IUCN BAT SPECIALIST GROUP

NEWSLETTER

VOLUME 4 • September 2019

THE USE OF TECHNOLOGY FOR BAT CONSERVATION

Dear Readers,

It is with great pleasure that we present the fourth volume of the IUCN Bat Specialist Group Newsletter. Our aim is to inform the BSG community about important bat threads and conservation strategies worldwide.

We hope you enjoy the reading,

Maria Sagot,
Editor of the IUCN Bat Specialist Group Newsletter

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Editorial

By Dr. Sharlene E. Santana

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This edition of the BSG Newsletter focuses on the use of technology for bat conservation research. The excellent articles showcasing research in this issue exemplify four major ways how technology is revolutionizing bat research: using non-invasive tools, automating data collection, and going big on data but small on devices. New tools, or new applications of existing tools, are allowing the study of live bats at a wide range of biological scales, from whole populations (e.g., LiDAR technology), to individuals (e.g., quantitative magnetic resonance, biologging), to components of the organism (e.g., NextGen sequencing of microbiomes). It is therefore an exciting time for bat conservation research, not only because of the completely novel information we are gaining from new technologies, but also because these are providing a more integrated perspective of the factors that drive bat population dynamics.

As technology rapidly advances, what lies ahead for bat conservation research? First, as many new tools are still costly, researchers may need to compare the effectiveness of previous and more modern approaches to maximize their value for studying bat populations. Second, just like genomics and phylogenetics have been revolutionized by big data, it is likely that large datasets will start transforming and creating new challenges in bat research. This will likely stimulate collaborations with other fields, including bioinformatics and data science, which will powerfully advance bat conservation research.

Bats without Borders Members: The Zambian mobilization Project and Education Program

By Bats without Borders

In case we are new to you: Bats without Borders is a small and relatively new NGO (registered in 2013), working across southern Africa to conserve bat populations. Our work is focused on four core areas: applied research, conservation advocacy, capacity building and education.

Zambian Bat Data Mobilization Project

Thanks to a Global Biodiversity Information Facility - Biodiversity Information for Development, which is an EU funding project, we had the opportunity to work with partners at the Livingstone Museum in Zambia to mobilize biodiversity data, in collaboration with international partners at the University of Stirling (Scotland), the Harrison Institute (England) and CBIO-InBIO (University of Porto in Portugal). Thanks to this program, a Zambian team travelled to Portugal to be trained by Dr. Hugo Rebelo, Dr. Raquel Godhino and the lab technician team, on Geographic Information Systems (GIS) and molecular techniques. Moreover, the Zambian bat team received training on taxonomy by Dr Paul Bates (Harrison Institute). Furthermore, in November, Dr Rebelo came to Zambian to train museum and Copperbelt University staff on GIS techniques, to facilitate open access of biodiversity data for future research and conservation strategies.

Education Program

In September 2018, we launched our first education project thanks to the crowdfunding campaign, Bat Environmental Education Project (BEEP). This funding has enabled us to employ our first education officer in Malawi and will allow us to further develop and test educational materials in schools and environmental clubs. Resources will be made freely available, and we hope to roll out a wider project after this initial pilot.

To find out more please follow us on Facebook, Twitter or LinkedIn or visit www.batswithoutborders.org

1st International Conference: Bats of Eastern Europe - Challenges for Conservation, 25-27th October, Yerevan, Armenia

By Astghik Ghazaryan

In October 25-27, 2018, the first International Conference on Eastern European Bats was held. The conference was organized by the Armenian Association of Mammologists, with financial support from EUROBATS. There were 45 participants from 12 countries: Russia, Georgia, Lithuania, UK, The Netherlands, Germany, Belarus, Ukraine, Bulgaria, Czech Republic, Slovakia and Armenia.

The aim of the conference was to bring together active bat researches and conservationists from eastern Europe countries with the primarily goal of resuscitating the dialog and mutual trust, and develop common priorities and an

agenda for future research . The abstract book is available on the conference web page.

During the meeting we established that the International Conference on Eastern European Bats will take place in Belarus in 2020.

Link to the conference
http://www.armbat.org/?fbclid=IwAR2G1294gbdz6nU5fflfyr9R-ThXjzUr0miKTn5Pt8iT9mqd6RYryZ52Kk4

Conference abstract Book
http://www.armbat.org/download/AbstractBook.pdf

Participants to the 1st International Conference: Bats of Eastern Europe - Challenges for Conservation. Photo by: T. Sekoyan

The Atlas of European Mammals planned for release in 2024 (2nd edition) - EMMA2

By Daniela Hamidović
National Atlas co-coordinator (Croatia)

The first edition of the Atlas of European Mammals was first published in 1999 and it is still available through the website www.european-mammals.org.

Distributional data is a fundamental tool for research and conservation and there is a need to update the Atlas to accurately represent and monitor the current distribution of mammals in Europe and set future priorities for research and conservation.

Thus, in 2015, members of the original editorial group proposed the idea of a second edition. After contacting mammologists across Europe, it was obvious that there was high interest, and after an editorial meeting in Rome in November 2016, the work began with funding from The European Mammal Foundation in The Netherlands.

The EMMA2 project is currently managed by a Steering Group of 11 professional scientists and conservation managers; coordinating the work of the national coordinators in 41 countries. The national coordinators are overseeing mammal surveys and thousands of people throughout Europe are contributing to the data collection.

The objectives of the EMMA2 are to determine the distribution of around 270 mammal species (out of which 45 are bats) in Europe, covering an area of 11.442.500 km². The publishing date for the second edition will be 2024. In the Atlas, each species will have a color photograph, a distribution map and a short text with general information written by a specialist.

Plecotus kolombatovici, photo by: Boris Krstinić

Knowing the distribution of mammal species is essential for their protection and hopefully will promote scientific research on mammals in Europe.

For more information, please contact the National Coordinator of your country (www.european-mammals.org/contact

Links
the EMMA2 website:
www.european-mammals.org/ž

Facebook:
www.facebook.com/EuroMammals/
http://discovermammals.org/projects/the-2nd-european-mammal-atlas/

Regional symposium "Conservation Status of Bats in the Central Europe and Western Balkan" and field training in Sarajevo, Bosnia and Herzegovina

By Denisa Löbbová

From May 31st until June 3rd 2018, the Regional Symposium "Conservation status of bats in the central Europe and western Balkan" in Sarajevo and field training in Bijambare protected area took place. The main organizer was the Center for Karst and Speleology (CKS), with cooperation of Slovak Bat Conservation Society (SON) and the Mammal Conservation Group of Birdlife Hungary (MME). The general aim of this symposium was to exchange know-how, and best practices between middle European countries and Balkan countries. More than 40 participants from 8 countries attended (Bosnia and Hercegovina, Croatia, Hungaria, Poland, Serbia, Slovakia, Slovenia and United Kingdom).

Participants to the Regional symposium "Conservation Status of Bats in the Central Europe and Western Balkan"photo by: **Denisa Löbbová**

The program was divided in four sections: bat distribution, bat ecology, bat conservation and a poster session. The coordinators were Primož Presetnik, Tomasz Kokurewicz and Henry Schofield. Useful discussions raised about various topics: new discovery of greater noctule *(Nyctalus lasiopterus)*, protection of bats in prefab buildings in Slovakia, new discoveries of Barbastelle in Montenegro, international biology camp in Rujište, promising development of bat research in Kosovo, foraging patterns of greater mouse-eared bat in Slovenia, ringing of *Miniopterus schreibersii* in Serbia, and research and protection of bats in Hungary and also bat rehabilitation.

Some of the participants created research groups and moved to the Bijambare protected landscape area for field training and to perform acoustic and mist-netting surveys in caves (Gornja Bijambarska pećina, Srednja Bijambarska pećina and Donja Bijambarska pećina) and around Jezero Lake.

The symposium and field training was supported by Visegrad Grant No. 21720391 "Lets be friendly to bats together".

Link
http://visegrad.netopiere.sk/Book%20of%20abstracts_Symposium%20Sarajevo_2018.pdf

UNEP/EUROBATS 8th Session of the Meeting of the Parties, Monte Carlo, Principality of Monaco, 8 - 10 October 2018

By Daniela Hamidović an Suren Gazaryan

The quadrennial meeting of the parties to the UNEP/EUROBATS Agreement was held in Monaco, and was attended by delegates from 30 parties, representatives of 13 non-party range states and observers from several key bat NGOs. The main decisions adopted by the parties are reflected in the resolutions:
http://www.eurobats.org/official_documents/meeting_of_parties/resolutions

The next meeting of the EUROBATS Advisory Committee will take place in Skopje, Macedonia, April 1st - 3rd , 2019. All NGOs and observers are welcome!

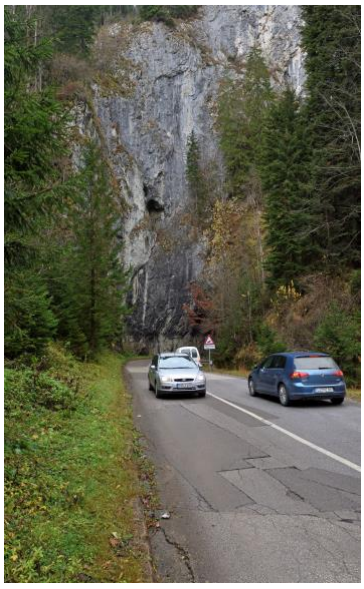
A New Traffic Sign "Bats flying – decelerate"

By Jasminko Mulaomerović

On November 3rd 2018, the members of the Center for Karst and Speleology Sarajevo set the first traffic hazard sign warning of bats in a cave. It is the first of such signs in Europe. The Signaling License was approved by the Road Directorate of the Zenica-Doboj Canton. The sign is placed on both sides of the cave / Ponikva tunnel on a regional road that runs from Vareš to the Zvijezda mountain in the Krivaja valley. This is one of the five caves in the world through which a road crosses the entire length of the cave. Ponikva Cave is home to several species of bats: *Rhinolophus ferrumequinum, Rhinolophus hipposideros, Myotis myotis/Myotis blythii oxygnathus*, *Eptesicus serotinus*, *Miniopterus schreibersii*, *Barbastella barbastellus* and *Plecotus macrobullaris*. The last two species are very rare species

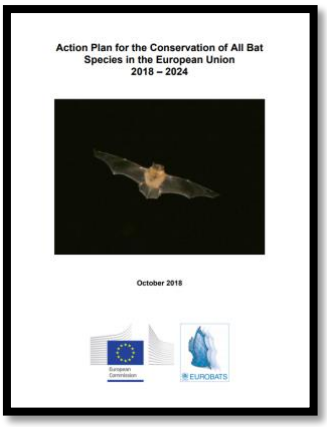
in Bosnia and Herzegovina.

The signs were set because bats have been affected by car crashes after public lighting was installed. Members of the Center for Karst and Speleology Sarajevo hope that the new traffic signs will draw the attention of drivers and void possible collisions with bats. Placing the sign financially supported by Lush Charity Pot (UK).



Action Plan for the Conservation of All Bat Species in the European Union 2018 – 2024

The EU Action Plan started to be developed by the European Commission and UNEP/EUROBATS in 2013 and was finally adopted in October 2018. A number of scientists and experts contributed to the plan, from scientific institutions, administration and NGOs. Main issues were identified and 15 main targets were developed. Targets include (1) adoption of multi/single bat species action plans developed and implemented in all EU Member states; (2) proper and sufficient number of Natura 2000 Ecological Network Sites designated for bat species especially those in unfavourable conservation status and proper management of sites; (3) knowledge on bats improved based on scientific research (population ecology, behaviour, species knowledge, migration, impact of various projects such as roads, windfarms, insulation of buildings) on local bat populations, effects of pesticides/biocides on survival and impact of forest management; (4) capacity building for assessment of bat population trends and bat conservation status; (5) decline of bat underground roosts stopped; (6) common approach to align the European building insulation schemes with bat conservation requirements; (7) Technical solutions for bat conservation implemented in all key over ground roosts; (8) Quality of bat studies in the framework of appropriate assessment and environmental impact assessment significantly improved; (9) mitigation measures applied in all new



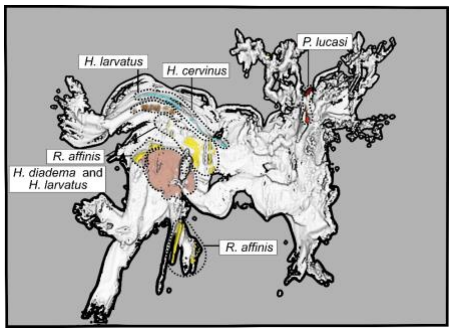
wind farm projects and old wind farms revised within Natura 2000 sites and other areas where bats are concerned in order to reduce large mortality rates; (10) developed system to monitor and mitigate road killing; (11) development of bat indicator to measure habitat fragmentation and starting any initiative to reduce fragmentation of EU landscape; (12) a common scheme/strategy is developed between EUROBATS, forest Europe and European Commission to better integrate bat conservation within forest management policies/practices since forests are key habitats for bats; (13) Define the best protocol possible concerning the use of antihelminthics/endectocides that lead to insect mortality, thus reducing prey of some bat species; (14) public health, environmental authorities and practitioners correctly informed on risks associated with viruses carried by bats and prevention measures are put in place; (15) increased public awareness and trainings and information for key stakeholders on action for bat protection responsible organizations for implementing numerous actions depending on specific target are: European Commission, EUROBATS, European Environment Agency, National and regional authorities, Conservation agencies, Batlife Europe, NGOs, Research institutions, site managers, land owners and users, European Topic Center.

LiDAR Systems Provide Efficient Means to Assess Cave Dwelling Bats and Their Microhabitat

By Nur Shafiqah Shazali and Faisal Ali Anwarali Khan

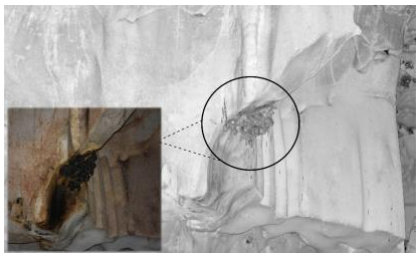
Universiti Malaysia Sarawak (Malaysia)

Detailed spatial information has become instrumental in supporting appropriate conservation efforts and sustainable decision making. In recent years, ecological studies for wildlife management have stated to use technologies traditionally developed in other fields of study. One example is LiDAR (light detection and ranging), a tool to create 3-D maps based on infrared light pulses. In the past 10 years, LiDAR have been used to determine relationships between wildlife and habitat structure.



Accurate roost site of bats that roost in Wind Cave Nature Reserve allows researchers to study habitat preferences such as roost site selection.

LiDAR provides an alternative to survey bat populations without disturbing them, as it allows scientists to study roosts in total darkness. Because LiDAR scan caves, including its inhabitants,



Bats roost in cluster becomes possible to count by using connected component labeling, a graph theory algorithm, which mostly been used in many image analysis applications.

scientists can use these images to distinguish occupied vs unoccupied caves, based on different laser intensity values from the recorded images. Additionally, a precise map showing the location of roost sites and species can be color-coded to monitor roost preferences and roost selection by cave-dwelling bats. In Wind Nature Reserve, Sarawak, Malaysia we have used LiDAR to determine cave morphology, count bats and swiftlet nests and recently, to map bat roost sites. Based on LiDAR data, now we know that the population of bats that roost in the Wind Cave have declined over the past 10 years, due to heavy tourism.

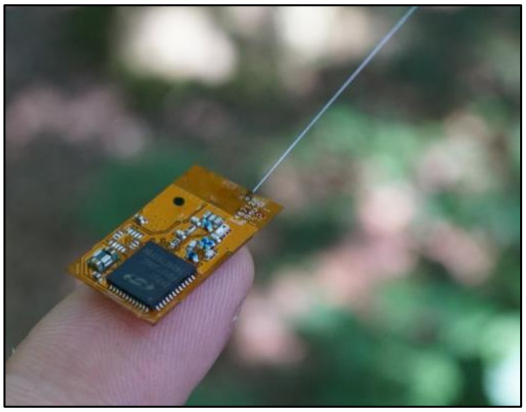
Understanding how bats use caves is important to properly manage these habitats and minimize the direct impact of tourism on bats. However, monitoring caves is challenging as they are generally complex and have different microhabitats. The use of LiDAR systems as conservation tools for monitoring and documenting bat populations will

facilitate long-term conservation efforts to protect bats.

Novel Bio-logging Technologies for Automated Tracking

By Simon Ripperger
Museum für Naturkunde, Berlin &
Smithsonian Tropical Research Institute

Humans are progressively changes the earth's appearance and land-use changes are considered the greatest threat to global biodiversity[1,2]. Successful, evidence-based conservation strategies, which aim at mitigating the negative effects of human activities and preserving high levels of biodiversity, rely on detailed knowledge on species-specific behaviour. Bio-logging, the observation of individual animals via animal-borne devices, holds great potential for species conservation.



Miniaturized electronic bio-logger developed for studying bats

Advances in bio-logging technology such as the availability of GPS-trackers allow for automated observation of large numbers of individuals at a time and provide global high-resolution movement data. A recent meta-analysis on 57 GPS-tracked species of mammals

Common noctule bat (*Nyctalus noctula*) carrying a bio-logger for encounter detection

has shown that increasing the human footprint, reduces animal vagility; thus, risking ecosystem functioning processes[3]. Besides positioning, modern electronic bio-logging devices collect complementary data on the animal's state, by built-in sensors for accelerometry, heart-rate or body temperature. Yet rarely used, such bio-loggers hold great potential for applications in animal conservation, (e.g., quantification of anthropogenic disturbance or understanding the effects of habitat selection[4]). However, despite the steady miniaturization of animal-borne tags, most devices for automated tracking of animals are still too heavy for the application in small-bodied vertebrates including the majority of bat species[5].

Our research group, funded by the German research foundation and composed of counterparts from electric engineering, computer sciences and biology (www.for-bats.de), try to overcome the technological limitations we are currently facing in tracking free-

ranging bats. During the past five years we have developed bio-loggers which are small enough for tagging a wide range of bat species (1-2g) and enable fully automated data collection including remote download over periods of 1-3 weeks[6,7]. Tagged bats can be localized at high spatial resolution, even in complex habitats, by installing a grid of receivers to study microhabitat selection in areas of interest. Direct communication among animal-borne tags can reveal social interactions among individuals of entire social groups both inside the roost and during foraging. The field of bio-logging is particularly technology-driven and current advances like the one achieved by our research team are fuelled by the developments of the smartphone and wearables industry. Interdisciplinary cooperation represents a great opportunity to create powerful tools for studying wildlife and ultimately helps to build a resilient basis for evidence-based conservation.

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The Case of Intensive Monocultures, Nectar-feeding Bats, and Next Generation Sequencing

By Priscilla Alpízar
Ulm Universität

Landscape modification for food production is a major threat to wildlife and biodiversity[1]. Costa Rica, like most tropical and subtropical countries, has suffered major changes to accommodate agricultural fields. A landscape that used to be covered in pristine tropical forests is now a heterogeneous area of intensive monocultures. The majority of which, indiscriminately use large amounts of agrochemicals to control undesired

weeds and pests without considering the effects this might have on workers and the local wildlife.

For almost 150 years, banana farming led to large-scale landscape transformations in the Costa Rican Caribbean lowlands. This crop represents the second largest in the country in terms of cultivated land and has broad economic importance due to exports[2]. Banana monocultures have flowers all year-round, and native nectar-feeding bats are often attracted to them. These anthropogenic disturbances might impose significant dietary changes on bats, which could translate in less conspicuous effects. Diet imposes a selective pressure and shapes host's gut microbiome[3]. In addition, pesticide consumption has been associated to changes in gut microbiome composition[4]. A decline of the microbial diversity in the host's digestive tract, potentially caused by a simplified diet and the presence of agrochemicals in their food resources, could reduce selected microbial functional groups as a consequence, the microbiome becomes less resistant, less efficient and more susceptible to pathogens[5,6].

In my research, I study the effects of intensive banana monocultures, and the associated agrochemical use, on *Glossophaga soricina* (Phyllostomidae: Glossophaginae) by exploring the relations between habitat alteration, diet, and gut microbiota. I combine classic diet-description techniques with cutting-edge molecular analyses to obtain results with clear conservation potential. In recent years, microbiome description has moved away from classic culture methods and closer to high-resolution molecular approaches. The use of next-generation sequencing (NGS) allows the production of extensive sequencing data at relatively low costs and with low error rates, enabling the assessment of complex microbial communities[7]. The description of the effects that intensive landscape modification and agrochemical use have on the bats' gut microbiome and their fitness, can be used to develop management plans. Together with local companies, bat researchers like me, could take actual measures that mitigate the effects that plantations have on bats, to ensure the health and fitness of local bat communities.

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Technology in the Field: Quantitative Magnetic Resonance Body Composition Analysis

By Liam McGuire

When capturing bats for research, most researchers take standard 'morphometric' measurements of the captured bat in hand. These measurements include, sex, age, forearm length, perhaps other measurements of size or morphological characteristics like ear length, and body mass. Body mass is most important for assessing the condition of an animal because it gives us some sense of 'How is this individual doing?'

When working with migrating bats, or bats preparing with hibernation, some individuals immediately catch your attention once in the hand, 'Wow, this animal has lots of fat!' Fat is the primary fuel for bats and therefore tells us a lot about both the condition of an individual we're measuring and the life history stage of the species we're studying. Because oil and water don't mix, fat stores are very dense with no associated water weight, and have very high energy density – all good things for animals that have to carry that fat while flying.

Dr. Catherine Haase uses QMR to measure body composition of a variety of species of bats to understand how they build and use fat stores for hibernation, and how that is likely to be impacted by the fungal disease white-nose syndrome. Inset: A Townsend's Big-eared Bat in the holding tube, ready to be placed in the analyzer for scanning. Main: At the bottom the holding tube is visible protruding from the antenna chamber, while Dr. Haase enters the information for the animal being scanned.

What if there was a way to measure how much fat an animal had, and not just a rough guess based on body mass? Traditional methods for measuring body condition rely on either indirect indices based on body mass of an animal or require terminal sampling to quantitatively assess the amount of fat stores.

Quantitative magnetic resonance (QMR) body composition analysis provides a novel and revolutionary way of measuring body condition of animals. In as little as 2 minutes, without any anesthesia, QMR provides a quantitative measurement of fat mass, lean mass (e.g., organs, muscles), and total body water. The internal workings of the

machine are far more complicated, but from the user perspective, it is pretty simple. You place the bat in a ventilated holding tube, place the tube inside an antenna chamber, press go, and wait 2 minutes for the numbers to pop up on the screen. With this technology, we can now be much more precise and more informed when we answer the question ''How is this bat doing?" We get an actual measurement of fat mass, but also a measurement of lean mass, all in a simple, rapid, minimally invasive, and highly accurate manner.

QMR is a rather expensive technology that is typically used in medical research settings, but with some creativity and preparation, a QMR machine can be made portable for field use. The QMR body composition analyzer can be installed in a temperature-controlled trailer, and towed out to the field site so that animals can be scanned onsite where they are captured, and then immediately released.

We currently use QMR in several projects looking at seasonal phenotypic flexibility and energetic strategies at summer maternity colonies, the energetics of migration and the role of thermoregulatory strategy and energy budgets, or hibernation energetics and questions of how different species prepare for hibernation and how they expend energy during hibernation. This latter project is especially important in the context of predicting differences in species responses to the fungal disease white-nose syndrome. Whether a summer maternity cave of Brazilian free-tailed bats (*Tadarida brasiliensis*) in Texas, migration sites where large numbers of silver-haired (*Lasionycteris noctivagans*) and hoary bats (*Lasiurus cinereus*) pass through seasonally, or winter hibernacula for little brown myotis (*Myotis lucifugus*) and a whole variety of other hibernating species, we can measure body composition onsite, in the field. As humans continue to modify the landscape, and the effects of climate change become more pronounced, the question of 'How is this bat doing?' is an important part of assessing and conserving the world's bats, and QMR is a technology that contributes an important part of the answer.

Dr. Liam McGuire is an Assistant Professor at Texas Tech University and studies the physiological ecology of animals in situations of energy limitation. He is particularly interested in migration and hibernation, and has recently become involved in several disease ecology research projects.

Obituary to Boyan Petrov (born 7 February 1973 - disappeared May 2018), IUCN SSC BSG and EUROBATS focal point for Bulgaria

By Hamidović and Suren Gazaryan

It is difficult to write of our dear friend Boyan Petrov in past tense. In Bulgaria, Boyan is a national hero and will remain one, but friends called him Sunny as he was so open and benevolent. Boyan «Sunny» Petrov was an extraordinary person in all his creeds, including our common field of bat research and conservation; and he was incredibly generous, loyal and a mindful friend. Although his acute mind and brilliant reasoning would guarantee him a glorious scientific career at the National Museum of Natural History (his permanent workplace), he never pursued any opportunistic goals or compromises. He cautiously focused his strength and vigour on two paramount issues - the protection of Bulgarian nature and alpinism.

However, his accomplishments in bat research are difficult to underestimate. In the beginning of 2000, he resuscitated bat-related activities in Bulgaria. After a long gap followed the fall of the Communist Bloc, Boyan inspired and brought up a new generation of national bat experts from various places across the country. In his role of Bulgarian delegate to the EUROBATS Advisory Committee, he was operational in many intersessional working groups sharing his unique expertise. He participated and personally organized numerous expeditions to all continents except Antarctica, and explored 450 caves. Besides bats, Boyan intensively studied invertebrate cave fauna and became an internationally renowned expert in this field, collecting more than 20 new species.

Boyan Petrov, UNEP/EUROBATS Advisory Committee Meeting, Belgrade, Serbia, 27-29 March 2017, photo by: Boris Krstinić

As the most renowned Bulgarian alpinist and climber, Boyan took the lead in a campaign against damaging developments in the Pirin National Park, a UNESCO world heritage site. He got severely injured in car accident while doing an independent environmental assessment of the motorway in the Pirin National Park. However, one year later he was back to the Himalayas. His resilience and motivation were astonishing!

Since his childhood Boyan considered alpinism as a main mission and destiny. Being a diabetic and cancer survivor he climbed without supplementary oxygen - 10 out of the 14 eight-thousanders: In 2001 - Broad Peak (Karakoram, Pakistan), in 2009 Gasherbrum I and II

(Karakorum, Pakistan), in 2014 Kangchenjunga (Himalayas, Nepal), Broad Peak and K2 (Karakoram, Pakistan), in 2015 Manaslu (Himalayas, Nepal), in 2016 Annapurna I, Makalu and Nanga Prabat (Himalayas, Nepal), in 2017 Gasherbrum II (Karakoram,Pakistan) and Dhaulagiri (Himalayas, Nepal). He fortunately had the opportunity to describe this unique experience in the book “The first seven” that he wrote in 2017.

Boyan vanished in the Himalayas in the beginning of May 2018, on his way from a base camp at 7500 metres to Mt. Shishapangma’s summit. The search and rescue mission involved organisers, Bulgarian, Nepalese and Chinese authorities. Under the international pressure, Chinese authorities allowed the use of Nepalese helicopters, for the first time in the history. Unfortunately, the mission did not achieved the goal during the first two weeks of intensive search and was discontinued due to bad weather.

For the European bat expert community, Boyan was not just a colleague. For anyone who ever met Sunny, he was a friend and a great loss. We will always miss his jokes, funny stories and warm friendly support. His soul will always stay with us and when we look upon mountain peaks we will send him our love. His legacy will live on through the young generation of Bulgarians, his brave wife Radoslava, children and the beautiful nature of his homeland.

Farewell Sunny... we salute you!