MONASH University

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| **Type of submission** | ASSESSMENT TASK 3: FIELD WORK IN BIOLOGY: PART A & B | | |

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## Part A - 1. Curriculum Map: Intertidal Rocky Shores Field Trip

Students will investigate factors affecting species distribution along a vertical profile of the intertidal zone along a rocky shore site at Barwon Bluff Marine Sanctuary. Working in groups, students will conduct a species distribution survey using quadrat/transect techniques. A separate habitat within the Sanctuary, which has different abiotic parameters, will also be investigated to further explore factors affecting species distribution.

| Learning Outcomes | VCE Curriculum Links[1] | |
|---|---|---|
| | **Key Skills** | **Unit: Area of Study – Key Knowledge** |
| Students will be able to identify site safety issues of working on a rocky shore within the intertidal zone and ethical considerations of working on a delicate ecosystem within a protected Marine Sanctuary. | *Investigate and inquire scientifically* - Acting responsibly* when conducting investigations which includes health & safety, and ethical considerations.<br><br>* Although not explicitly stated in the Study Design, 'responsibly' has been interpreted to include ethical behaviour. | *Unit 2: Area 1* - Techniques used to monitor species distribution. |
| Students will be able to identify and operate field equipment, including field thermometers, quadrats and transects to successfully execute a species distribution survey. In doing so, students will recognize strengths and weaknesses of these techniques. | *Investigate and inquire scientifically* - Conducting first hand investigations, using materials appropriate to the investigation and evaluating experimental procedure and reliability of data. | *Unit 2: Area 1* - Techniques used to monitor species distribution.<br><br>*Unit 2: Area 2* - Conduct and report on a field investigation related to the interactions between living things and their environment. |
| Students will improve their ability to make sound estimates and observations in the field through practice and reflection. | *Investigate and inquire scientifically* - Conducting first hand investigations | *Unit 2: Area 1* - Techniques used to monitor species distribution. |
| Students will be able to identify different species of flora and fauna. | *Investigate and inquire scientifically* - Conducting first hand investigations | *Unit 1: Area 2* - Classifying organisms: knowledge of features typically used in constructing major taxonomic groups. |
| Students will collaborate within groups and coordinate as a class to pool results. | *Communicate biological information and understandings* - Interpret, transpose and communicate information and ideas effectively<br>*Investigate and inquire scientifically* - working independently and collaboratively as required. | |
| Students will be able to record field data and perform data analysis and interpretation to hypothesize on results and make conclusions | *Investigate and inquire scientifically* - Collect, process and record field data, analyse and draw conclusions consistent with the question under investigation and evidence obtained. | |

| | | |
|---|---|---|
| Students will relate observations and results of species distribution patterns to organisms' tolerances, adaptations and habitats (niches). | *Apply biological understandings* - to familiar and new contexts and make connections between concepts. The concepts in this case being, tolerance levels, structural, physiological and behavioural adaptations, niche habitats, and the vertical profile of an intertidal zone with varying degrees of environmental factors and subsequent distribution of species populations. | *Unit 2: Area 1* Environmental factors, biotic and abiotic factors; structural, physiological, behavioural adaptations; tolerance range of organisms; maintaining equilibrium by detecting and responding to changes in environmental conditions. |
| Students will compare biotic and abiotic environmental factors at the two different sites and formulate conclusions of how they influence species distribution. | *Apply biological understandings* - to familiar and new contexts and make connections between concepts. The connections in this case are that other environment factors (other than those associated with a changing vertical profile) and predation or competition relationships between organisms can influence species distribution. | *Unit 2: Area 1* - Environmental factors, biotic and abiotic factors, available resources.<br>*Unit 2: Area 2* - Relationships between organisms: predator prey; Population dynamics: factors affecting distribution and abundance of organisms. |
| Students will gain experience in academic writing by presenting their results and conclusions in a structured report. | *Communicate biological information and understandings* - Interpret, transpose and communicate information and ideas effectively. Use scientific terminology and conventions appropriately | *Unit 2: Area 2* – Consistent with assessment recommendation. A written report on fieldwork. |
| Gain an appreciation for sensitive habitats and ecosystems which may be threatened by changes in climatic temperature and sea level rise. | *Apply biological understandings* - to familiar and new contexts; make connections between concepts. | *Unit 2: Area 2* - Change of ecosystems over time through natural changes and human activity |

[1] Victorian Curriculum and Assessment Authority. (2005). *VCE Biology Study Design*. Retrieved from http://www.vcaa.vic.edu.au/vce/studies/biology/biologyindex.html

**Key Skills**
Investigate and inquire scientifically
Apply biological understandings
Communicate biological information and understandings

**Key Knowledge**
**Unit 1: Unity and diversity - Area of Study 2: Functioning organisms**
**Unit 2: Organisms and their environment**
**Area of Study 1: Adaptations organisms**
Explain and analyse the relationship between environmental factors, and adaptations and distribution of living things.
**Area of Study 2: Dynamic ecosystems**
Conduct and report on a field investigation related to the interactions between living things and their environment.

## 2. Field Trip Summary

### Pre Trip

In class work leading up to the field trip students will cover topics of habitats, niches, environmental factors (abiotic and biotic) tolerance ranges and factors limiting occurrence. For example see Chapter 9: Habitats, environments and survival in *Nature of Biology, Book 1*, pages 256-296. A series of questions will be posed to students which they will have to research apply to the class work as part of the assessment report to be handed in. (See **Learning Activity d)** for details.

Administrative details: Follow and complete school processes for undertaking field trips, Make facility and transport bookings, Organise permission forms, information handout, and, if applicable, student cost subsidizations.

Lessons in the week preceding the field trip will be utilized as a mock/practice trip at the school's oval or (if available) a grassed, sloping table-drain. Students will become familiar with transect survey techniques using measuring tapes, quadrats, and recording data on practice field data sheets. This will assist students in knowing what to expect in the field and what is expected of them to get the most out of the trip and minimize 'I don't know what to do' discourses on the day. See **Learning Activity b)** for details.

Activities will also be implemented to develop students' skills in estimation and identifying common species. This will also build students' confidence in their ability which will help them cope with complexities they will not doubt encounter in the field. See **Learning Activity c)** for details.

Prior to the trip students will be briefed site safety issues, focusing on intertidal risks involving waves, organisms, footing, and sunburn. Students will be informed on appropriate clothing including hats and footwear. As the site is a Marine Sanctuary, students will be briefed on protocol to minimize human impact on the site.

### Field Trip

General introduction to site including geological landform and cultural heritage backgrounds.

Site 1. Limestone Platform

Students will investigate and record species distribution along a vertical profile of the intertidal zone. Working in groups of 3-4, students will conduct a survey using quadrat/transect techniques. A transect will run from the high tide line (0 metres) to the low tide line (~50m). Groups will choose 3 points along the survey (eg. 10 m, 25m, 50m) and ensure that all 5 metre increments of the transect are surveyed. Groups will randomly place the quadrat 3 times at each point and record on data sheets species numbers or percentage cover as appropriate to get an average result for that point. See data proforma **Appendix A.**

Site 2. Basalt Boulder Field.

Students will observe and note key physical differences between this site and the previous. They will conduct descriptive observations of the species distribution to compare and contrast the two different environments. Students will also investigate and record observations of three different microhabitats within the intertidal zone.

Resources required:

- Transport
- Student role
- First aid kit
- Mobile phone with school contact numbers
- Water
- Sunscreen
- 50 metre measuring tapes
- Quadrats (made from PVC tubing with bisecting cross strings)
- Data record proformas
- Identification sheets, estimation guides
- Pens/Pencils
- Camera
- Extra teacher/aide to assist with supervision
- Lunch (if provided)

**Post trip**

Each group to present its results as the class compiles a collated dataset over the entire transect. Results will be uploaded to the Intertidal Rocky Shores Interactive Database. http://www.rockyshores.auz.info/home.htm

Students will use Microsoft Excel to enter data, calculate averages and produce charts.

Working in groups, students will create a brief summary article, with a non-scientific target audience, describing the purpose of the field trip with photos for the school news letter or website.

Individual tasks will include completing discussion questions, and a scientific write up of the report, including aims, methods, results, and discussion. See **Learning Activity g)**.

## 3. Learning Activities

**a) Identification practice:** Have six trays set up with each containing one of the most likely species to be encountered (depending on availability of shell collections – could use photos instead). With a "Who am I?" sheet, describing some of species ecological characteristics. For example for Chequerboard Snails: I am found on rock platforms, rock pools and crevices. I like to scavenge for plant and animal material.

Students will use identification keys, photo cards and known characteristics to identify each of the species. See **Appendix B**.

**b) Practice field trip:** Students will become familiar with transect survey techniques using measuring tapes, quadrats, and recording data on practice field data sheets. Data will be collated on board at the end of the lesson to demonstrate how to construct vertical profiles and vertical distribution diagrams. Students will gain an appreciation of how variable their estimations can be.

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**Practice Transects (Handout)**

- Divide into two groups
- Each group will need a 50 metre tape measure and three quadrats.
- Run a transect line from the top of the slope to the bottom.
- Choose three points along the transect (one near the top, middle an bottom)
- Record the distance of each point on your record sheet
- Record the percentage cover of grass, weeds and other plants in your quadrat
- When you are finished, leave the quadrats exactly where they are and switch with the other transect group.
- Record where they have placed the transect, then record the percentage cover.
- Now compare your results to that of the other group. Are there any differences? Is estimating percentage cover an accurate method of data collection?

**Record Sheet**

| Transect 1 | | | | |
|---|---|---|---|---|
| Distance (metres) | Narrow leaf grass (% cover) | Broad leaf grass (% cover) | Weeds (% cover) | Other (% cover) |
| Quad 1 | | | | |
| Quad 2 | | | | |
| Quad 3 | | | | |
| **Transect 2** | | | | |
| Distance (metres) | Narrow leaf grass (% cover) | Broad leaf grass (% cover) | Weeds (% cover) | Other (% cover) |
| Quad 1 | | | | |
| Quad 2 | | | | |
| Quad 3 | | | | |

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**c) Practice Estimation Techniques:** Following on from the previous activity, I would facilitate class discussion around the previous exercise and get students to develop an experiment to test their estimation ability with the quadrats. Ideally, they would come up with something like this activity. If we were short for time I would incorporate this as part of the previous activity.

Prepare a number of pieces of cardboard of varying shapes, sizes and colour. Calculate and record the area in $cm^2$ on the back of each piece.

On a flat area of homogeneous substrate (either concrete or grass), set up a number of quadrats with a random assortment of cardboard pieces, coloured side up.

Get the students to work in small groups and rotate through the different quadrats and record their estimations. Give students a handout of an estimation guide See **Appendix C**.

| Quadrat Number | % Blue | % Red | % Black | Total % |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

When the students are finished, as a class, go back to each quadrat and add up the areas of the colours to give students a chance to reflect on their estimations.

Discuss any general trends that may have emerged from the results, e.g. under estimating dark colours.

Have some sort of prize for the most accurate group.

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**d) Pre field trip research questions:** These questions will form part of the final report that will be marked as part of the School Assessed Coursework. Students will be expected to utilise their text book, electronic resources, and presentations/discussions in class to complete them.

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The intertidal environment is one that is under constant change. The rise and fall of the tides result in organisms being alternately submerged and exposed.

1. List three important abiotic factors that organisms living in the intertidal zone have to cope with. How would each of these vary from low tide to high tide?

2. What biotic factors would an intertidal organism likely encounter?

3. Blue Periwinkles are found living close to the high tide line. Are they likely to encounter less or more stress from dehydration than an organism living closer to the low tide mark? Explain why.

4. Neptune's Necklace occurs close toward the low tide mark. Are they likely to encounter less or more stress from wave action than an organism living closer to the high tide line? Explain why.

5. Define the term, 'tolerance range' and suggest how an environmental factor of the intertidal zone might contribute to an organisms' distribution there.

6. Suggest four adaptations intertidal organisms have that enable them to tolerate the environmental stresses they encounter. Indicate if they are structural, physiological, or behavioural adaptations. Hint – reflect on your existing knowledge of snails, limpets, mussels, crabs, and barnacles and where they occur.

7. Shell A and Shell B both feed on the same type of algae that occurs between 0.5m and 1.5m above sea level. Under normal circumstances, Shell A occurs between 0.5m and 1.0m, while Shell B occurs between 1.0m and 1.5m. When Shell A is removed from the environment, Shell B occurs between 0.5m and 1.5m; however, when Shell B is removed, Shell A stays between 0.5m and 1.0m.

What does this tell you about the interaction between the two species? Suggest a reason why Shell A does not occur above 1.0m elevation above sea level.

**e) Field Trip** – details of methodology under "**Field Trip**" in Part 2: Field Trip Summary. Data Proforma are attached as **Appendix A**.

**f) Post Field Trip Data Collation and Presentation** – details under "**Post Field Trip**" in Part 2: Field Trip Summary.

**g) Post Field Trip Report** – Students are to complete a written report, including Aims, Methods and Materials Used, Results and Discussion Sections.

The class dataset will be attached as an appendix and the results section will contain a vertical profile and vertical distribution diagram used this height data.

| Transect Point | Height above sea level |
|---|---|
| 50 | 0m |
| 45 | 0.1m |
| 40 | 0.15m |
| 35 | 0.25m |
| 30 | 0.25m |
| 25 | 0.35m |
| 20 | 0.35m |
| 15 | 0.55m |
| 10 | 0.85m |
| 5 | 0.90 |
| 0 | 1.50m |

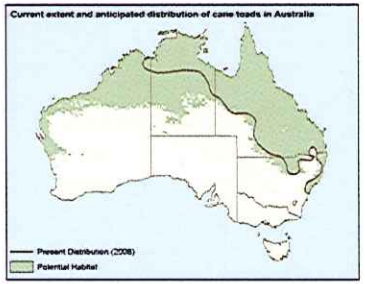
Discussion Section will include answers to the following questions:

1. List the abiotic and biotic factors that the organisms in the intertidal zone would experience in a 24 hr period and indicate whether those factors increase or decrease as you move from the low tide area to the high tide area.
2. Indicator species are the most abundant organisms in a particular area. Suggest indicator species for the following areas along your transect.
    a) the upper area
    b) the middle area
    c) the lower area.
3. Give examples of structural and behavioural adaptations for each indicator species and describe how it helps the organism survive.
4. Which species were only found in one particular area? Explain why these organisms may be restricted to the one zone.
5. Give an example of an organism that was found only in rock crevices. How do these micro habitats increase the organisms' chance for survival?
6. It has been scientifically proven that Periwinkles can physically tolerate all areas of the intertidal zone yet we only found them at higher levels along the transect. Suggest reasons why they were not very prevalent in the lower areas, focusing on relationships between organisms.

4. Presentation to class

## Cane Toads (Bufo Marinus)

-Where do they live?

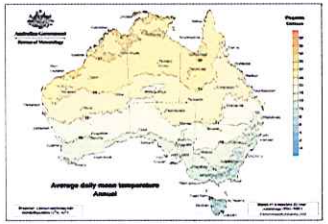



- Why?
- What factors might influence where they live?

## Factors affecting Cane Toad distribution

-Also maybe humidity and evaporation

-What type of environmental factors are these called?



## Questions

Use your text book and online resources to define these terms:

-Habitat

-Tolerance Range

-Abiotic and biotic Environmental Factors (with examples)

-Adaptations (Structural, Physiological & Behavioural)

Provide an explanation of the Cane Toads' distribution using these terms.

## Common Shore Crab

This Common Shore Crab inhabits rocky coastlines and is found hiding in crevices and rock shelves.

-Suggest some biotic and abiotic factors that might affect this organism.

-How might they change with the tide?

-What adaptations does this organism have that enables it to survive?

## Measuring and monitoring distribution

-How can we measure and monitor where organisms occur?

-Think of a scientific method to get standardized and repeatable results.

-Transect and quadrat method is common and simple but relies on human estimation

## Overview of Unit

We are going to investigate species distribution on the intertidal zone of a rocky coastline.




This involves an all day field trip to Barwon Heads Marine Sanctuary!

**Three good websites to check out for background**

- http://www.dpi.vic.gov.au/DPI/nrenfag.nsf/LinkView/3115B5E88F184A03CA25778400200B1E4FDD1D9FC3EAA8D5CA25779E001F7BA5
- http://www.rockyshores.auz.info/about_project.htm
- http://www.barwonbluff.com.au/partnerships/barwoncoast/barwoncoast.htm

## Overview of Unit

**Checklist**

Identification Activity
Practice Transect
Practice Estimation Techniques
Pre Field Trip Research Questions
Completed Record Sheet
Collated Class Data Set
Summary Article for Newsletter
Written Report

## How do you become a famous musician or big sports star?

Practice!

And it is the same for biologists, so we will practice and improve your identification, observation and estimation skills

## Practice Transects

- Divide into two groups
- Each group will need a 50 metre tape measure and three quadrats.
- Run a transect line from the top of the slope to the bottom.
- Choose three points along the transect (one near the top, middle an bottom)
- Record the distance of each point on your record sheet
- Record the percentage cover of grass, weeds and other plants in your quadrat
- When you are finished, leave the quadrats exactly where they are and switch with the other transect group.
- Record where they have placed the transect, then record the percentage cover.
- Now compare your results to that of the other group. Are there any differences? Is estimating percentage cover an accurate method of data collection?

## Identification Practice

- There are six trays set up with each containing one of the most likely species to be encountered
- Working in groups, rotate between the trays until you have identified all six specimens.
- Use Identification charts and the "Who am I?" sheet, which describes some of species ecological characteristics to determine what organism each sample is.

## Estimation Practice

- There are a number of quadrats with a random assortment of coloured cardboard pieces.
- Work in small groups and rotate through the different quadrats and record your estimations. Use the estimation guide to help.
- When you are finished, as a class, go back to each quadrat and add up the areas of the colours and calculate the real percentages.
- Make some general notes on your estimations, where some colour estimations better than others.
- Prize for the most accurate group.

## Risks and Safety

- We will be working outside on a rocky platform by the sea.
- What are some safety risks we might encounter?
- What actions could you take to minimise these risks?


•Complete the pre field work questions

## Field Trip

- Date, details, wear hats and appropriate footwear. Bring sunscreen, lunch etc..
- Working in groups of 3-4, students will conduct a survey using quadrat/transect techniques.
- A transect will run from the high tide line (0 metres) to the low tide line (~50m).
- Choose 3 points along the survey (eg. 10 m, 25m, 50m) and ensure that all 5 metre increments of the transect are surveyed.
- Randomly place the quadrat 3 times at each point and record on data sheets species numbers or percentage cover as appropriate to get an average result for that point.
- At the basalt boulder field site, observe and note key physical differences between this site and the previous. Conduct descriptive observations of the species distribution to compare and contrast the two different environments.

## Marine Sanctuary and Site History

Use the website links to look up the answers to these questions:

Who are the cultural owners of Barwon Heads Bluff?

What activities can't we do in a Marine Sanctuary?

Take only photos, leave only footprints!

## Report work

- Compile data to get class averages.
- Upload data to the rocky shores website.
- Working in groups, create a brief summary article, with a non-scientific target audience, describing the purpose of the field trip .
- We will add photos and publish the best summary in the school news letter or website.
- Create a vertical profile and vertical distribution diagram using class dataset for your report.
- Complete the report making sure all the discussion section questions are answered.

## Part B: The value and purpose of field trips in teaching and learning biology

Field work experience improves student academic achievement by covering VCE curriculum content, putting theory in a practical context, linking concepts, and increasing interest and motivation (Barker, Slingsby & Tilling, 2002; Michie, 1998). This is principally achieved through students' active participation, experiencing first-hand, the rich and complex natural world (Michie, 1998).

While laboratory work is highly beneficial to students learning Biology, the controlled and ordered nature of this work does not provide the authentic practical experience that biological field work delivers (Braund,& Reiss, 2006). Through holistic, real world experience, students will develop observation, perception and scientific investigative skills. Students participating in field work will realise that the real world is complex and scientists don't necessarily know everything, promoting interest in possible career pathways (Braund,& Reiss, 2006).

While not directly linked to key learning outcomes in the curriculum, field trips create positive student attitude towards biology. Field trips provide fun, enjoyment, lasting motivation, and further interest in biology (Barker et al., 2002). Student motivation is a key factor in active student engagement and learning (Shor, 1992).

Getting outside formal class room situation allows students to appreciate nature and provides opportunities to be exposed to new, and sometimes uncommon, environments (Barker et al., 2002). This arrangement also provides students with responsibility and enables students to development collaboration and communication social skills. This environment enables teachers to develop positive relationships with students and can enhance student behaviour (Michie, 1998).

Tytler (2007) documents the declining attitudes towards school science, declining numbers in science at higher levels in school and as a career. The call of 'Scientific Literacy' or 'Science for all', where science education meets the needs for all citizens of contemporary society by increasing scientific curiosity and creating life long learners will increase positive attitudes towards science (Rennie, Goodrum & Hackling, 2001). Field trips are key to this process, as they provide real life context to biological concepts and promote further interest in scientific investigation.

Class field work takes considerable resources to administer and working outside the classroom increases health and safety risks. Logically then, these events should be well planned and thought through to maximise benefit to the students. This would include investing in student preparation, to ensure students are kept on task. Described as the 'soul' of biology, field trips are a power teaching and learning tool and must be incorporated into all programs, regardless of how crowded the curriculum is or the time and financial costs involved (Barker et al., 2002).

## References


Barker, S., Slingsby, D., & Tilling, S. (2002). *Teaching Biology Outside the Classroom: Is it Heading for Extinction? A Report on Biology Fieldwork in the 14-19 Curriculum.* Shrewsbury: Field Studies Council.

Braund, M., & Reiss, M. (2006). Towards a More Authentic Science Curriculum: The contribution of out-of-school learning. *International Journal of Science Education*, 28(12), 1373-1388.

Michie, M. (1998). Factors influencing secondary science teachers to organise and conduct field trips. *Australian Science Teachers Journal, 44*(4), 43-50.

Rennie, L. J., Goodrum, D., & Hackling M. (2001). Science Teaching and Learning in Australian Schools: Results of a National Study. *Research in Science Education*, 31, 455-498.

Shor, I. (1992). *Empowering Education: Critical teaching for social change.* Chicago: University of Chicago press.

Tytler, R. (2007). *Re-imagining Science Education: Engaging students in science for Australia's future.* Victoria: Australian Council for Educational Research.

**SITE 1: Limestone Platform**

**Field Record Chart** Low tide at: Tide height:

**Barwon Heads Transect:** A B C Date: Weather conditions:
(circle)

**Record species numbers or percentage cover as appropriate**

| | Distance from high tide mark | Quadrat throw number | Periwinkle | Mussel | Variegated Limpet | Striped False Limpet | Scaly Limpet | Ribbed Top Shell | Chiton | Dog Whelk | Chequerboard Snail | Striped Conniwink | Warrener | Onchidellid | Abalone | Barnacle | Crab | Seastar | Waratah Anemone | other Anemone | Cunjevoi | Tubeworm | Coralline Red algae | Turf Red Algae | other Red Algae | Neptune'sNecklace | other Brown Algae | Green Algae | **Others** | Blue Green Algae | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Average | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Average | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Average | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Chiton**
*Plaxiphora albida*

**Characteristics:** Shell consists of eight overlapping plates, surrounded by a leathery mantle.
**Habitat:** Rocky shores.
**Diet:** Grazes on encrusting algae.

**Blacklip Abalone**
*Haliotis rubra*

**Characteristics:** Large rough, brown to red shell, strong thick black edged foot.
**Habitat:** Active at night shelters in crevices in day.
**Diet:** Algae.

**Elephant Snail**
*Scutus antipodes*

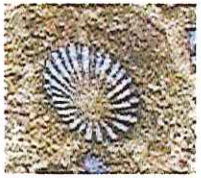
**Characteristics:** Black slug like animal with white oval shell.
**Habitat:** Rock crevices, rock pools and under rocks.
**Diet:** Generally feeds at night on algae. May catch drifting algae.

**Variegated limpet**
*Cellana tramoserica*

**Characteristics:** Yellow-brown shell with markings at base.
**Habitat:** Rock surface, uses chemical trail to return to same location after grazing.
**Diet:** Scrapes algae off rocks using radula.

**Scaly limpet**
*Patelloida latistrigata*

**Characteristics:** Brown shell with white rays.
**Habitat:** Depressions in rock surface.
**Diet:** Grazes on algae.



**Striped false limpet**
*Siphonaria diemenensis*

**Characteristics:** Obvious white stripes on a dark coloured shell.
Air breathing.
**Habitat:** Sheltered habitats on rock surface and wooded pylons.
**Diet:** grazes on macroalgae

**Warrener**
*Turbo undulatus*

**Characteristics:** White and green patterned shell. Distinctive white, round operculum.
**Habitat:** Intertidal rock pool areas, exposed reefs.
**Diet:** Grazes on macro-algae.

**Black Nerite**
*Nerita atramentosa*

**Characteristics:** Thick, matt black shell and operculum with white underside

**Habitat:** Exposed areas, rock crevices and under rocks.

**Diet:** Grazes on algae.

**Striped Conniwink**
*Bembicium nanum*

**Characteristics:** Conical shell with brown stripes. Yellow/ brown operculum.
**Habitat:** Mid to high tide sheltered reef areas.
**Diet:** Grazes on micro-algae.

**Periwinkle**
*Nodolittorina unifasciata*

**Characteristics:** Small pale-blue snail often found in groups.
**Habitat:** Usually found in crevices or depressions in rocks.
**Diet:** Micro-algae and lichens.

**Dog Winkle/ Whelk**
*Dicathais orbita*

**Characteristics:** Oblong cream shell with green tinge. Dark tan operculum.
**Habitat:** In crevices on rock platforms and rocky shores.
**Diet:** Barnacles, worms, and ascidians.

**Chequerboard snail**
*Cominella lineolata*

**Characteristics:** Cream, fawn or greenish shell, chequerboard pattern.
**Habitat:** Rock platforms, rockpools and crevices.
**Diet:** Scavenger of plant and animal material.

**Ribbed top-shell**
*Austrocochlea constricta*

**Characteristics:** Light tan shell with obvious raised encircling ribs.
**Habitat:** Rock surfaces, rockpools, mudflats, seagrass. Often leaves trail in the sand of rockpools.
**Diet:** Microalgae.

**Onchidella**
*Onchidella patelloides*

**Characteristics:** Slug like animals with leathery skin. Air breathing.
**Habitat:** Shelters in rock crevices during the day emerging at night or on overcast days.
**Diet:** Scrapes algae off rocks.

**Mussel**
*Xenostrobus pulex*

**Characteristics:** Two shiny, black shells hinged at the base. Usually forms dense black matts.
**Habitat:** Exposed areas. Attaches to rocks using strong threads.
**Diet:** Filter feeds on plankton.

**Common Seastar**
*Patiriella calcar*

**Characteristics:** Variable in colour (mottled) with light underside.
**Habitat:** Rockpools, sheltered areas.
**Diet:** Omnivore – algae, detritus and animal material.

**Tubeworm**
*Galeolaria caespitosa*

**Characteristics:** The worm is encased in a hard, white tube.
**Habitat:** Exposed rock platforms, jetty pylons.
**Diet:** Uses fan like tentacles for filter feeding plankton.

**Waratah Anemone**
*Actinia tenebrosa*

**Characteristics:** Soft, jelly like animal with tentacles. Out of water the tentacles are retracted and it appears as a dark reddish blob.
**Habitat:** Intertidal areas in crevices, rockpools and underneath rocks.
**Diet:** Uses stinging tentacles to capture prey.

**Barnacle**
*Chthamalus antennatus*

**Characteristics:** Cream coloured with six outer plates
**Habitat:** Exposed rock surfaces.
**Diet:** Uses long feathery 'legs' to capture plankton.

**Shore Crab**
*Paragrapsus quadridentatus*

**Characteristics:** Small (max 5cm) variable in colour.

**Habitat:** Under rocks and in crevices.

**Diet:** Scavenger.

**Cunjevoi**
*Pyura stolonifera*

**Characteristics:** Brown, but often covered in green algae with two siphons (openings).
**Habitat:** Sessile living low on rocky shore
**Diet:**plankton.

**Coralline Algae**
*Corallina sp.*

**Characteristics:** Branched fronds hardened with calcium carbonate. Pink to white in colour.
**Habitat:** Rock platforms and in rockpools with strong wave exposure.

**Neptune's Necklace**
*Hormorsira banksii*

**Characteristics:** Olive brown and spherical segments.
**Habitat:** Lower intertidal areas attached to rocks.

**Turf Red Algae**
*Gelidium pusillum*

**Characteristics:** Grows as a mat resembling turf.
**Habitat:** Lower levels of rocky shore.

Example handout of estimation guide, adapted from Figure 11., Page 98. McDonald, R., Isabel, R., Speight, J., Walker, J., & Hopkins, M. (1998). *Australian Soil and Land Survey: Field Handbook.* Canberra: CSIRO