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# Current status of the Northern Saw-whet Owl (*Aegolius acadicus*) in Arkansas

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Mitchell L. Pruitt\* and Kimberly G. Smith†

## Abstract

The secretive Northern Saw-whet Owl (*Aegolius acadicus*) is believed to be much more widespread during fall and winter than previously thought. Of the few places in the southern United States conducting research on this species, all have been successful at capturing birds. A total of 12 historic records existed for Arkansas until our work began in fall of 2014. The first confirmed record was in 1959 and the most recent, prior to this research, was in 2010. Over the course of two field seasons, we captured and banded 24 Northern Saw-whet Owls in rural Madison County. All birds were mist-netted along a trail, in woodland composed of pine and cedar with fairly dense undergrowth. Two were captured during our 2014 season after a late start and 22 were captured in 2015, likely the result of an earlier start. Comparing our data to that of several other banding operations in the south, it would appear that the peak of migration in Arkansas is late October through early November, with capture rates dropping by early December. Of the birds captured, all but one was female, the most common sex this far south. A variety of age classes were identified, with a fairly even distribution of hatch-year, second-year, and after-second-year birds. Exactly from where the saw-whets are migrating is unknown, although several foreign recoveries in Missouri and four recoveries in Arkansas suggest they are coming from the western Great Lakes region. Once considered a vagrant, based on this research, the saw-whet appears to be a fall migrant to the state of Arkansas.

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\* Mitchell L. Pruitt is a May 2016 honors program graduate with a major in Environmental, Soil, and Water Science.

† Kimberly G. Smith, the faculty mentor, is a distinguished professor in the Department of Biological Sciences.

## Meet the Student-Author



**Mitchell Pruitt**

I was born and raised in Jonesboro, Arkansas and graduated from Valley View High School in 2012. I graduated with honors from the University of Arkansas in May 2016 with a B.S. in Environmental, Soil, and Water Science. I developed a love of all things outdoors, especially birds, at a young age. During the summer, I teach at an ecology camp for 11-12 year olds, the same camp that inspired who I am today. When I am not doing schoolwork, I can be found birding in Arkansas and beyond. I am also a nature photographer, interested in wildlife (especially birds), herps (reptiles and amphibians), and more. My hobbies have snowballed into lifelong passions and, hopefully, a career. After graduating, I will complete a Master of Science degree in biology, working specifically with birds of prey. For two years, I have actively researched the Northern Saw-whet Owl, under the direction of Kimberly Smith in the Department of Biological Sciences. We documented the species' occurrence in Arkansas, where it was not previously known to regularly exist. It has been an amazing road and a great learning experience! I would like to thank my thesis advisor, Smith, and my thesis committee: Lisa Wood and Thad Scott. Everyone else who helped in making this research run smoothly has been a great resource, including Dana Ripper, Missouri River Bird Observatory, Matthew Miller and the staff of the Ozark Natural Science Center, and all banding volunteers, especially Melyssa St. Michael, Jacqueline Guzy, Joe Neal, David Oakley, and Meredith Swartwout.

## Introduction

In eastern North America, Northern Saw-whet Owls (*Aegolius acadicus*) are primarily a denizen of the boreal forests of Canada during the breeding season, but birds migrate south in fall into the United States (Confer et al., 2014), sometimes in large "invasions" (Brinker et al., 1997). However, its distribution is poorly known in the southern part of the United States. Recently, attempts to capture birds during fall migration have been successful in Missouri (D. Ripper, unpubl. data) and Alabama (R. Sargent, unpubl. data), as was an earlier attempt in South Carolina, primarily in 1999 (W. Hilton, pers. comm.).

Between 1959 and 2010, there were 12 reports of saw-whets in Arkansas, most of which occurred in November and December (Arkansas Audubon Society, James and Neal, 1986) (Fig. 1). These records were scattered, but were mostly north of the Arkansas River, with an emphasis on the Ozarks, Crowley's Ridge, and the tip of the Ouachita Mountains at Little Rock (Fig. 2).

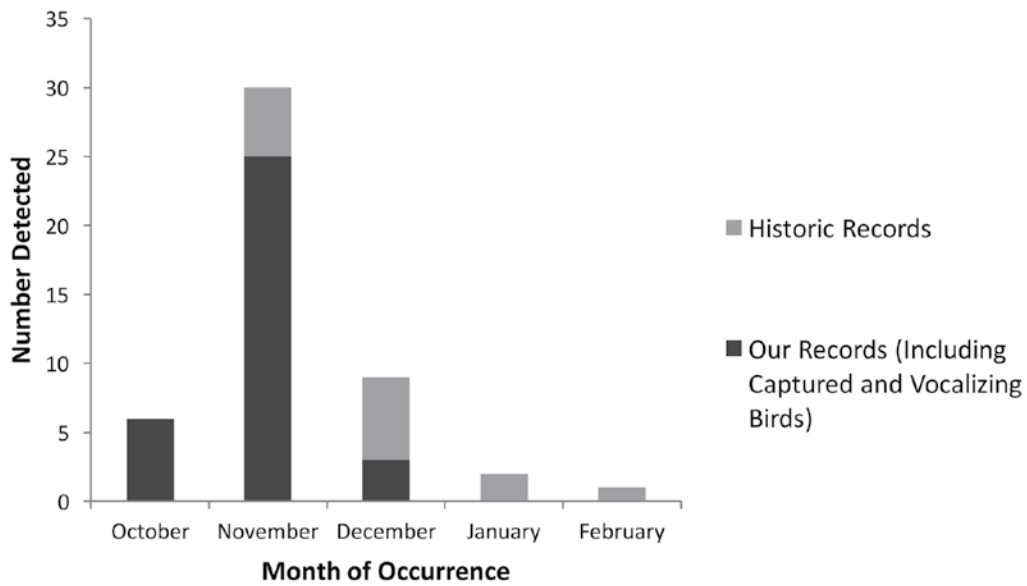
A saw-whet was photographed by Arkansas Gazette photographer, Larry Obsitnik, on a no parking sign during the day in Little Rock on 7 November 1969. It appeared on the front page on 8 November (Fig. 3). A detailed description of the history of saw-whets in Arkansas is presented in Pruitt and Smith (2016).

Based on the success of capturing birds in Missouri and Alabama, the objective of this study was to attempt to document the occurrence of saw-whets in Arkansas during fall and winter, using mist-nets and audio lures for the first time. Prior to our research, saw-whets were considered a rare bird within the state of Arkansas (James and Neal, 1986). James and Neal (1986) concluded that due to their nocturnal habits and secretive nature, saw-whets might be more common in Arkansas than records suggested. Nonetheless, our expectation was that we would capture no saw-whets.

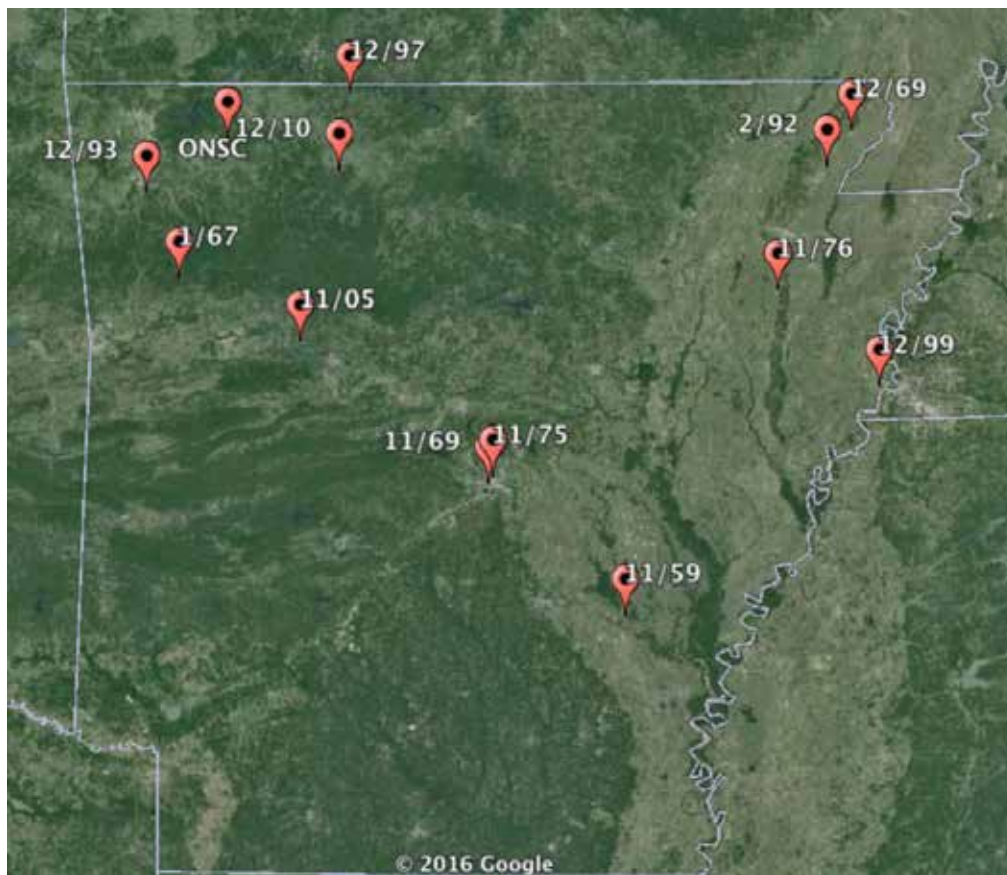
## Materials and Methods

This research used standard methods produced by a group of researchers in the northeastern United States (Project Owl-net, 2016). Before beginning, banding permits were acquired from both the national and state governments, as well as from the particular organization on whose property we were netting. Standard equipment included four 12-meter mist nets with 60-mm mesh, an audio lure to draw birds into the net area, and tools for processing upon capture. A typical night consisted of being in the field from 7:00 PM until 12:00 AM or later.

During fall and winter months, saw-whets seem to have a preference for woodland with a thick understory, ideally cedar or other coniferous component. Our field station



**Fig. 1.** Arkansas Northern Saw-whet Owl records from 1959 through 2015 by month. The historic records are from the Arkansas Audubon Society database and include the two game-camera records from Madison County in December 2014 and January 2015 mentioned in the text.



**Fig. 2.** Distribution of the first 12 records from Arkansas of Northern Saw-whet Owls with the month and year of each sighting. ONSC refers to the location of this field study, Ozark Natural Science Center. Note that most sightings are associated with heavily forested areas on the background map.

was located at the Ozark Natural Science Center (ONSC) in rural Madison County, Arkansas, where the habitat is a mixture of pine/deciduous upland with a thick cedar understory. Four mist nets were arranged in a line down a trail through the cedars. The audio lure was placed at the center of this arrangement and played continuously during time afield. The use of an audio lure began in 1986, at the Little Suamico Ornithological Station near Green Bay, Wisconsin, as a method to increase saw-whet captures (Erdman and Brinker, 1997). The lure was played on a FoxPro® brand predator caller programmed with several call types of the saw-whet. Call types played included the breeding male's toot, toot, toot as well as a whine call, which is often given during migration (Weidensaul, 2015). Calls were obtained from the Stokes Field Guide to Bird Songs CDs, by Donald and Lillian Stokes, and are part of the standard procedures for capturing saw-whets.

Upon capture, a bird was taken inside a building for processing. Processing involved sexing, ageing, and band-

ing. Like many raptors, saw-whet owls exhibit reverse sexual dimorphism meaning females are, on average, slightly larger than males (Weidensaul, 2015). Accurate sexing of saw-whets can only be done by comparing a bird's closed wing-chord (CWC; maintains the wing's natural arc) and its weight. Brinker (2000) created a chart for sexing with ease; it has a >95% probability for accuracy. On average, females have a CWC of 120-141 mm and weigh 88 to greater than 93 g, while males have a CWC of 120-135 mm and weigh less than 78-88 g. All birds were weighed in a mesh banding bag using a Pesola spring scale.

Ageing saw-whets involves the use of ultraviolet (UV) light to fluoresce porphyrin pigment on the ventral surface of flight feathers (Primaries: P1-P10; Secondaries: S1-S12). In saw-whets, this pigment is pink when fluoresced by UV light. Once exposed to sunlight, porphyrins begin to fade making different ages of feathers fairly distinct. New feathers fluoresce bright pink, middle-aged feathers are light pink, and old feathers may not show any pink (Weidensaul et al.,



**Fig. 3.** Photograph of Northern Saw-whet Owl by Larry Obsitnik taken the day before it appeared on the front page of the Arkansas Gazette on 8 November 1969. He had no idea what the owl was and was making a joke about the owl not being able to read the sign. Doug James identified the bird from the picture in the newspaper and obtained a copy of the picture for the Arkansas Audubon Society files. (Photo courtesy of Lyndal York).

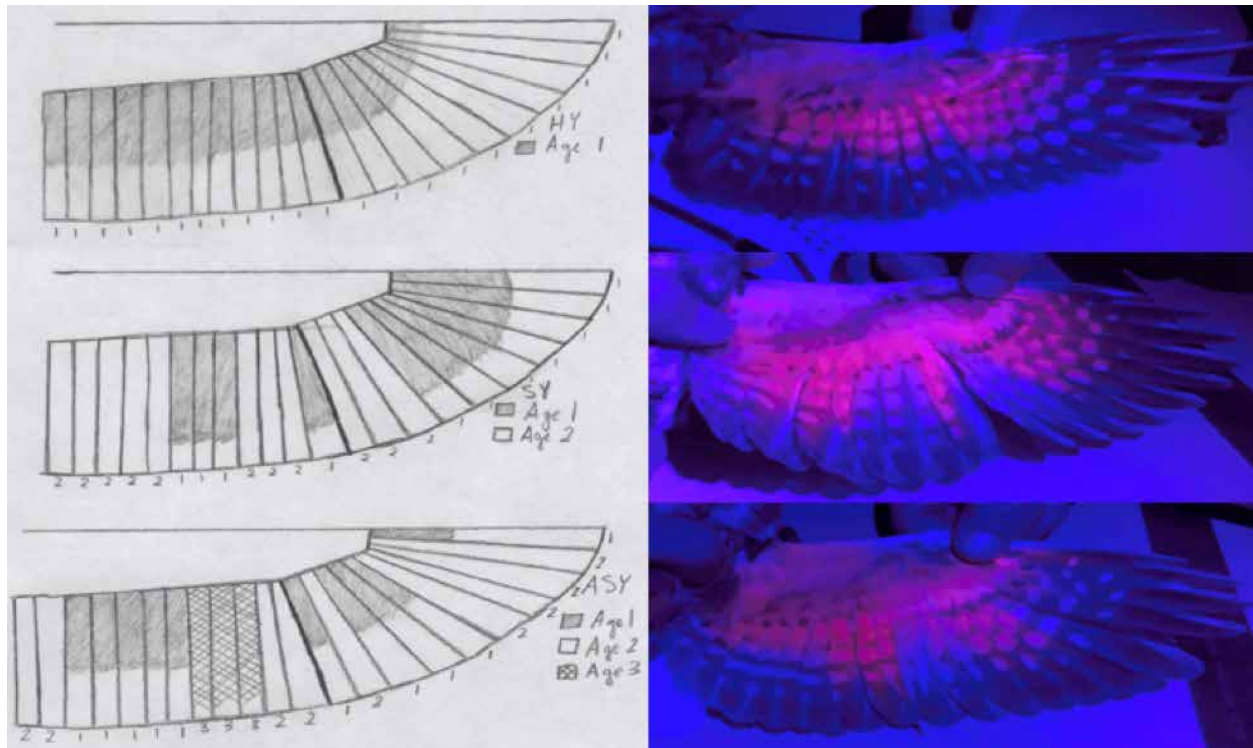
2011). Three distinct age classes can be identified using this method (Fig. 4). Hatch year (HY) birds exhibit flight feathers of a single age. Second year (SY) individuals exhibit two distinct ages of flight feathers. After second year (ASY) birds exhibit three or more distinct ages of feathers (Pyle, 1997). After a saw-whet's second year, its age cannot be identified more specifically unless it was previously banded. Finally, captured birds were banded using a size four short federal band, and released into the night.

Capture rates were calculated for the fall 2015 banding season based on birds captured per 100 net-hours, the standard way of reporting banding effort for saw-whets. Typically, 4 nets were open for 4 hours each night, or 16 net-hours per night. The season capture rate was calculated from the night with the first capture to the night of the last capture.

## Results and Discussion

Over the course of two field seasons, a total of 24 saw-whets were captured and banded at the Madison County field site. Ten more were detected vocally, resulting in 34 re-

corded individuals. In 2014, we did not begin netting efforts until 20 November due to issues in the permitting process. Even so, two individuals were captured and two others detected vocally. The first saw-whet owl was captured on 21 November and was in the company of another individual that was not captured. One of these birds responded to the audio lure earlier the same night. A second bird responded to the audio lure on 6 December, but was not captured. However, an individual was captured the following night of 7 December. Efforts continued through January 2015 and sporadically into February with no captures or vocal detections. With insight from researchers in central Missouri, the second field season began earlier, on 25 October 2015, and continued through 3 December 2015 (D. Ripper, pers. comm.). During this time, 22 saw-whets were captured and banded; eight others were detected vocally (Fig. 5). The 2015 field season consisted of 23 total nights afield, or 257.3 total net-hours. Of these 23 nights, 10 nights had captures (43.5%) and 12 nights had captures or vocal detections (52.2%). On 75.0% of nights when saw-whets were captured or detected, there were more than two captures or detections per night.



**Fig. 4.** Age classes of the saw-whet owl based on fluorescence of porphyrin on the underwing. Top: Hatching-year (HY) bird with uniform color indicating that all feathers are new. Middle: Second-year (SY) bird with 2 different kinds of feathers: new feathers are bright while second-year feathers are faded. Bottom: After second-year (ASY) bird with 3 different kinds of feathers: new feathers are bright, second year feathers are paler, and third year feathers hardly fluoresce. (Photos and drawings by Mitchell Pruitt 2015).

The sex ratio of the birds was skewed towards females. Only one individual out of 24 total captures was identified as a male; 23 were females. The single male was captured 21 November 2015 and was aged as a hatch-year bird. The male had a closed wing chord (CWC) of 136 mm and weighed 80 g. The average CWC of captured females was 141.9 mm (+/- 0.57 SE) with a range of 138-146 mm. The average weight of captured females was 90.9 g (+/- 1.16 SE) with a range of 80-105 g.

The age distribution was evenly distributed among the three identifiable classes: HY (n = 8), SY (n = 7), ASY (n = 8), and fourth year (n = 1). A saw-whet captured on 7 November 2015, at ONSC, was previously banded at the Linwood Springs Research Station near Stevens Point, Wisconsin on 17 October 2013. It was banded as a second year bird, meaning it was in its fourth year at the time of recapture at our field site. Comparing the ages of captured saw-whets to date of capture, it would appear that hatch-year birds arrive at about the same time as adults (Fig. 6).

The capture rate for 2015 was 8.6 birds per 100 net-hours. Records from this research were compared to Arkansas' historic records and show a peak in migration during November; more specifically the first two weeks in November (Figs. 1 and 5). Interestingly, most of the captures seemed to occur during the hours of 9:00 PM-10:00 PM and again around midnight (Fig. 7).

During the 2015 season, two captures were foreign recaptures (FRs), meaning they were banded somewhere oth-

er than the ONSC field site. First was the aforementioned 4-year-old bird banded (0914-53397) in October 2013 in Stevens Point, Wisconsin and captured at ONSC in November 2015 (Fig. 8). This owl was an underweight (80 g) female with a CWC of 144 mm, aged fourth year. The second FR occurred on 21 November 2015 and was banded (0914-99385) on 30 September 2015 at Hawk Ridge Bird Observatory near Duluth, Minnesota (Fig. 8). The distance between the two research sites is 1186 km indicating the bird averaged at least 23 km/night. This ASY female weighed 91 g and had a CWC of 145 mm. There was also a local recapture during our 2015 season. This saw-whet, a HY female, was banded at the ONSC field site on 7 November 2015. She weighed 86 g, slightly underweight. The bird was recaptured the following night, 8 November, weighing 91 g and had dried blood on her beak and talons suggesting that she had eaten.

From this research, we are able to conclude that the Northern Saw-whet Owl is, in fact, more common in Arkansas than previously thought, at least during fall migration. With only 12 confirmed records throughout the history of bird documentation in Arkansas, capturing the species was not expected. However, with 24 total captures, and 10 additional vocal detections, it is reasonable to think the species previously went undetected, probably due to their secretive nature.

All but one of our captured saw-whets were females. Males are captured with much less frequency further south of the species' normal range (Brittain et al., 2009, Beckett

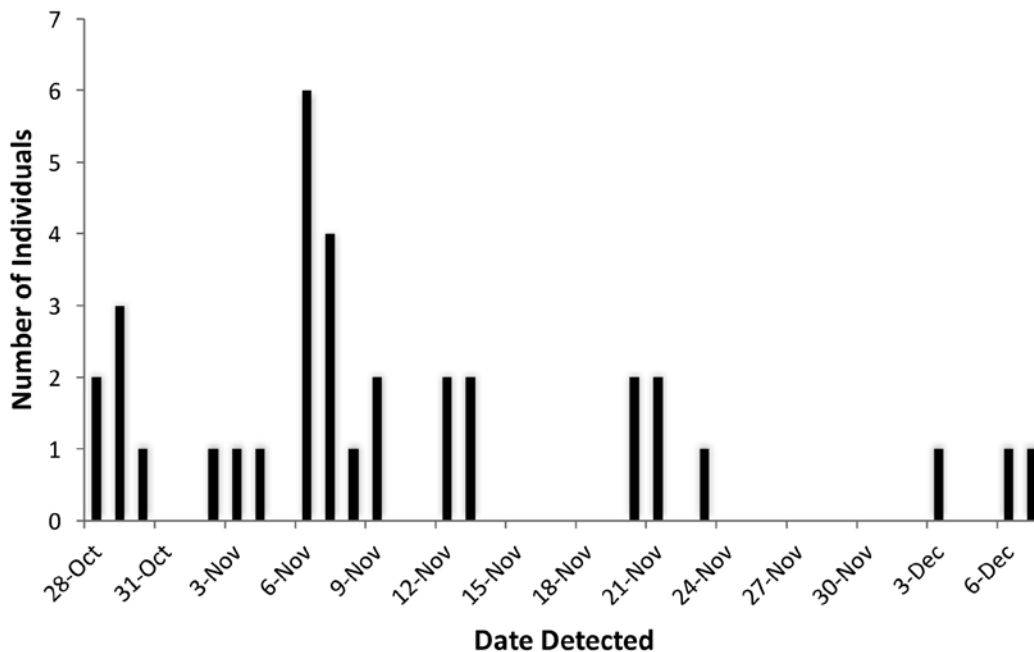
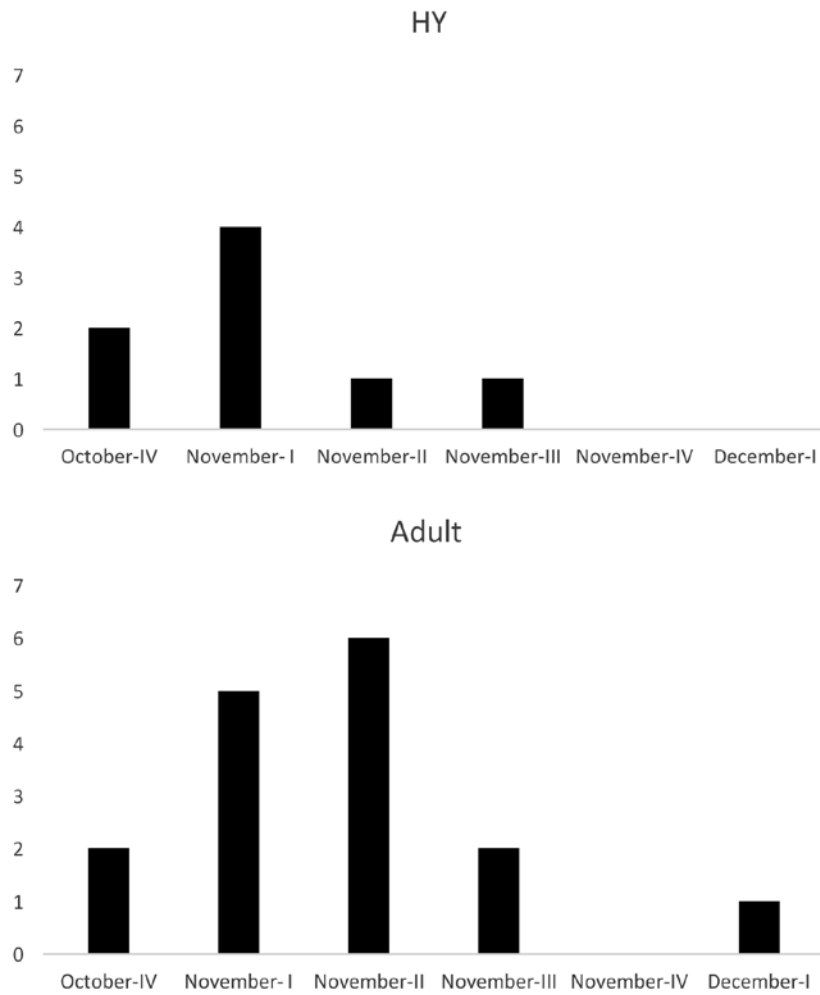
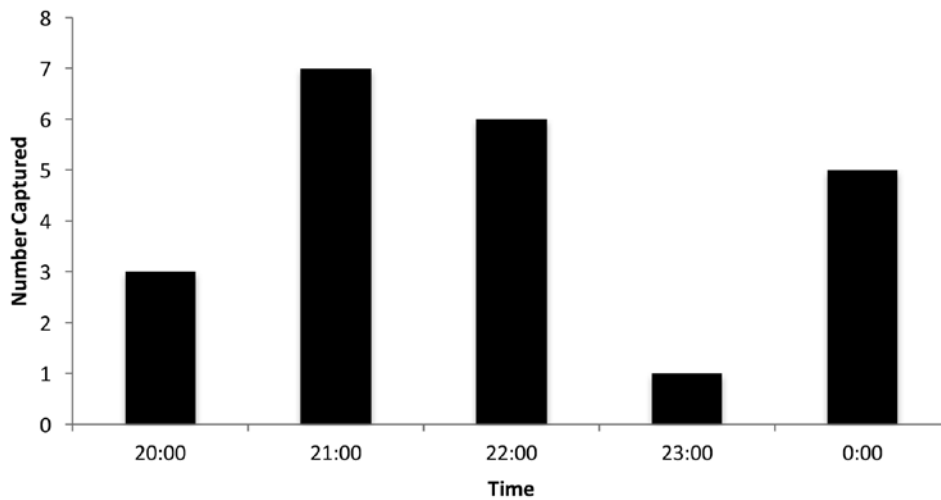


Fig. 5. Saw-whet detections (capture or vocal) at Ozark Natural Science Center during November and December 2014 and October to December 2015 (combined).



**Fig. 6.** Arrival of hatch-year (HY) and adult Northern Saw-whet Owls by week from the 4th week of October through the first week of December. Hatch-year birds appear to arrive at the same time as adults.



**Fig. 7.** Saw-whets captured per hour at Ozark Natural Science Center during November and December 2014 and October to December 2015.

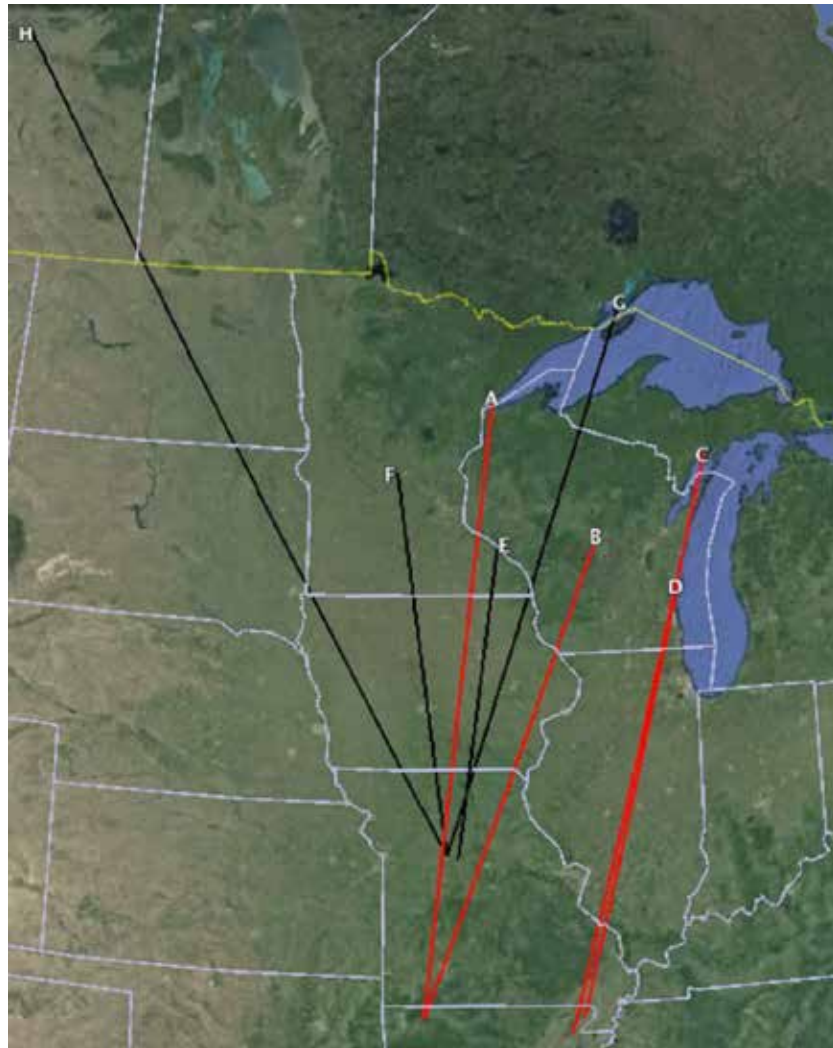


and Proudfoot, 2012). Brinker et al. (1997) suggested this is because males do not stray as far from prime breeding habitat, allowing for quicker reoccupation in spring when they are vying for precious cavities for nesting. Or the larger and heavier females may have dietary requirements that are met further south (Weir et al., 1980, Beckett and Proudfoot, 2012). Such differential migration is not uncommon in birds and has been documented in the Boreal Owl (*Aegolius funereus*), a close relative of the saw-whet (Brinker et al., 1997).

Based on only one full field season, we cannot attribute much to the equal distribution of age classes that were found. Brittain et al. (2009) found that the number of HY birds fluctuated annually from about 30% to 50% in south-

ern Indiana. At northern locations, HY birds usually appear first in the fall, but the limited data suggest that they arrive at the same time as adults in northwestern Arkansas.

Capture rates in our 2015 season started in late October, peaked during the first few weeks of November, and decreased to no captures after the first week of December. This trend is also similar to that of Missouri (D. Ripper, unpubl. data) and slightly before that of northern Alabama, where captures continued into January (R. Sargent, unpubl. data). This difference in Alabama might be because those birds are following a different migratory pathway (see below). This peak in early November coincides exactly with the prediction from the model presented in Beckett and Proudfoot (2011) for a northern latitude of about 36 degrees. Our



**Fig. 8.** Banding recoveries from Arkansas (red) and from the Missouri River Bird Observatory (black). Most birds appear to be coming from the western Great Lakes region. Key (banded, recovered): A (9/15, 11/15), B (10/13, 11/15), C (10/90, 2/92), D (11/69, 12/69), E (10/15, 11/15), F (10/15, 11/15), G (?/13, 10/14), H (9/12, 10/12).

results agree with those authors, that fall migration of saw-whets is a uniform front that moves southward as fall progresses.

Weather conditions also appear to play a role in successfully capturing saw-whets. The nights that most birds were captured followed cold fronts from the north, suggesting that migrating birds were riding those fronts. Brittain et al. (2009) also caught more birds in southern Indiana following the passage of fronts and on nights with calm winds (see also Weir et al., 1980). Nights with full moons are typically unproductive (Speicher et al., 2011), because birds can see the mist nets and/or are wary of larger, predatory owls, such as Barred Owls (*Strix varia*), which were commonly heard calling at the ONSC field site. However, four captures were made in late October when the moon was an 85% full waning gibbous. This was probably due to leaves still being on the trees, darkening the forest near the nets.

Based on four foreign recovery data from Arkansas and three of four from Missouri, it would appear that the saw-whets migrating to the region are coming from the western Great Lakes region (Fig. 8). Four recoveries from Arkansas include two birds banded in Wisconsin, one from Duluth, Minnesota, and another banded in the Upper Peninsula of Michigan. Three recoveries from Missouri include birds banded in Kellogg, Minnesota, Collegeville, Minnesota, and Silver Islet, Ontario (Fig. 8). (The other Missouri bird came from Prince Albert, Saskatchewan, far to the northwest.) These data appear to establish a heretofore unknown migration route for saw-whets, flying south or southwest from the western Great Lakes to the Ozarks (see Confer et al., 2014). Birds in Alabama could possibly be coming from somewhere other than the western Great Lakes, like down the Appalachian Mountains, which might explain the longer banding season there.

The fact that 10 vocalizations were observed during this research should also be noted, as vocalizations are thought to be uncommon outside the species' breeding season. The saw-whet is so-named by its vocalizations reminiscent of whetting a saw, although it is unknown specifically for which call it was named (Weidensaul, 2015). During the 2014 and 2015 field seasons, several different vocalizations were documented. One of the vocalizations played by the audio lure is the male's territorial toot, toot, toot call. No response was heard to this call because it is rarely heard outside breeding season. The second vocalization played by the audio lure is an eerie, drawn out whine call that is heard most frequently in fall and could be a contact call used during migration to locate other individuals (Rasmussen et al., 2008). Most often a response to the whine call was heard, but we documented several other vocalizations as well. Another common call heard during field research was a quick ksew or chirping note. This was often elicited by flushing birds while checking nets. Both the ksew and squeak seemed to be given by

agitated individuals. Ksew notes were also heard while listening from a distance, meaning they were probably given off in agitation towards other individuals as well. On one occasion, a two note, squeaking alarm call was heard from a flushing bird. On another occasion, two individuals were heard high up in a tree giving a series of soft chirping notes, seemingly talking back and forth to each other. The saw-whet is still vastly understudied outside migration, making it difficult to understand the social context behind most of their vocalizations.

Based on the scattered historic records, it would appear saw-whets could be found throughout Arkansas. There are also other large tracts of suitable cedar habitat in northwestern Arkansas. Thanks to publicity of this project, we were contacted by Becky Christenson, who had 2 images of a saw-whet owl from a trail camera that she had set up on her property approximately 16 km south of Kingston (Madison Co.) on County Road 3655. The first image was taken at night on 23 December 2014 and the second image (presumably both images were of the same bird) was taken on 12 January 2015. Her property is about 32 km due south of the research site at Ozark Natural Science Center. This is likely just one of several unknown and unreported individuals.

After early December, our capture rates drop to zero and saw-whets seem to vanish. We continued banding operations into January and early February of 2015, but caught or heard no birds. The banding station in Missouri also typically shuts down after the first week of December as they do not catch any birds after that time (D. Ripper, pers. comm.). However, sporadic records in Arkansas from December to February suggest that some individuals may spend the winter here. Is this suggestive of the population as a whole or just these few individuals?

There are several possibilities: First, they could be going further south, but there are no records in southern Arkansas and almost none in Louisiana. Second, they could be spending winter in the Ozarks, but they no longer respond to audio lures after late November. Third, they could be returning north in December, but that seems to oppose the logic behind migration. Or they could be doing something completely different, like wandering throughout winter, as has been found in Snowy Owls (*Bubo scandiacus*) (Norman Smith, pers. comm.).

From this study, it can be concluded that Arkansas is most likely in a previously unknown migratory pathway for the saw-whet owl. This research has more than doubled the state's previous 12 records in just two field seasons. One thing is certain, a species with such gaps in its natural history is dangerous in today's ever-progressing world. The goal of this research, and future projects, is to learn more about the migration of the Northern Saw-whet Owl in Arkansas and the southern region. Further research will be imperative to this secretive species' conservation in the future.

## Acknowledgements

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## Literature Cited

- Arkansas Audubon Society. 2004. Bird records database. Accessed 15 May 2016. Available at: <http://www.arbirds.org/results.asp>
- Beckett, S.R., and G.A. Proudfoot. 2011. Large-scale movement and migration of Northern Saw-Whet Owls in eastern North America. *Wilson J. Ornithol.* 123:521-535.
- Beckett, S.R., and G.A. Proudfoot. 2012. Sex-specific migration trends of Northern Saw-Whet Owls in eastern North America. *J. Raptor Res.* 46:98-108.
- Brinker, D.F., K.E. Duffy, D.M. Whalen, B.D. Watts, and K. M. Dodge. 1997. Autumn migration of Northern Saw-whet Owls (*Aegolius acadicus*) in the middle Atlantic and northeastern United States. pp. 74-89 in Duncan, J.R., D.H. Johnson, and T.H. Nicholls. (eds.). *Biology and conservation of owls of the northern hemisphere: second international symposium.* USDA Forest Service Gen. Tech. Rep. NC-190.
- Brinker, D.F. 2000. Sex criteria for Northern Saw-whet Owls. Project OwlNet. Retrieved from [www.projectowl.net](http://www.projectowl.net)
- Brittain, R.A., V.J. Meretsky, J.A. Gwinn, J.G. Hammond, and J.K. Riegel. 2009. Northern Saw-Whet Owl (*Aegolius acadicus*) autumn migration magnitude and demographics in south-central Indiana. *J. Raptor Res.* 43:199-209.
- Confer, J.L., L.L. Kanda, and I. Li. 2014. Northern Saw-whet Owl: regional patterns for fall migration and demographics revealed by banding data. *Wilson J. Ornithol.* 126:305-320.
- Erdman, T.C. and D.F. Brinker. 1997. Increasing mist net captures of migrant Northern Saw-whet Owls *Aegolius acadicus* with an audiolure. pp. 533-544 in Duncan, J. R., D. H. Johnson, and T. H. Nicholls. (eds.). *Biology and conservation of owls of the northern hemisphere: second international symposium.* USDA Forest Service Gen. Tech. Rep. NC-190.
- James, D. A., and J. C. Neal. 1986. Arkansas birds—Their distribution and abundance. University of Arkansas Press, Fayetteville.
- Project OwlNet. 2016. <http://www.projectowl.net>
- Pruitt, M. L., and K. G. Smith. 2016. History and current status of the Northern Saw-whet Owl (*Aegolius acadicus*) in Arkansas. *Proc. Ark. Acad. Sci.* 70: in press.
- Pyle, P. 1997. Identification guide to North American birds. Volume 1. Slate Creek Press, Bolinas, California, USA.
- Rasmussen, J.L., S.G. Sealy, and R.J. Cannings. 2008. Northern Saw-whet Owl (*Aegolius acadicus*). In: Poole, A. (ed.). *The Birds of North America Online.* Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna-proxy/birds.cornell.edu/bna/species/042/>
- Speicher, J., L. Schreffler, and D. Speicher. 2011. Lunar influence on the fall migration of Northern Saw-whet Owls. *Wilson J. Ornithol.* 123:158-160.
- Weidensaul, C. S. 2015. Peterson reference guide to owls of North America and the Caribbean. Houghton Mifflin Harcourt, New York, New York.
- Weidensaul, C. S., B. A. Colvin, D. F. Brinker, J. S. Huy. 2011. Use of ultraviolet light as an aid in age classification of owls. *Wilson J. Ornithol.* 123:373-377.
- Weir, R.D., F. Cooke, M.H. Edwards, and R.B. Stewart. 1980. Fall migration of saw-whet owls at Prince Edward Point, Ontario. *Wilson Bull.* 92:475-488.