# 7. Too much data!

## Q: Auto-detection to the rescue?

NOTE:  Depending upon how many bats are detected throughout the night, an experienced reviewer can analyze one night's recordings from one detector in 3-5 hours

18:00 - 05:30  = 10.5 hrs

x 5 detectors each night

x 3 nights per month (new moon)

_____

= 157.5 hrs to review each month

DATA STORAGE

1 min  = 46 MB

All night = 28,980 MB = 28 GB!



Bat Surveys in Windsor

~ 11,000 hours!!

WGC-lower

WGC-top

Image © 2012 GeoEye

# A continental-scale tool for acoustic identification of European bats

Charlotte L. Walters[1,2,3]*, Robin Freeman[4,5], Alanna Collen[1], Christian Dietz[6], M. Brock Fenton[7], Gareth Jones[8], Martin K. Obrist[9], Sébastien J. Puechmaille[10,11,12], Thomas Sattler[13,14,15], Björn M. Siemers[11], Stuart Parsons[16]† and Kate E. Jones[1,17]†

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## Summary

1. Acoustic methods are used increasingly to survey and monitor bat populations. However, the use of acoustic methods at continental scales can be hampered by the lack of standardized and objective methods to identify all species recorded. This makes comparable continent-wide monitoring difficult, impeding progress towards developing biodiversity indicators, trans-boundary conservation programmes and monitoring species distribution changes.

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4. These classifiers were packaged into an online tool, iBatsID, which is freely available, enabling anyone to classify European calls in an objective and consistent way, allowing standardized acoustic identification across the continent.

5. *Synthesis and applications.* iBatsID is the first freely available and easily accessible continental-scale bat call classifier, providing the basis for standardized, continental acoustic bat monitoring in Europe. This method can provide key information to managers and conservation planners on distribution changes and changes in bat species activity through time.

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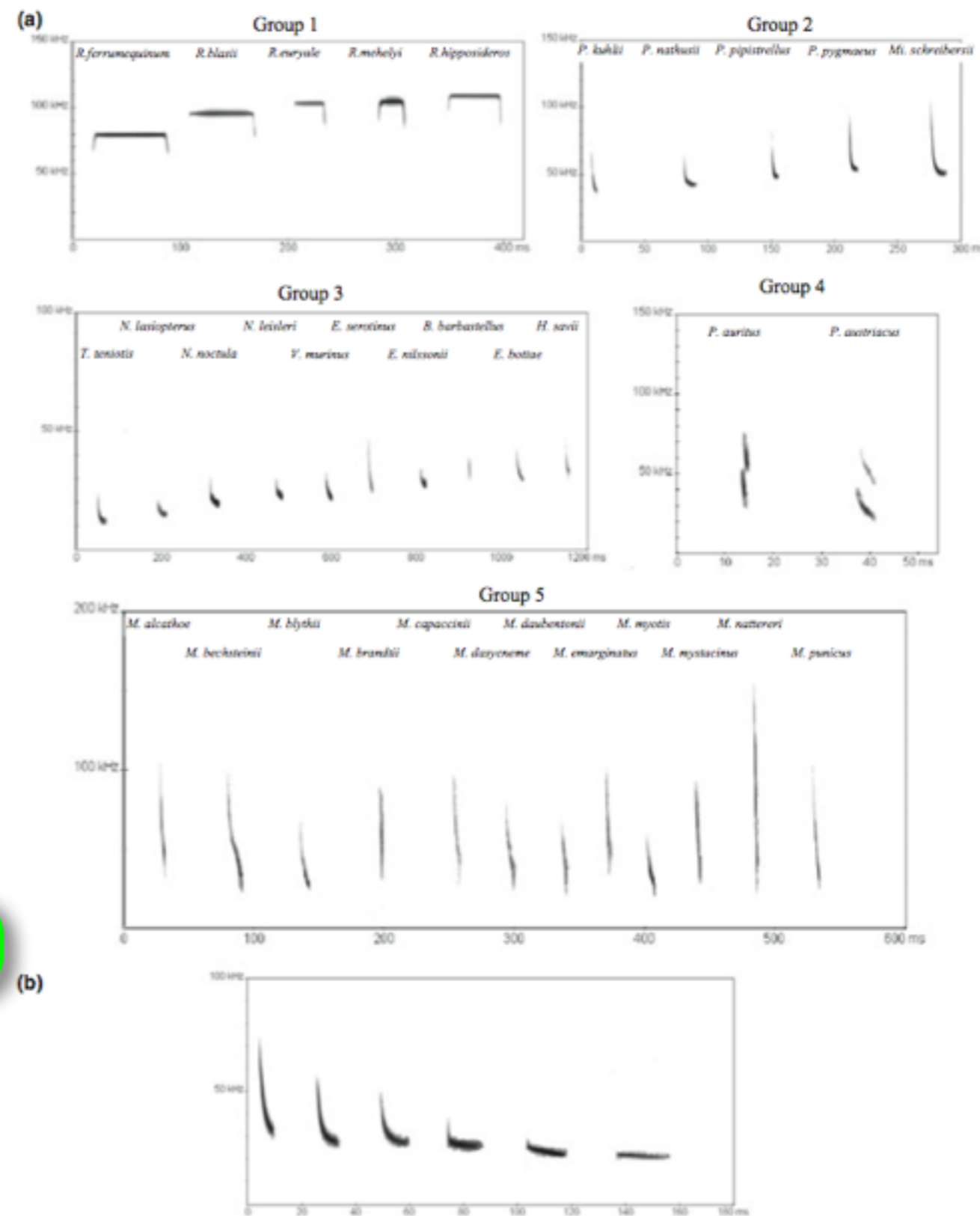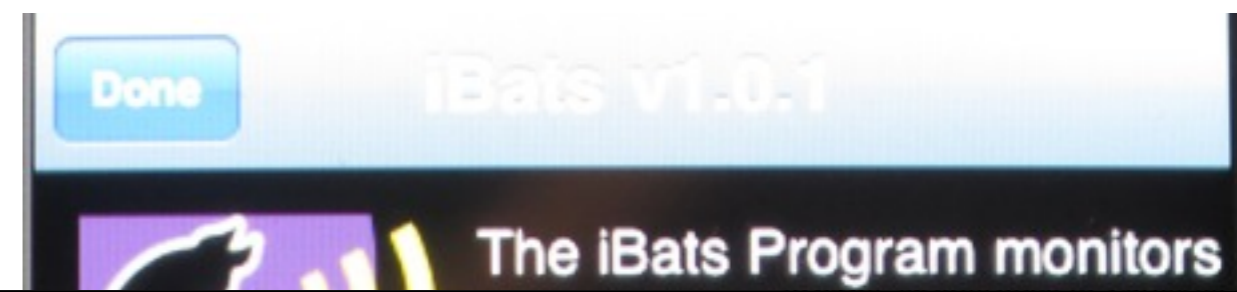
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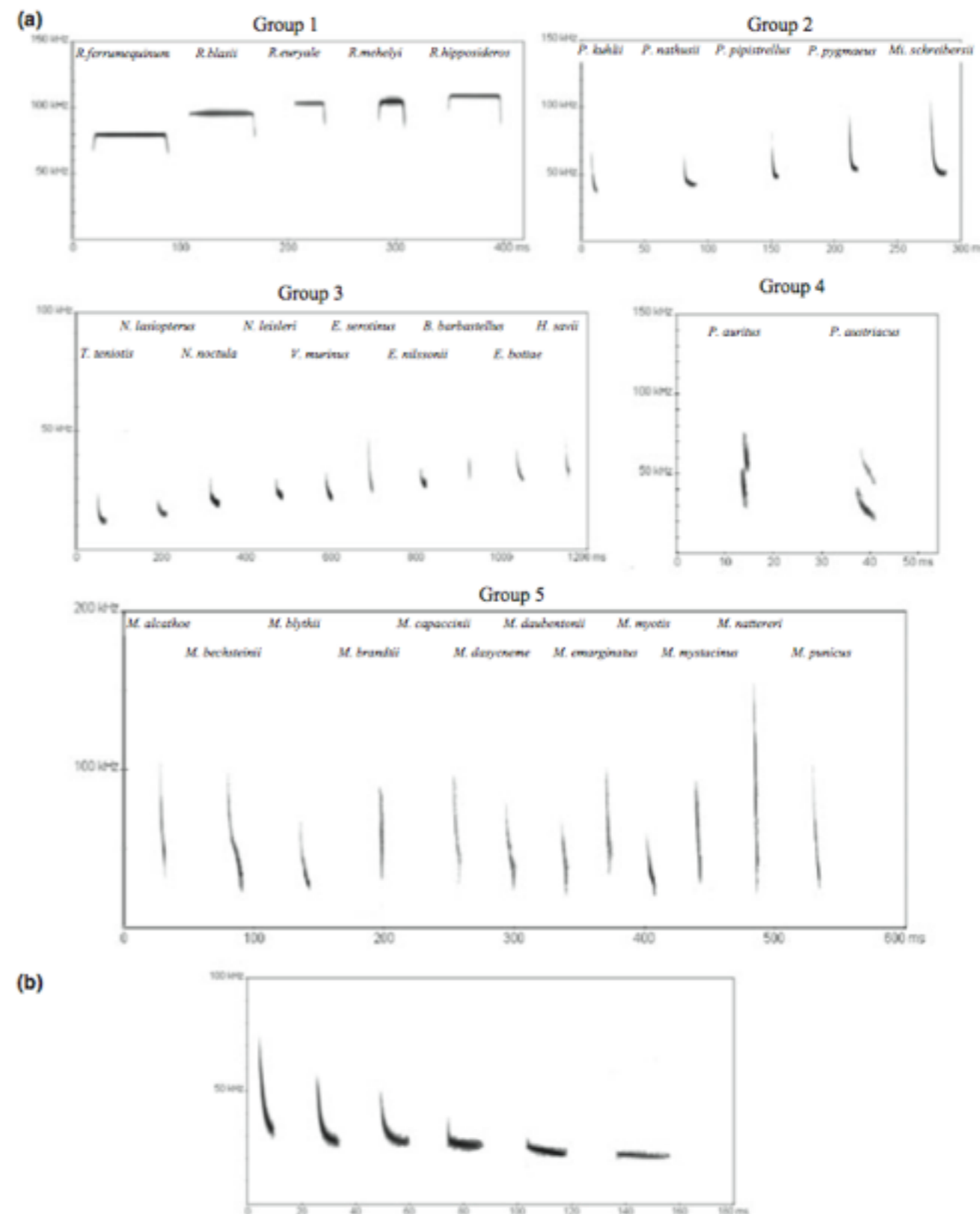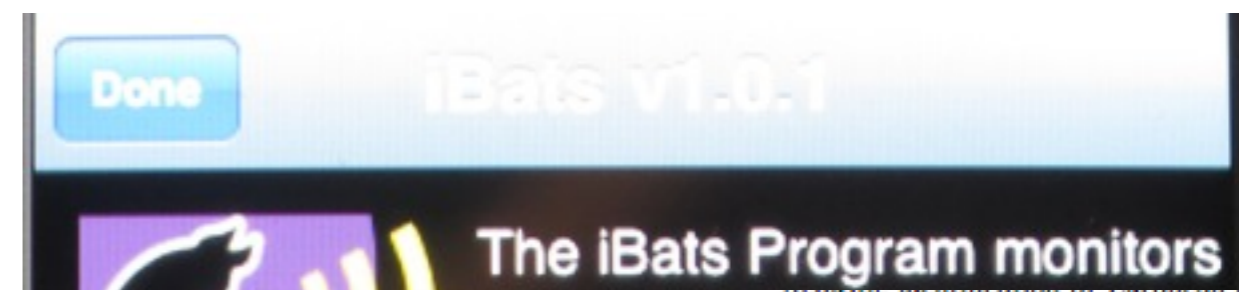
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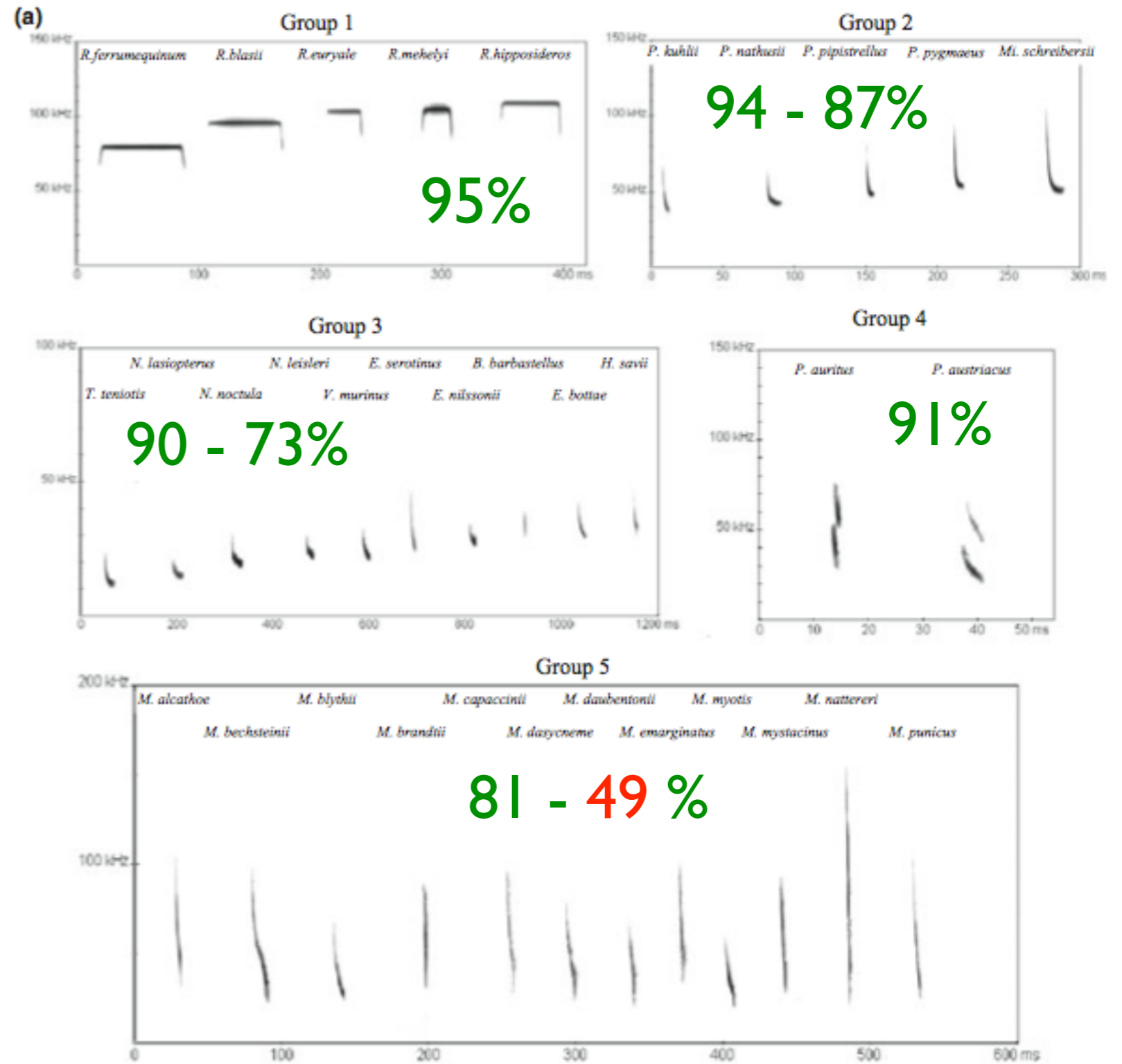
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# Correct ID of species



(a)

**Group 1**

R. ferrumequinum   R. blasii   R. euryale   R. mehelyi   R. hipposideros

95%

**Group 2**

P. kuhlii   P. nathusii   P. pipistrellus   P. pygmaeus   Mi. schreibersii

94 - 87%

**Group 3**

N. lasiopterus   N. leisleri   E. serotinus   B. barbastellus   H. savii
T. teniotis   N. noctula   V. murinus   E. nilssonii   E. bottae

90 - 73%

**Group 4**

P. auritus   P. austriacus

91%

**Group 5**

M. alcathoe   M. blythii   M. capaccinii   M. daubentonii   M. myotis   M. nattereri
M. bechsteinii   M. brandtii   M. dasycneme   M. emarginatus   M. mystacinus   M. punicus

81 - 49 %

(b)

Example of call variation within a species, *Nyctalus leisleri*

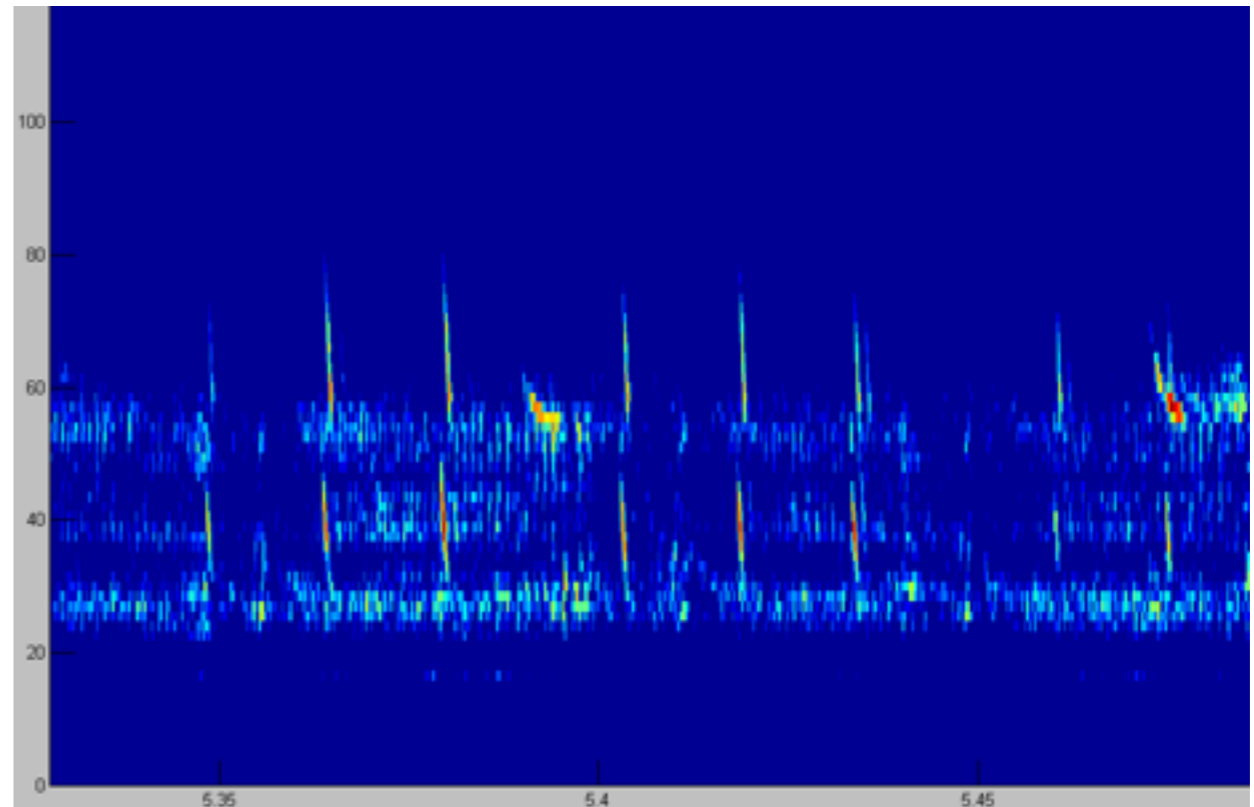= Challenge for auto-identification
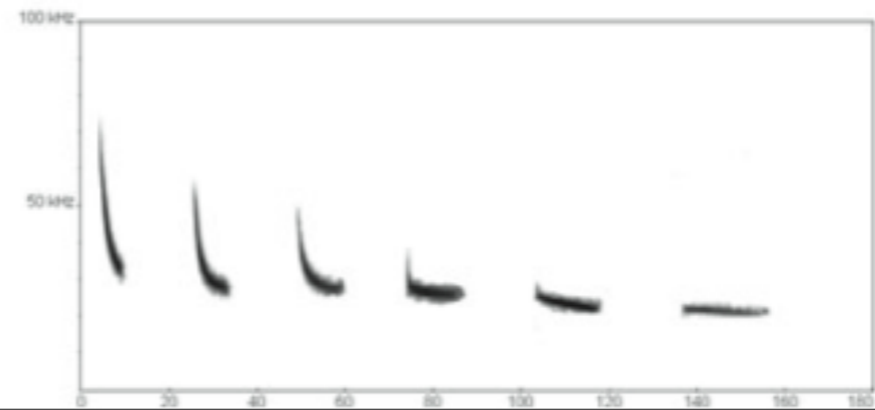
# What is needed for auto classification?

## Can we first filter-out "noise" (e.g., insects)
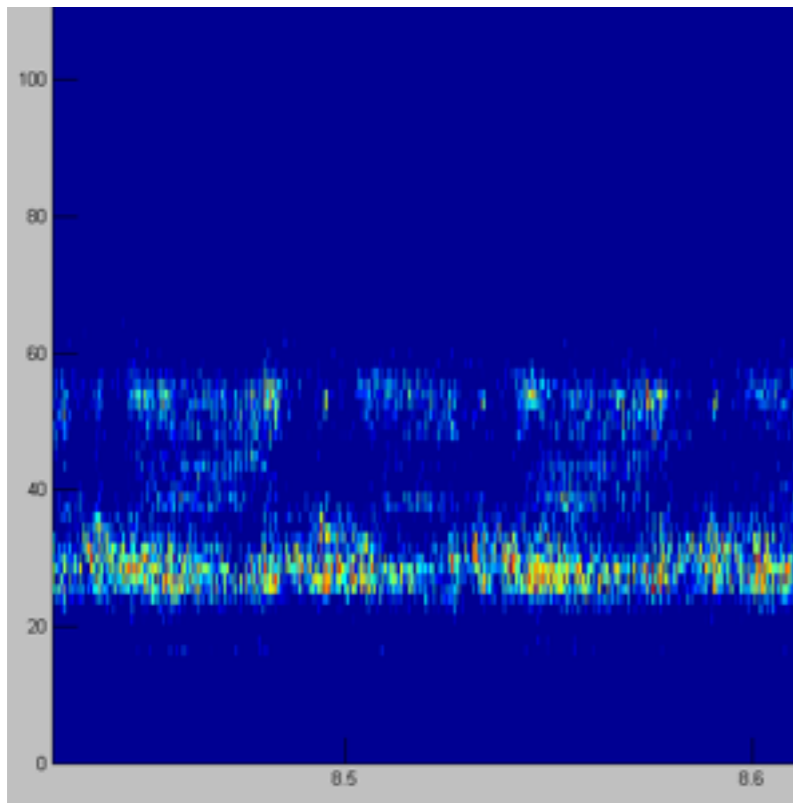




"Noise"
Correct
OK to delete file

"Noise"
False Negative
(poor signal : noise ratio)
Mistake to delete file

# EXAMPLE:
# Windsor Road
# Wildlife Acoustics "Noise" filter

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | Z:\Bat Recordings-SongMeter & Pettersson\Echo Meter\Data_2015_02-11_Windsor road\ | | | | | |
| 2 | callViewer17 | | | | | |
| 3 | Time: 12-Feb-2015 11:56:08 | | | | | |
| 4 | | | | | | |
| 5 | WAV FILE INFORMATION | | | | | |
| 6 | Number of channels: | Total number of files | | 184 | | |
| 7 | Sampling rate (Hz): | Classified noise | | 153 | | |
| 8 | Resolution (bits): | "Noise" incl. bat | | 30 | | |
| 9 | | | | | | |
| 10 | | % false negative | | 19.7% | | |
| 11 | QUICK SUMMARY PARAMETERS | | | | | |
| 12 | UPPER cutoff frequency: (kHz): | All Phyllostomidae misclassified as "noise" | | | | |
| 13 | LOWER cutoff frequency: (kHz): | | | | | |
| 14 | | | | | | |
| 15 | QUICK SUMMARY | | | | | |
| 16 | File name | Classified Noise | Includes bat | numCalls, 5 | 10 dB | 15 dB |
| 17 | EM3-JM_N_20150211_182427.wav | 1 | 1 | 11 | 8 | |
| 18 | EM3-JM_N_20150211_182443.wav | 1 | 1 | 1 | 0 | |
| 19 | EM3-JM_N_20150211_183218.wav | 1 | 1 | 2 | 1 | |
| 20 | EM3-JM_N_20150211_183237.wav | 1 | 1 | 1 | 0 | |
| 21 | EM3-JM_N_20150211_183253.wav | 1 | | 0 | 0 | |
| 22 | EM3-JM_N_20150211_183305.wav | 1 | | 3 | 0 | |
| 23 | EM3-JM_N_20150211_183310.wav | 1 | | 0 | 0 | |
| 24 | EM3-JM_N_20150211_183316.wav | 1 | | 1 | 1 | |
| 25 | EM3-JM_N_20150211_183515.wav | 1 | | 0 | 0 | |
| 26 | EM3-JM_N_20150211_183624.wav | 1 | | 0 | 0 | |

# Creating a Call Library:
## What is needed?

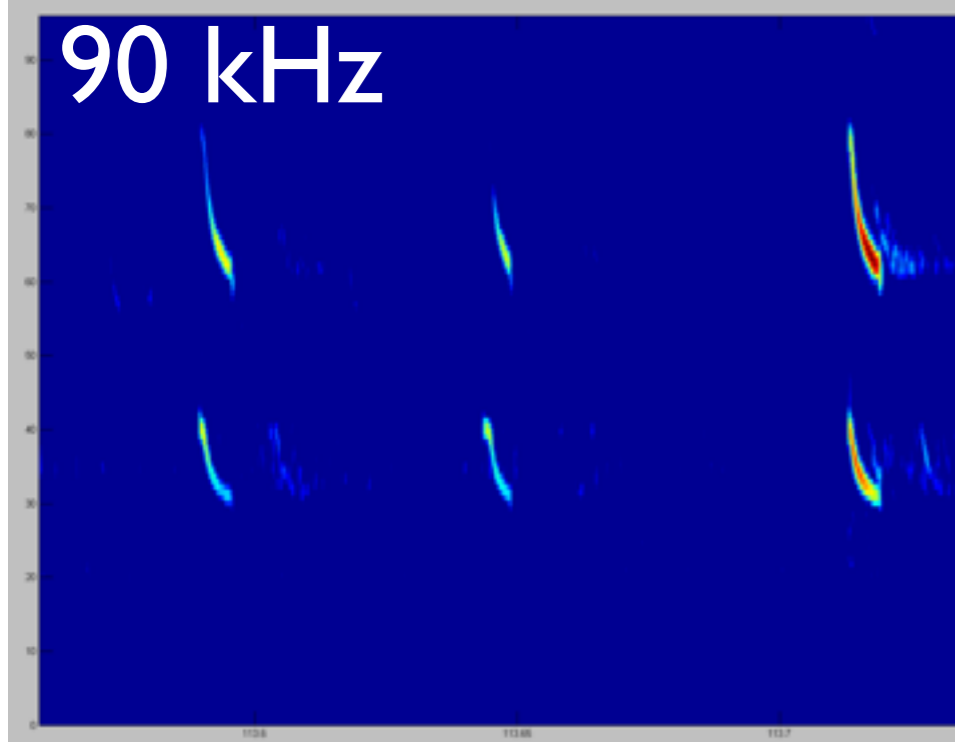## Complete frequency range of 2nd Harmonic
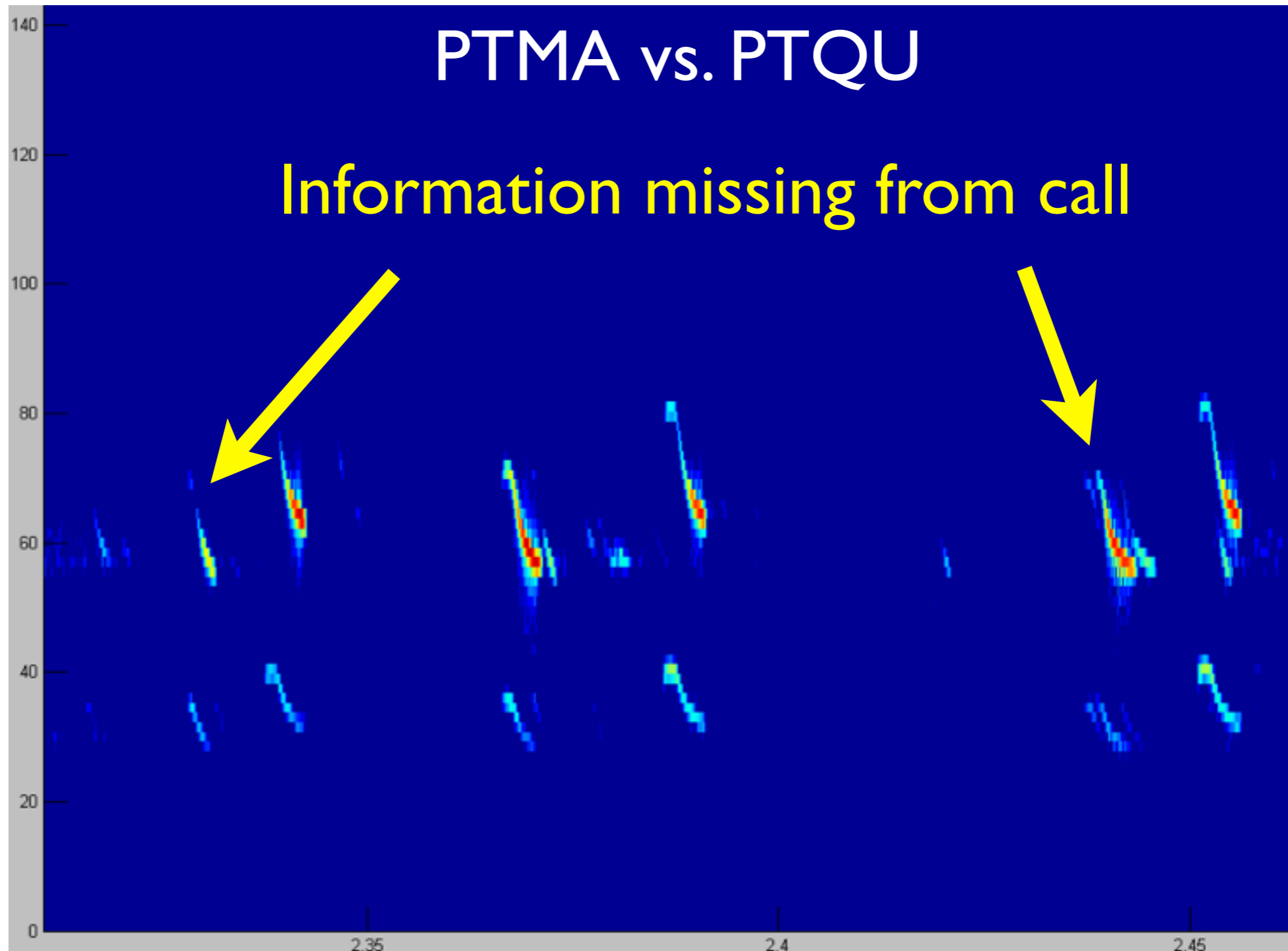
# Creating a Call Library:
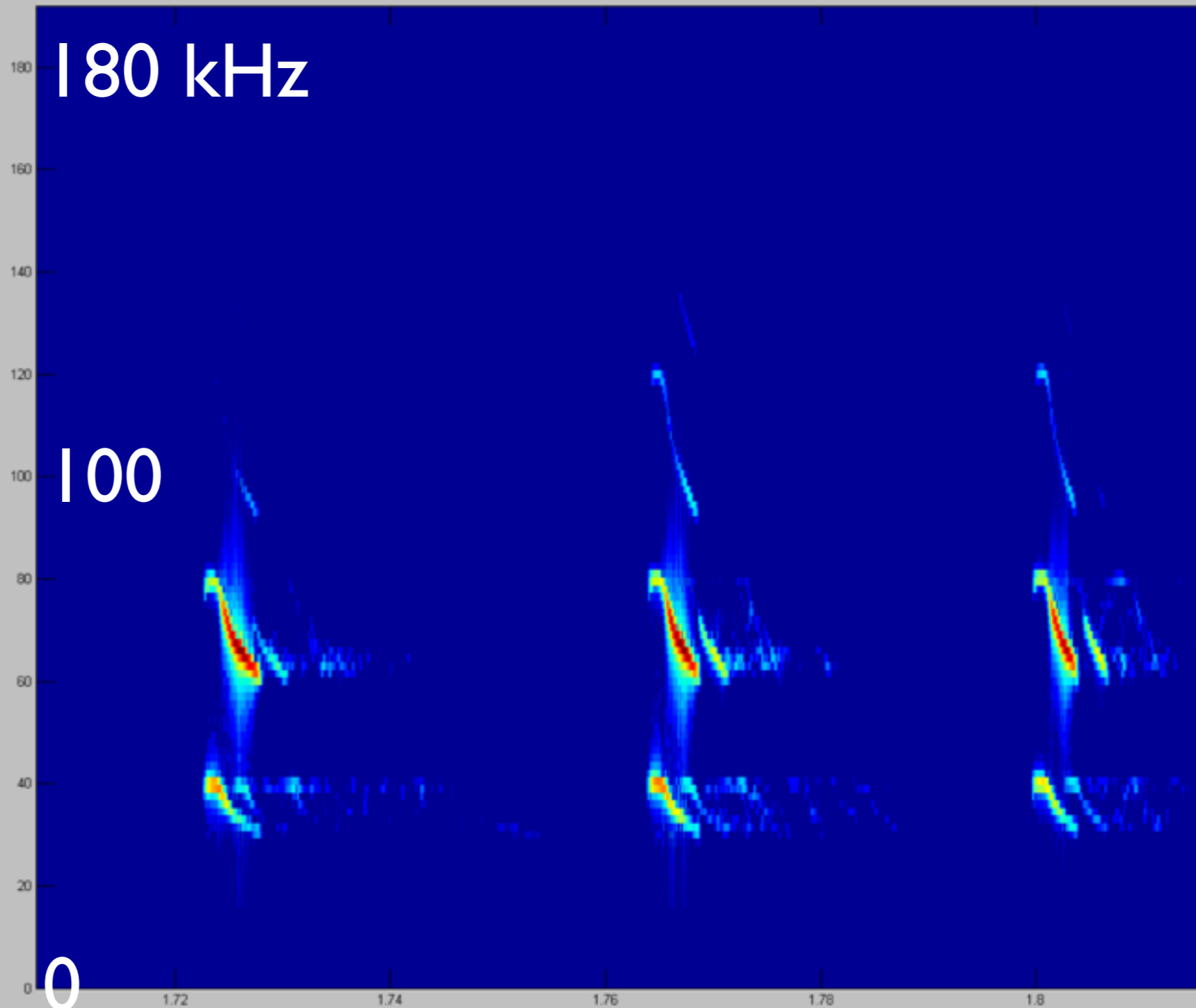## What is needed?

## Adequate Sample Rate for ALL species
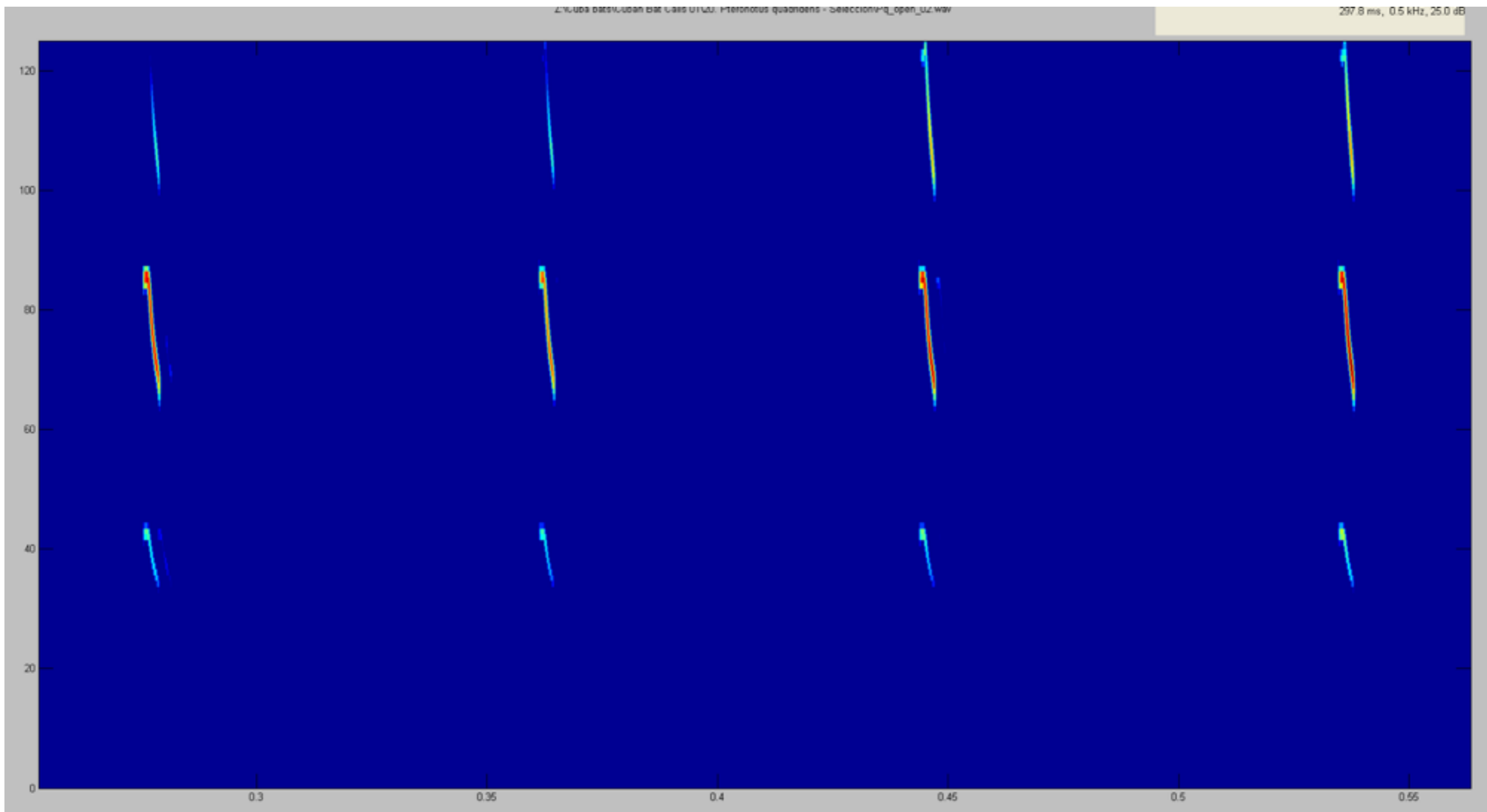
Inadequate bandwidth for tropical bats



90 kHz

180 kHz

100

0

# Creating a Call Library:
## What is needed?

## Minimal "noise", no echoes

# Towards Auto-Identification

See Walters *et al.* 2014 for complete list

**Table S2.** Definitions of the 24 call parameters extracted by SonoBat version 3.
* denotes the 12 parameters selected for training the classification tool of iBAT.

| Parameter | Parameter |
|-----------|-----------|
| FMin* | Minimum frequency of the call (kHz) |
| FPeak* | Frequency of the call at the point of maximum amplitude (KHz). |
| FMax* | Maximum frequency of the call (kHz) |
| BW* | Bandwidth: total frequency spread of the call, calculated from the difference between maximum and minimum frequencies of the call |
| Dur* | Duration of the call (ms) |
| FCtr* | Frequency at half the duration of the call (KHz) |
| FC* | Characteristic frequency: frequency of the instantaneous point in the final 40% of the call with lowest slope (KHz) |
| FKn* | Frequency at which the initial slope of the call most abruptly transitions to the slope of the body of the call (KHz) |
| FLg* | Frequency of the most extended flattest slope section of the call preceding the characteristic frequency (KHz) |
| StartS* | Slope in the first 5% of the call duration (KHz/ms) |

# ¡BATS - Caribeños ?

## A Work in Progress!