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Observations on the Courtship Behavior of *Ambystoma gracile*

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OBSERVATIONS ON THE COURTSHIP BEHAVIOR OF *AMBYSTOMA GRACILE*.—The only recorded description of the courtship behavior of the Northwestern salamander, *Ambystoma gracile*, is that by Knudsen (1960, Copeia 1960:44–46), who observed breeding between a neotenic female and a metamorphosed male, and two metamorphosed pairs. The first pair courted for about an hour after capture, one of the other pairs was observed “briefly,” and no time interval was given for observations made on the third pair.

According to Knudsen, the male approaches the female from either side of the body or tail and captures the female using his hind legs. He straddles the female’s body and then moves forward “. . . clasping her behind the forelegs with his hind legs” (Knudsen, 1960). Knudsen emphasizes this unusual manner of clasping and does not indicate that the male ever clasps the female pectorally with his forelimbs which is the method of amplexus shown by *A. laterale*, *A. macrodactylum*, and *A. jeffersonianum*. In these three species the other phases of courtship are otherwise quite similar to that of *A. gracile* (Salthe, 1967, Copeia 1967:100–117).

Observations of the courtship behavior of *A. gracile* have been made which differ from those by Knudsen in regard to the method of capture and subsequent clasping of breeding pairs. Because these are basic components of salamander breeding behavior and their description is useful for comparative purposes (Salthe, 1967), these differences are considered important.

Five pairs of courting *A. gracile* were observed in a shallow pond in Stanley Park, Vancouver, B. C., around midnight on 7 March 1968. The pond was 6 to 12 inches deep, with quiet clear water, a mud substratum, and scattered grasses and sedges. Water temperature was 8.2 C. All pairs were clasped when first sighted and for the following 20 to 30 min, but 4 pairs swam into the vegetation and were lost from sight. Each pair was about 4 feet from another, and several unpaired males were about the same distance from each other. On the previous two nights only unpaired males were seen, also several feet apart. Thus there is not a mass courtship behavior as in some *Ambystoma* species (Salthe, 1967).

A breeding pair was captured, placed in a plastic bucket with twigs, and taken to the laboratory where they continued courtship activity for the next 4 days. Temperature of the water was the same as the pond the first day, but gradually rose to 17.0 C. The pair was kept in a darkened room and observed with a 2-cell flashlight covered by 2 layers of red cellophane; they did not appear disturbed by the light.

Throughout the 4 days the pair continually repeated all phases of courtship, and deviations (of which there were few) were easily detected.

As Knudsen (1960) described, the male approaches the female from either side of her body and then straddles her. But the forelimbs not the hindlimbs were used to capture the female. The male then proceeded to clasp the female in the typical pectoral fashion, i.e., with the male's forelimbs clasped around the body of the female directly behind her forelimbs so that his snout was directly over hers. The other courting pairs referred to earlier were clasped in identical fashion. The hindlimbs of the male are usually wrapped around the hindlimbs of the female, but they are sometimes held tightly against her abdomen, immediately anterior to her hindlimbs. This clasping position, using all 4 limbs, has not been described for other *Ambystoma*, and is apparently unique to *A. gracile*. The male continually "pumps" his hind limbs in forward jerking motions which force the hindlimbs of the female forward. At the same time the male vigorously rubs his chin from side to side over the snout of the female, in a manner described for *A. macrodactylum* (Anderson, 1961, Copeia 1961:132-139). No mention of this activity was made by Knudsen, since in his description, the head of the male was far anterior to that of the female owing to his hindlimb clasping. The cloaca of the clasping male was widespread and often rubbed over the dorsum of the female's tail. The tail of the male was lashed from side to side but never vigorously.

Whenever the pair was observed during the first 2 days, they were in pectoral amplexus. Beginning on the 3rd day the male often broke amplexus, but after a few minutes he would again mount the female by seizing her forcefully with his forelimbs and sliding forward until fully clasped. During these brief periods when out of amplexus, the male often quickly nudged or butted the female's flanks or tail with his snout before remounting, but there was no obvious "walk" sequence as seen in *A. macrodactylum* (Anderson, 1961). The female remained receptive the entire time and did not appear to avoid the male's advances. Movement to the surface for air was initiated by the female who pushed off the bottom and swam to the top. When perpendicular or oblique to the surface she swallowed air first, and then the male, who had slipped slightly posterior, would lift his head for air. They never remained near the surface, but quickly submerged.

The actual transfer of the spermatophore was not witnessed, but a spermatophore cap was seen lodged in the female's cloaca on the 3rd day.

During the 4th day the male was removed from the female and put in a separate container with a female *Taricha granulosa*, also in breeding condition. The male quickly nudged the flanks of the *Taricha* several times, and then mounted in the same fashion as he did with the *A. gracile* female. Within the next 20 min the male clasped the female *Taricha* 6 times, but dismounted each

time in about 5 sec. Presumably, skin texture, glandular secretions, or other factors served as appropriate isolating mechanisms, for the *Taricha* was in breeding condition; the style of clasping by *T. granulosa* (Davis and Twitty, 1964, *Copeia* 1964:601-610) is similar to that described here for *A. gracile*.

About one hour after being separated, both the male and female *A. gracile* climbed onto twigs in the containers and remained out of water for 2 days. The female managed to escape before she had deposited eggs; she was visibly swollen and egg laying may have ensued later. Knudsen (1960) pointed out that females laid eggs 4 days after courtship ended. Moreover, egg masses were not seen at the Stanley Park breeding site until 5 days after the courting pairs were first observed.

An explanation for the contrast of this description of *A. gracile* courtship behavior with that by Knudsen (1960) is not readily apparent. Perhaps the differences reflect population adaptations. He studied *A. gracile* where sympatric with *A. macrodactylum*. At Stanley Park *A. macrodactylum* has not been found (the more distantly related *T. granulosa* has been), but it does occur with *A. gracile* about 30 miles from there. The behavior of these species where sympatric and allopatric should be investigated more closely.

Urodele courtship behavior was used by Noble (1931, *Biology of the Amphibia*, p. 384-387) to arrange a phylogenetic scheme in which the *Ambystoma* pattern is considered ancestral to that of the salamandrids and plethodontids. Noble included only those *Ambystoma* species, such as *A. maculatum* and *A. tigrinum*, which do not assume amplexus, but instead indulge in a *Liebesspiel* involving rubbing and butting by both sexes. Anderson (1961) agrees with Noble's hypothesis, and further suggests that those species which assume amplexus, such as *A. macrodactylum*, *A. jeffersonianum* and *A. laterale*, may represent a second *Ambystoma* courtship pattern which was derived from the first.

Comparing the courtship behavior of *A. gracile* to that of other *Ambystoma* leads one to establish a close affinity between it and *A. macrodactylum*, *A. jeffersonianum*, and *A. laterale*. Only these three as well as *A. gracile* exhibit amplexus and chin rubbing by the male. As previously described, however, there is still a tendency for male *A. gracile* to nudge and butt the female, whereas this behavior is not seen in the other three species. This nudging trait is not as obvious in *A. gracile* as in *A. maculatum* or *A. tigrinum*, but it suggests that *A. gracile* may still retain a remnant of the *Liebesspiel* pattern from which its own courtship pattern may be derived (Anderson, 1961).

There is a striking similarity between the courtship pattern of *A. gracile* and *Taricha*. *Taricha* may even use its hind limbs in amplexus (Davis and Twitty, 1964), a behavior which, among the

*Ambystoma*, only *A. gracile* seems to have. Both *Taricha* and *A. gracile* males lash their tails and rub their cloacas over the dorsum of the female while in amplexus. A further study of the subtle details of movements by breeding *A. gracile* between bouts of amplexus and also spermatophore transfer will clarify comparisons with *Taricha*.

In my opinion, the courtship behavior of *A. gracile* supports the hypothesis (Anderson, 1961), that there are two distinct *Ambystoma* courtship patterns and that one (with amplexus) may be derived from the other (with *Liebesspiel*). Moreover, this behavior does not detract from Noble's contention that the *Ambystoma* pattern is ancestral to the salamandrid one. The fact that *A. gracile*, *A. macrodactylum*, and *Taricha* are found only in western North America should not be underrated.

A final remark is pertinent. Based on the report by Knudsen, Salthe (1967) pointed out that the method of capture and clasp-  
ing by *A. gracile*, using the hindlimbs, exactly parallels that of *Notophthalmus*. This comparison no longer holds if based on the present description.

I thank Dr. J. D. McPhail for reading the manuscript.—LAWRENCE E. LICHT, *Department of Zoology, University of British Columbia, Vancouver, B. C., Canada.*

PARASITES OF THE BAJA CALIFORNIA STRIPED WHIP-TAIL, *CNEMIDOPHORUS LABIALIS*.—Parasites of *Cnemidophorus labialis*, a teiid lizard endemic to Baja California, Mexico, were obtained from 60 individuals collected at Camalú during the spring and summer of 1967.

The only ectoparasite was the chigger, *Eutrombicula belkini*, which was usually found in the proximal postfemoral area, cloacal folds, and beneath the scales at the base of the tail.

The oxyurid nematode, *Pharyngodon cnemidophori*, occurred in the stomach and rectum of each lizard examined.

The cestode, *Oochoristica bivitellobata*, was found in the small intestine of 25% of the specimens. Three of the 4 juvenile *C. labialis* (snout-vent, 30–39 mm), 6 of 24 immatures (snout-vent, 40–49 mm), and 7 of 32 adults (snout-vent, 50–63 mm) were parasitized. Differences of infestation are probably not related to sex, since 28.5% of the males and 21.8% of the females were parasitized.

I gratefully acknowledge identifications by Drs. MayBelle Chitwood and Sam Telford, Jr. (nematodes), Richard B. Loomis (mites) and E. A. Widmer (cestodes).—DENNIS L. BOSTIC, *Palomar College, San Marcos, California 92069.*