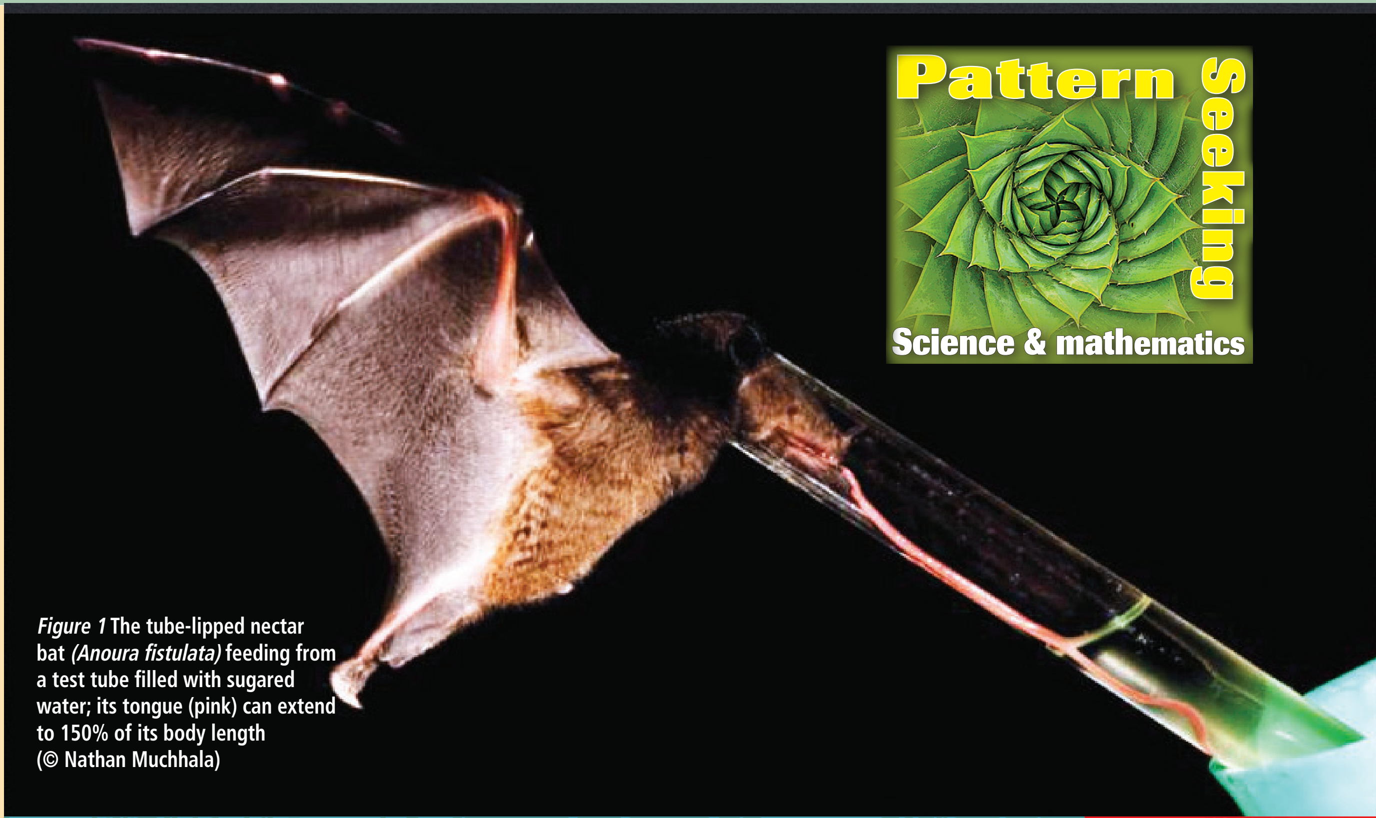

Figure 1 The tube-lipped nectar bat *(Anoura fistulata)* feeding from a test tube filled with sugared water; its tongue (pink) can extend to 150% of its body length (© Nathan Muchhala)

PROPORTION, RATIO AND SCALE

it's enough to drive kids batty!

NOT CORNER

***Victoria Pooler** explores how the natural world can be used to enhance the mathematics curriculum*

Key words:
Cross curricular
Types of activity
Life processes

Did you know that the tongue of a tube-lipped nectar bat (*Anoura fistulata*) is 8.6 cm long (Figure 1)? That doesn't sound particularly impressive until you find out that its body length is only 5.8 cm and its tongue has to be stored inside its ribcage because it is 150% longer than its whole body!

As interesting as this was to me, it made me wonder – how could children access this information? If I told my class that a tube-lipped nectar bat's tongue is 1.5 times its body length, could they envisage this? Initially I would say 'no'; most children would disregard this fascinating fact as just an abstract figure about an animal they had never heard of. However, the more I looked into the humble tube-lipped nectar bat, the more I realised that animals like this are a really interesting way to access some of the more abstract concepts in mathematics, such as ratio, proportion, percentage and scale. Furthermore, there are important links to science, specifically regarding adaptation: why on earth does it need such a long tongue anyway? All will be revealed.

Bats and mathematics?

Asking children to compare 5.8 cm to 8.6 cm may not be very interesting in a science or mathematics lesson. They could say there is a difference of 2.8 cm or convert the figures to millimetres. Even if you measured and cut two pieces of wool or string for each length, the difference between the two does not seem that great. However, when these figures relating to the bat are scaled up in proportion to your own body length, it becomes apparent how long the bat's tongue actually is (Figure 2).

Looking at the tube-lipped nectar bat alone, various areas of the mathematics curriculum can be covered with multiple opportunities for investigations and using and applying mathematics, depending on what area of the curriculum is being covered. Here are some ideas (with learning outcomes in italics):

- **If the ratio of body length to tongue length is 1 : 1.5, how long would my tongue be? How could I work this out?** *(Solve simple problems involving ratio and proportion.)*
- **I am a tube-lipped nectar bat and my tongue is 150% longer than my body. How long would your tongue be if you were me? (***Find percentages of whole number quantities, using a calculator where appropriate***.)**
- **A tube-lipped nectar bat's tongue is 1.5 times (or one-and-a-half times) longer than its body. If you transformed into one tomorrow, how long would your tongue be? (***Recognise approximate proportions of a whole and use simple fractions and percentages to describe them, explaining their methods and reasoning***.)**

Various strategies on how these could be worked out need to be modelled, but for all three investigations, children would find out that their answers would be the same if related to their own height. This could be used to demonstrate how ratio, proportion, percentage, decimals and fractions are all linked, and how children can use similar strategies to calculate the answer. For example, if I am 120 cm tall and my tongue is one-and-a-half times my body, I could work out what one times my body length is (120 cm) and add half of this (60 cm) to equal 180 cm. Would I get the same answer if I calculated 120 cm x 1.5? What if I worked out 150% of 120 cm? Furthermore, children can be encouraged to use estimation here; for example:

I know that the answer will be more than 120 cm but it won't be more than 2 x *120 cm.*

There are also opportunities for children to practise accurate measuring and conversion: what if I complete the calculations in metres instead of centimetres? And of course, children really enjoy actually carrying out the investigation to see how long their tongues would be, which could then be further linked to literacy (using descriptions and adjectives) to write imaginatively about the pros and cons of having such a tongue!

To create additional challenges, children could be given the measurements rather than the ratio, percentage or proportion, which would add another element of complexity to the investigation. Data-handling could be looked at by recording and plotting their results onto a line graph: What does the line look like? What would the line look like if the ratio was different?

Figure 2 Comparing your tongue's length to that of the tube-lipped nectar bat

How does this link to science?

Even with little-known animals such as a tube-lipped nectar bat, there are a range of links to be made to the science curriculum. A good discussion point could be why it has such a long tongue in the first place. It feeds mainly on nectar and is the sole pollinator for several plant species. This fact could lead on to learning about reproduction in plants, such as how plants are pollinated by various species and how the process occurs. Alternatively, adaptation could be covered: what habitat does the tube-lipped nectar bat live in and how has it adapted to its surroundings? By looking at this, more complex concepts beyond the scope of the primary curriculum, such as ecological niches and evolution, could be approached by using this real-life example. Additionally, principles of sound could be looked at in relation to echolocation in bats or the diversity of a species, or even keys and the taxonomic system for naming species of bats.

The example of the tube-lipped nectar bat could be taken further. The bat is endemic to Ecuador, so this could link to geography and to a study of the country. Children could use the internet to research whether there are other animals that have large body parts in proportion to their body length or height. Table 1 has some examples of animals that do, and these could be used in a similar

Table 1 Examples of animals with large body parts in proportion to their body length

Animal	Body length	Body-part length	Scale
Sword-billed hummingbird	10 cm	10 cm (bill)	1 times (equal proportion)
Vampire squid	30 cm	2.5 cm (eyes)	~0.1 times (would equal 15 cm diameter eyes in humans)
Wild water buffalo	2.75 m	2 m (horns)	~0.7 times

way to link to the mathematics curriculum.

Wow factor: the wandering albatross

Another interesting science and mathematics based investigation could involve looking at the wandering albatross (*Diomedea exulans*). It has the largest wingspan of any bird, with the largest recorded span being 3.63 m, and on average adults have a 3 m wingspan (Figure 3). Its body length from head to tail is 1.2 m so the wingspan is three times its body length. This means the calculations involved are slightly easier than when multiplying decimals with the tube-lipped nectar bat and therefore could be used with younger children. By taking wings and arms as equivalents in birds and humans, children can compare height to arm-span in humans – they are approximately the same. This could include key mathematical language, such as my height to arm-span ratio is 1:1. There is a further link to be made here to the art curriculum and looking at proportions when drawing people.

The best part of an investigation such as this is not just to see how long a child's arm-span is (3 m for a 1 m tall child), but to see, using a piece of string or wool, how large a wandering albatross's wingspan actually is compared to its body length (Figure 4). Visualising in this way brings to life how wonderful these birds are. This can be backed up by various photographs and videos available on the internet (see end). The wandering albatross is classified as a vulnerable species (IUCN, 2009) and this again can be linked to the science curriculum to look at ways in which living things and the environment need protection.

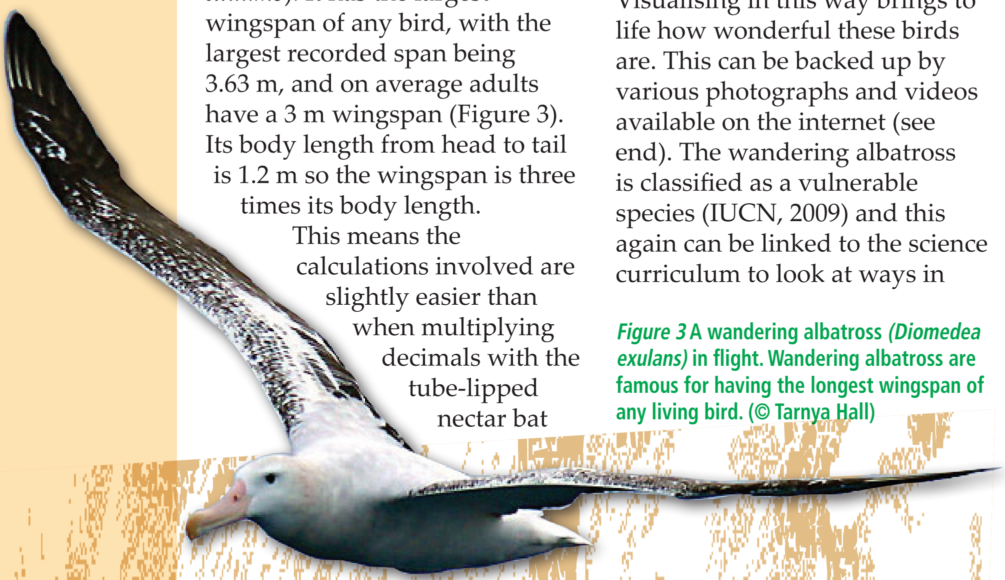

Figure 3 A wandering albatross *(Diomedea exulans)* in flight. Wandering albatross are famous for having the longest wingspan of any living bird. (© Tarnya Hall)

Figure 4 How long is the wingspan of a wandering albatross? It's THIS big!

For younger children

Although the above investigations involving ratio, scale and proportion may be beyond younger children, looking at amazing animals can still enhance mathematics lessons. Various animal body parts can be compared, which again links with the science curriculum aim to recognise animal body parts. For example, which is longer: an elephant's trunk or a giraffe's neck? What part of your body is like an elephant's trunk? Or, by using pre-measured string to display length, children could carry out an investigation to see how many children in their class would fit into a blue whale (30 m long) if they lay down head to toe? Or what about the world's tallest tree, a sequoia (115 m tall)?

Conclusion

These are just some examples of how animals can be linked to the mathematics curriculum to demonstrate some of the trickier concepts in mathematics through concrete, visual examples. They can also be great talking points to get children interested and engaged in the natural world. As these incredible feats of nature exist on Earth, let's use them to show children how amazing the natural world is.

Reference

IUCN (2009) The IUCN Red List of Threatened Species. Available from: www.iucnredlist.org/apps/redlist/search

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Websites

Tube-lipped nectar bats: **i.iucnredlist.org/documents/amazingspecies/anoura-fistulata.pdf**
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