

## Behavior and sound production by the northwestern salamander *Ambystoma gracile*

LAWRENCE E. LICHT

Department of Biology, York University, Downsview, Toronto, Ontario

Received May 9, 1973

LICHT, L. E. 1973. Behavior and sound production by the northwestern salamander *Ambystoma gracile*.  
Can. J. Zool. 51: 1055-1056.

The northwestern salamander, *Ambystoma gracile*, is capable of sound production. The sound, best imitated by the word 'tic,' is very constant in character, and is made when the salamander is showing either aggressive or defensive behavior.

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La salamandre du nord-ouest *Ambystoma gracile* est capable de produire des sons. Ce son, représenté le plus exactement par le mot "tic," est de caractère très constant; on l'entend lorsque la salamandre manifeste des comportements d'agression ou de défense. [Traduit par le journal]

Recent reports indicate that some urodele amphibians are capable of sound production, a phenomenon not usually associated with salamanders. Maslin (1950) provided a general review of sound production by salamanders, Bogert (1960) reported on sound production by *Dicamptodon ensatus*, and Wyman and Thrall (1972) described two types of sounds made by *Ambystoma maculatum*. Type I sound of *A. maculatum* may play a role in reproductive behavior but the biological significance of type II sound is unknown (Wyman and Thrall 1972).

In this report, I describe sounds made by the northwestern salamander, *Ambystoma gracile*, and observations on the behavior associated with sound production.

### Sound Descriptions

I recorded sounds of *A. gracile* in air (21°C) with a Uher 4000 report L tape recorder and Uher M514 microphone at tape speed of 19 cm per second. Attempts to record sounds by salamanders in water were made with a Uher 4000 report L tape recorder and LC-10 hydrophone. All recordings were analyzed on a Sonagraph (Kay Electric).

Analysis of 57 recordings from 10 individual *A. gracile* salamanders show the sound produced to be very constant in character. The sound is nearly identical with the type II sound of *A. maculatum* (Wyman and Thrall 1972). It is essentially a burst of energy between 400 to 7000 Hz with dominant frequencies from 400 to 2500 Hz. The sound lasts for 0.04 to 0.06 s. A sonagram of the sound is seen in Fig. 1. The sound is low in

intensity and is heard by a human listener to a distance of 1 m. It is best mimicked by the work 'tic.'

### Behavior Associated with Sound Production

The sound described was recorded from post-reproductive male *A. gracile* salamanders, all collected from Stanley Park, Vancouver, British Columbia. Female and juvenile salamanders were not available for observations.

Ten salamanders were housed individually in lid-covered plastic containers (40 × 30 × 15 cm) with a layer of mud on the bottom. When the lid of a container was removed the enclosed individual (7 of the 10 responded) would immediately emit a 'tic' and within the next 60 s repeat the sound 2-4 times. Thereafter, if undisturbed, all individuals remained quiet.

When any of the 10 individuals were touched lightly on the snout with a probe, it would emit a 'tic' and lower its head exposing its toxin-filled paratoid gland to the probe. This defensive posture and sound could be evoked 4-7 times after which the salamander would not respond.

Salamanders produced sounds when kept in groups as well. Each of two plastic containers with lids and mud bottoms were used to hold groups of five male salamanders. Animals had dug burrows in the mud bottom so that usually only two or three animals would be seen on the mud surface. When the lid of the container was removed, usually one or more 'tics' would be heard. As when held individually, after 60 s, animals were quiet.

By 1 month after being grouped, the largest

male in each container had become dominant. When food (live earthworms) was added to the container, the dominant salamander would emit several 'tics' in succession. (Food was added at least 5 min after lid was removed.) Often this individual would approach the other salamanders on the mud surface, nip them on the flanks or limbs, and then move quickly to the earthworm. Within 6 weeks, subordinate salamanders would lower their heads and assume defensive posture immediately after the dominant male made sounds. After 6 weeks, the dominant male in each container could evoke defensive behavior in the others by simply emitting 'tics.' The volume of sound produced by grouped animals was louder than when held individually.

I attempted to record sounds made by a pair of courting salamanders. Neither the male nor female made sounds during the 3 days of underwater courtship behavior described by Licht (1969).

#### *Possible Significance of Sounds*

The sounds emitted by *A. gracile* are clearly associated with a kind of aggressive-defensive behavior. The sound, heard as far as 1 m away by humans would be more intense to animals only inches away. The means by which the sounds are perceived is unknown, but Ferhat-Akat (1939) used training frequencies in learning studies with other *Ambystoma* species which are within the range of the sound produced by *A. gracile*. Moreover, the fact that subordinate grouped males responded by defense posturing when the dominant male made sounds is evidence that the 'tic' is audible and biologically significant.

It may be that *A. gracile* possess some form of territorial behavior, such as maintaining feeding territories, and sound production may function toward defending the territory from intruding competitors.

Another function of the sound may be that of discouraging predators. The paratoid gland and skin of *A. gracile* contain toxic secretions which

make the animal unpalatable to many predators, and the head down butting posture described is part of the defense behavior of *A. gracile* (Brodie and Gibson 1969). Because the sound is produced in conjunction with the defence behavior, it is possible that a predator may learn to associate the sound with the distasteful properties of *A. gracile* and thus leave it alone entirely. Thus emitting a 'tic' while fully exposing the toxic skin glands may have survival value. Important is the fact that *Ambystoma maculatum*, which also makes a similar sound during non-reproductive behavior, is distasteful as well (Barach 1951).

It is unknown whether females or juveniles can produce sounds. Nor is it known whether courting salamanders make sounds if disturbed. The courting pair being recorded were not disturbed by other salamanders.

Upon dissection, I found no vocal apparatus in *A. gracile*, although as indicated by Maslin (1950), a histological approach might be necessary. None was observed in *A. maculatum* dissected by Wyman and Thrall (1972). The similarity of the sounds in both duration and frequency made by the two species suggest they are made in the same manner, probably by epiglottal opening and closing.

- BARACH, J. P. 1951. The value of the skin secretions of the spotted salamander. *Herpetologica*, **7**: 58.
- BOGERT, C. M. 1960. The influence of sound on the behaviour of amphibians and reptiles. In *Animal sound and communication*, Edited by W. E. Lanyon and W. N. Tavolga. Am. Inst. Biol. Sci., Washington, D.C. pp. 137-320.
- BRODIE, E. D., and L. S. GIBSON. 1969. Defensive behaviour and skin glands of the northwestern salamander *Ambystoma gracile*. *Herpetologica*, **25**: 187-194.
- FERHAT-AKAT, S. 1939. Untersuchungen über den Gehörsinn der Amphibien. *Z. Physiol.* **26**: 253-281.
- LICHT, L. E. 1969. Observations on the courtship behaviour of *Ambystoma gracile*. *Herpetologica*, **25**: 49-52.
- MASLIN, T. P. 1950. The production of sound in caudate amphibians. *Univ. of Colorado Studies, Biol. Ser.* **1**: 29-45.
- WYMAN, R. L., and J. H. THRALL. 1972. Sound productions of the spotted salamander, *Ambystoma maculatum*. *Herpetologica*, **28**: 210-212.

PLATE I

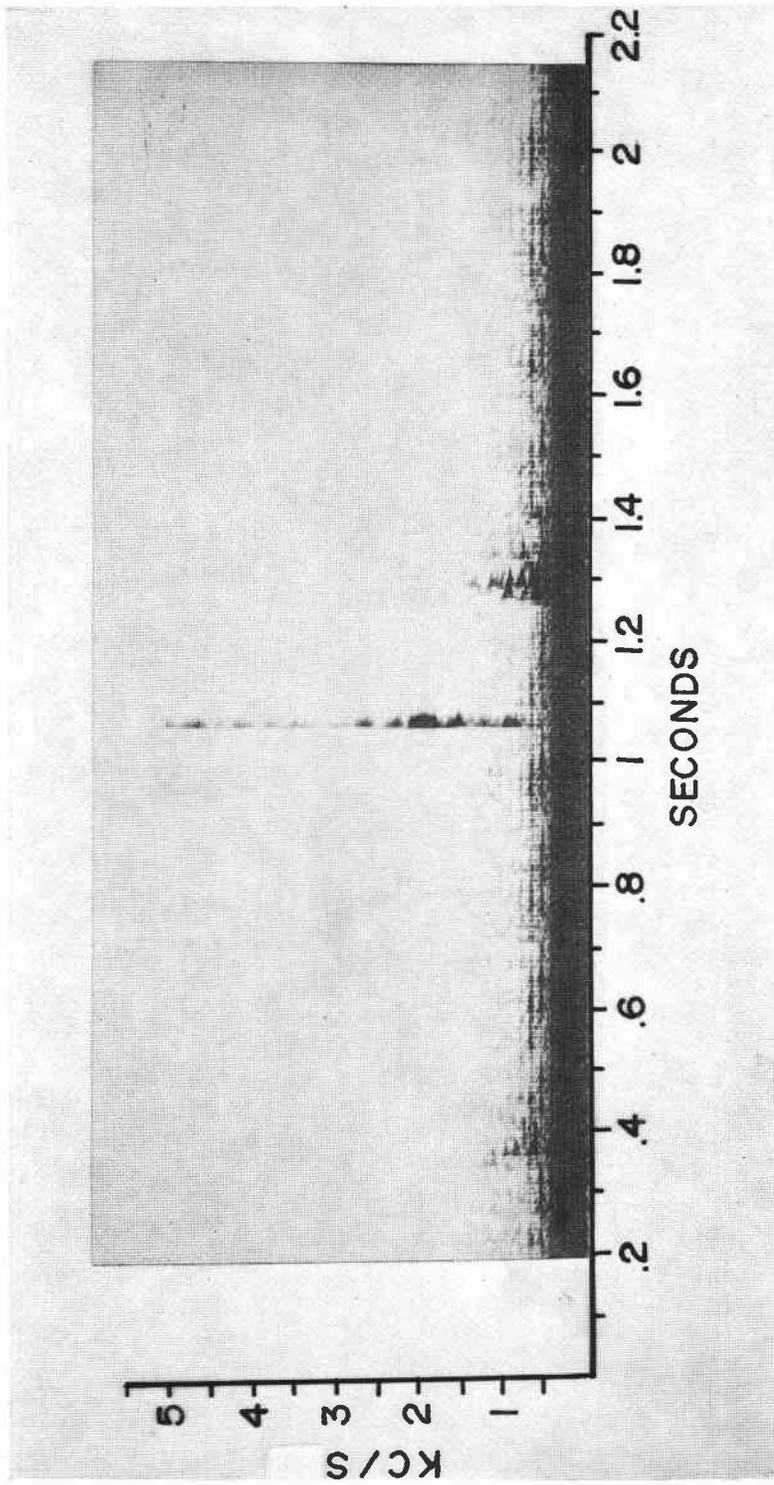


FIG. 1. Sonagram of sound produced in air (21°C) by *Ambystoma gracile*.