

Early Sexual Maturity and Longevity under Natural Conditions in the Great Plains Narrow-Mouthed Frog

By Henry S. Fitch

In my recent field study of the frog *Gastrophryne olivacea* (Hallowell) on the University of Kansas Natural History Reservation (Fitch, 1956, Univ. Kansas Publ. Mus. Nat. Hist. 8:275-306), I presented data on growth of several marked young living under natural conditions, and on the progressive size increase in successive samples taken in September and October, of the young metamorphosed in late August, 1954. On the basis of the growth rates indicated, I postulated that sexual maturity is most often attained late in the second year of life, or at an age of approximately two years. In the summer of 1955, after the above mentioned paper had gone to press, further evidence of early sexual maturity was obtained.

The sequence of events on which my findings are based began in the summer of 1951, when unusually heavy precipitation in northeastern Kansas created conditions especially favorable for the successful breeding of *Gastrophryne*: the young metamorphosed in great numbers. In both 1952 and 1953, on the other hand, drought conditions prevailed, and breeding success was at low ebb. When conditions again became favorable for breeding, with the advent of heavy rains in the summer of 1954, the population consisted chiefly of three-year-old adults surviving from the 1951 crop.

In a sample in 1954 of 67 adults mostly intercepted enroute to a breeding pond in heavy rain, size was unusually large. The twenty-four females averaged $37.4 \pm .41$ mm., and the 43 males averaged $34.3 \pm .31$ mm. Excluding the six smallest males and the five smallest females, which may have been stunted three-year-olds but probably were younger than the rest of the group, mean sizes were, females $38.2 \pm .32$, males $34.8 \pm .24$, and these sizes correspond well with the average measurements of known three-year-olds, marked at early ages and recaptured.

In 1954, the heavy rains creating conditions favorable for spawning came in the first week of June and again in the first week of August. Great numbers of young from the eggs produced at these times metamorphosed in late June and late August. Young from eggs laid in August were sampled frequently by collecting and measuring large series, in September and October. They made steady and fairly rapid growth, averaging a gain of .14 mm. per day; the last sample before hibernation, collected on October 12 to 17, averaged $22.3 \pm .09$ mm., having gained by 50 per cent over their length of approximately 15 mm. at the time of metamorphosis. June young were not sampled until early August, and by then they averaged 26.5 mm., having gained on the average approximately .25 mm. per day. Their much more rapid early growth, as compared with the August young, probably resulted from the higher mid-summer temperatures under which they developed. However, in the later stages of growth, from early August to early October, their gain was much slower, averaging only .035 mm. per day. Before hibernation these older young averaged 28.1 mm., thus approaching small adult size.

In 1955 heavy rains fell in the second week of May, but temperature was still near the threshold of activity for *Gastrophryne*, and only a few reached the breeding ponds. A rain of 3.15 inches on the night of July 5, 1955, brought forth great breeding choruses. A sample of 19 calling males collected on July 8 averaged $31.7 \pm .25$ mm. From their small size (smallest, 29 mm.), it was obvious that these males were mostly newly matured. Only five of the 19 exceeded 32 mm. in length (33, 33.5, 34, 35, 35) and these were regarded as probably being four-year-old survivors from 1951. The remaining 14 averaged $30.8 \pm .25$. Females are relatively hard to find at the breeding ponds, and none was recorded on this occasion. Obviously these small adults represented the young produced in 1954. Whether both the June and August young or only the former were represented is uncertain.

These males of *Gastrophryne* thus had reached breeding maturity just over twelve months from the time they metamorphosed and thirteen months from their conception, in the case of the June brood, with corresponding figures of ten months and eleven months for the August brood if, as seems probable, these also participated. Ability to complete the life cycle in a single year may be an important survival factor in this diminutive salientian, which is dependent on irregular heavy summer rains for its breeding.

Despite the spawning activity in July 1955, no *Gastrophryne* were found metamorphosing afterward, and few young of the year were seen later in the season. In 1956 breeding at the pond on the Reservation was first noted on July 4. The chief rains in late spring and early summer that year were: 1.78 inches on April 27-28, .79 inches on May 6-7-8, 1.37 inches on May 26-29, 1.46 inches on June 4-5, 1.02 inches on June 15-18, .98 inches on June 29 and 1.09 inches on July 1-3, and 1.32 inches on the morning of July 4, which finally triggered migration to the breeding pond. Throughout the day there was a great chorus, increasing in volume after dark. Twenty males that were measured averaged $33.7 \pm .35$ mm., and for eight females the corresponding figure was $36.1 \pm .88$. These adults were thus intermediate in size between the yearlings making up most of the breeding population in 1955 and the large old adults recorded in 1954. Obviously most of them were two-year-olds.

In June 1956 Mr. W. L. Burger collected several *Gastrophryne* at a hilltop pond, and these included a marked male which had migrated there from the Reservation. This frog was approximately 1500 feet from the study area where it was captured in 1950, 1951 and 1952. Measured after preservation, it was found to be 33 mm. in length, seemingly having made no gain since 1951, but it might have shrunk slightly in the preservative. This frog was of medium-small adult size (32 mm.) when it was first captured on August 23, 1950. It may have been only one year old then, but more probably it was at least two years old. By 1956 it had therefore lived to an age of seven or eight years. Judging from the rapid rate of population turnover that occurs under natural conditions, such advanced age is attained by only an extremely small percentage of individuals.

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