Spectacular Coast

ROCKY SHORE
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PROGRAMME DESCRIPTION (focus of programme)
To become familiar the coastal environment with a special focus on rock pools and their environment

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<thead>
<tr>
<th>Level</th>
<th>Essential Learning Area</th>
<th>Strand</th>
<th>Achievement Aim</th>
<th>Achievement Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Science</td>
<td>Living World</td>
<td>Structure and Function</td>
<td>Interdependence of living organisms</td>
</tr>
<tr>
<td>2</td>
<td>Science</td>
<td>Living World</td>
<td>Structure and Function</td>
<td>Interdependence of living organisms</td>
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<tr>
<td>3</td>
<td>Science</td>
<td>Living World</td>
<td>Structure and Function</td>
<td>Interdependence of living organisms</td>
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<tr>
<td>4</td>
<td>Science</td>
<td>Living World</td>
<td>Structure and Function</td>
<td>Interdependence of living organisms</td>
</tr>
</tbody>
</table>

PRE – VISIT ACTIVITIES (See: Black masters and additional information for activity examples)

1. Prior knowledge brainstorm
   - Have students share their views on what they know about the Rocky Shore.
   - Encourage the students to think about the animals and seaweeds living there as well as the habitats they live in.

2. Play ‘Who am I?’
   - Ask the children ‘who am I?’ Below are some examples to be started with.
   - Ask the children to make their own ‘Who am I’ clues for a marine creature that they know.
     Example: A shell is where I live
               I carry my protection as I walk.
               I have to find a new home as I grow bigger
               I have nippers
               I am a …..

3. Can you catch my drift?
   - With the class, match the animals’ pictures to their poems. NB: There is a master copy of cut-out pictures of the different animals supplied in the “Black masters and additional information” section.

4. Tidal zones (ECAN Environmental Educator lesson)
   - Learn about the different tidal zones found on the rocky shore. Relate the different zones found on the rocky shore with some of the environmental challenges that the marine creatures face. For example, animals in the high tide zone must survive dehydration, high temperatures and predation from terrestrial animals. Animals in the mid to low tidal zone must be able to withstand wave action, competition and predation from marine creatures.

5. Human impact on the rocky shore environment
   (ECAN Environmental Educator lesson)
   - Commercial (marine farming) – Since the arrival of Europeans in the 1800’s, with more people and more industry, pressure on the sea and its resources has increased. Please refer to appendix for black line master with information on marine farming.
     - Consequence Wheel – Brainstorm both positive and negative effects of marine farming. In the centre of the circle you need to write your event that will have “consequences” i.e. marine farming on the environment. In each outward radiating circle write consequences, which in turn lead to other effects. Effects can be both positive and negative. Please refer to appendix for black line masters.

6. Sketch a rocky shore creature
   - Have the children make a sketch of a rocky shore creature that they know of. This activity could be used for pre and post assessment. As an extension see if they can also include its habitat including tidal zone.

Fabulous facts
...do you know your tidal zones?
On the rocky shore, zones of seaweeds and animals are often quite distinctive. These zones are often correlated with the range of tides (i.e. the extent to which the tide moves up the shore). The zones of the shore can be split into the following categories:

- **Splash zone (Supralittoral zone)** – this area of the rocky shore occasionally gets sprayed with salt water and usually at a high spring tide.
- **High Tide Zone (Littoral fringe)** – this area of the rocky shore will be covered with salt water only at a high spring tide.
- **Mid tide zone (Intertidal or littoral zone)** – this area of rocky shore is covered with salt water during high tide and exposed during low tide (twice a day).
- **Low tide zone (Sub littoral fringe)** – this area of rocky shore is usually covered with water but during a low spring tide this area can be exposed.
7. How to make an underwater viewer SPYGLASS!

Can’t see below the sea? Make this to take on your visit to the rock pools. It’s perfect for looking into deeper parts of the tide pools that are always submerged.

You’ll need:
- Milk carton/plastic bottle opened at both ends
- Strong, tight rubber bands or duct tape
- Plastic wrap

How to make:
- Wrap a piece of plastic wrap around bottom of carton
- Secure with rubber bad or duct tape
- Place covered end underwater to view what’s hidden beneath the surface. If your plastic wrap tears while you’re at the shore, please don’t leave it there.

FIELD TRIP

Please minimize the disturbance of the seashore community during your study. Make sure your students understand the seashore code before taking them down to the shore.

Useful equipment to take to the rocky shore:
- Hat/sunglasses/sun block etc
- Drink and food
- Good walking shoes and appropriate clothing
- Spyglass
- Camera
- Rubbish bag to collect shore litter
- Thermometers
- Small aquarium nets
- Magnifying glass

REMEMBER: Check the tide tables on the web from Land Information, New Zealand (www.hydro.linz.govt.nz/tides/ports/index.asp). Time your visit far around the time of low tide.

Activity 1: Tidal Zones (ECAN Environmental Educator lesson) Approximately 15min.

As one big group, have the class sit in a prominent position on the beach where they can easily identify the different tidal zones.
- Having identified and discussed the zones briefly get the students in their groups (no more than 5 per group).
- Give each group a set of laminated cards showing the different animals and plants that will be found in each zone.
- The students then find a space to build their miniature tidal zones and place the appropriate card in each.
- Collect the cards from the students.

NB: this activity can serve as a follow up and assessment to the lesson taught by the ECAN educator.

Activity 2: Observation (ECAN Environmental Educator lesson) Approximately 45min.

Organise students into small working groups of two or three and emphasise the benefits of being patient and trying to remain perfectly motionless for several minutes at a pool.

As an example, crabs are naturally free rangers seeking food and mates and preying on any marine creatures that may have been caught out by the falling tide. For their own survival they are very sensitive to vibrations and moving objects and most are very fleet of foot. When we go to the shore crabs and other shore life are always aware of our approach before we see them, and they scurry deep into a crevice or dive into a pool before we get the chance to enjoy and study them.

Explore using your spyglasses and other equipment you have brought.

Activity 3: Human impacts (ECAN Environmental Educator lesson) Approximately 15min.

- Have the class sit down all together in a sheltered spot on the beach.
- Revisit the lesson “Human impact on the rocky shore environment” i.e. consequences using marine farming as an example.
- Supply each group with a plastic bag and ask them to collect foreign objects from the beach (things that don’t belong there and are human made).

NB: You will want to give the children boundaries and time limits (no more than 5 min).

- Call the children back and get one person from each group. Ask them to
  1. Report back briefly on what they found
  2. Choose one item and share the group’s opinion how that item would affect one of the zones and the animals and plants living there.
- Rubber band activity – refer to appendix under “Human impact on the rocky shore environment”

POST VISIT ACTIVITIES, ASSESSMENT AND EVALUATION

1. Sketch a rocky shore creature
   - Have the children make a sketch of a rocky shore creature that they know of including its habitat and what impacts humans could have on their environment.

NB: depending on the age/skill if the students you may want to break this assessment activity up.
A shell is where I live.
I carry my protection as I walk.
I have to find a new home as I grow bigger.
I have nippers.
I am a hermit crab...

I look like a flower, but really am an animal.
I can move very slowly.
I reach out with tentacles and grab my food.
I tuck my tentacles away when I am not covered with water.
I am a sea anemone ...

I have eight legs covered with suckers.
I have excellent eye-sight to spot my prey.
I can change colour to blend in with my surroundings.
I am an octopus ...

I come in many different shapes, sizes and colours.
I move around on my tube feet.
My stomach comes out of my mouth when I eat.
I am a sea star/starfish...
BLACK MASTERS AND ADDITIONAL INFORMATION: Pictures for “Can you catch my drift”

Mussel

Cat’s eye

Crab

Barnacle
Coastal profiles

Sandy
Back dunes
Foredune
Incipient foredune
Beach
Sea

Back dune species - coastal shrubs (flax, cassinia, akeake, ngaio, ribbonwood)
Sand-binding vegetation (introduced - marram/iceplant native pingao/spinifew) euphorbia

Rocky

High tide
Low tide

Rock pools
Kelp

Estuary
High tidal zone
Intertidal zone
Subtidal zone

Coastal scrub & shrublands
Saltmeadow
Rushes
Salt marsh
Eel grass zostera

Water channel
Coastal profiles

Sandy

Rocky

Estuary
Tidal zones

Animals and plants found in rocky and sandy shore zones

<table>
<thead>
<tr>
<th>Rocky Shore</th>
<th></th>
<th>Sandy Shore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Splash zone</strong></td>
<td><strong>High tide</strong></td>
<td><strong>Low tide</strong></td>
</tr>
<tr>
<td>Barnacle</td>
<td>Chiton</td>
<td>Mussel</td>
</tr>
<tr>
<td>Periwinkle</td>
<td>Cockatoo</td>
<td>Piddock</td>
</tr>
<tr>
<td><strong>Mid tide</strong></td>
<td><strong>Venus necklace</strong></td>
<td><strong>Kina</strong></td>
</tr>
<tr>
<td>Limpet</td>
<td>Sea anemone</td>
<td><strong>Sponge</strong></td>
</tr>
<tr>
<td><strong>Low tide</strong></td>
<td><strong>Cat’s eye</strong></td>
<td><strong>Octopus</strong></td>
</tr>
<tr>
<td>Shore crab</td>
<td>Sea lettuce</td>
<td><strong>Crayfish</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tidal fringe</th>
<th><strong>High tide</strong></th>
<th><strong>Low tide</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cockle</strong></td>
<td><strong>Tuatua</strong></td>
<td><strong>Toheroa</strong></td>
</tr>
<tr>
<td><strong>Snapper</strong></td>
<td><strong>Paddle crab</strong></td>
<td></td>
</tr>
</tbody>
</table>
BLACK MASTERS AND ADDITIONAL INFORMATION: Food Webs

**Food Web of Rocky Shore**
- **Producers**: Seaweed and plant plankton (microscopic algae, including diatoms)
- **Grazing Herbivores**: Periwinkle, Chiton, Pipa, Kina
- **Microscopic Herbivores**
- **Detritus**: Dead plants and animals
- **Filter-Feeding Herbivores**: Mussel, Barnacle, Sponge
- **Small Carnivores**: Cockabully, Crayfish
- **Large Carnivores**: Shag, Seal, Octopus
- **Decomposers and Scavengers**: Gull, Hagfish, Rockcrab

**Food Web of Sandy Shore**
- **Producers**: Seaweed and plant plankton (microscopic algae, including diatoms)
- **Microscopic Herbivores**
- **Grazing Herbivores**: Posidonia, Zostera
- **Detritus**: Dead plants and animals
- **Filter-Feeding Herbivores**: Cockle, Tuatua, Toheroa
- **Small Carnivores**: Swimming crab, Mullet, Starfish
- **Large Carnivores**: Shag, Oystercatcher, Stingray
- **Decomposers and Scavengers**: Gull, Sand hopper, Kea fly

**Food Web on Mudflats**
- **Producers**: Seaweed and plant plankton (microscopic algae, including diatoms)
- **Herbivores**: Ducks, Swans
- **Microscopic Herbivores**
- **Filter-Feeding Herbivores**: Cockerlolly, Predatory shrimp, Wheat
- **Small Carnivores**: Cockabully, Lugworm
- **Large Carnivores**: Silt, Stingray
- **Decomposers and Scavengers**: Mud snail, Mud crab, Dead plants and animals
Human impact on the rocky shore environment

Marine farms

What is marine farming?

A marine farm is a farm in the sea instead of the land. Another name for marine farms is aquaculture. In a marine farm, animals that live in the sea like mussels, oysters and salmon are farmed.

Marine farms become part of the sea environment. They need space; clean water and a lot require moderate water temperatures to be successful. Some can be situated close to land while others may be a long way off the coast. This makes them difficult to see from land and they may not affect coastal activities. However, because people make marine farms, they could affect existing marine life and the way people use the sea.

Activities for students

Ask: What activities do you do by and in the sea?

Here are some more facts and ideas about marine farming. As you read them think about how they may change the way you use and see the coastal environment.

- A marine farm is monocultural. Only one type of marine animal lives there.
- How a marine farm looks changes with the type of sea animal being farmed. With a mussel farm, buoys will be placed on the water. Lines will be attached to the buoys and will hang down into the water. Mussel ‘spat’ is attached in clusters to the lines. The ‘spat’ will become fully-grown mussels and farmed.
- Marine farming is a fast growing business and could make a lot of money for New Zealand.
- When a marine animal lives outside a farm it is called a natural habitat. The habitat is an ecosystem - a variety of marine animals and plants live in the same space. A marine farm can also be an ecosystem too, just not a natural one.
- Marine farms could create waste, both on the sea floor and on the coasts.
- The general public may not be able to use the area where the marine farm is.
- Marine farming could create jobs for people living in the area.

Ask: Do you think marine farming is a good idea? Can you think of any other effects marine farming could have?
Consequence wheel: partly completed

People’s use of the coast has increased over the last 20 years.

Acceleration of coastal erosion.

Increased employment.

Greater urban development along the coastline.
People use - commercial

Marine farming (mussels) Firth of Thames

Photos courtesy Environment Waikato
Cultural use

Collecting kai moana in the Kawhia Harbour.

Photos courtesy Environment Waikato
People use - recreation

Raglan boat ramp.  

River mouth - Awakino. 

Pauanui beach.

Photos courtesy Environment Waikato
Coastal structures

Coast south of Kaiaua.

Karioitahi beach.

Photos courtesy Environment Waikato
Activity: People impacts on the beach

Aim: To find examples of rubbish and litter on the beach and discuss the impact litter can have on the animal life at the beach.

Equipment: Rubber bands – 1 for each person

- You have one minute to find one thing that would not normally be on the beach. **You must not walk on any plants or harm the beach environment in any way to get your one thing.**
- Share with the rest of your group what you have found. What things did you find? How do you think they got to the beach? Is the beach where you normally expect to find them?
- Take a rubber band and pull it behind your thumb and little finger, across the back of your hand.
- Put your other hand behind your back and leave it there.
- Without touching any other part of your body, try to get the rubber band off your hand.

How long did it take you?

Could you do it?

Making the Links

What do you think this is trying to demonstrate in terms of litter and the effect it can have on animals? Which bits of litter do you think could be particularly dangerous for sea animals?

Please put your rubber bands back!

Remember, we don’t want to leave anything but our footprints!

Activity courtesy Environment Waikato
Rocky shore drawing

Draw a rocky shore animal that you know of in the box below.

Name:
How to make a Spyglass

Can't see below the sea? Make this to take on your visit to the rock pools. It's perfect for looking into deeper parts of the tide pools that are always submerged.

You'll need:
- milk carton/plastic bottle opened at both ends
- strong, tight rubber bands or duct tape
- plastic wrap.

How to make
- Wrap a piece of plastic wrap around bottom of carton.
- Secure with rubber bad or duct tape.
- Place covered end underwater to view what's hidden beneath the surface.
  If your plastic wrap tears while you’re at the shore, please don’t leave it there.

The Seashore Code

- Observe marine species where you find them. You may place them in containers in cool sea water for short periods of time only, and then return them to the place of collection.
- Make sure you have wet hands when touching marine species. Handle marine species carefully, gently and only when necessary.
- Lift rocks rather than roll them to ensure that you don’t crush the marine species. Remember to turn rocks back the way you have found them.
- Wear appropriate footwear and watch the waves!
- Take your rubbish home with you and pick up any left by others.
Maori terms for key words

- Algae: Pukohu wai
- Barnacle: Werewere
- Beach: Tatahi
- Carnivore: Kaikiko
- Closed season: Rahui
- Crab: Papaka
- Dune: Tahuahua
- Estuary: Wahapu
- Fish: Ika
- Guardianship of the environment: Kaitiakitanga
- Herbivore: Kaiota
- Inter-relatedness: Whanaungatanga
- Jellyfish: Petipeti
- Lagoon: Hapua
- Limpet: Ngakihi
- Mudflat: Oneparu
- Mussel: Kuku
- Oystercatcher: Tio
- Periwinkle: Ngaeti
- Phytoplankton: Tipurangi
- Rock pool: Haroto
- Rocky shore: Akau
- Sandhopper: Mowhiti
- Sandy shore: Onepu
- Sea: Moana
- Sea food: Kai moana
- Seaweed: Rimurimu
- Shag: Kawau
- Shingle shore: One kirikiri
- Shrimp: Kouraura
- Starfish: Patangatanga
- Stilt: Turituri-pourewa
- Tidal zone: Paetai
- Tide: Pai
- Whelk: Huamutu
Fabulous facts ... Do you know your tidal zones?

On the rocky shore, zones of seaweeds and animals are often quite distinctive. These zones are often correlated with the range of tides (i.e. the extent to which the tide moves up the shore). The zones of the shore can be split into the following categories:

**Splash zone (Supralittoral zone)** - this area of the rocky shore occasionally gets sprayed with salt water, usually at a high spring tide.*

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**Low tide zone (Sublittoral fringe)** - this area of rocky shore is usually covered with water but during a low spring tide, this area can be exposed.

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Fabulous facts ... Phytoplankton and zooplankton

So what are phytoplankton and zooplankton? Phytoplankton (phyto – plant, plankton) are microscopic plants such as unicellular algae, diatoms and dinoflagellates. Zooplankton (zoo – animal, plankton) are small microscopic animals, such as larval forms of barnacles, starfish, sea urchins as well as copepods, ciliates and krill. There are often other micro-organism swimming or floating around in the water for example, unicellular flagellates, ciliates, multicellular filaments of algae. These types of micro-organisms are commonly found in pond water samples. (See identification chart at back of booklet.)
Fabulous facts: Did you know ...

Hear of agar? Agar is a bit like gelatine. It is used in foods and to make agar plates that are often used for culturing microbes. Agar seaweed (Pterocladi lucida), is a red seaweed which is found along the coast of the North Island and the top of the South Island, New Zealand. This seaweed has been harvested in New Zealand for over 40 years. It is mainly gathered from beaches in Hawke’s Bay, Wairarapa, Poverty Bay and the Hokianga district.

Check out the fancy New Zealand seaweeds: Seaweeds of New Zealand, Nancy Adams (1994) and Common seaweeds of New Zealand, Nancy Adams (1997).

Fabulous facts: Did you know ...

Unlike humans and birds, the lifecycle of many marine species occurs in different environments. Adult marine species may be found low on the rocky shore or on the reef just off the rocky shore. Larval forms (plankton) grow and develop offshore, sometimes beyond the continental shelf. Juvenile stages swim back to shore and settle for sometime on the rocky shore or rock pools.

Example: The life-cycle of the crayfish

Marine animals often disperse eggs and sperm into the water. To increase the chances of fertilisation, the number of eggs and sperm produced by one adult is enormous! For example one female paua can produce 10,000 eggs or more in one season. There are many risks for young larvae as well. Predation of larval stages is high and unfavourable climates (strong off shore currents or changes to weather patterns - El Ñino) can often lead to many larvae dying. Also larvae can be very susceptible to temperature and salinity changes. Water temperature and salinity can be affected by increased pollution which in turn leads to larvae mortality or mutation. So the number of larvae which eventually become adult can be few.
**Facts on food webs ...**

Food webs are a diagrammatic way of expressing how energy flows through different organisms or more simply what eats what?

The most important part of food webs are the **producers** (e.g. plants, seaweed, algae films and phytoplankton). Without **producers** there wouldn’t be food webs! Producers obtain their ‘food’ from sunlight energy, water and nutrients. This process is called photosynthesis.

The rest of the food web can be split up into categories of **herbivores**, **carnivores** and **omnivores**. Animals that eat only plant material (producers) are called **herbivores**. Animals that eat other animals are called **carnivores** and those animals that eat both plant material and animals are called **omnivores**.

But wait there is more ... What are **detrivores**?

Detrivores are organisms that eat dead material. Detrivores play a very important role in food webs. Just imagine if there were no organisms to break down dead material! Some examples of detrivores are; bacteria, fungi, earthworms or hagfish.

**So what does a simple rocky shore food web look like?**

Think of all the marine and terrestrial creatures that live on the rocky shore. A real rocky shore food web would be much more complex than this one!!
Identification chart for micro-organisms commonly found in pond water

Take a few droplets of water from a pond near your school – look at it under a microscope!
Can you identify any of the micro-organisms in the water?

Other bigger creatures to watch out for are water bugs, copepods and daphnia.

Golf balls (Volvox) are bright green spiky balls. They are a type of colonial green algae.

Gonium are another type of colonial green algae. Each cell has flagella (swimming-like tails) which help the colony manoeuvre around.

Rotifers are transparent, tube-like creatures which have cilia at one end. They are very quick swimming and will zip in and out of the microscope viewers.

Multicellular algae are recognised as long green filaments or broad green sheets.

Diatoms are type of algae which are usually recognised as round or diamond shaped objects. They are able to move around using small cilia found in the groove along their bodies.

Unicellular flagellates (Euglenoids) are tube-like creatures with two flagella – tails, one is often visible and the other is often wrapped around its body. A red eye spot may also be visible.

Ciliates are small round creatures (they may have green blobs inside their bodies – chlorophyll). Ciliates are covered in small fine ‘hairs’ called cilia which help them manoeuvre around ... and yes they can swim fast!
Match up the adults with the larvae!

Use the pictures below, match up the larval form with the adult marine creature.

(Answers - see next page)
Food web snap

Use the snap cards (see pictures opposite). The children have to decide if any of their animal cards are eaten by, or eat the animal of the snap card that is face up on the table.

What eats what?

<table>
<thead>
<tr>
<th>Marine creature</th>
<th>Eats:</th>
<th>Is eaten by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotty</td>
<td>Shell fish, barnacles</td>
<td>Larges fish, humans</td>
</tr>
<tr>
<td>Barnacle</td>
<td>Zooplankton and phytoplankton</td>
<td>Spotty and snapper</td>
</tr>
<tr>
<td>Zooplankton</td>
<td>Phytoplankton</td>
<td>Filter-feeders, small fish</td>
</tr>
<tr>
<td>Phytoplankton</td>
<td>Sunlight, water and nutrients</td>
<td>Zooplankton</td>
</tr>
<tr>
<td>Seastar</td>
<td>Shellfish</td>
<td>Snapper and spotty</td>
</tr>
<tr>
<td>Paua</td>
<td>Algae films, seaweed</td>
<td>Sea stars, maybe crayfish</td>
</tr>
<tr>
<td>Kelp</td>
<td>Sunlight, water and nutrients</td>
<td>Kina</td>
</tr>
<tr>
<td>Seaweed</td>
<td>Sunlight, water and nutrients</td>
<td>Paua, kina, crayfish, humans</td>
</tr>
<tr>
<td>Sting ray</td>
<td>Small fish, small crayfish, shellfish</td>
<td>Humans</td>
</tr>
<tr>
<td>Humans</td>
<td>Pretty much everything</td>
<td>?</td>
</tr>
<tr>
<td>Kina</td>
<td>Kelp, seaweed</td>
<td>Crayfish, snapper</td>
</tr>
<tr>
<td>Crayfish</td>
<td>Kelp, kina, paua</td>
<td>Humans, snapper, octopus</td>
</tr>
<tr>
<td>Octopus</td>
<td>Crayfish, shellfish</td>
<td>Humans, large fish</td>
</tr>
<tr>
<td>Shellfish</td>
<td>Zooplankton, phytoplankton</td>
<td>Octopus, sea star, stingray, snapper</td>
</tr>
<tr>
<td>Yellow eye mullet</td>
<td>Zooplankton, seaweed</td>
<td>Large fish (snapper, stingray)</td>
</tr>
</tbody>
</table>
BLACK MASTERS AND ADDITIONAL INFORMATION: Snap cards
Pictures and activity sheet - adapting to change

Ask the class to look at the rocky shore animals and discuss what they will do when the tide goes out...
Adapting to change activity sheet

Using this activity sheet, write what each will do beside each animal. Some might do more than one thing.