

St Bede’s College

Internal Assessment Resource

Biology Level 3

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| This resource supports assessment against:  Achievement Standard 91601 v1  Carry out a practical investigation in a biological context, with guidance |
| Resource title: Stream Life |
| 4 credits |
| This resource:   * Clarifies the requirements of the standard * Supports good assessment practice * Should be subjected to the school’s usual assessment quality assurance process * Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic |

**Internal Assessment Resource**

Achievement Standard Biology 91601 v1: Carry out a practical investigation in a biological context, with guidance

Resource reference: Biology 3.1

Resource title: Stream Life – Coes Ford

Credits: 4

Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Biology 91601. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

This is an open-ended, individual activity which requires students to produce a report following a practical biological pattern-seeking or relationship investigation on their local stream.

Conditions

It is suggested that this assessment task take place over approximately three to four weeks of in-class and out-of-class time. Students should be introduced to the community site being used for the investigation as part of their planning.

The practical investigation is an activity covering the complete process: planning, carrying out, processing, interpreting data, and reporting on the investigation. It involves the collection of primary data. Students should have the opportunity to make changes to their initial method as they work through the investigation. Students may collaborate at the planning stage if they are carrying out different but related investigations. If a student is undertaking an investigation that has the same purpose as that of other students, collaboration with those students is not appropriate.

Students keep a logbookto record rough notes, brainstorming, possible investigations, collection of data and observations, research and planning, failures, successes, and tentative conclusions.

The logbook is a working document and its neatness is not important – its function is to record all findings, show the students’ investigative skills and to record checking of the milestones. Students write the formal report using information in the logbook and it can also be used to ensure authenticity. Unprocessed data in the logbook can be used as contributing evidence.

During the interpreting and reporting of their own findings students need to use the findings from other sources which may include other students, scientists, or historical findings relevant to their investigation. Any findings from other investigations used in the discussion can be incorporated in the students’ reports but must be clearly referenced (e.g. appended to the individual student’s final report rather than forming any part of their results section). These findings may be used to inform the discussion of the primary findings in the same way that published or unpublished research findings of scientists are always considered and used to explain any scientific results.

At Level 3, the investigation is carried out with guidance. While the whole process is student driven, the teacher provides support throughout. For example, the teacher negotiates the parameters for the investigation (such as suitability of organisms, equipment, and resources available) and provides general information (such as modifications or possible new directions related to the student’s investigative ideas). Students may seek guidance via milestone meetings with the teacher. However, the interpretation of their findings will be carried out individually. Guidance does not extend to the whole-group discussion about students’ interpretation of their findings that was appropriate at Level 2. The guidance role of the teacher also involves ensuring the student investigation context is based on *The New Zealand Curriculum* Level 8 achievement objectives.

**Resource requirements**

The resources required will depend on the investigations chosen by each student. Have the students list the equipment/resources they require so that their availability can be checked. Examples of required equipment include 10m tape, quadrats of varying size, metre rulers, nets, stream macro-invertebrate identification sheets, white trays, buckets, and equipment to measure abiotic factors such as temperature, dissolved oxygen, nitrates, nitrites, pH probe or paper, phosphates, flow rate, and clarity (e.g. black disc apparatus).

Additional information

Prior to carrying out the investigation students will need to be taught how to measure abiotic factors as well as catch and identify the macro-invertebrates found in their stream.

Students may need guidance in accessing relevant information that will help them in forming their hypothesis.

Teachers need to include strategies to ensure authenticity. These could include digital photos, conferencing at each milestone, regular checking of logbooks and signed authenticity statements.

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Achievement Standard Biology 91601 v1: Carry out a practical investigation in a biological context, with guidance

Resource reference: Biology 3.1

Resource title: Stream Life – Coes Ford

Credits: 4

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Carry out a practical investigation in a biological context, with guidance. | Carry out an in-depth practical investigation in a biological context, with guidance. | Carry out a comprehensive practical investigation in a biological context, with guidance. |

Student instructions

Introduction

This assessment activity requires you to plan and carry out a biological pattern-seeking investigation on a local stream community and to produce a written report on your findings which links to information/data from other students’ or scientists’ findings. It involves the collection of primary data. You will keep a record of your process in a logbook.

While you must work independently throughout, you can collaborate at the planning stage if you and others are carrying out different but related investigations. If your investigation has the same purpose as that of other students, collaboration with those students is not appropriate. You must still develop your own statement of the purpose, linked to a scientific concept or idea and written as a hypothesis, and individually carry out your investigation, including writing your own report.

You will be assessed on the quality of the written report of your investigation and the comprehensiveness of the discussion of your findings, as well as those findings from other sources.

**Conditions**:

Three to four weeks of class time has been put aside for this investigation. During this time you will visit both a local stream and the investigation site for the recording of your results. You will be provided with a log book and a timeframe of the logbook milestones in the first week of the investigation. This will vary between classes due to school activities but the final classtime is the same for each class. The final date for the investigation report is the **16 April.**

**Logbook**

This is to be used for all planning and gathering of resources and other data that may be useful. It will be handed in with the final report but will not be assessed, but it may help provide evidence for your final grade.

**Task**

Any stream community can show a number of features such as species diversity of plants and animals, numbers and pattern of distribution of organisms within it, and its ‘health’ based on biotic and abiotic environmental factors.

Diversitymeans the numbers and types of organisms in the community.

Macro-invertebratesare animals that do not have backbones and are visible to the naked eye.

Follow the steps outlined below to plan and carry out an investigation on a the Coes Ford stream community. Keep a record of each step in a logbook. Include in your logbook your recorded data, observations from trials or pilot investigations, notes from original planning of hypotheses/methods, and teacher feedback.

Plan your investigation

Choose an aspect of a stream community pattern or relationship that you could investigate. See Student Resource A for information about the pattern of distributions in any community.

Formulate possible hypotheses and consider how they could be tested with the time and equipment available to you. You can ask your teacher to supply the equipment that you will need tofind out about the abiotic and biotic factors of the stream.

Discuss your hypotheses and ideas with your teacher. After discussion with your teacher choose one hypothesisto investigate (explicit and testable) linked to a scientific/biological concept or idea.

***Develop your investigation***

Write adetailedstep-by-step methodthat describes how you will collect a valid range of data/samples. In writing your method, consider factors such as sampling bias and sources of error.

You may need to trial and/or adjust some aspects of your method to ensure it is workable.

Submit your initial method to your teacher for feedback.

Carry out your investigation

Collect and record all relevant data accurately and clearly in a way that allows it to be interpreted without reference to the method. Make sure you collect sufficient data to enable a valid trend or pattern (or lack thereof) to be seen so that you can draw a valid conclusion.

Evaluate the quality of the information gathered and its degree of relevance. Discuss this with your teacher.

Process and interpret your data

Process your datain a way that is appropriate to the type of data you have collected.

* Analyseyour processed data to identify trends, relationships, and patterns (or lack of) relevant to your hypothesis.
* Write a valid conclusionfor your investigation stating what the results show in relation to your purpose.

Report on your findings

Prepare a formal written report to present the findings of your investigation. Include the following sections:

* Purpose - written as a hypothesis linked to a scientific/biological concept or idea.
* Method - details of the final step-by-step method you used.
* Results - your appropriately processed data showing the presence (or absence) of a trend or pattern.
* Conclusion - a valid conclusion based on your interpretation of the processed data in relation to purpose of the investigation.
* Explain the biological ideas (giving reasons how or why) relating to your own primary findings and the findings from other source(s).
* Discuss the biological ideas relating to your investigation by making links to either the findings of others, scientific principles, theories, or models.

NOTE: Any relevant findings of others, scientific principles, theories, or models must be added as an appendix to your report.

* Justifythe choices you made throughout your investigation by evaluating:
* the validity of your method
* the reliability of your data.

You could consider such things as how sources of error were eliminated, how limitations were overcome and/or how the effects of bias were reduced.

Hand in your written report along with your logbook and a list of the source(s) you used.

Student Resource A

The pattern of distribution of organisms in any community is influenced by the physical conditions of the habitat (abiotic factors), the range of other organisms present (biotic factors), and how these link together to provide opportunities and threats for the organism. Adaptations allow organisms to exploit these opportunities and avoid the threats.

Biotic and abiotic factors include:

* temperature
* soil/substrate type
* aspect
* pH
* dissolved nutrient levels
* light intensity
* exposure
* density
* water depth
* water flow
* dissolved oxygen levels
* turbidity
* other organisms present

Adaptive features may be related to:

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| movement |  reproduction |  nutrition |
|  gas exchange |  excretion |  exploiters, e.g. predators/grazers |
|  sensitivity |  growth |  competition |

Assessment schedule: Biology 91601 Stream Life

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student carries out, and presents a report for, a practical biological investigation of a pattern or relationship, which includes:   * a purpose, written as a hypothesis linked to a scientific/biological concept or idea   For example:  “The faster the flow of water the greater the number of mayfly nymphs in the [named] stream.”   * a final detailed step-by-step method with a description of:   - what and how data is collected, with units  - a range of data/samples  - how some other factors (at least two) are considered.  For example:  I chose an area of fast flowing water (0.3 m/s) and slow flowing water (0.1m/s) with the same sized substrate in the same stream. I measured the flow rate by timing how long it took a tennis ball to flow 1 metre in the two areas. I sampled the water in each area (refer to the profile diagram and site map) with the same-sized 30cm by 30 cm net 3 times to determine the numbers of mayfly found and then averaged the results.   * collecting, recording, and processing data relevant to the purpose – data processed as a table, or graph, or calculation of averages, and minor processing errors ignored.   [Insert table, graph or calculation of averages in context as an appendix]   * reporting on the findings, with a conclusion based on the processed data in relation to the purpose of the investigation   For example:  I found an average of 2 mayflies in fast flowing and slow flowing water.  There are no more mayflies in fast flowing water than in slow water.   * findings from another source, which are identified and included.   For example:  My results are different from the findings in the resource [www.waicare.org.nz](http://www.waicare.org.nz). They found that more mayflies are found in fast flowing water.  *The examples above relate to only part of what is required, and are just indicative.* | The student carries out, and presents a report for, an in-depth practical biological investigation of a pattern or relationship, which includes:   * a purpose, written as a hypothesis linked to a scientific/biological concept or idea * a final detailed step-by-step valid method with a description of:   - a valid collection of data (sufficient range of data/samples), with units  - howmostfactors such as sampling bias and sources of errors are considered.  For example:  I chose an area of fast flowing water (1m/s–0.25m/s) and slow flowing water (0.1m/s– 0.01m/s) with the same sized substrate in the same stream. I measured the flow rate by timing how long it took a tennis ball to flow 1 metre in the two areas – refer to the map of the area and location of the site. I sampled the water in each area with the same 30cm by 30 cm sized net 3 times every 10 minutes to determine the numbers of mayfly found and then averaged the results. I made sure that in each area I sampled for the same time in the same way. For example, the distance from the bottom of the stream during the sampling was about 5 cm, and samples were taken at the same time of day. I also recorded the temperature of the stream at each sampling point, and noted the other organisms present.   * collecting, recording, and processing data relevant to the hypothesisto enable a trend or pattern (or absence) to be determined – data processed accurately as a table, or graph or calculation of averages   [Insert table, graph or calculation of averages in context as an appendix]   * reporting on the findings, with a valid conclusion reached based on the processed data in relation to the purpose of the investigation   For example:  I found an average of 2 mayflies/m2 in fast flowing water, and none in slow flowing water in the [named] stream.  There are more mayflies in fast flowing water than in slow flowing water in the [named] stream.   * findings from another source, which are identified and included.   For example:  Mayfly Society annual newsletter 2010   * biological ideas relating to the investigation, which are explained and based on the student’s findings and the findings from another source(s).   For example:  There are more mayflies found in fast flowing water because mayflies require water high in dissolved oxygen to survive and fast flowing water increases the dissolved oxygen in the water. This was also the conclusion of research carried out by a researcher for the Mayfly Society.  *The examples above relate to only part of what is required, and are just indicative.* | The student carries out, and presents a report for, a comprehensive practical biological investigation of a pattern or relationship, which includes:   * a purpose, written as a hypothesis linked to a scientific/biological concept or idea * a final detailed step-by-step valid method with a description of:   - a valid collection of data (sufficient range of data/samples), with units  - howmostfactors such as sampling bias and sources of errors are considered.   * collecting, recording, and processing data relevant to the hypothesisto enable a trend or pattern (or absence) to be determined – data processed accurately as a table, or graph or calculation of averages * reporting on the findings, with a valid conclusion reached based on the processed data in relation to the purpose of the investigation * findings from another source, which are identified and included.   For example:  <http://www.famu.org/mayfly/pubs/pub_b/pubbaumerc2000p77.pdf>  [Note: to access the PDF paste the text into your search engine and select Quick View]   * biological ideas relating to the investigation, which are explained based on the student’s findings and the findings from other source(s). * biological ideas relating to the investigation, which are discussed by making links to either the findings of others, scientific principles, theories, or models.   For example:  There are more mayflies found in fast flowing water because mayflies require water high in dissolved oxygen to survive and fast flowing water increases the dissolved oxygen in the water. This is because aeration occurs as the surface area of a body of water increases due to the extra turbulence, splashes, and ripples in a fast flowing river, causing greater diffusion and dissolving of oxygen. It is due to the energy requirements of the free-swimming nymphs and their gill structure that mayflies require high oxygen concentrations as reported on by C. Baumer in the article ‘Respiratory Adaptations to Running-Water Microhabitats in Mayfly Larvae’.   * the choices made throughout the investigation are justified by evaluating either the validity of the method or thereliability of the data, by considering such things as how sources of error were eliminated, how limitations were overcome, and/or how the effects of bias were reduced   For example:  The statistical analysis from my test rejected the null hypothesis, which indicates that my method and data are valid.  *The examples above relate to only part of what is required, and are just indicative.* |

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.