# BIOLOGY

## Intertidal Shelf Ecosystems Year 11

SURF LIFE SAVING
NEW SOUTH WALES

# Teacher Guide

## Lesson 1 Background Research

**Context:** This lesson provides students with understanding of key terms and relates this to intertidal shelf ecosystems. It forms the basis from which they will develop their inquiry questions and hypothesis.

**Time guide:** 60-90 minutes

**Curriculum mapping:** BIO 11- 11 IQ1

**Resources Required:**

✔Worksheet: Background research task

✔Intertidal Field guide (digital version)

**Differentiation opportunities/ Variations**

Research activity is designed to be conducted as a jigsaw task however this could be conducted as an individual task

## Lesson 2 Planning your investigation

**Context:** In this lesson students will construct a hypothesis and inquiry question based on the understanding they developed of ecosystems in the previous lesson. They will then plan their investigation by assessing risks, considering variables while maintaining validity and reliability.

**Time guide:** 90-120 minutes

**Curriculum mapping:** BIO 11/12-1 BIO 11/12-2

**Resources Required:**

✔Worksheet: Planning your investigation

**Differentiation opportunities/ Variations**

Lower ability:

✔Provide students with one inquiry question or a selection of inquiry questions to choose from (some examples have been provided).

✔Conduct risk assessment as a class group to ensure students have a full understanding of risks involved in field work

## Field Study

**Context:** This lesson is designed as a guide for a field study for students to complete on site.

**Time guide:** 2-3 hours

**Curriculum mapping:** BIO 11/12-3

**Resources Required:**

✔Worksheet: Field Study/Documents

✔30m Rope/ tape marked every metre - alternatively tape/ chalk could be used

✔25x 25cm quadrats (1 per group)

✔Thermometer (1 per group)

✔Field Identification guide in colour (1 per group)

✔Measuring tape (1 per group)

✔Ropes for transects (1 per group) alternatively tape/ chalk could be used

**Differentiation opportunities/ Variations**

Number of rockpools sampled can be reduced and students can share data to increase validity

Higher ability: students can develop tables to collect data specific to their inquiry question

# Teacher Guide

## Digital Field Study

**Context:** This lesson is designed as an alternative to a practical field study.

**Time guide:** 90 minutes

**Curriculum mapping:** BIO 11/12-3

**Resources Required:**

✔Worksheet Digital Field Study

✔Interactive Map

**Differentiation opportunities/ Variations**

Alternative interactive map of cruwee cove note: does not contain temperature data. This lesson can be simplified and used in conjunction with the physical field study to help students prepare for field study or in cases where insufficient data is collected during field study

Higher ability: Students construct their own digital quadrats using instructions below, this method could be used with photos students take during field study but a ruler must be included in the photo

**Creating Digital Quadrats**

Using quadrats enables ecologists to estimate populations of species without counting every single individual in an ecosystem.

Digital Quadrats can be created using google drawings (or any other photo editing app).

1. Create a square that is 25cm x 25cm by aligning it with the ruler within the image.
2. Place this quadrat randomly within the rockpool to create a quadrat (as you would a physical quadrat).
3. Count the number of individuals of each species and record in the table below. Note: for species that are on the boundary line count those that occur on 2 of the sides and do not include individuals on the opposite sides
4. Repeat this process for all 10 rockpools. Images can be downloaded from the interactive map

## Lesson 3 Writing a Lab report

**Context:** In this lesson students will write a lab report to communicate their findings

**Time guide:** 2 hours

**Curriculum mapping:** BIO 11/12-7

**Resources Required:**

✔Worksheet: Lab report

**Differentiation opportunities/ Variations**

Students can complete the lab report in their own time or in class.

Lower ability: Students only complete discussion section of lab report and previous lessons are used to assess outcomes 1,2,3,11

# Research Task

## Learning Intention

Students analyse ecosystem dynamics and the interrelationships of organisms within the ecosystem [BIO 11-11]

### Success Criteria

Students Can:

- ✔ Define the terms abiotic factor and biotic factor
- ✔ Explain the impacts of abiotic and biotic factors on an ecosystem
- ✔ Explain ecological niches occupied by species
- ✔ Describe the different relationships between species within an ecosystem including: predation, competition, symbiosis

## Context

An ecosystem is a geographic area where different species (biotic features) interact with each other and the physical (abiotic) features of their environment. Species can interact with each other through predation, competition as well as symbiotic relationships. The abiotic features that can influence species within their ecosystem can include; light, water, salinity, nutrients, temperature etc.

Ecology is the study of the relationships between different species within an ecosystem as well as the interaction these organisms have with their environment. This helps our understanding of how abiotic and biotic factors can influence species abundance and distribution and enable us to make predictions about how external factors may change a population.

Through this depth study you will be investigating these relationships within intertidal rocky shelves

## Background Research

### Biotic and Abiotic Factors

Biotic and Abiotic Factors

**Define** the following terms

- ✔ Abiotic Factor
- ✔ Biotic Factor

**Identify** examples of abiotic factors found in rockpools

**Outline** how the abiotic factors listed above could be measured/ recorded

### Ecological Relationships

Ecological Relationships

Describe the following relationships found between organisms in ecosystems and provide one example of each

- ✔ Predation
- ✔ Competition
- ✔ Symbiotic relationships
- ✔ Mutulaism

Ecological Niches

**Describe** the term ecological niche

Back

Next

# Research Task

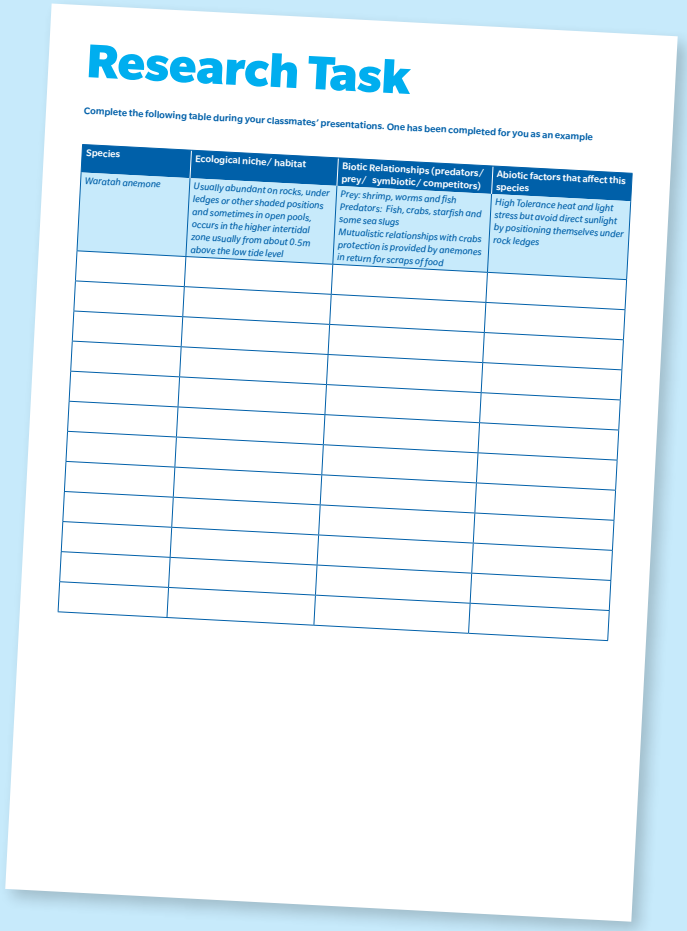
**Intertidal rocky shelves**

Intertidal rock shelf: Identification Guide

**Identify** 10 species are likely to be found in intertidal rocky shelves

In small groups **Research** a species designated by your teacher in depth. Create a short presentation for your class on this species including the following information:

- ✔ Scientific and common name of your species
- ✔ Image of the species
- ✔ Describe the Ecological niche which this species occupies
- ✔ Identify any predator and prey relationships for the species
- ✔ Describe any competitor relationships
- ✔ Describe any other relationships your species has with other organisms
- ✔ Explain how abiotic factors affect this species.



Research Task

Complete the following table during your classmates' presentations. One has been completed for you as an example

| Species | Ecological niche/ habitat | Biotic Relationships (predators/ prey/ symbiotic/ competitors) | Abiotic factors that affect this species |
|---|---|---|---|
| *Waratah anemone* | *Usually abundant on rocks, under ledges or other shaded positions and sometimes in open pools, occurs in the higher intertidal zone usually from about 0.5m above the low tide level* | *Prey: shrimp, worms and fish*<br>*Predators: Fish, crabs, starfish and some sea slugs*<br>*Mutualistic relationships with crabs protection is provided by anemones in return for scraps of food* | *High Tolerance heat and light stress but avoid direct sunlight by positioning themselves under rock ledges* |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Research task**

Complete this table during your classmates' presentations. One has been completed for you as an example

# Planning your investigation

**Learning Intention:**

Students develop and evaluate questions and hypotheses for scientific investigation [BIO11/12-1]

Students design and evaluate investigations in order to obtain primary and secondary data and information [BIO11/12-2]

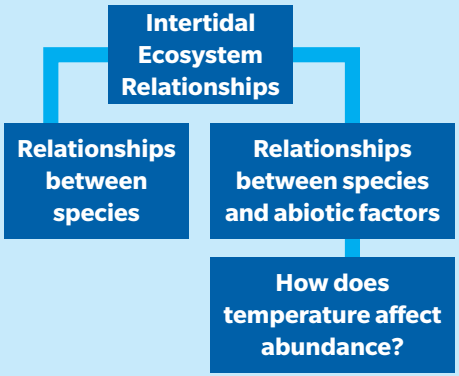
**Success Criteria**

Students can:

- ✔ Develop inquiry question(s) that require observations, experimentation
- ✔ Research to construct a reasonable and informed hypothesis
- ✔ Evaluate and refine inquiry question for investigation
- ✔ Determine the dependent and independent variables for experimentation
- ✔ Consider variables to be controlled
- ✔ Develop a plan to collect data
- ✔ Assess risks that may be encountered while collecting data
- ✔ Describe sampling techniques for measuring populations

**Inquiry Question and Hypothesis**

Use your research to brainstorm interactions that could be used to form the inquiry questions for your depth study. Some ideas have been added to get you started

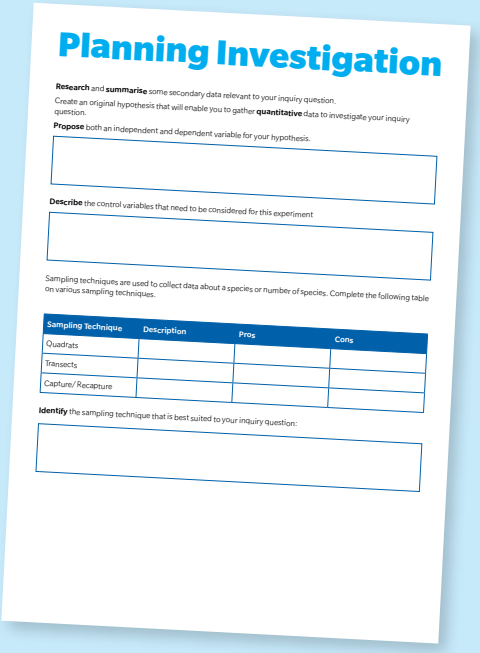



Use your brainstorm to develop an Inquiry Question to guide a scientific investigation to improve understanding of species diversity on the rocky platform.

Some examples of Inquiry Questions include:

- ✔ How is Invertebrate abundance affected by proximity to the low tide water mark?
- ✔ How is Invertebrate abundance affected by the temperature of water in a rockpool ?
- ✔ Is plant abundance affected by a rock pool surface area?
- ✔ What are the optimal conditions for invertebrates in rockpools?

Complete the Planning Investigation Worksheet.


Planning Investigation

**Research** and **summarise** some secondary data relevant to your inquiry question.
Create an original hypothesis that will enable you to gather **quantitative** data to investigate your inquiry question.

**Propose** both an independent and dependent variable for your hypothesis.

**Describe** the control variables that need to be considered for this experiment

Sampling techniques are used to collect data about a species or number of species. Complete the following table on various sampling techniques.

| Sampling Technique | Description | Pros | Cons |
|---|---|---|---|
| Quadrats | | | |
| Transects | | | |
| Capture/ Recapture | | | |

**Identify** the sampling technique that is best suited to your inquiry question:

Back

Next

# Planning your investigation

### Ethical Considerations

When working in the field ecologists have an ethical responsibility to conduct research in ways that are respectful to the environment, and minimize harm to species and ecosystems.

**Justify** any potential adverse impacts of the research in terms of advancing scientific understanding.

**Outline** some guidelines to ensure that field work is as non-destructive as possible

### Location

In preparing for fieldwork maps should be created to obtain geomorphology, distances to be travelled and access around fieldwork location/s. Information can be added to the map during your field work as primary data including; sites of data collection, ecological communities, areas of regeneration or conservation, areas of disturbances etc.

This can be created using google maps to add text, icons, photos and videos.

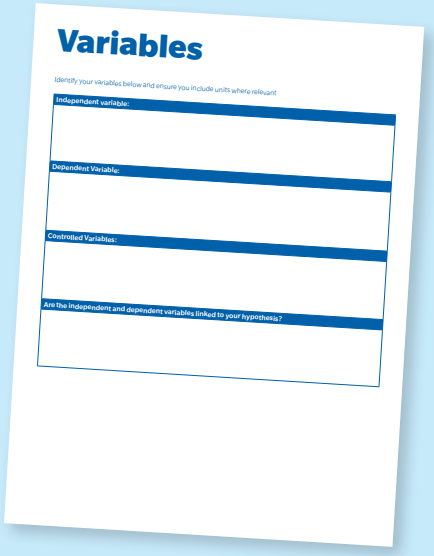
**Create** a custom map of your field work study location including a title a key, north and a scale.

### Planning Data Collection

When planning a scientific experimentation it is important to consider accuracy, validity and reliability to ensure that data collected

### Validity

Validity is the extent to which tests measure what was intended, this involves ensuring a fair test of the hypothesis. To ensure the hypothesis is being fairly tested, the variables need to be considered. Do the independent and dependent variable answer your hypothesis




### Reliability

Reliability is the extent to which repeated observations and/ or measurements taken under identical circumstances yield similar results. Reliability can be determined by taking repeat measurements. Reliability can be increased by ensuring that measurements and data is collected in a consistent way

**Describe** some ways in which you will ensure and increase validity during the collection of data

### Accuracy

Accuracy is the exactness or precision of a measurement; relating to the degree of refinement in measurement or specification. Accuracy can be improved by ensuring that all measurements are taken accurately for example the use of a colour field identification guide will enable accurate species identification.

Back

Next

# Field Documents

**Learning Intention:** Students conduct investigations to collect valid and reliable primary data and information [BIO11-12/3]

**Success Criteria**

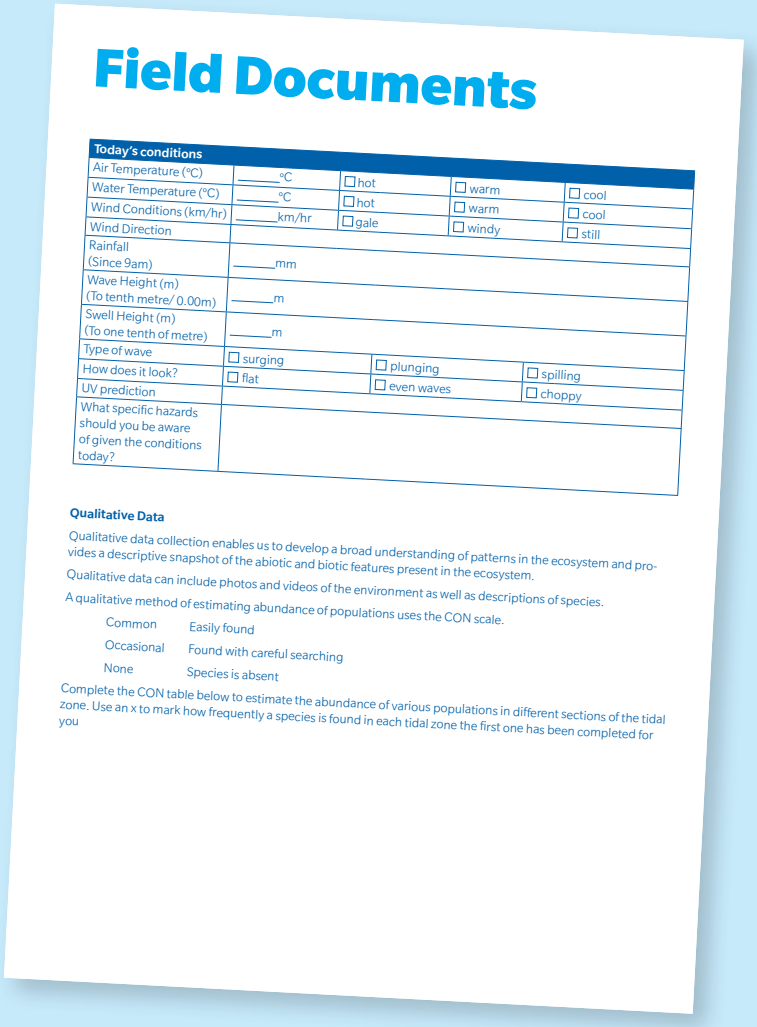
Students can:

- ✔ employ and evaluate safe work practices and manage risks
- ✔ Collect accurate quantitative and qualitative data relevant to their investigation

**Abiotic Features**

Create a Beach Report for your chosen beach. The following websites can be used to find current beach forecasts for your field study site

- ✔ Surf forecasts NSW
- ✔ Willyweather.com.au
- ✔ Nouvelle Galles du Sud Surf Forecast
- ✔ bom.gov.au
- ✔ Surf cams surf reports NSW
- ✔ (webcam of a beach - Search words: webcam (name) beach)
- ✔ Field Documents Worksheet



Field Documents

| Today's conditions | | | | |
|---|---|---|---|---|
| Air Temperature (°C) | _____°C | ☐ hot | ☐ warm | ☐ cool |
| Water Temperature (°C) | _____°C | ☐ hot | ☐ warm | ☐ cool |
| Wind Conditions (km/hr) | _____km/hr | ☐ gale | ☐ windy | ☐ still |
| Wind Direction | | | | |
| Rainfall (Since 9am) | _____mm | | | |
| Wave Height (m) (To tenth metre/ 0.00m) | _____m | | | |
| Swell Height (m) (To one tenth of metre) | _____m | | | |
| Type of wave | ☐ surging | ☐ plunging | ☐ spilling | |
| How does it look? | ☐ flat | ☐ even waves | ☐ choppy | |
| UV prediction | | | | |
| What specific hazards should you be aware of given the conditions today? | | | | |

**Qualitative Data**

Qualitative data collection enables us to develop a broad understanding of patterns in the ecosystem and provides a descriptive snapshot of the abiotic and biotic features present in the ecosystem.

Qualitative data can include photos and videos of the environment as well as descriptions of species.

A qualitative method of estimating abundance of populations uses the CON scale.

| | |
|---|---|
| Common | Easily found |
| Occasional | Found with careful searching |
| None | Species is absent |

Complete the CON table below to estimate the abundance of various populations in different sections of the tidal zone. Use an x to mark how frequently a species is found in each tidal zone the first one has been completed for you

Back Next

# Digital Field Study

**Learning Intention:** Students conduct investigations to collect valid and reliable secondary data and information [BIO11-12/3]

**Success Criteria**

Students can:

- ✔ employ and evaluate safe work practices and manage risks
- ✔ Collect accurate quantitative and qualitative data relevant to their investigation

**Abiotic Features**

Create a Beach Report for your chosen beach note: the interactive map data was collected at Malabar. The following websites can be used to find current beach forecasts for your field study site.

- ✔ Surf forecasts NSW
- ✔ willyweather.com.au
- ✔ Nouvelle Galles du Sud Surf Forecast
- ✔ bom.gov.au
- ✔ Surf cams surf reports NSW
- ✔ (webcam of a beach - Search words: webcam (name) beach)
- ✔ Digital Field Study Worksheet

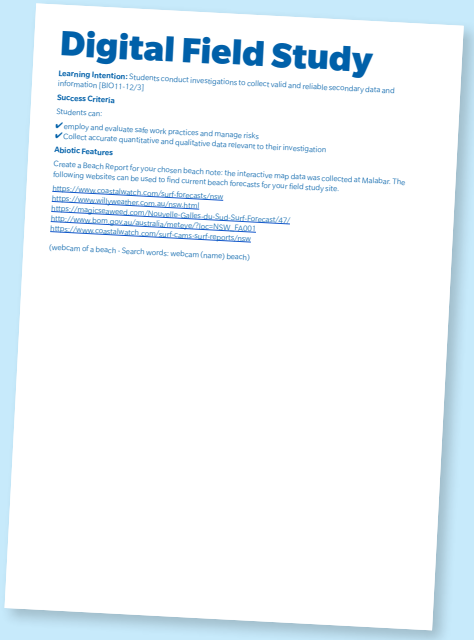
**Collecting Data virtually**

Use the interactive map to virtually examine the rockpools. The data was collected at Malabar close to the swimming pool

The data was collected using the following method

1. A random transect was set up running from the low tide mark to the high tide mark. The distance of the transect was recorded and samples were taken at 10 equal distances along the transect
2. At each sample point the closest rockpool (within 2 meters) was photographed
3. The temperature for each rockpool was recorded

- ✔ What is the length of the transect?
- ✔ How many rockpools have been examined?
- ✔ What is the distance between each rockpool?


Digital Field Study

Learning Intention: Students conduct investigations to collect valid and reliable secondary data and information [BIO11-12/3]

Success Criteria

Students can:

✔ employ and evaluate safe work practices and manage risks
✔ Collect accurate quantitative and qualitative data relevant to their investigation

Abiotic Features

Create a Beach Report for your chosen beach note: the interactive map data was collected at Malabar. The following websites can be used to find current beach forecasts for your field study site.

https://www.coastalwatch.com/surf-forecasts/nsw
https://www.willyweather.com.au/nsw.html
https://migiriskywest.com/Nouvelle-Galles-du-Sud-Surf-Forecast/47/
http://www.bom.gov.au/australia/meteye/?loc=NSW_FA001
https://www.coastalwatch.com/surf-cams-surf-reports/nsw

(webcam of a beach - Search words: webcam (name) beach)

Back

Next

# Lab report

**Learning Intention:** Students communicate scientific understanding using suitable language and terminology for a specific audience or purpose [BIO11/12-7]

**Success Criteria:**

Students can:

- ✔ select and use suitable forms of written communication
- ✔ select and apply appropriate scientific notations, nomenclature and scientific language to communicate
- ✔ construct evidence-based arguments to evaluate an argument or conclusion

**Aim**

States the intentions of the experiment.

- ✔ To investigate Inquiry Question

**Hypothesis**

A hypothesis is something that can be tested in measurable terms. A hypothesis should be based on research and prior knowledge

**Equipment**

List all the equipment and materials that were used.

**Risk Assessment**

**Method**

A detailed procedural recount of how the data was collected (in past tense).

**Results**

Include:

- ✔ qualitative data from the investigation e.g. photos and observations
- ✔ Quantitative Data relevant to the Inquiry question tabulated
- ✔ Relevant graphs showing trends in the data

**Discussion**

An explanation of the results and trends that have been found

Paragraph 1: The Experiment

Briefly summarise the experiment. Refer to the aims and hypothesis/ hypotheses and the type of experiment conducted. Did the experiment answer the Inquiry question? Was the hypothesis supported or refuted?

Paragraph 2: Trends

Identify trends in the data referring to graphs (in results). Provide explanations for trends identified.

Paragraph 3: Method and Approach

Justify method/ approaches selected, why was data collected in a specific way?

Discuss the validity(did the investigation answer the inquiry question?) and reliability (were results consistent across all trials and with other groups?) of the investigation

Discuss other possible sources of error:

- ✔ Human error – from tools/ instruments being used/read incorrectly
- ✔ Systematic error – equipment not correctly calibrated, so measurements are consistently incorrect
- ✔ Random errors – changes in materials used or varying conditions

Paragraph 4: Future Experimentation

Identify any limitations of your experiment. Have all variables been accounted for or considered in the discussion? What else could be tested to improve the reliability or validity of your results? How might this experiment be repeated in future?

What other inquiry questions and areas of further research could be investigated next?

Back

Next

# Lab report

**Conclusion**

This is a clear and logical statement that summarizes the experiment. Include:

- ✔ Was the aim of the experiment achieved?
- ✔ Was the hypothesis supported or refuted?


# Marking Criteria

| Outcome | Standards Of Achievement | | | |
|---|---|---|---|---|
| | Outstanding (5/5) | High (4/5) | Sound (3/5) | Basic (2/5) |
| General performance band descriptor for Skills outcomes | ✔ Applies highly developed skills & processes in a wide variety of contexts<br>✔ Demonstrates creative and critical thinking<br>✔ Uses perceptive analysis and evaluation | ✔ Applies well developed skills & processes in a wide variety of contexts<br>✔ Demonstrates creative and critical thinking<br>✔ Uses analysis and evaluation | ✔ Applies skills & processes in a range of familiar contexts<br>✔ Demonstrates skills in selecting and integrating information | ✔ Applies skills & processes in some familiar contexts<br>✔ Demonstrates skills in selecting and using information |
| Bio11/12-1<br>Develops and evaluates questions and hypotheses for scientific investigation | ✔ Uses perceptive analysis to develop and evaluate inquiry questions and hypotheses to identify a concept that can be investigated scientifically, involving primary and secondary data<br>✔ Demonstrates critical thinking when modifying questions and hypotheses to reflect new evidence | ✔ develops and evaluates inquiry questions and hypotheses to identify a concept that can be investigated scientifically, involving primary and secondary data<br>✔ modifies questions and hypotheses to reflect new evidence | ✔ explores inquiry questions and hypotheses to identify a concept that can be investigated scientifically, involving primary and secondary data | ✔ identifies a concept that can be investigated scientifically, involving primary and secondary data |
| BIO 11/12-2<br>Designs and evaluates investigations in order to obtain primary and secondary data and information. | ✔ Uses perceptive analysis when assessing a variety of risks<br>✔ Uses creativity and critical thinking when selecting appropriate materials and technologies when designing and planning an investigation<br>✔ Uses perceptive analysis to evaluate and modify an investigation in response to new evidence | ✔ Assesses a variety of risks<br>✔ Uses creativity and critical thinking when selecting appropriate materials and technologies when designing and planning an investigation<br>✔ Evaluates and modifies an investigation in response to new evidence | ✔ Assesses familiar risks<br>✔ Selects appropriate materials and technologies when designing and planning an investigation<br>✔ Selects and integrates modifications to an investigation in response to new evidence | ✔ Describes some familiar risks<br>✔ Selects appropriate materials and technologies when designing and planning an investigation<br>✔ Selects possible modifications to an investigation in response to new evidence |
| BIO 11/12-3<br>Conducts investigations to collect valid and reliable primary and secondary data and information. | ✔ Applies highly developed skills & processes when employing and evaluating safe work practices and can manages risks in a wide variety of contexts<br>✔ Uses appropriate technologies to ensure accuracy and demonstrates perceptive analysis when evaluating accuracy<br>✔ Demonstrates critical thinking and perceptive analysis when selecting and extracting information from a wide range of reliable secondary sources | ✔ Applies well developed skills & processes when employing and evaluating safe work practices and manages risks in a wide variety of contexts<br>✔ Uses appropriate technologies to ensure accuracy and evaluates accuracy<br>✔ Demonstrates critical thinking and/or perceptive analysis when selecting and extracting information from a wide range of reliable secondary sources | ✔ Employs safe work practices and manages risks in a range of familiar contexts<br>✔ Uses appropriate technologies to ensure accuracy<br>✔ Selects and extracts information from a range of reliable secondary sources | ✔ Employs safe work practices and manages risks in some familiar contexts<br>✔ Uses appropriate technologies and/or considers accuracy<br>✔ Selects and uses information from secondary sources |

# Marking Criteria

| Name: | | Grade: A B C D E Non Submission | | |
|---|---|---|---|---|
| BIO 11/12-4<br>Selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media. | ✔ Demonstrates creative and critical thinking when applying quantitative processes<br>✔ Demonstrates perceptive analysis and evaluation of the quality of data | ✔ Demonstrates creative and critical thinking when applying quantitative processes<br>✔ Evaluates the quality of data | ✔ Applies quantitative processes where appropriate<br>✔ Selects and uses data and/or considers the quality of data | ✔ Applies quantitative processes in some familiar contexts<br>✔ Selects and uses data |
| BIO 11/12-7<br>Communicates scientific understanding using suitable language and terminology for a specific audience or purpose. | ✔ Effectively communicates complex ideas and information<br>✔ Effectively selects and uses suitable forms of digital and written communication<br>✔ Selects and effectively applies appropriate scientific notations and scientific language<br>✔ Engages in peer feedback effectively to evaluate an argument or conclusion | ✔ Clearly communicates complex ideas and information<br>✔ Selects and uses suitable forms of digital and written communication<br>✔ Selects and clearly applies appropriate scientific notations and scientific language<br>✔ Engages in peer feedback to evaluate an argument or conclusion | ✔ Communicates relevant ideas in an appropriate manner<br>✔ Selects and/or uses suitable forms of digital and written communication<br>✔ Selects and applies appropriate scientific notations and scientific language<br>✔ Engages in peer feedback | ✔ Communicates ideas in a descriptive manner<br>✔ Uses suitable forms of digital and written communication<br>✔ Selects and/or applies appropriate scientific notations and scientific language<br>✔ Attempts to participate in peer feedback |
| General performance band descriptor for content outcomes | Demonstrates extensive knowledge and understanding | Demonstrates thorough knowledge and understanding | Demonstrates sound knowledge and understanding | Demonstrates basic knowledge and understanding |
| BIO 11-11 | With no major errors:<br>✔ Defines the terms abiotic factor and biotic factor<br>✔ Explains the impacts of abiotic and biotic factors on an ecosystem<br>✔ Describes ecological niches occupied by species<br>✔ Explains the different relationships between species within an ecosystem including: predation, competition, symbiosis | With minimal errors:<br>✔ Defines the terms abiotic factor and biotic factor<br>✔ Describes the impacts of abiotic and biotic factors on an ecosystem<br>✔ Describes ecological niches occupied by species<br>✔ Describes the different relationships between species within an ecosystem including: predation, competition, symbiosis | With some errors:<br>✔ Defines the terms abiotic factor and biotic factor<br>✔ Identifies the impacts of abiotic and biotic factors on an ecosystem<br>✔ Identifies ecological niches occupied by species<br>✔ Describes the different relationships between species within an ecosystem including: predation, competition, symbiosis | Attempts/ with assistance:<br>✔ Defines the terms abiotic factor and biotic factor<br>✔ Identifies some impacts of abiotic and biotic factors on an ecosystem<br>✔ Identifies an ecological niches occupied by species<br>✔ Defines the different relationships between species within an ecosystem including: predation, competition, symbiosis |