Spring Migration of Salamanders

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Three species of ambystomid salamanders *(Ambystoma jeffersonianum, A. maculatum* and *A. tigrinum)* were studied during the spring of 1953 and 1954. Mass breeding migrations of these ambystomids have been reported many times, but quantitative data are lacking. The area under observation is located in Rum Village Woods, St. Joseph County, Indiana. This study was limited to one pond (maximum in spring—2½ feet deep, area 0.3 acres) and its drainage area of 5 acres in a mixed, subclimax forest. Leaves, branches and logs as well as living trees and shrubs were common throughout the pond. In summer one-fourth of the pond supported a dense stand of grass and the remaining portion was covered with *Lemna minor*. The sloping, drainage area was covered in spring with about 2 inches of litter. Many depressions had a foot or more of debris. The subterranean region was perforated by small mammal tunnels and other cavities formed by the massive root system of the trees and shrubs.

Methods

In order to collect the majority of the salamanders before they entered the pond, a fine, wire screen fence (8 to 10 inches high and buried 2 inches in the ground) was built around the pond a few feet (average 10 feet) outside the water edge. All debris was cleared away for 2 feet on each side of the fence. The salamanders were collected along the fence; identified; sexed; then released in the pond. Representative collections in 1953 were weighed, measured and marked (metal tags or toe-clipping).

Discussion and Results

The salamanders traveled both over and under the litter en route to the pond, often stopping for short periods of time in depressions and pools. No eggs were laid in the pools. The fence was a temporary barrier to the salamanders. All of the heavy migrations (Table I) occurred during periods of considerable rain and between 7 p. m. and 2 a. m. The temperature of the forest litter during these active migrations ranged from 42° to 52° F.

It cannot be stated with certainty that all the salamanders came from the five-acre drainage area of the pond because no fence or trap was placed along the drainage divides. However, observations during the heavy migrations revealed no salamanders crossing the divides and there were other suitable ponds in the vicinity which supported equally as many adults during the breeding period. Also, adults were collected in the fall and winter from the runways and cavities in the drainage area. It can be stated with certainty that three species of ambystomids totaling a minimum of 415 individuals in 1953 and 224 in 1954 entered the 0.3 acre pond during the breeding period. Sufficient breeding niches were perhaps available for the three species. The ambystomids fed little or not at all during the actual breeding period. The food supply was plentiful for these top-predators during the period of feeding in the pond following breeding.

There were no fishes in the pond. The numerous, rapidly growing larvae which soon assumed the role of top-predators in the community probably experienced much greater inter- and intraspecies competition than the adults while in the pond. Also, the adults were in direct competition for food and shelter in the terrestrial habitats. Nevertheless, these data supplemented by the work of Manion and Cory (Unpublished dissertation, 1952) indicate that these species of ambystomids are established in the community and that the number of individuals (adults) in the three species remain in about the same ratio. Additional research must be done before the competitive factors can be understood. Likewise, of great interest are the sex ratios (Table I). These data indicate almost a complete absence of male *A. jeffersonianum*, a predominance of male *A. maculatum* and about equal numbers of male and female *A. tigrinum*.

TABLE I

Population Data and Dates of Migration to the Pond

	Ambystoma jeffersonianum		*Ambystoma maculatum*		*Ambystoma tigrinum*	
1953	♂	♀	♂	♀	♂	♀
March 11	0	1	0	0	2	1
March 12	1	36	159	35	8	7
March 14	0	16	85	24	7	3
March 15	0	0	0	1	0	1
March 22	0	2	0	24	1	1
Subtotals	1	55	244	84	18	13
Totals	56		328		31	
Grand Total						415
1954	♂	♀	♂	♀	♂	♀
March 19	0	4	0	0	0	0
March 20	0	0	2	0	0	1
March 24	0	9	127	45	5	8
March 25	0	2	1	1	0	0
March 28	0	0	0	0	1	0
April 10	0	3	6	5	0	4
Subtotals	0	18	136	51	6	13
Totals	18		187		19	
Grand Total						224

The decrease in total number of salamanders in 1954 (Table I) was in part the result of an extremely dry summer. The habitats suitable for feeding and shelter of adults were greatly reduced. This pond, as well as all other ponds in Rum Village Woods, was dry by the latter part of July which may have killed part of the crop of young salamanders; however,

since the majority of ambystomids in this region do not breed the first year, the loss of any 1953 young would not be reflected in the spring migration of 1954.

The weight and length measurements (Table II), were taken before the salamanders entered the water. The females of *A. maculatum* were about 10 mm. longer and one-third heavier than the males. The mean lengths of the male and the female *A. tigrinum* were nearly equal, but due to the very large egg mass, the females were much heavier. All of the females of *A. jeffersonianum* were large; more than 148 mm. in total length; a mean weight of 14.7 grams.

TABLE II

Weight and Length Measurement

Species	Sex	No.	Total Range	Length (mm.) Mean	Weight (gms.) Range	Mean
Ambystoma maculatum	♂	81	135-215	166.6	8.5-28.0	17.5
	♀	11	156-197	178.3	11.4-33.2	24.1
Ambystoma tigrinum	♂	6	205-257	220.8	27.3-51.3	36.5
	♀	4	190-240	220.0	40.9-74.2	57.5
Ambystoma jeffersonianum ...	♀	7	148-175	163.0	11.9-16.6	14.7

Thirty-five salamanders were marked by attaching a small metal tag to the dorsal tail muscles. No individual was recaptured with a tag, but a few indicated that the tag was lost and in the laboratory salamanders lose these tags in about 2 weeks. Toe-clipping seemed adequate for short periods of time, if done with great care; but could not be used for annual records. Regeneration and injuries hindered interpretation.

Using only the clearly marked individuals, the number of days between the date when each individual first entered the pond and the date when first recaptured along the fence after breeding were as follows: male *A. maculatum* one—9, one—10, three—19, six—27, one—33, and one—49 days; female *A. jeffersonianum* one—10 days; female *A. tigrinum*, one—10 days; male *A. tigrinum*, one—10, one—19, three—27, and one—29 days. The stomach contents of these salamanders were not examined. These data, observation of activity, and examination of other salamanders indicated that some individuals of each of the three species found shelter and food in the pond and the immediate vicinity for as long as 49 days. The fence did not confine the salamanders to the pond.

Literature Cited

MANION, J. J., and BROTHER LAWRENCE CORY, F.S.C. 1952. Comparative ecological studies on the amphibians of Cass County, Michigan, and vicinity. (Unpublished dissertation.)