**Annual Report**
**The Audubon Society of Missouri Graduate Research Scholarship**

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Habitat requirements and risks vary among life stages in species with complex lifecycles such as migratory birds (Faaborg et al. 2010). We need to understand the risks and requirements of each stage in order to properly manage species of conservation concern. Breeding season research has historically focused on the nesting stage of Neotropical migrant songbirds, with many studies focusing on nest success and nesting habitat selection. Recent work has emphasized the importance of looking beyond the nesting period into the postfledging juvenile period (Cox et al. 2014, Streby et al. 2014). Past values of juvenile survival were estimated using assumptions that did not allow yearly variation or stochasticity (Ricklefs 1973, Greenberg 1980). First year survival is strongly influenced by the first ~20 days after leaving the nest, termed the postfledge juvenile stage, due to high mortality during this period (Anders and Marshall 2005, Cox et al. 2014).

Management plans and resource selection studies assessing habitat quality using only nest production estimates often assume that both nesting and post-nesting habitat requirements are the same. Radio telemetry studies in the last 15 years have documented shifts in postbreeding adult and postfledge juvenile habitat use. Studies of interior forest breeding Neotropical migrant birds have shown shifts towards dense understory vegetation (e.g. clear cuts and habitat edges) after leaving the nest, with large variation in postfledge survival across landcover types (Anders et al. 1997, Vitz and Rodewald 2011). If habitat requirements are not the same for both periods, survival tradeoffs are likely present between the two stages.

Our goals were to establish baseline measurements of postfledging juvenile survival and habitat selection in Central Missouri forest fragments for Acadian Flycatchers (*Empidonax virescens*) and Ovenbirds (*Seiurus aurocapilla*) and to investigate potential tradeoffs in habitat selection strategies between the nesting and postfledging stages, specifically when considering season-long productivity. We established a three year study of nesting and fledgling Acadian Flycatchers and Ovenbirds in three Central Missouri forest fragments. In this paper we present preliminary results for nest and juvenile survival for the first few years of the study.

## METHODS

During May-August of 2013-2014, we searched for and monitored Ovenbird and Acadian Flycatcher nests at two large mature Oak-Hickory forests in Central Missouri, Baskett Forest Research and Education Area (UTM 15 S 569560 m E 4289600 m N), an 890 ha reserve, and Rudolf Bennitt State Conservation Area (UTM 15 S 547290m E, 4343830m

N), an 1146 ha forest reserve. Additionally, in May-June 2012 we conducted a pilot season with Ovenbirds at Baskett Forest. In 2014, we also searched for and monitored nests at Three Creeks Conservation Area (UTM 15 S 561800 m E, 429820 m N), however, no breeding pairs of Ovenbirds were observed in that smaller fragment. All available Ovenbird and Acadian Flycatcher nests were monitored using survey methods outlined in Martin et al. (1997), with special attention to projecting fledge date.

On the day before projected fledging, 1 or more (rarely 3) fledglings per nest received a radio transmitter (0.3g) weighing less than 3% of the birds body weight; radios were attached with a figure-8 harness (Rappole and Tipton 1991). Individuals were relocated daily or every two days with homing using handheld directional antennas. Behavioral observations and resource use were recorded at each location until radio failure or apparent migration. A Missouri Department of Conservation (MDC) telemetry equipped helicopter was used to scan for lost signals when scheduling allowed (one flight in 2013 and one flight 2014). Habitat characteristics were measured at every nest and at two paired random locations 50m from nest. Vegetation measurements were also collected for each juvenile relocation, one at the used area and two at random locations 50m from the used location.

Nest period survival and daily postfledge juvenile survival were determined with known-fate survival models in a general linear mixed models approach (Shaffer 2004). The nest success model included stage and year as fixed effects. The postfledge survival model included age and day of year as fixed effects. Preliminary results are given here, however one more year of data collection is planned for 2015.

## RESULTS

We monitored 65 active Ovenbird nests (17 in 2012, 18 in 2013, and 30 in 2014) and 151 Acadian Flycatcher nests (53 in 2013 and 98 in 2014). Ovenbird nests were checked every 2.73 ± 0.08 (mean ± Standard Error) days and Acadian Flycatcher nests were checked every 3.77 ± 0.07 days. Brown-headed Cowbirds (*Molothrus ater*) parasitized forty-nine percent of Ovenbird nests and 13.9 percent of Acadian Flycatchers nests. Thirty-five percent of Ovenbird nests and 30 percent of Acadian Flycatcher nests produced at least one fledgling. The cumulative nest survival rate was 0.25 ± 0.09 for Ovenbirds over the 3 years studied. The cumulative nest survival rate was 0.23 ± 0.03 for Acadian Flycatchers over the 2 years studied.

We attached radio transmitters to 40 Ovenbird juveniles from 2012-2014 and 24 Acadian Flycatcher juveniles from 2013-2014. Ovenbirds were relocated every 1.34 ± 0.04 SE days. Acadian Flycatchers were relocated every 1.53 ± 0.07 days. We recorded 23 Ovenbird mortalities; all but two were attributed to predation, all of which occurred before day ten postfledging. The two non-predation mortalities were due to weather/exposure to a strong storm on the day of fledging. We recorded Four Acadian Flycatcher mortalities; three predations took place on the first day out of the nest, and one occurred 26 days out of the nest. Initial estimates of postfledging daily survival using age and day of year as fixed effects show Ovenbird mean cumulative period survival converging to approximately 0.48 ± 0.11 around day ten out of the nest. Our Acadian Flycatcher model estimated much higher survival rates, 0.93 ± 0.12 at day ten and 0.88 ± 0.16 at day 22.

## DISCUSSION

Ovenbird and Acadian Flycatcher period nest success rates were not significantly different during the first few years of our study. These low period survival rates agree with prior work from our study region (Donovan et al. 1995, Hirsch-Jacobson 2011) and studies in other highly fragmented areas (Donovan et al. 1995, Whitehead and Taylor 2002). Our initial postfledging survival estimates describe very different patterns between species. Ovenbird cumulative survival drops very quickly then levels out to just under 0.5 around day ten postfledging. This pattern fits with the pattern seen in other Ovenbird fledging studies (King et al. 2006, Streby and Andersen 2011, Vitz and Rodewald 2011) and fits with the general pattern for high initial mortality that stabilizes to low or no mortality after independence from parental care discussed by Cox et al. (2014) in a review of 45 studies of 35 passerine species. To my knowledge only one other study has generated Acadian Flycatcher postfledging survival curves; Ausprey and Rodewald (2011) reported a period survival rate of 0.720 ± 0.097 for 22 days for postfledging Acadian Flycatchers in mature riparian forest patches in Central Ohio which agrees with the range of our survival estimate.

We will continue data collection in May–July of 2015 and expect to identify resources limiting production in the nesting and postfledging periods for each species and determine if limitations differ between periods. We will also test a wider range of logistic exposure survival models.

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