

# Enviroteach

An Environmental Education Resource for Teachers



## From the Editor

### Kia ora! Best wishes for the new year!

This issue of Enviroteach focuses on rocky shores and the rich opportunities they offer for learning about marine biodiversity and ecology. Rocky shores are an exciting part of Southland's coastline and children love exploring their pools, crevices and boulders, and discovering the weird and wonderful plants and animals living there.

We are fortunate in Southland, to have access to a range of sites suitable for school field trips, as well as some excellent educational resources. Many schools already undertake field trips to investigate rocky shore ecology and to practise using the skills, concepts and tools of science.

If you have never done a rocky shore study, or if you would like some help with your next field trip, feel free to contact the environmental education team at Environment Southland. We can also assist with lessons focusing on the rocky shore environment and a range of other environmental topics. These services are available to all schools in Southland, free of charge. Contact us on 0800 76 88 45 or [education@es.govt.nz](mailto:education@es.govt.nz).

All the best for term one.

*Pat Hoffmann*

Environmental education officer, Environment Southland



## Inside this issue

- Page 2-3 Life on the rocky shore
- Pages 4-6 Rocky shores you can visit
- Page 7 Top tips for field trips
- Page 8 Educational resources

# Life on the rocky shore

**R**ocky shores have the richest biodiversity of any coastal habitat in New Zealand. This makes them ideal contexts for learning about biodiversity and ecology - both in the classroom and on field trips.

Why are they so rich in biodiversity? The water is shallow, so light can penetrate and enable plants to photosynthesise. The complex surface of the intertidal rocky shore creates numerous sheltered microhabitats for organisms to live in, and a stable substrate on which plants can grow. Plentiful nutrients are supplied by run-off from the land and from decaying seaweeds. Seaweeds thrive and provide abundant food for grazing animals like marine snails, chitons and urchins, which in turn support predators like whelks and seastars.



Seaweeds at Ship Graveyard.

Visit the Science Learning Hub for more information about marine food webs:  
[www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/Science-Ideas-and-Concepts/Marine-food-webs](http://www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/Science-Ideas-and-Concepts/Marine-food-webs)

## Physical conditions in the intertidal zone

**T**he intertidal zone is the area of the seashore that is covered by the sea during high tides and exposed to the air during low tides. Physical conditions in the intertidal zone are harsh and constantly changing. Plant and animal species living in this zone have to be able to cope with the drying effects of wind, sunlight and high salinity, being battered by wind and waves, and predation by animals. Every day they experience dramatic shifts in light availability, degree of exposure, temperature, pH, oxygen availability, density and salinity. Crevices between and under rocks and boulders create microhabitats that provide some shelter from the heating and drying effects of the sun and the wind, protection from breaking waves, and a safe refuge from larger predators.



Shellfish left high and dry.

## Zonation

**A**biotic (physical) conditions from the low shore to the high shore vary widely. This prevents any single species from dominating the entire shore and leads to the development of distinct zones which are preferred by different sets of species.

### ACTIVITY IDEA:

Students can investigate zonation in a rocky shore community during a field trip.

Refer to Darren Smith's booklet *"Ecology of the New Zealand Rocky Shore Community"* (pp 22-34) for instructions and helpful notes on how to carry out a shore survey suitable for secondary schools ([www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf](http://www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf)). Appendix 1 offers survey data sheets and Appendix 2 has an assessment resource for Achievement Standard 91158.

Alternatively, design your own investigation in which students assess the relationship between abiotic factors and the distribution of plants and animals on the rocky shore. Here are some suggestions:

- To record the distribution of plants and animals: Set up a transect from the high shore to the low shore. At regular intervals along the transect lay down a 0.25m<sup>2</sup> quadrat and then identify and count the plants and animals within the quadrat.
- To measure abiotic factors: Within each quadrat measure a range of abiotic factors (e.g. water depth, wind speed, light intensity, temperature, dissolved oxygen, pH, salinity and density).
- The data should be presented on charts with quadrat numbers listed along the x-axis. Consider using a stacked bar chart to present the plant and animal data. Can a pattern in distribution be detected? Use line charts to present the abiotic data. Can any environmental gradients be detected?
- Compare the bar chart with the line charts to assess whether there are any relationships between the distribution of plant and animal species and the various abiotic factors you have measured.

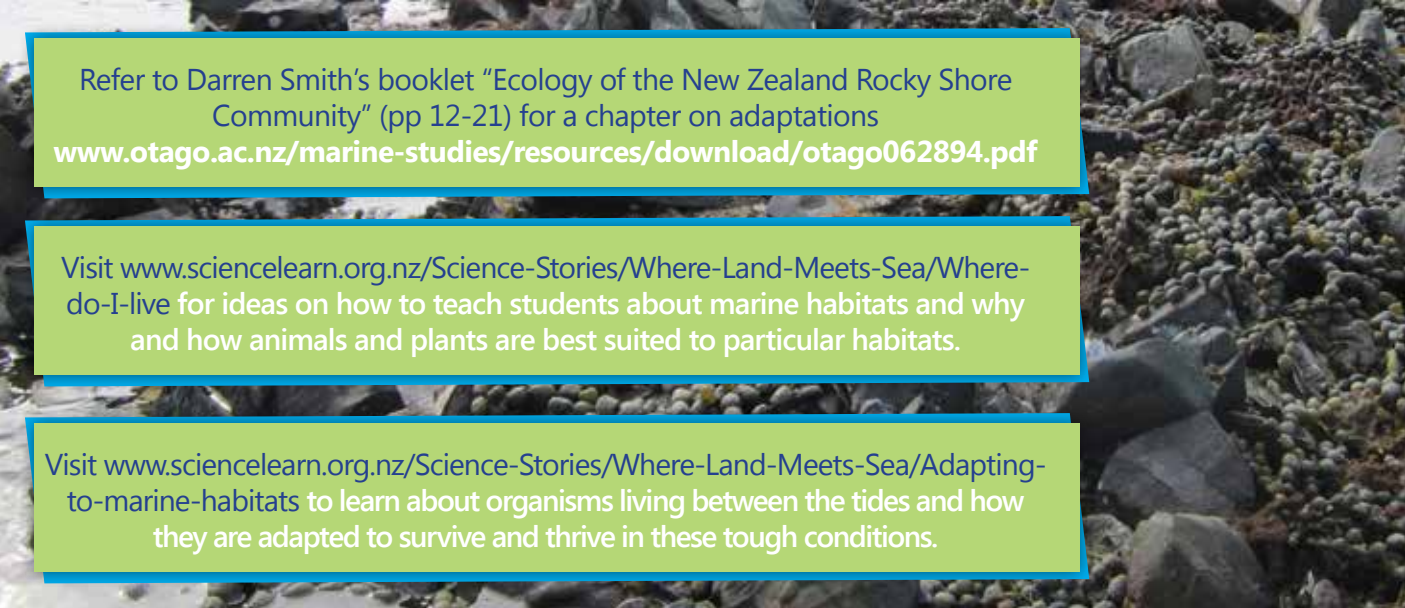


# Adaptations to life in the intertidal zone

The organisms that live in the intertidal zone have special adaptations which enable them to cope with the stresses (especially over-heating and desiccation) of spending part of their day uncovered by the sea.

For example:

- Many organisms have a low surface area to volume ratio which helps to reduce water loss.
- Many shelled animals can tightly close their shells to help them retain water and avoid drying out.
- Many marine snails secrete watery mucus to form a protective layer around their shell openings.
- Many seaweeds such as kelp secrete a slimy covering which helps them reduce water loss.
- Barnacles have light-coloured shells and blue banded periwinkles have white stripes to reflect radiation and reduce heating.
- The rays on the shells of limpets promote re-radiation of heat to help them cool down.
- Limpets scrape small depressions in the rock called home scars into which they can retreat as the tide recedes. They line the scars with mucus which helps to seal them in and reduce water loss.
- Purple shore crabs have a waxy, waterproof covering on their carapace to help reduce water loss.



Refer to Darren Smith's booklet "Ecology of the New Zealand Rocky Shore Community" (pp 12-21) for a chapter on adaptations  
[www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf](http://www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf)

Visit [www.sciencelearn.org.nz/Science-Stories/Where-Land-Meets-Sea/Where-do-I-live](http://www.sciencelearn.org.nz/Science-Stories/Where-Land-Meets-Sea/Where-do-I-live) for ideas on how to teach students about marine habitats and why and how animals and plants are best suited to particular habitats.

Visit [www.sciencelearn.org.nz/Science-Stories/Where-Land-Meets-Sea/Adapting-to-marine-habitats](http://www.sciencelearn.org.nz/Science-Stories/Where-Land-Meets-Sea/Adapting-to-marine-habitats) to learn about organisms living between the tides and how they are adapted to survive and thrive in these tough conditions.

## Impacts on rocky shores communities

The main threats to New Zealand's rocky shores are climate change and sea level rise, over-collection of living resources, introduction of invasive species and pollution (disease risk, sediment, eutrophication, toxic contamination).

## Environmental monitoring

Environment Southland's long-term coastal monitoring programme includes monitoring of rocky shore communities. Biological diversity is used as an indicator of the health of the rocky shore community. So far, baseline monitoring has been completed at Waipapa Point, Stirling Point and Frenzt Reef, and the plan is to survey these sites every five years to determine the extent to which the coast is affected by environmental pressures. The sampling has established a baseline against which any future changes can be assessed.

Reports on these sites are available on Environment Southland's website [www.es.govt.nz/environment/coast/shores](http://www.es.govt.nz/environment/coast/shores) & could be a valuable resource for secondary school projects on rocky shores.



# Rocky shores you can visit

The following pages offer some information, compiled by the education team at Environment Southland, about rocky shores sites we have visited along the Southland coast.

## Waipapa Point

### Suitability for school field trips

This site is ideal for school field trips. There is good access for buses and plenty of space for parking. There is also a DOC shelter with information boards and well-maintained toilets. The rocky shore area is a massive flat platform with plenty of room - even for very large groups. There are areas of the rocky shore that can be safely explored even if the tide is coming in. Also of interest at the site are Waipapa Point lighthouse, the cemetery and a memorial for victims of the Tararua shipwreck. Sealions can often be seen in the vicinity.

### Coastal health

Rocky shore life at this site is abundant and diverse which makes it an interesting site for a rocky shore study. Three years of monitoring at Waipapa Point indicated that this part of the coastline is healthy and unpolluted. No introduced invasive species were seen, and there was no indication of excessive nutrient or sediment inputs.

Read the report here: [www.es.govt.nz/media/25386/fine-scale-monitoring-waipapa-2012-rocky-shore.pdf](http://www.es.govt.nz/media/25386/fine-scale-monitoring-waipapa-2012-rocky-shore.pdf)



Waipapa Point.

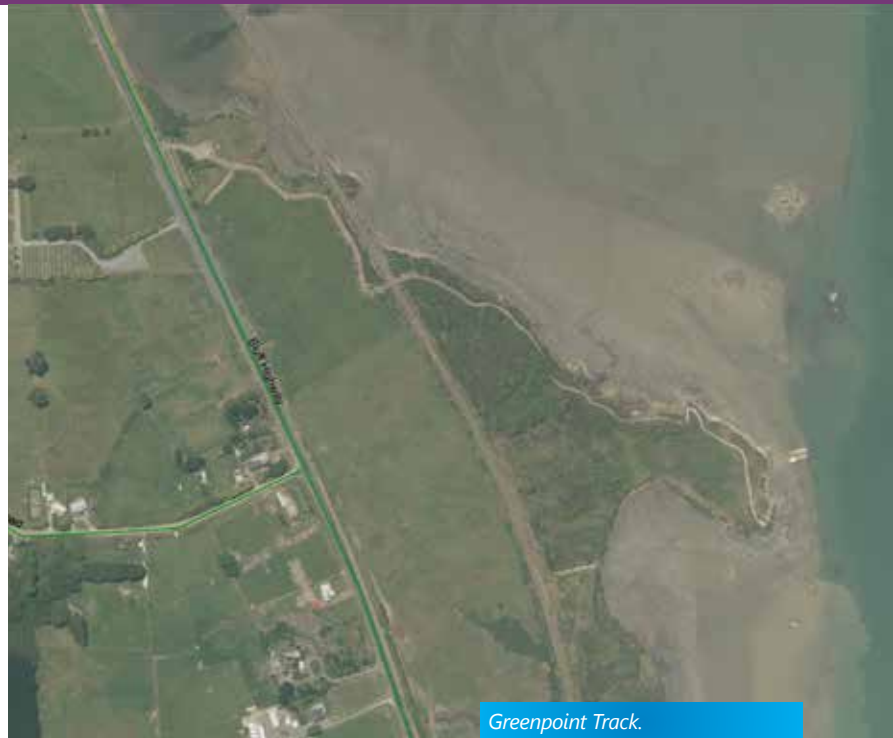


A sea lion emerging from the water.

# Greenpoint Domain and Ship Graveyard

## Suitability for school field trips

This site is suitable for school field trips with small to medium-sized groups. Access is good and there is parking space for a few vehicles. The Greenpoint Track is well-maintained and includes a very good boardwalk. There are no toilets. Signage is provided but is getting old. Also of interest at the site are shipwrecks, views of Bluff, a lagoon and birdlife. Some of New Zealand's oldest rocks are exposed along this coastline. The rocky shore area is narrow and best explored at the lowest tide. At low tide, it is possible to walk along the shore to closely examine the ship wrecks. Rocky shore life is abundant, but not as diverse as at Waipapa Point.



Greenpoint Track.



Ship Graveyard.

# Frentz Reef and Monkey Island

## Suitability for school field trips

Frentz Reef is located approximately 500m southwest of Monkey Island, in Te Waewae Bay near Riverton.

Frentz Reef is ideal for school field trips and can accommodate large groups. This section of coast has a series of connected intertidal and subtidal reefs, as well as submerged reefs further offshore. The site supports a diverse rocky shore community and shows strong zonation. There is no designated parking area at Frentz Reef. Also of interest at the site are petrified trees and scenic views across Te Waewae Bay.

Monkey Island offers reasonably good rocky shores and is suitable for small to medium-sized groups. The rocky shore area is narrow and best explored at the lowest tide. The Island can be accessed on foot at low tide and climbed. It is a popular tourist destination, a highly valued recreational paua fishery and is valued for diving, fishing and its scenic beauty and bird life. There is parking space for a few vehicles.

## Coastal health

Initial monitoring results from Frentz Reef indicate that the reef is in a healthy and unpolluted state

*Read the report here: [www.es.govt.nz/media/40238/frentz\\_reef\\_2013\\_-\\_fine\\_scale\\_rocky\\_shore\\_monitoring\\_report\\_web.pdf](http://www.es.govt.nz/media/40238/frentz_reef_2013_-_fine_scale_rocky_shore_monitoring_report_web.pdf).*



Monkey Island and Frentz Reef.



Petrified tree at Frentz Reef.



Frentz Reef.

# Top tips for field trips

## Planning the field trip:

- Identify a clear purpose for the field trip. What do you want to achieve?
- Check the tides. There are several apps and websites to choose from, e.g. MetService or my personal favourite: [www.tides4fishing.com/nz/southland](http://www.tides4fishing.com/nz/southland).
- Confirm the date of the field trip and select a back-up day in case of unsuitable weather.
- Decide what time you will arrive and depart from the site. Plan to arrive at the site an hour or two BEFORE the lowest tide. Allow yourself enough time to work your way from the high shore towards the low shore while the tide is still receding.
- Know what time the tide is expected to turn and plan to finish your activities on the low / mid shore well BEFORE the tide starts coming in.
- Find out what the height of the low tide will be compared with the minimum height. At certain times of the year, the low tide may not be particularly low and that could limit how much of the shore is exposed during your field trip.
- Do a site visit before the field trip to familiarise yourself with the intertidal zones and to identify health and safety risks. E.g. Keep an eye out for sealions and know how to behave around them.
- Invite an expert to accompany you on your trip. Contact our education team on 0800 76 88 45 or [education@es.govt.nz](mailto:education@es.govt.nz).
- Arrange transport.
- Organise equipment needed for your activities. You are welcome to borrow one of our Marine Metre Squared kits if suitable.

## Before the field trip:

- Do some preparatory work with the students. This magazine provides links to several helpful websites and educational resources.



## Field trip

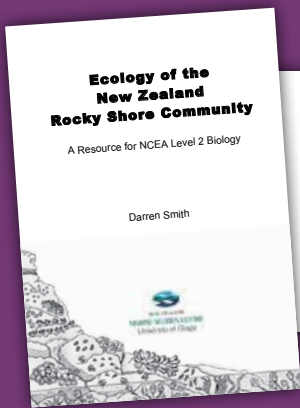
- On the day of the field trip students should wear clothing suitable for the weather conditions, plus gumboots, gym shoes or waders if they have any, as well as sun hats and sunscreen. It's a good idea to take a change of clothes, shoes and socks, in case they get wet.
- Take a first aid kit.
- If you wish to collect data, take clipboards, waterproof charts, pencils, data sheets / paper and cameras.
- Make sure that your group arrives at the rocky shore site well before low tide, so that children have the opportunity to see the many plants and animals that are usually under water.
- It's a good idea to start with a tuning in exercise.
- Allow students to work in small groups and make sure you have plenty of adult helpers and equipment.
- Plan how you will wrap up the field work activities.



## After the field trip:

- Do some follow-up work back at school to reinforce and build on what students have learned.

# Educational resources

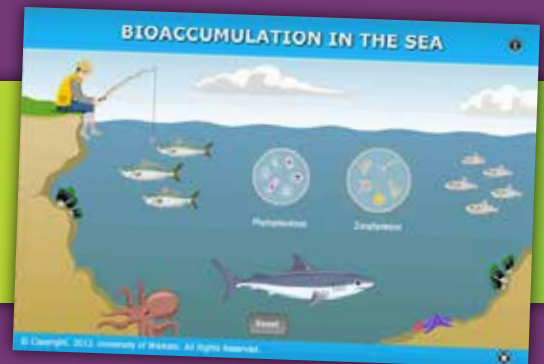


## Ecology of the New Zealand Rocky Shore Community

This is an excellent 55 page book, written by Darren Smith to assist teachers of NCEA Level 2 biology to carry out studies of the New Zealand rocky shore. Darren developed this resource when he was on the Endeavour Teacher Fellowship, New Zealand Science, Mathematics and Technology Teacher Fellowship Scheme 2012 ([www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf](http://www.otago.ac.nz/marine-studies/resources/download/otago062894.pdf)). This resource book is intended to assist teachers of NCEA Level 2 biology to carry out studies of the New Zealand rocky shore.

## The Science Learning Hub

offers a range of rocky shore resources, suitable for primary schools, related to the Living World strand of the New Zealand Curriculum  
[www.sciencelearn.org.nz/Primary-Science/Living-World-The-rocky-shore](http://www.sciencelearn.org.nz/Primary-Science/Living-World-The-rocky-shore)



## NZ Marine Studies Centre

[www.otago.ac.nz/marine-studies/index.html](http://www.otago.ac.nz/marine-studies/index.html)



## Many answers website

[www.manyanswers.co.nz](http://www.manyanswers.co.nz)



## EPIC

[www.tki.org.nz/epic2](http://www.tki.org.nz/epic2)

## LEARNZ virtual field trips

[www.learnz.org.nz](http://www.learnz.org.nz) Previous field trips to rocky shores include Marine Reserves, and Expedition Challenge - a South Pacific adventure.

