

# primary science & technology bulletin

Ideas and inspiration for teachers in primary schools and S1/S2

- > Wonderful wriggly worms!
- > Happy retirement Teresa McErlean
- > Scottish success at STEM Inspiration Awards
- > RBS STEM Ambassador
- > Recognition for SSERC



# Wonderful wriggly worms!

We are big fans of the not-so-humble earthworm and it seems we are not the first to feel this way. Aristotle described earthworms as “the intestines of the soil” and Charles Darwin was famously fascinated by these amazing invertebrates. Darwin’s last scientific book, *The Formation of Vegetable Mould through the Action of Worms, with Observations on their Habits* [1] was published in 1881, not long before his death. Darwin compared the actions of earthworms to that of the plough and was well aware of their importance to life on earth.

“It may be doubted whether there are many other animals which have played so important a part in the history of the world” - Charles Darwin.

Studying earthworms can help learners gain an understanding of the important role these invertebrates play in the fertility of the soil and the growth of plants. Taking a closer look at just some of the 27 different species of earthworm that live in the UK provides a fascinating insight into the hidden world beneath our feet and could help to support the teaching of the sciences within Curriculum for Excellence [2].

Earthworms are segmented animals without bones (Figure 1). These burrowing invertebrates form tunnels by literally eating their way through the soil. They consume fresh and decaying plant material, animal material and microorganisms mixed with earth. It can be hard to



Figure 2 - Worm casts.



Figure 1 - Earthworms - segmented soil living invertebrates.

spot earthworms without digging into the soil, but a sure sign of their presence are worm “casts” on lawns or vegetable beds (Figure 2). These casts are essentially worm poo - soil that has passed through the digestive system of the worm. These casts can be spotted when out and about, in the grass or on garden soil, they are rich in nutrients and provide evidence of a healthy earthworm population.

Learners can be encouraged to get close to earthworms in a variety of ways. Getting outside and finding out about the worms in your local area can involve taking part in a citizen science earthworm survey - such as those run by Earthworm Watch [3] and OPAL [4]. Both organisations, along with The Earthworm Society [5] have easy to use identification guides [4], [6] & [7]. Earthworm

Watch have produced an information booklet on how to complete an earthworm survey [8].

Learners may also be interested in worm charming - the “ancient art” of encouraging earthworms to the surface of the soil by producing vibrations in the earth. Common methods include using a stick to repeatedly strike a garden fork that has been stuck into the soil or paddling. This paddling of the feet is something that you may have observed birds carrying out on the school playing field or garden. Worms cannot hear but are sensitive to vibration, the idea behind “charming” is that the vibrations produced mimic rain falling on the surface of the soil, or the action of a mole hunting. Both encourage earthworms out of their burrows and onto the surface. You can >>



Figure 3 - Adult Brandling Worm Clitellum marked with an arrow.



Figure 4 - Brandling and Composting Worms in the SSERC wormery.

watch a BBC 2 clip of renowned wildlife fan Bill Oddie attempting to charm worms using a musical instrument [9].

In the clip [9] Bill Oddie also touches upon the interesting reproductive cycle of earthworms. Famously hermaphroditic, earthworms have both male and female reproductive organs in one body, though it still takes two worms to reproduce. Adult worms have a clitellum (Figure 3), also known as the saddle or collar - the reproductive organs are located here. When mating, worms coil around each other and exchange packets of sperm called spermatophores. Each worm uses the sperm from the other worm to fertilize its own eggs. The worm then secretes a membrane around its clitellum and stores the fertilized eggs inside. Then the worm wiggles out of the membrane and leaves it behind as an “egg cocoon”, which quickly hardens to protect the eggs inside. When conditions are right, the eggs hatch.

Earthworms continue to grow throughout their life. Earthworms in this country don’t grow very large compared, that is, to the Giant Gippsland Earthworm from Southern Australia which can reach lengths

of over 2 metres. This gentle giant is under threat from modern farming practices. Australian Geographic’s website contains a clip of David Attenborough coming “face to face” with a Giant Gippsland Earthworm [10].

### Keeping worms outside

As an alternative to carrying out an earthworm survey, learners could get a closer look at worms in the school garden, either in a compost bin or purpose built wormery. Keeping worms is known as vermiculture. The RHS and Wildlife Trusts have produced a guide to encouraging

learners to *Go wild for worms* - reinforcing the links between earthworms, composting and soils in supporting the growth of healthy plants [11]. A good compost bin, or garden wormery, should be teeming with the two common species of native composting worm - both are stripy - the **Brandling Worm** or **Tiger Worm** *Eisenia fetida* and the **Composting Worm** *Eisenia veneta* (Figure 4).

At SSERC we have two outdoor wormeries (Figure 5 & 6) - both purchased ready-made [12], but >>



Figure 5 - Plastic wormery at SSERC.



Figure 6 - Wooden wormery at SSERC.

it is possible to make your own wormery [13], [14] & [15]. Earthworms dug up from garden soil are not generally suitable for composting. Make sure you introduce composting worm species. These can be collected from an existing compost bin or wormery, or purchased from a fishing bait shop or on-line [12].

Feed the worms with fruit/vegetable waste and layers of damp shredded newspaper. Keep everything moist but not too wet, as worms can drown in waterlogged environments. When adding material to your wormery, the golden rule is little and often. How fast the worms process the waste depends on how many worms there are and how warm it is. In winter the worms will slow right down and process very little waste. In the summer they will feed much faster. General advice is not to add too much citrus peel or onion as the worms don't like strongly acidic conditions. Add more material when you can see the previous batch has been colonised by worms. If you add too much, the scraps may start to smell. As the worms settle in and start to breed, you will be able to increase the volume of material added. You also need to regularly add shredded or crumpled newspaper and card. This gives the worms a more balanced diet, absorbs excess moisture preventing everything getting too soggy and creates air spaces in the compost.

When the bin is full, you will need to empty out the compost. Most of your worms will be in the top 30 centimetres or so. Remove this top layer of worms and uncomposted waste and set aside. Empty out the composted material, replace the platform (or gravel) in the bottom of the wormery and cover it with a layer of card and shredded newspaper.



Figure 7 - "Desk-top wormery" at SSERC.

### Keeping worms inside

Small indoor wormeries can be purchased and set up [16] but they are usually only suitable for short-term study as there is insufficient space for worms to feed, thrive and multiply. However at SSERC we have been using an alternative "desk-top wormery" [17] with great success for a number of years (Figure 7). This setup allows the worms to behave naturally and learners can interact with the worms at close quarters. Any liquid (or exudate) coming off the wormery collects in the saucer and should be removed promptly, diluted and used to fertilize plants.

### Handling worms

When studying any living organism, in this case earthworms, respect for the animal is of paramount importance, along with minimising stress and returning the animal to its preferred habitat as quickly as possible. SSERC has published a Code of Practice entitled *Materials Of Living Origin* [18] which provides advice on keeping animals in school.

Earthworms should be handled as little as possible, kept moist and returned to soil as soon as possible. If you are careful and work quickly it is possible to listen to the action of the small bristles or chaetae that the worm uses to move through the soil and anchor itself in its burrow. Place a large earthworm onto a piece of paper and place your ear close by - if you listen carefully you can hear the rasping action of the chaetae against the paper as the worm moves along. You may have seen a bird trying to pull an earthworm from its burrow - the worm uses its chaetae to anchor itself against the walls of the burrow to try to avoid capture.

One myth about earthworms is that they can survive being cut in half with each portion forming a new animal - this is not the case. Cutting a worm in half leads to a dead worm.

### Literacy links

There are a number of good books to share with budding "book worms" - we especially like *Wiggling Worms at Work* by Wendy Pfeffer [19] and *Yucky Worms* by Vivian French [20].

Finally, if you would like to observe the actions of earthworms over time but have limited opportunity for observation then take a look at this amazing short film from the BBC [21]. This time lapse film illustrates the importance of these often overlooked and unsung heroes of the forest floor. >>

“ Without the work of this humble creature, who knows nothing of the benefits he confers upon mankind, agriculture, as we know it, would be very difficult, if not wholly impossible. ”

Charles Darwin on earthworms - 1881

## Health and Safety advice

When planning a study of earthworms and soil, whether exploring in the outdoors, keeping earthworms in the classroom or completing a survey, it is important to produce your own risk assessment in line with Local Authority guidelines. General advice to bear in mind:

- Cover any open wounds and consider providing gloves. Wash hands thoroughly after handling soil/worms.
- Wipe down any classroom surfaces that may have become contaminated.
- Ensure appropriate level of adult supervision for age and stage of the learners.
- When carrying out an earthworm survey if you discover glass, other sharp objects or dog fouling stop and find another site.
- Ensure you have permission from the land owner if using areas other than school grounds.
- Be careful not to disturb local wildlife. <<

## References

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# Happy retirement Teresa McErlean!

At the end of March 2018 SSERC bid a fond farewell and happy retirement to Primary Education Officer Teresa McErlean.

Teresa first joined SSERC back in 2008, originally on a secondment from City of Edinburgh Council. Once in post she quickly established herself as a rich source of ideas and expertise, transforming the provision of primary science and technology CLPL at SSERC and inspiring hundreds of teachers, practitioners and learners along the way.

After a stint back in the classroom Teresa re-joined SSERC's expanding

primary team in 2012 and set about collaborating on what was to become the SSERC Primary Cluster Programme in Science and Technology (PCP). PCP is an innovative programme of Science and Technology CLPL which aims to support all practitioners within a cluster - building confidence and expertise through a network of staff acting as mentors in Science and Technology. The on-going success of PCP is a testament to Teresa's dedication and commitment.

Teresa has been involved in many other developments in primary science and technology, not least many of our SSERC\_Meets. SSERC\_Meets are interactive on-line CLPL sessions that allow staff to take part

in fully resourced, high quality CLPL without leaving the comfort of their own school. In fact on Teresa's last day at work she was in front of the camera presenting a Further Fun with Forensics SSERC\_Meet!

We will all miss Teresa's sense of humour, honesty and enthusiasm and wish her all the very best for a long, healthy and happy retirement. <<



# Scottish success at STEM Inspiration Awards

St. Andrew's University Public Engagement department nominated Henry Rae for the Outstanding STEM technician award. He was shortlisted and invited to the House of Lords for the award ceremony and, much to his surprise and delight, was announced as the winner by Lord Sainsbury.



Henry Rae receiving his STEM Ambassador Award at the House of Lords.

STEM outreach and public engagement activities are well supported and popular within the School of Medicine and the wider University. After seven years of organising these, Henry now has members of staff chasing him down the corridor asking if he has any events they can help with.

"I especially like activities with Primary 5, 6 and 7s as I find they are always excited and interested and

not afraid of taking part in whatever is going on. My aim is to entice them into science by giving them interesting, fun and educational activities. By the time they go to high school I won't mind if they have forgotten the details of what they did as long as the feeling of 'science is really interesting and fun' stays with them and hopefully will lead to careers in science."

"Although a lot of activities I do can stand alone as a kind of 'wow! that's cool', if I ask the children why this particular thing happens it makes them think and try to understand what's going on. I have found that teachers have a lot to cram into their lessons and have to know a lot about a lot of wide and varying subjects. Having STEM activities delivered by external experts helps both staff and pupils understand the subject more deeply."



Henry has delivered STEM activity sessions to over 1000 school children and been told many stories about the positive impact on the children. One was about a boy that the teacher couldn't get to write more than 2 lines. When asked to write a thank you letter he wrote 2 full sides of A4 in one sitting! At a public science discovery day Henry noticed a 3 year old looking at what he was doing. Henry handed him an Automated External Defibrillator (AED) and said "Want a shot?" Without instruction he started the Defib, placed the pads in the right positions and shocked the manikin correctly. He didn't say a word, just grinned from ear to ear the whole time. <<



# RBS STEM Ambassador

**The STEM Ambassador Coding Club at RBS Gogarburn started with a few enthusiastic members of staff and has grown, over the last two years, to now involve 40 staff working across many Edinburgh primary schools.**

The Code Clubs generally have up to 10 children, aged 9-11 years, attending. STEM Ambassador Gary said: “We use a mixture of laptops, PCs, Raspberry Pis and Macs, with the young people switching between them, which helps them learn new systems. We’ve worked through the first Scratch module and are about halfway through the second, with

one of the children working solo through the HTML projects.” Engagement with the young people attending the club has helped RBS staff gain a better understanding of young people’s skills and capabilities. It has also provided an opportunity for RBS staff to better inform young people about potential STEM career pathways and the employment opportunities available within Banking & Financial Services. The hands on practical experience offered by the STEM Ambassadors also benefits the learners as it exposes them to the wider STEM agenda and offers them tangible skills and experience they can take back to the classroom and beyond.

In addition, RBS staff have had very positive experiences engaging with young learners and have been able

to build this type of engagement into their personal development plans. STEM Ambassador Ian reports that: “Volunteering helps to promote a feeling of well-being, especially when your activity is appreciated. Code Club is important to me as the country is short of people with the required IT skills. If I can help in a small way in adjusting the imbalance, then it’s definitely worthwhile.” From a teacher’s perspective it complements the teaching taking place in the classroom often in areas that teachers do not always have confidence or experience in. Due to the success at the Edinburgh site, RBS are looking to replicate this model during 2018 throughout other UK offices and sites. <<



## Recognition for SSERC

**We are delighted to be able to report that, at a recent meeting of a GTCS Accreditation Panel, SSERC was formally awarded with the ‘GTCS Quality Mark as a Professional Learning Organisation’.**

General Teaching Council Scotland offers a suite of Professional Learning Awards [1] which celebrate, promote, and encourage teacher professionalism and professional learning at all stages of a teacher’s

career. The Awards recognise and celebrate the impact of teacher professional learning along with the leadership of learning cultures in which teacher professionalism can thrive and bring about real impact.

Recently GTCS has introduced the Professional Learning Award for Organisations. The award celebrates organisations which support and promote teacher professional learning and identifies those which aim through their work:

*‘to develop and enhance teachers’ knowledge, expertise and skill; develop their professionalism, and*

*to impact positively on learning experiences and outcomes of children and young people’*

Whilst we have always believed that the professional learning which we offer is of high quality, this formal recognition by GTCS is important as we seek to further enhance our reputation for quality. <<

### Reference

[1] <http://www.gtcs.org.uk/News/news/gtcs-professional-learning-awards.aspx> (accessed April 18<sup>th</sup> 2018).

