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Evaluating Trapping Techniques to Reduce Potential for Injury to Mexican Wolves

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Appendixes for Open-File Report 2011-1190

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32

SI to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)

Appendix 1. Annotated Bibliography of Selected References

Andelt, W.F., Phillips, R.L, Schmidt, R.H., and Gill, R.B., 1999, Trapping furbearers: an overview of the biological and social issues surrounding a public policy controversy: Wildlife Society Bulletin, v. 27, p. 53-64.

The results of several previous furbearer (mostly coyote) trapping studies were contrasted, specifically with respect to injuries caused by various types of foothold traps. The authors found that, in general, padded traps were much less likely than laminated or standard steel-foothold traps to cause trauma and severe foot injury. The foot injury most frequently inflicted on coyotes and red foxes by padded traps was edema, and the injured individuals, when released, typically recovered within a few days. Also, the likelihood of limb freezing may be somewhat lower with padded traps, although it was still a rather frequent occurrence in the study cited (Onderka and others, 1990). The authors indicated that the padded traps evaluated caused less injury by virtue of the padding, and not because of the lighter spring pressure in some of the padded traps tested, because modified padded traps with heavier springs did not increase injury risk.

Association of Fish and Wildlife Agencies, 2006, Best management practices for trapping coyotes in the Western United States: Washington, D.C., Association of Fish and Wildlife Agencies, 12 pp.

The Association of Fish and Wildlife Agencies (AFWA) has conducted extensive, scientific field testing of various traps and cable restraints by using consistent techniques and has made recommendations for trappers to maximize trap practicality, productivity, and selectivity while minimizing animal suffering. The following general characteristics describe the device models tested which met AFWA Best Management Practices (BMP) standards: for padded-jaw traps, an inside jaw spread of 5 3/8 inch, for unaltered smooth-jaw traps, an inside spread of 4 11/16 inch to 6 1/8 inch, and for wide-jaw, offset, or laminated traps, an inside spread of 5 1/16 inch to 5 13/16 inch , and for cable foot restraints, an inside spread of 6 3/8 inch. For most foothold traps tested, a pan-tension device set at 2 pounds was recommended to effect correct holding position and to prevent the trap being tripped by some smaller, nontarget animals. Also, nearly all traps meeting the BMP standard were anchored with stakes; however, one accepted model was anchored with a grapple.

Darrow, P.A., Skirpstunas, R.T., Carlson, S.W., and Shivik, J.A., 2009, Comparison of injuries to coyote from 3 types of cable foot-restraints: Journal of Wildlife Management, v. 73, p. 1441-1444.

Three types of cable-foot restraints, which incorporated capture loops of bare cable, plastic-sleeved cable, and fine chain, were used to capture 21, 14, and 17 coyotes, respectively, mainly during June and July in central California, United States. The captured coyotes were euthanized, and their injuries were compared with those of coyotes captured in other studies. Of the cable restraints tested, the sleeved-cable restraint caused the most injury, and the chain restraint caused the least damage. The sleeved-cable and bare-cable restraints resulted in lesser

injuries than unpadded steel traps, but similar to slightly more severe injuries than padded traps. The chain-loop restraint caused slightly less damage than the padded traps. The authors surmised that, based on currently available research, padded traps will likely result in less injury than the cable restraints on the market today.

Earle, R.D., Lunning, D.M., Tuovila, V.R., and Shivik, J.A., 2003, Evaluating injury mitigation and performance of #3 Victor Soft Catch (R) traps to restrain bobcats: Wildlife Society Bulletin, v. 31, p. 617-629.

During the summer and early autumn of six consecutive years, 112 bobcats were captured a total of 150 times by using stock, rubber-padded #3 Victor Soft Catch traps; #3 Victor Soft Catch traps modified with heavier springs; and, as a control, standard, #3 unpadded Victor traps. Each captured bobcat was tranquilized, examined, assigned an injury score on an ordinal scale based on the most severe injury to the individual, and then released. The bobcats captured in the unmodified Soft Catch traps had lower injury scores than individuals caught in the standard, unpadded trap, but the modified, heavy-spring Soft Catch traps resulted in both lower injury scores and higher capture efficiency rates than either of the other two trap types. The authors suggested that the better performance of the modified traps is due to the faster closure time, resulting in a more consistent hold on the part of the foot immediately proximal to the interdigital pad. The authors also noted that the manufacturer of Victor Soft Catch traps has since 1999 incorporated modifications to these traps similar to those implemented during the study.

Englund, Jan, 1982, A comparison of injuries to leg-hold trapped and foot-snared red foxes: Journal of Wildlife Management, v. 46, p. 1113-1117.

Red foxes were captured and examined for leg and tooth injury during subfreezing conditions in northern Sweden by using five different traps and snares: #2 and #3 unpadded Victor double-longspring, the same traps with jaws and chain covered with plastic tubing, and a Swedish-manufactured plastic-coated foot snare. Differences in trap sizes were not taken into consideration; hence, there were only three device categories compared, with a total of 1,651 foxes being necropsied. Thirty-eight percent of foxes captured in unmodified traps had dental injuries classified as “severe,” whereas only 13 percent of those caught in the plastic-coated version and 2 percent of those captured in the snare had similarly severe dental injuries. Thirty and 43 percent, respectively, of foxes caught in the unmodified and modified traps sustained fractures, whereas 3 percent of snared foxes had fractures. The author concluded that plastic-sheathing of traps reduced dental injuries in red foxes but that foot and leg injuries were not affected by the modifications.

Frame, P.F., and Meier, T.J., 2007, Field-assessed injury to wolves captured in rubber-padded traps: Journal of Wildlife Management, v. 71, p. 2074-2076.

Ninety-six wolves were captured by using no. 7 EZ Grip, rubber-padded traps during the summer in Idaho, Montana, Minnesota, United States, and Alberta, Canada, tranquilized, and the resulting injuries were compared with those of two other wolf-trapping studies (Kuehn and

others, 1986; Sahr and Knowlton, 2000). The captured wolves received significantly less severe injuries than individuals captured in the other studies in which conventional, unpadded-foothold trap types were used; however, a modified, toothed, offset-foothold trap used by Kuehn and others (1986) produced fewer *severe* injuries than any of the other traps for which data were available. The wolves captured in this study were not recaptured to evaluate incidence of necrosis, but some individuals were observed after release, and they exhibited little or no limping. Frame and Meier concluded that the EZ Grip trap performed as well as, or better than, the other traps studied and recommended that managers consider using rubber-padded traps in future studies which require the live capture and release of wolves.

Houben, J.M., Holland, Merrilee, Jack, S.W., and Boyle, C.R., 1993, An evaluation of laminated offset jawed traps for reducing injuries to coyotes: Great Plains Wildlife Damage Control Workshop Proceedings, 147-153.

During the spring and fall of 1992 in northern Mississippi, United States, 10 coyotes were trapped in each of two types of foothold trap. The coyotes were then euthanized, and their legs were removed, necropsied, and assigned an injury score based on a revised Olson Scoring System (Olson and others, 1988). One trap was a modified #3 Victor Soft Catch trap with springs 40 percent heavier than an unmodified model, and the other was a #3 Northwoods offset, coil-spring trap with jaws laminated to be 0.635 cm thicker than standard, an extra swivel placed at the trap end of the chain, and a shock-absorbing coil spring in the trap chain. The tested trap types resulted in similar injury scores, much lower than scores exhibited by coyotes caught in conventional, nonlaminated, steel-jawed traps in other studies.

Hubert, G.F., Hungerford, L.L., and Bluett, R.D., 1997, Injuries to coyotes captured in modified foothold traps: Wildlife Society Bulletin, v. 25, p. 858-863.

Two types of traps were tested—an unmodified, #3 Bridger coil-spring trap, and a modified, #3 Bridger coil-spring trap with laminated, 0.95 cm-thick jaws, an extra chain swivel, and an additional set of coil springs for greater clamping force and closing speed. Forty-eight coyotes were captured in Illinois, United States, during the fall and winter when temperatures ranged from -17°C to 17°C. Each individual was euthanized, necropsied, and assigned a full-body and trapped-limb-only injury score similar to that used in another study (Onderka and others, 1990). Nineteen coyotes captured in the standard traps exhibited somewhat higher, but not significantly different, injury scores than the 29 individuals caught in the modified version; however, the modified trap did markedly reduce the incidence of very severe injuries. The authors suggested that although some injury reduction might be realized by using traps modified as in this study, the most significant modification that can be made to #3 traps used for coyotes is the addition of rubber-type padding as tested in other studies.

Kreeger, T.J., White, P.J., Seal, U.S., and Tester, J.R., 1990, Pathological responses of red foxes to foothold traps: Journal of Wildlife Management, v. 54, p. 147-160.

Twenty-one captive-raised red foxes were affixed with heart-rate and body-temperature transmitters, trapped in padded (Victor Soft Catch) or unpadded #1 ½ Victor foothold traps,

remotely observed for behavioral responses, and lastly euthanized from a distance by gunshot so the carcasses could be examined and blood samples analyzed for endocrine and other stress-related physiological response. Twenty-one free-ranging red foxes were also captured by using the same traps, then similarly shot from a distance. Lastly, 23 unsuspecting, free-ranging red foxes were instantly killed by gunshot and their carcasses chemically analyzed as a control group. Captive-raised and wild-trapped foxes showed similar physiological reactions to being caught in each type of trap, indicating that captive-raised foxes are probably reliable indicators of stresses undergone by free-ranging foxes. Length of time spent by each fox struggling against the trap, biochemical analysis, and examination of trapped limbs all indicated that foxes captured in the unpadded trap underwent significantly more trauma than those caught in the rubber-padded trap.

Kuehn, D.W., Fuller, T.K., Mech, L.D., Paul, W.J., Fritts, S.H., and Berg, W.E., 1986, Trap-related injuries to gray wolves in Minnesota: Journal of Wildlife Management, v. 50, p. 90-91.

From 1968 to 1985, 375 adult and 179 juvenile wolves were captured in northern Minnesota, United States, by using four different Oneida Newhouse double-longspring, unpadded traps: #4 smooth-jaw with no offset, #4 smooth-jaw with 0.2 cm offset, #14 toothed-jaw with standard 0.7 cm offset, and a #14 toothed-jaw, custom-modified with a 1.8-cm offset. Prior to release, each individual was examined and assigned an injury score on a scale of one to four similar to the one used by Van Ballenberghe (1984); additionally, each wolf was examined for damage to dentition. Of the traps tested, the modified, wide-offset toothed-jaw trap resulted in the least injury, with no individuals displaying class three or four injury scores (indicating no fractures, dislocations, or lacerations totaling more than 2.5 cm in aggregate), the two smooth-jaw traps caused the most severe injuries, including a high frequency of class three injuries in particular, and the unmodified, toothed-jaw model resulted in intermediate levels of damage, including some class three and four injuries. Fifty-five percent of wolves captured exhibited dental injury, mostly restricted to premolars, with severe damage to carnassials and canines occurring only rarely. The authors recommended that future researchers who intend to capture wolves use #14, toothed-jaw traps with wide offsets.

Logan, K.A., Sweanor, L.L., Smith, J.F., and Hornocker, M.G., 1999, Capturing pumas with foot-hold snares: Wildlife Society Bulletin, v. 27, p. 201-208.

Modified, Shimetz-Aldrich foothold snares with drags and shock-absorbing chains were used to capture 107 pumas 209 times in southern New Mexico, United States, during all seasons; however, no trapping was done during exceptionally cold, snowy, or hot weather. Most captured pumas sustained very slight or no apparent injuries, but 2.4 percent (five individuals) received injuries described as severe and life threatening. Only two individuals sustained leg bone fractures during the study. The authors recommended similar foothold snares as a superior alternative to conventional steel traps for the humane, comparatively safe capture of pumas and other large carnivores.

Mowat, Garth., Slough, B.G., and Rivard, René, 1994, A comparison of three live capturing devices for lynx: capture efficiency and injuries: Wildlife Society Bulletin, v. 22, p. 644-650.

From January to April in Yukon Territory, Canada, during 5 successive years, 135 lynx were captured 205 times by using a box (cage) trap, a Freemont foot snare, and a #3 Victor Soft Catch rubber-padded foothold trap. All injuries to lynx captured in the box trap and rubber-padded foothold trap were minor, but the snare sometimes caused major injuries (most commonly a fractured radius or ulna) until the researchers modified their technique by securely anchoring the device to vegetation rather than relying on a drag. Also, although neither the snare nor the box trap resulted in any limb or toe freezing, 39 percent of lynx caught in the rubber-padded trap had frozen feet or toes. Several of these individuals were recaptured 1–2 years later and ranged from having no apparent permanent damage to having lost all digits on the affected foot. The researchers suggested that rubber-padded foothold traps not be used at temperatures below -8°C because of high risk of limb freezing and recommended foothold snares for winter use, provided they are set and secured carefully.

Muñoz-Igualada, Jaime, Shivik, J.A., Dominguez, F.G., Gonzalez, L.M., Moreno, A.A., Olalla, M.F., and Garcia, C.A., 2010, Traditional and new cable restraint systems to capture fox in central Spain: Journal of Wildlife Management, v. 74, p. 181-187.

Red foxes were captured in Spain by using two different unpowered devices: a Wisconsin nonlethal cable neck restraint, and a locally produced, nonlethal, cable-neck device known as a "Spanish Snare." Both devices resulted in average injuries deemed acceptably low to meet international standards, with the most severe injuries being inflicted on teeth, apparently caused by chewing of the snare cable. The authors suggested that the negative effects of this sort of displacement behavior might be mitigated by attaching a soft chew tab to the noose of the snare.

Muñoz-Igualada, Jaime, Shivik, J.A., Dominguez, F.G., Lara, José., and Gonzalez, L.M., 2008, Evaluation of cage-traps and cable restraint devices to capture red foxes in Spain: Journal of Wildlife Management, v. 72, p. 830-836.

Red foxes were captured in Spain by using three different devices: a Belisle cable-foot snare, a Collarum nonlethal cable-neck restraint, and a wire-cage trap, which only made three captures that were not sufficient for comparison with the other two devices. After capture, foxes were euthanized and examined for trap-related injuries. 86.4 percent of foxes caught in the Collarum and 88.9 percent of those captured with the Belisle "had no indicators of poor welfare." The injuries of the remaining foxes consisted mostly of a three broken teeth for the Collarum and two limb fractures or dislocations in the Belisle. The authors concluded that these two cable restraints were potentially good options for capturing foxes without excessive trauma, and that the Collarum in particular might be a good choice when injury to nontarget animals is a concern.

Olsen, G.H., Linhart, S.B., Holmes, R.A., Dasch, G.J., and Male, C.B., 1986, Injuries to coyotes caught in padded and unpadded steel foothold traps: Wildlife Society Bulletin, v. 14, p. 219-223.

Twenty to 21 coyotes were captured in each of four types of foothold trap: an unpadded Victor #3 double longspring; two Victor #3 double longspring traps modified to accommodate rubber pads, one with a 91-cm kinkless chain, and the other with a 15-cm chain which included a shock-absorbing coil spring; and a Victor #3 Soft Catch trap with an identical, factory-standard, 15-cm shock-absorbing chain. Captured coyotes were necropsied and assigned a cumulative injury score based on estimates of the severity of the resultant loss of limb function for each injury. The unpadded trap resulted in the most severe injuries, with the average score being two to almost four times as high as those of the three padded models. Of the padded traps, the Soft Catch was the least injurious, with an average score of 28.6; the modified trap with the shock-absorbing 15-cm chain had an average injury score of 50.2. The padded traps also resulted in fewer fractures, with rates ranging from 15 percent to 25 percent of captures, whereas the unpadded model resulted in fractures 91 percent of the time.

Olsen, G.H., Linscombe, R.G., Wright, V.L., and Holmes, R.A., 1988, Reducing injuries to terrestrial furbearers by using padded foothold traps: Wildlife Society Bulletin, v. 16, p.303-307.

Red foxes, gray foxes, raccoons, coyotes, and bobcats were captured by using four different types of traps: #1 ½ and #3 standard, unpadded Victor coil-spring, and #1 ½ and #3 rubber-padded Victor Soft Catch traps. The biologists involved in this study stated that these sizes of traps were the ones most often used by trappers for the species studied. The #1 ½ traps were used for all animals except coyotes and the bobcats captured in western United States, for which the #3 traps were employed. The padded traps tested resulted in significantly lower average injury scores (on the same scale as Olsen and others [1986]) for all species, except for the eastern bobcats captured in #1 ½ traps, for which there was no difference between padded and unpadded models. The authors concluded that, when properly used, padded traps are a more humane option for capturing these species than are standard foothold traps.

Onderka, D.K., Skinner, D.L., and Todd, A.W., 1990, Injuries to coyotes and other species caused by 4 models of footholding devices: Wildlife Society Bulletin, v. 18, p. 175-182.

Eighty-two coyotes were captured, euthanized, and necropsied during two winters in Alberta, Canada, by using four different devices: a standard unpadded #3 Victor foothold trap, a padded #3 Victor Soft Catch trap, a Novak foot snare, and a Fremont foot snare. Each coyote was assigned an injury score, and the trapped foot was examined for partial or complete freezing. The Fremont snare and the Soft Catch trap typically resulted in low mean injury scores, whereas the mean scores for the Novak snare and standard Victor trap were much higher. Limb freezing occurred 53 percent of the time during subfreezing nights, with some limbs caught in each trap type exhibiting freezing. Not enough coyotes were caught in the snares for comparison, but individuals were more likely to sustain limb freezing in the unpadded trap than in the padded one.

Phillips, R.L., 1996, Evaluation of 3 types of snares for capturing coyotes: Wildlife Society Bulletin, v. 24, p. 107-110.

Three types of steel-cable, lethal neck snares with breakaway devices were tested by professional trappers in South Dakota, United States, to determine both their capture efficiency on coyotes and their ability to exclude larger, nontarget species. Although the three snares tested had high (near-90 percent of 374 possible captures) efficiency on coyotes, they failed to release 51 of 91 mule deer and white-tailed deer captured, 47 of which died while in the snare. The author stated that it is difficult to design and employ lethal neck snares in a way that consistently captures coyotes (has a breakaway device that requires greater force than can be generated by a coyote) but consistently releases somewhat larger, nontarget animals including deer and, particularly, fawns.

Phillips, R.L., Gruver, K.S., and Williams, E.S., 1996, Leg injuries to coyotes captured in three types of foothold traps: Wildlife Society Bulletin, v. 24, p. 260-263.

One hundred ninety-two coyotes were euthanized and necropsied after capture by using three types of traps including the Sterling MJ600, offset 0.64 cm, the #3 Northwoods modified by laminating the jaws to a thickness of 1.28 cm, and a #3 ½, rubber-padded EZ Grip trap. Mean trauma scores were highest for the offset MJ600, somewhat lower for the laminated Northwoods, and much lower for the EZ Grip. The authors, citing the much lower frequency of severe injuries incurred by the EZ Grip trap, contended that it, like the rubber-padded Victor Soft Catch evaluated in other studies, is a less injurious option for the capture of coyotes than conventional or even laminated steel-jawed traps.

Phillips, R.L., and Mullis, Curt., 1996, Expanded field testing of the No 3 Victor Soft Catch(R) trap: Wildlife Society Bulletin, v. 24, p.128-131.

Four different types of foothold traps were tested by U.S. Department of Agriculture, Animal Damage Control trappers in seven U.S. western states to determine comparative capture efficiency (the percentage of sprung traps resulting in successful capture) of the #3 Victor Soft Catch on coyotes. Traps tested included the rubber-padded, double coil-spring #3 Victor Soft Catch trap; the unpadded #4 Newhouse with offset jaws; the unpadded, offset Victor #3NM double-long spring; and the unpadded Sterling MJ600. The authors found that capture efficiency of the four traps tested did not differ significantly, but they added that the Soft Catch trap was not subjected to certain adverse conditions (wet ground, snow, etc.) which could potentially cause it to be less efficient than more conventional traps.

Proulx, Gilbert, Pawlina, I.M., Onderka, D.K., Badry, M.J., Seidel, Ken, 1994, Field evaluation of the number 1 ½ steel-jawed leghold and the Sauvageau 2001-8 traps to humanely capture arctic fox: Wildlife Society Bulletin, v. 22, p. 179-183.

Two traps, the Sauvageau 2001-8 killing, rotating-jaw trap, and the #1 ½ standard, steel-jaw Victor foothold, were tested on arctic fox in the Northwest Territories of Canada during the late fall and winter. All foxes captured in the rotating-jaw killing trap were dead upon trap

visitation and had head or neck injuries indicative of loss of consciousness within 3 minutes of the trap firing. The foothold trap was tested on two separate lines, one of which was on average checked every 1.4 days and the other checked only once every 8 days. Traps were ruled as humane if at least 70 percent of captured animals had nonserious (scoring 50 or lower on their scale) injuries. Eighty-six percent of foxes on the frequently checked line had nonserious injuries and only 3 percent had "severe" injuries. Only 60 percent of foxes caught on the other line had nonserious injuries, with 24 percent being found dead, apparently from trap-related injury or privation. The authors concluded that the Sauvageau trap was humane for capturing arctic foxes and that the # 1 ½ was also humane provided it was checked near daily, but they also noted the potential impracticality of frequent checking in the Canadian wilderness.

Sahr, D.P., and Knowlton, F.F., 2000, Evaluation of tranquilizer trap devices (TTDs) for foothold traps used to capture gray wolves: Wildlife Society Bulletin, v. 28, p. 597-605.

Wolves were captured, euthanized, and examined during normal depredation activities in Minnesota, United States, between April and October, with almost all captures occurring when temperatures were above freezing. The trap investigated was a Livestock Protection Company #4, with smooth, offset jaws. [Note: only results for the control traps without tranquilizers are here summarized. We limited our summary to the control traps because this review is focused on trapping methods used by the public. Because tranquilizers are unavailable to the general public, we omitted the results from traps equipped with tranquilizer devices.] Eighteen percent of wolves captured had dental injuries rated as "moderate" to severe," and the rest were described as uninjured to having "mild" injuries. Serious leg injuries were relatively common; however, compared with different trap types tested in other studies, 63 percent were scored as having moderate to severe damage including major cutaneous lacerations, tendon damage, and fractures including some to the radius or ulna.

Shivik, J.A., Gruver, K.S., and DiLiberto, T.J., 2000, Preliminary evaluation of new cable restraints to capture coyotes: Wildlife Society Bulletin, v. 28, p. 606-613.

Four relatively new types of nonlethal cable-restraining devices were evaluated for capture efficiency and injury on coyotes in southern Texas, United States: the Collarum neck restraint; the Panda foot snare, which employs a loop of chain around the foot; a Wildlife Services cable-foot snare; and the Belisle cable-foot restraint. Compared with conventional and rubber-padded foothold traps tested in other studies, the four cable restraints had very low rates of successful capture, ranging from 8.3 percent for the Panda to 39 percent for the Collarum. The devices did generally result in low injury scores, but the more capture-efficient devices tended to be the most likely to result in significant injury. The authors noted that manufacturers of the devices tested are still undergoing attempts at improvement, but that in their current iterations are probably not particularly effective options for humane, efficient coyote capture.

Shivik, J.A., Martin, D.J., Pipas, M.J., Turnan, John, and DiLiberto, T.J., 2005, Initial comparison: jaws, cables, and cage-traps to capture coyotes: Wildlife Society Bulletin, v. 33, p. 1375-1383.

Four types of traps were evaluated for capture efficiency and potential to cause significant injury (based on whole-body necropsy observations and scored according to the system used in Phillips and others [1996]) to coyotes in Arizona and Texas, United States: the Tomahawk 110C cage trap, the Collarum neck restraint (the model evaluated had been modified by the manufacturer since being tested by Shivik and others [2000]), the Wildlife Services Turman foot snare, and the rubber-padded Victor Soft Catch. No coyotes were captured in, or activated, the cage trap. The Collarum and WS-T devices were both near 90 percent efficient at making captures when sprung but only produced 27 and 14 captures per 1,000 trap nights, respectively; the Soft Catch was 100 percent efficient and had a capture rate of 48 coyotes per 1,000 trap nights. The Collarum caused only a few, very minor injuries, except for one death by strangulation caused by a malfunction, for an average injury score of 2.5; coyotes captured in the WS-T displayed a variety of mostly minor injuries, except for one inexplicable death, for a mean score of 30.7; and the Soft Catch's mean injury score was 21.7, with most injuries being minor and probably not permanent. Because all devices evaluated resulted in acceptably low levels of apparent injury and trauma, the authors asserted that none of these trap types are objectively superior for use on coyotes in all scenarios and that trap selection should be made based on the practicality of implementation in each situation.

Skinner, D. L., and Todd, A.W., 1990, Evaluating efficiency of footholding devices for coyote capture: Wildlife Society Bulletin, v. 18, p. 166-175.

Note: This article was intended as a companion to Onderka and others (1990); the same field research was used to generate data for both trap efficiency and the necropsy data summarized for that article. Four trap and snare types were tested by experienced local trappers for capture efficiency on coyotes during two fall-winter seasons in Alberta, Canada: the standard, Victor #3 coil-spring, the Victor #3 Soft Catch, the Novak foot snare, and the Fremont foot snare. Capture efficiency did not differ significantly between the two snares or the two foothold traps; however, the traps were nearly three times as efficient as the snares, with 4.3 captures per 1,000 trap nights, compared to 1.5 captures per 1,000 trap nights for the snares. The authors, citing potential for trappers to become more proficient with foothold snares through extensive practice, stated that although their study found the three types of foothold traps to be more effective than the snares, more long-term research will be necessary to determine whether this is actually the case.

Van Ballenberghe, Victor, 1984, Injuries to wolves sustained during live-capture: Journal of Wildlife Management, v. 48, p. 1425-1429.

One hundred six wolves were captured 124 times, tranquilized, and examined in Minnesota and Alaska, United States. Devices used included smooth-jawed, #3 and #4 double longspring Oneida-Newhouse foothold traps, an unidentified model of offset, toothed #14 double longspring trap, Aldrich cable-foot snares, and an unidentified type of neck snare, for which use was discontinued after its first capture resulted in a fatality. Eighty-four percent of trapped

wolves were captured in the smooth-jawed traps, so reliable comparison between trap types for injury severity was not possible. Leg injuries rated as “severe” or “very severe” occurred in 41 percent of individuals captured in steel traps; 46 percent sustained dental injuries caused by trap biting. Sample size for foot snares was small (n=14), but none of these individuals showed “severe” or “very severe” injuries, and tooth damage was also less severe for these individuals.

White, Bryant, 2009, Testing restraining traps for the development of best management practices for trapping gray wolf in the United States: Washington, D.C., Association of Fish and Wildlife Agencies, 9 p.

Sixty-seven wolves were captured, euthanized, and examined in Minnesota, United States, during the course of normal U.S. Department of Agriculture, Animal and Plant Health Inspection Service depredation efforts. The trap model tested was a Livestock Protection Company #4 with standard smooth, nonlaminated, offset jaws, modified to incorporate an aftermarket, Paws-I-Trip adjustable-tension pan. Traps were anchored either by a drag or by double-staking. Mean injury scores were very similar for wolves captured in the drag-anchored and staked traps; for both systems fewer than 10 percent of wolves had “moderately severe” or “severe” injuries, and fractures were sustained by 9 percent with the drag-anchored system and 4 percent with staked traps. No incidences of foot chewing or other self harm were observed.

White, Bryant, 2010, Testing restraining traps for the development of best management practices for trapping gray wolf in the United States: Washington, D.C., Association of Fish and Wildlife Agencies, 10p.

Fifteen wolves were captured, euthanized, and examined during U.S. Department of Agriculture, Animal and Plant Health Inspection Service depredation activities, by using the unmodified Minnesota Brand MB-750 foothold trap with ¼ inch offset and laminated steel jaws. Traps were anchored with drags or stakes. Ten wolves captured in traps with drags averaged an injury score of 51.0, and both “mild” and “moderate” (including one joint luxation and two incidences of significant periosteal abrasion) injuries were observed; five wolves caught in staked sets had an average score of 23.0, with only “mild” injuries being reported. No dental injuries, self mutilation, or bone fractures were sustained by any of the 15 individuals. The author noted that the sample size was small for both trap types and that trapping would continue until a minimum of 20 wolves have been captured in each type of set so meaningful comparisons can be made.

Appendix 2. References for Further Reading

Arthur, S.M., 1988, An evaluation of techniques for capturing and radiocollaring fishers: Wildlife Society Bulletin, v. 16, p. 417-421.

Austin, James, Chamberlain, M.T., Leopold, B.D., and Burger, L.W., Jr., 2004, An evaluation of EGG and wire cage traps for capturing raccoons. Wildlife Society Bulletin 32:351-356.

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