An effective box trap for capturing lynx

Jay A. Kolbe, John R. Squires, and Thomas W. Parker

Abstract We designed a box trap for capturing lynx (*Lynx lynx*) that is lightweight, safe, effective, and less expensive than many commercial models. It can be constructed in approximately 3–4 hours from readily available materials. We used this trap to capture 40 lynx 89 times (96% of lynx entering traps) and observed no trapping related injuries. We compare our box trap to other common lynx-capture techniques that we used in terms of capture success, injuries, efficacy, and cost. Our design provided a safe, economical, and efficient means of capturing lynx when even a moderate risk of injury was unacceptable.

Key words box trap, Canada lynx, foothold trap, live capture, live trap, *Lynx lynx*, snare, trapping injuries

The federal listing of lynx (*Lynx lynx*) as Threatened under the Endangered Species Act (Federal Register March 24, 2000; 65:16051–16086) has increased the need for information on this species. Telemetry studies require capturing and handling lynx in ways that minimize both animal stress and the risk of injury. Foothold traps, foot snares, and box traps have previously been used to live-capture lynx for research in subfreezing temperatures (Koehler 1990, Mowat et al. 1994, Staples 1995, O'Donoghue et al. 1998).

Mowat et al. (1994) found that the capture rate of box traps and foot snares was lower than that of padded foothold traps. However, they concluded that foothold traps caused unacceptably high rates of frost damage to the foot when used in temperatures below –8°C. Box traps reduced the risk of frost damage because the animal's foot was not constricted. Various box traps have been used to capture felids including bobcats (*Lynx rufus;* Litvaitis and Harrison 1989, Koehler and Hornocker 1991) and ocelots (*Leopardus pardalis;* Shindle and Tewes 2000). Mowat et al. (1994) recommended against using box traps because of their low capture efficiency (captures per trap night), difficulty of transport, and high cost per unit.

We studied lynx ecology near Seeley Lake, Montana from 1998–2002 and captured 65 lynx 143 times. Winter temperatures at Seeley Lake averaged –7°C during the day and –18°C at night (United States Forest Service Seeley Lake Ranger District records). Snow was present at trap sites from December–April in depths ranging from 0.5–2 m. The study area received regular precipitation and drifting snow was common. We captured lynx during winter to minimize nontarget captures and so that snow tracking could be used to guide trap-site selection. Our need to capture and handle lynx in winter provided an opportunity to evaluate the effectiveness of a home-built box trap design versus other trapping methods.

Methods

We used foothold traps and foot snares the first 2 winters of our study (1998, 1999) and box traps and foot snares during the following 3 winters (2000, 2001, 2002). We also occasionally handled lynx that were captured by local fur trappers, who mostly used nonpadded foothold traps.

Foothold traps

We used the Victor #3 Softcatch® (Oneida Victor Inc. Ltd., Euclid, Oh.), a coilspring trap with padded rubber jaws and weakened springs. We set these foothold traps in either temporary "cubbies" (enclosures constructed of small-diameter conifer boughs and brush that were easily knocked down without

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causing injury to the captured animal) or in permanent cubbies that were sufficiently large to prevent trapped animals from striking or becoming entangled on the sides of the set. Trap chains were 15 cm in length and included 2 box swivels and a shock spring. We either affixed traps to stakes in the ground or chained them to the bole of a tree that was cleared of limbs 2 m above the ground to reduce the chance of entanglement. We checked foothold traps every 24 hours when temperatures were above freezing and every 12 hours when subfreezing temperatures were predicted. We closed foothold traps when overnight temperatures <–8°C were expected.

Foot snares

We used 2 types of foot snares to capture lynx. The Freemont® snare (Bertram Trap Co. Ltd., Britle, Manit.), as modified by Mowat et al. (1994), was a pan-fired trap that used a thrower arm to tighten a snare cable around the target animal's leg. Belisle® foot snares (Belisle, Labelle, Que.) closely resembled a foothold trap in design and could be easily concealed like a standard trap, but when triggered the trap threw a snare cable around the target animal's leg. We anchored snares to trees with 2 m of lower branches removed and placed them in open cubbies constructed of small (<1-cm) branches that helped direct the animal's movements. Although snare-caught lynx have a relatively low incidence of frost damage to the foot (Mowat et al. 1994), we closed snares when temperatures <–20°C were predicted. Foot snares were checked at least every 24 hours. The 2 types of foot snares were grouped for analysis.

Box traps

We designed and built the box traps used to capture lynx for our study. We generally transported box traps to the set location by snow machine, set them under the canopy of a large conifer, and checked them every 24–48 hours. We placed up to 4 traps immediately adjacent to each other at a set location to capture entire family groups. We used predominantly road-killed deer (*Odocoileus* spp.) and beaver (*Castor canadensis*) carcasses for bait, often augmented with homemade or commercial castor-based scents. Visual attractors, such as bird wings or aluminum pie plates, were hung from monofilament fishing line near all sets. We found that placing pine boughs on the top and sides of the set trap prevented snow from affecting the treadle's operation, served to camouflage the set, and provided greater shelter for captured animals. We did not close box traps in response to low ambient temperatures.

Box-trap construction

Box traps were constructed with common shop tools. Total construction time was between 3 and 4 person-hours depending on the technician's experience and the available facilities. Materials used to build the trap are listed in Table 1. Figure 1 shows design details described below.

We cut the wooden stud in half lengthwise, yielding two 5 × 5 × 244-cm pieces. We then cut both of these pieces to 183 cm in length. Using a 1.5-cm-wide dado blade in a table saw, we cut a 1.90-cm-deep groove lengthwise down the center of the 183-cm pieces (Figure 1*b*). These grooves accept the metal trap door when the frame is assembled.

We cut the 0.64-cm (1/4 in.)-diameter steel rod to the lengths listed in Table 1. We then welded the door together and, using 14-gauge tie-wire, securely attached a piece of the 2.50 × 2.50-cm (1 × 1-in.) 14-gauge wire mesh to the inside portion of the door (Figure 1*c*). We then inserted the door into

Table 1. List of materials used to construct a box trap for lynx captured in Seeley Lake, Montana, 2000–2002.

Number	Material	Price[a]
9.45 m	1″ PVC pipe	$6.93
4	38-cm pieces	
3	122-cm pieces	
4	60-cm pieces	
2	99-cm pieces	
10	PVC couplers	$12.74
4	45° couplers	
2	"T" couplers	
4	90° w/1″ outlet couplers	
1	4.66-m × 0.64-cm (1/4″) steel rod	$1.32
4	92-cm pieces	
2	51-cm pieces	
1	52-cm piece	
2.5 m	14-ga 2.5 × 2.5 (1″×1″) × 123-cm (48″) wire mesh	$6.51
3.7 m	2.5 × 2.5 (1″×1″) × 123-cm (48″) chicken wire	$3.84
1	1.25-m 3/32″steel aircraft cable	$0.36
1	0.3-m × 0.61-m piece 1/4″ plywood	$0.90
1	5 × 10 × 244-cm (2 × 4-in. × 8-ft.) wooden stud	$2.95
Total		$35.55

[a] 2002 United States dollars.

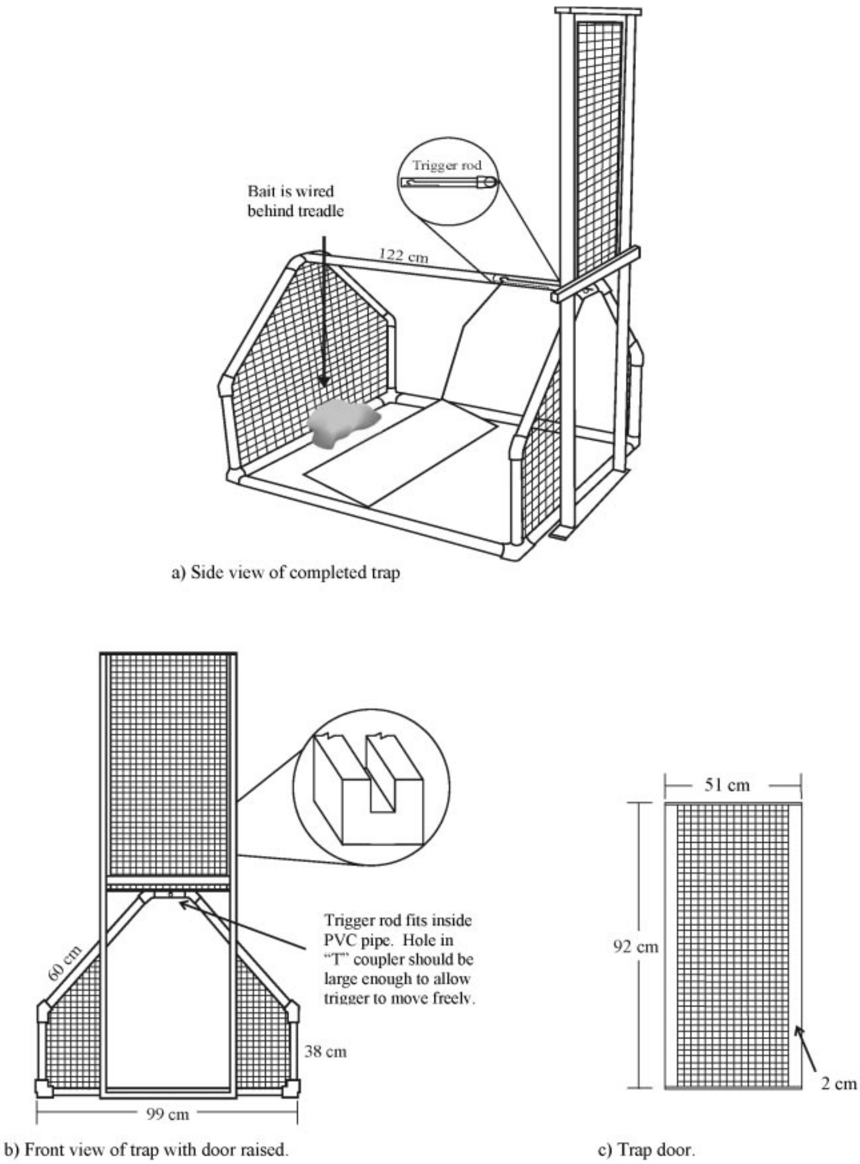

Figure 1. Home-built box trap for lynx capture. Construction details and materials are described in text.

the frame using the remaining two 61-cm pieces of wood for the top and bottom of the door frame and secured them with 7.60-cm (3-in.) wood screws. To strengthen the door frame, we screwed a wooden brace to the outside of the rails, even with the top of the closed door. We drilled holes through the outside of the lower portion of the door frame every 10 cm to allow it to be wired to the trap. We painted the door frame to better camouflage it.

Next, we cut a 1.30 × 22.50-cm groove in the underside of the long ridge piece of the trap frame beginning 50 cm from the front of the trap (Figure 1*a*). We drilled a 0.70-cm hole in the front "T" coupler to accept the 50-cm trigger rod. We bent a loop in the back portion of the trigger rod, attached the aircraft cable to it, and inserted the trigger rod into the groove and out the hole in the front of the trap. We assembled the cage frame as shown in Figure 1*a*. Using the heavier 14-gauge wire mesh for the back and front panels added necessary rigidity to the trap; using lighter chicken wire for the sides reduced the trap's weight and cost. Researchers may choose to use the heavier wire for the entire trap if the species to be captured could potentially chew through the lighter chicken wire. Joints may be entirely glued together if the trap is to be transported whole or selectively glued together ahead of time to allow the trap materials to more easily be transported to the set location and assembled on-site.

We found it easier to wire the completed doorframe assembly to the trap at the set location because we transported most traps on a sled behind a snow machine. We used 14-gauge tie-wire to attach both styles of wire mesh to the trap frame and stitched it tightly enough so that a captured animal was not able get a paw through any seam. We ran the cable from the rear of the trigger rod through the wire on the back or side panel of the cage and affixed it to the rear of the treadle. We drilled 2 holes in the leading edge of the treadle and wired it to the floor of the trap so that the treadle, when set, was positioned at a 30° angle to the floor of the trap and approximately 23 cm from the back.

Releasing a lynx from a home-built box trap, western Montana 2002.

Finally, we placed bait behind the treadle, extended the trigger rod approximately 3 cm from the front of the "T" coupler, and rested the door on the tip of the trigger rod. A 1–2-kg weight, such as a 2-m × 10-cm-diameter stick, can be placed on the top of the open door to ensure that it falls when triggered.

We also built similar box traps in remote wilderness areas using small-diameter (approximately 10-cm) poles to construct the trap frame. The door frame assembly, 14-gauge tie-wire, trigger rod, cable, and chicken wire can easily be carried to the set location and the poles cut on site. In this case, small eyebolts screwed into the bottom of the ridge pole were used to support the trigger rod. Our approximate assembly time for this type of trap was 3 hours.

Results

We captured 65 lynx a total of 143 times in winter using a combination of foot-hold traps, snares, and box traps. We captured 40 lynx (18F, 22M) a total of 89 times in box traps. We observed no trapping-related injuries using box traps (Table 2). Based on snow-track evidence, lynx approached to within 10 m of box traps 97 times and were successfully held 89 times. Lynx entered traps without being captured 4 times due to either failing to step on the treadle or the door failing to fall because it had frozen in its track. Lynx approached box traps but failed to enter on 4 other occasions. We believe that 3 of these approaches were by a single marked individual that proved unusually difficult to capture by any method. The box-trap capture rate {[lynx caught/(lynx caught + lynx entering trap but missed)] × 100; Mowat et al. 1994} for all years was 96%. Eighteen of 40 lynx captured in box traps were captured ≥2 times. We do not feel that trap aversion was commonly developed following initial capture using these traps. Birds, bobcats, and snowshoe hares (*Lepus americanus*) occasionally caught in box traps were easily released unharmed.

We caught lynx 39 times in padded foothold traps, and local fur trappers used nonpadded foothold traps to capture lynx 12 times (Table 2). Although the number of lynx approaches to foothold sets was not fully quantified during the first 2 winters of the study, we rarely observed lynx tracks approaching cubbies without entering. Traps occasionally failed to hold the animal because one or both trap jaws had frozen to the ground or the trap failed to securely grip the lynx's foot. The combined injury rate for lynx caught in both types of foothold traps was 43%. This was the highest injury rate of all capture techniques evaluated (Table 2). Nontarget wildlife captured in foothold traps included several bird species, snowshoe hares, red squirrels (*Tamiasciurus hudsonicus*), and one wolverine (*Gulo gulo*).

We captured lynx 3 times in foot snares (Table 2). Although lynx did not

Table 2. Capture-related injuries to lynx trapped in western Montana, 1998–2002. Injury rates per capture technique are listed in parentheses.

	n (capture events)				Minor injuries[a]	Major injuries[b]	Foot freezing	Edema[c]
	Total	Males	Females	Kittens				
Box trap	89	52	37	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Padded foothold	39	28	11	4	3 (8%)	1[d] (3%)	7 (18%)	3 (8%)
Nonpadded foothold[e]	12	9	3	0	5 (42%)	0 (0%)	1 (8%)	2 (17%)
Foot snare	3	2	1	1	0 (0%)	0 (0%)	0 (0%)	1 (33%)

[a] Minor injuries were trap-related injuries not considered life-threatening if left untreated, and commonly included foot lacerations and tooth damage. Does not include foot freezing or edema.

[b] Major injuries were those trap-related injuries considered to be life threatening if left untreated. Does not include either foot freezing or edema.

[c] Edema was defined as pronounced swelling of the foot in the trap.

[d] Fractured ulna.

[e] Nonpadded traps used by fur trappers.

appear to avoid snare sets, lynx sprung snares without being captured at an unacceptably high rate. We observed no major capture-related injuries to lynx while using foot snares. No nontarget animals were captured in foot snares.

Discussion

During the 2000–2002 field seasons, we used box traps of our own design almost exclusively because the trap was lightweight, relatively inexpensive, safe, and effective for the capture of lynx during winter. Lynx rarely refused to enter box traps and, once inside, were successfully held 96% of the time. This capture rate was higher than box-trap capture rates observed by Mowat et al. (1994) for any of the 4 years of their study. Box traps had several advantages over other trapping methods. First, they greatly reduced the risk of injury compared to other methods. Second, they were relatively easy to set and maintain, so trapping success was high regardless of the technician's experience. Third, using box traps allowed us to safely extend the trap-check interval to 48 hours because the animal was held without any constriction to its foot and was in a secure location with food (bait) and water (snow). This was especially important for trapping animals in wilderness areas with difficult access. Fourth, we could safely release nontarget animals without chemical immobilization. This was particularly important because we could trap in the home ranges of previously marked males while trying to capture a female within his territory. Finally, by deploying several traps at the same location, we were often able to successfully capture a female lynx and her young of the year without separating them.

Padded foothold traps set in loose cubbies were also effective for capturing lynx. However, despite having a protocol that required checking traps every 12 hours and closing them when temperatures <–8°C were expected, we encountered foot freezing and other injuries in several captured animals (Table 2). Rapidly changing weather conditions and microsite temperature variations made it difficult to accurately predict overnight low temperatures at specific set locations. For example, late-night clearing of cloud cover can cause air temperatures to drop quickly and cause frost damage despite frequent trap checks.

Foot snares proved problematic for several reasons. First, they had to be set in exposed locations to help prevent the entanglement and injury of the animal. Because traps were not protected, heavy snowfall and high winds often either rendered the snares inoperable or greatly decreased capture efficiency. Although snares could be safely used in lower temperatures than foothold traps, it was still necessary to close them when very low overnight temperatures were expected. Finally, the effective use of foot snares requires that technicians have a moderate level of skill and experience. Even when set as described by Mowat et al. (1994), the risk of major injuries using foot snares is measurable (G. Mowat, Aurora Wildlife Research, personal communication).

Although commercially available box traps have been used to capture lynx (Koehler 1990, Mowat et al. 1994, Staples 1995, O'Donoghue et al. 1998), we believe our design was particularly effective, in part because of its substantially larger size. Our design is nearly twice as tall, 50% wider, and 30–50% larger by volume than comparable commercial models. We believe this increased size both reduces trap-refusal rates and increases capture success once an animal enters the trap (Table 3).

It is interesting to note that the trap-refusal rate in Seeley Lake was lower than that observed by both Mowat et al. (1994), using commercial box traps, and a pilot lynx research project in extreme northwest Montana begun in 2003 using our box-trap design (J. Squires, United States Forest Service, personal communication). Although we believe our box-trap design is more effective for the capture of lynx in winter than commercially available

Table 3. Physical dimensions, cost, and assembly times for home-built and commercially available box traps. Shipping costs will vary by location and may be significant.

	Dimensions (cm)	Weight (kg)	Assembly[c]	Purchase cost[d]
Home-built box trap	99 × 102 × 122	14.5	3–4	$36 (materials)
Tomahawk 110A[a]	51 × 66 × 122	27.3	0	$238
New Haven Live Trap[b]	56 × 66 × 178	38.6	0	$250

[a] Available from Tomahawk Live Trap Co., Tomahawk, Wisconsin, USA.
[b] Available from Chagnon's Outdoor World, Manistique, Michigan, USA.
[c] Time in hours.
[d] 2002 United States dollars.

models, refusal rates may vary in response to prey densities, carrion availability, and the level of human activity on the study area.

Our box trap weighs only half as much as commercially available traps, costs up to 85% less, and is made from readily available materials. This design, appropriately modified, may also be useful for safely capturing other mid-sized mammals.

Acknowledgments. J. Deist, T. Ulizio, and T. Smucker provided valuable design input. We would like to thank D. Murray, G. Mowat, D. Pearson, D. Pletscher, and one anonymous reviewer for providing valuable comments on an earlier draft of the manuscript. We also thank J. Vandewater for her great help with the illustrations.

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Associate Editor: *Murray*