

# Environmental Issues

## Teachers

This unit of work has been designed to support your class visit for the 'Environmental Issues' programme at the National Aquarium of New Zealand. Students will participate in a range of level-specific interactive activities.

The primary focus of this programme is the Living World Strand of the Science Curriculum, however when planning your unit of work, links can be made to other essential learning areas. Similarly, different essential skills can be emphasised depending on the needs of your students.

## Programme Overview

The Environmental Issues programme teaches students about the different types of issues that affect both aquatic and terrestrial environments, with a special emphasis on environmental issues that affect New Zealand.

Students will examine the positive and negative impacts humans have on the environment. They will discover the importance of independence, biodiversity and sustainability as well as what they can do to help the environment.

**Essential Learning Area:** Science

**Strand:** Living World

**Achievement Aims 1 and 4:** Gain an understanding of order and pattern in the diversity of living organisms, including the special characteristics of New Zealand plants and animals. Investigate local ecosystems and understand the interdependence of living organisms, including humans, and their relationship with their physical environment.

**Strand:** Planet Earth and Beyond

**Achievement Aim 4:** Investigate how people's decisions and activities change planet Earth's physical environment, and develop a responsibility for the guardianship of planet Earth and its resources.

Level	Essential Learning Area	Strand	Achievement Aim	Achievement Objective
1	Science	Living World	Understanding order and pattern.	Observe and identify parts of animals and plants.
2	Science	Living World	Understanding the interdependence of living organisms and their relationship to the environment.	Investigate the responses of plants and animals, including people, to environmental changes in their habitats.
3	Science	Living World	Understanding order and pattern.	Investigate special features of common animals and plants. Describe how some species have become extinct or are endangered.
4	Science	Living World	Understanding the interdependence of living organisms and their relationship to the environment.	Use simple food chains to explain the feeding relationships of familiar animals and plants, and investigate effects of human intervention on these relationships.
2	Science	Planet Earth and Beyond	Investigate people's decisions and develop a responsibility for the guardianship of the planet.	Investigate easily observable physical features and patterns and consider how the features are affected by people.
3	Science	Planet Earth and Beyond	Investigate people's decisions and develop a responsibility for the guardianship of the planet.	Justify their personal involvement in a school or class-initiated local environmental project.
4	Science	Planet Earth and Beyond	Investigate people's decisions and develop a responsibility for the guardianship of the planet.	Investigate a local environment issue and explain the reasons for the community's involvement.

## Scientific Skills and Attitudes

- Focusing and Planning
- Information Gathering
- Processing and Interpreting
- Reporting

The 'Environmental Issues' programme at the National Aquarium of New Zealand lays the foundation for developing the above investigative skills and attitudes.

## **Specific Learning Outcomes**

- To understand, interdependence , biodiversity and sustainability
- To become aware how humans affect the environment

### **MAJOR TOPICS COVERED BY THIS BOOKLET consisting of three parts:**

- 1) New Zealand - a special place for biodiversity
- 2) Help! Our biodiversity
- 3) Habitat loss
- 4) Introduction of species
- 5) Pollution
- 6) Population growth and over-consumption
- 7) What can we do?

# Environmental Issues

## Pre-visit Activities

### Part 1 - Pre-visit activities

General: Environmental Issues

#### Prior Knowledge Brainstorm

Have students share their views on what they know about environmental issues. Encourage the students to think about the local environmental issues around the school and the community. Students can record their brainstorm in the left-hand column of the chart similar to the one below. The remaining columns can be filled out during the unit to track and focus student learning.

What Do You Know?	What Do You Want to Know?	What You Learned

#### Newspaper clippings

Ask the class to discuss what some of the environmental issues around the school are? What are some of the local environmental issues? Keep a record of newspaper clippings of local environmental issues and make them into a poster. Do a similar project using New Zealand and global environmental issues. Are there any issues that are specific to New Zealand?

Hint: you may need to source newspaper items from national or international newspapers. There are plenty of newspaper web sites.

### **New Zealand - a special place for biodiversity**

#### What is biodiversity?

Brainstorm the word biodiversity. List the words that the class comes up with when they think of biodiversity. Make a class definition.

*So what is biodiversity anyway?*

Bio-diversity is a way of describing how many different plants (flora) and animals (fauna) can be found within a certain environment or region. New Zealand has a *great* bio-diversity, both on the land and within the sea. Many of New Zealand plants and animals are endemic, that is, found in New Zealand and nowhere else on earth! New Zealand's high biodiversity and number of endemic species is due to the separation of New Zealand from other continents for a very long time (i.e. 80 million of years of isolation) and the general lack of mammalian predators.

#### Bio-diversity of the environment

Once the class understands the term biodiversity, get the class to suggest the biodiversity of different environments/habitats. For example, how many organisms would be found in; a rubbish dump, native forest, pine forest, a concrete car park, the school playground or the rocky shore zones. Remember biodiversity includes *all* types of animals and plants, for example birds could include sparrows, seagulls, wax-eyes and blackbirds.

Using the sheet provided at the back of the booklet, do a mini-biodiversity survey at your school.

#### *Extension task*

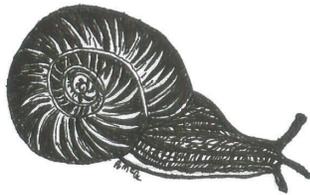
Once the class understands the terms 'native' and 'exotic', refine your biodiversity counts for different habitats, using native biodiversity and exotic biodiversity.

#### Why is NZ so special?

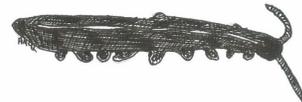
New Zealand has an amazingly rich flora and fauna. New Zealand has many endemic species (i.e. species that are only found in New Zealand and nowhere else in the world!). Some of the animals come from very ancient lineage and are often referred to as 'living fossils', for example, native frogs (*Leiopelma*) and the Tuatara (*Sphenodon*). Other animal and plants, such as beech forest (*Nothofagus*), peripatus, native earthworms and snails and wetas show links with other Gondwana countries (i.e. South America and Australia). The biodiversity of New Zealand's marine environment is impressive. At this stage there are 8000 known marine and coastal species found within New Zealand waters. These include plants, bottom dwelling organisms, fish, marine mammals and birds.



**Native frog**



**Native land snail**



**Peripatus**

### **Fabulous Facts .... Do you know?**

#### **Did you know that triplefins are endemic to New Zealand...**

Triplefins are rockpool and subtidal fishes that are often recognised as 'cockabullies'. In fact, there are 26 (known) different types of triplefin (they are very hard to tell apart!) in New Zealand. All triplefin species in New Zealand are found nowhere else in the world (i.e. endemic).

Did you know... New Zealand has over 650 species of seaweed. Of these seaweed 43% are endemic. That is, 280 different types of seaweed are only found in New Zealand!

### Gondawa and ancient New Zealand.

A very long time ago (~235 million years ago – before the beginning of the dinosaur age), the world's continents belonged to two 'super-continent'; Laurasia and Gondwana. At this stage, Gondwana was made up of the continents and islands; Central Europe, Iberia, Africa, South America, Arabia, Turkey, Iran, Tibet, India, Antarctica, Australia and New Zealand. At the end of the Jurassic (135 million years ago – while the dinosaur were roaming around), Gondwana split into Western and Eastern Gondwana. New Zealand was part of Eastern Gondwana, along with Australia, Antarctica, New Guinea and New Caledonia. In the early Cretaceous (the ancestors of the moa and kiwi were present then), there was yet another split; this time the eastern margin of Australia broke off from New Zealand. However, Antarctica and South America were still linked to New Zealand. The ancestors of the moa and kiwi probably walked onto the New Zealand land mass around this time. By 80 million years ago, New Zealand had separated from the rest of Gondwana. This last split was significant as it meant that none of the mammalian predators (apart from bats) found on other 'parts' of Gondwana made it onto the New Zealand land mass. Thus the birds, lizards, frogs and insects that were present in New Zealand at that time were left to evolve without the major impact of predators.

### **Fabulous Facts .... Do you know?**

#### ***How did the palaeontologist make the links between the different 'parts' of Gondwana?***

Many plants and animals that existed when Gondwana comprised of many different continents are not found today so palaeontologists use the fossil record. Fossil imprints of wood, leaves, flowers and even pollen and bones of animals were laid down in sediments over millions of years. Palaeontologists are able to suggest when different sections of Gondwana were linked, from the presence of similar fossils dating back to particular geological periods found within different land masses (e.g. New Zealand and Antarctica).

## The Gondwana jig-saw puzzle

Using the sheets provided at the back of the booklet, ask the class to identify the different countries at the different stages of splitting up. Colour in the different land masses and make a colour key for them.

### **Fabulous Facts .... Do you know?**

Moa were the tallest birds that ever lived (but not the heaviest). There were originally thought to be over 28 species of moa. However, it is now recognised the female and male moa are different sizes, so there are more likely to be only ~14 species of moa. Moa roamed all over New Zealand, thousands of years before humans arrived. The only predator moa had, prior to humans, was the Haast eagle (*Harpogornis moorei*). The Haast eagle was the largest eagle in the world! The eagle most likely ambushed smaller species of moa and young of most moa species by diving onto its prey at great speeds from forest perches!



Research one of New Zealand's weird animals or plants (e.g. podocarps, geckos, Peripatus, native frogs, weta and native land snail). Find out about its eating habits. How many offspring does it produce? Where is it found? Is it endemic? What are some of the cool, interesting facts about it?

### Species adaptation

Have a class discussion about how easy is it for an animal or plant to respond and adapt to a new environment? For example, possums have easily adapted to the New Zealand environment as there are many palatable plants (unlike gum trees in Australia) and it has no natural predators. Gorse and broom are examples of plants that have adapted well to New Zealand's climate. Both gorse and broom spread easily by seed dispersal and are able to grow quickly in disturbed soil. Gorse and broom have few insect predators.

Discuss with the class what makes good 'qualities' for an animal to survive in a new environment. For example discuss the following characteristics:

- Able to breed quickly, strong fit off-spring, lots of them
- Able to eat anything
- Live in many different habitats
- Have no predators or able to defend themselves adequately

Make a poster, displaying the key characteristics of an animal or plant that are able to cope in a new and changing environment.

Having made a list compare these qualities with known native animals/plants e.g. kiwi, mistletoe, kakapo and tuatara. What qualities do these animals have that make them susceptible to predation or habitat loss? E.g. Are they able to fly?

How rare is that?

Introduce the terms **common**, **rare**, **threatened/endangered**, **extinct**, **native**, **introduced**, **naturalised** and **exotic**. Discuss with the class what each of these terms mean to the class. Make definitions. Ask the class to suggest or find an animal or plant that fits each of these categories.

- Make mobiles of rare and threatened New Zealand birds (see instructions and cut-outs in the back of the booklet).
- Using the cards at the back of the book, make up a card game or play snap (i.e. match the animals and plants to the words).

## Fabulous Facts .... Do you know?

Definitions for whether a species is common, rare, threatened or extinct seem to be straight forward. However, in some cases it can be quite complicated. For example, some species can be common in a certain area but not found anywhere else so may be considered nationally rare, other species could be considered in more than one category (threatened or rare) depending on a person's perspective and species may be extinct in the wild but still could be grown in cultivation! Here are some definitions based on IUCN categories. For more information, use 'redlist' as a keyword to search for IUNC definitions.

**Extinct =** Where a species is believed to no longer occur naturally in the wild, although it may be found in zoos or cultivation.

**Threatened/ endangered =** A species that is in danger of becoming extinct and survival in the wild is unlikely if factors causing endangerment (e.g. predation) continue to occur or a species that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

**Rare =** Where a species is only found in small populations but may have a wide geographic range or a species that is locally common but found only in restricted areas.

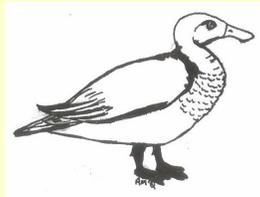
**Common =** A species which is commonly found over a large geographic range and are not likely to move into other categories (e.g. rare or endangered) as factors causing endangerment are not high.

**Naturalised =** A species that has, over time become adapted or acclimated to a new environment in which they were not native to.

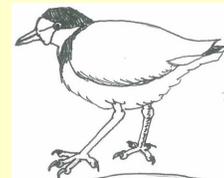
**Introduced/ Exotic =** A species that has been introduced (usually by humans) to an environment or community in which they are not native or endemic to.



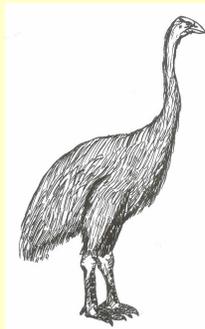
House Sparrow ... a common bird



Blue Duck... a threatened NZ bird



Spur-wing plover ... naturalised from Australia



Moa... extinct



Kea... an endemic bird



Huttons frog... a rare NZ frog

Brainstorm the word **introduced**. Ask the class to give examples of **introduced** plants and animals that they know. Fill in the suggested table (see back of the booklet) make the results into a classroom poster.

Hint: details about number of offspring can be found on the DOC web-site or the Handbook of New Zealand Mammals. Edited by King, C.M. (1995). Oxford University Press, Auckland.

### Bird research project

Research a New Zealand bird that is common, rare or threatened. Find out why it is in the category that it is. Does it have a limited habitat? Has the habitat been destroyed? Is it vulnerable to predators? How many offspring does the bird produce per year? Hint: The New Zealand Department of Conservation web site may have valuable information.

### Where are the rare and threatened birds found?

Discover where some of the populations of rare and threatened birds are found. Post a map of New Zealand and outlying islands on the classroom wall. Use coloured pins to point out where one or two rare New Zealand birds (e.g. kakapo, takahe, saddleback, kokako and black robin) can be found.

Hint: DOC web-site may have information about bird location or bird sanctuaries where bird recovery programmes are run (e.g. Mt Bruce).

### Our national icon under threat!

Do a research project about the North Island Brown Kiwi. What does it look like, what food does it eat? When does it eat? What size eggs does it lay? Find out what the main threats to the Brown Kiwi are? Visit a site which is involved with the recovery process of North Island Brown Kiwi. For example, Rainbow Springs in Rotorua is involved with rearing of kiwi chicks and Boundary Stream in Hawke's Bay is an area of bush that has re-introduced North Island kiwi.

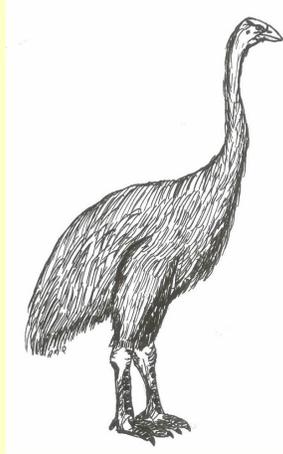
### What about New Zealand's other wildlife?

Find out some of New Zealand's other wildlife, for example Tuatara, Hooker's Sealion, Hector's Dolphin, Hapuku and Whitebait. Why are they threatened and who or what is responsible? Think about and discuss ways an endangered species can be saved and what role we can play in achieving that? Find out more about the organizations who are working to save and protect these threatened animals.

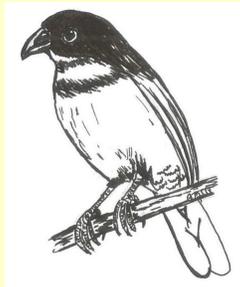
## Fabulous Facts .... Do you know?

New Zealand has its fair share of extinct birds. The introduction of predators such as stoats, rats, cats and dogs, the destruction of habitat, and the hunting and collection of specimens lead to the downfall of some of our weird and wonderful bird life.

New Zealand had one of the tallest birds in the world! The tallest of the Moa was ~3m tall and ate forest vegetation. They laid eggs the size of a small rugby ball (240mm in length).



New Zealand had its own thrush. The New Zealand thrush was much larger than the introduced thrush (in different bird families). The NZ thrush had olive-brown coloured feathers and were very tame, hopping around camp sites picking up bread crumbs.



New Zealand had a laughing owl! The laughing owl was a sizable bird (38cm in height) and 'laughed' with a series of chuckling, mewling and whistling notes. The laughing owl was present in Nelson, Canterbury and Otago.



## Help! Our Biodiversity

**HIPPO** is an acronym used by the World Wildlife Fund and by other environmental educators to talk about some of the major reasons why we are losing biodiversity.

The **HIPPO** Dilemma covers the 5 major problems threatening the Earth's biodiversity:

**H**abitat loss

**I**ntroduced Species

**P**ollution

**P**opulation Growth

**O**ver-consumption

CITES: The international way to stop the plight of biodiversity....

CITES stands for the Convention on International Trade in Endangered Species of wild fauna and flora. This is an international agreement between 150 state governments, including New Zealand, to ensure that the international trade of wild specimens of animals and plants does not threaten their survival. Trade in 'exotic' animals and plants or products from threatened animals or plants are worth billions of dollars and if not kept in check could deplete natural populations and risk the chance of extinctions.

In New Zealand, several agencies (customs, MAF and DOC – the wildlife enforcement group) work together to make sure CITES agreements are met.

Look up the CITES web site. Find out how many animals and plants are protected under the CITES convention. Have a class discussion about some of the New Zealand native animals and plants they know. Would these animals and plants be protected under the CITES agreement? *Note: Permits to collect native animals and plants may be given under certain circumstances and where collection is considered not to threaten the survival of wild populations.*

Using the word CITES, write out the names of plants protected by CITES. Look up the CITES web site to view animals and plants protected by CITES.

*For example,*

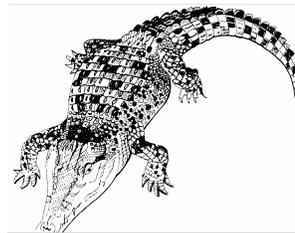
**C**rocodile

**I**bis

**T**ree squirrel

**E**lephant tusks

**S**nakes



Use the sheet at the back of the book to get started.

## Close to home!

In February 2004, two Czech nationals were found guilty of smuggling New Zealand native orchids (i.e. “trading in specimens of threatened species”). Although New Zealand orchids are generally not threatened with extinction, they may become so if trade is not closely controlled and therefore is considered seriously under CITES.



New Zealand native orchid – *Pterostylis* sp.

## **Habitat Loss**

### What is a **habitat**?

Brainstorm the word **habitats** – what are they? List some of the favourite habitats that the children visit (e.g. the beach, a lake, a forest walk, a mountain).

For each of the habitats listed, discuss with the class what some of the threats to that habitat might be.

### Habitat mural

Make a mural including some of the habitats found in the local region. Note on the mural what some of the threats to each of the habitats might be.

### How do you save biodiversity??

Draw a map or find a map of the local/regional area near your school. Using coloured dots or pins locate all the different types of reserves near the school.

Hint: Your local DOC office or regional council will be able to give information about the where about of reserves managed by them.

### The marine environment

Research some of the threats to different marine environments, such as the coral reef, the rocky shore and the open ocean. Make a mural or give an oral presentation about the different threats to marine environments – are there different or similar threats between the different types of marine environments?

## **Fabulous Facts .... Do you know?**

### **Some of the threats to the coral reef habitat are:**

- tourism
- silt, pesticides, chemicals and sediment
- coral eating starfish
- commercial fishing

### **Some of the threats to the rocky shore habitat are:**

- marine invertebrates being taken
- water contamination by sewage, storm water, industry,...

### **Some of the threats to the open ocean habitat are:**

- contamination from industry, storm water pollution, effluent...
- over-fishing
- litter
- oil spills

### The marine environment in the past

Interview some locals that can recall what the coastline was like in the past. Ask them questions about the type, size and number of fish they use to catch. Do they catch the same type and quantity of fish these days?

Hint: interviewing people about freshwater fisheries (e.g. white bait and eels) may also be interesting.

### Protecting our marine systems

Have a class discussion about marine reserves. How many marine reserves are there in New Zealand? Place them on a map of New Zealand (use coloured pins). Are there any in the local area? Who manages marine reserves? Why do we have them?

Visit a marine reserve in your local area or invite someone from the Department of Conservation to the school to talk about marine reserves.

Colour in the 'Marine Reserves are Cool' poster, found at the back of the booklet.

Examine the different attitudes to marine reserves. Students could research and then role-play how some of the following people may feel about their presence: *marine biologist, commercial fisherman, recreational fisherman, local Maori, elderly citizen, science teacher, Department of Conservation employee, SCUBA Hire Shop owner.*

### How would you protect a marine ecosystem?

Discuss with the class what issues need to be addressed if you are going to protect a marine system. For example you may need to stop people harvesting shellfish. Make a class set of rules for marine reserves.

Make educational posters about the rules – what are the rules and why are they important?

### The real list of rules for marine reserves!

*Note: the Marine Reserve Act (1971) is under review and may change slightly. Check with the Department of Conservation or Ministry of Fisheries for updated details.*

#### **It is illegal or an offence to:**

- Take or remove any marine life, mineral, sand, shingle or other natural material.
- Wilfully damage or injure any marine life, wilfully damage the foreshore (e.g. driving on rock platforms) or any natural features in the marine reserve.
- Introduce any living organism that does not naturally occur there, into the marine reserve.
- Discharge any explosive or firearm within the reserve.
- Discharge any substance (e.g. chemical) that may harm or threaten plant and animal life within the reserve.

Compare the class list of rules with the real marine reserve rules. Are there any differences or similarities? Again discuss with the class why each of the rules is important.

#### **Fabulous Facts .... Do you know?**

Sand and shells and dead seaweed are not allowed to be taken from marine reserves. *Why?*

Sand is an important substrate for plants to grow on and is a vital habitat for marine creatures (e.g. sand-hoppers, shellfish and marine worms).

Empty shells are important habitats for marine creatures (e.g. hermit crabs and tube worms). Empty shells are also ground down into small particles that become part of the sand and release nutrients for marine animals and seaweed.

Seaweed, even dead seaweed is an important food source for marine creatures. It is also an important habitat where marine creatures can hide from predators and the harsh environment.

#### Marine reserve proposal

Ask the class if there is any bit of coastline which they are particularly attached to or which they think is special enough to be reserved. Get the class to put together a marine reserve proposal. In the proposal they should address why they think the area is important, what are the benefits of having a reserve in that location and if there is community support for a reserve. To get you started, use the marine proposal sheet at back of the booklet. If you and your class are interested in taking this further, ask the Department of Conservation for guidelines for marine reserve proposals.

### Other forms of protection for marine ecosystems.

Some areas of the coastline are protected by local community groups or iwi. The protection of marine areas can range from rahui through to mataitai reserves. These bans apply to all people.

Rahui can be total ban on fishing until iwi are satisfied that fishing stocks are replenished or until people who have drowned in the area are found. Rahui is not bound by law.

Taiapure are local fishery areas within estuaries or shoreline coastal waters, which are customarily of special significance to local iwi or hapu. These areas have important significance as a source of seafood or have spiritual values. Taiapure allows Maori to have a greater say in managing local fishing areas, for example local Maori can advise the Ministry of Fisheries on rules of taking fish within a defined area.

Mataitai reserves are areas that cover traditional fishing grounds and is of special significance to the tangata whenua. These reserves are created under the Kaimona Regulations 1998. These reserves are not marine reserves and allow non-commercial fishing (with certain bylaws) to occur. Fish stocks within the mataitai reserve may be enhanced by the transfer of fish within the reserve. Fisheries officers or honorary fisheries officers employed by the Ministry of Fisheries are responsible for enforcement of mataitai reserve rules.

Invite a local iwi member or Ministry of Fisheries person to the school to talk about some of the traditional methods of marine protection.

### Mainland Islands

Mainland Islands are a special form of reserve where particular ecosystems (usually forest habitats) and their plant and animal populations are conserved and managed on the mainland. Mainland Islands are seen as an opportunity to allow a habitat to recover and flourish and in some cases give us an insight to what parts of New Zealand may have looked and sounded like before humans arrived. Mainland Islands can be managed by the Department of Conservation or by local businesses and communities. For example, Boundary Stream Mainland Island in Hawke's Bay is administered by the Department of Conservation whereas Karori Wildlife Sanctuary in Wellington is run by a community trust.

Brainstorm the word 'Mainland Island'. Make comparisons; how are Mainland Islands different to islands? What types of habitats are found on the mainland and what types are found on islands?

Ask the class if they have been to any Mainland Islands? What did they see? What type of protection did the Mainland Island have from predators (e.g. predator proof fence or trapping)?

Visit a Mainland Island near you! Make a day of it; learn about a 'Mainland Island' and what it is trying to achieve.