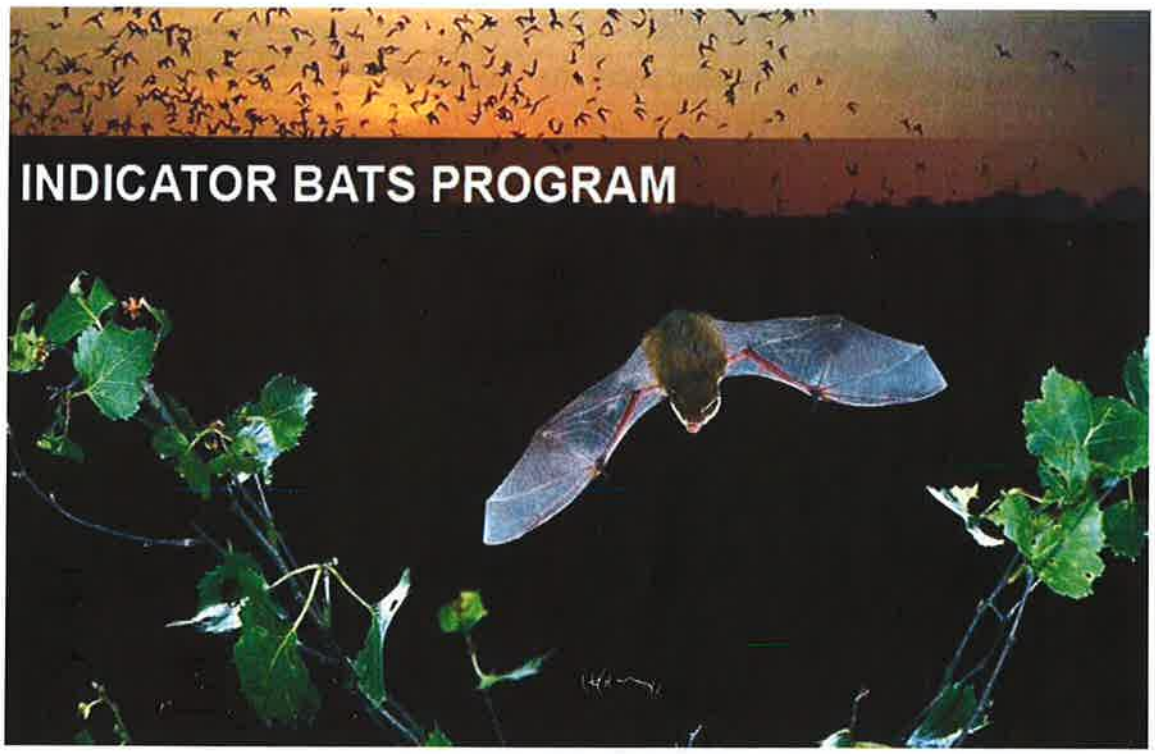
Monitoring bat biodiversity: indicators of sustainable development in Eastern Europe



Darwin Final Report: May 2006 – Aug 2009

Darwin Initiative – Final Report

Darwin project information

Project Reference	15/033
Project Title	Monitoring bat biodiversity: indicators of sustainable development in Eastern Europe
Host country(ies)	Romania, Bulgaria
UK Contract Holder Institution	Institute of Zoology, Zoological Society of London (ZSL)
UK Partner Institution(s)	The Bat Conservation Trust
Host Country Partner Institution(s)	The Romanian Bat Protection Association, The Green Balkans, The Nature Park Roussenski Lom, The Institute of Zoology: Bulgarian Academy of Sciences and The Bulgarian Bat Research and Protection Group.
Darwin Grant Value	£179,029
Start/End dates of Project	1st May 2006 – 31st August 2009
Project Leader Name	Dr Kate E. Jones
Project Website	http://www.ibats.org.uk/ and photos can be found at http://www.flickr.com/photos/ibatsprogram/
Report Author(s) and date	Kate E. Jones, Jon Russ, Colin Catto, Charlotte Walters, Abigel Szodoray-Paradi, Farkas Szodoray-Paradi, Elena Tilova and Ivan Pandourski. 30th September 2009

1 Project Background

Our project developed national bat monitoring programmes in Romania and Bulgaria (Fig. 1) in order to generate long-term data on biodiversity indicator species to assess the impact of national development and global change. Project delivery was through 74 volunteers recruited directly in-country and trained during 12 workshops or meetings.

These volunteers then recruited a total of 180 people over the project's lifespan. Our project developed monitoring protocols and training materials, a cutting edge project management web data portal, and gathered 18,360 geo-referenced bat calls from 14 species or species groups along 11,108.6 km of national road networks in Romania, Bulgaria and parts of Hungary and Croatia. With post-project funding we have extended the project further into Hungary, Ukraine and Russia.

Fig. 1. Workshop and meeting locations in Romania and Bulgaria 2006-2009 (marked as red circles, see later for details)

2 Project support to the Convention on Biological Diversity (CBD)

By generating long-term data on bats as biodiversity indicators, the project has supported the host countries to meet CBD commitments. As bats are migratory, establishing a monitoring programme also meets critical obligations under the Convention of Migratory Species. Both host countries have identified their CBD focal points: Mrs Ana Maris Comanoiu and Ms Maria Karadimova and these contacts are kept informed of the project's achievements. Our project was most relevant to CBD articles 6, 7, 8, 12, 13, 14, and 16 (see Annex 3 for relative contributions) and to five cross cutting themes, details as follows:

Article 6 - General measures for conservation and sustainable use

The project developed national biodiversity monitoring programmes for two countries in Eastern Europe. The data generated by these programmes are used to identify the status of an important indicator species and the road designs and roadside habitats that enhance wildlife populations enhancing sustainable use. Our protocols are being considered by the Environmental Executive Agency of the Bulgarian Ministry of Environment & Water as an official part of their national biodiversity monitoring program.

Article 7 - Identification and monitoring

The project has enabled host countries to identify and monitor components of their fauna that are important biodiversity indicators. Outputs relevant to this include:

We implemented national programs that generate monitoring data for 14 protected and threatened indicator bat species or species groups (Table 1). All European bats are protected under the Agreement on the Conservation of Populations of European Bats (1994) through legislation, education, conservation measures and international co-operation with Agreement members. Additionally, two species of bat recorded by this project are classified as 'near threatened' (*Miniopterus schreibersii*) or 'vulnerable' (*Barbastelle barbastellus*) on the IUCN Red List.

Family	Species	No. of Bats
Miniopteridae	*Miniopterus schreibersii*	97
Molossidae	*Tadarida teniotis*	29
Rhinolophidae	*Rhinolophus euryale*	1
Vespertilionidae	*Barbastelle barbastellus*	6
Vespertilionidae	*Eptesicus nilssonii*	340
Vespertilionidae	*Eptesicus serotinus*	335
Vespertilionidae	*Hypsugo savii*	432
Vespertilionidae	*Myotis spp.*	510
Vespertilionidae	*Nyctalus lasiopterus*	756
Vespertilionidae	*Nyctalus noctula*	1269
Vespertilionidae	*Pipistrellus kuhlii*	308
Vespertilionidae	*Pipistrellus pipistrellus*	1634
Vespertilionidae	*Pipistrellus pygmaeus*	268
Vespertilionidae	*Vespertilio murinus*	579
Uncertain		11796
Total		*18360*

Table 1. Total number of bats in different species or species group across the region from 2006-2008.

- An ongoing online international spatial and temporal database on bat species occurrences, abundances and distributions alongside road networks, allowing host countries to generate data on biodiversity indicators and establish how road design and the change in human development and climate impacts biodiversity.

Article 8 - In-situ conservation

The project has generated 18,360 bat species echolocation records across 11,108.6 km over the region. These data can be used to monitor populations of bats to identify adverse effects on biodiversity and then to identify causes. We can also use these data to identify habitats that are important to bats and model the impact of global change on these areas and wildlife populations and allow the host countries to provide environmentally sound and sustainable development.

Article 12 - Research and training

The project promoted and encouraged ecological training and research that facilitated conservation. Outputs relevant to this include:

- 11 training national workshops or meetings held over the course of the project, directly training 74 national participants in bat biology and ecology, monitoring, survey techniques, bat conservation, echolocation and acoustic analysis (Fig.2). These participants then went

on to train the rest of the volunteer network (in total 180 people) which is crucial for this project's sustainability. The protocols are all disseminated through the website.

- An online data portal (www.ibats.org.uk) for submitting, analysing and displaying iBats data allows participants easy access to these data for their research. For example, these data have been used in a number of research fellowships, PhD and Masters courses (i.e., Abigel Szodoray-Paradi's Cambridge University Student Internship in Conservation Science, the PhDs of Abigel Szodoray-Paradi, Charlotte Walters and Alice Hughes, István Csősz's MSc thesis) and to generate a number of scientific research papers.
- Additionally, our protocols, training, website and equipment have assisted other monitoring projects in UK, Belgium, France and Ireland and pilot projects were also started up in New York, Zambia, Mexico, Mongolia, Madagascar and Thailand. We also incorporated the project's innovative web portal technologies into the proposal for BCT's Pan European bat monitoring program.

Fig. 2. Colin Catto training volunteers in acoustic monitoring in Cefa, Romania, 2006.

Article 13 - Public education and awareness

The project encouraged understanding of the importance of, and the measures required from the conservation of biological diversity by raising awareness of the project and the project's results through its web portal (www.ibats.org.uk) and through 13 talks by the project staff around the world including Romania, UK, Mexico, Belgium, France, Germany and in particular an invited talk at the Pre-COP 9 scientific meeting in Bonn in 2008 (see later for full details of talks). The project has been widely disseminated through a number of different media over the project's lifetime (Fig 3). We have had coverage in national press and radio stations in Romania and Bulgaria at the start of their projects. Additionally, we have had articles in BCT's quarterly national bat conservation magazine and annual reports, ZSL's website and IoZ's annual reports and the Darwin Initiative's Newsletter. We had UK national press coverage in 2008 which was picked up online and in London newspapers. Kate Jones mentioned this project in a lecture to The Royal Geographic Society which was aired on Radio 4 on New Year's Eve in 2008.

Fig. 3. Selection of the project's media coverage.

Article 14 - Impact assessment and minimizing adverse impacts

The data generated by the project can enable host countries to develop an indicator to help measure progress towards The Convention on Biological Diversity's 2010 Target and identify the impacts of future development and global change.

Article 16 - Access to and transfer of technology

We have transferred approximately £20,000 of survey equipment (15 sets), consumables and hard discs. In addition we have transferred access to state-of-the-art web portal technologies, books, mapping and analytical software.

Cross Cutting Themes

- **The 2010 Biodiversity Target**

By establishing a biodiversity monitoring programme throughout the region we have provided the host countries with a system for identifying change in biodiversity in order for them to assess how best to meet the 2010 Biodiversity Target to reduce the loss of biodiversity.

- **Climate Change and Biological Diversity**

Our project has provided data on a group of species that are excellent indicators of global change (for example, in the UK, changes in bat populations have been accepted as headline indicators of biodiversity loss, along with butterflies and birds). Bats utilize many different habitats in the landscape, forage on a wide variety of insect prey (themselves indicators of habitat quality), are easy to monitor using echolocation calls and form a substantial part of mammalian biodiversity (a fifth of all mammalian species). The ecology of bats is also linked to environmental temperature as all European species hibernate or migrate over winter as they are dependent on the abundance of their insect prey. Bat distributions therefore can be used to assess what effect the change in climate has on biodiversity.

- **Identification, Monitoring, Indicators and Assessments** (See 2, Articles 7 & 14)
- **Protected Areas** (See 2, Articles 6 & 8)
- **Technology Transfer and Cooperation** (See 2, Article 16)

3 Project Partnerships

Partnership between UK lead institution and host country partner(s).

The Zoological Society of London (ZSL) established and developed very strong links with our Romanian and Bulgarian collaborators over the duration of the project which has developed into a network of links across the Eurasian region.

Romania. The Romanian partnership was built on an existing relationship between The Bat Conservation Trust (BCT) and The Romanian Bat Protection Association (RBPA), with the idea for the project naturally evolving from there. ZSL and BCT held an initial project meeting with Abigel Szodoray-Paradi from RBPA at the EUROBATS Inter-Sessional Working Group meeting in London in March 2006. Here we discussed the project aims and objectives and recruitment of the personnel to take part in the monitoring program, and a MoU between ZSL, BCT and RBPA was signed in May 2006. We held a training workshop in Cefa, Romania in July 2006 (Fig 2.) training 9 RBPA volunteers in acoustic bat monitoring, designing monitoring protocols for their national surveys and we provided all the necessary monitoring equipment. In November 2006, we invited Abigel and Farkas Szodoray-Paradi to represent Romania at our initial meeting with our Bulgarian partners in Ruse, Bulgaria (Fig.1), in order to facilitate networking across the region. The monitoring surveys in 2006 were successfully carried out and ZSL supported Abigel Szodoray-Paradi's successful application for the Cambridge University Miriam Rothschild Travel Bursary Programme for an internship in April 2007. Abigel visited for 3 weeks, firstly attending the Cambridge University Student Conference on Conservation Science where she presented a poster on the project and then spent the rest of the internship at ZSL. Together with BCT, we all evaluated the progress of the project, analysed the collected data and planned the monitoring for 2007.

Fig.4. Abigel Szodoray-Paradi (centre) and other RBPA volunteers designing their monitoring program in May 2007.

In May 2007, we organised a second training workshop for RBPA, providing feedback from the 2006 survey, training for 7 new participants and advanced sound analysis training for the previous participants (14 participants in total) (Fig. 4). At this meeting, RBPA took responsibility for designing and planning their surveys for their project for the subsequent years which were successfully carried out. The project had not budgeted for a further workshop in 2008, but RBPA secured further funding from The Matra KNIP (The Netherlands Embassy Matra KNIPP Programme) and the Romanian Environmental Ministry Environmental Funds Programme to hold one in Baile Herculane, Romania in May 2008, inviting a total of 19 participants (11 volunteers from previous years and 8 new volunteers). We also travelled back to Romania in August 2008 to attend the XIth European Bat Research Symposium, held in Cluj (hosted by the RBPA) and presented the results of the project at this European conference.

In May 2009, RBPA hosted the final workshop in Savadisla, Romania, the 1st International Indicator Bats Global Monitoring Workshop, with 21 Romanian volunteers attending (7 new volunteers) and inviting representatives from the Bulgarian project and from other existing international projects (Ireland, Belgium, USA, France and UK) and 11 people from the new groups in Russia, Ukraine and Hungary (Fig. 5). A total of 52 people participated in the workshop. RBPA were instrumental in writing the successful application for Post-Project funding as they are keen to establish a centre of excellence in Romania, to facilitate biodiversity monitoring across the region.

Fig 5. Training new recruits from Ukraine and Russia in Savadisla May 2009.

Over the course of the project the RBPA has developed links with a Habitat Management and Road mitigation planning project in Romania and Bulgaria funded by the Dutch government. This project looks at the implementation of roadside designs on biodiversity in the region. The Darwin project is nicely seen to compliment this initiative as the Darwin project provides data on which the project could use to inform policy makers.

Bulgaria. With advice from RBPA we visited Elena Tilova and colleagues from The Green Balkans in Plovdiv, Bulgaria in July 2006 (Fig.1) to establish their interest in becoming involved in the project. This led to a stake-holder meeting in Ruse, Bulgaria in November 2006 to which we also invited Abigel and Farkas Szodoray-Paradi from RBPA (Fig.6). At the meeting we agreed upon a working group for the Bulgarian project led by Elena Tilova from The Green Balkans and their network of volunteers with expert input from Dr. Tea Ivanova (The Bulgarian Bat Research and Protection Group and The Nature Park Roussenski Lom – our initial contact), and Dr. Ivan Pandourski (The Institute of Zoology: Bulgarian Academy of Sciences) and a MoU between ZSL, BCT and The Green Balkans was signed in December 2007.

Fig 6. Ruse, Bulgaria 2007 with our Bulgarian and Romanian partners. Elena Tilova (back left centre), Ivan Pandourski (front left) and Tea Ivanova (front centre).

In May 2007, The Green Balkans organised their first training workshop in Tabachka inviting 21 volunteers from the participating institutions which strengthened host country capacity by building links between these organisations and unifying them under the same project. Our Bulgarian partners designed and planned their surveys for the subsequent years of the project which were carried out very successfully. In May 2008, we held

the second Bulgarian workshop in Shkorpilovzi (Fig.1), providing training for 11 new volunteers and feedback to the volunteers from 2007 surveys, with additional lectures on more general aspects of bat biology and conservation (a total of 24 participants). More advanced sonogram analysis training was carried out in Sofia for Dr Ivan Pandourski, where we also met with the Bulgarian ministers to establish the program as part of their biodiversity monitoring. 10 Bulgarian project partners attended the final international workshop in Savadisla, Romania in May 2009.

Partnerships between other UK or regional partners.

The Bat Conservation Trust. The partnership between ZSL and BCT brings together excellent science and volunteer management skills to create a unique citizen science project which neither organisation could deliver separately. The relationship between these organisations is excellent and regular meetings were held to review project progress (principal project members from BCT were Drs Colin Catto and Jon Russ). Due to the Darwin's project's success formal links were made between the existing Bats and Roadside Mammals Survey (BRMS) in the UK, run by The Mammals Trust UK and BCT into the wider 'Indicator Bats Program' (iBats). The data generated by BRMS throughout the UK uses the same monitoring techniques as in Romania and Bulgaria. In April 2009, these UK data were formally added into the project's online portal and incorporated into the Indicator Bats Program (and renamed iBatsUK). ZSL and BCT's involvement has grown beyond the project, with Dr Kate Jones acting as a scientific advisor on a project developing a Pan European monitoring program for underground sites and setting up Bat Life Europe. She also took a lead role in developing bats as headline biodiversity indicators with BCT for UK Government's SEBI2010 Indicators and is now Vice-Chair of the BCT's Board of Trustees.

Europe and Beyond. The project made good progress extending the project outside Romania and Bulgaria under the auspices of iBats. In particular, we advised on monitoring protocols for similar projects being set up in Brussels (Belgium) and France. We also started up pilot bat monitoring projects in 2007 using this technique in Hungary and Croatia (as part of the Romanian monitoring project). We also started similar pilots in 2008: those in Madagascar (Dr. Richard Jenkins, Madagasikara Voakajy), Mexico (Dr. Griselda Segura, University of Campeche) and in Kasanka National Park, Zambia with funds from ZSL. Pilots in New York (Dr Chanda Bennett, American Museum of Natural History) were funded by Black Rock Forest Consortium, New York, Thailand (Dr. Sara Bumrungsri Prince of Songkla University) funded by British Ecological Society and EDGE and in Mongolia were funded by The Darwin Initiative) (Fig.7). In May 2007, ZSL organised an international workshop (funded by Conservation International, $25,000) on developing global bat monitoring protocols in Conservation International's Tropical Ecology Assessment and Monitoring (TEAM) sites (www.teaminitiative.org). We successfully applied for a post-project funding to continue the monitoring in Romania and Bulgaria for a further two years and we have extended the project to Hungary, Ukraine and Russia. Surveys were carried out between July-September in 2009.

Fig 7. Locations of iBats transects over the world from 2006-2009 (taken from www.ibats.org.uk).

Other Collaborations. ZSL has built its own capacity as a project leader by adding value to the existing proposal through several NERC PhD studentship projects and other collaborations. Alanna Maltby's PhD project (ZSL & University College London) develops a global echolocation call database (EchoBank) which will help identify species collected within the project. Alice Hughes (Bristol University) and Charlotte Walters (ZSL & Kent University) will investigate building ecological niche modelling of the distribution and abundance data collected. A small

grant from The Centre for Ecology and Evolution in London (£2,500) started collaborations with Dr. Jonathan Krieger and Prof. Norman Macleod from The Natural History Museum to develop new ways of classifying echolocation calls, and Dr. Stuart Parsons (University of Auckland) took a sabbatical at ZSL to transfer these new techniques into an automatic identification system. We have submitted a NERC research proposal to extend this area further (Proposed £440,000). A prize awarded to Dr. Jones from The Leverhulme Trust (£70,000) has enabled a further development in equipment to occur, namely the development of a data recording device based on the iPhone in collaboration with Birkbeck (University of London) and further development of the website in the next couple of years.

Partnership lessons, strengths and challenges.

At the start of the project, we were concerned about the possibility of insufficient volunteers in Bulgaria to implement the project. Our approach was to discuss the difficulty with our Romanian colleagues who identified an appropriate Bulgarian NGO (The Green Balkans) to approach. We arranged and had meetings with The Green Balkans who agreed to become a partner in the project and provide volunteers while our original contact remained onboard as a scientific advisor. Despite having no prior experience working with bats they were extremely interested and enthusiastic about the project. This was a successful approach that overcame the difficulties we faced. The experience demonstrated that it is important to start slowly and to work with NGOs who have established volunteer networks and are effective people managers rather than with single individuals and academics. It also demonstrated the importance of developing regional centres of excellence which can then use their existing contacts to develop monitoring networks.

The project far exceeded expectations with many additional transects being completed by the volunteers. The sonogram analysis proved to be a real bottleneck to this type of monitoring programme and therefore one of the challenges was train enough volunteers to carry out the analysis and to develop new analytical techniques to process these data. During the project we held extra training sessions and additionally diverted funding to employ a full-time sonogram analyser. Another real strength of this project was using cutting-edge web portal technologies to enable our project partners to manage their volunteers and store, manage and analyse their data over the web. Without the web portal, this project would not have been possible.

4 Project Achievements

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

This project generated data on distributions and abundances of biodiversity indicator species. Trends in these data can be used to inform policy makers about the state of biodiversity and their success in meeting CBD 2010 (and beyond) targets. These data also increase understanding of the causes of biodiversity loss and help to predict possible future loss under different global change scenarios which will help to minimise the impact of human development and climate change. By generating biodiversity along road-networks, the project has also raised awareness of the variety of biodiversity that can exist along well-designed roads. Reports of the initial baseline bat distribution data along roads and their habitat and environmental associations will inform the National Road Authorities as to best practices for road design to maximise biodiversity.

4.2 Outcomes: achievement of the project purpose and outcomes

The project achieved its stated purpose. The project has established an annual biodiversity monitoring programme across this region, using a network of 180 volunteers using innovative acoustic techniques to monitor bats across 11,109 km in Romania, Bulgaria and parts of Hungary and Croatia. The project has developed the capacity of volunteers in two national NGOs (The Romanian Bat Protection Association and The Green Balkans, Bulgaria). 12 training in-country workshops or meetings were held over the course of the project, directly

training 74 participants in survey techniques and acoustic analysis. These participants then went on to train the rest of the volunteer network which is crucial for project sustainability. 15 sets of acoustic monitoring equipment were donated to Romania and Bulgaria providing much needed capital investment in equipment. The project has generated 18,360 geo-referenced calls from 14 different bat species or species groups across the region with an encounter rate of 1.65 bats per km. The original targets of 10 volunteers and 200 km of transects were far exceeded and the project has been enormously successful. We have also developed a cutting edge data management system for this project which allows these data to be stored, managed and analysed through a web interface. We have also launched a global bat monitoring programme (iBats) from this project's original idea gaining over £158,000 of additional funding which allowed the program to be piloted to 6 further countries. With Post-Project funding (£197,000) we have extended the project for another two years and expanded the project into Hungary, Ukraine and Russia. The results of this project have been presented at international conferences across the world and were highlighted in the Pre-COP 9 scientific meeting in Bonn in May 2008. The innovative project data management system has been adopted by EUROBATS as part of its Pan European bat underground site monitoring programme.

4.3 Outputs (and activities)

Project outputs 1-3 were achieved extremely successfully. Due to the enormous success of the project, the amount of data collected was three times the original estimate. This has led to delays in the analysis of the sonograms and the habitat modelling. However, the sonogram analyses were completed in Aug 2009 and the write-ups are now in progress.

Project Outputs: (1) Establishment of statistically defensible long-term monitoring protocols for Romania and Bulgaria

Monitoring and sound analysis protocols were designed in 2006-2007 and were posted online for all project participants in English (www.ibats.org.uk). The Bulgarian collaborators recognised a need within their volunteers for a Bulgarian translation and provided volunteers with a translated handbook for the training workshop in 2007 (Fig.8). All equipment was bought, tested and transferred in 2006 (8 sets) to Romania and in 2007 to Bulgaria (7 sets plus 1 heterodyne detector) (Fig.9). Bulgaria requested one less set of equipment so that they could spend the money on general bat biology books and a web site for bats in Bulgaria (http://greenbalkans.org/prilepi/index.php). During the workshops, each country designed their own monitoring programmes and successfully carried them out in subsequent years (2007-2008). Their designs were unique to each country, based on how many volunteers they could recruit and maintain, country size and accessibility and the statistical power that the results could provide (i.e., the number of years it would take to generate enough data to detect significant trends in population densities).

Fig. 8. Bulgarian protocol handbook

Fig. 9. Transferring iBats Equipment to RBPA in Cefa, Romania, 2006.

Project Outputs: (2) Network of host country personnel trained in monitoring techniques, equipment and analysis

We held 12 meetings and workshops from 2006-2009 (Table 2) (Fig.10), directly training 74 nationals and the host countries recruiting and training an additional 74 people during the surveys in the subsequent years, so generating a network of 180 trained volunteers across the region.

Date	Place	Type	Volunteers Trained	New Volunteers Trained
Mar 06	EUROBATS Inter-Sessional Working Group, London	Meeting	-	-
July 06	Cefa, Romania	Workshop	9	9
July 06	Plovdiv, Bulgaria	Meeting	-	-
Nov 06	Ruse, Bulgaria	Meeting	-	-
April 07	ZSL, London	Internship	1	-
May 07	Cefa, Romania	Workshop	14	7
May 07	Tabachka, Bulgaria	Workshop	21	21
May 08	Baile Herculane, Romania	Workshop	19	8
May 08	Shkorpilovzi, Bulgaria	Workshop	24	11
May 08	Sofia, Bulgaria	Workshop	1	-
Aug 08	Cluj, Romania	Conference and meeting	-	-
May 09	Savadisla, Romania	Workshop and conference	18 (total attendance 52)	18

Fig 10. Colin Catto training a Romanian volunteer in Cefa, Romania 2006.

Table 2. Workshops and meetings held and volunteers trained between 2006-2009.

Project Output: (3) Ongoing online international spatial and temporal database on bat species abundances and distributions alongside road networks

We created a state-of-the-art web portal database in which to host and manage this project (www.ibats.org.uk). The database is hosted within an ASP.net framework and this allows users to upload their survey data and download and analyse their collected data. It also allows project leaders to manage their projects, volunteers and report on progress by downloading their data directly from the web portal. A total of 304 transects have been surveyed for bats from 2006-2008 covering 11,108.6 km across the region (Fig.11). These data have been uploaded to the web portal and are accessible by the project participants. Routes which were repeated every year in July and August can be used to monitor population abundance trends over time. Across the region there have been 153 different routes surveyed and 46 of these have been repeated in July and August (Table 3).

Fig.11. Locations of 153 routes surveyed in Romania, Bulgaria, Hungary and Croatia. See Table 3 for a detailed breakdown (taken from www. ibats.org.uk).

Power analysis based on the UK Bats and Roadside Mammals data estimated the number of monitoring years needed to detect statistically significant trends in populations (red alert 50% decline, amber alert 25% decline) (Table 4). Comparing Tables 3 and 4 suggests that statistically significant declines can be detected within 3.9 and 5 years (for a Red alert) and 10.4 and 13 years (for an Amber alert) across the region as a whole (assuming the detectability of bats in this region is similar to UK pipistrelles). Within each country, the figure is higher, approximately 6.8 years (Red alert) and 13.7 and 16.5 years (Amber alert). These analyses

are very useful to guide the choices of host countries of where to focus their survey efforts. For example, Romania might decide that it would be more cost effective to focus more effort on increasing the number of monitoring routes in their program.

Region	Yr1 06 (km)	Yr2 07 (km)	Yr3 08 (km)	Total (R/M)
Romania	16 (519.7)	52 (1841.8)	58 (2054.4)	126 (4415.9) (79/17)
Bulgaria	-	74 (2733)	88 (3364.5)	162 (6097.5) (67/27)
Hungary	-	8 (298.6)	7 (264.9)	15 (563.5) (6/2)
Croatia	-	1 (31.7)	-	1 (31.7) (1/0)
Total	**16 (519.7)**	**135 (4905.1)**	**153 (5683.8)**	**304 (11108.6) (153/46)**

Table 3. No. of transects per year. R/M distinguishes between the no. of different routes (R) and no. of monitoring transects (M).

Monitoring Routes	20	30	40	50	70
Amber Alert	16.5	13.7	13.2	10.4	7.5
Red Alert	6.8	6.8	5.0	3.9	<3.1yrs

Table 4. No. of years needed to achieve 80% power to detect population declines in common pipistrelles (*Pipistrellus pipistrellus*) in UK, with a given no. of monitoring routes.

Project Output: (4) Knowledge on how road design and the change in human development and climate impacts bat biodiversity

Due to the enthusiastic response from both host countries, three times more roads were surveyed than we originally planned (11,108.6 km compared with 400 km). Each 1.5 hour transect generated one sound file that takes a trained person up to 8-10 hours to analyse. Analysis involved manually finding bat echolocation calls in these ultrasonic time expansion recordings and measuring their standard parameters (peak minimum and maximum frequency, duration and call shape). We generated an interface on the web portal to allow sound files to be downloaded and the results entered online by volunteers. Identifying bat species from echolocation calls is challenging and we used published literature to create an online key using call shape and peak frequency which automatically generated a taxonomic estimate. 304 transects were driven and from these 274 could be used for analysis (the other 30 files have not yet been uploaded or there was a problem encountered when transferring the files onto our system). From these 274 transects covering 10,032.92 km, we identified 18,360 calls. These calls were automatically geo-referenced by the software in the web portal by obtaining the location from the accompanying GPS file. We have identified 6,564 individual calls to species or species group, while for 11,796 calls the identity was uncertain (i.e., split between one or more species or genera) (Table 5).

Family	Species	Romania N =107/126	Bulgaria N =153/162	Hungary N= 13/15	Croatia N=1/1
Miniopteridae	*Miniopterus schreibersii*	39 (0.010)	52 (0.009)	4 (0.008)	2 (0.063)
Molossidae	*Tadarida teniotis*	9 (0.002)	18 (0.003)	0 (0)	2 (0.063)
Rhinolophidae	*Rhinolophus euryale*	0 (0)	1 (0.000)	0 (0)	0 (0)
Vespertilionidae	*Barbastelle barbastellus*	1 (0.000)	5 (0.001)	0 (0)	0 (0)
Vespertilionidae	*Eptesicus nilssonii*	203 (0.054)	113 (0.020)	23 (0.047)	1 (0.032)
Vespertilionidae	*Eptesicus serotinus*	85 (0.023)	228 (0.040)	21 (0.043)	1 (0.032)
Vespertilionidae	*Hypsugo savii*	96 (0.026)	314 (0.055)	8 (0.016)	14 (0.442)
Vespertilionidae	*Myotis spp.*	320 (0.085)	151 (0.026)	31 (0.064)	8 (0.253)
Vespertilionidae	*Nyctalus lasiopterus*	559 (0.149)	169 (0.029)	28 (0.057)	0 (0)
Vespertilionidae	*Nyctalus noctula*	499 (0.133)	734 (0.127)	34 (0.070)	2 (0.063)
Vespertilionidae	*Pipistrellus kuhlii*	52 (0.014)	246 (0.043)	0 (0)	10 (0.316)
Vespertilionidae	*Pipistrellus pipistrellus*	435 (0.116)	1179 (0.205)	2 (0.004)	18 (0.569)
Vespertilionidae	*Pipistrellus pygmaeus*	179 (0.048)	70 (0.012)	11 (0.023)	8 (0.253)
Vespertilionidae	*Vespertilio murinus*	231 (0.062)	322 (0.056)	23 (0.047)	3 (0.094)
Uncertain		*5603 (1.492)*	*5649 (0.981)*	*449 (0.920)*	*95 (3.002)*
Total		**8311 (2.213)**	**9251 (1.607)**	**634 (1.299)**	**164 (5.182)**

Table 5. Number of encounters (encounters per km) for 14 species or species groups in 4 countries recorded in 274 transects from 2006-2008. N = number of transects analysed out of total number surveyed.

Nyctalus noctula (noctule bat) and *Pipistrellus pipistrellus* (common pipistrelle) had consistently the highest abundance along roads across this region with the abundance of calls per km

broadly consistent across countries (Croatia's higher abundance is probably confounded by small sample size) (Table 5). Comparing the data collected using the same techniques in the UK, we find similar call encounter rates per km (*Barbastelle barbastellus*: 0.001, *Eptesicus serotinus*: 0.026; *Myotis spp*: 0.032; *Nyctalus noctula*: 0.048). Interestingly, the densities of common (1.009) and soprano (0.337) pipistrelles (*P. pipistrellus* and *P. pygmaeus*, respectively) are much higher in the UK in comparison to this region. This is the first time that comparisons in bat abundances have been possible and demonstrate the power of the monitoring program.

Due to the time consuming nature of the analysis, the sonograms were not completely analysed until August 2009. We are only now beginning to investigate these data to answer the following questions: 1) What are the habitat and climate associations of different species and what recommendations can we make in road designs to maximise biodiversity; 2) How will the distributions of these species change with global climate and human development and; 3) How are populations changing through time? We are currently writing up the project's protocols and initial results in a joint paper with all the project partners (Jones *et al*. Monitoring ultrasonic biodiversity: using bats as biodiversity indicators. In: *Biodiversity monitoring and conservation: bridging the gaps between global commitment and local action* (eds. Collen *et al*.) Blackwell Press, London). Alice Hughes (PhD student, Bristol University) is carrying out Ecological Niche Factor Analysis modelling on the species distributions generated from these data to understand species habitat and climate associations (Fig.12).

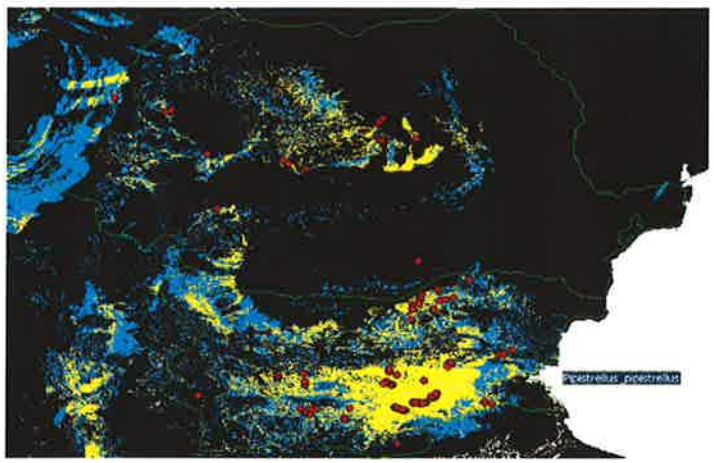


Fig.12. Ecological Niche Factor Analysis for the common pipistrelle (*P. pipistrellus*) across the region. Red dots indicate call locations from transects, yellow, blue and black areas represent predicted suitable, marginal and unsuitable habitat, respectively.

Charlotte Walters (PhD, ZSL/DICE) will be investigating these questions in her analyses for her PhD thesis starting 1st October 2009.

Future Challenges. We highlight a number of challenges facing this project and its future sustainability. *Equipment*. The equipment kits we currently use are complex to put together and to explain in other languages and we have experienced the loss of the data from a number of transects due to this problem. To address this, we are developing an application for the iPhone which can be directly attached to the ultrasonic detector and the geo-referenced sound files will then be automatically uploaded onto the web portal. *Sound Analysis*. The most expensive and unsustainable part of the project is the time consuming nature of the sonogram analyses. We are addressing this by working on automatic methods of identifying and extracting calls from long sequences with Dr. Stuart Parsons. These algorithms can then be built into the web portal and call parameters extracted automatically once uploaded. *Species Identification*. Over half the calls recorded could not be identified to species. We are addressing this in several ways by building a global call library of calls from a network of collaborators (EchoBank) so that we have a reference set to compare against, and working with Dr. Jonathan Krieger and Prof. Norman Macleod on better ways of parameterising calls. Then with the help of Dr. Parsons, we hope to build a neural classification network based on these new parameters to identify these calls more accurately. We hope to include these algorithms into the iPhone application in the future to give real time analysis of surveys to the volunteers in the field. These projects are being funded by a Post-Project follow up funding from The Darwin Initiative, a NERC PhD studentship, sabbatical leave for Dr. Stuart Parsons, a Leverhulme Prize for Kate Jones, CEE small grant and we have a NERC research grant submitted and in consideration.

4.4 Project standard measures and publications

(See Annexes 4 and 5)

4.5 Technical and Scientific achievements and co-operation

The project has developed an innovative method of monitoring ultrasonic biodiversity to deliver regional and international sustainable monitoring programmes to track the occurrences and abundances of bats – an important indicator species. This method combines novel methodologies in recording geo-referenced ultrasonic calls (Fig. 13), a cutting-edge web portal management system to manage, store and analyse data (Fig. 14), within existing volunteer networks. This project enhanced existing networks and strengthened in-country capacity in ecological research by providing training in bat ecology and evolution, ultrasonic technology, analysis software and applications and conservation.

Fig 13. iBats monitoring equipment.

We have for the first time provided host countries a valuable means of rapidly generating biodiversity data across large regions at minimal cost, generating over 18,360 species records over the course of the project. We have created objective methods of classifying echolocation calls to species within Europe for use in this project and these will be developed further in the future and applied to this project (i.e., through EchoBank and innovative methods of classifying calls).

Fig 14. iBats web portal (www.ibats.org.uk)

We have provided each country with technology which they can use to monitor ultrasonic biodiversity and training in its use and application. We will be developing this technology in the future to increase the usability of these devices (i.e., through an iPhone application). All the project's data and protocols have been made to the project's participants and analysis of these data are ongoing with the project partners. We have encouraged a number of students and internships within the UK and host countries.

4.6 Capacity building

The project has increased the capacity of host countries for further biodiversity work through a number of methods: 1) Transferring ultrasonic biodiversity equipment to host countries, this equipment can be used in other projects and consultancies; 2) Training existing volunteer networks in bat ecology, biology, conservation, monitoring, ultrasonic equipment and analysis (Fig.15); 3) Enhancing and expanding existing networks by recruiting more people into their networks through this project; 4) Establishing new networks across the region between countries to gain a stronger voice internationally for biodiversity conservation; 5) Publicising the work of host countries to international conservation organisations to enhance host country's reputation and commitment to conservation; 6) Generating a sustainable monitoring program to monitor biodiversity indicators; 7) Generating 18,360 bat species records across 11,108.6 km across the region.

Fig 15. Kate Jones lecturing to volunteers from The Green Balkans in Shkorpilovzi, Bulgaria 2008.

ZSL has effectively built its own capacity as a project partner, by setting up the iBats programme and inviting other countries to be involved and by developing other research projects and developing other funding initiatives (see earlier Project Partnerships section).

4.7 Sustainability and Legacy

Sustainability. This project was built on existing networks of volunteers, providing them with training and equipment. These networks will still exist after the project funds are finished. Host countries have the equipment and skills to continue to deliver national monitoring programmes. The main barriers for sustainability are the complexity of the equipment and the time consuming and technical nature of the sonogram analysis. We have initiated several projects from different funding sources to tackle this problem, including a 2 year follow-on project with funding from The Darwin Initiative. The aim at the end of the follow-on period is to have a monitoring program that is cheap and easy to perform and can be carried out sustainably by volunteer networks into the future. Both Romania and Bulgaria are Parties to the EUROBATS Agreement and a fundamental obligation of EUROBATS is to establish monitoring programmes for bats. Both host country managers are in discussion with their EUROBATS representatives to try and get the project officially recognised and hopefully this may lead to long term government support

Legacy. The project leaves a legacy of enhanced volunteer networks able to monitor bat biodiversity, and the necessary equipment and over 18,000 geo-referenced bat records across this region. The project has raised the profile of bat biodiversity monitoring at governmental levels through both the RBPA securing some matched funding from the Romanian Government to contribute to this project, and developed links with a Habitat Management and Road mitigation planning project for both Romania and Bulgaria.

5 Lessons learned, dissemination and communication

Lessons learned. It was critical to build the project into the activities of an existing country NGO that had access to a network of potential volunteers and is stable within that country. We feel that this is the only way of developing sustainable monitoring networks that can deliver long-term monitoring data. This design has, in our view, been critical to the success (as evidenced by the number of transects driven) of the project and could serve as a good example for future volunteer programmes. We did not require the volunteers to be able to identify species in the field as recordings on transects were recorded for later analyses. This reduced the barriers to participating in the project so that anyone who wants to become involved in bat conservation has access to a vehicle and receives training and equipment can participate. This enabled volunteers to make a significant contribution to bat conservation with relatively little training.

The sonograms collected are then later analysed, not necessarily by volunteers that participated in the surveys. Thus the project design enables different levels of commitment from volunteers and this makes it attractive to volunteers with a wide range of abilities. This means that large datasets can be delivered over a short period of time with quality-assured data that results in robust monitoring.

Critical to the success of the project is the host country volunteer managers who recruit and manage the volunteers, organise training workshops and take the project to a wider audience. Both host country managers have made an immense contribution through recruitment and excellent management of committed volunteers and this has been central to the smooth running of the project enabling the UK partners to concentrate on transferring the necessary skills and knowledge effectively. The project management across this many people and countries would not have been possible without the development of the online web portal and the direct feedback this gives to volunteers. The web portal has been an invaluable tool in this project and was originally completely underfunded and under-resourced.

The success of the volunteer productivity has produced some challenges for the project, namely in the increase in the number of transects driven and the subsequent increase in sonogram analysis and training required. The two management systems in the project model designed to deal with sonogram analysis (i.e. development of online database and recruitment/training of volunteer sonogram analysers), have been strained with the vastly

higher than anticipated number of transects surveyed. However, we are confident that we can address this issue over the next few years with new technological and analysis protocols.

Dissemination and communication. We have disseminated the project to a wide audience of scientists, conservation policy makers, NGOs and to the wider public. Project staff have presented talks at 13 venues around the world over the course of the project (see details below, Fig.16) and we have used the success of the project to generate more funds and publicity in the national media of the UK and host countries. As the project is ongoing, dissemination and communication will continue.

Fig.16. Kate Jones at the Earth Watch Species Debate, London 2008.

Venues: Nov 2006: National Romanian Bat Conference, Cluj, Romania; *March 2007*: Student Conference in Conservation Science, Cambridge, UK. *August 2007*: 15th International Bat Conference, Merida, Mexico. *Sept 2007*: Bat Conservation Trust's National Bat Conference, Reading, UK. *Nov 2007*: Microsoft Research Laboratories, Cambridge, UK. *Feb 2008*: Museum of Natural History, Paris, France. *April 2008*: Belgium Bat National Conference, Brussels, Belgium. *May 2008*: Pre-COP 9 scientific meeting. 'Biodiversity Research – Safeguarding the Future'. *August 2008*: XIth European Bat Research Symposium and EUROBATS Meeting, Cluj-Napoca, Romania. *Nov 2008*: Earth Watch Species Debates, Royal Geographic Society, London, UK. *March 2009*: Department of Zoology, Cambridge University, Cambridge, UK. *June 2009*: Max Planck Institute of Ornithology, Germany. *July 2009*: Biodiversity Monitoring and Conservation Symposium. Zoological Society of London, London, UK.

5.1 Darwin identity

The Darwin's Initiative's involvement in this project has been highlighted in every publication, website, press release and talk about this project. We gave out Darwin information, stickers and badges to all project participants at the start of the project. Many volunteers have Darwin stickers attached to their cars used for monitoring and all project equipment has a Darwin logo sticker on it (Fig. 17).

Fig.17. Recognition of Darwin Initiative's involvement in this project (left: car stickers, middle: equipment stickers and right: workshop in Tabachka, Bulgaria 2007).

The Darwin Initiative support was recognised as the main donor in a larger programme (iBats Program). Within each host county The Darwin Initiative is now familiar with their NGO and their donors, supporters, volunteers and government policy makers.

6 Monitoring and evaluation

Changes to the Logframe. There were only a few minor changes to the original log frame. We spent £4000 less on equipment because we diverted the money into web portal design. We also budgeted for a final project workshop in May 2009 for the Romanian and Bulgarian volunteers. Instead we used the budget from the post-project funding to host a larger more

international workshop in May 2009 in Romania and we freed this original budget to pay for Ms. Charlotte Walters to analyse all the Romanian sonograms. Our end date for the project (May 2009) was shifted until Aug 2009 to allow time for the analysis. All these changes were approved by The Darwin Initiative.

Darwin Initiative Monitoring & Evaluation System. We successful achieved all the measurable indicators for the project apart from some additional analyses of the database which we are currently working on (see Annex 1 for a summary of the results). We found the measurable indicators that we developed in the project design useful in evaluating the progress of the project to partners and other stakeholders.

Internal Evaluation System. Kate Jones has annual appraisals where progress was assessed against key targets by her line manager. Key milestones in the project were evaluated at this stage and any problems were raised.

6.1 Actions taken in response to annual report reviews

There are no outstanding issues and we have always discussed the reviews with our partners and other collaborators.

7 Finance and administration

7.1 Project expenditure

Expenditure is detailed in Tables 6-8. DI agreed to the movement of £4000 from capital budget into salaries to cover the cost of web portal development and movement of the final year's budget into salaries to pay for a sonogram analyst. The loss from the conference budget was made up from funds from elsewhere (Table 6 & 7).

Table 6. Project Expenditure

Project Costs	Original Budget	Agreed Budget	Claim	%Diff	Notes
Staff costs (see below)					
Rent, rates, heating, lighting and cleaning					
Postage, telephone and stationary					
Travel and subsistence					
Printing					
Conferences, seminars etc					
Capital items					
Others (Consumables)					
Total					

Table 7. Staff Salaries.

Project team member	Original Budget	Agreed Budget	Claim	%Diff	Notes
Bat Conservation Trust					
Jon Russ					
Abigel Szodoray-Paradi					
Green Balkans					
Web Portal Contract					
Sonogram Analysts					
Total					

Notes: 1. Rent costs are different because the overhead costs for the sonogram analyst and web portal development were not covered in the original proposal (DI queried this on 2008/09 claim and this was cleared). **2.** In the 2006/07, the project expenditure for travel and subsistence was claimed in combination but the funds were spent as allocated (DI queried this on 2006/07 claim and this was cleared). **3.** In the 2007/08, the claim for postage and consumables were claimed in combination but the

funds were spent as allocated. Full financial records are available on request. **4.** Overspend due to the web developer needing extra time to complete the contract.

Capital Budget Items	Spend
7*GPS PDAs	
7*Fence Mounts	
16*Minidiscs	
7*Tranquillity Bat detectors	
Car Power adaptors, Equipment bags	
Printer (Romania)	
Printer (UK)	
Digital camera	
Green Balkans books and website	
iBats equipment	
iBats equipment	
Total	

The capital budget (Table 8), was spent on 16 sets of iBats equipment (ultrasound detectors, GPS units, digital recording device, power adaptors, car clamps). 1 set was kept by UK, 8 donated to Romania, 7 to Bulgaria. Bulgaria used the extra money to develop their website and buy bat biology books. At the start of the project I bought the equipment separately, and at the end of the project I contracted a supplier to deliver it all together.

Table 8. Details of the spend on capital budget.

7.2 Additional funds or in-kind contributions secured

Additional funds for this project which were secured over and above the confirmed matched funding were a Leverhulme Prize of £70,000 to Kate Jones to develop the iPhone application and integrate this with the web portal. Centre for Ecology and Evolution provided £2500 funds for a pilot project exploring new ways of classifying calls. NERC have funded a three year studentship to analyse these databases for a PhD project. We also obtained a further £197,039 from a Darwin Initiative follow up funding bid to extend this project for another 2 years and extend it to Hungary, Ukraine and Russia. The Newcastle Data Management Centre at Newcastle University are providing in-kind support by hosting the web portal and storing the sonogram files.

The iBats Program has gained funding from different sources since it started off from this Darwin Project in 2006, getting funding from British Ecological Society and ZSL's EDGE for monitoring Thailand's bats, The Darwin Initiative Scoping Award to monitor Mongolia's bats. ZSL funded equipment for pilot projects in Mexico, Madagascar and Zambia.

7.3 Value of DI funding

The Darwin Initiative is unique in its funding approach of transferring UK expertise and enabling biodiversity conservation in countries rich in biodiversity and poor in resources. It is difficult to imagine another funding agency supporting this unique project. The Darwin funding has enabled the UK to further develop its reputation of scientific excellence, volunteer management and biodiversity monitoring, while the host countries have developed a national biodiversity indicator which they can use to report to the CBD. The Darwin funding has also enabled the establishment of biodiversity networks internationally, with Romania acting as a centre of excellence for the region.

Annex 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements May 2006 - Aug 2009	Actions required/planned for next period
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		UK expertise has been used to help train and sustain national networks to generate long term monitoring data for biodiversity indicator species. These data can be used to monitor the impacts of global change which will help future development to be sustainable.	(do not fill not applicable)
Purpose To generate long-term population data on biodiversity indicators to assess the impact of global change by developing bat biodiversity monitoring programmes for two countries in Eastern Europe	Online database of abundances and distribution of roadside bats in Romania and Bulgaria Network of monitoring personnel maintaining a long-term programme in each country Production of manuals of good practice in road design to enhance biodiversity and effect of development	Database available online and has continuing annual data entry from host countries (www.ibats.org.uk) Trained network of volunteers and personnel from each country inputting monitoring data each year Monitoring and sound analysis protocol manuals online	Manual on biodiversity and road design in progress
Output 1. Establishment of statistically defensible long-term monitoring protocols for Romania and Bulgaria	Monitoring and analysis protocol guidelines manual for each host country	Monitoring and sound analysis protocols online for host countries. These have been implemented across the region and the presence and abundances of bats has been determined from 2006-2009.	
Activity 1.1 Protocol & Equipment Development		Monitoring and analysis protocols were designed and equipment tested, bought and transferred in Year 1 (2006) in Romania and Year 2 (2007) for Bulgaria.	
Output 2. Network of host country personnel trained in monitoring techniques, equipment and analysis	Key personnel and 10 volunteers trained in survey methods Further workshops run by host Countries	We have directly trained 74 nationals in monitoring techniques, sound analysis and equipment and host countries have recruited and trained a further 64 people, so generating a network of 180 trained volunteers across the region. 12 meetings or workshops have been held from 2006-2009. All training materials and protocols are online.	

	Training materials produced	
Activity 2.2 Training/Workshops. 2 training workshops per country and one end of project meeting.		12 meetings or workshops have been held from 2006-2009, directly training 74 nationals with the host countries training a total of 180.
Output 3. Ongoing online international spatial and temporal database on bat species abundances and distributions alongside road networks	Roadside survey data from 200km of transects collected from each host country and uploaded to database Website and database are developed	Data collected from 304 transects (11,108.6 km) across the region from 2006-2008. There were 153 unique routes and 46 routes were repeated in July and August each year and can be used for monitoring population trends. Data has been uploaded and stored on the web portal database (www.ibats.org.uk).
Activity 3.1. Field Research Programme. Yr 1 (2006) Romanian pilot data and Yr 2 (2007) and Yr 3 (2008) data collected from Romania and Bulgaria.		In 2006, 16 transects (519.7 km of roads) were surveyed in Romania. In 2007, 52 transects (1841.8 km) in Romania and 73 transects (2733 km) in Bulgaria. In 2008, 58 transects (2054.4 km) in Romania and 88 transects (3364.5 km) in Bulgaria. Additionally, 15 surveys (563.5 km) were done in Hungary (8 in 2007, 7 in 2008) and 1 (31.7 km) in Croatia in 2007.
Activity 3.2. Database Development. Yr 1 (2006) Development and design of online database to host project data. Romania pilot data uploaded and initial analysis. Yr 2 (2007) and Yr 3 (2008) Romanian and Bulgarian data uploaded and analysed.		Online database was created in 2006. Yr 1 Romania pilot data uploaded and analysed in 2007. Yr 2 and Yr 3 Romania and Bulgarian data uploaded in 2007 and 2008, respectively. Analysis of all these data was completed in Aug 2009.
Output 4. Knowledge on how road design and the change in human development and climate impacts bat biodiversity	Statistical analysis of quantity and quality of roadside bat biodiversity along a range of road side types in host countries Statistical analysis of time series survey data with change in development and climate Annual report on roadside biodiversity index.	The sonogram analysis of 2006-2008 has been completed in Aug 2009. 18,444 bat calls have been recorded from 14 species or species groups across the region from 2006-2008 and uploaded to the online database. The analysis outputs are now in progress.
Activity 4.1. Spatial Analysis & Modelling. Examine 3 years of data for Romania to examine effect of global change on bat diversity.		In progress.
Activity 4.2. Project Reporting. Yrs 2-3: Production of guidelines to maximise biodiversity for roadside managers in Romania and Bulgaria. Report effect of human development on bat biodiversity in Romania using three years data.		In progress.

Annex 2 Project's final logframe, including criteria and indicators

Project summary	Measurable Indicators	Means of verification	Important assumptions
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose To generate long-term population data on biodiversity indicators to assess the impact of global change by developing bat biodiversity monitoring programmes for two countries in Eastern Europe	Online database of abundances and distribution of roadside bats in Romania and Bulgaria Network of monitoring personnel maintaining a long-term programme in each country Production of manuals of good practice in road design to enhance biodiversity and effect of development	Website and database available online and continuing annual data entry from host countries. Training manuals and reports and research results published in peer reviewed journals.	Host countries can recruit and maintain a sufficient volunteer network. Host countries willing to share data.
Output 1. Establishment of statistically defensible long-term monitoring protocols for Romania and Bulgaria	Protocol guidelines manual for each host country	Distribution of manuals to monitoring network	Protocols will deliver monitoring (risk reduced based on previous successful surveys carried out in the U.K. and Republic of Ireland).
Output 2. Network of host country personnel trained in monitoring techniques, equipment and analysis	Key personnel and 10 volunteers trained in survey methods Further workshops run by host Countries Training materials produced	Contact details of volunteers and workshops recorded. Training material available for download from project website.	Ability of host countries to recruit volunteers (risk reduced as Romania has already recruited some volunteers).
Output 3. Ongoing online international spatial and temporal	Roadside survey data from 200km of transect collected from each host	Verification of the quality and quantity of survey data. GPS log	Survey data is collected correctly.

database on bat species abundances and distributions alongside road networks	country and uploaded to database Website and database are developed	can be used to verify position of recordings.	Website can be accessed by host countries.
Output 4. Knowledge on how road design and the change in human development and climate impacts bat biodiversity	Statistical analysis of quantity and quality of roadside bat biodiversity along a range of road side types in host countries Statistical analysis of time series survey data with change in development and climate Annual report on roadside biodiversity.	Production of peer-reviewed papers and production of annual report to policy makers.	Sufficient data is collected for analysis

Annex 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use	20	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	20	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	10	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
12. Research and Training	15	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	10	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts	10	Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
16. Access to and Transfer of Technology	15	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
Total %	100%	Check % = total 100

Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		

Code	Description	Totals (plus additional detail as required)
1a	Number of people to submit PhD thesis	3 (Abigel Szodoray-Paradi, Alice Hughes, Charlotte Walters)
2	Number of Masters qualifications obtained	1 (István Csősz)
3	Number of other qualifications obtained	1 (Internship for Abigel Szodoray-Paradi)
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	74 from Romania, Bulgaria, Hungary, Ukraine and Russia. 180 in total trained by the host countries.
6b	Number of training weeks not leading to formal qualification	12 weeks (7 formal workshops, 4 meetings and 1 internship from 2006-2009).
7	Number of types of training materials produced for use by host country(s)	4 (Monitoring, analysis and identification protocols, research talks on bat ecology, evolution and conservation)
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	Approximately 10 weeks each for Kate Jones & Colin Catto, 1 week each for Jon Russ and Charlotte Walters
10	Number of formal documents produced to assist work related to species identification, classification and recording.	2 (online manuals for classification and analysis and recording), and 1 peer reviewed paper
11a	Number of papers published or accepted for publication in peer reviewed journals	1 peer reviewed paper
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1 (iBats Web Portal - geo-referenced occurrences of bat species calls are hosted online for all participants from all host countries)
13a	Number of species reference collections established and handed over to host country(s)	1 (iBats Web Portal – contains echolocation call data for different species within each country)
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	12 (7 formal workshops, 3 meetings and 1 internship from 2006-2009)
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	13 (talks around the world by project staff from 2006-2009)
15a	Number of national press releases or publicity articles in host country(s)	1 release in both Romania and Bulgaria which resulted in coverage in 3 newspapers in Romania and 3 newspapers and 10 internet sites in Bulgaria.
15c	Number of national press releases or publicity	1 which was taken up in national newspapers and also locally in

Code	Description	Totals (plus additional detail as required)
	articles in UK	London
16a	Number of issues of newsletters produced in the host country(s)	1 in Romania and Bulgaria
16b	Estimated circulation of each newsletter in the host country(s)	Unknown
16c	Estimated circulation of each newsletter in the UK	Reported in 'Bat News' (circulation 4000), ZSL Annual Report and Zoo News (3000).
17b	Number of dissemination networks enhanced or extended	The project worked with existing volunteer networks in Romania and Bulgaria
18a	Number of national TV programmes/features in host country(s)	2 in Bulgaria.
18c	Number of local TV programme/features in host country	See national coverage
19a	Number of national radio interviews/features in host country(s)	3 in Romania and 2 in Bulgaria
19b	Number of national radio interviews/features in the UK	2 (Radio 4, talked about this project in 'Tribes of Science' and 'Species Debate')
19c	Number of local radio interviews/features in host country (s)	See national coverage
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	15 sets of monitoring equipment, plus replacement kit, consumables and hard discs plus books and printer (approx. £20,000).
23	Value of additional resources raised for project	Rufford Lange Foundation (£15,000), Bat Conservation International (£500), CEE (£2500), Darwin Initiative Post Project Funding (£197,039), The Leverhulme Prize (£70,000), NERC Studentship (Charlotte Walters £70,000), NERC Research Project (proposed £440,000).

Annex 5 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Web Portal	Indicator Bats Program Web Portal	Indicator Bats Program	www.ibats.org.uk – there are some areas that are only accessible to project participants	Free

Protocols	Monitoring Protocols	Indicator Bats Program	http://www.ibats.org.uk/page.aspx?tabid=256	Free
Protocols	Sonogram Analysis Protocols	Indicator Bats Program	http://www.ibats.org.uk/page.aspx?tabid=270	Free
Guide	Identification Guide	Indicator Bats Program	http://www.ibats.org.uk/page.aspx?tabid=271	Free
Online Database	Indicator Bats Program	Indicator Bats Program	http://www.ibats.org.uk/page.aspx?tabid=280 – but access limited to project participants	Free
Web Site	The Green Balkans Bat Program	The Green Balkans	http://greenbalkans.org/prilepi/index.php	Free
Peer-Review Paper	Jones *et al*. in prep. Monitoring ultrasonic biodiversity: using bats as biodiversity indicators	In: Biodiversity monitoring and conservation: bridging the gaps between global commitment and local action. (eds Collen *et al*.) Blackwell Press, London		Unknown

Annex 6 Darwin Contacts

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Project Title	Monitoring bat biodiversity: indicators of sustainable development in Eastern Europe
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