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Incidence of Nest Material Kleptoparasitism Involving Cerulean Warblers

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ABSTRACT.—We document 21 observations of interspecific stealing of nesting material involving Cerulean Warblers (*Dendroica cerulea*), Red-eyed Vireos (*Vireo olivaceus*), Blue-gray Gnatcatchers (*Polioptila caerulea*), Northern Parulas (*Parula americana*), Black-throated Green Warblers (*D. virens*), American Redstarts (*Setophaga ruticilla*), and Orchard Orioles (*Icterus spurius*) that occurred during studies of Cerulean Warbler breeding biology. These incidents involved a variety of combinations of nest owner and nest material thief suggesting that each of these species is both a perpetrator and recipient of this behavior in our study areas. Kleptoparasitic incidents occurred at all stages of the nesting cycle from nest-building through post-fledging. Two possible motivations for this behavior are related to saving time in finding nest materials and collecting this material for nest construction. *Received 21 November 2005. Accepted 3 September 2006.*

The Cerulean Warbler (*Dendroica cerulea*) is a canopy-nesting bird of eastern deciduous forests. Nests of this species are composed mainly of bark fiber, fine grass stems, weed stalks, hairs, spider webs, grapevine bark, lichen, and moss (e.g., Bent 1953, Ehrlich et al. 1988, Oliarnyk and Robertson 1996, Hamel 2000). Nests are typically on horizontal branches and are concealed from above by nest-tree and/or vine foliage (Bent 1953, Hamel 2000, Roth 2004). Few published studies have documented interspecific nest kleptoparasitism involving Cerulean Warblers. Hamel (2000) noted in the Mississippi Alluvial Valley that Cerulean Warblers and American Redstarts (*Setophaga ruticilla*), and Cerulean Warblers and Blue-gray Gnatcatchers (*Polioptila caerulea*) interacted aggressively over nesting materials. Cerulean Warblers have also been observed gathering nesting materials from vireo nests (species unspecified) in New Jersey (Dater 1951).

Cerulean Warbler breeding biology studies have focused on nest observation beginning in 1992 in Tennessee and Arkansas, and in 2002 in southern Indiana. This paper documents 21 interspecific contests for nesting material involving Cerulean Warblers that were observed during stages of the nesting cycle (Table 1). We present three detailed accounts of nest material kleptoparasitism involving Cerulean Warblers as both victim and perpetrator. Owner defense usually started at the point at which the owner discovered the robber at its nest.

OBSERVATIONS

The following two accounts document nest material kleptoparasitism with the Cerulean Warbler as victim. The first incident occurred on 19 May 2003 between 1230 and 1300 hrs CST when a Red-eyed Vireo (*Vireo olivaceus*) was observed taking material from a Cerulean Warbler nest in a grove of black walnut (*Juglans nigra*) at Big Oaks National Wildlife Refuge (39° 03′ N, 85° 25′ W) near Madison, Indiana. The vireo landed on the nest branch within a meter of the nest, then flew to the nest and removed a piece of the outer cup when the Cerulean Warbler was not present. The nest material was sufficiently large to be seen in the vireo's beak as it flew to a more densely wooded area. No bird visited the nest for a period of several minutes until a vireo again landed on the nest branch. The vireo hopped toward the nest when the male Cerulean Warbler chased it into the heavily wooded area. The female Cerulean Warbler then flew to the nest and sat in it. The female Cerulean Warbler was first observed building the nest on 8 May and incubating on 17 May. She was last observed incubating on 29 May and the nest had failed on 31 May. The walnut

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TABLE 1. Nest material kleptoparasitism involving Cerulean Warblers recorded during Cerulean Warbler breeding biology studies in Tennessee, Arkansas, New York, and Indiana.

Study area	Date	Nest owner	Stage	Kleptoparasite
Meeman Shelby Forest, TN	9 May 93	Cerulean Warbler	Building	American Redstart
Meeman Shelby Forest, TN	15 May 93	Cerulean Warbler	Building	American Redstart
Meeman Shelby Forest, TN	16 May 93	Cerulean Warbler	Abandoned	American Redstart
Meeman Shelby Forest, TN	23 May 97	Cerulean Warbler	Building	American Redstart
Meeman Shelby Forest, TN	24 May 97	Cerulean Warbler	Building	American Redstart
Chickasaw NWR, TN	7 Jun 93	Cerulean Warbler	Building	Blue-gray Gnatcatcher
Chickasaw NWR, TN	22 May 94	Cerulean Warbler	Incubation	Blue-gray Gnatcatcher
Chickasaw NWR, TN	23 May 94	Cerulean Warbler	Immediately after depredation	Blue-gray Gnatcatcher
Chickasaw NWR, TN	5 Jun 94	Cerulean Warbler	Abandoned	Blue-gray Gnatcatcher
Desha, AR	11 May 93	Cerulean Warbler	Abandoned	Blue-gray Gnatcatcher
Desha, AR	13 May 93	Cerulean Warbler	Dismantling and Cerulean Warbler reconstructing	Blue-gray Gnatcatcher
Desha, AR	28 May 93	Cerulean Warbler	Dismantling and Cerulean Warbler reconstructing	Blue-gray Gnatcatcher
Meeman Shelby Forest, TN	10 Jun 93	Cerulean Warbler	Incubation	Blue-gray Gnatcatcher
Yellowwood State Forest, IN	29 May 05	Cerulean Warbler	Building	Black-throated Green Warbler
Meeman Shelby Forest, TN	11 May 94	Cerulean Warbler	Building	Northern Parula
Desha, AR	14 May 93	Cerulean Warbler	Incubation	Orchard Oriole
Desha, AR	27 Jul 93	Cerulean Warbler	Unknown	Orchard Oriole
Big Oaks NWR, IN	19 May 03	Cerulean Warbler	Incubation	Red-eyed Vireo
Ulster County, NY (Smith 2001)	26 May 99	Red-eyed Vireo	Abandoned	Cerulean Warbler
Hoosier National Forest, IN	6 May 05	Red-eyed Vireo	Building	Cerulean Warbler
Meeman Shelby Forest, TN	11 May 93	Blue-gray Gnatcatcher	Immediately after depredation	Cerulean Warbler

grove had an open canopy, permitting detailed observations of the birds' behavior.

The second incident occurred on 29 May 2005 between 1030 and 1130 hrs when a female Black-throated Green Warbler (*Dendroica virens*) was observed taking material from a Cerulean Warbler nest in Yellowwood State Forest (39° 12′ N, 86° 21′ W) near Bloomington, Indiana. It landed on the nest branch within 1 m of the nest, approached it in a quick hopping manner, and stole nest material. The female Black-throated Green Warbler repeated this behavior three times and each time she was chased from the nest by the female Cerulean Warbler. In one of the three incidents, a male Cerulean Warbler was observed chasing with the female Cerulean Warbler. Eventually, both male and female Cerulean Warblers exhibited aggressive behavior (making repeated harsh call notes and chasing) to-

ward the female Black-throated Green Warbler any time she perched within 15 m of the nest. The male Black-throated Green Warbler was not observed participating in chasing or nest robbing. The Cerulean Warbler nest was in a red elm (*Ulmus rubra*) near a planting of shortleaf (*Pinus echinata*) and eastern white pine (*P. strobus*). This may have increased the chances of proximity to a Black-throated Green Warbler territory, as that species is often associated with coniferous forests (Morse 1993).

The following account describes nest material kleptoparasitism with Cerulean Warbler as the perpetrator. On 6 May 2005 between 1430 and 1500 hrs a female Cerulean Warbler was observed taking material from a Red-eyed Vireo nest in the Pleasant Run Unit of the Hoosier National Forest (39° 01′ N, 86° 20′ W) near Bloomington, Indiana. The Cerulean Warbler made three separate trips from its own nest to the vireo nest approximately 30 m to the east, each time successfully acquiring material. On the first trip, the vireo presumably did not detect the Cerulean Warbler, as no interaction occurred; however, the vireo gave chase on the warbler's second and third trips. The stolen material was sufficiently large to be seen in the Cerulean Warbler's beak, and was incorporated into its nest. Both the Cerulean Warbler and the Red-eyed Vireo nests appeared to be mostly completed at the time of the raid. Construction of the Cerulean Warbler nest was first observed on 4 May 2005 at 1230 hrs; on 26 May 2005 the nest was confirmed to have failed.

DISCUSSION

The studies in which these observations occurred were specifically focused on Cerulean Warbler nests and it is not surprising that most incidents (18 of 21 observations, Table 1) involved Cerulean Warblers as victims rather than perpetrators. Most observations of female Cerulean Warblers returning to their nests with nesting material did not include observing them collect the material. Therefore, Cerulean Warblers may be robbing other nests more often than we are aware.

Red-eyed Vireos and Black-throated Green Warblers are not unlikely participants for nest material thievery interactions with Cerulean Warblers. Red-eyed Vireos are one of the most abundant bird species in our study areas (KCJ and KLR, pers. obs.), and both Red-eyed Vireos and Black-throated Green Warblers forage at the same heights where Cerulean Warbler nests occur (Morse 1993, Cimprich et al. 2000). Additionally, and perhaps most importantly, Cerulean Warblers, Red-eyed Vireos, and Black-throated Green Warblers may have similar requirements for nest composition and compete for materials. Red-eyed Vireos have been documented to use all of the same materials as Cerulean Warblers, with the exception of moss, in their nests (Harrison 1975, Ehrlich et al. 1988, Cimprich et al. 2000). Black-throated Green Warblers have been documented to use all materials except grapevine bark and lichen (Ehrlich et al. 1988, Morse 1993).

Prolonged completion of nest building may indicate that nest robbing has taken place, as was likely the case in the second nest robbing account. In this case, the Cerulean Warbler nest was probably not the pair's first attempt of the season based on the late date of nest construction. They began building their second nest on 25 May 2005, four days before nest robbing was observed. Immediately prior to observing nest material kleptoparasitism, the female Cerulean Warbler was seen bringing nesting material to her nest. As replacement nests are typically constructed more quickly than first nests, a 5-day spread of nest building was unexpected (KCJ and KLR, pers. obs.). Despite the interference, the nest successfully fledged at least two offspring.

Why would individuals risk physical conflict with neighboring birds to steal nesting material? It is possible that (1) some materials may take a great amount of time to locate, and (2) some materials may not be difficult to locate, but may be difficult to remove and collect in quantity in an appropriate size or shape to be incorporated into a nest (Yezerinac 1993).

Nest material may be in limited supply, as a result of the large demand for it by a variety of users, or the phenology of the source is limited in time. Nest construction is a time-consuming process, as it requires the adult bird to locate materials, to gather the materials into the nest site, and to form the actual nest. Nest construction appears to be a costly process in terms of energy expenditure. This pro-

cess involves a multitude of flights to gather material. Bent (1953) indicated a single female American Redstart might make 700 trips in the construction of a single nest. The female pulls material from sources, such as dried cambium of broken tree branches and grapevines, even from inner portions of stems of herbaceous materials. The female must identity the most useful adhesive materials for attaching nests to supports and for holding surfaces together. "Spider webs" or silk from cocoons of emerged moths are often listed as the adhesive material. A variety of types of spider silk exist; variation among species may indicate that some may be more useful than others and the possibility of discriminate selection by avian users (Gosline et al. 1999, Žurovec and Sehnal 2002). Early nesting behavior may in part be favored by the ability to find the most effective nest materials. Competition for materials that are limited in time may occur between users of the favored material, irrespective of cost considerations.

Benefits of stealing nest materials are substantial reductions in (1) distance the female must travel from her nest, (2) time spent away from her nest, and/or (3) amount of effort spent while away from the nest. Birds may be more likely to resort to time-saving nest kleptoparasitism because the benefits outweigh the risks. The Red-eyed Vireo and the Black-throated Green Warbler may have robbed Cerulean Warbler nests because of the pressure of time during what was probably (based on the time of season) their second nesting attempt.

Another potential benefit of engaging in nest kleptoparasitism is decreased predation risk. Nest building birds may experience increased predation risk when gathering so much material in such a short period of time, often from relatively few locations which are repeatedly visited. Canopy-nesting species must often resort to gathering nesting material near or on the ground. These sites are not typical for the species; the birds may have less experience with the potential escape routes from predators available in such situations. The large number of sorties to and from a nest site increases the likelihood that a nest parasite may observe the location, follow the progress of the construction, and time their parasitic laying event. It is equally possible that other species, including but not limited to birds, mammals, snakes, and parasitic insects, may also observe locations frequented by nest building birds. Banks and Martin (2001) noted that when visitations by nest owner decreased in frequency, rates of Brown-headed Cowbird (*Molothrus ater*) nest parasitism increased. Therefore, less time spent foraging for nesting materials would allow the female more time for activities such as egg-laying and nest guarding.

All of these factors, acting individually or in concert, indicate that time of nest construction is a critical part of the life cycle of a bird, when the most important reproductive activities, including mate selection and egg production, occur. Study of the process is difficult, particularly for small species that nest in tree canopies in forest habitats. It is difficult to observe canopy-nesting species gathering nesting materials. Consequently, few data exist on predation risks associated with gathering nest material and the propensity to avoid certain locations as sites for gathering material.

It is not clear exactly how advantageous or disadvantageous kleptoparasitism of nest material is to individuals which participate in it. The perpetrators in all three detailed accounts presented, consistently returned to the victimized nests, despite the threat of being chased, indicating the rewards of kleptoparasitism outweighed the risks. One of the two Cerulean Warbler nests that was raided was successful. This indicates that victimization did not necessitate failure. The Cerulean Warbler pair that stole from the vireo nest was unsuccessful in raising young despite any benefits obtained from nest robbing. Further studies on nest robbing behavior, as related to the phenology, availability, and selection of nest materials will contribute to our understanding of when a nest-building female engages in nest material kleptoparasitism.

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Home Range and Dispersal of Juvenile Florida Burrowing Owls

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ABSTRACT.—We present the first use of necklace radio transmitters to document the home range and dispersal of juvenile Burrowing Owls (*Athene cunicularia floridana*) during the breeding and post-breeding period in rural Florida. Juvenile Burrowing Owls (n = 4) were detected close to main and satellite burrows during 65 day-time relocations. Home range estimates (95% kernel) for juvenile owls varied from 98 to 177 m^2. Juvenile Burrowing Owls were not detected near main and satellite burrows during three evening relocations. Dispersal of juvenile owls coincided with flooding of burrows during the rainy season. Juvenile owls upon fledging used an extensive patch of saw palmetto (*Serenoa repens*) before dispersing beyond the range of ground telemetry capabilities. Aerial telemetry assisted in locating one juvenile Burrowing Owl using scrub oak (*Quercus* spp.) habitat approximately 10.1 km southeast of its main and satellite burrows. *Received 16 February 2006. Accepted 7 October 2006.*

Early observations of Florida Burrowing Owls (*Athene cunicularia floridana*) describe their propensity to excavate burrows in short grass habitat (Hoxie 1889, Rhoads 1892, Scott 1892, Palmer 1896). Typically, a breeding pair of owls excavate one breeding burrow and one or more satellite burrows (Scott 1892, Neill 1954, Wesemann 1986, Mealey 1997). Burrows, which can be 1–3 m in length, contain an enlarged nest chamber at their terminus (Rhoads 1892, Scott 1892, Nicholson 1954, Sprunt 1954). Male and female Florida Burrowing Owls can breed at 1 year of age (Haug

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