

INTERNAL ASSESSMENT RESOURCE

Internal assessment resource Biology 2.6A for Achievement Standard 91158
PAGE FOR TEACHER USE

Internal Assessment Resource

Achievement Standard Biology 91158: Investigate a pattern in an ecological community, with supervision

Resource reference: Biology 2.6

Resource title: Between the Tides

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 91158. The Achievement Criteria and the Explanatory Notes (EN) contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

The emphasis in this standard is for the student to investigate a pattern (or its absence) in an ecological community with reference to an environmental factor and the biology of interrelated organisms of different species. Refer to EN 2.

Students will use their own field data and observations collected during their practical investigation work at a local rocky intertidal shore, as well as relevant resources and information they collect during their research. You can also provide resource materials (including tables, graphs, resource sheets, photographs, websites, videos and/or reference texts) as appropriate. Refer to EN 3 and 7.

Teachers can adapt the task (and assessment schedule) to suit an investigation of their local rocky shore. Students will use **a range of data, collected by themselves and others, or provided by the teacher**, in order to investigate the presence (or absence) of a zonation pattern in the rocky shore community. Information about at least two interrelated species should be included in their final report.

Conditions

2–3 weeks of in and out-of-class time may be required. This does not include time for prior teaching of ecological concepts (see below). The written assessment is to be completed individually over 2 – 3 periods in class.

The following ecological concepts should be taught prior to beginning the task:

- Environmental factors: abiotic, biotic and gradients
- The ecological niche
- Adaptations to exploit a niche: structural (morphological), physiological and behavioural
- Tolerance, limiting factors and Liebig's Law of the Minimum
- Interspecific relationships: competition, predation, mutualism, parasitism, herbivory, commensalism
- Gause's Principle of Competitive Exclusion
- Features of populations: distribution, density, growth and intraspecific competition
- Ecological zonation patterns in communities

Resource requirements

Students will need access to the Internet, to allow them to investigate the relevant ecological concepts and to collect their own resources and information to use in their final report.

Additional information

The setting used for this assessment resource is a local intertidal rocky shore.

The investigation is carried out with supervision (EN 8). This means that the teacher provides guidelines for the investigation such as the context for the investigation, instructions that specify the requirements and provides appropriate resources for students to comprehensively investigate a pattern in an ecological community.

Below are some references that could be useful:

Portobello Marine Life Database:

<http://www.otago.ac.nz/marinstudies/database/newdatabase/index.html>

New Zealand Rocky Shore Guide:

<http://www.marine.ac.nz/resources>

New Zealand Marine Studies Centre's Marine Metre Squared Seashore Survey biodiversity monitoring project

<https://www.mm2.net.nz/>

Conditions of Assessment related to this achievement standard can be found at <http://ncea.tki.org.nz/Resources-for-aligned-standards/Science/Biology/Level-2-Biology/Related-resources>

Internal Assessment Resource

Achievement Standard Biology 91158 version 1:

Investigate a pattern in an ecological community, with supervision

Biology 2.6

“Between the Tides”

4 credits

Achievement	Achievement with Merit	Achievement with Excellence
Investigate a pattern in an ecological community, with supervision.	Investigate in-depth a pattern in an ecological community, with supervision	Comprehensively investigate a pattern in an ecological community, with supervision.

Student instructions

Introduction

This assessment activity requires you to produce a report about a pattern (or absence of a pattern) in an ecological community. You will investigate **zonation** in the intertidal rocky shore community at **[insert name of local shore here]**

This investigation involves **analysing** and **interpreting** information about this **community, an environmental factor** relating to a pattern and how this might affect **at least two species in the ecosystem**.

You will use **the field data and observations collected during your field work** and the **resource information** provided by your teacher.

Part 1: Research. You will have **[insert time here]** between **[insert date range here]** to carry out research into the intertidal community found at **[insert name of local shore here]**, any relevant environmental factors that affect the community and to research rocky shore survey methods. During this time you can discuss ideas with other students.

Part 2: Survey. You will have **[insert time here]** on **[insert date here]** to carry out a survey of the intertidal rocky shore community at **[insert name of local shore here]** and collect your field data.

You may compare the field data you collected during your field work with the data from another group, and/or with historical data or data from different locations found on the The NZ Seashore Survey website (www.mm2.net.nz).

Task

Part 1: Collecting and processing information

This task is not assessed, but it helps you prepare for writing your report. You can complete this work individually or as part of a group, and discuss your ideas and questions with other people, including your teacher.

You will use the method provided for you to collect information relevant to your investigation by carrying out research and gathering the field data you will need.

Look at the data about the distribution of different species on the shore at *[insert location here]* and use this information to choose at least two named organisms that are related to each other, and to the pattern you are investigating.

Make sure you have collected enough information to allow you to discuss:

- the biology of your two chosen species in terms of their
 - ecological niche
 - adaptations (you could consider: structural, behavioural and physiological adaptations) to occupy their niche in the intertidal zone
 - interrelationships and interactions with other organisms in the intertidal zone that might affect their distribution
- the environmental factors that could affect your organisms (biotic and abiotic)

You may also carry out research using any resources provided by your teacher or obtained from elsewhere. Record details of the information sources you use and include this in a bibliography at the end of your report.

You may organise and store your information (including field work data) in an online document such as a spread sheet or table, for easy access.

Part 2: Written Report

You will complete your written report **individually** in class, over *[insert number here]* periods.

You will have access to your class notes, research information, field data and observations and any other resources you have collected to help you write your report.

Your report will be assessed on your discussion of the zonation pattern in your rocky shore community, by relating it to environmental factors (biotic and abiotic) and the biology (adaptations and interspecific relationships) of organisms of different species.

[insert conditions for assessment here to ensure authenticity of the students' reports]

Your report should include:

1. **Introduction** – a brief description of your investigation’s focus, including details of your chosen area(s) and the scientific names of the organisms investigated.
2. **Biology of the Ecological Community** – information about the organisms in the community you investigated. Describe the ecological niche and adaptations of at least two species, and relevant interrelationships between these organisms.
3. **Abiotic Environment** – description of the abiotic factors found in the area you investigated. You could include observations or measurements collected in fieldwork.
4. **The data you used to identify a distribution pattern** – this can either be compiled by you *e.g.* a graph or table, or it could be processed data from other sources. It needs to be included in the report and referenced if it is from another source, either as an appendix or in the body of the report.
5. **Description of Pattern** – describe the findings (and/or observations) from the fieldwork/collected data and use these to identify the distribution pattern (or absence of a pattern) in the ecological community. You could include tables or graphs in this section, to clearly show the distribution pattern.
6. **Discussion** – relate the pattern in the community to the biology of the organisms and to the environmental factors in the ecosystem. Include:
 - a. explanations for how or why the biology (*i.e.* species’ adaptations; interspecific relationships) of at least two species relates to the pattern (or absence of a pattern)
 - b. a discussion of how environmental factors (abiotic and/or biotic) might affect the organisms in the community, and how this relates to the observed distribution pattern, or absence of a pattern. This could involve elaborating, applying, justifying, relating, evaluating, comparing and contrasting, and/or analysing.
7. **Bibliography** – a list of the information sources you used to help you write your report, written in a format that allows other people to find the information sources. This will not be assessed, but it is expected good practice to acknowledge information sources you used in your work.

Assessment schedule: Biology 91158 Between the Tides

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
<p>The student is able to investigate a pattern in an ecological community, with supervision.</p>	<p>The student is able to investigate in-depth a pattern in an ecological community, with supervision.</p>	<p>The student is able to comprehensively investigate a pattern in an ecological community, with supervision.</p>
<p>The report includes evidence of:</p> <ul style="list-style-type: none"> ○ Analysing, and interpreting information about intertidal rocky shore communities. ○ Describing observations or findings, and using those findings to identify the pattern (or absence) in intertidal rocky shore community.^{1.} ○ Relating this pattern to one environmental factor (abiotic or biotic).^{2.} ○ Describing how the environmental factor might affect two species within the community.^{3.} 	<p>In addition to the evidence for Achievement, the report also includes evidence of:</p> <ul style="list-style-type: none"> ○ Providing a reason to explain how or why the biology of one of the chosen species relates to the pattern (or absence), where the biology refers to <p style="text-align: center;">BOTH</p> <ul style="list-style-type: none"> ○ an adaptation^{4.} <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> ○ an interrelationship^{5.} with another species 	<p>In addition to the evidence for Achievement with Merit, the report also includes evidence of:</p> <ul style="list-style-type: none"> ○ Using biological concepts to comprehensively explain the pattern shown in the community in terms of both an environmental factor (abiotic or biotic) and the biology of interrelated* organisms of two different species ⁶ <p><i>*i.e. interacting</i></p>

Note: superscript numbers in italics refer to **some examples** of expected student responses for the above criteria that can be found on the following pages

<p>Examples:</p> <p>1. <i>The data show that different species are found at different heights on the shore. For instance, _____ is only found in the high shore between ___ and ___ m from the high water mark. Whereas _____ is found lower on the shore between ___ and ___ m from the HW mark.</i></p> <p><i>The data collected show zonation of the intertidal community on the rocky shore where different species are distributed in zones at certain tidal heights on the shore.</i></p> <p>2. Abiotic factors:</p> <p><i>An abiotic factor affecting the distribution of intertidal species and causing the zonation pattern in this community is...</i></p> <p><i>...the amount of aerial exposure/time spent submerged by seawater. The exposure time increases with height up the shore. This leads to greater desiccation stress.</i></p> <p><i>... the range of temperatures. The range increases with height up the shore. This leads to greater heat stress...</i></p> <p>Biotic:</p> <p><i>...is interspecific competition _____</i></p> <p><i>...is predation pressure from _____</i></p> <p>3. <i>(Species A) is found in the upper shore and so</i></p>	<p>Examples:</p> <p>4. <i>Barnacles are able to live in the upper shore because they are adapted to tolerate long periods of exposure to air e.g. they have tightly fitting shells that close and seal in a small amount of seawater as the tide falls. This prevents desiccation and allows them to continue to respire when they are uncovered by the falling tide.</i></p> <p><i>Shore crabs are able to live in the upper shore because they are adapted to tolerate long periods of aerial exposure when the tide uncovers them. They...</i></p> <p><i>...are flattened so that they can squeeze into shaded, humid crevices beneath rocks and stones (structural)</i></p> <p><i>...produce a waxy coating on their shell surface that reduces water loss across their body surface (physiological)</i></p> <p><i>...can tolerate a wide range of temperature changes by producing heat-shock proteins during periods of heat stress (physiological)</i></p> <p><i>...have a timing sense that enables them to anticipate the rise and fall of the tide, so that they can seek shelter beneath rocks shortly before the tide goes out (behavioural)</i></p> <p>5. <i>Barnacles are restricted to the zone between ___ and ___ m in the upper shore as they are outcompeted for space on the rocks by _____ in the lower shore.</i></p>	<p>Examples:</p> <p>6. <i>The main abiotic factor causing the zonation pattern is aerial exposure time. As aerial exposure time increases, salinity and temperature ranges increase, tissue pH and dissolved oxygen decreases, carbon dioxide increases, desiccation stress increases, and time for feeding and seawater gas exchange decreases.</i></p> <p><i>Marine animals need to be submerged to be able to carry out key life processes e.g. feeding, gas exchange and reproduction. The different periods of exposure to air at different shore levels have led to zonation in the intertidal community.</i></p> <p><i>Species that can tolerate long periods of exposure to the air exist mainly in the high shore where they spend more time exposed to the air e.g. _____. Less tolerant species such as _____ exist mainly in the lower shore zone where they spend less time exposed to the air.</i></p> <p><i>Species in the zones higher up the shore (e.g. limpets, acorn barnacles, snakeskin chitons, periwinkles, topshells, common shore crabs) have developed adaptations that allow them to survive when exposed to the air for long periods where the risk of desiccation/heat stress/osmotic stress/predation by shore birds is greater : such as....</i></p> <p><i>Tolerance to a limiting abiotic factor usually determines a species' upper distribution limit, whereas the lower distribution limit of a species zone is usually determined by biotic factors such as interspecific competition and/or predation.</i></p> <p><i>Gause's principle states that no species can occupy the same ecological niche for long, because they will be in competition with each other for resources such as light, space on the substrate and food. Each species has</i></p>
--	---	---

<p><i>spends long periods exposed to the air. This species can live here because it is able to tolerate long periods of aerial exposure.</i></p> <p><i>(Species B) is found lower on the shore (than Species A) and so spends less time exposed to the air. It cannot tolerate longer periods of exposure found in the upper shore as this causes desiccation stress/drying out. This is why it is not found in the upper shore.</i></p>	<p><i>Periwinkles are found in the upper shore zone. They are not found lower down the shore as they would experience higher mortality due to predation from _____.</i></p>	<p><i>adapted to exploit a different niche in the intertidal region and lives in a different zone. This allows them to reduce interspecific competition with other species in the intertidal region. For example...(two species with similar feeding and activity patterns living in separate zones such as common shore crab/smooth shore crab; snakeskin chiton/green chiton; different barnacle species)</i></p> <p><i>A species may not be able to occupy its full potential or fundamental niche and instead occupy a narrower realised niche due to interspecific competition with a species in the zone beneath. However, as it is adapted to tolerate greater aerial exposure higher up the shore it can still coexist with its adjacent competitor, and these species can coexist as they occupy slightly different niches.</i></p> <p><i>A biotic factor affecting the distribution of species into zones is predation. The presence of predators e.g. _____ in the lower shore determines the lower limit of _____ distribution in the intertidal zone and restricts it to the _____ shore zone. The high shore can also offer a prey refuge where species such as _____ experience lower predation from species that are not adapted to the high aerial exposure time in the upper shore such as _____ and are unable to tolerate the conditions there.</i></p>
--	---	---

Note: These 'expected student responses' are indicative only and relate to part of what is required. Annotated, complete reports in context that come from previous/current students or developed by teachers can be included as examples of evidence.

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