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New records of the golden jackal (*Canis aureus* L.) in the upper Soča valley, Slovenia

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Abstract. Golden jackals (*Canis aureus*) have been recorded in the Slovenian Julian pre-Alps for more than 50 years. In recent years, however, a substantial increase in sightings of golden jackalshas been recorded in the area around the town of Bovec. During the present study we gathered information through interviews with local hunters and other residents and conducted a basic questionnaire on their opinion about this expanding carnivore. In addition, we performed monitoring of jackals with the use of acoustic playback method, photo-traps and searching for footprints and other signs of jackal presence. We also reviewed the database of the reported jackal depredations on livestock at the Bovec Forest Service. In total, we conducted 31 interviews and gathered information on 100 records of jackal presence from 2009 to 2012. The questionnaire showed a negative attitude toward jackal among local hunters. Using acoustic methods, we were unable to confirm the presence of a territorial jackal group, but we did detect jackals on 26 photographs made with photo-traps at one location. During the study, two jackals were killed by car and we collected tissue samples for potential future genetic analysis. Official records of depredations showed high increase in assumed jackal attacks on sheep, but we could not confirm if or how many of these depredations were actually caused by jackals. Further studies are needed to understand the real extent of jackal predation on domestic and wild ungulates, as well as the origin and development of this new jackal group(s) in the Julian pre-Alps.

Key words: golden jackal, *Canis aureus*, photo-trapping, acoustic method, monitoring, Bovec, Slovenia

Izvleček. NOVI PODATKI O POJAVLJANJU ZLATEGA ŠAKALA (*CANIS AUREUS* L.) V ZGORNJI SOŠKI DOLINI – Najstarejši podatki o pojavu zlatega šakala (*Canis aureus*) v Julijskih Predalpah so znani izpred več kot 50 let. V zadnjih nekaj letih pa se je predvsem v okolici mesta Bovec število opažanj šakalov močno povečalo. V raziskavi sva zbrala podatke prek intervjujev s člani lokalnih lovskih družin ter nekaterimi drugimi domačini. Z anketo sva tudi ugotavljala, kakšno je njihovo mnenje o šakalu. Terensko delo je obsegalo izzivanje oglašanja šakalov s predvajanjem posnetkov, nastavljanje samosprožilnih kamer ter iskanje sledi in drugih znakov prisotnosti te vrste. Pregledali smo tudi arhiv zabeleženih škod na drobnici, ki ga vodi krajevna enota Zavoda za gozdove. Opravljenih je bilo 31 intervjujev, prek katerih smo zbrali 100 različnih lokacij šakala med letoma 2009 in 2012. Rezultati ankete so pokazali negativen odnos do pojava šakala na Bovškem. Z metodo predvajanja posnetkov oglašanja nam ni uspelo zabeležiti odziva, zato pa nam je pa pojavljanje šakalov uspelo potrditi z uporabo foto-pasti, in sicer na 26 posnetkih z ene lokacije. Med raziskavo sta bila na območju povožena tudi dva šakala, kar smo izkoristili za odvzem tkiva za morebitne nadaljnje genetske raziskave. Uradni podatki napadov na drobnico velik delež pripisujejo šakalu, a je trenutno težko oceniti, v kolikšni meri je te napade dejansko povzročil šakal. Za realno oceno obsega napadov na drobnico in divjad so potrebne tarčne raziskave, prav tako glede izvora in širjenja šakala v Julijskih Predalpah.

Ključne besede: zlati šakal, *Canis aureus*, foto-pasti, izzivanje oglašanja, monitoring, Bovec, Slovenija

Introduction

The golden jackal population in Europe recently successfully expanded from the Balkan region towards Central and Eastern Europe (Arnold et al. 2012). Golden jackals are believed to have been spreading towards Slovenia and the Italian region of Friuli–Venezia Giulia from Dalmatia via the Istrian peninsula (Kryštufek & Tvrtković 1990, Lapini et al. 2009). The oldest record of jackal presence in Slovenia is from the winter of 1952/53, when two individuals were shot near Vrhnika and one near Kobarid in the Upper Soča valley in the Julian pre-Alps (Mehora 1953, Brelih 1955). Confirmed data on the presence of territorial families in Slovenia so far exist only for Ljubljansko barje in central Slovenia (Krofel 2009).

After the jackal was shot at Kobarid in the 1950s, very few records of jackal presence were reported from NW Slovenia. In Italy, the oldest data on jackal presence is from the province of Udine in 1985 (Lapini et al. 1988, 2009, 2011), but in recent years more data have been gathered (Lapini et al. 2011). Also, in recent years several sightings of golden jackals have been claimed in the area around the town of Bovec in Slovenia. The oldest reliable data on jackals in the Bovec valley is from 2006 (Lapini et al. 2009). Following the increasing number of jackal sightings, several sensationalistic articles were published in the national media (e.g. Dnevnik and www.siol.net). Unil now, these new records have not yet been collected and no systematic study has been done to determine the present status of golden jackals in this area. In this study, we gathered all available information about new occurrences of jackals in the Julian pre-Alps and conducted systematic surveys using acoustic playback methods and opportunistic photo-trapping sessions. In addition, a short human-dimension survey was conducted to measure attitudes towards jackals by hunters of the Bovec area.

Study area and methods

The survey took place in the Bovec valley, a wide alpine glacier valley in NW Slovenia with an approximate elevation of 400 m a.s.l. (46°20'N, 13°33'E). The Soča river with its meanders created a diverse environment with willows (*Salix* spp.) as the main vegetation on its banks. The surrounding forests are mainly composed of common beech (*Fagus sylvatica*), hornbeam (*Carpinus betulus*) and Norway spruce (*Picea abies*). The total human population in the Bovec valley barely exceeds 2,000, with considerably higher numbers during the summer tourist season. Besides tourism and industry, sheep breeding is an important part of the local economy. The area has a Mediterranean-like climate with relatively mild winters, often almost without snow, even though the valley lies at the doorstep of the Julian Alps.

The first part of the study was based on interviews with local hunters and other inhabitants. We focused on getting information on sightings, vocalizations, tracks and other signs of jackal presence. A short human-dimension survey that consisted of four statements about jackals in the Bovec area was also included in the interviews with hunters – members of the four local hunting societies (LD Bovec, LD Čezsoča, LD Log pod Mangrtom and LD Soča). The interviews were mostly conducted at peoples' homes, some also via e-mail or telephone.

All members of the local hunting societies were invited to participate in the questionnaire, even though only a few had any previous contact with jackals. Therefore, more people participated in the questionnaires (41) than the total number of interviews conducted (31). Except for one case, all of the hunters were males. Seven local residents that had a contact with jackals were also interviewed, but were not included in the questionnaire.

The Bovec Forest Service keeps a record of attacks on livestock by predators in the region. Their archive for the past five years was examined due to a widely spread belief that golden jackals are the main source of attacks on sheep. We studied the archives for depredations by all predators from 2007 to 2011. Data from 2007 to 2009, when no depredations caused by jackals were recorded, were used for comparison to observe trends in depredations by other predators.

The acoustic playback method (Giannatos et al. 2005, Krofel 2008a, b, 2009) was conducted twice, i.e. on 21.11.2011 and 2.3.2011 in the evening time. The sky was clear, without wind, with temperatures near 0^{o}C. It is estimated that jackals would be able to respond from a distance of maximum 2 km (Giannatos et al. 2005); therefore six calling stations were chosen to cover the greater part of the Bovec valley. The locations were selected on the basis of data gathered from the hunters and in combination with landscape features that would allow for optimal sound transmission. The howl recordings were broadcasted for 30 seconds, followed by a 5 min break for listening. This was repeated five times.

The automatic photo-trap cameras were set up on locations, where photos of jackals with pups had previously been taken by hunters. We used Boly Guard SG550V 5MP Infrared and Bushnell Sentry 5MP night vision cameras. Bait with a strong smell was used to attract the carnivores.

Results

In 31 conducted interviews, we gathered 100 records of jackal presence (Table 1, Figure 1). Except for photographs, none of these records could be confirmed by material or some other evidence.

Table 1. Data on jackal presence gathered amongst hunters and other residents.
Tabela 1. Podatki pojavljanja šakala, zbrani med lovci ter ostalimi domačini.

	Σ 2009	Σ 2010	Σ 2011	Σ 2012*
Sightings	2	14	32	9
Howlings	0	1	22	3
Photographed	0	6	0	5
Tracks	0	2	0	2
Excrements	0	2	0	0
Total	2	25	54	19

*For 2012, the survey was completed by June.

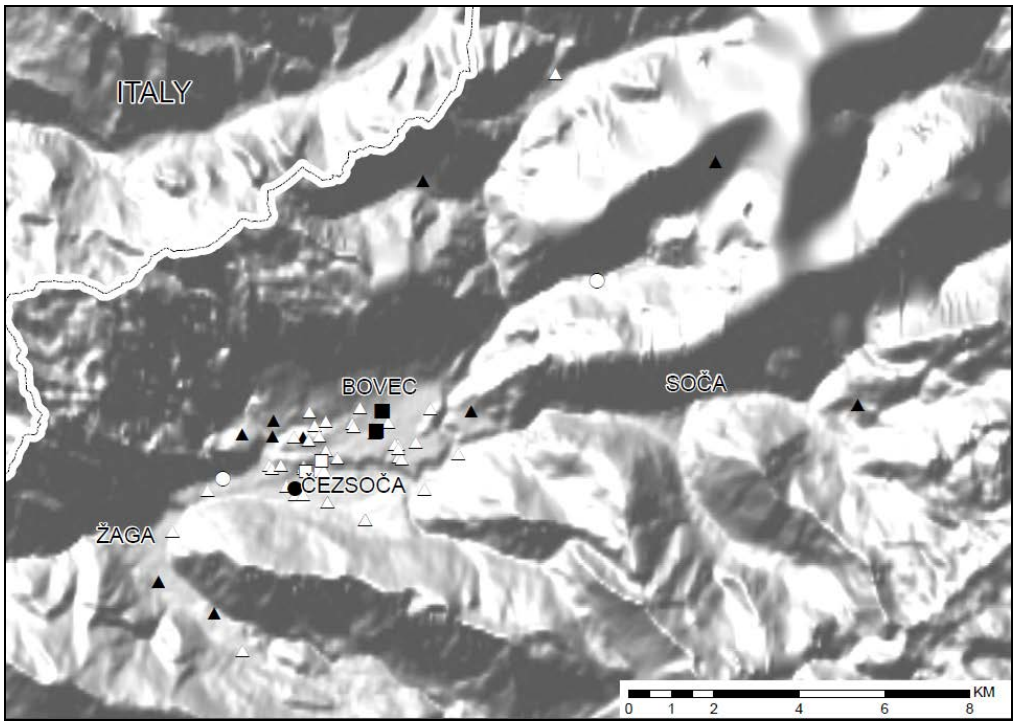

Figure 1. Map representing records of golden jackal (*Canis aureus*) presence in the Bovec valley in 2009-2012: direct observations (white triangles), howling (black triangles), scats (white circles), footprints (black circles), photographs (white squares), dead jackals (black squares).
Slika 1. Zemljevid z lokacijami pojavljanja zlatega šakala (*Canis aureus*) v Bovški dolini zabeleženimi med leti 2009-2012: neposredna opažanja (beli trikotniki), oglašanja (črni trikotniki), iztrebki (beli krogi), sledi (črni krogi), fotografije (beli kvadrati), najdeni mrtvi šakali (črni kvadrati).

Some of the most interesting information is presented here:

- In 17 cases, there were sightings of pups.
- The closest meeting with a jackal was claimed to be in three cases from a distance of about 5 m.
- The highest location of a jackal was 950 m a.s.l. (howling).
- In 2011, it was claimed that a Šarplaninec dog killed two jackals while protecting a herd of sheep.
- In June 2011, a local hunter claimed to have spent one hour observing a family of 13 jackals (8 cubs, 3 sub-adults and 2 adults).
- In July 2011, a local resident claimed to have observed 2 jackals killing a roe deer fawn (*Capreolus capreolus*).

Forty-one hunters participated in the questionnaires and they represent 24% of all members of four local hunting societies (Table 2).

Table 2. Results of the questionnaire on hunters' attitude toward golden jackals conducted among hunters (n=41) from four local hunting societies in the Upper Soča valley.
Tabela 2. Rezultati ankete o odnosu lovcev do zlatega šakala, opravljene med člani (n=41) štirih lovskih družin v Zgornjesoški dolini.

	Strongly disagree	Disagree	Hard to say	Agree	Strongly agree
»Jackals have a positive impact on the natural environment in Bovec.«	67%	14%	14%	5%	0%
»Jackals are not native of our region, therefore it would have been better if they had never appeared.«	23%	2%	12%	19%	44%
»Jackal populations in Slovenia need to be regulated by shooting.«	2%	0%	9%	14%	75%
»Very little is known about jackals in Slovenia.«	7%	2%	21%	21%	49%

The majority of hunters would prefer that jackals had never appeared in the region and they support the intention of shooting the animals. They also largely agreed with the statement that there is a deficit of knowledge about jackals in Slovenia and the majority disagreed that jackals have a positive effect on the natural environment in the Bovec valley.

We analysed records of sheep depredations provided by the Bovec Forest Service (Table 3, Figures 2 and 3). They indicated that 91% of the attacks were attributed to golden jackals, 2% to brown bears (*Ursus arctos*) and 7% to Eurasian lynx (*Lynx lynx*). The total number of recorded attacks was 40.

Table 3. Age structure of sheep assumed to be killed by golden jackals in 2010 and 2011.
Tabela 3. Starostna struktura ovc, ki naj bi bile žrtve napadov šakalov v letih 2010 in 2011.

	Adult sheep	Lambs	Σ
Number of attacks	17	25	40*
Percent	40.5%	59.5%	
Number of killed animals	22	40	62
Percent of killed animals	35.5%	64.5%	
Average number of killed animals per attack	1.3	1.6	

*In two cases, sheep and lambs were killed together, so we regard it as a single attack.

In 2010, the number of reported attacks on sheep by predators doubled compared to 2009 (Figure 2) and the number of killed animals almost tripled.

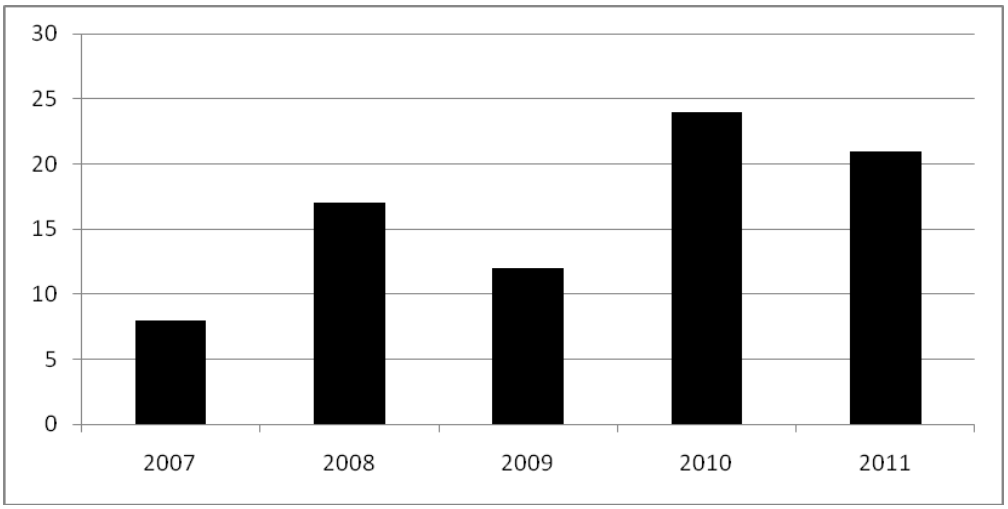

Figure 2. Number of attacks on sheep by all protected species of predators recorded by the Bovec administrative unit of the Slovenia Forest Service from 2007 to 2011.
Slika 2. Vsi napadi na ovce s strani zavarovanih vrst plenilcev dokumentirani med leti od 2007 do 2011 pri Zavodu za gozdove Slovenije, območni enoti Tolmin, krajevni enoti Bovec.

In the years from 2007 to 2009, there were on average 16 killed animals per year from predators that were determined not to be golden jackals (brown bear, lynx, raven [*Corvus corax*]), or 13 attacks per year (more than one animal could be killed per attack). After golden jackals became part of the official Slovenia Forest Service records in 2010 and 2011, this average of depredations caused by other predators decreased to 3.5 killed animals, or 2 attacks on average per year, which is 4.5 and 6.5 times less, respectively (Figure 3).

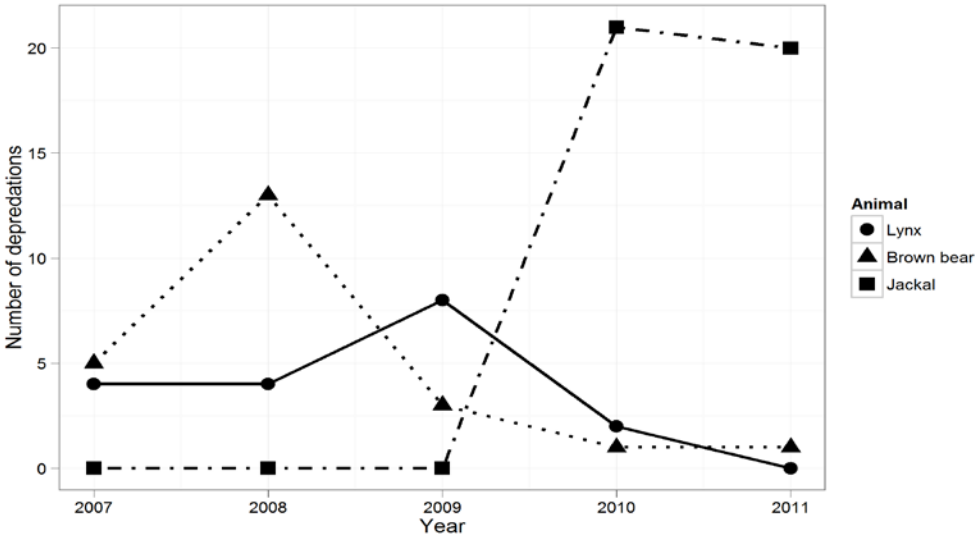

Figure 3. Number of recorded depredations of sheep attributed to Eurasian lynx, brown bear and golden jackal in the Upper Soča Valley from 2007 to 2011.
Slika 3. Primerjava števila napadov na ovce, pripisanih rjavem medvedu, evrazijskem risu in zlatem šakalu v obdobju 2007 – 2011.

We did not record any response to the 42 playbacks of jackal howling in any of the nights.

In March and April 2012, we used a single photo trap, set at three different locations. In total we kept it running for 21 days. At one location we photographed a single adult jackal for four consecutive days from April 22nd to April 25th (Figure 4). Based on its appearance, we believe that we were dealing with the same individual.

At two occasions (6th of March and 18th of March 2012) we found jackal tracks along the Soča river (Figure 5). According to the size of the footprint (length: 5.5 cm), we assume it was an adult individual.

In 2012, two jackals were killed by car. The first accident occurred on April 24th on the Bovec ring road. The killed male jackal weighed 15.2 kg and was estimated to be 2–3 years old. The second road-kill happened on the 13th of June, near the village Idrsko, about 22 km down the Soča valley from Bovec. It was a year old male weighing 10.5 kg. In both cases, tissue samples were collected for genetic analysis.

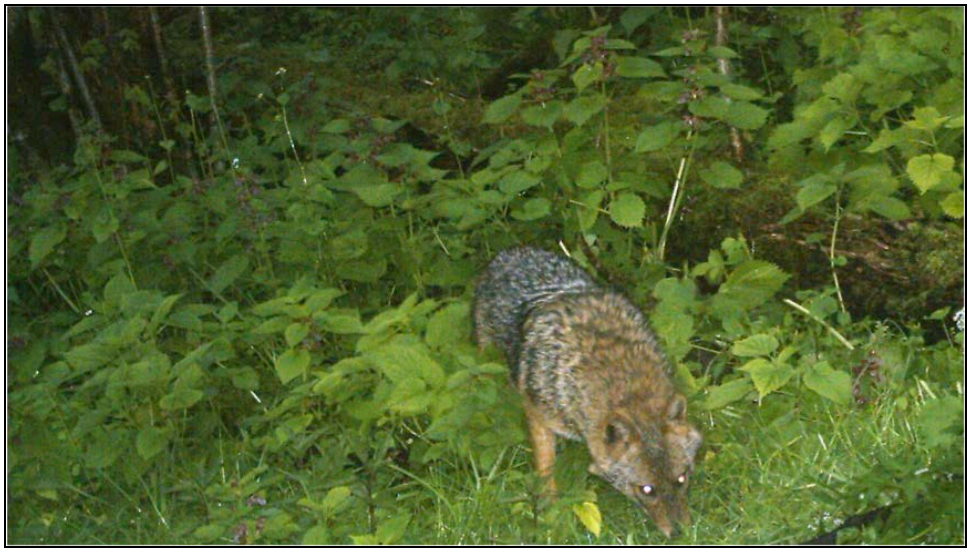

Figure 4. An adult golden jackal photographed on the bank of the Soča river near Bovec using a photo-trap (Photo: Miha Mihelič, 22nd April 2012).
Slika 4. Odrasel zlati šakal posnet s fotopastjo na obrežju reke Soče blizu Bovca (Foto: Miha Mihelič, 22. april 2012).

Figure 5. Jackal footprint in the mud along the Soča river (Photo: Miha Mihelič, 6th of March, 2012).
Slika 5. Sled zlatega šakala v blatu ob reki Soči (Foto: Miha Mihelič, 6. marec 2012).

Discussion

Two golden jackals killed by car, 26 photographs made with photo-traps and two records of jackal tracks in the mud were recorded in the Upper Soča valley during this survey. In addition, we collected information on 100 observations of jackal presence from hunters and local inhabitants, including photographs of jackal pups. These new data confirm that at least one territorial family has formed in the Bovec valley in the recent years. This has also become the second region after Ljubljansko barje in Slovenia where reproduction has been confirmed.

The longest distance between jackal records in the Bovec valley was 16 km. According to data from Greece, the only region in Europe where a telemetry study on jackals has been conducted so far, the home range size of golden jackals oscillates between 2 and 15 km^2 (Giannatos, 2004). This suggests that more than one jackal family group could be present in the Bovec valley. However, this cannot be confirmed as yet, since it is possible that some of the records refer to dispersing individuals. Also, the majority of records come from an area of 14 km^2, which could correspond to one home range, especially when considering that home range sizes of jackals in the Slovenian pre-Alps region could be larger than in primer habitats of Greece. Nevertheless, further studies (e.g. genetic analysis of non-invasive samples or telemetry study) would be needed to reliably determine the number of different jackal groups and animals. Lack of response to surveys with the acoustic playback method is probably due to a low density of jackals in the area (potentially only one territorial family group). In areas with a higher density of territorial families, the animals constantly use howls to maintain the borders of their territory, therefore they respond with a much higher rate compared to families in areas with low density (Giannatos 2004, Krofel 2008b). Jackal pups have been sighted 17 times, always within the same area along the Soča river. Therefore we believe that they were part of the same family.

According to the data on jackal occurrences in Friuli–Venezia Giulia (Lapini et al. 2011), a region in NE Italy that borders on western Slovenia, it seems likely that jackals that became established in the Bovec valley originate from the Julian pre-Alps in NE Italy, which in turn probably originate from NW Croatia. However, genetic analysis would be required to confirm these hypotheses. In 2011 and 2012, jackals were seen several times on Mt. Matajur and in Idrsko near the town of Kobarid, and a young male was killed by car in 2012 near Idrsko. Whether these were dispersers that originated from the Bovec family group (or any other), is currently unknown. But it could be an indication that some of the jackals from the Bovec valley have started dispersing and that new territorial families could become established in the region in the future.

The number of recorded attacks on sheep has increased by 61% from 2009 to 2010. It is possible that the jackal family that was first photographed in 2010 could have partly contributed to the increase in attacks on sheep, but at present this cannot be confirmed. According to official records, the jackal depredations started in 2010 and continued in 2011. What is unusual is that in this period official numbers also show a substantial decrease in sheep depredations attributed to other predators (i.e. brown bear and Eurasian lynx). The currently used method to determine the predator is based on the location and appearance of wounds, feeding signs and other signs of presence. However, this approach has limited

reliability, at least compared to other methods (e.g. genetic analysis of saliva from bite wounds). Therefore, some mistakes in the interpretation might be possible, especially as there is no obvious reason for a drastic decline in attacks by brown bear and Eurasian lynx after 2010. It is also not clear why jackal depredation would start only in 2010, although they have been present in the Bovec valley since 2006. Surprisingly, the Forest Service's archive also does not contain any data on attacks by red fox or domestic dogs, although it is known that these two animals have been attacking sheep in this region in the past (M. Krofel et al., unpublished data). Our assumptions are supported by preliminary genetic analysis. So far six genetic samples of saliva from wounds on sheep that were recorded as being killed by jackals were analysed at the Biotechnical Faculty, Department of Biology. In three cases the laboratory results showed presence of the red fox (*Vulpes vulpes*), which was likely the cause of the attack. In three other samples no canid DNA was detected. Jackals were thus not detected in any of the case analysed (T. Skrbinšek & M. Jelenčič, unpublished data).

Erroneous data on the identity of a predator and sensationalistic reports by the media can have a strong negative impact on attitudes towards predators by sheep breeders and the general public. In combination with the general opinion that jackals are not native to the Upper Soča valley, these beliefs can increase the incentive for poaching and demands for legal removal of animals. For example, the widespread belief that jackals caused most of the attacks on sheep in 2010, led the local Union of Sheep Herders to petition the Slovenian Environment Agency to allow the reduction of the jackal population in the Bovec valley. This, however, was later rejected. In Slovenia, golden jackal has been a protected species since 2004 and can only be killed with a special permission (Ur. l. RS 46/2004). So far, no jackals have been legally killed in Slovenia since their protection. The same is true for Italy, where jackals have been protected since 1997 (Lapini et al. 2011).

We recommend genetic analysis to be performed for future potential jackal attacks on livestock in order to reliably determine the frequency of depredations by jackals. In other countries, even in areas with high jackal and sheep density (e.g. in Greece), attacks on sheep by jackals are minimal (Giannatos 2004). In interviews, some hunters argued that presumed attacks on sheep occur because some sheep herders do not protect their animals effectively enough. Some claimed this was even on purpose, so farmers could receive certain compensations. Some interviewees also reported at least four illegal sheep carcass dumps, owned by the sheep herders, which also supposedly attracted jackals. Jackals are known to regularly use such anthropogenic food sources when available (Yom-Tov et al. 1995). According to the two cases reported in 2011, livestock guard dogs efficiently protected a flock of sheep and were claimed to have even killed two jackals that had approached the sheep.

The questionnaire showed that local hunters have a negative attitude toward jackals and their impact on the environment, mainly because of the common opinion that jackals are responsible for the decline in the roe deer population. Others believed that this decline was just part of fluctuations due to other causes. In general, reports on jackals attacking larger mammals are extremely rare and are much more common in other jackal species (e.g. the black-backed jackal [*Canis mesomelas*]; Krofel 2007, 2008c) than in golden jackal. In general, predation on ungulates by jackals is supposed to be mainly focused on weak individuals and neonates.

In contrast to golden jackal, only 14% of Slovenian hunters had negative attitude toward grey wolf (*Canis lupus*) (Marinko & Majić Skrbinšek 2011), although this species has a considerably stronger effect on wild ungulates. We suggest that the reason is in fact that wolves have been constantly present in Slovenia before the arrival of people, while jackals colonized this region relatively recently. In addition, negative attitudes toward jackals in Bovec could be linked with many hunters regarding them as alien and invasive species. It should be noted that jackals colonized Slovenia from its historic range in the Balkan Peninsula naturally, without being introduced by people, like some other species, e.g. racoon dog (*Nyctereutes procyonoides*), coypu (*Myocastor coypus*), mouflon (*Ovis ammon*), fallow deer (*Dama dama*), and pheasant (*Phasianus colchius*). However, it is possible that humans could have indirectly influenced recent golden jackal expansion in Europe, especially by exterminating grey wolves from many parts of Europe that were consequently colonized by jackals.

The majority of hunters also agreed that little is known about jackals, and this lack of knowledge probably again contributed to their negative attitudes, as is often observed in human-dimension studies on large carnivores (e.g. Korenjak 2000). Lack of knowledge and reliable data on jackal ecology in Slovenia contributes to various polemics and misbeliefs about their numbers, depredations and effects on other wildlife. Our survey has shed some light on the jackal status in NW Slovenia. To improve the knowledge on jackal status in the Julian pre-Alps, more international cooperation is needed, as this part of the population is likely trans-boundary. A detailed study on depredations and potential impacts on the roe deer population is also greatly needed in order to produce a basis for appropriate and science-based management of this potentially conflict species.

Povzetek

Zlati šakal živi v severni in vzhodni Afriki ter južnih predelih Evrazije. Danes je v Evropi razširjen predvsem po Balkanskem polotoku, kjer je bilo v 20. stoletju opaženo precejšnje širjenje areala proti severu. V Sloveniji sta bili do sedaj potrjeni dve območji, kjer obstajajo reproduktivne družine, in sicer na območju Ljubljanskega barja ter v Bovški dolini. Glavni namen tega prispevka je bil zbrati vse razpoložljive podatke o pojavljanju šakalov na območju Zgornjesoške doline ter zbrati nove podatke s pomočjo akustične metode izzivanja oglašanja s predvajanjem posnetka, iskanja sledi na terenu ter postavljanjem fotopasti. Preučili smo tudi arhiv napadov zveri na drobnico Zavoda za gozdove Slovenije, območne enote Tolmin, krajevne enote Bovec. Med člani štirih lovskih družin Zgornjesoške doline smo izvedli tudi anketo o njihovem odnosu do pojava šakala.

Popis z akustično metodo smo izvedli dvakrat, vendar nam ni uspelo dobiti odgovora. Fotopast smo v mesecih marcu in aprilu 2012 postavili na treh lokacijah in na eni lokaciji posneli skupno 26 fotografij odraslega osebka šakala. V dveh primerih, 6. in 18. marca smo v blatu ob reki Soči našli sledi šakala. V obdobju raziskave je v dveh primerih prišlo tudi do povoza dveh mladih samcev. Osebek, povožen 26.4.2012 pri Bovcu, je tehtal 15,2 kg. Glede na ohranjenost zobovja je bil ocenjen na starost 2 – 3 leta. Samec, povožen 13.6. pri vasi Idrsko pa je bil star 1 leto in je tehtal 10,5 kg. V obeh primerih smo odvzeli tkivo za prihodnje genetske raziskave.

V intervjujih z lovci in domačini smo zbrali 100 podatkov prisotnosti šakala, od tega so v sedmih primerih nastale tudi fotografije. Anketa je pokazala precej odklonilen odnos lovcev do pojava te zveri (63 %), a hkrati so se v 80 % strinjali, da se o šakalih ve premalo. 89 % lovcev meni, da bi bilo potrebno populacijo šakala v Sloveniji upravljati z odstrelom.

Preučitev arhiva podatkov o škodah na drobnici je pokazala nelogične povezave med porastom števila napadov, ki so bili pripisani šakalom, in istočasnim upadom napadov pripisanih medvedu in risu. Po tem, ko je bilo ugotovljeno, da so v bovški dolini prisotni tudi šakali, je bilo le-tem za leti 2010 ter 2011 pripisanih kar 91 % vseh napadov na drobnico. Skupno število napadov oz. pokončanih živali s strani risa in medveda pa se je zmanjšalo za 6,5 krat oz. 4,5 krat. To nakazuje, da trenutno obstoječa metoda določevanja povzročitelja napada na drobnico, ki se uporablja pri ZGS, verjetno ni najbolj zanesljiva. To so pokazale tudi genetske analize, ki v primerih napadov na ovce, ki so bili pripisani šakalom, niso potrdile prisotnosti šakala, v več primerih pa je bila potrjena prisotnost lisice. Za pridobitev boljše slike širjenja šakala v Zgornjem Posočju bi bilo nujno sodelovanje s sosednjo Italijo. Glede problematike napadov na drobnico bi bilo za bolj zanesljive rezultate potrebno pričeti s sistematično uporabo genetskih analiz, ki bi dale bolj realno sliko o pogosti napadov šakalov na drobnico.

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