Distribution and Mating Call
of the Treefrog, *Hyla chrysoscelis*,
at the Northeastern Edge of its Range

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ABSTRACT: The morphologically identical species of treefrogs, *Hyla chrysoscelis* and *H. versicolor*, differ in the pulse-rate of the mating call, as established by previous workers, but there is much more overlap in the ranges of variation of the two species than has been realized. Individuals of both species may utter calls at from about 25 to 35 pulses per second, so within this range the influence of temperature must be considered in arriving at a specific determination. *Hyla chrysoscelis* is recorded for the first time from Delaware (sympatric with *H. versicolor*) and New Jersey. The northern range limit of this species on the Atlantic Coast is at approximately 39° North latitude, so far as presently known.

Introduction

The first published account of two distinct kinds of mating calls within what had been considered as one species of treefrog (*Hyla versicolor*) was given by Noble and Hassler (1936), but objective characterization of the call-types awaited the development of equipment for recording and analyzing the calls (Blair, 1958). Subsequent studies demonstrated a high degree of genetic incompatibility between frogs of the two call-types (Johnson, 1959, 1963) and showed that female frogs discriminated in favor of their own call-type (Littlejohn et al., 1960). This evidence, together with the sympathy of the two forms in several regions, left no doubt that the two call-types represent distinct species even though, so far as has been determined, they are morphologically indistinguishable. Johnson (1966) provided a key for distinguishing (by voice) between the species and established that *Hyla chrysoscelis* Cope is the proper name for the form of the gray treefrog with the more rapidly-trilled mating call, whereas the older name *Hyla versicolor* Le Conte is appropriate for the species with the slowly-trilled call.

The calls of the two species are readily distinguished when heard together, but for certain identification (especially when only one species is present) the calls must be recorded and the pulse-rate analyzed. Because of this, information on the geographic distributions of the species has accumulated slowly. Maps published by Blair (1958), Johnson (1966) and Ralin (1968) have progressively refined the known distributions. Johnson (1966) showed no record for *H. chrysoscelis* on the Atlantic Coast north of North Carolina; Ralin (1968) included the coastal area as far as the southern part of the Del-Mar-Va peninsula in the range of *chrysoscelis*, but gave no specific records. The purposes of the present note are to record the presence of *Hyla chrysoscelis* in northern Virginia, Delaware and New Jersey; to report an instance of sympatry between *H. chrysoscelis* and *H. versicolor* in Delaware; and to comment on the influence of temperature on the mating calls of these species because this is pertinent to distinguishing between the species. Specimens discussed in this paper are in the collection of the American Museum of Natural History (abbreviated AMNH). I thank Dr. Kenneth R. John for the considerable aid he extended in the field.

Mating Calls

The mating calls of the two species are essentially similar, consisting of trains of pulses up to
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about one second in length. The chief difference is in the rate at which the pulses comprising individual calls are uttered: *chrysoscelis* has a much faster pulse rate than *versicolor*. Johnson (1966) provided a key which characterized *chrysoscelis* as producing 34 to 69 pulses per second, compared with 17 to 35 in *versicolor*. Johnson (1959) and Ralin (1968) published audiospectrograms of the calls of the two species. The calls may be heard on the commercially-available phonograph record “Sounds of North American Frogs” (C. M. Bogert; Folkways Records Album No. FX 6166). *Hyla versicolor* is heard on band 28, and *H. chrysoscelis* on bands 29, 30 and 31. I determined the pulse-rates discussed in this paper by the use of audiospectrograms (Sona-Graph: Kay Electric Co.), determining average pulse-rates from ten calls per individual in most instances.

Among six frogs I recorded in Sussex County, Delaware, the pulse-rates range from 17 to 39 pulses per second; one frog with a rate of 39 would key out to *chrysoscelis*, another at 34 pulses is intermediate and the remaining four (17 to 32.5 pulses per second) would be identified as *versicolor*. In a sample of five frogs recorded in Cape May County, New Jersey, the pulse-rates range from 34 to 46. Here a different situation prevails: one frog with a pulse-rate of 34 falls in the zone of overlap, whereas the remaining four are within the range of *chrysoscelis*.

Adhering strictly to Johnson’s key, one would consider the sample from Delaware to be mixed, but with a predominance of *versicolor*; in contrast, the sample from New Jersey would be considered to be *chrysoscelis* with one individual questionable. When the pulse-rates are plotted against temperature on a scatter diagram, however, quite a different picture emerges. The scatter diagram (Fig. 1) includes not only the samples discussed above but also two records from Lancaster County, Virginia, and a sample of *versicolor* from Bergen County, New Jersey (22 records from a pond in Alpine and one from Tenafly, 1.5 miles away). In most instances the temperature indicated is the body temperature of the frog. When it was not possible to obtain the body temperature, the appropriate environmental temperature (water or air, depending upon the frog’s calling position) was recorded.

All but two of the records for Delaware and Cape May County, New Jersey, (along with the two from Virginia) fall into a single linear regression pattern; only one individual (from Delaware) is *versicolor*. It is evident that several individuals whose pulse-rates fall below the minimum for *chrysoscelis* of 34 given by Johnson differ from those with “typical” rates in my sample only in that they were recorded at cooler temperatures.

The majority of records for Delaware and Cape May County, New Jersey, form a relatively tight and rectilinear regression pattern quite distinct from that for the records of *versicolor* from Bergen County, New Jersey. One specimen from Delaware is clearly *versicolor*, but the other five recorded at the same time and place are *chrysoscelis*, low pulse-rates notwithstanding. One individual in the Cape May sample, recorded at a body temperature of 24.6°C had a pulse-rate (38.5) well below that of other *chrysoscelis* at similar temperatures but still markedly above any recorded (or expected) in *versicolor*. It is possible that this individual is