



# Università degli Studi di Pavia

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CNRS & LSIS - Univ. of Toulon (France)

SABIOD Italy

Summary Report 2014 and Proposal 2015



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Rev. 16-11-2014

## **SABIOD Italy 2014**

The project focuses on the long term recording of soundscapes in natural habitats with different degrees of protections/anthropization. Three mountain habitats have been identified and monitored in summer 2014, two on the Alps, and one in Central Italy. A sea shore habitat has been also partially monitored on Isle Palmaria (Portovenere, La Spezia) in the “Cinque Terre” National Park. Two more sites planned in the Pianura Padana were not monitored because two requested recorders have not been dispatched yet.

The main area to be monitored is the Natural Integral Reserve of Sassofratino created in 1959 located in the core of the National Park “Foreste Casentinesi” in Tuscany and Emilia-Romagna (Central Italy); it is a wild area where any access is forbidden; no trails or roads pass through it and the area is surrounded by other Nature reserves. We consider it an example of silent area, the only human noises heard there are those of passing airplanes. The project has the support of the National Forestry Police (CFS) that provides logistics and the permits to enter, under their strict control, in the RNI area.

### **Personnel and collaborators**

PI Gianni Pavan

Collaborators:

Andrea Favaretto, freelance, CIBRA collaborator

Stefano Macchio, freelance, CIBRA collaborator

Bruna Bovelacci, thesis, Univ. of Pavia

Dino Scaravelli, IUCN bat specialist group, Univ. of Bologna, Ultrasonic monitoring of bats

Pamela Priori, PhD Student Univ. of Urbino, Ultrasonic monitoring of bats

Logistic support in Sassofratino provided by CFS – UTB

### **Materials and Methods**

For the preliminary phase we used 3 WildlifeAcoustics SM3 and 2 SM2 autonomous recorders; samples have been also taken with an Olympus LS100 recorder equipped with 256GB SDXC card, powered by external battery package to allow continuous recording, 24/24h, for 15 days (48 kHz, stereo, 16 bit).

For preliminary ultrasonic monitoring various models of digital bat detectors and Dodotronic microphones have been tested.

### **Data Collection**

The data collection based on autonomous recorders produces huge amount of data that needs to be copied from the original SDHC and SDXC memory cards to a portable hard disk and then definitively stored on a fast RAID disk system in the CIBRA lab. In a next step the archive will be made available by FTP, however, it must be taken into account that a huge amount of time is required just for data transfer.

With a scheduling of 10 minutes recording every half-hour, stereo 16 bit format at 48 kHz (usable bandwidth 21 kHz, file size 112.5 MB), we produce 5.53 GB every day, 166 GB every month, about 2TB/year for each recording location.

By extending recording to 24/24h we produce 16 GB/day, near to 6TB/year.

Recording ultrasounds, e.g. for monitoring bats, require further increase of storage requirements; recording full bandwidth at, say, 384 kHz single channel 16 bit, requires 2.6 GB/hour. However, considering that only bats and few insects do sounds in the ultrasonic range, and that the sounds are received only when sources are close, storage space can be dramatically reduced by using smart recording systems that save data only when signals are present.

Table – Recording sites, Recording period and data size for recording site  
(\*preliminary, latest data to be recovered; \*\* deployed for winter with external battery)

Site	Latitude	Longitude	Altitude
Sassofratino - La Bucaccia	43° 50' N	11° 50' E	900 m
La Vetreteria	43° 49' 50.24" N	11° 50' 28.97" E	726 m
La Lama	43° 49' 47.66" N	11° 50' 9.51" E	708 m
Cansiglio Valmenera - Corneseghe	46° 04' 56,88" N	12° 25' 41,27" E	948 m
Casa del Conte	46° 23' 03,29" N	12° 18' 59,41" E	1647 m
Palmaria	44° 2' 34" N	9° 50' 55" E	171 m

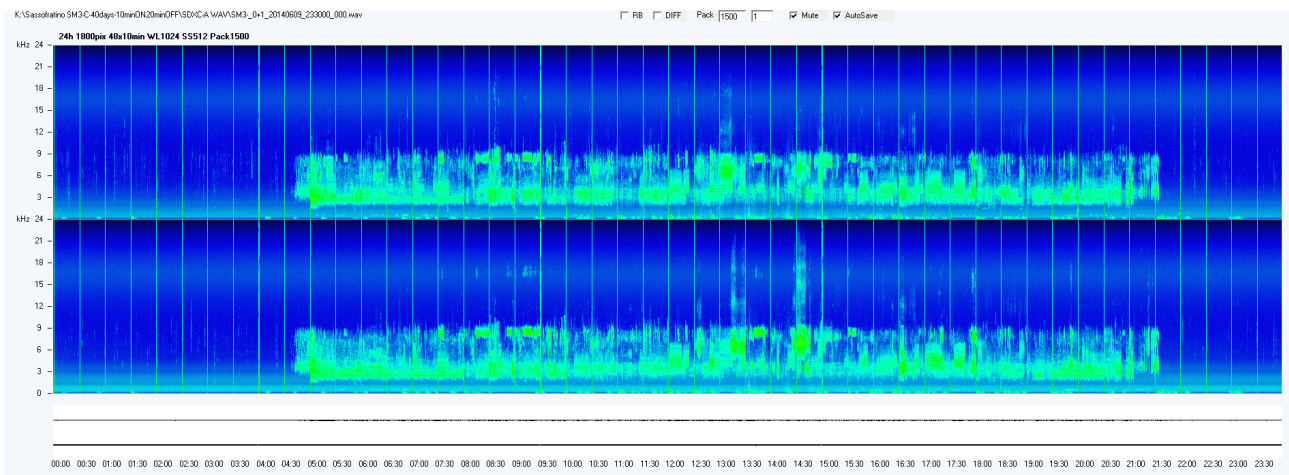
Site	Recording mode	N files	Total Size	N Species
Sassofratino La Bucaccia 28-05 to 05-07 La Vetreteria 06-07 to 06-08 La Lama 28-08 to 18-09 La Lama 18-09 to 13-11 La Lama 14-11 to **	10min every 30min stereo 48kHz sampling	8196 (1366 h)	930 GB	70 - 100 birds >5 mammals >5 amphibians (8 bats, monitoring planned in 2015)
La Lama 22-09 to 5-10	Continuous 24/24h 3:06 each file stereo 48kHz sampling	105 (325 h)	224 GB	
Casa del Conte * 03-06 to 09-08 31-08 to 06-09	10min every 30min stereo 48kHz sampling	3545 (591 h)	399 GB	50 – 90 birds
21-04 to 04-05	15 min every hour stereo 48 kHz sampling	320 (80 h)		
Cansiglio * 07-06 to 01-07 25-07 to 15-08	10min every 30min stereo 48kHz sampling	2174 (362 h)	245 GB	50 – 90 birds
Palmaria * 01-08 to 15-08	10min every 30min stereo 32kHz sampling	506 (84 h)	38 GB	40 – 60 birds

## Data analysis

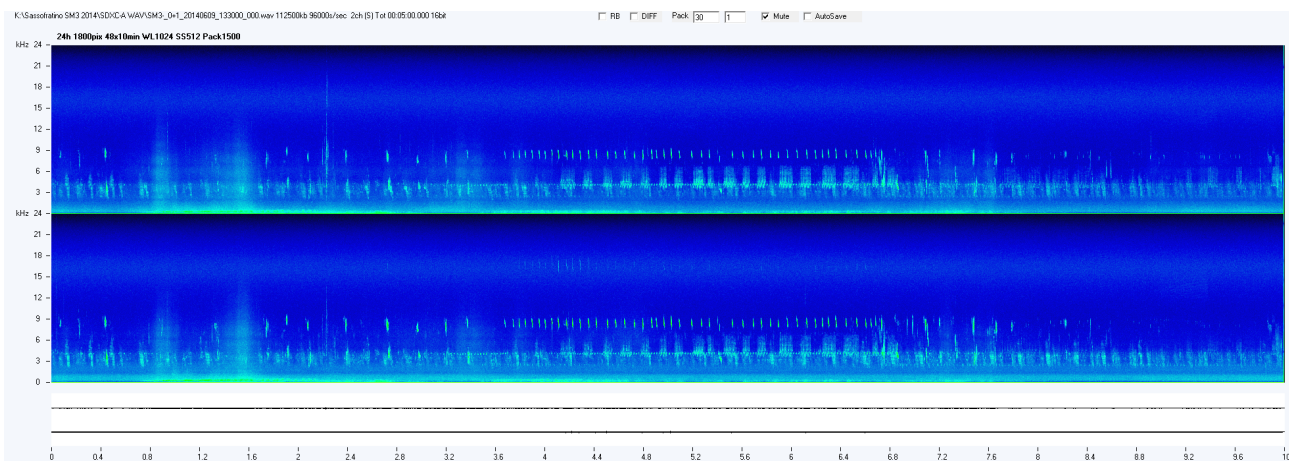
The software SeaPro has been modified to allow the analysis of series of consecutive files and to produce “packed spectrograms”. Depending on the time resolution needed, after having set the most appropriate analysis parameters for the specific sounds to be analyzed (FFT size, spectrogram height, frequency zoom factor, window size and shape, time scan step), it is possible to set a “packing factor” and a “packing mode”.

The recordings are primarily examined at 24h time scale, by producing daily packed spectrograms, to recognize macroscopic events (e.g. wind, rain), aggregation patterns of songs, and sparse acoustic elements (e.g. thunders, airplanes). Most typical aggregation patterns are then analyzed at 10 minute scale and at 10 or 20 seconds time scale to recognize components, e.g. specific individual songs. Specific individual songs are patterns of acoustic elements that compose a recognizable song that repeats with more or less the same structure.

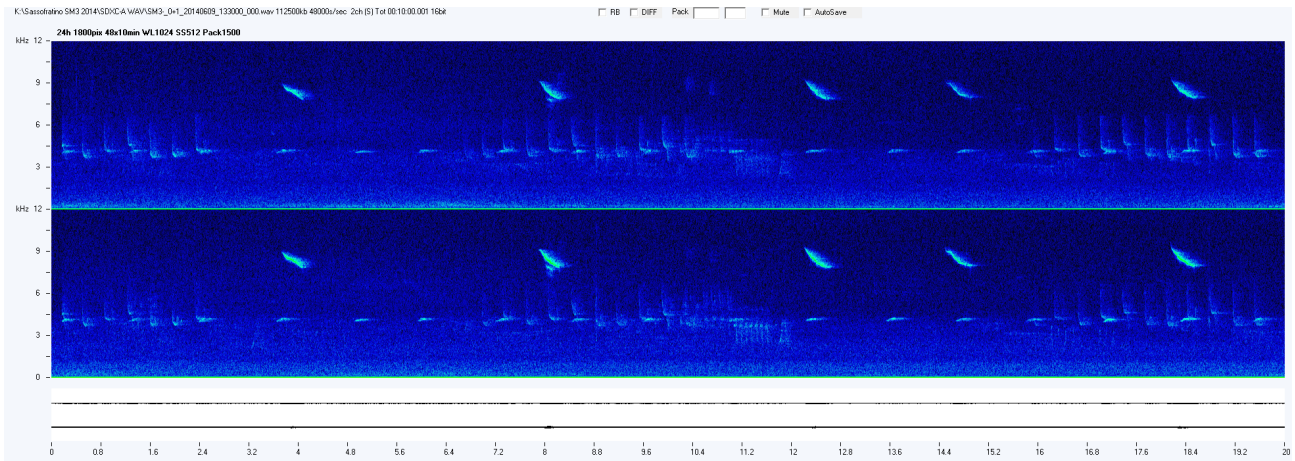
Once all specific individual songs and other sparse acoustic objects will be recognized, a library will be compiled to allow ornithologists match the songs with the emitting species.



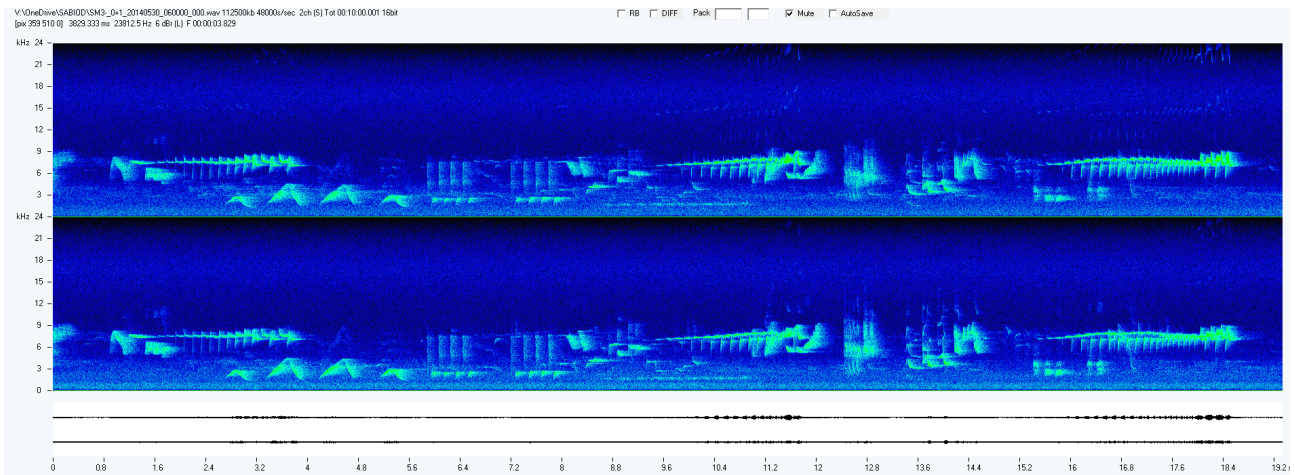
*La Bucaccia, day 20140609. Packed spectrograms (1500 spectra/line) of one day recording, 10 min every half-hour (48 frames/day). Clear transitions at dawn and dusk. Airplanes produce the small spots on the x axis.*



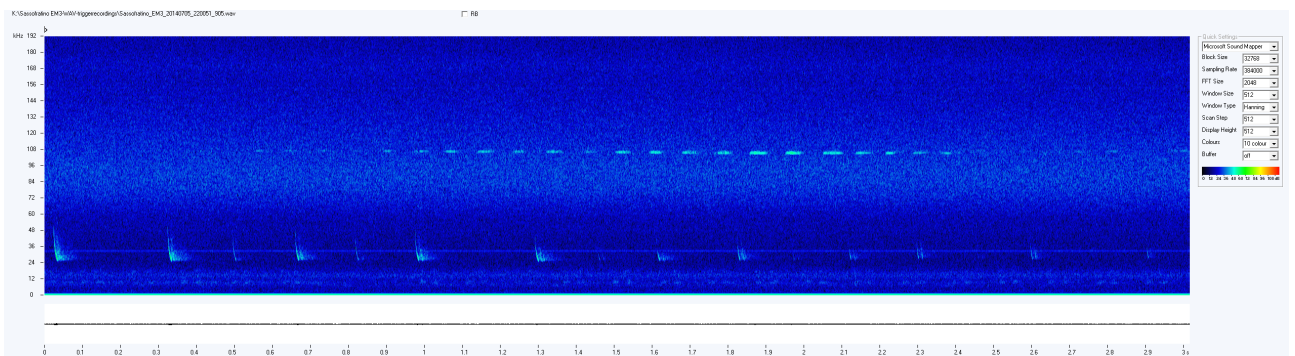
*Packed spectrogram (30 spectra x line) of 10 minutes (day 20140609 at 13:30). At least five species are singing together. On the left, wind appears as low frequency noise plus wideband noise produced by the leaves. An overflying airplane makes a low frequency rumble.*



*High resolution spectrogram of 20 seconds from the middle of the previous spectrogram shows four different species singing. Three specific songs overlap in time and frequency.*



*High resolution spectrogram of 19.2 seconds recorded in La Bucaccia. The high density of songs in the Sassofratino site makes difficult to "isolate" and extract individual songs to be used as a reference for automatic recognition and classification.*



*Ultrasonic monitoring of selected sites and time periods. Echolocation sequences of two bat species with base frequency at about 25 kHz and 108 kHz; the latest is very typical of *Rhinolophus ferrumequinum*.*

## SABIOD Italy - Equipment and costs

SABIOD - Italy in 2014 has been supported by CNRS with a 17K€ grant for equipment and travel costs. Equipment and travel costs have been also provided by CIBRA; logistic support in Sassofratino / La Lama has been provided by CFS at no cost; logistic support on the Alps has been provided by A.Favaretto with a grant from CIBRA; logistic support on Palmaria island has been provided by S.Macchio and by the Portovenere authorities.

Summary budget table for year 2014:

Institution	Activity	Amount in €
CNRS	Equipment + travels to France	20000
CIBRA	Research grant to A.Favaretto	4800
CIBRA	Equipment	7000
CIBRA	Travel costs in Italy	3000
CFS	Logistic support	

Equipment and materials provided by CIBRA (total value about 7000€):

Quantity	Description	Note
16	battery Lithium size D 3.6V 19000mAh	consumables
16	Battery Duracell Pro Size D	consumables
2	WildLifeAcoustics SongMeter 2 with 2 internal microphones	
3	WildLifeAcoustics SongMeter 3 with 2 internal microphones	
1	WildlifeAcoustics EM3 bat detector and ultrasonic recorder	
2	Dodotronic UltraMic250K ultrasonic microphone with USB interface	
8	SDXC 128GB memory card	
1	SDXC 256GB memory card	
2	Desktop PC Core i7 1TB HD 8GB RAM	
2	Portable Hard Disks 1TB	

Travel costs supported by CIBRA (total about 3000€):

- 6 travels to Sassofratino / La Lama, about 2000 €
- 2 travels on the Alps, about 800 €
- 1 travel to Portovenere, about 200 €

## Equipment provided by CNRS (requested on April 2014 – about 6000€):

Quantity	Description	Note
1	pack 50 batteries size D Duracell Procell PC1300	consumables
16	battery Lithium size D 3.6V 19000mAh	consumables
2	amplified speakers M-AUDIO M3-8	
2	Pelicans 1170 black	
8	SDXC 128GB memory card	
1	Olympus LS100 digital recorder	
1	1TB 2.5" Samsung SSD EVO 840 – solid state disk	
4	2TB 2.5" USB3 portable disks	
1	20TB USB3 RAID hard disk array	
2	Dell UltraSharp 27 Monitor - U2713HM - 2560x1440	
1	GoalZero Sherpa 50 rechargeable battery	
1	GoalZero Nomad 20 solar panels	

Equipment requested to CNRS (April 2014) not received yet (about 2000€):

Quantity	Description	Note
2	WildLifeAcoustics SongMeter 3 with 2 internal microphones	Not received

## Travel costs supported by CNRS (about 1000€)

- 1 travel to Paris to attend the ecoacoustics conference
- 1 travel to Toulon to participate to JASON instrument deployment in Port Cros

Equipment requested to CNRS on October 2014 (about 8000€):

Quantity	Description	Note
5	LASCAR EL-USB-2 Temperature & Humidity Data Logger	data logger
2	Laser Electronic 12V 20A Lithium battery	battery
3	Laser Electronic 12V 30A Lithium battery	battery
2	Dodotronic WaveShark multichannel high speed recorder	recorder
2	Dodotronic WaveFalcon microPC recorder with web control	recorder
4	Dodotronic Momic with connector for WaveShark	microphones
1	BRINNO TLC 200 PRO HDR - ATH 120 waterproof housing	videocamera
2	SAMSUNG EVO BASIC 840 1 TB	SSD disk
4	Western Digital WD Red Desktop WD40EFRX 3.5" 4TB	hard disk
1	iFi Micro Nano iDSD, DAC	DAC
1	Blue Microphones - Blue Yeti Pro USB/XLR	microphone USB
1	TASCAM DR-44WL	recorder Wi-Fi

## SABIOD – Italy – Program proposal for years 2015 & 2016

The next years' program will focus more on the RNI Sassofratino with continuous monitoring with two recorders located in the dense forest core and one in an open transitional area to provide synchronous recording. Temperature and humidity data loggers will be used to monitor the two weather parameters that mainly drive bird and insect singing activities. As in the site several species of bats have been recognized in a preliminary survey, a prototype of a permanent ultrasonic monitoring device will be installed as well.

Additional sites are being planned on the Alps, on the isle Palmaria, and on a wetland in North Italy. New recording instruments able to record ultrasounds (WaveShark and WaveFalcon prototypes) will be extensively tested and adapted to SABIOD in strict cooperation with the producer Dodotronic. Ultrasonic monitoring on two bats colonies is planned, one in Sassofratino (no cellphone coverage), one close to Pavia. In locations covered by 4G/LTE services the WaveFalcon web connected recorder will be tested and tuned to provide remote control and public online access to audio data. New powering options will be also tested, based on rechargeable external Lithium battery packages for SM3 recorders to allow 4 month recording, and based on solar panels and rechargeable Lithium battery packages to power the web connected WaveFalcon.

As for data processing, analysis and display software developed at CIBRA (e.g. the SeaPro package) will be further adapted to the analysis of SABIOD data. New algorithms for data reduction, data mining, and sound classification developed within SABIOD will be tested on SABIOD-Italy archives.

In May-June 2015 a workshop will be organized in Cooperation with the Italian Forestry Service to improve the understanding of acoustic methods for the study and management of natural habitats. The workshop will be targeted to the CFS personnel, researchers, and high-level students. The location will be in the National Park "Foreste Casentinesi".

Equipment to be requested to CNRS for 2015-2016 (preliminary list)

Quantity	Description	Estimated cost
10 sets	Non rechargeable batteries for long deployments	800 € / year
2	Cellphone wireless data connection plan 4G or LTE	240 € / year
1	Phonometer with web interface	4000 €
1	High performance multi CPU desktop PC	4000 €
4	WaveFalcon microPC recorder with web connection	3600 €
	Maintenance of instruments, accessories, etc.	2000 €

Estimated travel costs for year 2015 and 2016 (preliminary)

Quantity	Description	Estimated total cost
6/year	Management of recorders in Sassofratino	1800 € / year
6/year	Management of recorders on Alps	1800 € / year
2/year	Travel to Toulon University	1000 € / year
2/year	International Conferences	2000 € / year