## **Stage 1 Biology**

## **Investigation Folio Task: Science as a Human Endeavour**

Topic 4: Biodiversity and Ecosystem Dynamics

**Introduction and Purpose of task:**

The term keystone species was created by American zoologist [Robert T. Paine](http://www.britannica.com/biography/Robert-Paine) in 1969. He likened these species to the pillars of a bridge, as without these the bridge would not stand.

A keystone species

* is a species that has a disproportionately large effect on its ecosystem relative to its abundance (population’s size).
* can be described as playing an important role in maintaining the structure the community.
	+ Such [species](http://www.britannica.com/science/species-taxon) help to maintain local [biodiversity](http://www.britannica.com/science/biodiversity) within a [community](http://www.britannica.com/science/community-biology) either by controlling populations of other species that would otherwise dominate the community or by providing critical resources for a wide range of species.

**This task provides the opportunity to**

* investigate the importance of a keystone species and how humans impact these species
* determine the effect of scientists’ workon these species from various perspectives (e.g. the **influence** of economic, social or environmental factors)
* evaluate the solutions proposed by scientists (**Application and Limitation**) that could be used to reduce the impact of human activities on these species and their ecosystem
* communicate your findings as either an article in a scientific journal or a report providing an expert’s point of view
* use and acknowledge a variety of relevant sources to find data and information

**To complete this task you will need to consider the following stimulus materials and follow the steps outlined.**

1. Go to the following URL

http://www.australiangeographic.com.au/topics/wildlife/2014/09/australias-keystone-endangered-species

The URL provided, is to guide your search, and is not an extensive list of keystone species. You may choose to investigate other keystone species identified from other sources.

1. Choose a keystone species that may be endangered due to human activities.
2. Investigate the role of science and scientists in these activities and how they effect the species and its ecosystem.
3. Evaluate the potential solutions for reducing the impact of human activities on these species and their ecosystem, suggesting, with reasoning, which may be the most effective.
4. Choose at least one of the Science as a Human Endeavour key concepts (see Appendix I and II) and link it to the information you have researched as a **focus** for your scientific communication. Consider how the understanding is demonstrated by the information you have found.

*An example of a possible connection between a topic and the Science as a Human Endeavour key concept, Influence: ‘The acceptance and use of scientific knowledge can be influenced by social, economic, cultural, and ethical considerations’ is:*

*The economic impact of not using a fertiliser for farmers has not been assessed. While scientists have shown that the fertiliser is likely to be responsible for contamination of water sources, no suitable replacement has yet been developed. With the pressure of feeding ever growing numbers of people the idea of not using some type of fertiliser is not a viable solution.*

1. Prepare a scientific communication, using a format of your choice and the information you have researched, analysed and **connected to the Science as a Human Endeavour key concept**.

Your report **must** include the following:

* An introduction, which links the focus of your analysis to the SHE key concept(s) chosen
* Relevant biological concepts and background information (***this should support your report but not be the focus***)
* An explanation of **influence** of the keystone species and related scientific activities and/or the ethical, cultural, economic, political and social considerations
* A conclusion. You must include how the SHE key concept(s) has been addressed.
* In text referencing and bibliography using Harvard Referencing.

**Assessment Conditions:**

3 weeks to complete. Class time provided for research and support.

Students may submit one draft for feedback.

Word Count: maximum of 1000 words for Part C, if written, 6 minutes for an oral presentation, or equivalent if a multimodal product.

**Assessment Design Criteria**

Knowledge and Application: KA 1, 3, 4

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| **Note for teachers:** |
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| The planning, analysis and evaluation for the exploration of SHE are not included in the 1000 word count. |
| Appendix 1 is provided as an additional support material for this task and should not be used as a checklist. Teachers should encourage students to widely explore the possible SHE key concepts involved. |
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| While the biology and science involved will be a part of the report it should not be the focus. The assessment focus should be on the student’s ability to explore and connect the interaction between science and society. |
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**Performance Standards**

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|  | Investigation, Analysis and Evaluation | Knowledge and Application |
| A | Critically deconstructs a problem and designs a logical and coherent biological investigation with detailed justification.Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.Critically and logically evaluates procedures and their effect on data. | Demonstrates deep and broad knowledge and understanding of a range of biological concepts.Applies biological concepts highly effectively in new and familiar contexts.Critically explores and understands in depth the interaction between science and society.Communicates knowledge and understanding of biology coherently, with highly effective use of appropriate terms, conventions, and representations. |
| B | Logically deconstructs a problem and designs a well-considered and clear biological investigation with reasonable justification.Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.Logically evaluates procedures and their effect on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of biological concepts.Applies biological concepts mostly effectively in new and familiar contexts.Logically explores and understands in some depth the interaction between science and society.Communicates knowledge and understanding of biology mostly coherently, with effective use of appropriate terms, conventions, and representations. |
| C | Deconstructs a problem and designs a considered and generally clear biological investigation with some justification.Obtains, records, and represents data, using generally appropriate conventions and formats, with some errors but generally accurately and effectively.Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.Evaluates procedures and some of their effect on data. | Demonstrates knowledge and understanding of a general range of biological concepts.Applies biological concepts generally effectively in new or familiar contexts.Explores and understands aspects of the interaction between science and society.Communicates knowledge and understanding of biology generally effectively, using some appropriate terms, conventions, and representations. |
| D | Prepares a basic deconstruction of a problem and an outline of a biological investigation.Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.Describes data and undertakes some basic interpretation to formulate a basic conclusion.Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of biological concepts.Applies some biological concepts in familiar contexts.Partially explores and recognises aspects of the interaction between science and society.Communicates basic biological information, using some appropriate terms, conventions, and/or representations. |
| E | Attempts a simple deconstruction of a problem and a procedure for a biological investigation.Attempts to record and represent some data, with limited accuracy or effectiveness.Attempts to describe results and/or interpret data to formulate a basic conclusion.Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of biological concepts.Attempts to apply biological concepts in familiar contexts.Attempts to explore and identify an aspect of the interaction between science and society.Attempts to communicate information about biology. |

**Appendix 1:**

Your research and article/report should have a focus on at least one of the key concepts of Science as a Human Endeavour listed below:

**Communication and Collaboration**

* Science is a global enterprise that relies on clear communication, international conventions, and review and verification of results.
* Collaboration between scientists, governments, and other agencies is often required in scientific research and enterprise.

**Development**

* Development of complex scientific models and/or theories often requires a wide range of evidence from many sources and across disciplines.
* New technologies improve the efficiency of scientific procedures and data collection and analysis. This can reveal new evidence that may modify or replace models, theories, and processes.

**Influence**

* Advances in scientific understanding in one field can influence and be influenced by other areas of science, technology, engineering, and mathematics.
* The acceptance and use of scientific knowledge can be influenced by social, economic, cultural, and ethical considerations.

**Application and Limitation**

* Scientific knowledge, understanding, and inquiry can enable scientists to develop solutions, make discoveries, design action for sustainability, evaluate economic, social, and environmental impacts, offer valid explanations, and make reliable predictions.
* The use of scientific knowledge may have beneficial or unexpected consequences; this requires monitoring, assessment, and evaluation of risk, and provides opportunities for innovation.
* Science informs public debate and is in turn influenced by public debate; at times, there may be complex, unanticipated variables or insufficient data that may limit possible conclusions.

**Appendix II: Possible exploration of SHE**

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| **Aspect of SHE** | **Possible exploration** |
| **Communication and Collaboration** | **This may include*** **a discussion of the contribution of individuals, teams or organisations that were involved in the discovery of the species or are involved in the solution to prevent extinction of the keystone species.**
* **the conventions used by scientists to determine if a species is endangered and the wide of range of scientists and others that make these decisions and how the decisions are communicated.**
* **how communication to the wider community, in various forms may contribute to the solution to protect these species from extinction.**
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| **Development** | **This may include*** **an evaluation of the methods being used or proposed by scientists to prevent the extinction of the species- with consideration of the new technologies available and how data is collected and analysed.**
* **a consideration of new methods to protect species including genetic solutions or habitat preservation or reconstruction.**
* **how species population modelling has changed over time**
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| **Influence** | **This may include*** **how one scientific discipline or engineering, technology or mathematics may impact the advances of population modelling and methods to prevent extinction**
* **discuss the economic, social, environmental, ethical and cultural influences on why species are protected**
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| **Application and Limitation** | **This may include*** **how scientific knowledge can enable scientists to develop solutions for sustainable environments**
* **consider the economic, social and environmental impact of the extinction of keystone species**
* **consider the unintended consequences of the loss of a keystone species, or the risks of the potential interventions**
* **why some species are viewed by the public as more important than others, and how public debate may influence the science**
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