

KEY TO THE GILLED SALAMANDER LARVAE
AND LARVIFORM ADULTS OF ARKANSAS,
KANSAS, MISSOURI, AND OKLAHOMA

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ABSTRACT.—A key is presented for the identification of free-living aquatic salamander larvae and larviform adults of Arkansas, Kansas, Missouri, and Oklahoma. Multistage characters are presented for species that are difficult to identify because of ontogenetic variation.

Many life history aspects of larval salamanders are unknown due in part to the difficulty of identifying larval salamander species. Regional guides for the identification of larval salamanders do not include Arkansas, Kansas, Missouri, and Oklahoma (Brandon 1964, Ireland 1981), or do not include all species in this area (Ireland 1971). A key to the salamander larvae of the United States and Canada has recently been prepared (Altig and Ireland, in press); however, this key is restricted to larvae 20 mm total length or larger and because it includes all species in the United States and Canada, is more cumbersome to use than a regional key.

This key is not intended to provide a synoptic description of larvae but uses those characters that are useful for species identification. Multistage characters are used only for species that present special difficulty in identification. All species known to occur in this region and recognized by Conant (1965) are included in this key.

KEY

1. Three small toes on front foot *Amphiuma tridactylum*
Four toes on front foot 2
2. Hind limbs or limb buds absent; red markings on head of small individuals in life; tail fin well-developed and transparent in small larvae *Siren intermedia*
Hind limbs or limb buds present; red markings on head absent 3
3. Four toes on hind foot 4
Five toes on hind foot (specimens less than 20 mm total length may not have developed all toes and may not key via the first part of couplet 3) 7
4. Dorsum with dorsolateral light stripes bordered medially and laterally by gray to brown
..... *Necturus maculosus* (part)
Dorsum not striped 5
5. Dorsal fin extends well onto body *Hemidactylium scutatum*
Dorsal fin terminates on tail or at tail-body junction 6
6. Eye line present; head angular; lungs present; to 33 cm total length; belly pigmented and/or spotted
..... *Necturus maculosus* (part)
Eye line absent; 14-17 costal grooves; head rounded; lungless *Eurycea quadridigitata*
7. Grooves separating labial folds from lower jaw extend anterior to bisect the labial folds on each side of the mandibular symphysis 8
Labial folds not bisected by grooves on each side of mandibular symphysis 9
8. Collected in extreme south-central or northeastern Arkansas *Desmognathus fuscus*
Collected from west-central Arkansas south of the Arkansas River Valley to southeastern Oklahoma
..... *Desmognathus brimleyorum*

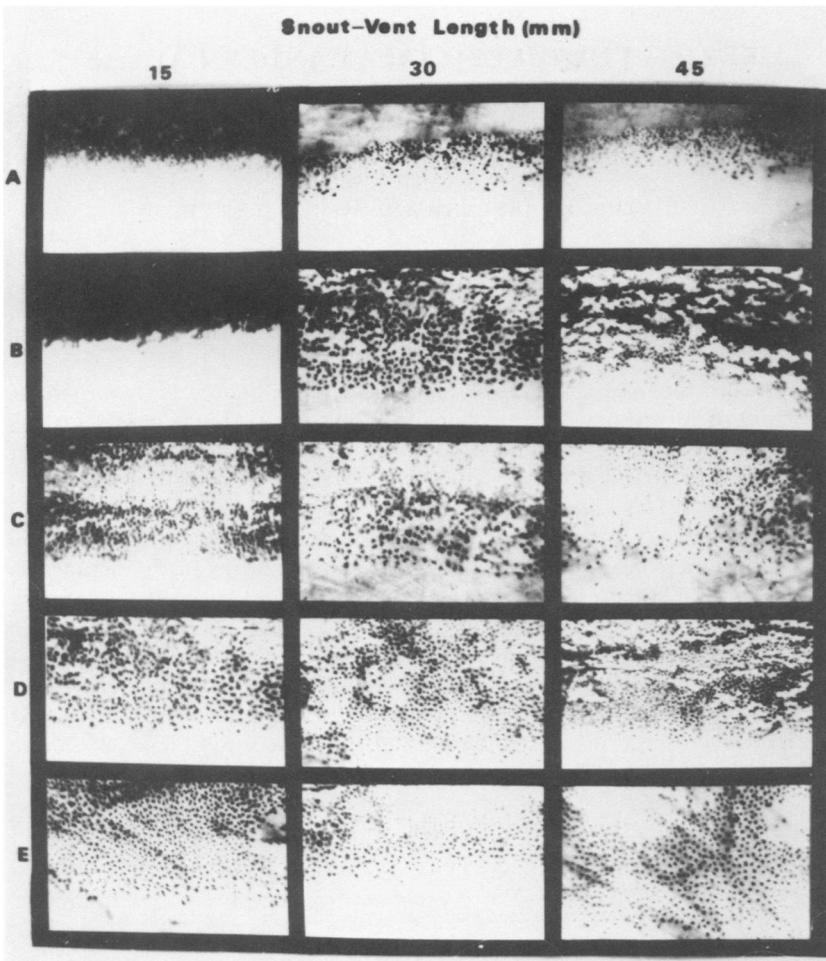


FIG. 1.—Ontogenetic variation in ventrolateral melanophore distribution of: A. *Eurycea multiplicata* B. *E. lucifuga* C. *E. longicauda* D. *E. tynerensis* E. *Typhlotriton spelaeus* (25 x).

- 9. Body robust with loose skin folds; large lateral folds at least in large specimens; 1 gill slit open low on neck; to 68 cm total length *Cryptobranchus alleganiensis*
Not as above 10
- 10. Lungless; tail fin terminates on tail or tail-body junction 11
Lunged; tail fin terminates on body (except during metamorphosis) 15
- 11. Sixteen or more costal grooves 12
Fifteen or fewer costal grooves 14
- 12. Sixteen-19 costal grooves; 4-6 costal folds between adpressed limbs; tail fin high; eyes small, especially in larger larvae; collected from caves or cave-associated waters; ventrolateral pigmentation like Fig. 1 E *Typhlotriton spelaeus*
Not as above 13
- 13. Eighteen-20 (usually 19) costal grooves; venter gray or yellow in life; dorsum striped at low magnification; head slightly wider than neck; tail without dorsal stripe; larger individuals with dorsal body stripe; dorsolateral pigmentation like Fig. 1 A *Eurycea multiplicata*

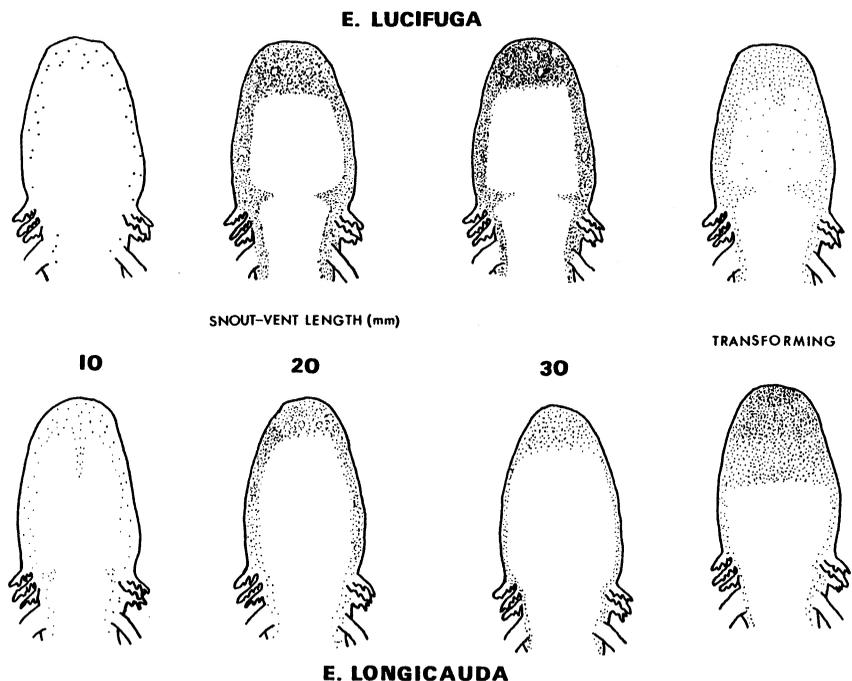


FIG. 2.—Ontogenetic variation in chin pigmentation of larval *Eurycea longicauda* and *E. lucifuga*.

- Nineteen to 21 costal grooves (usually 20; venter cream in life; head not wider than neck; body slender; dorsum reticulated at low magnification; dorsal tail stripe present; dorsolateral pigmentation like Fig. 1 D) *Eurycea tynerensis*
14. Gular pigmentation extends medially immediately in front of first gill, except in smallest individuals (Fig. 2); ventral surface of hind feet pigmented; costal grooves 14-16 (usually 15); dorsolateral pigmentation like Fig. 1 B *Eurycea lucifuga*
 Gular pigmentation not extending medially in front of first gill, except in small individuals where gular pigmentation extends posteriorly from mandibular symphysis (Fig. 2); ventral surface of hind feet not pigmented or lightly pigmented in larger individuals; costal grooves 13-15 (usually 14); dorsolateral pigmentation like Fig. 1 C *Eurycea longicauda*
15. Four gill slits open unless partially metamorphosed; keratinized dental sheath absent; head not significantly wider than body; body slender; skin in larger specimens may be granular
 *Notophthalmus viridescens*
- Three gill slits open unless partially metamorphosed; keratinized dental sheath usually present; head wider than body; head appears large and body chunky; skin always smooth 16
16. Toes flattened with a slight flange along each side; to 20 cm total length
 *Ambystoma tigrinum*
 Toes rounded without flanges; to 6 cm total length 17
17. Ten-11 costal grooves; dark midventral and ventrolateral stripes; body and tail banded dorsally unless neotenic *Ambystoma talpoideum*
 Eleven-15 costal grooves; without dark midventral and ventrolateral bands (small individuals with fully developed hind legs may show a banded pattern) 18
18. Chin and/or throat pigmented *Ambystoma opacum*
 Chin and throat immaculate 19
19. Eleven-13 costal grooves *Ambystoma maculatum*
 Fourteen-15 costal grooves 20
20. Squarish dark dorsal blotches separated by vertical light bars *Ambystoma texanum*
 Numerous irregular poorly defined bilaterally paired cream-yellow (in life) dorsal blotches; collected from the Ozark region *Ambystoma annulatum*

LITERAURE CITED

- ALTIG, R. AND P. H. IRELAND. Key to the free-living salamander larvae and larviform adults of the United States and Canada. *Herpetologica*, in press.
- BRANDON, R. A. 1964. An annotated and illustrated key to multistage larvae of Ohio salamanders. *Ohio J. Sci.*, 64: 252-258.
- CONANT, R. 1975. A field guide to reptiles and amphibians of eastern and central North America. Houghton-Mifflin Co., Boston.
- IRELAND, P. H. 1971. Systematics, reproduction and demography of the salamander, *Eurycea multiplicata* (Cope). The Univ. of Arkansas, Fayetteville, Arkansas.
- . 1981. A key to the aquatic salamander larvae and larviform adults of Virginia. *Catesbeiana*, 1: 3-7.

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