Techniques

A novel technique to improve capture success of common ravens

LINDSEY R. PERRY, Department of Animal and Rangeland Science, Oregon State University, Corvallis, OR 97331, USA lindsey.perry@oregonstate.edu

TERRAH M. OWENS, Department of Animal and Rangeland Science, Oregon State University, Corvallis, OR 97331, USA

ZACHARY T. SLICK, Department of Animal and Rangeland Science, Oregon State University, Corvallis, OR 97331, USA

JIMMY D. TAYLOR, USDA National Wildlife Research Center, Oregon Field Station, 321 Richardson Hall, Corvallis, OR 97331, USA

JONATHAN B. DINKINS, Department of Animal and Rangeland Science, Oregon State University, Corvallis, OR 97331, USA

Abstract: Traditional trapping techniques for common ravens (Corvus corax; raven) require significant effort, often produce low capture rates, and cannot be used in some situations. We designed a 3-m noose pole to secure ravens from nocturnal roost locations while using a strobe spotlight to temporarily disorient them. We collected measures of trapping efficiency and contrasted them with padded leghold traps also used in the study. We effectively implemented our noose pole method in July and August of 2018, 2019, and 2020 in the Baker and Cow Lakes sage-grouse (Centrocercus urophasianus) Priority Areas of Conservation in eastern Oregon, USA, which yielded trapping efficiency of 0.48 trap-hours/raven (37 total captured ravens). Our trapping efficiency using leghold traps during the same summer months was 76.42 trap-hours/raven (3 total captured ravens). Our new trapping method constitutes an inexpensive and simple way to safely trap ravens at accessible communal roosts and merits further refinement to increase utility and capitalize on the vulnerability of ravens to capture at night.

Key words: capture success, common raven, Corvus corax, leghold, noose pole, Oregon, spotlight, strobe light, summer trapping, trapping technique

Common ravens (Corvus corax; raven) and corvids in general (Caffrey 2002) have proven to be difficult to capture, requiring a great deal of time and effort while yielding relatively low success (Engel and Young 1989, Restani et al. 1996, Camp et al. 2013, Leo and Manley 2018). Soft-catch, padded leghold traps are commonly utilized for raven capture, as they have been effectively used in other studies to capture and mark ravens (Engel and Young 1989). Engel and Young (1989) tested the efficacy of multiple techniques in their study area and reported highest success (44.1 trap-hours per raven captured) using legholds. Peebles and Conover (2017) captured 73 ravens using leghold traps opportunistically at landfill and roadkill sites over a period of 3 years. Net launchers and rocket nets have also been used to capture ravens with varying levels of success. Webb et al. (2011) and Roth et al. (2004) captured 67 and 14 ravens, respectively, each utilizing a net launcher over a period of several years. Camp et al. (2013) captured an average of 57 ravens per capture event using a rocket net set at a landfill. Studies with the highest success in capturing ravens typically utilize a walk-in, or box, trap (Coldwell 1972; Restani et al. 1996, 2001). Coldwell (1972) captured 2,018 ravens over a period of 6 years in Nova Scotia, and Bernd Heinrich captured 54 ravens in 1 capture event using a similar structure (W. Wagman, retired Oregon Department of Fish and Wildlife, personal communication). All of these techniques require pre-baiting the capture area, awaiting opportunistic sources of bait, or deploying traps at congregated foraging areas, such as landfills (Restani et al. 1996, 2001; Camp et al. 2013; Marchand et al. 2018), often during seasons of food limitation (e.g., winter).

In 2017, we initiated a large-scale study to
understand how ravens are using the sagebrush (Artemisia spp.) ecosystem that is home to a critically declining population of greater sage-grouse (Centrocercus urophasianus; sage-grouse) in eastern Oregon, USA. We desired a large sample size of marked individuals to collect spatiotemporal data on ravens but were unable to utilize a number of the most common trapping techniques. The sagebrush landscape within our study area boundaries precluded the use of rocket nets, as shrubs prevented the discharged net from lying flat on the ground, and the use of explosives in eastern Oregon was precarious throughout the fire season (summer and fall).

Walk-in traps also were not feasible, as our study area was devoid of large landfills, and creating congregated foraging sites via long-term baiting was not possible because of potential conflicts with wolves (Canis lupus). Use of a net launcher in our study area was not precluded, but was attempted with no success. Legholds were easily deployed in the dense sagebrush vegetation and positioned to trap targeted individual ravens; however, the low capture rate and overall time investment in using this tech-

Figure 1. The study area was based on state-designated greater sage-grouse (Centrocercus urophasianus) Priority Areas of Conservation (PACs) in eastern Oregon, USA, and included the Baker (north boundary) and Cow Lakes (south boundary) PACs. The inset image shows the PAC locations within the state of Oregon.
A technique led us to design a novel raven trapping method. While monitoring marked ravens, we observed multiple communal roosts located on center-pivot irrigation systems (between 2.74 and 4.6 m tall) within our study area. We posited that combining spotlighting techniques used on sage-grouse (Giesen et al. 1982, Wakin et al. 1992) and noose pole techniques used on spotted owls (Strix occidentalis; Forsman 1983) and other bird species (Zwickel and Bendell 1967, Reynolds and Linkhart 1984) may be combined and a noose pole/strobe light technique used to capture ravens off roost positions on agricultural pivots. Troy et al. (2012) similarly incorporated sage-grouse spotlighting techniques into a modified trap for capturing quail off roost locations. Our objective was to create a safe and effective trapping method comparable to or more efficient than the leghold technique.

**Study area**

We captured ravens at multiple sites associated with our study area in eastern Oregon (Figure 1). The habitat was dominated by sagebrush and agricultural development. The climate was hot and dry in the summer and freezing and relatively dry in the winter (34–48 cm of snowfall per year, Baker City Municipal Airport and Rockville weather stations; Western Regional Climate Center 2021).

**Methods**

Raven trapping efforts began in January 2018, and in August 2018 we developed and tested a noose pole and strobe light method to capture ravens from irrigation pivots at night. Noose poles were constructed using a PVC pipe (3 m long and 1.27 cm in diameter), 18-gauge lamp cord, and electrical tape (Figure 2A). We used commercially available spotlights that had a strobe setting (Waypoint Yellow Flashlight, 550 lumens, Streamlight, Inc., Eagleville, Pennsylvania, USA). We minimized the use of white light from headlamps as we quietly approached the end of an irrigation pivot, and then walked parallel along the length (B). Once a group of ravens was identified, the spotlighters focused their strobe lights on an individual while the handler guided the noose over the focal raven’s head and guided it to the ground for safe restraint (C).
for both methods and did not include equipment preparation or pre-baiting time requirements. Trap-hours were defined as the total number of hours a trap was set and/or accessible to ravens for capture. Trap-hours, number of traps used (legholds), and number of ravens captured were documented for each event. A successful capture event was defined as yielding at least 1 captured raven. Trap efficiency was calculated as the number of trap-hours per raven captured as defined by Engel and Young (1989), which allowed us to directly compare efficacy between the novel technique and leghold traps. Higher trap efficiency indicated more time was required to trap 1 raven for that method. Season was also documented to evaluate changes in capture success based on seasonality. We defined spring as March to May, summer as June to August, and winter as December to February. Trapping effort was reduced in fall and winter months when our research team was not in the field full-time, which likely impacted the estimation of overall efficacy of our use of leghold traps in this study. For direct comparison to the noose pole/strobe technique, we focused on leghold efficacy during the summer months. We compiled and reported all data regarding capture success and relevant sample sizes. All work in this study was approved by the Oregon State University Institutional Animal Care and Use Committee (ACUP 4915 and IACUC-2020-0077) and U.S. Geological Survey Master Banding Permit #23893.
Results

Between January 2018 and August 2020, we captured 45 ravens using both our new method and the traditional leghold trapping methodology. Our novel noose pole/strobe light method yielded 37 ravens during 17.75 trap-hours (0.48 trap-hours/raven; Table 1). This technique was attempted 20 times, with 16 successful and 4 unsuccessful events. The noose pole and strobe light method was only utilized in the summer months when communal roosts were observed.

Eight ravens were successfully captured using leghold traps in 130 capture events. Each successful capture event yielded 1 raven. The total number of trap-hours in all seasons for leghold traps was 725 (90.63 trap-hours/raven; Table 1). During the summer months, 3 ravens were captured during 229.25 trap-hours (76.4 trap-hours/raven; Table 1).

Discussion

Ravens are overabundant in some areas of their range in North America, adding unprecedented predation pressure to a variety of threatened and endangered species (Boorman and Heinrich 2020). Contemporary Global Positioning System (GPS) technology provides us with fine-scale spatiotemporal data, which increases our knowledge of raven ecology, but capturing ravens for transmitter deployment remains an uphill battle. Large communal roosts can exceed 2,000 individuals, presenting an opportunity for multiple captures in a single event (Engel et al. 1992). A traditional noose pole afforded us the height we needed to reach roosting ravens, and a strobe light effectively disoriented and prevented flushing from their position. Our noose pole/strobe light technique provides an effective and efficient trapping tool for capturing ravens off roost positions, and an alternate method for landscapes where traditional methods are precluded.

Our novel raven trapping technique maximized our trapping efficiency and increased our sample size. During our first trapping night using this technique, the use of a simple spotlight focused on targeted ravens from approximately 30 m was not sufficient to disorient them, and they all flushed off their roost position. Later, we attempted to approach a second pivot with both spotlights turned on the strobe setting and directed at 1 focal raven within the group. A number of nearby ravens (within 50 m) flushed and moved out of sight, but the focal raven remained perched on the pivot. The noose pole handler was able to place the noose around the raven’s head and gently guide it to the ground for safe restraint. Two additional ravens were retrieved from their roost locations similarly on a third pivot, approximately 10 m from each other. If the focal raven flushed, we would redirect the strobe lights at the next closest raven still on the pivot. When all ravens flushed off the pivot, we would turn off all lights and quietly wait for them to land back on the pivot.

Ravens typically returned to the pivot within 5 minutes, and capture efforts were resumed within 10 minutes. Ravens that were effectively

<table>
<thead>
<tr>
<th>Table 1. Trap-hours, capture rate, and trap-hours/raven for common ravens (Corvus corax) captured between January 28, 2018 and August 19, 2020 in eastern Oregon, USA study area.</th>
<th>Ravens captured</th>
<th>Trap-hours</th>
<th>Capture rate(^a)</th>
<th>Trap-hours/raven(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leghold</td>
<td>4</td>
<td>412.25</td>
<td>0.01</td>
<td>103.06</td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leghold</td>
<td>3</td>
<td>229.25</td>
<td>0.01</td>
<td>76.42</td>
</tr>
<tr>
<td>Noose pole</td>
<td>37</td>
<td>17.75</td>
<td>2.08</td>
<td>0.48</td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leghold</td>
<td>1</td>
<td>83.50</td>
<td>0.01</td>
<td>83.50</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>742.75</td>
<td>0.06</td>
<td>16.51</td>
</tr>
</tbody>
</table>

\(^a\)Ravens/trap-hour

\(^b\)Trap-hours/raven as per Engel and Young (1989)
disoriented by strobe lights remained in position even during multiple failed attempts by the handler. The noose pole/strobe light method was an inexpensive and safe option for both ravens and biologists. There were zero injuries to ravens in any of the 37 captures, and in most cases, ravens were found roosting on the same pivot(s) the following evening. Our original noose pole used size 18 braided nylon masons’ line and 20-lb. (9.07 kg) test picture wire as the noose mechanism but was replaced by the lamp wire, which better held its shape while in use. Speaker wire and phone chargers have also successfully been used to construct the noose portion of the noose pole in the field. The noose pole/strobe light method was far more efficient in capturing ravens in our study area than the use of legholds and resulted in almost 78% of our study’s GPS marked individuals.

Legholds were the method most frequently used in our project ($n = 130$ capture events) and were successful but required >700 hours to capture 8 ravens (Table 1). Engel and Young (1989) reported higher capture efficiency with legholds during the winter and spring (21.0 and 23.1 trap-hours/raven, respectively). Peebles and Conover (2017) also had success capturing ravens with legholds in winter months, averaging 24 raven captures per winter (2013–2015); however, they did not report the number of hours spent trapping.

Engel and Young (1989) reported seasonal capture rates (trap-hours/raven) for leghold traps as 21.0 (winter), 23.1 (spring), 96.3 (summer), and 62.4 (autumn). Our seasonal capture rates (trap-hours/raven) for leghold traps are 83.50 (winter), 103.06 (spring), and 76.42 (sum-

While we found the noose pole/strobe light technique successful, there are several caveats to mention. First, our success capturing at roosts on pivots was partially contributed to the open structure of the roost location (i.e., no structure interfering with the noose pole or strobe light, such as branches of a tree). Implementation of the noose pole/strobe light at other roosting structures may require modifications or may not be possible. Second, communal roosts on irrigation pivots have only been observed in our study area during summer months, after fledgling. The use of this technique may be inadvertently targeting naïve juveniles that are more curious and less wary. However, we captured both breeding and non-breeding age classes using this method. Lastly, as a result of only locating these roosts in summer months, we have not evaluated this technique in other seasons. However, communal raven roosting behavior appears to peak during the late summer and early fall (Engel et al. 1992), suggesting it may be best used during those months.

Management implications

Our novel trapping technique afforded an opportunity for multiple captures in a short period of time, while also providing an efficient summer trapping option if other traps are not possible or as effective in a particular area. Although components of this technique are well-known and commonly used for other species, this is the first time these components have been joined and used to capture ravens. It is always helpful to have a variety of trapping tools available when trying to maximize the sample of marked individuals, and all of these methods will continue to be tools in our raven trapping toolbox.

Acknowledgments

We thank L. Peebles, B. Ratliff, J. Primus, P. Perrine, T. Segal, J. Cupples, L. Foster, W. Wagman, A. Harrington, R. Scheffler, and A. Stevens for help trapping and handling ravens. We would also like to thank all of our cooperating landowners throughout eastern Oregon for their continued support and property access. Our work was supported by funds from the Bureau of Land Management, Oregon Beef Council, Oregon Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. Comments provided by P. Coates, HWI associate editor, and 2 anonymous reviewers greatly improved an earlier version of our paper.

Literature cited


Associate Editor: Peter S. Coates

LINDSEY R. PERRY is a Ph.D. candidate in the Department of Animal and Rangeland sciences at Oregon State University. She is a graduate research assistant studying raven ecology in western North America. She holds a B.S. degree in biology from West Virginia University and an M.S. degree in biological sciences from Michigan Technological University. Her research interests include behavioral ecology, human–wildlife conflict, and conservation biology.

TERRAH M. OWENS is a Ph.D. student in rangeland ecology and management at Oregon State University, USA. She is a graduate research assistant focusing on the interactive effects of disturbance and avian predators on greater sage-grouse demographics in eastern Oregon, USA. She holds a B.S. degree in zoology from Humboldt State University, USA. Her broader research interests are landscape ecology, predator–prey dynamics, and population responses to disturbance.
**Zachary T. Slick** is a wildlife biologist with Oregon Department of Fish and Wildlife located in Prineville, Oregon. He has a bachelor’s degree from Trinity University and a master’s degree from North Dakota State University.

**Jimmy D. Taylor** is a supervisory research wildlife biologist and field station leader with the U.S. Department of Agriculture, National Wildlife Research Center. His research project is housed within the College of Forestry at Oregon State University in Corvallis, where he is a courtesy faculty member. He has an undergraduate degree in forestry and wildlife management, a master’s degree in wildlife science, and Ph.D. degree in forest resources from Mississippi State University, where he also holds an adjunct faculty appointment. His research is conducted at the human–wildlife interface and focuses primarily on defining impacts and developing strategies to reduce wildlife damage in forest and rangeland systems. His research often includes overabundant species and species of concern.

**Jonathan B. Dinkins** is an assistant professor in the Department of Animal and Range-land Sciences at Oregon State University. His position is focused on shrub-steppe wildlife ecology, which includes research and outreach through Extension. His interests include topics related to animal behavior, population dynamics, predator–prey dynamics, wildlife habitat use, and human–wildlife interactions. During the past decade, he has worked on quantitative research projects focused on wildlife habitat use and demography in relation to habitat condition, predator effects on site selection of prey, predator effects on prey vital rates, and wildlife habitat related to anthropogenic development.