

2012

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### Recommended Citation

Fielder, J. M.; Kannan, R.; James, D. A.; and Cunningham, J. (2012) "Status, Dispersal, and Breeding Biology of the Exotic Eurasian Collared-Dove (*Streptopelia decaocto*) in Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 66 , Article 13.

DOI: <https://doi.org/10.54119/jaas.2012.6606>

Available at: <https://scholarworks.uark.edu/jaas/vol66/iss1/13>

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## Status, Dispersal, and Breeding Biology of the Exotic Eurasian Collared-Dove (*Streptopelia decaocto*) in Arkansas

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### Abstract

The exotic Eurasian Collared-Dove (*Streptopelia decaocto*) was first sighted in Arkansas at Harrison (Boone Co.) on 25 June 1989. Since this initial sighting the species has grown in numbers and is now present in 42 of 75 counties across the state. In the spring and summer of 2009 and 2010, 20 nests were observed in the urban areas of Fort Smith (Sebastian County). Fifteen of the 20 nests (75%) were located on human-made structures of which 13 (65%) were on an electrical substation and two (10%) were on utility poles. The remaining 5 nests (25%) were in trees. Mean nest height was 7.62 m (n = 20 nests), and the mean width of the nest site support was 40 cm (n = 6 nests). Thirteen of the 20 nests (65%) yielded fledgling(s). Three focal nests were chosen for intense observation. Nest building lasted 1 to 3 days (mean = 2 days); incubation period was 15 days; and fledging occurred 17-18 days after hatching (n = 3 nests). A total of 6 young fledged from these 3 nests.

### Introduction

The Eurasian Collared-Dove (ECD; *Streptopelia decaocto*) is one of the world's most rapidly expanding species (Nowak 1971). Its historic range covers India, Sri Lanka, and Myanmar (Smith 1987, Romagosa and McEneaney 1999). By the 1900's ECDs began expanding their range across much of Europe (Romagosa and Labisky 2000). It was first observed in the United States in southern Florida in the early 1980s (Smith 1987). This initial population was the result of 50 doves escaping from a pet breeder in the Bahamas (Hengeveld 1988, 1993). A breeding population was quickly established in southern Florida. The species rapidly increased its range (Smith 1987, Romagosa and McEneaney 1999). By 2007 ECDs had expanded their range to the pacific coast and the Canadian border, representing a large geographical area in the continental United States (Hooten and Wikle 2008).

The extent of range expansion of ECD is one of the largest recorded for any bird species (Coombs et al. 1981). The dispersal pattern in Europe was in a northwesterly pattern at a rate of 45 km per year (Hengeveld 1988). A similar northwesterly "jump dispersal" pattern is underway in North America, with long distance dispersals of small groups of individuals followed by large scale population establishments (Hudson 1972, Romagosa and Labisky 2000). Reasons for this rapid expansion include increase in urbanization and also climate change, which allows for a longer breeding season (Crooks and Soulé 1999, Veech et al. 2010). ECDs are typically associated with human settlements such as suburban gardens and town parks which provide abundant food sources, nesting sites, and roosting habitat (Coombs et al. 1981).

The first report of ECD in Arkansas was of a single bird in a yard in Harrison, Boone Co., from 25 June to 1 August 1989 (James et al. 1994). Six years later, on 1 July 1995, 3-5 birds were observed at Island Harbor on the Arkansas River near Pine Bluff, Jefferson Co. (James et al. 2007). By 1997, ECDs were reported from 10 locations in the state, and by 2007, the species had been sighted in 36 counties across the state (James et al. 2007). A hunter from western Arkansas reported that the birds were "a bit larger and less maneuverable than mourning doves, but certainly challenging. The breasts were, of course, larger but proved to be just as delectable table fare" (Meeks 2008).

The breeding biology of ECD is poorly studied in North America. Investigators have stressed that the bird's broad diet and versatile breeding biology are keys to its invasion (Hengeveld 1988). The goal of this study was to provide insights into the status, breeding biology and dispersal of ECD in its new range in Arkansas.

### Study Area and Methods

Status and dispersal of the ECD in Arkansas was deduced mainly from Christmas Bird Counts (CBC),

which are organized and compiled annually by the National Audubon Society (2009). CBCs are conducted in late December and early January each winter across North and Central America by teams of volunteers who identify bird species and count the numbers of each species in specific 15-mile diameter circles at specified locations. We also compiled combined counts from four Arkansas counties in the area of the present study, Sebastian, Franklin, Logan, and Crawford, using data on the International Migratory Bird Counts (eBird 2011). Monitoring of ECD nests was conducted in urban areas of Fort Smith (Sebastian Co.), Arkansas, in April-September 2009 and April-October 2010. Four nests were observed in 2009, and 16 in 2010. Three nests were intensively observed and the other nests were monitored every 1-2 days. All three focal nests were monitored on a daily basis either from 0600 to 1200 hrs or from 1800 to 2200 hrs. Daily nest monitoring ranged from 2 - 6 hours, with 2.5 - 4 hours spent per nest. Nesting was observed using 10x50 binoculars. All nest heights were measured using a clinometer at known distances, and the diameter at breast height (DBH) of nest poles and trees were measured with a DBH tape. Site measurements could not be made at nest sites at the electrical substation due to inaccessibility. General notes on dove behavior were recorded. Statistical analysis employed were: regression analysis (SAS 2010), Mann-Whitney *U* test and chi-square (Siegel 1956), correlation coefficient (Snedecor 1946), and Tukey's means test using [www.r-project.org](http://www.r-project.org). In analyses  $\alpha=0.05$ .

## Results

**Dispersal and Current Status in Arkansas.**—ECDs now occur across Arkansas with sightings reported in 42 counties. In Arkansas, the species was first reported on the International Migratory Bird Count (IMBC; eBird 2011) and on the Christmas Bird Count (CBC) in 1997. ECD numbers in CBCs have shown a general upward trend with some fluctuations (Fig. 1). The number of counts in the state reporting ECDs on CBCs has increased steadily since 1998 (Fig. 2). A straight line regression for the data points shown in Fig. 2 is represented by the formula  $y=1.077x-2148.4$ , where *y* is the number of CBCs detecting ECDs and *x* is the year in question. Both the slope (1.077 and intercept -2148.4) of the regression line are significant ( $p<0.0001$ ). The correlation coefficient between numbers of ECDs on CBCs and years was  $r=0.933$ , which is significant ( $p<0.01$ ).

Based on CBC data, the species spread from the southeast corner of the state in 1997 to the northwest corner in 5 years, covering a distance of about 500 km at a rate of 100 km per year (Fig. 3). The compilations of sightings in the 4-county area from IMBCs indicate ECDs first arrived in Fort Smith area in 2003, peaked in 2005, declined and fluctuated thereafter. Year-by-year numbers in the four counties follow: the numbers in parentheses are numbers in Sebastian Co. which includes Fort Smith where the nesting studies were conducted: 7(7) in 2003, 13(4) in 2004, 266(266) in 2005, 29(29) in 2006, 34(34) in 2007, 9(0) in 2008, 9(1) in 2009, 3(3) in 2010, and 25(16) in 2011.

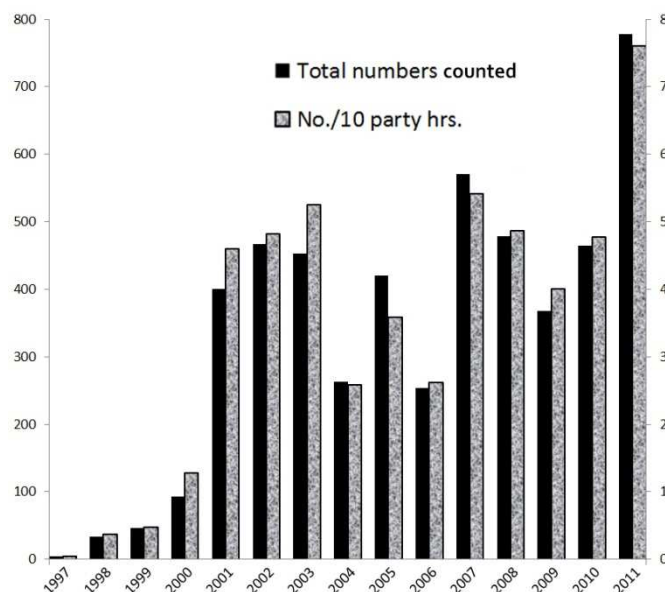


Fig. 1. Christmas Bird Counts of the Eurasian Collared-Dove in Arkansas for 15 years.

**Phenology.**—The three focal nests showed staggered phenological pattern of events (Fig. 4) in such a way that the nests were not synchronized in any of the four main phases of nesting: nest building, incubation, nestlings at nest, or parents tending to fledglings.

**Nest Sites, Nest Building, Courtship, and Copulation.**—All 4 nests observed in 2009 were located in 4 different willow oak trees (*Quercus phellos*) in the national cemetery in downtown Fort Smith. Of the 20 nests, 13 (65%) were built on electrical substation structures, two (10%) were on utility poles, and five (25%) were in trees (Table 1). Mean nest height was  $7.61\pm 2.72$  m (3.03 - 10.11, 20 nests) (mean, SD, range, *n*) and mean DBH of measured nest sites was  $40\pm 7.47$  cm (33-51, 6 nests).

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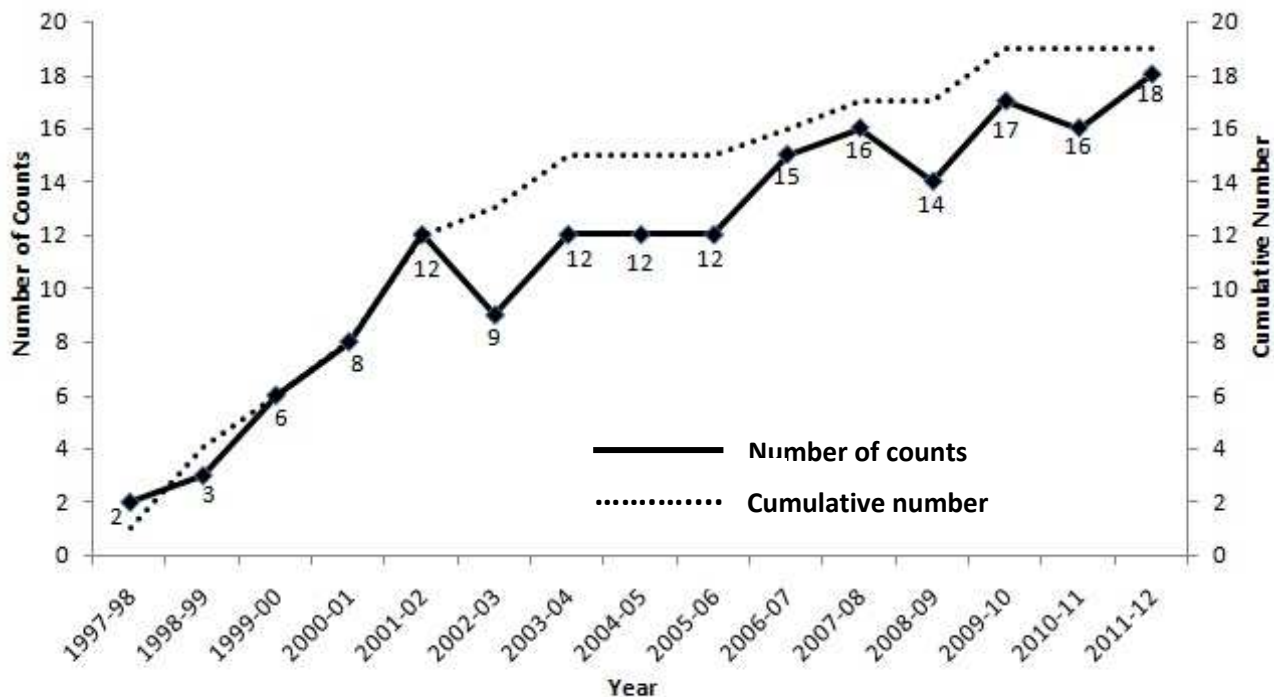


Fig. 2. Number of counts each year reporting Eurasian Collared-Doves on Christmas Bird Counts in Arkansas.

Table 1. Summary of Eurasian Collared-Dove nests observed in the present study.

Nest No.	Year	Nest Location	Nest Height (m)	DBH (cm)	Total Substrate Height (m)	No. of fledglings
1	2009	Willow Oak	8.81	42	12.1	0
2	2009	Willow Oak	7.02	46	11.5	0
3	2009	Willow Oak	9.31	34	12	0
4	2009	Willow Oak	9.22	51	11.8	2
5*	2010	Electric Substation	3.6		9.1	2
6	2010	Electric Substation	7.42		9.1	2
7*	2010	Electric Substation	3.6		9.1	2
8	2010	Electric Substation	8.31		12.2	2
9	2010	Electric Substation	8		12.2	1
10	2010	Utility Pole	10.09	34	10.09	0
11	2010	Electric Substation	9.91		12.2	1
12*	2010	Utility Pole	10.02	33	10.02	1
13	2010	Willow Oak	3.03		12.8	0
14	2010	Electric Substation	3.42		9.1	0
15	2010	Electric Substation	10.06		12.2	2
16	2010	Electric Substation	7.02		12.2	2
17	2010	Electric Substation	10.11		12.2	0
18	2010	Electric Substation	10.07		12.2	1
19	2010	Electric Substation	10.06		12.2	2
20	2010	Electric Substation	3.11		9.2	1

\*focal nests observed

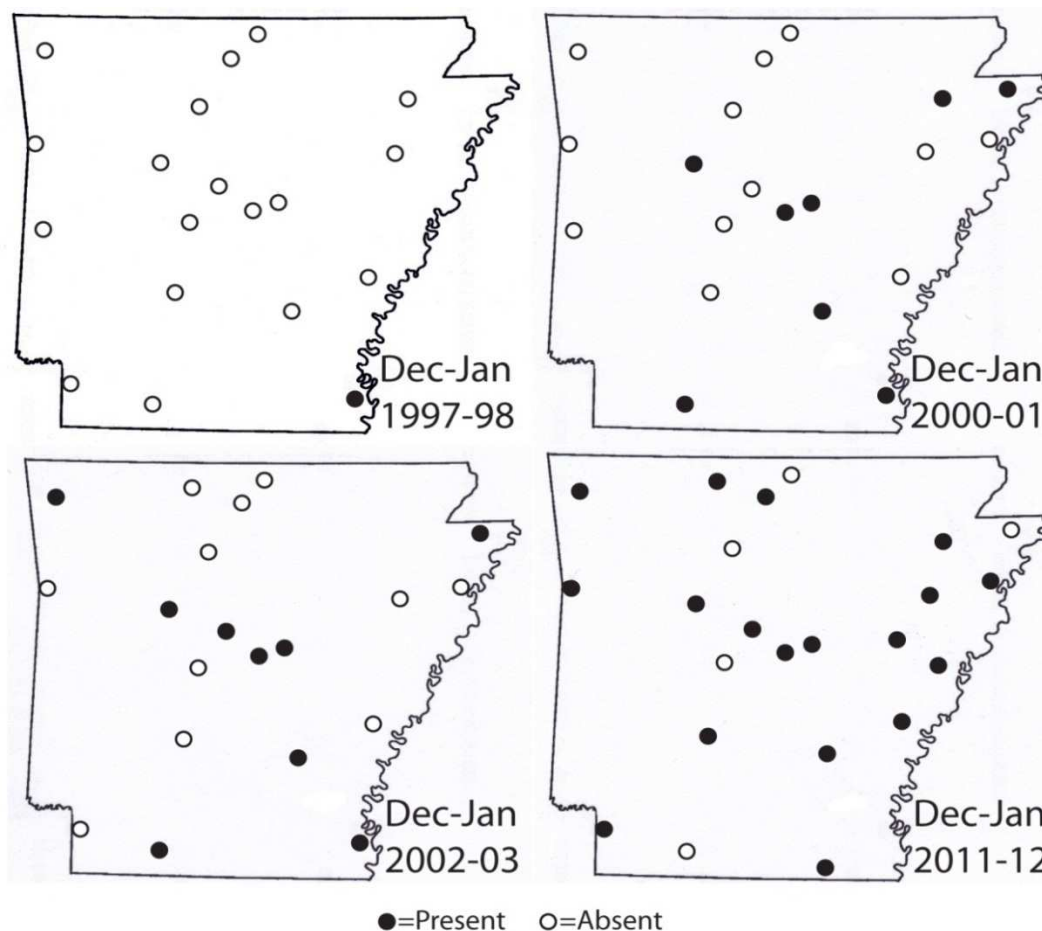


Fig. 3. Distribution of the Eurasian Collared-Dove for four years in Arkansas based on Christmas Bird Counts.

Nest building was monitored for the three focal nests. During early stages of nest building, both males and females were observed delivering nest material. Once a flimsy base of small twigs was formed, females began perching on nest and the males provided nesting material to females. Nest building at the electrical substation lasted one day whereas at utility poles and trees it lasted 2-3 days. The male and female parents made, respectively,  $13.67 \pm 2.52$  (11-16) and  $6.33 \pm 2.08$  (4-8) (mean, SD, range) nest material deliveries per hour (total of 6 hrs of observations on all three nests). Males delivered more nest material than females (Fig. 5). The difference between male and female delivery rates was statistically significant. Summing the paired chi-square values male vs. female at each nest produced an overall chi-square of 9.1109, 2 d.f.,  $p < 0.02 > 0.01$ . Intermittent deliveries of nest material were made during incubation.

Copulation (male mounting female for a few seconds) was observed at all three focal nests. The male *coo*-ed and bobbed its head while approaching

the female. Receptive females lowered their heads and allowed males to mount. In instances when female was unreceptive and flew away, the male followed.

**Incubation.**—Incubation period at all 3 focal nests was 15 days. It was determined by the amount of time the parent perched still on the nest without exhibiting feeding behavior. Feeding behavior was indicated by regurgitation or crop-milk expulsion. Both parents incubated. Commencement of crop-milk feeding indicated that at least one egg had hatched. The incubating parent was observed at nest being fed by the partner by regurgitation. All three nests were observed for 2 hr/day for 15 days (30 hr each) during incubation. The proportion of time adults were attentive (%) during incubation (time in minutes spent on eggs/total time observed  $\times$  100) averaged  $95.6 \pm 2.2$  (91.6-99.1) (mean, SD, range) for nest 1;  $96.4 \pm 3.4$  (90-100) for nest 2 and  $94.1 \pm 3.4$  (90-100) for nest 3. A side-by-side box plot comparison (Fig. 6) showed that attentiveness varied between the nests, with nests 2 and

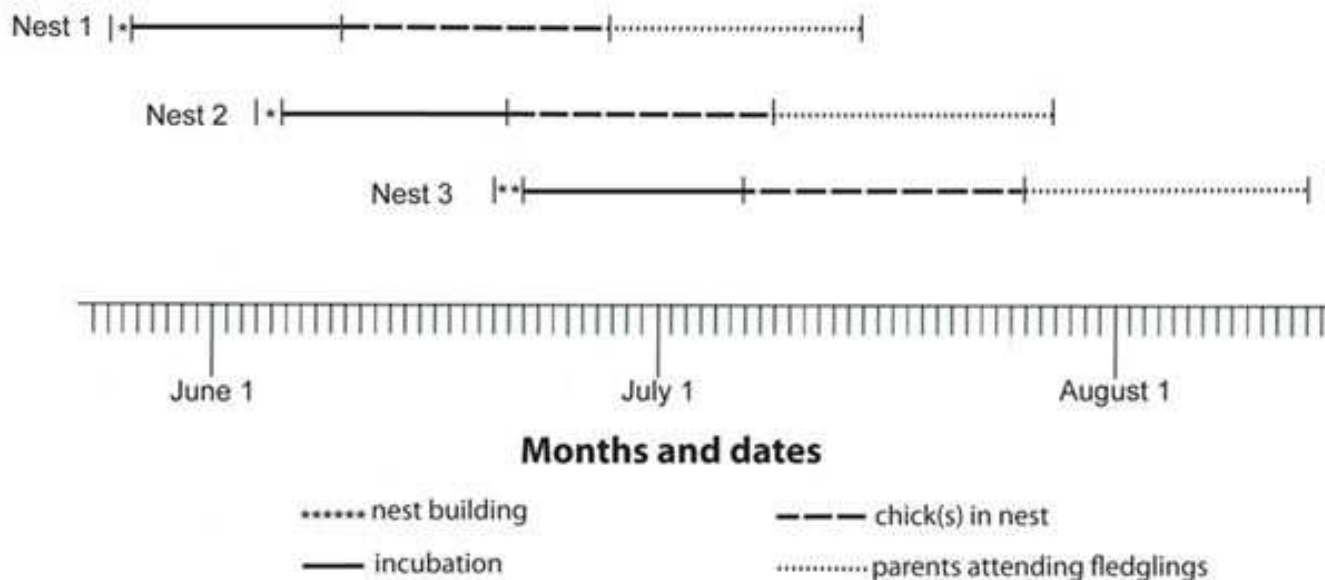


Fig. 4. Nesting phenology of three Eurasian Collared-Dove nests observed in 2010.

3 incubating parents showing more variability than nest 1 parents. Since the three nests showed a staggered phenological pattern, we tested the hypothesis that mean attentiveness (%) was significantly different between the nests. This hypothesis was rejected ( $p > 0.05$ , Tukey's means test).

**Parental care.**— The three focal nests yielded a total of 6 chicks (2 each) and all fledged. The young remained in the nest for 17 days in nest 1, and 18 days for nests 2 and 3. Both male and female fed the young by regurgitation or crop-milk expulsion. Frequent feedings were observed shortly after hatching. Young were fed with crop milk for 11 days on all three nests. On day 12 nestlings were fed seed with some crop feedings. There were two instances of the young being fed an invertebrate at nest 1. The first was by the female bird capturing a grasshopper, bludgeoning it and feeding it to the nestlings in a regurgitated form. The second involved feeding the young some maggots. The male bird removed maggots from rotting food and delivered them to the young. Removal of fecal sacs was observed at all three nests.

Hourly feeding attempts per week declined with time at all three nests (Fig. 7). This decrease through time was statistically significant employing Mann-Whitney  $U$  test (comparing 1<sup>st</sup> week with 2<sup>nd</sup> and 3<sup>rd</sup> weeks,  $n_1=3$ ,  $n_2=6$ ,  $U=0$ ,  $p=0.012$ ; comparing 2<sup>nd</sup> with 3<sup>rd</sup> week,  $n_1=3$ ,  $n_2=3$ ,  $U=0$ ,  $p=0.05$ ). A total of 165,

171, and 182 feeding attempts were observed in nests 1, 2, and 3 respectively. All three focal nests were observed through the months of June, July, and August for a total of 339 hrs.

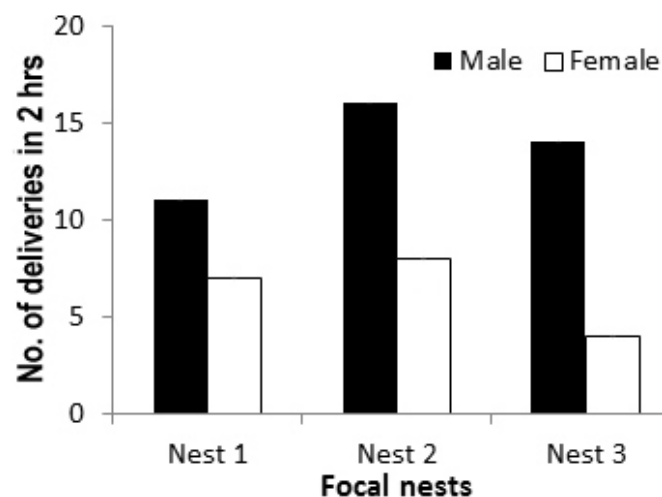


Fig. 5. Delivery rate of nest material by both parents before incubation.

**Fledging and Dispersal.**— One of the 4 nests (25%) observed in 2009, and 12 of the 16 nests (75%) observed in 2010, fledged young. The other 4 nests in 2010 were lost during a severe thunderstorm. After 9 days, young began to exhibit very active wing beats

and begging behavior. After day 12 the young were fully feathered without the black collar. At the electrical substation young ventured out of the nest on

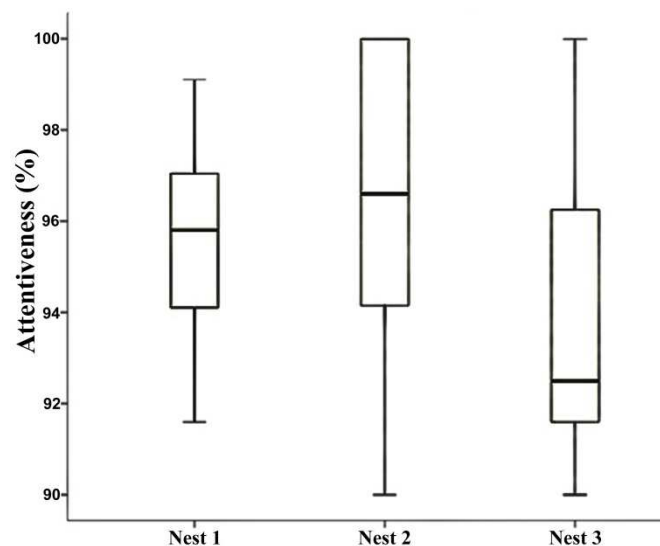


Fig. 6. Nest attentiveness (%) in the three focal nests. The vertical bars represent the middle half of the data; the horizontal line in the center of the bars is the median; and the top and bottom extensions represent the highest and lowest values, respectively.

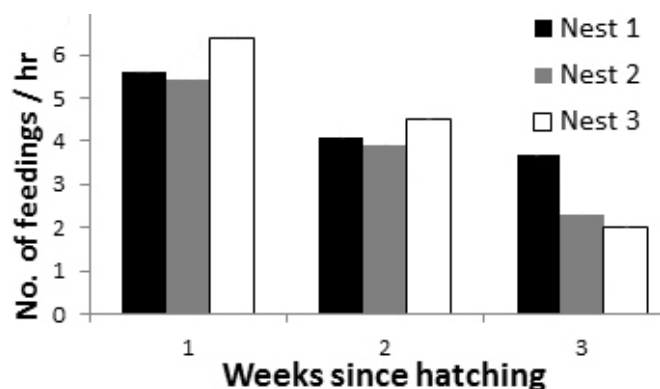


Fig. 7. Feeding rate by both parents at the three focal nests.

day 12 and walked on the cross beams; flight was not recorded at this time. On day 15 - 16 the young exercised wings and made short excursions to the ground to feed. On day 17 - 18 the black collar was present on the young. They then made short flights to utility poles. The entire process lasted 17 days on nest 1 and 2, and 18 days on nest 3. During the process the female was very attentive and often preened and fed the young.

**Predation and Interspecific Association** — There were no observed instances of predation at any of the

monitored nests. Several species nested in close proximity to the Eurasian Collared-Dove: Common Nighthawk (*Chordeiles minor*), Common Grackle (*Quiscalus quiscula*), House Sparrow (*Passer domesticus*), Rock Pigeon (*Columba livia*), Northern Mockingbird (*Mimus polyglottos*), and the Western Kingbird (*Tyrannus verticalis*).

## Discussion

The success of the ECD in North America has been attributed to the plethora of seeds available through backyard bird feeders (Romagosa 2002). In western Arkansas, grain silos have augmented food availability to the bird and hence its success locally. ECDs are now so abundant in Arkansas that the Arkansas Game and Fish Commission now has a Fall and Winter hunting season with no daily bag or possession limits (Arkansas Game and Fish Commission 2010). As an introduced species, it enjoys no legal protection and is in the unprotected group occupied by the Rock Pigeon (*C. livia*), House Sparrow (*P. domesticus*), and European Starling (*Sturnus vulgaris*). The dispersion occurred rapidly across the state (Figs. 1-3) in just 5 years at a rate of 100 kms/year (Fig. 3). This is more than double the dispersion rate observed in Europe (45 kms/yr; Hengeveld 1988). The total numbers and relative numbers on Christmas Bird Counts (Fig. 1) rose quickly across the state from 1997 to 2002 and thereafter more or less stabilized exhibiting annual fluctuations.

The ECD nesting population we studied in detail occupied an urbanized habitat developed for human use in the vicinity of Fort Smith, Arkansas, in the northwestern part of the state. This habitat characteristic agrees with other findings across North America and throughout Europe where ECDs inhabit towns, urban parks and gardens, all being environments modified by human activity (Coombs et al. 1981, Romagosa and McEaney 1999, Crooks and Soulé 1999, Romagosa and Labisky 2000, Romagosa 2002, Fujisaki et al. 2010).

Among the 20 nests we discovered (Table 1) more than half were on metal structures of an electrical substation and only a few were in trees. Nest heights were quite variable. Nineteen nests were followed to completion of which 7 fledged no young, 5 fledged one young, and 7 fledged 2 young. The seasonal spread of the 3 nests closely observed was quite large, from late May to mid-August (Fig. 4), suggestive of the year-round nesting that is known for ECDs (Romagosa

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2002). Our findings also agree with Romagosa concerning egg incubation period of 15 days, that the male bird delivers more nest material than female (Fig. 5), and that the young leave the nest 18 days after hatching. We found that the degree of attentiveness varied considerably (Fig. 6). We also found the rate of adults feeding the squabs decreased steadily through the 3 weeks of the nesting cycle (Fig. 7).

None of the nests we observed were predated and we noticed no interactions between nesting ECDs and other avian species. ECDs have been observed chasing other birds and also displacing local populations of Mourning Doves (*Zenaida macroura*) (Romagosa and McEneaney 1999).

**Acknowledgments**

The project was funded by the National Science Foundation EPSCoR RII Grant, "Arkansas ASSET Initiative" (# EPS-0701890), and the Arkansas Science and Technology Authority. Leif Anderson furnished most recent CBC data and helped us navigate through and interpret the information. Doug Leasure offered advice on data collection. Adam Nichols and Carol Hill assisted with figures and word processing.

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