Use of Video Probe Does Not Affect Burrowing Owl Reproductive Parameters or Return Rates

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ABSTRACT We tested how repeated use of an infrared video probe influenced burrowing owl (*Athene cunicularia*) reproduction and recruitment. In 2001, we randomly assigned occupied burrows in Washington State, USA, to one of 2 groups: 1) inspected throughout the breeding season with an infrared video probe ($n = 38$), or 2) never inspected with a probe ($n = 41$). We did not detect differences between the 2 groups in nesting success, number of fledglings per nest, natal recruitment, or likelihood of adults returning to the same burrow the following year (2002) or to the study area in a subsequent year (2002–2005). (JOURNAL OF WILDLIFE MANAGEMENT 73(1):154–157; 2009)

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Many organisms lay eggs or give birth in cavities or burrows. The contents of cavities and burrows are often examined by using mirrors and lights, excavating burrows (Seabloom et al. 2000, Berentsen and Salmon 2001), cutting holes into tree cavities (Koenig et al. 1995, Enkerlin-Hoeflich et al. 1999), or installing artificial nests that can be easily opened to check the contents (Blem et al. 1999, Smith and Belthoff 2001). Use of infrared video probes (and fiberscopes) has greatly expanded the quality and quantity of information that can be gathered from cavity- and burrow-dwelling animals, including salamanders (*Ambystoma californiense*; Semonsen 1998), ground squirrels (*Spermophilus beecheyi*; VerCauteren et al. 2002), and a variety of cavity-nesting birds (Purcell et al. 1997, Enkerlin-Hoeflich et al. 1999, Reillo et al. 1999, Richardson et al. 1999). Video probes are superior to other methods of looking into deep cavities and burrows for a variety of reasons (but see Hamilton 2000). Mirrors and lights may provide biased information because they can only be used on straight and shallow nests, and excavating burrows can prevent their reuse. Installing artificial cavities and burrows to estimate reproductive parameters is especially problematic because artificial nests often have different depredation rates, clutch initiation dates, and nesting success than do natural nests (Nilsson 1975, Korpimaki 1984, Møller 1989).

Use of video probes allows observers to look into deep and twisting natural nests without damaging the cavity or burrow. Hence, video probes are commonly used in many wildlife studies and their use will likely increase as the price of this technology continues to drop. Consequently, we need to evaluate whether use of video probes negatively affects reproductive parameters.

Infrared video probes are often used to estimate reproductive parameters in burrowing owls (*Athene cunicularia*; Rosier et al. 2006, Griebel 2007). Nesting female burrowing owls will sometimes vocalize and attack video probes used to check nest contents (V. Garcia, University of Arizona, personal observation). However, no studies have evaluated whether repeatedly disturbing nesting females in this manner causes any negative effects on reproductive parameters. Even when no short-term ill effects are readily apparent to observers, research techniques may negatively influence health or fitness (Carlisle and Holberton 2006). Use of video probes could result in increased nest abandonment, early dispersal of juveniles, decreased productivity, or decreased site fidelity.

A variety of studies on other species have examined the quality of the data that can be gathered using video probes (Flath and Rauscher 1998, Richardson et al. 1999, Hamilton 2000, Proudfoot 2002, McGee et al. 2005). Use of video probes is assumed to have little or no negative effect on the study species, but to our knowledge no previous studies have experimentally tested this assumption. We compared nesting success, number of fledglings per nest, natal recruitment, and adult site fidelity between burrowing owl nests at which we used an infrared video probe every 7–10 days and nests at which we never used an infrared video probe.

STUDY AREA

Our study area covered approximately 3,600 km^2 of irrigated croplands and sagebrush (*Artemisia tridentata*) steppe in eastern Washington (Grant and Adams counties), USA. Elevation varied from 316 m to 398 m above sea level, and annual precipitation was usually $<$25 cm, which fell primarily as rain from October to May (Blackwood 1997).

METHODS

In our study area, burrowing owls nested in burrows excavated by marmots (*Marmota flaviventris*) or badgers (*Taxidea taxus*) and in crevices underneath irrigation canals. Nesting chambers were usually $>$2 m underground, and tunnels leading to them often had turns, rises, and often contained shredded manure, grass, or other material (Smith

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and Conway 2007). We located burrows throughout the breeding season and at different stages in the nesting cycle using 3 approaches: roadside surveys (Conway and Simon 2003), incidental sightings, and conversations with landowners. We visited all burrows every 7–10 days from February through July 2001 to collect information on the presence of adults and juveniles, signs of burrow occupancy, and evidence of nesting such as shredded material in the burrow tunnel. We randomly assigned burrows to one of 2 treatments: 1) inspected with an infrared video probe (Peeper Video Probe; Sandpiper Technologies, Inc., Manteca, CA) and monitored every 7–10 days (i.e., probed nests), or 2) monitored every 7–10 days but never inspected with a video probe (i.e., control nests). We began inspecting burrows with the video probe in late March (or 0–7 days after discovery if we found the burrow later than late Mar) and used the probe to inspect burrows every 7–10 days until the juveniles fledged or the nest failed.

The video probe consisted of an infrared camera housed in a plastic cylinder and connected to a 3-m flexible hose attached to a battery interface. We spent approximately 20 minutes training field personnel on proper use of the video probe, with the bulk of the training focused on how to maneuver the probe. However, we also cautioned field personnel about the likely ways that use of the probe could damage nests. For example, observers had to kneel near the burrow entrance while operating the probe, so we trained them on how to avoid collapsing the burrow (by not standing above the entrance or tunnel). Also, debris often accumulated in front of the camera lens (and reduced visibility) as the observer pushed the video probe down into the burrow. If the tunnel curved, the observer had to maneuver the camera around the curves without being able to see what was ahead. If the observer were to push the camera too quickly or without care, the camera might break the eggs or injure an owl (especially young juv). Finally, observers had to use caution when withdrawing the video probe from the nest burrow to prevent injuring owls that were standing in the tunnel. Our use of the video probe did not injure any owls or break any eggs because we took these precautions.

To probe burrows, we placed the camera just inside the burrow tunnel and twisted the hose clockwise and then counterclockwise (or vice versa) as we fed the hose into the burrow to propel the camera forward along the burrow tunnel. If the tunnel curved, we twisted the hose in the direction of the curve as we continued to slowly feed the hose into the burrow. Twisting the hose made the camera turn slightly. If the view became obscured by debris (i.e., loose dirt, manure, or other nest lining), we were sometimes able to clear the debris by shaking the hose slightly as we twisted it. If we could not shake off the debris or if we could not see past a curve, we would feed the hose more slowly until we were past the debris or the curve to avoid breaking eggs or injuring owls.

We used estimates of daily nest survival to compare nesting success between probed and control nests (Mayfield 1961, 1975; Hensler and Nichols 1981). Our estimate of length of the nesting cycle (79 days) was based on average lengths of each nesting stage calculated from 1,014 nests at 5 sites (central and southeast WA, central and southern AZ, and WY, USA) over 4 years (2001–2004) for which we had accurate information on laying and hatching based on repeated use of the video probe. We defined a successful nest as having $\geq$1 juvenile reach 30 days of age (following Priest 1997). We used a *Z*-test (Hensler and Nichols 1981) to evaluate whether daily nest survival differed between probed and control nests. We found most nests prior to the end of egg laying. All nests that we found during incubation or later were successful whether or not we probed them. Therefore, we only included nests found prior to incubation in our analysis of nesting success.

We estimated number of 30-day-old juveniles produced per nest based on aboveground observations during repeated nest visits. We used a 2-way analysis of variance to compare number of juveniles produced per nest between control and probed burrows. We used all the nests in the study for this analysis, and we included stage in the nesting cycle that we found the burrow as well as treatment (probed and control) as fixed effects in the model. We included the stage in the nesting cycle when we found the burrow because nests found late in the nesting cycle are more likely to succeed (Mayfield 1975) and thus will (as a group, on average) produce more young than nests found early in the nesting cycle.

We attempted to trap and band all juvenile and adult owls at occupied burrows so that we could estimate natal recruitment and site fidelity. We banded owls with a United States Geological Survey band and a uniquely numbered aluminum color-band (Acraft Nameplate Co., Edmonton, AB, Canada). We resighted owls at known nest sites and conducted standardized surveys to locate new nest sites in the study area during the breeding season (Mar–Aug) each year from 2002 to 2005. We used *t*-tests to compare the following 3 parameters between the 2 treatments (probed and control): 1) number of juveniles per nest in 2001 that returned to any burrow in the study area during any of the 4 years from 2002 to 2005, 2) number of adults per nest in 2001 that returned to breed at the same burrow in 2002, and 3) number of adults per nest in 2001 that returned to any burrow in the study area during any of the 4 years from 2002 to 2005. Our study was approved by the University of Arizona Institutional Animal Care and Use Committee (protocol 03–190).

RESULTS

We included 79 nest burrows in our study, 38 of which we repeatedly probed and 41 of which we never probed. We found 56 of the 79 burrows prior to laying, 29 of which we repeatedly probed and 27 of which we never probed. We found 10 of the 79 burrows during the incubation stage, and we repeatedly probed 3 of those burrows. We found 13 of the 79 burrows after the eggs had hatched, and we repeatedly probed 6 of those burrows.

Repeated use of the video probe did not influence daily nest survival (Fig. 1). We also failed to detect a difference between probed and control nests in the number of juveniles produced per nest (Fig. 2; Table 1).

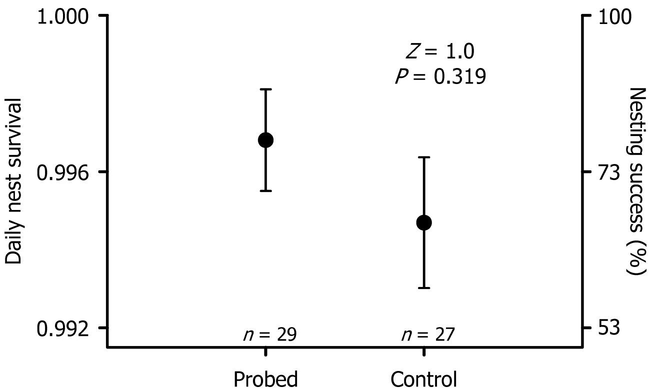

Figure 1. Probing burrows every 7–10 days throughout the breeding season in eastern Washington, USA, in 2001 did not negatively influence burrowing owl daily nest survival. We included only nest burrows that we found prior to incubation. Error bars represent ±1 standard error of daily nest survival estimates.

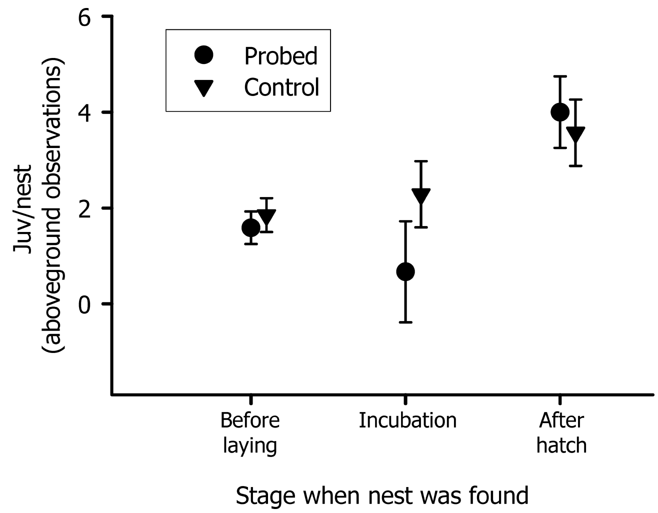

Figure 2. Probing burrows every 7–10 days throughout the breeding season in eastern Washington, USA, in 2001 did not negatively influence number of burrowing owl juveniles (30 days old) produced per nest, based on aboveground observations, even when we repeatedly probed burrows starting early in the nesting cycle. Error bars represent ±1 standard error. Sample sizes from left to right are 29, 27, 3, 7, 6, and 7.

We did not detect a difference between probed and control nests in the number of juveniles per nest that were recruited into the study area from 2002 to 2005 ($\bar{x}_{\text{probed}} = 0.11$, SE = 0.05, $\bar{x}_{\text{control}} = 0.05$, SE = 0.05; $t = -0.8$, $P = 0.424$, $n = 79$). We also did not detect a difference between probed and control nests in the number of adults per nest that returned to breed at the same burrow the following year (2002; $\bar{x}_{\text{probed}} = 0.26$, SE = 0.08, $\bar{x}_{\text{control}} = 0.29$, SE = 0.08; $t = 0.3$, $P = 0.797$, $n = 79$). Also, we did not detect a difference between probed and control nests in the number of adults per nest that returned to breed at any burrow in the study area from 2002 to 2005 ($\bar{x}_{\text{probed}} = 0.50$, SE = 0.11, $\bar{x}_{\text{control}} = 0.61$, SE = 0.11; $t = 0.7$, $P = 0.474$, $n = 79$).

DISCUSSION

Repeated use of an infrared video probe to inspect contents of nest burrows did not negatively affect nesting success, number of fledglings produced per nest, natal recruitment, adult site fidelity, or annual return rates in burrowing owls. Although use of these probes can disturb an owl and cause a behavioral response, we found that even repeated use did not cause any lasting harm in the variables we measured (also see Flath and Rauscher 1998). Ours is the first study to provide experimental evidence that video probes can be used to monitor a burrow-nesting species without negative impacts. We probed nests every 7–10 days and cannot predict whether using probes more frequently would yield similar results. Despite our results, another investigator noticed that burrowing owl nests in his study area (in FL) tended to fail if they were video probed (B. Millsap, United States Fish and Wildlife Service, personal communication). The soil in Florida may be sandier and less stable than in our study area, so burrows in Florida may be more likely to collapse inside due to video probing. Therefore, we encourage all investigators who use probes to inspect nest burrows or cavities to test whether probing or frequency of probing has any negative impacts on their study species and in their study area.

Although the number of juveniles produced per nest at the 10 burrows that we found during incubation did not differ statistically between probed and control nests (Fig. 2), the number of juveniles at nests that we probed ($n = 3$) was lower than at control nests ($n = 7$). We believe that this pattern is due to these small sample sizes. After all, the number of juveniles produced was not lower at probed nests for the 56 nests that we found prior to laying despite being probed repeatedly throughout the entire breeding season.

We trained our field personnel who used the video probe about the likely ways in which probes may damage nests. We have not experienced nor heard of any instances of broken eggs or injured owls due to video probing. However, after video probing several nests that had curves or a lot of debris in the tunnel, we were concerned that broken eggs or injured juveniles could occur and therefore trained personnel accordingly. Hence, we believe that repeated use of video probes could negatively affect burrowing owls if field personnel are not properly trained. Additionally, video probing nests that contain other species may be more likely to result in injury if those species tend to react to the presence of the probe by trying to exit the cavity or burrow because the animal could get caught between the video probe and the cavity entrance or the tunnel.

Video probes can be useful for estimating demographic

Table 1. Influence of probing burrows found at different stages in the nesting cycle on number of juvenile (30 days old) burrowing owls produced per nest, based on aboveground observations in eastern Washington, USA, in 2001.

Source	df	MS[a]	F	P
Model	5	10.5	3.1	0.013
Treatment (probed or control)	1	2.5	0.7	0.393
Stage in nesting cycle when we found the burrow	2	23.9	7.1	0.002
Treatment × stage in nesting cycle	2	2.7	0.8	0.451
Error	73	3.3		

[a] MS = mean square error.

parameters of burrow-, den-, and cavity-dwellers, but video probes also have some drawbacks: price (approx. US$5,000 retail); propensity to break when used many times per day (at least in our experience); increased time spent at each nest and longer field days (probing burrows sometimes took as long as 30 min/burrow); and limited use in very deep, twisting, or debris-filled cavities and burrows. Indeed, not seeing eggs or juveniles in a burrow is not proof that the burrow does not contain a nest because the nest may be hidden by debris, beyond the reach of the video probe, or in an inaccessible side tunnel. Our own data indicate that we were unable to reach the nest chamber or see its contents 21% of the time we used the probe. Even at those nests where we were able to confirm the presence of a nesting attempt (i.e., we saw eggs or nestlings), we were only able to get an accurate count of the eggs at 52% of the attempts. The attempts where we were able to get an accurate count of the eggs were at those nests that were the most accessible, had the least amount of debris, or where the female did not block our view. Therefore, estimates of reproductive parameters that are affected by nest accessibility (Steenhof 1987) may still be biased because complete data can only be collected from the most accessible nests. Nevertheless, video probes provide reliable information on whether any eggs or juveniles are present (i.e., whether a nesting attempt was initiated and whether eggs hatched) for many nests and are currently the best available option for estimating many demographic parameters of burrow-dwelling animals.

Management Implications

Managers and researchers can use infrared video probes repeatedly on burrowing owl nests every 7–10 days throughout the breeding season without negatively affecting reproduction or annual return rates. This technique can also be used by regulators to ensure compliance with the Migratory Bird Treaty Act in areas that have burrowing owls present because probes can confirm presence of eggs or juveniles.

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