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Jan F. Kamler
Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Lubbock, TX

Chad Richardson
USDA, APHIS, WS, Kansas State University

Philip S. Gipson
Kansas Cooperative Fish and Wildlife Research Unit, Division of Biology, Kansas State University, Manhattan,

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Comparison of standard and modified soft catch® traps for capturing coyotes, bobcats, and raccoons

Jan F. Kamler[1], Kansas Cooperative Fish and Wildlife Research Unit, 205 Leasure Hall, Division of Biology, Kansas State University, Manhattan, KS 66506, USA

Chad Richardson, U. S. Department of Agriculture, Animal Plant and Health Inspection Service, Wildlife Services, 124 Call Hall, Kansas State University, Manhattan, KS 66506, USA

Philip S. Gipson, Kansas Cooperative Fish and Wildlife Research Unit, 205 Leasure Hall, Division of Biology, Kansas State University, Manhattan, KS 66506, USA

Abstract: Capture rates and injury rates of coyotes *(Canis latrans)*, bobcats *{Lynx rufus)*, and raccoons *(Procyon lotor)* captured in standard No. 3 Soft Catch® traps were compared to those captured in the same trap type modified with the Taos Lightening Spring™ (TLS) double torsion spring. All traps were equipped with Paws-I-Trip™ pan tension devices and were successful in excluding most small nontarget species. We captured 15 coyotes and 17 bobcats from October 1995 to March 1997. In addition, 23 raccoons, a large nontarget species, were captured. Capture rates for coyotes were higher ($P < 0.10$) in TLS modified traps (92%) than standard traps (27%), whereas capture rates were similar ($P > 0.10$) for raccoons (85% and 67%, respectively) and identical for bobcats (100%). Injury rates were minimal (< 9%) for coyotes and bobcats in both types of traps. In contrast, injury rates for raccoons were higher ($P < 0.10$) in TLS modified traps (73%) than standard traps (33%).

Key words: bobcat, *Canis latrans*, capture rate, coyote, injury rate, *Lynx rufus*, *Procyon lotor*, raccoon, Soft Catch traps

Number 3 Victor Soft Catch® traps (Woodstream Corp., Lititz, Pa.; mention of commercial products is for identification and does not constitute endorsement by the authors or the federal government) are commonly used as a depredation management tool by personnel of the U. S. Department of Agriculture's (USDA) Wildlife Services program to control coyotes *(Canis latrans)* (Gruver et al. 1996). Research has shown Soft Catch traps cause less injury to coyotes than unpadded leghold traps (Olsen et al. 1986, 1988;Onderkaetal. 1990; Phillips etal. 1992) while having similar capture rates (Skinner and Todd 1990, Linhart and Dasch 1992, Phillips and Mullis 1996). Soft Catch traps are sold with double coil springs, although many Wildlife Services personnel, researchers and recreational trappers add the Taos Lightening Spring™ (TLS) double torsion spring (J.C. Conner Trapping Supply, Newcomerstown, Ohio, USA) to increase capture rates (Gruver et al. 1996). Increasing spring tension on traps can increase capture efficiency without

Present address: Department of Range, Wildlife, and Fisheries Management, Box 42125, Texas Tech University, Lubbock, TX 79409, USA

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increasing the injury rates (Houben et al. 1993, Andelt et al. 1999). However, only Graver et al. (1996) compared injury rates of coyotes captured in standard Soft Catch traps and TLS modified traps. We know of no other studies that compared the injury rates of bobcats *(Lynx rufus)* or nontarget animals that were captured in standard and TLS modified traps. This information is needed so that people trapping for various species can make informed decisions about their equipment.

We report on the capture rates and injury rates of standard and TLS modified No. 3 Victor Soft Catch traps that were used to trap coyotes and bobcats for research purposes. We also report on capture rates and injury rates for raccoons *(Procyon lotor)*, a large nontarget species, captured in both types of traps.

Study area and methods

Our study was conducted on Fort Riley Military Reservation, Kansas. Two trappers were involved in the study; C. Richardson, Wildlife Services employee who had >15 years of trapping experience, and J. Kamler, who was monitored and instructed in Soft Catch trap-setting procedures by Richardson. All Soft Catch traps were set according to Woodstream Corporation's recommended procedures described by Linhart and Dasch (1992). We used a variety of baits, lures, and urines with primarily dirt-hole sets when setting traps. Trapping efforts concentrated in the fall but occurred periodically from October 1995 to March 1997.

Two types of traps were compared: standard No. 3 Victor Soft Catch trap, and No. 3 Victor Soft Catch trap modified with a Taos Lightening Spring (TLS) double torsion spring attached to the opposite levers of the original double coil springs. All traps were equipped with a 15 cm center-mounted chain that had an attached shock spring and was anchored to a stake. Both types of traps were equipped with Paws-I-Trip™ pan tension devices (M-Y Enterprises, Homer City, Pennsylvania, USA) to reduce the capture of small nontarget species (Phillips and Graver 1996). Since both types of traps were equipped with pan tension devices, they technically were both modified. However, for the purposes of this study, we considered the Soft Catch traps equipped with the original springs as standard, and those equipped the TLS double torsion springs as modified. Initially, only the standard traps were used in the study. However, after we observed many sprang traps and several instances where animals pulled out of traps, the TLS double torsion springs were attached in an attempt to increase capture rates.

Researchers recorded the following data each day traps were checked: animals caught and held, injury to animal limb, traps sprang, and animals caught but pulled out of trap. Data from 4 days were excluded from the analysis because of heavy rains. Traps were checked near sunrise and again before sunset to assure that animals did not remain in traps more than 12 hr. Although the accepted standard is generally considered a 24-hr check, only 3 of 59 captures (2 coyotes, 1 bobcat) in this study occurred during the second check of the day. Therefore, we feel that our trapping results are comparable to others that use a 24-hr check interval. Captured coyotes, bobcats, and several raccoons were outfitted with radio transmitter collars and released for another study.

Capture rate was defined as the

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number of animal captures per trap type divided by the number of potential captures (Skinner and Todd 1990, Phillips and Mullis 1996). Potential captures were the sum of animals captured and held, animals captured and not held, and traps sprung but animal missed. Potential captures were identified to species based on hair found in traps (for animals captured and not held) and presence of footprints (for traps sprung but animal missed).

Injury rate was defined as the number of animals captured with major injuries per trap type divided by the total number of animals captured. Injuries for each animal were defined using an injury code (Table 1) similar to Linhart et al. (1981) and Phillips et al. (1992). Since animals were released for study purposes, limbs could not be necropsied Instead, limbs were given an external injury score and photographed for documentation. Injuries were defined as major or minor. M. Dryden, a veterinarian from Kansas State University School of Veterinarian Medicine, provided assistance in classifying injuries. Fisher's exact test (Mehta and Patel 1995) was used to compare capture rates and injury rates between the 2 types of traps.

Coyotes and bobcats were designated as target species, whereas raccoons and other smaller species were designated as non-targets. Raccoons and other smaller furbearers are not generally considered non-targets when trapping for fur during the legal season. However, we considered raccoons as nontargets because it is recommended that professional trappers use No.l or No. 1 ½ leghold traps for capturing raccoons (Boggess 1994). Thus, larger leghold traps such as No. 3's are likely to cause more injuries to raccoons than the recommended smaller leghold traps.

Results and discussion

Fifty-nine animals were captured and 22 animals escaped from traps during all trapping periods. Captured animals included 15 coyotes, 17 bobcats and 27 designated nontarget animals, including 23 raccoons, 3 opossums *(Didelphis virginiana)*, and 1 badger *(Taxidea taxus)*.

Table 1. Categories used to describe visual limb injuries to coyotes, bobcats, and raccoons captured with standard and Taos Lightening Spring™ (TLS) modified No. 3 Soft Catch® traps on Fort Riley Military Reservation, Kansas, from October 1995 to March 1997.

Minor injury	Major injury
1) None.	1) Large deep cut (> 0.5 cm) through skin, exposing tendons or bones.
2) Swollen foot / leg	2) Several small deep cuts (< 0.5 cm), exposing tendons or bones.
3) Small cut (< 0.5 cm) through skin, but no damage to tendons or bones.	3) Broken bones or cut tendons.
4) Large cut (> 0.5 cm), but not extending through skin.	4) Self-mutilation of captured limb

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Capture rates for coyotes using TLS modified (92%) traps were more than 3-times higher than standard (27%) traps (*P* = 0.002; Table 2). Capture rates for raccoons using TLS modified (85%) traps were similar although slightly higher than standard (67%) traps (*P* = 0.242), whereas bobcats had identical capture rates (100%) in both types of traps (Table 2).

Analyses of capture rates between the 2 types of traps had a temporal bias, because initially only standard traps were used in fall 1995, then all traps were equipped with TLS double torsion spring and used thereafter. However, we feel that abiotic temporal biases (i.e., precipitation, temperature, seasonal influence, soil condition, etc.) were minimal because all trapping periods occurred under similar conditions and in the same areas. Biotic temporal biases (i.e., physical and behavioral changes in animals) were also possible, but we feel that these did not significantly affect capture and injury rates. Additionally, efficiency of padded traps may improve as trappers gain experience using them (Skinner and Todd 1990). Despite these possible biases, we feel that our observed capture rates reflect a substantial improvement in the efficiency of Soft Catch traps that were modified with the TLS double torsion spring.

We further compared the 2 types of traps by recording the trap jaw location on all coyotes captured, similar to Phillips and Mullis (1996). The results were as follows: 10 were caught above the foot pads (all TLS modified

Table 2. Capture rates for standard and Taos Lightening Spring™ (TLS) modified No. 3 Soft Catch® traps, calculated from animals trapped on Fort Riley Military Reservation, Kansas, from October 1995 to March 1997.

Species	Captured (*n*)	Escaped (*n*)	Total (*n*)	Capture rate (%)
Standard No. 3 Soft Catch				
Coyote	3	8	11	27
Bobcat	5	0	5	100
Raccoon	12	6	18	67
Opossum	3	0	3	100
Unknown	—	3	3	—
TLS Modified No. 3 Soft Catch				
Coyote	12	1	13	92
Bobcat	12	0	12	100
Raccoon	11	2	13	85
Badger	1	1	2	50
Unknown	---	1	1	—

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traps), 2 were caught across the foot pads (1 TLS modified and 1 standard trap), and 3 were caught by the toes (1 TLS modified and 2 standard traps). These data demonstrate that TLS modified traps captured coyotes higher on the foot, providing a better grip than standard traps. We believe the low number of captures by standard traps was due to coyotes springing the traps and pulling away before the traps closed, and being caught by the toes and pulling out. When the standard traps did catch a coyote, the grip was generally poor, resulting in "toe catches" for 2 of 3 coyotes captured in that trap type.

Incidentally, the relatively poor performance of standard No. 3 Victor Soft Catch traps was the primary reason that we began using TLS modified traps. Phillips et al. (1996) found that standard No. 3 Victor Soft Catch traps were as effective as 3 types of unpadded traps in capturing coyotes in the western United States. Despite the findings by Phillips et al. (1996), field personnel with the USDA Wildlife Services program commonly modify No. 3 Soft Catch traps by replacing or supplementing the existing springs to increase capture efficiency (Gruver et al. 1996). We used the TLS double torsion spring because it is used by many Wildlife Services personnel and researchers in western states to modify No.3 Soft Catch traps (J. C. Conner, J. C. Conner Trapping Supply, Newcomerstown, Ohio, USA, personal communication).

Our comparison of injury rates between the 2 trap types was limited for coyotes and bobcats because of low sample sizes (3 coyotes, 5 bobcats) captured in standard traps. Injury rates were minimal (< 9%) for coyotes and bobcats, with apparently little difference between trap types (Table 3). The low injury rates for coyotes and bobcats

Table 3. Injury rates for standard and Taos Lightening Spring™ (TLS) modified No. 3 Soft Catch® traps, determined from coyotes, bobcats, and raccoons trapped on Fort Riley Military Reservation, Kansas, from October 1995 to March 1997.

Trap type	Minor injury (n)	Major injury *(n)*	Injury rate (%)
Coyotes			
Standard No. 3 Soft Catch	3	0	0
TLS Modified No. 3 Soft Catch	11	1[a]	8
Bobcats			
Standard No. 3 Soft Catch	5	0	0
TLS Modified No. 3 Soft Catch	11	1[b]	8
Raccoons			
Standard No. 3 Soft Catch	8	4[c]	33
TLS Modified No. 3 Soft Catch	3	8[c]	73

[a]Injury was categorized as Major #4 (See Table 1)
[b]Injury was categorized as Major #3 (fractured ulna)
[c]All injuries were categorized as Major #4

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were similar to that found by other studies that investigated injury rates of Soft Catch traps (Olsen et al. 1986, 1988; Phillips et al. 1992; Gruver et al. 1996).

Injury rates for raccoons, a large nontarget species, were higher in TLS modified (73%) than standard (33%) traps *(P* = 0.070; Table 3). Most of the major injuries that occurred to the raccoons resulted from inadvertent self-mutilation of the captured limb, and were not caused directly by the traps. Self-mutilation has been known to occur when raccoons are captured in leghold traps (Tullar 1984, Hubert et al. 1996). We feel that self-mutilation was inadvertent because it only occurred on the part of limb where blood circulation was obstructed (below the closed trap jaws), and not on the part of the limb where blood circulation was maintained (above the trap jaws). If blood circulation was completely obstructed to the limb below the trap jaws, then numbing would occur and a raccoon could unknowingly mutilate its own limb without feeling pain (M. Dryden, Kansas State University School of Veterinarian Medicine, Manhattan, Kansas, USA, personal communication). We suspect that increased incidence of self-mutilation in TLS modified traps was directly related to the greater pressure applied by the additional springs. The additional double torsion spring on the modified traps exerted a greater clamping force and increased the jaw pressure on the captured limb (2.1 kg/cm^ for standard and 3.6 kg/cm^ for modified traps, Gruver et al. 1996). The increased pressure probably increased the incidence of numbing of raccoon limbs, and consequently increased the incidence of inadvertent self-mutilations on the limbs below the trap jaws.

The No. 3 Soft Catch traps that were used at the beginning of this study were new and had been purchased in fall 1995. However, the original springs on No. 3 Soft Catch traps are known to weaken with use (Gruver et al. 1996, Tuovila et al. 1996), which may affect trapping results over long periods. Thus, as springs on traps weaken, the trapping efficiency may decrease (Gruver et al. 1996, Tuovila et al. 1996). This is not likely to affect our results because we used the original new springs on the standard Soft Catch traps for only a short period (approximately 2 months) before adding the TLS double torsion springs, which subsequently increased trapping efficiency. Interestingly, the latest version of Soft Catch traps (1997) have been manufactured with stronger springs (Andelt et al. 1999), possibly increasing the efficiency of more recently purchased traps.

Paws-I-Trip pan tension devices (set to trip at 1.8 kg of pressure) successfully excluded many small nontarget species. Tracks of many opossums *(Didelphis virginiana),* striped skunks *{Mephitis mephitis),* cottontail rabbits *(Sylvilagus floridanus),* and birds were observed on traps without the traps being sprung. However, the pan tension devices did not exclude large raccoons. The range of adult weights for the species trapped were: raccoons (5-11 kg); bobcats (8-11 kg); and coyotes (10-15 kg). Thus, it was not feasible to avoid capturing large raccoons and still effectively capture bobcats and coyotes.

We found that No. 3 Soft Catch traps modified with TLS double torsion springs had significantly higher capture rates for coyotes than standard Soft Catch traps. However, both types of traps had similar capture rates for raccoons and identical capture rates for

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bobcats. The TLS modified traps produced low injury rates to coyotes and bobcats. However, the increased jaw speed and clamping force increased injury rates to raccoons that were captured despite the use of pan tension devices. We believe using modified No. 3 Soft Catch traps should be evaluated in each trapping situation. Trappers should decide on the type of trap to use based on both target and nontarget animals that are likely to be captured.

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