



**National
Earthworm
Recording
Scheme**

Earthworm Recorder's Handbook



**Produced by Keiron Derek Brown on behalf of
the Earthworm Society of Britain**



This Handbook was produced for the earthworm recorders that enable the Earthworm Society of Britain to develop the current understanding of the distribution of earthworms in the British Isles.

The author would like to thank Frank Ashwood, Rich Burkmar, Kerry Calloway, Dan Carpenter and Emma Sherlock for volunteering their time and expertise to provide guidance and feedback regarding this publication.



The Earthworm Society of Britain's website can be found at www.earthwormsoc.org.uk and the society can be contacted by email at ESBenquiries@gmail.com.

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1 An Introduction to Earthworm Recording



1.1 The importance of recording earthworms

Earthworms are recognised as an ecologically important group of invertebrates that are crucial to the delivery of many ecosystem services. They facilitate the decomposition of plant and animal materials and break down soil, releasing nutrients and making them available for plants. Their burrows help to allow air and water to permeate into the soil, improving soil fertility and drainage. Furthermore, they are a vital food source for many vertebrates and other invertebrates.

However, despite being widely recognised by most people (such as gardeners and farmers) as ecologically important, earthworms are hugely under-recorded in the British Isles and we know relatively little about these organisms.

Many questions still remain unanswered:

- How is each earthworm species distributed across the British Isles?
- What specific conditions and habitats does each earthworm species require to survive?
- Are any of our earthworm species experiencing population declines and require intervention to ensure their conservation?

Biological records are very useful for answering these questions and many others. Every biological record must contain four core pieces of information:

- **Who** – The name of the recorder or determiner.
- **What** – The name of the organism or group of organisms that you are recording.
- **Where** – The location where the organism was observed.
- **When** – The date the organism was observed.

Combining these four pieces of data produces a biological record: **the presence of an organism at a specified time and place by a named individual**.

This Handbook was designed to provide guidance to individuals that are interested in generating earthworm biological records and contributing to our understanding of British earthworm species distribution and ecology.

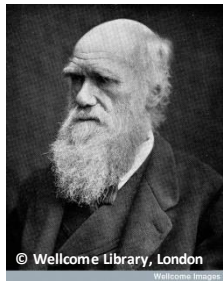


The Biological Records Centre (BRC), established in 1964, is a national focus in the UK for terrestrial and freshwater species recording.

The Earthworm Society of Britain (ESB) is registered with the BRC as the organisation responsible for recording earthworms in the United Kingdom.



1.2 A brief history of earthworm recording

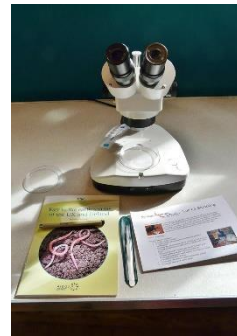


The Formation of Vegetable Mould Through the Action of Worms by Charles Darwin published



Earthworm Society of Britain (ESB) formed

Mapping of earthworm distribution for the British Isles and Eire highlights the under-recording of an ecologically important group (Carpenter et al.) journal paper published

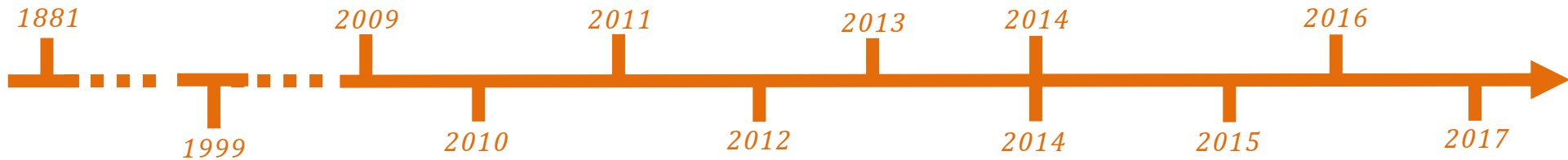


ESB introduces recorder packs to training courses

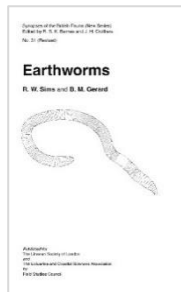
Earthworms in England: distribution, abundance and habitats (Jones) Natural England report published



NERS begins sharing data with Local Environmental Records Centres, NBN Gateway and Global Biodiversity Information Facility



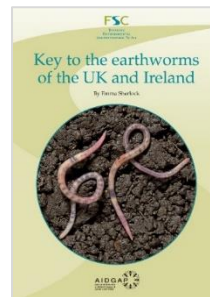
Synopses of the British Fauna: Earthworms (Sims & Gerard) published



ESB begins running identification training courses for recorders



FSC Key to the Earthworms of the UK & Ireland (Sherlock) published

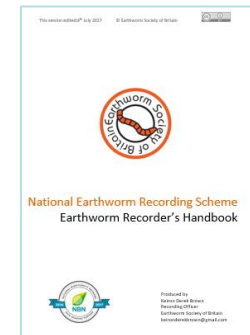


National Earthworm Recording Scheme (NERS) launched



ESB begins partnership with FSC Tomorrow's Biodiversity project

NERS Earthworm Recorder's Handbook (Brown) published





1.3 National Earthworm Recording Scheme



The Earthworm Society of Britain (ESB) is a non-profit organisation that was set up in 2009 to ensure that earthworms are represented in the biological recording community and wider biodiversity sector. The society is run entirely by volunteers and funded through grants, membership subscriptions and donations.

The ESB aims to promote and support scientific research so that earthworms and their environment can be better understood. Through its work the society aims to encourage the conservation of earthworms and their habitats and to educate and inspire people so that these fascinating creatures may continue to be enjoyed in the future.

The only society of its kind, the specific aims of the society are:

1. To conduct research into earthworms in the UK
2. To promote knowledge and appreciation of earthworms within the non-scientific community
3. To educate the non-scientific community in earthworm biology and ecology

The National Earthworm Recording Scheme (NERS) was officially launched in 2014 by the ESB to:

- undertake sampling of areas for earthworms
- train and support earthworm recorders (see **Training and events** section)
- create guidance for earthworm recording
- collate all earthworm records of the British Isles
- share ESB earthworm records through NBN (see **Open Data Agreement for Earthworm Records**)

These aims all revolve around the creation, collation and dissemination of earthworm biological records (species occurrence records).

Prior to the launch of the NERS, the ESB began seeking out earthworm records resulting from research institutions (such as government agencies, universities and natural history museums). These records focused on specific research questions and, as a result, the existing data may be biased towards earthworms found using certain sampling techniques and/or found in specific habitats favoured in academic research.

Therefore, the NERS encourages recorders to record by both:

Undertaking casual recording of earthworms By encouraging 'ad hoc' recording those earthworm species found outside of the soil and difficult to detect with standardised sampling techniques are also recorded.

Undertaking standardised sampling of earthworms This allows standardised data to be collected in a way that can help answer ecological questions by allowing comparison between sites or habitats. See **The NERS 5 Pit Protocol** and the **Earthworm Site Surveys** sections for more details.

Different sampling methods target different ecotypes of earthworm. More than one sampling method can be used at a single location and the sampling method should always be recorded with the biological records for earthworms. If a single species was recorded with two different sampling methods at the same location, then two records for that species would need to be made.



1.4 Training and events

The ESB hosts, and partners with other biodiversity training providers, to deliver a range of courses and events to help develop the skills of earthworm recorders. Check out the ESB website for details of upcoming training and events: <http://earthwormsoc.org.uk/upcoming-events>

Earthworm Ecology Courses

1 day - Suitable for all

A general interest course covering earthworm biology and ecology. suitable for all, from gardeners to recorders and students to farmers. This course does not include earthworm identification training.

Earthworm Site Surveys

1 day - Suitable for all

Sampling events held within the field (therefore requiring a reasonable level of physical fitness). These events demonstrate to participants how to undertake earthworm sampling methods and the resulting records are used to generate site species lists for the sites that are surveyed.

Annual Field Meeting

2 days - Suitable for all

Annual sampling events held within the field (therefore requiring a reasonable level of physical fitness). These events follow the same format as Earthworm Site Surveys, and also include the ESB Annual General Meeting and talks.

Earthworm Identification Workshops

1 day - Suitable for beginners

Workshops designed to give participants an introduction to earthworm identification using microscopes. Sampling methods may also be taught where a suitable venue is used. Upon completion of this course participants are considered qualified ESB Earthworm Recorders.

Earthworm Identification Weekends

1 day - Suitable for beginners

Comprehensive skills-based courses covering earthworm sampling, identification and recording. Includes Earthworm Site Survey and practical session identifying earthworms using microscopes. Upon completion of this course participants are considered qualified ESB Earthworm Recorders.

Advanced Earthworm ID Workshops

1 day - Some experience of earthworm ID required

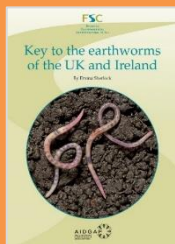
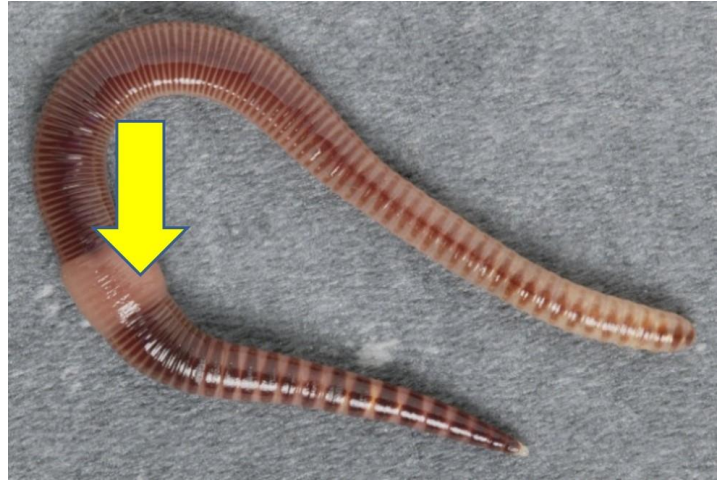
Workshops covering earthworm internal anatomy and dissection. This course is necessary for any recorders interested in sampling and identifying earthworms found in artificial environments in the UK (such as hothouses in botanical gardens).

1.5 Earthworm anatomy

There are a couple of basic anatomy lessons that should be learned before you continue on your journey to become an earthworm recorder. Importantly, earthworms often have a 'swelling' of fused segments known as the clitellum (or saddle) - indicated by the yellow arrow in the photo below.

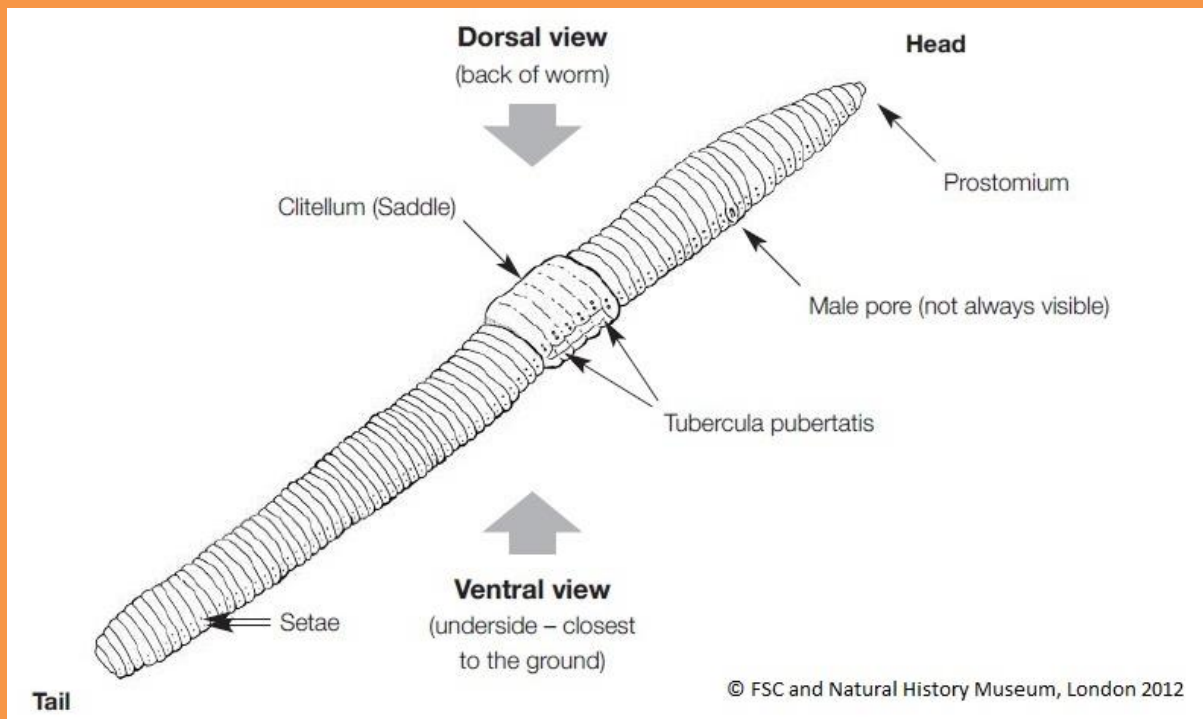
The clitellum tells us two things:

- (i) The presence of the clitellum on an earthworm tells us that it is an **adult**. Earthworms without a clitellum are juveniles. It is usually not possible to identify juvenile earthworms so these should not be collected and preserved.
- (ii) The clitellum is always found **nearest the head** end of an intact earthworm, making it simple to establish which end of the earthworm is the head.



More detail regarding earthworm anatomy, including the use of external characters used to identify earthworms can be found in the Field Studies Council's Key to the Earthworms of the UK & Ireland (2012) by Emma Sherlock. The book is available from the FSC website:

www.field-studies-council.org/publications/pubs/earthworms.aspx



External earthworm features used for identification diagram from Key to the Earthworms of the UK & Ireland (2012) by Emma Sherlock.

1.6 Earthworm ecology

Earthworms can be divided into four groups, called **ecotypes**, each of which describes a different grouping of earthworm species based on their ecology.

Anecic earthworms make permanent vertical burrows in the soil. They feed on leaves on the soil surface that they drag into their burrows. They also produce worm casts (a convoluted mass of soil, mud, or sand thrown up by an earthworm on the surface after passing through the worm's body) and these can quite often be seen on the surface in grasslands. Some species, such as *Lumbricus terrestris*, also make middens (piles of casts) around the entrance to their burrows. Anecic species include the largest species of earthworms in the British Isles. They are darkly coloured at the head end (red or brown) and have paler tails.

Endogeic earthworms live in and feed on the soil. They make horizontal burrows through the soil to move around and to feed and they will reuse these burrows to a certain extent. Endogeic earthworms are often pale colours (such as grey, pale pink, green or blue). Most species are found in the top layers of the soil, though some can burrow very deeply in the soil.

Epigeic earthworms live on the surface of the soil in leaf litter. These species tend not to make burrows but live in and feed on the leaf litter. Epigeic earthworms are also often bright red or reddy-brown, but they are not stripy.

Compost earthworms are really a subset of epigeic earthworms that contain the earthworm species that are most likely to be found in compost, areas very rich in rotting vegetation or dung. They prefer warm and moist environments with a ready supply of fresh compost material. They can very rapidly consume this material and also reproduce very quickly. Compost earthworms tend to be bright red in colour and stripy- some people call the stripy species 'tiger worms'. Compost worms are often used to help dispose of waste as they can also remove contaminants from soil.





2 Earthworm Sampling Techniques

2.1 The basics

Regardless of how you are sampling earthworms, whether it's a standardised sampling method for scientific research used or ad hoc earthworm searches under plant pots, there are some basic considerations that we recommend:

Preparation A map of your sample site is useful to mark where you will take your samples, or for identifying different habitats in to sample. New records on sites that have been previously sampled are still useful as you may get different results. Remember that if you do not own the land where you are sampling permission may be required from the landowner first. See the **Field Work Assessment**.



Equipment ("The basics") Consider the following equipment for collecting earthworms:

- **Plastic tubes of alcohol-based preservative** (to store and preserve earthworms).
- **Labels and pencil/alcohol resistant pen** (to label your samples and ensure they don't get mixed up).
- **Notebook and map/GPS/smartphone** (to make note of the location, habitat and other important factors).
- **Gloves** (to keep your hands clean).
- **Pointed non-serrated forceps** (optional but can be useful).



Details regarding the equipment to consider for specific sampling techniques are provided in the following sections.

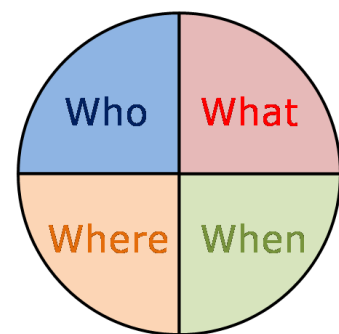
Preservation and Labelling In the majority of cases live earthworms can't be identified accurately. Therefore, adult earthworms should be collected (juveniles should be released), and preserved so they can be examined under a microscope. The collected earthworms should be placed in a tube of preservative, which will also act as a killing agent. Please see the **Earthworm Preservation** section.



Recording In order to make a record (as a minimum), the following information will need to be recorded in the field:

- **Who** – the recorder.
- **Where** - OS grid reference, which can be obtained using GPS or taken directly from an OS map or using online tools/apps.
- **When** – the date the earthworms are collected.

Other information, such as **sampling method** and **habitat** are also useful. Please see the **Recording Earthworms** section.



2.2 Microhabitat searches

Earthworms inhabit substrates other than soil so it is good practice to search any microhabitats present at each site. This will improve the likelihood of recording species that are less likely to be encountered in soil pits. Only adult earthworms should be collected as juveniles cannot be identified to species.

<i>Pros</i>	<i>Cons</i>
Detects all types of earthworm (anecic, compost, endogeic and epigeic), rather than only soil-dwelling species.	Non-quantitative method, meaning records have limited use when it comes to comparing sites or looking at abundance.

Equipment & Method

There is no exhaustive list of habitats and microhabitats that earthworms may be present in and equipment/search methods will vary depending on the nature of the microhabitat, but some examples are provided below:

Deadwood – contains several microhabitats, including under deadwood, under the bark and within rotting deadwood. When sampling deadwood destructively please ensure a minimal amount of deadwood is destroyed to maintain the microhabitat within the ecosystem.



Dung – dung contains rich organic matter and earthworms may be found within/beneath the dung or in the top layer of soil beneath the dung. Don't forget your gloves!

Under stones and other items – turning over items can often yield earthworms. Example objects to turnover include any item resting on soil and items such as plant pots, wooden boards and bin bags on any substrate.



Leaf Litter – leaf litter can be searched by hand or sieved. Some earthworms may be found within the very top layer of the soil, whereas others may be found on the surface amongst the litter.

Hedgerows – some earthworms are thought to be associated with hedgerows and may be found in the top layer of soil beneath them.

Compost – compost heaps/bins are often home to dense populations of earthworms. They can usually be found by simply searching the top layer of the compost. Don't forget your gloves!



Other interesting microhabitats include woodchip piles, shingle, stream beds, tree holes, molehills and many more...

Please record the earthworms you find in different microhabitats separately (even if a species occurs in multiple microhabitats at the same site). Recording the presence of a species in multiple habitats or microhabitats helps us learn more about the ecology of different earthworm species and their associations with specific conditions.

2.3 Mustard sampling

A vermifuge is a solution that causes earthworms to emerge from their burrows. Traditionally, vermifuges used for sampling earthworms consisted of using a formalin or potassium permanganate solution. Neither of these solutions is ideal to work with as formalin is carcinogenic and both solutions are thought to be detrimental to the environment. Scientific studies have shown that a mustard solution (made from English mustard powder and water) is effective at extracting earthworms and has little effect on the environment in comparison to formalin and potassium permanganate.

<i>Pros</i>	<i>Cons</i>
Effective for extracting soil-dwelling species (particularly deep-burrowing anecic species).	Sampling method biased towards soil-dwelling species. Less effective than soil pit sampling for extracting endogeic species from top layers of soil.
Relatively non-destructive technique. Useful for sampling soil-dwelling species on sites where digging is prohibited.	Success rate dependent on soil qualities and weather.
Relatively quick and simple to undertake. Great for engaging with the general public at relevant events/activities.	Solution is one time use and adds cost and weight to equipment.

Equipment

In addition to the equipment described in in **section 2.1**, you will need:

- **A bottle of water**
- **Mustard powder**

Method

- Mix mustard powder with still or tap water. It has been shown that the success rate of mustard-based vermifuge increases with increasing concentration until the point at which the solution thickness affects the viscosity of the liquid. We recommend mixing a solution of a few heaped teaspoons per 1.5 litres of water.
- Pour the vermifuge solution on approximately **1 square meter** of the ground (in long grass it can be useful to trim the grass first). As it soaks into the ground and flows down the burrows of anecic earthworm species, it will act as an irritant to any earthworms it reaches and will cause them to emerge on the surface. If the solution does not soak into the ground, conditions may be unsuitable for this sampling method.
- Any adult earthworms that surface should be removed and collected into a container/sample tubes. Allow earthworms to exit their burrows as completely as possible as they may retreat into their burrows if you try to collect them prematurely. Earthworms may surface outside of the area where the solution was poured and the area should be watched for a **minimum of 5 minutes**. Juvenile earthworms should be washed with water to remove mustard solution and returned to fresh soil as it is unlikely that these can be successfully identified.



2.4 Soil pit sampling

Digging soil pits and hand-sorting the excavated contents has been a standard earthworm sampling technique for scientific researchers for many years.

<i>Pros</i>	<i>Cons</i>
Effective for extracting soil-dwelling species, particularly endogeic species from the top layers of soil.	Sampling method biased towards soil-dwelling species. Less effective than mustard sampling for extracting deep-burrowing anecic species.
Effective sampling technique in most weather conditions (except where the ground is frozen).	Destructive sampling method that damages the soil and surface vegetation, and disturbs other soil organisms. Time consuming to hand-sort through contents of soil pits (even more so in wet soils).
Can easily be standardised and used to gain good qualitative data for research.	Can be difficult to get permission to dig on some sites due to destructive nature of sampling.

Equipment

In addition to the equipment described in in **section 2.1**, you will need:

- **A spade** (to dig the pits).
- **A sorting tray** (to place the soil on in order to sort through and look for earthworms, a pot or bin bag can be used as an alternative).
- **A bin bag or plastic sheet** (to sit on and prevent you getting wet and/or dirty while sorting your soil pits).



Method

- Dig a soil pit and remove the contents using a spade. The standard pit size for the National Earthworm Recording Scheme is approximately **25cm by 25cm, to a depth of 10cm**. Always check the empty pit to make sure no earthworms are in the bottom or sides!
- The soil from the pit should be placed on the sorting tray/bin bag/pot and sort through it with your hands.
- Any adult earthworms that are found in the soil should be removed and collected into a container/sample tubes.
- The soil should be returned to the pit once the contents has been sorted. This should be compacted down to avoid leaving a hole or uneven surface that people could trip over. Where possible, surface vegetation should be retained and returned to avoid leaving patches of bare earth that would be vulnerable to erosion. Juvenile earthworms should be counted and returned to the soil as it is unlikely that these can be successfully identified.
- Record number and size (dimensions) of soil pits sampled.





2.5 The NERS 5 Pit Protocol

The NERS 5 Pit Protocol is a standardised methodology for conducting soil pit sampling of a site for earthworms. This generates data that can be used to calculate the species composition and abundance of a site, making it useful for monitoring trends in earthworm populations. The standardised nature of the data allows different sites to be directly compared to one another.

Equipment

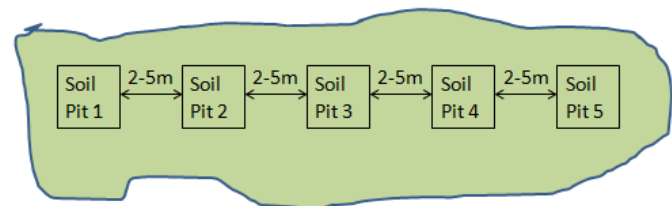
- In addition to the equipment outlined in the **Soil pit sampling** section, you will also need an **Earthworm Site Survey Form** to record your findings on.

Method

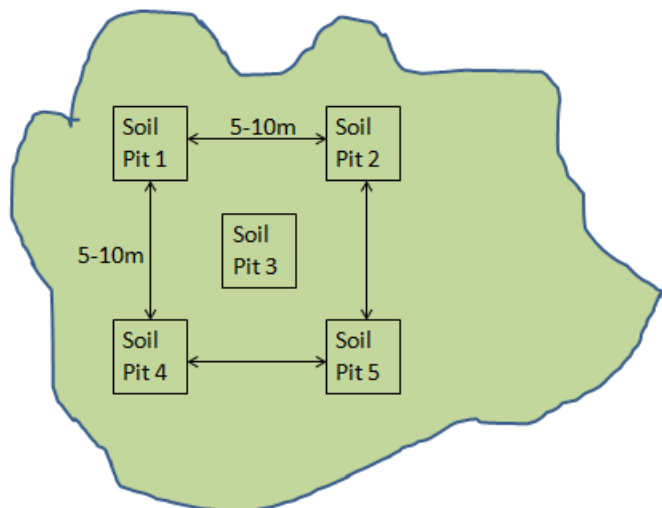
- Follow the method outlined in the **Soil pit sampling** section, with pits measuring approximately **25cm by 25cm, to a depth of 10cm**.
- Count and record the number of juveniles** returned to the soil on the **Earthworm Site Survey Form**.
- Repeat the process 5 times by digging **5 soil pits per site**.

Planning your soil pits is important so that all five soil pits fall within the habitat you are sampling. Please note that the distances provided in the following examples do not need to be exact and are given to provide approximate guidance so it is clear that soil pits should not be spaced a great distance apart.

Linear Habitats Some habitats are linear, and in these cases, a linear transect should be used with pits spaced evenly apart (for example between 2 and 5 metres). Linear transects may not necessarily be in a straight line and may be curved. Examples of this type of habitat may include hedgerows, riverbanks, pond edges and tree lines.



Large patches of habitat If you are sampling a habitat that covers a big enough area the soil pits can be arranged approximately in a square formation, with one pit in each corner (for example between 5 and 10 metres apart) and one in the centre. Examples of this type of habitat may include open fields, gardens, woodlands and parks.



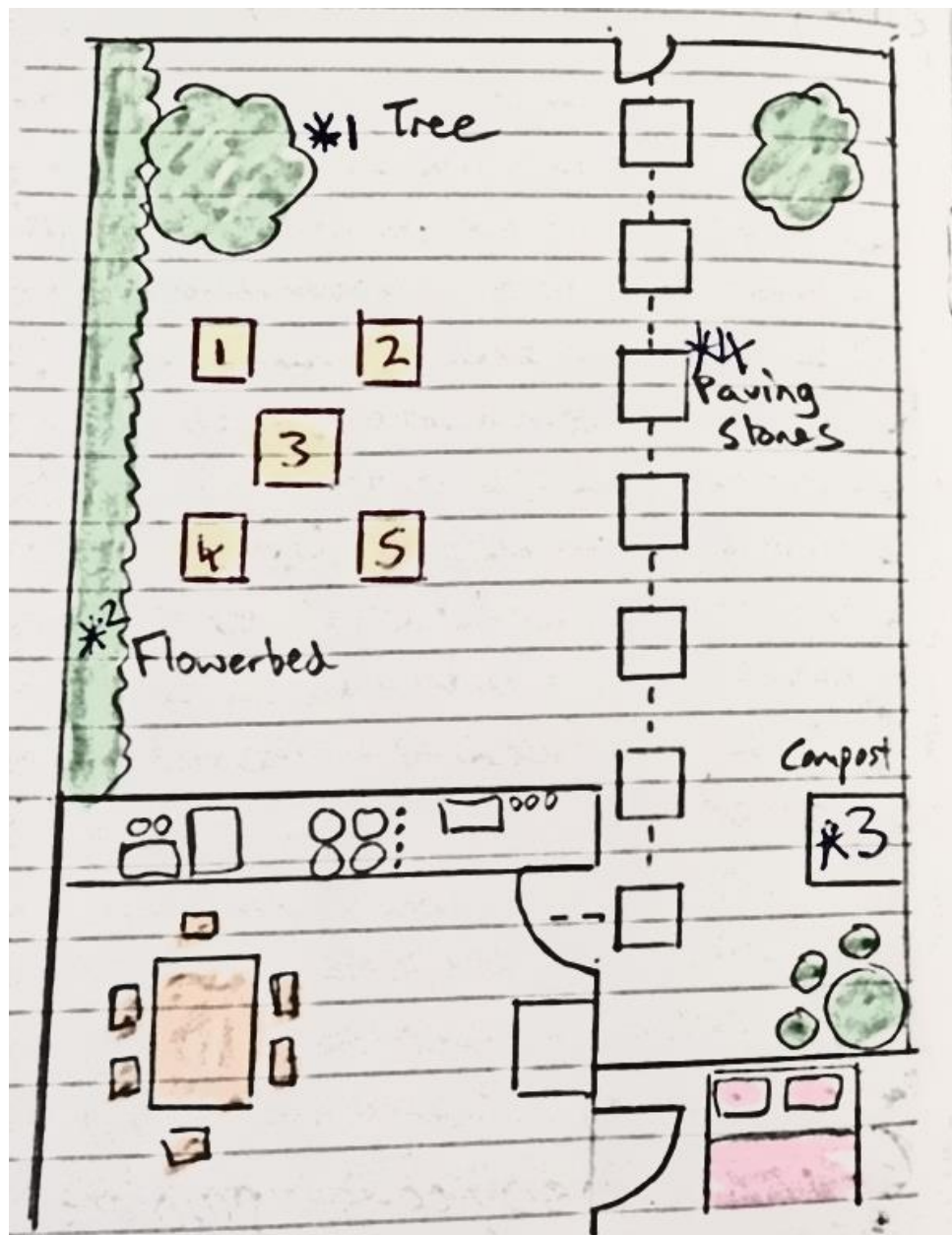
Other Habitats In some cases neither of these arrangements will be suitable and the arrangement will need to be adapted to suit the habitat you are sampling. If the habitat is patchy, soil pits should be planned in patches of the same habitat (remembering that they should not be great distances apart).

2.6 Earthworm Site Surveys

The Earthworm Society of Britain is currently reviewing the standard protocol for surveying sites, particularly gardens, and aims to launch an Earthworm Garden Survey in the near future.

The first phase of the review involved supporting a MSc dissertation looking at garden survey methods for earthworms and will inform the next stage of the review: a review of the existing scientific literature.

Later review stages will involve undertaking sampling projects to fill any survey method evidence gaps and consultation with biological recording and ecology professionals regarding the proposed survey methods.





3 Earthworm Preservation

3.1 Why is preserving necessary for earthworm recording?

The majority of earthworm species can't be identified in the field. Despite best efforts, no accurate identification key to live specimens currently exists and most specimens require observation under a microscope in order to reach reliable species identifications.

The Earthworm Society of Britain supports the collection of earthworm specimens for scientific purposes that further our understanding of earthworm ecology and biology. This involves the collection and killing of earthworms for the purpose of identifying the species and generating a biological record of species occurrence. It is recommended that earthworm sampling techniques are undertaken in a manner that ensures any impact to local earthworm populations is negligible.



This can be achieved by:

- Only taking adult specimens (identifiable through the presence of the clitellum or "saddle"). Juvenile earthworms cannot usually be identified and should therefore be returned to their environment to prevent the unnecessary killing of earthworms. Where quantitative methods are being used to gather abundance data, juveniles should be counted and released where possible.
- Following the NERS guidance regarding sampling techniques as these methods are unlikely to have a significant impact on local populations due to the low proportion of individuals that would be collected from any one habitat.
- Taking representative specimens when undertaking non-quantitative sampling techniques to ensure numerous specimens of a single species are not taken when this would add no value to the data.

Code of Conduct for Collecting Earthworms

We refer our recorders to the British Entomological & Natural History Society Code of Conduct for Collecting Insects and Other Invertebrates at www.benhs.org.uk/resources/collecting for further information regarding good practice when collecting invertebrates for scientific or educational purposes.

Preserved specimens can also be beneficial for future studies and identifications. The ESB encourages the building of personal reference collections and use of previously identified or verified specimens, to assist in the identification of future earthworm specimens. Where earthworm recorders do not have the capacity or willingness to build and maintain a personal reference collection, we encourage earthworm recorders to contact local natural history curators to discuss the possibility of accessing and contributing to those collections (though please note that many local natural history collections are under-funded and may be unable to accept new specimens or any specimens stored in alcohol).



3.2 Collecting specimens

Collected earthworms should be stored in a tube of 70-80% preservative (see the table in **Preserving specimens** on the following page for more details). The size/number of tubes used will depend on how many earthworms were collected, tubes should never be more than half full of specimens. The 70-80% preservative will also act as a fixing agent while preserving the earthworms. Earthworms contain a lot of fluid and this is released into the preservative, diluting the solution and causing the specimens to deteriorate. Therefore, if you have large specimens or a number of specimens within one tube, the preservative can be changed following sampling (preferably within 48 hours).

Do I always need to preserve earthworms in the field?

The simple answer is no. We recommend preserving earthworms in the field when you are planning to go and undertake earthworm sampling methods such as soil pit sampling or mustard sampling. However, there may be times when you happen upon earthworms or don't want to carry bottles of preservative with you. To collect earthworms in the field you will need a container that is aerated (such as a plastic take-away container with some breathing holes in the lid). When collecting earthworms in this way ensure that you take some of the substrate you found the earthworm in (such as soil, moss or leaf litter) and add a few drops of water to ensure the conditions remain damp enough for the earthworm to survive. Specimens should be able to survive in these conditions for a few days provided you regularly check the environment remains damp and add a few drops of water whenever necessary.

3.3 Relaxing/setting specimens

Earthworms can be relaxed and straightened. This is a completely optional step but can make identification of the specimens much easier as earthworms can stiffen in awkward-to-identify positions. It also acts as an anaesthetising agent so we would encourage people to use this step where possible.

- (i) Place the earthworms in a container of 20-30% preservative (if you dilute stronger preservative to 30% ensure you use distilled water, otherwise the solution will be cloudy)
- (ii) Leave for a few minutes
- (iii) Straighten out the earthworms in the grooves of the lid, as illustrated in the picture (forceps can be useful when doing this).
- (iv) Pour 70-80% preservative onto the straight earthworms.
- (v) Leave for 5-10 minutes before placing the earthworms in the plastic tube containing a label and 70-80% preservative.





3.4 Preserving specimens

Recorders preserve earthworms for a number of reasons, depending on their intended uses for the preserved specimen. The reasons for preservation will determine the required:

- (i) **Concentration of preservative** – dilution of alcohol-based preservatives can be achieved with deionized or distilled water (not tap water) which is easily purchased from any high-street chemist. Dilution rates can be calculated using this online tool: <http://homedistiller.org/distill/dilute/calc>
- (ii) **Type of preservative** - details of the different types of preservative and how to source them can be found in the **Sourcing preservatives** section.

The ESB recommends the following preservative types and concentrations:

Reason for preservation	Recommended preservative
Identification only – when specimens need only be preserved for a short period of time until identified, and will be disposed of once a species determination is reached.	70% ethanol, IMS or IPA is acceptable. The earthworm will deteriorate more quickly than in 80% so only use 70% when you are planning to identify your specimens in the near future. Using 70% has the advantage of reducing cost as less volume of preservative is used per specimen tube than with 80%.
Verification – where a specimen will need to be stored until it can be verified by an ESB tutor or earthworm expert.	80% ethanol, IMS or IPA is recommended if a specimen is to be stored for more than a couple of weeks.
Collections – where a specimen will be stored for a long period of time and used as part of a museum natural history or personal reference collection.	80% ethanol is a requirement for museum collections and recommended for personal collections. The specimen will decay rapidly in <80% and go brittle in >80%.
DNA research – where a specimen is being stored with the intention of extracting genetic material.	96% ethanol is required to preserve genetic material. IMS and IPA are not suitable for preserving genetic material.

3.5 Labelling specimens

A label should also be placed in the tube to identify the pit and site that the sample belongs to. The label should contain as much information about the specimen as possible, and at the very least should indicate the four core fields (**who, what, where** and **when**). It should be on good quality paper if planning to keep the specimens for reference collections. Regular ink will dissolve in alcohol so use a lead pencil, or an alcohol-resistant pen to write your labels.

To the right is an example of good labelling in the field, as it contains all of the information gathered during the sampling. You may notice that it does not contain the species name. This is because it is rarely possible to identify the specimen in the field.

When storing specimens within a collection, good practice would be to separate specimens within a sample by species and add the species determination to the label alongside the name of the determiner (see example to the right). Alternatively, a second label could be added with this information.

Fairy Green
Site 1 - TP123456
Mustard Sampling
12/09/2016
Playing field
John Smith

Fairy Green
Site 1 - TP123456
Mustard Sampling
12/09/2016
Playing field
Recorder: John Smith

Aporrectodea rosea
Determiner: Jane doe



3.6 Sourcing preservatives

Obtaining preservatives is not always the easiest of tasks as preservatives are alcohol-based flammable liquids, and the sale of these is strictly controlled by various regulations. Throughout our guidance we refer to 70-80% preservative, and the table below discusses the options that you may want to consider. *Although formalin is long considered the best preservative for earthworms (at 4% the colour is kept better, and the worm is well preserved) we do not recommend the use of this for earthworm recorders as it is a carcinogen and very dangerous to work with.*

<i>Preservative</i>	<i>Description</i>	<i>Where to source</i>
Ethanol	Ethanol is pure alcohol and is widely used to preserve invertebrates in institutions such as museums and universities. The standard concentration for these organisations is often 80%. It's also a necessity for DNA work, as 96% ethanol provides the best available preservation down to the molecular level.	Pure ethanol is very difficult to source as its sale is strictly controlled, usually requiring a licence. Amateur naturalists can sometimes get hold of pure ethanol if they have contacts with institutions that are licensed to use it and supply it to associates for legitimate purposes. However, 98% bio-ethanol has recently become available in garden centres for burners (though may not be suitable for DNA work).
IMS or IDA (Industrial Methylated Spirits or Industrial Denatured Alcohol)	IMS/IDA is excellent for preserving invertebrates and a suitable alternative to ethanol. However, it is not suitable for DNA work.	Educational establishments, such as field centres and schools, can purchase up to 5 litres of IMS/IDA each year without a license, but individual amateur naturalists need a license from HM Revenue & Customs to buy it. However, 70% IMS can be purchased without a licence from some online suppliers of cleaning products.
Isopropyl, Isopropanol or IPA (Isopropyl Alcohol)	Isopropyl has a tendency to dehydrate specimens and can make them brittle. To mitigate this, you can add a little glycerol (which is available without a license!). It is suggested that 20ml of glycerol is added to each litre of 70% Isopropyl.	Isopropyl can be bought without a license over the internet or from many high street chemists.
CDA (Completely Denatured Alcohol)	CDA is made by adding chemicals to pure ethanol to make it unfit for human consumption. There are many different formulations for CDA. Until recently it was required that a dye (usually blue, pink or purple) was part of these formulations, but this requirement has now been dropped so CDA may become available as a clear liquid.	CDA is not suitable for preserving invertebrates. There was often an assumption that this was because of the dye - which would certainly have made it less suitable - but in fact there are other ingredients in the formulations, such as wood naphtha, which make them unsuitable, possibly causing a milky suspension when diluted with water.

Please note that you should always check the safety information on any preservatives that you purchase and ensure that you follow any guidelines that the manufacturers provide for using these products safely.



4 Recording Earthworms

Records can be submitted to the National Earthworm Recording Scheme using our online **iRecord Earthworm Survey Form** or the **Excel Earthworm Records Submission Form** (see Section 1.1).

Making a biological record requires four pieces of compulsory information: **who**, **what**, **where** and **when**. If any of these pieces of information are missing the record cannot be accepted.

These squares indicate the compulsory fields for the National Earthworm Recording Scheme.

There is a wealth of additional information that can be provided that may will add to the usefulness of the record by expanding on the four core fields (**who**, **what**, **where** and **when**). To make recording simpler, our submission forms have drop down menus for some of these additional fields. The options available are provided alongside the field descriptions in the guide below.

4.1 Who

Recorder Please provide the name of the individual who collected the specimen.

Determiner Please provide the name of the individual who identified the specimen. This may be the same individual as the recorder.

(If your identifications have been verified by another earthworm recorder or scientists, their name should be recorded in the comments field. This can't be the same individual as the determiner).

4.2 What

Species Each species should be recorded using its scientific name. A separate record should be created for each species found at a location and for each microhabitat/sampling method (so three species within a single microhabitat at one location would count as three records). UK species are listed in the **UK & Ireland Species Checklist (Natural Environments)** section below.

Number Abundance can be recorded by specifying the number of individuals found in the 'Number' column. This is particularly useful when standardised sampling has taken place as comparisons between sites are possible.

4.3 Where

Grid Reference Grid references allow the record to be pin-pointed to a location. We request a 6 figure grid reference (or 8 figure where possible). These can be attained using ordnance survey maps, GPS (such as a smartphone app or a handheld GPS device) or online grid reference tools (such as <http://gridreferencefinder.com>). Latitude/longitude is acceptable as an alternative to a grid reference. For a better understanding of how grid references work please check out <http://www.ordnancesurvey.co.uk/blog/2013/03/map-reading-skills-learn-how-to-use-grid-references/>

Site Name The site name should be recorded wherever possible. This can be the name of the site (e.g. Clints Quarry) or the address (e.g. King Street) and should include the county.

4.4 When

Date The date of specimen collection should be recorded in the standard dd/mm/yyyy format.



4.5 Additional fields

Habitat Pick the habitat that best describes the location. Options in upper case describe general habitats and options in lower case describe more specific habitats. If you feel the location does not fit into any of the categories below, please record it as 'other' and specify in the comments box.

010 WETLAND	041 park	073 mixed
011 fen	042 orchard	deciduous/coniferous
012 carr	043 churchyard	080 PLANTATION WOODLAND
013 bog	044 garden	081 deciduous
020 HEATHLAND/MOORLAND	045 compost bin	082 coniferous
021 lowland wet heath	050 FARMLAND	083 mixed
022 lowland dry heath	051 arable	deciduous/coniferous
023 valley mire	052 pasture	090 BUILDING
024 upland heath/moor	060 SCRUBLAND	091 glasshouse (heated)
030 GRASSLAND	061 dense scrub	092 glasshouse (heated)
031 acid grassland	062 scrub with open areas	100 CAVE/TUNNEL/WALL
032 neutral grassland	070 SEMI-NATURAL	110 WASTE GROUND
033 calcareous grassland	WOODLAND	120 OTHER (please specify)
034 upland grassland	071 deciduous	
040 URBAN	072 coniferous	

Sampling method Different sampling methods will often yield different species as they may target different substrates or microhabitats.

401 Soil pit sampling	438 Shingle/gravel search
402 NERS 5 Soil Pit Protocol	441 Leaf litter search
411 Molehill search	451 Compost search
412 Mustard sampling	455 Dung search
421 Under deadwood bark	456 Carrion search
422 Inside deadwood	462 Under moss (stone surface)
423 Inside tree hole	462 Under moss (wooden surface)
424 Under deadwood (turnover)	465 Hedgerow base search
432 Under rock/stone (turnover)	471 River/stream bed search
433 Under other item (turnover)	491 Found by chance (specify microhabitat)
435 In the open on natural substrate	495 Microhabitat search (unspecified)
436 In the open on artificial substrate	496 Other microhabitat (specify)
437 Woodchip pile search	499 Other sampling method

Comments field The comments field should be used to record any data or information it was not possible to record in the other fields. Where you have chosen an option that states 'specify', please enter the relevant details in the comments field. Some earthworms exist in different morphs (for example *Allolobophora chlorotica* occurs in a pink and a green form) and this should be recorded here where possible. Any additional fields can also be recorded here such as species of plant present, soil texture, soil pH, soil moisture, soil temperature, aspect and any site designation afforded to the site (many sites across the UK are designated due to their importance to biodiversity, geology or natural beauty). **You can never provide too much information in the comments box!**



4.6 Record submission

There are two methods of submitting records to the ESB:

1) *Excel Earthworm Records Submission Form* This is a Microsoft Excel spreadsheet that is available to download at www.earthwormsoc.org.uk/further-information/downloads

This can be completed and submitted to the National Earthworm Recording Scheme at ESBenquiries@gmail.com with the subject heading 'Earthworm Records (Your Name, Date of submission)' e.g. Earthworm Records (John Smith, 01/01/2000)

2) *iRecord Earthworm Survey Form* This online form can be accessed by any registered user of iRecord (an online recording portal created by the Biological Records Centre). *Registering is free and very easy* at www.brc.ac.uk/irecord/user/register

1. Log in to iRecord at www.brc.ac.uk/irecord/

Please note that you must have an iRecord account in order to submit records through the iRecord system.

2. Click on **Record** on the menu bar.

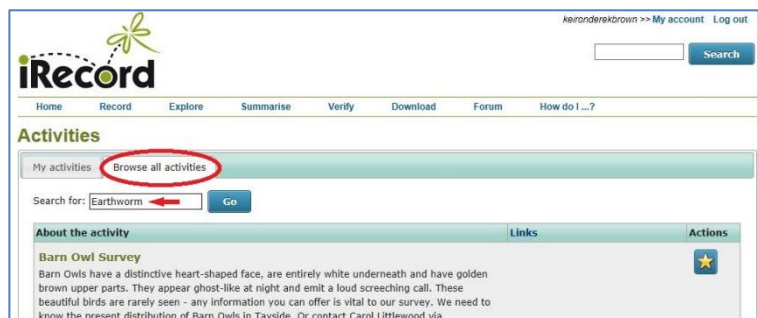
3. Select the option **Activities**.

Please note that you can also submit earthworm species records through other general iRecord forms, though this is not ideal as it does not gather some of the specific data we ask for with regards to earthworm records.



4. Click on the **Browse all activities** tab.

5. Enter **Earthworm** into the search bar and click **Go**.



6. Click on **Enter an earthworm record** to begin using the form.



The form will allow you to enter multiple records for the same site and has a great map function for finding the location data.

4.7 The journey of an earthworm record

It is the aim of the Earthworm Society of Britain to increase our understanding of earthworms in the UK and the ecological impact that these animals have on their environment. This involves ensuring that earthworm records are shared widely and are available for other potential data users to put the data collected by earthworm recorders and research institutions to good use. So, exactly what happens to earthworm records after they have been submitted to the ESB or iRecord?



Processing Records are processed and subjected to NERS verification protocols. Where necessary, queries are sent to recorders.

Records that are processed through iRecord are then available for both the Earthworm Society of Britain and the relevant Local Environmental Records Centre to download.

Collation Records are added to the relevant dataset. Currently there are two NERS datasets and three research datasets managed by the ESB:

- National Earthworm Recording Scheme records (Great Britain)
- National Earthworm Recording Scheme records (Channel Islands)
- Soil Biodiversity Group (NHM) earthworm records (Great Britain)
- Environment Agency *Eiseniella tetraedra* records (England)
- Earthworm Research Group (UCLan) earthworm records (Great Britain)

Dissemination The ESB then shares these records:

- **Locally** by emailing all earthworm records to all of the Local Environmental Records Centres in the UK on an annual basis.
- **Nationally** through bi-annual uploads of ESB datasets to the NBN Atlas: <https://registry.nbnatlas.org/public/show/dp88>
- **Internationally** by allowing the NBN to also make our earthworm datasets available through the Global Biodiversity Information Facility at www.gbif.org/publisher/0b8171d0-6b32-4ccc-bf3d-bf34b56c36d3



4.8 Open Data Agreement for Earthworm Records

The Earthworm Society of Britain (ESB) actively encourages the use of our data and hope that it can be used to further the current understanding of earthworms, both nationally and internationally. We are always interested to hear about how others have used our data (whether for use in science, sociology, art or anything else) and are glad to have produced a resource that is being put to use.

We ask all our data suppliers to read this document and only submit records to the ESB if they are happy with the policy stated below.

Access to ESB earthworm records

The ESB has an open data policy, allowing **open access** to our earthworm records with **no constraints** to the use of the data and ensuring records are available at the **full resolution** they are accepted at.

This is achieved through the submission of our databases to the **National Biodiversity Network (NBN) Atlas**. As a Data Sharing Partner of the NBN, the ESB is committed to ensuring this data set is updated on a regular basis (and no less than twice per year).



Datasets that are managed by the ESB can be found through the Data Partner webpage for the ESB on the NBN Atlas: <https://registry.nbnatlas.org/public/show/dp88>

Furthermore, we allow our records to be made available through:

- **Global Biodiversity Information Facility** (an international open data infrastructure, funded by governments) in accordance with their vision: "A world in which biodiversity information is freely and universally available for science, society and a sustainable future."
- **Local Environmental Records Centres (LERCs)** (regional not-for-profit organisations that collect, collate and manage information on the natural environment for a defined geographic area). ESB data is submitted to LERCs annually, though no formal data sharing agreements exist.

Licences and attribution

All data submitted to the Earthworm Society of Britain is assigned a **Creative Commons Attribution 4.0 International licence** as it is recommended for maximum dissemination and use of licensed materials.



It allows others to:

Share — copy and redistribute the material in any medium or format for any purpose, even commercially.

Adapt — remix, transform, and build upon the material for any purpose, even commercially.

(The licensor cannot revoke these freedoms as long as the user follows the license terms)

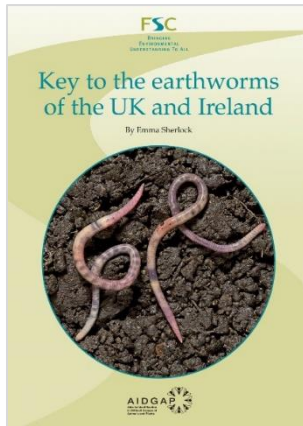
Under the following terms:

Attribution — Users must give **appropriate credit**, provide a link to the license, and **indicate if changes were made**. Users may do so in any reasonable manner, but not in any way that suggests the licensor endorses the user or their use of the data.

No additional restrictions — Users may not apply legal terms or **technological measures** that legally restrict others from doing anything the license permits.

5 Identifying earthworms

5.1 Printed identification keys



Key to the Earthworms of the UK & Ireland (2012) *E. Sherlock*

Part of the Field Studies Council (FSC) AIDGAP series. The aim of the AIDGAP series is to produce accessible keys suitable for non-specialists from sixth-form age upwards. This key provides a basic background in earthworm biology as well as information on sampling, recording and preserving earthworms. In addition to a dichotomous key, there is a quick earthworm comparison chart and species accounts.

The book is available from the FSC website:

www.field-studies-council.org/publications/pubs/earthworms.aspx

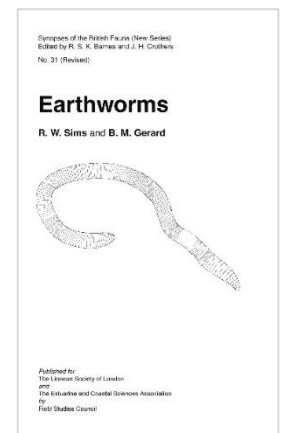
A second edition of the Sherlock key is currently in progress. The new edition will include two earthworm species that have been added to the species checklist since the first edition (*Aporrectodea nocturna* and *Kenleenus armadus*), a key to hothouse species, photos of live specimens and more details. The key was tested in ESB workshops by both experienced and new earthworm recorders and is expected in 2018.

Earthworms (Synopsis of the British Fauna) (1985) *R.W. Sims & B.M. Gerard*

Part of the Synopses of the British Fauna produced by the Linnean Society and published by the FSC. This book provides a detailed account of UK earthworm biology and taxonomy. The technical detail contained within the dichotomous key and diagrams make this key suitable for more experienced users rather than beginners. Some of the taxonomy is out of date and many of the species names have since changed. A 1999 revised edition is available from the FSC.

The book is available from the FSC website:

www.field-studies-council.org/publications/pubs/earthworms-synopsis.aspx



OPAL Earthworm Guide *D.T. Jones & C. N. Lowe*

This key is for the common species of UK earthworms only and covers less than half of UK earthworm species. It is a fantastic resource for looking at earthworms in more depth with children and individuals not experienced in biological recording. However, it is not a sufficiently detailed identification key for the purpose of the National Earthworm Recording Scheme. Few British species can be reliably identified from live specimens in the field.



5.2 Digital identification resources

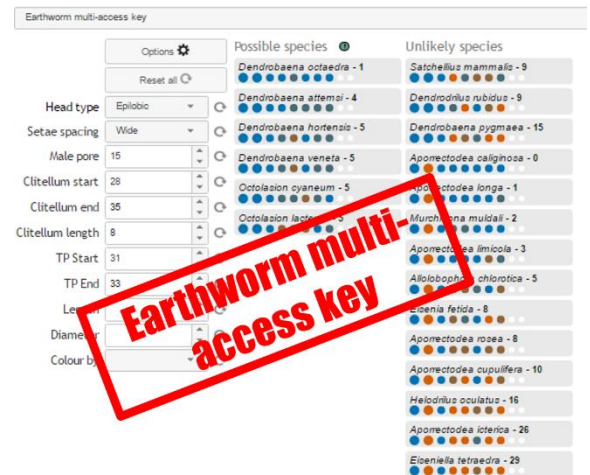
Earthworm Multi-Access Key

E. Sherlock & R. Burkmar

This online visualisation was created by R. Burkmar as part of the FSC Tomorrow's Biodiversity project using the knowledge base of Sherlock (2012). Please note that not all characteristics are considered (TP shape is omitted) and the printed key is often still required to verify identification.

This tool is a great aid to the printed key and is available to use for free from the Earthworm Society of Britain website.

www.earthwormsoc.org.uk/fullscreen/earthwormkey



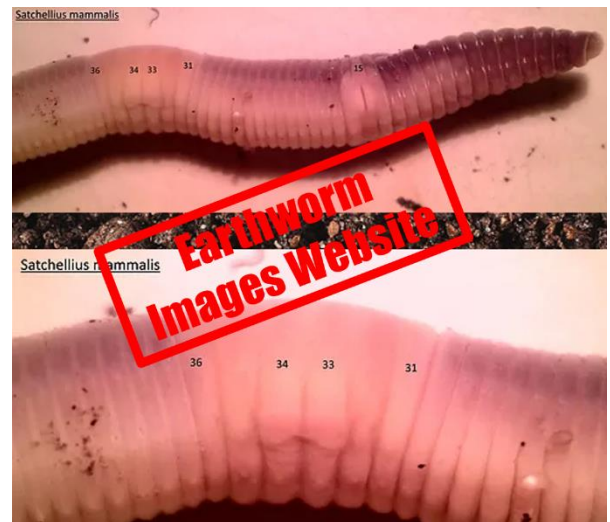
Earthworm Images Website

B. Crabb

This online gallery of images is a collection of photos of various species of earthworm native to the UK. The photographs were taken using a USB microscope and have been labelled to indicate the location and appearance of identification features.

The resource was created by an earthworm recorder in order to assist other earthworm recorders with their identifications, and is not intended to be used as the sole method of identification for UK earthworms. The labels which appear on some of the images refer to that specimen only, they are not intended as a general description of the species.

<https://bjc792.wixsite.com/earthworm-images>



Earthworms UK Facebook Group

L. Andrews & N. Barrett

A Facebook group set up to allow those interested in earthworm identification to give support to others and pose identification queries to others. The group was created to allow people to discuss earthworm identification regardless of their ability level and is a useful resource for both new and experienced recorders.

www.facebook.com/groups/1059301190824485/





5.3 Microscopes and lab work

In order to identify earthworms, you will need access to a microscope and some basic lab equipment.

Microscopes

British earthworms vary from under 2cm to 40cm in length so you'll need to consider this when selecting a suitable microscope. We recommend the use of a **stereo microscope with zoom magnification from X10 (for bigger earthworms) through to X30 (for smaller earthworms)**.

In addition, you should also consider:

- **A light source** – if your microscope doesn't come with lighting you may need to purchase a lamp as you will need to illuminate earthworms from above to be able to clearly see their identification features.
- **Stage plates** – These are the discs that sit beneath the petri dish when examining an earthworm specimen. Traditionally, they are white, black or transparent. When observing earthworms, some features on specimens may be clearer with a black stage plate and some clearer with a white stage plate (this can even differ between features on the same specimen). Most features are less clear when using a transparent stage plate. If your microscope does not have white or black stage plates you can make your own using black or white paper/card or purchase reversible black-white stage plates online.

Microscope suppliers that sell suitable equipment for earthworm recorders

- Brunel Microscopes
New microscopes: <http://www.brunelmicroscopes.co.uk/stereo-tour.html>
Used microscopes: <http://www.usedmicroscopes.co.uk/>
- Mazurek Optical services
<http://mazurekopticalservices.co.uk/microscopes/type/stereo/>
- Severn Sales (laboratory Equipment)
<http://www.severnsaleslabequip.com/index.php/metallurgy-and-microscopy/stereo-microscopes.html?limit=all>
- Fullerscope services
<http://www.fullerscopeservices.co.uk/products?cat=23>
- GT Vision
http://www.gtvision.co.uk/epages/es141397.sf/en_GB/?ObjectPath=/Shops/es141397/Categories/Stereo_Microscopes

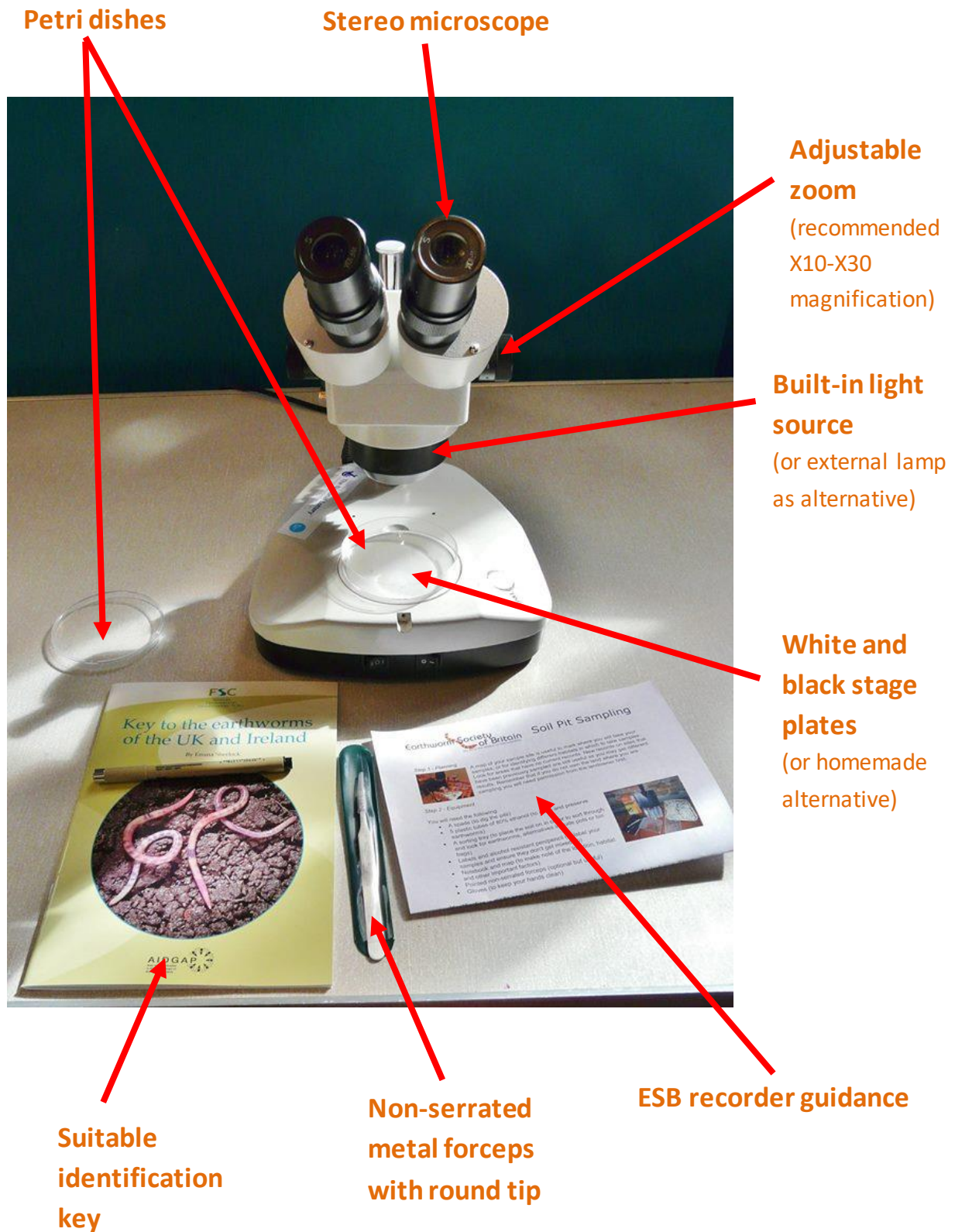
In addition to traditional microscopes, more digital microscopes are becoming available on the market (including very reasonably-priced USB microscopes). If you are considering purchasing a digital or USB microscope you should consider all of the above plus the stability of the model.

Forceps

Earthworms are soft-bodied animals and easy to damage if suitable forceps are not used to manipulate specimens. We advise using **non-serrated forceps with a rounded tip**, as both serrated edges and pointed tips can easily damage specimens and make it more difficult to identify your specimen. In general metal forceps are also better than plastic alternatives when manipulating earthworms under a microscope.

When identifying earthworms, you may find our **Earthworm Identification Features Sheet** useful to record the different features of your earthworms.

Earthworm identification lab set up

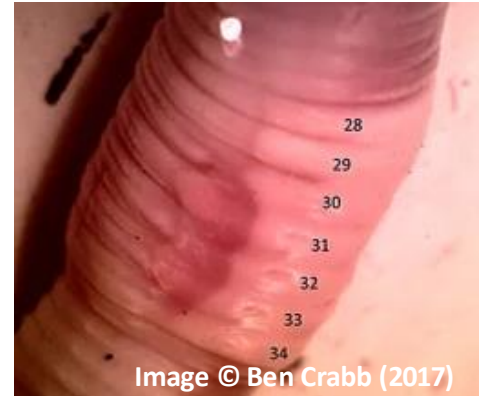


5.4 Photographing earthworms

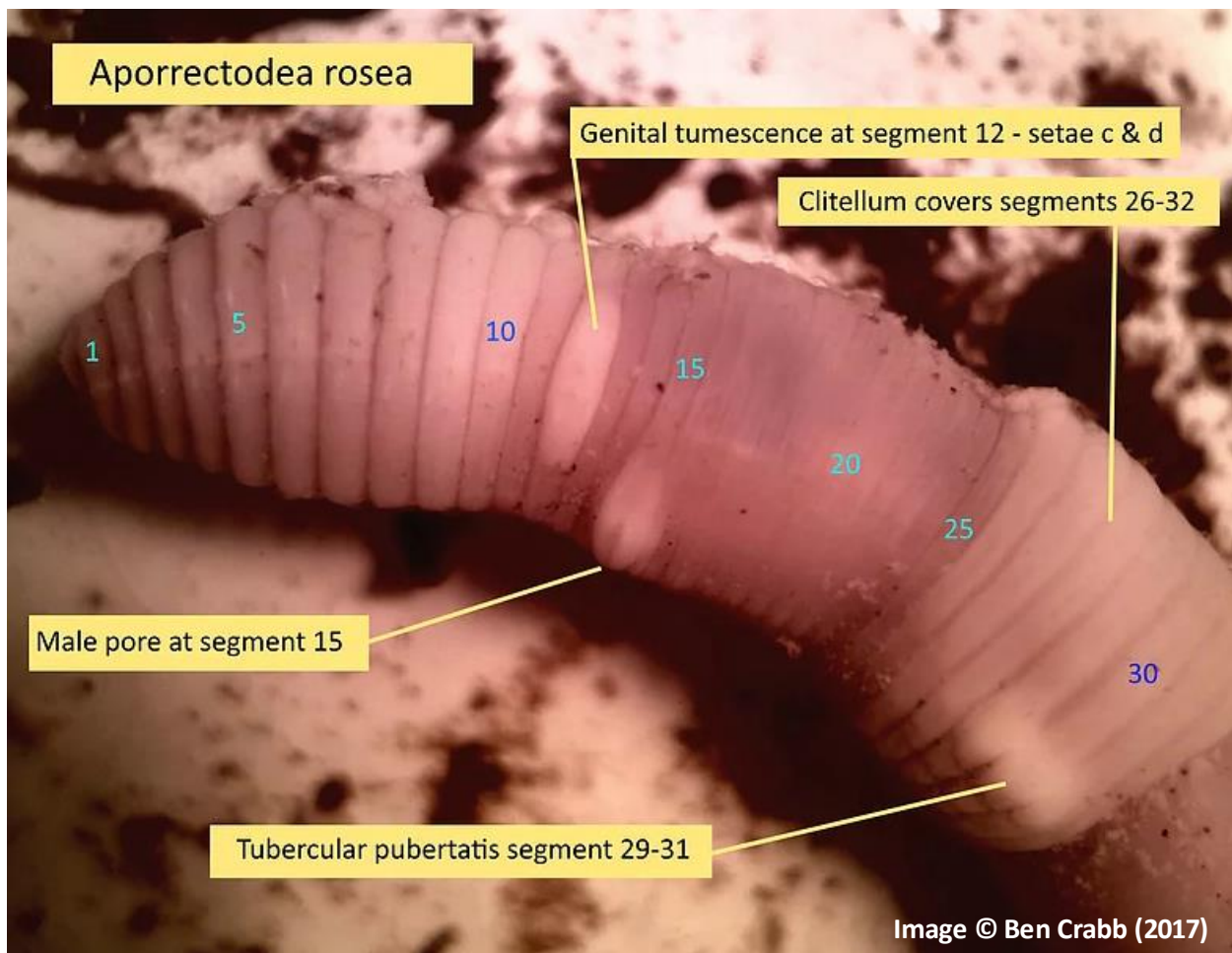
Identifying earthworms from photographs can be extremely difficult. This is particularly true if the photos are of live specimens, as it can be very difficult to see the features needed to make a reliable species determination. However, if you are submitting photos to the Earthworm Society of Britain for identification or verification purposes here are a few tips:

Provide several photos – for many specimens it is extremely difficult (if not impossible) to capture all the identification features in one photo. By taking several images you can capture a specimen from different angles and positions.

Provide close-up photos - the identification features of earthworms are often small and difficult to see on photographs of an entire specimen. Close-up photos of the saddle are particularly useful as they give insight into the location and shape of the TP – a key identification feature.



Label your photos – don't be afraid to add labels and notes to your photos. Numbering the segments (such as every fifth segment) can be useful, particularly on close up photos as there would otherwise be no reference with regards to segment numbers.



Examples of well-labelled photographs suitable for the identification of earthworms can be found on the Earthworm Images Website at <https://bjc792.wixsite.com/earthworm-images>



5.5 UK & Ireland Earthworm Species Checklist (Natural Environments)

This list was compiled by Keiron Derek Brown on 07/02/16 in accordance with Sims & Gerard (1999) and Sherlock (2012,) and with guidance from the Natural History Museum to take into account subsequent developments in the taxonomy of UK & Ireland earthworm species occurring in natural environments.

Class CLITELLATA

Record verification level

Subclass OLIGOCHAETA

Order CRASSCLITELLATA

Family ACANTHRODRILIDAE Claus, 1880

Microscolex phosphoreus (Duges, 1837)

Expert

Family LUMBRICIDAE Rafinesque-Schmatz, 1815

Allolobophora chlorotica (Savigny, 1826)

Recorder

Allolobophoridella eiseni (Levinsen, 1884)

Recorder

Aporrectodea caliginosa ((Savigny, 1826)

Recorder

Aporrectodea cupulifera (Tetry, 1937)

Expert

Aporrectodea icterica (Savigny, 1826)

Recorder

Aporrectodea limicola (Michaelsen, 1890)

Tutor

Aporrectodea longa (Ude, 1885)

Recorder

Aporrectodea nocturna Evans, 1946

Tutor

Aporrectodea rosea(Savigny 1826)

Recorder

Dendrobaena attemsi (Michaelsen, 1890)

Recorder

Dendrobaena hortensis (Michaelsen, 1890)

Tutor

Dendrobaena octaedra (Savigny, 1826)

Recorder

Dendrobaena pygmaea (Savigny, 1826)

Expert

Dendrobaena veneta (Rosa, 1886)

Recorder

Dendrodrilus rubidus (Savigny, 1826)

Recorder

Eisenia fetida (Savigny, 1826)

Recorder

Eisenia andrei Bouché, 1972

Expert

Eiseniella teraedra (Savigny, 1826)

Recorder

Helodrilus oculatus Hoffmeister, 1845

Expert

Kenleenus armadas Blakemore 2012

Expert

Lumbricus castaneus (Savigny, 1826)

Recorder

Lumbricus festivus (Savigny, 1826)

Recorder

Lumbricus friendi Cognetti, 1904

Expert

Lumbricus rubellus Hoffmeister, 1845

Recorder

Lumbricus terrestris Linnaeus, 1758

Recorder

Murchieona muldali (Omodeo, 1956)

Recorder

Octolasion cyaneum (Savigny, 1826)

Recorder

Octolasion lacteum (Örley, 1881)

Recorder

Satchellius mammalis (Savigny, 1826)

Recorder

Family SPARGANOPHILIDAE Michaelsen, 1928

Sparganophilus tamesis Benham,1892

Expert



Species checklist notes

- *Aporrectodea caliginosa* was previously known to exist as a distinctly different morph: *nocturna*. This morph is an anecic earthworm. Molecular research has indicated that this morph is a distinct species and yet to be published morphological work has confirmed this. For the NERS, recorders are asked to submit records of the *nocturna* morph as *Aporrectodea nocturna*. *A. nocturna* can be distinguished relatively easily as it is generally larger than *A. caliginosa* and has a deep red colour.
- *Eisenia andrei* is extremely difficult to separate from *Eisenia fetida*, and possibly only distinguishable through molecular work. Some earthworm taxonomists believe that *E. andrei* and *E. fetida* belong to a single species. For the NERS all *Eisenia* species records are recorded as *Eisenia fetida*, as an aggregate species, unless an earthworm taxonomist has determined that the record is of *E. andrei*.
- *Aporrectodea cupulifera* and *Kenleenus armadus* are known from Ireland and not from mainland Britain.
- *Sparganophilus tamesis* may not be currently present in the UK and has only been found in proximity to gardens where it is believed it arrived with imported aquatic plants.

5.6 UK & Ireland Earthworm Species Checklist (Artificial Environments)

Numerous non-native earthworm species have been recorded in artificial environments across the United Kingdom. Any non-native species found in the UK should be verified by an expert through examination of the preserved voucher specimen. Identification of non-native earthworms is likely to require dissection of the specimen.

Coming soon....

5.7 Verification

Once submitted to the NERS, earthworm records may require verification dependent on the species recorded and the experience of the recorder. Below is an explanation of the record verification levels we have assigned to each earthworm species as indicated in the **UK & Ireland Earthworm Species Checklist (Natural Environments)**:

Recorder

- Records will be accepted from **ESB recorders, trusted non-ESB recorders, ESB tutors** and **experts** (earthworm taxonomists).
- Verification by an **ESB tutor** or **expert** will be required for records provided from other sources.

Tutor

- Records will be accepted from **ESB tutors** and **experts** (earthworm taxonomists).
- Verification by an **ESB tutor** or **expert** will be required for records provided from other sources (unless the recorder has previous experience of identifying the species in question).

Expert

- Records will only be accepted from **experts** (earthworm taxonomists).
- Verification by an **expert** will be required for records provided from any source.

How can I get my record verified by a tutor or an expert?

Please submit your record as per the usual submission pathways and the ESB will get in touch. Please note that it is likely that a tutor or expert will need to inspect the voucher specimen so it's always useful to retain the preserved specimen for any determinations that you believe may require verification.

If you have any questions relating to the identification of British or Irish earthworms, please contact the Earthworm Society of Britain at ESBenquiries@gmail.com.



6 Field Work Assessment

We recommend that recorders carry out a field work assessment in advance of any earthworm sampling. The Earthworm Society of Britain (ESB) recommends you should consider the following:

6.1 Permissions

You should contact the land owner or site manager to ensure you have the necessary permission to undertake your sampling. It is good practice to request permission for the following:

- Access to the site.
- Destructive sampling methods (such as digging or searching through deadwood).
- Collection and removal of specimens from the site.
- Submission of the records to the National Earthworm Recording Scheme (NERS) and refer them to the **Open Data Agreement for Earthworm Records** Error! Reference source not found. contained in this document.

Furthermore, the land owner/site manager may be interested in what was found so we recommend you always share your results with them in the form of the records or a site species list.

6.2 Health and safety

Consider carrying out your own risk assessment before doing fieldwork with the following considerations:

- Avoid doing fieldwork on your own, if you do ensure you tell someone exactly where you will be and when you expect to return.
- Always ask permission from the owner before entering land.
- Always tell a responsible adult where you are going and what time you expect to return.
- Check the weather forecast before doing fieldwork, and take appropriate clothing.
- Be aware of local hazards such as dangerous wildlife or hazardous terrain.
- Watch out for dangers such as sharp objects and broken glass in soil.
- Take care to avoid injuries to your hands and soil borne diseases by wearing gloves.
- Always take a mobile phone and a map of the area.
- Know who to contact in the event of an emergency and check where the nearest source of help is in case your mobile phone does not work.
- Carry out a risk assessment for the planned field work.





6.3 Risk assessment

An example risk assessment is given below that is used by the ESB when conducting field work for collecting earthworm records for ESB events to give earthworm recorders an idea regarding some of the risks that should be considered. Different sites and weather conditions will require specific considerations so earthworm recorders are responsible for conducting their own risk assessments and ensuring they operate within any parameters outlined by site managers/land owners (e.g. site-specific risk assessments) when permission is granted to sample a site for earthworms.

<i>Hazard</i>	<i>Risk</i>	<i>Precautions/action</i>	<i>Likelihood</i>
Natural hazards (e.g. open or moving water, cliff or quarry edges, steep slopes)	Drowning, injuries or falls, exposure,	Exercise caution near water, keep away from cliff edges and quarries, be aware of steep slopes.	Low
Adverse weather	Hypothermia, exposure, sunburn, heat stroke	Ensure you have the correct clothing for the conditions. If the weather is too extreme abandon the sampling or seek shelter. Ensure you have something to eat and drink with you.	Low
Tools (e.g. spade, trowel etc...)	Injuries, bruises, cuts, muscle injuries	Transport tools safely, use only for intended purpose, seek training if required, be aware of others during use.	Low
Holes dug during sampling	Trips, breaks, falls	Never leave holes unattended, ensure they are filled in at the end of sampling.	Low
Soil/earthworm borne bacteria or pathogens	Infection	Wear gloves if appropriate, wash hands before eating.	Low

The Earthworm Society of Britain shall not, in any circumstances, have any liability whatsoever for any injury, losses or damages which may be suffered by any participants carrying out earthworm sampling, recording and related activities, whether in contract, tort or otherwise. By participating in any Recording Activities, all participants agree, acknowledge and accept the foregoing.

New Zealand Flatworm

The New Zealand Flatworm (*Arthurdendyus triangulates*) is a non-native flatworm species that is known to have colonised the UK, and is now common in Scotland and Northern Ireland. The NZ Flatworm is known to eat earthworms and is dark brown with pale, spotted margins and underside. It grows up to 15cm in length and has a flattened body. **NZ Flatworms should only be handled wearing gloves as they can cause irritation to the skin.**

Please note that it is illegal to release non-native flatworms, such as the NZ Flatworm, or allow them to escape into the wild in the UK. More information about non-native invertebrate species can be found on the Buglife website: www.buglife.org.uk



7 References

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Sherlock, E. 2012. Key to the earthworms of the UK and Ireland. AIDGAP, Field Studies Council, Shresbury.

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Earthworm Site Survey Form

For use when undertaking the National Earthworm Recording Scheme 5-Pit Protocol or a full Earthworm Site Survey.

Site Name:	Date (dd/mm/yyyy):	
Grid reference	Recorder Name(s):	
Vice county:	Habitat:	
<p style="text-align: center;">Soil Pits</p> <p>Soil pit sampling undertaken?</p> <p style="text-align: center;">Yes No</p> <p style="text-align: center;"> <input type="checkbox"/> <input type="checkbox"/> </p> <p>Number of soil pits:</p> <p>No. of juveniles returned to soil:</p>	<p style="text-align: center;">Mustard Sampling</p> <p>Mustard sampling undertaken?</p> <p style="text-align: center;">Yes No</p> <p style="text-align: center;"> <input type="checkbox"/> <input type="checkbox"/> </p> <p>Number of mustard sampling points:</p> <p>No. of juveniles returned to soil:</p>	<p style="text-align: center;">Microhabitat Searches</p> <p>Microhabitat searches undertaken?</p> <p style="text-align: center;">Yes No</p> <p style="text-align: center;"> <input type="checkbox"/> <input type="checkbox"/> </p> <p>Microhabitat 1 details:</p> <p>Microhabitat 2 details:</p> <p>Microhabitat 3 details:</p>
Comments:		



Earthworm Identification Features Sheet

For use when identifying earthworms only: Please submit records using the ESB earthworm records submission sheet or the iRecord Earthworm Survey Form

Date	Site details	Head	Male Pore	Clitellum	TP		Clitellum	Setae	Comments (including TP shape)	Species
		Epi or Tany		Start	Start	End	End	Close or Wide		