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Michael E. Cartwright
Arkansas Game and Fish Commission

Stanley E. Trauth
Arkansas State University

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Wood Frog *(Rana sylvatica)* Use of Wildlife Ponds in Northcentral Arkansas

Michael E. Cartwright, Stanley E. Trauth and J. D. Wilhide
Arkansas Game and Fish Commission, P. O. Box 729, Calico Rock, AR 72519 (MEC)
Department of Biological Sciences, Arkansas State University, State University, AR 72467 (SET, JDW)

Abstract

Forty-one wildlife ponds were monitored between 1988 and 1992 for breeding use by wood frogs *(Rana sylvatica)*. Data were collected on egg deposition and pond characteristics. Breeding activity and characteristics were similar to that reported in other portions of the range of the wood frog. We also monitored 15 newly-constructed ponds to determine chronological breeding patterns. Data collected for each site indicated a significant increase ($P \leq 0.05$) in the number of egg masses deposited in ponds as they age from 1-3 years during our study period. Increased chronological use of newly-constructed ponds may be due to localized population increase resulting from greater availability of breeding habitat.

Introduction

The range of the northern wood frog *(Rana sylvatica)* extends over much of northern North America and occurs southward into northern Arkansas where populations are somewhat discontinuous (Black, 1933; Dowling, 1956; Martof, 1970; Conant and Collins, 1991). Most published accounts in Arkansas relate to distributional records for specfic population localities (Black, 1933; Black, 1938; Dowling, 1957; Schuier et al., 1972; Robison and Douglas, 1977; Plummer and Godwin, 1979; Turnipseed, 1980, 1981; Cline and Tumlison, 1985; Trauth et al., 1987, 1995). Limited information is available on the biology and life history of wood frog populations in Arkansas. Pertinent data associated with population status, reproduction, predation, ecological associates and general habitat use are found in Trauth et al. (1989, 1995). Our study was designed to evaluate the use of both well-established and newly-constructed wildlife ponds as wood frog breeding sites.

Materials and Methods

Forty-one wildlife ponds constructed on the Sylamore Ranger District (SRD) of the Ozark/St. Francis National Forest (OSFNF) in north-central Arkansas were monitored for use by wood frogs. Data were collected over a five-year period between 1988 and 1992. All monitored ponds were constructed by the U.S. Forest Service (USFS) and/or the Arkansas Game and Fish Commission (AGFC) in order to provide year round water sources for native wildlife species.

Pond ages during the study ranged from < 1 year to 11 years. Characteristics of the ponds were addressed by Trauth et al. (1995). Wildlife ponds generally were constructed in mid-to-late summer. Immediately following construction, water capacity sufficient for breeding amphibians did not occur until fall and early winter. Ponds were monitored during the wood frog breeding season which occurred during late January through early March of each year (Trauth et al., 1995).

Data collected on or after February 15 of each year of observation were used in the analyses to reduce bias associated with variation in egg deposition periods during the annual breeding seasons. We collected data on number of communal egg mass clusters at pond sites, number of egg masses at each deposition site, water temperature at the egg deposition site (°C), maximum pond depth (cm), egg mass temperature in the center of communal clusters (°C), diameter of communal clusters (cm), and maximum water depth (cm) at the deposition site. Water depth was recorded in cm using a standard meter stick. Water temperature and egg mass temperature were recorded with a standard Celsius thermometer. Water temperature readings were recorded at a depth of 5 cm at a distance of 0.5 m from the water's edge and 10 cm from the outer edge of the egg mass cluster. Egg mass temperatures were recorded at a depth of 5 cm inside the horizontal surface of the central egg mass within a cluster.

Fifteen ponds constructed by the USFS between 1988 and 1991 were evaluated to assess the chronology of use patterns with increasing pond age. Pond ages in the analysis correspond to the number of breeding seasons following construction of the pond. The number of wood frog egg masses observed in these ponds in 1989, 1991 and 1992 provided data for evaluation of changes in breeding use. We used a single factor ANOVA to detect differences in egg mass deposition levels between years.

Results

Thirty seven (90%) of 41 ponds monitored supported breeding populations of wood frogs. Fifty eight (88%) of 66

Table 1. Differences in numbers of wood frog egg masses found in 1-4 year old ponds. NSF = no significant difference.

Pond Age (in years)	N	Average Egg Mass Size	Range
1	10	13.70	(3-31)
2	6	57.83	(20-105)
3	6	141.33	(56-226)
4	5	159.80	(99-206)

In single factor ANOVA tests, NSF between yrs. 3 vs 4; all other year combinations significant ($P < 0.05$).

pond locations had at least one communal egg mass cluster. Five (9%) of the 58 locations also contained a second but smaller secondary communal egg mass cluster. No monitored ponds contained more than two communal clusters. Mean number of egg masses for primary and secondary communal clusters for each pond was 62.14 (range 1-290) and 37.20 (range 15-63), respectively. Generally, only one communal cluster was found in each breeding pond. Maximum water depth for 44 pond locations averaged 74.34 cm (range 8-180 cm). Maximum water depth at primary sites of communal egg deposition at 14 pond locations averaged 23.46 cm (range 15-45 cm). Maximum diameter of primary communal clusters at 31 pond locations averaged 197.68 cm (range 35-570). At nine pond locations water temperature adjacent to primary clusters of egg masses and temperature for an egg mass located in the center of a cluster averaged 9.11° C (range 3.5°-14°) and 10.39° C (range 4.5°-15.4°), respectively. We found significant differences ($P < 0.05$) in the number of egg masses deposited in newly-constructed ponds, 1 - 3 years of age (Table 1). A comparison of egg deposition levels for 3 and 4 year old ponds indicated no significant differences ($P \leq 0.05$). Limited use of newly-constructed ponds was noted during the first breeding season following construction. No egg masses or frogs were observed in two newly-constructed ponds during the first wood frog breeding season following pond construction. Based on deposition of egg masses and general observations, breeding use of wildlife ponds appeared to increase for up to three years following construction.

Discussion

Data collected on wood frog breeding activity and characteristics of egg deposition for northcentral Arkansas are comparable to much of the natural history data collected in the more northern sections of the geographic range of the wood frog (Seale, 1982; Waldman and Ryan, 1983) and also on the southern periphery of the range (Davis and Folkerts, 1986; Camp et al., 1990). Average and maximum water depth at oviposition sites in Arkansas ponds was slightly greater than depths reported in Alabama (Davis and Folkerts, 1986). This may be due to the fact that ponds in Arkansas were slightly larger and classified as permanent whereas ponds in Alabama were classified as shallow and temporary.

Number of egg masses at communal oviposition sites varied considerably ranging up to a maximum of 290. During a three-year study in Colorado and Wyoming, Corn et al. (1989) reported a maximum of 38 egg masses at individual pond sites. Davis and Folkerts (1986) reported a maximum of 147 egg masses at a communal oviposition site in Alabama. In contrast, Seale (1982) reported a maximum of 963 at a site in Pennsylvania. Different selective pressures in different environments may confer differential selective advantages of particular reproductive characteristics (Berven 1982a,b). Lower number of masses in oviposition sites in the Rocky Mountains may result from the presence of very small disjunct relict populations (Hammerson 1982b). Lower number of masses in southern latitudes may relate to warmer climatic conditions, earlier breeding, and a reduced need for accelerated development which favors a larger cluster of masses.

Our data indicate that wood frogs increase breeding use of newly-constructed ponds over time based on number of deposited egg masses. Corn et al (1989) could not identify trends in wood frog populations in the Rocky Mountains based on numbers of deposited egg masses over a three-year period. This may have been due to the fact that small established relict populations were studied in areas where available breeding habitat did not change appreciably which was unlike conditions in our study in Arkansas. Although this variation in breeding use of ponds in Arkansas could be attributed to annual variations in egg deposition due to variability in winter adult survivorship (Seale, 1982), we believe this is not likely in southern latitudes where winters are considered mild compared to winters in the more northern portions of the distribution of the wood frog. In Arkansas it is conceivable that increased use of breeding ponds may be due to localized population increase as newly-constructed ponds create additional breeding habitat.

Long-term assessment will be necessary to identify wood frog population trends. It is likely that current populations, at least on USFS lands, will remain somewhat stable as overall habitat management likely will not change drastically over time. Generally populations are not expected to increase significantly on USFS lands because the rate of establishing new wildlife ponds which serve as additional breeding habitat is expected to decline. This primarily is due to the fact that wildlife ponds are established for white-tailed deer *(Odocoileus virginianus)* and wild turkey *(Meleagris gallopavo)*, and the present number and distribution of ponds appear to be nearing an adequate level for supporting acceptable populations of these species. The fate of wood frog populations is more uncertain on private lands as more and more forest land within the range of the wood frog in northern Arkansas is being cleared for cattle pastures and hay meadows.

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