THE ISRAELI BIOACOUSTICS CONFERENCE

11 - 12 OCTOBER 2026 | UNIVERSITY OF HAIFA

ABOUT THE CONFERENCE

Welcome to The Israeli Bioacoustics Conference 2026

We are happy to welcome you to the Israeli Bioacoustics Conference, held on October 11-12, 2026, at the Carmel Campus of the University of Haifa.

This conference was established with the goal of bringing together researchers, students, conservation practitioners, and environmental professionals who share an interest in the study of animal sounds and acoustic environments. Bioacoustics has become an essential tool in modern ecology, enabling the study of animal communication, migration, biodiversity, and environmental change through non-invasive monitoring and advanced analytical approaches.

Our aim is to create a platform for the exchange of up-to-date scientific knowledge, methodological advances, and practical experience. Beyond presenting research findings, we hope to foster new collaborations across disciplines and institutions, strengthen connections between academy and conservation organizations, and encourage the integration of emerging technologies — including data science and artificial intelligence — into ecological research and monitoring.

Our supporters

We are grateful to the many individuals and institutions whose support has made this conference possible. We sincerely thank our sponsors and partners-

- KKL–JNF (Jewish National Fund)
- University of Haifa
- Israel Nature and Parks Authority

- Society for the Protection of Nature in Israel (SPNI)
- The Institute of Evolution, University of Haifa
- The Zoological Society of Israel
- Bird Language Israel

This support reflects a shared commitment to advancing research, conservation, and collaboration in the growing field of bioacoustics.

We wish you an inspiring and productive conference.

SCIENTIFIC PROGRAM

DAY 1 - Sunday, October 11th, Hatter student building	
Time	**Session**
08:30-09:15	**Gathering and registration**
09:15-09:30	**Opening remarks and greeting by Shlomo Wagner, Dean of Natural Sciences, University of Haifa**
09:30-10:15	**Keynote speaker -** *Inbal Arnon*
	Cultural evolution creates language-like structure: from humans to humpback whales and beyond
10:15-10:30	**Coffee break**
10:30-12:00	**First oral session - Ecology, Behavior and Communication 1**
	Passive acoustic monitoring reveals persistent habitat use by deep-diving cetaceans in Israeli offshore waters – *Yaly Mevorach*
	Female moths incorporate plant acoustic emissions into their oviposition decision-making process – *Guy Zer Eshel*
	Turning up the volume: Evidence for marine soundscape amplification in Mediterranean waters due to ocean acidification – *Jacob Silverman*
	Bioacoustics monitoring as a circadian tool for sensory pollution – *Keren Levy*
	Listening to the ocean: Recent developments in passive acoustic monitoring – *Michael Michelashvili*
	What deep learning can and cannot tell us about animal vocal communication – *Yoav Ram*

Time	Session
12:00-12:15	**Poster speed talks**
	Generalization with acoustic indices: Noise limitations for predicting biodiversity – *Samuel Suarez Ronay*
	First Comes the Feeding, Then the Singing: Insights into Nocturnal Behavior Using Multisensor Tags – *Marie Guggenberger*
	What does the reef hear? Continuous real-time monitoring of underwater noise in the Gulf of Eilat/Aqaba – *Roee Diamant*
	Using species-specific aural surveys and plot counts to study local urban habitat features correlation with bird species richness and abundance – *Zacharie Alisse Stern*
	Differential association of high- and low-frequency rat vocalizations with breathing and locomotion during social interactions – *Yizhaq Goussha*
	Dolphin whistle source separation: A bearings tracking approach using Vector hydrophone – *Lixing Chen*
	Compression pulses in lipid membranes: Do cells communicate via sound? – *Matan Mussel*
	First evidence consistent with context-dependent alarm calls in bats – *Omer Yinon*
	Acoustic survey for the detection of the Dead Sea Mole Cricket (*Gryllotalpa marismortui*) - *Asaf Ben David*
	The echoic potential of social calls: a glimpse into the evolution of echolocation – *Mor Taub*
	Defining the Acoustic Properties of Cryptobenthic Fish in the Mediterranean Sea – *Lior Naaman*
	Military training noise in nature reserves – Is this even a problem? A case study from the Carmel nature reserve – O*ri Shapira*
12:15-13:15	**Second oral session - KKL**
	Passive acoustic monitoring of bird communities across fire-affected forest plots: A case study from Birya KKL-JNF Forest, Northern Israel – *Efrat Toren*

	NatureSound – a Long-term bioacoustics monitoring of birds framework using deep learning models: Patterns of vocal activity – *Michael Yair*
	Crane conversations: Decoding the acoustic repertoire of Eurasian Cranes through spectrotemporal patterns and functional insights – *Oz Drumlevich*
	Listening to the night sky: Nocturnal bird migration patterns in Southern Israel revealed by bioacoustics monitoring – *Aya Marck*

Time	**Session**
13:15-14:30	**Lunch break + poster session**
14:30-16:00	**Third oral session - Ecology, Behavior and Communication 2**
	Eavesdropping on Gazelles: first acoustic description and analysis of mountain gazelle vocal communication in the wild – *Amir Arnon*
	Dynamic programming-based localization of Sperm Whale echolocation clicks using a two-element array – *Guy Gubnitsky*
	Interactions between acoustic parameters as a mechanism for species differentiation in the *Hyla savignyi- Hyla felixarabica* complex – *Anat Katzir Alliel*
	Passive acoustic monitoring for smart aquaculture: From fish feeding to Crustacean behavior – *Shay Tal*
	Multi-species vocalization analysis using a self-supervised learning reveals information about individual identity and context – *Yuval Mendelson*
	Voices from the sea; Whistle-based acoustic classification of two dolphin species in southern Israel for night-time ecological monitoring – *Yutam Zuriel*
16:00-16:15	**Coffee break**
16:15-16:55	**Keynote speaker -** *Arjan Boonman*
	The acoustic animal world, signaling, analysis and problems in implementing technology-based survey techniques
16:55-17:00	**Closing remarks**

17:00-18:30	**Happy hour and light dinner**
18:30-20:00	**Night excursion – Bat recordings** *with Arjan Boonman* * limited space available, registration required on the first day

DAY 2 - Monday, October 12th, Eshkol observatory	
Time	**Session**
07:00-09:00	**Morning excursion – Birds recordings** *with Patrick Franke* * limited space available, registration required on the first day
09:00-09:30	**Coffee and light breakfast**
09:30-10:00	**Keynote speaker –** *Yael Lehnardt*
	How huch noise is too much? Measuring and mapping the effects of noise pollution on wildlife behavior
10:00-11:00	**Fourth oral session - Noise**
	Evidence for the influence of shipping underwater radiated noise on Sperm Whale coda structure – *Roee Diamant*
	When blasts meet boundaries: Applying conservation-based noise thresholds in a nature reserve – *Sefi Horesh*
	ShipEcho - An interactive tool for mapping underwater radiated noise from vessels – *Mark Shipton*
	Navigating the soundscape: Anthropogenic noise impacts on Cetaceans and policy recommendations for Israel's maritime environment – *Mor Harnik Blum*
11:00-11:15	**Coffee break**
11:15-12:00	**BirdNet Introduction** *with Aya Marck and Yizhar Lavner*
12:00-13:00	**Lunch break**

13:00-15:00	**Round tables with coffee**
15:00-15:30	**Round tables presentations and discussion**
15:30-16:00	**Closing remarks**

KEYNOTE SPEAKERS

Inbal Arnon

October 11, 09:30h

Prof. Arnon is a developmental psychologist, linguist, and cognitive scientist (PhD, Stanford, 2011). She is a Full Professor of Psychology at the Hebrew University, and currently a Leverhulme Trust Visiting Professor at the University of Edinburgh. Her work focuses on how children learn language, why they do so better than adults, and how studying language learning can help us understand language evolution and animal communication. Prof. Arnon has worked extensively on first language learning, developing a novel framework for understanding why children are better language learners than adults, with applied implications for human and machine learning. Her recent work applies insights from child language learning to language evolution and animal communication, generating transformational bridges across the fields.

Cultural evolution creates language-like structure: from humans to humpback whales and beyond

While the world's languages differ in many respects, they share certain commonalities: these can provide crucial insight into our shared cognition and how it impacts language structure. In this talk, I focus on two statistical properties of language: All known languages are made up of statistically coherent sequences – words – whose frequency distribution follows a power law known as a Zipfian distribution. Despite the ubiquity of these features across languages their origins are poorly understood. Here, I propose both properties confer a learnability advantage, making them good candidates for arising through cultural transmission. In the first part, I will present a set of results on the learnability sources and consequences of such distributions in human language, looking at infants, children, and adults. I will then present results from an iterated learning study in which non-linguistic sequences evolve to have both properties as they are transmitted across multiple generations of participants. Using insights from infant speech segmentation, we develop analytic pipelines for analyzing the sequences, and observe the emergence of Zipfian distribution over generations. If cultural

transmission drives the emergence of such distributions, we may find them in other culturally transmitted communication systems in nature. Together with Simon Kirby and Ellen Garland, we test this prediction by looking at the culturally evolving song of humpback whales. We apply our infant-inspired pipeline to 8 years of whale recordings, and show, for the first time in another species, that these characteristic statistical properties are indeed present in whale song. Finally, I will present new data finding similar statistical structure in the song of Bengalese Finches, another species with culturally transmitted communication. This demonstrates a deep commonality between three very different species united by having culturally transmitted communication. Throughout the talk I will highlight open questions at the intersection of developmental psychology, language evolution, and comparative cognition, and point to ways in which cross-species and cross-method collaborations can promote our understanding of the origin of complex communication.

Arjan Boonman

October 11, 16:15h

Arjan Boonman born in the Netherlands, birder and batter, PhD in Bristol UK, Tübingen Germany, CNRS France, Indonesian Institute of Research, TA University, Max Planck Konstanz. Main interests: bioacoustics birds, frogs, bats (echolocation). Contributions: why bats evolved echolocation, multiple echo resolution, echo entropy in landscapes, frog ultrasound evolution functional distance.

The acoustic animal world, signaling, analysis and problems in implementing technology-based survey techniques

This talk will examine the optimal structure of acoustic signals in relation to their communicative functions. It will then explore methodological approaches for detecting and recognizing these signals, both through human auditory perception and automated analytical systems. Finally, the talk will address the practical implementation of automated acoustic surveys, highlighting the gap between recommended methodological standards and the constraints imposed by limited funding and time in real-world applications. The discussion will conclude by considering methodological developments needed to better align academic research practices with the practical demands faced by landscape planners and conservation practitioners.

Evening excursion - Bat walk

During this evening field walk, participants will be introduced to the acoustic signals used by bats, along with a demonstration of bat detector use in the field. We expect to encounter species such as Pipistrellus kuhlii, and possibly Eptesicus serotinus or Taphozous nudiventris. While sightings cannot be guaranteed, the walk will provide an opportunity to discuss topics raised during the day's lectures, as well as to offer further insight into the sound analysis workshop scheduled for the following day.

Yael Lehnardt

October 12, 09:30h

Yael Lehnardt is a post-doctoral researcher in the Conservation Behavioral Lab at Ben Gurion University of the Negev, specializing in bioacoustics and the ecological impacts of anthropogenic noise. Many years of birding sparked a growing interest in how wildlife perceives and responds to its sensory environment. Her research focuses on how wind turbine and road traffic noise alter soundscapes and affect bird behavior, distribution, and vocal activity across spatial scales. Combining passive acoustic monitoring, various measurements of bird behavior, and advanced statistical analyses, she develops wildlife-oriented tools to quantify noise pollution and assess its consequences for monitoring and nature conservation. Yael's work positions bioacoustics as a central framework for understanding and mitigating noise pollution in Israeli and global ecosystems.

How much noise is too much? Measuring and mapping the effects of noise pollution on wildlife behavior

Anthropogenic noise is increasingly recognized as a pervasive sensory pollutant that alters habitat quality and animal behavior, yet its ecological footprint often remains vague. In this talk, I combine large-scale literature review results, soundscape mapping of noise impacts across landscapes, and empirical results from field studies in Israel to quantify the extent to which noise impacts affect wildlife presence and behavior. I conclude by highlighting emerging thresholds of impact and discussing key conservation takeaways for managing noise in highly fragmented systems like Israel's.

Patrick Franke

October 12, 07:30

Morning Excursion

Patrick Franke began making sound recordings in the late 1990s. During his studies in Sound Art, his interests increasingly shifted toward wildlife sound and ecology. After completing his master's degree in 2008, Franke switched to field biology. Since then, the aim of his work has been to make reference sound recordings of the highest possible quality and to make them available for research and environmental education – contributing wildlife sound recordings as a tool for conservation. Patrick Franke is a co-founder of the migratory bird ID guide Birds in Flight, the Finch Research Network, and the Bioacoustics Working Group of the German Ornithologists' Society. Since 2024, he is elected Vize-chairman of the Wildlife Sound Recording Society. Since 2022 he has been working freelance on projects for the Cornell Lab of Ornithology. Patrick regularly runs bioacoustics and sound recording workshops.

Morning excursion - Birds recordings

The rapid technological developments of recent years have provided bioacoustics and soundscape ecology with an almost unlimited availability of data, as well as the possibility of automated analysis.

Nevertheless, there is still a lack of high-quality, and above all contextualized, reference recordings. These can only be captured manually. Creating reference recordings usually requires a significant investment of time and often a specific approach tailored to the target species.

In this workshop, we will listen together to a selection of recordings in order to discuss different approaches and technical options. Afterwards, there will be an opportunity to test and compare equipment.

ORAL PRESENTATIONS

SESSION 1 : Ecology, Communication and Behavior 1

Passive acoustic monitoring reveals persistent habitat use by deep-diving Cetaceans in Israeli offshore waters

Yaly Mevorach, Kim Kobo, Yotam Zuriel, Eden Barzilai, Leigh Livne, Ole Johannes R. Sørensen, Aviad Scheinin, Dan Tchernov

Morris Kahn Marine Research Station, Leon H. Charney School of Marine Sciences, University of Haifa, Haifa, Israel; Delphis (NGO), Ashdod, Israel.

In the dark environment of the deep sea, deep-diving cetaceans rely heavily on sound for communication, navigation, and foraging. As these species spend most of their lives underwater and are rarely detected visually, passive acoustic monitoring (PAM) is a highly effective method for studying their occurrence, distribution, and habitat use. The Mediterranean sea inhabits two endangered deep-diving cetacean species, the sperm whales (*Physeter macrocephalus*) and Cuvier's beaked whales (*Ziphius cavirostris*), yet their distribution in the eastern Levantine sea and the Israeli offshore waters is unknown. This study integrates towed hydrophone arrays, systematic visual and acoustic surveys, photo-identification, opportunistic detections, and an autonomous underwater glider to document cetacean activity beyond the continental shelf, up to 100 nautical miles offshore in the Israeli Exclusive Economic Zone (EEZ). Acoustic detections across ten surveys revealed generally low encounter rates, consistent with the ultra-oligotrophic nature of the eastern Mediterranean. Despite this, repeated acoustic detections were consistently associated with the ~1,200 m depth contour along the Carmel continental slope, suggesting a strong relationship between deep-diving cetacean presence and slope-related bathymetric features. This pattern was observed across multiple seasons, including fall, winter, and spring, indicating persistent or recurrent habitat use rather than a single seasonal aggregation or random encounter. The rapid expansion of offshore industries within the Israeli EEZ, including shipping and oil and gas activities, is increasing levels of anthropogenic underwater noise. Given the strong dependence of deep-diving cetaceans on sound, these findings emphasize the importance of bioacoustics-based monitoring to establish baseline distributions, assess noise impacts, inform mitigation strategies, and support the conservation of endangered deep-sea cetaceans in the eastern Mediterranean.

Female moths incorporate plant acoustic emissions into their oviposition decision-making process

Rya Seltzer, Guy Zer Eshel, Omer Yinon, Ahmed Afani, Ofri Eitan, Sabina Matveev, Galina Levedev, Michael Davidovitz, Tal Ben Tov, Gayl Sharabi, Yuval Shapira, Neta Shvil, Maya Harari Gibli, Ireen Atallah, Sahar Hadad, Dana Ment, Lilach Hadany, and Yossi Yovel

School of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University, Ramat Aviv, 6997801, Israel; Plant Protection Institute, Agricultural Research Organization - Volcani Institute, Derech Maccabim 68, Rishon LeZion, Israel; School of Plant Sciences and Food Security, George S. Wise Faculty of Life Sciences, Tel Aviv University, Ramat Aviv, 6997801, Israel; Sagol School of Neuroscience, Tel Aviv University, Ramat Aviv, 6997801, Israel

While insects utilize multimodal plant cues, the role of plant-derived acoustic signals remains unexplored. Dehydrated plants emit ultrasonic clicks within the auditory range of moths; we investigated if these influence oviposition. Without physical plants, female moths oviposited near playbacks mimicking dehydration, shifting toward the source. With physical plants, moths preferred silent (hydrated) hosts, consistent with innate preferences. Deafening abolished these effects, and conspecific signals did not modulate the response, confirming the behavior is audition-mediated and specific to plant-like emissions. These findings provide the first evidence of moth-plant acoustic interaction, revealing a novel dimension of plant-insect ecology.

Turning up the volume: Evidence for marine soundscape amplification in Mediterranean waters due to ocean acidification

Jacob Silverman, Mustafa Asfur

Israel Oceanographic and Limnological Research (IOLR), Ruppin Academic Center (RAC)

The coastal waters of Israel have undergone relatively rapid acidification over the past two decades due to the combined influence of rising atmospheric CO_2, eutrophication and submarine groundwater discharge enriched in CO_2, nitric and silicic acid. Here, we examine the extent to which seasonal and interannual variability in seawater pH influences the marine soundscape. Where, ocean acidification reduces low-frequency (<10 kHz) acoustic absorption, thereby increasing sound propagation distances and ambient

noise levels. Passive acoustic monitoring was conducted during two consecutive winter seasons (2021–22 and 2022–23) in Israeli coastal waters. Hydrophone recordings were integrated with concurrent measurements of temperature, salinity, and pH from the nearby Habonim Beach monitoring station. These data were used to calculate the seawater acoustic absorption coefficient (α) and evaluate its relationship with recorded ambient noise.

Variations in the mean Noise Index (NI), which is root-mean-square (RMS) of sound levels recorded by the hydrophone, deployed at 15 m depth in a 30 m water column during winter storm events were strongly correlated with changes in α. Mean wintertime pH declined from 8.24 in 2021-22 to 8.10 in 2022-23, corresponding to a calculated 25–30% reduction in α at 1 kHz, which is consistent with increase in mean wintertime NI. Across individual storm events, α at 1 kHz was negatively correlated with mean noise index ($n = 7$, $r = -0.73$, $p = 0.06$). These findings indicate that ongoing acidification may increase the acoustic transparency of Israeli coastal waters, enhancing sound propagation from both natural and anthropogenic sources. The results highlight the soundscape sensitivity to chemical forcing and suggest that continued acidification and eutrophication could elevate background noise levels, with potential implications for marine organisms and coastal aquaculture through increased chronic acoustic stress.

Bioacoustics monitoring as a circadian tool for sensory pollution

Keren Levy, Ronny Efronny, Yoav Wegrzyn, Anat Barnea, Amir Ayali

Department of Zoology, Tel Aviv University, Tel-Aviv, Israel; Department of Natural Sciences, The Open University of Israel, Raanana, Israel

Monitoring acoustic activity is common practice in many studies of insect behavior. Long-term monitoring may serve for chronobiological research and studies of activity patterns, revealing short-term and long-term plasticity in acoustic behavior. In this study, acoustic monitoring was utilized as a tool to assess the influence of sensory pollution, specifically light pollution, on circadian stridulation behavior in a cricket. Gryllus bimaculatus crickets were reared under LD conditions (12 hours light and 12 hours darkness) and exposed as adults to one of two treatments: i) 12 hours daylight and 12 hours artificial light at night (ALAN) of various intensities; ii) LD conditions and a 3-hours long nocturnal pulse of light. Individual cricket stridulation was constantly recorded using RavenLite2.0.0 (Cornell, Ithaca). Sound extraction,

analysis, and transformation into actograms were achieved using custom-written R, python scripts, and the ImageJ program. The results revealed that light pollution affects circadian acoustic signaling in the cricket. Long exposure to ALAN evoked a loss of synchrony with the natural environmental conditions. A temporal shift in acoustic signaling resulted in free-run behavior. The short exposure to a light pulse evoked masking, manifested in an immediate cessation of the nocturnal, acoustic signaling. Furthermore, an immediate and transient increase in diurnal locomotion was observed. These results emphasize the importance of biacoustic tools in behavioral and chronobiological research, as well as the sensitivity of acoustic signalling to environmental conditions and sensory pollutants.

Listening to the ocean: Recent developments in passive acoustic monitoring

Michael Moshe Michelashvili, Yuval Mendelson, Danielle Hausler, Tomer Nachshon, Shai Nahum Gefen, Amit Galor

Deep Voice NGO

Automated biodiversity monitoring is essential for understanding and mitigating the impacts of environmental change. At Deep Voice, we develop open-source AI tools for acoustic classification to advance marine mammal conservation. In this talk, we will review the recent advancements in the field of passive acoustic monitoring. We will discuss the main challenges in the field, parallels and distinctions with methods from the computer vision domain and speech recognition, and share a set of practical techniques that significantly boost performance.

What deep learning can and cannot tell us about animal vocal communication

Zlotorinsky, Lior; Ilany; Amyaal; Geffen, Eli; Yovel, Yossi; Ram, Yoav

School of Zoology, Faculty of Life Sciences, Tel Aviv University

Understanding animal vocal communication means mapping signals onto meaning in the receiver's perceptual space, yet most computational studies cluster signals by acoustic similarity, treating a physically tractable layer (who called, which call) as if it were the semantic layer where meaning lives. We use

two complementary studies to ask when this conflation holds and when it breaks.

First, in a system where we retain partial access to the receiver's perceptual space — pre-linguistic human toddler vocalizations directed at adults in distress, contact, and begging contexts — we compared a classical spectrogram approach with two self-supervised networks, AVES (trained on animal sounds) and WavLM (trained on human speech). Their acoustic embeddings recovered meaning imperfectly, conflating toddler calls of different meaning while splitting calls of shared meaning. Acoustic similarity did not recover perceptual category, even in this maximally favorable, decodable case.

Second, we applied a self-supervised transformer model (animal2vec) to rock hyrax (Procavia capensis) vocalizations to test cross-species transfer learning. Comparing three regimes — meerkat pre-training, hyrax pre-training, and meerkat pre-training followed by hyrax mid-training — cross-species pre-training gave a head start but species-specific exposure was decisive. Frozen embeddings were linearly separable by individual identity, and fine-tuned detectors localized hyrax calls in continuous recordings far better than energy- and threshold-based heuristics. Under blind re-review by a hyrax expert, much of the apparent model–annotator disagreement reflected event-boundary segmentation rather than genuine detection error. Call-type classification recovered structured types but confused acoustically overlapping ones (e.g., growls, which resemble dense click sequences) — exactly where acoustic form underdetermines perceptual category.

Together these results seem to sketch a boundary: self-supervised models are powerful for the tractable layer of communication — detection, identity, and coarse repertoire structure, partially transferable across species — yet the acoustic space they learn is not the perceptual space in which meaning lives. We offer this boundary not as a conclusion but as an invitation for machine-learning and ecology researchers to think and talk together about where these tools can be trusted and what can be done to allow them to recover meaning.

ORAL PRESENTATIONS

SESSION 2 : KKL - JNF Jewish National Fund

Passive acoustic monitoring of bird communities across fire-affected forest plots: A case study from Birya KKL-JNF forest, Northern Israel

Efrat Toren, Nir Sapir, Yizhar Lavner, Yossi Yovel

Department of Evolutionary and Environmental Biology, University of Haifa, Haifa, Israel ; Department of Computer Science, Tel-Hai University of Kiryat Shmona, Israel; School of Zoology, Tel Aviv University, Tel Aviv, Israel

Israel is characterized by a wide range of habitats, including KKL-JNF forests covering approximately 7% of the Mediterranean region of the country. These predominantly coniferous forests were long considered an "ecological desert," but recent evidence shows that they are inhabited by many bird species, including species for which they are their primary habitat. In an era of climate change and global warming, the frequency and severity of fires are expected to increase, affecting planted forests in the Middle East as well. Therefore, it is important to understand how these extreme events impact forest birds. In this study, we examined how fire affects bird community composition in Birya Forest, northern Israel's largest planted forest, during the first spring post-fire using extensive passive acoustic monitoring. The 2024 war in northern Israel caused numerous forest fires damaging extensive areas. Although not directly climate-related, these fires created an opportunity to examine fire impacts on forest bird communities. One burned area is the Naburia basin (approximately 260 dunams), characterized by various conifers (pines, cypresses, cedars) without an understory layer. In spring 2025, acoustic recording devices were deployed throughout the forest in burned, unburned, and fire-edge areas (intermediate zones between burned and unburned plots). Devices operated for over a total of 50 days during morning (5:00-9:00) and afternoon (16:00-19:00) hours. Manual analysis by expert ornithologists of unburned plots identified 30 bird species, including residents and migratory. The 10 most vocally common species in unburned coniferous plots were selected, and a dedicated classifier was trained using BirdNET GUI Analyzer 2.1.0. Using the acoustic data and custom classifier model, we examined bird communities across the three plot types and measured vocal activity levels of identified species. This data will illuminate the direct impact of fire on bird communities

in planted forests, providing a baseline for long-term monitoring of recovery processes under different management approaches. This work is expected to manifest the importance of acoustic monitoring for Mediterranean planted forests.

NatureSound – A long-term bioacoustics monitoring of birds framework using deep learning models: Patterns of vocal activity

Michael Yair, Yoni Vortman, Dima Ruinskiy and Yizhar Lavner,

Department of Computer Science, Tel-Hai University of Kiryat Shmona, Israel; Department of Animal Science, Tel-Hai University of Kiryat Shmona, Israel.

Recent technological advancements have enabled the large-scale collection of bioacoustic data, with autonomous recording units continuously capturing vast numbers of bird vocalizations in natural habitats.

In this study, we aimed to develop an integrated framework and database that leverage audio signal processing and deep learning models to automatically identify bird species based on their vocalizations. A structured database has been implemented to store full bioacoustic recordings and their corresponding annotations and associated metadata in the form of three second segments, facilitating detailed analysis of species-specific vocal patterns and broader ecological trends. The system is designed to support long-term monitoring of avian populations at high spatial and temporal resolution, enabling the detection of changes in vocal activity associated with climate variability, disease outbreaks, and anthropogenic noise. The system currently performs inference using BirdNet v2.4 model, while its design allows the integration of multiple inference models, enabling the inclusion of additional bioacoustic taxa and anthropogenic sound sources beyond those currently supported. The application programming interface (API) provides flexible queries by time, location, and species, along with a web-based interface for visualizing results in HTML, generating high-resolution graphical outputs on the server, and allows the download of subsets of data for further analysis. Over the past five years, recordings were collected from multiple autonomous recorders deployed across the Hula Valley, a major migratory stopover.

To visualize vocal activity, we developed the species vocalogram, intensity vocalogram, and species richness vocalogram, which capture seasonal and

diurnal patterns across multiple species. Long-term analysis of recordings from Agmon Hula Lake Park revealed notable findings, including temporal changes in vocal activity, and interannually patterns in species phenology and richness.

At present, the database contains inference results for nearly 50,000 hours of an accumulated sound record in nature.

Crane conversations: Decoding the acoustic repertoire of Eurasian Cranes through spectro-temporal patterns and functional insights

Oz Drumlevich

Movement Ecology Lab, Department of Ecology, Evolution and Behavior, Hebrew University in Jerusalem

Cranes (family Gruidae) exhibit a remarkably rich vocal repertoire underpinning complex social and pair-bonding behavior. This study explores the acoustic "language" of common cranes (Grus grus) through methodologies of signal processing, call clustering, and ecological interpretation of flight calls, contact calls, guard calls (individual and duet), unison calls, and chick calls. Field recordings across behavioral contexts collected in the Hula Valley were analyzed using Mel-Frequency Cepstral Coefficients (MFCCs), Short-Time Fourier Transform (STFT) spectrograms, and Perch deep learning toolkit benchmarking to characterize call types.

Acoustic clustering examined high-dimensional feature spaces emphasizing spectral envelope dynamics, harmonic dispersion, and temporal modulation. Transfer learning (Sensu Ghani et al., 2023) leveraged pre-trained convolutional auditory embeddings to detect feature variability across contexts. Emerging patterns suggest overlapping yet functionally meaningful call distributions, reflecting flexible signaling in semi-precocial species.

Functionally, crane vocal communication mirrors semi-precocial ontogeny and gregarious structure. Chick calls, contact calls, and duets form a dependency-coordination continuum, aligning with ontogenetic and ecological needs as described by Johnsgard (1983), Archibald & Lewis (1996), and Meine & Archibald (1996). Ongoing work incorporates datasets of acoustically tagged cranes from the Movement Ecology Lab, linking vocal behavior to space use and movement dynamics.

This approach integrates acoustic analysis with ecological interpretation, modeling crane communication as a dynamic signaling system. The classification framework aims to support longitudinal monitoring of call type use, frequency, timing, and behavioral context, providing novel tools for avian vocal communication research.

Listening to the night sky: Nocturnal bird migration patterns in Southern Israel revealed by bioacoustics monitoring

Aya Marck, Yizhar Lavner, Nir Sapir

Department of Evolutionary and Environmental Biology, Faculty of Natural Sciences, University of Haifa, Haifa, Israel; Department of Computer Science, Tel-Hai College, Israel

Avian migration is an important transport process involving billions of birds, with individuals facing both natural challenges and growing anthropogenic pressures. Effective monitoring is essential for understanding migration dynamics and guiding conservation actions. Situated within a major flyway, Israel offers a key opportunity to study the large-scale movements of migrating birds. Passive acoustic monitoring (PAM) is emerging as a powerful and cost-effective tool for long-term ecological research. By detecting and classifying nocturnal flight calls of migrating birds, PAM provides critical insights into species composition, migration timing, and its intensity. Importantly, this method enables identification to the species level – a major challenge for other large-scale methods.

Here, we present results from continuous monitoring in southern Israel during fall 2024 and spring 2025, processed using a deep-learning-based framework for species detection and classification. A retrained BirdNET model was applied to identify nocturnal flight calls of 35 common migratory species, achieving an average recall of 0.94 and precision of 0.96 on test data. The acoustic detections revealed clear seasonal differences: fall migration showed higher call rates and greater species diversity, whereas spring migration exhibited a weaker signal and lower species diversity. Nightly vocal activity also differed between seasons—detections in fall are spread throughout the night, while in spring they concentrate near dawn, possibly reflecting birds descending after crossing arid regions to the south. This data aligned closely with visual observations from eBird, validating the method's accuracy.

Together, these results provide a comprehensive view of songbird migration in Israel and demonstrate that PAM is a robust and scalable approach for

quantifying nocturnal bird migration, characterizing species phenology, and enhancing long-term monitoring and conservation across migratory flyways.

ORAL PRESENTATIONS

SESSION 3 : Ecology, Communication and Behavior 2

Eavesdropping on Gazelles: First acoustic description and analysis of mountain gazelle vocal communication in the wild

Amir Arnon, Nicola F. Koyama, Torsten Wronski

Ramat Hanadiv, Israel; Faculty of Science, School of Biological and Environmental Sciences, Liverpool John Moores University, UK

This study provides the first detailed acoustic description of vocalizations in wild-living mountain gazelles (Gazella gazella) using camera trap recordings from Ramat Hanadiv Nature Park in Israel. Six distinct call types were identified and categorized by behavioral context: threat calls, alarm calls, and courtship calls.

Threat calls were short, sharp nasal vocalizations (approximately 0.08 seconds) produced during territorial conflicts between adult males. Analysis of 52 calls from two males revealed individual differences in peak frequency (1,699 Hz vs. 3,206 Hz), suggesting these calls may convey information about individual identity or physical condition.

Alarm calls, recorded from both males and females, were similarly brief (0.18-0.21 seconds) with comparable acoustic structures between sexes. A variant form accompanied stotting behavior, where each call is synchronized with individual jumps. These nasal calls likely serve as warning signals to conspecifics.

Three courtship call types were documented, including two previously unreported vocalizations. The most notable was a long "weeping call" (0.65 seconds) produced during low-stretch approach behavior, possibly of oral origin given noticeable jaw movements observed during vocalization.

The study highlights the remarkably soft and inconspicuous nature of many gazelle vocalizations, and the potential of using camera traps with high-quality recording equipment to unveil the acoustic repertoire and social communication systems of timid species in the wild.

Dynamic programming-based localization of Sperm Whale echolocation clicks using a two-element array

Guy Gubnitsky, Roee Diamant

Department of Marine Technology, University of Haifa, 3498838, Haifa, Israel

Sperm whales (Physeter macrocephalus) produce powerful broadband echolocation clicks for navigation and foraging, which are detectable over several kilometers in the ocean. Accurate localization of the whale source using these clicks is important for behavior study, determine population size, and explore effects of, e.g., anthropogenic activities. As a practical, easy to deploy setup, we consider for localization a two hydrophone

array vertically deployed from, e.g., a small vessel or buoy. Different than existing approaches that perform localization per click, our solution exploits the sequential structure of sperm-whale echolocation clicks to formalize the localization solution as a hidden Markov model (HMM) whose states encode the whale's range and depth. Emission probabilities are derived by the similarity between the expected and measured time-

difference-of-arrival between the direct and first reflection paths, while considering uncertainties such as the hydrophones' depth and the sound speed profile. The HMM is processed by a dynamic programming for a batch localization solution. Region-of-interest (ROI) gating reduces the computational complexity towards real-time operation. Performance evaluation by emulations and a controlled sea experiment show

that the proposed framework outperforms three benchmarks in terms of localization accuracy, robustness to environmental uncertainty and computational efficiency.

Interactions between acoustic parameters as a mechanism for species differentiation in the *Hyla savignyi- Hyla*

felixarabica complex

Annat Katzir Alliel, Eli Geffen, Sarig Gafny, Uri Roll, Michal Hadas-Sasson

School of Zoology, Tel Aviv University, Tel Aviv, Israel; School of Marine Sciences, Ruppin Academic Center, Michmoret, Israel; Mitrani Department of Desert Ecology, The Jacob Blaustein Institutes of Desert Research, Ben-Gurion University of the Negev, 8499000 Midreshet Ben-Gurion, Israel

Hyla savignyi and Hyla felixarabica form a formerly cryptic species pair, treated as one taxon until genetic studies confirmed separation. Both species show deep genetic divergence and largely allopatric ranges on opposite sides of Jordan Rift Valley, yet no hybridization has been detected despite absence of an obvious geographic barrier. In anurans, male advertisement calls can mediate prezygotic isolation via female mate recognition. We combined genetic verification with detailed acoustic analyses to test whether call divergence contributes to reproductive isolation. We recorded advertisement calls from 15 populations and measured temporal and spectral parameters. Overall acoustic differentiation was moderate, yielding about 75% correct species classification. Still, several traits reliably separated species, especially note duration and number of elements per call. A second model incorporating all two-way interactions among acoustic variables increased classification accuracy to about 90%. Interaction effects indicate that species recognition in Hyla may rely on combinations of acoustic cues rather than single traits. Results support selective acoustic divergence as a behavioral barrier that helps maintain species boundaries and complements long term genetic isolation and ecological differentiation across Jordan Rift Valley.

Passive acoustic monitoring for smart aquaculture: From fish feeding to Crustacean behavior

Shay Tal, Dror Ettlinger-Levy, Shai Kendler, Barak Fishbain

National Center for Mariculture, Israel Oceanographic and Limnological Research Institute, Eilat, Israel; Faculty of Civil and Environmental Engineering, Technion - Israel Institute of Technology, Haifa, Israel

The increasing scale and intensity of aquaculture systems demand new approaches for monitoring animal behavior, welfare, and production efficiency. Passive acoustic monitoring (PAM) offers a non-invasive and scalable tool for detecting biologically meaningful behaviors through sound, even in visually opaque underwater environments.

In this presentation, I will introduce a series of studies applying bioacoustics methods to monitor feeding and behavior in aquaculture-relevant species. First, I will present our work on gilthead seabream (*Sparus aurata*), where we identified a specific acoustic signature associated with pellet biting during feeding. By applying matched filtering and sliding-window aggregation, we quantified feeding intensity directly from continuous underwater recordings. Coupling these acoustic metrics with machine-learning models enabled us to track temporal variations in feeding behavior and identify deviations linked to stress or disease conditions. I will then present recent results from freshwater prawns (*Macrobrachium rosenbergii*), where we investigated the acoustic basis of snapping, feeding, and social interactions. Distinct high-frequency sound events were associated with specific behaviors, demonstrating that crustacean activity can also be monitored acoustically in real time.

Together, these case studies illustrate how bioacoustics signal processing can be used to extract behavioral information across taxonomically diverse aquaculture species. Finally, I will briefly discuss ongoing efforts to extend PAM to additional organisms, including other fish species and bivalves (notably oysters), toward the development of multi-species acoustic monitoring frameworks for future smart aquaculture systems.

Multi-species vocalization analysis using a self-supervised learning reveals information about individual identity and context

Yuval Mendelson, Yossi Yovel

School of Zoology, George S. Wise Faculty of Life Sciences, Tel-Aviv University, Tel Aviv 6997801, Israel; The Center for AI & Data Science, Tel-Aviv University, Tel Aviv 6997801, Israel; Sagol School of Neuroscience, Tel Aviv University, Tel Aviv 6997801, Israel

Animal vocalizations are widely used in the animal world. While vocalization analysis is widely studied in biology, different techniques are used with varying degrees of success across species. A technique that works for one type of vocalization might not work at all for another. Self-supervised learning (SSL) is a deep learning technique that enables a network to train on a dataset without supervision, while enhancing the data features. In this study, we propose leveraging this technique in bioacoustics for vocalization analysis. To demonstrate this network's ability to capture fine details in multi-species vocalizations, we analyze vocalizations from Egyptian fruit bats (Roussetus aegyptiacus), Domestic canaries (Serinus canaria), and humans (Homo

sapiens) separately. We demonstrate the network's ability by solving classification tasks, including subject sex, age, ID, and vocalization context. This method shows great potential for extracting diverse features from multiple species vocalizations.

Voices from the sea; Whistle-based acoustic classification of two dolphin species in southern Israel for night-time ecological monitoring

Yotam Zuriel, Imri Aharoni, David Atch, Ori Galili, Dan Tchernov, Aviad Scheinin, Dani Kerem

Morris Kahn Marine Research Station, Leon H. Charney School of Marine Science, University of Haifa, Haifa 3498838, Israel; Data Science Research Center, University of Haifa. Haifa 3498838, Israel

Two coastal dolphin species, the common bottlenose dolphin (Tursiops truncatus, Tt) and the short-beaked common dolphin (Delphinus delphis, Dd), co-occur along the southern Israeli Mediterranean coast, where the critically endangered Dd population faces ecological pressures, including potential competition with Tt. These pressures may drive Dd to migrate to deeper waters at night as a survival strategy. Effective acoustic differentiation is therefore essential to complement visual surveys. We analyzed 940 high-quality whistles recorded between 2018 and 2024, south to Ashdod (705 Dd, 235 Tt), using the manual contour extraction tool Sound Annotator. Sixteen parameters describing frequency, timing, and contour shape were measured and evaluated with machine learning models. Despite substantial acoustic overlap, the model identified specific frequency features, including minimum, median, and start frequencies, as particularly informative for distinguishing between species. This approach enables continuous, around-the-clock species-specific monitoring, which can help test hypotheses about nocturnal migration, while providing a valuable tool for conservation-focused acoustic studies of dolphin populations in the eastern Mediterranean.

ORAL PRESENTATIONS

SESSION 4 : Noise

Evidence for the influence of shipping underwater radiated noise on Sperm Whale coda structure

Roee Diamant, David F. Gruber, Shane Gero, Gašper Beguš

University of Haifa; Project CETI; University of California, Berkeley

Shipping underwater radiated noise (S-URN) has been shown to cause harm to whale populations, yet the mechanisms by which anthropogenic sounds interfere with whale communication systems is less understood. This paper investigates the impacts of S-URN on the structure of sperm whale coda vocalizations. We show that the presence or absence of S-URN can be predicted by changes in the coda features, which arguably indicates a systematic effect on the sperm whale vocalization. S-URN also results in changes in the spectral properties of the codas. In particular, S-URN decreases the accuracy of coda-vowel classification even at short distances (several meters), suggesting that underwater noise impacts bidirectional sperm whale communication. We further show that in the presence of S-URN, a) codas are shorter and b) more coda signals with a specific spectral pattern are vocalized.

When blasts meet boundaries: Applying conservation-based noise thresholds in a nature reserve

Sefi Horesh, Zehava Sigel, David Strokov, Noam Leader

Israel Nature and Parks Authority

In the past, quarry blasting in Israel's eastern Negev was suspected to contribute to vulture nesting-site abandonment, leading to a precautionary ban on blasting throughout the breeding season. Here we present a practical alternative for an active open-pit mine beside a sensitive nature reserve used by endangered cliff-nesting raptors. The mine recently switched to quieter NONEL blasting (non-electric shock-tube initiation), and the Israel Nature and Parks Authority (INPA) developed a conservation-oriented compliance framework to protect the reserve while addressing the mine's operational needs.

To design and evaluate this framework, we measured a representative maximum blast, produced terrain-based acoustic propagation maps, and deployed SM4 autonomous recorders at the blast site and within the reserve to capture sound levels during blasting. Using published evidence on raptor behavioral responses to impulsive noise (startle, flushing, and breeding disruption), we translated conservation needs into an operational boundary criterion of 60 dBA (A-weighted) and 80 dBC (C-weighted). These thresholds were intentionally set below any level expected to pose biological risk and are more conservative than typical criteria applied for human residential settings, reflecting the precautionary requirements of protected areas. As in receptor-based noise regulation, the reserve boundary serves as the compliance point for wildlife habitat.

Under the proposed regime (up to four daytime blasts per week), the mine is required to remain within the boundary threshold during every blast. Compliance will be verified through monitoring by INPA, combining synchronized measurements at the blast site and at stations inside the reserve. The monitoring and control mechanism will be implemented and evaluated for one year, after which INPA will issue a final management decision. This boundary-based, biologically motivated approach provides a transparent alternative to season-long bans, enabling adaptive management of impulsive noise while maintaining protection for sensitive raptor nesting habitat. To our knowledge, this is one of the first implementations in Israel of explicit, enforceable noise thresholds developed specifically for wildlife and ecosystem protection (not human annoyance) and applied at a nature-reserve boundary. It supports INPA's leading efforts to develop ecological noise-pollution policy and monitoring that better safeguards protected areas from harmful noise.

ShipEcho - An interactive tool for mapping underwater radiated noise from vessels

Mark Shipton, Valentino Denona, Dula Nad, Roee Diamant

University of Haifa, Charney School of Marine Sciences; Faculty of Electrical Engineering and Computing; University of Zagreb

Underwater radiated noise from vessels (V-URN) is a recognized environmental stressor that negatively impacts marine life, ranging from increased stress levels

and altered behavioral patterns to hearing impairment and increased

mortality due to predation. The impact of V-URN has motivated regional and international organizations to develop monitoring indicators, regulatory frameworks, and management-oriented assessments. In this context, V-URN maps can provide actionable spatiotemporal information for environmental assessment and mitigation planning; however, producing management-scale maps remains challenging as passive acoustic measurements are spatially sparse and many operational systems depend on specialist workflows and costly access to wide-area vessel activity data. To address these constraints, we introduce *ShipEcho* (https://noisemaps.marble.eu/), a freely accessible web-based Geographic Information System (GIS) that provides real-time V-URN mapping using vessel data acquired through a community-based vessel activity monitoring exchange. *ShipEcho* displays estimated sound pressure levels and sound exposure levels using standard indicators, including the 63 Hz and 125 Hz one-third octave bands and a 20–2000 Hz broadband level. In our presentation, we describe the effects of V-URN on marine life and discuss how *ShipEcho* can support management-level assessment, decision-making, and policy initiatives.

Navigating the soundscape: Anthropogenic noise impacts on Cetaceans and policy recommendations for Israel's maritime environment

Mor Harnik Blum

Delphis NGO

Bioacoustics offers vital insight into marine ecosystems, especially for cetaceans that depend almost entirely on sound for communication, navigation, and foraging. Over the past century, human activities such as shipping, seismic exploration, and naval exercises have dramatically altered the underwater acoustic landscape, turning once-quiet habitats into noisy environments that threaten marine life.

This presentation, led by the Delphis Association, examines key ecological impacts of underwater noise pollution in the Mediterranean and Red Seas: masking of vital communication signals, behavioral disruptions, stress-related physiological effects and sonar-linked strandings. It will review the current lack of dedicated acoustic regulation in Israel and compare it with established international frameworks such as the EU Marine Strategy Directive and ACCOBAMS guidelines.

Building on these insights, Delphis proposes a national roadmap for managing underwater noise pollution: combining establishing "quiet zones" within Marine Protected Areas; adopting marine-specific noise thresholds; implementing quiet-ship technologies; mandating acoustic assessments for maritime projects, regulating acoustic experiments; and collaborating with the Navy for responsible active sonar use. By linking bioacoustics scientific research with targeted policy action, Israel can position itself as a regional leader in protecting its underwater soundscapes and the marine life that depends on them.

Posters

Generalization with acoustic indices: Noise limitations for predicting biodiversity

Samuel Hugo Suarez-Ronay; Yoni Belmaker; Yossi Yovel

Tel Aviv University

Passive Acoustic Monitoring (PAM) is now an essential tool for biodiversity monitoring and conservation. Acoustic indices are widely used for rapid assessment of biodiversity, but inconsistent index predictive accuracy across datasets is deterring the confidence of researchers in PAM as an indispensable complementary tool alongside visual surveys, eDNA, camera traps and satellite remote-sensing. Limited generalization of acoustic index models across domains is a recurrent issue that has prevented the reliable quantification of vocal communities. Biophony is often cited as a principal limit to the generalizability of these models, but geophony and anthropophony have increasingly been suggested as additional sources of error. In this study we aimed to assess the effects of background noise on acoustic indices, and identify possible solutions to overcome any associated noise limitations for predicting biodiversity. We used both synthetic soundscapes and field recordings, and manipulated acoustic and ecological parameters while isolating the effects of the Sound to Noise Ratio (SNR), noise types (static, non-static, geophonic, anthropophonic, etc.) and index robustness to different noise types. We then used these findings to significantly improve generalization through careful selection of model predictors, noise exposure training and a segmentation method to minimize noise limitations. The framework has wide implications for the potential of acoustic indices, model generalization across domains and wider efforts to enhance effective biodiversity monitoring. Lastly, we make our method available for synthetic soundscape generation and biodiversity modeling so that other researchers can further develop noise modeling.

First comes the Feeding, Then the Singing: Insights into Nocturnal Behavior Using Multisensor Tags

Marie Guggenberger, Ismaeel Janoo, Yossi Yovel

Sagol School of Neuroscience, Tel–Aviv University, Tel-Aviv, Israel; School of Zoology, The George S. Wise Faculty of Life Sciences, Tel-Aviv University, Tel-Aviv, Israel

Crepuscular birds must partition limited time between foraging and territorial song. We deployed multi-sensor biologgers (GNSS, IMU, and audio) on European Nightjars (*Caprimulgus europaeus*) in southern Israel. Throughout the activity period, nightjars foraged rather at dusk and sang at dawn. Birds visited discrete patches between relocation flights; within these patches, behavior followed a U-shaped temporal pattern characterized by a mid-visit decline in activity, with foraging being highest upon arrival and singing peaking prior to departure. Individual birds showed ~3× greater variance in singing than in flight, suggesting territorial strategies are more flexible and personalized than foraging and exploration efforts. Spatially, forested habitat served both behaviors. These findings provide a high-resolution template for conservation monitoring.

Using species-specific aural surveys and plot counts to study local urban habitat features correlation with bird species richness and abundance

Zacharie Alisse Stern

University of Haifa

Urban bird community composition and species abundances respond to urbanization intensity at different scales, yet parcel-scale relationships remain poorly documented. This study examines at this scale how species richness and abundance respond to canopy cover rate (CCR) and built-area rate (BAR). Due to their high variation between parcels and around them, the detectability is highly heterogeneous.

Visual (plot counts) and aural (short recordings) surveys were conducted, in two residential neighborhoods in Haifa, covering 17 and 15 sites respectively, with 10 in common. It is hence also a case study for the use of species-specific aural surveys for urban bird monitoring in a low-resources setting. Aural surveys were analyzed using vocal activity rates (VAR) derived from

BirdNET detections corrected for recall rates.

Discrepancies between aural and visual survey results on urban dweller species abundance suggest that detectability varies with BAR and CCR values. The lower the BAR, the more informational aural surveys get relatively to visual ones. High negative correlations were found between VAR and BAR (r=-0.89), likely in part due to sound obstruction by buildings. Both surveys showed urban adapter species richness and abundance to be correlated positively with CCR (r/rho=0.6-0.8) and negatively with BAR.

This study shows species-specific aural surveys can widen the range of data collected in urban bird surveys, especially for urban adapters and high CCR conditions.

Differential association of high- and low-frequency rat vocalizations with breathing and locomotion during social interactions

Yizhaq Goussha, Noemi Foà, Rishika Tiwari, Shanah Rachel John, Shai Netser, Philip Tzvi Reiss, Shlomo Wagner

Sagol Department of Neurobiology, Faculty of Natural Sciences, University of Haifa. Department of Statistics, Faculty of Natural Sciences, University of Haifa. Solomon H. Snyder Department of Neuroscience, Johns Hopkins University School of Medicine, Baltimore MD USA 21205.

Rodents, including rats, utilize vocalizations as a primary mode of social communication. While high-frequency ultrasonic vocalizations (USVs) have been extensively explored in laboratory rats, low-frequency (<10 kHz) vocalizations (LFVs) were first described only recently, and it is as yet unclear whether these two types of vocalizations are driven by the same behavioral mechanisms. This study investigates the behavioral distinctions between USVs and LFVs in socially interacting rats. In line with previous studies, we found that USVs, mostly associated with social interactions, are emitted during later stages of exhalation and involve complex respiratory modulations. In contrast, LFVs, which correlate with general arousal, occur at the onset of exhalation, show limited deviation from baseline breathing patterns, and are significantly associated with locomotion. A long short-term memory convolutional neural network (LSTM-CNN) framework was employed to analyze the relationship between vocalizations and respiration. The results demonstrate that USVs are well predicted by the breathing pattern, while

LFVs cannot be predicted from the breathing pattern alone. Moreover, LFVs shared common dynamics with the power of theta oscillations in the nucleus accumbens core, a brain area associated with motivation and emotions. We conclude that these two vocalization types represent distinct communicative and physiological phenomena. These findings advance the understanding of rodent vocal communication and highlight the possible adaptive roles of LFVs in behavioral contexts.

Dolphin whistle source separation: A bearings tracking approach using vector hydrophone

Lixing Chen

Acoustic and Navigation Laboratory (ANL), Department of Marine Technologies, University of Haifa, Israel

Associating dolphin whistles with individuals is the basis for understanding dolphin behavior and social structure deeply. In this study, we propose a self-contained pipeline for dolphin whistle separation, where each detection is represented by bearings and direct-reflection time difference (DRTD), combined with high-resolution time-frequency representation method and confidence-linked modeling, and trajectories are inferred via EM with min-cost flow for robustness. The dolphin whistles are collected at Dolphin Reef in Eilat. We believe that our method can effectively distinguish whether adjacent whistles are emitted by the same dolphin, which provides a new technical means for dolphin behavior research and conservation.

What does the reef hear? Continuous real-time monitoring of underwater noise in the Gulf of Eilat/Aqaba

Roee Diamant, Asaf Zvuloni

Acoustic and Navigation Laboratory (ANL), Department of Marine Technologies, University of Haifa, Israel ; Israel Nature and Park Authority

Underwater radiated noise (URN) is an important and increasingly recognized anthropogenic stressor in marine environments, affecting organisms from invertebrates to marine mammals. Its impacts include behavioral responses,

acoustic masking, stress reactions, and physiological changes in hearing sensitivity. Quantifying URN is therefore essential for marine nature reserve management, from establishing baseline conditions to detecting and assessing disturbance events. Existing approaches are largely based on expensive long-term acoustic recorders that require offline data retrieval and analysis. Here, we present the first continuous, real-time assessment of URN in the Gulf of Eilat using a low-cost, autonomous monitoring system. We deployed a self-made solar-powered buoy equipped with hydrophones and onboard processing, transmitting processed acoustic metrics to shore in real time. An onshore camera provides independent information on nearby vessel activity. The system enables fully autonomous operation and immediate access to a growing URN database, supporting long-term comparisons and near real-time management insights. The buoy was deployed at a depth of 8 m in the Eilat Coral Beach Nature Reserve during November–December 2025. We compare URN levels during the Hanukkah tourism period and adjacent non-tourism periods (one week), demonstrating clear decrease of 2dB on average in the soundscape across spectrum associated with human presence. Our talk will describe the system design, analytical framework, and management-relevant implications of the collected data, and present a live demonstration of real-time URN measurements.

Compression pulses in lipid membranes: Do cells communicate via sound?

Matan Mussel

Department of Physics, University of Haifa

Lipid membranes are compressible, and propagating density-pressure disturbances have been measured in nonliving lipid monolayers. At physiological conditions, the speed of sound in lipid systems is on the order of 0.1-100 m/s, much slower than the speed of sound in water or air due to the softness of the medium. Notably, these values are comparable to the propagation velocities of action potentials in excitable cells. Compression pulses in lipid membranes exhibit additional similarities to action potentials, including an all-or-nothing response, co-propagating electrical voltage changes accompanying the density and pressure variations, and annihilation of pulses upon head-on collision. These properties arise from two key features of lipid membranes: many biomembranes carry electrical charge on their head group, and they often exist close to a liquid-ordered—liquid-disordered

phase transition under physiological conditions. This raises the question of whether these similarities are more than coincidental, and whether action potentials may possess an intrinsic compressional component. If so, this would imply that non-electrical dimensions may also participate in cellular communication, information encoding, and information processing between excitable cells.

Acoustic survey for the detection of the Dead Sea Mole Cricket (*Gryllotalpa marismortui*)

Asaf Ben-David, Aviv Sarfati, Gilad Ben Zvi, Yael Miara, Eldad Hazan, Tania Bird, Amos Sabah, Ofer Steinitz, Itai Renan

The-Steinhardt-Museum of Natural History, Tel Aviv University; Israel Nature and Parks Authority; HaMa'arag

The Dead Sea mole cricket (Gryllotalpa marismortui) is an insect species endemic to the saline coastal habitats along the shores of the Dead Sea. While the species was a subject of research during the 20th century, the last recorded specimen was documented in the 1990s. For two decades, it was hypothesized that the species had been displaced or driven to local extinction by the expansion of the common mole cricket (Gryllotalpa tali). As a generalist favoring freshwater, G. tali likely benefited from agricultural development and the introduction of non-native vegetation, allowing it to encroach upon the endemic mole cricket's niche. However, its cryptic nature and morphological similarity to the common mole cricket made it difficult to confirm the specie status.

First evidence consistent with context-dependent alarm calls in bats

Yinon, Omer; Krivoruchko, Ksenia; Eitan, Ofri; Janoo, Ismaeel; National Parks and Conservation Service; Oleksy, Ryszard; Yovel, Yossi

Department of Zoology, Tel Aviv University; Department of Zoology, Tel Aviv University; Department of Zoology, Tel Aviv University; Department of Zoology, Tel Aviv University; National Parks and Conservation Service, Mauritius; Ecosystem Restoration Alliance Indian Ocean, Albion, Mauritius; Department of Zoology, Tel Aviv University

Alarm calls enable animals to warn conspecifics of imminent threats and coordinate collective responses. Remarkably, despite bats' rich social vocal behaviour, and the predation pressures faced by many of the species, no experimental evidence of such calls has been reported in this order.
Here, to our knowledge, we report the first evidence of alarm calls in the order Chiroptera, demonstrated in the Mauritian flying fox (Pteropus niger), an island endemic species that evolved in the absence of natural predators, yet now faces intense anthropogenic pressures. Acoustic analyses showed that experimentally elicited calls formed a discrete alarm vocal category, clearly distinct from spontaneous social calls. Notably, call production was context-dependent: calls were more frequent during the day, when roosting bats are relatively immobile and potentially more vulnerable, whereas at night the same stimuli preferentially elicited flight. Moreover, calls emerged only when group size reached at least four individuals, underscoring the socially contingent and flexible deployment of this signal.
Taken together, these findings broaden the known communicative repertoire of bats and highlight the need to reassess the prevalence of alarm signalling across Pteropodidae, providing a foundation for comparative work on the origins, development, and function of this communication system.

The echoic potential of social calls: a glimpse into the evolution of echolocation

Taub, Mor; Bergmann, Anja; Panyutina, Aleksandra; Goldshtein, Aya; Koblitz, Jens; Knörnschild, Mirjam ; Yovel, Yossi.

School of Zoology, Faculty of Life Sciences, Tel Aviv University, Tel Aviv 6997801, Israel; Museum für Naturkunde, Leibniz-Institute for Evolution and Biodiversity Science, Berlin 10115, Germany; Animal Behavior Lab, Free University of Berlin, Berlin 14195, Germany; Department of Ecology, Evolution and Environmental Biology, Columbia University, New York 10027, NY, USA; Department of Collective Behavior, Max Planck Institute of Animal Behavior, Konstanz 78464, Germany; Evolutionary Ethology, Institute for Biology, Humboldt-Universität zu Berlin, Berlin 10117, Germany; Sagol School of Neuroscience, Tel Aviv University, Tel Aviv 6997801, Israel.

The evolutionary origin of echolocation in bats remains uncertain. Although the chiropteran fossil record is limited and incomplete, it provides valuable insight into the sensory capabilities of early Eocene bats. Most known fossil bats already appear to exhibit anatomical traits associated with some form of echolocation, leaving the timing and process by which it developed unresolved. One prominent hypothesis proposes that echolocation evolved from ancestral social vocalizations that enabled an initially rudimentary detection system. Given that these ancestral calls are unknown, we investigated the echoic potential of social calls across extant mammalian taxa. We show that the social calls of 15 species from four mammalian orders all produced salient, detectable echoes. We further demonstrate that echoes

generated by bat social calls can occur under natural conditions and are sufficient to evoke neural responses in the bat auditory system. Finally, by examining the acoustic characteristics of social calls from 92 species belonging to eight orders, we show that the social calls of laryngeal echolocating bats possess acoustic features known to enhance echo detection, supporting the hypothesis that echolocation may have evolved through the gradual modification of social vocalizations.

Defining the Acoustic Properties of Cryptobenthic Fish in the Mediterranean Sea

Lior Naaman, Shevy Rothman

Tel Aviv University, Tel Aviv University

Cryptobenthic fishes are an important component of shallow rocky reef communities, yet their small size, cryptic behavior, and close association with complex substrates make them difficult to monitor using conventional visual survey methods. Passive acoustic monitoring (PAM) has emerged as a promising non-invasive approach for assessing marine biodiversity, but its application to cryptobenthic fishes remains limited by the scarcity of validated acoustic information, particularly in the Mediterranean Sea.
This study aims to characterize the acoustic repertoire of Mediterranean cryptobenthic fishes and establish the acoustic foundation required for future PAM applications. Field recordings were conducted in shallow rocky intertidal pools using hydrophones. Each sampling session consisted of an initial baseline recording, followed by the deployment of a baited remote underwater video (BRUV) system adjacent to the hydrophones. The baseline recording documented acoustic activity prior to experimental manipulation, whereas the BRUV was used to attract individuals into the recording area, increasing the likelihood of capturing identifiable acoustic events while synchronizing sounds with video observations. Complementary laboratory experiments employing synchronized audio and video recordings were conducted under controlled conditions to further validate sound-producing behaviors and aid interpretation of field recordings.
The combined field and laboratory approach consistently produced bait-induced feeding interactions in close proximity to the hydrophones, allowing repeated recording of feeding-associated acoustic events. Current analyses focus primarily on blenniid species, for which acoustic information remains limited. Preliminary observations indicate that synchronized video and acoustic recordings enable reliable annotation of feeding-associated sounds and their association with individual species and observed behaviors, providing the basis for the development of a validated acoustic reference library.
By integrating passive acoustic recordings with synchronized behavioral

observations, this study presents a framework for systematically characterizing the acoustic properties of cryptobenthic fishes. The resulting reference library will facilitate future automated sound classification and the evaluation of passive acoustic monitoring as a complementary tool for detecting and monitoring cryptobenthic fish assemblages in Mediterranean rocky reefs.

Military training noise in nature reserves – Is this even a problem? A case study from the Carmel nature reserve

Ori Shapira, Noam Leader

Israel Nature and Parks Authority

Anthropogenic noise pollution is a major threat to natural environments and wildlife species. In Israel, almost 50% of military firearms training grounds (MFTG's) overlap with protected natural reserves or national parks, and most of these areas are used for live-fire training. As a result, we assume an unmitigated interference with natural processes in these protected habitats, hindering their legitimate role in preserving biodiversity.

In this work, we aimed to raise awareness of this potential threat by characterizing the soundscape of a nature reserve that contains an MFTG. To do this, we deployed six passive acoustic monitors (PAMs) in the Carmel Mountain Nature Reserve, which protects dense Mediterranean forest and typical wildlife communities. On a more physical level, we analyzed Sound Exposure Levels (SEL), and Signal-to-Noise Ratios (SNR). To quantify a possible effect of the physical disturbance, we used several bioacoustics indices, comparing them between areas closer to and farther from military training grounds, and between weekdays (when training occurs) and weekends (when training does not occur) in the same area.

For each PAM, we found a significant difference in SEL between weekdays and weekends, with differences of up to 5dB(A) and 7 dB(C) in SELs (eq_{min}). When measuring the SNR of verified gunshots relative to the time directly before them, we found an SNR of 14.5 dB(fs) across all PAMs during the day, with a Max value of 20 dB(fs) in one of the PAM's. To complement this, we calculated how often an acoustic event exceeded 12 dB in 1 minute of recording (an index named EVN) and found a mean of 10 such events per minute across recorders throughout the day (05:00 to 20:00).

Using standard spherical modeling, we estimate that a large proportion of the Carmel Nature Reserve experiences acute and chronic sound levels. However, bioacoustic indices did not show a significant difference between sites closer to or farther from shooting ranges, even though we observed a gradient trend.

Our findings clearly show physical interference with the natural soundscape,

yet its effect on biodiversity (as measured by biodiversity indices) still needs further investigation. Because nature reserves and military training grounds overlap in many of Israel's protected habitats, we strongly recommend a methodical, large-scale exploration of this topic at the national level and across different habitats. We also recommend using our study site (Carmel nature reserves) as a case study to model methods that can mitigate firearms training noise in protected habitats.