Nesting Northern Saw-whet Owls (*Aegolius acadicus*) in the Southern Appalachian Mountains

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Introduction

The Northern Saw-whet Owl (*Aegolius acadicus*) is a common breeding species in forests of southern Canada and the northern United States, as well as in mountainous areas of the western United States and Mexico. In the eastern United States the presence of adult owls during the breeding season has been known for more than 75 years as far south as Great Smoky Mountains National Park in the Appalachian range in North Carolina and Tennessee (Stupka 1946, 1963). In North Carolina early indications of potential breeding occurred when chocolate-brown juveniles were found in July 1965 in the Great Balsam Mountains, twice in September 1965 in the Black Mountains, and in September 1972 on the Pisgah Ridge (Simpson 1974). However, no actual nests were found that far south until 1989 and 1992. In North Carolina the first nest was discovered in the Black Mountains in a flying squirrel box by Allen Boynton in summer 1989 (LeGrand 1990). The first nest in Tennessee was discovered in June 1992 in a nest box that D. Rad Mayfield and Dr. Fred Alsop had set up at Unaka Mountain (Mayfield and Alsop 1992). In 1995, and again from 1999 through 2001, nest boxes were placed at Unaka Mountain, Roan Mountain, and Grandfather Mountain by master's degree students at East Tennessee State University and Appalachian State University. In 1995 four nest boxes were occupied, three on Roan Mountain and one on Unaka Mountain, and two of these boxes fledged chicks (Barb 1995). From 1999 through 2001 a total of six boxes were occupied over the three year period, two on Roan Mountain and four on Grandfather Mountain, and four of these fledged chicks (Williams 2003).

Methods

In 2011 we began regularly monitoring Northern Saw-whet Owl nesting boxes built and installed by Simpson from 2007 through 2017. These boxes were placed at elevations from 1486 to 1905 meters (4874 to 6249 feet) in areas of the Southern Appalachians along the Great Balsam, Pisgah Ridge, and Black Mountain Ranges. Areas selected consisted predominantly of mixed Red Spruce (*Picea rubens*), Fraser Fir (*Abies fraseri*), and deciduous forest generally in close proximity to forest openings created by fires, logging, and tree loss as a result of Balsam Wooly Adelgids (*Adelges piceae*). Box locations were based on Northern Saw-whet Owl calling surveys conducted periodically since the 1960's by Simpson (Simpson 1968, 1971, 1974a, 1974b; Simpson and Range 1974; Simpson and Ruiz 1975). By 2015 there were 25 boxes throughout the three ranges. Because of research permit limitations, specific box locations are not identified. Some of the earlier boxes were single placements, but Canadian biologist Jean Pierre

Savard studying Saw-whet Owl breeding suggested placing these boxes in pairs (pers. comm.), so several were added to existing sites between 2011 and 2015, and in subsequent years boxes were paired at all new locations. Thus, in 2015 there were 11 sites with at least two boxes within 23 meters (75 feet) of each other and two locations with three or four boxes in close proximity. From 2008 to 2015 the boxes were checked, usually twice, during the nesting season (March-June) mainly by tapping on the boxes to see if any owls appeared in the entrance. In 2015 John Gerwin from the N.C. Museum of Natural Sciences loaned us a "tree peeper" camera, which is attached to a long pole and connected to a viewing monitor on the ground. This was a more effective method of checking boxes.

Results

Tapping on boxes, and later using the camera, we found no evidence of owls at any of the boxes until the last box checked during the 2015 season. On 26 April we found an adult owl in a box along the Pisgah Ridge. As this was our first occupied box and we had no way to determine where it was in the nesting cycle, extensive precautions were taken to avoid disturbing it further since the risk of nest abandonment increases when an owl is disturbed early in the nesting process (Rasmussen et al. 2008). On 10 May we returned to check the box, and a well-feathered chick appeared in the box entrance. We returned on 13 May, and a chick once again popped into the box entrance. With greater experience we discovered that this is a common behavior for chicks about to fledge (Fig. 1).

Figure 1. Chick near fledging in box

With revived hope for the 2016 season, we began monitoring boxes in mid-March of that year, once again using the "tree peeper" camera. Unexpectedly, we found an occupied box our first day in a different location from the previous year along the Pisgah Ridge. No other occupied boxes were found that month, but on 20 April, two were found in the Great Balsam Mountains, along with another occupied box along the Pisgah Ridge on 23 April. This last was the paired box of the one that was occupied in 2015. Boxes are rarely used by the same owl two successive years even when the box has been cleaned (Rasmussen et al. 2008). Finally, on 10 May a fifth occupied box was found in the Black Mountains. All of the occupied boxes were monitored regularly throughout the nesting season using the "tree peeper" camera and by placing motion activated wildlife cameras with night vision capability, borrowed from N.C. Wildlife Resources Commission, on tree limbs near each box. The main object of

the night vision camera was to monitor the male bringing prey to the nest (Fig. 2), observe potential predator activity near the nest, and document fledging dates of chicks. As we repeatedly observed, the arriving adult typically landed on a branch near the box entrance and transferred the prey item from its talons to its bill before entering the box. Thus, abundant photos were obtained in areas where we correctly assumed the location of the landing branch. Four of the boxes monitored in 2016 fledged a total of 12 chicks. The fifth box was abandoned after the female incubated evidently infertile eggs for almost two months. Normal hatching occurs 27-29 days from egg-laying (Rasmussen et al. 2008).

Figure 2. Chick in box entrance watching adult with prey. Photo taken by motion-activated night vision camera.

Late in 2016 we installed eight additional boxes at four new locations, so during the 2017 season there were 33 boxes in 15 potential territories. Once again, in 2017 we found five occupied boxes, all in the same areas as the previous year. However, the box in the Black Mountains was found abandoned with two eggs in it on the day it was discovered. Another in the Balsam Mountains was found with a female sitting on three eggs on 20 April, but the nest was abandoned by 2 May. On 18 May we found the paired box at this location occupied with a female sitting on eggs. By 21 June this box was also abandoned. Interestingly, this was the same box that was abandoned the previous year.

The remaining three occupied boxes, two on the Pisgah Ridge and one in the Great Balsam Mountains, all fledged chicks, five from the Pisgah Ridge boxes and one from the Balsam Mountains box. Motion activated cameras were also set up during the nesting cycle at two of the three successful nest sites, and many additional photos were obtained.

Late in 2017 we installed a pair of boxes at another new location, so at the beginning of the 2018 season there were 35 boxes in 16 locations along the three ranges. The 2018 breeding season was quite unusual. April was a very cold month and precipitation in May was well above average. The atypical weather may have had an effect on nesting. We started checking boxes in February, but the first occupied box was not found until 1 April on the Pisgah Ridge in the same area that owls had successfully nested the previous three years. Five eggs hatched from this box, but about two weeks after the last chick had hatched out, on 21 May at 5:17a.m., a Long-tailed Weasel (*Mustela frenata*) was caught on the wildlife camera raiding the box (Fig. 3). As no feathers were found in the box when it was later examined, it is possible that at least some of the chicks managed to escape, but also probable that at least the two youngest owlets were carried off. No photos were obtained of either the weasel or any owls coming out of the box because the reaction time of the wildlife camera is not fast enough to catch rapidly moving objects. This was not the first time a weasel had been caught entering a box. During the 2016 season a long-tailed weasel was caught on camera entering one of the owl boxes, but at the time the box was occupied by a Northern Flying Squirrel (*Glaucomys sabrinus*), which the weasel was seen carrying off. This is the only predator species caught on camera entering any of the owl boxes. Red Squirrels were frequently caught on camera near all of the boxes, but never near the box entrance while it was occupied by an owl, possibly because the female never leaves the box during the day and repeatedly snaps its bill when disturbed. By the time the female finally leaves the nest permanently about two weeks before the chicks fledge, the chicks are old enough to snap their bills when disturbed.

Figure 3. Long-tailed Weasel entering owl box.
Photo taken by motion-activated night vision camera.

As it was already late in the nesting season, based on previous experience, we were not expecting further nesting activity in 2018, but on 24 May we found two occupied boxes in the Great Balsam Mountains. One of these was in the same area where owls had abandoned nests in 2016 and 2017. In this box we found a female sitting on four eggs, but as in previous years, by 20 June it had been abandoned once again. The eggs were collected from this box in July. The other occupied Balsam Mountains box, also in one of the same areas used the previous two years, was found with four eggs. Three of the eggs hatched, and two chicks successfully fledged from this box. A night vision camera placed at this site again took numerous photos of the male bringing in prey.

The 2019 season was somewhat disappointing. After checking the boxes in March, April, and early May, we had almost given up hope until we finally found an occupied box on 22 May. This was one of the boxes installed at a new location along the Pisgah Ridge in November 2016. As the female in this box refused to budge whenever we checked with the "tree peeper" camera, we were unable to determine the number of eggs, or even the number of eggs that hatched. Not until 19 June were we able to see the contents of the box when the banding crew came to band the female. Even then she refused to get off the nest, and the assistant banders had to open the top and physically remove her. At that time the nest held two chicks that were between one and two weeks old. Both chicks fledged by early July. This box was also the only other one where we observed attempted predation caught on the motion-activated camera, this time by a large Black Bear (*Ursus americanus*). The bear could reach the box entrance with its nose, but was unable to pull it down (Figure 4).

Figure 4. Black bear inspecting occupied box

The 2020 season started well with two occupied boxes found on 15 April, both along the Pisgah Ridge. One occupied box was in an area where boxes have been occupied almost every year, and the other was the paired box of the one that was occupied the previous year. Unfortunately, we were unable to check boxes again until 15 May because of road closures as a result of the Covid-19 pandemic, but the day the road reopened we found another occupied box in the Balsam Mountains at another traditionally successful location. By then the first two boxes were well along. Three chicks fledged from one of them, but the other was raided by a predator about two weeks before probable fledge date, probably shortly after the female left the box. As there was no camera focused on this box, the identity of the predator raiding the nest is unknown. At the third box in the Balsam Mountains the female sat on six eggs, but once the eggs started hatching she would not leave the box under any circumstances, so we were unable to tell how many actually hatched, although we know that one egg definitely did not hatch and we could see at least two chicks under her. It was probably a week after the female left the box that we were able to check it again, and at that time there were two feathered chicks. These chicks fledged between 6 and 9 July.

Our goal in this study has not just been to obtain data on Saw-whet Owl nesting behavior, but to ensure that nesting owls are as successful as they might be if left undisturbed. Thus, to avoid potential nest abandonment, once we discovered an occupied box we did not return again for at least a week. We also never opened any boxes during the nesting period except when banding and measuring chicks and adults. We relied on the "tree peeper" camera, the night vision motion activated cameras, and observation from the ground for all data while owls were in the box. This often meant forfeiting obtaining exact data on egg numbers, and possibly even the exact numbers of chicks hatched. Information was missed in some cases because of the varying behavior of the female owl sitting on the nest. Females remain in the box constantly from the time the eggs are laid until all of the chicks in the box are sufficiently feathered to maintain body heat (Rasmussen et al. 2008). This typically occurs about two weeks after hatching. During the time there are eggs or young chicks in the nest, the male does all of the feeding of female and chicks. Females exhibited a wide variety of reactions to nest disturbance ranging from two birds that refused to leave the nest box under any circumstances, to those that would jump into the entrance when approached, but would back down into the box when the "tree peeper" camera was inserted, to those that would flee to a nearby tree at the mere sight of the "tree peeper" camera. Since some females would not leave the nest it was often difficult to see what they were covering, so the actual number of eggs or chicks was sometimes difficult to determine until she left the box permanently about two weeks after the last egg hatched (Figure 5). However, valuable data were obtained from use of the "tree peeper" cameras, night vision cameras, and from analyzing the remains left in the boxes after the chicks had fledged. Once females leave a nest they do not return to keep it clean, so pellets from the chicks remain in the box and can be analyzed for prey bones. Much of this data is still being analyzed. However, some initial findings are summarized in Table 1.

Table 1:

	2016	**2017**	**2018**	**2019**	**2020**
# boxes occupied	5	5	3	1	3
Approximate egg laying dates	Mid-March to late April	Early April to mid-May	Early April to late May	Mid-May	Mid-March to mid-May
Approximate # eggs per nest	3 - 5	3 - 4	4 - 5	?	3 - 6
Approximate hatch dates	Mid-April to late May	Early to mid-May*	Early May to mid-June	Early June	Mid-April to mid-June
Approximate # eggs hatched per nest	2 - 5	3 - 4	3 - 5	2?	At least 2
Approximate date female departs nest	Late April to mid-June	Mid to late May	Mid-May to early July	Mid to late June	Late June
Approximate fledge dates	Mid-May to late June	Early to mid-June	Late May to late July	Early July	Mid-May to 9 July
# chicks fledged per nest	2 - 4	1 - 3	2 - ?**	2	2
Total # of chicks fledged	12	6	2 - ?**	2	4
# nest failures	1	2	1	0	1

*later nests failed

**uncertain as some may have fledged from raided nest

Prey item analysis is incomplete, but thus far most common prey items found on camera and in box remains include:

- Deer Mouse *(Peromyscus maniculatus*)
- Southern Red-backed Vole (*Clethrionomys gapperi*)
- Woodland Jumping Mouse (*Napaeozapus insignis*)
- Northern Short-tailed Shrew *(Blarina brevicauda*)
- Smoky Shrew (*Sorex fumeus*)
- Masked Shrew (*Sorex cinereus*)

A small number of probable Dark-eyed Juncos (*Junco hyemalis*) were also found. Prey items are being identified by Alan Smith, retired, Biology Department, Mars Hill University.

Figure 5. Female covering either eggs or very young chicks. Leftover prey item in box. Photo taken with IBWO (new "tree peeper" type camera).

In the past three years John Gerwin from the N.C. State Museum of Natural Sciences and his assistants have also banded and/or measured five adult females and 15 chicks. Thus far none of the banded birds have been recaptured. As additional capturing and measuring occurs in coming years this data will also be made available.

This is a very preliminary summary of some of the information thus far obtained from this study. The analysis continues, and additional study of existing data and that from future years will provide critical information on the breeding activities of Saw-whet Owls in the Southern Appalachians. There are many unanswered questions including: causes of nest failure, potential nest predation, the relationship between prey items and prey abundance and the relationship between prey abundance and nest success, site fidelity, reasons for unhatched eggs or chick death and the fate of chicks when they die in the nest (are they removed by the parent or eaten by siblings), the effects of weather on nest success, what are the effects of climate change, and many others. For these reasons this study will hopefully continue for many more years. Also, to date, we are not aware

of any natural cavity nests having been found or reported in the Southern Appalachians, and this will continue to be another challenge.

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Literature Cited

Barb, M.A. 1995. Natural History of the Northern Saw-whet Owl (*Aegolius acadicus*) in Southern Appalachian Mountains. Unpublished Master's thesis, East Tennessee State University

LeGrand, Jr. H.E. Briefs for the File. Chat, 54: 68.

Mayfield, G. R, III and F.j. Alsop III, 1992. First Confirmed Tennessee Nest Record of the Northern Saw-whet Owl. Migrant. 63: 81-88.

Rasmussen, J.L., S.G. Sealy and R.J. Cannings. 2008. Northern Saw-whet Owl *(Aegolius acadicus) In* The Birds of North America (A. Poole, Ed.) Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North America: https://birdsoftheworld.org/

Simpson Jr, M.B. General Notes. Migrant, 86: 173

Simpson, Jr. M.B. The Saw-whet Owl: 1968. Breeding Distribution in North Carolina. Chat, 32:83-89.

Simpson Jr. M.B. 1971. The Saw-whet Owl population of North Carolina's Southern Great Balsam Mountains. Chat, 36: 39-47.

Simpson Jr. M.B. 1974a. Recent Observations of Saw-whet Owls in the Southern Great Balsam and Black Mountains of North Carolina. Chat. 38: 94

Simpson, M.B. Jr. and P. G. Range. 1974b. Evidence of the breeding of Saw-whet Owls in Western North Carolina. Wilson Bulletin, 86: 173-174.

Simpson, M.B. Jr. and R.C. Ruiz. 1975. Saw-whet Owl records from the Southern Great Balsam Mountains of North Carolina. Chat 40: 14.

Williams, A.C. 2003. A Natural History of the Northern Saw-whet Owl's (*Aegolius acadicus*) Breeding Biology and Juvenile Dispersal in the Southern Appalachian Mountains. Unpublished Master's thesis, Appalachian State University.