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Barbed wire hair traps as a tool for remotely collecting hair samples from beavers (*Castor* sp.)

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Abstract: The recolonisation of much of Europe by the Eurasian beaver (*Castor fiber*) entails new management, conservation and research challenges. DNA analysis can function as a powerful method in this respect. We conducted a trial to determine the effectiveness of barbed wire hair traps for remotely plucking hair from free-ranging beavers. At all sites it was possible to rapidly obtain hair samples containing guard hairs with follicles. Barbed wire hair traps can thus be employed as a cost effective way of collecting DNA from beavers without subjecting them to the stress of capture and handling.

Keywords: barbed wire, beaver, *Castor* sp., DNA, genetic monitoring, hair, non-invasive.

Introduction

Eurasian beavers (*Castor fiber*) have staged a remarkable comeback since the late 19th century following reintroductions to and natural recolonisation of most of their former geographical range (Halley & Rosell 2002). This has also led to a desire to better understand the underlying biological processes that influence population growth, e.g. colony composition, dispersal patterns, inbreeding, and to a necessity to address various management or conservation issues, e.g. population monitoring, hybridisation of subspecies, or possible presence of American beaver (*Castor canadensis*).

Individuals, sexes and both beaver species are virtually indistinguishable behaviourally and morphologically in the field (Rosell et al. 2005). Therefore, studies aiming at individual, sex or species identification usually have to resort to capture in order to look at more subtle clues such as anal gland secretion colour (Rosell & Sun 1999) or to collect material for subsequent genetic analyses (i.e. tissue, blood, hair) (Crawford et al. 2008). However, live-trapping is often expensive, time consuming or impractical. It can also cause considerable stress or even harm to the animals (Rosell & Hovde 2001). Ideally, genetic material could be collected without resorting to trapping. Recently glue or barbed wire hair traps have been successfully used to remotely pluck hair from terrestrial mammals (e.g. Frantz et al. 2004). In terms of semi-aquatic mammals remote hair capture has only been applied to the North American river otter (*Lontra canadensis*) (Depue & Ben-David 2007), but never to beavers.

Here we report on the results of a trial conducted to assess the feasibility of barbed wire hair trapping as a simple, cost effective and non-invasive way of remotely collecting hair samples from free-ranging beavers, which could be used for DNA analysis.

Materials and methods

The study was carried out in Luxembourg, which is currently being recolonised by beavers from the neighbouring regions of Belgium, France and Germany. Between 26th February and 4th April, 2008 we set up hair

Photo 1. Barbed wire hair trap (trap ID = *erp1*) suspended between two willow (*Salix* sp.) stems next to a river in Luxembourg. *Photograph: J. Herr.*

traps at all four beaver sites then known in Luxembourg. The sites were situated on the rivers Sûre (site and trap codes: *erp*, *ste*, *was*) and Clerve (site and trap code: *dra*) and had only been colonised recently with beaver activity having first been discovered between February 2006 and October 2007. None of the available information from crepuscular observations, reports or photographs indicated the presence of more than a single beaver per site.

Hair traps consisted of ordinary barbed wire (2-strand wire, four point barbs, 15 cm between barbs). We placed the traps (n = 7) on the shore (1-2 m from the water's edge), in proximity to obvious fresh beaver activity such as cut trees, feeding beds or visible trails. Due to difficulties of giving metal stakes a firm hold in the muddy ground we chose to attach the wire to the stems of woody vegetation instead. The wire was suspended 20-25 cm above ground (photo 1). Beavers were lured to the traps with apples (2-3 per site; cut in half and rubbed against tree stems to enhance the smell), a commercially available beaver scent lure (Ground Castor, Wildlife Control Supplies, East Granby, CT, USA) or a combination of both. The apples were attached to vegetation 40 cm above ground to prevent muskrats (*Ondatra zibethicus*) from taking them. Where, due to dense vegetation, beavers could reach the bait from one side only, the trap consisted of a single strand of barbed wire suspended between two trees. Where the bait could be reached from several sides a barbed wire enclosure was formed around the bait or lure by suspending the wire around three or more woody stems (Woods et al. 1999, Frantz et al. 2004). Consequently the length of the wire (and thus the number of barbs) varied from trap to trap.

Traps were checked and hairs collected at one- or two-day intervals, except during flooding events when trapping was suspended (no baiting, no trap-checking). A 'control day' was

Photo 2. Beaver hair sample containing guard hairs and underfur hairs (trap ID = *was1*, control day: 3 – see table 1). *Photograph: J. Herr.*

defined as any day on which a trap was checked. A 'sample day' was defined as a control day on which at least one sample was collected from a given trap. A 'sample' was defined as all the hairs (underfur and guard hairs) that were collected from a single barb (Scheppers et al. 2007). Thus a single trap could yield several samples on one sample day. Each sample was removed with tweezers and stored separately in a paper envelope. Beaver guard hairs could be easily identified based on colour and morphology, which was characterised by a conspicuous narrowing of the hair diameter in the middle portion of the hair (Keller 1983).

Results

Twenty-seven beaver hair samples (photo 2) were collected on 31 control days, translating into a hair-trapping success of 0.87 samples per control day. When only considering samples with ≥4 guard hairs, trapping success was 0.26 samples per control day. At each one of the four sites we obtained at least one sample with ≥10 guard hairs (table 1). Based on hair morphology, only one hair sample could be assigned to a non-target species (badger, *Meles meles*). The first sample was usually already obtained one or two days after a trap had initially been set or after trapping was resumed following a flooding event (table 1). Trap *was3* was dismantled without having provided a sample because traps *was1* and *was2* had by then already yielded good samples for that site. All samples contained underfur, but only 19 of 27 samples (70.4%) contained at least one guard hair with a visible follicle (table 1).

Discussion

We have shown here for the first time that it is possible to remotely pluck hairs from beavers. This method could provide a harmless and cost-effective alternative to the use of either live-trapping, collection of roadkill or destructive sampling. In North America, destructive sampling may be acceptable or, from a nuisance management perspective, even desirable (e.g. Crawford et al. 2008). However, it is clearly unacceptable for Eurasian beavers which are strictly protected within the European Union. Research on other wildlife has demonstrated that questions on group size, kinship and mating strategies can indeed be addressed by using DNA from remotely plucked hair (e.g. Scheppers et al. 2007).

Few studies have used hair (from dead or live-trapped individuals) as a source of DNA for genetic analyses in beavers (Kühn et al. 2000, Kühn et al. 2002, Ducroz et al. 2005, Durka et al. 2005). Kühn et al. (2000, 2002) used between five and 20 guard hairs per beaver to extract DNA for successful gender and species discrimination. No such information was available from the other studies. We managed to collect, from each site, one or more samples for which the number of guard hairs was situated within the range indicated by Kühn et al. (2000, 2002). In Norway a standard of only four guard hairs per beaver has been used for genotyping purposes (F. Rosell & M. Sabo, personal communication). However, studies on other species have shown that DNA from a single guard hair may be sufficient and in some cases necessary for carrying out complex genetic analyses such as genetic

Table 1. Hair trapping summary data for seven barbed wire hair traps at four active beaver sites in Luxembourg.

Trap ID	Trap control day [a]						Total (*n*)		
	1	2	3	4	5	6	Sample days [b]	Samples	Guard hairs
erp1	1(0) [c]	0 [d]	3(2,2,0)	1(35)	0	0	3	5	39
erp2	-	1(4)	0	0	0	- [f]	1	1	4
dra1	2(3,1)	6(17,5,4,1,0,0)	0	0	-	-	2	8	31
was1	0	[e] 0	2(45,3)	0	-	-	1	2	48
was2	0	1(2)	0	-	-	-	1	1	2
was3	0	0	0	-	-	-	0	0	0
ste1	0	0	0	3(1,0,0)	6(10,2,1,1,0,0)	1(8)	3	10	23
Total:							11	27	147

[a] day on which the hair trap was checked
[b] control days on which a sample was collected
[c] x(y,z): x = # of samples, y and z = # of guard hairs per sample
[d] no sample collected
[e] double vertical line: several days interruption due to flooding of the trap
[f] no control of trap

profiling based on microsatellites (Scheppers et al. 2007).

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Samenvatting

Prikkeldraad-haarvallen als instrument voor de collectie van haarmonsters van bevers (*Castor* sp.)

De rekolonisatie van een groot deel van Europa door de bever (*Castor fiber*) brengt nieuwe uitdagingen met zich op het terrein van beheer, bescherming en onderzoek. DNA-analyse kan hierbij een belangrijke hulp vormen. We hebben een proef uitgevoerd om de effectiviteit vast te stellen van prikkeldraad-haarvallen voor het verzamelen van haar van vrijlevende bevers. Op alle onderzoeklocaties zijn snel haarmonsters van haren met haarfollikels verkregen. Het gebruik van prikkeldraad-haarvallen kan daarom gezien worden als een kostenefficiënte manier voor het verzamelen van DNA van bevers zonder deze te onderwerpen aan stress als gevolg van het vangen van de dieren.

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