will only be carried out using hairs obtained from sites with bear photos.

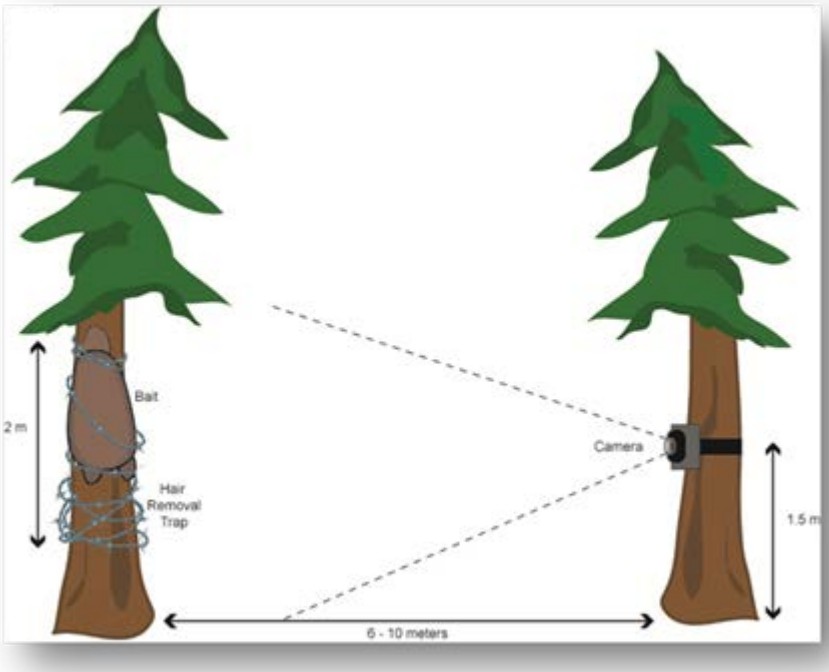

Fig. 2. Relationship between non-invasive genetic tagging (left) and camera traps (right) as methods for surveying Brown Bear (Fisher and Bradbury 2014)

3.2.1 Sampling strategy and survey set up

To get a clear idea of the true density of bears in the area and to avoid reporting any false absences, sampling should occur at a relatively dense scale, e.g. with sampling sites located no more than 5 km from each other. Thus, one sampling site was selected in each 5x5 km grid square. The minimal distance between two sampling sites from neighbouring squares was 1.4 km, the maximum distance always less than 5 km except for site 1, which was at 6.1 km from the nearest one.

The survey started early in spring 2015, when the focus was on detecting den emergence and making observations on apparent age and gender of bears using hibernation/breeding dens on Amulsar Mountain and their movement patterns on emergence. This part of the survey was carried out from the end of February to the end of April. The amount of snow cover at this time of year is ideal for observing bear footprints and all of these were recorded with GPS.

An exploration of the wider area on foot was required to select the ideal sampling locations. This was done from mid April to mid May. The sampling sites were set up from mid May to mid June. The

location of all 34 sites is shown in Figure 3. Each sampling site consisted of a hair trap made by looping approximately 5 m of barbed wire around a tree or boulder and one infrared, motion-triggered Ltl Acorn 6210 MC digital camera placed at a distance of 5-10 m looking directly at the wire. A similar sampling design has been used many times before in North America (e.g. de Barba *et a*l., 2010, Fisher *et al.,* 2013) but only in a wooded environment using trees. We also used trees if they were available (see Plate 2), but large parts of our survey area were entirely devoid of trees and in that case the barbed wire was anchored around big boulders, as shown in Plate 3. Each hair trap was baited with O'Gorman's LDC Extra scent lure (O'Gorman's Co., Montana, USA). Bears can smell the lure from a couple of hundred metres and will often come to investigate and rub against the baited barbed wire, thus leaving hair samples.

When all cameras and hair traps were in place, each trapping site was visited approximately twice a month to collect and replace memory cards, replace batteries, and collect hair samples using sterile methods. Hairs taken from each barb were put into separate coin envelopes and stored in a cool, dry place. Envelopes were labelled with date, number of square, number of loop (counting upwards), number of barb, and position/height in cm above the ground.

In squares 14 and 24 new locations for trapping sites had to be selected, as the cameras were stolen after having been operational for several months. In these two squares, data was therefore collected from two sites rather than one. This will be corrected for in the later statistical analysis. Camera 8 was stolen too, but much earlier in the season, when it had been operational for a few weeks only. In this square only the new location will be used in the analysis.

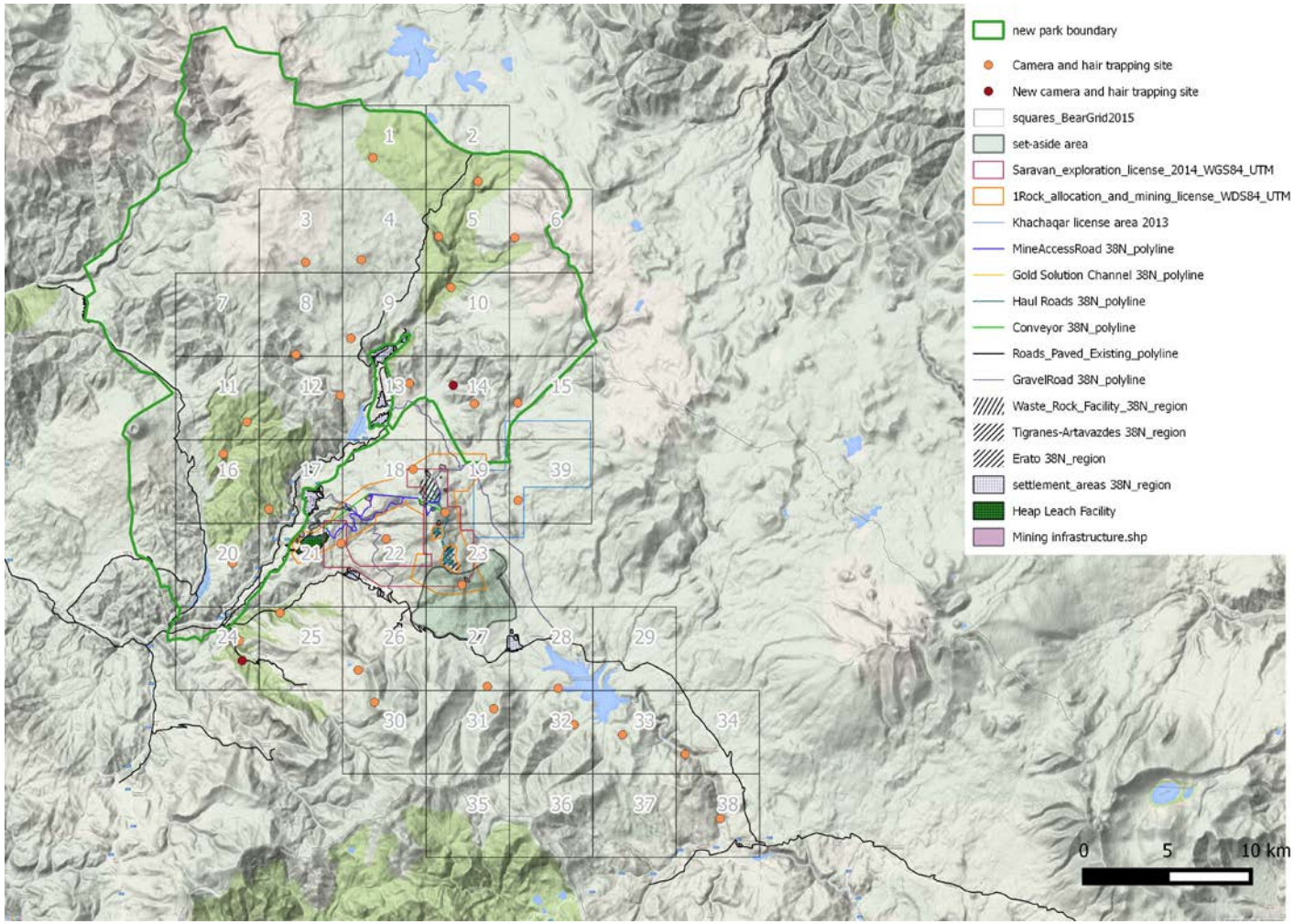

Figure 3. Location of wildlife cameras, with indication of set-aside area and proposed National Park.

Plate 2. Bear using "rubbing station", i.e. barbed wire looped around a tree

Plate 3. Hair trap on boulder in area devoid of trees (square 19)

3.2.2 *Safety aspects of scent lure*

O'Gorman's LDC Extra scent lure was used to increase the chances of detecting bears in each square and to induce rubbing behaviour. Bears have a very good sense of smell and are curious about new, unfamiliar presences in their home range. They will often rub their body against a tree or boulder so as to leave their own scent, thus informing any other bears moving through the area about their presence. When confronted with a strong, unfamiliar fragrance, they may rub and try to top it with their own body odour. The lure is not a food source and therefore not a very strong attractant, but local bears already present and wandering around within the 5x5 km square may come to investigate, improving chances of photographing them and collecting hair. They tend not to stay for long due to lack of a food reward. Lure sites are not defended against other bears and do not induce any aggression. Thus, the risk of any bear - man conflict is minimal.

The use of scent lure is a well-established method in bear surveys. It has been used for many years in studies in North America, such as by Fisher *et al.,* (2013). Recent research into the use of lure was discussed at a grizzly bear monitoring workshop in Alberta in April 2015 and we took this into account when planning the survey. This concluded that use of lure does not unduly increase risk to human safety and that encounter rates between bears and humans do not alter significantly when lure is used. Data are available from several studies to support this conclusion. A bear population inventory project in 2004-2008 along the eastern slopes of the Rocky Mountains in Alberta, Canada had 53,520 survey days from 1500 camera/lure locations. There were no human injuries (field crew workers or the general public) and no significant encounters with bears at these sites. In Montana in 2008-2009 there were 81,046 lure sites implemented with no injuries and hardly any encounters recorded.

3.2.3 *Genetic testing*

Hair samples will be analysed by Wildlife Genetics International (WGI; Nelson, British Columbia, Canada) to identify the species and gender of the animal and each individual, so that the number of bears in the survey area can be estimated.

3.2.4 *Interpreting results*

Statistical occupancy models will be used to analyse both data types (MacKenzie *et al*., 2003; MacKenzie *et al.,* 2006; Nichols *et al*., 2007; Fisher and Bradbury, 2014). The results will be analysed

to identify the different individuals present and to support estimates of population size (Proctor *et al.* 2004, Solberg *et al.* 2006, Kendall *et al.* 2009). At the moment of writing this interim report (October 2015), all of the genetic testing remains to be done, so statistical analysis down to individual level is not yet possible. It is therefore impossible to draw firm conclusions about the population size and density of Brown Bears in the survey area. Data from camera traps can only be used to show presence of bears. To determine the identity of these bears and their movement patterns through the study area requires definitive information from genetic analysis. Although cameras are invaluable for judging the extent of underestimation of bear occupancy as indicated by the hair sample data, they do not allow reliable identification to individual level. Unlike cats, which often have spotted or striped fur with unique pattern, all bears have more or less the same type of uniformly coloured fur and therefore look similar. In addition, many photos were taken at night (see Plate 4), and even during the daytime the resolution of wildlife cameras is not high enough to reliably assess details of the fur. Bears can wander over long distances, some covering more than 100 km in a month, so a single bear could theoretically visit many squares and be captured by several cameras, creating the false impression that several bears are present.

The results of this interim report should therefore be interpreted with care. At this stage, they only reflect presence of bears in a particular square, and they give some indication of which parts of the survey area are used by the species and the suitability of different areas as bear habitat.

Plate 4. Identification of individuals is difficult from photos taken at night

3.3 Methods for stakeholder engagement

The ability to develop an effective mitigation strategy for bears affected by the Project requires understanding of the true impact of bears on livelihoods and of the interactions currently taking place between bears and land users, including seasonal herding communities, villagers and hunters. Local communities often also have important information about the distribution and number of bears.

3.3.1 Interviews with land users

A programme of semi-structured interviews was therefore designed. Interviews were held with villagers, local livestock herders and other land users potentially in conflict with bears in July 2015. Where communities are cohesive, “snowball sampling” was used to facilitate reaching the target respondents and to obtain information as follows:

- Perceived risk of conflict, tolerance towards conflict species and individual vulnerability to a conflict event were recorded via semi-structured household interviews to shed light on conflict resolution strategies that are likely to be the most effective and cost efficient.
- Attitude towards bears: behavioural intention and behavioural expression. Individuals' behavioural expression or behavioural intention with regard to bears was recorded alongside their support or disagreement with potential management options. Behaviours of interest included intention to harm or exclude Brown Bear from an area and existing, proactive conflict reduction activities. Randomised Response Techniques were utilised for questions involving potentially sensitive or illegal behaviours to ensure data validity. Analysis of results will use methods specifically devised for human carnivore conflict scenarios.

3.3.2 Wider stakeholder consultation

Stakeholder consultation will be carried out with NGOs and other organisations active in bear conservation in the region when results of the survey are available. Field Officers and an Armenian bear specialist from the Armenian Society for the Protection of Birds formed part of the survey team. Close collaboration will also be sought with the FPWC, an organisation already carrying out camera trapping in the Khosrov area. The FPWC is working to develop the Caucasus Wildlife Refuge - a 2000 ha territory which FPWC maintains as a privately managed conservation area, located in the south of the country in the Ararat region (Urtsadzor community, near Khosrov Forest State Reserve). (see http://www.sunchild.org/index.php?id=138&L=0&id=138 for further information).

Some engagement will also take place with the Yerevan zoo which cooperates with the Ministry of Territorial Administration and Emergency Situations to rescue trapped wild animals. FPWC is also involved with the conservation-related efforts of the zoo.

As part of the addendum to the Environmental and Social Impact Assessment (ESIA), additional disclosure and consultation will take place in late 2015 and first quarter of 2016 to raise bear awareness and explain the results of the current study.

3.4 Survey programme

The baseline study has been designed to ensure effective application of the methods identified in Section 3.3 as summarised in the following table.

Activity	Timing	Personnel
Scoping		
Observations on the number, age and gender composition of bears in early-spring following den-emergence and the habitat areas they use on Amulsar Mountain	Late February/ early March to mid April 2015	RA NAS IoZ
Reconnaissance of wider survey area	April - May 2015	RA NAS IoZ with TEC survey team under supervision of Jason Fisher of Alberta Innovates
Set up camera and hair traps	mid May – mid June 2015	RA NAS IoZ with TEC survey team under supervision of Jason Fisher
Monthly checks of 34 traps on rotation (each one checked *c* twice per month)	June – mid October 2015	TEC/IoZ under supervision of Jason Fisher
Herder and other land user interviews in proposed natural habitat offset area and villages in mine-affected area	July 2015	TEC/ Geoteam
Lab testing of hair samples	September 2015 – March 2016	Wildlife Genetics International
Observations on the late-autumn (fattening period) habitat area of the bears, identification of potential bear's lair stations both within, and in vicinity of, the Amulsar Mine	October and November 2015	RA NAS IoZ
Data interpretation	March - April 2016	Jason Fisher
Final review and interpretation	April – May 2016	All

4 Results

This chapter presents a summary of initial findings and observations from the surveys. It will not be possible to provide robust results, conclusions or recommendations until genetic analysis of hair samples has been completed. This is pre-requisite for Alberta Innovates to analyse the camera observations as indicated in Section 3.2.3.

4.1 Observations

4.1.1 Early spring

Explorations on foot in early spring produced a few observations of Brown Bears, including the same female with two cubs on the southern slopes of Amulsar that had been seen the year before as well (Plate 5-6). The locations of all eight sightings in 2015 are shown in Figure 4. In late March, two

subadult bears were seen along the Yerevan – Meghri road west of Gorayk. On 30 April, an adult Brown Bear was seen resting in the snow on a faraway mountain slope in square 39, and a female with cubs was spotted from great distance in square 15. On the southern slopes of Amulsar, the local female with her two cubs (now approximately 1.5 years old) was observed on 2 May, and a lone adult bear was also seen there on 17 September. On 12 July, an unfortunate incident occurred when a young bear attacked a villager in apricot orchards in the proposed heap leach facility area. Finally, a Brown Bear was seen crossing the road north of Gndevaz at night on 30 July.

The explorations on foot also allowed us to find lots of bear tracks and scat, and the locations of these are shown in Figure 5. Tracks include footprints as well as overturned stones. Bears will often flick big stones upside down to see if there is any food underneath, such as bulbs or ants, and such "rearranged stone fields" can be a very striking sign of bear activity. Footprints are easier to see in snow; however, snow cover also limits accessibility to many areas. In spring, access to the big mountain range south of Gorayk (squares 30 – 33) was very limited and the number of bear tracks here is likely to have been under-recorded.

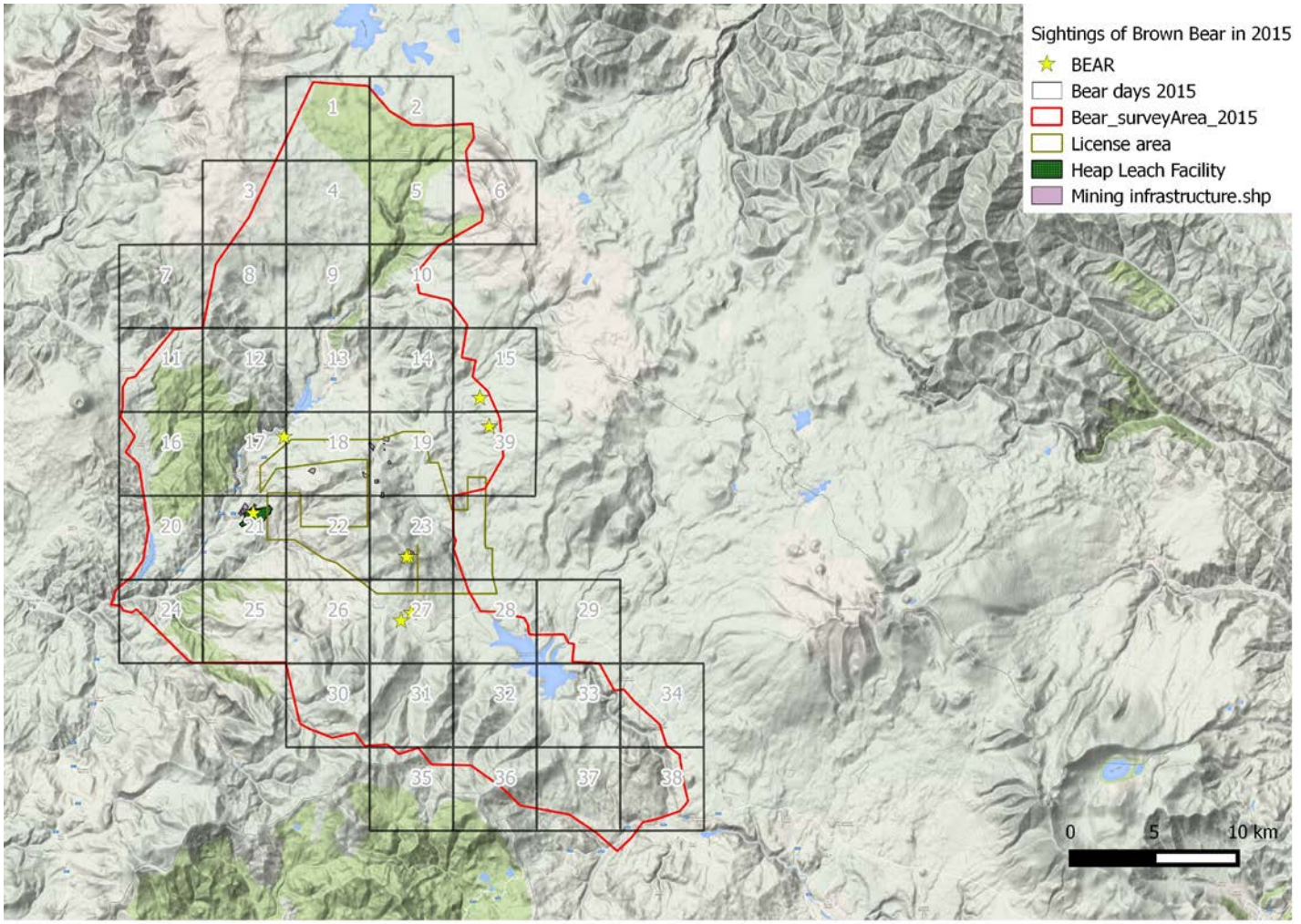

Figure 4. Sightings of Brown Bear in 2015

Plate 5. Female Brown Bear with two cubs, *c* 0.5 years old, Amulsar, 29 May 2014

Plate 6. Same female Brown Bear with two cubs, now *c* 1.5 years old, Amulsar, 2 May 2015

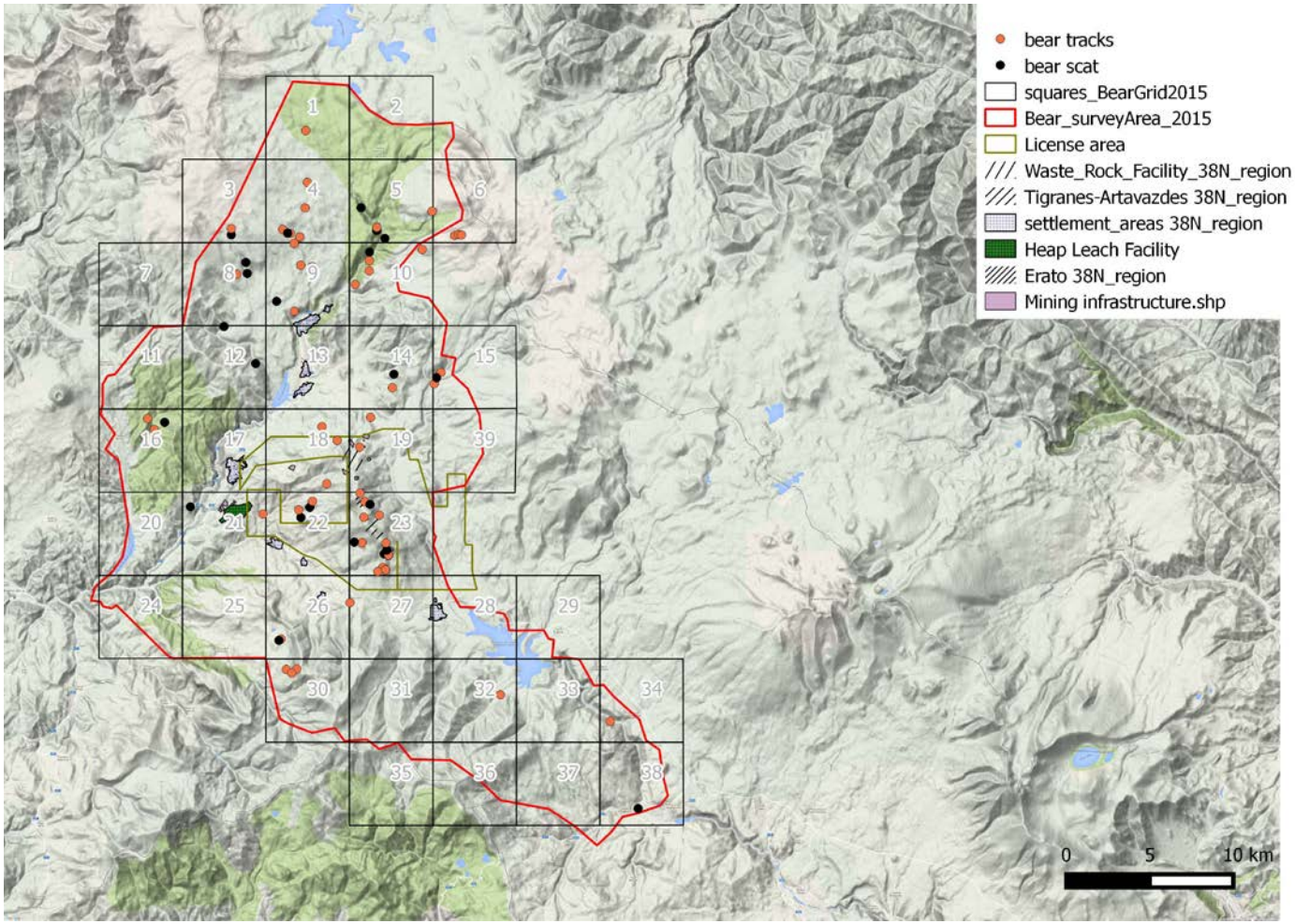

Figure 5. Locations of bear tracks and bear scat found in 2015

4.2 Camera trap results

From mid May to the end of September 2015 the camera traps captured a total of 2,422 pictures of Brown Bears. Of the 34 camera sites, 28 were visited, 23 more than once, and 15 by more than one bear. Females with cubs were photographed at 9 sites; however, this does not include square 15, where a mother with cubs was seen in late April (see 4.1 above).

Figure 6 shows the number of "bear days" for each square, i.e. the number of days on which the camera took photographs of a bear. While this method of presentation is not flawless since, for example, it does not distinguish between three consecutive days (a short visit) and three days spread over a period of several months (indicating continued presence of bears in the square), it does give an idea of the parts of the study area where bear activity was concentrated. From our data it is clear that repeated bear activity was mainly found in the following areas (in order of importance):

- Herher State Sanctuary (squares 16-17, with 39 "bear days" in the latter).
- southern slopes of Amulsar (Arshak set-aside, square 23, with 24 "bear days").
- woodlands between Amulsar and Saravan (square 22, with 17 "bear days").

To a lesser extent, bear activity was also notable in:

- the wooded valley west of Kechut lake (squares 8 and 12, with 8 "bear days" in the latter).
- the Arpa river valley in Jermuk Hydrological State Park (square 5, with 6 "bear days").
- the wooded valley along Artavan Road, and the mountains southeast of Artavan village (squares 24 and 30, with 5 "bear days" in the latter).

Not surprisingly, these six areas also appear to be important for reproduction, as bear cubs were photographed in all of them. Cubs were also photographed around Spandaryan reservoir (in squares 28 and 32), but it is not clear where they had come from. The shores of the reservoir do not offer suitable bear habitat, and there is rather a lot of human activity (herders, farmers) in the mountain range to the south.

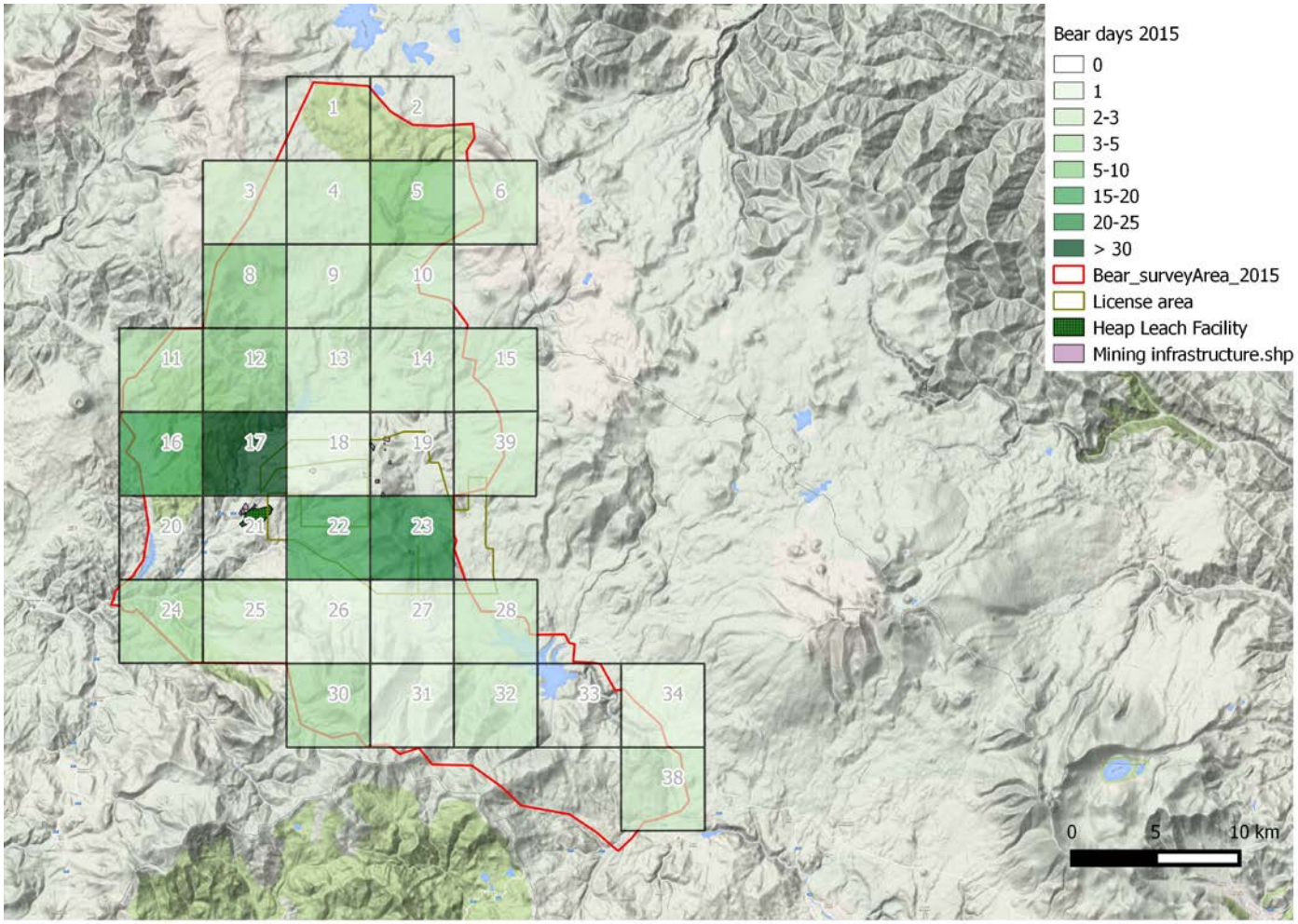

Figure 6. Number of "bear days" per 5x5 km square (May – Sep 2015)

4.3 Hair samples

Between early June and 1 October 2015, a total of 203 hair samples were collected from 23 squares. This means that in some squares (9 to be precise) bears were photographed but did not leave any hairs. This is not surprising, as bears are not very territorial and rubbing is mainly done by adults, especially males, to leave their scent and thus inform any other bears that wander into the same area about their presence. Younger bears and cubs may not rub at all. In addition, hairs are more easily obtained in late summer, when bears are moulting their fur. Less expected, though, is that a few hair samples were collected from three squares where no bears had been photographed. Lab testing will reveal whether these are really bear hairs or something else such as dog or Wild Boar. 134 hair samples have already been sent to WGI in Canada for DNA testing; a second batch will follow at the end of October.

A map of the number of hair samples collected per square (Figure 7) shows a fairly similar pattern to the distribution of “bear days” (Figure 6). Most samples were encountered in the wooded valley west of Kechut Lake (especially at the southern edge of square 8), in the woodland between Amulsar and Saravan, in Herher State Park, and on the southern slopes of Amulsar (Arshak set-aside). One difference is that quite a lot of samples were found in the woodlands east of Jermuk/Kechut (e.g. 13 samples in square 14). It could be argued that a large number of hair samples in a square is a sign of territorial behaviour and therefore continued presence of bears, which would indicate that these woodlands are also an important area for the species. Likewise, the area around Shaghat village (square 38) may be more important than suggested by the camera trap results. However, it cannot be excluded that a large number of hairs may simply have been the result of one or a few visits by a heavily moulting bear.

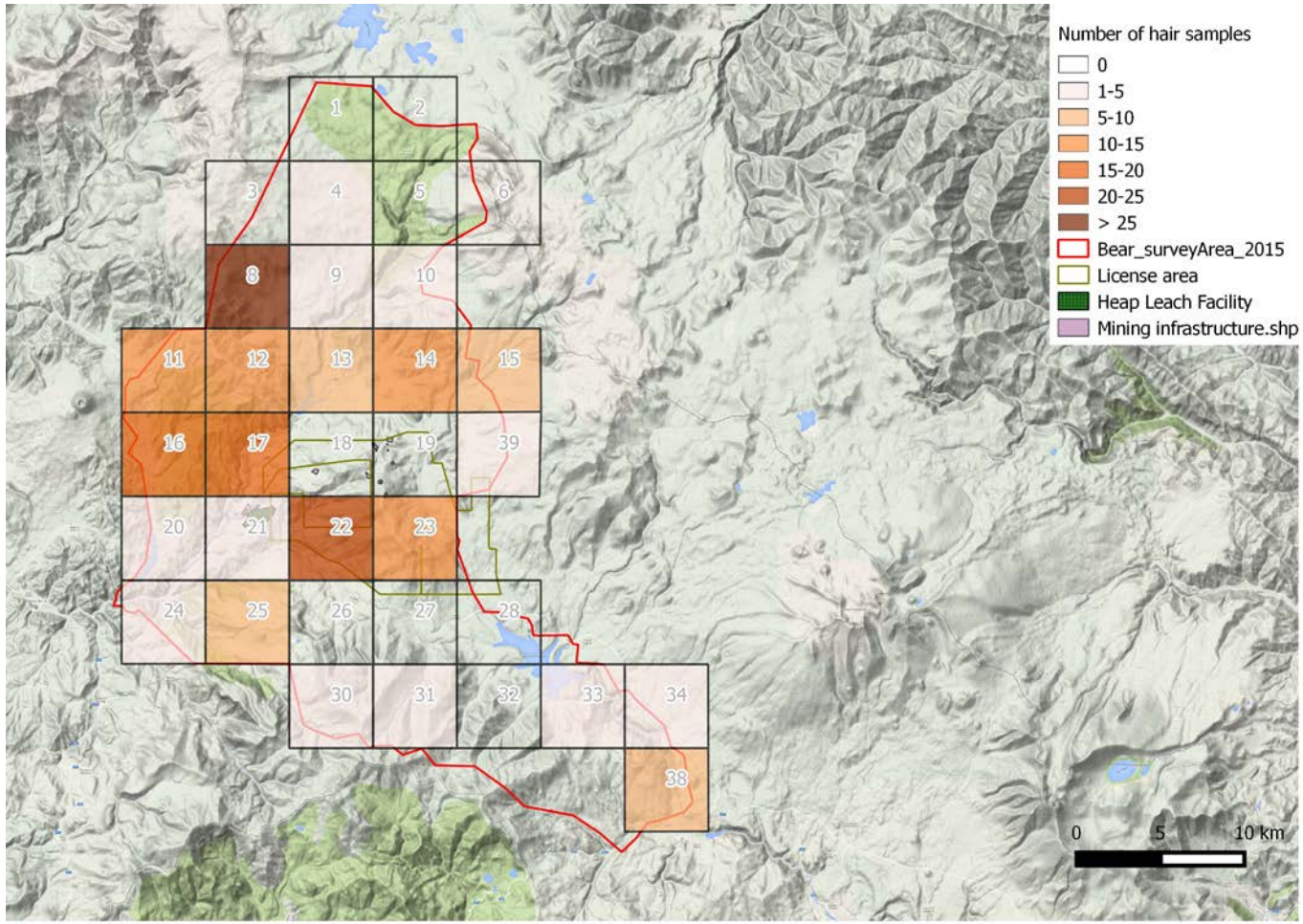

Figure 7. Number of hair samples collected per 5x5 km square in June – Oct 2015

4.4 Other mammals

A number of other mammal species were also captured by the camera traps and an overview of these is presented in Table 1. Bezoar Goat was noteworthy since this species is listed in the Armenian Red Book. Two individuals were photographed on the southern slopes of Amulsar on 8 September. This species should also be present in Herher State Park, though we did not encounter any there in 2015. Eurasian Lynx was photographed in 5 squares, Wild Boar in 7, and Grey Wolf in 6. An unexpected visitor was a Jungle Cat in square 38 on 4 August.

Plate 7. Bezoar in the Amulsar Set Aside September 2015

Table 1. List of other mammals photographed per 5x5 km square

	Square	Bezoar Goat	Eastern European Hedgehog	Eurasian Badger	Eurasian Lynx	European Hare	Grey Wolf	Jird sp.	Jungle Cat	Least Weasel	Red Fox	Stone Marten	Wild Boar
IUCN status		vulnerable	least concern	least concern	least concern	least concern	least concern		least concern	least concern	least concern	least concern	least concern
status in Armenia (Red Data Book)		vulnerable	least concern	least concern	least concern	least concern	least concern		least concern	least concern	least concern	least concern	least concern
European status (Habitat Directive)		Annex II, Annex IV	(not listed)	(not listed)	Annex II, Annex IV	(not listed)	Annex II, Annex IV		(not applicable)	(not listed)	(not listed)	(not listed)	(not listed)
	1			x			x				x		
	2												
	3				x						x		
	4			x			x			x	x		
	5				x							x	
	6												
	8												
	9			x						x	x	x	
	10										x	x	
	11					x							
	12											x	x
	13						x				x	x	
	14												x
	15												
	16		x		x	x	x				x		x
	17			x	x	x	x						

	Square	Bezoar Goat	Eastern European Hedgehog	Eurasian Badger	Eurasian Lynx	European Hare	Grey Wolf	Jird sp.	Jungle Cat	Least Weasel	Red Fox	Stone Marten	Wild Boar
	18										x		
	19					x							
	20			x		x		x			x	x	
	21					x						x	x
	22			x									x
	23	x			x		x					x	
	24					x						x	
	25											x	
	26										x		
	27			x							x	x	
	28										x		
	30									x	x		
	31									x			
	32			x							x		
	33			x									
	34											x	x
	38								x		x	x	x
	39			x						x	x		

Plate 8. Eurasian Lynx in the proposed Jermuk National Park area (at the hair trap in square 5)

5 Preliminary conclusions

The Project area is critical habitat for Brown Bear in relation to EBRD's Performance Requirement 6 (PR6) as it provides regularly used breeding habitat. EBRD expects clients to follow the spirit of the EU Habitats Directive. Article 12/ Annex II and Annex IV of this directive prohibit degradation of habitat for species such as Brown Bear, which is listed on both Annexes. More specifically, Article 12 stipulates that:

"*Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting (among other things)*

deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration, as well as deterioration or destruction of breeding sites or resting places."
Brown Bear is also included in the Red Data Book of Armenia, which means it is a priority species for conservation of biodiversity in this country and should be avoided by mining. The species is protected by the Armenian Law on Fauna, which states that "*any activity that will result in decrease of the quantity of animal species registered in the Red Book of the Republic of Armenia or will spoil their habitat is prohibited*".

While we do not yet know the population size, density or exact distribution of Brown Bears in the study area, numerous observations and photographs already prove that the southern slopes of Amulsar are critical habitat for the species. In 2015, this area was visited by at least five different bears (one female with two cubs, an adult male, and one sub-adult) and three caves were found that were regularly used (i.e. had lots of bear scat inside). This area is located at *c* 800 m south of the Tigranes – Artavazdes mine pit area (square 23) and bears using it are expected to be disturbed by noise from blasting, drilling and vehicles. This disturbance is highly likely to displace them and force them to abandon the site. Similarly, the woodland between Amulsar and Saravan (square 22) appears to be an important area for bears; at least six different individuals were photographed here (one female with three cubs, one adult male, one sub-adult). As this woodland is located at approximately 1 km from planned mining infrastructure such as earthwork platforms and service roads, and at 1.5 km from the heap leach facility (square 21), local bears could also be affected by the increased human activity here.

Disturbance, Project footprint and activities and barrier effects (such as the planned conveyor corridor) are all likely to have an impact on the local bear population, reducing feeding habitat and availability of undisturbed breeding habitat. Altered distributions and behaviour patterns are likely. The conveyor corridor will include a lot of mining infrastructure (earth platforms, service roads, ponds) and will be noisy, with frequent vehicle movements and lighting. Bears will try to avoid the entire corridor, but may need crossings if other options are closed off due to human activity.

The Project's mitigation strategy is to preserve the Arshak area as set-aside and to respect a buffer zone between the closest open pit area (Tigranes – Artavzdes) and this set-aside. Depending on the responses of bears to levels of disturbance, they may be displaced and continued monitoring is

therefore needed, at least in the Amulsar – Gndevaz – Saravan region (Lydian license area) so that the residual impact can be quantified and specific offset activities designed accordingly.

The possibility of radio-collaring the female associated with the Amulsar set aside has been considered, but is viewed as inadvisable by specialists due to the associated stress at a time when she could be either pregnant (next autumn), or still with cubs (next spring, prior to construction start). Moreover, transmitter collars may cause neck ulceration if mounted too tightly or may fall off if mounted too loosely. Bears experience dramatic seasonal weight gain and loss, making it difficult to properly fit them with collars to avoid this problem. Radio-collaring requires recapturing and handling the individual bear on a regular basis in order to prevent any neck injuries. Capturing and recapturing a bear is logistically challenging in relatively inaccessible terrain, such as that in the set-aside, and could become really problematic if the radio transmitter stopped working, making it difficult to locate the bear. Collaring of bears should only be done when it is absolutely necessary, since it is invasive, expensive, logistically challenging, and may bring welfare complications for the animal concerned.

Similarly, sedating and artificially relocating the bears from Arshak is considered inadvisable because it would be stressful for the animals, would be logistically challenging and has little chance of being successful. Adult Brown Bears are faithful to their breeding and wintering area. When they are removed from it, they are highly likely to return. Blanchard & Knight (1995) found that return rates were lower only when bears were transported for more than 75 km and the proposed Jermuk National Park is only 10 – 15 km from Arshak. Moreover, the same study also showed that survival rates of transported bears were lower than those not transported. Therefore, transporting bears should be considered only a final, last-resort action.

The proposed approach is therefore to preserve the Arshak area as set-aside and to respect a buffer zone between the closest open pit area (Tigranes – Artavzdes) and this set-aside to the extent possible, minimising disturbance. Furthermore, to the extent practicable construction will be phased to allow as much time as possible for a) behavioural responses of bears to disturbance to be monitored and b) to allow the resident bears to relocate independently if necessary.

Continued monitoring will therefore take place through the Project's Biodiversity Monitoring and Evaluation Plan. Monitoring will take place initially in the Amulsar – Gndevaz – Saravan region

(Lydian license area) so that the residual impact can be confirmed and specific offset activities designed accordingly, but the monitoring programme will have to be refined when data analysis is complete.

Safe passage of bears westward from the set-aside area through the woodlands near Ughedzor and Saravan (squares 22 and 26) is important and needs to be discussed with communities to ensure safety for people and wildlife. This will be reflected in the Species Action Plan. In addition, the need for crossings over the planned conveyor corridor is being reviewed. However use of crossings is difficult to confirm. Continued long-term use of Amulsar for breeding cannot be assured and therefore an offset will likely be needed for residual impact on Amulsar bears and other species such as Eurasian Lynx (listed as 'Endangered' at European level by IUCN), Grey Wolf and Bezoar Goat (the latter included in Annex II and IV of the European Habitat Directive and also listed in the Armenian Red Book). The preliminary results of this baseline survey suggest that the proposed Jermuk National Park / Natural Habitat Offset can provide a suitable offset for impacts on these species, as small numbers of them already appear to be present in this area and they all have suitable habitat present, but are adversely affected by hunting, over-grazing and road-construction. Through targeted interventions to control these threats and pressures within the proposed National Park, it should be possible to increase the potential of this area for these species and demonstrate a net positive impact. The required gain will be quantified and proposals for positive outcome finalised in summer 2016, when all survey data including the results of genetic testing are analysed.

Plate 9. Young bear on Amulsar, July 2015

Plate 10. Female with cub in Jermuk National Park, 8 September 2015

6 Literature and references

Blanchard, B.M. and Knight, R.R. (1995) Biological consequences of relocating Grizzly Bears in the Yellowstone ecosystem. The Journal of Wildlife Management 59:560-565.

Chestin, I. E., Gubar, Y. P., Sokolov, V. E and Lobachev, V.S (1992) The brown bear (*Ursus arctos* L.) in the USSR: Numbers, hunting and systematics. Finnish Zoological Publishing Board 29:57–68.

de Barba, M., Waits, L. P., Garton, E. O., Genovesi, P., Randi, E., Mustoni, A., and Groff, C. 2010. The power of genetic monitoring for studying demography, ecology and genetics of a reintroduced brown bear population.

Fisher J.T., Wheatley M. and MacKenzie D. (2014). Spatial Patterns of Breeding Success of Grizzly Bears Derived from Hierarchical Multistate Models. Conservation Biology.

Fisher, J. T. and S. Bradbury. 2014. A multi-method hierarchical modeling approach to quantifying bias in occupancy from noninvasive genetic tagging studies. The Journal of Wildlife Management 78:1087-1095.

Fisher, J. T., Heim, N. and Paczkowski J. 2013. East Slopes Predators Project. Alberta Innovates – Technology Futures. Research note.

Kendall, K. C., J. B. Stetz, J. Boulanger, A. C. Macleod, D. Paetkau, and G. C. White. 2009. Demography and Genetic Structure of a Recovering Grizzly Bear Population. Journal of Wildlife Management 73:3-17.

Kudaktinm A.N and Chestin, I. E. (1993). The Caucasus. Pages 136–141 in Bears. Nauka, Moscow, Russia. (In Russian and summary in English)

MacKenzie, D. I., J. D. Nichols, J. E. Hines, M. G. Knutson, and A. B. Franklin. 2003. Estimating site occupancy, colonization, and local extinction when a species is detected imperfectly. Ecology 84:2200-2207.

MacKenzie, D. I., J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Academic Press.

Nichols, J. D., J. E. Hines, D. I. Mackenzie, M. E. Seamans, and R. Gutierrez. 2007. Occupancy estimation and modeling with multiple states and state uncertainty. Ecology 88:1395-1400.

Proctor, M. F., B. N. McLellan, C. Strobeck, and R. M. Barclay. 2004. Gender-specific dispersal distances of grizzly bears estimated by genetic analysis. Canadian Journal of Zoology 82:1108-1118.

Lortkipanidze, Bejan (2010) Brown Bears in the South Caucasus. Ursus 21(1):000–000. http://www.bearconservation.org.uk/Brown%20bear%20in%20South%20Caucasus.pdf

Margarian (1987) Republic of Armenia Red Book.

McLellan, B.N., Servheen, C. & Huber, D. (IUCN SSC Bear Specialist Group) 2008. *Ursus arctos*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 01 June 2014.

NACRES (2003) Baza Dannykh Zhivotnogo Mira Yuzhnogo Kavkaza (Amphibia, Reptilia, Aves, Mammalia). [Wildlife Data Bank of the Caucasus (Amphibia, Reptilia, Aves, Mammalia)]. NACRES — Centre for Biodiversity Conservation and Research, Tbilisi, Georgia. (In Russian.)

Nicolini, G., Avancini, G., Zambelli, F., and Chemini, C. 1997. Automatic monitoring system for brown bear in Trentino, Italy. Int. Conf. Bear Res. and Manage. 9(2): 139-143.

Solberg, K. H., Bellemain, E., and Drageset, O.-M. 2006. An evaluation of field and non-invasive genetic methods to estimate brown bear (*Ursus arctos*) population size. Biol. Conserv. 128: 158-168.

Treweek Environmental Consultants. 2015. Amulsar Gold Mine Project. Environmental and Social Impact Assessment, chapter 4.10 – Biodiversity. *In* Wardell Armstrong International. 2015. The Amulsar Gold Project. Environmental and Social Impact Assessment, version 9f. Lydian International. http://www.lydianinternational.co.uk/reponsibility/esia

Vereshchagin, N. K. (1958) Zhivotni Mir SSSR. [Mammals of USSR]. Volume V. Pages 180–220. Akademii Nauk USSR, Moscow, Leningrad, Russia. (In Russian.)

— 1972. Ckol'ko zhe burykh medvedı¨ v SSSR. [How many bears are in USSR]. Okhota i Okhotnich'e Khozyaistvo. [Hunting and hunting management]. Volume 11:20–21, Moscow, Russia. (In Russian.)

Wardell Armstrong International. 2015. The Amulsar Gold Project. Environmental and Social Impact Assessment, version 9f. Lydian International.
http://www.lydianinternational.co.uk/reponsibility/esia