Explore the world of bat conservation through the national curriculum

Teachers' notes

5. ECHOLOCATION

Relevant areas of learning and experience:

Science and Technology, Language, Literacy and Communication

All sounds are made by something moving – banging, shaking, blowing – which in turn cause vibrations that travel in waves through the air. When these vibrations reach the eardrum they are changed to vibrations in bones in the inner ear, which send information to the brain.

If the sound waves hit something hard they bounce back; this reflected sound is called an echo. Echolocation – locating things by their echoes – is the system bats use to fly and feed in the dark

Seeing with sound

- Compare the sounds made by different mammals, including bats and ourselves.
- Bat sounds are produced in essentially the same way as human sounds. The larynx is much larger in bats, for the bats size, than other mammals. Why?
- Do all bats echolocate?
- Do all bats that echolocate do so though their mouths?
- What other adaptations might bats use to help hearing?
- The calls of some bats are relatively loud to them. How do bats stop themselves from being deafened by their own calls?
- Discuss the long-term dangers of listening to loud sounds.

- What is the difference between the way sound travels through air and through water? Why?
- Compare echolocation in bats and dolphins. How does this relate to the way they live?

Collect photographs of the variation in animal's ears. Discuss the relationships between the size of ears, the animal's habits and which of its senses it depends on most.

How good a bat are you? Working in pairs, one blindfolded, try to identify sounds made by tapping a stick on different surfaces. Compare the sounds indoors and out in the open.

Ask somebody from your local bat group to run a bat walk one evening when bats are active, to listen to bat calls and to hear and describe what they sound like.

Look at some sonograms to see what the calls look like when plotted out on a computer.

Who was Donald Griffin? Read about his discoveries and discuss the importance of his work to subsequent bat research.

Investigating sound

Our surroundings affect the sounds we hear as a result of echoes.

- Explore this, making sounds (e.g. tap two sticks together) indoors, out of doors, in a confined place and so on. Explain what is happening.
- Plan a test to measure or observe how well different materials muffle sound. (Fur, bubble wrap, blanket material). Predict what will be effective and why.

Blind people sometimes tap a stick in front of them, listening to the echoes to help them avoid obstacles. Work in pairs, with one blindfolded, to test this.

Test the loudness and softness of the sounds produced by a range of musical instruments

Test ways of producing sounds and how to vary loudness and softness sung the same instrument.

- Distinguish between pitch and loudness.
- Discuss the long-term dangers of listening to loud music.
- What is noise pollution?

- Do big ears improve your hearing? Use stiff paper to cut out a band with big ears. Make Test ears of different shapes and sizes with your friends. Which ones work best?
- Experiment with an open umbrella (a radar dish) and a stop watch. Can you create echoes and time them?
- Air absorbs sound so vibrations do not carry very far. The higher the sounds, the shorter distance they carry. Low sounds can travel a very long way. Test this. Shout messages outside and see how far the sound carries. Find out about other mammals (e.g. elephants, howler monkeys).
- Range pupils in order according to the pitch of their speaking voices.
- How does sound move? Find out about other systems that use echoes, - sonar, radar and lidar. All can detect an object's distance, shape, size and direction. All these systems include a clock which records the time taken for a wave to travel to an object and back. The farther the distance, the longer it takes. What sort of waves do these systems rely on? How and where are they used?
- Contrast light and sound and the way they travel (through solids, liquids)

Bat detectors

A bat detector makes the bat's echolocation calls audible to humans - and because different bat species hunt different prey and are different sizes, they make different calls which can help identify them.

There is a bewildering range of bat detectors now available, varying in complexity and price.

At the most basic level, a bat detector contains

a microphone which is sensitive to high frequencies

an electronic circuit which changes these to low signals

a speaker system which enables us to hear them

There are three different types of detectors, Heterodyne, Frequency division and Time expansion. Each has advantages and disadvantages.

Heterodyne detectors are the most widely used and the best for a new user. By adjusting the tuning frequency of we can "listen" to different portions of the bat call and with practice can distinguish the calls of a number of bat species or families.

Frequency division and time expansion listen to all frequencies at the same time, and are often used with recording equipment for later analysis. By adjusting the tuning frequency of the bat detector we can "listen" to different portions of the bat call and with practice can distinguish the calls of a number of bat species or families.

Like frequency division and time expansion detectors, full spectrum, real-time sampling detectors detect all frequencies.

Visit the Bat Conservation Trust site **http://www.bats.org.uk/pages/bat_detectors.html#tuneable** This provides further details of the different types. You can also listen bat echolocation calls on the different types of detector.

Look for a bat walk advertised in the summer for the opportunity to listen to bats.

Find out if the local bat group runs walks using detectors.