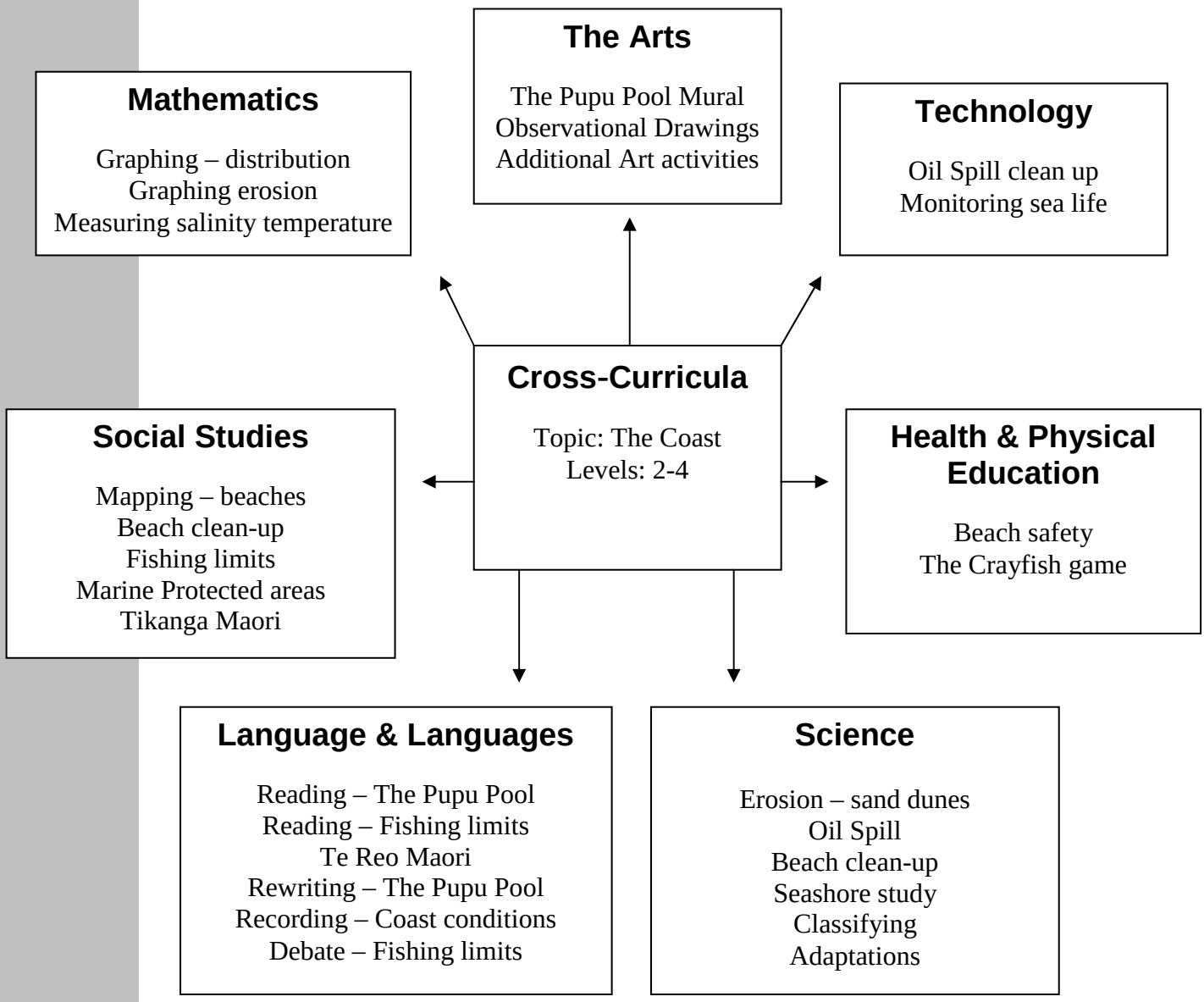
Contents

Appendices

Cross-Curricula



Curriculum Links

Links with New Zealand curriculum statements

Science *Making Sense of the Living World*

Achievement objectives and possible learning experiences

Level 1

- observing small plants or animals and reading books about their main functions
- exploring a beach and observing the different plants and animals that live there

Level 2

- establishing some of the criteria which help to distinguish fish, birds and insects
- drawing different animals

Level 3

- visiting an estuary to observe the special features of plants and animals which enable them to survive in this particular environment
- developing a large wall chart about the habitats of some common New Zealand animals and plants

Level 4

- collecting newspaper articles to find out about an environmental issue
- debating a global conservation issue to develop an awareness of the possible consequences of human activity on other living things
- visiting a local recreation area to collect data about the impact of people on the area
- researching background information and debating the statement "there should be an open season for gathering shellfish at the local beach"

Making Sense of Planet Earth and Beyond

Level 1

- talking about and recording the activities that people do in different seasons
- listening to someone who has lived in the area for many years talk about how the local environment has changed as they have grown up

Level 2

- observing and describing a beach scene, particularly changing water levels
- viewing and sharing ideas about a significant rock formation in their area

Level 3

- brainstorming in groups, the recreational uses of water as preparation for the creation of a wall mural
- investigating Maori tapu as pertaining to wai, awa, and puna
- listening to Maori legends to learn more about local landforms
- justify their personal involvement in a school or class initiated local environmental project, eg beach clean-up, planting project, recycling

Level 4

- using evidence of fossils or rock types to speculate about the local history of an area
- investigating the role of rahui in the guardianship of natural resources
- writing a letter to the local council justifying why a special area should be conserved
- investigate a local environmental issue and explain the reasons for the community's involvement, eg replanting a cleared hillside, dune planting.

Making Sense of the Material World

Level 1

- explore simple physical properties and use them to describe and group everyday materials, eg shape, texture, colour, size, smell.

Level 2

- investigate and describe everyday changes to common substances, eg evaporation, condensation, dissolving, melting.

Level 3

- investigate the physical properties and uses of flax
- slowly evaporate a sugar or salt solution to dryness

Level 4

- investigate the positive and negative effects of substances on people and on the environment, eg petroleum products, fertilisers, acid rain.
- survey and report on the solid forms of pollution on a local recreation area.

Social Studies

- Place and Environment Using a range of skills, students will demonstrate their understanding of:

Level 1

- places that are important to them and why they are important
- how a natural feature and a cultural feature in the local area affect people and how people affect these features, eg in groups, students visit a local coast area and observe how people use the coast and how the coast influences the activities of people

Level 2

- how and why people perceive their local area differently
- how natural and cultural features of an environment affect people's lives and how people affect these features, eg students identify different places in the local community which are significant to various groups for gathering food

Level 3

- people's perceptions of different environments and the reasons for these perceptions
- how and why people in the past have interacted with their environments, eg students research how waste disposal has impacted on the sea in the past

Level 4

- how and why people's perceptions of place and environment change over time
- how and why the interactions between people and the environment change over time, eg students interview people of different generations to investigate how and why their views and actions relating to waste disposal may have changed over time. They show their findings on a values continuum

- Resource and Economic activities

Level 1

- what resources are and why people need them.
- identifying resources, eg forests, rivers, lakes, sea

Level 2

- how and why a group of people has developed a resource within a community.
- contributing to a group project, eg tidying up a local beach.

Level 3

- how and why different cultural groups value and use a resource
- making choices about the use of resources, eg conservation

Level 4

- the implications of the various decisions people make about the use of resources
- making decisions, eg identify different values people may attach to a resource (aesthetic, spiritual, industrial, recreational)

Technology

- The Intertidal Ecological Environment

Contexts: Environmental; Community **Main Area**: Biotechnology

- Technological knowledge and understanding

  - students investigate environments intertidal animals thrive in, eg cleansed and replenished by tide, rocky
  - teacher arranges a visit from a marine biologist to talk about intertidal life and learn about its importance as a pollution indicator
  - students visit the intertidal environment
  - students find out about possible influences on the intertidal community, eg sewerage outfall

- Technological capability

  - students consider the needs of some specific intertidal animals in terms of protection access to food
  - students develop a system for monitoring number and diversity of animal life in the intertidal zone
  - they send their system plan to a marine biologist for assessment
  - they prepare a schedule for monitoring
  - students learn how to read tide tables
  - students learn how to identify different types of sea life

- Technology and Society

  - students learn about the special importance of kaimoana to tangata whenua
  - they survey local people to gauge attitudes on the need for good coastal water quality

- Assessment

  - students write a report on what they found comparing sites or one site on different occasions

Study 1

The Taranaki coast

Taranaki has a fascinating coast formed by a high energy wave environment. The Taranaki coast is erosional in nature, and can be broadly split into two different coastal forms. The Taranaki ringplain coast is formed from volcanic deposits associated with Mt Taranaki/Egmont. It is often termed the laharic coast, and is characterised by large boulder reefs. The coastlines to the north of Buchanans Bay (Motonui), and to the SE of Ohawe, are termed the papa coasts, and are characterised by high cliffs of papa/mudstone deposits.

Taranaki beaches have black sand which is formed from the volcanic material that is washed down the rivers, eroded from the coast and abrasion (wearing down) of cobbles in the foreshore. Rock pools are a common feature of the more rocky coastlines.

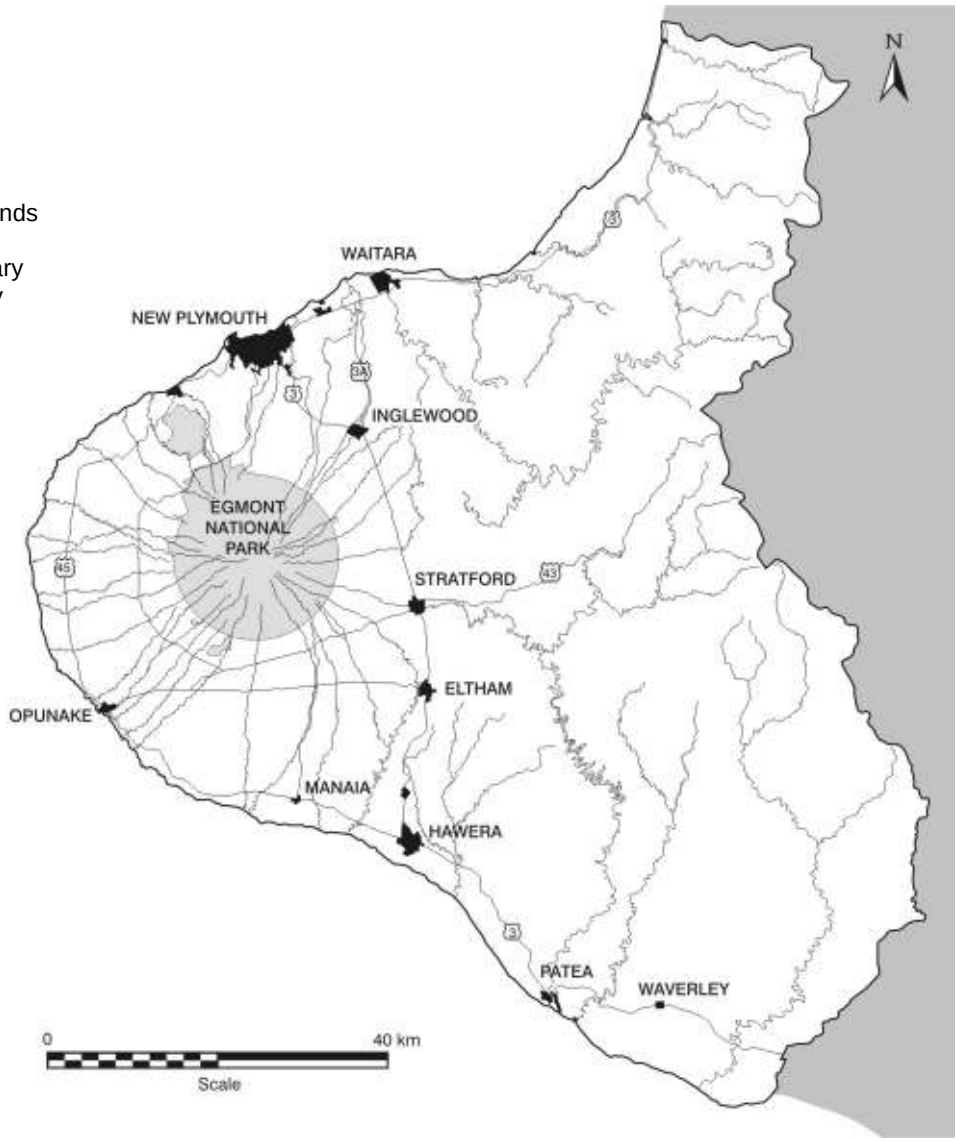
Much of the coast is subject to erosion with weather and sea causing the high cliffs to erode in the south and threatening the foreshore in the north.

Taranaki reefs provide an important source of kaimoana to Taranaki people and the beaches are a source of a wide range of recreational activities. As well there are a number of sites of special character.

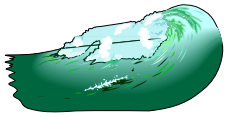
Activity Mapping

On the outline map provided, locate the following to familiarise yourself with the Taranaki coastal environment.

1. Port Taranaki
2. Urenui Beach
3. Ohawe Beach
4. Opunake Beach
5. Oakura Beach
6. The Sugar Loaf Islands
7. Cape Egmont
8. Waitara River Estuary
9. Patea River Estuary
10. Waiinu Beach



Study 2



Erosion and sand dunes

The Taranaki Coast is erosional in nature. Erosion is a natural process resulting in the loss of coastal land by the action of the sea. In Taranaki coastal erosion is typically shown in the retreat of coastal cliffs. However on sandy beaches it is shown by the erosion of the sand and its transportation offshore during storms.

A coastal erosion hazard arises when people and/or their assets become threatened.

The Problem with Sea Walls

Sea walls are solid fixed walls that are built to protect property from the sea. In other words, they are designed to protect the assets behind them, but they do not protect the coast itself.

The problem is that they interfere with the natural movement of the sand. After a big storm the seaward side of the wall becomes badly scoured because the sea can't work on the whole sand dune as it normally would and concentrates its energy on the part of the beach it can get to. This can result in the loss of the beach in front of the seawall. Sea walls can also result in accelerated erosion of the land at their ends. This is called ‘end effects erosion’.

Dunes are great

Sand dunes are the best protection from the sea, as they can readily adapt to changes in the waves approaching the coast.

When big waves hit sand dunes in a storm the dunes take the force and some of the sand is dragged out to sea. This sand builds a sandhill on the sea floor under the water called a sand bar. After the storm passes the waves bring the sand from the sand bar back to the beach. Onshore winds blow the sand to the dunes and therefore help to rebuild the sand dune again, in preparation for the next storm.

So what can we do?

Unfortunately many buildings and roads were built too close to the sea before we understood how the coast works. But we can try to protect remaining sand dunes by not walking all over them and looking after the plants that grow on them.

Table 22 State of the Environment Report – Mean annual observed coastline change (metres/year)

Location	Rate	Location	Rate
Waitara East	-1.37	Paritutu Beach	-0.45
Waitara West	-0.54	Herekawe West	-0.29
New Plymouth Airport	-0.60	Omata	-0.43
Bell Block Beach	-0.32	Waireka	-0.25
Waiwhakaiho East	-0.31	Oakura Beach (variable)	-0.20
Waiwhakaiho West	-0.67	Stony River Mouth	+1.53
Fitzroy Beach	-0.24		

As you can see from the above table most of Taranaki is eroding except for one part which accreted. This accretion was associated with the movement of a river mouth.

Activity

- Maths

Take the data in Table 22 and present it on a bar graph.

Study 3

The Pupu Pool

Read the story "The Pupu Pool" by Witi Ihimaera. This story is available in School Journal Part 3 No. 3 1974. There is also a taped story available in most schools. If you would like a taped copy contact the Information Officer, Taranaki Regional Council.

This excellent story deals with an important coastal issue and focuses on the special importance of the coast to Maori people.

Activity

- Reading comprehension vocabulary

Answer the following questions:

1. How did the father convince the mother to go to the reef?
2. How often did the family travel to the reef?
3. Why did the children wear shoes when collecting kai?
4. What did the mother do when she got out to the reef?
5. What special discovery did the children make?
6. What did the children do when they returned to the beach?
7. What was the first sign of something unusual when they returned to the reef?
8. Why couldn't they collect shellfish anymore?
9. What was their father's first reaction after reading the sign?
10. What did the old woman do?

- Interpretation

1. In what ways was the reef important to this family?
2. Why did the father teach the children about respecting the sea?
3. Why did the old woman cry a tangi to the reef?
4. What effect would the closure of the reef have on their way of life?
5. What steps could be taken to improve the situation?

- Vocabulary

Find synonyms (words similar in meaning) to these words:
Clue: some of them are Maori words

seafood _____ 4	stomach _____5	food_____ 5	see through_____7
peaceful/calm __ 7	fragile _____7	talk _____ 7	love/respect ____9
consideration___ 9	abandoned____10	grouped together _ 12	not safe _____12
cry of sorrow __ 12	contaminated __13		

Activity

- Language

Retell the story of the pupu pool in your own words. Use Te Reo where you can. Share your story with your class.

Activity

- Art

As a class project or individually, draw and colour a mural of the pupu pool scene. Draw the beach, the people, the reef. Perhaps even a before and after picture showing the effect the sewerage pipe has had.

Study 4

Pollution - Oil Spill

The Coast is a special place and we all have an interest in keeping it pollution free.

One of our greatest fears is an oil spill. The oil spill that occurred in Alaska some few years ago cost over $2 billion to clean up and caused serious problems to fish and bird life and other animals poisoned through the food chain. As well as this there was the problem of oil lying on the beaches

Taranaki's port is the second busiest in New Zealand for oil products.

The Taranaki Regional Council staff are trained to deal with oil spills and have equipment stored at the Port to deal with oil spills. More equipment can be called in if need be.

How does an oil boom work?

An oil boom consists of a float which is filled with air, a skirt which keeps the oil contained and a weight which keeps the skirt below the water.

Once the oil is contained skimmers pick up the oil from the sea and it is taken away for disposal.

Activity

- Science-Technology

Use: a tray that will contain water
an eye dropper
and various pollutants, eg petrol, diesel, oil, etc

Try putting in drops of each substance to see how it behaves on the water.

Make a beach at one end of your water tray and see what effect your pollutant has on the beach. You can even make waves at one end.

Try making your own oil boom. You could use: straws
fabric
cotton wool
string etc

Experiment with your boom to see which is the most effective at containing and/or absorbing a spill.

Activity

- Research

See if you can find out about oil spills in history using encyclopaedias etc.

Study 5

Rubbish kills

Every year birds, seals, whales, dolphins and fish die needlessly because people throw rubbish into the sea or leave it on the beach.

Some facts about Marine Debris

- about three times more rubbish is dumped into the world's oceans annually than the amount of fish caught
- a glass bottle takes one to two million years to decompose
- a foam cup takes 500 years to break down
- an aluminium can takes decades to break down
- a rubber flipper will take 75 years to decompose

What is the worst debris?

Plastic is the biggest threat to marine life

- plastic six-pack tops entangle marine birds and mammals as they dive and scavenge for food
- plastic bags become stuck in the throat or stomach of whales and turtles, choking or starving them
- plastic in small pieces such as lids and broken containers get stuck in birds' stomachs when they mistake it for food. They then die of starvation.

What is the most common debris?

In 1992, the Centre for Marine Conservation in Washington USA collected information from beach clean-ups carried out throughout the world.

Here are the 12 most common items reported

cigarette butts	plastic caps and lids
plastic pieces	drink cans
polystyrene pieces	plastic straws
plastic food bags	glass drink bottles
paper pieces	polystyrene cups
glass pieces	plastic drink bottles

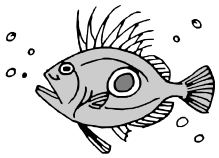
Activity

- Beach clean-up

Your class or school could organise a beach clean-up of your local beach. You would be helping contribute data on the Taranaki region, improving the beauty of the beach and maybe saving some marine creature from a nasty death.

Use the beach clean-up log provided in the appendix of this unit and fax the information to the Information Officer, Taranaki Regional Council (06) 765 5097. Your data will be very useful to us.

Study 6



Fishing limits

Fishing is very popular in Taranaki as it is anywhere in New Zealand. Most New Zealanders regard fishing and shellfish gathering as an important part of our way of life.

Some people however take more than they are allowed to or take undersized seafood. This has the effect of seriously depleting local fisheries.

It is everyone's responsibility to ensure that our fisheries are conserved so everyone can enjoy them now and in the future.

The three main points to remember are:

- Don't take more than your daily limit
- Don't take undersized fish
- Don't sell or trade your fish

Below are the rules for taking shellfish in our part of the country:

SHELLFISH

Shellfish species	Daily limit per person	Minimum size
Cockles	150	none
Kina (sea eggs)	50	none
Mussels	50	none
Oysters - dredge	50	58#
- rock & Pacific	250	none~
Paua - ordinary	10	125mm#
- yellow foot	10	80mm#
Pipi	150	none
Scallops - Challenger	50	90mm#
- Central	20	100mm#
Toheroa	prohibited*	
Tuatua	150	none
All other (combined)	50	none

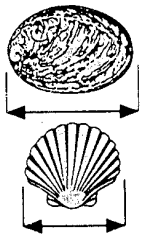
* *Toheroa must not be taken, possessed, or disturbed unless an open season is declared by the Director-General of Agricultur and Fisheries.*

~ *Rock oysters and pacific oysters must not be opened while they adhere to the object on which they grow.*

\# *Scallops, dredge oysters, rock lobsters and paua may not be possessed at sea at any time out of the shell.*

Measuring shellfish

- Paua - measure the greatest length of the shell in a straight line.
- Scallops - measure the greatest diameter of the shell.
- Dredge oysters - must not pass through a rigid circular metal ring with an inside diameter of 58mm.



Scuba gear *(does not include snorkel)*

- No person may take paua and/or mussles using scuba.
- No person may be in possession of paua and/or mussels whil in possession of scuba. This includes possession in or on any vessel or vehicle.

Open season for scallops

- 15 July to 14 February inclusive.

Activity

- Paua Poachers

Read the article in the appendix taken from the front page of the Daily News about Paua Poachers.

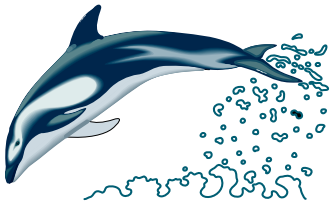
Have a class discussion with a values continuum. This could be done by actually having the children position themselves along a physical continuum, eg a line on the floor: at one end "strongly agree" at the other end "strongly disagree". Children can position themselves where they think they are on the values continuum and argue their stance.

Use the following discussion points:

- the people caught with undersized or too many paua should be charged
- only those who are way over the limit should be charged
- because it is difficult to get paua of legal size in Taranaki, the size limit should be smaller for Taranaki
- people should be allowed to take what shellfish they like, ie there should be no limits
- There should be no shellfish gathered for one year to allow stocks to build up
- You may think of some of your own.

- Play the Crayfish game (see appendix)

Study 7



Marine protected areas

About one-third of New Zealand's land area is protected in reserves.

These have been created to protect representative samples of our natural landscapes and ecosystems and to protect biodiversity. Most New Zealanders accept that it is important to protect this land area.

Yet less than 4% of our territorial sea is protected in marine reserves and if the huge Kermadec Islands Marine Reserves were taken out it would only be 1%.

Why have marine reserves?

Marine Reserves are a bit like a national park in the sea. Nothing in a marine reserve can be killed, removed or disturbed. People would be able to swim and dive in the area and see sea-life that is protected from being exploited. We would see larger fish and more of them and perhaps they would be friendlier because they wouldn't be afraid of us.

What do we have here in Taranaki?

Taranaki does not have any marine reserves but we do have the 'Sugar Loaf Islands Marine Protected Area'. It was originally a marine park because the people of Taranaki thought it needed to be protected. In marine parks there are restrictions on what sort of fish you are allowed to collect and how, eg no long lines.

In 1991 the Sugar Loaf Islands Marine Park changed to the Sugar Loaf Islands Marine Protected Area. This is the only one in New Zealand and is protected by its own Act.

This is different to a marine reserve because you can still fish and take crayfish or any other plants and animals, or rocks, but you are still subject to fishing restrictions.

Activity

- Debate Topic

That New Zealand should have more marine reserves.

Activity

- Mapping

Using an atlas see if you can locate these New Zealand marine reserves

- Poor Knights Islands
- Cape Rodney - Okakari Pt
- Long Bay - Okura
- Whanganui-a-hei (Cathedral Cove)
- Tuhua (Mayor Island)
- Motu Manawa (Pollen Island)
- Kapiti Island
- Long Island Kokomohua
- Westhaven (Te Tai Tapu)
- Tonga Island
- Piopiotahi (Milford Sound)
- Te Awaatu Channel (Doubtful Sound)
- Kermadec Islands
- Te Angiangi East Coast of Central Hawkes Bay

N.B. A map of marine reserves can be found in the appendix

Study 8

Safety at coast and sea

With summer coming up and many of us heading off to the beach at some stage we need to remember our safety so we'll all be back to school to see our friends next year.

Think about all the safety measures you can take to make yourself safe at the beach and on the water.

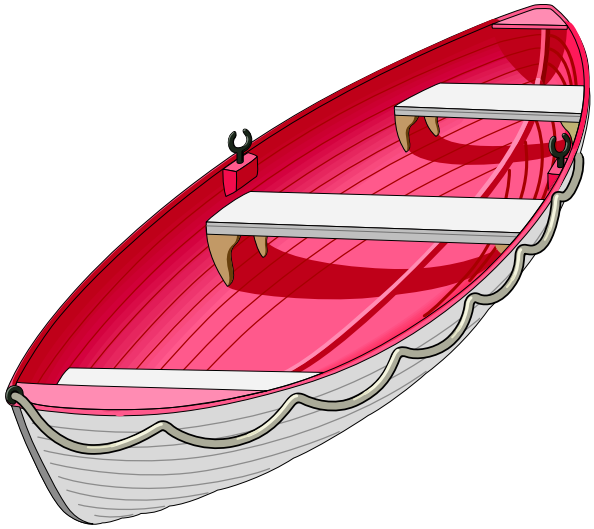
Here is a list - you may want to add some more of your own.

1. Wear a life jacket
2. Swim between the flags
3. If in trouble in the water raise your arm for help
4. Check the weather before going boating
5. Check the tide so you don't get trapped
6. Be careful walking along cliff tops, stay to the tracks
7. Don't explore the beach alone
8. Don't do any thing you are not sure about, eg swimming out too far, climbing a rock face
9. Protect yourself from the sun
10. Don't sit under cliffs where rocks could fall on you

Activity

- Design a poster promoting beach and water safety.

Ask your local beach motor camp if you can display them around the camp, eg noticeboards, cookhouses.



Study 9

Tikanga Maori

Maori people have collected kina, paua, koura and other shellfish as well as catch fish for many years. Kaimoana is a valuable resource and has been an important part of the diet and culture of Maori for centuries.

It is important to provide kaimoana at a hakari (feast) to manuhiri (visitors) and is a very important part of tribal mana (prestige and honour).

To ensure this resource is maintained Maori have traditionally looked after their reefs in a number of ways:

- They collected seafood rotationally
- They collected certain types of seafood only in certain seasons
- They avoided any form of rubbish or human waste near the sea or the streams that run into the sea
- No fishing was allowed after a death at sea
- They avoided gutting fish and shelling shellfish below the high tide mark
- Each hapu had its own reef area to collect shellfish from.

To Maori, water is tapu (sacred) and waste water is not to be mixed with a food source or water used for washing or bathing. Even if it has been treated waste water is regarded as culturally polluted.

The issue

Since the arrival of Europeans in the 1800's, with more people and more industry, pressure on the sea and its resources has increased. It is important that the quality of kaimoana gathering grounds are maintained to avoid causing embarrassment to hapu who can't provide seafood for their visitors.

The Resource Management Act and Maori

The Resource Management Act requires
that the relationship of Maori with their ancestral lands, water, sites, wāhi tapu (sacred places), and other taonga (treasures) is recognised and provided for. This means that:

- wāhi tapu and other areas or sites of special significance to Maori; should be protected;
- development or the adverse effects on mahinga mātaitai (areas from which seafood are gathered) are avoided, as far as possible.
- the values and perspectives of Maori with respect to the spiritual qualities of water (its mauri or life force and wairua or spiritual dimension) are recognised and provided for in decision-making.

Activity

- Read 'A Gift from Tangaroa' - School Journal Part 3 No. 1 1990

Find out from this story what traditional ways Maori protect kaimoana and show respect for the sea.

Ask a Maori elder to talk to your class about collecting kaimoana and/or how the coast has changed over time.

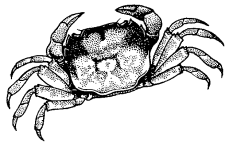
Activity

- Te Reo Maori

Below are some Maori words which will help you identify place names on the Taranaki Coast and familiarise yourself with traditional terms

awa - river	whenua – land	ngaru – waves	toka – rock
pari – cliff	one – sand	moana – sea	ngutuawa – estuary
motu – island	timu – low tide	manga – stream	tai – tide
whanga – harbour, bay		pari – high tide	

Study 10



The seashore study

The seashore study can suit all ages from 5 upwards and the following ideas/activities can be adapted to suit the age you are working with.

The main aim is to familiarise children with the coastal environment and the plants and animals which live there.

The Taranaki Regional Council monitor intertidal life at sites around the region to assess number and diversity of life and the effects of pollution.

Children can mirror some of this monitoring as the methods are relatively simple.

Before the visit, talk about the intertidal zone and what sort of creatures and plants we might expect to find there. You can use the information contained in the appendix for this.

At the coastal site the children can examine the rock pools to find the life and compare it with the information they have.

When the children first arrive at the beach:

Observe
- the state of the tide
- the weather conditions
- the sea conditions
- the nature of the beach, eg sandy, rocky, sand dunes present, evidence of erosion
- evidence of pollution

Children may wish to draw a cross section of the beach labelling various features.

Children then move into the tidal area looking for sea life.

Children observe animals in the rock pools making a note of what they see on top of the rocks, on the pool walls and under the rocks.

Children observe their position, what they are doing, how they move or hide, whether they are camouflaged. Children can use a quadrat (see appendix for details) to collate the number of each species at a random site in the rock pool. Alternatively they could use a P.E. hoop.

Children collate the number found on their field sheet. They move further down toward the sea and compare the life there with the first site.

Children can work in groups with one child recording, one locating and one or two identifying the species. Children can attempt to catch crabs or fish, topshells, cushion stars, catseyes etc to examine and identify them.

They can be kept in a plastic container for a while and then returned to the water.

Children may wish to make observational drawings of some sea life.

The strings on the quadrat can be used to estimate percentage cover of algae, eg corraline paint or turf. Children should also measure temperature of the rock pools and possibly take a sample of water from each to check for differences in salinity. This can be done by taking samples back to school and evaporating them off.

Equipment

thermometers	hand lenses
plastic containers, sieves	identification sheets
clipboards, field sheets, pencils	quadrats (or P.E hoops)

These can be borrowed from the Regional Council by contacting the Information Officer (Environmental Education).

Safety - please ensure children are aware of safety - check safety page in this unit of work.

Sandshoes can be handy on sharp rocks.

Additional Art Ideas

Seashore Mask

- Attach papier mache to an inflated balloon.
- Use PVA glue mixed with wallpaper paste to make a strong mask.
- After gluing two layers of paper, paste on some shells, seaweed and other bits and pieces from the beach or reef. Pebbles and sand can also be added to the mask.
- Cut out the eye holes and attach elastic if you want to wear the mask.

***Note**: the balloon can be cut in half once the paper has set to make two masks.*

Beach Mural

- Make a mural of a beach scene showing the different life which exists at different areas.
- Draw the plants that grow, the creatures that live in the rock pools, the birds that fly.
- Write a speech bubble or caption for each one saying what they do or how they are part of the ecosystem
  (information about rocky shore life in this unit will help)

Mobile

- Collect pieces of driftwood, shells, dried seaweed etc, and maybe some old string or fishing line.
- Attach all the objects to the driftwood with the string and get everything to balance.

Face Painting

- Children can have crabs and starfish painted onto their faces as part of their reinforcement activities or on their field trip to the shore.

Sand Casting

- Children can make interesting three dimensional objects by digging into the sand until they reach the damp hard-packed sand.
- Once in the sand make a mould using fingers and small tools etc.
- Alternatively, the children can use an object to stamp a shape such as a shell in the damp sand.
- Once the mould is established, pour some plaster of Paris in.
- Allow the plaster of Paris to harden then remove the cast.
- These can be painted back at the classroom or left as they are.
- Note: Avoid making very ornate objects or objects that are too thin as they tend to break.

Seashell Jar

- Cover the outside of a glass jar with plaster of Paris.
- Gently press shells into the mixture and leave it to set.
- The piece of art can then be varnished.
- This can also be done on a box or plant pot.

Note: It is OK to collect shells from the beach in moderation, especially from high up on the beach where they are unlikely to be needed by a hermit crab for a home.

Additional Maths Activities

A rocky shore study has many opportunities for practical maths

- Measurement –length – shellfish

  Using plastic rules children can measure the size of shellfish to the nearest millimetre. This can be to establish if they are of acceptable size for taking.

- Graphing – Statistics – Distribution

  After counting the number of animals the children found at each site the information can be put on a graph. This could show graphically the difference between sites and indicate the preferred conditions of certain animals. A stem-and-leaf graph would be ideal for this.

- Measurement – tide tables and charts

  Children are to find out when low tide and high tide occur to plan a successful field trip to the rocky shore. Children can also measure the difference in tide height from low tide to high tide. This information can be found in a tide table.

- Measurement - scale

  Children can use a thermometer to measure the difference in water temperature between the high and low water marks. Children should be able to measure to the nearest 0.5 of a degree.

- Measurement – volume – evaporation

  In shallow ovenproof containers evaporate 20 millilitres of freshwater and 20 millilitres of seawater. Compare the evaporation rates and comment on the residue in each container.

- Measurement – weight – buoyancy

  Use two identical containers eg, margarine containers. Float one container on saltwater and one in freshwater. Progressively add known weights to each container, eg, unit cubes and see which container sinks first.

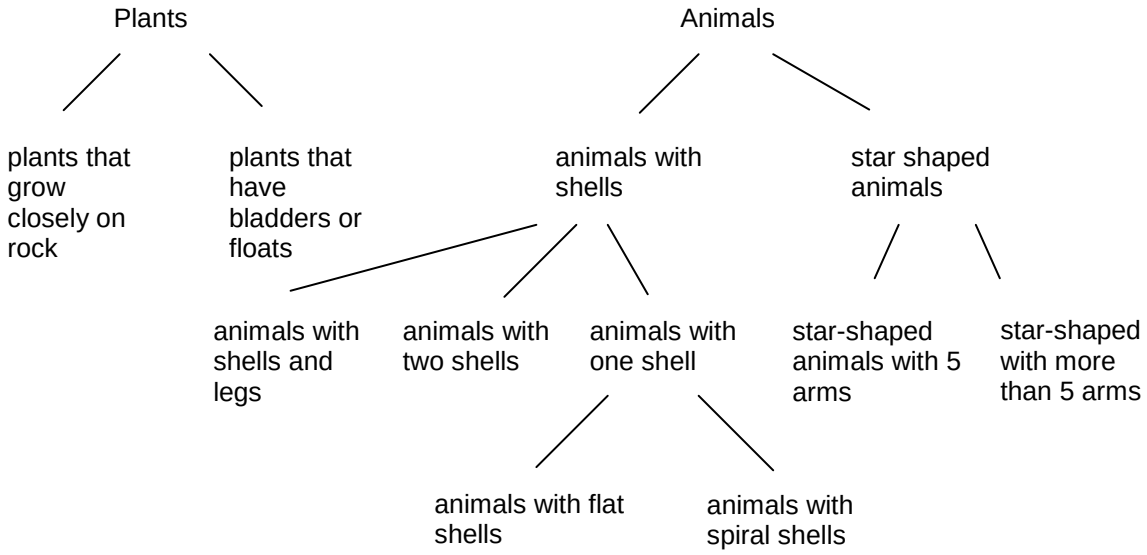
Additional Science Activity

Classifying

Children can have a lot of fun and learn from trying to place sea life into certain categories.

This gives an understanding of what a scientist does and helps the children understand more about the life they are studying.

Photocopy the sheet of seashore life and ask the children to group them. They may choose to categorise them according to plant, animal, shells, number of shells, legs, etc



The children can do this activity as individuals or in groups of two or three. Working in groups leads to good discussion and debate.

After the children have had some time to work out their classification they can present their work to the class saying why they chose to group their creatures and plants in the way they did.

This categorising can also be done at the reef where children can clearly see the characteristics of the plants and animals. When at the reef the children can put the plants and animals they group together in the same trays.

For example, all creatures with one shell could go in one tray and they could be further sorted, eg limpets, whelks.

Physical Education

The Crayfish game

This game enables children to understand the predator prey relationship and the delicate balance in our marine environment.

The game is best played on grass or sand within an area approximately 20 metres by 20 metres. The players must stay within the boundaries. Two areas within the boundaries can be identified as havens. These are places where the crayfish can go to recover as explained later. These havens can be marked by a PE hoop. Two, three or four players are given bibs to put on. They are the predators. They prey on the crayfish by tagging them.

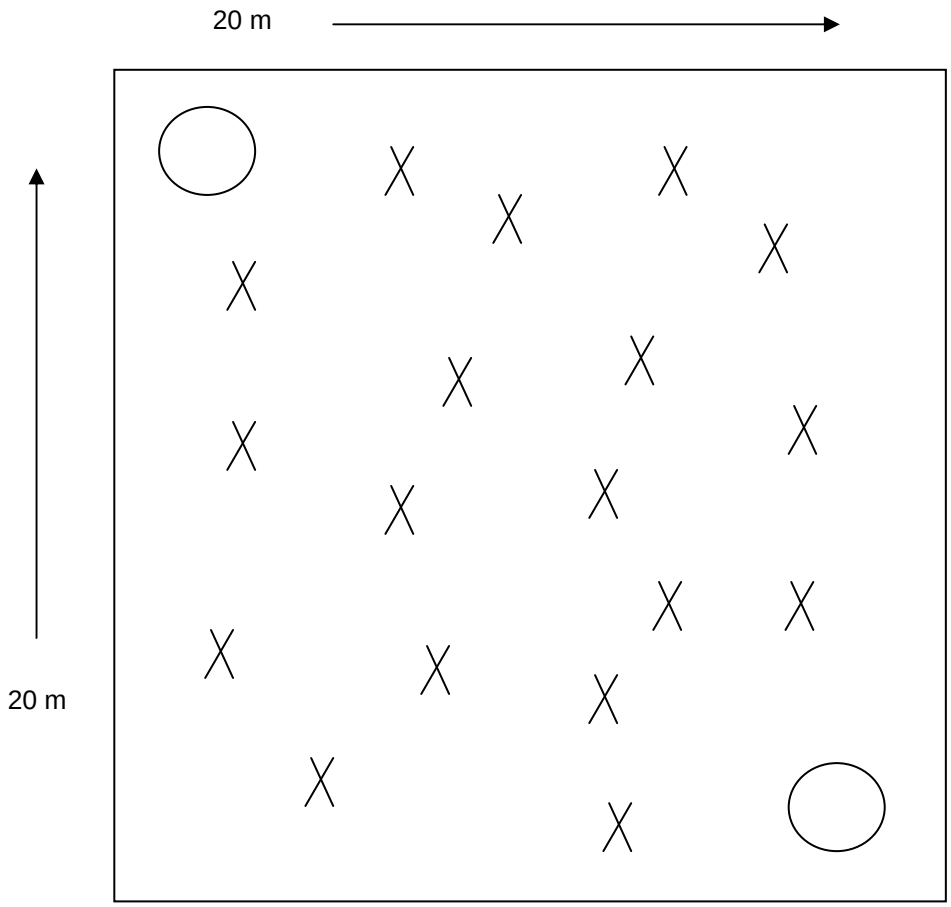
Once a crayfish is tagged it must lie down on the ground with its legs in the air. The other crayfish are allowed to rescue the captured one. They do this by putting a hand on a limb of the captured crayfish. It takes four people (one on each limb) to rescue a crayfish. The crayfish is then carried to the haven where it is free again.

Note: While the rescuers have a hand on the crayfish they cannot be tagged by the predators.

The game continues like this and the crayfish population ebbs and flows.

At some stage more predators can be introduced to impact more on the crayfish population.

After playing this game the teacher can discuss with children the effects of altering conditions in the marine environment, eg if too many crayfish were caught by fishing people what effect could this have on them and their predators.



Information about Rocky Shore life

Grazers, filterers, killers, scavengers and thieves

- Chitons

  Chitons have a shell made up of eight overlapping plates. This allows them to move easily while having protection. Chitons have a leathery skirt around their shells. They graze on small algae. Young chiton have only seven pieces of armour. Chiton have metal in their teeth so they don't wear out.

- Mussels

  Mussels attach themselves to the rocks using fine threads. Mussels filter feed by opening their shells to allow water and food in. Because mussels feed in this way they can be dangerous to eat when collected from polluted water

- Limpets

  Many limpets return home at the end of each feeding session. They return to exactly the same spot and exactly the same position. Limpets feed by grazing and scraping tiny seaweed or algae off rocks.

- Hermit Crabs

  Hermit crabs use the discarded shells of other creatures to protect their soft bodies. One nipper is usually larger than the other and is used to block the opening to the shell. Crabs scavenge dead plants and animals using their pincers to pull the food apart.

- Anemones

  Anemones have stinging tentacles for catching their prey. They can also reproduce in an unusual way including splitting in half or breaking into pieces. Out of the water an anemone looks like a blob of jelly.

- Seaweed

  Generally green seaweed is found higher up the shore while browns are in the intermediate area and the reds deeper down.

- Flexible Flapjack

  This species has floats on it which help keep the fronds near the surface of the water closer to the sunlight.

- Neptunes Necklace

  This has thick walled bladders filled with liquid to prevent drying out. Plants growing higher up the shore have a bigger bladder than those lower on the shore.

- Sea Urchin, Kina

  The kina has long sharp spines which can swivel on a ball and socket joint. The animal can move along using these spines. Kina crawl over seaweed and grind it up with their teeth.

- Starfish

  Starfish generally have five arms although some have more than five. Their skin has small plates and the mouth is on the underside in the centre of the star.

  Starfish are predators. They wrap themselves around mussels and cockles, pull their shells apart and push their stomachs between the shells.

- Sea Cucumber

  This is a sausage-shaped creature with limy plates on its skeleton. If it is disturbed it throws out sticky white threads.

- Sea horses

  Sea horses use their tail to curl around seaweed to help them stay in one place. The male sea horse carries the babies as the female lays her eggs in the male's pouch.

- Cockabullies (or triple fins)

  These have camouflaged skins to help them tide in the rock pools. They prefer to hide in the rock pools, rather than going into the deeper water where there are bigger fish.

- Topshells

  These are creatures similar to snails in that they have a slimy body covered by a shell. Most graze on seaweeds although some are meat eaters. Whelks use their long rasping tongue to drill through shells to suck out the contents.