IUCN BAT SPECIALIST GROUP NEWSLETTER

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BATS AND CLIMATE CHANGE

Dear Readers,

It is with great pleasure that we present the third 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

Editorial

By Professor Paul Racey[1]

This latest edition of the BSG Newsletter focusses on the effects of climate change on bats. All contributors agree that it is a major biodiversity conservation issue.

So what do we actually know about the effects?

Northward range shifts are already evident in some European species although that runs counter to the trends forecast by some of the contributors for neotropical and Old World bats. A bat community has also moved higher up a mountain in the neotropics.

Extreme weather events such as cyclones have already brought some island pteropodids close to the brink of extinction and although some modellers predict that cyclones will be less frequent, they are likely to be more severe. Extreme heat has already killed many pteropodids in Australia and India and extreme precipitation is thought to be responsible for the recent decline in populations of one species of insectivorous bat in Europe and this may result from a decline in the availability of insect food during lactation.

If that is what we know, what can we do?

Distribution modelling suggests likely range changes and ecologists can assess the extent to which the new range may be able to meet the bats' foraging and roosting requirements, particularly for cave-dwelling insectivores.

Maintaining connectivity between existing ranges and predicted extensions is clearly vital – not only to us as bat biologists and conservationists but also to those concerned with other faunal and floral groups affected by climate change, particularly birds and butterflies.

Together we would form a more powerful lobby to influence statutory conservation bodies and governments. An interdisciplinary conference might be the way forward to agree common ground on how to mitigate the effects of climate change and how to influence land managers.

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August 2017

1. BatLife Europe's Bat of the Year 2017

By Jasja Dekker[1]

BatLife Europe is an umbrella organisation of European national bat NGO's. In 2015, BatLife Europe started an initiative called Bat of the Year. The aim of this initiative was the same as the aim of BatLife Europe itself: bats do not care for borders, so to conserve and protect them, we must look across national borders and work together. For 2016, member organizations chose the Noctule *Nyctalus noctula*. The Noctule is a bat species that occurs in a large part of Europe. It is a migratory species, it flies relatively high and hunts in open spaces, and inhabits tree cavities. So, it is a symbol of conservation issues such as the conflict between wind parks and bats, and of the importance of conservation of natural woodland. Many people can hear Noctules' echolocation and social calls by the naked ear, and in autumn it can be seen flying in the daytime. These aspects make it a species that is not only relevant as a symbol for international conservation of bats, but also makes it quite easy to engage the public, in talks, excursions and other outreach activities.

So, during 2016, BatLife Europe provided a standardized press release, a fact sheet and postcards to the member organizations. The printing of the latter was kindly sponsored by ecoObs from Germany. Our members organized special events where the Noctule was in the center of attention such as special

Photo by: Boris Krstinic

lectures, excursions for the public, or gave extra attention to the species during annual activities, such as the night of the Bat. Beside public events there was also some scientific work done. Some of participants focused on finding out if Noctules are breeding in their regions. The most widely spread activity was organized by our Austrian member, Fledermausschutz Austria, who organized country wide counting of flying Noctules. This study was joined also by some neighboring countries.

Seeing the potential of the species as Bat of the Year, and the opportunities that are for activities with this species, the trustees have decided to prolong this species as Bat of the Year in 2017. Keep an eye on our website (http://www.batlife-europe.info/) and our Facebook page (https://www.facebook.com/BatLifeEurope) for reports of activities for Bat of the Year, and other European news on bats.

[1]Chair of BatLife Europe

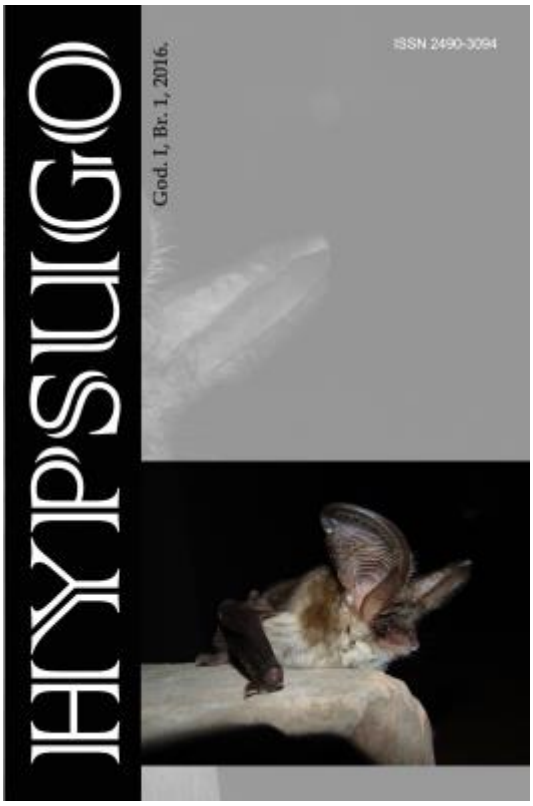
2. New bat journal: Hypsugo – Journal of Bat Research in the Balkan

By Branko Karapandža

A new bat journal has been launched in 2016: Hypsugo – Journal of Bat Research in the Balkan (Glasnik za istraživanje šišmiša Balkana). It is published biannually by several NGOs and edited by a board from across the western Balkans (Slovenia, Croatia, Serbia, Bosnia and Herzegovina, Montenegro and Albania).

The journal is the latest and consequent result of intense more than a decade long cooperation between the bat workers from the region. Annual meetings of EUROBATS Advisory Committee were crucial for a creation of this snowball which started rolling as a group of people from all ex-Yugoslav republics met and immediately found a common ground. As a bat research in the region has intensified the need for a regular publication increased and thus the first annual bulletin was launched in 2013, as Supplementum of the speleological magazine Naš krš from Bosnia and Herzegovina. Good acceptance of the bulletin and growing experience of the editorial board raised their ambitions and thus, after recruiting a few more members, Hypsugo has been born.

So far two issues have been published and freely available as printed copies and as pdf (http://www.centarzakrs.ba/bh/literatura/224-hysugo.html). All usual types of



contributions (articles, short communications, notes) presenting results of bat research are accepted, as well as announcements and reports from symposiums, workshops etc., original reviews of books and equipment, bibliographies, biographies, obituaries etc., related to bats in Balkans. Contributions are mostly in local language (all linguistic standards are accepted – Bosnian, Croatian, Montenegrin and Serbian) with abstracts in English, but manuscript in English are accepted as well.

3. Kate Barlow Award

As many of you know, Dr Kate Barlow was the former Head of Monitoring at the Bat Conservation Trust and sadly passed away in 2015. Kate and her colleague's work in developing and running the National Bat Monitoring Programme has been instrumental to our understanding of UK bat population trends and has influenced bat conservation projects around the world. The Kate Barlow Award has been set up to honour Kate's memory and to encourage the next generation of bat researchers, with the generous support of her family and friends.

The Award is open to Masters or PhD students anywhere in the world conducting research which has direct relevance for bat conservation.

An annual award of up to £4,500 will be made to one student. The Bat Conservation Trust, who administer the award, will also pay for the award winner to attend either the BCT National Bat Conference or another relevant bat research and conservation conference.

form and details on eligibility and how to apply see:

http://www.bats.org.uk/pages/the_kate_barlow_award.html

Fundraising is continuing to support this award – there is a link for donations at the same web page.

4. New publication of EUROBATS: Common names of European bat species

by Peter H. Lina.

The publication contains common names for each of 53 bat species occurring within the area of EUROBATS Agreement, which are enlisted in its Annex 1. Names are given in 50 European languages including all of the national and several regional ones.

The author, Mr. Peter H.C. Lina, conceived this amazing dictionary more than five years ago in order to help local bat researches and conservationists

with the popularisation of their results and in order to standardise the application of vernacular names in alignment with scientific ones.

This has been a tremendous work over the past years, as many names did not previously exist in a number of languages and had to be developed by national experts in sometimes lengthy consultation processes in order to meet the highest linguistic and scientific standards.

An introductory chapter explains the etymology of the word "bat" in the various languages, without doubt the most poetic expression being the "night butterfly" from Malta; it also provides insights into the etymology of generic and scientific names of individual species. Published as the EUROBATS Publication Series No.7, this new volume is dedicated to the 25th anniversary of the Agreement.

The online version of **"Common Names of European Bats"** is available on the EUROBATS website www.eurobats.org

Paper booklets can be ordered on the website via its online order form and will be shipped free of charge.

5. Educational movie: Bats need Friends

A new educational film has been created during the project "Protection of Bats in the Neretva River Catchment Area" (http://www.centarzakrs.ba/bats/o-projektu.html), in memory of Ilhan Dervović, cameraman, director and producer. The movie is in Bosnian with English subtitles and can be acceded here: https://www.youtube.com/watch?v=HY0ThceHOeI

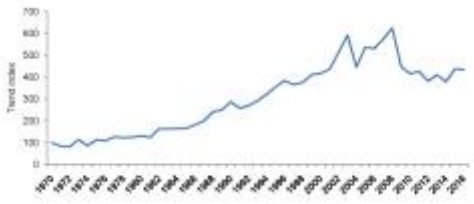
1. Bats, climate change and challenges for conservation

By Hugo Rebelo[1], Orly Razgour[2], Radek K. Lučan[3] & Daniela Hamidovic[4]

Climate change is becoming a top priority on the biodiversity conservation agenda. Little was known on the impact of climate change on bats 11 years ago and no major impact was proven, based on scarce evidence. Nevertheless, climate modelling is predicting range contractions throughout the 21st century for the majority of bat species. Moreover, recent research showed a northward spreading of suitable climate for species that formerly occurred in southern areas. Ecologically flexible species, such as *Pipistrellus kuhlii, P. nathusii* and *Hypsugo savii*, may use new space in previously unoccupied areas for increasing their distribution range. However, roost specialist such as some cave-dwelling bats, could hardly undergo such large northward expansion because caves are absent or very rare in northern areas. These predicted range shifts will likely increase the fragmentation and isolation of populations.

Female *Myotis daubentonii* lactating young, photo by: Radek. K. Lučan

In Europe, extreme precipitation during the breeding period have already caused a decreased reproductive success and drop in population size of *Myotis daubentonii*. Moreover, the predicted increase in the frequency of heat waves and drought episodes will impact the reproductive success of bats. On the other hand, the increase in extreme weather events in winter can also reduce the survival of individuals and may promote the outbreak of infectious diseases. Another potential impact of climate change on bats is on the phenological patterns of life cycles and changes in temporal patterns of food availability.



Results of analysis of long term trends of the *Myotis daubentonii* from the Czech Republic, based on winter census of 386 sites between 1970 and 2016; source: Radek. K.Lučan

Important challenges to consider when managing bat populations under future climate change are: 1) identifying non-resilient bat species; 2) identifying European areas where bat populations could suffer severe consequences; 3) genetic adaptations to local climatic conditions that can prevent populations from surviving; 4) landscape barriers to movement; 5) availability of suitable roosts and foraging habitats in new climatically suitable areas; 6) interspecific competition with bat species already present in these new suitable areas; 7) considering bats in the

future review of the Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment, as well as in Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment.

Through distribution modelling, it is possible to identify which of the currently occupied areas will still have suitable conditions for bats in the future. These stable populations can maintain the genetic pool of the species while also promoting colonisers to occupy new suitable areas that will appear at higher latitudes. These are likely to be the main source areas for dispersal of individuals to new climatically suitable areas. The potential dispersal routes towards new suitable areas must also be considered for conservation management, as well as the availability of potential roosts and suitable foraging habitats. These pre-emptive measures would promote and facilitate the establishment of new bat populations in the expansion areas. Underlining all these management guidelines it is paramount to establish adequate monitoring programs to detect species' range shifts, both in areas under contraction or expansion, and to identify sensitive species and populations at risk due to high sensitivity and exposure to climate change.

What is clear from current evidence and model projections is that climate change will be one of the major challenges for the survival of bat populations during this century. Only through the successful implementation of proactive measures it will be possible to address this potential threat.

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2. Potential impacts of climate change on bats in the Neotropical rain forest

By Manuel Rodríguez-Rocha, Bernal Rodríguez-Herrera & Sergio Vilchez-Mendoza

Climate change (CC) has been recognized as a statistical variation in the average state of climate, and its effects over vulnerable systems. After more 40 years of research on CC, the Neotropics, the Caribbean and the tropical Andes have been recognized as highly vulnerable biomes, where about the 11.6% of the endemic species could be affected and the rate of species loss will be even greater due to deforestation.

Climate change affects bat species reducing their geographic ranges, lowering reproductive rates (associated with energy cost), altering behavior, affecting competition and reducing resource availability. For instance, in savanna bats, climatic conditions will move about 281 km in relation to its current area by 2050. If bats are not able to move to new areas, or are

Release of *Artibeus jamaicensis*, bat that may has disappeared from the lowlands under climatic change scenarios RCP 4.5 to 2050. Picture: Rehbein 2016 (24).

unable to adapt to new conditions, nearly 31.6% of the species will lose 80% of the current distribution, and at least five species will lose 98% their actual range. Moreover, the thermal niches of lowland species are narrower than those of highland species. Because of CC, species from lowlands could shift their distribution to higher altitudes, leading to biotic attrition in lower areas, and increasing competition with species of medium-high areas. This will lead to declines in populations of specialist species in highlands. A study in Costa Rica shows an altitudinal increase in the range of bat species associated with lowlands, as well as an increase in altitudinal migrations of species associated with medium and high elevations. Moreover, six species showed a reduction of 60-85% of the area they can potentially occupy by 2080.

In any scenario, a reorganization of assemblies at local levels is expected, and interactions that were not previously established, such as competition or mutualisms, will emerge or increase. Specialist bats are expected to be more threatened due to increased competition. On the other hand, more generalist species could be more resilient or even be benefited by CC induced disturbance, by increasing their abundance and/or dominance. Therefore, changes at the species level may, in the long term, affect mutualistic networks and thus, ecosystem functionality. Highly connected bat species in mutualistic networks will tend to increase their distribution and abundance, with a tendency to increase competition with poorly connected bat species in the network, leading to a homogenization of the assemblies and the biotic attrition in lowlands. On the other hand, highland species with restricted distribution ranges and poorly connected in the network, may decrease their distribution, with a tendency towards local extinction.

It has been recognized that the loss of fauna reduces the capacity of natural and intervened systems to keep their functionality. This is especially true in tropical forests. Since a great proportion of plant species are dispersed by fauna, CC will generate a cascade of negative consequences.

Climate change will have a variable impact on different bat species. Poorly connected species (specialists) in mutualistic networks will show a tendency to extinction, while highly connected species will increase their population numbers and range. The effects of climate change will overtake the limits of protected areas, where adaptation and mitigation strategies must be geared towards connectivity and multifunctional landscape management.

3. The status of research on bat response to climate change

By Rachel V. Blakey[1]

Climate change is one of the great biodiversity conservation challenges of our time. Bats are widespread, diverse and fill a range of trophic roles in ecosystems. Furthermore, their reproduction, roosting and foraging behavior are strongly linked to climate. Research into the effects of climate change on bats is still sparse, though the number of studies has increased greatly in the past 5 years.

Dramatic increases in the number and severity of heat waves along the eastern coast of Australia have resulted in massive mortality events for flying foxes like the Grey-headed Flying-fox (*Pteropus poliocephalus*), credit: Viv Jones.

Shifts in species ranges dominate the literature on bats and climate change including both observations of recent (< 100 years) range shifts and predictions of future range shifts as linked to changing climates. Predictions for bats shifting their ranges by 2020-2080 have been reported for Europe, North America, Latin America and Asia, with many range contractions predicted.

An obvious question arising from the literature on bat range shifts is: what are the underlying mechanisms causing bat species to shift their range? Researchers have tackled this question by investigating how climate may affect bats through direct mortality, physiological limitations and behavioral changes. Direct mortality of bats can result from increased frequency and severity of extreme climatic events such as heat waves, cyclones, wildfires and drought. For example, over the last 100 years the number and severity of Australian heat waves has increased dramatically and this has resulted in death of tens of thousands of flying foxes (*Pteropus spp.*) with the latest mass mortality event in February 2017. Flying foxes that roost in trees are not only exposed to heat stress, but also storm events. Populations of two Pacific Island flying fox species *P. samoensis* and *P. tonganus* were reduced by up to 90% after cyclones in the 1990s. Physiological limits that may restrict bats to certain climates include: roost microclimates that minimize energy expenditure and water loss, ability to dissipate heat during flight and availability of water for drinking and foraging. Decreases in water availability due to a changing climate are likely to reduce bat survival and reproductive output. Behavioral changes can also result for changing climates, for example bats may risk predation by emerging earlier from their roosts in response to drought food shortages.

The influence of climate change on interactions between different bat species, as well as interactions between bats and other species is an understudied but fascinating field. Changes in bat food dynamics, like flowering times of plants pollinated by

bats or emergence of flying insects may strongly affect bat populations.

A study in Texas, US showed that extreme weather events reduced moth populations, potentially changing the migratory behavior of the Mexican free-tail bats (*Tadarida brasiliensis*) that rely on them. Changes in climate can also influence bat predators. Warmer climates in New Zealand are associated with large seed masting events, providing abundant food for introduced predators (rats and stoats). These predators then increase their populations and suppress populations of New Zealand long-tailed bats (*Chalinolobus tuberculatus*). Interactions between bat species are also likely to change with the changing climate. For example, as water bodies dry out and their surface area decreases, successful drinking attempts by larger-bodied less maneuverable bats decreases, as does competition with smaller more maneuverable bats. Climate change can even affect the transmission of bat calls in the air, as global temperatures increase, lower frequency calling insectivorous bats will gain an advantage as their prey detection area will increase, while the prey detection area of higher frequency calling bats with decrease. Bat traits such as generalist foraging, flexible use of torpor, water conservation abilities like urine concentration and migratory behavior are also likely to influence which bats are successful in adapting to climate change.

There is more work ahead before we can understand bat responses to climate change and take necessary steps to conserving bats in a changing climate.

The range of the White-striped Free-tailed bat (*Austronomus australis*) may be limited by the bat's ability to dissipate flight muscle heat. This may result in future range contractions to the south-eastern corner of Australia, where it has been recorded recently expanding its range, credit: Terry Reardon.

The current literature is limited by the usual geographic biases, with the majority of research from temperate zones (North America and Europe) and few studies from Africa, Latin American and the Caribbean or Asia, though Oceania is well represented. While risk assessments and conservation planning are beginning to emerge, there must be a greater commitment to partnerships between scientists and conservation managers. Now more than ever, scientists must join the fight to demand enforced global emission reductions and increased commitment to conservation from world governments to conserve our bat communities into an uncertain future.

[1]University of New South Wales, Australia

4. Tropical rainforest bats reproduction and climate change

By Nurul Ain Elias[1]

Climate change is known to alter the phenology of food resources needed to support energetic demands during reproduction. A study involving resource availability and bat reproduction in tropical rainforests shows that weather patterns increase chance of reproductive failure in bats. For instance, a prolonged and severe drought due to El Niño Southern Oscillation (ENSO) in 1997-1998, interrupted the annual reproductive success of *Cynopterus brachyotis* in Thailand during that year, but resulted in high reproductive success in the following year, due to mass flowering and fruiting. In the same drought period, fig phenology in Lambir National Park, Malaysia, was affected by drought, which led to the disruption of plant-animal interactions and resulted in the disappearance of fig pollinator wasps.

Based on data from the Malaysian Meteorological Department, Peninsular Malaysia and East Malaysia are predicted to have warmer temperatures (increasing between 1.1 – 3.6^{o}C and 1.0 – 3.5^{o}C, respectively). Moreover, rainfall is predicted to be the most important variable associated with insect biomass during the peak lactation period in bats. Projections of rainfall in Peninsular Malaysia, predict that Western areas will receive more rainfall than the east.

Kerivoula pellucida (Clear-winged Woolly Bat) carrying pup captured in Peninsular Malaysia.

Slight changes in rainfall also affect the temporal patterns of insects, altering their life cycles and reducing their populations. This will have a direct influence on bats, as insects are the main food resource for insectivorous species.

Climate change slowly alters synchronization of different biological events and causes mismatch in food availability during critical reproductive periods. This threatens survival of seasonal breeders. Different species have their own pace to adapt to changes in the environment. Bats, have a slow recovery rate if they are exposed to disturbances. Altered weather patterns will compromise reproductive success which will at the same time contribute to bat population declines. Climate change, in concert with

Lactating *Kerivoula papillosa* (Papillose woolly bat) captured in Peninsular Malaysia.

anthropogenic disturbance, will speed up the process and lead to the most critical outcome that we all worry– extinction.

[1]University of Science, Malaysia

Volunteers make valuable contributions to Bat Conservation in Nigeria

By Iroro Tanshi

Public understanding about the ecosystem role of bats is limited. In Nigeria, bats attract a lot of negative perceptions which is primarily fueled by folklore, depicting bats as witches. In Benin city, Nigeria, there is a large colony of the Straw-colored fruit bats. According to traditional chiefs from the Oba's palace, the presence of bats is traditionally considered good luck. This makes bats special items for good luck charms. This disparity in views made us realize that the public require education, which ultimately lead to changes in perception and attitude towards bats.

A volunteer team made up of 16 students (undergraduate and postgraduates) from the University of Benin, have played a valuable role in this regard and children are an excellent target audience for such conservation outreach programs. The volunteer team worked tirelessly for three weeks, planning an engaging bat outreach program for school kids. The event was held at the University Demonstration Secondary School (UDSS), within the University of Benin, Ugbowo campus, where 100 students between ages 10 – 12 attended.

Students were surprised to learn that about 90 species of bats are known to occur in Nigeria. Furthermore, children and staff were very curious about the role of bats in the ecosystem. They were further amazed to learn that common food items, such as local spices and timber trees, are pollinated or dispersed by bats.

At the end, both students and staff were excited about this workshop because it improved their knowledge about bats. It was also a rewarding time for the volunteers who were pleased to contribute to public awareness in support to bat conservation.

One of the volunteers, Juliana Labiran, presented about this experience at the Nigerian Tropical Biology Association, 4th Biodiversity Conference, where she received an award for best presentation. This award is important, as it helps to motivate people about bat conservation. As a result, multiple new students joint the volunteer outreach program and will serve as local organizers and contacts for similar bat

conservation outreach programs in the future.

Funding for the school outreach project was received from Prof L.I.N. Ezemonye and three anonymous donors. Three members of the volunteer team were sponsored by another anonymous donor to attend the Biodiversity Conference in Lagos.