



Fig. 1. A game warden reeling *fladry* during a wolf hunt in the Belarussian part (Khvoynikskoe forest administration unit) of Białowieża Primeval Forest in March 1994. Photo by W. Jędrzejewski.

Livetrapping wolves with nets

Henryk Okarma and Włodzimierz Jędrzejewski

The authors test an old but safe, economical and effective method for capturing wolves in the Białowieża Primeval Forest in Poland

Since the 1980s, wolves (*Canis lupus*) have recolonized several parts of Europe (Promberger and Schröder 1993); this has attracted public attention and stimulated research. The public now sees large carnivores, especially wolves, as symbols of wilderness, and this increases the emotional debate about capture, particularly trapping, of these animals. Public concern over the treatment of animals for scientific purposes continues to grow. Traditionally wolves have been captured with foothold traps. However, in North America and Europe, there is strong public opposition to the use of such traps (Gentile 1987).

In North America, wolves are commonly captured with modified steel foothold traps (Mech 1974, Kuehn

et al. 1986) that, compared to older versions of steel traps, ensure minimal permanent damage to the captured animals (Van Ballenberghe 1984). Other techniques of wolf capture used in Europe are neck snares (F. Fonseca, Univ. Lisbon, Lisbon, Portugal, pers. commun.) and foot snares in Poland (authors' unpubl. data). Development of maximally safe and humane methods of livetrapping wolves may soon be critical to conducting wolf research in Europe. Several countries (e.g., Poland, Switzerland, Sweden) have already banned steel traps for use in scientific research.

In an effort to explore alternative trapping techniques, we discuss preliminary data from the testing of nets and *fladry*. In addition, we present the his-

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tory of this technique, details of the trapping operation, and the success of efforts using this method in Białowieża Primeval Forest (Poland).

Historical background of wolf netting

Białowieża Primeval Forest (BPF; 52°30'–53°N, 23°30'–24°15'E) is a vast woodland (about 1500 km²) divided between Poland and Belarus Republic. In the fifteenth century it became a royal hunting ground of Polish kings, and big game, especially ungulates, were target species of monarchical hunts. For such hunts, they used ropes with large rags hung along forest paths to encircle animals in a part of the forest (Hedemann 1939). The animals were then driven by beaters toward hemp nets erected at an outlet. Various sizes of rags and nets were used for species varying in size from wolves to ungulates (Karcev 1903). Many historical documents about duties of game wardens in BPF (e.g., from 1639, 1703, 1764) report on the maintenance and repair of nets and canvas rags (Hedemann 1939). In BPF, by the end of the eighteenth century, the use of nets was discontinued (Hedemann 1935), and instead, a line of hunters with fire-arms was positioned at 1 narrow gap left in the ropes.

Apparently, for several centuries this was the local, upper-class mode of hunting practiced in Białowieża Primeval Forest (and perhaps in other royal forests in the western part of the Grand Duchy of Lithuania). When the eastern sector of the Polish-Lithuanian Commonwealth passed into Russian control in 1795, the use of ropes with flags in wolf hunting was introduced into the European area of Russia by exiles from the Polish-Lithuanian forests (Sabanev 1881). In the twentieth century, it became the most popular and effective mode of wolf hunting in the Soviet Union (Pavlov 1990).

Having witnessed that type of hunt, Sabanev (1881) concluded that rags loosely hung on vegetation were an effective barrier to wolves' movements and that wolves were aversively conditioned to these visual and olfactory substitutes for human beings. Sabanev (1881) even recommended using old coats, or rags that resemble old coats.

In Białowieża, the use of ropes with flags (*fladry*, in Polish) for hunting wolves persisted until 1989 in the Polish sector of BPF; they are still used in the Belarussian sector of the forest, where wolves are regarded as pests. We learned the technique of using *fladry* from the Polish and Belarussian game wardens and hunters.

The use of nets, long forgotten in BPF, reappeared around 1890, and nets were successfully applied for

livetrapping roe deer (*Capreolus capreolus*) for relocation (Karcev 1903). A professional description supplemented with detailed drawings by Karcev (1903) enabled us to reconstruct the size of the nets, to set up replicates, and to implement use of nets in the field. The nets used in this study were made by a manufacturer of fishing-nets (Olsztynskie Zakłady Sieci Rybackick, Korsze, Poland), according to our instructions.

Description of the method

Surrounding wolves with *fladry*

A wolf pack is located in its daytime resting place by snow-tracking; the immediate surrounding area is then roped off with *fladry*. The *fladry* we used consisted of about 500-m lengths of rope with strips of red (also bright pink, orange, yellow) cloth, 30–40 cm long and about 15 cm wide, hanging every 50 cm. Wolves were deterred by these fence-like, loosely hanging flags and would not cross a *fladry* line (Okarma 1993). Because wolves are easily disturbed, the area closed with a *fladry* line should be >1 km².

The *fladry* we used were reeled on spools, with 500 m of rope on each spool (Fig. 1). Four technicians, working simultaneously with 2 spools each, hung the *fladry*. The enclosed areas were about 1 km x 1 km. The work proceeded most quickly in places where there were small roads or trails. After tying 1 end of a *fladry* rope to a tree, a technician walked and unreeling *fladry* until he came to the beginning of *fladry* put down by his neighbor. It was important for the team to work as quietly as possible. It took approximately 1 hour to close off 1 km².

Rope with *fladry* should be hung on bushes, sticks, and branches of trees approximately 60 cm above the ground or snow surface, i.e., approximately the height of a wolf. The ends of bright-colored strips of cloth should not touch the ground, but stream freely. The rope cannot be placed too high, or wolves will crawl out from under the *fladry*. Because *fladry* must be visible to wolves from a distance, preferred areas for placement are the edges of roads or trails, while dense thickets or other areas with poor visibility should be avoided (Fig. 2).

Setting up nets

After a pack of wolves has been surrounded with *fladry*, a site outside of and approximately 100 m from the *fladry* line is chosen for the nets. The ideal location would be a trail in dense vegetation (i.e., a thicket) where wolves enter a resting site. If the wolves' entrance trail is in an open forest stand, another place with dense vegetation should be considered, prefer-



Fig. 2. Area surrounded with *fladry* for livetrapping of wolves in Białowieża Primeval Forest (Browsk forest administration unit) in January 1995. Photo by H. Okarma.

ably downwind from the wolves. Properly set nets would not be visible to wolves at a distance.

The nets used in this study were 3.5 m high and 50 m long, woven from 0.2 cm (0.3–0.4 cm would be even better) string with mesh large enough for the wolf to put its head through (approx 15 cm), and reeled on spools. Thicker ropes (0.6 cm) along the upper and bottom edges made the nets easier to stretch.

We set nets in 2 parallel rows, 150 m long each and 2–3 m apart. Nets were hung on spruce branches and high sticks (the upper edges of nets were about 2.5 m above the ground) so they would fall down easily and cover a wolf running into them. The sticks supporting the nets were placed on the inner side and attached loosely to trees. Nets were stretched with the bottom section (approx 1 m) lying on the ground and folded like a pocket, open toward entering wolves. We covered the bottom rope with snow and moss. Setting the nets was the most time-consuming part of the procedure (approx 5 hrs).

After the nets had been set, the *fladry* lines were connected at their left and right ends so that the enclosed area led into a bottleneck about 150–200 m wide closed with 2 rows of nets.

Driving wolves to nets

With the *fladry* in place and nets set, the next step was to move the resting wolves toward the bottleneck. A battue line stationed itself along the rear side of the area surrounded with *fladry*. We had a beater every 100 m; however, experienced beaters placed at 250-m intervals probably would be adequate. A steady, even walk of the battue line forward was the most effective for driving wolves towards the nets. Beaters produced regular noise, e.g., continuous loud counting-off from a central beater to the left- and right-wing beaters and back (a voice-line). This was to prevent wolves from

sneaking back between the beaters. Near the bottleneck with the nets, the central beaters walked at a slower pace than those on the left and right wings, which moved at a faster pace to form a crescent line.

In situations where there are not enough beaters or it is difficult to keep an even line (in bogs, thickets), the surrounded area could be subdivided with a second *fladry* line into 2 smaller closed-off areas.

Wolves were driven by approaching beaters into the bottleneck. We placed 2 observers hidden at the entrance to the bottleneck, outside the *fladry* line. When a wolf (usually walking or trotting) entered the bottleneck, the observers ran after it shouting. Typically, the wolf increased speed, jumped into the nets at a full run, and became entangled (Fig. 3).

Handling the netted wolf

When caught in the nets, wolves usually struggled and were able to move short distances. We used additional nets (2 x 2 m) with 2 sticks along 2 opposite edges of the nets to cover wolves and bring them down. Wolves could be restrained properly for only a short time; we prepared immobilization equipment with drugs in advance, before driving had started. We injected wolves by hand, but it would also be possible to use blow-pipes or immobilization guns. We immobilized wolves using 1.2–2.0 ml of a Ketamin-Xylazin mixture (583 mg Rompun [Bayer AG, Leverkusen, Germany] dissolved in 4 ml Ketavet 100mg/ml [Parke-Davis SA, Barcelona, Spain]).

Results of wolf netting attempts, Białowieża Primeval Forest, winters 1994–1995 and 1995–1996

In January, February, and December 1995 and February 1996, we made 5 attempts to capture wolves in

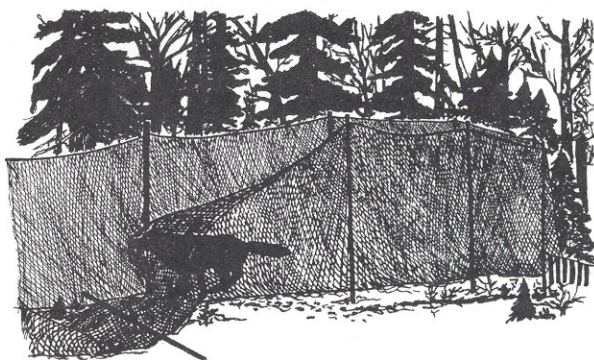


Fig. 3. Schematic drawing of a wolf tangled in nets connected with *fladry* line.

nets (Table 1). Overall, ≥ 14 wolves were surrounded with *fladry* and 5 were netted. One large male tore open a net and escaped (only 1 row of nets had been set in that instance), 2 adult females were radiocollared, and 2 previously radiocollared wolves were captured (1 was released after handling; the second had a failed collar, which we replaced; Table 1, Fig. 4).

Each of the 5 attempts took 2 days to complete. On the first day, 2 teams in cars searched the system of forest roads and paths in the 530-km² terrain (exploited forests in the Polish sector of Białowieża Primeval Forest). One of the cars carried equipment, and both teams were in contact by CB radio. As soon as a wolf resting site was identified, *fladry* were hung out.

In the attempt of 5–6 February 1996 we used a radio-collared wolf as an indicator of the pack position. After we determined (by snow-tracking) that this wolf was accompanied by 2 other wolves, *fladry* were hung out.

In 2 trapping attempts (12–13 Jan and 26–27 Jan) nets were put up, and 1 or 2 drives (unsuccessful) were attempted on the first day. In the third and fourth attempts, nets were set up the following morning. In all cases, *fladry* lines were left out overnight (but disconnected from the rows of nets and closed). In all cases, one or 2 drives were conducted on the second day. *Fladry* were always removed in the afternoon on the second day. Thus, in each case, wolves spent about 24 hours encircled by *fladry*.

There was 1 more trapping attempt 24–25 January 1996 (not described in Table 1), which failed as a result of inadequate snow-tracking: instead of a whole pack, only 1 wolf (already radiocollared) was surrounded by *fladry*. The next day, the enclosed area was divided with a second *fladry* line into 2 narrower parts. We drove the wolf into 1 of these areas, but during the final drive it managed to escape under the *fladry*.

Manpower involved in the 5 consecutive trapping attempts was as follows: 11 man-days (5 people on day 1 and 6 people on day 2), 22 man-days (4 + 18), 19 man-days (4 + 15), 27 man-days (4 + 23), and 22 man-days (5 + 17).

Prospects and restrictions of livetrapping wolves with nets

These first few applications of trapping wolves with *fladry* and nets allow a preliminary assessment of the suitability of this technique for scientific purposes. Livetrapping wolves with nets requires special but fairly inexpensive equipment, a well-trained and experienced staff, and a number of beaters. The field work is rather strenuous. The number of beaters can be reduced by subdividing enclosed areas with additional *fladry* lines.

When untagged packs of wolves are targeted, snowtracking is necessary. However, if a pack member already has a radiocollar, the pack can be located easily and trapping can be conducted in snowless conditions. The method eliminates capture of non-target species; ungulates are not afraid of *fladry*. To date we have not observed any injuries to wolves. The risk of such injuries can be better assessed after we have collected more data. Compared to foothold traps, which cause injuries and stress to wolves, we believe that this method is safe and effective.

Livetrapping wolves with nets relies on wolves' fear of *fladry*, which is an unexplained behavior. It would be of interest to test whether *fladry* line (properly hung) is an efficient barrier to wolves in regions other than those where *fladry* were or still are being used as a hunting method (i.e., Poland, Belarus, Russia, Ukraine, Lithuania, Latvia, Estonia, and Fin-

Table 1. Results of 5 attempts to livetrapping wolves with nets in Białowieża Primeval Forest in the winters of 1994–1995 and 1995–1996.

Description of trapping	Consecutive trapping efforts				
	12–13 Jan. 1995	26–27 Jan. 1995	25–26 Feb. 1995	11–12 Dec. 1995	5–6 Feb. 1996
Area enclosed with <i>fladry</i>	1 km ²	1 km ²	1 km ²	0.75 km ²	1 km ²
No. men hanging out <i>fladry</i>	5	4	4	4	5
No. men in a battue line	4	15	12	19	14
No. drives of wolves	3	3	3	2	2
No. wolves surrounded with <i>fladry</i>	1	5	3 or 4	2 or 3	3
No. wolves in nets	0 ^a	2 ^b	0 ^c	1	2 ^d
No. wolves collared	0	1	0	1	1

^a Nets were set in open forest, and wolves appeared to be afraid to cross the open area in front of the nets.

^b A male wolf became entangled in nets, tore them up, and escaped; an adult female was captured.

^c Nets were set behind a small hill. Driven wolves turned back at the base of the hill and 1 wolf jumped over the *fladry*.

^d One wolf had a failed collar, which we replaced; the second wolf, with an active collar, was immobilized and then released.



Fig. 4. Female wolf (tranquilized) captured with nets and radio-collared in Białowieża Primeval Forest (forest compartment No. 518) on 27 January 1995. Photo by W. Jędrzejewski.

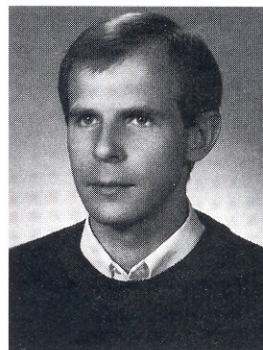
land). However, we do not recommend tests with *fladry* on tame or captive wolves. In Białowieża, a tame wolf (captured by a poacher from the den as a small pup, reared by humans, and given to the Mammal Research Institute, Polish Academy of Sciences) was indifferent to *fladry*.

In conclusion, at a time when public concern over the treatment of animals, especially large carnivores like wolves (Gentile 1987), is increasing, wildlife biologists should explore alternative ways of minimizing stress to the animals they study. Public pressure is mounting against the use of foothold traps, even for scientific purposes. While the use of nets and *fladry* for capturing wolves is still in its infancy, preliminary results seem to indicate that the method has potential as an alternative to the foothold trap. This technique may not be useful in open areas (where aerial darting may still be the most effective method), but in forests and shrublands, netting of wolves can be an efficient and humane method of livetrapping, either as a supplement or as an alternative to steel traps and foot snares.

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