Hermit Thrush (*Catharus guttatus*) Nesting in the Blue Ridge Mountains of North Carolina

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The Hermit Thrush (*Catharus guttatus*) nests in coniferous and deciduous forests across Canada and the northern and western United States. In eastern North America, the defined breeding-season range extended southward in the Appalachian Mountain system to Mt. Rogers, Virginia, until 1979, when observers began documenting the gradual expansion of the species' summer range into the Blue Ridge Province of western North Carolina and eastern Tennessee (Jones and Donovan 1996; Potter and LeGrand 1980; Scott 1966; Westphal et al 2008). Despite the occurrence of Hermit Thrushes in high-elevation forests of this region, published breeding evidence south of Mt. Rogers has been limited to records of fledglings and juveniles. Our observations of an active nest in Yancey County, NC, provide additional documentation of the species' breeding ecology in the southern Blue Ridge Mountains.

Range expansion in the southern Blue Ridge Province of the Appalachians: historical summary and current status

Within the Blue Ridge Province (Fenneman 1938), Hermit Thrushes are now well documented as summer residents in western boundary ranges along the North Carolina/Tennessee state line, including the Roan massif, Unaka Mountain, and the Great Smoky Mountains, with isolated reports from the Unicoi Mountains and Pond Mountain. On the eastern front range, the species occurs at Grandfather Mountain and on the Blue Ridge crest for short distances south and east from the vicinity of Black Mountain Gap. Interior transverse ranges with documented populations include the Black Mountains, Great Craggy Mountains, Pisgah Ridge, Shining Rock Ledge, Southern Great Balsam Mountains, Plott Balsam Mountains, and Northern Great Balsam Mountains. During summer months, the birds have been reported from elevations generally above 1460 m (4800 ft) up to the highest summits, including Mt. Mitchell and Clingman's Dome. The majority of breeding season records are from disturbed forests of red spruce (*Picea rubens*), Fraser fir (*Abies fraseri*), and northern hardwoods.

The southernmost location in the Appalachians where the species has been consistently reported for three or more breeding seasons is along the Blue Ridge Parkway near mile 423.5, at the headwaters of the West Fork Pigeon River near Tanasee Bald (35.29617N, 82.91667W) (Westphal et al, 2008). This area, including the terrain between Silvermine Bald and Buckeye Gap, constitutes the southernmost locale in the east where the red spruce-Fraser fir community occurs (Simpson 1992). Details are from Browning

(2003); Davis (1998, 2004a, 2004b, 2005); Knight (2010); Lee et al (1985); LeGrand (1993); Southern (2009); and Westphal et al (2008). Unpublished records are from Christine Kelly (pers. comm.), Andrew Laughlin (pers. comm.), Nora Murdock (pers. comm.), William Sullivan (pers. comm.), M. B. Simpson, and M. J. Westphal (observations 2002–2011). Prior to the current report, the southernmost site where nests have been documented in the Blue Ridge province is at Mt. Rogers, VA, where 6 nests were discovered between 1979 and 2007 (Rottenborn and Brinkley 2007; Phil Shelton pers. comm.).

Previous breeding evidence in North Carolina and Tennessee

Evidence that Hermit Thrushes breed in the Blue Ridge province of NC and TN is based on reports of recently fledged juveniles just east of Roan Mountain at Carver's Gap (1680 m/5512 ft), at nearby Round Bald (ca 1700 m / 5600 ft), and at Walker Knob in the Great Craggy Mountains (1658 m / 5440 ft). The first report came when Knight banded a juvenile at Carver's Gap on 12 September 1997 (Davis 1998; Knight 1997, 2010). Between 2002 and 2007 Knight subsequently netted and banded a total of 20 juveniles at Carver's Gap, with dates between 19 August and 29 September (Davis 1998, 2004a, 2005; Knight 2010). Browning (2003) provided an account of fledglings at Walker Knob, just south of Balsam Gap in the Great Craggy Mountains on 21 June 2001. At a tree-fall gap in a spruce-fir-birch forest, Browning encountered an adult carrying food to three speckled fledglings with short tails. More recently, fledged young were seen on Round Bald, just north of Carver's Gap, by Trently on 1 July 2002 and by Laughlin on 15 June 2009, when two adults were feeding a recently fledged juvenile (Knight 2010; Laughlin pers. comm.).

Nest site at Bald Knob Ridge

On 18 July 2011, we discovered an active Hermit Thrush nest on the east slope of Bald Knob, near Black Mountain Gap in Yancey County, NC. Hermit Thrushes have been present at least since 2004 during the nesting season in this area and at nearby Cherry Log Ridge, Glass Rock Knob, Pinnacle, and Rocky Knob. This is currently the only section of the southern Blue Ridge front range, other than Grandfather Mountain, where this species has been reported in summer months.

The nest was located in the margin of a small forest gap at an elevation of 1564 m (5132 ft) along the crest line of Bald Knob Ridge, which runs east from the summit of Bald Knob and divides the headwaters of the South Toe River into left and right branches. The natural forest community along this upper portion of the ridge consists largely of red spruce, Fraser fir, and northern hardwoods. The vegetation in the area surrounding the nest site gap includes stands of mature spruce-fir and hardwood forest intermixed with areas of canopy disturbance that vary in extent and age. These include small to large gaps, recent tree-falls, extensive windthrows, and an irregular

mosaic of various stages of reforestation, with canopy and subcanopy seedlings and saplings, shrubs, grasses, sedges, ferns, and mosses. The long axis orientation of these gaps tends to be east-west, following the ridge line.

Subcanopy and reforestation species include seedlings and saplings, mainly of young red spruce, but also scattered yellow birch (*Betula alleghaniensis*), mountain ash (*Sorbus americana*), mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), red maple (*Acer rubrum*), mountain holly (*Ilex montana*), black cherry (*Prunus serotina*) and Fraser fir. Fire cherry (*Prunus pensylvanica*) is notable here mostly in a larger, older, more extensively disrupted area approximately 30 m southeast of the nesting site. Allegheny blackberry (*Rubus allegheniensis*) is common in all the disturbed areas.

The ridge top at the nest site is about 40 to 60 m wide, fairly level and smooth, with little slope for about 25 m in both directions from the crest line. The gap is open overhead for an area approximately 5 m by 20 m, while the ground area involved in the gap is 10 by 25 m. The transition from the gap into the adjacent, mature spruce-fir forest is sharply demarcated on one side but irregular and uneven on the more disturbed opposite margin. The spruce-fir forest floor is largely open, with a spongy layer of spruce needles, small twigs, spruce cones, scattered seedlings, infrequent canopy saplings (e.g. Fraser fir, red spruce, yellow birch) and only a few shrub or herbaceous species. Other canopy species nearby include black cherry, yellow birch, and American beech (*Fagus grandifolia*). The largest red spruce in the contiguous forest have crown tops above 18 to 20 m and mean dbh values of 46 cm. The canopy coverage in the mature portions of the adjacent spruce-fir-hardwood forest is 90 to 95%.

Climate data are not available from the nest site. The closest station is 4.2 km (2.6 mi) due north on Mt. Mitchell, at 1902 m (6240 ft) elevation, where the normal monthly July mean temperature is 15.8º C (60.4º F). Using the approximation that each 1000 m elevation change is associated with a 6.5º C temperature change, an estimated value for the nest site would be 18.0º C (64.4º F). Mean annual precipitation at Mt. Mitchell is 189 cm (74.5 in), but given its elevation difference and prevailing wind direction, precipitation at the Bald Knob Ridge site is probably lower. Climate data for Hermit Thrush nesting areas reported in New York include mean July temperatures < 21º C (70º F) and annual precipitation > 89 cm (35 in). (Andrle and Carroll 1988). Mt. Mitchell data are from the State Climate Office of North Carolina (1971–2000).

Nesting details

On 18 July 2011 we flushed an adult Hermit Thrush from an area of dense fern cover less than a half meter from the edge of Bald Knob Ridge Trail, as we hiked past the spot. Careful examination revealed a nest containing two turquoise-colored eggs (Fig. 1). When we returned on 20 July the nest contained two very recently hatched chicks. On 21 July we established an observation site 20 m from the nest. We visited the site every

Figure 1. Hermit Thrush nest with two eggs, 18 July 2011. Photo M.B. Simpson, Jr.

morning, except one, for the next 8 days and recorded all activities in the area for at least 2 to 5 hours daily. Total time on location was 21 hours 45 minutes. Photos of the nest were taken on two subsequent days, the last on 29 July (Fig. 2).

Two males were heard singing during the monitoring period, one within 50 m on all sides of the site, and another farther away to the north. The singing of one often induced the other to sing as well. The *chupp chupp* call

Figure 2. Hermit Thrush nest with two chicks, 29 July 2011. The second chick is hidden beneath the larger chick and by the shape of the nest. Photo by Todd Arcos.

notes were frequently heard within the singing area and near the nest, but the most common call heard was the slurred-up *vreeh* that resembles the call note of the Eastern Towhee (*Pipilo erythrophthalmus*). The only other call was heard as we arrived at the site on the last day of observation, when a strange "wee"-like cry was heard repeatedly. The call became softer and ceased entirely after about 5 minutes.

The behavior of Hermit Thrushes at the nest was characteristically elusive. The adults were more cautious approaching the nest than when leaving, as departures were observed 68 times, approximately twice as often as arrivals. Departure was usually by flying up and out of the ferns for about a meter then moving laterally away. About a quarter of departures involved flying up to a nearby branch and pausing a few seconds before flying off. Although the nest and ground near the nest were shielded from our direct view by the fern layer, it was sometimes possible to detect the adults due to movement of the ferns, presumably from the birds jumping up into the nest from the ground below. On a few occasions adults were seen carrying caterpillars or small winged insects to the nest. Adults were observed flying directly into the nest only 14 times and hopping into the nest from the ground 15 times. The approaching adult occasionally flew down into the ferns 2 to 7 m from the nest a few seconds or a minute before the bird was seen hopping into the nest or fern movement at the nest site was observed.

Species noted in the vicinity of the nest every day of surveillance include Ruby-throated Hummingbird (*Archilochus colubris*), Downy Woodpecker (*Picoides pubescens*), Blue-headed Vireo (*Vireo solitarius*), Red-breasted

Nuthatch (*Sitta canadensis*), Winter Wren (*Troglodytes hyemalis*), Brown Creeper (*Certhia familiaris*), Golden-crowned Kinglet (*Regulus satrapa*), Cedar Waxwing (*Bombycilla cedorum*), Dark-eyed Junco (*Junco hyemalis*), and Red Crossbill (*Loxia curvirostra*). These species are mostly associated with mid-level and tree canopy, and only Winter Wren, Dark-eyed Junco, Black-throated Blue Warbler (*Setophaga caerulescens*), and a juvenile Hermit Thrush were observed within 3 to 5 m of the nest. Curiously, no Veeries (*Catharus fuscescens*) were heard or seen during our surveillance, although earlier in the season individuals were frequently noted here and were thought to be nesting. A juvenile Hermit Thrush (spotted back and complete tail) was driven away by one of the adults on 22 July, which suggests a previous nesting. The late date and small clutch size (two eggs) also suggest that this may have been a second or even third nesting.

The nest was examined on 30 July, after we noted that the adults were not present in the area during the two-hour period following our arrival. The nest was noted to be empty and damaged, with a 2 cm hole in the bottom and considerable flattening of one side. No trace of the chicks could be found.

Nest failure was probably due to predation, a very common outcome for this species (Jones and Donovan 1996). Candidate species would include bobcat (*Lynx rufus*), coyote (*Canis latrans*), red squirrel (*Tamiasciurus hudsonicus*), Northern Saw-whet Owl (*Aegolius acadicus*), Sharp-shinned Hawk (*Accipiter stratus*), or snakes such as timber rattler (*Crotalus horridus*) (Jones and Donovan 1996; Martin and Li 1992; Martin and Roper 1988; Sealy 1999). Northern Saw-whet Owls and Red Squirrels are regular in this area on Bald Knob Ridge (Simpson and Westphal, unpublished records).

Nest description

The nest was embedded and well-concealed within a dense layer of hayscented fern (*Dennstaedtia punctilobula*), barely 30 cm from the edge of a narrow, lightly used hiking trail. The fern cover encompasses an irregular area of approximately 10 m by 20 m. Mostly along its margins and elsewhere in the gap floor are woodfern (*Dryopteris campyloptera*), southern lady fern (*Athyrium asplenoides*), blackberry, white snakeroot (*Agerotina altissima*), joe-pye weed (*Eutrochium* sp.), and scattered patches of moss.

The nest was positioned in the ferns beneath denuded branches of the upper crown of a downed spruce, the trunk of which is 60 to 135 cm above the ground at the nest site. The nest lip was 15 to 17 cm above the ground and slightly tilted due to the nest being anchored and partially embedded on a 1.5 cm diameter branch from the crown of the downed conifer. Live fronds of hayscented fern were incorporated into the nest structure and provided some balance and lateral stability. The nest was constructed mostly of short spruce twigs and contained some coarse grasses, sedge, and bark fragments, lined with fine grasses, mosses and small pieces of hayscented fern. The remains of the nest are now in the North Carolina State Museum of Natural Sciences in Raleigh.

Discussion

The habitat at our nest and at Browning's (2003) fledgling site is consistent with that described for Hermit Thrush in other portions of its range (Dilger 1956; Jones and Donovan 1996). Preferred nesting locales include interior forest edges, particularly small clearings within wooded areas, created by disturbances such as individual tree death, logging, wind, and fire. The species also uses undisturbed sites, mostly those near interior forest edges, such as bogs and glades. In the east, the Hermit Thrush generally nests on the ground in natural depressions of knolls or hummocks, under small conifers that provide protective canopy, or in open woodland spaces with bunchberry or ferns. In a large series, 36% of nests were placed under a live non-woody plant, such as ferns, grasses, forbs, mosses or sedges, while 53% were under a live tree, shrub or sapling. Nests in the east ranged from ground level to 0.3 m, while those in western parts of the range are generally higher off the ground, placed in small tree branches, with some saddled on a branch or in fork or crotch of a branch (Jones and Donovan, 1996).

Disturbed interior forest edges and gaps are common in high elevation plant communities where Hermit Thrushes have become established in the southern Blue Ridge. From the 1880s through the 1930s, extensive logging and wildfires destroyed an estimated 90% of the spruce forests in the southern Appalachians (Korstian 1937). This period of largely wholesale removal was followed by an interval of relative stability, until the arrival in the mid-1950s of the balsam woolly adelgid (*Adelges piceae*), which attacks and destroys *Abies* species, including Fraser fir. Introduced into the United States in the early 1900s, the adelgid was initially discovered in the southern Blue Ridge at Mt. Mitchell in 1957 and subsequently at Roan Mountain by 1962, Great Smoky Mountains by 1970, and Richland Balsam by 1972. Heavily infested Fraser firs usually die within 2 to 7 years, resulting in catastrophic mortality of canopy, although abundant regeneration may occur in some areas (Eager 1984; Smith and Nicholas 2000).

The now widespread die-off of adult Fraser fir has created extensive blowdowns and canopy loss in the highest elevations, particularly above 1830 m (6000 ft), where fir typically occurs as the sole conifer. At lower elevations, red spruce becomes progressively the more common and dominant species, so that forest gaps of varying sizes are caused by the death of fir in these sites. With the loss of fir, the remaining red spruce become exposed to greater wind damage, resulting in blowdowns and further disruption and loss of canopy. Additional factors, including airborne pollutants and climate changes, are contributing to a decline in red spruce. The typically thin soil in spruce-fir forests increases the vulnerability of canopy trees to damage from ice storms, local windstorms, and hurricane remnants. The result is a complex mosaic of regenerating forest tracts, disturbed interior clearings, forest gaps, and irregular edges through most of the areas formerly occupied by mature spruce and fir forests. These adelgid-related changes in the spruce-fir-hardwood communities are substantially

different from those subsequent to earlier wholesale removal by logging and by wildfire (Busing and Pauley 1994; Eager 1984; Pyle and Schafale 1988).

If internal forest gaps contribute to the spread of Hermit Thrush in the southern Blue Ridge, then reforestation dynamics are important in that process. An obviously critical component of reforestation is the successful establishment of seedlings and saplings of successional and canopy species. Hayscented fern is a common herbaceous species that has been shown elsewhere to interfere with forest regeneration in gaps and forest edges by inhibiting woody seedlings of certain species, thereby tending to perpetuate these gaps. In turn, processes that maintain an open, disturbed canopy enhance perpetuation of hayscented fern, which thrives on direct sunlight and often spreads widely as a nearly continuous dense layer (George and Bazzaz 1999; Hill and Silander 2001; Horsley 1993). The extent to which these phenomena are relevant in disturbed southern Appalachian spruce-fir forests remains undefined, and to date studies have not examined the effects of *Dennstaedtia* on Fraser fir or red spruce reproduction (James Runkle pers. comm.; Alejandro Royo pers. comm.; Royo and Carson 2006; Sarah Schliemann pers. comm.; Stephen B. Horsley pers. comm.; Peter S. White pers. comm.). The potential role of delayed or arrested reforestation in spruce-fir forests requires additional study, particularly in light of the complex structure, vegetation, and dynamics of forest gaps. Important reviews of gap ecology and research issues have been recently published by Royo and Carson (2006) and by Schilemann and Bockheim (2011).

In the case of ground nesters, such as Hermit Thrush, hayscented fern may provide excellent cover for the nest. The present report and Browning's (2003) discovery of three fledglings involved large areas of hayscented fern within tree-fall gaps. In northwest Pennsylvania, long-term studies in managed northern hardwood forests demonstrated that experimental removal of hayscented fern was associated with a reduction in the number of nesting Hermit Thrushes (Stoleson et al 2011). Stoleson (pers. comm.) reports that five of the eight Hermit Thrush nests discovered during their research were located within hayscented fern.

Conclusions

Evidence has accumulated over the past 15 years that Hermit Thrushes breed in high-elevation forests of the southern Blue Ridge Mountains of North Carolina and Tennessee. The nest monitored at Bald Knob Ridge, Yancey Country, NC, from 18 through 30 July 2011 provides further documentation of breeding in this region. Tree-fall gaps and other disturbed forest interior sites in spruce-fir and northern hardwood communities may be important by creating conditions favorable to the nesting requirements of this species in the southern Blue Ridge. In some situations, hayscented fern may contribute to Hermit Thrush reproductive success by providing dense protective cover for nests. Aggressive herbaceous and understory species may also support nesting of Hermit Thrushes by slowing restoration of the mature forest in gaps and other disturbed areas favored by the thrush.

Because nests have not heretofore been reported in the NC/TN Blue Ridge, insufficient data are available for assessing the extent to which the spread of Hermit Thrush is related to internal gaps and disturbed edge. Further research is needed to define factors that contribute to the establishment of the Hermit Thrush as a breeding bird in the region.

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