



DARWIN200

## **Monitoring biodiversity indicators through volunteer networks across Eurasia**



**Darwin Final Report: April 2009 – March 2011**

# Darwin Initiative – Final Report

## Darwin project information

Project Reference	EIDPO036
Project Title	Monitoring biodiversity indicators through volunteer networks across Eurasia
Host country(ies)	Romania, Bulgaria, Hungary, Ukraine, Russia
UK Contract Holder Institution	Institute of Zoology, Zoological Society of London
UK Partner Institution(s)	The Bat Conservation Trust
Host Country Partner Institution(s)	The Romanian Bat Protection Association, The Green Balkans, The Institute of Zoology Bulgarian Academy of Sciences, The Bulgarian Bat Research and Protection Group, Nature Foundation (Hungary), Animal Research and Protection Association (Ukraine) and Peresvet (Russia).
Darwin Grant Value	£197,039
Start/End dates of Project	1 <sup>st</sup> April 2009 to 31 <sup>st</sup> March 2011
Project Leader Name	Dr. Kate E. Jones
Project Website	<b>Website:</b> <a href="http://www.ibats.org.uk">http://www.ibats.org.uk</a> , <a href="http://www.bats.org.uk/pages/ibatsprogram.html">http://www.bats.org.uk/pages/ibatsprogram.html</a> <b>Facebook:</b> <a href="https://www.facebook.com/iBatsProgram">https://www.facebook.com/iBatsProgram</a> , <b>Twitter:</b> iBatsProgram, <b>Flickr:</b> <a href="http://www.flickr.com/photos/ibatsprogram">http://www.flickr.com/photos/ibatsprogram</a>
Report Author(s) and date	Kate E. Jones, Jon Russ, Abigel Szodoray-Paradi, Farkas Szodoray-Paradi, Elena Tilova, Zoltan Bilhari, Dai Fukui, Andriy-Taras Bashta and Igor Prokofyev. 15 <sup>th</sup> August 2011

## 1 Project Background

The project builds on the success of a previous DI-Project 15/033 (May 2006-Aug 2009) which developed a bat biodiversity monitoring programme (iBats) for Romania and Bulgaria (covering 11,109 km of road networks in 304 transects with 180 people). With post-project funding, we have maintained iBats' momentum, increased its sustainability and legacy across the region and extended it further across Eurasia into Hungary, Slovenia, Croatia, Bosnia, Serbia, Ukraine, Russia, Mongolia and Japan (Fig 1 for a map of the region covered). We have also fully incorporated an existing iBats project in the UK (started in 2005). Since 2005, the Eurasian iBats Programme has now collected data from over 48,617 km in 1351 transects, directly training 159 volunteers in 20 workshops or meetings, involving a total of 703 volunteers.

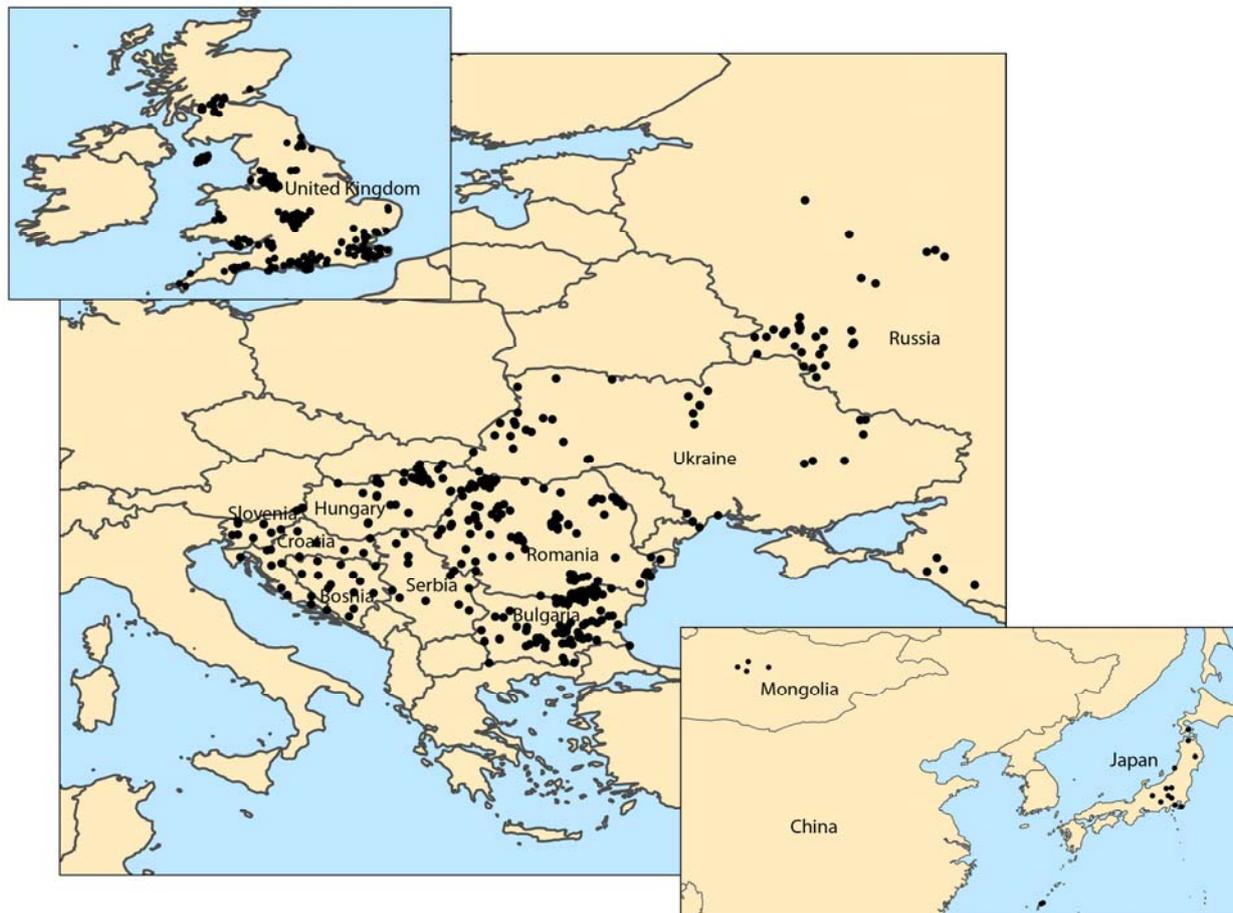


Fig.1. iBats transects surveyed and monitored between 2005-2010.

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

This project generated data on the distributions and abundances of biodiversity indicator species and species on the CMS. Trends in these data can be used to inform policy makers about the state of biodiversity and their success in meeting CBD 2010 targets and other multilateral environmental agreements (such as CMS, CITIES), and to also contribute to the 2010 strategic plan (CBD 2011). 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. The project has also raised awareness of the importance of bats as indicator species and the importance of biodiversity to human health and wellbeing. All countries have identified their CBD focal points and these contacts are kept informed about the project's achievements. The project was most relevant to CBD articles 7 (Identification and monitoring), 12 (Research and training), and 13 (Public education and awareness) (see Annex 3) and to three cross cutting themes: 2010 Biodiversity Target; Climate Change and Biological Diversity and Identification; and Monitoring, Indicators and Assessments.

## 3 Project Partnerships

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

Romania Bat Protection Association (RBPA) (Romania). The Zoological Society of London (ZSL) and Bat Conservation Trust (BCT) have a very strong relationship with RBPA (MoU signed in May 2006 as part a previous DI-Project 15/033). Over the course of this project we have strengthen those links and RBPA's regional influence and reputation as a centre of excellence. For example, RBPA hosted the 1<sup>st</sup> International Indicator Bats Global Monitoring Workshop in Savadisla, Romania in May 2009, with 21 Romanian volunteers attending and representatives from the other existing projects (total of 52 participants, from 10 countries). RBPA volunteers have successfully planned their activities for 2009 and 2010 and have completed and uploaded 88 transects for 2009 (60 expected) and 92 transects for 2010 (60

expected). We originally planned to have a further workshop for RBPA volunteers in 2010 but RBPA decided to use the money to continue the monitoring for 2011 (beyond the EIDPO036 end date).

The Green Balkans (Bulgaria). ZSL and BCT have strengthened our collaboration with The Green Balkans. 10 participants attended the 1<sup>st</sup> International Indicator Bats Global Monitoring Workshop in May 2009 in Romania. Green Balkan volunteers have successfully completed and uploaded 73 transects for 2009 (60 expected) and 70 transects for 2010 (60 expected). Again we originally planned to have a further workshop for The Green Balkan volunteers but they decided to use the money to continue the monitoring beyond the end date of the EIDPO036 project.

Protection Group, Natura Foundation (PGNF) (Hungary). Three representatives of the Nature Foundation attended the 1<sup>st</sup> International Workshop in May 2009. These volunteers completed and uploaded the 25 required transects for 2009. This was followed up in October 2009 by Dr. Kate Jones (ZSL), Abigel and Farkas Szodoray-Paradi (RBPA) and Dr. Zoltan Bilhari (Nature Foundation) attending the VIIIth Hungarian National Bat Conservation Conference in Felsotarkany Hungary, relating their involvement with the iBats project. The meeting generated more interest from bat researchers in Hungary and four more teams volunteered for the project



**Fig 2. iBats Hungary workshop in May 2010.**

from different parts of Hungary for 2010. PGNF with Dr. Kate Jones (ZSL) and Dr. Kate Barlow (BCT) organised an iBats workshop in Hungary (7<sup>th</sup>-10<sup>th</sup> May 2010) to train 15 participants to carry out iBats surveys and to decide on their survey plans for the forthcoming season (Fig 2). 67 transects were carried out in 2010 (30 expected) with 56 volunteers, significantly expanding the iBats project in Hungary. PGNF is continuing to collect data for the 2011 season.

Animal Research and Protection Association (ARPA) (Ukraine). Two representatives from ARPA, including the chair Dr. Andriy-Taras Bashta attended the 1<sup>st</sup> International Indicator Bats Global Monitoring Workshop. Following the successful survey season where 7 volunteers collected, analysed and uploaded 23 transects, Dr. Kate Jones (ZSL) and Dr. Jon Russ (BCT) visited Dr. Andriy-Taras Bashta in L'viv, Ukraine (23-26 November 2009) to discuss project progress and the nature of the volunteer network across Ukraine. They also gave talks at the Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine in L'viv and visited a number of the field sites surveyed the previous summer. The visit generated more interest in the project and four more teams from different parts of Ukraine were identified to carry out the project in 2010. ARPA with Dr. Kate Jones (ZSL) and Dr. Jon Russ (BCT) organised an iBats workshop in Ukraine (19<sup>th</sup>-23<sup>rd</sup> May 2010) to train 15 participants to carry out iBats surveys and to decide on their survey plans for the forthcoming season (Fig 3). 59 transects were carried out in 2010 (30 expected) with 47 volunteers, significantly expanding the iBats project in Ukraine. With further funding from the Rufford Foundation, ARPA is continuing to collect data for the 2011 season.



**Fig 3. iBats Ukraine workshop in May 2010.**

The Grassroots Alliance (Peresvet) (Russia). Five representatives of The Grassroots Alliance (Peresvet) attended the 1<sup>st</sup> International Indicator Bats Global Monitoring Workshop in May and subsequently completed, analysed and uploaded 20 monitoring transects throughout the Bryansk region of Russia. Dr. Kate Jones (ZSL) and Dr. Jon Russ (BCT) visited Bryansk, Russia (26 November – 1 December 2009) and met with Dr Igor Prokofyev and other members of Peresvet to discuss project progress and the nature of the volunteer network in Russia. We gave presentations at 2 schools in the region (run by members of Peresvet) and visited sites surveyed the previous summer. Dr. Kate Jones assisted Alexander Gorbachev from Peresvet to apply and successfully obtain funding to attend The Student Conference on Conservation Science in Cambridge in March 2010 and for a one month internship at ZSL learning analytical techniques to analyse the data from the project. Alexander won the student prize for his project on habitat modelling of Russian bats. Dr. Kate Jones is now jointly supervising Alexander's PhD project that started in October 2010 (with an MoU signed). Dr Igor Prokofyev, Natalia Koryagine and Oleg Zavarzin (Peresvet) also attended the Cambridge Student Conference at the invitation of Dr Kate Jones and visited ZSL offices learning about NGO development and projects. Peresvet also visited the Bat Conservation Offices in London on 19<sup>th</sup> March 2010. They attended short presentations by key members in staff involved with the National Bat Monitoring Programme, Training, The Helpline, Bat Groups and Education and were presented with a variety of BCT publications to support their project in Russia.

Peresvet with Dr. Kate Jones (ZSL) and Dr. Jon Russ (BCT) organised an iBats workshop in Russia (27<sup>th</sup>-31<sup>st</sup> May 2010) to train 22 participants to carry out iBats surveys and to decide on their survey plans for the forthcoming season (Fig 4). 72 transects were carried out in 2010 (30 expected) with 87 volunteers, significantly expanding the iBats project in Russia. Peresvet with help from BCT raised further funds with a 1<sup>st</sup> Round Rufford Small Grant For Nature Conservation and a Whitley Award for Nature Conservation for Dr Igor Prokofyev (Fig 5). With this funding Peresvet is continuing to collect data for the 2011 season.



Fig 4. iBats Russia workshop in May 2010.



Fig 5. Dr. Prokofyev receiving his award.

### ***Partnerships between other UK or regional partner(s)***

The partnership between ZSL and BCT continues to be excellent and we have regular meeting to review project progress. As a member of the board of trustees at BCT (Chair from September 2010), Dr Kate Jones has helped BCT with their 5 year strategic development plan. The Darwin project forms an important part of BCT's international development plan and has the potential to be taken forward as a partnership project by BatLife Europe, the first pan-European NGO devoted to the conservation of bats and their habitats, of which BCT is an initiator and founder member. Dr. Jones also attended the 6<sup>th</sup> Session of the Meeting of Parties (MoP6) to EUROBATS in Bonn, Germany as a scientific advisor for BCT. She also assisted BCT to successfully apply for iBats funding from The Rufford Foundation for £20,000 for 2010-2012. Dr. Jon Russ and Kate Jones ran two iBats workshops at Bat Conservation Trust's National Bat Conference in UK in September 2009 and 2010 to further promote the project. The Bats & Roadside Mammals Survey, a partnership project between the Bat Conservation Trust and Mammals Trust UK, has now been fully integrated into the iBats Program as iBatsUK. The

data generated since its inception in 2005 has been transferred to the iBats web portal. Since 2005, 186 volunteers have monitored 14,124.9 km in 387 transects.

ZSL has also been building its own capacity as a project partner. With funding from The Leverhulme Trust, Dr. Kate Jones visited The University of Auckland, New Zealand to collaborate with Dr. Stuart Parsons to develop methods to automatically identify and extract calls from long call sequences and to automatically parameterize calls. Charlotte Walters started her PhD in Oct 2009 to investigate the habitat and climate associations of Eastern European bats collaborating with our partners. An MSc student from Imperial College, London (Annie Pagan) investigated 'Status of UK Bats' estimating population abundances of bats in the UK obtained from the iBatsUK to investigate any trends over the last 5 years and compare these results to other more traditional surveys carried out by the UK's National Bat Monitoring Programme.

The project employed a commercial software development company MSM to overhaul the iBats web portal and to increase its capabilities and collaborated with Dr. George Roussos (Birkbeck, University of London) to develop the smartphone software – the *iBats App* (for Android and Apple phones).

### Other iBats Projects

**iBats Mongolia** - Following the pilot project in Mongolia in 2008 (funded by the Darwin Initiative – Scoping Award), ZSL has been awarded a grant from the World Bank to develop a Mongolian mammal monitoring program. Dr Kate Jones trained Dr Sue Parsons and Batbayar GaltBalt (ZSL) to carry out bat biodiversity monitoring and donated one set of equipment to this project. They hosted a workshop in June 2011 in Ulaanbaatar and the monitoring initially will be done as part of Batbayar GaltBalt's PhD research (registered at University of Mongolia and ZSL) from 2011-2013.



**iBats Japan** - With one year funding from the Japan Fund for Global Environment, Dr. Kate Jones collaborated with Dr. Dai Fukui to launch iBatsJapan in 2010 with the local NGO 'Komori No Kai' (Japanese Bat Group). We organised a training workshop in July 2010 in Mount Fuji training 16 volunteers (Fig. 6). In total, 43 volunteers collected data along 722.7 km of road networks in 2010. Dr. Fukui has obtained continued funding for 2011-2014 from the Japan Fund for Global Environment (5.7 Million Yen) and 2011-2012 from Seven-eleven Midorino Kikin Fund (1 Million Yen) and ran a workshop in 2011 which trained 17 further volunteers.

**Fig 6. iBats Japan workshop in July 2010.**

**iBats Explore** – As part of Charlotte Walter's PhD project, acoustic data was collected from areas in Europe where very little distribution data for bats has ever been recorded. Surveys were carried out in July-August 2010 in Slovenia, Croatia, Bosnia, and Serbia. These base-line distribution data was collected along 1,949.5 km of roads (see Fig.1).

### Partnership lessons, strengths and challenges

The formula of collaborating with existing volunteer based environmental NGOs and providing training on bat acoustic monitoring has again worked well. We have provided the equipment and training and the NGOs have self-organised and taken ownership of their projects and have raised further funds themselves. Communication is an essential part of this project and the Facebook, Twitter feed and the webpage have been extremely helpful in keeping everyone in touch with the latest developments. One of the challenges Peresvet in particular has faced is internal communication about their project with the other bat experts in Russia. The project has met with initial scepticism about the validity of identifying bats from acoustic signals. However, the team at Peresvet are working more closely with the other Russian bat experts to integrate them more fully within the project.

## 4 Project Achievements

The narrative against the log frame is presented in Annex 1.

### 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 and species on the CMS. Trends in these data can be used to inform policy makers about the state of biodiversity and their success in meeting CBD 2010 targets and other multilateral environmental agreements (such as CMS, CITIES), and also contribute to the 2010 strategic plan (CBD 2011). 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 data 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. The project has also raised awareness of the importance of bats as indicator species and the importance of biodiversity to human health and wellbeing.

### 4.2 Outcomes: achievement of the project purpose and outcomes

The project achieved its stated goal: to monitor biodiversity across five countries in Eurasia sustainably and effectively. The project maintained and enhanced monitoring projects in Romania and Bulgaria, and established projects in Hungary, Ukraine and Russia. Additionally, the project fully incorporated an existing monitoring project in the UK and initiated two others in Mongolia and Japan and collected base-line data from Slovenia, Croatia, Bosnia, and Serbia. In total, since 2009 the project has collected acoustic data over 38,560 km (in total 49,669 km since 2005) in 1088 transects (in total 1392 transects), directly training 85 volunteers (in total 159 volunteers) in 8 workshops or meetings (in total 20 since 2005), involving 523 volunteers (a total of 703 volunteers since 2005). 22 further sets of acoustic monitoring equipment were donated to the projects (6 each in Russia, Ukraine and Hungary, 1 each for Mongolia and Japan and replacement kits for Romania and Bulgaria). The project has developed new techniques to automatically extract and identify calls to species and has improved and re-launched the web portal, and has also developed smartphone applications to reduce the amount of equipment needed to take part in the iBats Programme. The project has generated a huge amount of media at an international level to help raise the profile of bats and biodiversity. The project has also enabled participating countries to raise further funds to continue with their monitoring projects beyond the life-time of the project. We have several research papers published, in press or in review with more planned over the course of the next 12 months.

### 4.3 Outputs (and activities)

All project outputs were achieved extremely successfully although analyses of the data generated from the project is still ongoing.

#### 1. Ongoing statistically defensible monitoring programme for Romania and Bulgaria.

Data continues to be collected annually across Romania and Bulgaria (see Table 1). 60 transects per year were planned per country and 88 transects in 2009 and 92 transects in 2010 were carried out in Romania and 73 in 2009 and 70 in 2010 in Bulgaria. This brings the total across Romania and Bulgaria since 2009 to 323 transects covering 11,209.93 km. All data were uploaded successfully onto the iBats web portal.

Project	Years						
	2005	2006	2007	2008	2009	2010	All Years
UK	71 (3361.8)	84 (3183.6)	72 (2220.9)	66 (2379.6)	46 (1356.7)	48 (1622.3)	387 (14124.9)
Romania	▪	16 (519.7)	52 (1786.3)	58 (1843.3)	88 (3012)	92 (2906.7)	306 (10068)
Bulgaria	▪	▪	74 (2694.3)	85 (3107.1)	73 (2754.5)	70 (2536.7)	302 (11092.6)
Hungary	▪	▪	8 (184.5)	7 (225.7)	25 (847.1)	67 (2663.1)	107 (3920.4)
Mongolia	▪	▪	▪	4 (131.7)	▪	▪	4 (131.7)
Ukraine	▪	▪	▪	▪	23 (862)	59 (2244.8)	82 (3106.8)
Russia	▪	▪	▪	▪	20 (873.3)	72 (2627.8)	92 (3501.1)
Japan	▪	▪	▪	▪	▪	17 (722.7)	17 (722.7)
Explore	▪	▪	1 (31.7)	▪	▪	53 (1917.8)	54 (1949.5)
<b>Total</b>	<b>71 (3361.8)</b>	<b>100 (3703.3)</b>	<b>207 (6917.7)</b>	<b>220 (7687.4)</b>	<b>275 (9705.4)</b>	<b>478 (17241.9)</b>	<b>1351 (48617.7)</b>

**Table 1. Number of transects per year (kilometres driven) per project (data from iBats website).**

In May 2009, RBPA hosted an international monitoring workshop in Savadisla, Romania with 21 Romanian volunteers attending and inviting representatives from the Bulgarian project and 11 people from the new groups in Hungary, Ukraine and Russia and representatives from other existing international projects (Ireland, Belgium, USA, France and UK). A total of 52 people participated in the workshop, and this helped establish RBPA as a centre of excellence in Romania facilitating biodiversity monitoring across the region.

## **2. Development of statistically defensible monitoring programme for Hungary, Ukraine and Russia**

Individuals from NGOs representing Hungary (Protection Group, Natura Foundation), Ukraine (Animal Research and Protection Association) and Russia (Peresvet) were invited to the International workshop in Romania in May 2009. Here these key personnel received training in acoustic monitoring and bat biology and conservation. These individuals then went onto collect transects for the 2009 season (Table 1). All three countries were visited by ZSL and BCT between November and December 2009 to discuss plans for the 2010 workshops and the development of their biodiversity networks. One workshop was held in each country in May 2010 with the NGOs recruiting and training volunteers to carry out the 2010 transects (see Table 1). 6 sets of equipment were donated to each NGO. All data were uploaded successfully onto the iBats web portal. Complete details of the workshops and meetings are given in Section 3 (Project Partnerships).

## **3. Ongoing improved online international spatial and temporal database on bat species abundances and distributions**

We employed the database company MSM to transfer the existing iBats web portal onto their servers. However, the language the original web portal was written in was not industry standard, so MSM recoded the entire system again. We improved the functionality of the web portal as a result of this process. It now has better reporting tools for volunteers and it has been translated into 6 languages of the different countries involved (see Fig. 7). The new web portal also allows data to be uploaded directly from a smartphone (see below). All data has been successfully transferred onto the new system and the web portal launched in May 2011. Data and training resources can be easily viewed and downloaded by the project volunteers. A Facebook and twitter account was set up in October 2010 and the membership is steadily growing and we currently have over 280 Facebook fans from over 13 countries.



Fig 7. New iBats web portal (Japanese version).

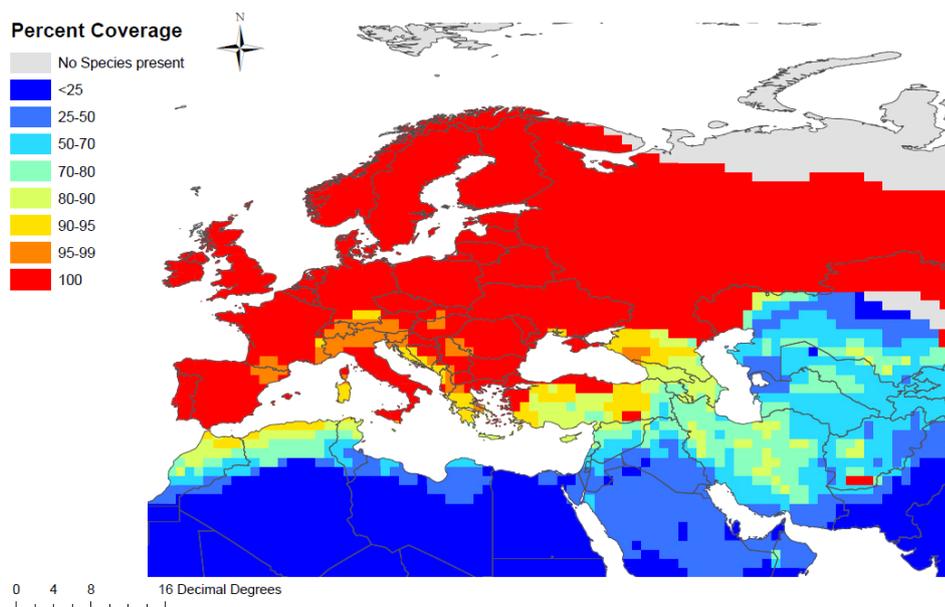
#### 4. Improved analysis techniques to automatically detect and identify calls from transect data and improved equipment

**Signal detection and feature extraction** - We identified a spectrum analysis software package, Sonobat to isolate bat calls and automatically extract call parameters. With some modifications to the original code, it now works well with iBats recordings with very little manual processing. The processing time for a 90 minute recording has been reduced from 6-8 hours to 1 hour. Parameters are extracted from each call and stored as text files.

**Signal Classification** - Charlotte Walters (PhD, University of Kent & ZSL) has developed a neural network tool for species identification with Dr. Stuart Parsons (University of Auckland). This identification tool was trained using 12 call parameters measured from over 1250 calls from 33 species of European bats. The network is hierarchical, whereby species are first classified as 1 of 5 'higher groups' and are then classified to species level within each group. Recognition rates for the 5 main groupings of bat species is excellent, with an average of 98.7% of calls classified correctly at this stage (Table 2).

Groups	Groups/Species	Classification rate (% correct)
<b>Higher Groups</b>	<i>Rhinolophus</i> ; HQCF; <i>Myotis</i> , LQCF, <i>Plecotus</i>	100; 99.2; 99; 98; 97.1
<b>Rhinolophus</b>	<i>R. ferrumequinum</i> ; <i>R. euryale</i> ; <i>R. hipposideros</i> ; <i>R. blasii</i>	100; 92.3; 100; 100
<b>Plecotus</b>	<i>P. austriacus</i> ; <i>P. auritus</i>	92.3; 95
<b>HQCF</b>	<i>P. pipistrellus</i> & <i>P. pygmaeus</i> & <i>M. schreibersii</i>	<b>98</b>
	<i>P. pipistrellus</i> ; <i>P. pygmaeus</i> ; <i>M. schreibersii</i>	100; 96.2; 100
	<i>P. kuhlii</i> & <i>P. nathusii</i>	<b>100</b>
<b>LQCF</b>	<i>P. kuhlii</i> ; <i>P. nathusii</i>	87; 84.6
	<i>N. lasiopterus</i> ; <i>B. barbastellus</i> ; <i>E. nilssonii</i> ; <i>T. teniotis</i>	100; 92.9; 100; 100
	<i>E. serotinus</i> & <i>N. noctula</i> & <i>N. leisleri</i> & <i>V. murinus</i>	<b>97.4</b>
<b>Myotis</b>	<i>E. serotinus</i> ; <i>V. murinus</i> ; <i>N. noctule</i> ; <i>N. leisleri</i>	80; 76.9; 95.7; 84.2
	<i>E. bottae</i> & <i>H. savii</i>	<b>93.1</b>
	<i>E. bottae</i> ; <i>H. savii</i>	100; 87.5
<b>Myotis</b>	<i>M. nattereri</i> ; <i>M. dasycneme</i> ; <i>M. capaccinii</i>	78.8; 84.6; 73.3
	<i>M. emarginatus</i> & <i>M. alcaethoe</i>	<b>61.5</b>
	<i>M. alcaethoe</i>	76.9
	<i>M. emarginatus</i>	92.3
	<i>M. myotis</i> & <i>M. blythii</i> & <i>M. punicus</i>	<b>61.5</b>
	<i>M. myotis</i> ; <i>M. blythii</i> ; <i>M. punicus</i>	76.9; 69.2; 69.2
<b>Myotis</b>	<i>M. brandtii</i> & <i>M. bechsteinii</i> & <i>M. daubentonii</i> & <i>M. mystacinus</i>	<b>79.7</b>
	<i>M. brandtii</i> ; <i>M. bechsteinii</i> ; <i>M. daubentonii</i> ; <i>M. mystacinus</i>	65.2; 61.5; 66.7; 66.7

Table 2. Classification rates for different hierarchies of neural networks for European bat species.



Identification to species level within each group varies between 61.5 and 100%. The best recognition rates are within *Rhinolophus* and the worst within *Myotis* (Table 2). This tool works across Europe with limited coverage for other regions (Fig 8).

**Fig 8. Coverage of the Acoustic ID tool across Eurasia.**

**Equipment** – We originally intended to produce a bespoke detector for the project, but instead we decided to concentrate on developing software to integrate existing hardware. In particular by developing an application for the iPhone and Android phone which can be attached to an ultrasonic microphone. This application has been completed in collaboration with Dr. George

Roussos at Birkbeck (University of London). The 'iBats app' allows a smartphone to be directly attached to the ultrasonic detector and the sound recorded and geo-referenced directly onto the phone. These geo-referenced files can then be automatically uploaded onto the web portal, replacing the recording device, GPS unit and the recording sheets (Fig. 9). These applications were launched in June 2011 and are available for free to download from iTunes or the Android market place.



**Figure 9. Screenshots from the iBats application**

## 5. Knowledge of how change in human development and climate impacts bat biodiversity

We have manually analysed all data collected up until 2008 and for most of 2009 for all the projects and we developed a simple key based on peak frequency and call shape to identify calls to species or species groups. Call abundances between countries and a review of the project and an initial analysis of the habitat suitability for the common pipistrelle bat (*Pipistrellus pipistrellus*) is in press (Jones *et al.* 2011 In: Biodiversity monitoring and conservation: bridging the gaps between global commitment and local action. Eds. Collen, B, P. *et al.* Blackwell Press, London). A review of the challenges of developing a global bat acoustic monitoring programme and the technical challenges of identifying species from acoustic signals is in preparation (Walters, *et al.* in prep. In: Current trends in bat evolution, ecology and conservation. Eds. Adams & Pedersen, Springer Science Press). A paper using our techniques by BCT project member Dr. Jon Russ was published (Roche *et al.* 2011. Animal Conservation), which shows trends in 3 species over a 6 year monitoring period in Ireland.

The problem with the manual analyses of these data is firstly, that it takes a long time and requires a great deal of training and is therefore very subjective between analysts. Secondly

the simple key we previously devised gives no probability on the species classification rates, is only suitable for some easy to identify species and leaves nearly two thirds of the calls unclassified. We therefore have reanalysed all the data collected using the new techniques we have recently developed (see above). We are currently finishing data analyses investigating trends in the data over 5 years across this region. The neural network acoustic identification tool for European species is complete and is in preparation for submission (Walters *et al.* in prep Journal of Applied Ecology). Charlotte Walters will also be generating habitat models with the geo-referenced call data to investigate how change in human development and climate will impact bat populations in Europe as part of her PhD. Alexander Gorbachev will be doing a similar analysis but for Western Russia as part of his PhD.

#### **4.4 Project standard measures and publications**

See Annex 4.

#### **4.5 Technical and Scientific achievements and co-operation**

iBats is an innovative citizen science project, engaging citizens to record ultrasonic biodiversity to deliver regional and international sustainable monitoring tracking the occurrences and abundances of bats – an important indicator species. This method combines novel methodologies in recording geo-referenced ultrasonic calls, (Jones *et al.* 2011; Roche *et al.* 2011), new software applications to use on smartphones to collect data (<http://itunes.apple.com/us/app/ibats/id426795283?mt=8>), using automatic ways of detecting extracting call parameters and new ways of identifying calls to species using a neural network (Walters *et al.* in prep), and a cutting-edge web portal management system to manage, store and analyse data, within existing volunteer networks (<http://www.ibats.org.uk>). iBats has enhanced existing networks and strengthened in-country capacity in ecological research by providing training in bat ecology and evolution, ultrasonic technology, analysis software and conservation. 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; 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. 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**

iBats is built on existing networks of volunteers, providing them with training and equipment and enhancing these. These networks existed before the project and will continue to exist after the project funds are finished. Host countries have the equipment and skills to continue to deliver national monitoring programmes. We have removed the main barriers for sustainability for example, the complexity of the equipment and the time consuming and technical nature of the sonogram analysis. iBats as a monitoring programme is now cheap and easy to perform and can be carried out sustainably by volunteer networks into the future across Eurasia. We feel that iBats is likely to continue to grow and spread to other parts of the world. The project leaves a legacy of enhanced volunteer networks able to monitor bat biodiversity, and the necessary equipment and geo-referenced bat records across this region. The project has raised the profile

of bats and biodiversity monitoring through the publicity generated (over 100 news articles, TV and radio broadcasts).

## 5 Lessons learned, dissemination and communication

*Lessons.* This is a highly ambitious project on the cutting edge of citizen science. Consequently it needed a lot of scientific and technical development to accomplish it. It has taken the full course of the project (over the full five years) to get everything in place to create a sustainable effective monitoring programme that can be used to track trends in populations in a scientifically defensible manner. With any ambitious innovative project there was a lot of scepticism from other colleagues that this could be accomplished but we can now show that it has worked. There are some final pieces of the project to write up and to disseminate (bat population trends through time across different countries and habitat modelling) but this is now possible in a scientifically rigorous way with our new acoustic tool and project staff.

*Dissemination and communication.* We have disseminated the project to a wide audience of scientists, NGOs, conservationists and the wider public. Project staff and volunteers have presented the results of the project at 27 venues over the course of the project: May 2009 – iBats International workshop, Romania; June 2009 – Max Planck Institute of Ornithology, Germany; July 2009 – Biodiversity Monitoring and Conservation Symposium, Zoological Society of London; September 2009 – The Bat Conservation Trust, York; November 2009 – Hungarian Research Conference, Hungary; November 2009 – Ukraine Academy of Sciences, L’viv, Ukraine; December 2009 – University of Bryansk and local schools, Bryansk Russia; December 2009 – Bat Conservation Ireland, Dublin; Feb 2010 – Gloucester Bat Group, Gloucester UK; Feb 2010 – University of Auckland, New Zealand; March 2010 – Leicester and Rutland Bat Group, Leicester UK; March 2010 – Cambridge University Student Conference, Cambridge; March 2010 – British Bat Research Symposium, London; March 2010 – Midlands Bat Conference, Warwick University; May 2010 – EUROBATs, Germany; May 2010 – University College London, London; July 2010 – iBats Japan, Japan; Aug 2010 – International Bat Conference, Prague; Sept 2010 – Russian Bats Meeting, Russia; Sept 2010 – XVII Theriological School, Ukraine; Sept 2010 – 6<sup>th</sup> Meeting of the Parties EUROBATs, Prague; Sept 2010 – The Bat Conservation Trust, Loughborough; November 2010 – Mammal Society, London; Jan 2011 – Oxford University, Oxford; May 2011 – Romanian Bat Research Association, Romania; July 2011 – Cambridge University; July 2011 – SoapBox Science, South Bank, London.

The screenshot shows a Scientific American article. At the top, it says 'SCIENTIFIC AMERICAN' and 'Winner of the 2011 National Magazine Award for General Excellence'. Below the title 'Want to Conserve Bats? There's an App for That' by John Platt, dated Jul 19, 2011 09:00 AM, is a sub-headline: 'Many smartphone applications are designed more for fun than substance (Angry Birds, anyone?), but a new app from the Zoological Society of London (ZSL) and the Bat Conservation Trust offers individuals and communities a chance to get involved in citizen science in a very real way and to help conserve bat populations in the process.' The article text continues: 'The app is called iBats, named after the Indicator Bats Program, which got its start in Transylvania in 2006. "Where else would you start a global bat monitoring program?" says ZSL senior research fellow and iBats program manager Kate Jones. For the past five years, iBats volunteers in 16 countries have been collecting recordings of bats' ultrasonic echo-location calls, which are used to find and locate objects. The recordings are uploaded into a central database where the calls can be identified by species by program coordinators. Each species has a "somewhat distinctive" call'.

We have also generated a large amount of media attention over the course of the project. The launch of the iBats app for iPhone and Android phones led to worldwide media coverage including articles in BBC, The Daily Telegraph, The Daily Mail, Irish Independent, Bangkok Post, and Scientific American (Fig 10). Dr. Prokofyev's Whitley award also received international media coverage including The Telegraph and lots of coverage in the Russian media. An article about the iBats project appeared in the Zoological Society of London's Magazine, Wild About in August 2009, ZSL annual report in October 2009; Bat Conservation Trust annual report in March 2010 and we have also blogged about the project in The Independent.

**Fig 10. iBats article in The Scientific American.**

The iBatsUK project was featured in the BBC programme Autumn Watch on 9th October 2009 (<http://www.flickr.com/photos/ibatsprogram/4011024145/>). Dr Kate Jones' research (including iBats) was featured on the BBC Radio 4 programme, Tribes of Science. In Romania there was

a national press release on 9th October 2009 and 3 articles about the iBats Romania project were published in local newspapers (two from Satu Mare, one from Sibiu). Peresvet (iBats Russia) started two children's clubs for bats (Domoshovsky and Bryansk schools) developing their own research projects. Peresvet are also forming an Association for Protection of Bats and planning a Russian language website for the organisation.

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

## 6 Monitoring and evaluation

*Changes to the Logframe.* There were no changes to the logframe, although we saved some money to use on analysis from holding one international conference at the start of the project (see Section 7). Also the Romanian and Bulgarian teams decided, after discussion with us to use their conference money for 2010, to continue monitoring in 2011.

*Darwin Initiative Monitoring & Evaluation System.* We successfully achieved all the measurable indicators for the project, although some analysis and write up of the scientific papers is ongoing. 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 had 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. Monitoring and evaluation of the project is made easy by the online data portal which can track the progress of each country's project making a web-based system critical to the project's success.

### 6.1 Actions taken in response to annual report reviews

The 2010 annual review congratulated us on another excellent year for the project. Amongst other things, the reviewer was pleased that we had recognised the vital role that the web hub provided to the project partnerships and felt that the redesign and improvement to the site was a prudent move. However, there was concern that without dedicated funding for updates beyond the project, website and software products may quickly become incompatible and so obsolete. We recognise that this is a problem with any website or online project. However, this online website has the full backing of Zoological Society of London and Bat Conservation Trust and is therefore protected from funding vagaries. However, we realise that we need to get this project more widely recognised and obtain a longer term funding mechanism.

The reviewer was also concerned that we had not made connections with the government and CBD focal points within the host countries. This has been done and the project information has been disseminated to countries and throughout the European Union through EUROBATS. We apologise for not making this clearer in the last report.

## 7 Finance and administration

### 7.1 Project expenditure

Expenditure is detailed in Tables 3-5. Darwin Initiative agreed to a spend of £ on salaries to cover the cost of salaries for Dr Jon Russ and Dr Ivan Pandourski for extra assistance in analysing sonograms. We also agreed to spend £4000 on meetings in Russia, Hungary and Ukraine for the new country participants after the international conference at the start of the project. The overall budget remained the same as this money came from an under-spend on

the operating budget for conferences. We saved £7000 by having one conference and inviting everyone to it, rather than having a conference in each country in 2009. Note that we have overspent on the total budget by £110 but we are only claiming for the amount agreed (£197,039).

Project Costs	Original Budget	Agreed Budget	Claim	%Diff
Staff Costs	£			-0.03
Overhead Costs	£			7.04
Travel & Subsistence	£			-2.22
Operating Costs	£			-0.87
Capital Equipment	£			-2.95
Other Costs	£			5.68
<b>Total</b>	<b>£</b>			<b>0.06</b>

**Table 3. Project Expenditure**

Staff Costs	Original Budget	Agreed Budget	Claim	%Diff	Notes
Kate Jones	£			1.63	
Bat Conservation Trust	£			0.00	
Ms. Abigel Szodoray-Paradi	£			0.00	
Ms. Elena Tilova	£			0.00	
Dr. Zoltán Bihari	£			0.00	
Dr. Andriy-Taras Bashta	£			-16.21	1
Dr. Igor Prokofyev	£			10.91	2
Dr. Jon Russ				0.00	
Dr. Ivan Pandourski				10.00	3
<b>Total</b>	<b>£</b>			<b>-0.03</b>	

**Table 4. Staff Costs.** Notes 1&2: Salary for Andriy Taras-Bashita and Igor Prokofyev were allocated to a code for overhead costs by mistake in our accounts although the correct amount was paid. Note 3: The salary for Ivan Pandourski was slightly more than anticipated.

The capital budget (Table 5), was spent on 19 sets of iBats equipment (ultrasound detectors, GPS units, digital recording device, power adaptors, car clamps). 6 sets were sent to each of the three new participating countries. 4 sets of GPS and digital recording devices were replaced in Hungary and Russia and replacement kit and were sent to Romania and Bulgaria. Each country received a hard disc to store data. 2 2TB disks remain in London for data backup.

Capital Equipment Items	Location	Cost
Zoom H2 Recorders (x4), Garmin GPS (x4)	Hungary & Russia	£
2T Hard Discs (x2)	London	£
iBats equipment (x19), iBats replacement equipment (x1), hard disks (x5)	Hungary, Russia, Ukraine, Bulgaria, Romania	£
		£

**Table 5. Capital Equipment Items**

## 7.2 Additional funds or in-kind contributions secured

In addition to the matched funds confirmed for this project (£90,589), we also obtained further money from several other sources over the course of the project. These were as follows Rufford Fund (£20,000); Rufford Small Grants for iBats Russia (£6,000); Whitely Award for iBats Russia (£30,000); Cambridge University Student Conference Fellowship Program for iBats Russia (worth approximately £3,000); Japan Fund for Global Environment (5.7 Million Yen) and from Seven-eleven Midorino Kikin Fund (1 Million Yen) for iBats Japan; and a NERC PhD studentship award for C. Walters (worth approximately £60,000).

### **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 April 2009 - March 2011	Actions required/planned for next period
<p><b>Goal:</b> 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</p> <ul style="list-style-type: none"> <li>• The conservation of biological diversity,</li> <li>• The sustainable use of its components, and</li> <li>• The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</li> </ul>		<p>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.</p>	
<p><b>Purpose</b></p> <p>To generate long-term population data on biodiversity indicators to assess the impact of global change by maintaining and enhancing bat biodiversity programmes in two Eastern European countries and extending the programme to three other countries.</p>	<p>Continued online database of abundances and distribution of bats in Romania and Bulgaria and new data for bats in Hungary, Ukraine and Western Russia.</p> <p>Maintenance or establishment of monitoring personnel in each country.</p> <p>Development of new techniques in analysis of acoustic data, improvements to the web data portal and production of new equipment.</p> <p>Production of papers on bat distribution and habitat use to determine effect of future global change on bat populations.</p>	<p>Improved online database continues to hold project's data for all of participating countries.</p> <p>Maintained network of volunteers from Romania, Bulgaria and trained new ones in Hungary, Ukraine and Russia.</p> <p>We now have an automated way of detecting and extracting call parameters from recordings, and developed the identification tool for European species. Improved web portal launched and all data copied over. iPhone and Android phone 'iBats app' launched.</p> <p>One paper published (Roche et al. 2011); a paper in press (Jones et al. in press) and two papers in preparation (Walters et al.; Walters et al.). Further papers are in production as part of four PhD student theses.</p>	
<p><b>Output 1.</b></p> <p>Ongoing statistically defensible monitoring programme for Romania and Bulgaria</p>	<p>Maintenance of the volunteer network and 60 transects per year per country.</p>	<p>Volunteer network maintained. 60 transects per year per country were planned and 88 transects in 2009 and 92 transects in 2010 were carried out in Romania and 73 in 2009 and 70 in 2010 in Bulgaria. This brings the total across Romania and Bulgaria since 2009 to 323 transects covering 11,209.93 km. Data has been uploaded to the web portal and is available to the volunteers.</p>	

<p><b>Activity: 1.1</b> (Year 1, Months 1-3) International monitoring workshop hosted by Romanian and Bulgaria (assisted by UK partners) inviting key participants from Hungary, Ukraine and Western Russia to introduce the project and train key personnel.</p>	<p>Workshop held in Savadisla, Romania from 15-18th May 2009 and attended by representatives and volunteers from RBPA, Bulgaria (The Green Balkans), Russia (Peresvet), Ukraine (Animals Research and Protection Foundation), Hungary (Nature Foundation) and UK (Institute of Zoology, The Bat Conservation Trust).</p>
<p><b>Activity: 1.2</b> (Year 1, Months 1-3) Equipment bought and transferred for Hungary, Ukraine and Western Russia and replacement equipment purchased for Romania and Bulgaria.</p>	<p>Hungary, Ukraine and Russia each received 6 sets of surveying equipment (2 each in 2009 and a further 4 in 2010), maps and hard discs for data storage. We also replaced damaged equipment in Bulgaria and Romania.</p>
<p><b>Activity: 1.3</b> (Year 1, Months 1-6) Ongoing monitoring data collected by network of volunteer personnel in Romania and Bulgaria. Pilot data collected by Hungary, Ukraine and Western Russia. 60 transects for Romania and Bulgaria and 20 transects for additional countries.</p>	<p>In 2009, 88 transects were surveyed in Romania, 73 in Bulgaria, 25 in Hungary, 23 in Ukraine, and 20 in Russia. In 2010, 92 transects were surveyed in Romania, 70 in Bulgaria, 67 in Hungary, 59 in Ukraine, and 72 in Russia.</p>
<p><b>Activity: 3.4</b> (Year 2, Months 1-6) Ongoing monitoring data collected by network of volunteer personnel in Romania and Bulgaria. Pilot data collected by Hungary, Ukraine and Western Russia. 60 transects for Romania and Bulgaria and 30 transects for additional countries.</p>	<p>See Activity 1.3.</p>
<p><b>Activity: 1.4</b> (Year 1, Months 7-12). All data uploaded to the online web database and analysed</p>	<p>All survey data was uploaded to the iBats website. The majority of the data from the 2009 surveys were analysed.</p>
<p><b>Activity: 3.2</b> (Year 2, Months 1-3) National monitoring workshops hosted by each country (assisted by UK partners) reporting on annual progress and recruiting or maintaining volunteer network (10 volunteers for each additional country)</p>	<p>One workshop was held in Hungary, Ukraine and Russia in May 2010 with the NGOs recruiting and training volunteers to carry out the 2010 transects. Romania and Bulgaria preferred to spend their money for the conference on monitoring efforts for 2011.</p>
<p><b>Activity: 3.3</b> (Year 2, Months 1-3) Transfer of any replacement kit to countries</p>	<p>See Activity 1.2.</p>
<p><b>Activity: 4.1</b> (Year 2, Months 7-12) All data uploaded to the online web database and analysed.</p>	<p>All data were uploaded to the web portal. However, because we were developing an automatic analysis system, we agreed with the project partners that we would use the money earmarked for analysis for extra surveys.</p>
<p><b>Output 2.</b> Development of statistically defensible monitoring programme for Hungary, Ukraine and Russia</p>	<p>Key personnel and 10 volunteers trained in survey methods per country</p> <p>Further workshops run by host countries</p>
<p>We have added to our network of 703 existing iBats volunteers by adding 56 in Hungary, 87 in Russia, 47 in Ukraine.</p> <p>See Activity 1.1. and 3.2.</p>	

	Training material produced	Existing survey and analysis protocols were updated and new ones relating to the use of the web portal and smartphone app were created and distributed through the web portal.
Activities as for Output 1.		
<b>Output 3.</b> Ongoing improved online international spatial and temporal database on bat species abundances and distributions	Survey data collected from 60 transects from Romania and Bulgaria and 20 transects collected from each additional country in Yr1 and 30 in Yr 2  Functionality and appearance of the online database improved	A total of 589 surveys were carried out between 2009-2010 in participating countries, exceeding expectations and these data were all uploaded to the web portal.  We completed work on the new version of the iBats web portal and have transferred all data to the new site.
Activity: 2.3 (Years 1 and 2, Months 1-24) Improvements to the online data portal		See Output 3.
<b>Output 4.</b> Improved analysis techniques to automatically detect and identify bat calls from transect data and improved equipment	Analysis of sonograms no longer a bottleneck to the analysis.  Production of a new bespoke detector	We identified a method to identify and extract calls from call sequences and to extract the relevant features and we have completed a neural classification network to identify echolocation calls to species throughout Europe.  We have not created new detector hardware but instead created software to link together existing hardware – the <i>iBats app</i> for iPhones and Android phones. This ‘app’ is available freely for download across the world from the iTunes store or the Android market place.
Activity: 2.1 (Years 1 and 2, Months 1-24) Development of new analytical techniques to automatically analyse and identify acoustic data		See Output 4.
Activity: 2.2 (Years 1 and 2, Months 1-24) Development of new detector		See Output 4.
Activity: 4.2 (Year 2, Months 10-12) Production of new bat detector and purchase and distribution to volunteer network		See Output 4.
<b>Output 5.</b> Knowledge of how change in human development and climate impacts bat biodiversity	Statistical analysis of spatial distributions and abundances with habitat and environmental conditions  Analysis of predicted impacts on bat populations with change in	We have a paper in press (Jones et al. in press) analysing the 2005-2009 data and an analysis of the habitat and environmental conditions of <i>Pipistrellus pipistrellus</i> .  Charlotte Walters has begun collating the iBats data from Europe as well as additional data from the literature to carry out a Europe-wide analysis

	human impacts and climate	as part of her PhD to investigate the habitat and climate associations of Eastern European bats. Alexander Gorbachev produced the first habitat model for Russian bats, Romanian and Hungarian iBats data was analysed and presented at international workshops.
Activity: 3.1 (Year 1, Months 9-12) Analysis of the Yr 1 data from all countries		See Output 5.
Activity: 4.3 (Year 2, Months 7-12) Production of papers on impact of future global change on bat biodiversity in the region.		See Output 5. We also have two papers in preparation (Walters et al.; Walters et al.) and BCT has published the trends in Ireland using the same technique (Roche et al. 2011).

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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Goal:</p> <p>Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.</p>			
<p>Sub-Goal: Biodiversity across five countries in Eurasia is monitored sustainably and effectively, providing information on how to minimise the impacts of global change on ecosystems and ecosystem services.</p>	<p>Biodiversity population data collected yearly by a national network to provide statistically robust population trends over time and beyond the lifetime of the project.</p>	<p>Analysis of data collected by the project.</p>	
<p>Purpose</p> <p>To generate long-term population data on biodiversity indicators to assess the impact of global change by maintaining and enhancing bat biodiversity</p>	<p>Continued online database of abundances and distribution of bats in Romania and Bulgaria and new data for bats in Hungary, Ukraine and Western Russia.</p>	<p>Data available from the data portal and continuing annual entry from host countries</p> <p>New techniques incorporated into the analysis, production of a new detector and web site functionality</p>	<p>Host countries can recruit and maintain a sufficient volunteer network</p> <p>New techniques and equipment are successfully developed.</p> <p>Host countries willing to share data</p>

programmes in two Eastern European countries and extending the programme to three other countries	<p>Maintenance or establishment of monitoring personnel in each country</p> <p>Development of new techniques in analysis of acoustic data, improvements to the web data portal and the production of new detector equipment</p> <p>Production of papers on bat distribution and habitat use to determine effect of future global change on bat populations</p>	<p>improved</p> <p>Results of the analyses published in peer reviewed journals</p>	
<p>Outputs (add or delete rows as necessary)</p> <p>1. Ongoing statistically defensible monitoring programme for Romania and Bulgaria</p>	Maintenance of the volunteer network and 60 transects completed per year per country	Data available from the data portal and continuing annual entry from host countries	Romania and Bulgaria can recruit and maintain a sufficient volunteer network
2. Development of statistically defensible monitoring programme for Hungary, Ukraine and Russia	<p>Key personnel and 10 volunteers trained in survey methods per country</p> <p>Further workshops run by host countries</p> <p>Training material produced</p>	<p>Contact details of volunteers and workshops recorded</p> <p>Training material available for download from the website</p>	Ability of host countries to recruit volunteers (risk reduced as Hungary has already recruited some volunteers)
3. Ongoing improved online international spatial and temporal database on bat species abundances and distributions	<p>Survey data collected from 60 transects from Romania and Bulgaria and 20 transects collected from each additional country in Yr1 and 30 in Yr 2</p> <p>Functionality and appearance of the online database improved</p>	Verification of the quality and quantity of survey data. GPS log can be used to verify position of the recordings.	<p>Survey data is collected correctly</p> <p>Website can be accessed by host countries</p>

<p>4. Improved analysis techniques to automatically detect and identify bat calls from transect data and improved equipment</p>	<p>Analysis of sonograms no longer a bottleneck to the analysis.</p> <p>Production of a new bespoke detector</p>	<p>Algorithms incorporated into analysis</p> <p>Designs for new detector produced and new detectors made and incorporated into the monitoring programme</p>	<p>Algorithms do not work.</p> <p>Detector is not produced.</p>
<p>5. Knowledge of how change in human development and climate impacts bat biodiversity</p>	<p>Statistical analysis of spatial distributions and abundances with habitat and environmental conditions</p> <p>Analysis of predicted impacts on bat populations with change in human impacts and climate</p>	<p>Production of peer-reviewed papers</p>	<p>Sufficient data is collected for analysis</p>

## 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		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	60	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		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.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	30	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		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.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

<b>Article No./Title</b>	<b>Project %</b>	<b>Article Description</b>
16. Access to and Transfer of Technology		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.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution		Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

## Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
<b>Training Measures</b>		
1a	Number of people to submit PhD thesis	3 (Charlotte Walters, Alexander Gorbachev, Batbayar Galtbalt)
1b	Number of PhD qualifications obtained	1 (Abigel Szodoray-Paradi)
2	Number of Masters qualifications obtained	1 (Annie Pagan, Pavlo Chegorka)
3	Number of other qualifications obtained	1 (Internship for Alexander Gorbachev)
4a	Number of undergraduate students receiving training	0
4b	Number of training weeks provided to undergraduate students	0
4c	Number of postgraduate students receiving training (not 1-3 above)	0
4d	Number of training weeks for postgraduate students	0
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification( ie not categories 1-4 above)	0
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	139 (International iBats workshop for 52 people and workshops in Hungary, Ukraine, Russia, Mongolia and Japan, Internship for Alexander Gorbachev)
6b	Number of training weeks not leading to formal qualification	13 (1 x International workshop and 8 meetings and workshops in Hungary, Ukraine and Russia and Japan and 4 week internship for Alexander Gorbachev)
7	Number of types of training materials produced for use by host country(s)	7 (Updated talks on Bat biology, echolocation, monitoring biodiversity, protocols for monitoring, echolocation analysis, species identification, using the website)
<b>Research Measures</b>		
8	Number of weeks spent by UK project staff on project work in host country(s)	16 (1 week for Charlotte Walters, 8 weeks for Kate Jones and 7 weeks for BCT Staff)
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	0
10	Number of formal documents produced to assist work related to species identification, classification and recording.	2 Online manuals for classification and 1 peer reviewed paper
11a	Number of papers published or accepted for publication in peer reviewed journals	2 peer reviewed papers (Jones et al. Roche et al.) 2 papers in prep. (Walters et al.; Walters et al.) and 3

<b>Code</b>	<b>Description</b>	<b>Totals (plus additional detail as required)</b>
		conference proceedings.
11b	Number of papers published or accepted for publication elsewhere	0
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	5 (Hungary, UK, Japan, Russia and Ukraine) and available to host country
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	2 (Romania and Bulgaria) and available to host country
13a	Number of species reference collections established and handed over to host country(s)	1 iBats database contains echolocation call data for different species within each country
13b	Number of species reference collections enhanced and handed over to host country(s)	
<b>Dissemination Measures</b>		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	9
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	27
15a	Number of national press releases or publicity articles in host country(s)	20 Russian, 3 Japan
15b	Number of local press releases or publicity articles in host country(s)	3 Romania
15c	Number of national press releases or publicity articles in UK	Over 70 (Including Daily Telegraph, Independent, Scientific American, BBC)
15d	Number of local press releases or publicity articles in UK	1
16a	Number of issues of newsletters produced in the host country(s)	
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	
18b	Number of national TV programme/features in the UK	2 (BBC Autumn Watch, BBC 1 London News)
18c	Number of local TV programme/features in host country	1 Ukraine

<b>Code</b>	<b>Description</b>	<b>Totals (plus additional detail as required)</b>
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	1 Ukraine, 1 Russia
19b	Number of national radio interviews/features in the UK	2 (Tribes of Science, BBC; BBC 3 Countries Radio)
19c	Number of local radio interviews/features in host country (s)	
19d	Number of local radio interviews/features in the UK	
<b>Physical Measures</b>		
20	Estimated value (£s) of physical assets handed over to host country(s)	£21,932 (19 sets of equipment plus replacement equipment, hard discs, books)
21	Number of permanent educational/training/research facilities or organisation established	
22	Number of permanent field plots established	
23	Value of additional resources raised for project	£90,589 confirmed matched funding. In addition £20,000 (Rufford Fund), £6,000 (Rufford Small Grants), £30,000 (Whitely Award), £3,000 (Cambridge University Internship), £60,000 (NERC PhD Studentship), 6.7 Million Yen (Japan Fund for Global Environment & Severn-eleven Midorino Kikin Fund)
<b>Other Measures used by the project and not currently including in DI standard measures</b>		

## Annex 5 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Type (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Website	Indicator Bats Program	iBats	www.ibats.org.uk	Free
Online Manual	Instructions for using the iBats website	iBats	www.ibats.org.uk	Free
Online Manual	Monitoring Protocol (for Garmin GPS and Zoom H2)	iBats	www.ibats.org.uk	Free
Online Manual	Monitoring Protocol (for PDA with Memory Map)	iBats	www.ibats.org.uk	Free
Online Manual	Monitoring Protocol (for PDA with GPSTuner)	iBats	www.ibats.org.uk	Free
Online Manual	Sonogram Analysis Protocol	iBats	www.ibats.org.uk	Free
Online Manual	Bat Call Guide	iBats	www.ibats.org.uk	Free
Online Database	Database of georeferenced calls	iBats	www.ibats.org.uk	Free but access limited to project participa nts
Peer-reviewed paper	Jones et al. 2011. Monitoring ultrasonic biodiversity: using bats as biodiversity indicators	In: Biodiversity monitoring and conservation: bridging gaps between global commitment and local action (eds. Collen et al.) Blackwell Press, London		Unknown
Peer-reviewed paper	Roche, N., S. Langton, T. Aughney, J.M. Russ, F. Marnell, D. Lynn and C. Catto. 2011. A car-based monitoring method reveals new information on bat populations and distributions in Ireland	Animal Conservation		Unknown
In prep – Peer- reviewed paper	Walters.C., Maltby,A., Barataud,M., Dietz, C., Fenton, B., Jennings, N., Jones, G., Obrist, M., Puechmaille, S., Sattler, T., Jones, K. and Parsons, S. Identifying European bats from echolocation	Journal of Applied Ecology		Unknown

	calls: a tool for surveying bats in Europe.		
In prep – Peer-reviewed paper	Walters, C., A. Maltby, J. Russ and K.E. Jones. Using echolocation to survey and monitor bats globally	In: Current Trends in Bat Evolution, Ecology and Conservation (Eds. Rick A. Adams, R.A. Pedersen, S.C.). London: Springer Science Press.	Unknown
Conference proceeding	A. Szodoray-Paradi & F. Szodoray-Paradi. 2009. Results of the Romanian Indicator Bats Programme	In: Proceedings of the VII th Conference on Bat Conservation in Hungary, Felsotarkany	
Conference proceeding	C. Istvan & F. Szodoray-Paradi. 2009. The use of time expansion ultrasound detectors in the Hungarian bat research	In: Proceedings of the VII th Conference on Bat Conservation in Hungary, Felsotarkany	
Conference proceeding	Bashta A.-T., Jones K., Russ J. (2010). Monitoring of bats in Ukraine: first results.	Plecotus et al. 13: 88-89. (Material of the 10th Russian Bat Conference, Penza, 8-11.09.2010)	
PhD Thesis	A. Szodoray-Paradi. 2011. Faunistical and ecological research of bats from Transylvania.	PhD Thesis, University of Bucharest, Romania.	
Masters Thesis	Pavlo Chegorka. 2011. Bat fauna biodiversity in different parts of Dnipropetrovsk region.	MSc Thesis. Dnipropetrovsk National University	
Masters Thesis	Annie Pagan. 2010. An analysis of iBatsUK: How effective is iBats at generating an indicator of bat abundance in comparison to existing programs?	MSc Thesis. Imperial College	

## Annex 6 Darwin Contacts

<b>Ref No</b>	EIDPO036
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