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# Unhatched Eggs in Nests of Red-cockaded Woodpeckers

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## Abstract

During 1991 and 1992, nests of Red-cockaded Woodpeckers (*Picoides borealis*) were monitored in the Ouachita National Forest in Scott and Polk counties of west-central Arkansas. Nests in three additional woodpecker areas in Arkansas and Oklahoma were also monitored in 1992. Of 92 eggs laid in 27 nesting attempts in the Ouachita National Forest, 18 (19%) failed to hatch. When viewed in the cavities, six unhatched eggs were noticeably below average in size for the species and eight were average size. Seven unhatched eggs were removed in 1992 from seven nests in Arkansas and Oklahoma; three eggs showed some embryological development and three showed no development. Techniques used to remove unhatched eggs and results of analysis of eggs are presented. Possible management applications of egg data are discussed.

## Introduction

Remnant populations of endangered Red-cockaded Woodpeckers (*Picoides borealis*) occur in several areas in Arkansas (James and Neal, 1986; 1989), at one location in southeastern Oklahoma (Masters et al. 1989), and elsewhere in the southeastern United States (Ligon et al., 1986). These cooperatively-breeding birds have been studied in the Ouachita National Forest (Ouachita NF) in west-central Arkansas as part of a management program designed to stabilize and rebuild the population (Neal, 1992; Montague et al., 1993; Withgott et al., 1993). Embryological data, including egg sizes and hatching rates, could prove useful in planning recovery efforts in the Ouachita NF.

The average size of Red-cockaded Woodpecker eggs was 24.04 by 17.86 mm (Bent, 1939), but unusually large and small eggs are also laid (Ramey and Jackson, 1979; Koenig, 1980). An analysis of unhatched eggs from nests in Arkansas and Oklahoma based on a new technique to remove eggs from cavity nests is presented.

## Study Area

Shortleaf pine (*Pinus echinata*) forests in the Ouachita NF inhabited by groups of Red-cockaded Woodpeckers have been previously described (Neal and Montague, 1991) as have techniques used in the study of the breeding biology of the bird (Neal, 1992). In 1992 nests of Red-cockaded Woodpeckers were examined in the Ouachita NF (Scott and Polk counties, Arkansas), at Crossett Experimental Forest (Ashley County, Arkansas), Pine City

Natural Area (Monroe County, Arkansas) and McCurtain County Wilderness Area (McCurtain County, Oklahoma).

## Methods

During the 1991 and 1992 breeding seasons, nest trees in the Ouachita NF were climbed with ladders and nest contents examined using a light and mirror. Nests were checked at least 1-2 times each week from mid-April to early July. Clutch size, hatching rates, nestling survival, and fledging rates were determined. Nestlings were removed from cavities and banded. In 1992 nestlings were also banded at Crossett Experimental Forest, Pine City Natural Area and in McCurtain County Wilderness Area.

A battery-powered portable vacuum (e.g., Black & Decker Power Pro, DB6000 with the AK10 accessory kit) equipped with a 75-mm-long flexible hose (e.g., Hoover Elite upright vacuum hose) was used in 1992 to remove unhatched eggs from nest cavities (Fig. 1). When it was determined that an egg was not going to hatch, the flexible hose was inserted into the cavity. A nylon stocking pouch covering the end of the hose was brought into close proximity to the egg. Suction from the vacuum "cradled" the egg, permitting its safe removal from the nest cavity.

Unhatched eggs were removed from 6 to 17 May 1992 at the time nestlings were banded (usually age 7-10 days after hatching). Unhatched eggs remaining in the nest at the time of banding were considered nonviable. Nest checks, nestling banding, and removal of unhatched eggs usually required <20 min.

Eggs removed from nests were transported to the



Fig. 1. Warren G. Montague (right) holds an artificial bird box containing two eggs. A nylon stocking is fitted over the end of the flexible hose of a portable vacuum. The hose is inserted into the opening and down inside the cavity to the eggs. Suction from the vacuum will allow safe retrieval of the eggs. The same technique and equipment were used to remove unhatched eggs of Red-cockaded Woodpeckers in 1992.

Department of Biological Sciences at the University of Arkansas in Fayetteville, Arkansas. The eggs were measured and contents examined microscopically. Egg contents were preserved in formaldehyde and eggshells were retained.

### Results

During the 1991 and 1992 nesting seasons, 92 eggs were laid in 27 nesting attempts in the Ouachita NF; of these, 18 (19%) failed to hatch (Neal, 1992). When viewed in the cavities, eight unhatched eggs were judged to be average in size and six less than average size (Tables 1, 2); the remaining four eggs disappeared before size was noted. The six small eggs (Tables 1, 2) were laid in five nests (6 of 92 eggs laid during 5 of 27 nesting attempts). Small eggs therefore constituted 6.5% of total eggs laid; 18.5% of total clutches included at least one of these small eggs.

In 1992 seven eggs were removed from seven different nests in four woodpecker nesting areas in Arkansas and Oklahoma; six were available for analysis (Table 3). Of these six, three showed some embryological development (Table 3; Nos. 1, 2, 4) and three showed no signs of devel-

opment (Nos. 3, 5, 6). One of the six eggs (No. 2) was larger than the average size for Red-cockaded Woodpeckers, and two (Nos. 3, 4) were smaller than average. A seventh unhatched egg was successfully removed from a nest cavity in the Ouachita NF, but was dropped and broken. While it could not be salvaged for more detailed evaluation, gross visual examination did not indicate any embryological development.

### Discussion

Unusually small, or runt, eggs have been reported in several species of birds, including North American woodpeckers (Koenig, 1980). It appears that unusual-sized eggs are infrequent in nests of Red-cockaded Woodpeckers. Jerome Jackson examined 60 apparently normal clutches before observing a clutch with one unusually large egg and three unusually small eggs (Ramey and Jackson, 1979). Only 1.33% of 75 eggs of Red-cockaded Woodpeckers in museum collections were runts (Koenig, 1980). In North Carolina 23 eggs of Red-cockaded Woodpeckers (1.1% of eggs seen) were runts. It appears that production of small eggs in the Ouachita NF (6.5% of all eggs laid) occurs

more frequently when compared to other populations of the woodpecker.

Table 1. Production of unhatched eggs of Red-cockaded Woodpeckers in the Ouachita National Forest in 1991.

Compartment/ stand <sup>1</sup>	Clutch size	Unhatched eggs, average size	Unhatched eggs, small size
323/13	4	1	0
323/14	4	1	0
862/25	4	1	0
1244/12	5	1	1
1252/26	4	0	1

<sup>1</sup>Compartments and stands are locations as designated in the Ouachita National Forest.

Table 2. Production of unhatched eggs of Red-cockaded Woodpeckers in the Ouachita National Forest in 1992.

Compartment/ stand <sup>1</sup>	Clutch size	Unhatched eggs average size	Unhatched eggs, small size
323/14	4	0	2 <sup>2</sup>
323/23	3	1	0
326/14	4	1	0
1244/12	4	1	0
1274/9	4	0	1
1261/8	2	1	1

<sup>1</sup>Compartments and stands are locations as designated in the Ouachita National Forest.

<sup>2</sup>One small egg hatched, but nestling died within seven days; second small egg did not hatch.

Table 3. Unhatched eggs removed from nests of Red-cockaded Woodpeckers in Arkansas and Oklahoma in 1992<sup>1</sup>.

No.	Site <sup>2</sup>	Size (mm)	Comment
1.	MCWA	23.3 x 17.8	Fertile egg with blastoderm evident; development ceased early
2.	CEF	25.4 x 19.0	Fertile egg; embryo started to develop, then stopped
3.	ONF	22.7 x 15.65	No development evident; yolk and albumen appeared normal
4.	ONF	20.09 x 10.51	Well-developed embryo; no yolk remained in very small egg
5.	ONF	24.9 x 17.5	No development evident; stress marks on shell
6.	PCNA	24.88 x 17.0	No development evident

<sup>1</sup>A seventh egg was dropped and broken after removal from the nest.

<sup>2</sup>Sites of nests of Red-cockaded Woodpeckers are abbreviated as follows: ONF = Ouachita National Forest; MCWA = McCurtain County Wilderness Area; CEF = Crossett Experimental Forest; PCNA = Pine City Natural Area.

Runt eggs appeared more frequently in clutches of cooperatively breeding Acorn Woodpeckers (*Melanerpes formicivorus*) than in clutches of other North American woodpeckers (Koenig, 1980; Koenig and Mumme, 1987). Four percent of eggs were runts and these were laid in 11.2% of Acorn Woodpecker nests (Koenig and Mumme, 1987). Koenig (1980) hypothesized that the relatively high incidence of runt eggs in Acorn Woodpeckers might have resulted from disturbance during the laying period, especially due to contact at the nest site between communally nesting females. Red-cockaded Woodpeckers do not nest communally. If production of small eggs is a result of disturbance at the nest site, some of the small eggs produced in the Ouachita NF may be due, in part, to unsettled social conditions at the onset of the nesting season.

Management of Red-cockaded Woodpeckers now includes translocation techniques in which unmated birds (often subadult females, or helper males, or both) are captured and moved into appropriate clusters of cavity trees where either a male, female, or birds of both sexes are lacking. This technique, which increases the effective number of breeding pairs, has been employed in the Ouachita NF since 1990.

On 18 March 1992, an unmated subadult female Red-cockaded Woodpecker was captured in compartment 862 and moved to an unmated adult male in compartment

323. The augmentation was successful, since between 28 April and 3 May the female laid four eggs, including two runt eggs (Table 2). A runt egg was also laid in a clutch that resulted from another translocation (Table 2, compartment 1274). Runt eggs were laid in these nests for unknown reasons, but unsettled social conditions provide a possible explanation.

Nest monitoring results in the Ouachita NF indicate hatching success rates that are within the range reported elsewhere for Red-cockaded Woodpeckers. In the Ouachita NF in 1991 and 1992, 81% of the eggs laid hatched (Neal, 1992). In South Carolina hatching success was 75% (Lennartz et al., 1987). In North Carolina at least 7.1% of eggs observed failed to hatch (range 5.5 to 12.1%); this figure was considered an underestimation since the birds themselves may have removed some eggs prior to the nest checks (M.S. LaBranche and J.R. Walters, pers. comm.). In Florida Ligon (1970) reported that 95% of eggs hatched.

Small, isolated populations of Red-cockaded Woodpeckers are susceptible to loss of heterozygosity, which could reduce the species ability to adapt to changing environmental conditions or other disturbances (Stangel et al., 1992). Embryological data could prove useful in recovery work. Efforts like egg exchanges or egg "cross-fostering" could improve heterozygosity in isolated populations. As with other endangered species (Wood and Collopy, 1993), induced renesting could potentially increase reproductive outputs. Determination of egg fertility rates or of stages of embryological development in unhatched eggs could help in assessing potential adverse impacts of nest monitoring. If production of small eggs is associated with unsettled social conditions, the timing of augmentations could be adjusted to improve nesting success.

Our technique for extraction of unhatched eggs could be easily incorporated as a routine procedure employed at the time nestlings are removed from cavities for banding. Vacuum suction was sufficient to hold the egg in the nylon stocking pouch. No eggs were damaged during removal from the nest cavity using the technique described here.

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