

PREMETAMORPHIC GROWTH OF *RANA CATESBEIANA* IN SOUTHWESTERN OHIO.<sup>1</sup> *Rana catesbeiana* tadpoles used in this study were taken from a lake at the Cincinnati Nature Center in unplatted Clermont County, and from an unnamed lake in T2N, R1E, Sec. 7, SW, NW in Hamilton County. An east-west distance of 52 km separates the two lakes. Tadpoles were collected along the lakeshores with long-handled dip nets, killed immediately in 10% formalin, and later measured, weighed and staged. Total length was measured to 0.1 mm with steel calipers from the tip of the snout to the tip of the tail. Each animal was blotted dry on paper towels and weighed to 0.001 g. The 304 tadpoles studied were staged according to Gosner (1960).

The growth pattern of *R. catesbeiana* tadpoles from July to November was derived from samples of animals hatched

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in the Clermont County lake in 1970. Egg masses were noted at the edge of the lake from 10 June through 15 July. Bi-weekly samples of 20 tadpoles each were taken from 15 July through 8 November. No tadpoles from the 1970 breeding season were found after November, although diligent searches were carried out through April 1971. The tadpoles may have been exterminated during the 1970-1971 winter by anaerobic conditions under the ice, food shortages, or diseases.

Lengths, weights, and stages of the collected tadpoles are given in table 1, and the mean lengths and weights are plotted in figure 1. The mean weights of the bullfrog tadpoles from southwestern Ohio were consistently lighter than the mean weights of similar-age tadpoles taken by seine in central Kentucky by Viparina and Just (1975). This discrepancy may be due in part to the author's use of a shallow water dip net rather than a deeper water seine for collecting specimens.

Ryan (1953) noted that postmeta-

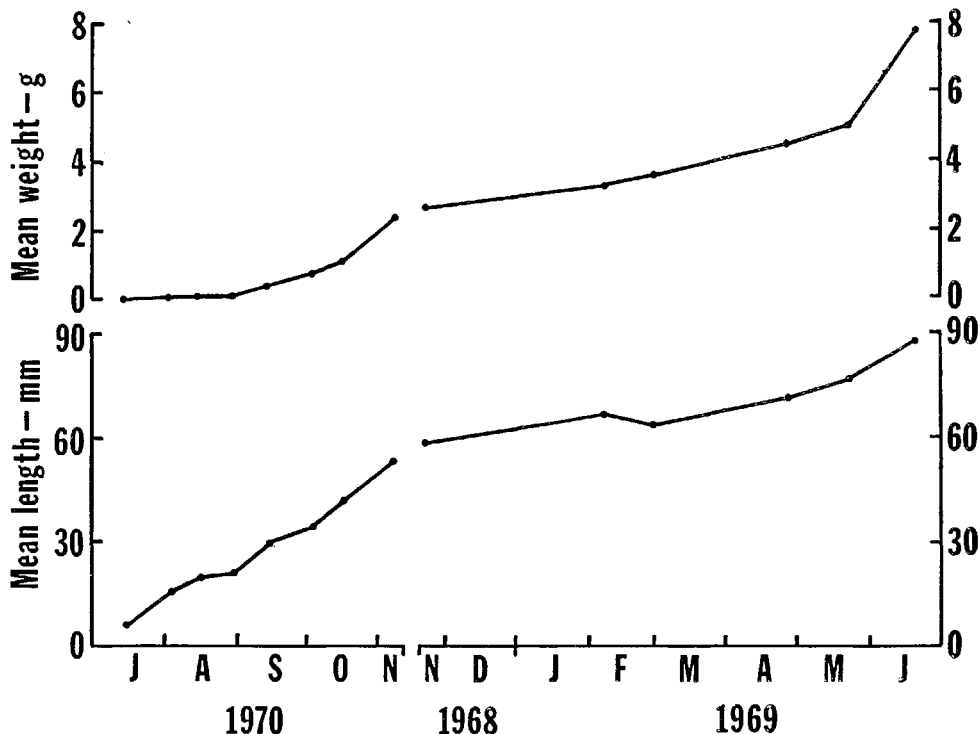


FIGURE 1. Growth patterns derived from 304 *Rana catesbeiana* tadpoles collected from two lakes in southwestern Ohio. Data points for 15 July to 8 Nov 1970 represent mean of 20 tadpoles from Clermont County lake. Data points for 22 Nov 1968 to 21 June 1969 represent mean of 24 tadpoles from a Hamilton County lake.

TABLE 1  
*Growth patterns of Rana catesbeiana tadpoles collected in SW Ohio.*

Collection Date	Length (mm)		Weight (g)		Stage*	
	Mean	Range	Mean	Range	Mean	Range
1970	Clermont County lake (N=20 in each collection)					
7/15	6.1	5.4-11.7	0.003	0.002-0.024	20.6	20-25
8/4	15.4	9.0-30.3	0.074	0.011-0.403	25.0	25-25
8/16	19.6	14.1-31.6	0.117	0.039-0.454	25.2	25-27
8/31	20.9	13.2-28.2	0.139	0.037-0.319	25.8	25-27
9/15	30.0	19.8-43.8	0.422	0.100-0.987	28.2	25-33
10/4	35.1	23.6-74.2	0.805	0.155-5.110	29.3	27-39
10/18	42.0	31.5-66.8	1.153	0.353-4.189	30.5	27-38
11/8	53.5	30.9-92.1	2.337	0.391-8.658	31.9	26-40
1968	Hamilton County lake (N=24 in each collection)					
11/22	58.7	38.6-74.4	2.657	0.543-5.261	28.7	26-33
1969						
2/7	66.7	57.5-75.2	3.300	1.774-4.370	30.1	28-39
2/28	63.5	52.2-88.1	3.586	1.368-8.738	29.3	27-35
4/27	71.0	59.3-86.3	4.477	2.473-8.122	30.5	28-39
5/23	76.5	63.6-92.1	4.991	3.113-11.213	31.4	28-40
6/21	87.8	76.5-106.7	7.684	3.712-12.872	40.3	37-43

\*Stages based on tables of Gosner (1960). Tadpoles hatch at stage 20, begin hindlimb development at stage 26, show forelimbs at stage 42, and complete metamorphosis at stage 46.

morphic *R. catesbeiana* in New York show little growth in length during the winter period. Viparina and Just (1975) reported a decreased winter growth in weight by premetamorphic *R. catesbeiana* in Kentucky. In the present study, premetamorphic growth in length and weight during a 156-day winter period (22 November 1968 to 27 April 1969) was less than during a 54-day autumn period (15 September to 8 November 1970), or a 55-day spring period (27 April to 21 June 1969).

Temperature is probably responsible for seasonal changes in growth, and for differences in the number of seasons *R. catesbeiana* tadpoles need to metamorphose (Brattstrom, 1962). The number of winters a bullfrog remains a tadpole varies from none in southern United States, to one or more in northern United States (Willis et al., 1956). In Kentucky, the majority of bullfrogs spend at least one winter as larvae (Viparina and Just, 1975). In Ohio, *R. catesbeiana* may spend two winters in the larval stage (Walker, 1946), although the data of Bruggers and Jackson (1974) and Walker (1946) suggested that some bullfrogs spend only one winter as tadpoles in northwestern and southeastern Ohio.

The present study indicated that most *R. catesbeiana* transform after a single winter of larval life in southwestern Ohio. Newly metamorphosed animals in stage 46 appeared on shore in June and July, about one year from their date of hatching at stage 20.—STANLEY E. HEDEEN. *Department of Biology, Xavier University, Cincinnati, Ohio 45207.*

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