[Journal of the Arkansas Academy of Science](https://scholarworks.uark.edu/jaas)

Volume 46 | Article 23

1992

Sequential Occupation by Red-cockaded Woodpeckers and Red-bellied Woodpeckers in the Ouachita National Forest

Joseph C. Neal
Arkansas Cooperative Fish and Wildlife Research Unit

Warren G. Montague
US Forest Service

Douglas A. James
University of Arkansas, Fayetteville

SEQUENTIAL OCCUPATION OF CAVITIES BY RED-COCKADED WOODPECKERS AND RED-BELLIED WOODPECKERS IN THE OUACHITA NATIONAL FOREST

For competition to exist, there should be scarcity of a resource required by more than one species. The use of this resource by one species should adversely affect the other species (Pianka, 1983). Red-cockaded Woodpeckers (*Picoides borealis*) are virtually unique in excavating cavities in mature living pines used for nesting and roosting (Jackson, 1971). This habitat of old pines maintained as open stands by periodic fire is essential for *P. borealis* in the southeast (USFWS, 1985; Jackson, 1988). This habitat and the cavities of *P. borealis* also are attractive to other cavity nesting species (Jackson, 1978a; Everhart, 1986), including Red-bellied Woodpeckers (*Melanerpes carolinus*), which occur sympatrically with *P. borealis* in Arkansas (James and Neal, 1986). At a time when most of the original widespread habitat of old-growth pine in open, fire-maintained stands has disappeared (Lennartz *et al.*, 1983), the potential for cavity competition between cavity using species has increased. The purpose of this study was to evaluate the impact of this potential competition and to test a method of protecting cavities of *P. borealis*.

We monitored 15 clusters of cavity trees of endangered *P. borealis* in the Ouachita National Forest in Scott and Polk counties of west-central Arkansas from February 1990 to March 1992 (Neal and Montague, 1991). These cavity trees are shortleaf pines (*Pinus echinata*) that occur in maturing stands of second-growth pine or mixed pine-hardwood.

Our monitoring included: 1) observing birds as they entered or departed from roost cavities in mornings and evenings, 2) climbing cavity trees and inspecting cavity interiors with a light and mirror, and 3) recording use of these cavities by species other than *P. borealis*. Active use by *P. borealis* was determined by noting cavity tree characteristics, including redness of bark around the plate at the cavity entrance and whether or not resin wells were being actively worked by *P. borealis* (Jackson, 1977; 1978b). Our monitoring was most intensive during the breeding season of *P. borealis* (late April-early July), but included all seasons of the year. All *P. borealis* in the forest were marked with unique combinations of color bands so that individual birds could be recognized in the field.

When we discovered that an active *P. borealis* cavity had been usurped by another species, we took steps to exclude that species. In most cases we installed a cavity entrance restrictor (Carter *et al.*, 1989), which usually leads to exclusion of species, like *M. carolinus*, that are larger than *P. borealis*. In one case, we physically removed the usurper from the area. We also removed any foreign materials inside the cavity, such as nesting material. These activities were followed up with additional monitoring of the cavities in order to assess the affects of our activities, especially reactions of *P. borealis* to exclusion of the cavity usurper.

Our monitoring and subsequent field work revealed that Red-bellied Woodpeckers occupied 8 of approximately 40 active or recently active cavities of Red-cockaded Woodpeckers (Table 1). In 6 cases, our installation of a cavity restrictor or physical removal of *M. carolinus* from the area (1 case) was effective in restoring the cavity for use by Red-cockaded Woodpeckers. *P. borealis* readily accepts cavity restrictors (Carter *et al.*, 1989; Raulston, 1992). One of these reoccupied cavities which was fitted with a restrictor was subsequently used for nesting by *P. borealis*.

In compartment 323, stand 13 (Table 1), *M. carolinus* occupied an inactive *P. borealis* cavity in tree 2-4. When this cavity was restricted, *M. carolinus* was excluded and the male *P. borealis* abandoned his former cavity in tree 2-2, which had been restricted at the same time. Subsequently, another *P. borealis* began roosting in 2-2, which eventually became the nest cavity for a second year (1991 and 1992).

In one instance, we were not able to restore the cavity usurped by *M. carolinus* to its former occupant. On 25 April 1991 we found a dead juvenile male *P. borealis* lodged in the entrance tunnel of its roost cavity. We had previously trapped and banded this bird at this same cavity. Following removal of the dead *P. borealis*, a dead *M. carolinus* was discovered in the cavity. Finally, in one case our exclusion of *M. carolinus* from a recently active *P. borealis* cavity did not result in reoccupation by *P. borealis*. This cavity was instead usurped by a southern flying squirrel, *Glaucomys volans*, a frequent occupier of *P. borealis* cavities in the Ouachita National Forest and elsewhere in the southeast (Table 2).

Table 1. Sequential Occupation of Cavities by Red-cockaded Woodpeckers (RCW) and Red-bellied Woodpeckers (RBW) in the Ouachita National Forest.

Location*	Date	Interactions between RCWs and RBWs
C 323 S 13 Tree 2-4	3-92	RBW occupied inactive RCW cavity. Restrictor installed and male RCW immediately began roosting in it.
C 323 S 23 Tree 2-1	1-91	RBW roosting in active RCW cavity. Restrictor installed and female RCW resumed use of cavity.
C 323 S 23 Tree 3-2	3-92	Recently active RCW cavity occupied by RBW. RBW excluded with restrictor. Later occupied by flying squirrel.
C 326 S 14 Tree 1-1	7-91	RBW roosting in former, inactive RCW cavity in Jan. 1990. Restrictor installed. No known use by RCWs until 1991 breeding season, when an RCW fledgling began roosting in it.
C 1252 S 23 Tree 1	2-91	RBW roosting in active cavity. Restrictor installed and RCW resumed roosting. Cavity subsequently used for successful RCW nesting in the 1991 season.
C 1252 S 25 Tree 6	2-91	RBW trapped in active RCW cavity and removed from area. RCW female resumed roosting the following day.
C 1261 S 7 Tree 1	2-90	RBW roosting in RCW cavity. Cavity restrictor installed, excluding RBW. RCW later used cavity in Feb. 1992.
C 1274 S 9 Tree 10	4-91	RCW found dead in cavity entrance tunnel with RBW within cavity.

* Locations are compartments (C) and stands (S) within compartments as designated in the Ouachita National Forest.

Table 2. Interspecific Use of Active and Inactive Red-cockaded Woodpecker Cavities in the Southeastern United States.

Numbers at the top of the table correspond as follows: 1=rat snake (Elaphe obsoleta), 2=southern flying squirrel (Glaucomys volans), 3=Red-bellied Woodpecker (Melanerpes carolinus), 4=Red-headed Woodpecker (Melanerpes erythrocephalus), 5=Pileated Woodpecker (Dryocopus pileatus), 6=Northern Flicker (Colaptes auratus), 7=Eastern Bluebird (Sialia sialis), 8=Tufted Titmouse (Parus bicolor), 9=European Starling (Sturnus vulgaris), 10=Great Crested Flycatcher (Myiarchus crinitus). Number 11 refers to whether or not it was known if interspecific users usurped active Red-cockaded Woodpecker cavities, enlarged cavities or interfered with nesting: y=usurped or interfered, o=usurpation of active cavities or interference with nesting not mentioned or did not occur, p=probably interfered. (Some species mentioned in some papers are not included here.)

Source and locale	1	2	3	4	5	6	7	8	9	10	11
Baker, 1971; 1983 (Florida)	x	x	x	x	x	x	x	x	-	x	p
Beckett, 1971 (SC)	x	x	x	x	-	-	x	x	-	x	y
Carter et al., 1989 (NC)	-	x	x	x	x	x	-	-	x	-	y
Celotelle&Newman, 1983 (Fl.)	-	-	x	-	-	-	-	-	-	-	y
Dennis, 1971 a,b (SC)	x	x	x	x	x	x	-	x	x	x	p
Everhart, 1986 (NC)	-	x	x	x	-	x	x	-	x	x	y
Harlow & Lennartz, 1983 (SC)	-	x	x	x	-	x	x	-	-	x	y
Hopkins & Lynn, 1971 (SC)	-	x	x	x	-	x	-	-	-	-	p
Jackson, 1978 a,b*	x	x	x	x	x	x	x	x	x	x	y
Kilham, 1977 (SC)	-	-	x	-	-	-	-	-	-	-	o
Lennartz et al., 1983*	-	-	x	-	x	-	-	-	-	-	y
Lennartz&Heckel, 1987 (Ga.)	x	x	-	-	-	-	-	-	-	-	y
Lennartz&Stengel, 1989 (SC)	x	x	x	-	-	-	-	-	-	-	y
Ligon, 1970; 1971 (Fl.)	-	x	x	x	-	-	x	-	-	-	y
Ligon et al., 1986*	-	x	x	-	x	-	-	-	-	-	y
Murphey, 1939*	-	x	x	x	-	-	x	-	-	x	o
Neal & Montague, 1991(Ark.)	-	x	x	-	x	x	x	-	-	-	p
Rudolph et al., 1990 (Tx.)	-	x	-	-	-	-	-	x	-	x	o
USFWS, 1985*	-	x	x	-	x	-	-	-	-	-	y
Wood, 1983 (Okla.)	-	-	-	-	-	-	-	-	-	-	o
Totals	6	16	17	10	8	8	8	5	4	8	

*-rangewide data

Reported use of Red-cockaded Woodpecker cavities by other species, including Red-bellied Woodpeckers, is rangewide in the southeast (Table 2). Jackson (1978a) found that *M. carolinus* was the most important user of *P. borealis* cavities in his study areas in Mississippi, Georgia and South Carolina. In North Carolina, Everhart (1986) reported that during the period 1978-1981, 34% of the avian occupants of *P. borealis* cavities were *M. carolinus*. However, use of *P. borealis* cavities by other species, including *M. carolinus*, is not in itself evidence of competition for these cavities. Many factors contribute to cavity abandonment by *P. borealis* (Rudolph *et al.*, 1990). In Oklahoma, Wood (1983) found no instance of *P. borealis* engaged in interspecific defense of cavities. In

Texas, interspecific struggles for cavities between these two woodpeckers was minimal (Rudolph *et al.*, 1990; personal comm., D. Rudolph and R. Conner). If alternative cavities were available, Harlow and Lennartz (1983) found that while *M. carolinus* did occupy *P. borealis* cavities, apparent usurpation was unimportant in affecting the fitness of *P. borealis* groups studied, even when *P. borealis* was forced to shift their use of cavities or even excavate new ones.

On the other hand, our evidence of aggressive encounters between these two woodpeckers in the Ouachita National Forest, including an encounter that resulted in death, is not unique. In Florida, Ligon (1970, 1971) found that defense of roost cavities from *M. carolinus* was an important part of daily activities of *P. borealis*. Baker (1983) thought such interactions may have played a role in the decline of a *P. borealis* population. There have also been several previous observations of *P. borealis* killed by *M. carolinus* (Jackson, 1978a; Ligon, 1971) and *M. carolinus* killing young or taking eggs of other bird species (Stickel, 1963; Brackbill, 1969; Rodgers, 1990).

We are not arguing that Red-cockaded Woodpeckers became endangered because of interspecific competition. Rather, rarity resulted from massive rangewide habitat degradation as a result of fire suppression that reduced the quality of once open pine forests and removal of mature forest that reduced the supply of mature, live pines required by this woodpecker for cavity excavation (USFWS, 1985; Ligon *et al.*, 1986).

Recent experiments have shown that a key limiting factor in *P. borealis* population expansion is availability of suitable cavities (Walters, 1991). When suitable artificial cavities were supplied, *P. borealis* was induced to form new breeding units. Our work in the Ouachitas showed that the loss of cavities resulted from interspecific conflicts rather than voluntary abandonment by *P. borealis*. We hypothesize that the natural sequence of cavity use is upset in a situation where suitable trees and high quality cavities are in short supply, with the result that sympatric species are forced into conflict. In a period in which suitable habitat is in critically short supply, management techniques which reduce the effects of competition for high quality cavities can potentially speed the recovery of *P. borealis*. Management tools including use of cavity restrictors, physical removal of usurping *M. carolinus*, and installation of artificial cavities serve to increase the number of suitable cavities that can be used by *P. borealis*.

These are proximate solutions to the problem of cavity limitation. Ultimate solutions lie in the maturation of existing pine stands and managing periodic use of prescribed fire to maintain these stands in an open condition.

LITERATURE CITED

BAKER, W.W. 1971. Progress report on life history studies of Red-cockaded Woodpeckers at Tall Timbers Research Station *in* Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.). Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., Tallahassee, pp. 44-59.

BAKER, W.W. 1983. Decline and extirpation of a population of Red-cockaded Woodpeckers in northwest Florida. *in* Red-cockaded Woodpecker Symposium II (D.A. Wood, ed.). Fla. Game and Freshwater Comm., Tallahassee, pp 44-45.

BECKETT, T. 1971. A summary of Red-cockaded Woodpecker observations in South Carolina. *in* Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.). Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., Tallahassee, pp. 87-95.

BRACKBILL, H. 1969. Red-bellied Woodpecker taking bird eggs. Bird-banding 40:323-324.

CARTER, J. H. III, J.R. WALTERS, S.H. EVERHART, and P.D. DOERR. 1989. Restrictors for Red-cockaded Woodpecker cavities. Wildl. Soc. Bull. 17:68-72.

DELOTELLE, R.S. and J.R. NEWMAN. 1983. Possible factors influencing Red-cockaded Woodpecker colony abandonment: a case study. *in* Red-cockaded Woodpecker symposium II. (D.A. Wood, ed.) Fla. Game and Freshwater Comm., Tallahassee, pp. 104-106.

DENNIS, J.V. 1971a. Species using Red-cockaded Woodpecker holes in northeastern South Carolina. Bird-Banding 42:79-87.

DENNIS, J.V. 1971b. Utilization of pine resin by the Red-cockaded Woodpecker and its effectiveness in protecting roosting and nest sites. *in* Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.) Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., Tallahassee, pp. 78-86.

EVERHART, S.H. 1986. Interspecific utilization of Red-cockaded Woodpecker cavities. Unpub. Ph.D. thesis, N.C. State Univ., Raleigh, 107 pp.

HARLOW, R.F. and M.R. LENNARTZ. 1983. Interspecific competition for Red-cockaded Woodpecker cavities during the nesting season in South Carolina. *in* Red-cockaded Woodpecker Symposium II. (D.A. Wood, ed.) Fla. Game and Freshwater Comm., Tallahassee, pp. 41-43.

HOPKINS, M.L. and T.E. LYNN, JR. 1971. Some characteristics of Red-cockaded Woodpecker cavity trees and management implications in South Carolina. In Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.) Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., Tallahassee, pp. 140-169.

JACKSON, J.A. 1971. The evolution, taxonomy, distribution, past populations and current status of the Red-cockaded Woodpecker. *in* Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.) Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., Tallahassee, pp. 4-29.

JACKSON, J.A. 1977. Determination of the status of Red-cockaded Woodpecker colonies. J. Wildl. Manage. 41:448-452.

JACKSON, J.A. 1978a. Competition for cavities and Red-cockaded Woodpecker management. *in* Management techniques for preserving threatened species (S.A. Temple, ed.) Univ. Wisconsin Press, Madison, pp. 103-112.

JACKSON, J.A. 1978b. Pine bark redness as an indicator of Red-cockaded Woodpecker activity. Wildl. Soc. Bull. 6:171-172.

JACKSON, J.A. 1988. The southeastern pine forest ecosystem and its birds: past, present, and future. *in* Bird Conservation 3 (J.A. Jackson, ed.) Int. Council for Bird Pres., Univ. of Wisconsin Press, Madison, pp. 119-159.

JAMES, D.A. and J.C. NEAL. 1986. Arkansas birds, their distribution and abundance. Univ. of Ark. Press, Fayetteville, Ark. 402 pp.

KILHAM, L. 1977. Nest-site differences between Red-headed and Red-bellied Woodpeckers in South Carolina. Wils. Bull. 89:164-165.

LENNARTZ, M.R., H.A. KNIGHT, J.P. MCCLURE, and V.A. RUDIS. 1983. Status of Red-cockaded Woodpecker nesting habitat in the South. *in* Red-cockaded Woodpecker Symposium II (D.A. Wood, ed.) Fla. Game and Freshwater Comm., Tallahassee, pp. 13-19.

LENNARTZ, M.R. and D.G. HECKEL. 1987. *in* Population dynamics of a Red-cockaded Woodpecker population in Georgia Piedmont loblolly pine habitat. Proc. Third Southeast. Nongame Endangered Wildl. Sympos. (R. Odum, ed.), pp. 48-55.

LENNARTZ, M.R. and P.W. STENGEL. 1989. Few and far between. Liv. Bird Q. 8(4):15-20.

LIGON, J.D. 1970. Behavior and breeding biology of the Red-cockaded Woodpecker. Auk 87: 255-278.

LIGON, J.D. 1971. Some factors influencing numbers of the Red-cockaded Woodpecker. *In* Ecology and management of the Red-cockaded Woodpecker (R.L. Thompson, ed.). Tallahassee, Fla. Bur. Sport Fish. and Wildl. and Tall Timbers Res. Sta., pp. 30-43.

LIGON, J.D., P.B. STACEY, R.N. CONNER, C.E. BOCK, and C.S. ADKISSON. 1986. Report of the American Ornithologists' Union committee for the conservation of the Red-cockaded Woodpecker. Auk 103:848-855.

MURPHEY, E.E. 1939. Red-cockaded Woodpecker *Dryobates borealis* (Vieillot) *in* Life histories of North American woodpeckers (A.C. Bent, ed.), Bull. 174, U.S. Nat. Mus., pp. 72-79.

NEAL, J.C. and W.G. MONTAGUE. 1991. Past and present distribution of the Red-cockaded Woodpecker and its habitat in the Ouachita Mountains in Arkansas. Proc. Ark. Acad. Sci. 45:71-75.

PIANKA, E.R. 1983. Evolutionary ecology, 3rd ed. Harper & Row Pub., N.Y., 416 pp.

RAULSTON, B.E. 1992. Effects of cavity restrictors on Red-cockaded Woodpeckers. M.S. thesis, Univ. of Ark., Fayetteville, 34 pp.

RODGERS JR., S.P. 1990. Predation of domestic fowl eggs by Red-bellied Woodpeckers. Florida Field Nat. 18(3):57-58.

RUDOLPH, D.C., R.N. CONNER and J. TURNER. 1990. Competition for Red-cockaded Woodpecker roost and nest cavities: effects of resin age and entrance diameter. Wils. Bull. 102:23-36.

STICKEL, D.W. 1963. Interspecific relations among Red-bellied and Hairy Woodpeckers and a Flying Squirrel. Wils. Bull. 75:203-204.

U.S. FISH AND WILDLIFE SERVICE. 1985. Red-cockaded Woodpecker recovery plan. U.S. Fish & Wildl. Serv., Atlanta, Ga., 88 pp.

WALTERS, J. R. 1991. Application of ecological principles to the management of the Red-cockaded Woodpecker. Annu. Rev. Ecol. Syst. 22:505-523.

WOOD, D.A. 1983. Observations on the behavior and breeding biology of the Red-cockaded Woodpecker in Oklahoma. *In* Red-cockaded Woodpecker Symposium II. (D.A. Wood, ed.) Fla. Game and Freshwater Comm., Tallahassee, pp. 92-94.

JOSEPH C. NEAL, Arkansas Cooperative Fish and Wildlife Research Unit, University of Arkansas, Fayetteville, AR 72701, WARREN G. MONTAGUE, Poteau Ranger District, USDA Forest Service, P.O. Box 2255, Waldron, AR 72958, and DOUGLAS A. JAMES, Department of Biological Sciences, University of

A MATERNITY COLONY OF GRAY BATS IN A NON-CAVE SITE

Colonies of the endangered gray bat, *Myotis grisescens*, are primarily found inhabiting caves in the limestone karst regions of Arkansas, Missouri, Kentucky, Tennessee, and Alabama (Barbour and Davis, 1969). There are only two previously published accounts of gray bats inhabiting non-cave sites. In 1964, Hays and Bingman reported the presence of a maternity colony in a storm sewer in Pittsburg, Kansas, and Gunier and Elder (1971) studied a maternity colony roosting in an old barn in Missouri. In 1988, another maternity colony was found inhabiting a storm drain in Newark, Independence County, Arkansas. The town has a population of approximately 1100 and lies at the extreme eastern edge of the Ozark Plateau.

Because of the endangered status of the gray bat, precautions were taken during our activities to provide minimal disturbance to the colony. The physical and structural characteristics of the drain were studied in winter or after emergence when the maternity colony was not present. Temperatures at the roost site were monitored by means of a temperature transducer connected to a microprocessor-based data acquisition system mounted at the tunnel entrance. The population was estimated by direct count upon emergence.

The western inlet of the storm drain, at the intersection of Front and Main Streets, measures 7 m across by 1.7 m in height. The tunnel itself is 160 m long and runs southwest under the sidewalk, Highway 122, and Paraquete Road after which it empties into a creek bed by means of two rectangular concrete culverts approximately 1 m high by 2 m wide.

Since there are two openings to the drain as well as several sidewalk grates and drain openings to the street, air circulates through the drain and ammonia levels do not build up. Gasoline fumes from a service station, however, are sometimes present.

The walls and ceiling are constructed of reinforced concrete with the exception of an older section along Front Street where sandstone blocks make up the lower walls. The horizontal ceiling is not a uniform height above the floor, but is constructed in sections, some of which are lower than others. The floor of the sewer consists of coarse gravel and small cobbles. In some parts of the drain the floor is nearly level, but in others there are depressions and gravel bars so that the height of the floor may vary by as much as .5 m across the width of the drain. The topography of the floor changes from year to year depending on the water flow. At the time of the survey, the maximum height measured from gravel to ceiling was 1.9 m, 1.45 m above the water level. The minimum height above the floor was 1.1 m, .89 m above the water. The width of the drain also varies from a maximum of 4.6 m to a minimum of 3.3 m. The sewer is smallest in height and width in the section under Highway 122.

Water is present in the drain all year, but depth varies depending on floor topography and precipitation. During heavy rains water depths of over 1.5 m completely flood the tunnel west of Hwy. 122 as well as the outlet culverts.

Unlike natural caves, the temperature near the ceiling of the drain can fluctuate up to 10 degrees Celsius per day. In sunny weather there is a regular cycle of heating and cooling in the drain dependent on changes in air temperature and heating of the pavement and concrete. Heat from above is transferred to the roost environment through the concrete even on days when the air is cool.

There are two roost sites in the storm drain as determined by ceiling stains. It is not known if the maternity colony uses both sites, but they do serve as night roosts and hibernation sites for a small group of gray bats. Maternity colonies require warm temperatures to promote rapid growth of the young. In natural caves, rooms with domed ceilings to trap the colonies' heat are chosen for bearing and raising young. Such roosts are generally located over water to provide humidity and protection from disturbance and predation (Tuttle, 1975). The primary roost site of the maternity colony in Newark exhibits these same characteristics. It is located 50-65 m from the outlet of the drain in the section between Paraquete Road and Highway 122, where the sewer attains its maximum height and width. There the ceiling rises forming a rectangular dome. This heat trapping dome, along with the increased dimensions of the site, prevent flood waters from reaching the ceiling. Permanent pools of water up to 0.7 m deep are present beneath the roost site. In the summer when the maternity colony is present the temperatures at the primary roost site average 34 degrees Celsius and may rise to 40 degrees.