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Why conserve bats?

White nose-syndrome (WNS) is a devastating disease caused by the fungus *Geomyces destructans* that, since 2009, has killed more than 1 million hibernating bats in North America. This has prompted scientists to evaluate just how important bats are for food production and other ecological services.

This Factsheet summarises recent research into bat conservation in the UK and the global role of bats in:

- Controlling insect pests
- Seed germination
- Seed dispersal

Bata have been on Earth for over 52 million years and there are at least 1,232 separate species.

Most species spend their days in caves, tree cavities and eaves and then forage for insects, nectar, seeds, fruit, fish, small mammals, frogs and even blood during the night.

Human activity is increasingly threatening bat survival: forest destruction, cave disturbance, depletion of food resources, increased use of pesticides and the construction of wind farms have all increased bat mortality.

But, why should we care about bats? Table 1 summarises key ecological services provided by bats.

Pest control

Scientists dissected and analysed the DNA of guano pellets from a colony of 150 big brown bats (*Eptesicus fuscus*) in the midwestern United States.

Based upon the dietary composition, number of agricultural pest species in each pellet and the average number of active foraging days per year ,they estimated that annually this small colony consumes:

- 600,000 cucumber beetles (corn rootworms which feed on corn and spinach). More hectares of cropland are treated with insecticide to control corn rootworm than any other pest in the US. If each female cucumber beetle lays 110 eggs, this single bat colony could prevent the production of 33,000,000 cucumber beetle larvae.
- 194,000 June beetles (feed on corn, wheat, oats, barley, sugarbeets, soybeans, and potatoes)
- 158,000 leafhoppers (feed on potatoes, grapes, almonds and citrus fruits and transmit harmful viruses)
- 335,000 stinkbugs (feed on apples, pecans, soybeans and cotton)

Table 1 Key ecological services provided by bats

Ecological service	Benefit	Example
Destruction of insect pests of crops	Reduces insect damage Reduces need to apply insecticide – to which >400 insect pests have developed some resistance – and which may kill beneficial species	Herbivorous arthropods destroy approximately 25–50% of crops worldwide. >60% of bats are insectivorous. A single colony of 150 big brown bats (*Eptesicus fuscus*) in Indiana has been estimated to eat nearly 1.3 million pest insects each year. Economists estimate that this is worth about $74/acre in cotton plantations
Pollination	Increases crop yield Increases fruit production and increases genetic diversity of fruiting plants	Nectar and pollen-feeding species help to propogate trees, shrubs, epiphytes and lianas. Economically important plants pollinated by bats include cashews, mangoes, date palms, papaya, figs, bananas and tree species used for timber (e.g. balsa) and thatch
Fruit dispersal	Introduces seeds of fruit into new areas, reducing local competition	Aids dispersal of figs into wild forest, providing food for other economically important dispersal species
Redistribution of nutrients through guano	Important in e.g. phosphorus cycle	Guano is been mined from caves and is a rich source of nitrogen and phosphorus
Food source	Bat bushmeat	e.g. in Malaysia and the Phillipines
Tourism	Bat watching	The 5th Annual Austin Bat Fest attracted over 40,000 participants to the area surrounding the Congress Avenue Bridge, a roosting site for an estimated 1.5 million Brazilian free-tailed bats Could become a valuable source of ecotourism funds for bat conservation

Case Study: Brazilian free-tailed bat

Each spring, millions of Brazilian free-tailed bats migrate north from Mexico to limestone caves and bridges in the southwestern US.

Each evening, large numbers of bats emerge from these roosts and forage in natural and agricultural areas. They feed mainly on moths including corn earworm or cotton bollworm moth (*Helicoverpa zea*) and the tobacco budworm moth (*Heliothis virescens*).

Economists have estimated that the bats effectively prevent $30 million of damage to cotton and tobacco alone. This takes into account crop loss, the money saved on producing, transporting and applying pesticides but excludes any costs associated with greenhouse emissions associated with the pesticides – so the economic benefits are even greater! Conservationists argue that it makes economic sense – as well as moral and ethical sense – to promote conservation of bats and other biological controls.

G. destructans the fungus that has wiped out over a million bats in the US has been found to be widely distributed in Europe. However, it does not appear to be causing widespread mortality. This supports the hypothesis that *G. destructans* has co-evolved with European bats and has only recently arrived in North America. However, scientists are only just beginning to look for sub-lethal effects and that will be at the centre of research over the next few years.

Bat conservation in the UK

Bats account for almost a third of all mammal species in the UK and occupy a diverse range of habitats such as wetlands, woodlands, farmland, as well as urban areas. They are useful **indicator species** as they are top predators of common nocturnal insects and are sensitive to changes in land use practices. The threats that they face - agricultural intensification, development and habitat fragmentation are also relevant to many other wildlife species, making them excellent indicators of the wider health of the UK's wildlife.

The Bat Conservation Trust runs the National Bat Monitoring Programme (NBMP) and covers 11 species using three different methods: colony counts, field surveys and hibernation counts. The programme is leading the way for other multispecies surveillance programmes and is important because bats are likely to be sensitive indicators of environmental change in the countryside.

Volunteers often undertake bat monitoring and this raises the problem of varying levels of expertise. Scientists at the University of Bristol are putting together a reference library of DNA information on all 17 bat species that are breeding in the UK. Once completed the library will be publicly available and could form the basis of an accurate method for identifying species from hair samples if a cheap, automated DNA sequencing method can be developed.

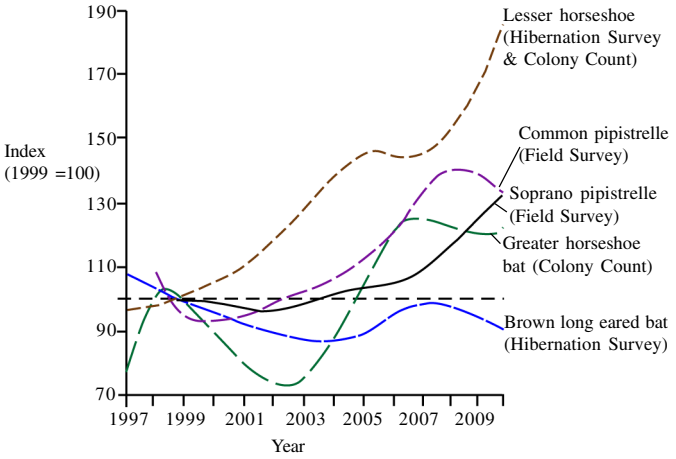
This would potentially allow even larger numbers of volunteers – including those lacking formal mammal identification experience – to get involved.

References

Kunz,T.H Braun de Torez, E Bauer, D Lobove, T Fleming, T.H(2011) Ecosystem services provided by bats. Annals of the New York Academy of Sciences. Issue: *The Year in Ecology and Conservation Biology* 1223 p1-38

Typical Exam Question

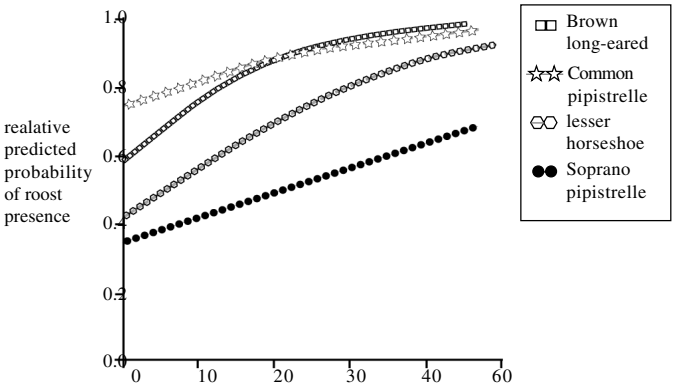
The graph shows trends in 5 key bat populations as measured in 2010 by the National Bat Monitoring Programme (NBMP).



(a) The data for the Lesser Horsehoe bat is considered to be the most reliable of the five species. Suggest why. (1)

(b) Why is it useful to present the data in the form of an index based upon a 1999 baseline? (1)

(c) Under agri-environment schemes in Wales, farmers have been offered financial incentives to increase the proportion of broadleaved woodland. Scientists from the University of East Anglia assessed the relationship between the probability of bat roosts and the proximity of newly-planted broadleaved/ mixed woodland. The graph shows the results.



(i) Outline the significance of this data (2)

(ii) Suggest why planting broadleaf woodland may improve crop yields (1).

Markscheme

(a) Data involves a combination of two survey techniques;

(b) Enables trend to be identified;

(c)(i) Roosts more likely near woodland;
Roosts increase as the proportion of woodland increases;

(ii) Bats prey on insect pests/ reduced pest damage;

Since 1996 more than 3,000 volunteers have taken part in the NBMP. Why not get involved? The Bat Conservation Trust run training courses for beginners and, apart from helping monitor bat populations and helping to conserve these valuable and intriguing mammals, you'll get experience that looks great on your UCAS application!

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