

An Interesting Aquatic Insect Project:

Holomorphology, Life History, Delayed
Development and Mate Searching Behavior
of *Isogenoides* (Plecoptera: Perlodidae)

John Sandberg

Outline

1. **Holomorphology** = all the morphological characters of an entire life cycle
2. **Life history** of *I. zionensis* in San Miguel River, CO
3. **Delayed egg development** and hatching in *I. zionensis* from San Miguel River, CO
4. Vibrational communication (**Drumming**): intersexual mate-finding behavior

Stonefly Adult Female



Isogenoides Taxonomic Questions

Western Species

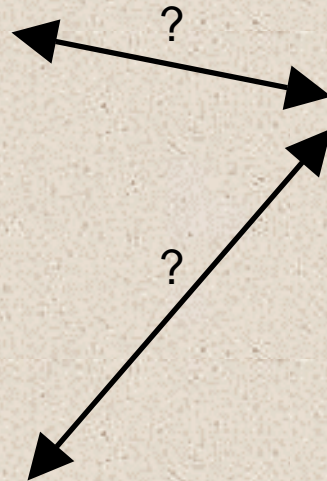
- *I. colubrinus*
- *I. elongatus*
- *I. zionensis*

I. hudsonicus

Eastern Species

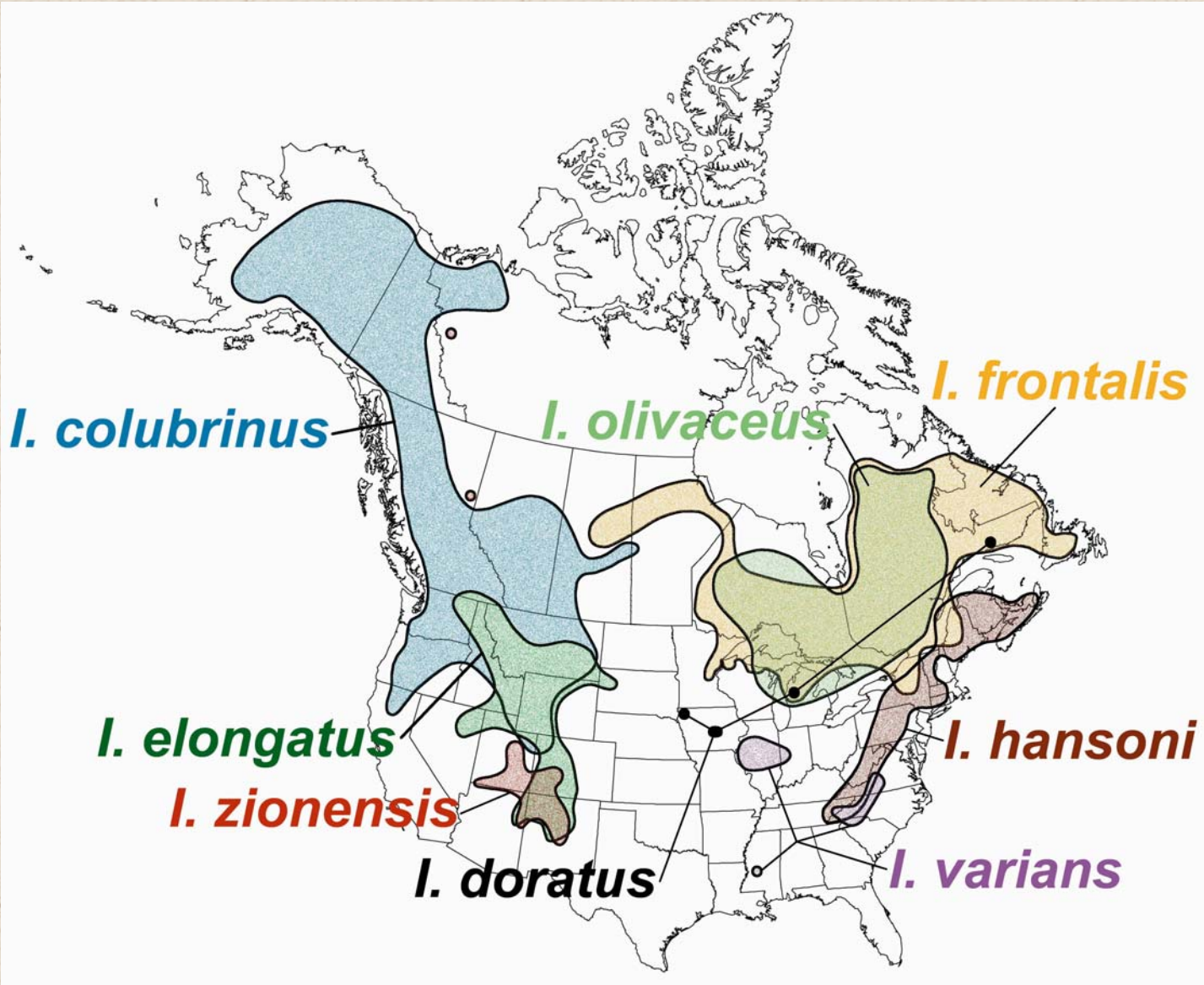
- *I. doratus*
- *I. frontalis*
- *I. hansonii*
- *I. olivaceus*
- *I. varians*

I. krumholzi



?

Species Distribution



Methods

Quartz Creek, CO



Field Rearing

Laboratory Rearing



Egg Incubation

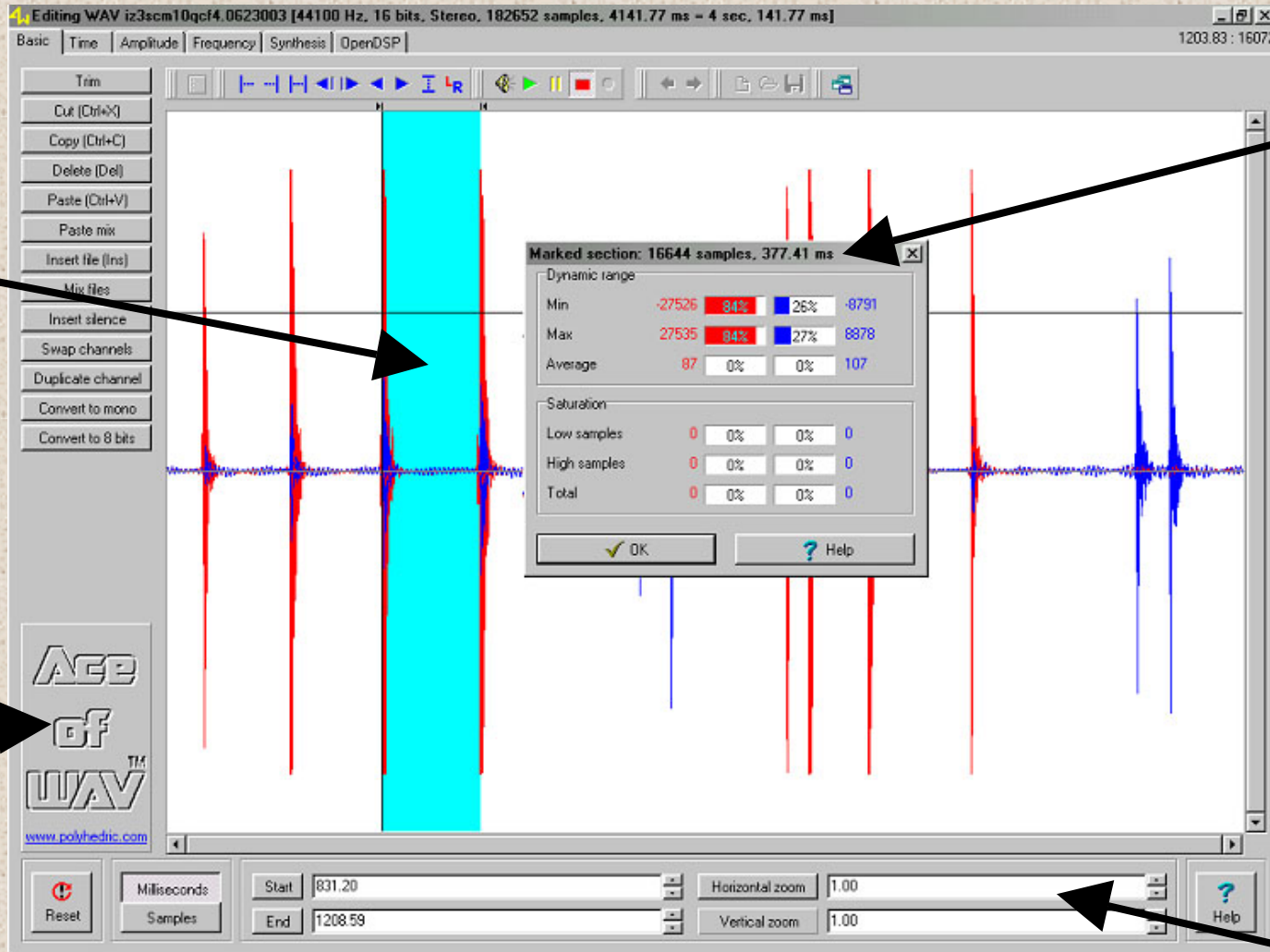


Methods



Drumming Recording Chamber

Methods



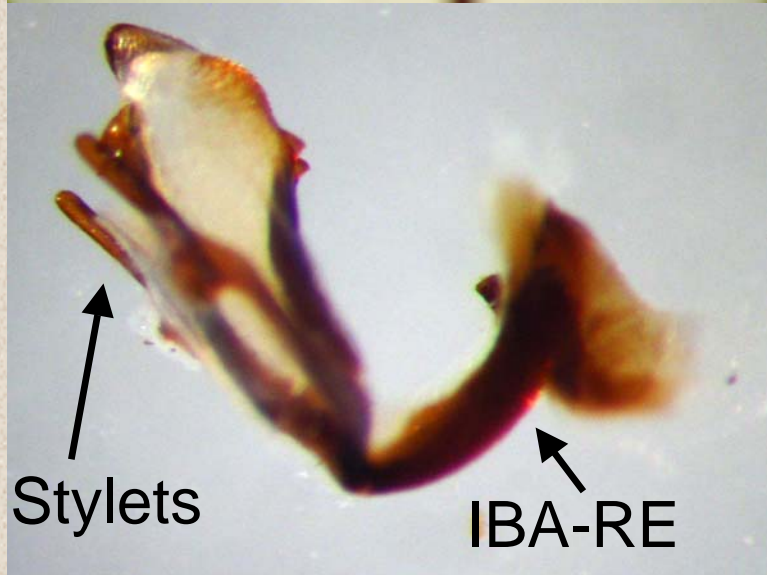
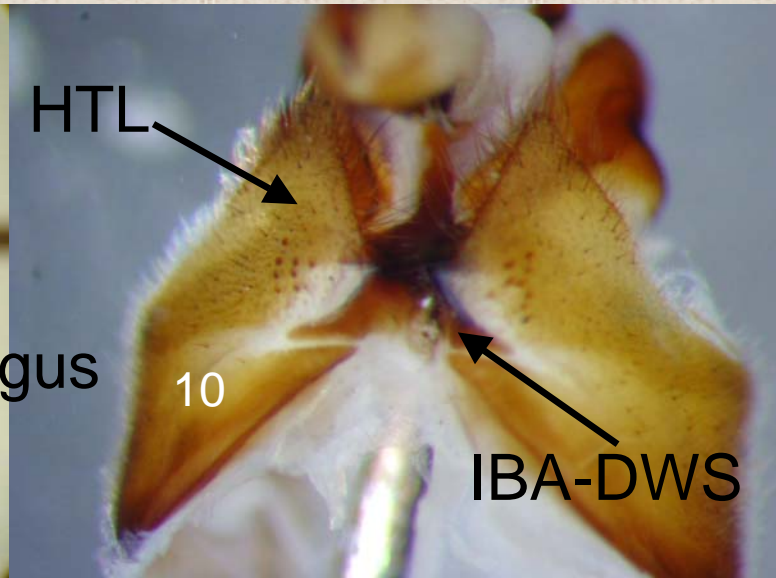
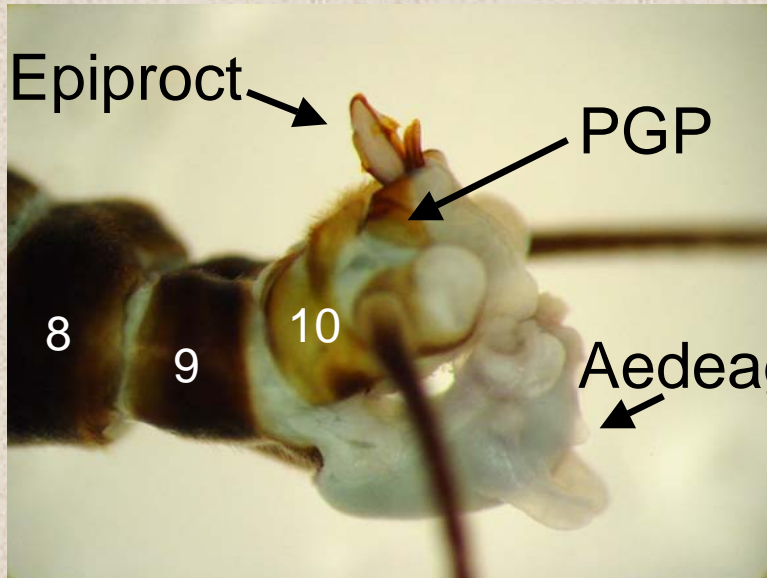
Measure

Interval (ms)

Zoom

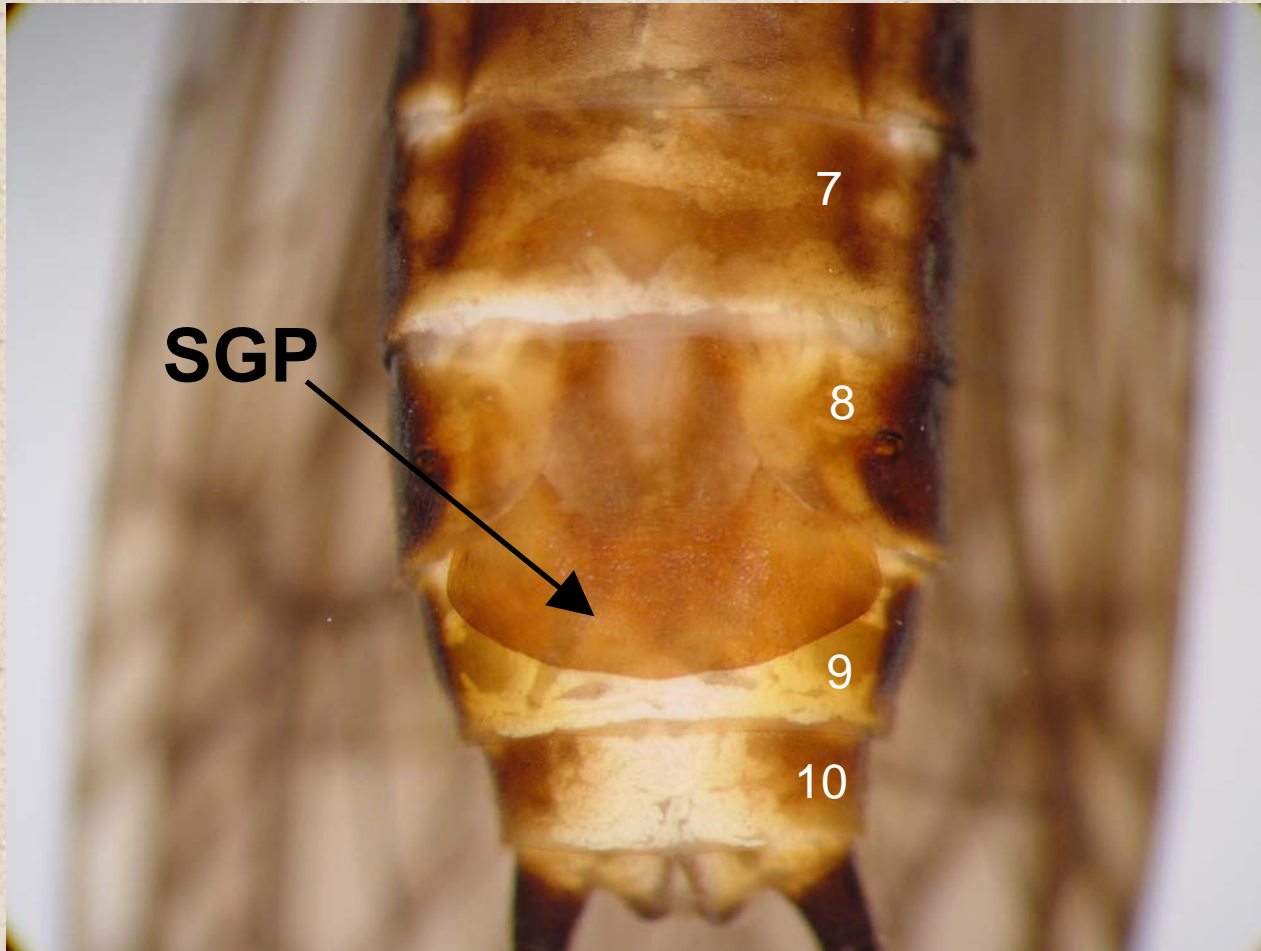
Drumming Signal Analysis

Adult Male Characters



Female Adult Characters

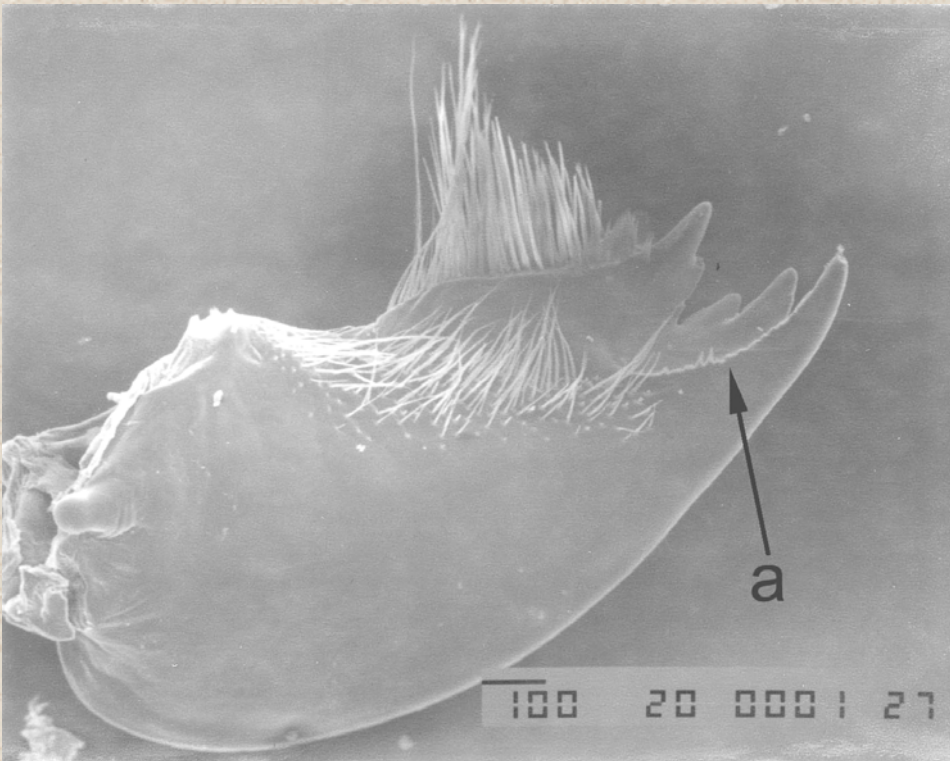
Subgenital Plate



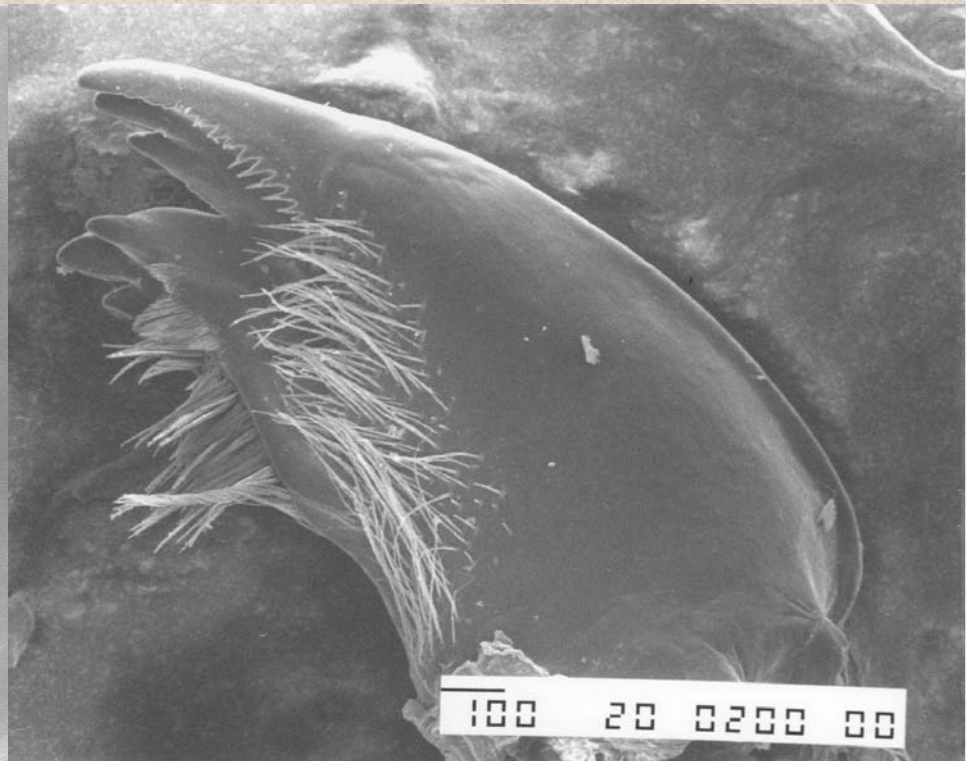
I. varians

Nymph Characters

Right Mandibles

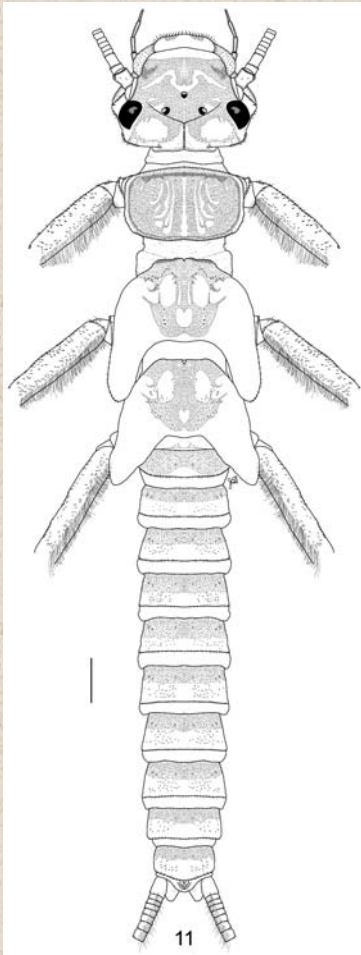


I. colubrinus

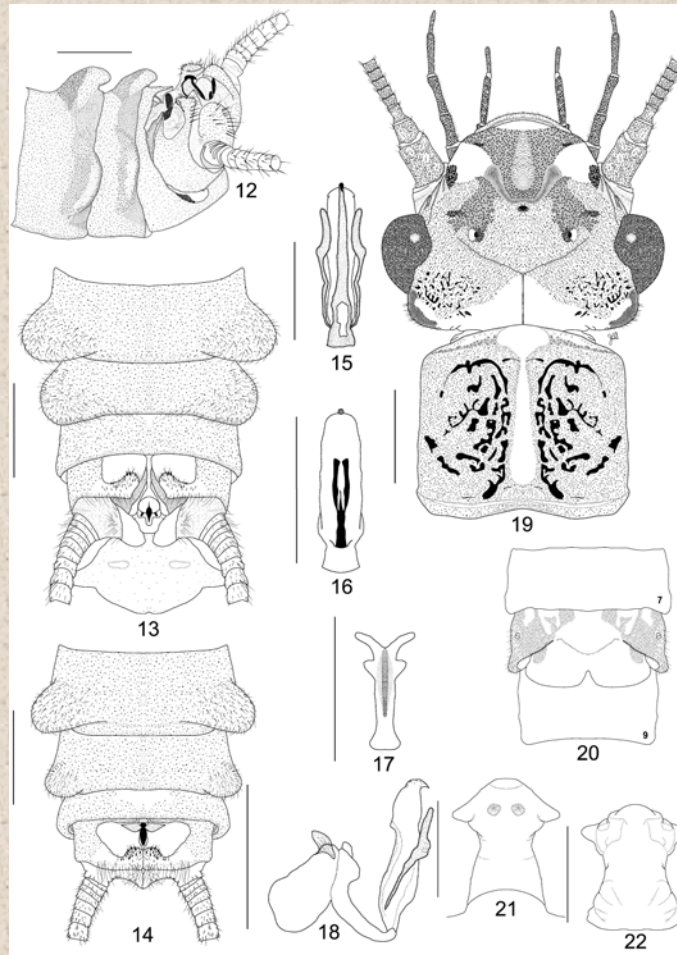


I. elongatus

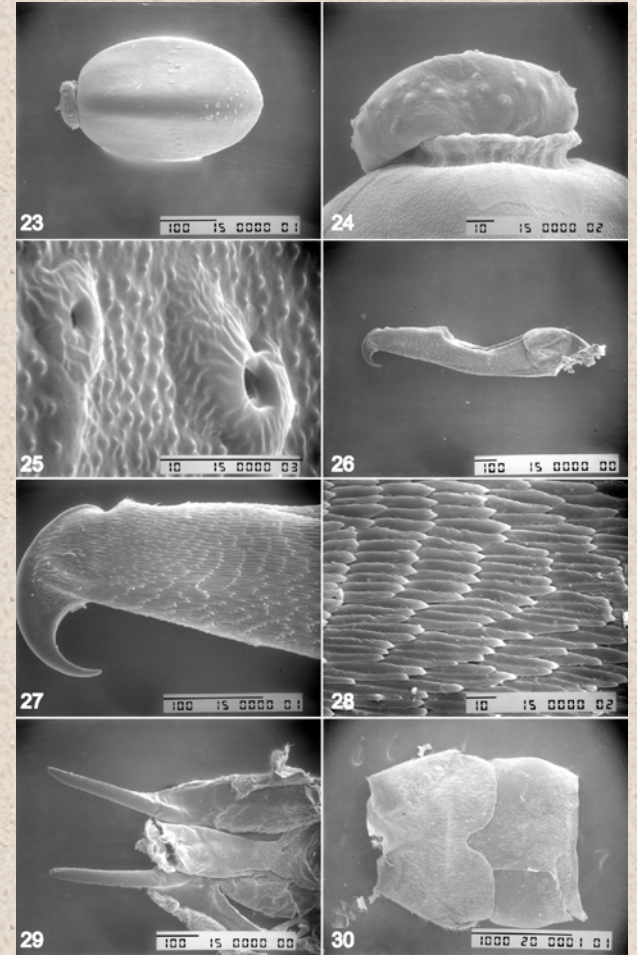
I. colubrinus Plates & Keys



Nymph

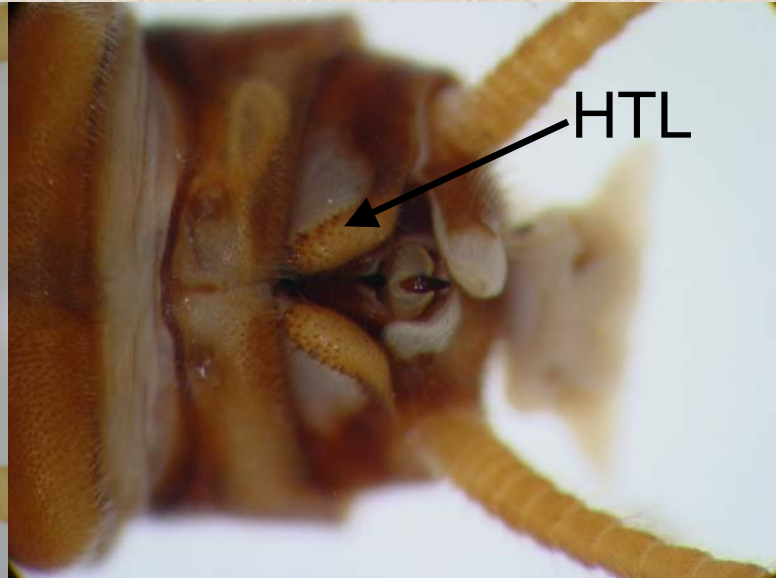
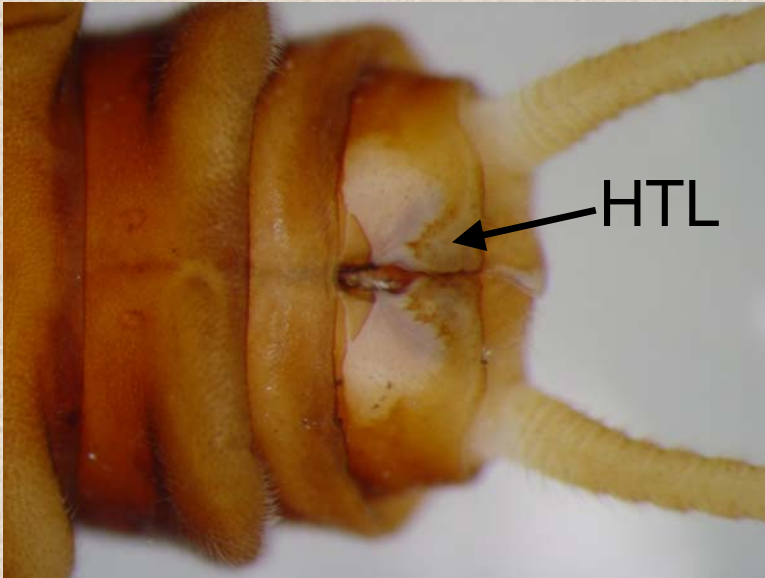


Adult M & F



Egg, M & F

I. colubrinus & *I. frontalis* males

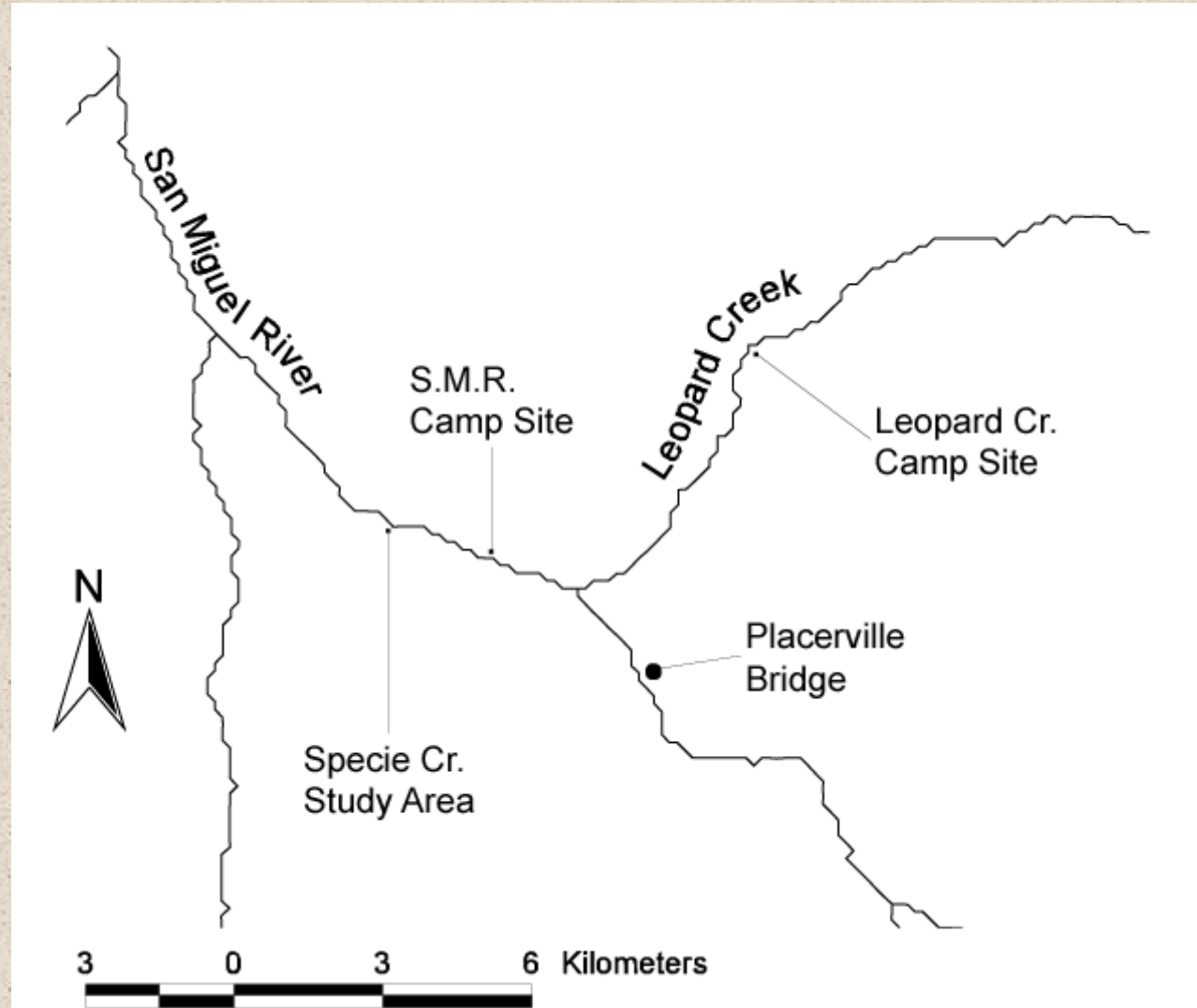


I. zionensis Study Area

Colorado



San Miguel Co.

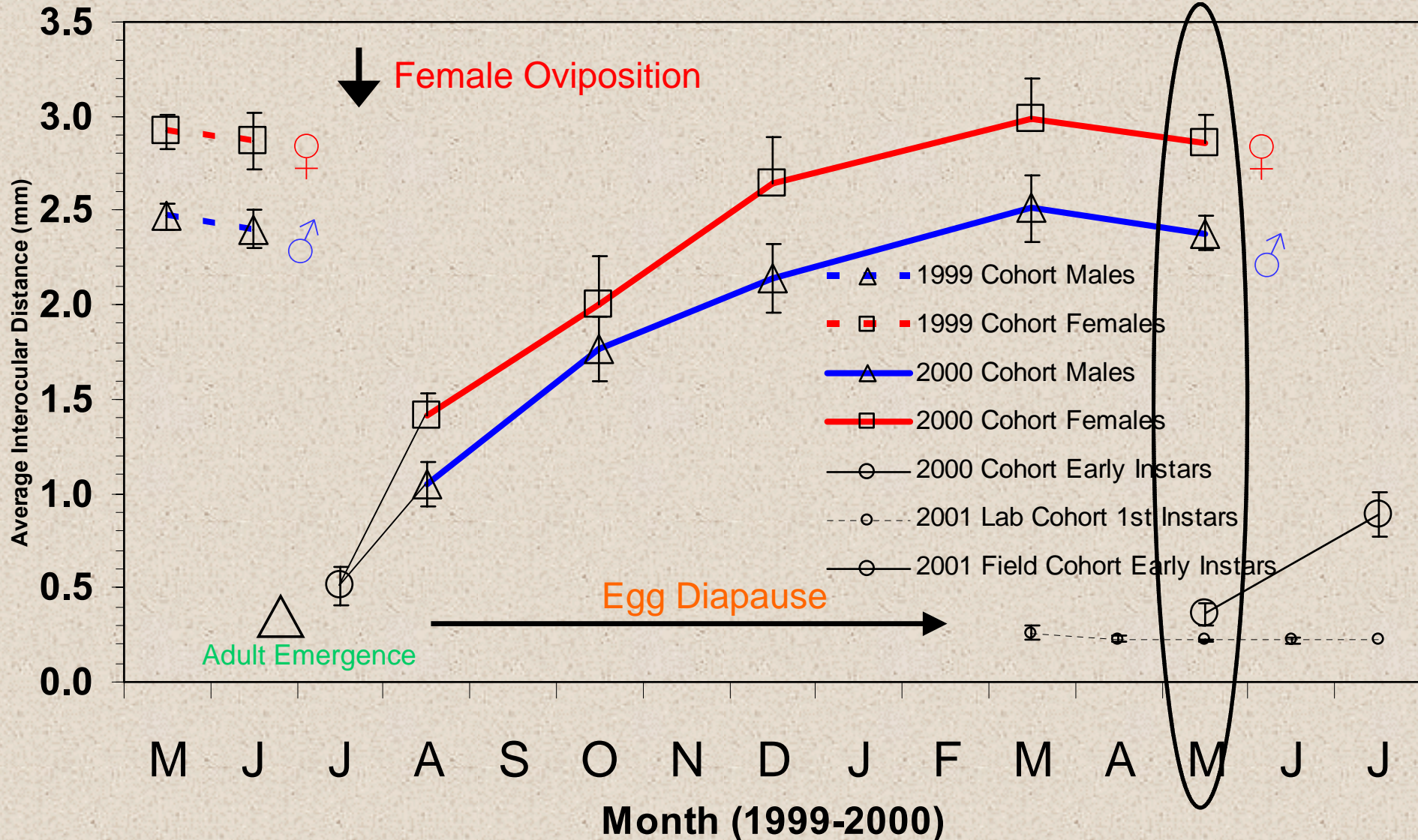


San Miguel River



Isogenoides zionensis

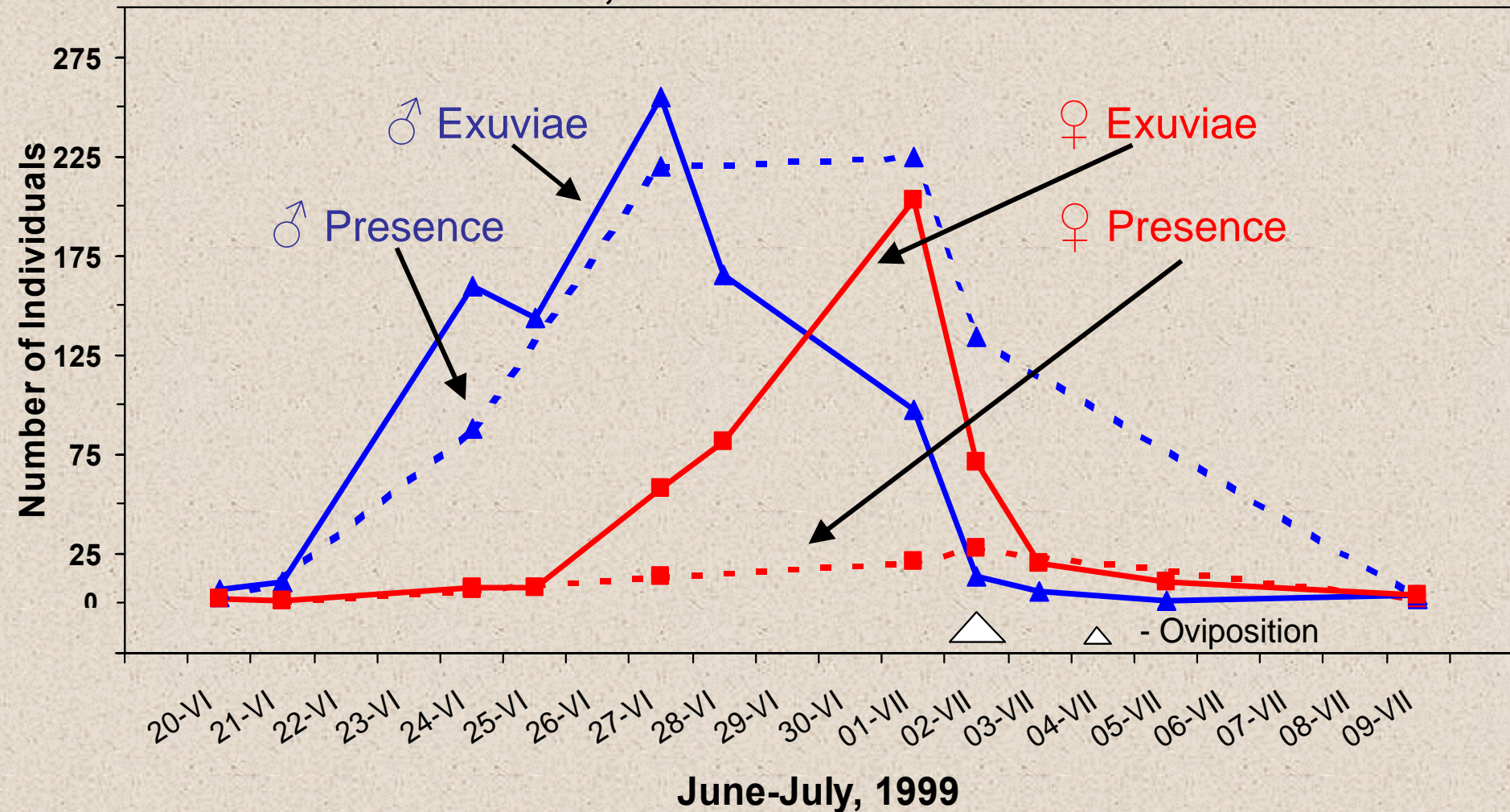
Seasonal Nymphal Growth (N=851)



Adult Emergence & Presence

I. zionensis

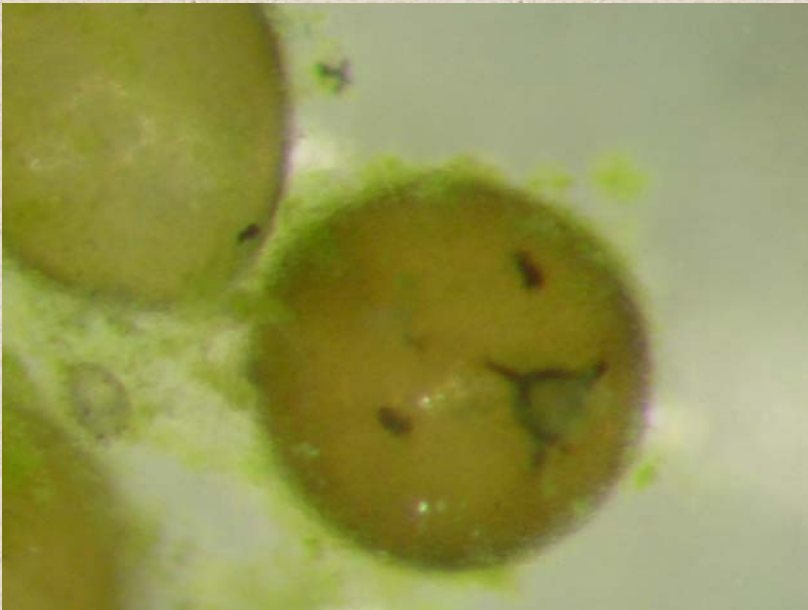
N=1331 exuviae; Male:Female exuviae=1.8:1



Adult Emergence
Resting Habitat &
Oviposition
Movies

Egg Incubation & Hatching

Isogenoides zionensis

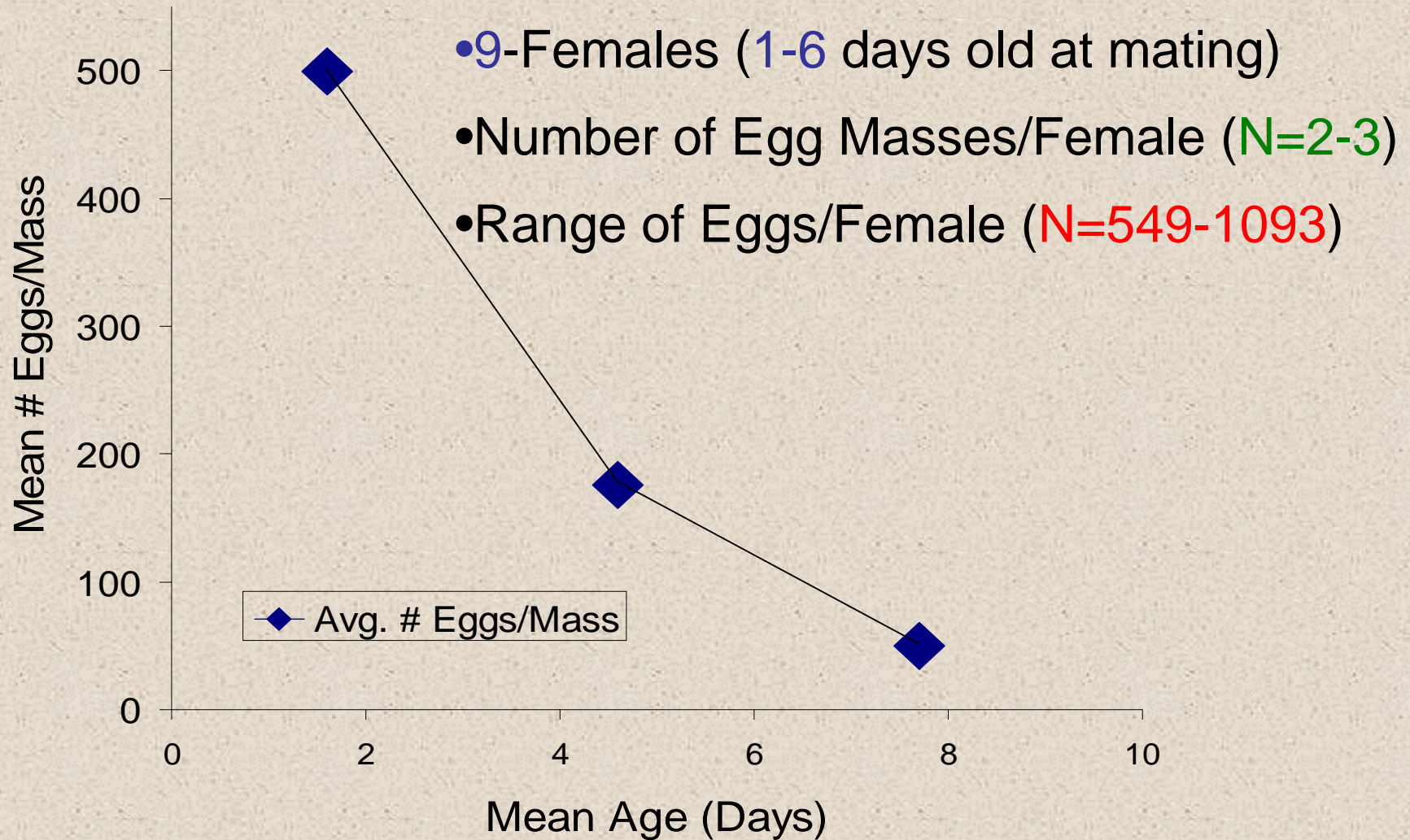


Eye spots

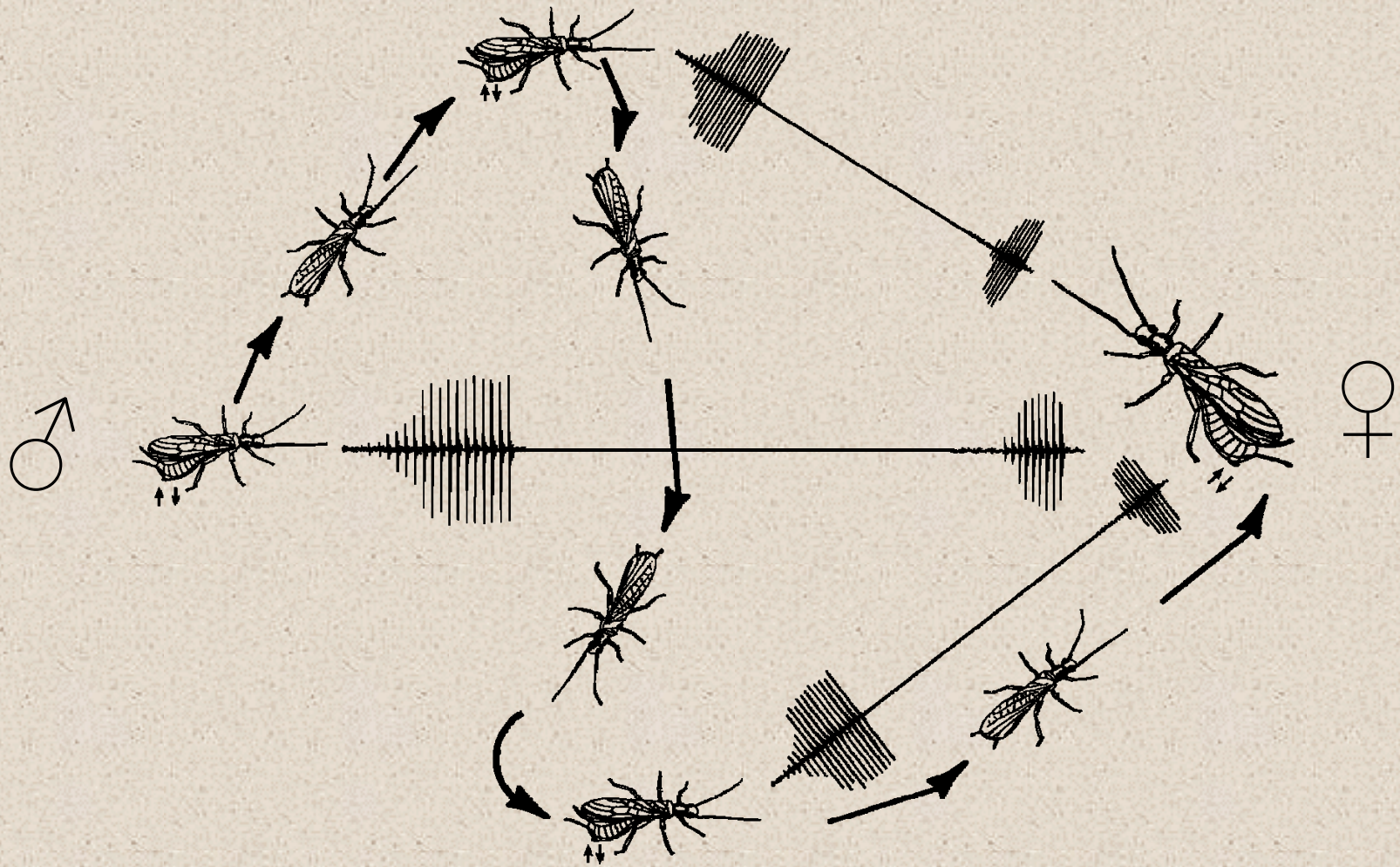


First Instar Hatching

Egg Mass Production & Fecundity



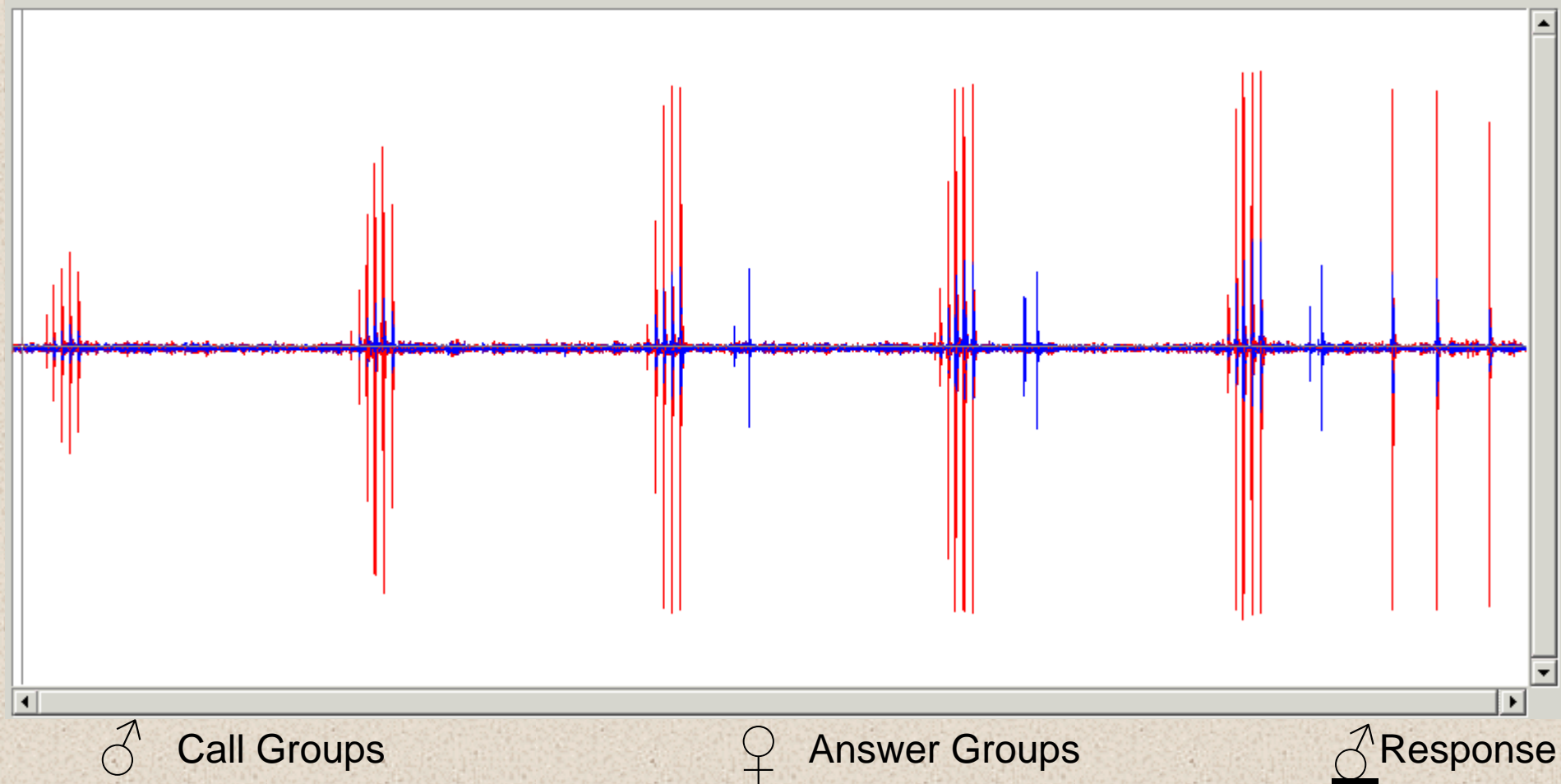
Vibrational Communication & Search Behavior



Isogenoides colubrinus CO (2002)

- Grouped Call, Interspersed Answer
 - Male Call Beats/Group: (3-7) [5]
 - Male Call Interval: (65.0 ± 8.3 msec)

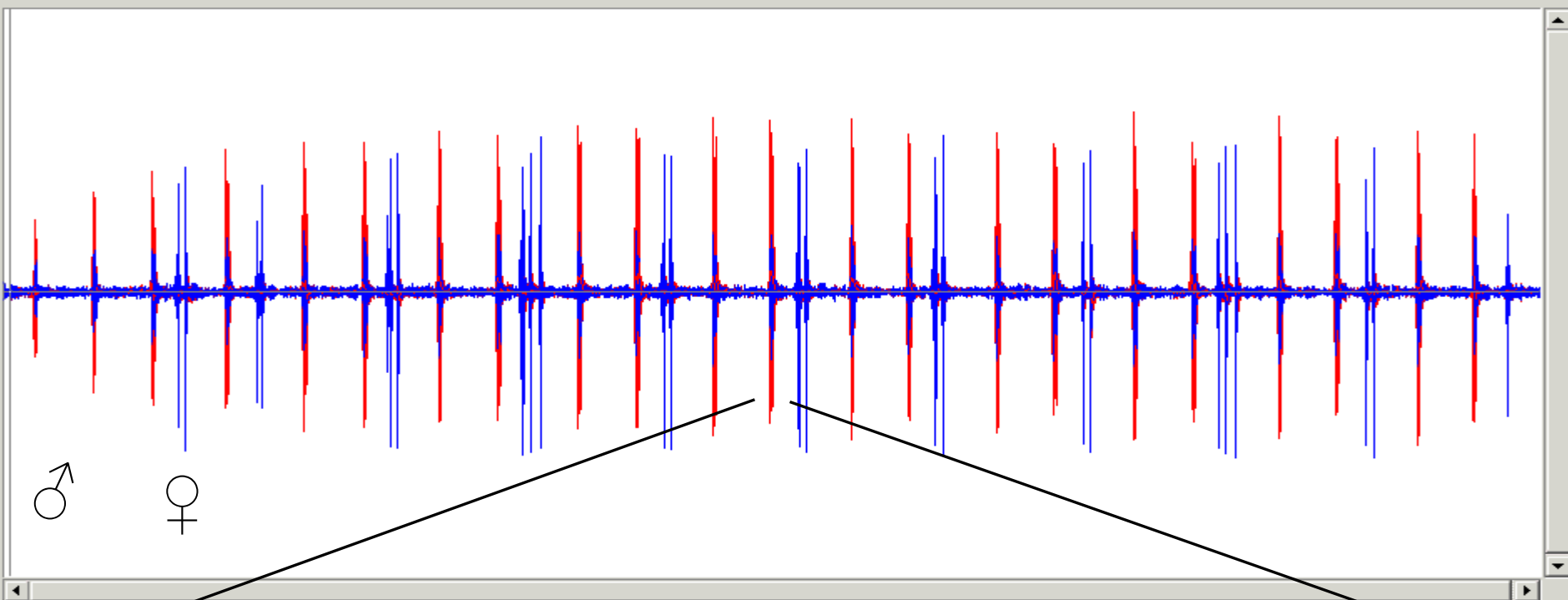
5 sec



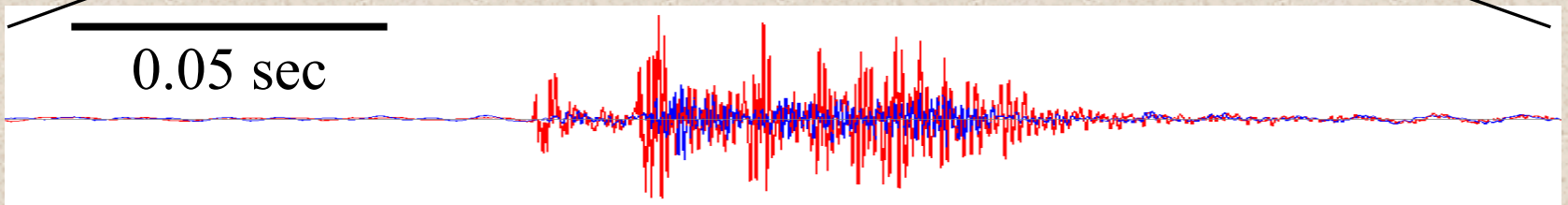
Isogenoides doratus - MI (1999)

- Grouped Call, Interspersed Answer
- Male Call (1-5) beats [3]/group
- Male Interval (16.7 ± 3.0 msec)

5 sec



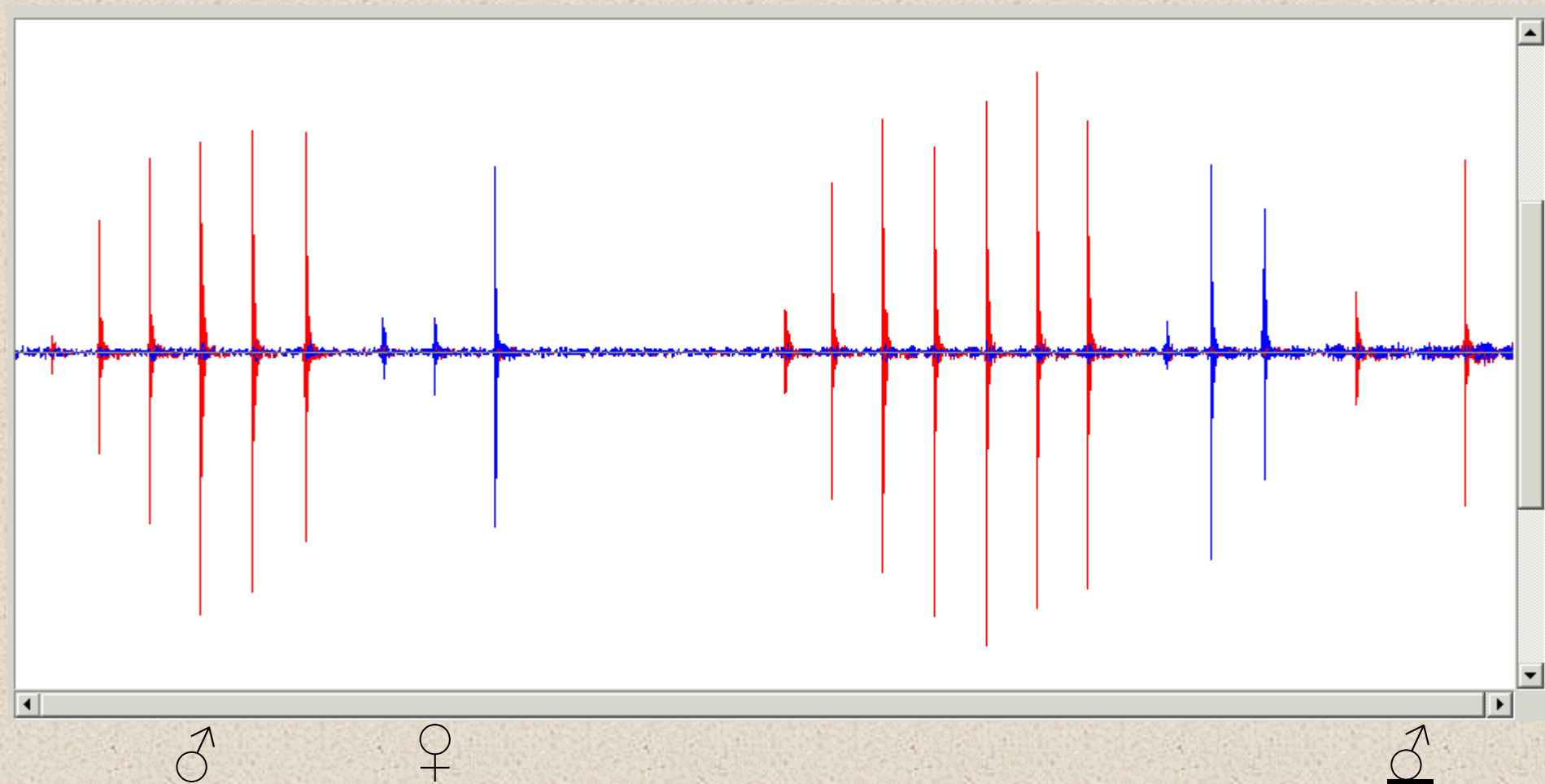
0.05 sec



Isogenoides elongatus - CO (1999)

- Grouped Call, Interspersed Answer
- Male Call (3-10) beats [7]/group
- Male Interval (397.0 ± 75.0 msec)

3 sec



***Isogenoides elongatus* - CO (2000)**

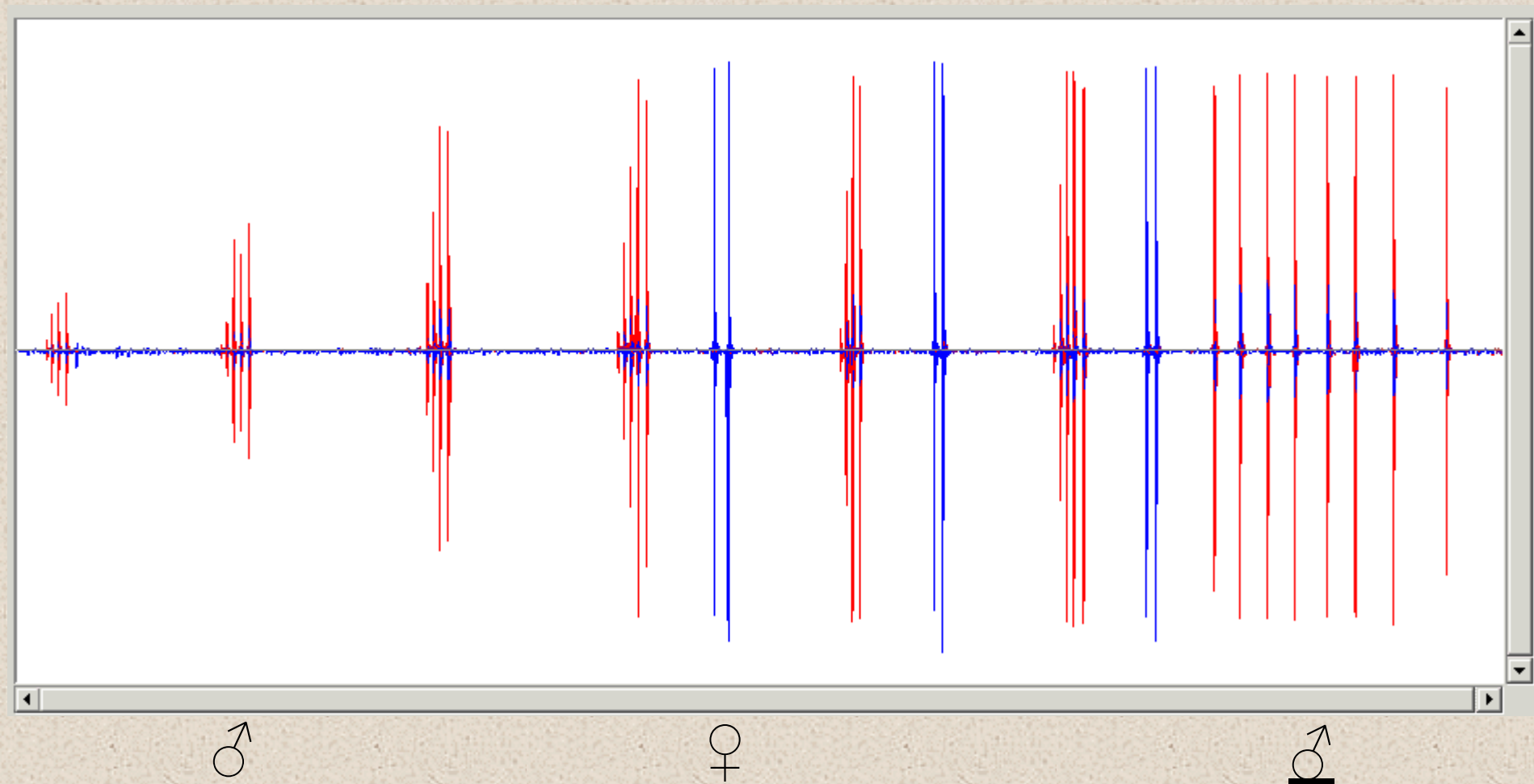
- Grouped Call, Interspersed Answer
 - Male Call (4-8) beats [6]/group
 - Male Interval (222.1 ± 14.0 msec)
 - Ages: 1-4 days old

Movie

Isogenoides frontalis - WI (2000)

- Grouped Call, Interspersed Answer
 - Male Call (2-6) beats [4]/group
 - Male Interval (61.2 ± 11.3 msec)

1 sec



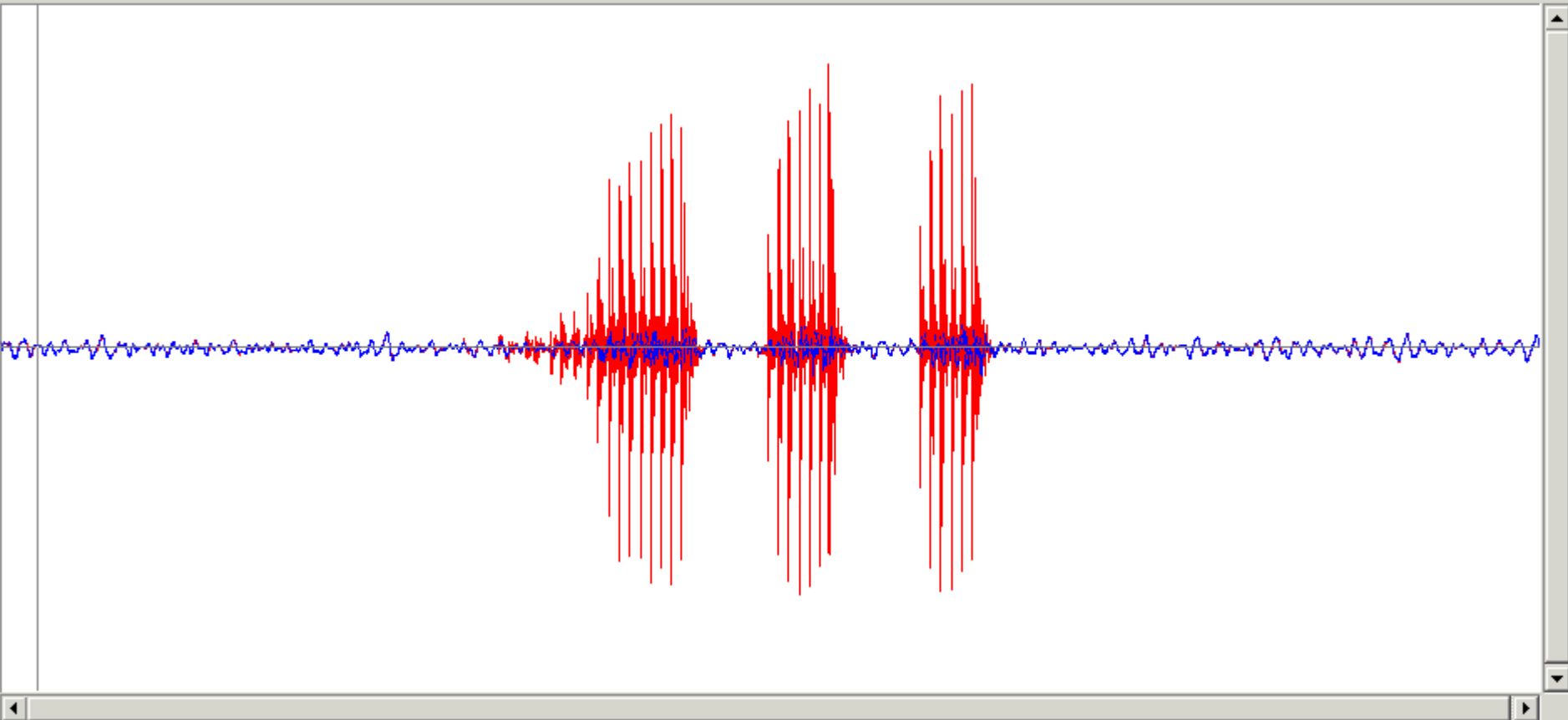
Isogenoides hansonii - VA (2001)

- Grouped Male Call

- Male Call (5-19) beats [6]/group

- Male Interval (31.3 ± 9.4 msec)

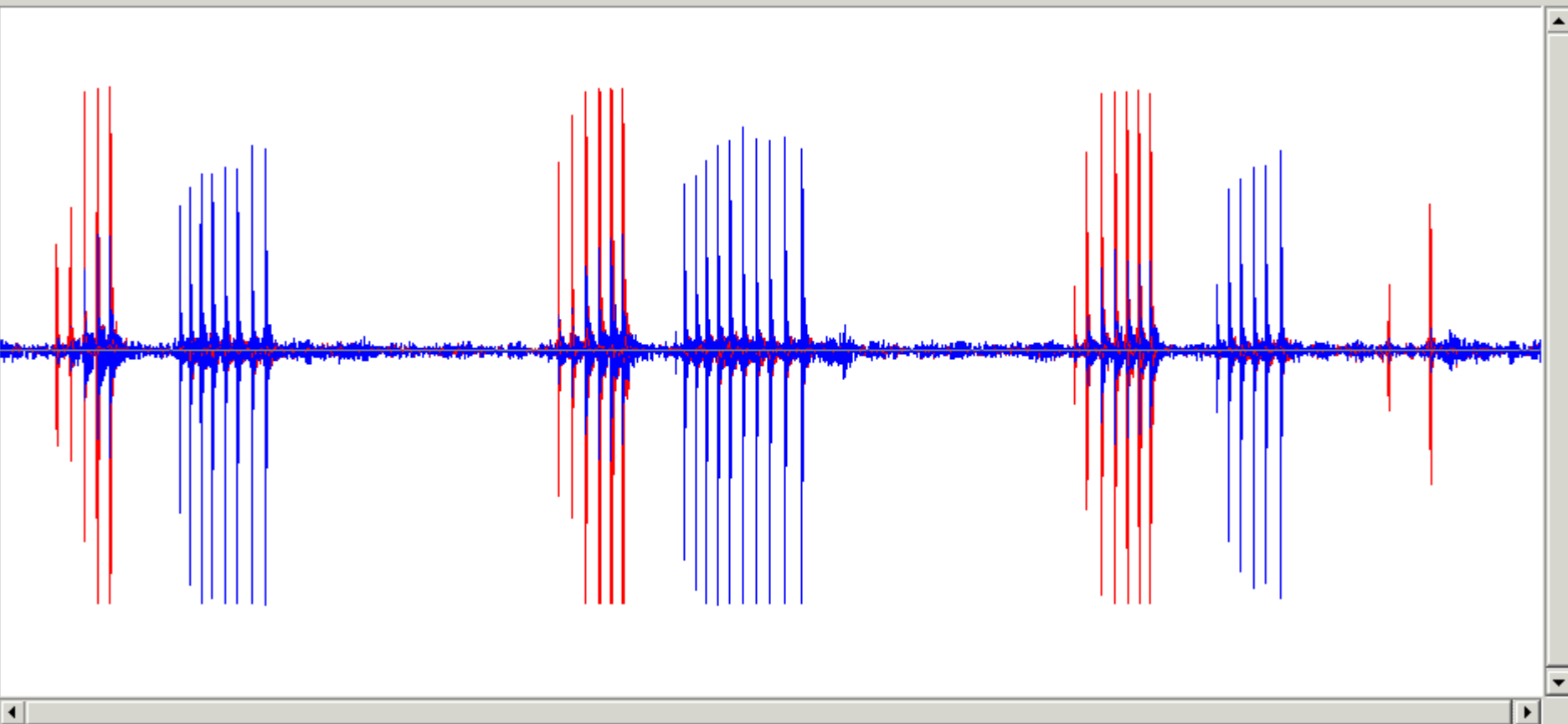
0.5 sec



Isogenoides olivaceus - WI (1999)

- Sequenced call-answer-response (3-way)
 - Male Call (5-8) beats [7]/group
 - Male Interval (98.2 ± 12.0 msec)

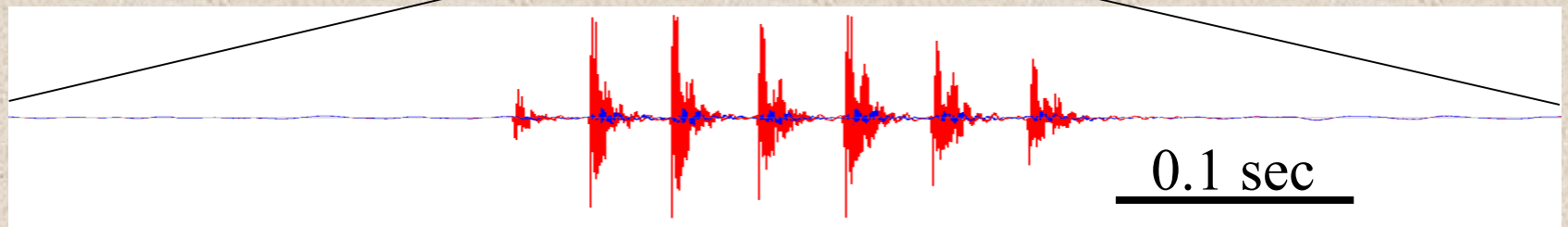
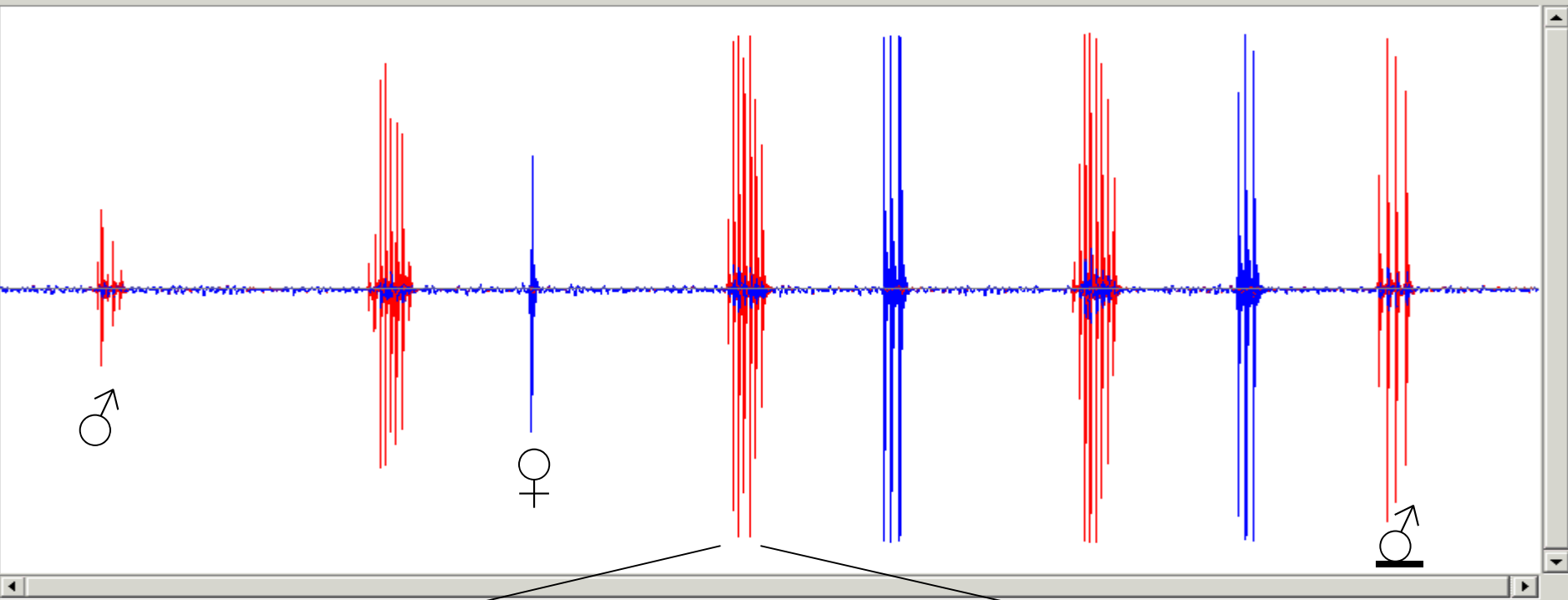
1 sec



Isogenoides varians - VA (2001)

- Grouped Call, Interspersed Answer
 - Male Call (2-11) beats [8]/group
 - Male Interval (36.9 ± 4.0 msec)

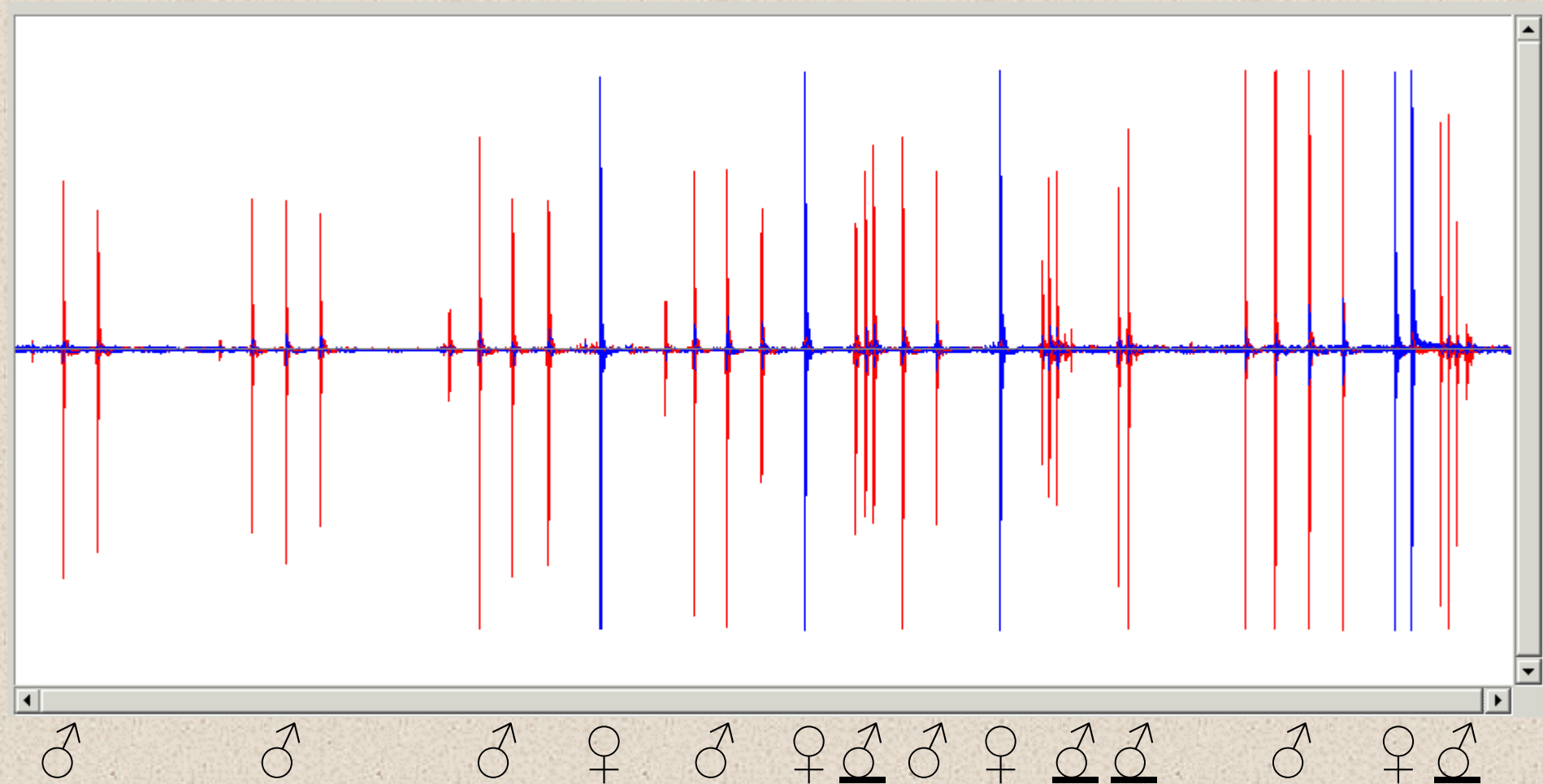
3 sec



Isogenoides zionensis - CO (1999)

- Complex exchange (sequenced + grouped)
- Male Call (1-6) beats [4]/group
- Male Interval (344.83 ± 32.2 msec)

2 sec



Phylogenetic Arrangement

Sequenced Signals [M > F(2-way); M > F > M(3-way)]

- *I. olivaceus* - **Ancestral**

Grouped Signals (M > M > F; M > M > F > M)

- *I. hansonii* - **Derived**

- *I. doratus* - **Derived**

Sequenced and Grouped Signals

- *I. colubrinus*

- *I. elongatus*

- *I. frontalis*

- *I. varians*

Transitional

Complex Exchanges (both sequenced and grouped)

- *I. zionensis* – **Most Derived**