

# Understanding hunters' habits and motivations for shooting raptors in the Batumi raptor-migration bottleneck, southwest Georgia

ANNA SANDOR, JOHANNES JANSEN & WOUTER M VANSTEELENT

Every autumn in Georgia, more than one million birds of prey migrate through the Batumi raptor-migration bottleneck, between the east coast of the Black sea and the foothills of the Lesser Caucasus. In cloudy and, especially, rainy weather, raptors fly low and become easy targets for local hunters that await the birds from hides and other strategic locations. Although the autumn hunting of raptors has long been widespread in the region, conservationists still have only limited understanding of the underlying reasons for its popularity, and of its impact on raptor populations. According to previous studies, the range of estimated raptor casualties is large (1500–10 000 individuals per year). To get a better understanding of the social drivers and conservation impact of illegal shooting, we filled out questionnaires with local hunters ( $n = 43$ ) about their habits and motivations and conducted systematic observation of hunting activities. About half of the respondents claimed their main target species were raptors; 89% were shooting primarily for fun; and 51% were eating the raptors they shot. We found seven raptor species to be most affected by the shooting, three of which show globally decreasing trends. We concluded that shooting in the Batumi bottleneck is not subsistence hunting and that it likely poses a threat to certain migratory raptor populations. However, hunters' attitudes towards hunting ethics do suggest an opportunity to negotiate mutually agreeable solutions for sustainable exploitation of migrant birds with the hunting community. We hope this research will help Ajara region (southwest Georgia) and Georgia to lead by example in the conservation of raptors that migrate along the Black sea coast and in the eastern Mediterranean flyway.

## INTRODUCTION

Illegal killing and taking of birds is considered a major threat for the conservation of bird species migrating between Europe and Africa. A recent review assessed the scale of the problem in countries bordering the Mediterranean, based mostly on expert knowledge (Brochet *et al* 2016). However, there is very little accurate data available to estimate the impact of the often obscure practice of illegal killing of migrant birds, and the problem extends far beyond the Mediterranean. In Ajara region, southwest Georgia, many protected migrant-bird species, both threatened and common species, fall victim to illegal shooting (MENRPG 2015). The problem of illegal killing in Georgia especially concerns migratory birds of prey (Abuladze *et al* 2011).

Raptor populations are particularly sensitive to excessive shooting due to several factors including their low reproductive rates and small population sizes (Newton 1979, Shaffer 1981). The en route congregation of migratory raptors exposes a high number of them to environmental and human threats (Bildstein 2006). This is particularly true for the Batumi bottleneck (Figure 1), one of three migration bottlenecks where more than one million birds of prey can be seen in a single season (Shirihai *et al* 2000, Zalles & Bildstein 2000). The Batumi bottleneck is located along the eastern coast of the Black sea in the Ajara region of southwestern Georgia. The birds that pass here breed from northeastern Europe to eastern Kazakhstan (Verhelst *et al* 2011).

Although a few studies have been conducted on the shooting of migratory raptors in Georgia (Abuladze 1997, 2012, Abuladze *et al* 2011), the exact number of raptors affected in the Batumi bottleneck is unknown. Casualties are very difficult to assess due to the illegal and temporal nature of the shooting. According to recent estimates 1500–10 279 (van Maanen *et al* 2001, Jansen 2013) individual raptors fall victim to shooting in the Batumi bottleneck every autumn. Trapping of Eurasian Sparrowhawks *Accipiter nisus* is a



**Figure 1.** Study area, the ‘Batumi Bottleneck’ (white with dots, between east coast of the Black sea and Lesser Caucasus foothills), Georgia (inset shows regional location of Georgia). Map data sources: Esri 2015, Natural Earth 2015, ASTER GDEM 2015.

widespread practice in Ajara region with c500 registered trappers (van Maanen *et al* 2001, Magnin 1988, Magnin & Kurdoglu 2016). The trappers can be divided into professional falconers, who train their sparrowhawks for Quail *Coturnix coturnix* hunting, and amateur trappers who do it for the ‘thrill’ of catching birds. In this paper we refer to them together as ‘trappers’.

We report on a social science survey of illegal shooting of migrating raptors and a pilot monitoring survey of the effects of illegal shooting on migrating raptors, carried out in autumn 2014. This was a joint effort of SABUKO (a local conservation NGO) and the conservation working group of the Batumi Raptor Count (BRC). The aim was to collect data on hunters’ demographic and social backgrounds, motivation, hunting habits, and their knowledge of legislation. We used novel interviewing techniques and a standardized observation scheme to quantify the impact of illegal shooting. We wanted to evaluate knowledge of the social dimensions of illegal shooting in Georgia and its impact on raptor populations. We have used this data to establish a long-term monitoring project in the Batumi bottleneck that started in 2015.

Georgia is party to international agreements that protect wildlife (CMS, Bern Convention, CITES), but, although it is a range state, it is not a signatory of the CMS MOU on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MOU). Birds of prey are protected by national legislation but there is no local enforcement by relevant authorities. New legislation is currently being drafted and we hope the present paper will aid the relevant authorities to decide on adequate conservation measures for migrant raptors and other birds in Georgia.

## METHODS

Our research took place in a c60 km long × 15 km wide coastal strip of southwest Georgia. This roughly covers the Batumi bottleneck, between the east coast of the Black sea and foothills of the Lesser Caucasus (Figure 1, Verhelst *et al* 2011). The study area is in Ajara region and has been described as the region with the most intensive

shooting of migratory raptors in the country (van Maanen *et al* 2001, Jansen 2013). From 13 August–12 September 2014 we carried out two field work studies: (1) a social research questionnaire into the habits, motivations and knowledge of local hunters and (2) monitoring of illegal shooting activities. The two surveys were conducted in the same period, but not simultaneously, in order not to influence hunters' behaviour.

### *Hunters' habits and motivations questionnaire*

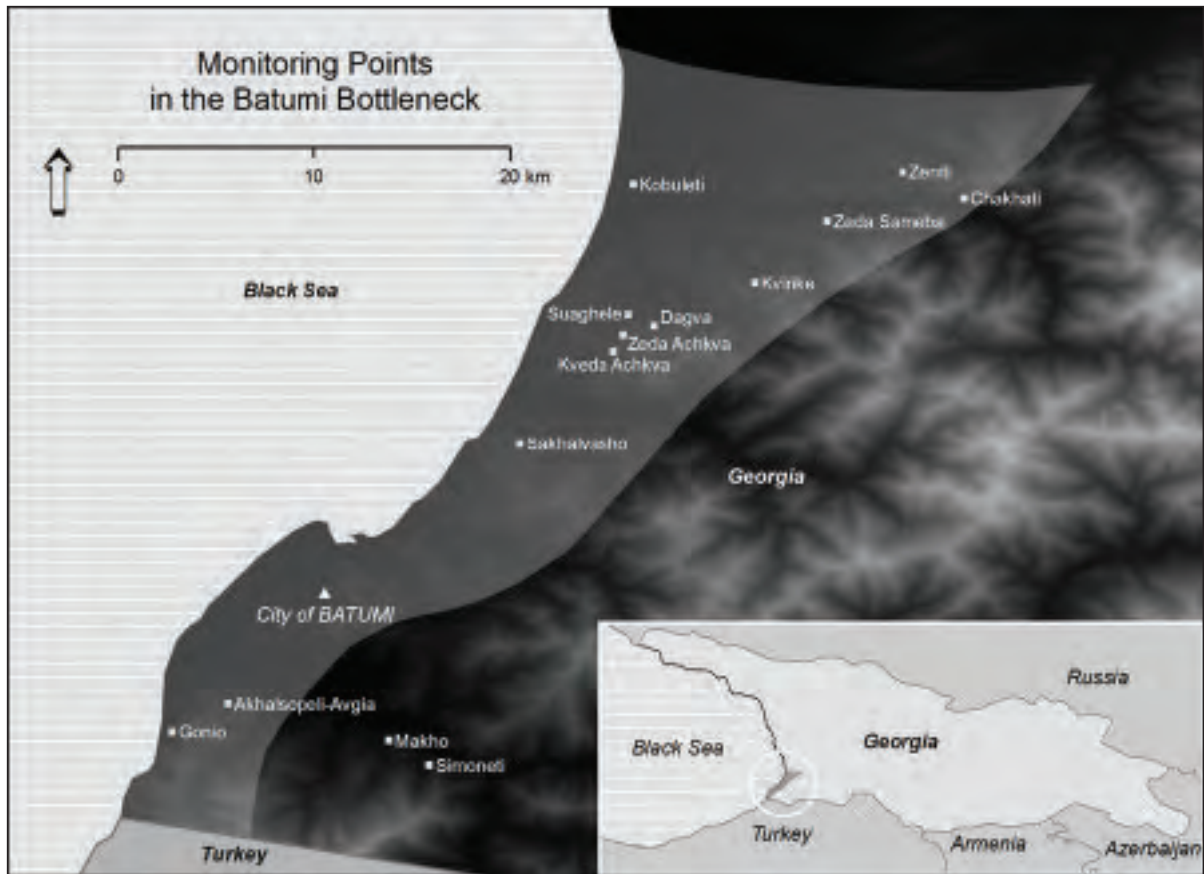
During the social research study 31 villages were visited in the Batumi bottleneck, where anonymous open-ended questionnaires (Patton 2002) were presented to hunters by AS. The questionnaires targeted hunting habits and hunter's knowledge of hunting legislation. The selected villages were either identified as shooting hot spots by Jansen (2013), or selected based on their location and elevation following Jansen's (2013) methods. As the study took place during the hunting season we looked for hunters by driving along the main road in the villages searching for signs of hunting activities (hunting dogs, jeeps, hunters, shots heard). The respondents were identified based on being actively engaged in hunting activity, and were asked if they were willing to answer questions regarding hunting habits and traditions. The goal of the research was introduced to them prior to presenting the questionnaire, and we did not ask for the name of participants to assure them they would remain anonymous. In all cases the questions were read for them by the surveyor, and their answers recorded on the printed questionnaire sheets. Interpretation of the questions and answers was conducted with the help of a translator.

The questionnaire (Appendix 1) consisted of a mixture of closed and open-ended questions, and it aimed to understand (1) whether hunters would specifically target raptors; (2) whether hunters would eat the raptors; and (3) what the hunter's primary motivations were for raptor shooting. Furthermore, the questionnaire targeted demographics, general hunting habits, main target species, the best seasons for hunting, the type of shotguns and shells used, as well as knowledge on the relevant legislation. At the end of each questionnaire, the respondent's willingness to answer as perceived by the surveyor was marked on a 3-category scale (reluctant to answer/willing to answer/happy and proud to answer).

### *Impact of illegal shooting field work study*

During the second study 14 villages (Figure 2) were selected using the same method, and 159 hours were spent with systematic monitoring. Observations were carried out from vantage points selected to provide a good view over the village and hunting spots. The vantage points were occupied by two observers (AS and volunteers with ornithological experience) equipped with binoculars, telescopes, cameras, and a guide to identification of birds of prey (Forsman 2007). All data were recorded on printed monitoring sheets. The data recorded included the date, start and end time of observation, weather data (wind speed, precipitation, cloud cover), migration data (intensity, altitude), hunting effort (total number of hunters seen, total number of shots heard), as well as trapping effort (total number of trappers/hides seen). To avoid double counting, the minimum number of hunters/trappers/active hides was recorded. It is important to note that some hides were not always used, some were used frequently, and others almost daily. This could result in overestimation of trapping effort based on inactive hides, or underestimation due to not noticing trappers inside the hides.

The intensity of migration was noted on a 0–5 scale, where 0 was no visible migration/very low intensity (fewer than 10 birds/hour) and 5 was very high intensity (~10 000 birds/hour). The altitude of migration was recorded on a 0–6 scale (0 = up to 10 m, 1 = 10–30 m, 2 = 30–50 m, 3 = 50–100m, 4 = 100–150 m, 5 = >150 m).



**Figure 2.** The 14 villages in the Batumi bottleneck where hunting effort was monitored. Inset shows location of the Batumi bottleneck in Georgia. Map data sources: Esri 2015, Natural Earth 2015, ASTER GDEM 2015.

Wind and precipitation were recorded on 5-category scales from no wind to gale, and dry to constant rain. Cloud cover was recorded according to the proportion of the sky covered by clouds on a 0–5 scale from 0–25% to 76–100% (overcast).

Shot and injured birds were counted and recorded on the monitoring sheet. They were also sexed, aged and identified to species level whenever possible. If exact identification was not possible, we identified birds to higher-order taxonomic levels (*Circus*, *Accipiter*, *Aquila/Clanga* spp, and MUID for medium-sized unidentified raptor). Bird remains were also counted, sexed, aged, identified and recorded using the same method (Plates 1, 2). Scattered remains were meticulously searched for distinctive feathers. In this case only minimum numbers were estimated.

The data collected for this study were complemented with BRC’s migration, weather, and shooting data. The latter data was recorded by migration count volunteers according to the BRC’s standardised count protocol, and they include the number of shots and shot birds detected from the two count stations used for the migration count. We compared our data regarding peak shooting/peak migration days, and the representation of shot birds compared to the total number of birds counted during the latter migration surveys.

## RESULTS

### *Hunters’ habits and motivations questionnaire survey*

A total of 43 questionnaires were completed face-to-face with hunters in 29 villages (in a further two villages no hunters were found). Nine percent were reluctant to answer and expressed certain mistrust in the inquiry, while 89% answered willingly and readily. One hunter (2%) explicitly refused to participate in the study.



**Plate 1.** (above) Cut-off harrier *Circus* wings found near a popular shooting spot, Batumi bottleneck, Georgia, 15 September 2014. © A Sandor

**Plate 2.** (right) Collecting and organising cut-off wings for identification, Batumi bottleneck, Georgia, 18 September 2014. © A Sandor

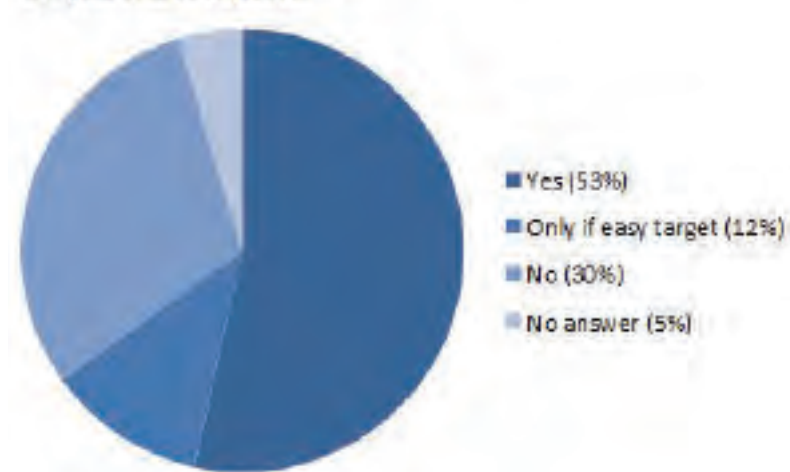


All respondents were men aged between 17 and 73 years (mean = 39, SD = 15). The educational background of the respondents was primary school (47%), university (28%), professional education (12%), and PhD (2%), 12% gave no answer. Thirty-seven percent were unemployed, 16% had temporary work in the village, 23% were regularly employed, and 7% retired (16% no answer).

#### *General hunting habits*

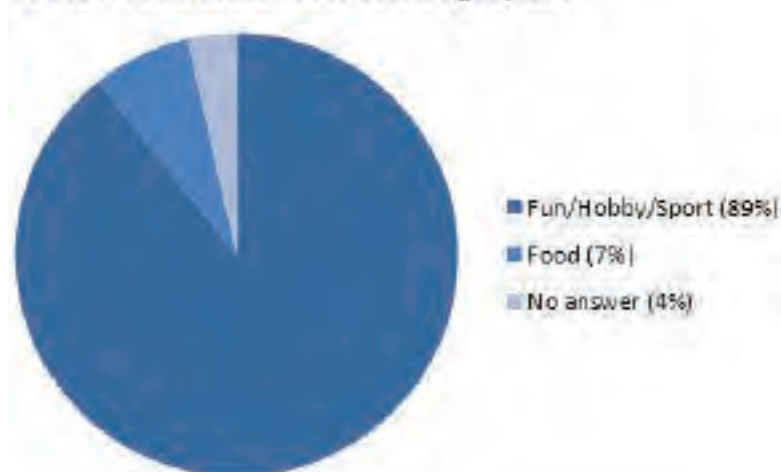
All respondents identified themselves as hunters; while four of them (9%) said they were trappers as well. They estimated the number of hunters in their village from 2 to 30% of the inhabitants. In three villages 'all capable men' were considered to be hunters by the respondents from the respective villages. Forty-four percent perceived that only local hunters were in their villages, while 7% claimed that "trappers come here from Turkey" and "some hunters come from Batumi, Kutaisi or Tbilisi".

### "Do you shoot raptors?"



**Figure 3.** Distribution of responses to the question "Do you shoot raptors?" (N=43).

### The first stated reason for shooting raptors



**Figure 4.** Distribution of responses stated first to the question "Why do you shoot raptors?" (N=28).

The claimed best seasons for hunting were autumn and winter, while all respondents claimed they observe the no-hunting period in spring ('birds are pregnant' and "go to breed, thus it would be unethical to shoot them then").

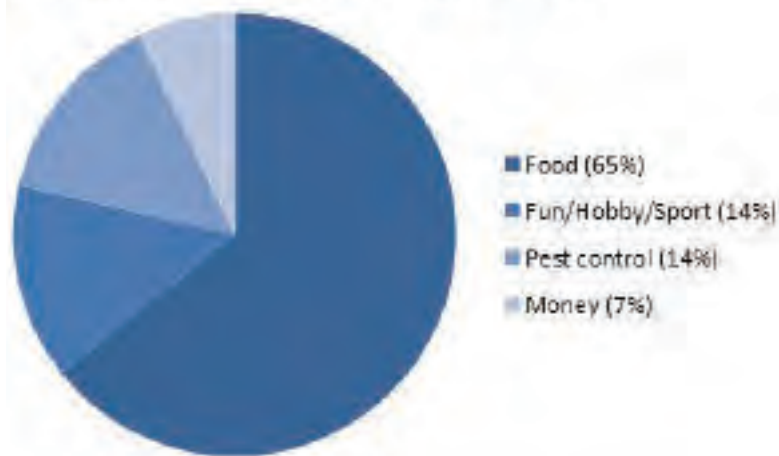
The frequency with which respondents claimed to hunt ranged from 1 day in a season (5%) to every day (33%), mostly 'depending on the weather'. Most respondents prefer hunting in groups of 2–10 people, and they use either their own or their hunting partners' dog for searching and retrieving the quarry. All hunters use single or double barrel shotguns with 12 or 16 bore. More than half of them (58%) used home-made shotgun shells: they would recycle the used plastic hull, fill it with home-mixed powder and lead birdshot, and close it with a piece of plastic or cardboard. Five percent of the respondents noted that if the person making the shell is not skilled enough and uses too much powder, the shotgun can blow up when firing.

#### *Shooting habits*

Thirty percent of the respondents said they never shoot raptors ('it is illegal', 'raptors are not edible'), 12% only shoot raptors if they provide an easy target, while for 53% the main target is raptors (5% no answer) (Figure 3). All trappers opposed raptor shooting.

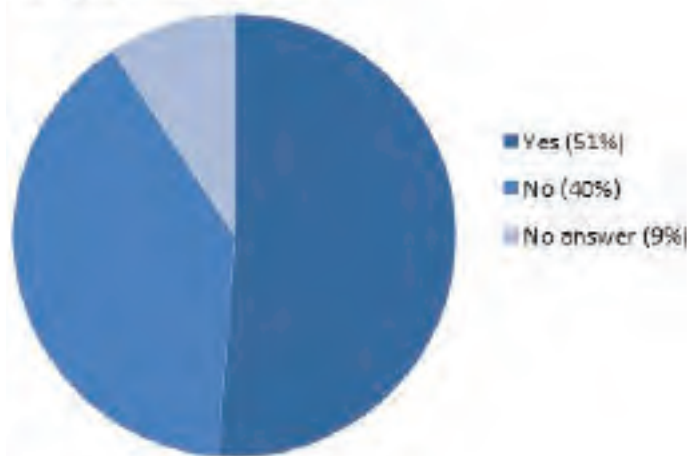
The claimed maximum number of shot birds on a good day ranged from 1–2 to 40–50. The most frequent answer was that it was possible to shoot 10–15 raptors on a good day, while one respondent said that a decade ago it was not uncommon to shoot 100 raptors a day.

### The second stated reason for shooting raptors



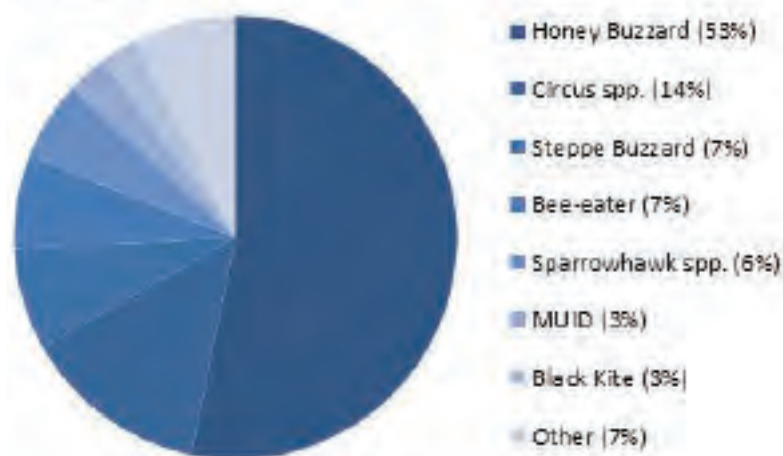
**Figure 5.** Distribution of responses stated second to the question “Why do you shoot raptors?” (N=16).

### “Do you eat raptors?”



**Figure 6.** Distribution of responses to the question “Do you eat raptors?” (N=43).

### Birds killed or injured



**Figure 7.** Birds killed or injured by hunters during monitoring. ‘MUIID’: medium-sized unidentified raptor. ‘Other’: Golden Oriole, Turtle Dove, Booted Eagle, European Roller, Short-toed Eagle and Hoopoe combined.

Seven percent expressed their views that it was mostly young people who were more involved in intensive shooting (“young people are killing everything that moves”) and it is young hunters who do not follow rules.

Respondents were overwhelmingly (72%) found to be unaware of the legislation and the potential legal consequences of their activity, although 58% claimed they distinguished between legal and illegal species, and were obeying regulations. Five percent stated

explicitly that Golden Oriole *Oriolus oriolus*, Hoopoe *Upupa epops* and Cuckoo *Cuculus canorus* were 'illegal' quarry, but they shoot them nonetheless. Seven percent preferred Golden Orioles to raptors as a delicacy served for honoured guests.

Half (51%) of the respondents stated they experienced a decrease in the number of migrating birds year by year, and most of them attributed this fact to certain avian diseases and changes in the migratory route. One hunter mentioned that climate change and hunting also contributes to the decrease. Regarding population trends, 26% perceived no change, 9% experienced an increase, 14% had no opinion on this question.

Besides raptors, other often targeted species include legal game birds (Quail, Woodcock *Scolopax rusticola*, Wood Pigeon *Columba palumbus*, and different unspecified species of ducks), protected birds (Blackbird *Turdus merula*, Golden Oriole, Bee-eater *Merops apiaster*, Plate 3) and mammals (Golden Jackal *Canis aureus* and Brown Bear *Ursus arctos*).

#### *Motivations for raptor shooting*

The first stated reason for shooting raptors was 'sport/hobby/fun' by 89% of the respondents (N = 28), while 7% (2 people) claimed 'food' as their primary motivation (Figure 4). The latter two respondents mentioned no other motivation but food, and both of them claimed they preserve the meat for the winter if they can shoot enough. Thirty-seven percent had a second reason for shooting, where food was a motivation for 65% (Figure 5), which is roughly in line with the answers to the question 'Do you eat raptors?' to which 51% answered yes (Figure 6).

#### *Impact of illegal shooting survey*

##### *Hunting effort*

During the monitoring of the hunting effort at least 223 individual hunters were observed (average 16 hunters/village), and minimum 2044 shots were heard (average 12 shots/hour). Minimum of 8 trappers and 33 hides were observed in 5 villages (average 1.6 trappers and 6.6 hides/village).

The two days with the highest count of shots were 31 August 2014 with 512 shots in Sakhalvasho and 23 September 2014 with 241 shots in Zeda Achkva (Table 1). On 31 August the cloud cover was 26–50% with occasional light rain and no wind, and the migration intensity was high all day. On 23 September the cloud cover was 0–25% with no precipitation and no wind. The day started with no visible migration/very low intensity (0), and ended with low to medium intensity (1 and 2). A Spearman's rank correlation test



**Plate 3.** Remnants of a Steppe Buzzard *Buteo buteo vulpinus*, Eurasian Sparrowhawk *Accipiter nisus* and Bee-eater *Merops apiaster* 18 September 2014, Batumi bottleneck, Georgia: a frequent sight during the shooting season. © A Sandor



**Plate 4.** Remnants of an adult male Honey Buzzard *Pernis apivorus* Batumi bottleneck, Georgia, 18 September 2014. © A Sandor



**Table 1.** Village weather data for days with more than 50 shots heard at a village.

| Village           | Date (2014) | Wind         | Cloud cover (%) | Precipitation | Shots heard |
|-------------------|-------------|--------------|-----------------|---------------|-------------|
| Zeda Achkva       | 29 Aug      | No wind      | 76–100          | Showers       | 89          |
| Sakhalvasho       | 31 Aug      | No wind      | 26–50           | Light rain    | 512         |
| Sakhalvasho       | 01 Sep      | Light breeze | 0–25            | Dry           | 40+         |
| Sakhalvasho       | 02 Sep      | Light breeze | 26–50           | Dry           | 50          |
| Zeda Achkva       | 09 Sep      | Light breeze | 51–75           | Light rain    | 64          |
| Zeda Sameba       | 09 Sep      | Light breeze | 51–75           | Dry           | 67          |
| Dagva             | 14 Sep      | No wind      | 0–25            | Dry           | 70          |
| Zeda Sameba       | 17 Sep      | No wind      | 76–100          | Light rain    | 51          |
| Sakhalvasho       | 18 Sep      | No wind      | 0–25            | Dry           | 66          |
| Sakhalvasho       | 19 Sep      | Light breeze | 26–50           | Dry           | 60          |
| Sakhalvasho       | 22 Sep      | No wind      | 0–25            | Dry           | 99          |
| Sakhalvasho       | 23 Sep      | No wind      | 0–25            | Dry           | 65          |
| Zeda Achkva       | 23 Sep      | No wind      | 0–25            | Dry           | 241         |
| Total shots heard |             |              |                 |               | 1434        |

indicated no significant correlation between the number of shots and migration intensity ( $r_s = 0.062$ ;  $p = 0.691$  (2-sided);  $p = 0.346$  (1-sided)).

#### *Affected species*

We summarize the 295 birds that were seen shot down, or were found dead or injured, in Figure 7. The majority of the casualties were Honey Buzzards *Pernis apivorus* (53%, Plate 4) and Montagu's *Circus pygargus*, Pallid *C. macrourus*, and Marsh Harriers *C. aeruginosus* combined (14%). During the 159 hour monitoring 157 individual Honey Buzzards were killed, which equates to  $c1$  Honey Buzzard  $h^{-1}$ . Other highly affected species were Steppe Buzzards *Buteo buteo vulpinus* (7%), Bee-eaters (7%), Eurasian and Levant Sparrowhawks *A. brevipes* (6%) and Black Kites *Milvus migrans* (3%).

## DISCUSSION

### *Limitations*

The main limitation of the study lies in its timing. The survey period, 13 August–12 September 2014, was aimed to include the main migration periods of harriers (*Circus* spp). It did not include, however, the peak migration of Steppe Buzzard or of Lesser *Clanga pomarina* and Greater Spotted Eagles *C. clanga* (Verhelst *et al* 2011). Weather conditions also affected the results especially comparison with previous studies. Owing to the generally worse weather late autumn, studies in October probably record more rainy days and more intensive shooting. Based on previous studies, we presume that the total number of eagles that fall victim to hunting throughout an entire season may be of serious concern (Jansen 2013).

### *Hunters' habits and motivations: social context*

Although the findings of the present study cannot be considered representative of the entire hunter community in the Batumi bottleneck (which also includes hunters that specialize in quail, waterfowl and other legal quarry) it gives us an insight into local hunters' motivations and habits. The shooting of migrating raptors seems far less rooted in

a tradition of self-sustenance than previously thought (Jansen 2013). Instead, participants of this research stated 'fun' as a primary reason for shooting, and many of them would not eat the shot birds. This means that the practice of raptor shooting cannot be categorised as subsistence hunting. van Maanen *et al* (2001) had stated that hunting in western Georgia was performed mainly for pleasure to obtain game birds for consumption though gave no supporting data. For those who do shoot for the pot, it seems to be merely a cheap and entertaining way to get some meat on the table. However, we assume that local communities are not homogenous regarding their practices and perception of raptor shooting and hunting in general. Although this was not examined directly during this study, we perceived polarised views around (raptor) shooting inside certain communities. In many cases the questionnaires were filled out in the presence of other interested villagers, who claimed they were not hunters, or even that they were rather against raptor shooting or hunting in general.

The two villages where we did not encounter hunters were located farther from the main migration corridor, and the inhabitants there experienced no spectacular raptor migration nearby. This suggests that while shooting raptors is a popular pastime, this is mostly because raptors are convenient targets. Hunters do not need to travel far to reach good shooting grounds.

The topic of hunting ethics was often iterated during the questionnaires, which implies that certain hunters do think about what is right or wrong when it comes to shooting. This is supported by the fact that all respondents claimed they abstained from spring hunting as it would be unscrupulous to kill 'pregnant' birds. van Maanen *et al* (2001) had claimed that hunting in western Georgia is practiced during spring though with less intensity. The appraisal of hunters' code of conduct might prove to be useful during the designing of future conservation actions. In general, we also found some hunters to be very receptive to participate in our questionnaires, being aware of the conservation context of this research.

Also interesting is the fact that hunters perceive a positive relation between age and being law-abiding. To determine whether this is indeed the case, future activities should specifically target younger generations. However, the mean age of the hunters questioned during the study was 39 years (SD = 15), which suggests that this claim about young people may not be well founded, and it emphasizes the importance of providing good data on the average age of the hunters. In the meantime we suggest social media and television campaigns on ethical hunting could be highly effective in reaching out to young and middle-aged hunters (who are widely scattered across a large area).

The results of this study regarding the hunters' motivations are very different from those in another study into the social aspects of raptor shooting in the Batumi bottleneck (Jansen 2013), and we believe this is due to the different methodologies applied. Jansen (2013) used a multiple-choice questionnaire where under the question "Why do you hunt raptors?" the first possible answer was 'Food'. Such leading questions are likely to skew results towards the first possible answer (Patton 2002, Ritchie *et al* 2013). Our study thus emphasizes the importance of open-ended questions to carry out social science research.

### ***Impact of illegal shooting: conservation concerns***

The results of the present study raise conservation concerns regarding potential species loss, which can be a major problem for slow-reproducing species such as large eagles (*Aquila/Clanga* spp) and also for species that are vulnerable to shooting such as harriers (*Circus* spp). The three harrier species (Marsh, Montagu's and Pallid Harriers) that migrate through the Batumi bottleneck in record numbers (Verhelst *et al* 2011) all show globally decreasing trends with Pallid Harrier being Near Threatened (BirdLife 2013a,b,c). The high representation of these three species among hunting casualties (14% in total) is substantially

higher than their representation in the total number of birds counted during the migration surveys (1.5%, BRC 2014). Even though harrier passage is probably underestimated from visual counts, because many individuals are missed when they pass at dusk, in the early morning and at low altitudes, we are convinced that harriers are effectively much more vulnerable to shooting than other raptors. We think this is due to their fly-forage migration behaviour, whereby they often fly low enough to be within shooting range, irrespective of weather conditions (Vansteelant *et al* 2014, 2015, Jansen 2013).

Honey Buzzards were underrepresented among hunting casualties compared to BRC migration counts even though we recorded an average of 1 Honey Buzzard shot per hour. Similarly, other large species such as eagles are underrepresented among hunting casualties compared to migration counts. At first glance, buzzards, eagles and kites are all large, relatively slow birds that provide easy targets. However, due to their dependence on thermals for soaring migration, they mostly migrate at high altitude (>100m) under fair weather conditions, thus passing out of range for local hunters, except when forced down due to adverse weather (Vansteelant *et al* 2014). Weather-dependent flight behaviour also explains the lack of correlation between migration intensity and number of shots, and highlights the importance of controlling for weather conditions when estimating annual mortality due to shooting.

Black Kites made up a minor fraction of all casualties (3%), whilst they were the second most common species observed during migration surveys by ourselves and BRC throughout the study period (13%, BRC 2015). It seems they are unpopular quarry due to the widespread notion among hunters that Black Kites are 'filthy' birds (because of their strong, putrid smell).

It is of interest to see that the killed or injured Steppe Buzzards only amounted to 7% of all killed and injured birds, while being the second most numerous migrant after Honey Buzzard (38% and 48% of total number of birds counted during the migration surveys respectively; BRC 2014). However, this can be accounted for by the mismatch in the timing of the hunting monitoring and the peak migration of Steppe Buzzards, the latter taking place at a later date (Verhelst *et al* 2011).

## **CONCLUSION AND RECOMMENDATIONS**

To improve estimates of hunting impact we suggest extending shooting monitoring programmes into the late migration season, especially considering that soaring conditions deteriorate in late September and October, forcing buzzards, eagles and other thermal-soaring species to pass within shooting range. As hunters are likely to kill most of their seasonal total on a few rainy days each year, it is advisable to investigate more closely to what extent hunting casualties may be correlated with differences in weather conditions. Since the start of Batumi Raptor Count in 2008, extraordinarily intensive hunting is usually reported during days with moderate to intensive raptor migration with intermittent rainfall and late afternoon downpours or thunderstorms. Long-term monitoring which will follow from the pilot research presented here will enable us to better understand how annual differences in the frequency and intensity of rainfall determine the impact of illegal hunting.

It is not known whether mortality of migrant raptors due to illegal shooting is additive or compensatory to natural mortality (Burham & Anderson 1984, Sandercock *et al* 2011), nor whether raptors may adjust migration patterns in relation to detrimental human activity (Palacín *et al* 2016). Tracking migrant raptors will certainly help to evaluate the relative importance of natural and human factors in driving mortality across the African-Eurasian flyways (Klaassen *et al* 2014). However, as long as potential adverse effects of illegal shooting on populations of migrant birds of prey are not fully understood, we

recommend that local authorities act from a principle of strong precaution, assuming that shooting cannot sustainably continue at current levels.

Unsustainable use of biological resources is a growing global problem fostered by inadequate policies, legislative gaps, and lack of support for on-the-ground conservation and law enforcement (Gavin *et al* 2010, Solomon *et al* 2015), which often leads to conservation conflicts between the affected stakeholders (Anthony & Bellinger 2007, Mehta & Kellert 1998). In order to achieve sustainable solutions for the shooting of migrant birds in the Batumi bottleneck, it is crucial to find mutually agreeable resolution measures by involving all stakeholders in the discussions and negotiations regarding the future of the raptors migrating in the Batumi bottleneck. Considering that existing hunting legislation has long not been implemented adequately in the region, we strongly recommend local authorities to invest in raising awareness about the existing legislation and the international importance of the Batumi bottleneck as a migration corridor among local communities. Capacity-building, in the form of training regional conservationists, is another important priority to help roll-out the non-confrontational approach of BRC and SABUKO, including education, awareness-raising and ecotourism development, over a larger geographical area within the Batumi bottleneck. The willingness of hunters to engage with researchers and conservationists is also an important consideration for effective monitoring and regulation of hunting activities in the region. We strongly advise conservation workers to maintain this positive relationship with the hunting community. As a next step, it is necessary to understand the underlying human dimensions of the shooting with the help of social science approaches, and to assess stakeholders' receptivity towards conservation actions before developing potential mitigation strategies (Pierce *et al* 2001, Manfredo & Dayer 2004).

Large numbers of raptors and other migrants that pass safely through the Batumi bottleneck may still be shot further south along the flyway *eg* in Lebanon. For species that migrate socially along highly constrained migration routes, such as the Honey Buzzard, the cumulative impact of illegal killing across different nations is of serious concern. In the case of other species, such as harriers, the numbers observed in the Batumi bottleneck are several orders of magnitude higher than in other illegal killing hot-spots. Therefore, Ajara and Georgia have an important role to play in the conservation of all these species. To demonstrate its commitment to minimize illegal shooting of migratory raptors we encourage Georgia to become a signatory party to the CMS Raptors MoU as soon as possible. We suggest drafting an Action Plan that provides the basis for coordinated region-wide activities to help conserve migratory birds of prey along this important flyway.

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Anna Sandor, Johannes Jansen & Wouter M Vansteelant, Dijkgraaf 35, 6721NJ Bennekom, Netherlands. [anna.sandor@batumiraptorcount.org](mailto:anna.sandor@batumiraptorcount.org)

## Appendix I. Hunting habits and motivations questionnaire

“We are interested in the hunting traditions of Georgia and Ajara region. Would you mind answering some questions in about 10 minutes? The questionnaire is anonymous.”

### Demographic data

How old are you? What is your religion and nationality?

What is your occupation?

What is your highest education?

What is the name of this village?

How many inhabitants/families are there in the village?

How long have you been living here?

### Hunting habits and motivations

Are you a hunter?

Do you have licence to hunt?

What is hunting for you? / What is your reason for hunting?

How many hunters are there in this village?

Where are they coming from?

What is the best/your favourite season for hunting?

What is your favourite game species?

Do you shoot raptors?

If the answer is yes: Why do you shoot raptors?

If he does not mention eating raptors: Are they edible? Do you eat them?

Do you hunt in spring?

How many days do you spend hunting during the season?

Are you hunting now? For what?

What do you do with the shot birds? (Eats/Gives away/Takes the whole bird/Cuts and leaves the wings on the spot etc)

What weapon do you use?

Do you make your own cartridges?

Do you use a dog?

Do you prefer to go alone or with friends?

How many people are there in a group usually?

Are there falconers in this village?

How many? Do they shoot as well?

Are there poachers in the village?

Do all hunters follow the rules here?

Are you aware of the migration?

Have you noticed a change in the number of birds seen in autumn?

Are there animals that are problematic for you? What / why?

Please specify whether you shoot the following species or not. If yes, how many can you shoot on an average day and on a very good day? Do you eat the said species?

| Species   | average no./day | on a good day | Do you eat it? | Species  | average no./day | on a good day | Do you eat it? |
|-----------|-----------------|---------------|----------------|----------|-----------------|---------------|----------------|
| Quail     |                 |               |                | Duck     |                 |               |                |
| Blackbird |                 |               |                | Woodcock |                 |               |                |
| Oriole    |                 |               |                | Raptor   |                 |               |                |
| Bee-eater |                 |               |                | Rabbit   |                 |               |                |
| Hoopoe    |                 |               |                | Jackal   |                 |               |                |
| Pigeon    |                 |               |                | Fox      |                 |               |                |
| Dove      |                 |               |                | Bear     |                 |               |                |