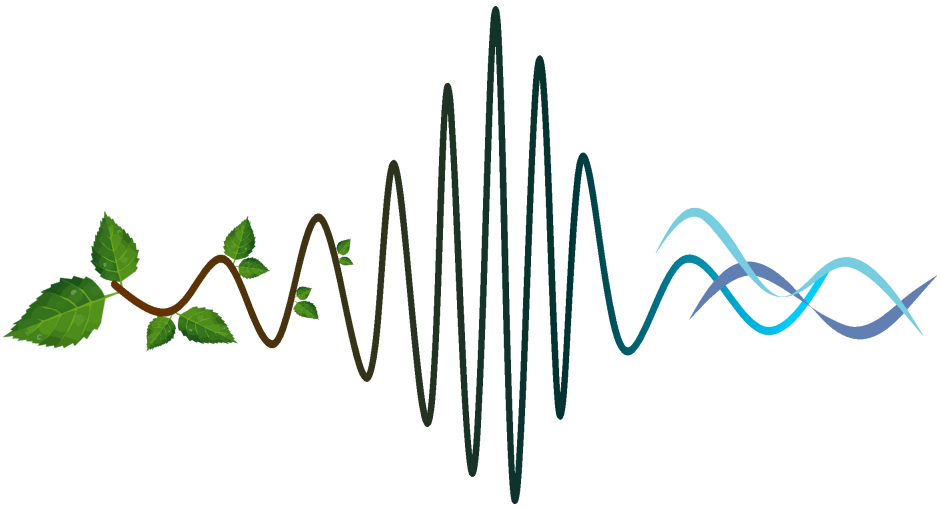
ECOACOUSTICS

Ecology and acoustics:
emergent properties from community to landscape



ABSTRACT BOOK

Muséum national d'Histoire naturelle
Paris, France
16-18 June 2014

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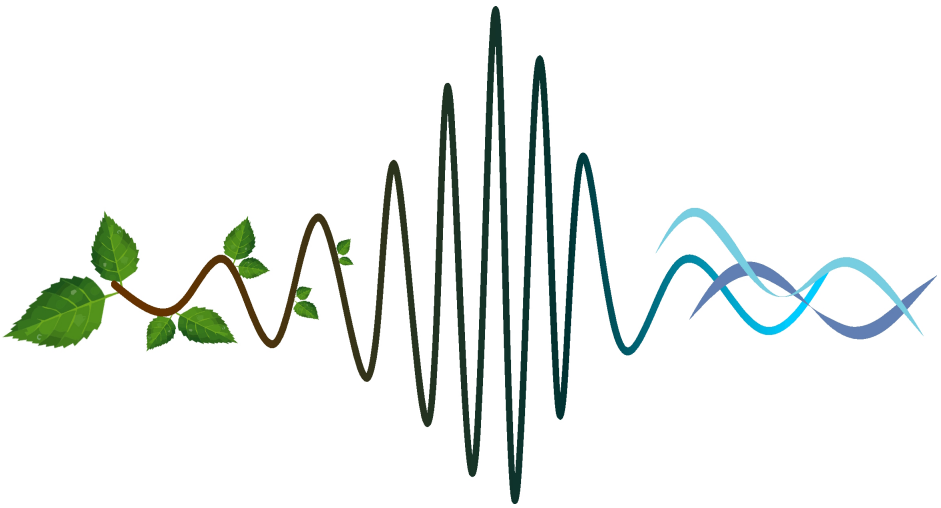

ABSTRACT BOOK

Muséum national d'Histoire naturelle
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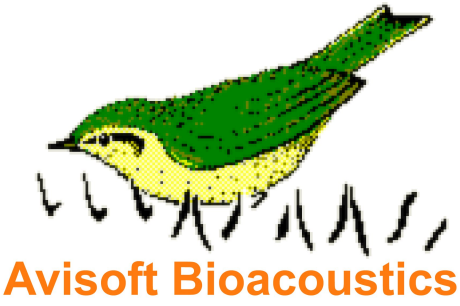


Welcome

Sounds represent a fundamental part of the environment and reflect the complexity of systems that living organisms at every level of organization (from individual to landscape) use to capture and share strategic information to survive and reproduce. Until recent time, the study of sound was generally under the responsibility of acoustic engineers, urban planners, and bioacousticians.

In a few decades, the interest of relationships between sounds, animals, and humans has grown exponentially for ecologists because sounds reflect rich sources of information related to functions of ecological systems. Symposia and workshops are now being organized at an increasing rate and are paralleled with a similar growth in scientific and educational papers; however, a meeting has ever been organised that fully integrates acoustics and ecology.

It seems to becoming clearer to ecologists, as time progresses, that sounds are powerful proxies for auscultation of the "hearth beat" of coupled human and natural systems, and to explore the rich world of the acoustic semeiosis. In addition, new recording devices, metrics, and dedicated software have offered new and efficient tools to further explore the acoustic dimensions of nature. The objective of this first congress is to create a permanent gathering in which different competencies coming from ecology, biology, urban and landscape planning, and education may initiate a deep discussion on the complexity of problems that emerge when ecology meets sound.

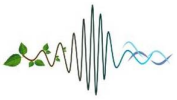
From the excellent list of abstracts found within this book, you will find interesting polarizations that are currently driving the advancement of the emergent discipline of ecological acoustics (soundscape ecology). The abstracts address diverse theses that range from: principles and theories, methods and techniques, monitoring and conservations of biodiversity, to problems related to the growing intrusion of humans in natural systems,and sounds produced by technologies (technophonies) in terrestrial, freshwater, and marine systems.

One of the major challenges that we have to solve is how to effectively introduce the concept of sound analysis for environmental assessments and long-term monitoring of the environment. For instance, the identification of sources of biophonies in marine systems or tropical forests represents a critical gap in knowledge that requires advanced research and group efforts to fully address. Additional goals that this congress aims to achieve include gathering suggestions and guidelines to better face the challenges that the study of sounds at various levels of biological and ecological organizations pose to the scientific community and all of society.

This meeting aims to help humans to better tune the complexity of the natural systems toward the desired sustainability under a growing concern of irreversible climatic changes. In the very near future, it will become even more critical to confront the concerns of the conservation of the quality of our sonic environment in a dynamic world. We must prepare to embark on new research, explore the unknown, and engage with others to solve the problems facing human and animal health, maintenance, biodiversity conservation, and overall quality of the environment.

We would like to warmly welcome you to the conference, thank you for joining us, and hope you have a pleasant stay in Paris.

Sincerely,
The Organizing Committee



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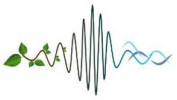

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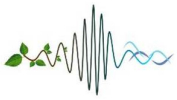
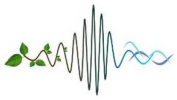


List of Attendees



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Abstracts

The ecology of acoustic signalling in breeding Lusitanian toadfish (*Halobatrachus didactylus*) males: influence of environmental fluctuations and boat noise

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Ecological characteristics that affect acoustic communication should shape acoustic signalling. In particular, information transfer between individuals needs to be adapted to the species social requirements and to ecological fluctuations. Environmental fluctuations in coastal and estuarine habitats include variations in the soundscape, tidal level, cyclic variations in turbidity, temperature, diel fluctuations, etc, which affect biological rhythms as well as signal transmission and degradation. Animals must cope with these fluctuations through physiological and behavioural adaptations. The Lusitanian toadfish males form breeding aggregations in coastal waters and use acoustic signals to advertise their presence, engage in interactions with other males, and attract females to their nests. We used round-the-clock sound recordings to monitor vocal activity in three locations in a natural habitat in the Tagus estuary (Portugal): intertidal nests only exposed in spring tides, subtidal nests (minimum 0.3 m water level) and infratidal areas (minimum 2.5 m water level). Individual vocal activity was quantified with an automatic pattern recognition methodology based on the Hidden Markov Model which allowed accurate detection and recognition of fish vocalizations. We investigated the relation of the vocal activity pattern with habitat parameters such as water level, temperature, light fluctuations and ambient noise. Ambient noise varied with changes of tide and currents but the main factor affecting underwater noise was human-related activity, such as the passage of small boat and ferry-boats. Toadfish vocal patterns were mainly affected by tide levels and only in intertidal/subtidal areas, as expected. Increased noise levels did not seem to cause consistent changes in vocal activity in breeding males. The influence of environmental and anthropogenic factors on fish social systems and reproductive success are discussed.

Keywords: Fish, Acoustic communication, Vocal rhythms, Environmental fluctuations, Tidal levels, Tagus estuary, Soundscape, Anthropogenic noise, Boat noise

*Speaker

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Meta-acoustic approach of cricket communities to detect biological invasion by exotic ants

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With only 5% of the global terrestrial area, and more than 20% of the terrestrial plant and vertebrate species in the world, islands are major components of worldwide biodiversity and receive increasingly attention in the context of the current biodiversity crisis. Among threats, invasive ant species are recognized as one of the most noxious ones for island biodiversity. For example, in New Caledonia, there are 4 invasive ant species that are spreading. Regarding invasive ant and their management, one of the challenges is to detect early impacts in high value ecosystems. Cricket communities, are recognized as a major component of forest floors, according to their richness and high abundance all year round. Because of their high diversity and endemism level, and with the ability for male to produce sound through the environment to attract female, cricket fauna appear to be a good candidate to be used in community assessment. They contribute greatly to acoustic environments, which can be related, through analysis of sound signal complexity, to the richness of the community and then to perturbations from ants. We investigate the impact of invasive ant Wasmannia auropunctata on the structure and the composition of crickets including from acoustic perspective. We investigate how meta-acoustic can be used as a non invasive, innovative, and efficient method to identify biological invasions from ants, to manage natural and invasive free natural reserves. We tested its efficiency in the southern part of New Caledonia, contrasting different biotopes invaded or not by one of the three invasive ants found in the area. Our results already demonstrate that crickets communities modifications are efficient biomarkers to detect invasive ants, as the ants modify the composition and profile of cricket communities. Acoustic measurements of crickets may be used as an innovative tool to early detect biological invasion, using meta-acoustics.

Keywords: meta, acoustics, crickets communities, invasive ants, wasmannia auropunctata, new caledonia

*Speaker

Calls reveal population structure of the elusive blue whale

Naysa Balcazar * [1], Sharon Nieukirk [2], Holger Klinck [2], David Mellinger [2], Joy Tripovich [1], Robert Dziak [2], Tracey Rogers [1]

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Our inability to directly observe animals in complex environments has limited our understanding of elusive species. The blue whale, although the largest animal that has ever lived, has elusive behaviour. Their pelagic habitat, wide dispersal and low population densities make field observations difficult. The sub-species the pygmy blue whale, listed as data deficient, occurs in the southeast Indian Ocean, yet little is known about their occurrence in the southwest Pacific Ocean. Pygmy blue whales (Balaenoptera musculus brevicauda) produce regionally-specific calls-dialects- including the Madagascan, Sri Lankan, Australian, New Zealand and Solomon type calls. We recorded year-round passive acoustic data at six sites, three in the southeast Indian Ocean and three in the southwest Pacific Ocean (2009-2012) and used automated methods to detect occurrence of different call types. Over a three year period two types of pygmy blue whale calls (Australia and New Zealand) were detected, where the 'Australian' dialect dominates the southeast Indian Ocean the 'New Zealand' dialect dominate the southwest Pacific Ocean. Distribution patterns divide at the Bass Strait (southeast Australia) which appears to be a separation boundary. Differences in temporal occurrence patterns between the ocean basins suggest the whales use theses areas differently. Here acoustics plays a vital role in providing not only evidence of a previously unknown population, but also insight into differences in population structure and migration patterns across the ocean basins. We propose that these "acoustic populations" should be considered when assessing conservation needs of blue whales in the Indian and Pacific Oceans.

Keywords: Elusive species, pygmy blue whale, Balaenoptera musculus ssp, acoustic population, passive acoustics, Tasman Sea

*Speaker

Assessing structural complexity of temperate agroforestry systems using soundscape analysis

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The homogenization of the landscape is threatening to weaken ecosystem function by minimizing structural complexity. This is evident in agricultural systems where intensification has created major disparities in ecosystem functions by reducing variations in structure across landscapes. Agroforestry is an integrated, land-use option that supports ecosystem properties coupled with socioeconomic benefit by incorporating trees and grasses with traditional agricultural crops. The developing field of soundscape analysis is a practical tool for describing complex phenomena and presents an effective approach for assessing and monitoring ecological functions across integrated land-use systems. A small-scale study was conducted using low-cost recorders (LCR) within varying agroforestry systems to test the utility of the acoustic complexity index (ACI) as an indicator for ecosystem structure along 4 land-use types (mixed hardwood forest, alley-cropping, silvopasture, and monoculture). Preliminary results indicated a relationship between ACI as a function of gradients in complexity (R-sqr. = 0.38) and soundscape composition (R-sqr. = 0.58). This study is a first step in understanding how soundscape analysis may be used as an assessment tool for indicating ecosystem dynamics within integrated agroforestry systems.

Keywords: Agroforestry, Acoustic Complexity Index, Low cost recorder, Sustainable agriculture

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Searching Soundscapes of Seabird Islands for Ecological Patterns

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Healthy seabird colonies are centers of information exchange, and generate complex and dynamic soundscapes, often raucous and overwhelming. Seabirds are highly threatened, and while potent conservation actions exist, the hurdles of traditional monitoring on remote and challenging islands have hindered the evaluation of conservation actions and threats. Thus, we are developing tools and methods for measuring and quantifying seabird island soundscapes to provide managers and ecologists with reliable metrics of abundance and diversity on seabird islands. Acoustic monitoring greatly decreases the cost and increases the utility of monitoring efforts aimed at assessing community health, monitoring trends in abundance and diversity through time, and measuring the effectiveness of conservation. Our research has focused on how acoustic metrics can be used to assess relative abundance of birds (case studies of Wedge-tailed Shearwater and Forster's Terns), the phenology of seabird colonies, and to detect rare species (case studies of Marbled Murrelets and Bryan's Shearwater). We are currently assessing how soundscape patterns may vary across manageable ecological gradients on seabird islands, and present an island scale exploration of the soundscape at California's (USA) largest seabird colony, Southeast Farallon Island.

Keywords: seabirds, diversity, abundance, management

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Studying the spatiotemporal dynamics of the soundscape in a protected area in Greece; a mixed-methods approach

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Ecology and nature conservation are starting to view sound as an intrinsic component of the landscape. A novel sub-discipline of ecology, soundscape ecology, attempts to study soundscape/landscape links in order to better understand and manage the natural environment. Drawing on the theoretical and practical work on soundscape ecology, we studied a rural soundscape of a protected area in Greece, asking: a) how is the soundscape transformed through space and time and b) which are the drivers of this transformation c) how is the soundscape related to the landscape?

Our study area was Mandraki village on the shores of Kerkini Reservoir in North Greece. We employed a mixed-methods approach that combines quantitative sound-pressure measurements; qualitative recording of sound-categories by human observers; sound mapping; and interviews with local residents to provide a holistic view of the soundscape/landscape nexus. Our observations were repeated on a seasonal basis.

Overall, we discovered that the sounscape's temporal and spatial variation in Mandraki is dominated by human made sounds. Also, while the soundscape is related to land use type, it is not determined by it. The qualitative part of our methodology allowed us to infer that anthropogenic sound mainly comes from trucks carrying goods across countries, helping us to grasp how the soundscape can be shaped not only by local but also national all the way to global drivers.

The soundscape is a complex "entity", presenting significant temporal and spatial variation. Temporal variation is mainly seasonal and daily, relating both to biological and human rhythms of activities, while spatial variation mainly reflects land-uses in the landscape. Space and time are closely interrelated in the soundscape/landscape nexus, requiring a close investigation of processes to: a) understand the latter's dynamics and b) avoid simplistic reductions e.g. from land-use to sound-category.

Keywords: soundscape, landscape, qualitative methods, scale, Greece, Kerkini Reservoir

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The soundscape of the shallow water of a Mediterranean Marine Reserve: the case of Capo Grecale in Lampedusa island

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An underwater acoustic recorder was positioned inside the integral marine reserve of Capo Grecale in Lampedusa (35.525N, 12.620E) at 150 m from the cliff (depth 20 m). Here we presented data collected from June to September 2013 in the frequency range 8-96000 Hz with a duty-cycle of 10%. Data were analyzed both manually than using the mean power spectrum and the acoustic index complexity. Noise in the low frequency, below 2kHz, is positively correlated with the wind intensity. Below 3 kHz, acoustic activity of fish is present especially after the sunset. At the upper frequency , 3-96 kHz, the soundscape is dominated by the snapping shrimps that presents an evident circadian cycle with an higher number and a powerful signals during the sunset until the sunset. The snapping shrimps activity is negatively correlated with the wind intensity. Even if the acoustic monitoring site is an integral reserve, at least in the 8% of wave-file (2 minutes long) the passages of vessel traffic were recorded.

Keywords: marine soundscape, vessel traffic noise, circadian cycles of bioacoustic signals, fish, crustaceans

*Speaker

Cetacean detections and environment characterization from continuous underwater acoustic recordings

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Different complementary methods are used to observe cetacean species. Passive acoustics is useful to detect vocal cetaceans. The last decade show strong interest from the scientific communauty including specialists in marine biology, underwater acoustics, signal processing. But up to now, this topic is still under investigation because some of challenges are still open, especially when the objective is not focus on the vocal activity from one specific species. This is the case with acoustic observatories in areas frequented by many different species because the diversity of their emitted sounds is large and the acoustic recordings are depending to many other parameters, like the sensitivity of the sonobuoy, the underwater acoustic propagation, the presence of other sounds, including the anthropogenic noise, corresponding to the variant ambient noise. Trying to define one single detector for different datasets is a challenging objective.
To improve the detection rate, we propose to add a preliminary step based on the definition of the quality of the acoustic signal. This step is also used to characterize the acoustic environment (echoes, reverberation, noises). The quality criterio is then used to give a confidence index to the user for the different results of the detection step, based on 2 opposite methods: the use of acoustic descriptors from the detected signal (duration, onset, sustained part, fundamental, harmonics...) and the use of mathematical representations (MFCC, wavelet).
We applied this approach to the recorded dataset from St Pierre-et-Miquelon, including 8509 files for 353 cumulative days (5158h) during 2010 and 2011. Same species are detected in different noisy conditions (rain, traffic, knocking on the hydrophone) and this dataset allowed us to adjust our method.

Keywords: cetacean detection, acoustic environment

*Speaker

Acoustic Complexity Index (ACI) and anuran calls. Tests with Iberian species and choruses.

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Chorus structure and chorus dynamics may differ based on the acoustic taxa considered. In this study we present the first results obtained applying the Acoustic Complexity Index (ACI), by means of the informatic tool SoundScape Meter, to the recordings of the calls of some of the main amphibian species in the order Anura from the Iberian Peninsula. Measurements are obtained from natural recordings both at the individual level and at the level of monospecific and multispecific choruses. We aim to test the behavior of this index when studying anuran calls and chorus: At the individual level, we find that there is a hyerarchy of complexity among species and a correlation with duty cycle. At the monospecific chorus level, ACI measurements reflect a generally similar hyerarchy as the individual calls, and there are no significant differences between values of monospecific and multispecific (2-3 species) chorus.

Keywords: anuran calls, choruses, acoustic diversity index

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Monitoring the acoustic activity of an aquatic insect (*Micronecta scholtzi*) in Mediterranean ponds.

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Passive acoustic monitoring is a promising method to better understand ecological processes. So far this method has only rarely been applied to freshwater environments and soundscape ecology has mainly investigated terrestrial and marine environments. Thanks to the development of powerful acoustic tools for signal analysis and recording, it is now becoming easier to investigate underwater acoustic productions. Micronecta scholtzi is a water boatman of the Hemiptera order which is the loudest animal known on earth scaled to its size. To better estimate the importance of M. scholtzi in the underwater biophony of Mediterranean ponds, we carried out a long term acoustic monitoring of this species in the field and attempted to characterise factors that might influence its sound production. We recorded the soundscape of three Mediterranean ponds in France from June to July with underwater automatic acoustic sensors. The acoustic activity of M. scholtzi was estimated as the ratio of amplitudes between 7 and 12 kHz to amplitudes between 7 and 22 kHz. These frequency bands were chosen respectively as the band occupied by M. scholtzi and the remaining frequencies that are rarely occupied by other organisms in the acoustic community such as frogs or other insects. We showed that the acoustic activity of M. scholtzi had a clear 24 hour period. The acoustic activity remained stable over the duration of the monitoring in two of the ponds. In the third pond, the acoustic activity showed a different seasonal trend with periodicity breaks. Investigating the cause of these periodicity breaks, we found that the anthrophony of the pond was particularly important due to the occurrence of an artificial waterfall. We therefore assume that the variations in M. scholtzi stridulation observed were due to anthropogenic noise perturbation but additional field observations and laboratory experiments are needed to support this hypothesis.

Keywords: Anthropogenic noise, automatic detection, periodicity, wetlands, aquatic insects

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Spatial soundscape variability within a marine landscape: what benthic sounds tell us

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Spatial structure plays an important role in ecology and management. Underwater, habitat structure is usually defined using physical rather than biological features and temporal information is generally spares, based on punctual surveys. Although it is know that different habitats produce distinct underwater sound signatures, very few studies have exploited these sonic habitat properties to evaluate spatial variability in zoobenthic activity. In this study, continuous 20-days recordings from three sites within a similar habitat (rocky bottom, with patches of kelp) were compared in terms of zoobenthic sound production. Between-site analyses of identifiable, impulsive sounds of zoobenthic origin (snaps) as well as the underlying background noise were computed. Significant differences were observed in terms of snap rate, overall snap received levels and background noise levels. One of the sites had snap received levels equivalent to the background noise levels of the other sites, indicating a local very faint zoobenthic activity, likely reflecting low animal abundance. Marked differences were also identified in the spectral and temporal composition of the soundscapes of the three sites. Generally, significantly more snaps were produced at dusk and night compared with daytime. Differences in water depth, light, tidal current strength and small-scale habitat structures likely explain the observed differences in zoobenthic sound production. Our findings indicate that passive acoustic monitoring of soundscapes provides important, often lacking biological information to habitat structure in terms of animal activity also within an apparently similar habitat. Acoustic cues that convey continuous information about a key compartment of coastal ecosystems have the potential to be of great value to describe seascape structure and variability.

Keywords: marine soundscapes, benthic activity, habitat, spatio, temporal variability

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Acoustic partitioning in a marine vertebrate community off Brazil

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In order to increase intra-specific communication efficacy and to decrease probability of miscommunications errors and masking a certain degree of partition of a community's acoustic space is expected. Aiming to investigate the acoustic partitioning of a marine vertebrate community composed by fish, dolphin and whale species, eight acoustic features (aggregate entropy, average entropy, 90% bandwidth, center frequency, 90% duration, interquartile bandwidth, low frequency and peak frequency) of calls manually extracted from recordings off Brazil were submitted to discriminant function analysis (DFA). Results show that species are discriminated in acoustic space and thus occupy different acoustic niches. All acoustic features significantly contribute to species' discrimination. Function 1 explained 95,9% of the variation in the acoustic parameters due to species. The most important parameters were central frequency, interquartile bandwidth and average entropy. Spectral partitioning may also function as a mechanism to avoid masking in this marine community. Work supported by: Rufford Small Grants Foundation (RSGF), Cetacean Society International (CSI), Instituto Chico Mendes de Conservação da Biodiversidade (ICMBIO), Projeto Baleia Franca (Project Right Whale) and Federal University of Rio Grande do Norte (UFRN)

Keywords: acoustic partition, acoustic ecology, marine community, vertebrate communication, acoustic niche

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Emerging Soundscape Characteristic Patterns Across a Gradient of Land Use Intensity

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Noise from energy intensive processes is not confined; it spreads outward, introducing noise disturbance into neighboring landscapes. The Landscape Development Intensity Index (LDI) uses the non-renewable energy use of surrounding land uses to predict the ecological condition of a specific point or area. Although the impacts of noise pollution were not considered in the development of the LDI, it is based on the influence of other forms of pollution that radiate from areas of intense human development. This study looked at study areas (n=50) encircled by various land use types and intensities in North Central Florida. The LDI was used to characterize surrounding land use of each area. Soundscape metrics including Acoustic Complexity Index, Entropy, average power of ecologically significant frequency bands, among others were used in this study to describe morning sound recordings. A new metric, adapted from rhythm analysis in music theory, was used to describe the similarity and periodicity of sound events in the soundscapes. Periodicity at a shorter time scale then diurnal is a characteristic of soundscapes that has not been adequately explored. This study defines patterns between landscapes and soundscapes. Preliminary results indicate that areas with high surrounding land use intensity have frequency spectrums that are concentrated (low entropy) in lower frequencies. Including the LDI index in the descriptions of study areas allows surrounding land use to be thought of as a source of energy flux to a study system and looks at the effects it has on soundscapes. This work also contributes to the formation of a predictive tool that can make assumptions about soundscapes remotely through geographic information system analysis.

Keywords: Landscape Intensity, Soundscape metrics, Soundscape Description, Geographic Information Systems, Periodicity

*Speaker

Mining noise effects on Atlantic forest soundscapes

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Anthropogenic noise is a growing concern among stakeholders since it causes negative impacts on animal communication and their wellbeing. Particularly, mining activity produces high levels of noise through heavy machinery, busy roads, explosions and frequent sirens during the day and night. An important part of the Brazilian economy is based on mining, which is often conducted in habitats considered biodiversity hotspots with many threatened and endemic species. The Atlantic forest biome is one of the habitats that is commonly affected by the mining noise. Were characterized and compared the soundscapes of two different areas in the same Atlantic forest fragment in Southeast of Brazil: 1) noise-polluted environment – at a distance of 500m from the mine and 25m from the closest road - and 2) - quiet environment – at a distance of 2,500m from the mine - in order to establish the potential impact of noise from mining activities on animal communication systems. Six SongMeter Digital Field Recorders (SM2) (Wildlife Acoustics, Inc., Massachusetts) were installed and programmed to record continuously at 44.1kHz during seven days every two months from October 2012 to August 2013 in both areas (noisy and quiet). The data were subsampled by analyzing two minutes of recording every hour. The values derived by power spectra and a recently introduced index (the acoustic complexity index, ACI) were used to characterize anthrophony and biophony, respectively. Results were pooled by season (wet or dry) and time of day (day or night) to investigate significant modifications of the acoustic behavior of the community in respect to the level of noise produced by the mining activity. Power spectrum values were significantly higher in the noisy area and especially on weekdays, as expected, and the ACI values tended also to vary where and when noise levels were highest.

Keywords: soundscape ecology, noise pollution, tropical forest, community monitoring

*Speaker

Automatic classification of birds calls and songs from Provence

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Neural Information Processing Scaled for Bioacoustics bird challenge consisted in automatically identify 87 classes present in thousand audio recordings, collected in many places of Provence with Song Meter recorders. The difficulty of this task lies in the large number of classes, various background noises and simultaneously vocalising animals. Among 32 international teams, best Area Under the Curve score of the official benchmark has been 91.7%, which corresponds to a mean recall of 50% (all classes confunded). Our objective is to increase performances to get an operationnal system. It implies to reach a 80% mean recall. For this, we decided to merge winning models of NIPS4B, test new improvements and add training databases : xeno-canto.org (161 605 recordings) and Animal Sound Archive (Natural History Museum of Berlin, 5 209 recordings). We succeeded in increasing mean recall and precision. Plus, our recall and precision calculations are statistically solid: for each class, the number of test files is important and equivalent. In february 2014, we began a twelve monthes continuous acoustic recording experience in 10 different sites: natural habitats (wetlands, oak groves, ...) and semi natural habitats (melange between garrigue and grapevines) affected by anthropogenic activities whose some of them are suspected to be threats (windfirms) for avifauna. In conclusion, our algorithms are now enough good to:

- precisely measure temporal evolution of acoustic activity of 50 species of birds from Eastern Palaearctic. As far as we know, unbiased studies of daily and annual phenology of migratory and non migratory bird species are completely unseen. Plus, as we discriminate song and call for most of birds, we can monitore the calls/songs ratio during bird migration and the rest of the year.
- check efficacy of bird acoustic repellent systems for windfirms.

Keywords: automatic ; birds ; songs ; classification

*Speaker

Shift in Songbird Vocalizations Suggest Possible Threats of Acoustic Masking for Human Health

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Global change, including increased anthropogenic noise, has been linked to multiple human health concerns. To further examine potential impacts of rising anthropogenic noise on health, we conducted an acoustic analysis of the response of songbird vocalizations in upstate South Carolina to traffic noise across an urban-rural gradient. Our data demonstrate that even moderate levels of noise alter the structure of avian vocalizations. In particular, Brown-headed Nuthatch (Sitta pusilla) bottom of vocalizations shifted upward to avoid overlap with the increased ambient noise associated with vehicular traffic. Eastern Towhee (Pipilo erythrophthalmus) bottom of vocalizations display the same shift, though only in the final 'tea' component of their call.

Vocalization adjustment to overcome acoustic masking reduces reproduction and survival and the effects of noise pollution on inter-species reactions are only now being identified. Understanding the impacts of anthropogenic noise on bird health provides insight into ecosystem health as well as human health. Thus it is essential that we understand the impact of this noise pollution on the ecosystem and implement effective and efficient conservation strategies to protect global ecosystem and human health.

Keywords: soundscape, anthropogenic noise, traffic, avian vocalizations, acoustic masking, human health, conservation

*Speaker

Challenges and Perspectives in Soundscape Ecology Research

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Soundscape ecology has recently exhibited an enormous surge of research that has demonstrated the ability of acoustic diversity to be an efficient tool for describing complex phenomena at community, ecosystem and landscape scales within natural and human dominated systems. Testing new theoretical assumptions will create stronger linkages between landscape ecology, ecological acoustics and soundscape ecology, supporting the relationship between topographic, environmental and acoustic patterns. The scientific practice of soundscape ecology has been powered by recording devices that are readily evolving into inexpensive units with improved microphone quality, efficient data storage, and better acoustic parameterization. At the same time, innovative metrics have allowed researchers to manipulate acoustic files enabling robust synthesis of emergent patterns in frequency dynamics. New technological development that incorporates both improved recording capabilities and acoustic metrics is critical to continue advancing soundscape analyses. Advancement of soundscape research has also extended into several journal publications, books, and dedicated software, which are readily available to students and practitioners. To make advances in education, a new course on Soundscape theory and applications has been constructed for students at various levels. Soundscape ecology is a promising discipline that will aid in understanding global threats of biodiversity loss and growing pressures on fragile ecosystems under scenarios of the climatic change and a rapid evolution of human societies.

Keywords: soundscape ecology, tools, metrics, education

*Speaker

Acoustic Assessment of Social Group of Birds

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For public health, economical and environmental reasons, surveying of bird populations is a major issue because of their proximity with humans. We propose a passive acoustic method that allows to assess the social structure of wild-type population and estimate several parameters of social groups. Whole population acoustic network assessment can be a powerful tool to analyze and study important social groups of birds. However studies have focused mostly on vocal communication between two individuals and little is known about properties emerging from an acoustical network where several individuals are involved. On the other hand, animal social network analysis relies on static graphs of proximity – proximal – and most of the time ignore more distal information such as acoustic network of whole groups. Our study aims to provide a non-invasive and cheap method to investigate the characteristics of a gregarious species social network. We developed an in-house software suite that automatically detects vocalizations from hours of passive recording in a whole group setup. We tested our setup in lab conditions. Our mathematical model can extract temporal and acoustic features and is able to infer some of the social network structure. For example, it seems that simple correlates were shown to indicate precisely the sex ratio composition and the pair bond ratio. Thus, this method uses bioacoustics as a tool to access the social group quality across several scales (individual and relationship between individuals). It can also bring information about the evolution of this group quality by allowing passive recordings over long period of time.

Keywords: acoustic network ; population coding ; songbird ; zebra finch

*Speaker

Identification of woodpecker species through their drumming

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Because of the potential applications in wildlife monitoring, interest rose in recent years for the automated identification of bird species through audio recordings of their vocalizations. Recent works progressed up to a glass ceiling of roughly 70% of accurate recognitions. This number is most commonly reached by using a combination of Mel-Frequency Cepstral Coefficients (MFCC) and Hidden Markov Models. A reason for the glass ceiling is that some of the specificities of bird songs cannot be captured by MFCCs. Even further, the proper descriptors might be species-specific. In the present study, seven species of European woodpeckers are looked into. Woodpeckers use both vocalizations and drumming on trees for territory marking and partner attraction. For some species, such as the great spotted woodpecker (Dendrocopos major), drumming is the only sound used in that regard. For the purpose of characterization, a database of woodpecker drumming sounds is assembled from the Xeno-Canto online archive (168 recordings, 1520 drumming events). A set of acoustic features is then computed for each recording: the drumming speed, the mean drumming event duration, the duration of the pause between drumming events and a crude description of the spectral content. Using these descriptors, a generic unsupervised clustering algorithm accurately regroups 67% of the sound files according to species. For comparison, a set of MFCCs is computed through the drumming events. The unsupervised algorithm then successfully re-clusters only 29% of the files. A random assignment would yield a 20% success rate.

Keywords: acoustic monitoring, species recognition, bird songs, acoustic features, woodpeckers

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Monitoring and modeling sound levels at landscape scales in U. S. National Parks

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NPS has pursued a program of acoustical monitoring to inventory existing conditions in parks throughout the NPS system to estimate natural sound levels and evaluate the costs of noise to both wildlife and visitor experience. Acoustic data have been collected at over 300 sites within 73 parks. The NPS recently created a predictive map of sound levels throughout the contiguous U. S. by fitting geospatial data related to sound sources and propagation to the acoustic monitoring data. These maps include predictions of existing and natural sound levels for A-weighted summaries and one-third octave spectra. The acoustic data were also analysed for broad patterns in bioacoustic activity that relate to ecological and seasonal variables, and visitor use.

To evaluate the human costs of noise, the NPS pursued measurement and modeling of the duration of audible noise using one-third octave spectrum levels. The median hourly percentage of noise audibility across all sites within park units is about 25%. Audibility analysis is complemented by evaluating the masking effects of noise, seeking to preserve opportunities for visitors to appreciate the rich auditory experience that is vital to many wildlife species, and to establish a framework for evaluating costs of noise that generalize across species.

Through partnerships, NPS has produced a standard for sound level measurement in parks and quiet rural areas, and sponsored studies of noise impacts to wildlife and visitor experience. Collectively, these efforts inform park managers and the public about the value of natural acoustic environments and the costs of noise.

Keywords: parks, noise, masking, models, audibility

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Estimating density of birds on the base of multichannel recordings

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Recent audio recording technics allow an unsupervised recording of environmental sounds over long periods of time. However, it is still a challenge to extract useful information for assessing the environment from these long-term recordings. Mostly unsupervised recordings are used to search for rear species, to estimate the species composition or to assess the soundscape. Here we will show how on the basis of multichannel recordings not only the species composition but also the abundance of birds could be determined. We present two approaches. The first is based on hyperbolic localization of calling birds. Using an array of synchronized multichannel audio-recorders we studied the distribution of European bittern (Botaurus stellaris) in an extended wetland area. On the basis of the audio recordings we could estimate the number of territorial behaving birds over a period of six years. Our second approach is based on four channel recordings with directional microphones. On the example of different rail species (Porzana spec.) we show how the number of calling birds could be assessed based on differences in amplitude and time delay of arrival on the different sound tracks of a single recording device. We will discuss advantages and limitations of the two approaches. We recommend the use of four-channel recordings for soundscape studies which give the opportunity to extract besides general soundscape parameters more detailed species specific information.

Keywords: soundscape, multichannel recordings, abundance estimation

*Speaker

Disentangling landscape and vegetation drivers of soundscape quality in urban forest remnants

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Natural landscapes are increasingly subjected to anthropogenic pressure and fragmentation resulting in biodiversity loss and reduced ecological condition. Previous studies in eastern Australia have revealed a strong relationship between soundscape patterns, ecological condition and the extent of landscape fragmentation. However the effect that vegetation structure and species richness has on soundscape patterns remains little studied. Our goal in the current study was to examine the vegetation/soundscape relationship in urban forest remnants characterized by two different vegetation communities, spotted gum open forest and scribbly gum woodland.

Our results indicate that landscape attributes, particularly patch size and extent of road fragmentation, are the primary drivers of soundscape patterns in both vegetation communities. Large, remnant forest patches close to conservation areas exhibit higher soundscape quality (normalized difference soundscape index; NDSI) than small urban fragments. However, soundscape quality was also related to a number of different vegetation structural attributes in spotted gum and scribbly gum forests. For example, native shrub cover was negatively correlated with soundscape quality in spotted gum forests, but positively correlated in scribbly gum woodland. Neither vegetation type displayed any significant correlation between NDSI and native vegetation species richness. We did not identify any one vegetation attribute that could be positively correlated with soundscape patterns in both vegetation communities.

Comparison to a benchmark (or 'natural') site revealed that different patterns were related to disturbance and reduced vegetation quality; spotted gum forests in an undisturbed state have sparse shrub cover, while scribbly gum woodlands are characterized by a shrubby heath layer when in pristine condition. We conclude that soundscape patterns in urban forest remnants are strongly influenced by landscape fragmentation, disturbance and resultant changes in vegetation quality.

Keywords: landscape fragmentation, disturbance, vegetation, soundscape

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Spatio-temporal movement patterns of Alaskan beluga (*Delphinapterus leucas*) populations based on vocal peaks and common call types

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Beluga whales (Delphinapterus leucas) are likely to be impacted by climate change as a reduction in sea-ice may increase both the seasonal range and timing of migration, as well as modify prey availability and increase the risk of human-induced impacts. Belugas are highly vocal animals which make them ideal candidates for passive acoustic monitoring (PAM). In Alaska, two subpopulations migrate annually from their predictable summering grounds in the eastern Chukchi and eastern Beaufort Seas to overwinter in the Bering Sea. Determining the timing and migration route(s) in spring and autumn for each subpopulation requires additional information due to spatial and seasonal overlaps that complicate stock assessment and management. To differentiate migratory streams we investigated temporal peaks in vocal activity based on detections (Sep-2010 to Aug-2011) and common call types from long-term acoustic recorders located in the Bering, Chukchi and Beaufort Seas. Belugas were detected sporadically throughout autumn in the western Beaufort and eastern Chukchi Seas, with a strong temporal migration peak in the inshore waters of the eastern Chukchi in late November. Winter detections were confined to the Bering Sea, except for sporadic Chukchi detections. During spring, belugas were detected migrating through the eastern Chukchi in two distinct vocal peaks (early and late-May). An early-May peak followed by smaller late-May detections occurred in the western Beaufort; the timing suggests that these animals were from the first and second Chukchi peaks. In addition, common call types were identified and proportions compared among temporal peaks in autumn and spring; anecdotal evidence suggests that subpopulations may be identified through vocalizations and fine-scale spatio-temporal separation. This study highlights the successful application of PAM of seasonal beluga movements to improve our understanding of stock structure for management and conservation in a region undergoing rapid change. [Funding: National Research Council and Bureau of Ocean Energy Management].

Keywords: seasonal movements, passive acoustic monitoring, call types, vocal, Alaskan Arctic, stock structure, beluga whale, Delphinapterus leucas

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Soundscape measurements to evaluate impacts of habitat degradation on acoustic animal communities

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Ecosystems around the world are under threat from a multitude of global change disturbances. One of the most important is certainly habitat degradation. A new, emerging science, named soundscape ecology, studies the acoustic processes and associated ecological patterns occurring within a landscape. This science holds promise in addressing the ecological challenges of global environmental change. Here, we investigate how natural soundscapes respond to disturbances. More precisely, we evaluate the impact of two habitat degradation regimes on singing animal communities, i) the deforestation in New Caledonia and ii) a wildfire event in the Chiricahua National Monument, Arizona, USA.

New-Caledonia is a biodiversity hotspot where deforestation is considered as one of the major threats to biodiversity. Cricket species compose a large part of the acoustic animal community. We evaluated cricket's diversity along a gradient of habitat degradation. For each location, acoustic recorders were placed during two weeks and a taxonomic inventory was conducted. Acoustic diversity indices were then calculated for the acoustic recordings. The first results of the analysis of these indices reveal a significant modification of acoustic diversity reflecting a change in community composition.

In 2011, a wildfire spread across the Chiricahua National Monument leading to a new spatial heterogeneity pattern. Recorders were placed in locations ranged by different wildfire severity levels, in four different life zones. Similarly, we compared the acoustic diversity with regard to different modalities. Plans are to conduct this study for several years in order to monitor the recovery process of severely disturbed ecosystems.

The results of these two studies will provide robust elements to support the use of soundscape measurements to evaluate disturbance impacts on natural ecosystems.

Keywords: Soundscape, community acoustic diversity, disturbance impact

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Towards Scaled Bird Species Automatic Biacoustic Identification

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Automatic bird species identification based on their song or call is one promising method for assessing biodiversity, but it requires improvement. Up to now, only four itiatives in world-wide evaluation took place. The 1st was the ICML4B bird challenge [1] by univ. of Toulon within the framework of CNRS MASTODONS SABIOD (http://sabiod.org), with Musée National d'Histoire Naturelle of Paris. It concerned 35 species, and 76 teams participanted, 400 runs. The 2nd [2] had 15 species, 79 participants. The 3rd (UTLN+Biotope) got 80 species, 30 teams [3]. In collaboration with SABIOD, INRIA, TU and Xeno Canto, a new challenge opened in LifeClef 2014. It goes one step further by (i) significantly increasing the species number by almost an order of magnitude (ii) working on real-world social data contributed by hundreds of recordists (iii) moving to a more usage-driven and system-oriented benchmark by allowing the use of metadata and defining information retrieval oriented metrics [4]: 14k recordings, 501 species from Amazon forests. It is expected to be more challenging: high confusion risk between the classes, high background noise,high diversity in the acquisition conditions (devices, recordist customs...). It will probably produce substantially lower scores and a better progression margin towards building real-world generalist identification tools. In this communication, we review the methods submitted to these challenges. We thank SABIOD MASTODON for [1,2] and partly to [4] with others detailed in:

1 Glotin, Clark, LeCun,.., Sueur, 'Proc. of the 1st workshop Machine Learning for Bioacoustics', ICML, Atlanta, http://sabiod.org/,ISSN979-10-90821-02-6, june.2013

2 Briggs, Raich et al.'The nith annual MLSP competition: Overview', Proc. IEEE MLSP workshop, sept.2013

3 Glotin, LeCun, Artières, Mallat, et al., 'Proc. of Neural Information Processing Scaled for Bioacoustics: from Neurons to Big Data', NIPS, http://sabiod.org/nips4b, ISSN979-10-90821-04-0, dec.2013

4 Joly, Muller, Goeau, Glotin, Spampinato, et al.,'LifeCLEF: Multimedia Life Species Identification',proc. EMR Workshop, april.2014

Keywords: Bird species automatic identification ; Scaled bioacoustic classification ; Amazon forest ; SABIOD

*Speaker

Animal choruses : ecological acoustics, emergent properties, and feedback loops

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Collective displays of acoustic animals are among the more spectacular phenomena in animal behavior. These displays, generally termed 'choruses', range from crude timing of advertisement signaling during a restricted part of the day or night to precisely adjusted phase relationships between the call rhythms of neighboring individuals. The latter behavior may generate collective patterns of call synchrony or alternation that form an important aspect of the 'acoustic environment' for a local population. In some species this acoustic environment may represent an adaptation that enhances species recognition, that maximizes the ability of a local group of males to attract females, or that helps to evade phonotactic natural enemies. However, in other cases the patterns of group calling, no matter how precisely choreographed, may simply emerge from pairwise interactions between neighbors. For example, hearing in many acoustic species is influenced by psycho-physical precedence effects wherein a call that leads another one by a brief time interval is perceived clearly while the following one is not. In sexual advertisement signaling such effects may select for pairwise interactions in which individual males modify their call timing and thereby increase their relative incidence of effective, leading calls. At the population level a specialized pattern of group calling may arise from these modifications even though this calling pattern per se is not preferred by females and does not benefit the males who produce it. Nonetheless, because the group chorus that emerges from simple interactions between neighbors forms the acoustic environment of the population, the chorus may, via feedback loops, influence evolution of behavior at the individual level. I shall explore how such feedback loops can function between different hierarchical levels of animal signaling behavior – group (population) and individual – and ultimately temper or exaggerate the evolution of mating signals and collective display.

Keywords: communication, evolution, acoustic environment

*Speaker

Combining Soundscape Recordings and Environmental Data to Evaluate the Impact of Anthropogenic Noise in Marine Ecosystems

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Anthropogenic noise within marine ecosystems can generate physical, physiological or behavioral effects over marine fauna like mammals, reptiles, fish and invertebrates. These effects could vary according to the proximity and typology of the anthropogenic noise and have led to regulate underwater noise as a pollutant source. To correctly determine how noise and other variables can affect marine wildlife is necessary to have a monitoring methodology that works regardless of environmental conditions and that incorporates information collected from other environmental sensors or by human observers.

In this work we introduce a computational monitoring system called ACOUA (Acoustic Characterization Of Underwater Areas). This system allows the massive processing of acoustic records aiming at monitoring the long-term evolution of underwater noise levels and the characterization of acoustic events within marine soundscapes. The ACOUA system integrates database management, noise level monitoring and automatic event detection and classification algorithms with data mining and data visualization tools. At the same time, the system takes advantage of the synergy generated by complementing acoustic data with other data sources such as: meteorological variables (wind speed, precipitation levels, solar irradiance, etc.), marine traffic information obtained via automatic tracking systems (AIS receptors), water quality monitoring instrument (water temperature, salinity, conductivity, etc.), observations made by marine mammal observers, etc.
We also provide evidence of the system's efficiency to unveil correlations between noise fluctuations, biological and anthropogenic activities and environmental variables. Clearly, the obtained results point towards the advantage of combining soundscape recordings and environmental data to correctly evaluate the long-term impact of anthropogenic activities in marine ecosystems.

Keywords: marine soundscape, anthropogenic noise, monitoring system, marine wildlife, automatic classification, multimodal

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Masking of fish calls by man-made sounds

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Many fish produce sounds as part of their reproductive behaviour. Important food fishes, including the cod and haddock, gather in large numbers on the seabed at particular locations, with the male fish broadcasting low frequency calls. Both cod and haddock show lekking behaviour, where females visit aggregations of males and select males on the basis of their sounds. Other exploited species like the brown meagre live on coastal rocky reefs, where spawning also involves extensive vocal displays by the males. The sites where these different fishes spawn, and the acoustical and other factors that bring fish together at these locations, are not well known. We have located spawning fishes in the sea by listening for the calls they make during their reproductive behaviour. The sounds of individual fishes are low in frequency and amplitude, and there is considerable scope for masking of the calls by man-made sounds. Noise from offshore activities like pile driving, seismic airgun surveys, naval sonars, dredging, and recreational and commercial shipping travels great distances in the sea. Noise levels are increasing, with dramatic effects upon natural marine soundscapes. The presence of this noise has deleterious effects upon the detection of fish calls, and may impair the ability of fish to discriminate between different sound producers, likely affecting mate selection. Masking of fish calls by man-made sound may therefore affect spawning success, with long-term adverse effects upon the sustainability of fish populations. Listening for fish sounds and monitoring the soundscape at spawning locations provides a reliable, non-invasive way of locating spawning aggregations in the sea. It may allow closer definition of reproductive areas and more detailed examination of the ecological requirements of spawning fish.

Keywords: fish, soundscape, spawning, reproduction, lekking, anthropogenic noise, masking

*Speaker

Promoting marine soundscape awareness in middle school students

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The Duke University Marine Laboratory is located on the Atlantic coast in Beaufort, North Carolina, USA. The waters surrounding the lab support many jobs and livelihoods including fishing, recreation, and scientific research. Thus students in local K-12 classrooms experience their "backyard" environment in a variety of ways. To promote a deeper sense of connection to the local marine environment, we are developing educational activities that will help young students experience the underwater soundscape and gain awareness of the role of sound and hearing for marine animals, as well as in their own lives. These activities will build on students' classroom knowledge and allow them to interact with local scientists studying marine animals and sound. Student learning objectives include 1) explaining the importance of sound especially for marine mammals, 2) collecting and analyzing acoustic recordings, 3) demonstrating the technology used in passive acoustic research, and 4) discussing noise pollution issues to promote understanding the effects of anthropogenic sound on marine animals. Our overarching goal is to promote interest and enthusiasm for scientific research, by making science more personal and engaging. In April 2014 we will host more than 150 local sixth grade students at the Duke Marine Lab to participate in a day of hands-on marine soundscape activities, featuring a field trip on a coastal research vessel to collect acoustic recordings. We are creating a hydrophone kit for use on this field trip, which will be available for loan to local students and teachers in the future. After the field day, we will assess the effectiveness and impact of these activities. Here, we would like to present an overview of our educational efforts, discuss the outcomes of the field day, and invite feedback on how to effectively engage younger generations in acoustic research and soundscape awareness.

Keywords: Soundscape, Anthropogenic Sound, Marine Mammals, Education, Outreach, STEM education, Technology

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Exploring the call management of frogs through automated bioacoustic monitoring

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For many animal species, especially frogs, acoustic communication is essential for species recognition, mate choice or territorial behavior. The signal (the male advertisement call) is composed of different components that may have different functions for the receiver (a female or a competitor). However, still our knowledge of anuran call variation, call repertoire, and especially of the actual call effort and their influencing factors is rare. Although there are many recent studies on anuran communication, only a few take into account the complete call effort of single species, i.e. the "call management". However, this is essential for our understanding of evolution and (sexual and natural) selection, as well as the influences of climate change on reproduction and survival.

Recent developments in automated bioacoustic monitoring and acoustic pattern recognition enable us today to comprehensively record and analyze acoustic events. Aim of this project is to study the call management of white-lipped frogs (genus Leptodactylus) using these modern methods. Preliminary results (an analysis of more than 25.000 calls out of three nights) show that the call effort varies significantly during consecutive nights with a maximum of 11.500 calls per night. Some of the studied call parameters vary during one night as well as between nights, whereas other remained static and may function as "individual signature". Some parameters assumingly important for the metabolism rate and energy reservoir of the frog (such as call intensity) show distinct nocturnal variation. The rather simplified traditional definition of "call effort" as the product of call rate and call duration [call seconds/h] has to be viewed critically.

Keywords: Automated bioacoustics monitoring, Calling behavior, Frogs

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Surveying ultra-soundscape to monitor echolocating bats activities and populations.

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While the audible soundscape of almost every terrestrial ecosystems encompasses an huge proportion of communication, advertising and display calls, the ultrasound domain is mostly populated by bats echolocation calls. Because those calls are emitted in a quasi-continuous way by active and mobile animals, they offer a better opportunity for monitoring than territorial or display calls. In addition, echolocation calls at an intraspecific level are tightly tailored to fit both the bat's surrounding, open or cluttered, and their requirements such as commuting, catch or landing. At an interspecific level, too, call structure reflects more or less the habitat specialization and feeding habits of a given species. Owing to those advantages, a citizen science monitoring project (Vigie Chiros) was launched by the French Natural History Museum, seven years ago, using acoustic road transects and point counts to survey bats populations' trends. We will present here the results obtained from the data it yields, at the temporal level, i.e.trends in the apparent abundance of some species and at the spatial level, i.e. habitat preferences and landscape influence. In addition, we will discuss the challenges we faced and the solutions we explored in such analyses and, especially, the automatic identification of echolocation calls by machine learning techniques.

Keywords: bats, echolocation, monitoring, trends, automatic identification

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Insights into the structure of ecological communities from acoustic sensor networks

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Little is known about the role of acoustic communication in structuring ecological communities. Using acoustic sensors we can record and localise acoustically communicating animals and determine spatial and temporal activity and interactions between individuals. Such communication networks can inform us about patterns of competition among species and how acoustic communication may regulate spatial movements. We tested the ability of a wireless sensor network to localise birds in a Mexican rainforest environment. We found that bird songs projected within the area could be localised at high accuracies, with error levels on the order of 20cm, with similar results for localisation of Formicarius antthrushes vocalising in response to playback experiments. We also tested the extent to which individuals can be identified from their songs and used vocal signatures to map the territories of pairs in the study area. We discuss how using these methods will allow us to examine spatial and temporal interactions in a community of vocally active, ground-dwelling rainforest birds. Such studies can provide an insight into the role of the sound environment in the temporal structure of acoustic behaviour of animals but also in spatial partitioning of an ecological community.

Keywords: acoustic sensors, spatial partitioning, vocal signatures

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Anthropogenic sounds (vessels) reduce acoustic communication in oyster toadfish (*Opsanus tau*)

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Male oyster toadfish (Opsanus tau) produce "boop" sounds to attract females to dens in shallow estuaries. Calls produced in the natural soundscape include snapping shrimp, soniferous fishes, and bottlenose dolphin (Tursiops truncatus). Dolphins are known toadfish predators. This study will determine if anthropogenic noise from large and small vessels and predator sounds cause acoustic disturbance in oyster toadfish living in two habitats (concealed in seagrass beds or on exposed sand flats). Toadfish colonized artificial dens placed in each habitat. Six sound types were played to toadfish in dens positioned 1 m from an underwater speaker. The sound treatments were snapping shrimp sounds (SN, control), low-frequency (LFD) and high-frequency (HFD) bottlenose dolphin biosonar, large vessels (LV) and outboard motorboat (OB) noises, and a combination of anthropogenic and predator sounds (LV+LFD). Toadfish calling rates were quantified in 600-s intervals before, during, and after noise exposure and mean call rates were compared using bootstrapped repeated measures ANOVA. Playback type, habitat type, and the number of toadfish colonizing each den (covariate) significantly influenced toadfish calling rates ($p \leq 0.047$). Calling rates declined during the playback, compared with pre-exposure levels ($p \leq 0.042$), with highest calling rates in seagrass (pre=5.9, during=2.2, and post=6.9 calls/min), compared with sand (pre=2.2, during=1.5, and post=1.9 calls/min). The magnitude of acoustic disturbance occurred in the following order $SN < OB \leq LV \approx HFD \approx LFD < LV + LFD$, with all treatments different from SN ($p \leq 0.003$). This suggests that both vessel noises and predatory dolphin sounds are detected by reproductively active male toadfish in the natural soundscape. Acoustic disturbances by vessels appear to have synergistic impacts on toadfish calling rates when occurring with natural predator sounds. In busy navigation channels, repetitive boat noise disturbance, especially when combined with predator sounds, may cause reduced mating success (fewer mating opportunities) for oyster toadfish in a natural soundscape.

Keywords: underwater noise pollution, fish, dolphins, seagrass, acoustic refuge, boats, Batrachoididae, sound production

*Speaker

The evolution of soundscape ecology: personal observations

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The new field of Soundscape Ecology informs many disciplines. Springing from the interest of a few isolated naturalists and recordists of the last century who focused their acoustic attention on biophonies, geophonies, and the effects of anthrophony as expressed through a wider, more holistic lens, their approach was a stark contrast to the limited information scope provided by earlier paradigms of single-species capture favored by many institutions. In 1977, when Murray Schafer identified the acoustic phenomenon of all received sound by any organism in one word – soundscape – he framed an area of enquiry into the sonic universe that has inspired a fresh investigation into the diverse narratives communicated through the collective voices of the natural world, both marine and terrestrial. This is a personal overview of that history, the author's mentors, the possible applications of research models, and some thoughts on the future development of Soundscape Ecology as a discipline.

Keywords: Soundscape ecology ; geophony ; biophony ; anthrophony ; soundscape

*Speaker

The effect of airplane noise on the calls of the critically endangered Pickersgill's reed frog (*Hyperolius pickersgilli*), an in situ evaluation

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As a result of urbanisation many breeding sites for frogs have been lost or degraded and many are now surrounded by urban structures. Frogs rely on their vocalization to establish territories and call sites and to attract mates. Various studies have shown that these acoustic signals can be degraded by urban noise. Anuran abundance has shown to be negatively correlated to traffic. Although many studies have concentrated on traffic noise, only one other study documented effects of low flying airplane flyby noise on frogs. Hyperolius pickersgilli is a critically endangered reed frog native to the eastern coastal regions of South Africa. In order to effectively evaluate the call of H. pickersgilli, we included a description of the call properties. We compared a site with high levels of airplane flyby noise to a reference site without any airplane activity. Our results show that H. pickersgilli males made changes in both temporal and spectral properties of their call. Males call significantly more during and after an airplane flyby in relation to the call rate before the noise stimulus. We found that males call at higher median power weighted frequencies (mean weighted frequency difference = 161.4 Hz) when exposed to high-intensity airplane flyby noise. In comparison with call rate five minutes before the airplane flyby, males called 12% more during and 18% more after the airplane flyby. Although changes in the spectral and temporal properties of the call of H. pickersgilli were observed, this species were actively calling for much longer than any other local species. This is the first study from Africa to report effects of anthropogenic noise on anuran communication.

Keywords: airplane flyby noise, bioacoustics, urbanisation, call description, Hyperolius pickersgilli, critically endangered, acoustic habitat degradation, South Africa, anthropogenic noise

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Estuarine Soundscapes: Characterizing habitat-associated underwater sound from an ecological perspective

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Despite their potential importance to marine ecological processes such as larval orientation and settlement, the soundscapes of most coastal and estuarine habitats have not been characterized. Different seafloor habitat types likely produce distinct soundscapes due to differences in the physical and biological contributors to ambient sound. To investigate habitat-related estuarine soundscape patterns we comprehensively measured the sounds of oyster reef and nearby off-reef soft bottom areas in Pamlico Sound, North Carolina, USA, and applied several soundscape analysis approaches to characterize the acoustic variability. Short- and long-term acoustic sampling across the estuary found distinct acoustic patterns in oyster reef habitats compared to surrounding off-reef areas, with reefs producing higher levels of sound within frequency bands dominated by snapping shrimp sounds and the vocalizations of reef-dwelling fish species. Compared to soft bottom habitat, oyster reefs had consistently higher sound pressure levels at higher frequencies (~2-23 kHz) and higher acoustic diversity index values. Passive sound propagation surveys as well as a novel drifting hydrophone technique found that the distinct acoustic characteristics of oyster reefs were highly localized to the habitat. The spectral dissimilarities between concurrent recordings in the two types of habitats were consistent over the summer/fall sampling season and across three years; however, the acoustic signal strength differed between reef sites, likely reflecting differences in their biological or physical properties. This study serves to establish a possible ecological function of the estuarine soundscape as a reliable indicator of habitat-type and habitat quality to dispersing organisms, and also highlights the need to study the drivers of soundscape variation in estuarine and coastal systems to develop effective soundscape analyses and meaningful acoustic diversity indices. Further characterizations of habitat-related acoustic patterns are necessary to evaluate the potential adverse effects of anthropogenic noise or soundscape degradation on marine ecosystems.

Keywords: estuaries, oyster reefs, drifting hydrophones, acoustic diversity

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Acoustic monitoring of individuals in birds: lessons from owls and songbirds

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Individual acoustic monitoring based on individual differences in vocalizations is considered as promising tool that could substitute or complement traditional capture-mark individual tracking techniques at least for certain species of birds. In this lecture, we will give an example that capture-mark techniques may have long-term impact on a bird's behaviour (willow warblers avoid the second capturing even year after the first capture) and hence the development of non-invasive acoustic individual tracking techniques would be highly desirable. We will then continue by exploring the potential application of acoustic individual monitoring techniques in the two model bird species with fundamentally different vocalizations: little owl and chiffchaff. We will present the data on individual variation in calls and songs within and between years in both species and will discuss different practical issues associated with application of acoustic monitoring techniques: how many calls do we need to record, quality of recordings, which parameters should we focus on; size of the population that can be monitored, etc. We will argue that acoustic monitoring of songbirds is particularly challenging. Probably, analogues of content-independent speaker recognition methods will need to be used in many songbird species due to their complex and variable songs.

Keywords: individual recognition, population monitoring, songbird, owl, behavior, long, term monitoring

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Soundscape monitoring in assessing climate change impacts. An experience in temperate anurans

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Soundscape monitoring may provide insights into basic biological traits of animal populations and their response capacity to changing environments. Climate change forces species to confront altered thermal conditions and hence might compromise the performance of calling behaviour in ectothermic animals, such as insects and amphibians. The recent development of automated sound recording systems now allows for long-term acoustic monitoring of multiple populations, even if they are located at the latitudinal margins of the species' distribution range. Thus, we are able to evaluate how species respond to distinct thermal environments at time of displaying calling behaviour, enhancing our predictions of the impacts of global warming on biodiversity. By a long-term automated sound monitoring, we examined temporal patterns of calling activity of anuran populations located at the thermal extremes of their distribution range, and estimated annual and inter-annual calling temperatures for populations and species. In all cases, the diel patterns of calling activity were similar between conspecific populations, whereas their calling temperatures differed both geographically and seasonally, both in terrestrial and aquatic species. Our results suggest that temperate anurans may perform calling behaviour at a wide thermal range and show plasticity mechanisms to adjust to changing thermal environments. These findings imply that global warming would not directly inhibit calling behaviour in these species, although might affect other temperature-dependent features of their acoustic communication system. We discuss the methodological constraints of these new acoustic monitoring tools as well as some suggestions for future research.

Keywords: population monitoring, passive acoustic methods, temporal patterns, thermal breadth, global warming, amphibians

*Speaker

Acoustic biodiversity observation systems: the need and challenges of preserving recordings

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Nature recordings portray the acoustic dimension of the natural world. Since many animals use sound on a daily basis, sound recordings can be used to sample and monitor biodiversity. Here we advocate the need to preserve sound recordings and establish a preservation strategy taking into account factors like storage capacity, scientific interest and historical value. Soundscape recordings are valuable scientific specimens that constitute an acoustic memory of habitats and ecosystems.. If preserved, we can secure this primary source information guaranteeing the verification principle and also enabling the use of recorded specimens to test in the future new hypotheses, either derived from technological or conceptual developments. However these recordings might be at risk. We recently estimated a loss rate of 20% for nature recordings made in Portugal with the highest loss risk being the associated with its misplacement. To avoid inadvertent losses a preservation strategy should be put into action in monitoring program. The preservation strategy should account for the storage and data-curation capacity, combined with the geographical, taxonomical and temporal coverage (both considering local and global scales). During the Global assessment of Animal Sound Archives coverage we found strong biased coverage towards birds, and northern hemisphere and South America. The preservation of soundscape recordings raise a new set of challenges at the data-curation level affecting both the conceptual and infrastructure dimensions as for the preservation of recordings from the project SPEA/LIFE07/NAT/P/000649 in the Portuguese Sounds Archive. Overall, our results point to the need of incorporating from conception a preservation strategy in this type of projects. Strategy that should ideally be developed in association with institutions devoted to long-term data-curation (Sound archives) securing resources for preservation and according to standards.

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Keywords: sound archives, sound specimens, preservation strategy, acoustic memory

*Speaker

Biodiversity assesment of bats population at an urban scale through dense cover of ultrasonic sensors

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We will introduce in this talk a first temptative to deploy massively distributed network of ultrasonic sensor in order to assess bat population at a scale of tens of kilometers. The area considered in this original experiment is the city of Grenoble, France, including suburban cities. One of the particularity of this city is to lay down an alpine valley surrounded by three mountain area. We expect that some of the bat species living in the area of Grenoble, just live in the cliffs and may fly over the city during the night in order to reach their breading areas. This is the case for example for Tadarida Teniotis that have been observed in the past. However, like many others big cities in the world and for the many bat species that may live in urban areas (more than ten in the case of Grenoble), there is a deep lack of knowledge concerning the repartition and the locations of bat roots, as well as the density of bat populations. Since the only solution to detect bat lies on ultrasound detection, two ideas have emerged to try to fully understand the population dynamics:

1. to put a sufficiently large amount of ultrasonic sensors connected on the web and transferring the detection statistics on the web,

2. to invite the population to use their smart phone computers connected to ultrasonic sensors, and let them outdoor to detect the bat calls.

Many high quality smartphone have now built-in microphones that can record sounds up to 24 Khz, thus detecting the low frequency bat species. We finally explained how we plan to reach a critical number of sensors of good quality all over the Grenoble valley to have one of the clearer view of bat population density estimates that have never been obtained before.

Keywords: low cost ultrasonic detection, bat population density estimates, network of connected sensors

*Speaker

Measuring changing levels of recreational boating throug underwater soundscape monitoring in Loch Lomond, Scotland

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Concerns for the influence of anthropogenic noise on animals in aquatic environments have been increasing in recent years, particularly with regard to the marine environment, but little attention has focused on a similar question in freshwater environments. Loch Lomond is a site of considerable ecological, geological and cultural importance that is located close to highly urban areas and attracts considerable numbers of recreational boaters throughout the summer months, which causes both temporal and spatial variability in the extent of acoustic pollution within the loch. As a result, it is an ideal location to study the effects of recreational tourism on noise in freshwater systems. This study presents preliminary work done as part of an undergraduate summer research experience to measure and compare the underwater soundscape of Loch Lomond, Scotland, with the aim of establishing the level of and variation in acoustic pollution and identifying sources of biological sound that could be affected by it within the loch. In this work, we collected underwater acoustic recordings from a small boat at five sites distributed in different habitats of the loch over a period of three months. These recordings were complimented by shore-based underwater recordings collected from a fixed shallow-water location at the southern end of the loch. From this work, we catalogued a variety of biological sounds, including several likely from known fish species, documented a shift in the dominance of man-made noise through the tourist season, and demonstrated the advantages of involving young scientists in fieldwork, particularly in emergent research areas such as soundscape ecology.

Keywords: freshwater habitat, noise pollution, underwater, anthropogenic noise

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Monitoring coastal marine soundscapes: Challenges, opportunities and progress

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The growing academic, governmental and social interest in marine soundscapes is an encouraging development for soundscape ecology and marine conservation initiatives. Recent technological advances in both software and hardware have increased the accessibility for conducting acoustic survey, which have created new opportunities to progress soundscape monitoring techniques. It is evident that adoption, development and integration of these technologies is becoming more widespread in terrestrial soundscape research practices. However, these are not always directly transferable to monitoring coastal marine systems. It is crucial that researchers are aware of the limitations and challenges when studying coastal marine systems in order to minimise the risk of compromising data quality. This paper will review the main challenges facing coastal marine soundscape research and evaluate key research progress and opportunities.

Keywords: marine soundscape, monitoring, coastal, acoustic

*Speaker

Acoustic diversity indices in marine ecosystems: long-term patterns, spatial considerations, and abiotic influence

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Proxy indicators of biodiversity exploiting acoustic techniques offer the prospect of mapping variability in biodiversity across a range of spatiotemporal scales. Studies in the terrestrial domain have brought to light the potential for rapid and cost-efficient biodiversity appraisal, and have also highlighted the need for signal conditioning to limit the influence of abiotic and anthropogenic sources. In marine ecosystems, the differing vocal taxa, acoustic propagation characteristics, and abiotic contributions call for a reassessment of the applicability of acoustic diversity indices and requirements for signal conditioning. Here, we discuss how these indices might be applied to marine habitats, taking examples from a long-term acoustic monitoring study in Massachusetts Bay, a year-round marine mammal habitat in the Northwest Atlantic. Recordings were made using an array of autonomous recorders, monitoring continuously over a 6-year period. The variability of acoustic diversity indices is assessed with regard to marine mammal and fish detections, analyses of spectral probability density, and meteorological and oceanographic parameters. Given the influence of anthropogenic and abiotic sources on each index, we examine implications for signal conditioning in comparable habitats. Finally, we consider diversity indices in the spatial dimension, taking into account the strong interrelationship with frequency in the marine context, and examining the role of sounds in this ecosystem at landscape scales.

Keywords: marine, acoustic diversity, long term, signal conditioning, spatial

*Speaker

Speech intelligibility in natural background noise with or without animal foreground in a open field and a tropical forest

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Listening abilities in humans have developed in rural environments which are the dominant setting for the vast majority of human evolution. Hence, the natural acoustic constraints present in such ecological soundscapes are important to take into account in order to study human speech recognition. So far, there are very few systematic studies dealing with the impact of outdoor natural acoustic environments on speech. One difficulty explaining this situation is that natural rural sound environments are known to be rather variable. They depend on the geographical situation, the terrain, the vegetation, meteorological circumstances, but also biophony and geophony. However, the rather quiet natural soundscapes have common underlying basic properties characterized by a non uniform distribution of frequencies emphasizing low frequency content. In the present paper we measured the impact of such basic properties on speech, as well as the impact of acoustic propagation and some insect stridulations on speech. A behavioral experiment was implemented to analyze the intelligibility loss in spoken word lists with increasing listener-to-speaker distance in a typical low-level natural background noise recorded in a plain dirt field. Next, we measured until which distance (and Signal-to-Noise Ratios) the automatic method Speech Intelligibility Index (SII) was still relevant to measure speech recognition in such typical natural conditions. We showed that at low SNR values the SII missed significant low-frequency masking sources but was accurate at high SNRs and high frequencies. These data validated the fact that we could apply SII measures to similar low level background noise recorded in a tropical forest in Brazil, with or without stridulating insects. We found that SII decreased of about 15% with such rather stationary biophony because it impacted mostly bursts of plosive consonants, fricatives and upper formants of vowels.

Keywords: speech recognition, Speech Intelligibility Index (SII), natural background noise, insect stridulation, tropical forest

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Fragments of Extinction - A New Recording Approach in Primary Equatorial Forests

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Through a case study of field recordings collected in Borneo's undisturbed rainforest within the scope of Monacchi's long-term project "Fragments of Extinction" – An Eco-acoustic Music Project on Primary Rainforest Biodiversity, this paper will focus on a particular methodology for deriving punctual analytical data from omnidirectional sound-art oriented field recordings.

Soundscapes were recorded with innovative three-dimensional microphone systems deployed in remote and challenging habitats, where the rate of biodiversity loss will be increasing. The result is one of the most vivid sound portraits possible with current hi-definition technology, providing a detailed example of the current state of Bornean biophony.

This paper will focus on a specific analysis of a 27 hour (dusk to dusk - included) continuous recording. Data are being evaluated with different methodologies to assess the ecosystem richness and variability through an entire circadian cycle. A careful dissection of species' sonic languages within an omnidirectional recording domain is followed by species mapping, to then outline the entire 27-hour eco-acoustic behaviour of life cycles. In parallel, data are examined with Acoustic Complexity Indexes as important ecological meters of information, and acoustic codes are traced.

Within the aim of the study two questions are posed: how do soundscape data represent significant ecological indicators for revealing the complexity and interconnected equilibrium of these primary natural systems? How can the specific recording techniques employed preserve essential information for the investigation of acoustic communities?

In consideration of the Acoustic Niche Hypothesis (Krause 1987), engaged here to interpret and frame one of the most diverse soundscapes on Earth, we think that the different degrees of complexity found in the communication codes of insects, amphibians, birds and mammals reflect evolutionary mechanisms of long-term cross-adaptation confirmed by extreme acoustic efficiency, niche partitioning, and systemic behaviour.

Keywords: soundscape portraits, primary equatorial rainforests, ecoacoustic composition, three dimensional recording techniques, acoustic complexity of biodiversity.

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BEsound, a new project proposed to study the relationships between land use intensity, organismic diversity and acoustic complexity

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The Biodiversity Exploratories were established in 2006, on three sites in Germany. In each site 50 plots in forests and 50 plots in grasslands were installed as long term research plots along a land-use and biodiversity gradient. The main target of the Exploratories is to understand the relationships between biodiversity, ecosystem functioning and land-use intensity. Within this framework we recently proposed a project to investigate how these relationships are reflected in the soundscape of the respective habitat and if acoustic diversity measures can be used to monitor effects on land-use intensity on biodiversity.

The already existing assessments of biodiversity for different plant, animal, fungal and microbial taxa within the Biodiversity Exploratories allow us to address the following questions:

a) Which aspects of biodiversity can be captured by acoustic diversity measures?

b) How are patterns of acoustic diversity altered by land-use intensity?

c) How do biophony and geophony vary with the complexity of vegetation structure?

To answer these questions we will install autonomous recording systems within each of the 300 plots. By recording the soundscape for a whole year and during several recordings per day, both daily and seasonal variations can be captured to document various aspects of sonic components. Recordings will be programmed to an acoustic sensors added to the VirtualSense node. VirtualSense is an open hardware, ultra-low-power, wireless sensor node, developed by the Department of Base Sciences and Foundations at the University of Urbino. The device will already provide values for acoustic complexity index (ACI) for each temporal unit for each frequency bin.

Keywords: acoustic diversity, biodiversity, ecosystem functioning, land, use intensity

*Speaker

Temporal and Spatial Variation of a Winter Soundscape

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Sound is an intrinsic component of ecosystems and studies have shown that sound plays a significant role in how plants and wildlife interact with their surroundings. The same is true for human-wildlife interactions. Soundscapes vary by day, by season, and across space. Winter in northern latitudes possesses unique soundscape attributes because of a substantial decrease in wildlife vocalizations (biophony), an increase in wind events (geophony), and encroaching noise from winter recreation like snowmobiling (anthrophony). We introduce a fourth soundscape component, silence, as an additional attribute of winter soundscapes. Our objectives were to quantify and visualize the temporal and spatial variation of these four soundscape components in a winter landscape. We sampled 62 locations across the 805,000 ha of Kenai National Wildlife Refuge, Alaska, USA between December 2011 and April 2012. We recorded ambient sounds and quantified the power spectral density in spectrograms at 1 kHz frequency intervals using the Remote Environmental Assessment Laboratory (www.real.msu.edu). We identified sounds from 67,461 recordings and visualized the temporal variation of all soundscape components. We generated predictive spatial models of each soundscape component using machine learning (TreeNet). Silence was the most prevalent record, occurring predominantly at night. Anthrophony, biophony, and geophony were all more prevalent during the day. Anthrophony and biophony had similar temporal patterns over monthly time frames. Geophony was highest in February and January was the quietest month of the season. Spatially, distance to urban interface and rivers were the most common predictors of biophony and anthrophony. Geophony's top predictors were distance to forest and urban interface, and elevation. Distance to rivers, shrubland, and barren land were the top three most important predictors of silence. Our results reveal how winter's biophony, anthrophony, geophony, and silence are arranged over space and time. We also provide evidence of anthrophony's further encroachment into remote wilderness.

Keywords: Winter Soundscape, Biophony, Anthrophony, Geophony, Silence, Machine Learning

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Effects of noise on communciation in breeding birds

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Acoustic signals, such as bird song, are often used over long distances and/or in noisy areas, so that information in signals will be degraded or masked. Moreover, noise can indirectly affect communication by acting as general stressor or by shifting attention away from relevant signals. Yet, any such effects of noise depend on both, the nature of the noise and the characteristics of the individuals exposed to it. Here, I will outline some basic constraints of communicating in the wild by focusing on adaptations of signal structures and receiver behaviour to long range communication. I will also present some recent experiments in which we investigated the influence of noise differing in spectral characteristics on (a) male song and breeding success and (b) on parental nest box visits and nestling begging in field population personality-typed wild great tits (Parus major). The results indicate that effects of noise depend on the nature of noise as well as on characteristics of the exposed individuals, providing new insights in how disturbance can differently affect individuals in a population.

Keywords: anthropogentic noise, vocal communication, songbirds, animal personality

*Speaker

The influence of anthropogenic noise on the evolution of communication systems

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Many species of animals, including man, face the formidable task of communicating in noisy environments. In this talk, I shall discuss the effects of anthropogenic noise on the calling behavior of anuran amphibians. Moreover, the role of spectral, temporal and spatial separation in minimizing masking by background noise will be examined. For example, presenting high-level, periodic tones at the male's Co-note frequency to males of the Puerto Rican treefrog, Eleutherodactylus coqui results in a clear shift in their calling pattern such that they avoid acoustic overlap with the interfering playback stimulus. Moreover, even if the interfering tones are aperiodic (that is, if a sequence of interfering tones of short and long duration are presented randomly), males of this species are capable of initiating their calls in the gaps between the interfering tones. Amphibians also have a remarkable ability to shift their call timing in response to small intensity shifts in the background noise. Males of E. coqui are capable of reliably detecting a change in interfering tone intensity as small as 2-4 dB. Finally, I shall present behavioral evidence that anthropogenic noise may act as a strong selective force in sculpting the acoustic communication systems of several species of Old World frogs. In response to airplane flyby noise and playbacks of low-frequency motorcycle sounds, three species of actively calling species (Microhyla butleri, Rana nigrovittata and Kaloula pulchra) significantly decreased their call rates. Yet under the identical stimulus regime, Rana taipehensis consistently increased its call rate. These results, coupled with the natural calling behavior of these species, suggest that anthropogenic acoustic interference affects anuran choruses differentially and indirectly, by suppressing calling behavior of one set of species which in turn, stimulates calling in other species. Supported by grants from the NIDCD (no. DC-00222), and the UCLA Academic Senate (3501).

Keywords: acoustic interference, amphibians, frogs, playback experiments

*Speaker

Auditory affordances - the role of action in perception of urban soundscapes

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Throughout evolution, the auditory system has specialized to detect, localize, and identify significant events in the environment. From the most rudimentary hearing system of our aquatic ancestors to the complex human auditory system, perception of such events is instrumental; it guides the perceiver's behavior. Sounds can, then, be considered as sign vehicles or carriers of affordances: They inform the perceiver about potentials for interaction in the environment. Ecological psychology and biosemiotics suggest a tight link between perception and action, but this linkage has been largely ignored in traditional research on human audition. In contrast, ecologically informed studies of auditory perception suggest that listeners' perception of soundscapes is structured by semantic categories in relation to events and activities taking place in the heard environment. In a recent behavioral study (Nielbo et al. 2013) we investigated the affordance potentials of urban soundscapes. Participants listened to recordings of eight different outdoor urban soundscapes (public squares and parks), evaluated on a continuous scale how appropriate they were for four different activity types (e.g. 'studying for an exam' or 'riding your bicycle'), and justified their evaluations in free-format comments. The results revealed significant effects of soundscapes and activities, supporting the hypothesis that evaluation of a soundscape is influenced by the perceived potential for interaction of the environment, and the analysis of the comments gave an indication of the participants' motivation. Consequently, in this talk I wish to draw attention to the role of action in perception of soundscapes.

References:
Nielbo, F., Steele, D., Guastavino, C. (2013): Investigating soundscape affordances through activity appropriateness. Proceedings of Meetings on Acoustics, volume 19, 040059.

Keywords: affordance, action

*Speaker

Crowd-sourcing soundscape characterisation and biodiversity monitoring

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We live in an era of widespread use of audio enabled mobile devices, such as smart phones, and heightened public awareness of the need for environmental and ecosystem protection. This offers unprecedented possibilities for the implementation of acoustic-based biodiversity monitoring and soundscape characterisation at a global scale. Data capture at high spatio-temporal resolutions is possible using very large numbers of crowd-sourced acoustic sensors. Such an implementation requires a detailed accommodation for device-specific audio hardware characteristics (microphone directivity, sensitivity and frequency response and differing embedded audio processing algorithms) and for the limitations of device-available computational power, signal acquisition storage and allowed battery consumption. Human-in-the-loop systems offer the potential to utilise user expertise to help disambiguate automated decision making. It also allows us to enhance spatial and temporal information gathering and sensor distribution modelling by suggesting to users locations or routes that maximise likely information gained about the soundscape so reducing uncertainty in the overall soundscape and species distribution maps. This talk will present results from our work to examine the use of acoustic indices based on higher-order moment statistics and information theoretic measures such as spectral flatness and negentropy. We will discuss our testing of methods on mixtures of biophony (birdsong and call recordings) as well as anthrophony and geophony components and the feasibility of gaining reliable soundscape characterisation and automated recognition/characterisation of biophony using a crowd-sourcing paradigm.

Keywords: Soundscape characterisation, Sound complexity indices, Biodiversity monitoring

*Speaker
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Recording and analysis of italian soundscapes

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The collecting of animal sound recordings is increasingly recognized as a valuable and non-invasive tool for taxonomy, systematics and biodiversity research, because of the species-specificity of bioacoustic signals.

The recording of soundscapes, as opposed to the recording of individual sounds, allows to capture all the sounds generated by the biological and non-biological elements composing the environment, including anthropogenic noise. The analysis of all these components and the evaluation of the relations among them provides indexes related with biodiversity, richness, and noise contamination. The project initiated by CIBRA is aimed at collecting soundscapes in a series of natural habitats with diverse level of biological richness and noise contamination. Among the monitored sites there are remote Integral Nature Reserves to provide examples of pristine habitats where the only noise contamination is due to flight routes.

Recording techniques and instruments to perform long term soundscape recordings are also developed and tested in the field to produce optimal results, by increasing bandwidth and lowering self-noise to expand the receiving sound space. The cooperation with the SABIOD (Scaled Acoustic Biodiversity) project addresses the problem of the analysis of extensive recordings by using advanced algorithms.

Within the frame of the Soundscape Project, several products have been already developed for the valorization of educational trails where to discover valuable natural habitats by listening to nature sounds.

Keywords: sound recording, soundscape analysis

*Speaker

Telemeta, an open and collaborative web audio platform for digital sound archives management

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Since 2007, Parisson, a small french company, has been developing a scalable and collaborative web platform for the management, access and automatic analysis of digital sound archives in the context of scientific research activities. This web platform is based on Telemeta, an open-source web audio framework. It carries out digital sound archives secure storing, indexing, geolocating and publishing and simplifies the process of uploading and synchronizing large audio data. Telemeta also transparently handles most multimedia file formats. For this purpose, it provides decoding, encoding and streaming features together with a smart embeddable HTML audio player that can display waveform or time-frequency representations of the signal. Furthermore, the Telemeta platform focuses on the enhanced and collaborative user-experience in accessing audio items and their associated metadata. It also provides to the expert users the possibility to further edit and enrich those metadata through global or time-based annotations. One of the key features of the Telemeta architecture is to integrate TimeSide, an external open-source audio processing framework written in Python. TimeSide provides Telemeta with automatic signal processing and computational analysis capabilities. It also wraps several audio features extraction libraries to provide a basis for automatic annotation, segmentation and acoustical analysis. The TimeSide framework is designed to be flexible in terms of multimedia content analysis and researchers can easily plug their own audio analysis algorithms. By putting together a digital sound archive management framework, a collaborative annotation framework and an audio signal analysis framework, Telemeta can constitute a very valuable and stimulating platform for bioacoustical, ecological and soundscape research. Besides ensuring the preservation of the collected data, by publishing their sound archives, researchers can promote their works and make them accessible securely. They could also benefit from the interaction with peers and practitioners from different spheres and scientific disciplines.

Keywords: web platform ; sound archives ; collaborative tool ; open ; source

*Speaker

Effects of diverse sampling intensity in soundscape studies on tropical ecosystems

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A lack of well-defined protocols makes it difficult to apply the acoustic approach in studying ecology by different users, such as wildlife managers or landscape planners. The definition of the minimum required sampling effort to achieve soundscape characterization goals is fundamental for planning robust investigations on animal communities. We present a study that provides the first guidelines for monitoring soundscapes along three different tropical environments in south-eastern Brazil (Minas Gerais state): Atlantic Forest, Rupestrian fields and Cerrado (Brazilian savanna). Three autonomous recording devices (SM2, Wildlife Acoustics) recorded 24hours a day, for 6 days along a period of 15 days, both in wet and dry seasons. Recordings were successively processed via the use of an acoustic complexity index and then subsampled in order to simulate less intense recording schemes to assess the information loss when decreasing the amount of data used in the analyses. We describe the soundscape structure of the three environments and make considerations on preferable programming routines to achieve an ideal compromise between rigorous sampling efforts and robust results. These kinds of studies are particularly important at this early stage of Soundscape Ecology research, since they could be useful to researchers and wildlife managers in order to avoid time- and resource- consuming analyses and excessive financial resources, which will be used in relation to the minimum required to obtain reliable outcomes.

Keywords: acoustic community, environmental monitoring, soundscape ecology, tropical environments

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A Naturalist's Guide to Soundscape Ecology

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1

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Soundscape ecology has recently been showcased as a new science that leverages an assortment of new sensor technologies; leading scientists down a path of creating "big data" warehouses which are generally associated with other areas of discovery, such as physics, genomics and satellite remote sensing. Such a characterization of this new science – that it is an enormous digital form of discovery – would seem like it is centuries from the days of the great observational naturalists like Darwin, Humboldt and Wallace. Indeed, today we often we pay homage to these great naturalists who spent decades in nature with only the simplest of technologies, a pen and paper. Over the past three years, the first author has developed a set of naturalist observational techniques that trains our ears, focuses our thoughts that connect the sounds to ecosystem patterns and processes, and links the human psychological attachment of place to the sensory inputs generally experienced by what we would classify as 19th century naturalists. This presentation will focus on the logistics, form, style, and interface of these naturalist's observational activities and their interface to the 21st century scientific discovery process that is "big data" driven. Indeed, soundscape ecology provides unique opportunities for scientists to discover nature in a very unique AND personal way – through solitude and a deep connection to nature that is emotional, cultural, symbolic and scientific.

Keywords: Sense of place, big data, soundscape tools

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On Classifying Insects from their Wing-beat: New Results

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Insects variously affect many kinds of cultivations that are vital for rural economy, local heritage and environment: it is well known that insects pollinate a large number of plant species, while certain kinds of insects are pests that have a detrimental effect on cultivations. On top of the hazard list, mosquitoes can transmit serious diseases to humans and livestock. Pests can be controlled with aerial and ground bait pesticide sprays, the efficiency of which depends on knowing the time and location of insect infestations as early as possible. Automatic monitoring traps can enhance efficient monitoring of flying pests by identifying and counting targeted pests.

This work deals with novel advanced feature extraction and classification techniques as applied to the task of classifying insects from their wing-beat. It reports the most accurate results in the literature on two different datasets coming from a large number of flying insect species.

Keywords: automatic insects classification, automatic monitoring of insect traps

*Speaker

"Marine Soundscape Ecology": a new and emerging field.

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In the face of accelerated climate change, monitoring biodiversity has become a critical task for ecologists. Habitat loss is occurring at an alarming rate both in terrestrial and marine ecosystems, resulting in endangerment and extinction of species up to 1,000 times faster than natural rates. However, traditional biodiversity measurements are logistically and financially difficult, making biodiversity monitoring a challenging obstacle to conservation efforts. In terrestrial environments, "soundscape ecology" has recently emerged as a potential solution to these problems, providing a mechanism for measuring biodiversity at various temporal and spatial scales using acoustic signatures. Several acoustic diversity indices have proven to be useful indicators of biodiversity in a variety of landscapes. Thus far, this technique has not been extended to marine environments. What we do know in the marine environment is that different habitats have specific sound signatures both in temperate and tropical waters. For example, studies have shown that temperate reefs from within a marine reserve have a different spectral signature compared to reefs outside the reserve. Also, a fringing reef from a tropical Island has a different spectral signature to those of the lagoon and back reefs. In this presentation I will highlight the research potential of using acoustics to monitor marine biodiversity and what is required for this field to progress.

Keywords: Marine Soundscapes, fish, invertebrates, biodiversity

*Speaker

Assessing changes of animal diversity in the ocean: the application of acoustic indices to monitor bioacoustic activity in a marine sanctuary

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Increasing human development in coastal regions and associated loss of habitat and biodiversity have led to an urgent need for techniques that can quickly assess changes in the composition of marine ecological communities. Many marine animals use sounds in different contexts, such as navigation, foraging, and reproduction. These vocalizations can provide valuable information about the occurrence, distribution, and relative abundance of species. However, species-specific detection approaches are time-consuming and often infeasible on larger temporal and spatial scales. In this study we will explore the capacity of acoustic biodiversity indices, originally developed for terrestrial applications, to reflect seasonal patterns in the relative abundance of vocally active marine animals in the Stellwagen Bank National Marine Sanctuary (SBNMS). SBNMS comprises an important spawning ground for soniferous fish species such as cod and haddock and a major summer feeding habitat for North Atlantic humpback whales. At least four other baleen whale species, including endangered North Atlantic right whales, use the sanctuary seasonally during migration. Spatial and temporal differences in the relative abundance of these diverse taxa should thus be reflected in the overall soundscape of the SBNMS. Year-round, low-frequency acoustic recordings have been collected at various locations throughout the sanctuary for over eight years. A subset of these data, reflecting different seasonal and spatial scenarios, will be analyzed using several acoustic metrics and indices with the aim to explore patterns of general bioacoustic activity. The resulting patterns will be correlated to biological and anthropogenic sources, through comparison to species-specific detections and visual sightings, as well as shipping traffic. In addition, these results will be used to support larger-scale modeling efforts using geospatial data and machine learning techniques to explore how various biological, physical and anthropogenic factors influence marine soundscapes.

Keywords: marine, soundscape, anthropogenic noise, biodiversity

*Speaker

Temporal and spatial variability of animal sound within a neotropical forest

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Preserved tropical forests are the location of unique, highly diverse, and animal sound. However, although the acoustic behavior of several tropical species has been examined, very few analyses have attempted tropical sounds at a spatial scale able to incorporate landscape characters. Here we analyze the acoustic structure of a neotropical forest landscape in French Guiana. We used a four dimensional synchronous acoustic sampling (three spatial dimensions and the temporal dimension) by deploying an array of 24 microphones in the understory and canopy of the Nouragues Nature Reserve during a 43 day period and we undertook a detailed signal analysis to detect spatial and temporal animal acoustic heterogeneity. We identified a clear pattern of acoustic activity with four distinct periods of activity that differed by their spectral characteristics indicating acoustic heterogeneity along the 24-hour cycle but periodicity at a longer time scale. We revealed acoustic divergences between the understory and the canopy layers in terms of amplitude level and frequency content. We highlighted vertical (understory/canopy) and horizontal acoustic heterogeneities with a more diverse (frequency) patch in the north of the study area sampled and a more active (intensity) patch in the southeast of the study area. Our results show that the soundscape of a tropical forest, in the absence of human disturbance, is subtly structured in time and is heterogeneous in space. This structure is probably linked to endogenous factors that rule out the acoustic time activity of animal species, to the vertical stratification of singing communities or guilds, to horizontal variations in the distributions of species and to vegetation spatial heterogeneity. Our study emphasizes that tropical soundscapes need to be recorded and analyzed in considerable spatial and temporal detail to understand their dynamics without the presence of human produced noise.

Keywords: Soundscape description, spatio, temporal dynamics, tropical forest

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Density can be misleading for monitoring top predators distributed at low densities: benefits of Passive Acoustic Monitoring

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Climate-induced changes may be more substantial within the marine environment, where following ecological change is logistically difficult, and typically expensive. As marine animals tend to produce stereotyped, long-range signals, they are ideal for repeatable surveying. In this study we illustrate the potential for calling rates along with remote sensing data to be used as a tool for determining habitat quality by using an Antarctic pack-ice seal, the leopard seal, as a model. With an understanding of the vocal behaviour of a species, their seasonal and diurnal patterns, sex and age-related differences, an underwater passive-acoustic survey conducted alongside a visual survey in an arc of 4,225 km across the Davis Sea, Eastern Antarctica, showed that while acoustic and visual surveys identified similar regions as having high densities, the acoustic surveys surprisingly identified the opposite regions as being 'critical' habitats. Density surveys of species that cannot be differentiated into population classes may be misleading because overall density can be a negative indicator of habitat quality. Under special circumstances acoustics can offer enormous advantage over traditional techniques and open up monitoring to regions that are remote, difficult and expensive to work within, no longer restricting long-term community assessment to resource-wealthy communities. As climatic change affects a broad range of organisms across geographic boundaries we propose that capitalizing on the significant advances in passive acoustic technology, alongside physical acoustics and population modeling, can help in addressing ecological questions more broadly.

Keywords: bioacoustics, Antarctica, spatial behaviour, Leopard seals, pack ice seals, marine mammals

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Strings, Woodwinds, Brass, and Percussions: What are the divisions in the Brazilian Cerrado Symphony Orchestra?

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The Brazilian Cerrado biome is considered a biodiversity hotspot but how different animal groups contribute to its soundscape is yet to be explored. The Acoustic Niche Hypothesis (ANH) suggests that animals, along an evolutionary path, tend to adjust their acoustic signals to the ones of other animals, especially in areas with high animal density and diversity, by the partition of the acoustic space in temporal, spatial and spectral dimensions. This results in a metaphoric symphony orchestra where all players can hear and be heard, and thus avoiding masking from similar sounds. This study tested the ANH in a Cerrado area located at the National Park of Serra do Cipó, Minas Gerais, Brazil. The animal community of the study area is comprised by 226 bird species, 26 large and medium sized mammals, more than forty species of amphibians and hundreds of insect species. Four Song Meter Digital Field Recorders (SM2) (Wildlife Acoustics, Inc., Massachusetts) were installed approximately 200m from each other and programmed to record continuously at 44.1kHz during 2 non-consecutive days of birds breeding season (September 2012) from 00:00 to 23:59. Data were subsampled by analyzing 1 minute every hour of recording, totaling 192 minutes of sounds for the four SM2s. The acoustic niches were characterized using the software XBAT (xbat.org), by collecting several acoustic parameters (start time, end time, duration, maximum frequency, minimum frequency and bandwidth) for any animal vocalization or stridulating encountered in the files. Birds, mammal and amphibian vocalizations were also identified to the species level by field specialists. Preliminary results showed a tendency of the organisms to distribute themselves in spectral and temporal patterns so that only a few partial overlaps were found, especially during the afternoon.

Keywords: acoustic niches, communication, community monitoring

*Speaker

Titmice as community informants: information-scapes for coping with landscapes of fear

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Birds in family Paridae encode specific anti-predator information in their vocalizations that is used to manage predator-attack risk by diverse species. We hypothesize that Paridae accurately assess predator attack risks across landscapes they inhabit. Moreover, because of their vocal abilities and high abundances, we propose that Paridae produce information-scapes that accurately map landscapes of risk (fear) for fellow prey to use in coping with spatiotemporal variation in predation risk.

To determine if Paridae accurately assess predator attack risk, we are quantifying (a) actual attack risk and whether resident Parids and other birds exhibit (b) higher perception of ambient attack risk where actual risk is highest. To determine if Paridae are, in turn, producing accurate information-scapes regarding predation risk variation, we are determining whether (c) risk-relevant information encoded in calls co-varies with actual attack risk.

For (a) we are recording raptor approaches to avian distress calls broadcast during playback in conifer versus hardwood forest and have determined preliminarily using GLM that raptor approaches are more common in species-rich hardwood than conifer. For (b) we are conducting two playback studies: broadcast of (i) screech owl calls to attract bird mobs in Winter and (ii) territorial calls of Paridae (titmice, chickadees) in Spring to generate territorial display in both habitats. Assuming that in both mobbing and territorial displays, birds' perceptions of ambient attack risk are reflected in their conspicuousness, we are using behavioral metrics (calling rate, approach). Preliminary GLM analyses for (b) detect more conspicuous behaviors in conifer than hardwood. Finally, to address (c), we are gathering recordings with 'song meters' and applying automated spectral imaging to extract and quantify information encoded in parid calls for statistical comparison of the structure and production of risk-specific information by habitat type (analyses underway).

Keywords: Paridae, encoded anti-predator information, soundscapes, informationscapes

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Integrating online environmental data repositories and bioacoustic research: a study case on Amazonian frogs.

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In Brazil, widespread changes in land use occur faster than the accumulation of data on native species and their associated behavioral diversity in response to environmental gradients. Information gaps are especially wide regarding clinal changes in forest structure and its associated biota and their effects on acoustic signals of highly vocal vertebrates. Intra-specific variation in acoustic signals of Amazonian anurans have been investigated, but studies generally focused on isolation by distance, vicariant barriers or reinforcement in mate selection, and did not test predictions of the Acoustic Adaptation Hypothesis (AAH). Here, we investigated the relationships between forest structure and the spectral and temporal properties of acoustic signals of an anuran species (Allobates sp.) to test the AAH. Additionally, we searched the acoustic environment across sampling plots for species that emitted signals that overlapped in bandwidth with those of the focal species. The study was conducted in 35 permanent sampling plots distributed in forests along a 600 km SW-NE transect of the interfluve between two large southern tributaries of the Amazon River. Plots are used by several research groups and vegetation structure parameters and species composition in each plot were available in online repositories, allowing tests of associations between divergence in acoustic signals and fine-grained environmental gradients. The acoustic signals of Allobates sp. are shorter and emitted at lower frequencies in forests with higher tree densities and larger tree basal areas, as predicted by AAH. However, signal modulation was not affected by any environmental parameter. The presence of a congeneric species that emitted signals with overlapping frequency bandwidth was not associated with the variation of any acoustic trait of the focal species. In addition to the findings in relation to the focal species, our work highlights the importance of environmental and biodiversity data repositories in accelerating bioacoustic research.

Keywords: acoustic adaptation, amphibians, habitat structure, masking interference

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Blue and fin whale habitat modeling using calls

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Passive acoustics provide a cost-effective method to estimate presence of marine animals. However, extrapolation of presence data to ecologically relevant topics, such as abundance estimation or habitat use, requires application of assumptions about detection range, calling behavior, etc. A case study in how to use passive acoustics for habitat modeling will be presented based on multi-year, passive acoustic recordings collected at multiple locations off Southern California since 2006. Automatic detection methods were used to extract blue whale B calls and fin whale 20 Hz calls from the recordings. There was a seasonal variation in calling for the two species. Peak in blue whale B calls occurred in late summer and early fall. Fin whale 20 Hz calls, on the other hand, peaked in late fall, often with a secondary peak in the spring. Since propagation varied among sites, to use them as response variables for habitat modeling, call rates were normalized by the area over which detection was feasible at each location based on reported source levels and propagation modeling. A variety of environmental, remotely sensed data were available for habitat modeling, including sea surface temperature, sea surface height, chlorophyll a concentration, etc. In addition, anthropogenic factors such as presence of noise from boats or naval sonar activities, as well as temporal variables like month and year were used as explanatory variables for the models. The variability in model output across sites will be used to discuss implications of using calls for habitat modeling.

Keywords: baleen whales, habitat modeling, passive acoustics, blue whale, fin whale

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Robust bird species recognition: making it work for dawn chorus audio archives

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The recent (2013) bird species recognition challenges organised by the SABIOD project attracted some strong performances from automatic classifiers applied to short audio excerpts from passive acoustic monitoring stations. Can such strong results be achieved for dawn chorus field recordings in audio archives? The question is important because archives (such as the British Library Sound Archive) hold thousands such recordings, covering many decades and many countries, but they are mostly unlabelled. Automatic labelling holds the potential to unlock their value to ecological studies.

Audio in such archives is quite different from passive acoustic monitoring data: importantly, the recording conditions vary randomly (and are usually unknown), making the scenario a "cross-condition" rather than "single-condition" train/test task. Dawn chorus recordings are generally long, and the annotations often indicate which birds are in a 20-minute recording but not within which 5-second segments they are active. Further, the amount of annotation available is very small.

We report on experiments to evaluate a variety of classifier configurations for automatic multilabel species annotation in dawn chorus archive recordings. The audio data is an order of magnitude larger than the SABIOD challenges, but the ground-truth data is an order of magnitude smaller. We report some surprising findings, including clear variation in the benefits of some analysis choices (audio features, pooling techniques noise-robustness techniques) as we move to handle the specific multi-condition case relevant for audio archives.

Keywords: bird, bird song, automatic classification, multilabel, noise, archives

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Acoustic dissimilarity indices for ecology

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Biodiversity assessment mainly relies on two families of indices, the alpha indices that measure the diversity of a single unit, and the beta indices that estimate how two units differ. Alpha and beta indices are therefore used to assess within and between-group diversity respectively, a group being a site, a habitat or a time event. Recent developments at large ecological scales led to the development of several alpha acoustic indices (e.g. L_{i}, H_{i}, ACI, NDSI) to estimate the energy, the level of complexity or the composition of an acoustic community or a landscape. However, few beta indices have been developped when between-group metrics could be very useful to estimate the spatial and temporal heterogeneities of large scale acoustic units. In this talk, we will review the acoustic dissimilarity indices developed so far, detail their mathematical properties, pinpoint their advantages and potential bias, and illustrate their use in the analysis of temperate and tropical acoustic communities.

Keywords: beta acoustic indices, dissimilarity, spectral differences

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Long duration false-colour spectrograms

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Acoustic recordings of the environment are an important aid to ecologists monitoring biodiversity and environmental health. It is fortunate that three major groups of vocal species, birds, insects and frogs, are also accepted as important indicators of environmental health. The group of Sueur et al. has demonstrated that measures of temporal and spectral acoustic entropy are promising surrogates for biodiversity. Likewise, the group of Farina et al. has found that measures of "acoustic complexity" correlate with meaningful ecological parameters. Towsey et al. have shown that combinations of acoustic indices can be more effective in the determination of avian species diversity than single indices.

Rapid advances in recording technology, storage and computing make it possible to accumulate thousands of hours of recordings, of which, ecologists can only listen to a small fraction. This presents a big-data challenge. We address this problem by using acoustic indices (such temporal entropy, ACI, acoustic cover) to construct false-colour spectrograms that permit visualization and navigation through audio recordings on multiple time scales, from hours, days, months to years. False-colour spectrograms map any three indices (ideally acoustically independent of one another) to the red-green-blue colour space. They provide meaningful information to ecologists for navigation purposes and they can be interpreted as soundscape acoustic-fingerprints.

While they have the advantage of easy interpretability, false-colour spectrograms do not easily lend themselves to statistical interpretation. In more recent work, we have constructed "difference spectrograms", using an (unconstrained) number of relevant acoustic indices, to reveal statistically significant differences between long-duration recordings (days to months) from different locations and/or different times. These can be used to monitor long-term changes in the soundscape of a location.

Keywords: acoustic indices, false, colour spectrograms, navigation

*Speaker

The soundmark of Amazonia: where and when does the loud tropical bird *Lipaugus vociferans* sing?

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The soundscape of the Amazonian forest is a complex mixture of sounds produced by a high number of frog, mammal, bird and insect species. Among all these intricated sounds, highly diverse in rhythm and frequency, the loud and commonly heard song of the Screaming Piha (Lipaugus vociferans) is a remarkable soundmark known by anyone who visited the South American tropical forest. Males gather in leks of around 25 individuals where they highly compete vocally to mate with selecting females. L. vociferans is very common but the species is supposed to decline significantly due to habitat loss. The density and distribution in space and time has never been estimated, neither locally nor at a regional scale. Passive acoustic monitoring has proved to be a valuable tool to monitor populations but few attempts have been done on common species found in tropical habitats. Here, we take advantage of a large acoustic sample conducted in French Guiana in 2010 to try to estimate the spatial position and temporal pattern of a population of L. vociferans. To achieve this, we plan to develop a supervised algorithm to automatically detect the occurrence of L. vociferans song in the ~ 100,000 audio files collected with 24 microphones during 43 days in the understory and the canopy forest of the CNRS Nouragues research station. We then wish to estimate the night and day pattern of the acoustic activity of L. vociferans and to localise in the forest the different leks based on recorders GPS coordinates and on a model of sound propagation. These analyses, combining acoustics and machine learning at large scales, should produce for the first time dynamics temporal and spatial maps of one of the most famous sound on Earth.

Keywords: Tropical soundscape, bird song, population monitoring, French Guiana

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Acoustic monitoring to infer activity and intake of grazing animals

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Despite their economic and ecological importance, the activity and intake of grazing animals are notoriously difficult to measure. Using acoustic monitoring with cattle we found that: bites can be identified more reliably than by visual observation; chewing jaw movements could be heard and bite and chew actions could be distinguished; there are chew-bites in which a chewing and a biting action are performed in a single jaw movement cycle. Acoustic monitoring became an essential tool in detailed studies of the grazing process and intake. In one study, animals showed large variation in their allocation of jaw movements among pure bites, pure chews, and chew-bites, however these different allocations aligned themselves along an isocline of constant number of chews per bite. This raised the possibility that intake could be estimated from counts of the different types of jaw movement. In an experiment with goats we found a linear relationship between intake and chew number, and a fairly constant chewing coefficient for different bite weights and internal states of the animal. The approach is being developed into a practical tool. Recording capacity is about two weeks in cattle, and the equipment has been deployed on free-grazing animals in commercial herds of cattle, sheep and goats. We have developed software that can identify the sound bursts associated with jaw movements, and this can be applied without calibration to acoustic signals obtained from cattle sheep or goats, and from different recording devices. The program generates the activity timeline of the animal and identifies periods of active grazing and rumination. Acoustic monitoring would appear to be a promising technology that could provide precise and continuous information about grazing behavior, improve our understanding of grazing systems, and improve grazing management decisions. It should be possible to extend the approach to a wider range of animal species.

Keywords: activity timeline, bites, cattle, chew, bites, chewing coefficient, chews, goats, jaw movements, rumination, sheep, signal processing

*Speaker

Soundscape planning: an acoustic niche for anthropogenic sound in the ocean?

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Both marine mammals and hydroacoustic instruments use underwater sound to communicate, navigate and/or infer information about the marine environment. Concurrent timing of acoustic activity and/or the use of similar frequency regimes may result in (potentially mutual) masking of acoustic signals when both sources are within reception range. Earlier studies have provided evidence that marine mammal fitness might be negatively impacted both on individual and population level when animal sounds are masked by anthropogenic sound sources. Hydroacoustic studies on the other hand may generate low quality data or suffer data loss as a result of bioacoustic interference. In analogy to landscape planning, the concept of soundscape planning aims to reconcile potentially competing uses of acoustic space by managing the anthropogenic sound sources. We here present a conceptual framework to explore the potential of soundscape planning in reducing (mutual) acoustic interference between hydroacoustic instrumentation and marine mammals. The basis of this framework is formed by the various mechanisms by which acoustic niche formation occurs in species-rich communities that acoustically coexist while maintaining hi-fi soundscapes, i.e., by acoustically partitioning the environment on the basis of time, space, frequency and/or signal form. Hydroacoustic measurements often exhibit certain flexibility in the timing, signal characteristics and even instrument positioning, potentially offering the opportunity to minimize the underwater acoustic imprint. We evaluate how the principle of acoustic niches (i.e., the partitioning of the acoustic space) could contribute to reduce potential (mutual) acoustic interference based on actual acoustic data from three recording locations in polar oceans.

Keywords: acoustic niche, marine mammals, anthropogenic sound, hydroacoustic instrumentation, polar oceans

*Speaker

Seasonality in singing activity of birds in tropical lowland rainforest of Mount Cameroon

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In relative comparison to the temperate zone, tropical areas are much more stable. This applies in particular to the temperature and the length of the daylight. Stability in environmental conditions in tropics is reflected in the relatively stable food supply throughout the year. It is thus generally expected that the breeding of tropical bird species can be spread throughout the year and is synchronized with other, less predictable environmental conditions, such as precipitation and peaks of availability of food sources. Just like the seasons, it is suggested that annual cycles of singing and breeding activity may not be clearly defined in the tropics. However, such predictions are rarely supported by empirical studies so far. This is mainly because year-round monitoring of singing and breeding activity of bird communities in the tropics using conventional methods is financially and logisticaly challenging. The newly developed bioacoustic approaches using automatic recording of sounds provide probably the easiest way how to obtain the data on a year-round singing activity of bird communities, even on long-term scales. In our study we focuse on seasonality in singing activity of birds and comparison among different feeding guilds in tropical lowland rainforest of Mt. Cameroon. Knowledge of the distribution of reproductive effort of bird species in the tropics are a key requirement for any considerations about the differences in the evolution of life histories along latitudinal gradient.

Keywords: Bird, song, tropics, lowland forest, seasonality

*Speaker
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Can we use bioacoustic methods in habitat suitability modeling?

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Traditionally birds habitat preferences analysis are very rarely considered to be connected with bioacoustic methods. Meanwhile the technology of recording and analyzing acoustic data have developed in a way which allows us to use it in completely new areas of biological sciences. Here we present results of a comparison of two habitat suitability models built on distribution data gathered in two ways: traditional and bioacoustic.

As a model species we used Cinnamon-breasted Rock Bunting Emberiza tahapisi subsp. goslingi, one of many African birds, which biology and ecology is almost not known. The study site (approximately 9 km2) was situated in the Bamenda-Banso Highlands near Big Babanki village (NW Province, Cameroon) is covered with the mosaic of montane forests, woodlands, scrublands and pastures.

During three seasons (November-December in years 2011-2013) repeated transect countings were conducted and locations of all the birds seen and heard were marked. Simultaneously automatic recordings took place and all habitat types were sampled giving all together over 1200 hours of recordings. For detecting species' vocalizations on the recordings we used automatic and semi-automatic methods. (SongScope, Xbat).

Based on detailed habitat map and two types of distribution data, habitat suitability models for E.tahapisi were built using MaxEnt. Best models were selected from each group and detailed comparison were conducted. Despite the differences in number of locations used (106 for transect countings and 42 for bioacoustic recordings), models based on two methods appeared to be remarkably similar in predicting species' distribution and also in predictive power of each model's variables.

Those results show that even though bioacoustic and transect counting methods are so different, they can give the same results. Moreover, we believe that further analyzes of already gathered acoustic data will allow us to build habitat suitability models for many more species from study area.

Keywords: automatic recording, habitat suitabilty modeling, probability of distribution, Africa

*Speaker

Using laser vibrometry to detect incidental vibrational signals

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Bioacoustic approaches in detection of wood-boring insects exploit the sounds generated by larvae inside trees, cut wood and wood packaging material. The sounds are mostly a by-product of eating and locomotion. In our study, laser vibrometry was tested as a novel method to detect hidden insect infestations. The focus was on two invasive beetle species, the Asian Longhorn Beetle (Anoplophora glabripennis) and the Red Palm Weevil (Rhynchophorus ferrugineus).

Most bioacoustic sensors (microphones, accelerometers) require mounting to the measuring surface, which can be complicated, time consuming and may even damage the tested material. The laser vibrometer, on the other hand, offers possibility of a non-contact measurement of surface vibrations via the laser beam. This eliminates the mass loading of structures by conventional piezoelectric transducers. Other advantages of laser Doppler vibrometry are the broad frequency range (from 0 to 22 kHz), robustness and working distance up to several meters. Additional equipment needed for recording with the laser vibrometer (weight: 2.6 kg) includes a laptop, a tripod, and for outdoor recording a battery to power the vibrometer.

We used a portable digital laser vibrometer to detect larval activity within poplar logs and palm trees. Several types of vibratory signals were recorded in species of beetles, most very short in duration (1-6 ms), with frequencies between 2 and 20 kHz. The signal-to-noise ratio across the whole frequency range of the laser vibrometer (0-22 kHz) was around 35 dB. We showed that laser vibrometry can be successfully employed as a very sensitive non-destructive diagnostic tool for detecting infestations by the wood-boring beetles.

Detecting such vibrations can be widely used for detecting hidden organisms, in pest management, and potentially also for monitoring activities for ecological assessment.

Keywords: laser vibrometry, wood, boring insects, vibrations

*Speaker

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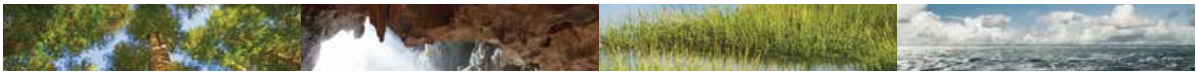

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