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Netguns: a technique for capturing Black-backed Woodpeckers

Chad P. Lehman,[1,4] Dylan C. Kesler,[2] Christopher T. Rota,[2] Mark A. Rumble,[3] Eric M. Seckinger,[2] Thomas M. Juntti,[3] and Joshua J. Millspaugh[2]

[1] *South Dakota Department of Game, Fish, and Parks, Custer State Park, 13329 US Highway 16A, Custer, South Dakota 57730, USA*

[2] *Department of Fisheries and Wildlife Sciences, University of Missouri, 302 Anheuser-Busch Natural Resources Building, Columbia, Missouri 65211, USA*

[3] *U.S. Forest Service, Rocky Mountain Research Station, 8221 South Highway 16, Rapid City, South Dakota 57702, USA*

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ABSTRACT. Effective capture techniques are essential for studying bird populations, but commonly used techniques have proven ineffective for capturing Black-backed Woodpeckers (*Picoides arcticus*) during the nonbreeding period. As a result, little is known about the winter ecology of Black-backed Woodpeckers. We used two netguns, one powered with a 0.308 cartridge and another with CO_2 propellant, to capture 101 Black-backed Woodpeckers ($N = 75$ initial captures and 26 recaptures) in the Black Hills of South Dakota from 2008 to 2011. Captures with the 0.308 netgun resulted in an impact mortality probability of 0.061 ± 0.034 (SE), whereas no impact mortalities were associated with the CO_2 netgun. We also tracked birds for 72 h post-release, and determined a capture-related mortality rate of 0.102 ± 0.04 with the 0.308 netgun and 0.038 ± 0.027 with the CO_2 netgun. With the CO_2 netgun, we captured woodpeckers in 31 of 43 net deployments (72%), with an average of 7.2 ± 0.4 h of capture effort for each bird. Many unsuccessful attempts were caused by tree branches that prevented net deployment. Netguns powered by CO_2 provide an effective capture technique that we recommend for studies of Black-backed Woodpeckers and possibly other species of birds that forage low on trees.

RESUMEN. **Las armas de red: una tecnica para capturar *Picoides arcticus***
Técnicas eficaces de captura son esenciales para el estudio de las poblaciones de aves, pero las técnicas de uso común se han mostrado ineficaces para capturar *Picoides arcticus* durante el período no reproductivo. Como resultado, poco se sabe sobre la ecología invernal de *P. arcticus*. Utilizamos dos armas de red, uno con un cartucho de 0.308 y otra con un propulsor de CO_2, para capturar 101 *P. arcticus* ($N = 75$ capturas iniciales y 26 recapturas) en las Lomas Negras de Dakota del Sur, desde 2008 hasta 2011. Las capturas con el arma de red de 0.308 resultaron en una probabilidad de mortalidad debido al impacto de 0.061 ± 0.034 (EE), mientras que no hubo mortalidad debido al impacto del arma de red de CO_2. También seguimos las aves durante 72 horas después de la liberación y determinamos que hubo una tasa de mortalidad asociado con la captura de 0.102 ± 0.04 con el arma de red de 0.308 y una tasa de 0.038 ± 0.027 con el arma de red de CO_2. Capturamos pájaros carpinteros con el arma de red de CO_2 en 31 de 43 despliegues (72%), con un promedio de 7.2 ± 0.4 horas de esfuerzo de captura invertidas para cada ave. Muchos intentos fallidos fueron causados por ramas de árboles que impedían el despliegue de la red. Las armas de red impulsados por CO_2 proporcionan una técnica de captura efectiva que recomendamos para los estudios de *P. arcticus* y posiblemente para otras especies de aves que se alimentan a niveles bajos en los árboles.

Key words: black hills, capture success, capture technique, handling time, Picoides arcticus

Mist nets are probably the most commonly used devices for capturing birds (Berthold and Schlenker 1975, Vega and Rappole 1994, Bull and Cooper 1996). Strategically placed mist nets can be used in combination with bait, territorial calls, and decoys to capture birds (York et al. 1998, Farris et al. 2004, Covert-Bratland et al. 2007, Coulombe et al. 2010). Other capture techniques include walk-in and nest traps for terrestrial and ground-nesting birds (Weller 1957, Weaver and Kadlec 1970, Mills and Ryder 1979, Meissner 1998). Hoop-nets have been used to trap birds that nest or roost in cavities (Jackson 1977, Jackson and Parris 1991, Kesler et al. 2010). Methods have also been described for capturing cavity-nesting birds by drilling a "door" into cavities (Stanback and Koenig 1994).

Commonly used techniques have proven ineffective for capturing Black-backed Woodpeckers

[4] Corresponding author. Email: Chad.Lehman@state.sd.us

(*Picoides arcticus*) during the nonbreeding season. Mist nets are ineffective because Black-backed Woodpeckers do not reliably traverse the same routes or respond to decoys and territorial calls (Lehman, pers. obs.). Downy (Picoides pubescens) and Hairy (P. villosus) woodpeckers have been captured with bait stations and traps (Jackson and Hoover 1975, Hart and Todd 1976), but Black-backed Woodpeckers are not attracted to bait stations (Lehman, pers. obs.).

Previous studies of radio-marked Black-backed Woodpeckers have been limited to the breeding season, when nest-associated capture techniques and call broadcasts were found to be effective (Dudley and Saab 2007, Tremblay et al. 2009). Because Black-backed Woodpeckers are a species of special concern (South Dakota Department of Game, Fish, and Parks 2006, U.S Forest Service Region 2 Regional Forester's Sensitive Species List 2009), understanding both their summer and winter ecology may be crucial for effective conservation management. Developing effective capture techniques for the nonbreeding season is vital to filling this information gap.

We describe the use of handheld netguns to capture Black-backed Woodpeckers. This technique was developed as part of a study of the movements and demography of Black-backed Woodpeckers. At the onset of the project, we tested other capture techniques. During the breeding season, we captured 88 Black-backed Woodpeckers using hoop-nets placed over nest-cavity entrances (Jackson and Parris 1991). During the nonbreeding season, however, our observations of Black-backed Woodpeckers during evening hours and after sunset corroborated previous reports (Goggans et al. 1989) indicating that these woodpeckers do not roost in cavities during the nonbreeding season. Thus, roost-based capture techniques could not be used. From September to December 2007, we attempted to capture Black-backed Woodpeckers in mist nets using decoys and territorial calls with no success. We also attempted to use mist nets with suet bait stations and mealworms pinned to trees with no success. Black-backed Woodpeckers were also unresponsive to calls and decoys outside the breeding season.

Given these difficulties, we developed netgun-based capture techniques. Netguns have been used to capture Golden Eagles (*Aquila chrysaetos*; O'Gara and Getz 1986), waterbirds (Herring et al. 2008), and waterfowl (Mechlin and Schaiffer 1980) with some success. However, we found no previous studies involving the use of netguns to capture small forest birds. Thus, we evaluated the effectiveness of netguns for capturing Black-backed Woodpeckers as well as mortality risks associated with two netgun capture techniques.

METHODS

Our study was conducted in the Black Hills of southwestern South Dakota where Black-backed Woodpeckers are found in forests recently impacted by insects and fire (Hutto 1995, Dudley and Saab 2007, Bonnot et al. 2008). Six study sites were located in burned and beetle-colonized forests (Box Elder: 44°9′N, 103°24′W; Four Mile: 43°41′N, 103°26′W; Ricco: 44°13′N, 103°25′W; Norbeck: 43°50′N, 103°30′W; Deerfield:43°55′N, 103°44′W; Sheridan: 44°0′N, 103°31′W).

Capture and radiotelemetry. We captured Black-backed Woodpeckers from September 2008 to June 2011 using two netguns. We used a Coda netgun (Coda Enterprises, Mesa, AZ) powered by a blank 0.308 caliber cartridge (hereafter, 0.308 netgun) during 2008 and 2009. Four 13-cm weights (312 g each) were attached at the corners of the net to maintain the flight trajectory of the net following discharge. We used two models of Coda 0.308 netguns, with model 82-2040 weighing 9.5 kg and model ULA-06 weighing 8.1 kg. Nets used with the 0.308 netguns were 5-cm mesh with 7.3 m^2 in area coverage and constructed of 1.2-mm nylon cord (Model number N-9-2-85). We used the lightest 0.308 propellant loads manufactured for capturing birds (red cartridge loads). The cost of the ULA-06 netgun was $3695.

Beginning in August 2009, we switched to a CO_2-powered netgun (hereafter, CO_2 netgun; Super Talon, Advanced Weapons Technology, La Quinta, CA). Eight 4-cm-long rubber-coated weights (26 g each) were attached to the net. The CO_2 netgun weighed 1.1 kg. Nets used with the CO_2 netgun were 5-cm mesh with 4.6 m^2 in area coverage and constructed with 0.6-mm nylon cord (Model Blue Cover Net). We attached weights to the CO_2 net using fishing swivels (size #5). The cost of the CO_2 netgun was $1550. Safety training was

required and investigators were trained by experienced personnel to use netguns before using them to capture Black-backed Woodpeckers. Investigators were required to safely operate and fire netguns at decoys on trees before using them on woodpeckers.

To capture Black-backed Woodpeckers with netguns, we systematically searched forests and listened for birds foraging on trees (pecking), drumming, or vocalizing. Typically, we worked in teams of two to facilitate pursuits and provide assistance in climbing trees, removing birds from nets, and radio-marking birds. Once a woodpecker was observed, we usually remained >20 m from birds until they moved low enough for a potential netting attempt (<3 m from the ground). We then moved quietly into a shooting position while the target bird foraged. We used large trees to block the woodpecker's line of sight during approach. Most successful captures occurred when nets were deployed at distances of <5 m, and when birds were on tree trunks so branches and other obstructions did not block the net's travel path.

When deployed correctly, nets wrapped around the tree, and held the target bird against the trunk. If unable to reach a bird from the ground, we used small portable aluminum climbing sticks (Lone Wolf, Edwards, IL) to climb trees. We first removed weights from the net (CO_2 netgun only) and untangled the net and bird from the tree to facilitate bird removal. After removal from nets, we placed a hood over the bird's head, inspected it for possible injuries, recorded morphological measures, and attached radio-transmitters. We recorded handling times from capture to release because longer handling times could cause increased risks to birds (Höfle et al. 2004). Handling time included removing birds from nets, radio-marking birds, and collecting morphological measurements.

From January 2010 to June 2011, we measured capture effort with the CO_2 netgun by recording the number of hours needed for each capture. We report capture effort in hours for two-person teams and also by season, including winter (December–March), spring-summer (April–August), and fall (September–November). Capture effort was the time between when a target bird was first identified and when a net was deployed for successful capture. Capture effort also included unsuccessful capture attempts. For the CO_2 netgun, we also recorded the number of netgun deployments required to capture each bird. Netgun captures were attempted throughout the year, but we only attempted netgun captures ≥200 m away from nest cavities during the breeding season (May–July) to reduce the likelihood of nest abandonment.

Two types of capture-related mortalities were recorded. Impact mortality was assigned to birds that died during net deployment, likely due to direct impacts of weights or nets. Dead birds were inspected for hemorrhaging and broken bones (i.e., direct impact). Some birds died shortly after release even though they appeared unharmed after capture and we referred to this as unknown capture-related mortality. We attributed deaths within 72 h of release to capture-related causes when whole carcasses were found and no other cause of mortality could be identified.

Analyses. We compared handling times for each netgun capture technique using a Wilcoxon Rank Sum test (Conover 1999) in SAS (SAS version 9.02, SAS Institute 2010). We evaluated the probability that 0.308 netgun and CO_2 netgun capture methods would result in bird death using a Fisher's exact test (Conover 1999) in program R (R Development Core Team, 2011). We also used Fisher's exact test to evaluate the probability that each capture method would result in bird death from net or weight impact and death related to postcapture causes (death within 72 h of release). We provide an odds ratio statistic and 95% confidence intervals for resulting estimates. Statistical significance was accepted at $\alpha = 0.05$. Values are presented as means ± SE.

RESULTS

We captured 75 Black-backed Woodpeckers with netguns, including 36 with the 0.308 netgun and 39 with the CO_2 netgun. We also recaptured 26 birds for a total of 101 netgun captures. We recaptured 13 birds using the 0.308 netgun and 13 using the CO_2 netgun. We captured 15 woodpeckers (15%) during the breeding season and 86 (85%) during the nonbreeding season.

We spent an average of 7.2 ± 0.4 h of effort for each bird captured with CO_2 netguns. We recorded capture effort for 27 successful capture attempts during winter ($N = 19$,

mean = 7.4 ± 0.5 h), spring-summer ($N = 7$, mean = 7.0 ± 0.7 h), and fall ($N = 1$, 6 h). Nets were deployed 43 times, resulting in 31 captures (72%). Tree branches blocked net deployment during many unsuccessful attempts. Mean handling time after capture was 16.8 ± 1.1 min ($N = 45$) for the 0.308 netgun and 13.3 ± 0.7 min ($N = 51$) for the CO_2 netgun, a significant difference ($Z = 2.9$, $P = 0.004$).

Most birds captured with netguns were released with no obvious adverse effects ($N = 94$). Five mortalities were attributed to the 0.308 netgun, with three due to injuries caused by net or weight impact and two post-release mortalities. We stopped using the 0.308 netgun after these mortalities. No impact mortalities were caused by the CO_2 netgun, but two birds were found dead within 72 h post-release. Handling times for woodpeckers that died within 72 h post-release were 17 min for the two CO_2 netgun mortalities, and 25 and 30 min for the 0.308 netgun mortalities.

The observed probability of impact mortality from the 0.308 netgun was 0.061 ± 0.034 and no impact mortalities were observed for the CO_2 netgun (Fisher's exact test; $P = 0.11$). The odds ratio statistic for this test was 0.00 (95% confidence limit: 0.00–2.25). When combined with post-release mortalities, probabilities of capture-related mortality were 0.102 ± 0.043 for the 0.308 netgun, and 0.038 ± 0.027 for the CO_2 netgun (Fisher's exact test; $P = 0.26$). The odds ratio statistic for this test was 0.36 (95% confidence limit: 0.03–2.30).

DISCUSSION

Netguns were an effective tool for capturing Black-backed Woodpeckers. After releasing birds, we used radio-telemetry to verify that most were in good condition, and birds were observed foraging within a few hours. Impact mortality occurred only with the 0.308 netgun so we do not recommend using this netgun to capture Black-backed Woodpeckers. We were unable to determine the cause of death for four birds that died post-release, but extended handling times may have been a factor. We reduced removal and handling times as we gained experience. Near the end of our study, we were sometimes able to remove birds from the net, measure, band, radio-mark, and release them in ≤10 min. Unlocking the fishing swivels used to attach weights to nets deployed by the CO_2 netgun facilitated removal of birds from nets and reduced handling times.

Little information is available concerning mortality rates due to capture of small nongame birds. However, Spotswood et al. (2011) reported a low incidence of injury or mortality (<1%) for birds captured in mist nets, and Hart and Todd (1976) reported a 3% injury rate for birds captured using a bait station and live trap constructed of hail screen and modified mouse traps. Mortality rates associated with rocket nets vary and range from 0% to 10.7% (Jurek 1974, Cox and Afton 1994, King et al. 1998). We observed no direct-impact mortality with the CO_2 netgun, and mortality for the 0.308 netgun (6%) was similar to the 8% reported with the same technique for Mallards (*Anas platyrhynchos*; Mechlin and Schaiffer 1980). Nonetheless, we believe the risks associated with the 0.308 netgun were too high, especially when the CO_2 netgun proved as effective and resulted in fewer mortalities.

We found that CO_2-powered netguns were an effective capture technique for woodpeckers. Despite the increased effort needed to capture birds, netguns allowed us to capture Black-backed Woodpeckers during the nonbreeding period when other methods failed. CO_2 netguns might also be useful for capturing other species of birds ranging in mass from 60 to 200 g. For example, we had opportunities to capture several American Three-toed Woodpeckers (*Picoides dorsalis*) and Hairy Woodpeckers during our study. Netguns would likely be more effective for species that forage low on trees because the limited range of netguns requires that researchers get close to target birds before deploying the net. In addition, netguns would likely be more effective in habitats where trees have fewer branches. During our study, tree branches sometimes obstructed net deployments and prevented nets from wrapping around trees, causing many of the unsuccessful capture attempts.

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LITERATURE CITED

Berthold, P., and R. Schlenker. 1975. Das "Mettnau-Reit-Illmitz-Programm" -ein langfristiges Vogelfangprogramm der Vogelwarte Radolfzell mit vielfiltiger Fragestellung. Vogelwarte 28: 97–123.

Bonnot, T. W., M. A. Rumble, and J. J. Millspaugh. 2008. Nest success of Black-backed Woodpeckers in forests with mountain pine beetle outbreaks in the Black Hills, South Dakota. Condor 110:450–457.

Bull, E. L., and H. D. Cooper. 1996. New techniques to capture Pileated Woodpeckers and Vaux's Swifts. North American Bird Bander 21: 138–142.

Conover, W. J. 1999. Practical nonparametric statistics, 3rd ed. John Wiley, New York, NY.

Coulombe, G. L., D. C. Kesler, and A. Gouni. 2010. Agricultural coconut forest as habitat for the critically endangered Tuamotu Kingfisher. Auk 128: 283–292.

Covert-Bratland, K. A., T. C. Theimer, and W. M. Block. 2007. Hairy Woodpecker winter roost characteristics in burned ponderosa pine forest. Wilson Journal of Ornithology 119: 43–52.

Cox, R. R., Jr., and A. D. Afton. 1994. Portable platforms for setting rocket nets in open-water habitats. Journal of Field Ornithology 65: 551–555.

Dudley, J. G., and V. A. Saab. 2007. Home range size of Black-backed Woodpeckers in burned forests of southwestern Idaho. Western North American Naturalist 67: 593–600.

Farris, K. L., M. J. Huss, and S. Zack. 2004. The role of foraging woodpeckers in the decomposition of ponderosa pine snags. Condor 106: 50–59.

Goggans, R., R. D. Dixon, and C. L. Seminara. 1989. Habitat use by Three-toed and Black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife Nongame Wildlife Program, USDA Deschutes National Forest Technical Report 87-3-02, Portland, OR.

Hart, J. L., and L. L. Todd. 1976. A live trap for birds attending a feeding station. Transactions of the Kansas Academy of Science 79: 43–45.

Herring, G., D. E. Gawlik, and J. M. Beerens. 2008. Evaluating two new methods for capturing large wetland birds. Journal of Field Ornithology 79: 102–110.

Höfle, U., J. Millán, C. Gortázar, F. J. Buenestado, I. Marco, and R. Villafuerte. 2004. Self injury and capture myopathy in net-captured juvenile Red-legged Partridge with necklace radiotags. Wildlife Society Bulletin 32: 344–350.

Hutto, R. L. 1995. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (USA) conifer forests. Conservation Biology 9: 1041–1058.

Jackson, J. A. 1977. A device for capturing tree cavity roosting birds. North American Bird Bander 2: 14–15.

Jackson, J. A., and E. E. Hoover. 1975. A potentially harmful effect of suet on woodpeckers. Bird-Banding 46: 131–134.

———, and S. D. Parris. 1991. A simple, effective net for capturing cavity roosting birds. North American Bird Bander 16: 30–31.

Jurek, R. M. [online]. 1974. California shorebird study. Transactions Western Section the Wildlife Society. 49–57. <http://www.tws-west.org/transactions/Jurek.pdf> (19 July 2011).

Kesler, D. C., J. R. Walters, and J. J. Kapes. 2010. Multiple movement modes and the fat-tailed distribution of dispersal distances in Red-cockaded Woodpeckers. Behavioral Ecology 21: 1337–1343.

King, D. T., J. D. Paulson, D. J. Leblanc, and K. Bruce. 1998. Two capture techniques for American White Pelicans and Great Blue Herons. Colonial Waterbirds 21: 258–260.

Mechlin, L. M., and C. W. Shaiffer. 1980. Net-firing gun for capturing breeding waterfowl. Journal of Wildlife Management 44: 895–896.

Meissner, W. 1998. Some notes on using walk-in traps. Wader Study Group Bulletin 86: 33–35.

Mills, J. A., and J. P. Ryder. 1979. Trap for capturing shore and seabirds. Bird-Banding 50: 121–123.

O'Gara, B. W., and D. C. Getz. 1986. Capturing Golden Eagles using a helicopter and net gun Wildlife Society Bulletin 14: 400–402.

R Development Core Team [online]. 2011. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <http://www.R-project.org/> (15 June 2011).

SAS Institute. 2010. Version 9.02. SAS Institute, Cary, NC.

South Dakota Game, Fish, and Parks. 2006. South Dakota comprehensive wildlife conservation plan. South Dakota Department of Game, Fish, and Parks, Pierre Wildlife Division Rep. 2006–08, Pierre, SD.

Spotswood, E. N., K. R. Goodman, J. Carlisle, R. L. Cormier, D. L. Humple, J. Rousseau, S. L. Guers, and G. G. Barton. 2011. How safe is mist netting? Evaluating the risk of injury and mortality to birds. Methods in Ecology and Evolution. doi: 10.1111/j.2041-210X.2011.00123.x.

Stanback, M. T., and W. D. Koenig. 1994. Techniques for capturing birds inside natural cavities. Journal of Field Ornithology 65: 70–75.

Tremblay, J. A., J. Ibarzabal, C. Dussault, and J. L. Savard [online]. 2009. Habitat requirements of breeding Black-backed Woodpeckers (*Picoides arcticus*) in managed, unburned boreal forest. Avian Conservation and Ecology 4. <http://www.ace-eco.org/vol4/iss1/art2/> (14 July 2010).

U.S. Forest Service Region 2 Regional Forester's Sensitive Species List [online]. 2009. Sensitive species list: birds. <http://www.fs.fed.us/r2/projects/scp/Sensitive species/index.shtml> (12 June 2009).

VEGA, J. H., AND J. H. RAPPOLE. 1994. Composition and phenology of an avian community in the Rio Grande plain of Texas. Wilson Bulletin 106: 366–381.

WEAVER, D. K., AND J. A. KADLEC. 1970. A method for trapping breeding adult gulls. Bird-Banding 41: 28–31.

WELLER, M. W. 1957. An automatic nest-trap for waterfowl. Journal of Wildlife Management 21: 456–458.

YORK, D. L., J. E. DAVIS, JR., AND J. L. CUMMINGS. 1998. Pileated Woodpecker capture using a mist net and taped call. North American Bird Bander 23: 81–82.