New perspectives in Amazonian bird vocal behaviour.

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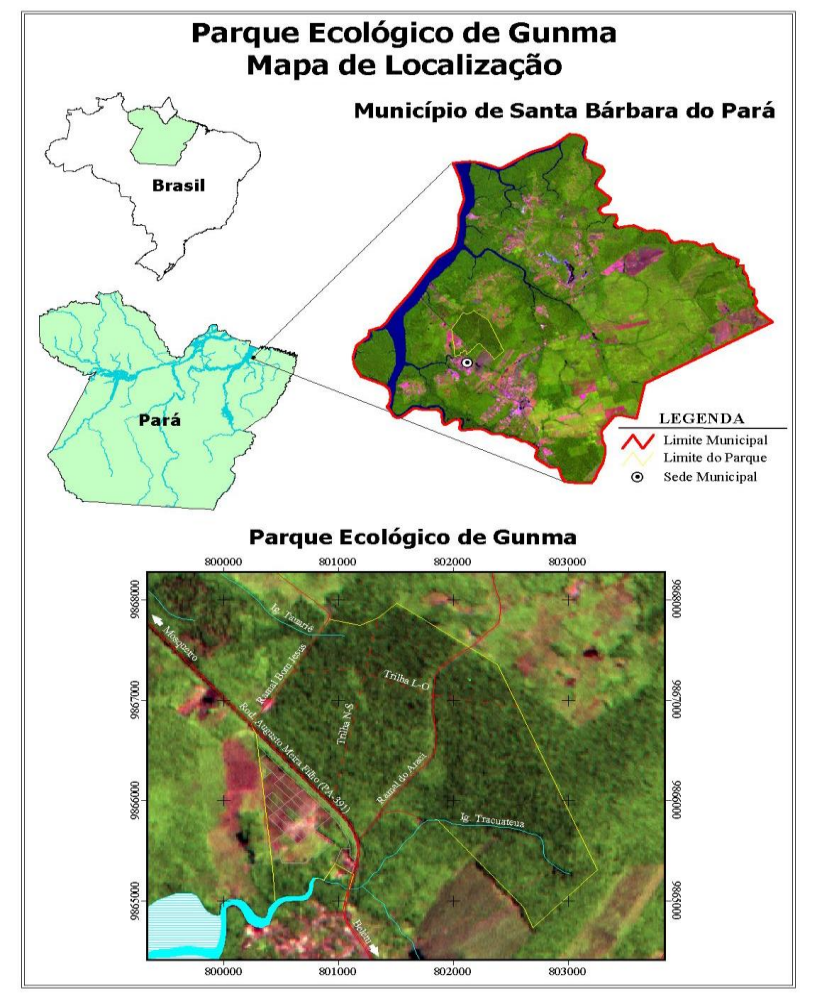
- The “functional song”, i.e. the acoustic signal carrying the species-specific recognition code, may present complex structures and individual variations that cannot be explained by current ontogeny models.

Our goal

Investigate evidences of vocal learning in suboscines that presents particularity in their communication's system such as lekking behavior and duet song

Where?

Gunma Ecological Park with around 400 ha of primary forest and 140 ha of commom.



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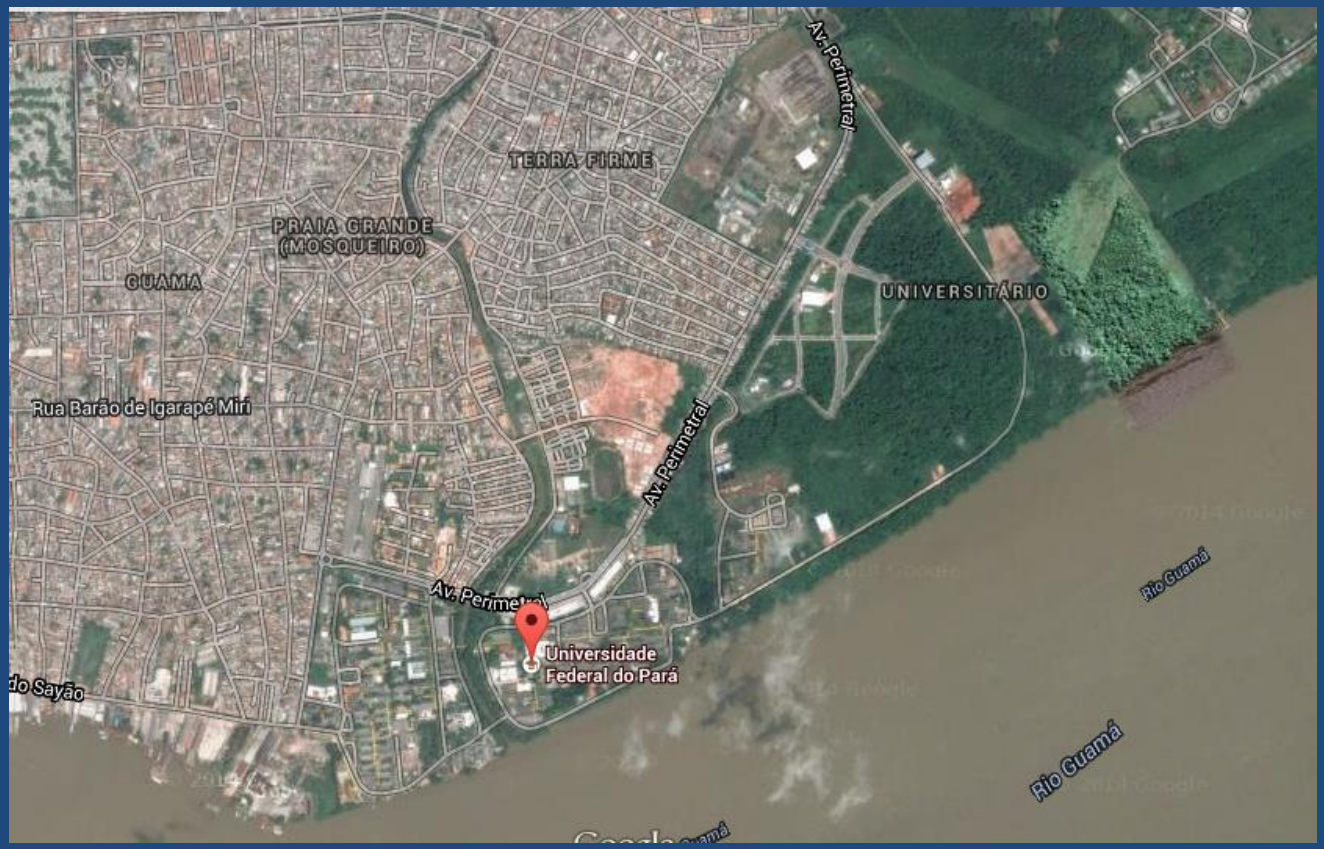
Investigate evidences of vocal learning in suboscines that presents particularity in their communication's system such as lekking behavior and duet song

Where?

Federal University of Pará

around 450 ha with a floodplain forest



Studied species

Duetting suboscine

Rusty-margined Flycatcher
Myiozetetes cayanensis

Lekking suboscine

Screaming Piha
Lipaugus vociferans

Presumed innate song with complex repertoire

Duet (rusty-margined flycatcher *Myiozetetes cayanensis*)

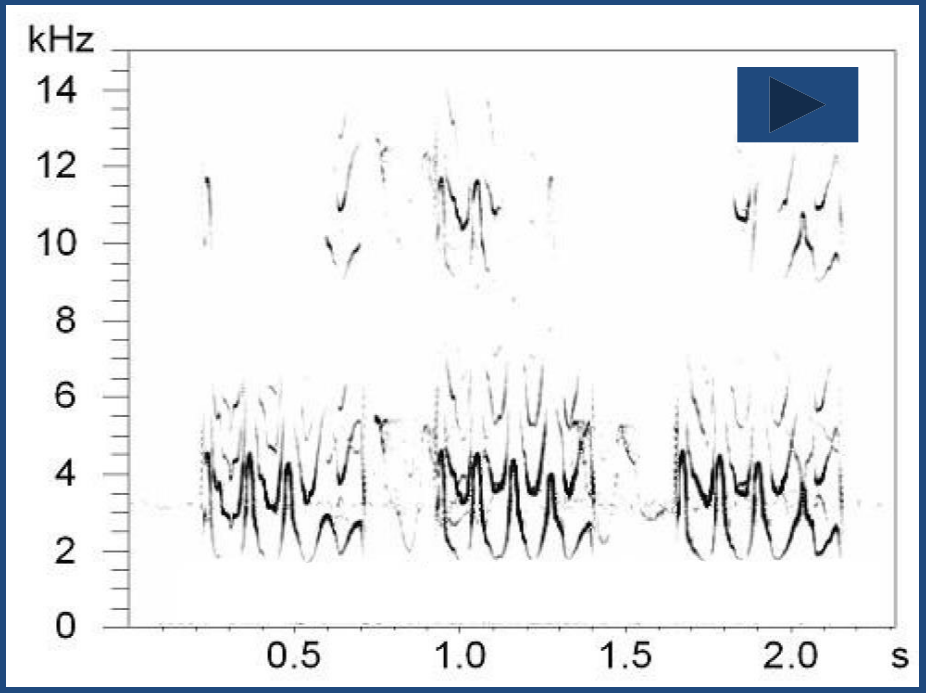
Methodology

- Two years of observation, from 2006 to 2008
- Spontaneous calls recorded, behavioral context observated
- Playback experiments with calls to confirm their context

Vocal repertoire of *Myiozetetes cayanensis*

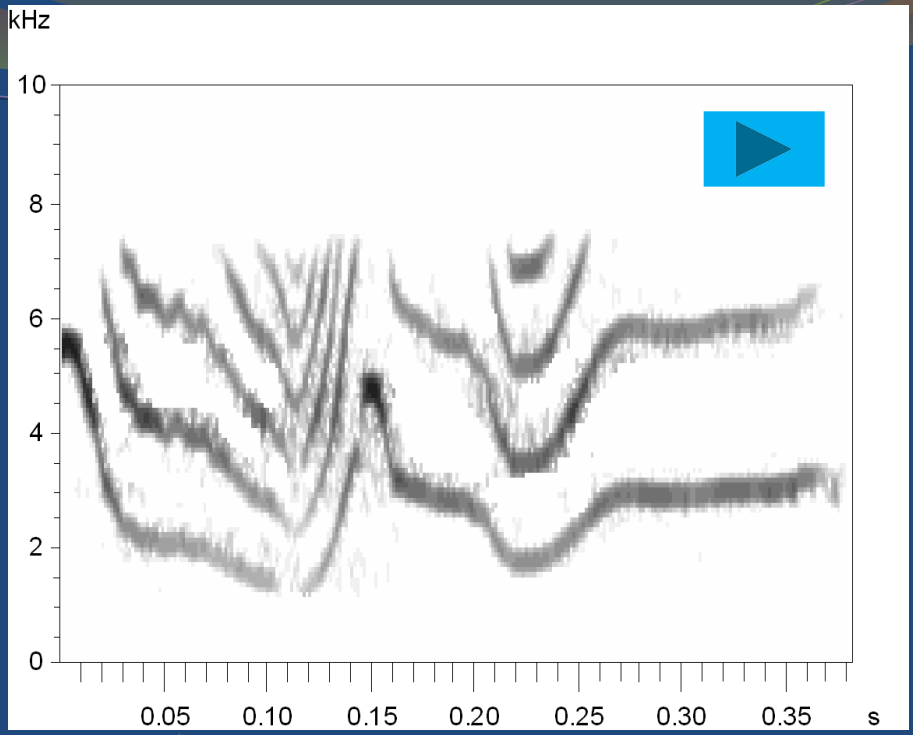
Song

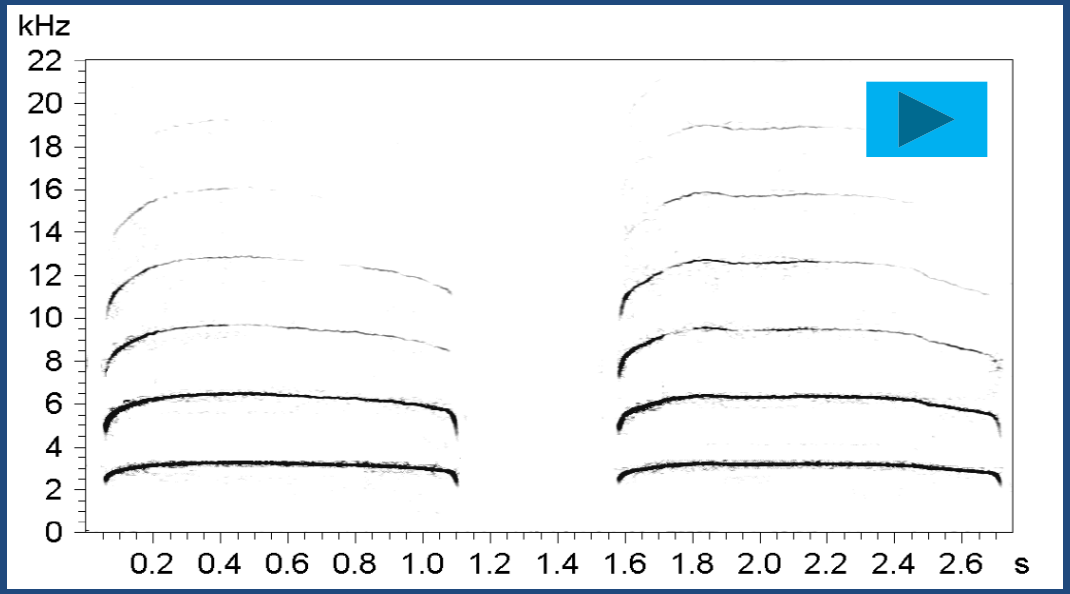
- Sycronized duet (M+F or M+F+J);
- Mechanic sound with the wings;
- Freq. bandwidth 1.5 to 5.3 kHz
- Territorial defence.



Call 1

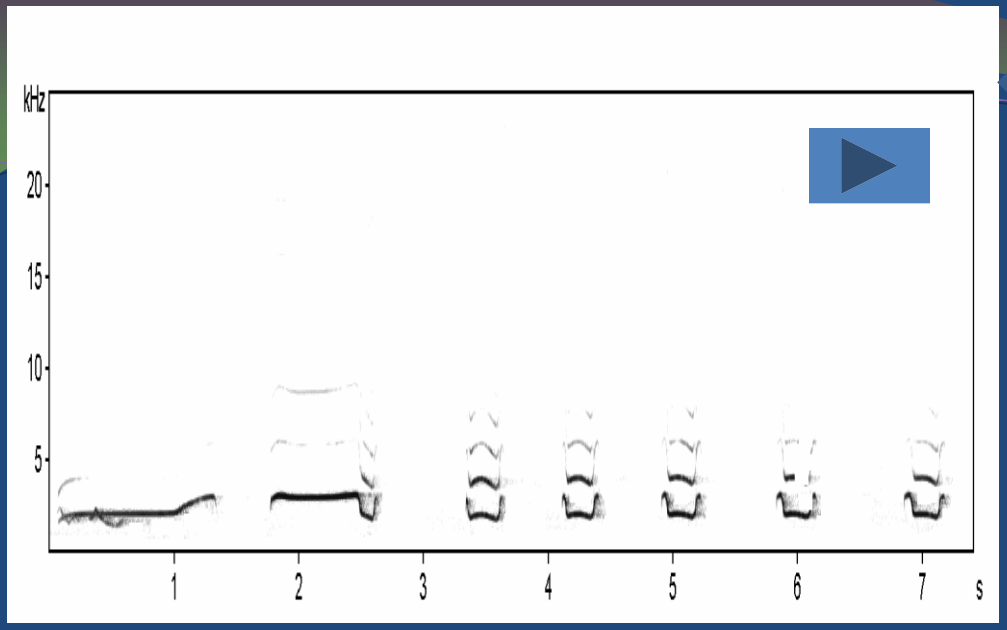
- Approach of other individual as response;
- Also used to defend against heterospecific intruders (*Thraupis episcopis* and *Legatus leucophaius*);
- Freq. bandwidth 1.1to 5.1 kHz
- Mobbing call (????).





Call 2

- When the observer was around;
- Short flights toward the observer;
- Freq. bandwidth 2.6 to 4 kHz;
- Alarm call.

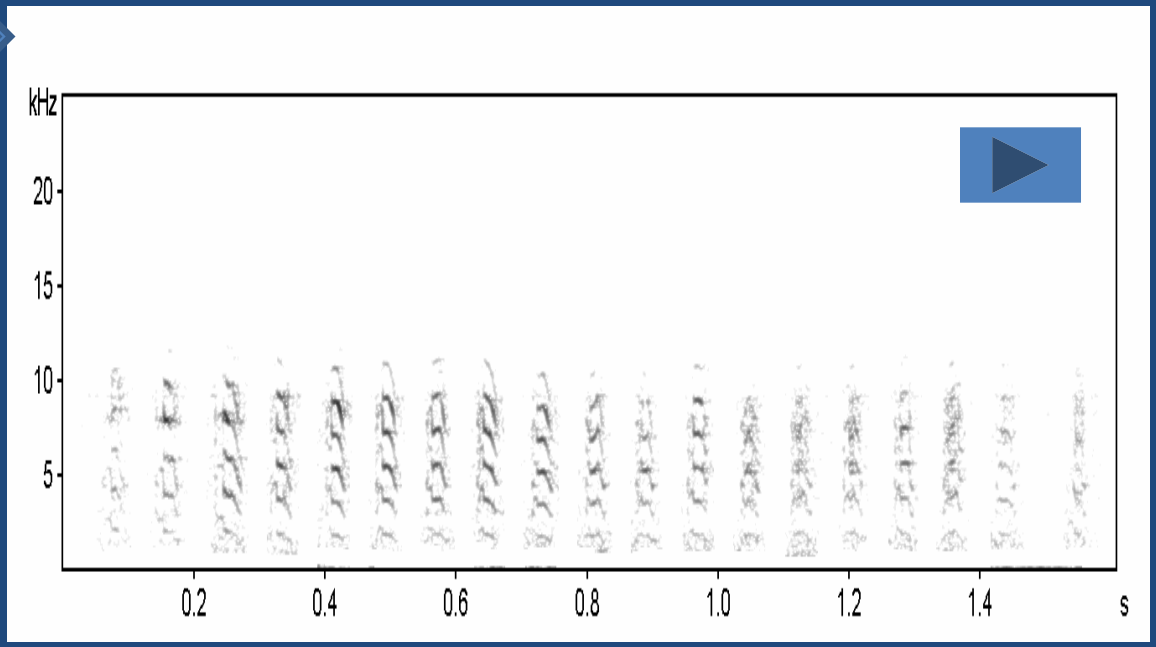


Call 3

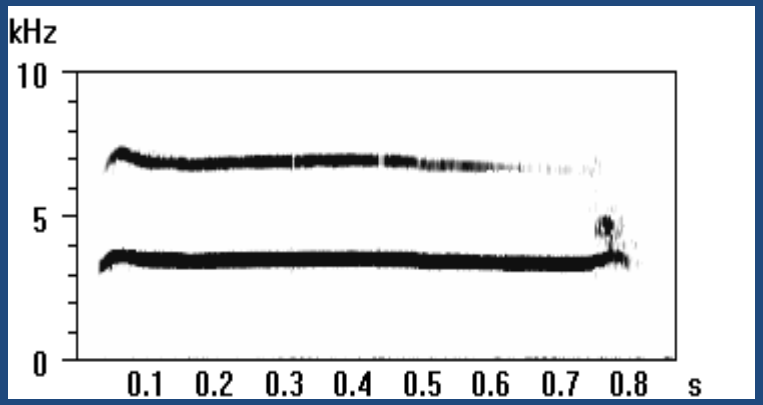
- Bird alone uttered followed of answers from other distant individual
- Freq. bandwidth 2.7 to 5.5 kHz
- Long distance contact call.

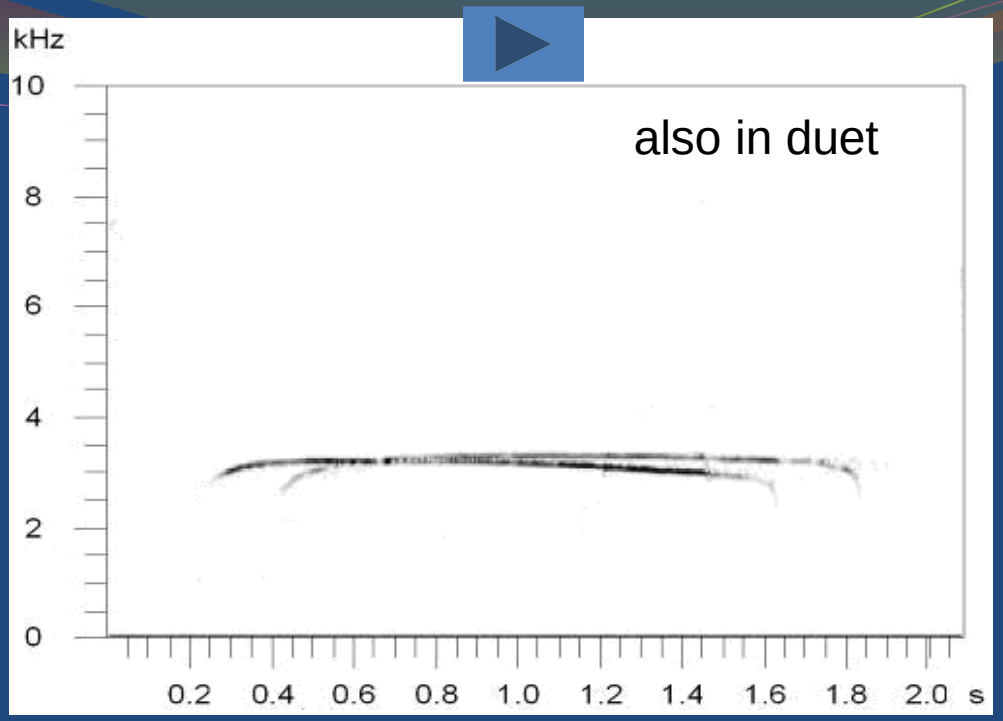
Call 4

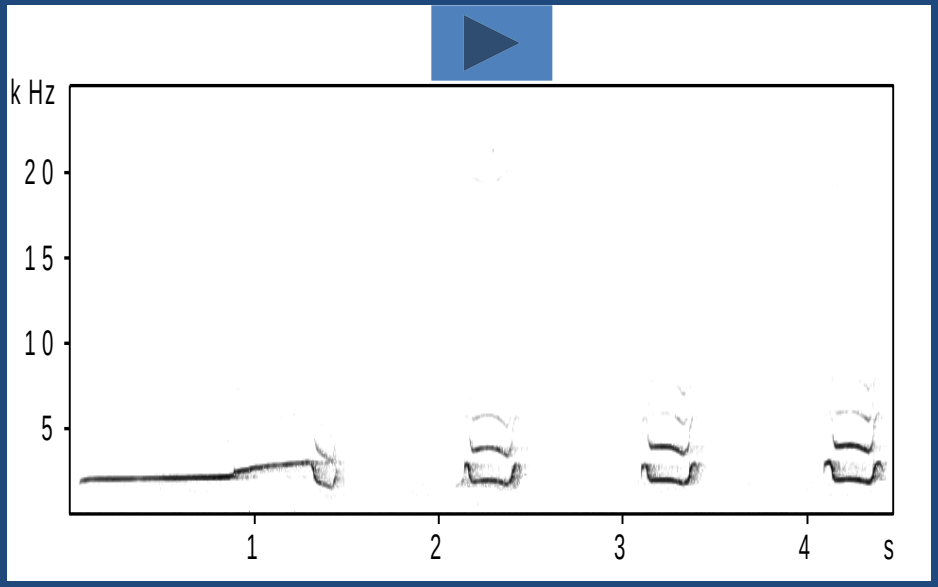
- Call uttered by the parents when they were taking care of the fledglings
- Freq. bandwidth 3.5 to 5.2 kHz
- Short distance contact call.

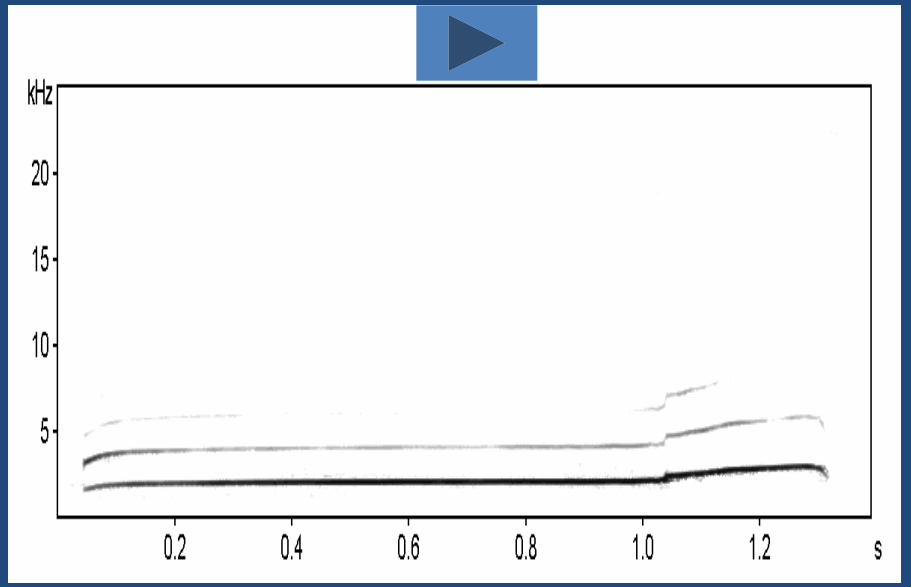


Other variants of the contact calls



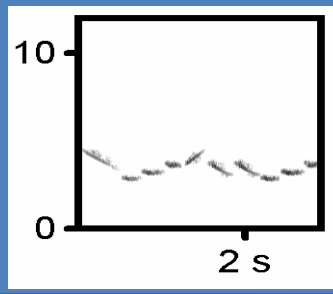


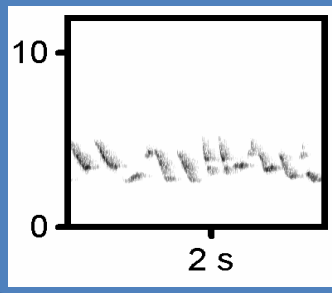




- Complex vocal repertoire for a suboscine species;
- Need more investigations – neuroanatomical and in other neotropical species;

Stereotyped vs. Varied songs





Vocal learning

Dialects and/or individual variation

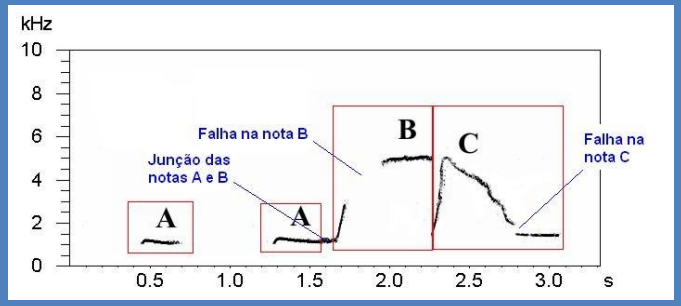
Complex and varied songs

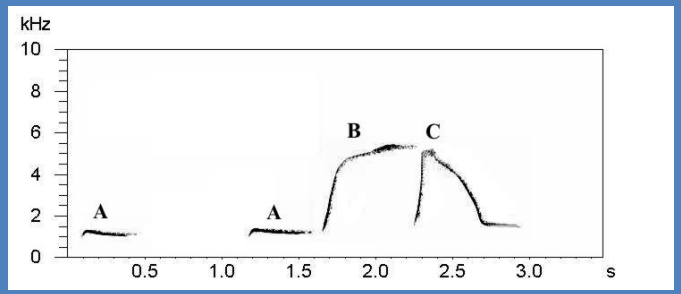
Evolutionary constrain to increase complexity

It must keep the species-specific code

Oscines songbirds, parrots and Humingbirds

Stereotyped vs. Varied songs





Inate song

Stereotyped song, functional if acoustic isolated

No geografic variation

Evolutionary constrain to maintain song fixed

It must keep the species-specific code

Tinamidae, Columbidae and Suboscines

Questions about vocal learning and sexual selection in birds with fixed song parameters

- **Could we find song variation within suboscines birds?**
- **Song parameters can be used like a criteria to show male quality and sexual selection?**
- **Is there individual variation among suboscines birds song?**
- **Is there geografic variation or dialects within suboscines birds song?**

Amazonian case of a fixed song – the Screeming piha

Geographic distribution

It is common and abundant through the Amazon forest
It has grey colour and no sexual dimorphism.

Sick, 1997

Study area
Ecological Park of Gunma, Santa Bárbara do Pará, PA, Brazil

01º13’00.86” S
48º17’41.18” W.

Mosqueiro

Arena IG

Base de Pesquisa do Ipê

Arena D

Arena B1

Arena B2

Arena C1

Arena C2

Santa Bárb do Pará

Belém

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Google

Ponteiro 1°12'10.48" S 48°17'48.60" O elev 41 m Fluxo 100% Altitude do ponto de visão 6.48 km

Lek B1

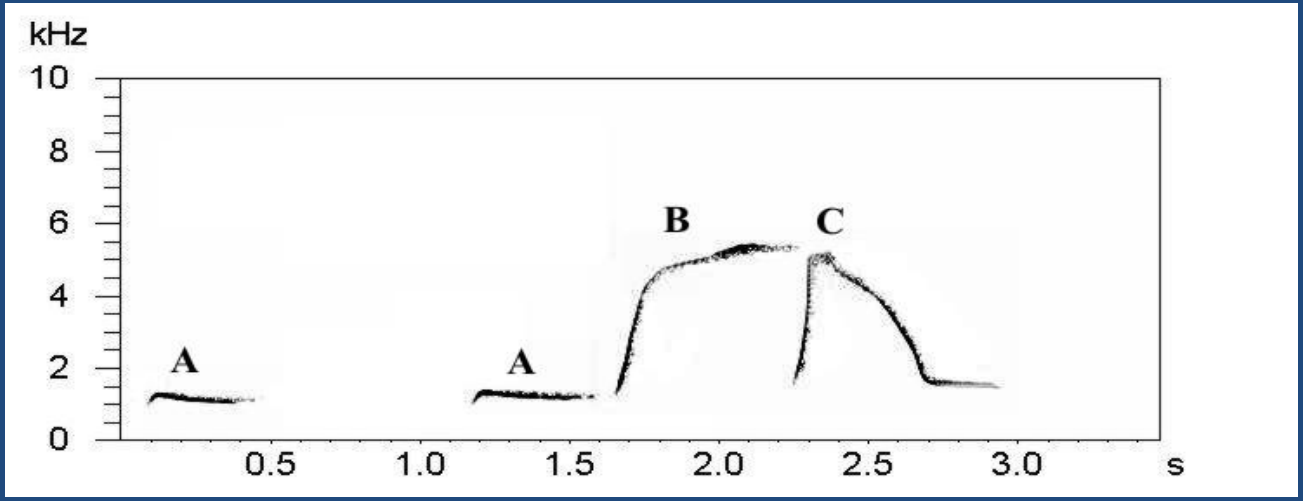

Trilha B
B1Lv9
B1Lv4
B1Lv2
B1Lv1
B1Lv5
B1Lv6
B1Lv7
B1Lv11
B1Lv8
Image © 2009 DigitalGlobe
©2009 Google
1°12'05.36" S 48°17'50.16" O
Altitude do ponto de visão 419 m

Methods

- To quantify variation in the songs we recorded 19 males
- 10 songs for each male
- Males from six lek sites in Gunma Ecological Park
- There was 2 – 11 individuals per lek
- Recordings: September 2007 – February 2008
- Measurements: Frequencies and duration

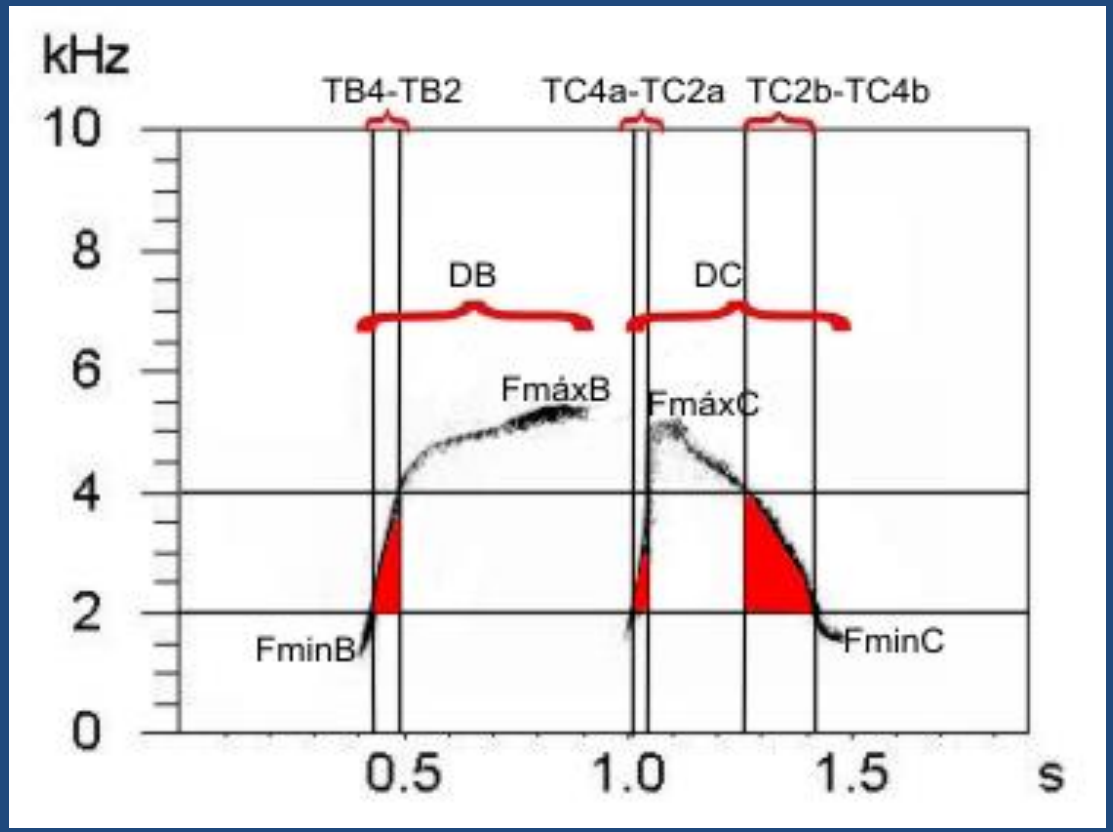
Screeming piha - *Lipaugus vociferans*

- Emits a typical loud song, composed by three different notes



Sample, song analysis

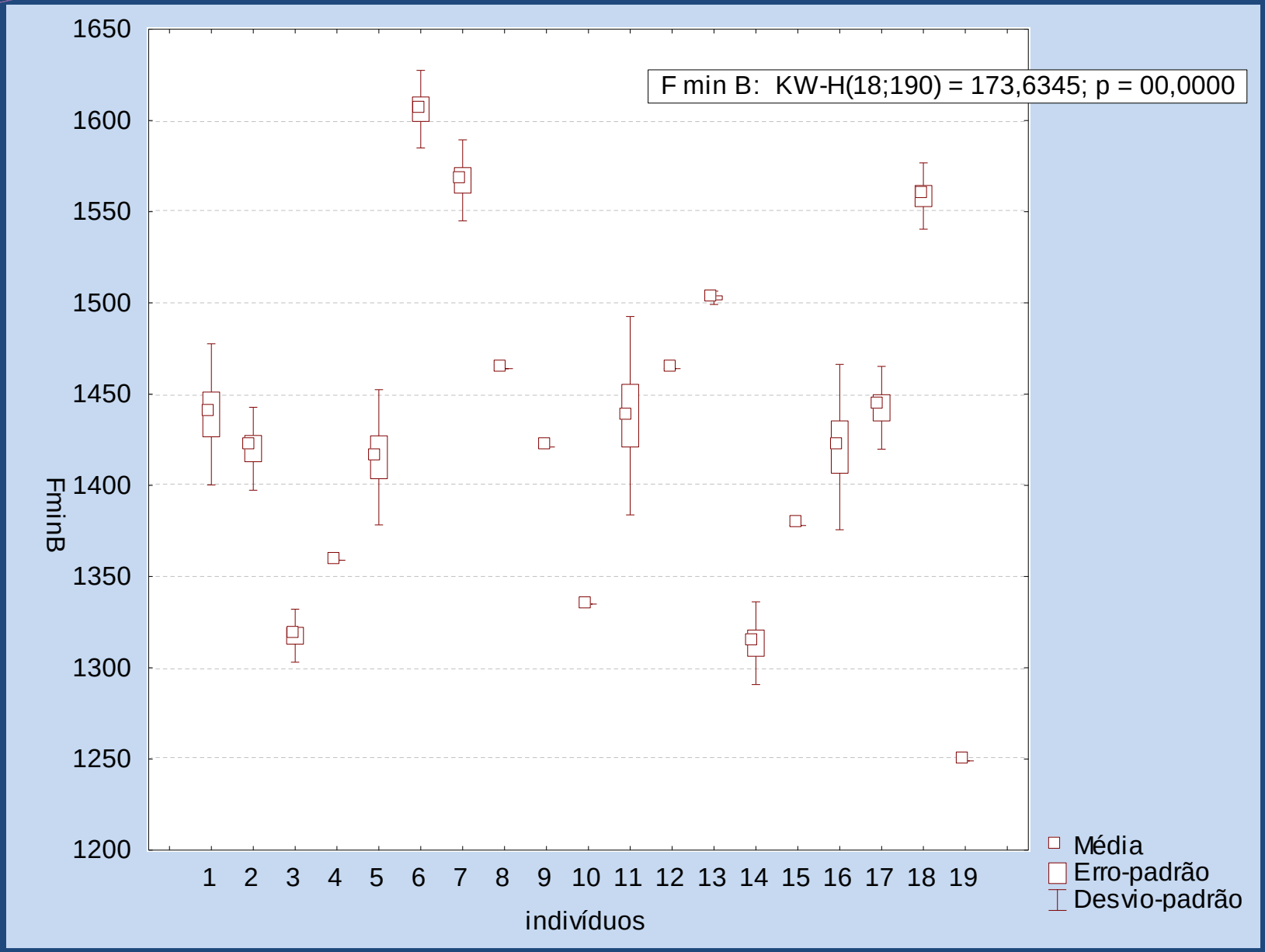
- Measurements: Frequencies and duration
- Software: Avisoft, Audition and Praat
- Recordings: shotgun microphone Sennheiser ME-67 and digital recorder Marantz PMD660.



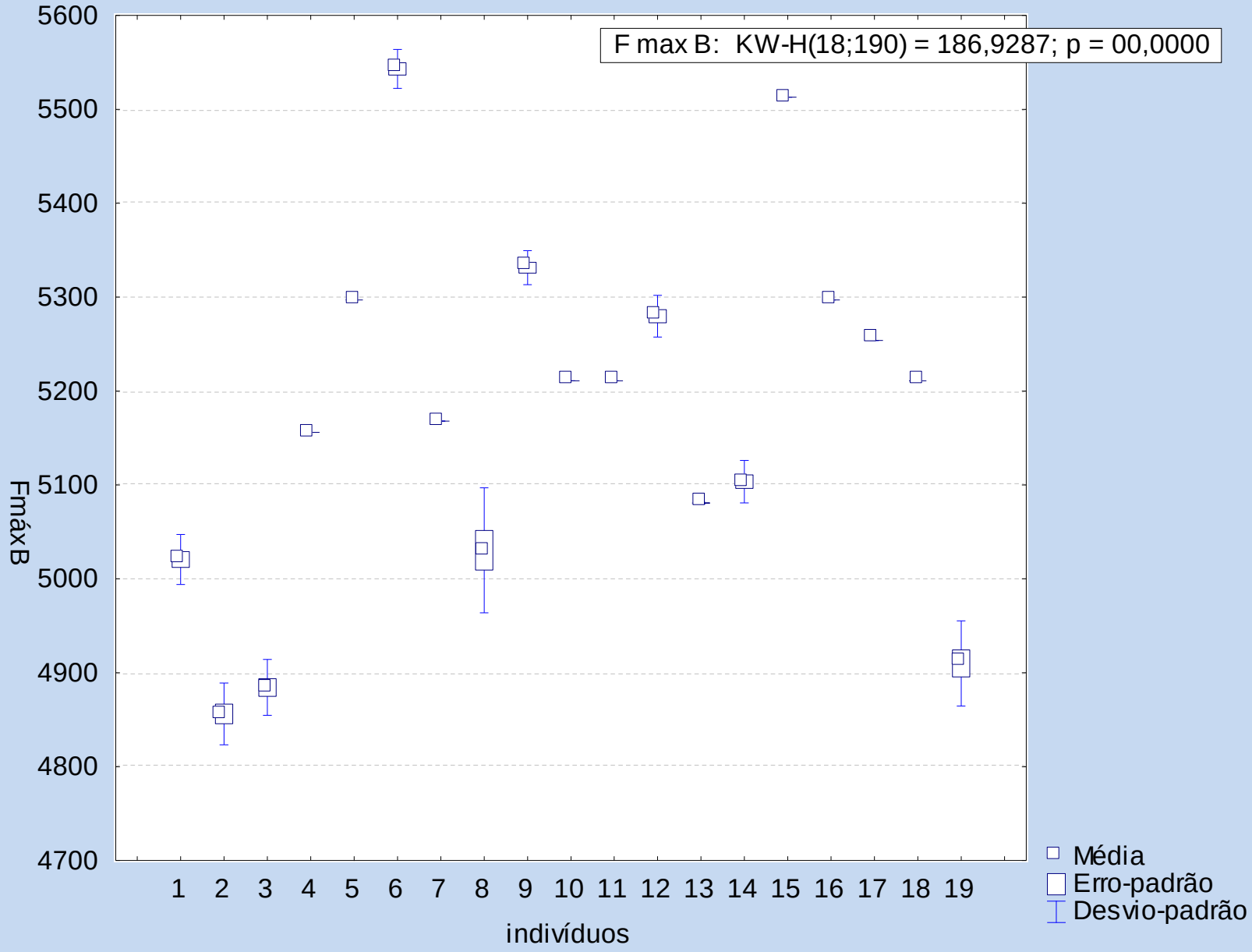
Principal component analysis

Factor Loadings (Varimax raw): Principal components (Marked loadings are >0,60)		
	Factor 1	Factor 2
TB4-TB2	-0,13	0,38
F min B	0,29	0,63
F max B	0,96	0,04
TC4a-TC2a	-0,11	0,09
TC2b-TC4b	-0,69	-0,03
F min C	0,49	-0,45
F max C	0,96	0,09
Dur B	0,20	-0,01
Dur C	0,04	0,79
bandwith B	0,89	-0,30
bandwith C	0,84	0,29

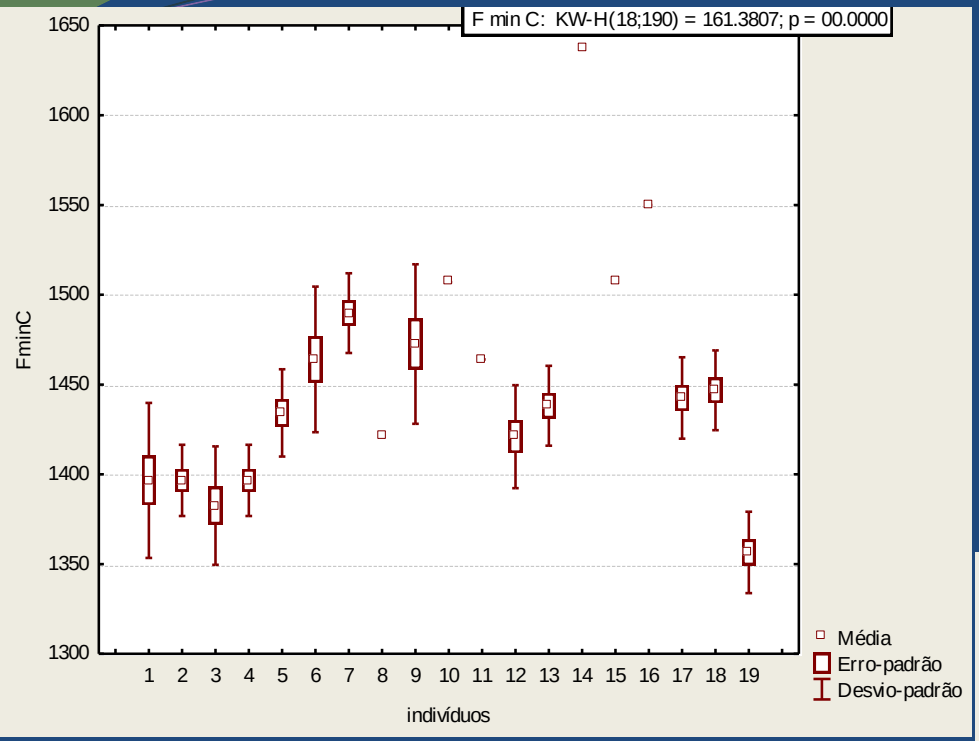
Results - FMIN B note

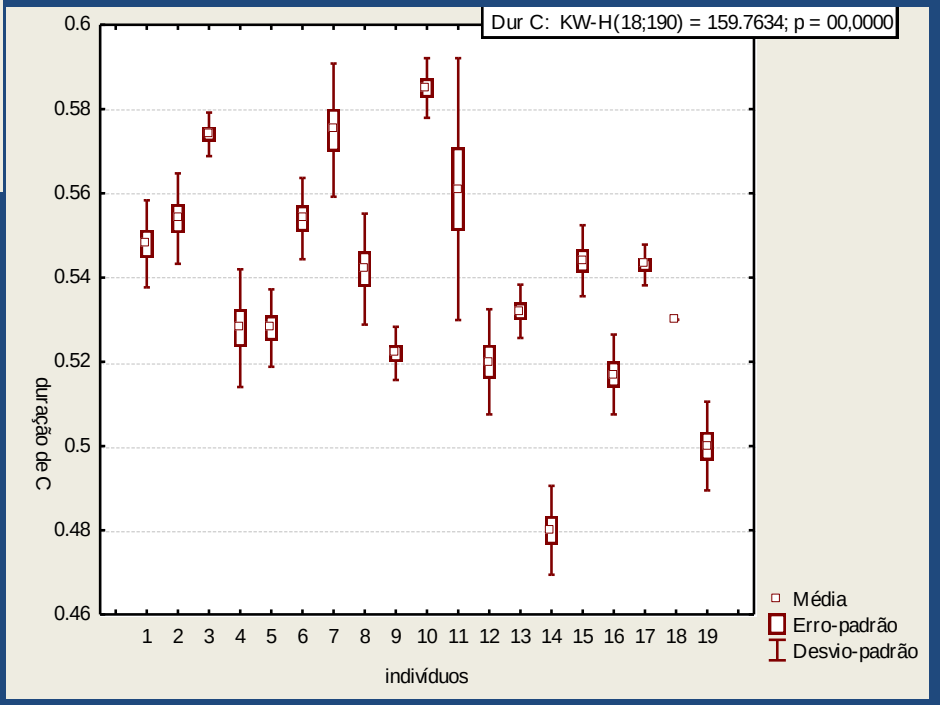


Results - FMAX B note

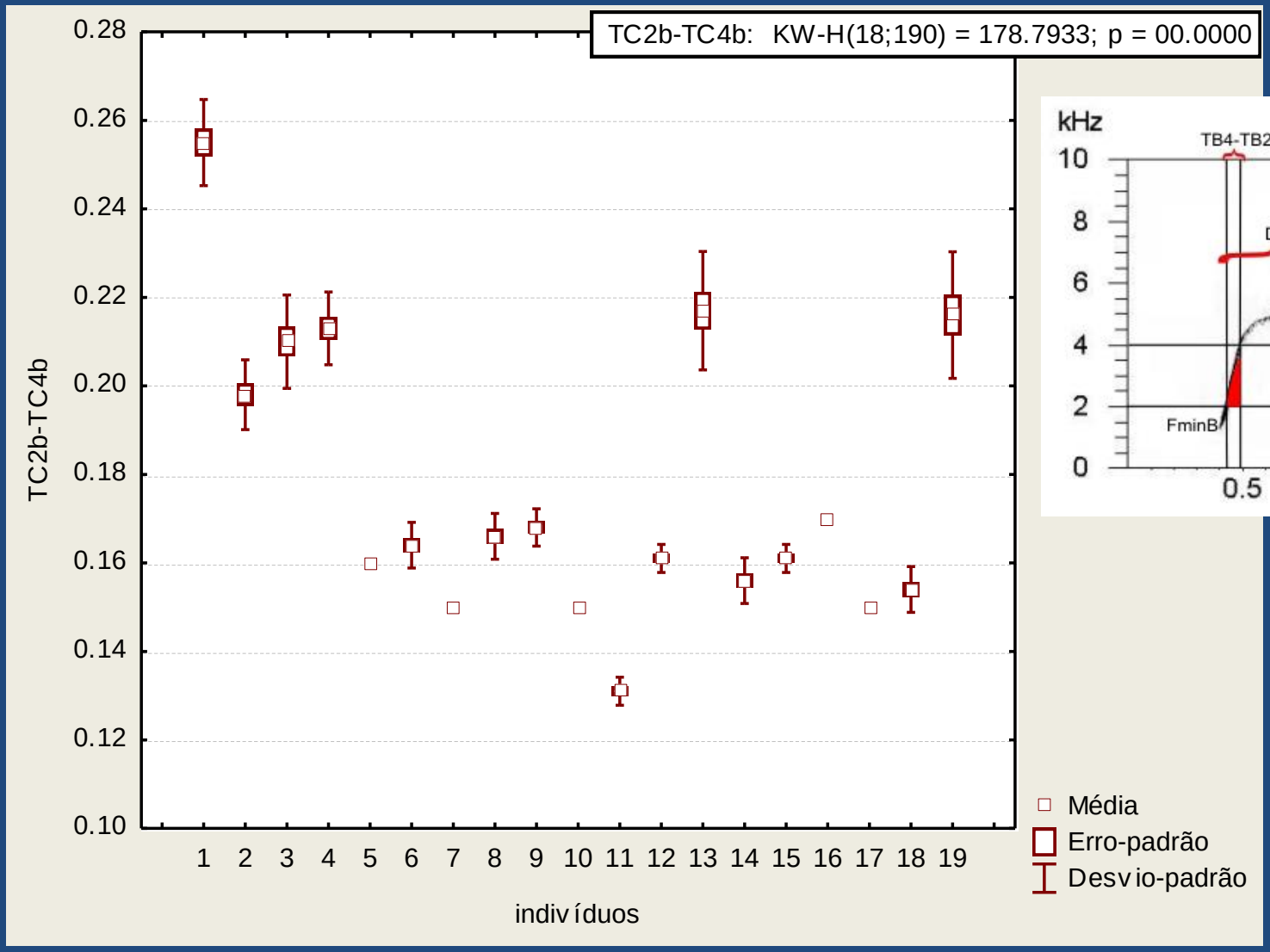


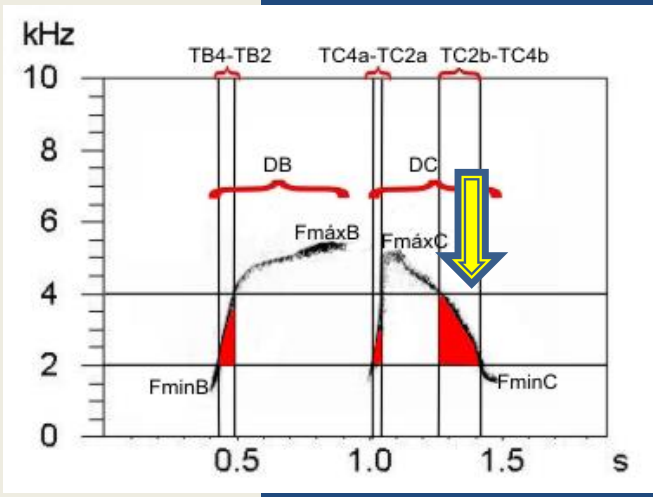
Results – FMAX and duration of C note



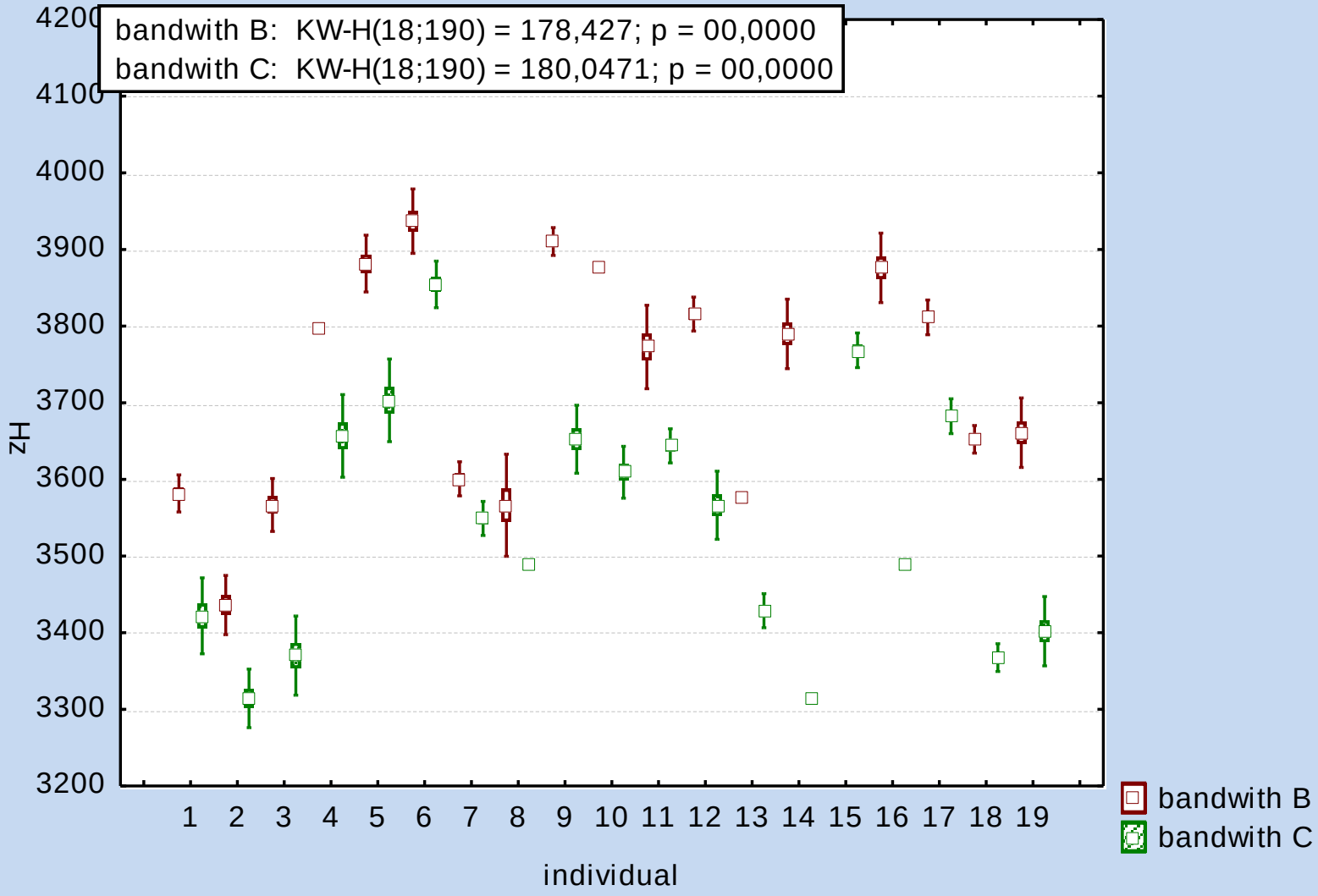


Results - TC2b-TC4b

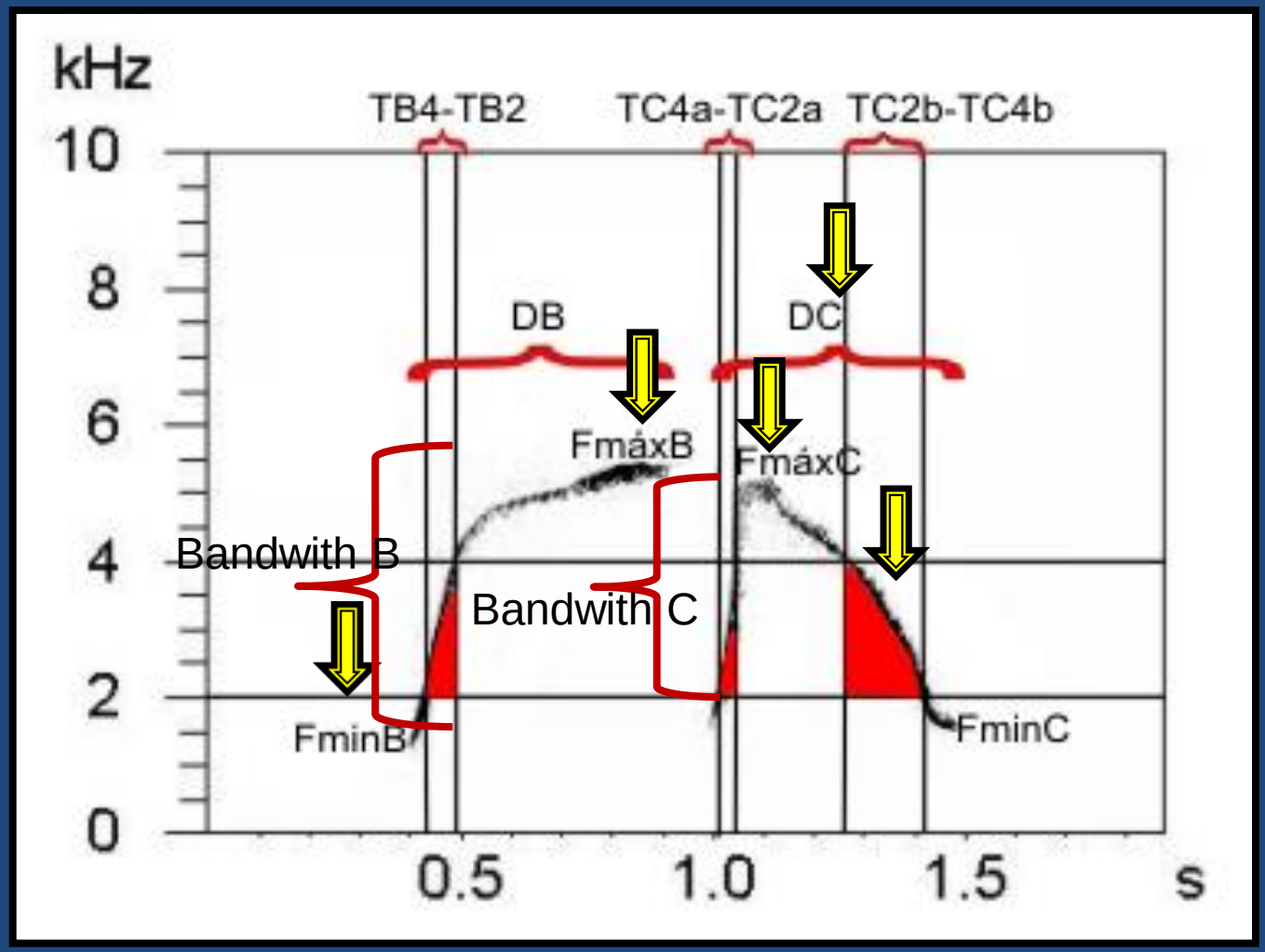




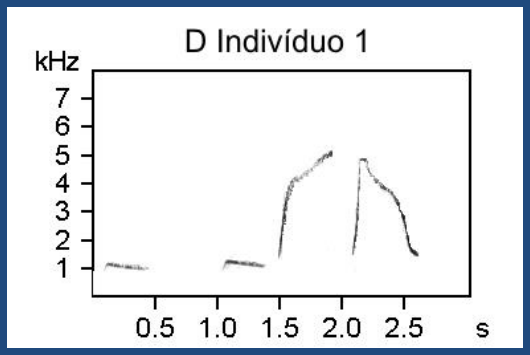
Results: Bandwith B and C

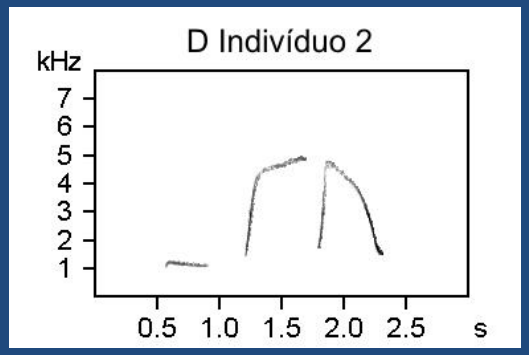


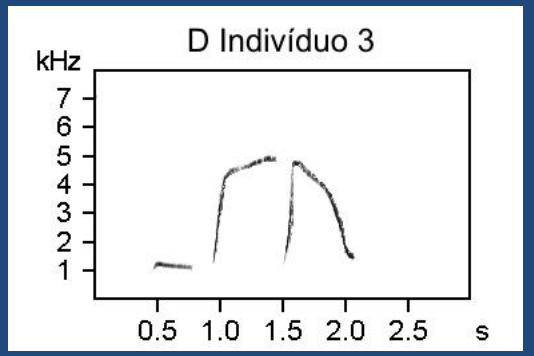
PCA

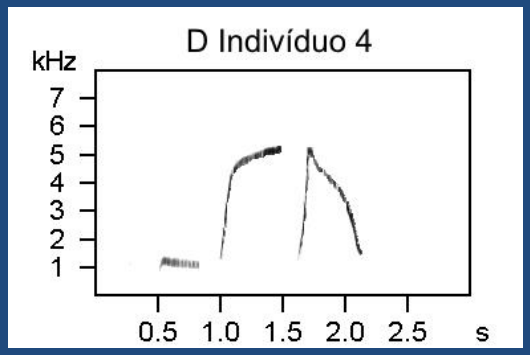

kHz
10
8
6
4
2
0
TB4-TB2
TC4a-TC2a
TC2b-TC4b
DB
DC
FmáxB
FmáxC
Bandwith B
Bandwith C
FminB
FminC
0.5
1.0
1.5
s

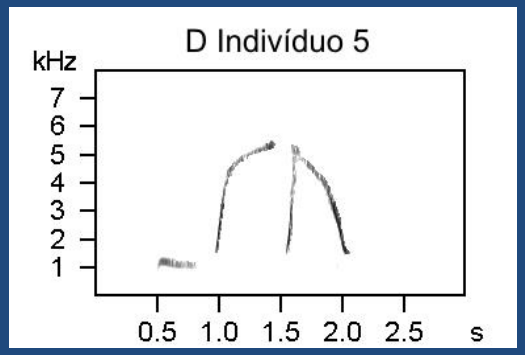
Individual Variation in Song

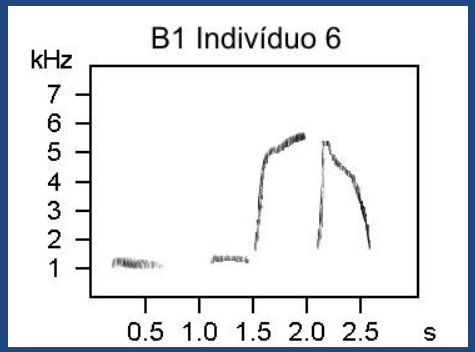


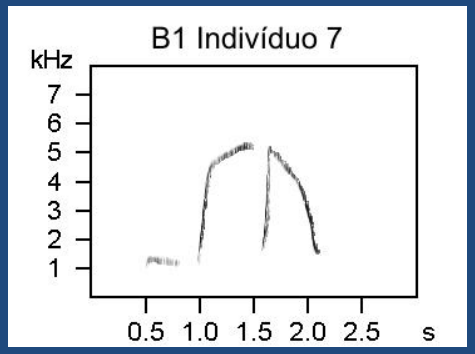


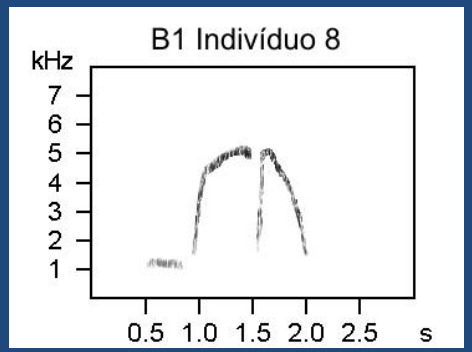


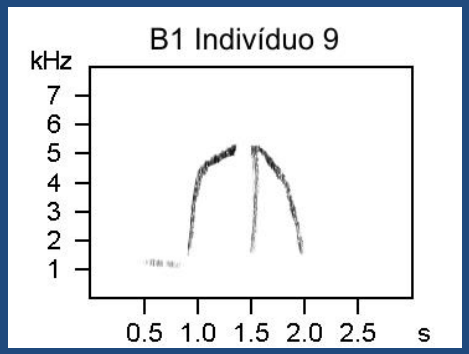




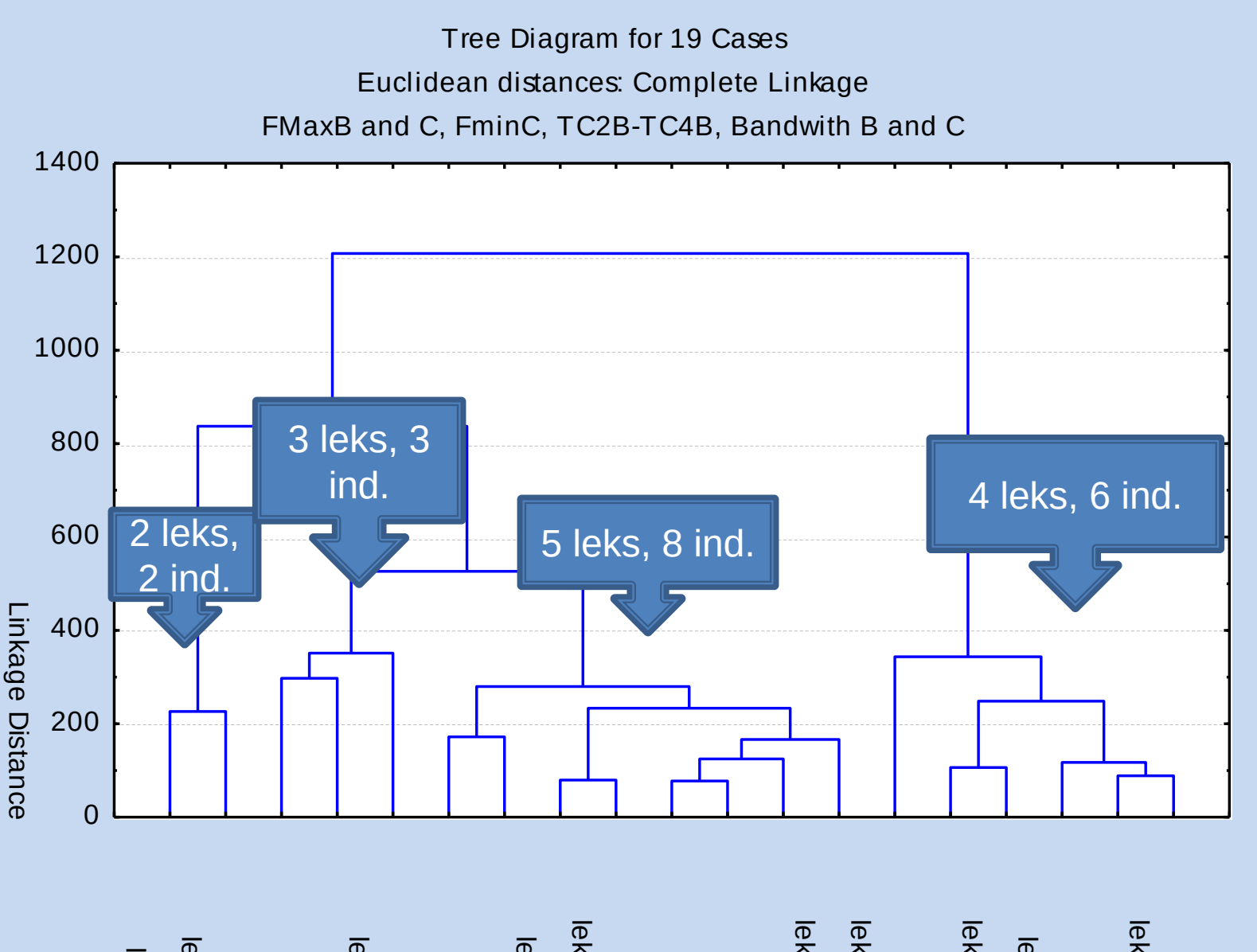








Cluster analysis



Sumarized results

- All the song parameters were significatively different between individuals – they have a vocal signature.
- It is difficult to differentiate the individuals auditively, but if you pay attention and look at sonogram it is possible to recognize an individual by the song.
- The most important parameters – according with PCA - were: note B maximum frequency, note C maximum frequency and the duration between TC2b-TC4b – final part of C.

Sumarized results

- We had not find any lek patern.
- According with cluster analysis there are more differences between male songs from the same lek than from a distint one.
- It seems that individuals in the same lek avoid similarities.
- That fact can implies that song must be important to differentiate individuals at short distance

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Conclusions

- Individual differences in song features cannot necessarily be interpreted as evidence of vocal learning; those differences could arise from individual differences in physical or developmental constraints or from genetic differences among individuals (Gil and Gahr 2002).

Conclusions

- However, song learning may have recently evolved in polygynous, lekking cotingas and in the case of Screaming piha, that has no conspicous colour or any other visual mark or signal, thus the song features must be important criteria to sexual selection and competition within males.

- 1) multiple genetic control,
- 2) combination of genetic control with some learning or individual differentiation,
- 3) combination of learning with:
- a) individual creativity,
- b) individual recombination of learned parts,
- c) individual sequencing of learned and/or created note structures,
- d) incorporation of hetero-specific models.

Conclusions

- Social interactions within Screaming pihas can play a relevant role in song development and in vocal learning, that could explain a necessity of male neighbouring recognition.

Final considerations

- The paradigm of fixed and stereotyped songs within suboscines must be rethought.
- The the evolution of song learning in suboscine passerines needs to be more investigate.
- Suggestions:
  - Play back experiments - to delimitate how the social interactions work
  - Neurobiological investigations to find vocal learning cues.

LOBio

Laboratório de Ornitologia e Bioacústica

Some of us...

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