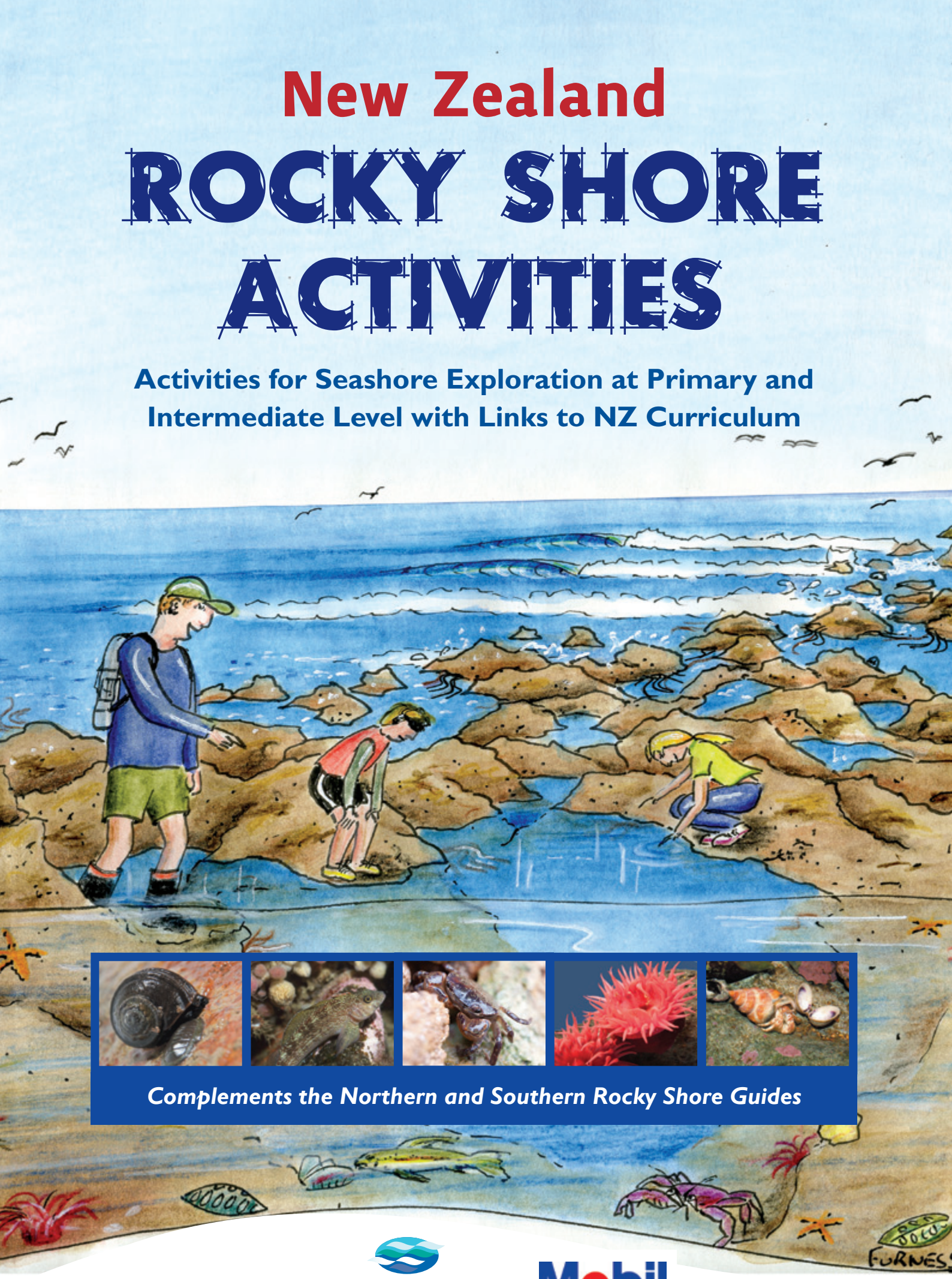
# New Zealand
# ROCKY SHORE ACTIVITIES

## Activities for Seashore Exploration at Primary and Intermediate Level with Links to NZ Curriculum





*Complements the Northern and Southern Rocky Shore Guides*

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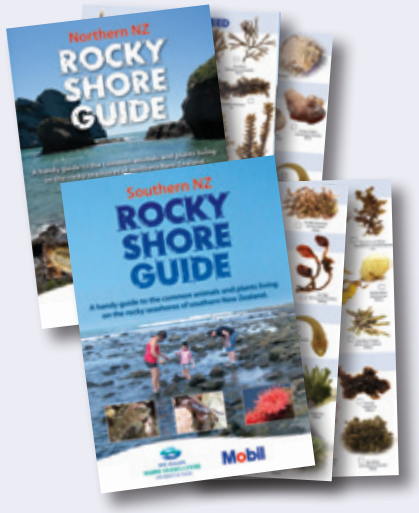
# INTRODUCING... ROCKY SHORE RESOURCES




The **Rocky Shore Guides** (left) and this **Activity Book** are designed to aid in the study of the rocky shore and can be used together or individually. This book contains activities that can be carried out during a class trip to the rocky shore as well as classroom based pre- and post-trip activities. The activities are independent of each other and can be used in any order or combination. The activities are aimed at **science living world levels 3-4** of the NZ Curriculum but could easily be modified for other levels. Copies of the Rocky Shore Guides are available on request from the NZ Marine Studies Centre.

**Key to Symbols**

Classroom Activity 

Field trip Activity 

**Mobil Oil New Zealand Limited** provides funds for community projects in areas where it operates and has been supporting the NZ Marine Studies Centre to develop and promote marine education resources since 2008. Mobil congratulates the NZ Marine Studies Centre on producing the Rocky Shore Activity Book to complement the Southern and Northern Rocky Shore Guide publications. This initiative, which aims to promote awareness of seashore marine plants and creatures, will be an excellent resource for schools, environmental/coastal groups and families. Further information about Mobil's operations and community programmes is available at www.mobil.co.nz

The University of Otago's NZ Marine Studies Centre showcases marine life from southern NZ waters and provides expert knowledge and education about New Zealand's marine environment. The educational programmes involve students in the excitement of scientific discovery, develop knowledge and skills and encourage individuals to take responsibility and action for the future of our ocean resource. Contact the NZ Marine Studies Centre for further information about the range of educational programmes and resources available for schools and interest groups.

Scan this QR code to go directly to our website for more resources and information.

## SCHOOL VISITS TO THE NZ MARINE STUDIES CENTRE

***Primary and Secondary School options available***

***Call (03) 479 5826***

***email marine-studies@otago.ac.nz***

***visit www.marine.ac.nz***

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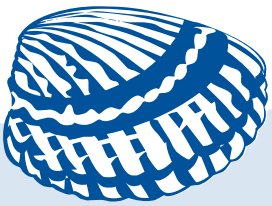
# Introduction to Rocky Shores



Rocky shores come in all shapes and sizes. Exposed coastlines, such as headlands, are often made of continuous rock. In quieter waters, rocky shores may take on a different form. They are often made of cobble, smaller rocks piled on top of each other.

### Are Rocky Shores suitable for life?

These shores are the most densely populated and show the greatest diversity of plants and animals of all the seashore types. In fact you can find representatives from almost every animal group living on these shores. Rocky shores provide a firm surface for plants and animals to attach to and many different places to live: in a crevice, under a boulder, on top of a rock, in a rock pool, beneath seaweed, on the protected side, on the wild side, high on the shore or low on the shore.

Living conditions on the shore vary according to the vertical position on the intertidal zone. Creatures living in the high tide zone are exposed to air for a longer time period than those living in the low tide zone. Exposure to air means higher (or lower) temperatures, danger of drying out, changes in salinity, difficulty breathing if gills dry out, no planktonic food and the possibility of being eaten by birds and other land predators.

Special adaptations have evolved which allow certain plants and animals to survive in this stressful environment. Many animals have hard shells for protection against drying out. Body shape and attachment structures are important to avoid being knocked off by waves. Most animals stop moving at low tide, slow down their metabolism, and just wait until the tide comes in.

### Who lives on the Rocky Shore?

The rocky shore resembles a garden at low tide. There is a lush growth of red, brown and green seaweed forming a carpet over the rocks. Under this carpet is a diverse collection of marine invertebrates such as sponges, sea anemones, worms, snails, starfish and crabs. Small fish are common in the pools and if you are lucky you will see a fur seal hauled out on the rocks.

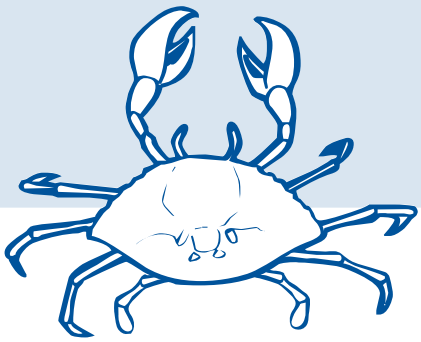
Rocky shores clearly illustrate a vertical zonation pattern. Animals and plants are distributed in distinct horizontal bands. In general, the upper distribution is set by their ability to survive exposure to the air and the lower distribution is controlled by predation and competition with other species for a space on the rock. The rocky shore community also changes as you move from sheltered to exposed areas as the environmental conditions differ between these two habitats.

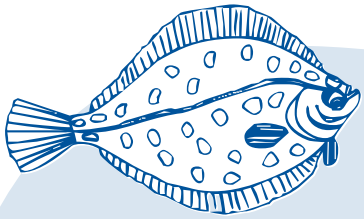
### What do Rocky Shore animals eat?

Seaweeds are abundant on the rocky shore so you would expect to find many vegetarians. Grazers like snails and kina work hard to keep the plants trimmed. Filter feeding is very important for those species that are permanently attached to the rock surface. Barnacles and mussels have specialised structures for filtering the plankton out of the water when it flows past at high tide. Scavengers such as crabs remove the dead and dying from the community. Predators are constantly searching for a tasty meal so methods of defence become important.

### Why are Rocky Shores exciting?

These shores change continually with the seasons and the tides, so that every seashore trip leads to an interesting discovery.





# Curriculum Guide

| | ACHIEVEMENT OBJECTIVE | CLASSROOM PRE-TRIP ACTIVITY | FIELD TRIP | CLASSROOM POST-TRIP ACTIVITY |
|---|---|---|---|---|
| NATURE OF SCIENCE Levels 3-4 | ***Investigating Science Levels 3-4***<br>Ask questions, find evidence, explore simple models & carry out appropriate investigations to develop simple explanations. | Time and Tide | Seashore Study<br>Tide Pool Study<br>Rocky Shore Study – Crabs<br>Crab Crawl | Specific Heat |
| | ***Participating and Contributing***<br>Use their growing science knowledge when considering issues of concern to them. | Design a Seashore Code<br>Environmental Action Planner | Tracking our Trash | Tracking our Trash |
| | ***Understanding about Science***<br>Appreciate that science is a way of explaining the world & that science knowledge changes over time. | | | Become a Marine Scientist<br>Survey Data Graphing |
| | ***Communicating about Science***<br>Begin to use a range of scientific symbols, conventions and vocabulary. | Design a Seashore Code<br>My Research Project | | |
| LIVING WORLD Levels 3-4 | ***Ecology Levels 3-4***<br>Explain how living things are suited to their particular environment and how they respond to environmental changes both natural and man made. | Survivor Seashore<br>Seashore Stage – Pre-Trip activity<br>Tangaroa – God of the Sea | Seashore Study<br>Tide Pool Study<br>Rocky Shore Study – Crabs<br>Crab Crawl<br>Survivor Seashore | Seashore Stage – Post-Trip activity<br>Design a Seashore Species |
| | ***Evolution Levels 3-4***<br>Begin to group plants, animals & other living things into science based classifications. | Something's on My Back<br>Who Am I? | Scavenger Hunt | Pressing Seaweed |
| | ***Life Processes Level 3-4***<br>Recognise that there are life processes common to all living things and that these occur in different ways. | | | Mussels Inside and Out<br>Who Am I? |

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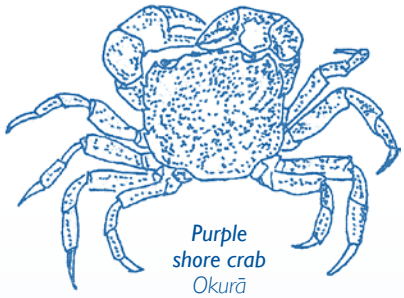
# Crustaceans

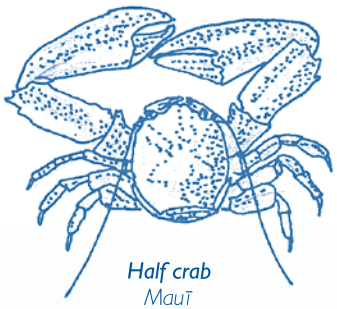
Related to insects, this group typically has a hard exoskeleton and jointed legs. Many crustacean species are planktonic and never grow to more than a millimetre in length.

*Hairy handed crab*
*Pāpaka*

*Crabs* scuttle sideways to hide under rocks and seaweed where it is damp and out of the view of birds.



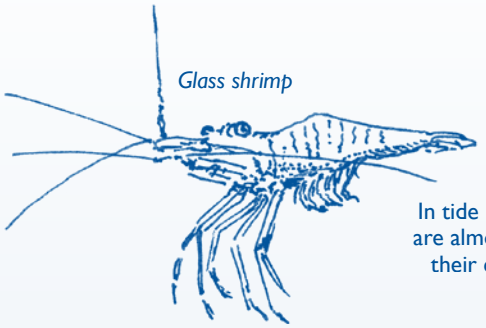
*Purple shore crab*
*Okurā*



*Half crab*
*Maurī*

The exoskeleton resembles a volcano, but when the top door opens, the *barnacle* kicks out its hair-covered legs to filter tiny plankton from the passing water.

*Barnacles*
*Werewere*



*Glass shrimp*

In tide pools *Glass shrimp* are almost invisible due to their clear exoskeletons.

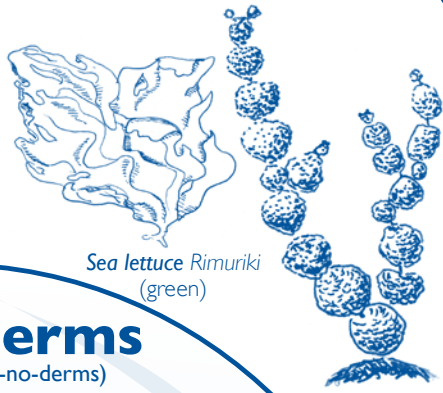
# Seaweeds Rimurimu

Plants in the ocean are vital as food producers and oxygen releasers. Oceanic plants may produce as much as 70% of the world's oxygen. Phytoplanton are microscopic but seaweeds are macroscopic and easy to find. Look out for the three main groups; red, green and brown.

*Bladder kelp*
(brown)



*Corallina*
(red)



*Sea lettuce* Rimuriki
(green)

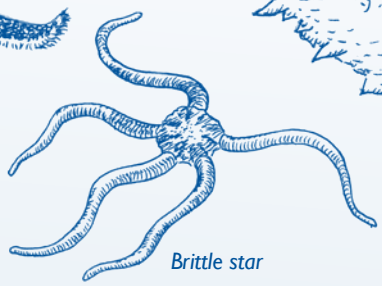
*Neptunes necklace*
(brown)

# Echinoderms

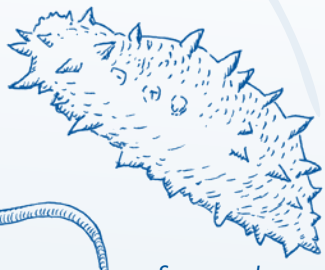
(pronounced ee-ky-no-derms)

The name refers to the spiny-skin of this group.
All echinoderms have radial symmetry like the *seastar*.
They have water-filled tube feet for holding on to the rocks and are able to grow back lost body parts.
They are found only at the water's edge and deeper.

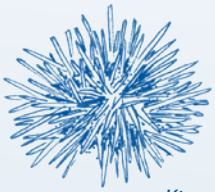
*Spiny sea star*
*Pātangatanga*



*Brittle star*



*Sea cucumber*



*Kina*
*Kina*

# Sea Squirts (ascidians)

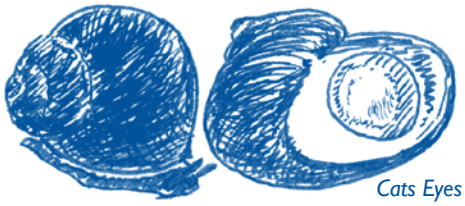
Some sea squirts are colonial and look like shiny jelly. Others are solitary with obvious openings where water is pumped in and out to filter food.

*Solitary sea squirt*

*Sea tulip*
*Kāeo*

# Molluscs

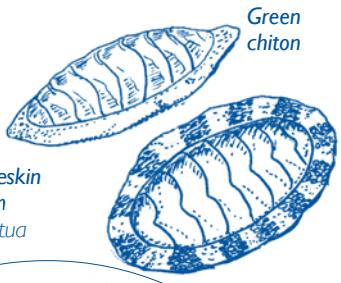
Despite the variety, most molluscs share a basic body plan with a muscular foot and a protective shell. They are well adapted for life in the intertidal zone as the shell helps keep them wet and cool.



*Cats Eyes*
*Atāta*

## Chitons

(pronounced kai-ton)
Chitons have eight interconnecting shell plates allowing them to mold to uneven rock surfaces.



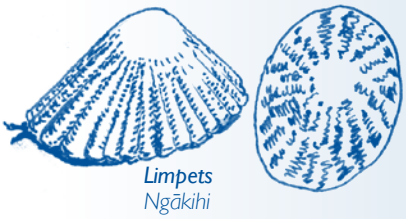
*Green chiton*

*Snakeskin chiton*
*Papatua*

## Snails Pūpū

Snails come in many shapes: long and thin, short and fat, with shell and without! Most snails are grazers, but whelks prey on barnacles and mussels.

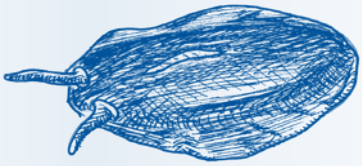
*Whelks*
*Titiko*



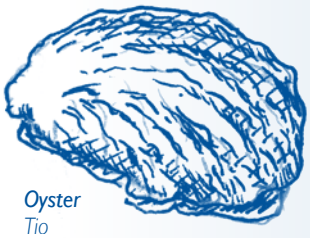
*Limpets*
*Ngākihi*

*Top snails*
*Pūpū*

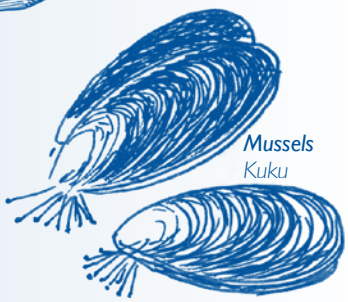
*Limpets* have a cone-shaped shell for protection. The shell of the ducks-bill limpet is small so it relies on its bad taste for protection.



*Ducks-bill limpet*
*Rori*



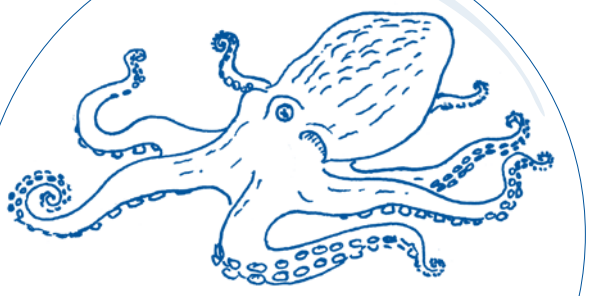
*Oyster*
*Tio*



*Mussels*
*Kuku*

## Bivalves (two shells)

Bivalves like mussels and oysters filter feed. Extremely efficient plankton feeders, mussels can filter 6-9 litres of water per hour at high tide. At low tide the shells are pulled tightly closed to prevent them from drying out.



## Octopus Wheke

Common but often unseen, octopus lurk in the shallow water. Crab shells, leftover from its supper, may mark the entrance to an octopus lair!

# Cnidarians

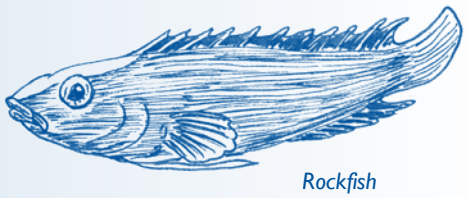
(a silent 'C' -pronounced ny-dairy-ans)
All cnidarians have stinging tentacles which stun their prey. Luckily, most *anemones* have such small stinging cells they can't hurt us. However, beware of the blue bottle jellyfish often found washed up on the beach.

*Anemone* *Kōtere moana*

# Fish Ika

During low tide you will only see small fish living in the rock pools. Triplefins may be found under large rocks at low tide guarding eggs.
Most fish are predators or scavengers, but some species are vegetarians and feed on seaweed.

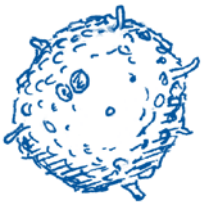
*Triplefin*



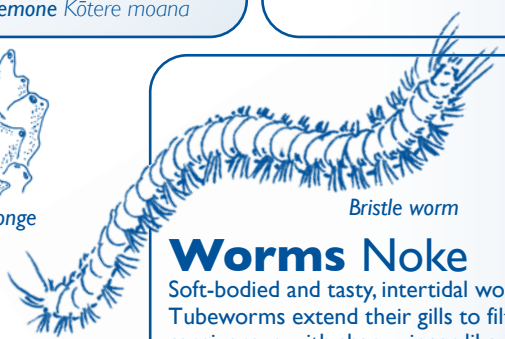
*Rockfish*

# Sponges Kōpūpūtai

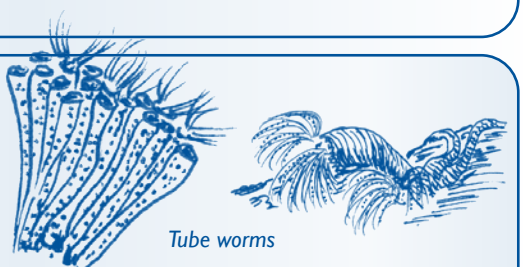
*Encrusting sponge*



*Golfball sponge*



*Bristle worm*



*Tube worms*

## Worms Noke

Soft-bodied and tasty, intertidal worms hide in the sand or in their own hard tubes. Tubeworms extend their gills to filter plankton at high tide. The bristle worms are carnivorous with sharp pincer-like jaws.

Sponges are not plants but rather an apartment block of individual animals living together as one organism. On the rocky shore they keep a low profile and often encrust rocks and shells. Sponges suck water in, filter out tiny plankton, then expel it through the larger openings.

# Time and Tide

The twice daily rise and fall of sea level is known as the tide. Tides are caused by the gravitational pull of the moon and sun on the earth's surface, resulting in a rise in water level in one area and a drop in water level in another area.

The relative position of the earth, sun and moon are continuously changing. The earth rotates on its axis, the moon orbits the earth and they both rotate around the sun. As a result the time and level of the tide varies from day to day. The period between each high and low tide is over six hours, and the time when the tide turns is about 50 minutes later each day.

Understanding tides is essential for exploring the seashore. Predicted times and levels of low tide can be found in the local newspaper or in a tide table book. Remember that these are just estimates. Weather (wind, barometric pressure) can affect the level of the tide.

## Objectives

- To investigate how tides work.
- To predict times of low tide using a tide table.

## What You Need

- Tide table for your region can be found online at www.linz.govt.nz/hydro/
- Graph paper

## Set-up Ideas

- This is a good planning activity to do before a field trip to the beach.

## Method

1. Discuss how tides are formed with your class.
2. Discuss the number of low tides per day and why it is important to plan a trip to the beach at low tide.
3. In the tide table book, find a port near you and the month of your field trip. Look at the low tide times and find a week that would be suitable for a field trip. e.g. low tides that are in the morning or midday.

## Results

1. Record the tide times and levels over a week period.
2. Graph the data.

## Discussion

1. When was the lowest tide? When was the highest tide? What was the tidal range?
2. How do you think the zero level (chart datum) was calculated?
3. Why would it be important to be able to predict the time and height of the tide?
4. Why would the tide times at Dunedin be later than the tide times at Taiaroa Head?
5. What factors affect the height of the tide, other than the sun and moon?
6. How do the tide times differ from day to day? How are tide times predicted?

## Extension Activities

Find tide times for different locations around NZ. Record this information on the NZ bathymetric chart. How does the tide move around NZ? Find out what the tide levels are at either end of Cook Strait at the same time.

tai nui = high tide
tai timu = low tide

# The Seashore Stage

Art and science have always been natural partners, but what about combining drama with science? The following activities can be done before and after a trip to the rocky shore.

## Objectives

- To understand environmental conditions and hazards faced by intertidal plants / animals and foster appropriate behaviour for seashore visitors through process drama.

## What You Need

- Paper
- String

## Pre-Trip Activity Method *(before the Rocky Shore Field Trip)*

1. Ask each student to draw a rocky shore and list the animals / plants they would expect to find living there. Discuss the tidal cycle.
2. Create the slope of the seashore using chairs or staircase or a natural slope in the playground. Position some students near the top at 'high tide' and some near 'low tide' and some in between at 'mid tide'.
3. Use a length of string to indicate where the water level is at high tide and explain that marine animals breathe and feed when they are covered by water. But as the water level drops, these activities become more difficult. Have the students hold their breath as the 'tide' passes below their face and take their next breath only when the 'tide' returns.
4. Repeat the process for two or three tides. The students near the top of the rocky shore will be finding it quite hard to get enough breath to last them while the 'tide' is out.

- So how do intertidal animals breathe?
- How does their environment change when the tide goes out?
- How do they survive when the tide is low? Brainstorm ideas with the class.

## Post-Trip Activity Method *(after the Rocky Shore Field Trip)*

1. Have students revisit their rocky shore drawing and make a second list with the animals/plants that they actually found living there. Were they found in the high, mid or low tide zone?
2. Each student chooses a role - an animal or plant that they encountered on the field trip to investigate further.
   - What does it eat?
   - How does it catch its prey, avoid its predators?
   - How does it move, stay damp and cool at low tide?
   - How does its behaviour change from high to low tide?
   - Some students may want to act as scientists, tourists or school children visiting the shore.
3. Have students make a hat or prop and name tag to illustrate their character.
4. Go back to the slope and have the students position themselves in the appropriate tidal zone. Present the following scenarios and give them 30 - 60 seconds to act them out:
   - Tide comes in
   - Tide goes out
   - Pollution washes up on the shore
   - A developer bulldozes the shore
   - A strange foreign seastar moves into the area
   - Plankton is abundant (plankton bloom)
   - A school class visits the shore

## Discussion

1. Ask the animals / plants how it felt to have people exploring their home.
2. Which scenarios had a positive effect on the seashore residents?
3. Which had a negative effect?

## Extension Activities

Environmental Action-As a class, write a code of conduct for the seashore. Present it as a poster and display it in a prominent place where visitors to the seashore will see it. Send it to the local paper etc.

# Design a Seashore Code

Beaches that are frequently visited by school children are often devoid of life. It is very important for students to understand how they can affect the seashore environment. It is important for the students to have some clear guidelines before they set off to explore the seashore.

## Objectives

- To become aware of how our activities can affect the seashore community.

## What You Need

- Rocky Shore Guide
- Tangaroa – God of the Sea (page 9).

## Set-up Ideas

- This activity is very important to do before a field trip to the seashore.

## Method

1. Have a brainstorm session with the students and list all the ways that our activities could harm the seashore creatures.
2. Read Tangaroa – God of the Sea (page 9).
3. Have the students develop a list of guidelines for the seashore trip to ensure that the plants and animals are not harmed and that the beach is left the way that they found it.
4. Compare the students' guidelines to the Seashore Code outlined on the back cover.

## Results

1. Practice these guidelines during a field trip to the beach. Have the students monitor the behaviours of their fellow students.
2. Modify the guidelines after the field trip.

## Discussion

1. Why is it important to develop a set of guidelines for seashore exploration? Do the guidelines depend on the seashore type?
2. What should you do if you see other people on the beach not following the guidelines?
3. Design a publicity campaign to inform the public about your seashore guidelines.

## Extension Activities

Draw a comic strip or write a story about a school field trip to the beach from a crab's point of view. Design a poster to illustrate the logo "Caring for Our Coast".

# Tangaroa – God of the Sea

Tangaroa is known as the God of the Sea. The tikanga (protocols/rules) that were practiced while gathering kai moana (seafood) acknowledged that kai moana belonged to Tangaroa and this had to be respected. Karakia (prayers) were said before people departed for the fishing grounds.

## Objectives

- To become aware of how our activities can affect the sea.

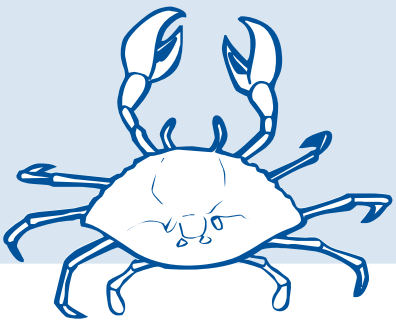
## Method

1. Read some of the traditional rules that are practiced while fishing and gathering kai moana.

- *Never turn your back on Tangaroa.*
- *No shouting and calling while food is being gathered.*
- *The food gatherers must leave home without ill feelings of any kind.*
- *Food gathered must not be eaten on the rocks or near the seashore, while food is still being gathered.*
- *The first of the catch must be put back in the sea.*
- *Small rocks and stones turned over while gathering seafood must be put back the way they were found.*
- *Never take more seafood than you can use.*

Excerpt from:
Between Land and Sea, a source book for teachers. *Dept of Conservation - 1988*

2. Identify the possible consequences of not following the traditional rules.



## Discussion

1. Do you think these protocols still apply to today?
2. Write some guidelines for your up coming trip to the rocky shore to ensure that the plants and animals are not harmed and that the beach is left the way you found it.

**My Guidelines...**

# Something's on My Back

This is a fun game to play with your students before or after the field trip to the beach. It may be a game that you play at the beginning of a unit to establish their prior knowledge and again at the end of the unit to evaluate how much they have learned.

## Objectives

- To become familiar with the characteristics of common seashore plants and animals.
- To determine the most helpful characteristics to focus on when trying to identify seashore creatures.

## What You Need

- Cut out pictures of rocky shore animals: follow this link to download the Rocky Shore Guide to make cut outs www.marine.ac.nz
- Sellotape

## Method

1. Divide the class into two groups. Group A selects a picture from the collection. Then they stick it onto the back of someone in Group B.
2. The students in Group B ask yes/no type questions of the other students in order to find out which plant/animal is on their back. e.g. "Does it live in sand?" "Does it have jointed legs?" "Does it have a shell?" "Does it eat plankton?"
3. Once everyone has discovered what is on their back, the groups swap roles.

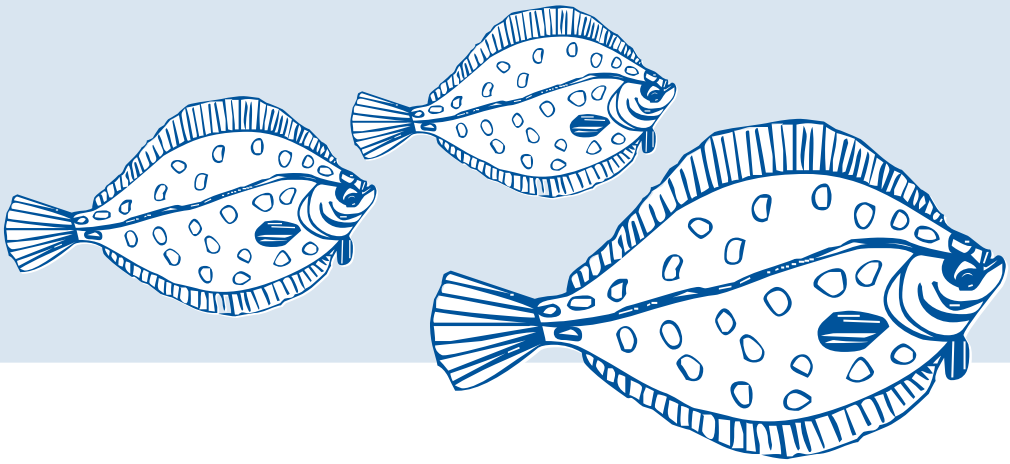
## Discussion

1. What questions did the students ask to find out what was on their back?
2. Make a list of all the questions and try to group them into categories e.g. questions about feeding, mobility, appearance, growth etc.
3. Which questions could be answered from looking at the appearance of the plant or animal? Which questions needed information on behaviour?

## Extension Activities

Have each student choose a species picture out of a hat. Have them investigate and do an individual project on that species. Have them come up with an inquiry question about this species to investigate while on a field trip to the seashore or the Aquarium. Students could present their results as a report, a poster or give a presentation to the rest of the class.

Students could use *My Research Project* activity sheet (pg. 11) to support their inquiry.





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# My Research Project

**Objectives**

- To choose a marine animal that you want to know more about.

**What You Need**

- As many different methods of research as you can find.

**Method**

1. Answer the questions below about your animal.

My animal is

What is the scientific name?

How big does the animal grow?

Where does it live?

What does it eat?

How does it go about getting food?

Does anything eat your animal?

What does your animal do to protect itself from being eaten?

What things might threaten or harm your animal?

What can you do to help look after it?

Draw a diagram of your animal here and label as many features as you can.

Draw a food web that involves your animal.

**Discussion**

1. What other questions do you have about your animal?

A great resource for this activity is the marine life database on our website:

**www.marine.ac.nz**

# Who Am I?

**Objectives**
- Identify who is who by using the clues.

**What You Need**
- Rocky Shore Guide

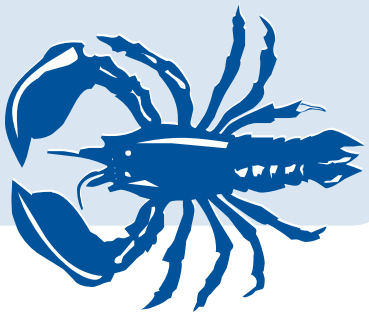
**Method**
1. Use the Rocky Shore Guide to help you identify who is who.
2. Match the name to the correct description.

| | | | |
|---|---|---|---|
| **Green shelled mussel** | **Paua** | **Hermit crab** | **Encrusting coralline algae** |
| **White whelk** | **Flat worm** | **Chiton** | **Spiny sea star** |
| **Intestine weed** | **Anemone** | **Barnacle** | **Neptune's necklace** |

| | | |
|---|---|---|
| *I am a bivalve (2 shells).*<br>*I can filter 9 litres of seawater in an hour to capture plankton.*<br>*I attach myself firmly to rocks with my byssus threads.* | *I scavenge dead food off the seafloor.*<br>*I am a crustacean with an exoskeleton.*<br>*I make my home out of an empty shell.* | *I cement my head to rocks.*<br>*I kick out my feet to filter feed on plankton.* |
| *I am a type of snail.*<br>*I use my radula (zipper-like tongue) to drill a hole in the shell of my prey.* | *I am a producer and need sunlight to grow.*<br>*I am brown.*<br>*I am named after a Greek god and a piece of jewelry.* | *I use my strong arms to open shellfish.*<br>*I push my stomach outside of my body to eat my prey.*<br>*I am spiny to touch.* |
| *I am a vegetarian and like to graze on algae/seaweed.*<br>*Humans like to eat me.*<br>*The inside of my shell is brightly coloured.* | *I am a red producer.*<br>*I am only found on top of rocks.* | *I am a grazer and scrap algae off rocks with my radula (zipper-like tongue).*<br>*My shell is made up of 8 plates.* |
| *I am a green producer.*<br>*I am named after a human organ.* | *I use my tentacles to sting my prey.*<br>*I attach myself to rocks.*<br>*My mouth is also my bottom.* | *I am flat, thin and slimy.*<br>*I scavenge my food, eating dead things and poo.* |

**Extension Activities**

1. Choose an animal and use the measurement on the Rocky Shore Guide to draw a life size sketch of it.
2. Write a definition for the following terms
   *grazer* *scavenger* *predator* *filter feeder* *producer*
3. Find out who eats who and create a rocky shore food web.





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# Scavenger Hunt

**Objectives**

To look for items on the beach that have certain characteristics.

**What You Need**

Beach

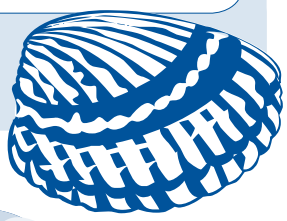
**Method**

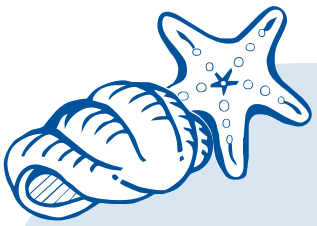
1. Look for the following on the beach. *Remember not to collect anything that is alive, just describe it.*
2. Write/draw what you find.

1. Something smooth.
2. Something bumpy.
3. Something that is soft.
4. An animal with more than 2 legs.
5. Four different shaped shells – think about the type of animal that made the shell.
6. Something man-made – think about where it came from.
7. Something that has been in the water for a long time.
8. Something spikey or hairy.
9. Something with joints.
10. Something that is hiding. Describe how it is hiding.
11. Two colours and shapes of seaweed. Draw them.
12. Two interesting smells. Describe them.
13. Something that hangs onto the rocks and is hard to lift off.
14. A shell with growth rings.
15. Something that is red.
16. A shell with a round hole in it – think about how the hole was made.
17. Something that is special to you. Why is it special to you?

**Extension Activities**

1. Create your own category to add to the Scavenger Hunt from something you find at the beach.







# Rocky Shore Study – Crabs

Some crabs have big nippers, some are flat, some look like seaweed and some can swim. Each species has a special place to live and unique adaptations to survive there. Students will survey the local crab populations, look at the life history stages under the microscope (eggs, planktonic larvae, juveniles, adults), and become a scientist for a morning to find out more about the feeding strategies of these crusty creatures.

## Objectives

- To conduct a scientific survey of the crab population on your local shoreline.
- To develop your students' investigative skills and attitudes.

## What is a survey?

Scientists use survey methods to learn about biological communities. Many of the methods they use can be used by students of all ages. Surveys need to be uncomplicated, logical and systematic. Techniques used in shore sampling include using quadrats and transects to determine patterns of abundance and distribution of organisms.

Quadrats (square frames which define a measured area) are used to obtain data from a sample of the population when it is impossible or too time consuming to obtain data from the whole population. As long as the data is collected from a large enough number of samples and those samples are a good representation of the whole population, then the data can represent the whole population. Use hoops (from P.E. class) to define spaces if your school does not own a set of quadrats.

Transects (measured lines) are used to look at the change in a community over an environmental gradient (e.g. the tidal level). The transect line should be positioned across the gradient (e.g. from high tide to low tide). Use measuring tapes or measured lengths of rope.

## Before the Field Trip

Visit the shore yourself to become familiar with the crab species found there, identify potential hazards and define the boundaries of the study.

Check tide tables and plan your visit around the time of low tide.

## Seashore Code

Please minimise disturbance of the seashore community during your study.

- Observe crabs and marine species where you find them. You may place them in containers in cool sea water for short periods only and return them to the place of collection.
- Handle crabs and other marine species carefully and only when necessary.
- Remember to turn rocks back the way you found them.
- Wear appropriate footwear and watch for waves!
- Take your rubbish home with you and pick up any left by others.

## Field Trip – What You Need

- Ice cream containers
- Transect (measured line)
- Quadrat (square frame)
- Thermometers
- Rocky Shore Guide
- Small aquarium nets
- Camera
- Rubbish bag to collect shore litter

## Habitat Description

Have students record the physical features of the shore with photographs, sketches, written descriptions and measurements. Details may include:

- Map of study area (e.g. open coast or protected bay)
- Weather (e.g. wind direction and strength, cloud cover)
- Temperature of water and air
- Tidal level and range
- Direction of exposure (e.g. west facing)



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# Crabs Continued

- Level of exposure (e.g. size and frequency of waves)
- Sediment type (e.g. sand, mud, loose cobble or bedrock)
- Signs of human impact

Give students time to explore the environment before you expect them to focus on the survey.

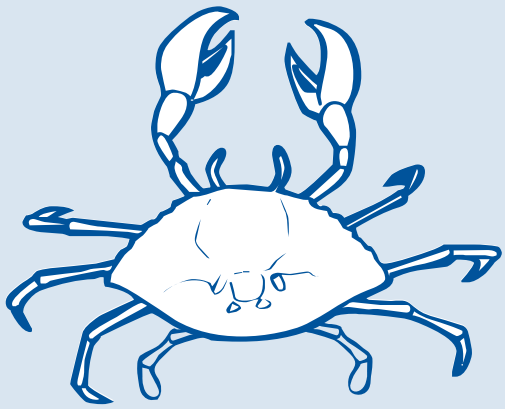
**Method – *Design a Crab Survey***

1. *Brainstorm the conditions crabs experience on the seashore at low and high tide.*
2. *Choose a crab species known to be common on your chosen seashore.*
3. *Research as much information about your chosen species as possible (e.g. distribution, diet, life cycle, predators).*
4. *Develop questions about your chosen crab species that can be answered by surveying a local population.*
5. *Design a survey to investigate a question. Show the class a list of the equipment available to them and discuss how it may be used.*
6. *Make a tally sheet to record the data you want to collect.*
7. *Predict what you expect to find out with your survey and give your reasons.*
8. *Conduct the survey and collect your data.*
9. *Collate and present the data (e.g. tables and graphs). You may want to compare or pool the findings of different groups.*
10. *Analyse and discuss your data. Suggest reasons for the patterns observed.*
11. *Compare your results with your predictions.*
12. *Identify the limitations or problems with your survey. How would you change the survey method if you had more time? What other equipment would be useful?*

**Discussion – Crab Survey Ideas**

Rocky shores are rich with crabs hiding under rocks and seaweed, in rock crevices and tidal pools. Some questions to explore include:

- What is the most common type of crab found at high tide? low tide?
- Are there more female crabs then male crabs? How many are carrying eggs?
- How many crabs have missing legs?
- What is the average size of crabs on the shore?
- Are more crabs found under bigger rocks?
- Do you find different types of crabs under the same rock? in the tidal pool?



# Crab Crawl on the Rocky Shore

**Objectives**

- To compare the crabs found at different tidal levels on the rocky shore.

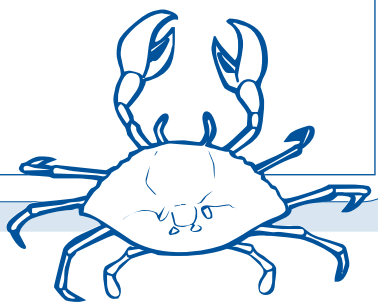
**What You Need**

- Quadrats or hula-hoops

**Method**

1. Place a quadrat or hula-hoop at low, mid and high tide.
2. Use a Rocky Shore Guide to help you identify the different crabs in your quadrat or hula-hoop.

| Low tide | What sort? | How many? |
|---|---|---|
| Mid tide | | |
| High tide | | |





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# Survey Data Graphing

Graphing your shore data will help you see patterns in the seashore community that aren't always noticeable. Below is actual shore survey data taken at the NZ Marine Studies Centre's rocky shore.

| | | Number of | | | |
|---|---|---|---|---|---|
| **Date** | **Tide Zone** | **Half Crab** | **Common Rock Crab** | **Green Chiton** | **Snakeskin Chiton** |
| 8/2009 | Low | 5 | 4 | 11 | 17 |
| | Mid | 1 | 3 | 0 | 7 |
| | High | 0 | 2 | 0 | 1 |
| 11/2009 | Low | 4 | 0 | 29 | 17 |
| | Mid | 2 | 6 | 0 | 1 |
| | High | 0 | 2 | 0 | 5 |
| 12/2009 | Low | 2 | 0 | 18 | 18 |
| | Mid | 0 | 2 | 5 | 4 |
| | High | 0 | 1 | 0 | 1 |

### Objectives

- To look for patterns in rocky shore data.

### What You Need

Rocky Shore Data · Graph paper · Pencils/rubbers

### Set-up Ideas

- This activity is great to do with your own data when a class does a survey.

### Method

1. Review the data table. Decide what kind of graph would be good to plot the data on (line, bar, pie, etc.).
2. Create the graph.
3. Interpret the graph.

### Discussion

1. Describe the tidal zone where the most chitons were found.
2. Describe the tidal zone where the most crabs were found.
3. Did the number of chitons increase or decrease as you moved away from the water?
4. Did the number of crabs increase or decrease as you moved away from the water?
5. How would you explain this distribution pattern?
6. If you had to find Green Chitons and Half Crabs – where would you predicate you'd have the most luck in looking? Why do you think that is?

### Extension Activities

Pick 2-3 animals from the shore survey you did and graph the results. Compare it with a classmate's. What can you say about the animals/plants you found by interpreting your graph?

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# SURVIVOR SEASHORE

*Pre- or Post-Trip Activity*

## An environmental game about living on the rocky shore

***This game helps people to understand the stresses on animals living on the beach. There is choice involved and a certain amount of luck too. The aim of the game is to survive through to the end without succumbing to a bad end!***

### PREPARATION

Photocopy and enlarge the crab pictures so they can be placed on the ground and stood on. Make up a 'Survivor' disk that indicates if you survived or perished. A simple disk, coin, piece of card or bottle top coloured red on one side and green on the other is OK. A classier disk with "Lucky you survived." and "Sorry you didn't make it." on the other is good too. If playing with a big group it helps to have several disks (say 12) so the fate of more than one player can be found out.

### PLAYING THE GAME

Explain to the class that they are going to be crabs on the beach. Crabs have legs and can move. They can survive both in water and out of it for quite long periods of time, but surviving can be difficult all the same. As a crab they are a little limited in what they can do but some suggestions are on the laminated crab pictures (Run, Sleep, Hide under a Rock, Find a Tide Pool, Fight, etc.)

Distribute the crab pictures on the ground within a comfortable talking distance.

Take the first card and read out the scenario to the group, for example, a flock of seagulls arrive.

The children now must decide what they are going to do. For example, Run, Hide, Fight etc. Give them time to discuss the options amongst themselves and then commit to a choice.

Now read out the corresponding consequences of their choice. If they have chosen a good option they survive. If the have chosen a bad option then they have failed to survive, however they are NOT out of the game but must remember how many times they have not survived. For those whose choice may or may not work out they must toss the 'Survivor' disk. The side that lands up determines their outcome.

The person(s) with the least 'deaths' is the survivor!

## 1. Heavy Rain

If you chose:

**Dive into the Sea** you have solved the rain effects but the shallows are full of predators like spotties. Make another choice now or you'll get eaten!

**Tide Pool** you may be in trouble, because the rain may dilute the salt in the pool causing you to swell up. Toss a Survivor disk to see if you survive.

**Digging in the Substrate** is not guaranteed. Toss a Survivor disk.

**Hiding under a Rock** and **Going to Sleep** are probably the best options. You must try and conserve body water.

For all other choices – toss the disk!

HAZARD

## 2. Some food washes in

For 'eat' to count at least some part of your body must be touching the card!

If you chose:

**Eat**, well done! Competition between individuals is often the most intense type of competition there is! Competition doesn't usually reward the winner, but may kill the loser! You don't need to be first, but don't be last!

**Fight** it may work if the other crabs don't win. Toss a Survivor disk to see if you survive.

**Hiding under a Rock** and **Going to Sleep** are good options, because you will conserve energy. Remember crabs don't use much energy not being warm-blooded, so food need not be a big issue.

For all other choices – toss the disk!

HAZARD

## 3. Flock of seagulls arrive

If you chose:

**Run** you are dead! Seagulls have good eyesight and will pick up movement easily.

**Fighting** is no good you will never beat a gull! You are dead.

**Tide Pool** you may be in trouble, because seagulls can swim. Toss a Survivor disk to see if you survive.

**Digging in the Substrate** and **Hiding under a Rock** are probably the best options.

For all other choices – toss the disk!

HAZARD

## 4. School kids arrive on the beach

If you chose:

**Run** you are dead! Kids have good eyesight and will see movement easily.

**Fighting** is no good you will never beat a human child! You are dead.

**Tide Pool** you may be in trouble, because children like tide pools. Toss a Survivor disk to see if you survive.

**Digging in the Substrate** and **Hiding under a Rock** are probably the best options.

For all other choices – toss the disk! Hope they don't try picking you up or you may get dropped. Hope they don't roll rocks around, because that will squash you. Hope they don't try and keep you as a pet!

HAZARD

## 5. A nearby landslip covers the beach with mud

If you chose:

**Dive into the Sea** you have solved the mud problem, and the predators will be put off by the mud. Good choice!

**Tide Pool** if you can find a tide pool it may be ok. It's a risk but this time you survive.

**Digging in the Substrate or Hiding under a Rock** is no good; the mud will clog your gills. You don't survive!

For all other choices – toss the disk!

How would you cope if machinery was brought onto the beach to clear the mud?

HAZARD

## 6. Stormy weather with big waves

If you chose:

**Hiding under a Rock** is a bad move! The rocks will roll around with the waves and squash you. You don't survive!

**Tide Pool** you may be in trouble, because the waves may explode so hard that you are flung up the shore. Toss a Survivor disk to see if you survive.

**Dive into the Sea** is probably the best option as there will be a little less water movement here.

For all other choices – toss the disk!

HAZARD

## 7. Hot sunshine and wind

If you chose:

**Dive into the Sea** you have solved the drying effects, but the warm water has attracted stingrays into the shallows. Make another choice now or you'll get eaten!

**Tide Pool** you may be in trouble, because the sun may concentrate the salt in the pool causing you to lose body water. Toss a Survivor disk to see if you survive.

**Digging in the Substrate, Hiding under a Rock** and **Going to Sleep** are probably the best options. You must try and conserve body water.

For all other choices – toss the disk!

HAZARD

## 8. Foreign seastars are taking over the beach

The North Pacific seastar would have no natural predators in New Zealand if they were to get here. They breed very fast, up to 20 million eggs a year. They eat anything!

You are in trouble! No place is safe, you will probably get eaten!

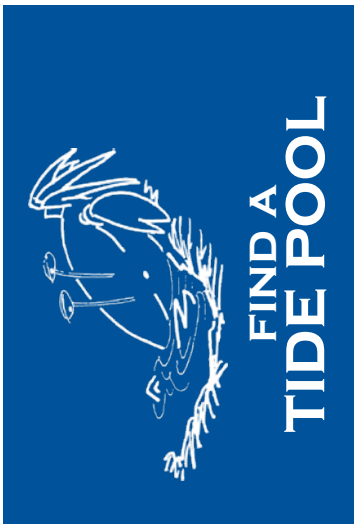
Whatever your choice – you must toss the Survivor disk twice to survive!

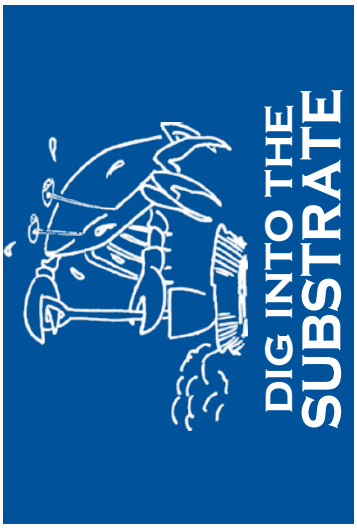
Good Luck!

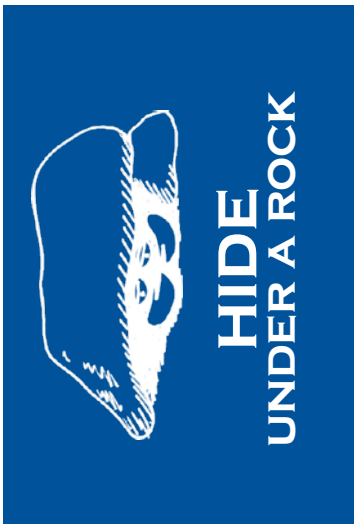
If you see a strange seastar it could be worth reporting it.

HAZARD

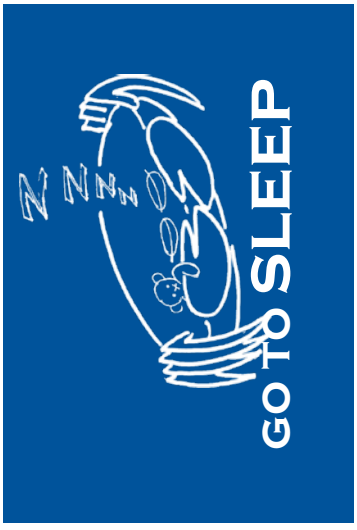
Photocopy and enlarge the crab pictures so they can be thrown on the ground and stood on! (You can laminate them as well.)







# Tide Pool Study

Temperature changes associated with the incoming tide may occur quickly, resulting in temperature shock.

### Salinity & Dissolved Oxygen – Notes

On hot days, fresh water evaporation from tidal pools, cracks and crevices may be quite significant. As a result the salinity of the water left behind increases. In contrast tidal pools may become diluted with fresh water on rainy days resulting in a decrease in salinity.

When water temperature increases, the solubility of oxygen decreases. On warm days, the amount of dissolved oxygen available to animals in tidal pools may be limited.

### Objectives

- To observe and record plants and animals found in a tide pool.
- Compare and contrast animals living in tide pools at different tidal zones.
- Identify stresses involved with living in a tide pool.
- To construct a tide pool food web.

### What You Need

- Rocky Shore Guides
- Paper, pencils, clipboards
- Thermometers, measuring tape
- Mussels (from supermarket)
- String, blue tac

### Set-up Ideas

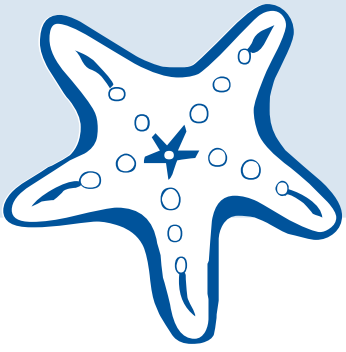
Prior to visiting the rocky shore explore the changing conditions of a tide pool (tides, oxygen, temperature and salinity.)

### Method

1. Have students work through all or some of the activities outlined on the Tide Pool Activity Sheet (page 21).
2. Encourage students to write down all the plants and animals found in their pool and find out what they eat. From this information they can then construct a tide pool food web.
3. Get students to identify the producers, grazers, filter feeders, predators, and scavengers in their tide pool.
4. Analyse data collected–make graphs, charts and diagrams.

### Extension Activities

- Predict how their tide pool would change when the tide comes in. They could then modify their food web to include the organisms that are brought in with the tide. Get students to explore and define the term 'ecosystem'. Have them consider if their tide pool is an ecosystem and explain their decision.
- Play marine charades. Use names and terms, which relate to the rocky shore and tide pool habitat. Have the students form teams and try and act out this new vocabulary
- Write a story or newspaper article about the activities in their pool.



# Tide Pool Activity Sheet

Choose a tide pool that is fairly shallow and observe it without disturbance for 10 minutes. Record your observations below and on the back of this sheet. Use the Rocky Shore Guide to help you identify plants and animals in your tide pool.

1. Circle your tide pool position: Low Mid High

2. Tide pool depth: _____ Diameter: _____

3. Measure the temperature of the water in the pool and at the ocean's edge.

   Temperature: Ocean _____ Tide Pool _____

4. Make a list of the animals and plants in your tide pool on the back of this sheet.

5. Sketch a bird's eye view of your tide pool on the back of this sheet.

6. Compare your pool with others at the same tidal height. How does the size and depth of the pool effect the temperature, diversity and density of life?

7. Place an open mussel in your tide pool, watch carefully for the next 5 minutes.

8. Describe how animals move and measure how far they move.

9. Blue tac a piece of string across the pool and record how many times a crab, snail or fish cross the line.

10. Write down 4 headings that could be used for newspaper articles about your tide pool.

| | |
|---|---|
| 1. | 2. |
| 3. | 4. |

11. Predict how weather changes effect the temperature and the salinity of the pool and the ocean.

12. Discuss the stresses involved with living in a tide pool and the adaptations that animals have, which allow them to survive.

# Seashore Study

The rise and fall of tides is the most important factor governing life in the intertidal zone. At high tide it is a great place to live; lots of sunlight, oxygen and food. But at low tide these animals are exposed to the air. Living conditions on the rocky shore vary according to the position in the intertidal zone.

## Adaptations

*Structural* – many animals have shells or exoskeletons to protect them. The shell allows them to retain moisture and provides a barrier to salinity changes. A secure means of attachment is important to maintain position from wave action. Barnacles cement their heads to rocks, limpets use suction and mussels secrete attachment fibres.

*Behavioural* – mobile animals are able to move under rocks and among seaweed to areas where it is damp and cool. Shelled animals close their shells during low tide.

*Physiological* – Many intertidal creatures have internal clocks that tell them when the tide is low. These creatures will slow down their metabolism and only carry out life sustaining activities. Moving, feeding and reproduction are put on hold.

## Objectives

- To observe and record plants and animals found on the rocky seashore using a quadrat.
- Compare and contrast animals that live in different tidal zones.
- Identify stresses with living on the rocky shore and the adaptations that organisms have which allow them to survive.

## What You Need

- Rocky Shore Guide
- Different coloured pens/pencils
- Quadrats or hula-hoops
- Seashore Study Data Sheet (page 23)

## Set-up Ideas

Prior to visiting the rocky shore explore the changing conditions of the intertidal zones (tides, oxygen, temperature and salinity – see tide pool teacher notes page 20).

## Method

1. Divide class into small groups of 3-4 students.
2. Give each group a quadrat or hula-hoop to place somewhere along the shore. Ensure each of the different tidal zones is being surveyed.
3. Using the activity sheet, students record the number of plants and animals found and map what they see in their quadrat using symbols.

## Extension Activities

1. Back in class groups recreate a life-size version of their quadrat. Lift a flap could be used to represent rocks and then draw what was found under each rock.
2. Compare and contrast animals in the different tidal zones.
3. Display enlarged quadrats to make a cross section of the rocky shore.
4. Have students find out about adaptations (structural, behavioural and physiological) that animals have evolved to allow them to survive in the rocky shore habitat.

# Seashore Study Data Sheet

### Conditions of the Intertidal Zone

Observe the plants and animals that are found on the seashore. List 4 problems that these marine creatures have to deal with at low tide.

1. 2.

3. 4.

### Distribution of Plants and Animals (Quadrat Study)

1. *Work in groups of 3 or 4 persons.*
2. *Choose a 1metre area (quadrat) that has been placed on the shore. Record the number of animals and plants found in the table below.*
3. *Map your quadrat on the back of this page. Create your own key and symbols.*

### Quadrat Map

Circle where your quadrat is – Low tide Mid tide High tide

| Animals | Number | Plants | Number |
|---|---|---|---|
| Barnacles | | Greens (green coloured) | |
| Limpets | | Sea lettuce | |
| Chitons | | Other greens | |
| Snails | | | |
| Shore crabs | | Browns (brown coloured) | |
| Half crabs | | Bladder kelp | |
| Sea stars | | Neptune's necklace | |
| Tube worms | | Other browns | |
| Mussels | | | |
| Oysters | | Reds (red coloured) | |
| Sea slugs | | Moss weed | |
| Others | | Encrusting coralline algae | |
| | | Other reds | |

# Tracking our Trash

Did you know up to 90% of marine rubbish found on coasts worldwide is related to purchased drinks –caps, straws and all the other packaging?

## Background

New Zealanders throw away 3.6 million tonnes of rubbish each year. This is equal to 400,000 buses of rubbish or more than 1000 buses of rubbish per day! (Bus weight 9 tonnes). Considering that no one in NZ lives more than 130 km from the sea – what is the likelihood that some of this rubbish will end up in the sea?

In addition to being unsightly, rubbish is a hazard to boats and divers and it poses a real threat to marine wildlife. Plastics, which generally make up about 60 percent of rubbish, are the worst offenders. An estimated 100,000 marine mammals and turtles around the world are killed annually by plastic rubbish. They can be trapped and strangled by fishing line, netting, rope and bait box packaging bands. If muzzled by plastic litter, they can starve to death. Plastic is also mistaken for squid or jellyfish and eaten by marine animals. Animals who swallow plastic items can starve to death because it can accumulate in their digestive tract and make them feel "full" which stops them looking for real food.

A leading cause of marine debris is thoughtlessness– people making the poor decision to litter.

## Animals particularly at risk

***Marine mammals*** *(seals, sea lions, whales, dolphins, porpoises)*

- *Almost half of all marine mammal species have been found entangled in fishing nets and line and some have been found dead from suffocation or starvation after having ingested marine litter like plastic bags and plastic sheeting.*
- *Approximately 100,000 are killed each year.*

***Seabirds***

- *Frequent victims of abandoned fishing nets. Many birds are entangled in six-pack rings and 111 different species of seabirds are known to ingest plastics.*
- *Anywhere from 700,000 to 1 million seabirds are killed by entanglement and ingesting litter each year.*

***Fish and crustaceans***

- *Lobsters and crabs are frequently caught in lost or discarded fishing gear through ghost fishing (nets and traps). Fish can also ingest plastic pellets.*

***Sea turtles***

- *Entanglement may occur but ingestion is the main issue as plastic bags look like their favourite food, jellyfish.*

***Corals***

- *Killed when discarded fishing gear and nets drag along the ocean floor. As coral reefs provide a home for lots of other animals, these species are also affected.*

Plastic items regurgitated by the Northern Royal Albatross at their Taiaroa Head nests include squid lures and plastic fishing floats. A hair curler and blue bait box packing tape were found in the stomach of a petrel that washed up on one of the Otago Peninsula beaches.

## Objectives

- To understand how marine debris can affect the local marine environment and raise the community's awareness of how they are responsible.

## What You Need

- Rubbish sacks
- Gloves (optional)
- Card and other materials to make the display

## Method

1. Take your class on a field trip to pick up rubbish. This could be to the beach, school grounds, town centre, area around a river or stream. (With younger groups you could try a rubbish relay, where each team sends out one member at a time to find a piece of rubbish. The team with the most rubbish after a set time period wins.)
2. Discuss how this rubbish could have been transported to the ocean.



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Results Example:

| Item | # Collected | Harm Rating (1=rarely, 2=sometimes, 3=very harmful) | | | |
|---|---|---|---|---|---|
| | | Animal | People | Boats | Places |
| Fishing Net | 2 small pieces | 3 (entanglement) | 2 (divers could get tangled in large pieces) | 3 (net could wrap around propeller) | 1 (unsightly) |
| | | | | | |
| | | | | | |

3. Sort through the rubbish, identify and quantify the different components and find out how long it would take the different items to break down in the sea.
4. Decide how harmful each type of marine rubbish would be if it came in contact with marine animals, people, boats and places.

## Results

1. Visually present the data collected in a table or graph form (see above).
2. Create a display with the rubbish and the biodegradation time line data to inform the public of how their actions are killing life in the sea.
3. Put up the display either in the area where the rubbish was collected or an area where it will be viewed by large numbers of people.

## Discussion

1. How might you measure what impact your display has had? (Do a second collection one or two months later, compare your results with the original data to see if your display may have resulted in changed behaviours).
2. Brainstorm ideas about how we can change our behaviour to reduce the amount of marine rubbish.
3. As a group, prepare an action plan to change people's behaviour.

## Extension Activities

1. Visit the NZ Marine Studies Centre to increase your knowledge of local marine life and question staff about the impacts of rubbish on local marine species.
2. Visit the Royal Albatross Centre to learn about local seabird species and find out how marine rubbish affects albatross and other seabirds.
3. Adopt-a-beach (or park, street, shopping area) and take responsibility for keeping it litter free by collecting rubbish regularly.

**Marine Debris Biodegradation Time Line**

| Item | Time to Degrade |
|---|---|
| Paper towel | 2-4 weeks |
| Newspaper | 6 weeks |
| Cardboard box | 2 months |
| Waxed milk carton | 3 months |
| Apple core | 2 months |
| Cotton gloves | 1-5 months |
| Cotton rope | 3-14 months |
| Wool gloves | 1 year |
| Plywood | 1-3 years |
| Painted wooden sticks | 13 years |
| Photo-degradable beverage holder | 6 months |
| Plastic beverage holder | 400 years |
| Plastic bags | 10-20 years |
| Plastic bottle | 100 years |
| Glass bottle and jars | undetermined |
| Disposable nappies | 50-100 years |
| Tin can | 50 years |
| Aluminium can | 200 years |
| Monofilament fishing line | 600 years |

(Mote Marine Laboratory, 1993)

In April 2003, scientists from the Portobello Marine Laboratory were out in the boat counting seal pups around the Otago Peninsula when they came across a seal pup tangled in a net. The net had large holes, and the pup had wrapped the net around its neck 15 or 20 times. It was getting very tired and could hardly swim, so it didn't put up much of a fight when Bill and Debbie started to cut the net off. Once freed, the seal pup swam slowly to shore, where it pulled itself up onto the beach to recover. This seal pup was very lucky, but many are not. Nets left by fishers drift around in the sea, catching marine animals for a long time - how long would it take a monofilament fishing net to break down in the sea?

*Note: This is a suggested format. Let your students come up with their own ideas. Then together you and your students can decide on an action plan for your class.*

# Environmental Action Planner – action plan

**What's the Issue?**

*Rubbish gets into the ocean and affects the local marine environment.*

**What's our Goal?**

*We want our community to understand the effect of rubbish in the local marine environment and to throw less rubbish in the ocean.*

**What skills will we need?**

- *Research – to find answers to our questions*
- *Literacy – Written/oral communication – to communicate our findings and to find things out*
- *Problem solving – to help solve the issue*
- *Co-operation – work together doing it*
- *Numeracy (quantify rubbish found)*

**Who could influence the decision?**

- *Users of the local marine environment*
- *Tourists*
- *Local businesses*
- *Local runanga*
- *Local 'care' groups*
- *Parents*
- *School Principal and Board of Trustees*

**Evaluation of action**
*(Did our actions lead to our goals being met)*

**Action**

- *Clean up rubbish from our local beach, park, schoolyard, street and investigate how that rubbish could reach the ocean (see Tracking the Trash activity pg. 24)*
- *Put together a display to educate the community about the effect of rubbish in the ocean*
- *Visit the NZ Marine Studies Centre to find out how marine life is affected by rubbish*
- *Visit the Royal Albatross Centre and find out how seabirds are affected by rubbish in the sea*

**Evaluation of plan**
*(Will our plans lead to us accomplishing our goals?)*

**How will we find out what people think and feel about the issue?**

- *Talk to them and ask*
- *Design a questionnaire and survey the community*
- *Talk to experts in the field who deal with this issue*

**How can we make people more aware of the issue?**

- *Put up a rubbish display in areas where people will see it*
- *Publish any findings in the school newsletter, local newspaper etc*
- *Do a presentation for school assembly, parent/community groups*
- *Get the community involved in a 'clean up' day*

**What information do we need and where will we find it?**

- *How rubbish in the ocean affects marine animals and seabirds? – Experts, books, internet*
- *How long does it take different types of rubbish to break down? – Books, internet*
- *Where did the rubbish come from and how did it get into the ocean? – Local experts, investigations*
- *Does it affect humans? – Experts, books, internet*

Template from Education for Sustainability TKI website http://efs.tki.org.nz



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# Environmental Action Activity Sheet

**What's the Issue?**

**What's our Goal?**

**What skills will we need?**

**Who could influence the decision?**

**Evaluation of action**

***Action***

**Evaluation of plan**

**How will we find out what people think and feel about the issue?**

**How can we make people more aware of the issue?**

**What information do we need and where will we find it?**

Template from Education for Sustainability TKI website http://efs.tki.org.nz

# Design a Seashore Species

There is more than one way to catch a fish!

The plants and animals of the seashore have developed quite different solutions to the problems of living on the shore. This activity focuses on physical and biological condition of the shore and asks the students to build their own unique seashore creature, perfectly adapted to its place.

## Objectives

- To investigate how animals and plants are adapted to live in the seashore environment.
- To understand the nature of the adaptation (structural, physiological or behavioural).

## What You Need

- Rocky Shore Guide
- Paper, coloured pencils and other art materials
- Design a Seashore Species Activity Sheet (page 29)

## Method

1. Review the physical and biological conditions of the shoreline. Look at seashore type, substrate, exposure, tide zones, temperature change, exposure to light, salinity etc.
2. Choose a seashore type as the home for the creature to be designed. Decide where on the shore this creature will live; on the exposed side, on the protected side, in the sediment, on top of the sediment, etc.
3. Decide which tide level the creature will live in. Approximately how many hours in every tidal cycle is it out of the water? Does it move or is it attached to the rock?
4. What does it eat and how? What eats it, and how does it avoid being eaten? How does it get rid of waste products?
5. What are the implications of living in the environment chosen? What are the conditions the plant or animal has to deal with?
6. What adaptations does your plant or animal have for these conditions? Is it a behavioural, structural or physiological adaptation?

## Results

1. The students record their choices on the activity sheet.
2. The students draw a picture (or make a model) of their plant or animal and give it a name.
3. Each student introduces their species to the class, explaining/describing its special features (adaptations) to the conditions.
4. The students ask questions of each other about how their species would deal with a particular physical condition/predation, etc.

## Discussion

1. Were the adaptations of your creature similar to those exhibited by seashore animals and plants, or did you come up with some original ideas?
2. Do you think your creature would be able to survive or does it need further modification?
3. What would happen to your creature if it moved into deeper water or to a different tide level?
4. Could your creature survive on a different seashore type?
5. What would be an appropriate name for your creature?

## Extension Activities

Write an article for the newspaper that announces the discovery of your creature. Give your story an angle e.g. of what importance it may be as a food source, or any useful medical chemicals it has. Describe its appearance, and the habitat it is found in. What can humans do to protect this special new species?

Write a story describing an encounter with your species. Where did you find it? What was it doing? What did you do when you saw or touched it? How did it feel? What did it look like, did it respond to your presence?

Define one of your creatures adaptations in more detail. Draw a diagram showing how it functions.

# Design a Seashore Species Activity Sheet

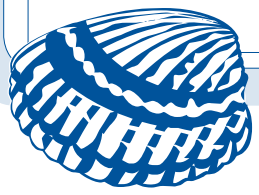
Name: Date:

1. Fill in the table to describe where your species lives and how it is adapted to living there.
2. Give your species a name and draw (or model) it.

Seashore Type:

Location on the Seashore:

| Physical and biological conditions your species has to deal with | Your species' adaptation to the conditions |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |



# Mussels – Inside and Out

Mussels are a 'mollusc'. Most molluscs have a foot, a shell and a mantle. The mantle is responsible for making the shell, pigment cells in the mantle produce the shell's colour.

*Adaptations* –Mussels are a bivalve (they have 2 shells). Their two shells are connected together by muscles and a hinge. When underwater the shells gape open allowing the animal to filter feed. When the tide is low the shells are pulled tightly together to prevent water loss.

Mussels attach themselves to rocks by their byssal threads.

*Feeding* – bivalves circulate water over their gills and filter out plankton. Mussels can filter 6-9 litres of sea water an hour!

*Growth lines* – look for ridges on a shell, they tell the story of its growth. Molluscs make their shells by laying down layers of calcium carbonate. As the animal inside the shell grows, another layer is added to the outer edge of the shell. The oldest part of a bivalve is called the umbo.

*Why have a shell?* – shells protect the animal from waves and other physical damage. They also provide protection from predators. A shell helps to stop an animal drying out at low tide by keeping moisture in.

## Objectives

- Identify and label the internal structures of a mussel.
- Describe the function of the internal structures of a mussel.

## What You Need

- Live mussels (in shells) from supermarket (enough for one between 2-3 chidlren)
- A knife to open the mussels
- Trays or newspaper to carry out the dissection on

## Method

1. Establish students' prior knowledge about mussels through a class brainstorm/discussion.
2. Once mussels have been distributed have students work through the Mussels Inside and Out Activity Sheet (page 31).

## Discussion

1. Why do you think mussels have a shell?
2. What terms/words do we now need to find more out about?
3. Find more out about filter feeders – what other rocky shore animals are filter feeders?
4. Make a list of all the questions students may now have about mussels. Discuss how they could find the answers to their questions.



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# Mussels – Inside and Out Activity Sheet

START HERE

1. Measure your mussel.

Compare the mussel's size with the class data. Is it smaller or larger than the average size?

2. Can you open your mussel with your fingers?
yes ❍ no ❍

Do you think a mussel is a bivalve or a univalve?

3. Describe the outside of the shell using three words only.

4. What colours can you see on your shell?

5. Is anything growing on the outside of the shell?

6. Label the **umbo** (oldest part of the shell) and the hinge on the diagram.

7. Does your mussel have **byssal threads** *(These are hairy threads that attach the mussel to the rock.)*

yes ❍ no ❍

8. How many **growth lines** can you count?

9. Ask an adult to open the shell for you.

*(Males have white sacs filled with sperm and females have yellow/orange sacs filled with eggs. Only mature mussels display this and only at the right time of the year.)*

10. Is your mussel a
male ❍
or a female ❍
can't tell ❍ ?

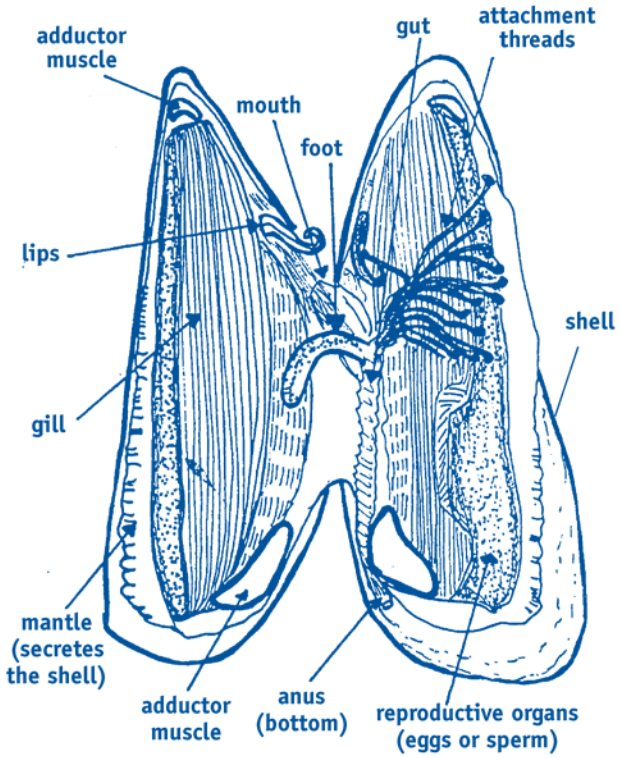
11. Find the muscles (adductor muscles) that pull the shell closed. How many are there?

12. The **mantle** tissue is located at the edge of the shell. It adds new shell on the outer edge. What colour is it?

13. The **foot** looks like a large dark tongue. What is it used for?

14. The gills are used to breath and filter plankton out of the water. How many gills are there?

15. When you eat mussels, what part do you eat?



# Pressing Seaweed

Scientists use the following method to preserve seaweed specimens. You can use it to make your own pressed seaweed collection (called a "herbarium") or to make unique greeting cards or pictures.

## Objectives

- To learn the technique used by scientists to preserve seaweeds.
- To become familiar with the local seaweed species.

## What You Need

- Rocky Shore Guide
- Drift seaweed collected during a field trip to the beach
- Tray of water
- Card (that does not break down in water)
- Corrugated cardboard (A3 size)
- Newspaper or blotting paper
- Nappy liners (or cotton, wax paper etc.)

## Set-up Ideas

- This activity must be done after a field trip to the beach. The seaweeds will have to be pressed within a day of collection.

## Method

1. Plan a walk along a rocky shore at low tide to collect your plants. Look for drift plants that are often washed up on the shore, especially after storms, but be careful to choose healthy specimens. If you are collecting attached plants, take the outer fronds (leaves) in order not to kill the plant.
2. Press the seaweeds as soon as possible after collection. Float the seaweed in a pan of water and run your fingers along the length of the plant to dislodge any small marine creatures. Place your card beneath the floating seaweed and lift out. The final arrangement of the fronds can be made with squirts of water from an eye dropper.
3. Corrugated cardboard is used to allow air to reach the drying specimens. Place the newspaper, (or other absorbent material) on the cardboard. The wet specimen on card is placed on top of the newspaper. A nappy liner is placed over the specimen to prevent it from sticking to the upper layer of newsprint. Cardboard is placed on top of the newspaper. If many specimens are being pressed, just continue to add layers in the same order.
4. All the layers should then be placed in a standard plant press consisting of two rigid frames or sheets of plywood and straps of rope to bind the press. If you don't have a press, try piling books on top. The press should be left in a warm, dry place for a couple of days or longer. The newspaper layer should be changed every day.
5. Seaweeds have their own natural glue, so most will adhere to the paper. Some of the thicker plants may not adhere as well, but a bit of glue will help. If you plan to keep your specimens for teaching, laminating will extend their life.

## Results

1. Have each student put together a label for their pressing. The label should include the specimen name, collection site, habitat description, date of collection and the collector's name. It is a good idea to have a local marine scientist check your identification. Other useful information includes the common and Māori name, classification group, and description of the species.
2. Label the parts of the seaweed on the pressing and explain the function of each part.

## Discussion

1. How many different types of seaweed did you find on your field trip to the beach? How many were red, brown or green species?
2. What features do you think scientist use to identify different species?

## Extension Activities

Make Christmas or greeting cards with pressed seaweed. Remember to only use drift seaweed for this activity. Thin delicate plants are the prettiest when pressed.



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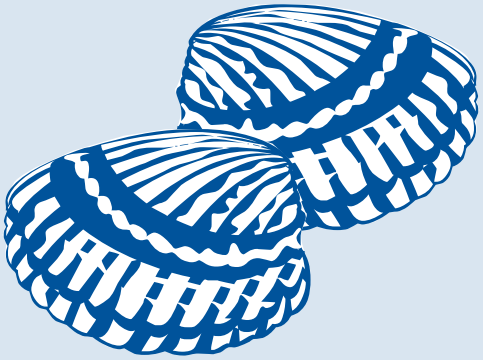
# Seashore Te Reo



### Objective

- To have a list of Te Reo words to use when studying the rocky shore.

### What You Need

- Māori Version of Rocky Shore Guide (available on line at www.marine.ac.nz)
- List of Māori seashore words (below)

### Set-up Ideas

- Incorporate a few words into your normal vocabulary about the sea to slowly build up your knowledge.

### Extension Activities

Make flash cards to practice remembering the Māori names.

Have students check with their whānau and see if there are any local names that can be added to your list.

| Māori | English | Māori | English | Māori | English |
|---|---|---|---|---|---|
| ākau | rocky shore | ngākihi | limpet | tai | tide |
| au | current | ngaru | wave | Tangaroa | god/guardian of the sea |
| auheke | surf (where waves break) | ngata | snail | tai timu | low tide |
| hoiho | yellow-eyed penguin | noke | worm | tiotio | barnacles |
| ika | fish | one | beach | tōrea | oystercatchers |
| kai moana | seafood | onepū | sand | waka | canoe |
| karoro | seagull | pāpaka | crab | whakahao | sea lion |
| kekeno | fur seal | papatua | chiton | wheke | octopus |
| kina | sea urchin | pātakaroa/ pātangatanga | seastar | | |
| kōpūpūtai | sponge | pāua | paua | | |
| kororā | blue penguin | tai nui | high tide | | |
| kōtere moana | anemones | rāhui | total ban on harvesting kai moana from an area. | | |
| kōwhatu | rocks | | | | |
| kupenga | fishing net | rimurimu | seaweed | | |
| mākū | wet | tahatai | shore, seashore | | |
| moana | sea | | | | |

# Specific Heat

The air, the land, and the sea are all exposed to the sun for the same number of hours during the day. Yet the temperatures of these three substances are usually quite different from one another. While swimming, you may have noticed that the water is cold, the air above is warm and the beach sand is scorching hot. During the winter, the sea may be warm but the air and the land are quite cool. At night, the temperature of the land and air usually drops, while the temperature of the ocean may not change at all. Some parts of New Zealand and Australia experience cold weather and snow in winter, while the coastline remains relatively warm, even though both areas are at the same latitude.

### Objectives

- To investigate the ability of different substances to absorb, retain and release heat at different rates.

### What You Need

- 3 black containers (tin cans covered with black paper)
- 3 polystyrene lids (cut from food trays)
- 3 thermometers
- 1 flood lamp (with high watt bulb)
- 1 clock or stopwatch
- Sand and water

### Method

1. Fill one can 3/4 full with dry sand, the other with tap water, and leave the third one empty. Insert a thermometer in each lid and seal the lids firmly on each can.
2. Place the cans about four inches from the lamp, so that they all receive equal amounts of light. Turn on the lamp, then start the stopwatch (or note the time). Record the temperature on the thermometers every two minutes for the next twenty minutes using the Specific Heat Activity Sheet (page 35).
3. After twenty minutes, turn off the lamp and continue taking temperature readings at two minute intervals for another twenty minutes; recording on the activity sheet.

### Results

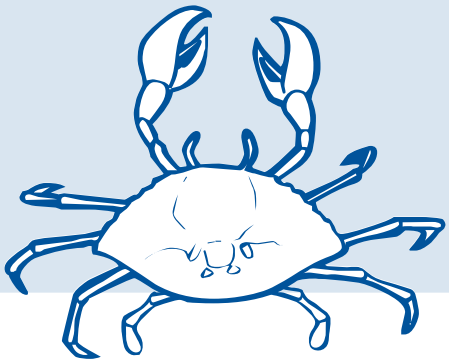
- Make a graph of time vs. temperature for the three variables (water, air, sand).

### Discussion

1. What relationship can you draw between the three variables?
2. Define the term 'specific heat'.
3. Why do different substances have different heat capacities?

### Extension Activities

Design some experiments to find out how such properties as conductivity, porosity and reflectivity effect the transfer of heat.





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# Specific Heat Activity Sheet

Name: Date:

1. Record the temperature of the sand, water and air every two minutes over a twenty minute period with the light on. Record the temperature for a further twenty minutes with the light off.
2. Graph your results.

| TIME (minutes) | TEMPERATURE | | |
|---|---|---|---|
| | Air | Sand | Water |
| 2 | | | |
| 4 | | | |
| 6 | | | |
| 8 | | | |
| 10 | | | |
| 12 | | | |
| 14 | | | |
| 16 | | | |
| 18 | | | |
| 20 | | | |
| 22 | | | |
| 24 | | | |
| 26 | | | |
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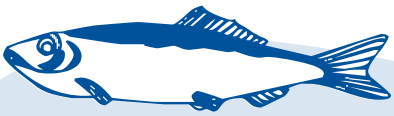




# Become a Marine Scientist

Here are some useful links to find out what marine scientists do:

**Becoming a marine scientist – Dr. Miles Lamare, University of Otago**
http://www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/People/Dr-Miles-Lamare

**What is an ecologist – Associate Professor Steve Wing, University of Otago**
http://www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/People/Assoc-Prof-Stephen-Wing

**Meet scientists and find out about marine research at the University of Otago**
http://www.marine.ac.nz/ Go to 'Research' tab then click on 'Meet the Scientist'.

Imagine that you are a marine scientist.
What questions would you like to find the answer to?

Where would you go to do your research?

What equipment would you need?

What skills would you need?

What items would you need to take when you do field work?

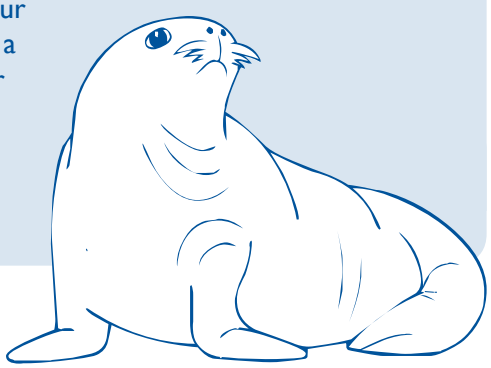
Think of three questions you would like to ask a marine scientist.
1.

2.

3.

**Extension Activities**

Choose a marine scientist, find out about his/her research and present your findings to your class. You could do a talk, PowerPoint or create a poster.





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# MARINE LIFE DATABASE
# ROCKY SHORE ANIMALS & PLANTS

***You can find out more by exploring the Marine Life Database!***

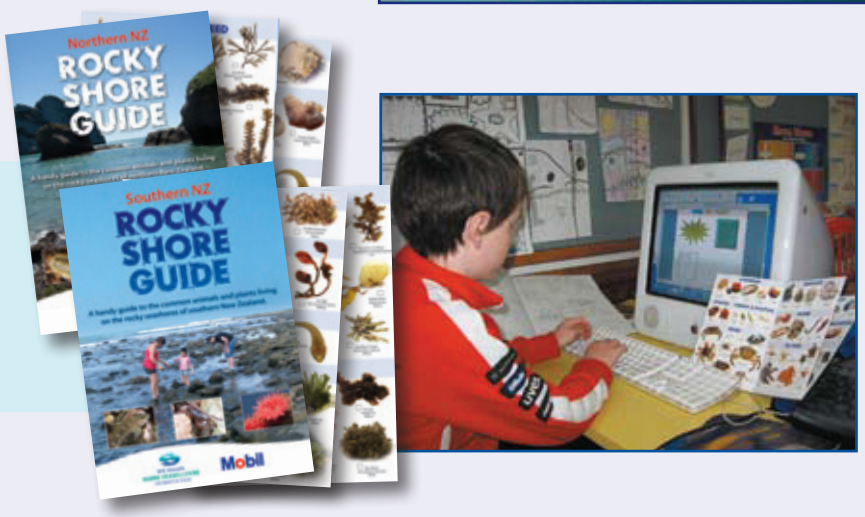
Go to www.marine.ac.nz and click on 'Resources' then 'Marine Life Database'- choose **Aquarium Guide**


Search by common name, habitat or scientific name. To find all the Rocky Shore animals search by habitat.

**Search By Common Name** **Search By Common Name** **Search By Common Name**

Click on a species name to find information about their identification, classification, feeding strategies, predators, ecology and more. There are lots of good photos as well.


The Marine Life Database provides detailed information about the species included in the Rocky Shore Guides and also highlights less common rocky shore species.




www.marine.ac.nz

# SHOW RESPECT FOR SEASHORE CREATURES

- Tread carefully.
- Leave creatures where you found them.
- Leave attached seaweed in place.
- Handle creatures with care - close to the ground with wet hands.
- Carefully put rocks back in the same position you found them.
- Limit your collection of empty shells as other creatures use them as homes.

# AVOID DISTURBING WILDLIFE

- Keep your distance from seabirds including penguins.
- Keep your distance from seals and sea lions.
- Use the zoom on your camera or binoculars for close viewing.
- If a sea lion approaches you - back away slowly.
- Keep dogs under control.

# BE CAREFUL AND KEEP SAFE

- Check tide times to avoid being cut off by rising tide.
- Do not explore the seashore alone.
- Watch for changing weather.
- Look out for waves - never turn your back to the ocean.
- Beware of slippery and uneven rock surfaces.
- Pick up any rubbish found on the shore and dispose of it appropriately.

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