

# Hastings Cave and Thermal Springs



## Focus Topic: Cave Biodiversity

### Topic Introduction

Caves are not the lifeless places one might expect; more than 40 species have been discovered in Newdegate Cave, some very strange looking and still unclassified. This unit is designed to enable students to examine how the cave flora and fauna (biotic factors) have adapted to live there. Students also learn about ways in which humans are having an impact on the cave, both inside and out, and how scientists study the cave environment. They may conduct their own environmental investigation as part of their visit.

It is recommended that students also include Focus Topics **Measuring the Cave Environment** and **Cave Development** in their program.



*Cave cockroach*

### Summary of Cave Visit Program

| Focus topic core  | Hastings Cave – biodiversity  | Assessment for learning   | Time                      |
|---|---|---|---------------------------|
| <p><b>Cave biodiversity</b></p> <ul style="list-style-type: none"> <li>conducting an ecological inquiry</li> <li>data collection</li> </ul> | <p>Some possible activities:</p> <ul style="list-style-type: none"> <li>Measure environmental factors inside and outside the cave.</li> <li>Perform a walking linear transect survey into the cave with the Guide, looking at the plants and animals present in the zones.</li> <li>Use appropriate field guides to identify the plants and animals in a particular area.</li> <li>Collect evidence to identify what kinds of animals use the area, e.g. tracks and traces.</li> <li>Take digital photos to record animals and plants, and human interactions.</li> <li>Observe behaviour of animal species.</li> <li>Study physical adaptations of biota to cave habitats.</li> <li>Compare the diversity of biota inside and outside the cave.</li> <li>Research human activity around the cave (wood-felling and log extraction).</li> </ul> | <p>Assess students' ability to:</p> <ul style="list-style-type: none"> <li>work as part of a team to conduct an ecological study</li> <li>collect, record and interpret data</li> </ul> | <p>One-day field trip</p> |



## Topic Reference

|                            |  |
|----------------------------|--|
| Standard                   | 4–5  |
| Stages                     | 10–15  |
| Year level(s)              | 7–10   |
| Curriculum areas           | Science  |
| <b>Strand(s)</b>           | <ol style="list-style-type: none"> <li>1. Scientific inquiry (SI)</li> <li>2. Scientific communication(SC)</li> <li>3. Science as a body of knowledge(SBK) <ul style="list-style-type: none"> <li>• Energy and force</li> <li>• Living things (LT)</li> <li>• Earth and space (ES)</li> </ul> </li> </ol>  |
| <b>Understanding goals</b> | <ol style="list-style-type: none"> <li>1. Students will understand how to record and communicate the results of an ecological study. (SC)</li> <li>2. Students will understand that organisms have different characteristics which make them suited to living in particular cave environments. (SBK – LT)</li> <li>3. Students will understand the effect of humans' impact on the cave ecosystem. (SBK – LT)</li> </ol> |

## Links to the Science Strands and Substrands

| Strand/substrand                   | Possible key questions   |
|------------------------------------|--|
| Science as a human endeavour (SHE) | <ul style="list-style-type: none"> <li>• How does human activity impact on biodiversity in the cave system?</li> </ul>   |
| Scientific inquiry (SI)            | <ul style="list-style-type: none"> <li>• What kinds of questions can be answered by ecological studies?</li> <li>• How do scientists decide which questions they are going to investigate?</li> <li>• How can ecological studies be conducted accurately?</li> </ul>   |
| Scientific communication (SC)      | <ul style="list-style-type: none"> <li>• How do we identify different plants and animals?</li> <li>• How can we record the results of ecological studies?</li> <li>• How can we communicate our findings in similar ways to scientists?</li> </ul>   |
| Energy and force (EF)              | <ul style="list-style-type: none"> <li>• How does energy flow through the cave ecosystem?</li> <li>• What are the energy needs of animals with different lifestyles (e.g. inside/outside the cave)?</li> <li>• What impacts can human energy production have on biodiversity in the short and long term?</li> </ul>  |
| Matter (M)                         | <ul style="list-style-type: none"> <li>• How is matter cycled through the cave ecosystems?</li> </ul>  |
| Life and living (LL)               | <ul style="list-style-type: none"> <li>• What adaptations do particular cave organisms have that suit them to their way of life/environment?</li> <li>• What are some ways in which cave organisms interact with each other and the non-living parts of their environment?</li> <li>• Have humans affected the population numbers of different cave organisms (e.g. extinctions, introduced species)?</li> </ul> |
| Earth and space (ES)               | <ul style="list-style-type: none"> <li>• How do changes that are occurring on Earth impact on cave organisms?</li> </ul>   |

## Suggested Topic Plan

### Pre-visit

- Which plants and animals might live in a cave and where?
- How are animals and plants classified?
- What is 'adaptation' and what special adaptations might be needed to survive underground (structural, behavioural, physiological)?
- Energy sources and energy budgets
- Food chains and webs



### Hastings Cave visit

- Visit to the Hastings Cave to conduct field work and ecological investigation; environmental factors, zonation, qualitative biota survey and identification, parallels to the world outside



### Post-visit follow-up

- Develop a food/energy web for the cave system.
- Analyse the adaptations of biota to the cave environment.
- Review human impacts in the short/long term, including inside and outside.
- What positive and negative impacts have humans had/are they having on the cave ecosystem environment?
- Why are cave reserves important, globally and in Tasmania?
- Prepare presentation of work using multimedia (Facebook, PowerPoint, video, photos, artwork and written reports).

## Suggested Pre- and Post-visit Teaching Plan

| <b>Pre-visit</b><br>• concepts/main ideas   | <b>Optional learning opportunities</b>   | <b>Assessment and Teacher Notes</b>   | <b>Time</b>                |
|---|--|---|----------------------------|
| <p><b>I. The cave habitats</b></p> <ul style="list-style-type: none"> <li>• Different parts of the cave habitats have different characteristics</li> <li>• Cave organisms are adapted to their environment</li> </ul> | <ol style="list-style-type: none"> <li>1. Look at video of caves.</li> <li>2. Discuss points such as:               <ul style="list-style-type: none"> <li>- how the environment inside a cave differs from outside</li> <li>- abiotic factors of cave environment (list them), such as temperature, light, humidity, substrate</li> <li>- what a habitat is.</li> </ul> </li> <li>3. Divide class into four or five groups, and allot a different terrestrial and/or aquatic environment to each group, where the sun is the main source of energy. Ask each group to make a list of the living and non-living elements in their habitat. Groups develop theoretical food web models for their chosen environments, focussing on a minimum of five producers and consumers.</li> <li>4. Introduce the term <b>adaptation</b>. Where possible, use illustrations, internet photos etc to show some examples. <b>Adaptations help animals to:</b> <ul style="list-style-type: none"> <li>• obtain oxygen, water, food and nutrients</li> <li>• cope with physical conditions such as temperature, light and heat</li> <li>• defend themselves from their natural enemies</li> <li>• reproduce</li> <li>• find shelter and build nests</li> <li>• respond to changes around them.</li> </ul> </li> </ol> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Colour: animals that display darker colours are more likely to be able to hide from predators.</li> <li>• Light: glow-worms use bioluminescence to attract prey to their snares in the darkness of the cave.</li> <li>• Body shape: to cope with cool cave temperatures animals have developed a more rounded body shape, which is better at conserving heat.</li> </ul> <p>Some useful sites for conducting research:</p> <p><a href="http://www.abc.net.au/catalyst/stories/by-date/2010/default.htm">http://www.abc.net.au/catalyst/stories/by-date/2010/default.htm</a></p> <p><a href="http://www.abc.net.au/science/ozfossil/megafauna/caves/default.htm">http://www.abc.net.au/science/ozfossil/megafauna/caves/default.htm</a></p> <p><a href="http://www.abc.net.au/science/ozfossil/megafauna/caves/activity-stalactites.htm">http://www.abc.net.au/science/ozfossil/megafauna/caves/activity-stalactites.htm</a></p> <p><a href="http://www.abc.net.au/local/audio/2010/05/10/2895127.htm?site=kimberley">http://www.abc.net.au/local/audio/2010/05/10/2895127.htm?site=kimberley</a></p> <p><a href="http://www.abc.net.au/rural/sa/stories/s1291222.htm">http://www.abc.net.au/rural/sa/stories/s1291222.htm</a></p> <ol style="list-style-type: none"> <li>5. Each group chooses a method of sharing their information with the rest of the class and reports back to the class (possibly as a role play, PowerPoint or photo story)</li> </ol> | <p><b>Assessment for learning</b></p> <p>Assess students' understanding of:</p> <ul style="list-style-type: none"> <li>• the work of cave scientists</li> <li>• cave formation</li> </ul> | <p>Two x 50min lessons</p> |

| <b>Pre-visit</b><br><ul style="list-style-type: none"> <li>concepts/main ideas</li> </ul>   | <b>Optional learning opportunities</b>  | <b>Assessment and Teacher Notes</b>  | <b>Time</b>         |
|---|---|--|---------------------|
| <b>2. Cave biota</b> <ul style="list-style-type: none"> <li>Introduction to adaptation of animals and plants to cave environment</li> </ul>   | <p>6. Allocate each group a particular cave organism and have students research their adaptations to the cave environment.</p> <p>7. Create a silhouette mobile or poster showing the adaptations. Present to rest of class and use as a class display. Choose an organism from the Parks and Wildlife slideshow or Hastings Cave <a href="#">Teachers Fact Sheet</a>.</p>  | <b>Assessment for learning</b><br>Assess students' understanding of: <ul style="list-style-type: none"> <li>the term 'environment'</li> <li>the term 'adaptation'</li> </ul>                     | One x 50min lesson  |
| <b>3. Optional: guest speaker – researcher</b> <ul style="list-style-type: none"> <li>How cave scientists work</li> </ul>   | Invite a guest speaker from Southern Tasmanian Caverneers ( <a href="http://www.lmrs.com.au/stc/">http://www.lmrs.com.au/stc/</a> ), Parks and Wildlife ( <a href="http://www.parks.tas.gov.au/">http://www.parks.tas.gov.au/</a> ) or Forestry Tasmania ( <a href="http://www.forestrytas.com.au/">http://www.forestrytas.com.au/</a> ) to come and talk about their work.   | <b>Assessment for learning</b><br>Assess students' understanding of: <ul style="list-style-type: none"> <li>the role of guide, forester, scientist</li> </ul>                                    | One x 50min lesson  |
| <b>4. Tasmanian cave reserves</b> <ul style="list-style-type: none"> <li>Develop an understanding of why Tasmania has declared cave reserves to conserve habitat and species, and for research, education and recreation</li> </ul> | <p>1. Discuss with students:</p> <p>What is a cave reserve?</p> <p>Has anyone visited a cave reserve? Where was it?</p> <p>Where are the cave reserves in Tasmania?</p> <p>2. Ask students to research one cave reserve, and develop a guide for visitors (either PowerPoint or brochure), that shows:</p> <p>location and directions to get there (include map)</p> <p>what is special about the reserve, including details of notable formations and history, flora and fauna found there (include photos or video as possible)</p> <p>why it was declared</p> <p>activities that are and are not permitted in the reserve (e.g. logging, mining) and why they might affect the biodiversity.</p> <p>NB If internet is not available, print pages from the Parks and Wildlife website and copy for students as necessary.</p> <p>3. Give students a scenario in which it has been proposed a local area become a cave reserve. Ask students to list pros and cons of the proposal, and then justify their personal opinion.</p> | <b>Assessment for learning</b><br>Assess students' ability to: <ul style="list-style-type: none"> <li>identify some of the different cave habitats/ ecosystems that occur in Tasmania</li> </ul> | Two x 50min lessons |

| Pre-visit   | Optional learning opportunities   | Assessment and Teacher Notes  | Time                                |
|---|---|---|-------------------------------------|
| <ul style="list-style-type: none"> <li>concepts/main ideas</li> </ul> <p><b>5. Food chains and webs</b></p> <ul style="list-style-type: none"> <li>Understand how producers and consumers interact and the flow of energy in a cave system</li> </ul> | <p>1. Use the online food web activities from the sites listed below to develop an understanding of food chains and webs.</p> <p><a href="http://www.ecokids.ca/pub/eco_info/topics/frogs/chain_reaction/index.cfm">http://www.ecokids.ca/pub/eco_info/topics/frogs/chain_reaction/index.cfm</a></p> <p><a href="http://www.gould.edu.au/foodwebs/kids_web.htm">http://www.gould.edu.au/foodwebs/kids_web.htm</a></p> <p><a href="http://teacher.scholastic.com/activities/explorer/ecosystems/be_an_explorer/map/form.htm">http://teacher.scholastic.com/activities/explorer/ecosystems/be_an_explorer/map/form.htm</a></p> <p>2. Select a Tasmanian cave species and create a food web which demonstrates the energy flow through the ecosystem it is part of. Check out the Hastings Cave website for information and photos. A printable worksheet for this activity is available.</p> <p>Students may then present their food web as a poster.</p> <p>Optional: Play the Food Chain Checkers game at <a href="http://www.windows.ucar.edu/teacher_resources/checkers_20march.pdf">http://www.windows.ucar.edu/teacher_resources/checkers_20march.pdf</a></p> | <p><b>Assessment of learning</b></p> <p>Living things. Humans interact with ecosystems, and this raises ethical and sustainability issues (stages 7– 2). Assess the accuracy and complexity of food webs created by the students.</p>   | <p>Two or three x 50min lessons</p> |
| Post-visit follow-up  | Optional learning opportunities   | Assessment and Teacher Notes  | Time                                |
| <p>1. <b>Adaptation to life in a cave</b></p> <ul style="list-style-type: none"> <li>Develop an understanding of the way animals and plants have adapted to life in a cave, and their interrelationship and interdependency</li> </ul>                | <p>1. Develop a comprehensive, illustrated food/energy web for the cave system.</p> <p>2. Analyse the adaptations of biota to the cave environment.</p> <p>3. Investigate and present a report on the effects of human impact in the short and long term, including inside and outside.</p> <p>4. Review the water cycle and the importance of karst areas as water sources for animals and humans.</p> <p>5. Why are cave reserves important, globally and in Tasmania, and how is global warming likely to affect their biodiversity?</p> <p>6. Prepare a detailed report on the biodiversity of caves using a variety of media.</p> <p>7. Select a Tasmanian cave species and create a food web which demonstrates the energy flow through the ecosystem it is part of. Check out the Hastings Cave website for information and photos. A printable worksheet for this activity is available. Students may then present their food web as a poster.</p> <p>8. Undertake an investigation from the <a href="#">Additional Activities Folder</a>.</p>  | <p><b>Assessment for and of learning</b></p> <p>Assess students' ability to:</p> <ul style="list-style-type: none"> <li>identify a question that can be investigated as an ecological study</li> <li>collect data that will allow them to answer the question they posed</li> <li>communicate their scientific information</li> <li>undertake an independent investigation</li> </ul> | <p>Two x 50min lessons</p>          |

## Possible Web Resources

<http://waitomocaves.com/newwebpages/EDlessons.htm>

<http://www.reec.nsw.edu.au/geo/cave/caves/textcave/10cavewb.htm> (worksheet)

<http://www.reec.nsw.edu.au/geo/cave/caves/textcave/3acavecl.htm> (climates in caves)

[http://www.blm.gov/wo/st/en/res/Education\\_in\\_BLM/Learning\\_Landscapes/For\\_Teachers/science\\_and\\_children/caves/index.html](http://www.blm.gov/wo/st/en/res/Education_in_BLM/Learning_Landscapes/For_Teachers/science_and_children/caves/index.html) (good American information on caves)

[http://www.jenolancaves.org.au/jenolan\\_facts.php](http://www.jenolancaves.org.au/jenolan_facts.php) (Jenolan Caves, NSW)

<http://www.goodearthgraphics.com/virtcave/> (Virtual Cave – good selection of photos etc)

<http://www.capricorncaves.com.au/pdf/schoolprogram.pdf> (Capricorn Caves, Qld)

<http://www.howecaverns.com/live-in-the-cave> (Howe Caverns, USA, educational information)

[http://www.marengocave.com/schools/cave\\_map.php](http://www.marengocave.com/schools/cave_map.php) (Marengo Cave, USA, GI-5 materials)

[http://www.caves.org/committee/education/science\\_topics.htm#hydro](http://www.caves.org/committee/education/science_topics.htm#hydro) (National Speleological Society, USA – lots of topics and useful links)

<http://cavingintro.net/science.html> (Provides many links to cave-related sites)

See also: Teachers Resources and

<http://www.parks.tas.gov.au/file.aspx?id=7062> – What is a Habitat?