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OBSERVATIONS UPON THE HABITS OF
ASCAPHUS TRUEI STEJNEGER

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Our knowledge of the American representative of the Discoglossidae, *Ascaphus truei* Stejneger, is limited. Since its description by Stejneger in 1897 (*Proc. U.S. Nat. Mus.*, Vol. XXI, No. 1178) but five additional specimens have been recorded. The genotype, evidently a female, was captured at Humptulips, Chehalis County, Washington. In 1912, Van Denburgh, in his "Notes on *Ascaphus*" (*Proc. Cal. Acad. Sci.*, III, 259-64), reported the finding by Slevin of three males on Mount Ranier, Pierce County, Washington, at an elevation of 6,000 feet, and mentioned a fourth specimen, which had been destroyed, also taken on Mount Ranier at 4,861 feet. Van Denburgh's paper includes an excellent account of the skeleton and external appearance of the hitherto undescribed male, and apparently the only notes¹ upon the habits of the species.

¹ Slevin found his specimens about the edge of a pool two or three feet deep in a small, slow-flowing stream. They jumped into the pool when disturbed and then dropped to the bottom where they remained motionless. They died a few hours after their capture, although they were kept in a well-ventilated can.

The fifth specimen is recorded in the "Distributional List of the Amphibians and Reptiles of California" (*Univ. of Cal. Pub. in Zool.*, Vol. 17, No. 10, pp. 127-208) by Grinnell and Camp, from the Siskiyou Mountains, northern California.

During the past four years the Museum of Zoology has received through its Washington collector, Phillips Putnam, nine specimens of this apparently rare Discoglossoid, collected on Mount Rose, the type locality of *Ranodon olympicus*. This summer, with his characteristic generosity to the Museum, Dr. Bryant Walker made possible an expedition to this interesting region, and F. M. Gaige and the writer were sent out to collect specimens and gather data upon the habits of the insect and amphibian faunas.²

Lake Cushman lies at the foot of Mount Rose, in the valley of the north fork of the Skokomish River, by road nine miles northwest of Hood's Canal. The valley is narrow, not more than a mile wide, and on either side the mountains rise abruptly. Below Lake Cushman most of the country has been logged, but the forest boundary begins at the lake and above this there is a dense coniferous forest to the very tops of the mountains, except for occasional small alpine meadows and areas which have been devastated by fire. The mountains are very precipitous, with numerous small, dashing streams, snow-fed and spring-fed, seldom more than a foot or so wide and a few inches deep. Collecting in these creeks was an arduous task; they were very swift, with many falls and miniature rapids, filled with rocks, with great tangles of devil's club and fallen trees along their banks, and the water was extraordinarily cold, usually under 40° even on the warmest days.

It was under the rocks in these little creeks that *Ascaphus* lived. They were found in almost all of the creeks that were

² We were fortunate enough to secure quarters at Lake Cushman with William T. Putnam and his family, to whom we are deeply indebted for their kindly co-operation and hospitality.

worked intensively, from MacTaggart Creek (Mason County), which is between the north and south forks of the Skokomish, eight miles below Lake Cushman, to the creeks on Mount Steel (Jefferson County), twenty-five miles above, and from an elevation of 400 to 4,500 feet.

The apparent rareness of the species may be accounted for by the fact that so little has been known about its habitat. As noted above, the only specimens reported upon have been found in the open. Only six specimens in the series of over a hundred which were acquired this summer were found on the banks of the streams, and only two were farther away from the water. One found them only by working slowly upstream and turning over every movable stone. Usually they either floated down the stream with the débris which was released when the stone under which they were resting was overturned, in which case it took quick action to catch them before they were out of sight, or they made no effort to move, and in the shifting lights and shadows their color so closely resembled a bit of fir bark or the small red stones which were abundant in the streams that they were distinguished with difficulty. Occasionally they were alert and slipped away like a shadow. When placed on land they were awkward and stupid in action and appearance and made little effort to escape. They were solitary; never more than one was found under a single stone and individuals were usually well separated in the stream. There was a decided element of chance to be reckoned with in collecting them, although they were not uncommon. A day's collecting, six to eight hours, seldom yielded more than five; on July 30 twenty-five were found in MacTaggart Creek in not more than three hours' work, while a week later our day's catch from the same creek numbered only four.

Specimens were found only in streams with densely forested banks with one exception; this was a little snow-fed creek on Mount Steel (4,500 feet) that ran through a small alpine meadow.

The banks of Laundry Creek, flowing into Lake Cushman, had been recently logged for some distance and no adults were taken on this cleared slope, though several were captured just above it. A low temperature and cold water are evidently necessary for the welfare of the species, for they died very quickly when placed in the sunlight. By putting fresh ice water on them at short intervals we were able to bring two, collected on August 8, to Michigan alive. They lived in an ice box until September 11, when they were preserved. They refused to eat in captivity. The stomach contents consist almost entirely of unidentifiable beetle elytra and spider fragments.

The appearance of the toads has been well described by Stejneger and Van Denburgh. The elongated gland on the body, mentioned in the type description, is frequently lacking or is broken up into a row of large glandules, and the pupil is a vertical, almost round oval. In live specimens there is a considerable range of color variation which is rather difficult to describe. The following color³ notes were made on a live female: back cacao brown, light spot on head pinkish cinnamon, warts on sides and legs cinnamon buff, sides of head and body dark olive buff, below flesh color which was most distinct on chin and legs, belly densely spotted with mustard yellow. A live male differed from the female in having a citrine drab back and the warts cacao brown; the "tail" above was the color of the body with a dark stripe down either side, beneath darker. The ground color is most commonly old rose or brick red, but it may vary from cream white, through various shades of pink, gray, and brown to almost black. In the lightest and darkest specimens the pattern is fairly well obscured. The glandular ridge or row of glandules on the side is usually dark tipped with golden yellow; the dark spot on the head is almost triangular; the dark line on the wrist is seldom interrupted; the

³ Ridgway's Color Code.

upper surface of the limbs is often set off from the lower by a dark line which merges gradually into the color beneath. The females are usually more brightly colored than the males.

Males are smaller than females and their legs are correspondingly longer. Twenty-five females varied from 33 to 50 mm. in length,⁴ average 42.1+mm.; in this series the tibio-tarsal articulation marked the middle of the eye in three, the front of the eye in eighteen, and the nostril in four. The length to the "tail" of thirty-one males varied from 29 to 40 mm., average 35.4+mm.; the "tails" were from 3 to 9 mm. in length, average 5.4 mm.; the tibio-tarsal articulation reached to the front of the eye in four, to between the eye and the nostril in three, and to the nostril in twenty-four. Breeding males differ from the non-breeding in having an enormously enlarged (two to three times normal size) forearm and inner palmar tubercle; they have a white horny patch on the forearm where the inner palmar tubercle touches it when the arm is folded, and several have the inner palmar tubercle, the inner side of the first two fingers, and the round spot on the forearm covered with black; the underside of the "tail" is greatly congested; the underside of the forearm becomes gray thickly dotted with white.

That the breeding season is greatly prolonged is evidenced by an examination of the specimens. On June 27, July 2, July 8, July 30, August 22, August 24, and early in September, females contained large eggs and males possessed the enlarged forearm and anal region characteristic of the breeding season, while other males and females taken on the same dates are normal. The length of the breeding season is further borne out by the fact that larvae in all stages of development might be taken in the same stream on the same day. Two bunches of eggs were found under large stones in MacTaggart Creek on August 5. They were large

⁴ Measurements were made on specimens before they were preserved.

(capsule 8 mm., yolk 5 mm. in diameter), unpigmented, and laid in a rosary-like string twisted about to form a large circular mass which was attached to the lower surface of the stone. The eggs were brought in and development continued until August 13, when we were unable to get cold water for them and were forced to preserve them. At this time they showed no trace of pigmentation. The strings of eggs were so entangled that it was impossible to count them, but two of the females mentioned above contained thirty-five (sixteen, left side, seventeen, right) and forty-nine (twenty-four, left side, twenty-five, right) respectively.

The tadpoles are most curious, both in habits and appearance. They cling with the mouth to the stones in the creeks. One finds them in the swifter water and quieter pools alike, always with the tail pointing downstream. They may be in plain view or may appear after the stones have been moved. When disturbed they always swim upstream; when the water is so swift that it carries them down they quickly attach themselves to a rock. It is not unusual to find them clinging to rocks in the falls. They do not swim for great distances and were not observed moving about in the water when they had not been disturbed. Occasionally they wriggle about over the surface of the stone to which they are attached. It was sometimes possible to pick them up on a stone and transfer them to a bottle, or if one moved very quietly they could occasionally be induced to attach themselves to a finger, or they would adhere to the stone so firmly that it was difficult to dislodge them without injury. They seldom survived the trip home in a bottle; they would attach themselves to the glass above the water and were usually dead in an hour or so.

The immature *Ascaphus* looks not unlike a large *Bufo* tadpole, but the resemblance is purely superficial. It may be perfectly black or blackish brown thickly speckled with black. The eyes are all black, and there is no trace of iridescence in the coloration. The tail may be either all dark like the body, or obscurely or

strongly spotted with creamy white; the tip may be creamy white with a dark band just behind it, and occasionally these light spots are rose or flame color. The tadpoles with the latter coloration are very conspicuous in the water.

The body is perfectly round; the tail is unusually long (even tadpoles with legs so well developed that they could hop about on land had tails twice as long as the body); the muscular portion of the tail is so wide that the crests are not conspicuous, and the latter are so pigmented that they are not translucent. When the animal is alive the crests are thickly covered with protruding pores which have the appearance of tiny tubercles. Three very striking characters, the dentition, and the positions of the spiraculum and anus, distinguish this tadpole from other known American forms. The mouth is very large and almost round. The upper beak is black edged with white, and there is no horny beak on the lower lip. The teeth are in 2-3 ridges above and 7-8-9-10 below; the upper series bear more than one row of teeth on each ridge. Below the first lower series there are often several ridges which either have no teeth or scattered patches of very small ones. The spiraculum is median, very inconspicuous, and is either just caudad to the lower lip or concealed beneath it. The median anal opening is concealed under the tip of a prominent flap which is attached to the body at its base and to the tail by a thin membrane.

DESCRIPTION OF THE TADPOLE

The following detailed description of the tadpole has been prepared from specimen No. 53892, Museum of Zoology, University of Michigan; collected from Laundry Creek on June 25, 1919.

Length of body once and three-fourths its width and one-half the width of the tail; nostrils protruding, much nearer the eyes than the end of the snout, their distance from the eyes equal to the diameter of the latter; eyes small, on upper surface of the body,

distance between them four-fifths of the distance between the nostrils; spiraculum median, a small slit just below the lower lip, much nearer the insertion of the hind limbs than the end of the snout. Anal opening median, concealed under the tip of a prominent flap which is connected with the body at its base, and folds back over the tail to which it is attached by a thin membrane. Tail three times as long as deep, tip rounded, upper and lower crests only slightly curved, the upper a little wider than the lower and not extending on the body; depth of the muscular part at the base seven-tenths the greatest total depth.

Mouth unusually large; upper beak black, with narrow white vertical line in the center and edged with white; no lower beak, the only trace of it being a tiny curved black patch below the upper beak; many series of minute papillae around the lower lip; conspicuous flaps above and on either side, the latter bordered by a single row of little papillae. Series of labial teeth $1\frac{3}{0}$, occupying the entire width of the lips, the tenth lower series interrupted in the center; upper three ridges with more than one row of teeth, the first ridge several, the second three, the third two; on the lower lip the size of the teeth increases toward the beak.

Lines of muciferous crypts not very distinct. There is a short curving line on either side of the belly; another line starts on the upper lip, curves forward, following the line of the lip, and then turns sharply upward and backward along the lower part of the nose and eye; just back of the eye it is met by another line which curves around the eye and nostril above and meets the corresponding line from the other side on the center of the muzzle; from the juncture of the two lines behind the eye a single wavy line extends backward over the first third of the median line of the muscular portion of the tail, then curves upward and is continued on the upper edge of the muscular portion almost to the tip. Several little groups of the crypts, in no apparent pattern, can be distinguished on the back between the two wavy lines.

Color (in alcohol) of the body grayish white, spotted with black, growing gradually lighter on the sides; belly, deep cream color; tail, cream almost obscured by minute black spots; crests densely spotted with dark with the exception of part of the extreme edge and the tip, which are cream; legs, dark gray above, cream beneath; crypts, dark.

The measurements are as follows: length of body, 15 mm.; length of tail, 30 mm.; width of body, 12 mm.; length of mouth, 10 mm.; width of mouth, 8 mm.; distance between nostrils, 5 mm.; distance between eyes, 4 mm.; diameter of eye, 1 mm.; length of anal flap, 5 mm.; width of anal flap at base, 5 mm.; greatest depth of tail, 10 mm.; depth of muscular portion tail at base, 7 mm.

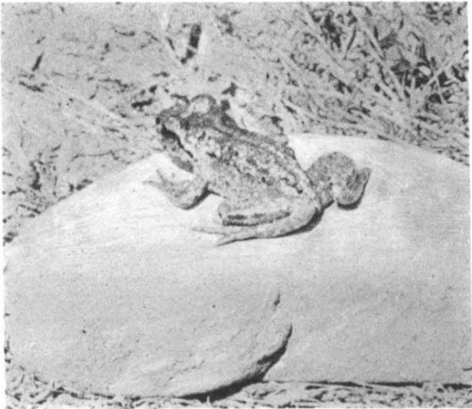
PLATE I

Ascaphus truei STEJNEGER

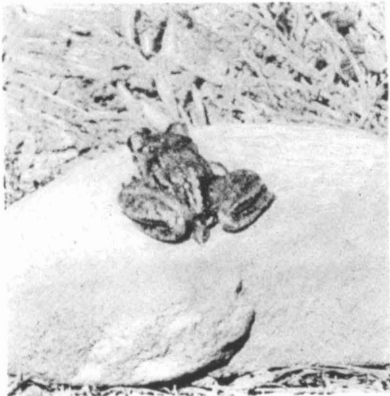
FIGS. 1 and 2.—Adult female.

FIG. 3.—Adult male.

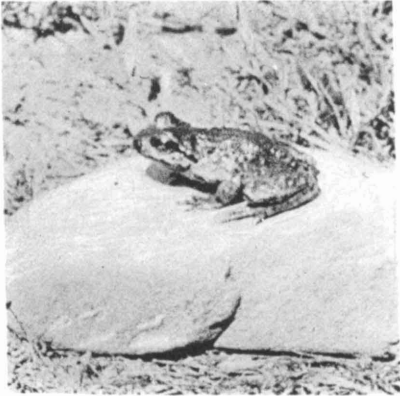
FIG. 4.—Mouth of tadpole, $\times 6$.



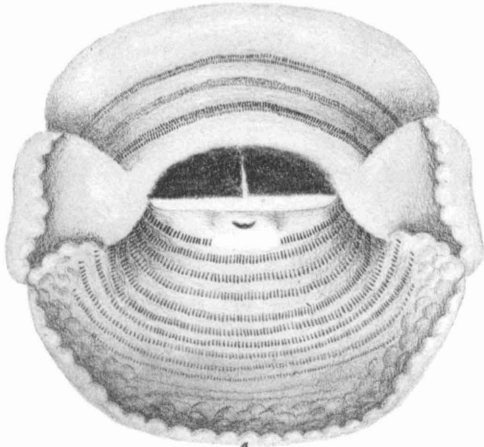
1



3



2



4

