## Ecoacoustics Congress 2016 Agenda

### June 5, 2016

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00-8:00 p.m.</td>
<td><strong>Reception and Exhibitor Showcase</strong></td>
<td>Kellogg Center River Patio</td>
</tr>
</tbody>
</table>

### June 6, 2016

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00-8:45 a.m.</td>
<td><strong>Registration</strong></td>
<td>Central Lobby</td>
</tr>
<tr>
<td>8:45-9:00 a.m.</td>
<td><strong>Opening Remarks</strong></td>
<td>Lincoln Room Auditorium</td>
</tr>
<tr>
<td></td>
<td>• Dr. Fred Poston (former Dean of CANR and VP Operations and Finance)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Welcome the Congress on behalf of MSU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Professor Almo Farina (President of ISE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Welcome the Congress on behalf of ISE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Professor Emeritus and Congress Organizer Stuart Gage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Recognize Congress sponsors and he will also address Congress logistics</td>
<td></td>
</tr>
<tr>
<td>9:00-10:30 a.m.</td>
<td><strong>Tropical</strong></td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• Marconi Campos Cerqueira</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>University of Puerto Rico</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Modeling the effect of elevation on anuran distributions in Puerto Rico through automated species identifications and occupancy models.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Amauri Sarmiento Rojas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Instituto de Ecología, A.C.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Patterns of Acoustic Diversity and Ecosystem integrity in a tropical fragmented forest</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Freshwater</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Simon Linke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Griffith University</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Real-time Ecosystem Monitoring in Freshwater Environments using Passive Acoustics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Jo-Anne Wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Goulburn Broken Catchment Management Authority</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Using acoustic techniques to monitor wetland responses to environmental water deliveries in the Goulburn Broken Catchment</td>
<td></td>
</tr>
<tr>
<td>10:30-10:50 a.m.</td>
<td><strong>Break</strong></td>
<td>Central Lobby</td>
</tr>
<tr>
<td>10:50-11:40 a.m.</td>
<td><strong>Marine</strong></td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• Katherine Cameron</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Scripps Institution of Oceanography</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Soundscapes of multispecies fish spawning habitat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Denise Risch (online presentation?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Scottish Association for Marine Science (SAMS)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Humpback and minke whale acoustic presence with reference to fish sounds at Saba Bank, Caribbean Windward Dutch Islands</td>
<td></td>
</tr>
<tr>
<td>11:40 a.m. - 1 p.m.</td>
<td><strong>Lunch</strong></td>
<td>Lincoln Room</td>
</tr>
</tbody>
</table>
### June 6, 2016 - Continued

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2:20 p.m.</td>
<td>Community</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• Abe Borker</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• University of California Santa Cruz Title: Soundscapes in Conservation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitoring and Adaptive Management: A case study in seabirds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Almo Farina</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Urbino University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Exploring soundscapes with the Ecoacoustic Event Detection and Identification (EEDI) model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Darren Proppe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Calvin College</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Redemption song: Using song playback to reduce songbird avoidance of anthropogenic noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Laila Fan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Soundscape Association of Taiwan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The beckoning silence---The quiet revolution of SAT in Taiwan</td>
<td></td>
</tr>
<tr>
<td>2:20-3:40 p.m.</td>
<td>Health/Disturbance</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• Jim Cummings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Acoustic Ecology Institute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Saving Remote Soundscapes: Identifying areas of relative natural quiet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Amandine Gasc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Purdue University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Computational tools for biodiversity survey using soundscape recordings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Paola Moscoso</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• University of Sussex</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Human perception of soundscape across cultures: from forest to urban landscapes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Susan Fuller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Queensland University of Technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Acoustic monitoring of biodiversity on rehabilitated sand mines in south-eastern Australia.</td>
<td></td>
</tr>
<tr>
<td>3:40-4:00 p.m.</td>
<td>Break</td>
<td>Central Lobby</td>
</tr>
</tbody>
</table>
## June 6, 2016 - Continued

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00-5:00 p.m.</td>
<td>Terrestrial</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>- Philip Amuyunzy Mang’are</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Masinde Muliro University of Science &amp; Technology &amp; Egerton University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Investigation into the 35 kHz – 60 kHz frequency range of the naturally generated ultrasound of the African Bat, <em>C. afr</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Eliciting Optimal evasive response in the African <em>A. gambiae</em> s.s.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Leah Barclay (Presented by Toby Gifford)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Griffith University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Biosphere Soundscapes: The art and science of ecoacoustics in UNESCO Biosphere Reserves</td>
<td></td>
</tr>
<tr>
<td>6-7:30 p.m.</td>
<td>Ecouacoustics Banquet</td>
<td>Lincoln Room</td>
</tr>
<tr>
<td></td>
<td>Plenary Speaker: Stuart Gage: Ecoacoustics and Ecosystem Health</td>
<td></td>
</tr>
<tr>
<td>7:30-9:30 p.m.</td>
<td>Art/Soundscape Concert</td>
<td>Auditorium</td>
</tr>
</tbody>
</table>

## June 7, 2016

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00-9:00 a.m.</td>
<td>Old Growth, Ted Black Woods</td>
<td>Bus to Location</td>
</tr>
<tr>
<td>7:30-9:00 a.m.</td>
<td>Registration</td>
<td>Central Lobby</td>
</tr>
<tr>
<td></td>
<td>Breakfast</td>
<td>Lincoln Room</td>
</tr>
<tr>
<td>9:10-10:30 a.m.</td>
<td>General Ecology</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>- Toby Gifford</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Griffith University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sound quality in ecoacoustics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Eric Leonardson</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- School of the Art Institute of Chicago</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Eco-sensing and the soundscape</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Michael Maggs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Frontier Labs Pty Ltd.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Practical issues of bioacoustic recording</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Timothy Mullet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Ecological Services, U.S. Fish and Wildlife Service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Acoustic habitat hypothesis: an ecoacoustic perspective on species habitat selection and conservation biology</td>
<td></td>
</tr>
</tbody>
</table>
# Ecoacoustics Congress 2016 Agenda

## June 7, 2016 (continued)

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30-11 a.m.</td>
<td>Break</td>
<td>Central Lobby</td>
</tr>
<tr>
<td>11:00 a.m. - 12:00 p.m.</td>
<td>Terrestrial</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>- Antonio Celis-Murillo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Prairie Research institute, University of Illinois at Urbana-Champaign</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surveying soundscapes to investigate the role of nocturnal singing in the reproductive activities of a diurnal passerine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sophan Chhin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Michigan State University</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Using acoustic tomography to infer stem wood quality of pine forests affected by a fungal pathogen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Alison Fairbrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>University College London</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Usefulness of acoustic indices to measure biodiversity in urban areas</td>
<td></td>
</tr>
<tr>
<td>12:00-1:45 p.m.</td>
<td>Lunch</td>
<td>Lincoln Room</td>
</tr>
<tr>
<td>1:45-3:05 p.m.</td>
<td>Terrestrial/Analytics</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>- Juliette Florentin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Université de Mons</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• An autonomous recording station that searches for woodpecker drums</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Ian Agranat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Wildlife Acoustics, Inc.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Acoustic clustering: automatic sorting of large-scale acoustic data for biodiversity inventory and assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Stacy DeRuiter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Calvin College</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Statistical analysis of bioacoustic data: Methods for combining variables and modelling animal behaviour</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Erick Greene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>University of Montana</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A practical guide for designing recording arrays in terrestrial environments: best practices for maximizing location accuracy and precision</td>
<td></td>
</tr>
<tr>
<td>3:05-3:30 p.m.</td>
<td>Break</td>
<td>Central Lobby</td>
</tr>
<tr>
<td>3:30-5:00 p.m.</td>
<td>Terrestrial/Analytics</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>- Emilio Padoa-Schioppa</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>University of Milano-Bicocca, Department of Earth and Environmental Sciences</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Soundscape approach in an urban park of Milano (Italy)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Michael Towsey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Electrical Engineering and Computer Science School, Queensland University of Technology, Brisbane, Australia</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The use of network analysis techniques to investigate acoustic recordings of the environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Michael Scherer-Lorenzen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>University of Freiburg</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The relationship between land use intensity, organismic diversity and acoustic complexity – a large-scale approach to soundscape ecology (BEsound)</td>
<td></td>
</tr>
<tr>
<td>5 p.m.</td>
<td>Dinner</td>
<td>On Your Own</td>
</tr>
</tbody>
</table>
### International Society of Ecoacoustics
Ecoacoustics Congress 2016 Agenda

#### June 8, 2016

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-9:00 a.m.</td>
<td>Breakfast</td>
<td>Lincoln Room</td>
</tr>
<tr>
<td>9:00-9:40 a.m.</td>
<td>Terrestrial/Analytics</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• <em>Santiago Utumi</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Kellogg Biological Station &amp; Dept of Animal Science, Michigan State University</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decoding acoustic signals of herbage intake</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Erick Greene</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Division of Biological Sciences, University of Montana</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Encoding and decoding alarm calls in multispecies communication networks</td>
<td></td>
</tr>
<tr>
<td>9:40-10:00 a.m.</td>
<td>Break</td>
<td>Central Lobby</td>
</tr>
<tr>
<td>10:00 a.m.-12:00 p.m.</td>
<td>Hands-on Workshops</td>
<td>Auditorium</td>
</tr>
<tr>
<td></td>
<td>• <em>Mona Doss</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Wildlife Acoustics, Inc.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Wildlife Acoustics Song Meter SM4 Hands-on Workshop</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Mark Calder</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Frontier Labs, Inc.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bioacoustic Recorder Hands-on Workshop</td>
<td></td>
</tr>
<tr>
<td>12:00-12:30 p.m.</td>
<td>Concluding Remarks</td>
<td>Auditorium</td>
</tr>
<tr>
<td>12:30-3:00 p.m.</td>
<td>ISE Executive Meeting</td>
<td>Room 108</td>
</tr>
</tbody>
</table>
Modeling the Effect of Elevation on Anuran Distributions in Puerto Rico through Automated Species Identifications and Occupancy Models

Marconi Campos Cerqueira and T. Mitchell Aide
*University of Puerto Rico-Rio Piedras*

El Yunque National Forest (EYNF) in Puerto Rico shelters a rich anuran community comprising 11 endemic species of Eleutherodactylus frogs that are the major components of the nocturnal soundscape. Many of these species, which historically had a wide altitudinal distribution, now seem to be restricted to the highest peaks of the island, even within protected areas. Here I examine how elevation affects the distribution of native frog species in EYNF.

I used autonomous portable recorders to collect acoustic information along three altitudinal transects (95 -1072 m), which included a total of 63 sampling sites, and I used species-specific identification models (ARBIMON) to acquire the detection history for each species. The detection history was, in turn, used to generate occupancy models through a maximum likelihood state-space approach. I detected all 11 species of Eleutherodactylus that still occur in EYNF, and created occupancy models for six species (in bold) (*E. antillensis*, *E. cochranae*, *E. brittoni*, *E. unicolor*, *E. hedricki*, *E. gryllus*, *E. wightmanae*, *E. locustos*, *E. richmondi*, *E. portoricensis* and *E. coqui*).

The low end of the altitudinal distribution of four of the six species shifted up the mountain (*E. hedricki* 270-500 m, *E. gryllus* 370-700 m, *E. wightmanae* 150-500 m, *E. portoricensis* 180-600 m). These dramatic shifts suggest a strong effect of climate change, which is restricting these species to higher elevation and a much smaller area. We suggest the establishment of acoustic permanent stations along an elevational gradient to continuously monitor species distribution in EYNF.

Patterns of Acoustic Diversity and Ecosystem Integrity in a Tropical Fragmented Forest

Amauri Sarmiento-Rojas and Brian Napoletano
*Instituto de Ecología, A.C. and Universidad Nacional Autónoma de México*

Accelerated rhythms of tropical forest degradation by human activities are causing a rapid biodiversity loss; many species will disappear without being known by science. This challenging scenario makes it necessary to rely on quick methods for ecosystem assessment and biodiversity monitoring, specifically in areas with high levels of ecological integrity. Acoustic signals play an important role for communication in many animals, especially in densely vegetated habitats. The acoustic diversity of the biophony produced by animal communities is one of the components of the Soundscape, and it has been proposed as an indicator of environmental health, but few studies have tested this relationship. In this sense, some soundscape measures could be relevant to characterize the ecosystem status. In this project, we will analyze the activity patterns of biophony in the tropical rain forest environment of Los Tuxtlas, Veracruz.

Automatic recording devices will be used in sites with distinct levels of ecological integrity. For every sampling site, we will register sound pressure levels, audio recordings, camera trap images and meteorological data. We will evaluate if acoustic complexity of soundscape is related to ecosystem integrity, by assuming that habitat degradation also disturbs the sound component. Then in sites with contrasting habitat complexity, we will test the effectivity of acoustic diversity indices as indirect estimators of species richness, by using amphibians as target group. With this study, we will contribute to the understanding of sound dynamics of a tropical fragmented forest. Generated information will be useful in ecosystem monitoring programs that include the acoustic component.
Freshwater

Real-Time Ecosystem Monitoring in Freshwater Environments Using Passive Acoustics

S. Linke, T. Gifford, L. Barclay, C. Desjonqueres, D. Tonolla and C. Karaconstantis

*Griffith University*

Traditional methods of freshwater ecosystem monitoring have three key disadvantages due to their invasive nature. The survey techniques bear a) risks to fish health and habitat integrity, b) introduce bias, because it might cause fright responses in key aquatic species and c) standard surveying only produces a snapshot from the time of surveying – which in many cases does not happen more than once a year.

Non-invasive passive bioacoustic monitoring can improve all three problems, however it can also offer a holistic real-time glimpse into aquatic ecosystems. We think a holistic ecosystem monitoring program is feasible in freshwater ecosystems as a comprehensive literature review has identified considerable knowledge about sonically identifying three key elements in a river ecosystem.

- Freshwater fish: at least 20% of taxa are estimated to be soniferous.
- Invertebrates: key indicator families among benthic invertebrates are – at least in part – soniferous. This includes indicators of good water quality (Trichoptera, Odonata) as well as indicators of degraded systems (Coleoptera, Hemiptera)
- Geophysical habitat: in the last decade, half a dozen studies have measured habitat quality and diversity by sonic properties

We argue that recent advances in technology, particularly the availability of inexpensive low power ubiquitous computing devices, mean it is now feasible to conduct large scale real-time monitoring, affording potential benefits including high spatio-temporal resolution and rapid response to detection events. We will demonstrate the feasibility of this approach with identified sounds of fish, invertebrate and riverine habitats from Queensland, Australia.

Using Acoustic Techniques to Monitor Wetland Responses to Environmental Water Deliveries in the Goulburn Broken Catchment

Jo Wood and Simon Casanelia

*Goulburn Broken Catchment Management Authority*

Wetlands in the Goulburn Broken Catchment (Victoria, Australia) provide habitat for a diverse fauna assemblage including many of conservation significance. Environmental water is delivered to a number of these wetlands to provide more natural wetting regimes, which have been impacted by infrastructure development, diversions and drainage works. Acoustic monitoring has been routinely used since 2008 in wetlands of the Goulburn Broken Catchment as part of the management agency’s broader monitoring program to gauge fauna response to environmental water management deliveries.

Here I report on some of the ecological responses recorded using event-based acoustic monitoring at five wetlands that have received environmental water between 2008 and 2016. This information has provided insight to population dynamics and has given insight into species presence, activity periods and succession during periods of flooding, drawdown and drying at these ephemeral sites. In addition, the finding of distant anthrophony affecting some faunal vocalizations.

Acoustic monitoring has broadened our knowledge of these sites, assisted with natural resource management decision making, and improved the basis for future planning of environmental water deliveries.
Soundscapes of Multispecies Fish Spawning Habitat

Katherine Cameron and Ana Širovi
Scripps Institution of Oceanography

A diverse reef community is present off Little Cayman Island year round and during the winter, it becomes an active spawning area for the largest known remaining aggregation of Nassau grouper (Epinephelus striatus) and at least four other Serranid species, including tiger grouper (Mycteroperca tigris), red hind (Epinephelus guttatus), black grouper (Mycteroperca bonaci), and yellowfin grouper (Mycteroperca venenosa). Continuous passive acoustic data were recorded at this multispecies grouper spawning site off Little Cayman, for 5 days in 2015 and 33 days in 2016. Data were collected during the spawning of Nassau grouper, with additional coverage the month prior to spawning in 2016. In addition to biophony, the location is subjected to increasing anthropogenic noise from recreational diving and fishing activity.

The acoustic data were manually analyzed to identify dominant sound sources and their related frequency bands. Subsequently, soundscape analysis was conducted to reveal temporal trends in both biological and anthropogenic activity. Anthropogenic activity dominated during the day, while fish chorusing peaked after sunset and showed lunar dependence. The soundscape analysis results were compared to individual calls that were logged in 2015 to determine whether this method could be a proxy for call rate estimation. This work is the first step towards characterizing the soundscape of this critical spawning habitat and an attempt to validate whether this is an appropriate method for long-term monitoring of the ecosystem.

Humpback and Minke Whale Acoustic Presence with Reference to Fish Sounds at Saba Bank, Caribbean Windward Dutch Islands

Denise Risch, Meike Scheidat, Steve Geelhoed, Dolfi Debrot, Dick de Haan, Hans Verdaat, Klaus Lucke and Sofie Van Parijs
Scottish Association for Marine Science (SAMS)

The Antillean Island chain is a known breeding and calving ground for North Atlantic humpback whales (Megaptera novaeangliae). However, while most research efforts for this species have focused on the largest aggregation of whales, located on Silver Bank, off the northern coast of the Dominican Republic, there are still significant knowledge gaps with respect to humpback whale movements along the Antillean Island chain. Even less is known about the spatio-temporal distribution of other marine mammal and fish species in the region. This report summarizes analysis results from six months of passive acoustic data, recorded in the north east of Saba Bank from October 2011 to April 2012. Humpback whale song at this site occurred consistently from the end of December to the end of the recording period in April. From February to April humpback whale song was recorded on more than 89 % of all recording days, though it occurred most frequently in March. All recording days in March showed song presence, with an average of 8.5 ± 2.8 (mean ± SE) hours of recorded song per day. In contrast, minke whale (Balaenoptera acutorostrata) pulse trains were detected much less frequently in the months of February to April 2012. Only 48 individual pulse trains were detected overall, most of which (n = 32) occurred also in March. A variety of unidentified fish sounds were present throughout the recordings. Although the occurrence of these sounds was not quantified, notable fish choruses consisting of one to two distinct pulsed calls in the frequency range of 100-600 Hz were documented from October to December 2011 in particular. The results of this pilot project highlight the feasibility of using passive acoustic monitoring (PAM) to explore year-round marine mammal and fish presence and distribution in otherwise understudied and remote field sites. The results show the consistent presence of humpback whales in the vicinity of Saba Bank during their winter breeding season, occasional presence of minke whales and the presence of sound producing fish assemblages.
Soundscapes in Conservation Monitoring and Adaptive Management: A Case Study in Seabirds

Abraham Borker, Matthew McKown and Rachel Buxton
University of California Santa Cruz, Conservation Metrics, Inc. and Colorado State University

The need for adaptive management and monitoring of conservation outcomes has never been greater. With limited conservation funds, conservation practitioners struggle to identify the most effective actions to protect biodiversity and ecosystems. Soundscapes monitoring is a potentially low cost and scalable approach that could be used to inform adaptive management. Species-specific passive acoustic monitoring has already revolutionized the monitoring of bats and whales and increasingly soundscapes are being used to monitor seabirds. Seabirds, being highly threatened and ecologically important are the focus of millions of conservation dollars. However, their remote breeding colonies and secretive nature make evaluating these efforts a challenge. We present preliminary findings using soundscapes recordings and indices to measure the phenology and abundance of seabird colonies (in two case studies the Forster’s Tern (Sterna forsteri) and Cassin’s Auklet (Ptychoramphus aleuticus)); and evaluate the outcome of island-wide restoration in the Western Aleutian Islands. In each study soundscapes approaches complemented species-specific call detection and improved the ability of monitoring programs to provide information that could be used for decision making. We discuss more widely how soundscapes could be used to set decision thresholds in adaptive management, and promote evidence based conservation, measuring outcomes at the same scale as actions.

Exploring Soundscapes with the Ecoacoustic Event Detection and Identification (EEDI) Model

Almo Farina and Paolo Salutari
Urbino University and International Institute of Ecoacoustics

We define ecoacoustic events as inclusive portions of soundscapes, at which we recognize distinct roles and/or meanings. The ecoacoustic events may be represented by geophonic, biophonic, and technophonic sounds (e.g., thunder, ice melting, eruptions, currents, different typologies of wind and rain, morning and dusk choruses, alarm calls, human voices, blasts, horns, bells, and road and airplane traffic) and their combinations. Their identification results in great assistance to better interpret soundscapes composition and dynamics.

We propose an ecoacoustic event detection and identification (EEDI) model, powered by a dedicated software (SoundscapesMeter 2.0) articulated in the following three successive steps:

1. Processing acoustics files by adopting the acoustic complexity index (ACIf and ACIt) methodology.

2. Combining ACIf with its temporal evenness (ACIfc) and the frequency evenness of ACIt (ACItc) in an 3-D Euclidean space, which we call ecoacoustics event space (EES), after the assumption that the value of ACIf and ACIt found in a temporal interval (e.g., one minute) may have a different temporal and frequency distribution inside the sampled time. For instance, heavy rains are characterized by high values of ACIf, ACItc and ACIfc, while background isolated calls of a bird are characterized by low values of ACIf, ACItc and ACIfc. The application of empirical thresholds to these three metrics can restrict the identification process to events of interest.

3. Searching for significant correlations between the selected events and a library of classified acoustic signatures (ACIt) to complete the event identification process.

Due to the capacity to classify a large amount of acoustic data in a short time, EEDI results in a powerful tool for analysis of large data sets from long-term monitoring programs of soundscapes surveys.
Community

Redemption Song: Using Song Playback to Reduce Songbird Avoidance of Anthropogenic Noise

Darren S. Proppe, Matthew J. Schepper, Leanna N. DeJong, Samuel D. Cowell and Thuy-Nhi N. Nguyen
Calvin College

Animals must interpret and respond to a myriad of acoustic signals within their environment. Increasingly, anthropogenic noise is a dominant component of this soundscape, likely reducing the audibility and perception of many animal signals. Even at low amplitudes, human noise may be responsible for distraction and increased stress in many organisms. But animal communication systems are not static. For example, many songbirds change the pitch, amplitude, and timing of their vocalizations when noise is present. Yet, other songbird species avoid noisy environments, a situation which may exacerbate population declines by reducing habitat availability. We have begun testing whether avoidance behavior is also subject to modification. Specifically, we have added an additional, biologically relevant signal to the soundscape in noise-impacted areas to determine whether we can intentionally increase habitat use. Conspecific song playback during migration is a technique known to increase territory establishment in a broad range of songbird species. But it has not been used previously in the context of anthropogenic noise. Initial experiments conducted in Northern Michigan confirm that song playback increases territory establishment in a community of songbirds, although some non-target species also become less common. Further tests suggest that song playback remains useful in the noise context, specifically near roads. A number of caveats must be addressed before this method can be recommended for widespread application. Nonetheless, initial results suggest that deliberately increasing songbird utilization of areas affected by low-level anthropogenic noise may be feasible and warrants continued examination.

The Beckoning Silence---The Quiet Revolution of SAT in Taiwan

Laila Fan
Soundscape Association of Taiwan

The SAT (Soundscape Association of Taiwan) was established in 2015, this is the second soundscape association in Asia. As a nature sound recorder, I have produced "Nature Notes" for almost 20 years in National Education Radio in Taiwan which allowed me to contact with so many scholars or experts in this program. Some of them are bioacoustic scientist or sound artist, forest ranger, historians. Everything has come together in a natural way, and I have become the unique point of convergence for all those involved with sound. We are gathering together as a group and form this association. The main direction for SAT is using artistic and cultural points of view to achieve harmonious development between humans and the environment, and working on the basis of bioacoustics and related research to promote policies for the conservation of biodiversity. We aim to pay attention to both the construction and the preservation of local soundscape. SAT conducted a series of lectures and organized the “soundscape walk” which led a group of adults and children to rediscovery a place from hearing. Sometimes, in my speech, I will broadcast the sound I recorded in 1997, and making the comparison with the sound in the same site which I recoded today. People will easily tell the change from that, and I believe it is very strong point to prove what I just want to share with them.
Health/Disturbance

Saving Remote Soundscapes: Identifying Areas of Relative Natural Quiet

Jim Cummings
Acoustic Ecology Institute

Over the past several years, increased deployment of autonomous recorders and more robust modeling techniques have informed a steady stream of papers, presentations, and reports characterizing the current state of soundscapes around the world, both on land and at sea. This presentation will highlight research efforts that are beginning to identify areas of relative natural quiet. These areas may offer comparatively achievable opportunities for realizing the conservation benefits of healthy acoustic habitat; in general, there is less social/economic cost in avoiding the initial introduction of anthropogenic impacts, rather than attempting to reduce or eliminate impacts once they have become established. The presentation will include both a big-picture overview of the scope of current research, and representative examples of the value of regionally relevant fine-scale modeling.

Computational Tools for Biodiversity Survey Using Soundscape Recordings

Amandine Gasc, Boyu Zhang, Dante Francomano and Bryan Pijanowski
Purdue University

Soundscape studies represent an attractive new methodology for biodiversity assessment, as they are non-invasive and well suited to the challenge of global ecological assessment over large spatial and temporal scales. Despite the technical challenges associated with massive amounts of data, recent advances in automated acoustic recording, large data storage, and rapid soundscape measurement have all made this approach more feasible. Soundscape studies could still benefit, however, from greater use of computational tools in order to perform robust statistical analysis from soundscapes libraries. In this paper, we share examples of classical statistical analyses that can be applied to soundscapes measurements to facilitate the assessment and quantification of: a) aspects of biodiversity at a single location and time period, b) temporal variation in biodiversity, and c) spatial variation of biodiversity. We present a modularized system that enables acoustic analysis workflows on High Performance Computing (HPC) platforms over hundreds of Terabytes of soundscape recording collections. The system allows users to construct flexible analysis workflows and automatically runs them on HPC clusters. We present and discuss two workflows: a) the calculation of acoustic indices on datasets that used to be prohibitively large and b) the filtering of problematic recording data. We recommend that statistical analysis be fully embraced by soundscape scientists, and we suggest that such analysis be integrated with existing tools for soundscape storage and measurement to create an efficient, user-friendly interface for soundscape studies.
Health/Disturbance

Human Perception of Soundscape across Cultures: From Forest to Urban Landscapes

Paula Moscoso, Mika Peck and Alice Eldridge
University of Sussex

There is increasing interest in the role of human soundscape perception in understanding and evaluating social-ecological interactions; the importance of natural soundscapes for human wellbeing is also increasingly recognized. Research to date has focused on preferences and attitudes to western, urban locations where natural soundscapes are restricted to parks and open areas. This paper reports a study of soundscape perception in three social groups living in areas differing in the level of landscape disturbance, from pristine forest and pre-urban landscapes in Ecuador to urban landscapes in UK and USA. In a series of structured interviews, participants described three sounds they associated with a range of emotions. These were categorized according to an adapted version of Schafer’s sound classification scheme. Statistical analyses were carried out to test differences between groups and map the overall soundscape. Results suggest that although the sonic environment of each group differed, some patterns in the relationship between sound and emotions were similar: 1) Natural sounds were mostly associated with positive emotions – although in the forest group, they were associated with the full range of emotions. 2) Human sounds were not related to specific emotions. 3) Mechanical and industrial sounds were mainly associated with negative emotions. This assessment is a fast and cheap tool that provides an overview of soundscape from a community perspective. It could help to identify sound sensibilities and soundscape values among societies, to investigate the impacts of habitat disturbance on human well-being. The potential contribution of soundscape perception within current conservation approaches is discussed.

Acoustic Monitoring of Biodiversity on Rehabilitated Sand Mines in South-Eastern Australia

Susan Fuller, Isabelle de Haviland, Anne Axel and Michael Towsey
Queensland University of Technology and Marshall University

Monitoring plays an integral role in directing successful mine rehabilitation towards a self-sustaining functional state. Ecosystems are inherently complex with a large number of components that could be measured to give an indication of rehabilitation progress or condition. However, it is commonplace for land managers to select only a few indicators for monitoring purposes, because of time and cost constraints. This study compared two acoustic indicators, representing species (cluster spectral diversity) and community (acoustic dissimilarity) level diversity, with vegetation indicators to determine their capacity to detect differences between six rehabilitated sand mines and their un-mined reference state in south-eastern Australia.

The results indicate that differences detected using vegetation indicators were largely dependent on time since rehabilitation and historical revegetation practices, while the two acoustic indicators were highly concordant and sensitive, effectively distinguishing between rehabilitated and reference states. However, one reference site exhibited greatly decreased levels of spectral diversity compared with the rehabilitated state indicating an intrinsic site level difference potentially related to a local scale disturbance that was not measured. It was also noted that sites located in close proximity to an active mine exhibited significantly lower spectral diversity in both the rehabilitated and unmined reference sites indicating on-going impacts on faunal biodiversity.

Finally, we advocate the use of acoustic monitoring to track faunal rehabilitation as a cost-effective alternative to fauna surveys. Furthermore, this technology can be used to remotely monitor different stages of rehabilitation, and identify when rehabilitation deviates from a desired trajectory, thereby promoting a close relationship between monitoring and management intervention.
Investigation into the 35 kHz - 60 kHz Frequency Range of the Naturally Generated Ultrasound of the African Bat, C. Afra, Eliciting Optimal Evasive Response in the African A. Gambiae S. S.

P. A. Mang’ are, O. M. Mawe, F. G. Ndiritu and J. M. Vulule
Masinde Muliro University of Science and Technology, SEKU, Egerton University and Kenya Medical Research Institute Centre for Global Health Research

This research investigated the 35 kHz - 60 kHz frequency band of the naturally generated ultrasound of the African sheathed bat, Coleura afra, which elicited optimal evasive response in the African Anopheles gambiae. Recent study findings with the natural sounds of C. afra had shown ultrasonic components (35 kHz - 60 kHz) with capability to evoke avoidance response in the female A. gambiae s. s. Malaria whose vector are mated female A. gambiae is a health challenge in Africa and responsible for many deaths. Efforts to reverse the trend have shown low impact as manifested in the 2006 and 2008 World Health Organization statistics on Malaria. Currently, the effective vector control measures include indoor residual spraying and the long-lasting insecticide-treated nets. Therefore there was need to critically investigate the 35 kHz - 60 kHz sound of C. afra with a view of exploiting it as an additional vector control measure. The study therefore aimed at filtering the 35 kHz - 60 kHz frequency band, determine and analyse the acoustic transmission parameters of the sound of C. afra in the 35 kHz - 60 kHz frequency range; determine the activity and the behavioral response of the female A. gambiae to the ultrasound in the 35 kHz - 60 kHz frequency range. A set of ten 3-5 day old female A. gambiae bred and reared at the Kenya Medical Research Institute, Kenya were used in the bioassay study. The temperature and humidity was maintained at 25±2 O°C and (60-80 %) respectively. The sound samples of C. afra were recorded using the Avisoft recorder from Kit-Mikayi caves, Kenya. The 35-60 kHz frequency band was filtered and analyzed using the Avisoft SASLab Pro version 5.1 and Raven Pro. Version 1.4 software. The mosquitoes' behavioral response to the 35-60 kHz sound of C. afra and associated activities were observed and noted. It was established that the 35-60 kHz sound of C. afra consisted of 5046 calls of FM and CF modulated harmonics. The calls were generated through tongue clicks at the rate of 493.016 calls/minute. The calls were dominated by the short duration high frequency signals with an average acoustic energy of 9.2433 x 10-4 Pa2s which was lowest. The non-pulsate sound had a minimum and maximum amplitude of 71.21 Pa and 104.82 Pa respectively, with 2,519 calls between 90.00 - 99.00 Pa peak amplitude range. The signal power steadily declined with the increase in signal frequency.

Statistically, there was a highly significant relationship between the acoustic energy with the amplitude, frequency and bandwidth. The female A. gambiae assumed a normal posture with the body inclined at 45o accompanied by occasional rubbed wings and legs under the bioassay control experiment. There was no remarkable change in physical behavioral activities in 60 % of the sample mosquitoes on exposure to the 35 - 60 kHz sound. Only 40 % exhibited immobility and excitation tendencies. At 95 % confidence level, a paired T-test showed that the acoustic energy significantly affected the mean activities of the female A. gambiae (p = 5.6477 x 10-5) with a low positive correlation. It was established that the mean mosquito activities under the influence of 35 - 60 kHz differed significantly from the mean activities under the control (p = 0.008). Only 30 % of the mosquito samples showed significant difference in the individual total mosquito activities under the influence of the 35 - 60 kHz sound of C. afra and the individual total activities under the control. The mosquitoes recorded a mean rate of activities of 1.5598/minute when exposed to the 35 - 60 kHz sound of C. afra, 2.5195 times above the rate of activities at the control experiment. The rate of mosquito activities was significantly affected by the peak amplitude, peak frequency and the bandwidth. The low significance in evasive response was attributed the non-pulsate nature of the sound of C. afra, declining signal power with increase in frequency, mixed sonar and social calls, and short duration high frequency calls. These results of this study give an insight into the reasons for low evasive response in female A. gambiae on exposure to the 35 - 60 kHz sound of C. afra. The acoustic transmission parameters of the sound required modifications in order to yield improved results. The improved results would provide Ultrasound as an addition malaria vector control measure which is locally available in Africa and hence cut down on mortality and economic burden resulting from Malaria.
Biosphere Soundscapes: The Art and Science of Ecoacoustics in UNESCO Biosphere Reserves

Dr. Leah Barclay and Dr. Toby Gifford,
Griffith University

Biosphere Soundscapes is a large-scale interdisciplinary research project underpinned by the creative possibilities of acoustic ecology, ecoacoustics and rapidly emerging fields of biology concerned with the study of environmental patterns and changes through sound. This project is designed to inspire communities across the world to listen to the environment and explore the value of sound as a measure for environmental health in UNESCO biosphere reserves. The project is delivered through immersive residencies with artists and scientists, research laboratories, intensive masterclasses and a diversity of community projects spanning four continents.

Biosphere reserves are sites recognized under UNESCO’s Man and the Biosphere Program (MAB) to promote innovative approaches to sustainable development. There are currently 669 biosphere reserves in 120 countries comprising terrestrial, marine and coastal ecosystems. Each biosphere reserve is designed and managed in a different way, but all seek to reconcile the conservation of biological and cultural diversity. They differ from world heritage sites in that they encourage active community participation and are ideal locations to test and demonstrate innovative approaches to ecosystem monitoring and sustainable development. Biosphere Soundscapes draws on the inherently interdisciplinary nature of sound to explore cultural and biological diversity through accessible audio recording technologies and environmental engagement with local and global communities.

This paper introduces the framework and methodology for Biosphere Soundscapes, including reflections on best practice for in situ field recording, equipment recommendations for long durational remote recordings and approaches to analysis and dissemination of the database from each biosphere reserve. This presentation will also introduce the potential role of ecoacoustics in the Lima Action Plan (2016-2025) adopted by UNESCO at the 4th World Congress of Biosphere Reserves in Lima, Peru in March 2016. Biosphere Soundscapes sits at the intersection of art and science, with the recordings providing valuable scientific data for biodiversity analysis and incredible source material for creative works that can bring awareness to these environments. This project is designed as a platform for artists, scientists and global communities to collaborate and expose the creative and scientific possibilities of environmental sound to a global audience.
Investigation on the Dynamics of Soundscape by Using Unsupervised Detection and Classification Algorithms

Tzu-Hao Lin, Lien-Siang Chou and Yu-Huang Wang
*National Taiwan University and Academia Sinica*

Soundscape has been proposed as a potential information source to study the variability of biodiversity. However, analysis of the soundscape is a challenging task when there is no sufficient database to recognize various sounds collected from long duration recordings. Previous researches have measured several acoustic diversity indexes to quantify the variation of biodiversity, but the acoustic diversity indexes are still difficult to interpret without any ground truth. In this study, we propose to analyze the composition of soundscape scenes and visualize the dynamics of soundscape by using unsupervised detection and classification algorithms. Different soundscape scenes were classified according to the tonal sounds, pulsed sounds, and acoustic features obtained from long-term spectrogram. By adjusting the variation explained through classification results, the number of soundscape scenes will be automatically determined. The unsupervised classifier has been employed to analyze the soundscape dynamics in several forests and shallow marine environments in Taiwan. Our results demonstrate that the seasonal and diurnal changing patterns of geophony, biophony, and anthrophony can be effectively investigated. Besides, the spatial change of soundscape can also be discriminated according to the composition of soundscape scenes. After the biophony scenes have been identified, we can apply the same classifier again to measure the complexity of biological sounds and examine the variability of biodiversity. The current approach provides researchers and managers a visualization platform to monitor the dynamics of soundscape and to study the interactions among acoustic environment, biodiversity, and human activities in the future.

Integration of Soundscape Recording Technology in Canada’s National Parks: Scientific and Managerial Perspectives

Leonardo Cabrera-Garcia and Antonio Celis-Murillo
*Parks Canada Agency and Illinois Natural History Survey*

Parks Canada’s ecological integrity monitoring program was established across Canada’s national parks with the purpose to document biodiversity components, ecological processes and stressors so ecological integrity can be protected or enhanced. Monitoring in Parks Canada is a key component in the planning and information cycles. The agency’s directions (2007, 2011) established that ecosystem monitoring needed to be cost-effective, science / community-based, long-term oriented, sensitive to local realities and adaptively inform management decisions. These requirements challenge park scientists as they face socio-ecological complexity that requires effective sampling design and analysis, and databases and field monitoring protocols, while integrate traditional methods with innovative and efficient monitoring technologies. Parks Canada’ suite of monitoring measures usually includes birds as they often meet the above-mentioned criteria to assess ecosystem condition and inform on management needs. Bird monitoring, however, can result challenging because its dependency of highly trained personnel to accurately detect and identify birds when implementing bird census protocols. Sound recording technologies have been proposed to address some of the challenges bird monitoring encompasses, such as recording entire bird communities; increasing probabilities for detecting secretive and rare species; and monitoring avifauna of remote locations. This study describes and discusses 1) the process of integration of diverse sound recording devices (Song Meters, Wildlife Acoustics, the soundscape recording system, SRS, Celis-Murillo, et al., 2009 and the stereo ambient sampling system, SASS, Crown); 2) the financial and managerial implications; and 3) the diversity of outcomes obtained for addressing / meeting the agency’s expectations.
Sound Quality in Ecoacoustics

Toby Gifford, Leah Barclay and Simon Linke
Griffith University

Ecoacoustics, as an emerging interdisciplinary academic field, draws on a number of existing sonic disciplines – including bioacoustics, acoustic ecology and soundscape ecology – whose boundaries are sometimes contested. A point of contention, and in some cases demarcation, is the role of aesthetics and human perception, with epistemological tensions mirroring C.P. Snow’s observation of the “Two Cultures” of arts and science. As a practical example of disciplinary divergence within this constellation, consider differing approaches to sound quality. In bioacoustics it is not uncommon to take field recordings in ‘mono’ at low sampling rates, for reasons both practical — cost, data storage, power consumption, bandwidth; and theoretical — most acoustic indices and classifier algorithms are monophonic, and operate in the frequency domain, so that the high sampling rates needed to encode complex spatial or the de facto standard, high sampling rates preferred, and more complex techniques such as binaural or ambisonic recording common.

At root this divergence relates to the role of human perception in the process: typically bioacoustics seeks to remove subjective perception whilst acoustic ecology privileges it. Yet these approaches need not be mutually exclusive. Computational Auditory Scene Analysis remains in infancy – the best machine listening systems still are no match for the human auditory perception of complex soundscapes. The human mind possesses remarkable pattern perception mechanisms which may assist the process of exploration and discovery, even if a purely objective theory validation process is also sought.

Eco-Sensing and the Soundscape

Eric Leonardson
School of the Art Institute of Chicago

In the pedagogy of sound and landscape the relationship between creative artists and scientists seems to have changed from an informative, yet sometimes awkward "dance," over to what evidently requires urgent intervention for future survival on our planet. Partnerships then, are essential and increasingly needed. "Eco-Sensing and the Soundscape" is new course co-taught in the fall of 2015 by the author and Lindsey French, at The School of the Art Institute of Chicago. It is a conceptually focused studio course, connecting concepts and practices of acoustic ecology with the hacking aesthetic of art and technology to open up possibilities for transdisciplinary collaborations that offer new understandings of our environments and our boundaries, locations, and roles within it. Ecological concerns are intrinsically tied to new media technologies, and as we use them to understand our environments these practices must also be paired with critical discussions, public engagement, group collaborations, and an understanding of these techniques in a broader repertoire of unmediated listening and observation. This presentation shows how educators may implement a blend of acoustic ecology and the hacking aesthetic of new media in a post-secondary school curriculum, while bridging and cementing partnerships between artists and scientists for the greater benefit of all.
Practical Issues of Bioacoustic Recording

Michael Maggs and Mark Calder
*Frontier Labs Pty Ltd.*

The purpose of the session is to talk about the practical and technical aspects of bioacoustic monitoring and how it affects your study. We'll discuss deploying recorders, environmental issues, understanding signal processing and the FFT and the effects of data compression.

**The outline of the talk will be:**

1. Environmental issues that can affect your deployment.
   - Heat, cold, water and condensation.
   - Pests and biofouling
2. Understanding signal processing
   - Sample rates explained. What is an antialiasing filter good for? How does noise affect what I can hear?
   - Visualizing frequencies (spectrograms and the FFT).
   - Sound attenuation in the environment.
3. Data compression
   - Can I use it?
   - What's the best one?

---

**Acoustic Habitat Hypothesis: An Ecoacoustic Perspective on Species Habitat Selection and Conservation Biology**

Timothy C. Mullet
*Ecological Services, U.S. Fish and Wildlife Service*

Sound-producing species require environmental conditions suitable for their signals to be transmitted, received, and effectively interpreted in order to function within their ecological niche. The Acoustic Adaptation Hypothesis (AAH) suggests that sound-producing species have physically evolved specific vocalizations in frequency and duration as an adaptation to their physical environment. Furthermore, the Acoustic Niche Hypothesis (ANH) postulates that sound-producing species have evolved vocalizations or undulations within specific frequency ranges and temporal intervals (acoustic niche) not utilized by other species in order to compete within an acoustically diverse environment. I add to these hypotheses by suggesting that sound-producing, sound-dependent species will select habitats based on their acoustic characteristics, including the structure of the biological acoustic community and influence from anthropogenic sounds that are indicative of niche availability and environmental conditions. I refer to this as the Acoustic Habitat Hypothesis (AHH). If this hypothesis applies to explaining some aspects of habitat selection by sound-producing species, biologists can utilize acoustic monitoring and ecoacoustic analyses to evaluate habitat suitability for conservation research and planning. I provide some supporting evidence from previous work that has led to this hypothesis and I also include the results of a study where I tested the AHH to a small sound data set taken from five breeding pond habitats of the critically endangered Dusky Gopher Frog (*Rana sevosa*) in Mississippi and Alabama, U.S.A., as a precursor of how the AHH can potentially be applied to habitat assessment and conservation planning.
Surveying Soundscapes to Investigate the Role of Nocturnal Singing in the Reproductive Activities of a Diurnal Passerine

Antonio Celis-Murillo, T.J. Benson, Michael P. Ward and K. Roberto Sosa Lopez
University of Illinois at Urbana-Champaign, Illinois Natural History Survey and Prairie Research Institute

Soundscapes contain rich sources of information related to the functions of the complex ecological systems. Yet, while much research has focused in the global acoustic environment, addressing diversity assessments (at the population and community levels), less research has focused on the investigation of individual behaviors from soundscapes. Here we show how we used soundscapes to study nocturnal singing in diurnal birds, a poorly described and not well understood behavior. We used manual and autonomous soundscapes recording, automated detection and classification, and individual acoustic identification to investigate the role of nocturnal singing in the reproductive activities of the diurnal Field Sparrow (Spizella pusilla). We quantified the signal effort of resident territory-holders (individuals living near recorders), neighboring territory-holders and intruders (individuals detected singing near resident territory-holders but known to be established in a different grassland patch). We used general linear mixed models to examine if social (fertility stages, the presence of neighbors and intruders singing) and ecological factors (moon illumination) influence nocturnal signaling effort in mated male Field Sparrows. We found that resident males sing more during their post-fertile periods and when neighbors and intruders are also singing. We also found that neighbors and intruders sing more near resident males when their mates are fertile. Our data demonstrates that the social environment influences nocturnal song and that nocturnal song plays a role in the reproductive activities. Our study also demonstrates how soundscapes, in addition to biodiversity assessments, can provide information about the complex acoustic dynamics of individuals in the landscape.

Using Acoustic Tomography to Infer Stem Wood Quality of Pine Forests Affected by a Fungal Pathogen

Sophan Chhin
Michigan State University

Diplodia (Diplodia pinea) shoot blight is a fungal pathogen that affects red pine (Pinus resinosa) and jack pine (Pinus banksiana) forests in Michigan. The objective of this study is to examine whether infection with Diplodia compromises wood quality in pine stands. Acoustic data was collected using an acoustic tomographer from the stem region at breast height (1.3 m) of red pine and jack pine trees across two categories of forest health condition (control vs. Diplodia affected), in two latitudinal regions (Lower Peninsula vs. Upper Peninsula), and two levels of initial stand density (low vs. high). This acoustic data was used to infer the wood quality of the stem of these two tree species since material of higher density generally has higher sound velocity rates. Red pine had significantly higher wood quality (i.e., higher sound velocities) in the Upper Peninsula region compared to the Lower Peninsula region. Within each latitudinal region, red pine did not show significant differences between forest health condition or stand density levels. Jack pine showed no significant differences across the treatment categories. The results indicate that latitudinal region appears to have an impact on red pine wood quality more so than the influence of forest health condition or initial stand density. All factors (latitudinal region, forest health condition, and stand density) do not have a significant impact on wood quality of jack pine.
Usefulness of Acoustic Indices to Measure Biodiversity in Urban Areas

Alison J. Fairbrass, Peter Rennett, Lisa Hundt, Helena Titheridge and Kate E. Jones

University College London and Institute of Zoology

1. Understanding how biodiversity responds to urban environments is crucial to understand how to design sustainable cities. Acoustic indices (AIs) have been applied to a range of habitats to quantify ecological communities through the sound they produce. Although AIs could provide useful methods to monitor acoustic urban biodiversity, their use in acoustically complex urban habitats is not well understood.

2. We test 4 AIs (Acoustic Complexity Index ACI, Acoustic Diversity Index ADI, Bioacoustic Index BI, and Normalized Difference Soundscape Index NDSI) for monitoring acoustic urban biodiversity. We collected 2452 hours of acoustic recordings (infrasonic 0-12kHz, ultrasonic 12-96 kHz) across London in 2013. We randomly selected 1-minute infrasonic and 2-second ultrasonic recordings, and measured the activity and richness of the biotic, anthropogenic, and abiotic components of these recordings using a bespoke software programme AudioTagger. We compared the sound activity and richness of infrasonic recordings to all four indices, and for ultrasonic recordings to 2 indices (ACI and ADI).

3. Infrasonic biotic activity and richness was positively correlated by 3 AIs (ACI, BI, NDSI), but all were biased by anthropogenic and abiotic sound. Ultrasonic biotic activity was only positively correlated by one AI (ACI), but this was biased by anthropogenic activity. No index captured ultrasonic biotic richness. The most biasing anthropogenic sound was human speech and road traffic sounds.

4. Our findings suggest that none of the AIs tested here could reliably be used to measure infrasonic or ultrasonic biotic activity or richness independent of anthropogenic or abiotic sounds in the urban environment.
An Autonomous Recording Station That Searches for Woodpecker Drums

Juliette Florentin, Georges Kouroussis and Olivier Verlinden
Université de Mons

There are only a few specimens of Picus canus left in Belgium and the ornithologists monitoring their population have reported a poor detectability of the specie. This motivated the construction of an Autonomous Recording Station (ARS) and its deployment in a known hot spot. The electronics box of this ARS comprises a Raspberry Pi2 Linux computer, an external sound card, an omnidirectional microphone and a SIM card dongle. An external power board shuts the system down at night. Using two 12V car batteries, the station is powered for ca. one month. Status is monitored daily by SMS. To control disk space, GNU Octave scripts resample the audio feed on the spot and select which segments to save based on a calculation of the Acoustic Complexity Index (ACI). This last process derives from the preliminary analysis of 2665 drumming rolls; for all, the maximum ACI value over all frequencies was greater than a threshold of 1.2. The ARS also stores full ACI spectrograms for each day, enabling quick reviews of the past weeks' bird activity. The field data is eventually processed in the lab using previously developed algorithms for drumming detection and species identification. The station was deployed on February 25th, 2016 and will remain in place through the spring. On March 12th, the first drumming woodpecker was detected and identified as Dendrocopus minor. However, the samples were placed on a region of the t-SNE map that borders Picus canus. Both were previously observed at that location by the resident ornithologist.

Acoustic Clustering: Automatic Sorting of Large-Scale Acoustic Data for Biodiversity Inventory and Assessment

Ian Agranat
Wildlife Acoustics, Inc.

Large scale acoustic monitoring has grown significantly in the last decade enabled by affordable, programmable, weatherproof autonomous audio recorders. Today there are tens of thousands of recorders deployed worldwide amassing tens of millions of hours of audio recordings annually. This data can be used to assess and monitor biodiversity through the detection of specific species of vocal animals such as birds and frogs facilitating land management and conservation efforts. However, the data collected cannot be fully or efficiently utilized manually by listening to recordings or scrolling through spectrograms. We discuss new scalable signal processing techniques based on our prior work in birdsong and bat echolocation call classification. Using the Fisher Scores of Hidden Markov Models built from acoustic features of detected signals, large datasets can be sorted into clusters of similar biological vocalizations. These vocalizations can then be quickly and efficiently sorted and reviewed by researchers to quickly assess the biodiversity and inventory of a site and to build classifiers to search for specific species of interest. We will be discussing our techniques and demonstrating our progress in developing capabilities that will be added to our commercially available Kaleidoscope Pro software later this year.
Statistical Analysis of Bioacoustic Data: Methods for Combining Variables and Modelling Animal Behavior

Stacy L. DeRuiter
Calvin College

Statistical analysis of data from passive acoustic recordings and multi-sensor acoustic tags presents several characteristic challenges. Datasets generally include long time-series of measurements collected in specific locations or for a few specific individuals. Acoustic data are often processed to estimate many spectral and temporal characteristics, or they are accompanied by additional data streams (visual observations or data from non-acoustic sensors) which often have distinct temporal resolution and precision. This talk will discuss several approaches for appropriate, effective statistical analysis of such datasets, with an emphasis on quantitative assessment of changes in animal behavior in response to acoustic disturbance. Issues to be addressed will include: combining multiple data streams for statistical analysis; statistical methods to characterize or summarize normal behavior and detect departures from normal; methods for analysis of acoustic call-production-rate data; and methods for combining analysis of data from multiple recordings, individuals, or species. Specific case studies and statistical methods to be presented will include Mahalanobis distance as a summary of multivariate data, used to detect the time, intensity, and duration of beaked whale behavior changes in response to military sonar sounds; state-switching models, used to quantify changes in sperm whale foraging behavior in response to air gun and military sonar sounds and to describe pilot whale call production rates in behavioral context; and extensions of generalized linear models, to assess behavior and call rates of fin whales while accounting for individual variation and temporal auto-correlation in call rates.

A Practical Guide for Designing Recording Arrays in Terrestrial Environments: Best Practices for Maximizing Location Accuracy and Precision

Erick Greene, Yu Shiu, Janelle Morano, Christopher Clark, Pat Little, Alexis Billings and Dean Hawthrone
Cornell Lab of Ornithology and University of Montana

Sensor arrays for locating and tracking acoustically-active animals are valuable tools for studies in animal behavior, ecology and conservation biology. Recording arrays have been used for over three decades to track animals in marine environments, and there has been considerable research into the sources of error and the best array geometries. The use of recording arrays in terrestrial environments is now growing quickly, but since sound propagates so differently through water and air, the lessons learned from marine arrays are difficult to apply directly to terrestrial arrays. We understand far less about the sources of error in sound localization and optimal array geometry for terrestrial studies. We offer advice on the “best practices” for designing terrestrial recording arrays, and summarize what ecologists need to know about the relative sources of error for location accuracy and precision. A major source of location error for arrays that depend on sensors with independent clocks is the miniscule drift between the clocks. Other sources of location uncertainty result from error in the relative locations of the sensors, signal features (e.g. broadband impulsive, frequency-modulated, complex bi-phonation), the vegetation characteristics of a habitat, and the array geometry. In addition, to localize animals in 2 dimensions versus 3 dimensions requires very different placement of sensors in the environment. We summarize the most important factors for constructing the best terrestrial recording arrays.
Soundscape Approach in an Urban Park of Milano (Italy)

Emilio Padoa-Schioppa, Claudia Canedoli, Alessandro Bisceglie and Giovanni Zambon  
University of Milano-Bicocca, Department of Earth and Environmental Sciences

Urban parks are characterized by a large amount of acoustic sources. Besides the typical anthropogenic noises, birds contribute most to the biophonies, especially during singing activity picks. At the same time, they are immersed in the acoustic environment and thus subjected to its influence. The aim of this study is to apply an Acoustic Complexity Index (ACI) to evaluate the spatial and temporal variability of the singing activity of a bird community in an urban park and to identify patterns of singing activity in relation with increasing distances from the main noise sources. The study has been conducted in a wood lot in Parco Nord (Milan). We recorded sounds with LCR recordings in 22 sites over a regular grid at an increasing distances from the main source of noise. Each recording was 4-5 days duration and was repeated for 6 sessions from April to June 2015. Simultaneously to one session, we conducted a campaign of assisted traditional phonometric measures and traditional noise indexes (Leq e L95) were used for a comparison with ACI values. These measures highlight the negative relationship between vocalization abundance and proximity to a disturbance source. From an evaluation of the spatial and temporal trend of ACI values, no clear patterns emerged. This might be due because of the complexity of surroundings noises sources that act simultaneously and leading responses to noise to be nonlinear in space and thus hard to find some relevant relations between the ACI index and the distance from noise sources in urban environments.

The Use of Network Analysis Techniques to Investigate Acoustic Recordings of the Environment

Michael Towsey, Yvonne Phillips, Susan Fuller, Mangalam Sankupellay and Paul Roe  
Electrical Engineering and Computer Science School, Queensland University of Technology

Acoustic recordings are an emerging technique to monitor terrestrial environments and they are particularly useful for bird species richness studies. Acoustic indices, statistics which quantify the spectro-temporal distribution of acoustic energy in a recording, have been investigated as "surrogate" measures of the diversity of vocalizing animals at a location. In previous work, we have used combinations of indices (rather than single indices) to assist in bird species richness studies by identifying recording segments that are likely to contain bird calls. We have also clustered combinations of indices to identify patterns of acoustic activity. The soundscapes of different environments can be distinguished using "acoustic state" histograms.

In this work, we analyze 24-hour sequences of acoustic activity at different sites by comparing their "acoustic state" transition matrices. Each matrix can be analyzed as a state transition network with the same techniques used to analyze social networks and gene networks.

The advantage of this technique is that it reveals subtle differences in soundscape dynamics. We demonstrate the utility of the method by comparing recordings from six woodland sites in Queensland, Australia, which differ in the amount of canopy cover, foliage density and shrub layer. The site with greatest canopy and shrub cover has double the number of acoustic state transitions than the site with least tree cover in grazed grassland even though both sites share common acoustic elements. We also find differences in the acoustic transition matrices between sites which have the same bird species richness but differ in their vegetation characteristics.
Terrestrial/AnalytYics

The Relationship between Land Use Intensity, Organismic Diversity and Acoustic Complexity – a Large-Scale Approach to Soundscape Ecology (BEsound)

Michael Scherer-Lorenzen and Sandra Müller
University of Freiburg

The aim of the BEsound-project is to investigate how the relationships between land-use intensity and biodiversity are reflected in the soundscape of the respective habitat and if acoustic diversity measures can be used to monitor effects of land-use intensity on biodiversity. Therefore we recently set up 300 autonomous recorders to monitor the soundscape of 300 plots, established within the German Biodiversity Exploratories. 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 land-use and biodiversity gradients. Acoustic recordings started in summer 2015 and will continue for a whole annual cycle.

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?

Here, we present a first visualization of the data and show the relation between the Acoustic Complexity Index (ACI) and local biodiversity of selected organismic groups. We will further present how the ACI varies during an annual cycle and how such a pattern would be affected by land-use intensity.

Heard but Little Seen: Territorial Singing in the African Heart-Nosed Bat

Grace C. Smarch and Michael Smotherman
Texas A&M University

The diversity of song repertoires and functions of singing in mammals have been little investigated. In bats, singing has been largely associated with courtship and mate defense in the roost, however the concept and role of territorial singing outside of the roost is poorly understood. Cardioderma cor, the heart-nosed bat, was first noted as a singer due to their conspicuously loud, low-frequency songs. Unlike other singing bat models, this species roosts in groups in the hollows of baobab trees but disperses nightly to exclusive areas where they move about foraging and singing. We tested the overarching hypothesis that singing is used to create and defend foraging territories by mist-netting, pit-tagging, and tracking 12 singing individuals during which we recorded songs and collected movement and singing behavioral data. Through song playbacks we tested song function. Male C. cor individuals are spatially arranged on separate foraging areas of over 100m across that they return to nightly. They sing back and forth with neighbors from preferred perches. Low-frequency, repetitive syllables are likely adapted for song transmission across the cluttered bush habitat. Songs vary within and across individuals both spectrally and temporally. Song playbacks elicited investigative and aggressive responses, confirming the territorial function of singing. Song variability supports the possibility of other functions of singing, such as discrimination of conspecifics or displays of motivational level.
Decoding Acoustic Signals of Herbage Intake

Julio R. Galli, Emilio A. Laca, Santiago A. Utsumi, José O. Chelotti, Sebastián R. Vanrell, Diego H. Milone, Hugo L. Rufiner and Leonardo L. Giovanini
Kellogg Biological Station & Dept. of Animal Science, Michigan State University

Easy and accurate measurement of grazing behavior and herbage intake is critical to promote progress in science and management of grazing systems. Hence, we seek to improve the efficacy of automatically detecting and classifying digestive events of grazing ruminants by means of more effective acoustic instrumentation and analytical procedures. Rigorous testing of a system called Chew-Bite Real-Time Analysis (CBRTA) was conducted with dairy cows of the MSU and UNR grazing herds. The CBRTA processing algorithm was capable to evaluate complex grazing soundtracks with a speed of 50 times faster than real-time and without affecting accuracy in event detection and classification or sound properties quantification. Furthermore, when 24 h sound tracks were sampled, and digitally and automatically processed, 96% of the digestive events were correctly detected and up to 83% of them were effectively classified as being bites, chews or composite chew-bites (i.e. compound chewing and biting). The ability of CBRTA to integrate both, behavior and acoustic variables for real-time assessment of herbage dry matter intake (DMI) was also tested. Energy flux density (EFD) of chewing sounds was linearly related to DMI and up to 74% of the total variation in EFD was due to variation in DMI alone. The best predictive model explained 91% of the observed DMI (CV 17%) and included the predictors: total chewing EFD, number of chew-bites and plant height (tall vs. short). The present research confirmed that digestive sounds contain valuable information to remotely monitor feeding behavior and to predict herbage intake.

Encoding and Decoding Alarm Calls in Multispecies Communication Networks

Erick Greene, Alexis Billings, Pat Little, Janelle Morano, Christopher Clark and Yu Shiu
University of Montana, Pat Little Consulting and Cornell Lab of Ornithology

Alarm calls about danger are used by conspecifics and heterospecifics in communication networks. We know little about which species participate in these networks, or how far and fast the information travels. We experimentally tested how alarm call communication networks operate in North American winter bird communities. To test how wild birds encode information about predators in their alarm calls, we presented robotic raptors to elicit high and low threat alarm calls. Each species responded, but they responded differently in call rate and call structure for different threat levels. To test how birds decode the alarm calls of others, we deployed microphone arrays to localize sounds. We played back high and low threat alarm calls and recorded acoustic responses. Our dynamic maps of alarm call communication networks show when and where species start alarm calling and how quickly birds communicate over large distances about a predator.
Wildlife Acoustics Song Meter SM4 Hands-On Workshop

Mona Doss  
*Wildlife Acoustics, Inc.*

Acoustic recorders provide a non-invasive and cost-effective technique to assess species biodiversity within a region. This will be a hands-on workshop based on the new Song Meter SM4 family. Participants will learn about Song Meter SM4 features and capabilities while selecting settings and creating programs for the recorders. If time permits, we will also review the Song Meter SM4 Configurator. We request that interested participants sign up in advance by sending an email to sales2016@wildlifeacoustics.com.

Frontier Labs – BAR bioacoustic audio recorder Hands-on Workshop

Mark Calder and Michael Maggs  
*Frontier Labs*

Mark Calder and Michael Maggs will present information about the BAR bioacoustic audio recorder. They will demonstrate the different configurations, scheduling options and the usefulness of the inbuilt GPS. They will help attendees understand the log files records. They will record sounds from the woods tour and play them back and interpret them during the hands-on workshop where participants will have a chance to use and see the equipment. To learn more about the BAR recorder go to: [http://www.frontierlabs.com.au/index.php?p=1_8_Bioacoustic-Audio-Recorder](http://www.frontierlabs.com.au/index.php?p=1_8_Bioacoustic-Audio-Recorder). Frontier Labs is an Australian company that makes electronic equipment for ecologists, specializing in low noise bioacoustic recorders, telemetry and remote trap monitoring. [www.frontierlabs.com.au](http://www.frontierlabs.com.au)
River Listening Sound Installation - On Your Own Anytime  June 5-8, 2016

Leah Barclay, Simon Linke and Toby Gifford - Griffith University, Australia
www.riverlistening.com

River Listening is an interdisciplinary research project that explores the creative possibilities of aquatic bioacoustics and the potential for new approaches in the conservation of global river systems. The project inspires community engagement through interactive listening labs, sound maps, immersive performances and augmented reality sound installations that have travelled the world. River Listening combines digital technologies, science and creativity to connect communities and inspire environmental engagement.

At the 2016 Ecoacoustics Congress you can experience the River Listening augmented reality sound installation by downloading the free app Recho and connecting your headphones. Your phone will act as a sonic compass, allowing you to explore a sound map of geo-located hydrophone recordings from rivers across the world. These recordings are layered with ecoacoustic soundscapes responding to global river systems. River Listening explores rivers as the lifeblood of communities and underscores the value of listening in our current state of ecological uncertainty.

Art and Sound - Ecoacoustic Concert - June 6 at 7:30 p.m.  Kellogg Center Auditorium

“Recent years have seen an exponential increase in the number of composers and sound artists directly responding to global environmental issues, such as biodiversity loss, pollution and climate change, through their creative practice. The philosophical concerns and practical methodologies of these composers and sound artists build on the established field of acoustic ecology, and the related genre of soundscape composition, but also venture well beyond them, setting them apart as a distinct new movement in music and sound art.

Two composers who are at the forefront of this movement, David Monacchi and Matthew Burtner, have each independently adopted the term “ecoacoustic” in reference to their work. Ecoacoustic composition is increasingly being embraced by artists to describe an area of music and sound art which focuses on human engagement with an ecosystem through sound, functioning as a creative response to contemporary environmental issues. It draws from a range of techniques related to the artistic use of natural sound, including soundscape composition, sonification, and direct musical engagements with nature. Its key characteristics include revealing and emphasising the musical characteristics of natural environmental sound, and the employment of musical metaphors for the rediscovery of humankind’s harmonious functioning within the earth’s ecosystems.

This concert brings together immersive compositions from established and emerging leaders in the field including Bernie Krause, David Monacchi, Leah Barclay, Eric Leonardson and Toby Gifford in an exclusive event for the 2016 Ecoacoustics Congress.” - Jonathan Gilmurray, University of the Arts, London

Concert curated by Leah Barclay, live diffusion by Toby Gifford.
Ted Black Woods Tour

Ted Black Woods is located off Van Atta Road in Meridian Township, about a mile North of East Grand River Avenue. Ted Black Woods is a 75-acre deciduous woodland with associated wetlands. Stuart Gage requested access to these woods from Meridian Parks in order to deploy Wildlife Acoustics Song Meters (SM2) there near three wetlands. The Song Meters record every 30 minutes for 1-minute duration. You can see and hear recordings from Ted Black Woods at: http://www.real.msu.edu/projects/one_proj.php?proj=tb. Ted Black passed away on 30 November 2007 at age 93. Black did postdoctoral research at the University of Wisconsin with Aldo Leopold, considered the founding father of wildlife ecology. Ted Black was an expert birder and published Birds of Michigan with Gregory Kennedy and Ted Nordhagen in June, 2003. We will walk along some portion of the trails and hear the sounds of a Michigan June Morning. You will be provided with recordings from three sites during May. The bus will leave the Kellog Hotel and Conference Center at 6 a.m. sharp on June 7.

International Society of Ecoacoustics Board Members

Officers
- President: Almo Farina, almo.farina@uniurb.it
- Vice President: Jerome Sueur, sueur@mnhn.fr
- Secretary General: Stuart Gage, gages@msu.edu
- Treasurer: Denise Risch, denise.risch@noaa.gov

Councilors
- Councilor: Bernie Krause
- Councilor: Diego Llusia, diego_llusia@yahoo.es
- Councilor: David Monacchi, info@davidmonacchi.it
- Councilor: Gianni Pavan, gianni.pavan@unipv.it
- Councilor: Susan Fuller, s.fuller@qut.edu.au

Stay up to date: https://sites.google.com/site/ecoacousticsociety/

Special Thanks To Our Sponsors

MICHIGAN STATE UNIVERSITY | College of Agriculture and Natural Resources

Frontier Labs FL
### EAST SIDE DINING OPTIONS (continued)

**BAR & GRILL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coral Gables</td>
<td>2836 E. Grand River Ave., East Lansing, 48823</td>
<td>(517) 337-1311 $</td>
<td></td>
</tr>
<tr>
<td>Outback Steakhouse</td>
<td>4860 Marsh Rd., Okemos, 48864</td>
<td>(517) 331-1704 $</td>
<td></td>
</tr>
<tr>
<td>Red Lobster Restaurant</td>
<td>3130 E. Saginaw St., Lansing, 48912</td>
<td>(517) 351-0610 $</td>
<td></td>
</tr>
</tbody>
</table>

**QUICK CASUAL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leo’s Coney Island - MSU</td>
<td>333 Alburt Ave., Stk. 100, East Lansing, 48823</td>
<td>(517) 704-2560 $</td>
<td></td>
</tr>
<tr>
<td>Lou &amp; Harry’s - Grill and Bakery</td>
<td>1429 W. Saginaw St., East Lansing, 48823</td>
<td>(517) 351-1066 $</td>
<td></td>
</tr>
<tr>
<td>MSU Union</td>
<td>400 Abbott Rd., East Lansing, 48824</td>
<td>(517) 355-3460 $</td>
<td></td>
</tr>
<tr>
<td>Noodles &amp; Company - East Lansing</td>
<td>201 E. Grand River Ave., East Lansing, 48824</td>
<td>(517) 332-4040 $</td>
<td></td>
</tr>
<tr>
<td>Noodles &amp; Company - Okemos</td>
<td>1165 W. Grand River Ave., Okemos, 48864</td>
<td>(517) 347-1400 $</td>
<td></td>
</tr>
<tr>
<td>The Purple Carrot Food Truck</td>
<td>4450 S. Hagadorn Rd., Okemos, 48864</td>
<td>(517) 679-0309 $</td>
<td></td>
</tr>
<tr>
<td>Sweet Lorraine’s Fabulous Mac n’ Cheez’</td>
<td>647 E. Grand River Ave., East Lansing, 48823</td>
<td>(517) 325-0803 $</td>
<td></td>
</tr>
</tbody>
</table>

**FINE DINING**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bistro 43 &amp; The Great Room</td>
<td>300 M.A.O. Ave., East Lansing, 48823</td>
<td>(517) 337-4440 $</td>
<td></td>
</tr>
</tbody>
</table>

**MEXICAN/SOUTHWESTERN**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Azteco - East</td>
<td>225 Ann St., East Lansing, 48823</td>
<td>(517) 351-8111 $</td>
<td></td>
</tr>
<tr>
<td>Los Tres Amigos - East Lansing</td>
<td>1227 E. Grand River Ave., East Lansing, 48823</td>
<td>(517) 853-5800 $</td>
<td></td>
</tr>
<tr>
<td>Qdoba Mexican Grill - Frandor</td>
<td>301 N. Clipper St., Lansing, 48912</td>
<td>(517) 664-2004 $</td>
<td></td>
</tr>
<tr>
<td>Qdoba Mexican Grill - Okemos</td>
<td>1341 West Grand River, Okemos, 48864</td>
<td>(517) 580-8121 $</td>
<td></td>
</tr>
</tbody>
</table>

**STEAK & SEAFOOD**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillwater Grill</td>
<td>3644 Meridian Crossings Dr., Okemos, 48864</td>
<td>(517) 340-1600 $</td>
<td></td>
</tr>
</tbody>
</table>

**ITALIAN/GREEK**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dusty’s Cellar Wine Bar</td>
<td>1630 Grand River Ave., Okemos, 48864</td>
<td>(517) 349-8080 $</td>
<td></td>
</tr>
<tr>
<td>Gracie’s Place</td>
<td>1611. S. Putnam St., Williamston, 48895</td>
<td>(517) 655-1100 $-$-$-$</td>
<td></td>
</tr>
<tr>
<td>Red Haven</td>
<td>4450 S. Hagadorn Rd., Okemos, 48864</td>
<td>(517) 679-6300 $</td>
<td></td>
</tr>
<tr>
<td>River House Inn</td>
<td>310 W. Grand River Ave., Williamston, 48895</td>
<td>(517) 655-4200 $</td>
<td></td>
</tr>
<tr>
<td>State Room Restaurant &amp; Lounge</td>
<td>219 S. Harrison Rd., East Lansing, 48824</td>
<td>(517) 432-4000 $</td>
<td></td>
</tr>
<tr>
<td>Tannin</td>
<td>6100. Marsh Rd., Stk. C, Okemos, 48864</td>
<td>(517) 675-6540 $</td>
<td></td>
</tr>
<tr>
<td>Tavern 109</td>
<td>109 E. Grand River Ave., Williamston, 48895</td>
<td>(517) 655-2100 $</td>
<td></td>
</tr>
</tbody>
</table>

**$** Entree under $15

**$** Entree over $15

[Image of a map showing East Lansing and surrounding areas, with restaurant locations marked.]
## EAST SIDE DINING OPTIONS

### ASIAN/MIDDLE EASTERN
- **Ai Fusion**
  - 2627 E. Grand River Ave,
  - East Lansing, 48823 • (517) 853-3700 $

- **Bubble Island**
  - 515 E. Grand River Ave., Ste. E
  - East Lansing, 48823 • (517) 333-3860 $

- **Incredible**
  - 1500 W. Lake Lansing Rd,
  - East Lansing, 48823 • (517) 333-3309 $

- **Maru Sushi and Grill - East Lansing**
  - 1500 W. Lake Lansing Rd,
  - East Lansing, 48823 • (517) 337-1500 $$$

- **Maru Sushi and Grill - Okemos**
  - 5100 Marsh Rd,
  - Okemos, 48864 • (517) 349-7500 $$$

- **SanSu Sushi & Cocktails**
  - 4750 Hagadorn Rd., Ste. 100
  - East Lansing, 48823 • (517) 355-1933 $

- **Ukai Hibachi Sushi Bar - East**
  - 2187 W. Grand River Ave,
  - Okemos, 48864 • (517) 343-9823 $%

### BAKERIES, BISTROS, & DESSERTS
- **Bake N' Cakes**
  - 3003 E. Kalamazoo St,
  - Lansing, 48912 • (517) 337-2230 $

- **Black Cat Bistro**
  - 115 Albert Ave,
  - East Lansing, 48823 • (517) 580-3821 $%

- **Chapelure Fine Pastry and Espresso**
  - 4750 S. Hagadorn Rd., Ste. 10
  - East Lansing, 48823 • (517) 333-7172 $

- **MSU Dairy Store**
  - 220 Trowbridge Rd
  - East Lansing, 48824 • (517) 355-1655 $

- **Panera Bread - Frandor**
  - 310 N. Clipper St
  - Lansing, 48912 • (517) 332-9183 $%

- **Panera Bread - Okemos**
  - 4738 E. Central Park Dr., Ste. B
  - Okemos, 48864 • (517) 355-4234 $%

- **Sugar Shack - The Bakery That Delivers**
  - 215 N. Clippet St,
  - Lansing, 48823 • (517) 316-2009 $

- **Velvet A Candy Store**
  - 507 E. Grand River Ave,
  - East Lansing, 48823 • (517) 337-2630 $

### BAR & GRILL
- **Bagger Dave's Burger Tavern**
  - 1351 E. Grand River Ave,
  - East Lansing, 48823 • (517) 482-5062 $

- **Beggar's Banquet**
  - 218 Abbott Rd,
  - East Lansing, 48823 • (517) 351-4573 $

- **Brookshire Inn & Golf Club**
  - 205 W. Church St,
  - Williamston, 48895 • (517) 655-4994 $

- **Buddies Pub & Grill**
  - 3048 E. Lake Lansing Rd,
  - East Lansing, 48823 • (517) 333-9212 $

- **Buffalo Wild Wings - East Lansing**
  - 300 Albert Ave,
  - East Lansing, 48823 • (517) 333-2999 $

- **City Limite Late Night Grill - East Lansing**
  - 2120 E. Saginaw Hwy,
  - East Lansing, 48823 • (517) 337-7000 $

- **Crunchy's**
  - 254 W. Grand River Ave,
  - East Lansing, 48823 • (517) 351-2506 $

- **Dublin Square**
  - 327 Abbott Rd,
  - East Lansing, 48823 • (517) 351-2222 $

- **Dusty's Tap Room**
  - 1957 Grand River Ave.
  - Okemos, 48864 • (517) 853-6840 $

- **Ellison Brewery and Spirits**
  - 4903 Dawn Ave,
  - East Lansing, 48823 • (517) 357-5298 $

- **Grand River Bar & Grill**
  - 3101 E. Grand River Ave,
  - Lansing, 48912 • (517) 337-2695 $

- **Harper's Brew Pub**
  - 131 Albert Ave,
  - East Lansing, 48823 • (517) 333-4040 $

- **Harrison Roadhouse**
  - 720 Michigan Ave,
  - East Lansing, 48823 • (517) 337-0200 $

- **Hobie's Cafe & Pub**
  - 3245 Trowbridge Rd,
  - East Lansing, 48823 • (517) 351-3800 $

- **HogCat - East Lansing**
  - 500 Grove St,
  - East Lansing, 48823 • (517) 816-4300 $

- **Old Nation Brewing Company**
  - 1500 W. Grand River Ave.,
  - Williamston, 48895 • (517) 655-1301 $

- **Pizza House**
  - 4900 E. Hagadorn Rd., Ste. 116
  - East Lansing, 48823 • (517) 336-0033 $

- **Reno's Sports Bar and Grill - East**
  - 1310 N. Abbott Rd,
  - East Lansing, 48823 • (517) 331-7300 $

- **The Soup Spoon Café**
  - 1419 E. Michigan Ave,
  - Lansing, 48912 • (517) 316-2377 $

- **Spare Time Entertainment Center**
  - 3101 E. Grand River Ave,
  - Lansing, 48912 • (517) 337-2695 $

- **Spartan Hall of Fame Café**
  - 1601 W. Lake Lansing Rd,
  - East Lansing, 48823 • (517) 337-3680 $

- **Studio CI**
  - 1999 Central Park Dr.
  - Okemos, 48864 • (517) 381-8100 $
DOWNTOWN DINING OPTIONS

ASIAN/MIDDLE EASTERN
- Sultan's Express
  306 S. Washington Sq.
  Lansing, 48933 • (517) 484-2850
- Thai Village Restaurant LLC
  400 S. Washington Sq.
  Lansing, 48933 • (517) 371-1000

BAKERIES, BISTROS, & DESSERTS
- For Crêpe Sake
  221 S. Washington Ave.
  Lansing, 48912 • (517) 374-0477
- Glazed and Confused
  107 S. Washington Ave.
  Lansing, 48933 • (517) 253-7147
- Grand Traverse Pie Company
  200 S. Washington Sq.
  Lansing, 48933 • (517) 316-0900
- Roma Bakery & Imported Foods
  420 N. Cedar St.
  Lansing, 48912 • (517) 485-9456

BAR & GRILL
- Capitol City Grille
  111 N. Grand Ave.
  Lansing, 48933 • (517) 267-3459
- Crafty Palate
  333 S. Washington Sq.
  Lansing, 48933 • (517) 657-2002
- Henry's on the Square
  229 S. Washington Sq.
  Lansing, 48933 • (517) 487-3663
- Midtown Brewing Company
  402 S. Washington Sq.
  Lansing, 48933 • (517) 977-1340
- Nuthouse Sports Grill
  420 E. Michigan Ave.
  Lansing, 48933 • (517) 484-5997
- Tavern + Tap
  101 S. Washington Sq.
  Lansing, 48933 • (517) 374-5000
- The Waterfront Bar and Grille
  326 City Market Dr.
  Lansing, 48912 • (517) 267-3600

FAMILY
- Clara’s Lansing Station
  637 E. Michigan Ave.
  Lansing, 48912 • (517) 372-7120

QUICK CASUAL
- Domino’s Pizza
  204 S. Washington Sq.
  Lansing, 48933 • (517) 372-3030
- Firehouse Subs
  200 S. Washington Sq.
  Lansing, 48933 • (517) 316-0883
- Good Truckin’ Diner & Food Truck
  1107 S. Washington Rd.
  Lansing, 48906 • (517) 499-9163
- Jersey Giant Subs!
  221 S. Washington Sq.
  Lansing, 48933 • (517) 263-5396
- Jimmy John’s
  134 S. Washington Sq.
  Lansing, 48933 • (517) 485-3000
- Zoup! Fresh Soup Company
  214 S. Washington Sq.
  Lansing, 48933 • (517) 367-7400

FINE DINING
- Knight Cap
  320 E. Michigan Ave.
  Lansing, 48933 • (517) 484-7676
- Troppo
  111 E. Michigan Ave.
  Lansing, 48933 • (517) 371-4000

MEXICAN/SOUTHWESTERN
- Los Tres Amigos
  107 E. Allegan St.
  Lansing, 48933 • (517) 316-0065
- Taco 911
  414 E. Michigan Ave.
  Lansing, 48933 • (517) 492-7911

NIGHTLIFE & ENTERTAINMENT
- American Fifth Spirits
  112 N. Larch St.
  Lansing, 48912 • (517) 900-2631
- The Beer Grotto
  500 E. Michigan Ave.
  Lansing, 48912 • (517) 371-1080
- Duke’s Saloon
  414 E. Michigan Ave.
  Lansing, 48912 • (517) 377-2348
- The Exchange of Lansing
  514 E. Michigan Ave.
  Lansing, 48933 • (517) 309-4500
- Green Door Blues Bar & Grill
  2005 E. Michigan Ave.
  Lansing, 48912 • (517) 452-6376
- Lansing Brewing Company
  615 E. Shiawassee St.
  Lansing, 48912 • (517) 371-2600
- Taps 25
  414 E. Michigan Ave.
  Lansing, 48912 • (517) 913-0103
- Tin Can Bar
  414 E. Michigan Ave.
  Lansing, 48912 • (517) 708-3441

$ Entree under $15
$$ Entree over $15
---

American fifth Spirits
Introducing the Song Meter SM4 Acoustic Recorder

The smallest and lightest dual-channel, weatherproof acoustic recorder available.

When designing the new Song Meter SM4, we focused on a singular mission: *Make bioacoustics recording easier, more efficient, more flexible, and more secure.*

**Easier.** The SM4 is small and light – making it easy to fit many into a backpack. Programming is fast and easy, thanks to built-in schedules and the new Scheduler feature that makes complex, custom schedules extremely easy to create.

**More efficient.** Your goal. Collect the right data, and collect a lot of it. The SM4 was designed around 4 D-size batteries. Combined with its new, low-power processor and more than a terabyte of storage capacity, the SM4 gives you the longest deployment times of any recorder available today – up to 400 hours. Even longer with the SM4 Power Cable and an external power supply.

**More flexible.** The SM4 features two built-in next-generation, low-noise, microphones. You can also connect cabled microphones or even a hydrophone if you need to capture amphibian or marine life vocalizations. When deploying multiple SM4 recorders you can use a single GPS accessory to automatically set the date, time and location of the recorders, or log the recording locations and path.

**More secure.** Water and weather are no match for the SM4. Its rugged polycarbonate case with an integrated, lockable security cover ensures that your recorders – and your data – are always kept dry and safe.

Learn more about the Song Meter SM4 and all of our tools for avian research at:

[wildlifeacoustics.com/ise2016](http://wildlifeacoustics.com/ise2016)

Attend our SM4 Hands-On workshop, and you might win an SM4 – an $849 value.
Wednesday, June 8 at 10:00am
Central Lobby Auditorium

©2016 Wildlife Acoustics, Inc.

[Watch the SM4 videos on our YouTube channel](https://www.youtube.com/watch?v=SM4_Video)