

Using Skeletochronology to Estimate the Age-size Relationship of Silvery Salamanders, *Ambystoma platineum*, at Kickapoo State Park

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Introduction

The silvery salamander, *Ambystoma platineum*, is an all-female, triploid species known in Illinois from a single site at Kickapoo State Park (KSP) in Vermilion County. Silvery salamanders reproduce gynogenetically, using sperm of another species to trigger embryonic cleavage. No genetic material is normally contributed by the host species. At KSP, silvery salamanders are sexual parasites on the smallmouth salamander, *Ambystoma texanum*. Over the past ten years, the number of breeding smallmouth salamanders has decreased and the pond in which they (and the silvery salamanders) breed has held water only sporadically. Both of these factors cause concern that the silvery salamanders have not been reproducing over the last 5 to 10 years. This study used a drift fence - pitfall trap array and utilized skeletochronology to estimate the age structure of breeding adults and document reproductive success of silvery salamanders at KSP over the last five years.

Materials & Methods

The site consists of two ephemeral ponds bordered by dense to light mesic forest in Middle Fork Woods Nature Preserve. We surrounded both ponds with a drift fence constructed of aluminum window screening. We placed 29 drop-cans at 4.4 m intervals along the inside of the 127 m diameter fence at the large pond and 12 drop-cans at 3.9 m intervals along the inside of the 47 m diameter fence at the small pond. Plywood covers that allowed salamanders to enter, but discouraged raccoons and other predators from meddling with the captives, were constructed and placed over the drop-cans. Drop-cans were checked from 10 February to 16 April, 1998 except 12-16, 21, 23-25, and 28 February; 1-2, 4-5, 7-8, 10-15, 21-22, 24, 26, and 30 March; and 2-3, 5-6, 9-11, 13, and 15 April.

Adult salamanders were identified to species by gross morphological characteristics such as head width, body coloration, and size. Identifications were verified by measuring red blood cell (RBC) area on a subset of the total captures. We recorded the number and size of polyploid (*A. platineum* plus higher ploidy individuals resulting from fertilization with *A. texanum* sperm) adults and the number of *A. maculatum*, and *A. texanum* adults immigrating to both ponds. For polyploids snout to posterior end of vent (SVL) and total length (TL) were measured to the nearest mm with a plastic ruler. Tail injuries were noted and adults of all species were released on the inside of the fence. Maximum depth (to the

nearest cm) of the pond was recorded during each visit at a fixed location, and daily rainfall and average daily air temperature was obtained from the Illinois State Water Survey from the Danville, IL weather station, approximately 3 km west of the study site.

Clipped toes from 80 adult salamanders were stored individually in 10% buffered formalin in a small tube marked with the SVL of the salamander. Each toe was decalcified with several changes of 3% nitric acid over five days, then dehydrated by submersions in 70, 95 and 100% ethanol. Paraplast paraffin was used for wax infiltration and the digits were embedded in the same material. Serial cross sections were made at a thickness of 9 microns. The sections were mounted then stained with Gill' formulation No 2. haematoxylin for 20 min. Age assessment were made by counting the number of growth rings (annuli). No growth ring was counted unless it was continuous around the digit. Regression analysis was used to determine the relationship between annuli number and size

Results

We collected 1155 polyploids, 113 *A. maculatum*, and 58 *A. texanum* from 11 February 1998 to 14 April 1998. Slightly more than one-third of these were intercepted at the small pond fence. Table 1 gives the SVL (snout to vent length) and TL (total length) for polyploid adults from KSP in 1998. Figure 1 gives the frequency distribution of adult polyploid SVL. No modal groups that could be equivalent to age classes are discernible. Only 32 of the 80 salamanders for which skeletochronology slides were prepared for could be read reliably. Age estimates for these 32 salamanders ranged from 2 to 7 years and did not correlate well with SVL (Appendix 1).

Discussion

The lack of correlation between estimated age (number of bone layers) and SVL prevented us from drawing strong conclusions about the age structure of the population and suggests that silvery salamanders exhibit a wide range of growth rates. Variable growth rates may also account for the nearly unimodal SVL distribution. Even though we were unable to use the skeletochronology age estimates to "calibrate" the SVL frequency data, a few valuable insights were gained through this work. First, it appears that at least a few silvery salamanders are able to breed at two years of age. This means that animals which

metamorphose in June may return to breed within as little as 21 months. Second, 6 of 32 animals (19%) were over five years old. Third, there are a surprisingly large number of adults breeding at KSP. Our total, 1155, is almost an order of magnitude greater than the next highest estimate available for this site. The large population size and maximum age estimation of six or seven years suggests that recruitment into this population has been good at least once in the last five years. The unimodality of the SVLs suggests that recruitment has been high several times during that period. This is in general agreement with our records of water levels at KSP that indicate that the pond has held water in three of the last five years.

Table 1. SVL and TL (mm) of immigrating adult polyploids caught in drop-cans at Middle Fork Woods Nature Preserve, Kickapoo State Park, Vermilion County, Illinois in winter/spring 1998.

Mean (n)	Range	SD
SVL: 87.93 (1155)	42.0 - 106.0	6.49
TL: 160.15 (1131*)	79.0 - 200.0	12.42

* SVL and TL totals do not match because some adults had broken tails.

Appendix 1. SVL and age estimate for adult
 polyploids at KSP, winter/spring 1998.

SVL (mm)	Age Estimate (yrs.)
77.08	3
77.93	7
78.69	3
81.01	4
81.4	2
81.49	6
82.32	3
83.13	3
83.9	4
84.76	4
85.61	5
85.95	2
86.69	4
86.82	4
87.45	7
87.59	2
88.13	4
88.36	3
88.38	4
88.93	3
89.81	6
90.06	5
90.2	6
90.95	4
90.98	3
91.02	3
91.7	6
92.45	2
93.95	3
94.9	4
98.13	3
103.83	2

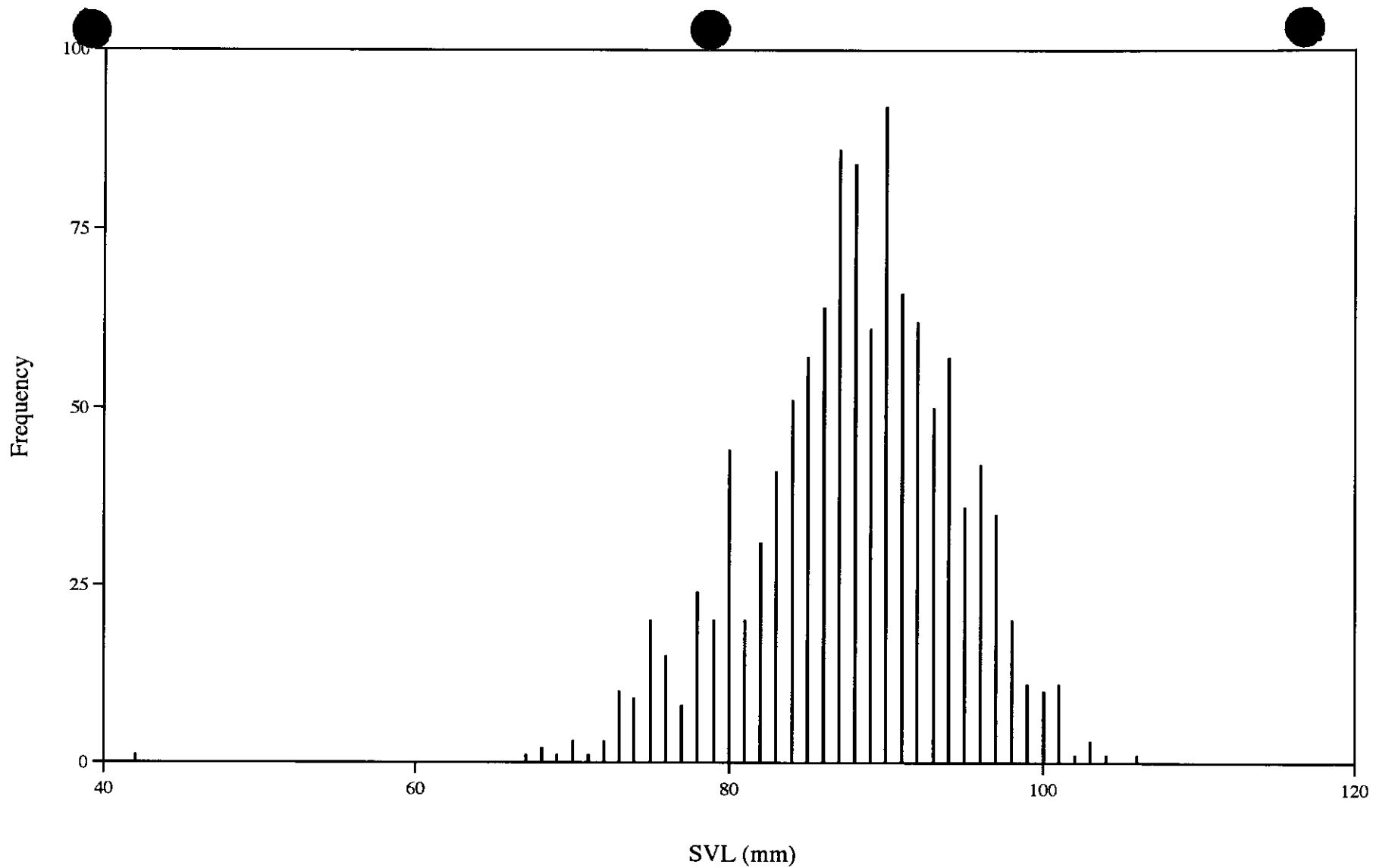


Figure 1. Histogram of adult SVL measurements from individuals captured in 1998 at Kickapoo State Park