

# New criteria for the acoustic identification of the Greater Noctule, *Nyctalus lasiopterus*, lead to a better knowledge of its distribution in France.



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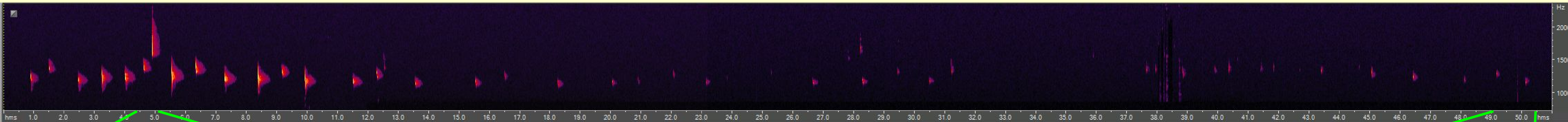
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## Abstract:

Although several important features of *Nyctalus lasiopterus* biology are now well understood, its echolocation calls were not yet described in details. Using automatic and long lasting recordings, we were able to gather typical search sequences of free flying animals which differ from the calls collected near the roost or from hand released individuals. The detection of that species was also hampered by the high-pass filter present in many bat detectors as well as by a predominant use of the heterodyne technique for bat detection.

The most characteristic and most frequent search calls can be described as shallow fm signals, lasting 20 to 35 ms, of limited bandwidth (no more than 2 kHz) and a final frequency of 11 to 13 kHz. Inter-calls intervals are long, with a mean value of 800 ms. As in *N. noctula* and *N. leisleri*, two alternating types are often present. As usual, in cluttered locations, calls tends to be higher, shorter and less spaced. Confusion can then be made, not with *N. noctula* as previously reported, but with *Tadarida teniotis*.

The new criteria of identification drawn from that study permitted to extend and refine the distribution of that species in France, from new recordings as well as from ancient unassigned or misclassified sound sequences. The Greater Noctule now appears to occurs in many wooded areas of the south two thirds of the country with three stronghold: Corsica Island, the Landes forest (south west) and the south of the Massif Central.

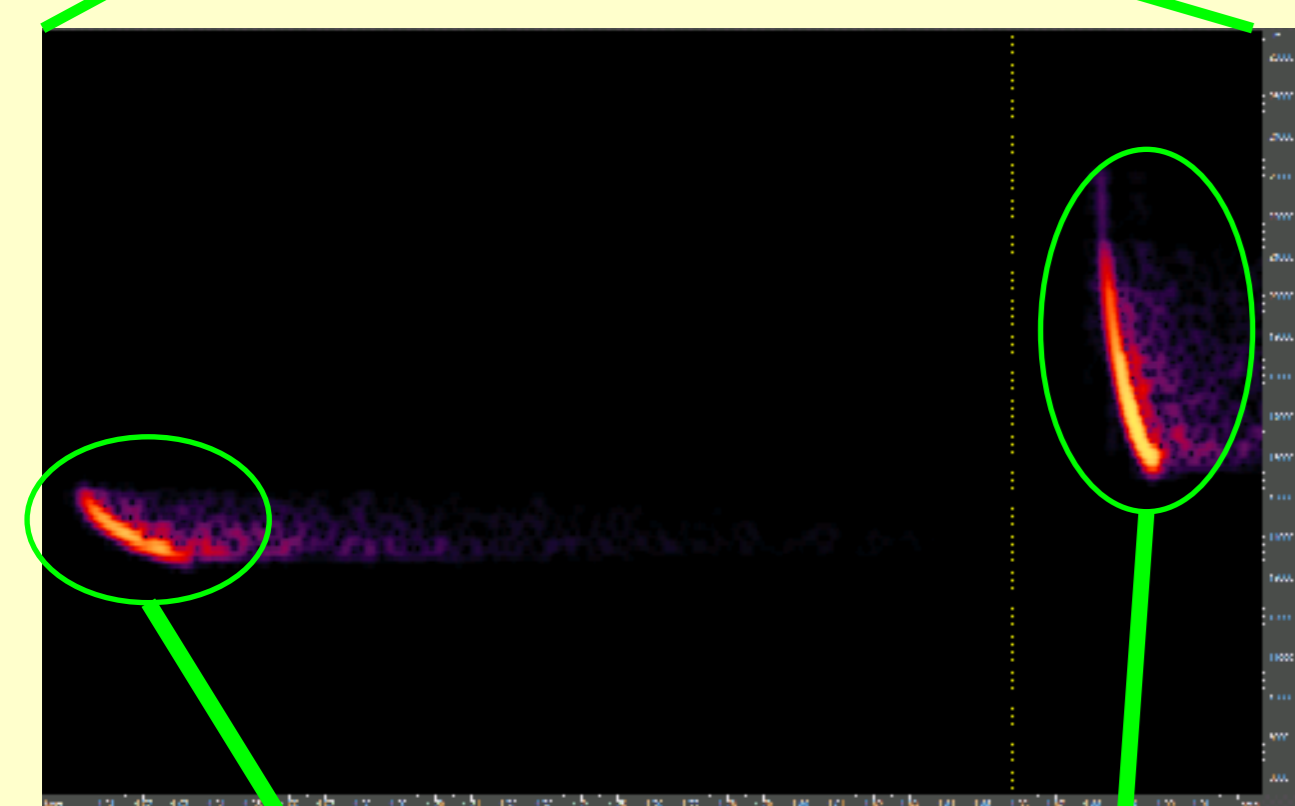


## Echolocation calls.

### Methods:

Most recordings were direct and unattended (continuous or volume triggered) using solid state recorder (Korg MR-1000), or computer and analog to digital converter (N.I. DaqCard AI-16E-4) or a bat detector (D1000X). In that way, we overcame an inherent bias of many field studies where both the high pass filter of most bat detectors and the habit of listening frequencies higher than 15 or 20 kHz lead to a strong underrepresentation of the most frequent and most characteristic *N. lasiopterus* sequences such as the one above.

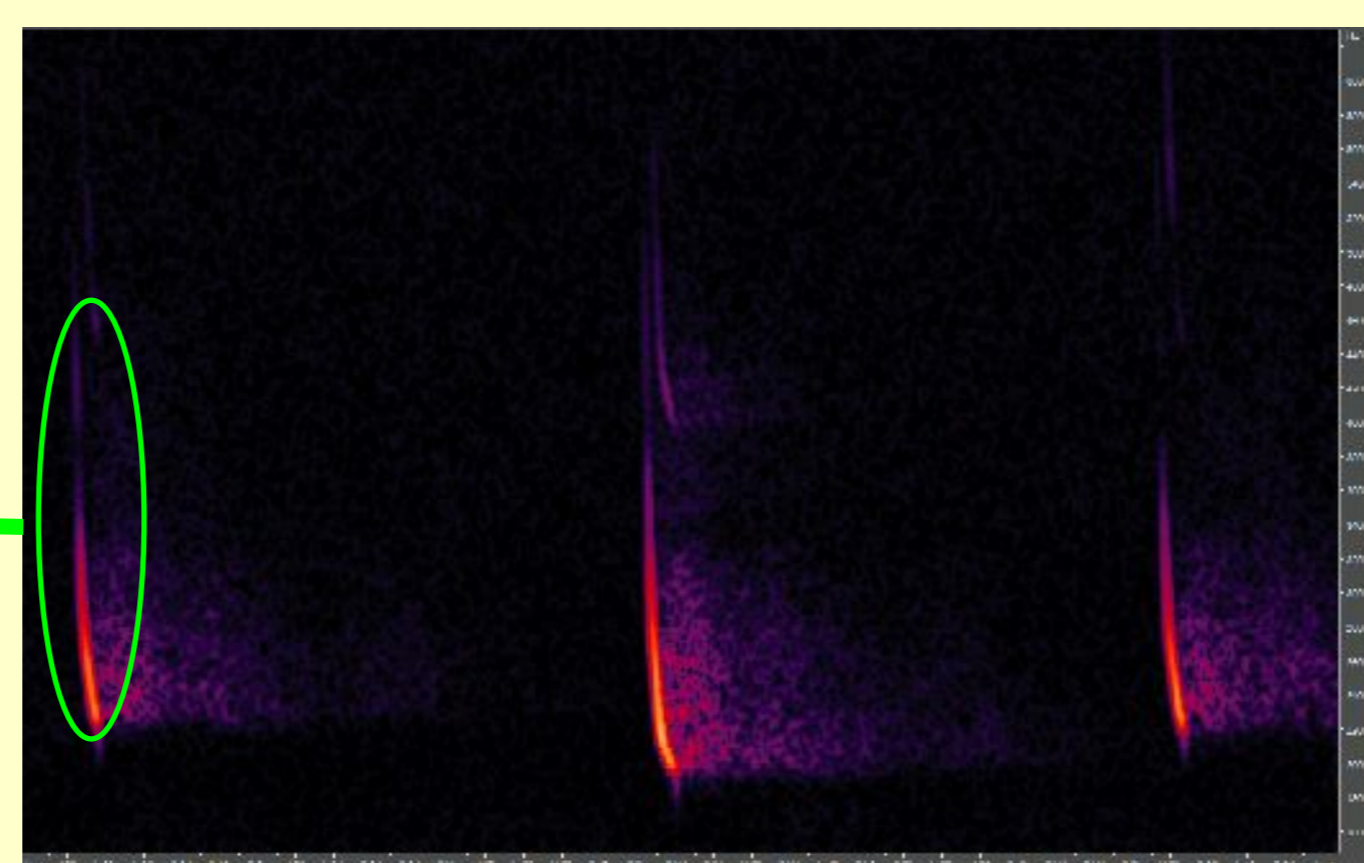
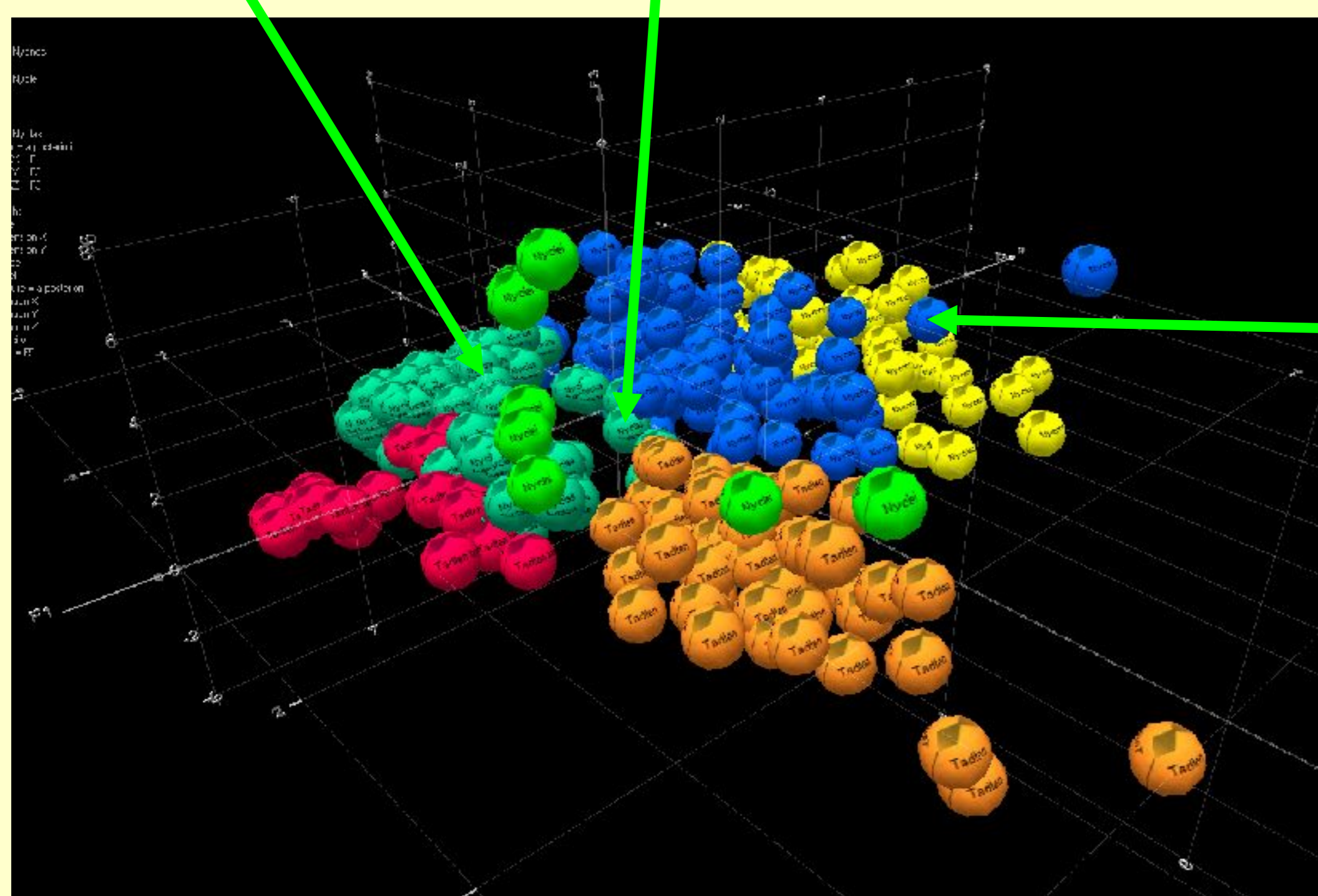
**Results:** Defining an archetypal call pattern (low frequency alternance) and being able to link such sequences to less characteristic calls such as pseudo buzzes, pursuit phases etc. present in the same recording make feasible to retrospectively identify some ambiguous recordings which were either unidentified or misclassified.



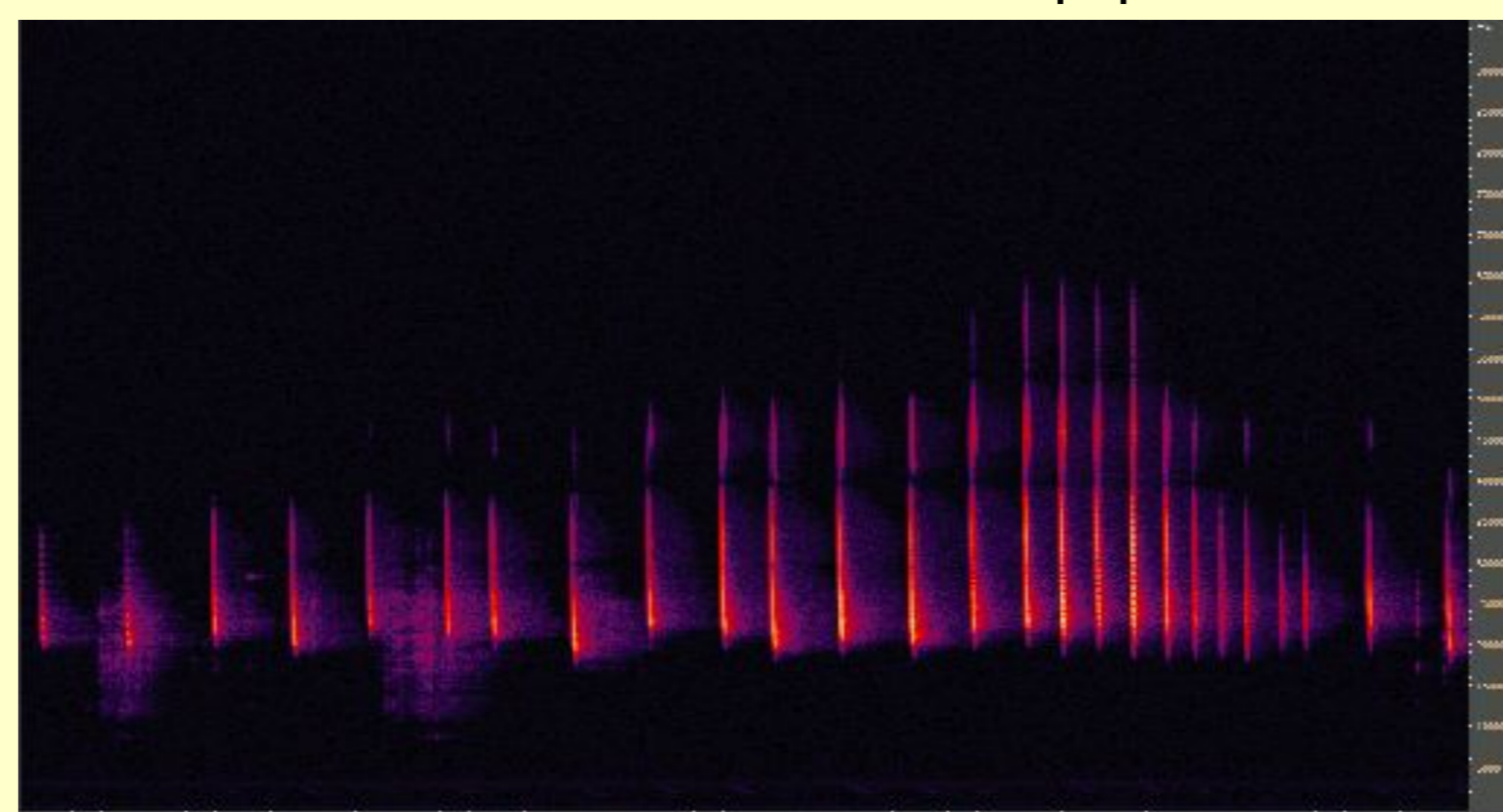
Typical « pseudo-buzz » intervening in search phase. The highest call is not very different from a *Tadarida* one.



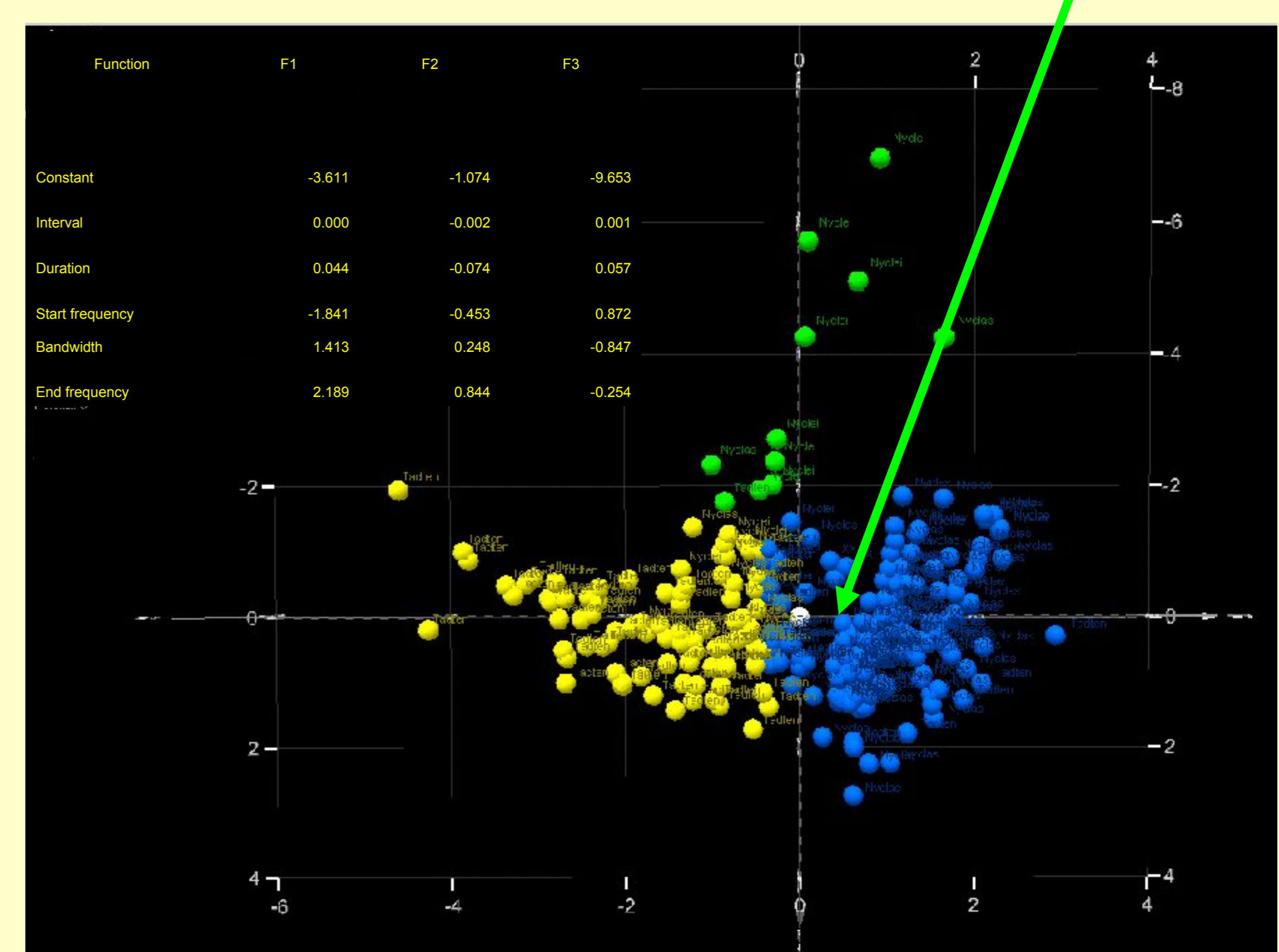
Characteristic search phase, with an irregular alternance of terminal frequencies which vary between 11.3 and 14 kHz. Mean interval is about 800ms. Some calls can be misclassified as *N. leisleri* social calls type K (cf. Pfälzer thesis).



Terminal part of a buzz emitted just before colliding mistnet. Ending sometimes higher than 20 kHz, those calls are reminiscent of *N. noctula* « plips ».



Drinking buzz. Interferences between calls and echoes from the water surface are visible.



Discriminant function analysis from 5 simple parameters: Interval, Duration, Start and End Frequencies and Bandwidth. Only « low frequencies » calls, i. e. with an End Frequency < 15 kHz, were retained for analysis. *Nyctalus leisleri* social calls are the more difficult to assign..

To:	Nyctalus	Nyctalus low f	Nyctale	Nyctoc	Tadten	Tadten low f	% correct	n	
from Nyctalus	77	5	0	5	0	0	_94%	87	
from Nyctalus low f	7	117	2	0	2	10	_89%	138	
from Nyctale	0	6	4	0	1	0	_36%	11	
from Nyctoc	20	0	0	39	0	0	_66%	59	
from Tadten	1	2	2	0	43	0	_69%	48	
from Tadten low f	0	8	0	0	1	19	_71%	28	
							Global	_84%	371

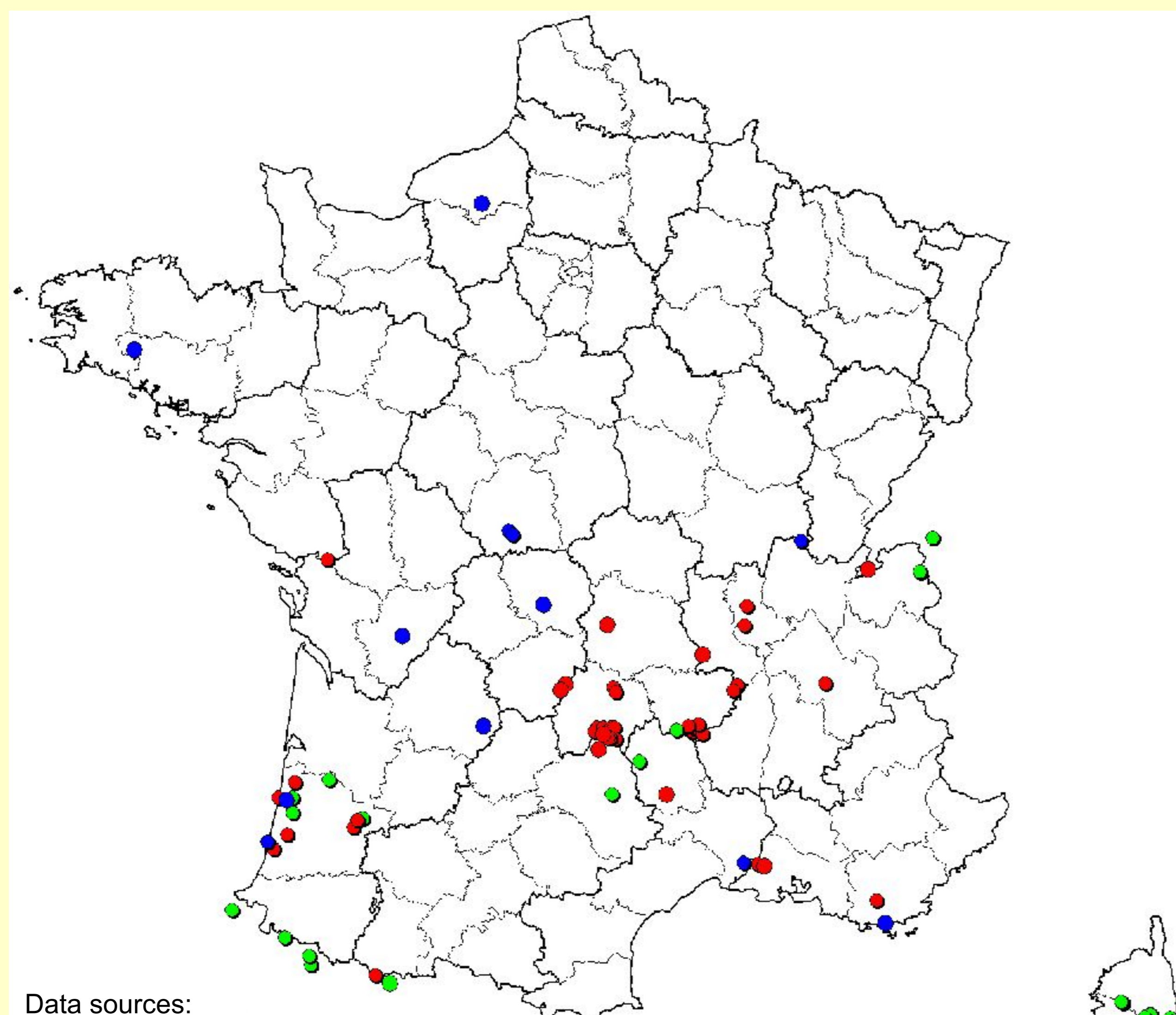
Discriminant function analysis using a set of parameters automatically measured with Osprey (duration,high freq,Bandwidth,Time Quart.,Time Concent.,Time Asymm.,Median Freq.,Freq. Quart.,Freq. Concent.,Freq. Asymm.,Pk.,verall F,AM Rate,AM Rate Var.,FM Rate.,FM Rate Var.,Cepstrum Width,Upsweep Mean,Upsweep Frac,MaxFreqTerm; Dave Mellinger). Many calls were recorded during manual survey when listening for higher emitting species and are thus unusual and more prone to be misclassified. Nevertheless, 84% of the calls are correctly classified.

## Distribution of *Nyctalus lasiopterus* in France. Is it linked to coniferous woodlands ?

During the XIX<sup>th</sup> century and most part of the XX<sup>th</sup> century, only thirteen individuals were recorded, most often dead except for two females caught in mistnet at Col de Coux in the French Alps. At the beginning of the XXI<sup>st</sup> century, several catches were made in Corsica and Landes. Since then, the refinement of acoustic identification allows many French observers to gather or to reinterpret recordings and led to an huge increase in the distribution data.

The sixty or so locations focus on three main areas:

- Corsica island where only males were recorded in mountains.
- Landes forest where, among twelve different records, three females were caught or collected. One of them was lactating.
- Massif Central mountains where most records are acoustic.



Data sources:  
■ Acoustic (39)  
■ Mistnet captures (25)  
■ Museum collection, rehab. (12)

