**Part 1: Learning outcomes plan**

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| **Main idea:*** New Zealand has native and introduced earthworms that are adapted to live in specific soil niche habitats.
 | **Science strand:**Living World: Life processes * Recognise that there are life processes in common to all living things and that these occur in different ways.
* Recognise that living things are suited to their particular habitat and they respond to environmental changes, both natural and human-induced.
* Begin to group plants, animals, and other living things into science-based classifications.
 | **Level:** 3-4**Year:** 5-8**Teacher:** Angela Schipper |
| **Overarching learning outcomes:** In building understandings about earthworms, students will integrate:* understanding the relationship between niche and earthworm physical characteristics and behaviours (scientific knowledge)
* investigations into adaptations and observation (scientific practice)
* engagement with a range of science text and media and use a range of scientific vocabulary (nature of science).
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| **Conceptual learning outcomes**  | **Procedural learning outcomes**  | **Nature of science outcomes**  | **Technical learning outcomes**  |
| Students will understand that:* living things share common characteristics and life processes
* earthworms have general adaptations to suit their soil habitat
* earthworms have further adaptations to suit their niche dwellings within the soil habitat
* NZ has endemic, native and introduced earthworms.
 | Students will be able to:* identify and group things according to common characteristics
* identify earthworm adaptations
* discuss the relationship between niche and some earthworm physical characteristics
* discuss earthworm research and/or observations – either their own or others.
 | Students will understand and appreciate that:* scientists have specialist vocabulary to help them communicate effectively
* scientists build knowledge through observation and written information
 | Students will be able to:* use interactives from the SLH to explore and discuss the characteristics of living things
* use the internet and other resources for research purposes
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| **Management/materials:*** Resources: Articles, activities and media mentioned in [Investigating earthworms](https://www.sciencelearn.org.nz/resources/36-investigating-earthworms-introduction)
* Equipment for the student activities [Living or non-living?](https://www.sciencelearn.org.nz/resources/27-living-or-non-living), [Observing earthworms](https://www.sciencelearn.org.nz/resources/28-observing-earthworms) and [Caring for earthworms in the classroom](https://www.sciencelearn.org.nz/resources/10-caring-for-earthworms-in-the-classroom).
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| **Assessment:*** To assess niche and adaptations, complete and print the profile in [Wormface – social networking for earthworms](https://www.sciencelearn.org.nz/resources/2641-wormface-social-networking-for-earthworms).
* Use results from students’ own research or the [Observing earthworms](https://www.sciencelearn.org.nz/resources/28-observing-earthworms) activity.
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**Part 2: Lesson plan**

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| **Main ideas:** Earthworms and other living things share common life processes. Scientists use these and other characteristics to group or classify living things. |
| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks** | **Micro tasks** |
| **Day 1**Explore the characteristics of living things. | 1.1 Group image cards into categories of students’ choosing. | * Image cards from Earthworms [Living or non-living](https://www.sciencelearn.org.nz/resources/27-living-or-non-living)? – one set for each group or pair of students
 | * In pairs or small groups, students organise the images into categories of their own choosing. There are no right or wrong answers but they must be able to justify why they’ve grouped them in this manner.
 | * Students recognise that living things share common characteristics and we can group them according to these characteristics.
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| 1.2 Read and discuss the article Characteristics of living things. | * [Characteristics of living things](https://www.sciencelearn.org.nz/resources/14-characteristics-of-living-things)
 | * Read through the article as a class, individually or in pairs.
* Clarify/discuss specific vocabulary or concepts according to level of understanding.
 | * Students develop a greater understanding of the characteristics of living things.
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| 1.3 Students use the characteristics of living things to complete an activity. | * [Living or non-living](https://www.sciencelearn.org.nz/resources/27-living-or-non-living) graphic organiser Living or not?
* [Earthworms: Inside](https://www.sciencelearn.org.nz/image_maps/24-inside-of-an-earthworm) and [Earthworms: Outside](https://www.sciencelearn.org.nz/image_maps/27-outside-of-an-earthworm)
 | * Younger students work through the Living or not? graphic organiser.
* Older students: Print screen shots of the Earthworms: Inside and outside interactives. Students match up the seven characteristics of living things with the various parts of the earthworm’s anatomy.
 | * Students apply their knowledge of the characteristics of living things.
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| **Main idea:** Earthworms have special adaptations that enable them to live in the soil. |
| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks** | **Micro tasks** |
| **Day 2**Introduce the concept of adaptations, adaptations specific to earthworms and how these adaptations compare with those of other soil animals. | 2.1 Explore the special features that enable the earthworm to live underground. | * Image of [Tiger worms](https://www.sciencelearn.org.nz/images/26-tiger-worms-eisenia-fetida)
* IWB or data projector
* Whiteboard or paper
 | * Show students the image. Ask them what special features enable the tiger worm to live in the soil. (i.e. streamlined body, no eyes due to the dark).
* Record ideas.
 | * Students begin to think of earthworm adaptations.
* Students recognise how earthworms are suited to live in the soil environment.
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| 2.2 Continue to explore earthworm adaptations | * Video [Physical adaptations for life underground](https://www.sciencelearn.org.nz/videos/3-physical-adaptations-for-life-underground)
* IWB or data projector
 | * Watch the video clip Physical adaptations for life underground
* Ask students to add adaptations/special features to the list begun earlier.
 | * Students add to their knowledge of earthworm adaptations.
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| 2.3 Learn about structural, physiological and behavioural adaptations and examples of these in earthworms. | * [Earthworm adaptations](https://www.sciencelearn.org.nz/resources/17-earthworm-adaptations)
* IWB or data projector or laptops
* Whiteboard or paper
 | * Read through the article Earthworm adaptations as a group or individually.
* Refer to the class list of earthworm adaptations and group them according to structural, physiological or behavioural.
 | * Students learn about the three main categories of adaptation.
* Students use these categories to group earthworm adaptations.
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| 2.4 Compare earthworm adaptations with other animals that live underground. | * Access to the website <http://soilbugs.massey.ac.nz/>
 | * Older students can compare earthworm adaptations with other animals that live in soil. [Soil bugs](http://soilbugs.massey.ac.nz/) has details on many NZ invertebrates. Students can also research vertebrates like burrowing animals. Encourage students to think about the need for oxygen, food, moisture etc.
 | * Students gain a deeper understanding of earthworm adaptations by comparing these adaptations with those of other soil animals.
* Students use the internet as a research tool to locate and evaluate information from a variety of texts.
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| **Main idea:** Earthworms occupy specific niches within the soil environment. |
| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks** | **Micro tasks** |
| **Day 3**An introduction to the concept of a niche within a habitat and the three niches soil-dwelling earthworms occupy. | 3.1 An introduction to the concept of niches within a particular habitat. | * Image of [Earthworm niche groupings](https://www.sciencelearn.org.nz/images/16-earthworm-niche-groupings)
* IWB or data projector
 | * View the Earthworm niche groupings image.
* Look at blue lines representing earthworm burrows.
* Ask students for possible explanations for the different burrow widths and depths.
 | * Students are introduced to earthworm niche groupings within the soil environment.
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| 3.2 Read about earthworm niches. | * Article [Niches within earthworms’ habitat](https://www.sciencelearn.org.nz/resources/7-niches-within-earthworms-habitat)
* IWB or data projector
 | * Read through the article Niches within earthworms’ habitat.
* Discuss the three niches of soil-dwelling earthworms.
* Discuss the origins of these niche grouping names.
* Discuss how living in a particular niche affects an earthworm’s location in soil profile, burrowing behaviour, pigmentation, muscle strength and diet.
 | * Students learn about the relationship between niche and physical characteristics of earthworms.
* Students learn that scientists have special vocabulary, learn the origins of some of these words and begin to use the vocabulary.
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| 3.3 Watch a video about differences amongst earthworm species. | * Video [Not all the same](https://www.sciencelearn.org.nz/videos/4-not-all-the-same)
* IWB or data projector
 | * Watch clip Not all the same.
* Watch video a second time. Pause to discuss various physical characteristics and how these relate to the earthworms’ niche within the soil.
 | * Students deepen their knowledge of the relationship between niche and some earthworm physical characteristics.
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| 3.4 Placing common New Zealand earthworms into their niche groups. | * Slide show [Common New Zealand earthworms](https://www.sciencelearn.org.nz/embeds/93-common-new-zealand-earthworms-slide-show)
* IWB or data projector
* Paper and pens for recording
 | * Use Common New Zealand earthworms for information on earthworms that live in NZ.
* Students make a chart with the headings epigeic, endogeic and anecic and place the earthworms in the appropriate niche group.
* Note common characteristics of earthworms within each group.
 | * Students are able to sort earthworms into their niche groupings.

Students are able to look for similarities amongst the niche groupings.  |

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| **Main idea:** New Zealand has both native and introduced earthworms. |
| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks** | **Micro tasks** |
| **Day 4**New Zealand has both native and introduced earthworms. The native *O. multiporus* is a deep-dwelling bioluminescent earthworm species. | 4.1 Introduction to Gondwana and one theory about why NZ has unique native flora and fauna. | * [Gondwana animation (Tectonic plates animation)](https://www.sciencelearn.org.nz/videos/798-tectonic-plates-animation)
* IWB or data projector
 | * Watch the Gondwana animation.
* Discuss this with students to gauge their level of knowledge and understanding about this concept.
 | * Students learn how New Zealand broke away from Gondwana about 60-80 million years ago.
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| 4.2 An introduction to the terms native, endemic and introduced species. | * Article [Native and introduced earthworms](https://www.sciencelearn.org.nz/resources/20-native-and-introduced-earthworms)
 | * Use the article Native and introduced earthworms to define the terms native, endemic and introduced.
* Discuss origins of the various earthworm species in NZ.
 | * Students continue to learn and use scientific vocabulary.
* Students learn how native and introduced earthworm species arrived in New Zealand.
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| 4.3 Impacts of introduced earthworm species on natives. | * Internet or library for research
* Paper and pens for recording
 | * Discuss impacts of introduced earthworms on native worms.
* Compare and contrast this with other introduced species such as possums or gorse.
* Older students might like to research the New Zealand flatworm and its impact in UK.
 | * Students learn that native earthworms are displaced due to habitat change rather than through competition with introduced species.
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| 4.4 Introduction to *O. multiporus*, a native earthworm. | * Video [New Zealand native earthworm O. multiporus](https://www.sciencelearn.org.nz/videos/5-new-zealand-native-earthworm-o-multiporus)
* Article [Octochaetus multiporus](https://www.sciencelearn.org.nz/resources/21-octochaetus-multiporus)
* IWB or data projector
 | * Watch the video about *O. multiporus.*
* As a class or small groups, read through the article. Ask students to write down or point out new information they find in the article that is not in the video.
* Give more capable readers copies of video transcript and article to highlight facts the two texts have in common in one colour and information unique to the texts in a separate colour.
 | * Students learn about a NZ native earthworm species.
* Students locate, evaluate and integrate information from a variety of texts.
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| **Main idea:** Investigations involving earthworms. |
| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks** | **Micro tasks** |
| **Day 5**Investigations are a key part of scientific research. Learn about earthworm research, past and present. Students conduct their own earthworm observations and/or research. | 5.1 Charles Darwin and his earthworm research. | * Article [Charles Darwin and earthworms](https://www.sciencelearn.org.nz/resources/22-charles-darwin-and-earthworms)
* IWB or data projector
 | * Display the [Man is but a worm](https://www.sciencelearn.org.nz/images/28-man-is-but-a-worm) image in the Charles Darwin and earthworms article. What clues can students discover from the image? (From the date or the progression from earthworm to monkey to human?)
* Read the article to learn more about Darwin and his research.
 | * Students are introduced to Charles Darwin and his research into earthworm behaviour and intelligence.
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| 5.2 Current earthworm research. | * Articles [Investigations in science](https://www.sciencelearn.org.nz/resources/5-investigations-in-science)

and [The role of observation in science](https://www.sciencelearn.org.nz/resources/8-the-role-of-observation-in-science)* IWB or data projector
 | * Read the articles on earthworm research by New Zealand scientists.
* Discuss/record what these scientists have in common with Charles Darwin and his earthworm research.
* What were/are the scientists’ purposes for research?
* How have techniques changed between Darwin’s time and now?
 | * Students learn about the social and cultural nature of science. Darwin conducted his earthworm research to satisfy his own curiosity. As the Punch cartoon shows, those around him did not always value this research. Trish Fraser and Nicole Schon conduct their research to discover the economic or environmental benefits of earthworms.
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| 5.2 Students conduct their own earthworm observations and/or research. | * Activity [Observing earthworms](https://www.sciencelearn.org.nz/resources/28-observing-earthworms)
* Activity [Caring for earthworms in the classroom](https://www.sciencelearn.org.nz/resources/10-caring-for-earthworms-in-the-classroom)
* See student activities for materials needed.
 | * Use the Observing earthworms activity to explore earthworm anatomy and the nature of science.
* Alternatively, students can recreate some of Darwin’s earthworm research. Refer to the student activity Caring for earthworms in the classroom for legal and ethical guidelines when studying earthworms at school.
 | * Students use observation to identify various physical or behavioural characteristics.
* Students discuss how their observations and experiences mirror those of real scientists.
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