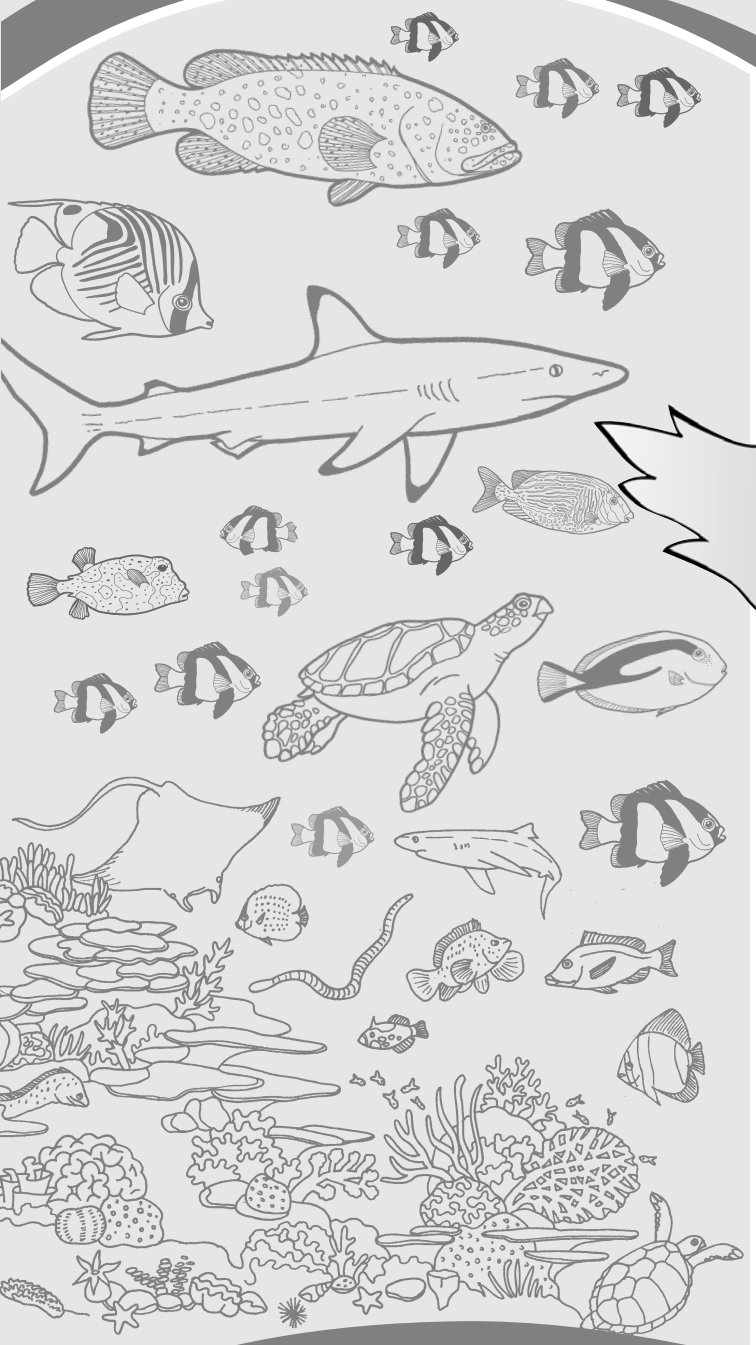
REEF Beat

yesterday, today and tomorrow

Learning about the past, looking to the future



A Great Barrier Reef
Marine Park Authority Initiative

Australian Government
Great Barrier Reef
Marine Park Authority

IYOR 2008
INTERNATIONAL YEAR OF THE REEF

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Contents

Notes for Teachers

Reef Beat – Yesterday, Today and Tomorrow is an innovative and curriculum-centred teaching resource that includes activities and challenges that will stimulate inquiring minds to discover all they can about the Reef. The implementation of the teaching and learning opportunities offered by these curriculum-linked activities will enhance and extend student learning. Teachers and students can gain additional support by accessing the Reef ED web site www.reefED.edu.au

The activities within this resource can support you to:

* Plan learning activities that focus student learning and thinking on the biological diversity that inhabits the Reef, the connected ecosystems that support it and the activities and behaviours we can all adopt to ensure its sustainable future.
* Provide students with opportunities to gain an appreciation for the Shifting Baselines concept and how it applies to their environment including the Great Barrier Reef.
* Contribute to the responsible development of active and informed citizens with a better knowledge of the Great Barrier Reef ecosystem and its inhabitants.
* Engage students and empower them to educate their peers and other members of the broader school community.

The activities within this unit are targeted at Upper Primary and Middle School students. The activities cover a range of Key Learning Areas with an aim to engage students via multiple intelligences, targeting essential learnings, whilst working towards achievement standards.

Introduction

Reef Beat – Yesterday, Today and Tomorrow is a product of the Great Barrier Reef Marine Park Authority. This Reef Beat series has been created in celebration of the International Year of the Reef. We are celebrating the beauty and wonder of the Great Barrier Reef Marine Park. The Great Barrier Reef has been evolving for millions of years. It is up to us all to ensure that the eyes that look upon this species-rich and visually stunning part of planet in the future see what we see today, if not better!

It aims to provide students and teachers with information about the biological diversity that inhabits the Reef, the connected ecosystems that support it and the activities and behaviours we can all adopt to ensure the Great Barrier Reef of tomorrow remains as great as it was yesterday and is today.

The goal of the Great Barrier Reef Marine Park Authority is:

> *To provide for the long-term protection, ecologically sustainable use, understanding and enjoyment of the Great Barrier Reef through the care and development of the Great Barrier Reef Marine Park.*

In working towards this goal the Great Barrier Reef Marine Park Authority's Education Team has developed a range of reef education programs and activities. These can all be found at **www.reefED.edu.au**

For enquiries about ***Reef Beat – Yesterday, Today and Tomorrow*** please contact the Great Barrier Reef Marine Park Authority's Education Team.

Telephone: (07) 4750 0700
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Rationale

As Australians we have one of the most internationally recognised natural icons on our doorstep – the Great Barrier Reef Marine Park. Covering over 344 000 km^2 and stretching over 2300 km along the northeastern Australian coastline, it is the largest coral reef ecosystem in the world.

A baseline is a reference point from the present or past – how things are or used to be. If these reference points change or shift over time, we risk losing track of our standards and eventually accept the degraded state as being the natural one. This concept is known as *Shifting Baselines*. In this International Year of the Reef it is important that everybody makes an effort to make some small changes to their behaviour, to ensure a sustainable future for our marine environment.

A vital economic hub, the Marine Park is central to activities such as tourism, recreational boating and fishing, commercial fishing, diving, aquaculture, scientific research and shipping. The Great Barrier Reef Marine Park Authority manages this multiple-use resource to ensure its long-term sustainability. This is achieved by balancing ecologically sustainable use, commercial realities and an overarching conservation objective.

Everything we do on the Reef, along the shore and in the adjacent catchment affects this diverse and fragile ecosystem. Protecting our Reef is very important to ensure the continued existence of this amazing ecosystem.

Poster 1 - The Great Barrier Reef

"Yesterday, Today and Tomorrow"

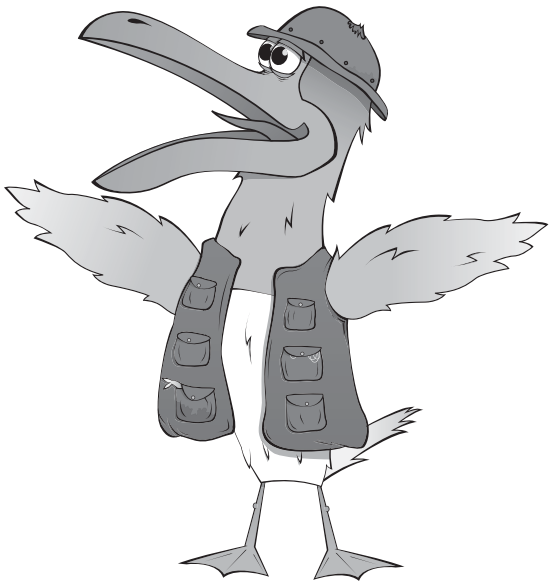
What do we already know?

KWL (Know, Want to Know, Learning) Charts serve as a fabulous class shared resource. A KWL chart has three sections: prior knowledge (**Know**), curiosity knowledge (**Want to Know**) and acquiring knowledge (**Learning**). Use a KWL chart to organise and help students categorise their thoughts.

What do we already know about human impacts over time on the Reef?	What do we want to know about human impacts over time on the Reef?	Where will we find the information to help us learn about human impacts over time on the Reef?
Know	**Want to Know**	**Learning**

Hint: Use large poster sheets, which can be displayed in the classroom and added to as students progress through this Reef Beat series. As a class, fill in the KWL Chart at the beginning of the series. Throughout the Reef Beat journey and at the end of each poster/activity session allow time to update the KWL Chart. When the Reef Beat journey is complete as a class, finalise the KWL Chart.

One way of adding to your chart and stimulating student interest is to provide a range of texts on the Great Barrier Reef, the animals and plants that live there, food webs, their interrelationships and the impacts that human activities are having on the Reef. Allow students a short period of time where they are to find an interesting fact to list in the ***Learning*** column of the KWL Chart. This could also be used as a time for confirming information and extending the vision of your unit of work.



How long have we been here?

The table below represents the **Geological Timescale.**

The aim of this activity is to visually represent the geological timescale and to develop an appreciation for the short period of time that humans have been influencing and impacting on the Earth's environments.

Geological era	Geological period that makes up each era	Important evolutionary events	Time in millions of years
Cainozoic	Holocene (recent)	Some animals disappear. Modern humans. Climate starts getting warmer	0.015
	Pleistocene	Ice ages, large mammals, primitive humans.	2
	Pliocene	Life as we know it develops e.g. birds,	5
	Miocene	mammals, insects. Mountain building, lakes,	23
	Oligocene	tropical climates. Huge reptiles disappear.	36
	Eocene	Flowering trees and shrubs replace giant	53
	Paleocene	ferns and mosses.	65
Mesozoic	Cretaceous	Flowering plants trees, small mammals.	135
	Jurassic	Reptiles dominate – dinosaurs. First birds and mammals. Widespread lowlands.	185
	Triassic	Vertebrates replace invertebrates. Reptiles develop. Sea creatures appear.	220
Palaeozoic	Permian	Many plants and ferns. Reptiles and amphibians progress. Insects appear.	280
	Carboniferous	Tropical coal swamps formed. Giant insects dominate. Fish develop. First reptiles.	345
	Devonian	Fish dominate – variety. Development of amphibians. Land supports large tree plants.	400
	Silurian	Flat landscape, primitive animal life. First land plants appear.	440
	Orodovician	Marine invertebrates (sea stars, coral). Primitive fish. First insects.	500
	Cambrian	First abundant fossils – trilobites, molluscs, sponges.	570
Precambrian	Proterozoic	Earliest fossil life, algae, fungi.	1000
	Archaeozoic	Earliest known life. Mountain building.	2400
	Azoic	Formation of Earth's crust. No life.	3000 – 6000

Source: Casinader et al. (1997) *A Place for Geography Book 2.* Addison Wesley Longman Australia Pty Limited; South Melbourne.

To complete this activity you will need a 50-metre length of rope, measuring tape, thin coloured ribbon and a number of paper tags. You will need to find a place where you can lay out the rope flat and straight; for example the school oval or under cover area.

Using a scale of **one centimetre equalling one million years** work backwards from the present day. Students have to work out where each period in the geological timescale begins and ends on the rope, marking each position with coloured ribbon. Each piece of ribbon should be labelled with a tag that explains its meaning.

> Another option is to complete this activity on butcher's paper on a display wall in the classroom **(the scale will have to be adjusted)**. Students can mark each period in the geological timescale with different coloured textas. Students could also find and draw images that represent the different animals, plants and landscapes that occur during each period.

Once this has been completed provide students with the following information:

Evidence indicates that modern humans originated in Africa about 200 000 years ago, and they now inhabit almost every continent, with a total population of over 6.6 billion.

Have students mark this position on the geological timescale. As a class discuss what impressions or conclusions that they have developed about:

1. The age of planet Earth
2. The geological history of the Earth
3. The time that humans have been on the planet
4. How much have humans changed the planet in the time that we have been here?

An extension activity could be to have the class describe the geological timescale and their conclusions to other classes in the school.

Beating the Baseline

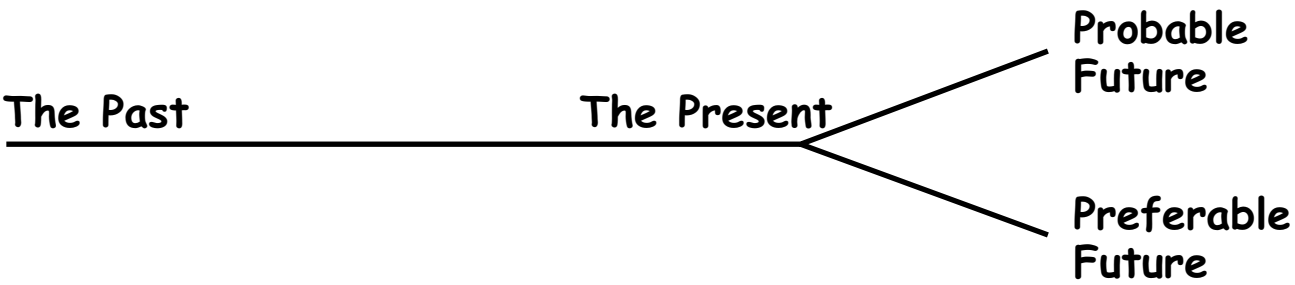
A baseline is a reference point from the present or past – how things are or used to be. If these reference points change or shift over time, we risk losing track of our standards and eventually accept the degraded state as being the natural one. This concept is known as *Shifting Baselines.*

What are probable and preferable baselines for the Great Barrier Reef?

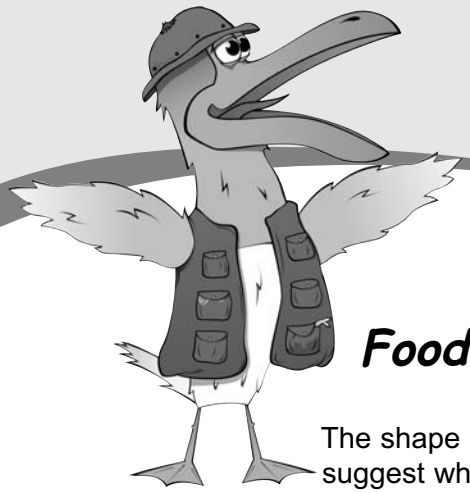
Working in small groups, students plot the significant events for the Great Barrier Reef on a timeline. Students distinguish between those they think local societies had some control over and those over which they had little control.

Teachers demonstrate the continuation of the baseline timeline, encouraging students to consider the probable and preferable futures of the Great Barrier Reef. In groups, students discuss the types of decisions needed if these preferable futures were to eventuate.

Students create the timeline inclusive of probable and preferable baselines by adding a < shape.



Students plot probable baselines along the upper axis and preferable baselines along the lower axis. Probable baselines refer to how students expect the future to be, both in their own lives and in the wider world. Preferable baselines refer to how students would like the future to be, both in their own lives and in the wider world. Suggested issues for consideration are global climate change and coral bleaching.

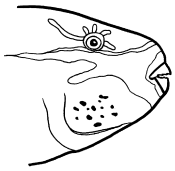
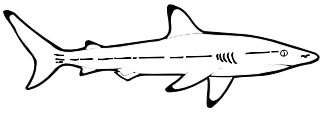
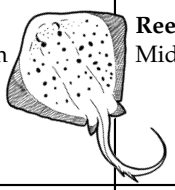
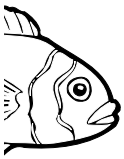
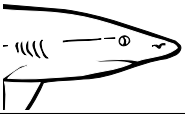
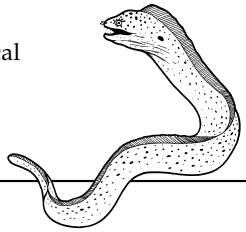
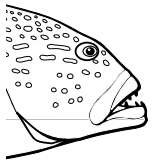
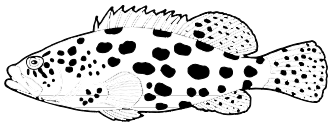


Poster 2
Fish

Food Glorious Food

The shape of a fish's mouth, its body shape and the habitat where it lives can suggest what the animal feeds on.

The Food Glorious Food information below gives examples of different fish mouth shapes, body shapes and habitats.

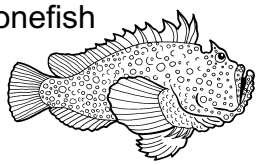
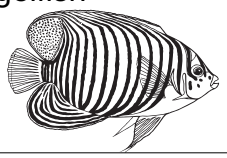
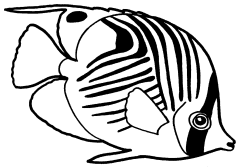
Mouth Shape	Body Shape	Habitat
Strong beak Scrape hard surfaces 	**Fusiform** Streamlined and torpedo shaped 	**Benthic** Lives on bottom
Tubular Pick small food 	**Dorso-ventrally flattened** Flattened from top to bottom 	**Reef associated** Midwater, living close to the coral
Small Mouth Suck plankton or algae 	**Laterally compressed** Flattened from side to side 	**Pelagic** Living close to the surface in open water
Subterminal Mouth opens below the snout 	**Elongated** Long, cylindrical 	
Superior Mouth opens upwards 	**Compact** Round bodied 	

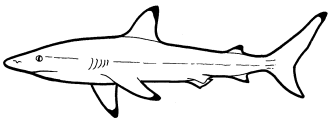
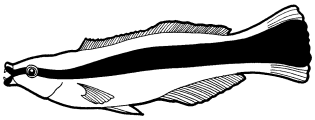
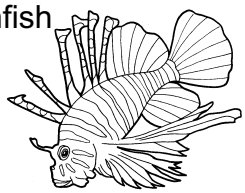
Have students use the Food Glorious Food information, Internet and other information resources including the GBR Explorer found at www.reefED.edu.au to complete the following table that has various types of fish that call the Great Barrier Reef home.

Marine Organism	Mouth Shape	Body Shape	Habitat	Special Features	What does it eat?	Defence Mechanism
Parrot Fish						
Butterfly Fish						
Surgeon Fish						
Coral Cod						
Blacktip Reef Shark						
Stone Fish						
Sea Horse						
Lionfish						
Stingray						
Sea-snake						

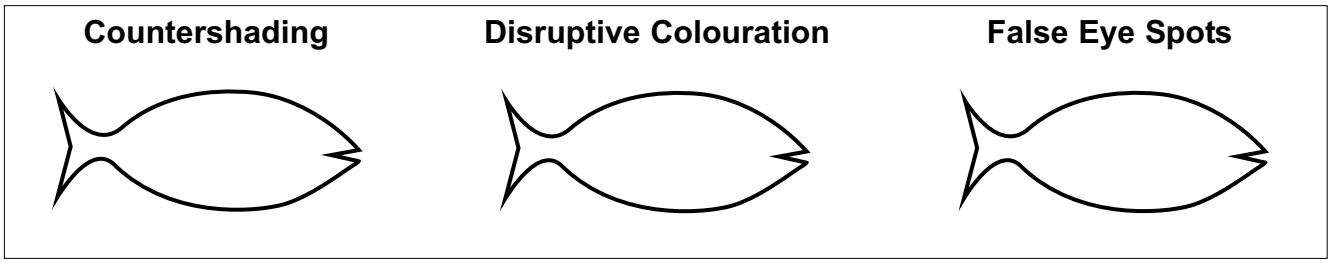
Why are fish so colourful?

Fish use their colours and patterns for many different reasons.

Stonefish 	Camouflage Camouflage colouration helps animals blend in with their surroundings. The Stonefish's colour and texture of its skin helps it blend in with its environment.
Angelfish 	Disruptive Colouration Spots and stripes are used to break up the body shape of some fish. This hides them against their backgrounds. This type of disruptive colouration is common in coral reef fish.
Butterfly fish 	False Eye Spots Colour patterns are used to hide vulnerable parts of an animal's body. The true eyes of most butterfly fish are hidden by a black stripe. Near their tail there is usually a very prominent "false eye" on each side. Confused predators attack these instead of the real eyes, allowing the butterfly fish to escape in the opposite direction.

Blacktip Reef Shark 	Countershading Many open water (pelagic) animals have dark backs and very light bellies. This colouration is called countershading. Viewed from above an animal's dark back blends in with the darkness of the deep ocean. From below, it is difficult to see the light bellies against brightly sunlit surface water. Countershading can be used by fish to hide from predators, some predators use it to make it easier to hunt their prey.
Cleaner wrasse 	Advertising Colouration Some animals have coloration that attracts attention and advertises a special service. The cleaner wrasse has a very special relationship with other reef fish and helps to remove harmful parasites from their skin. Predators recognise the bright colour pattern of the cleaner wrasse and don't harm them because of the useful service they provide.
Lionfish 	Warning Colouration Some animals are well protected with spines, poisons, and armour that their colouration is a warning to other animals to stay away. The lionfish has brightly striped fins with poisonous spines that it displays when it feels threatened.

Help protect the fish below by giving them the type of colouration that is listed.



Have students find pictures of other reef fish that use the following types of colouration:

- Advertising Colouration
- Camouflage
- Warning Colouration

For each fish have students describe why they use this colouration.

Sustainable Fishing

Have a class discussion about the meaning of the word sustainable and how it applies to the environment and the Reef. Ask why it is important to have sustainable fishing.

Students visit Fish Web
http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/28_3011_ENA_HTML.htm

After catching a fish the first thing to do is identify and measure it. Students complete the following sentence.

When measuring a fish, you measure it from the tip of their _____ to the end of their _____.

Draw a picture that represents that sentence.

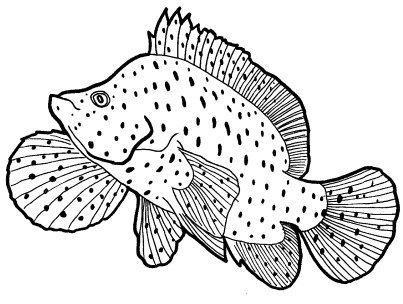
Using the information found at the following Fish Web page:
http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/28_3042_ENA_HTML.htm

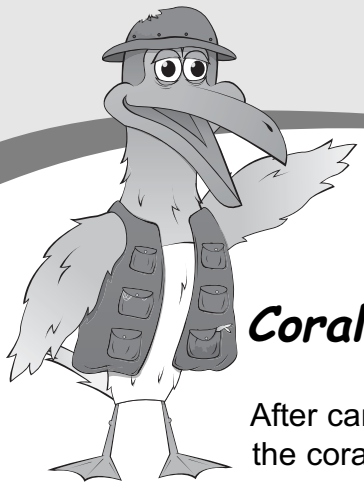
Complete the following table that contains some of the fish humans love to catch.

Fish species	**Minimum Size** *(If required)*	**Maximum Size** *(If required)*	**Possession Limit** *(Also known as Bag Limit)*
Dusky Flathead			
Sand Whiting			
Mangrove Jack (East coast)			
Barramundi (East coast)			
Red Emperor			
Coral Trout			

Have students research the life history of the Barramundi.

- What is the reason for Barramundi having a maximum size limit?
- Why are possession limits (bag limits) important?

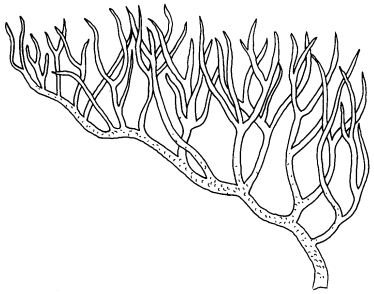


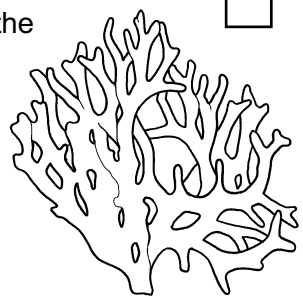


Poster 3
Corals

Coral Crossword

After carefully reading through the Corals poster unravel the clues to complete the coral crossword below.



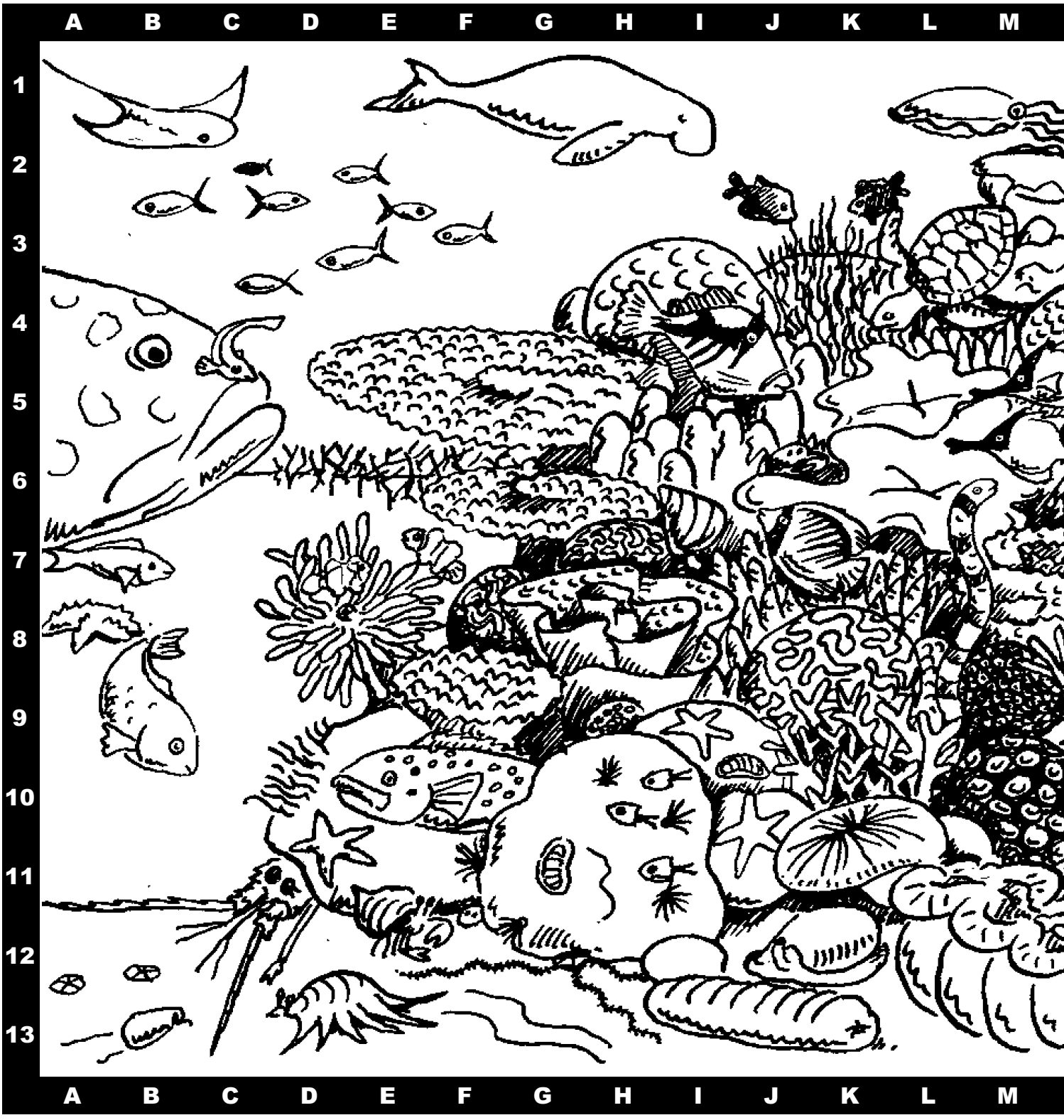


Across

5. Poor water quality will cause corals to become less _____.
8. Riding your bike or sharing a lift to school with friends will mean less _____.
10. The tiny animals that create corals are known as _____.
11. Corals use their tenticles to _____ food.
12. Corals are suffering because of poor water _____.
13. The number of people that come and visit the Great Barrier Reef each year.
14. Excessively hot ocean temperatures are one of the causes of this phenomena.

Down

1. Coral polyps form together to build the coral _____.
2. What proportion of the world's soft corals found on the Great Barrier Reef.
3. This type of change is causing ocean temperatures to rise.
4. Remember what goes down the drain will end up in the _____.
6. Corals thrive in these types of waters.
7. Tiny algae like organisms that live within the cells of coral.
9. The process that corals undergo each year between October and December to reproduce.
15. 360 species of these call the Great Barrier Reef home.



Species	Code		Species	Code	
Loaf of Bread Sea Cucumber	13	J	Palette Surgeon Fish	8	P
Lobed Coral	5	O	Plate Coral	5	F
Longnosed Butterflyfish	5	M	Potato Cod	12	P
Moorish Idol	7	T	Prawns	13	V
Moray Eel	12	O	Prickly Red Fish Sea Cucumber	10	Y
Mushroom Coral	11	K	Puffer Fish	7	R
Nudibranch	12	T	Queensland Grouper	5	A
Octopus	10	P	Red Lipped Stromb	13	B

Species	Code		Species	Code	
Sand Dollar	12	A	Trevally	2	Y
Sea Anemone	8	D	Trochus Shell	7	I
Sea Turtle	3	L	Trumpet Fish	2	Q
Sea Whips	11	W	Vase Coral	8	H
Slipper Coral	11	Y	White-lined Trigger Fish	4	I
Spider Shell	13	D	Zooanthids	12	S
Sponge	7	X			
Staghorn Coral	11	U			

Coral Survival Game

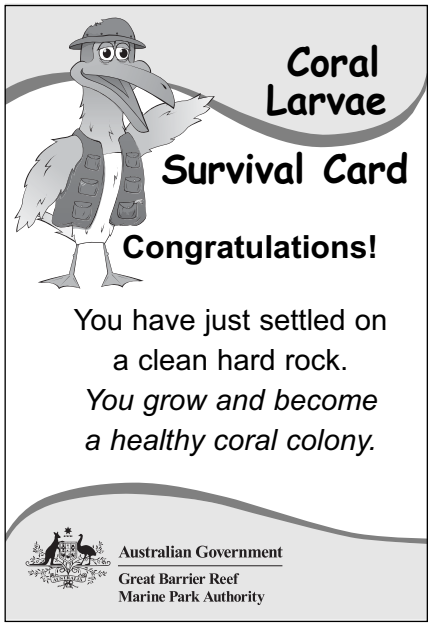
You will need the following materials to play the game:

- Four **coral larvae badges / headbands**
- Enough **coral badges / headbands** to give to each student in the class
- Three copies of the **coral larvae survival cards** that list the requirements for a larvae (young coral also known as planula) to successfully settle on the bottom
- Three copies of the **coral larvae disaster cards** that list conditions that do not allow larvae to settle on the bottom
- Two copies of the **reef survival cards** that list the coral survival needs
- One copy of the eight **reef disaster cards** that list the various damage that is caused to corals by human activities
- Two containers - one to hold coral larvae survival and disaster cards and one to hold the reef survival and disaster cards
- Enough floor space for students to sit and form coral reefs by linking arms.

How to play:

1. Divide class into two teams. The aim of the game is to see which team will be the first to form a healthy coral reef.
2. Each team chooses two members to represent coral larvae that will start the reef building. **Each student wears a coral larvae badge.**
3. Each student wearing a **coral larvae badge** takes a turn pulling a card from the container holding **coral larvae survival and disaster cards**. If they choose a **coral larvae survival card** listing appropriate places for corals to settle they go to the front of the room and sit on the floor. If both coral larvae from the same team are successful they sit (settle) together and link arms. Once they sit they are no longer coral larvae, but have transformed into a young coral colony and trade their **coral larvae badges** for **coral badges**.
4. If a coral larvae student pulls a **coral larvae disaster card**, they cannot settle. They return to their seat with the rest of the team and the team has to choose another pair of coral larvae. They also miss a turn.
5. Once new corals are formed they take turns at pulling a card out of the container holding reef survival and disaster cards. If they choose a **reef survival card** they can choose another two team members to join them. They link arms with their coral teammates and are given **coral badges**. A coral reef is beginning to form. If they choose a **coral disaster card**, the reef cannot grow, the student who drew the card has to return to the rest of the team.
6. If a team only has one coral on the reef and the coral draws a reef disaster card, he or she returns to the team and another two students are selected to be coral larvae.
7. Teams keep taking turns drawing cards and adding and losing corals on the reef. After drawing each card students must read their card aloud so that all other students understand why their reef grew or not.
8. The object is to see which team can build a reef with ten healthy corals first. You may wish to keep going until all members of the team are healthy corals but this may take some time just like building real healthy coral reefs.

Adapted from: The “Coral Reef Race For Survival” Game, Waikiki Aquarium Education Department, Waikiki Aquarium, Honolulu, Hawaii.



Coral Larvae

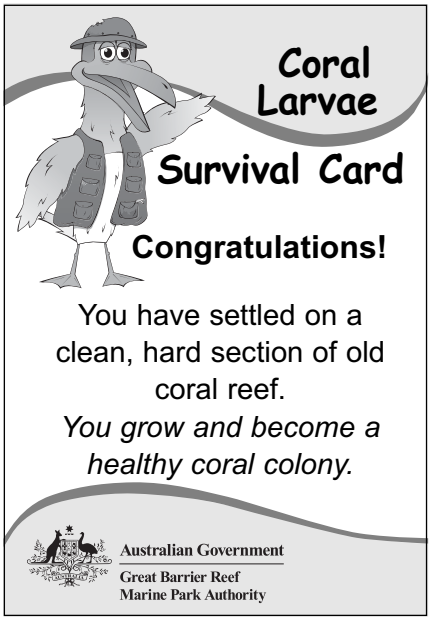
Survival Card

Congratulations!

You have just settled on a clean hard rock.

You grow and become a healthy coral colony.

Australian Government
Great Barrier Reef Marine Park Authority



Coral Larvae

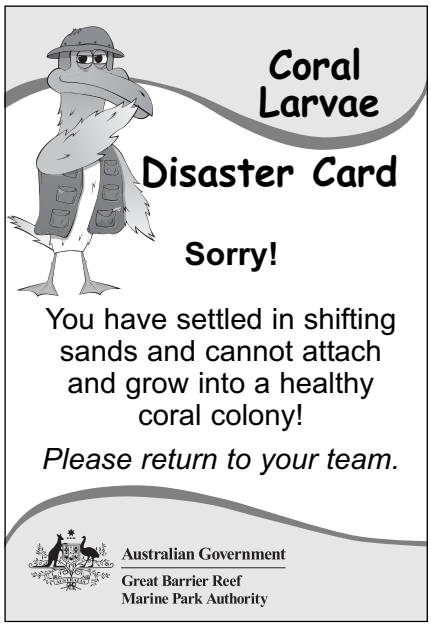
Survival Card

Congratulations!

You have settled on a clean, hard section of old coral reef.

You grow and become a healthy coral colony.

Australian Government
Great Barrier Reef Marine Park Authority



Coral Larvae

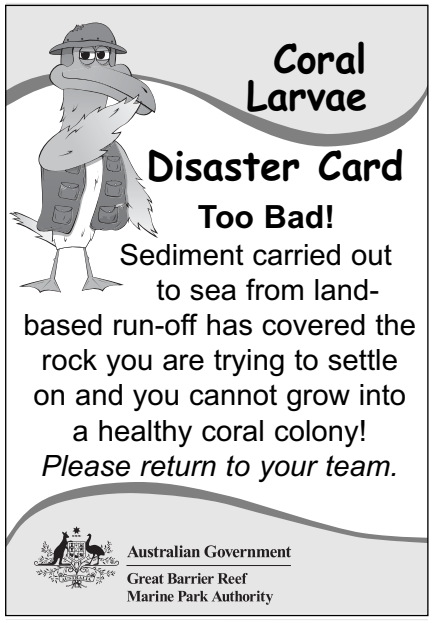
Disaster Card

Sorry!

You have settled in shifting sands and cannot attach and grow into a healthy coral colony!

Please return to your team.

Australian Government
Great Barrier Reef Marine Park Authority



Coral Larvae

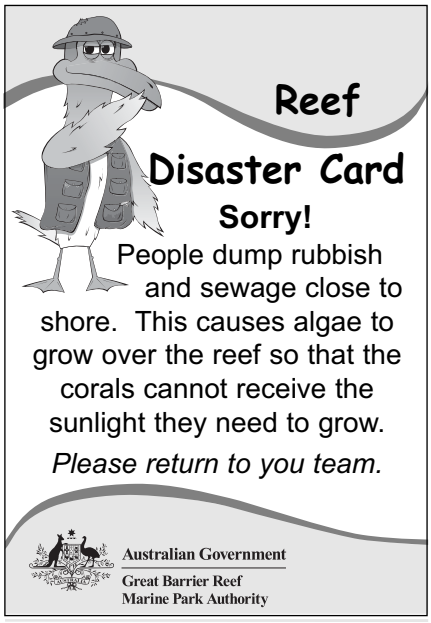
Disaster Card

Too Bad!

Sediment carried out to sea from land-based run-off has covered the rock you are trying to settle on and you cannot grow into a healthy coral colony!

Please return to your team.

Australian Government
Great Barrier Reef Marine Park Authority



Reef

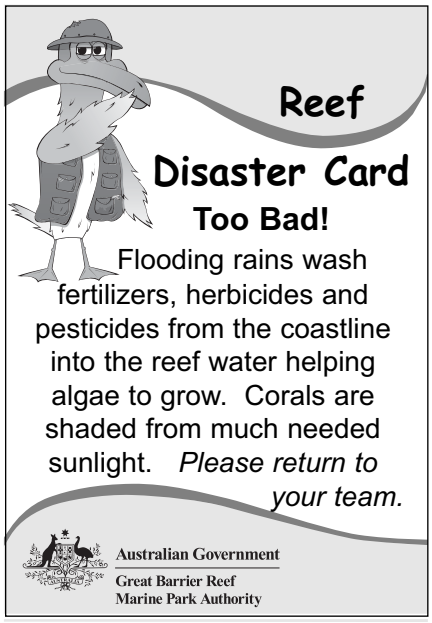
Disaster Card

Sorry!

People dump rubbish and sewage close to shore. This causes algae to grow over the reef so that the corals cannot receive the sunlight they need to grow.

Please return to you team.

Australian Government
Great Barrier Reef Marine Park Authority



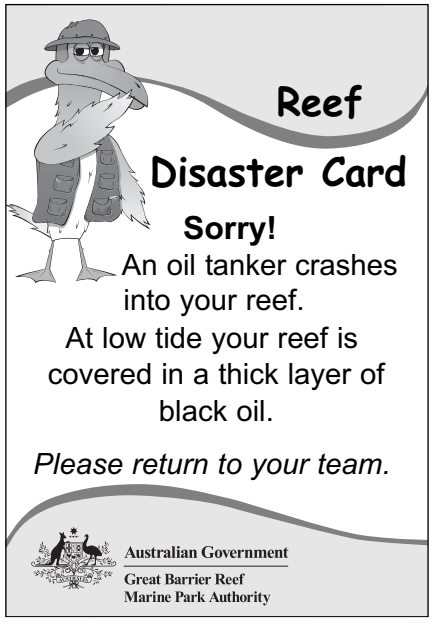
Reef

Disaster Card

Too Bad!

Flooding rains wash fertilizers, herbicides and pesticides from the coastline into the reef water helping algae to grow. Corals are shaded from much needed sunlight. *Please return to your team.*

Australian Government
Great Barrier Reef Marine Park Authority



Reef

Disaster Card

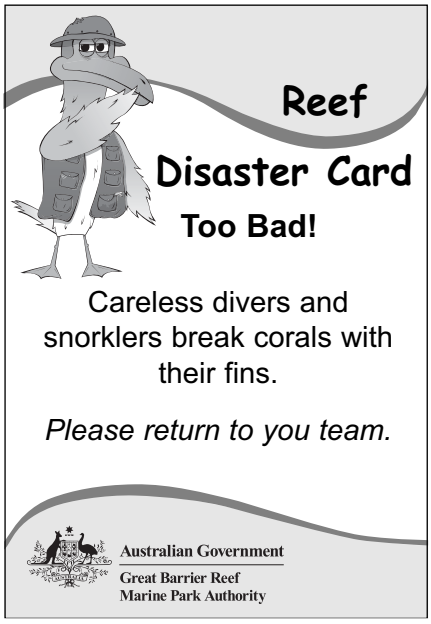
Sorry!

An oil tanker crashes into your reef.

At low tide your reef is covered in a thick layer of black oil.

Please return to your team.

Australian Government
Great Barrier Reef Marine Park Authority



Reef

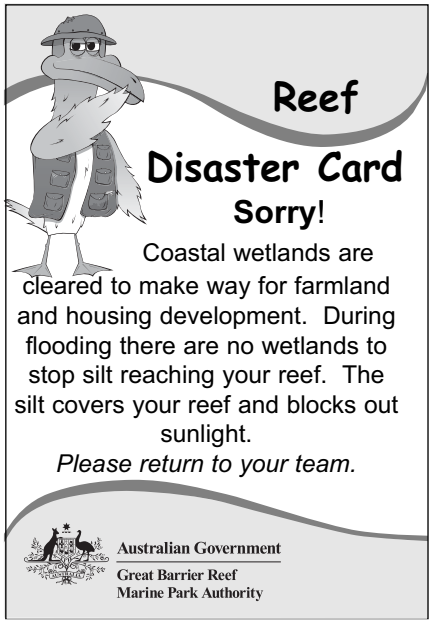
Disaster Card

Too Bad!

Careless divers and snorklers break corals with their fins.

Please return to you team.

Australian Government
Great Barrier Reef Marine Park Authority



Reef

Disaster Card

Sorry!

Coastal wetlands are cleared to make way for farmland and housing development. During flooding there are no wetlands to stop silt reaching your reef. The silt covers your reef and blocks out sunlight.

Please return to your team.

Australian Government
Great Barrier Reef Marine Park Authority

Reef

Disaster Card

Too Bad!

People anchoring their boat do not watch where they are putting down. The heavy metal anchor breaks off coral.

Please return to your team.

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

Disaster Card

Sorry!

Large nets from trawlers are dragged across your reef breaking off coral.

Please return to your team.

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

Disaster Card

Too Bad!

People do not consider using alternative forms of energy. Climate change causes the sea temperature to rise for longer periods and coral bleaching results.

Please return to your team.

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

Survival Card

Congratulations!

You spend your days bathed in sunlight. Your zooxanthellae make plenty of food for themselves and for you!

Add two new corals to your reef!

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

Survival Card

Congratulations!

The water that surrounds you is clean, clear and free of silt and sediment. These are perfect conditions for growth!

Add two new corals to your reef!

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

Survival Card

Congratulations!

The tentacles that surround your polyp's mouth capture several plankton animals from the water for food.

Add two new corals to your reef!

Australian Government
Great Barrier Reef
Marine Park Authority

Reef

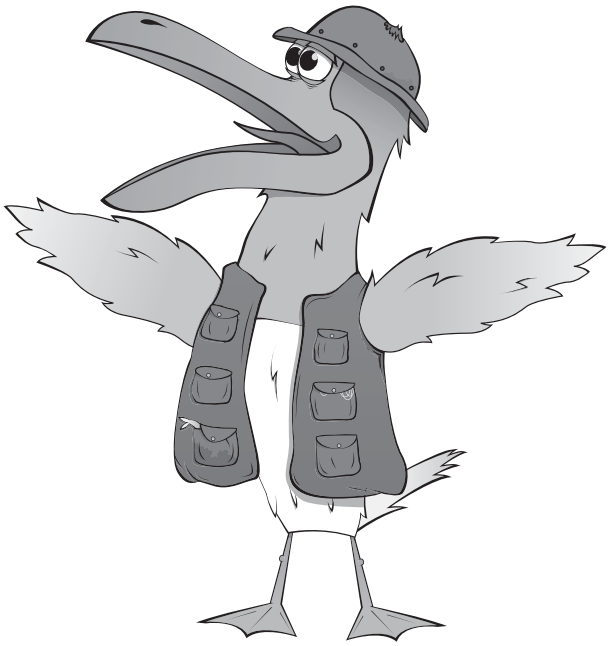
Survival Card

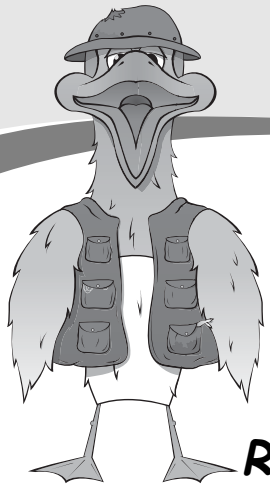
Congratulations!

People make the decision to change some of their behaviours so that they minimise impacts on the environment (for example recycling). This helps to keep the reef environment healthy.

Add two new corals to your reef!

Australian Government
Great Barrier Reef
Marine Park Authority





Poster 4
Reptiles

Turtle, Snakes and Crocodiles

Reptilian Limericks

Limericks are nonsense poems that are fun to say. A limerick has five lines. Lines one, two and five rhyme with each other and have approximately the same number of syllables. Lines three and four rhyme with each other only and are shorter. It has action words in it. It is written in past tense. The beginning is usually 'There…' Each line starts with a capital.

There was a turtle named Crush
Who was never in a great rush
He said jellyfish
Were is favourite dish
Because they tasted so lush.

Have students write their own reptilian limerick using a reptile found on the Reef as the character.

Revealing Reptiles

After reading the Reptiles poster very carefully uncover all the hidden words below.

S	U	R	V	I	V	A	L	W	Z	P	Y	E	N	D
U	I	I	H	Q	B	N	B	Y	D	R	E	S	E	E
C	Q	U	T	A	Z	M	L	J	E	R	G	T	S	D
G	O	V	N	P	B	M	O	S	H	N	A	U	T	O
T	R	A	D	I	T	I	O	N	A	L	T	A	I	O
G	E	S	S	E	D	U	T	S	Q	N	I	R	N	L
C	I	N	G	T	R	E	U	A	E	R	R	I	G	B
E	R	G	I	C	H	O	T	M	T	E	E	N	B	D
L	S	O	E	R	M	Q	P	C	K	N	H	E	E	L
T	P	S	C	O	A	O	C	A	E	U	O	L	A	O
R	A	O	N	O	L	M	N	T	Q	T	J	F	C	C
U	C	E	U	E	D	S	J	Y	X	Q	O	H	H	D
T	V	U	V	V	K	I	Z	A	G	L	H	R	W	J
G	Q	E	Q	G	N	I	L	H	C	T	A	H	P	Z
S	D	N	F	A	N	G	S	E	T	A	M	I	L	C

BEACH
CLIMATE
COAST
COLD-BLOODED
CROCODILE
DEVELOPMENT
EGGS
ESTUARINE
FANGS
HABITAT
HATCHLING
HERITAGE
MARINE
NESTING
PROTECTED
RESOURCES
SNAKE
SURVIVAL
TRADITIONAL
TURTLE
VENOMOUS

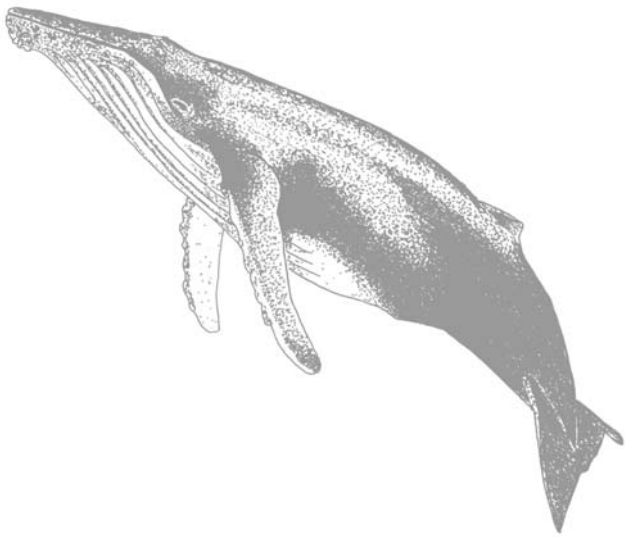
Poster 5
Mammals

Whales, Dolphins and Dugongs

Six Hat thinking about marine mammals

Introduce Edward de Bonos's *Six Thinking Hats*. This process can be used to conceive, design and contextualise ideals and feelings about the Great Barrier Reef and its inhabitants. Place cut out coloured hats on the floor and group responses as a class.

Red Hat ***(Feelings)*** What are my feelings about the whales, dolphins and dugongs?	**White Hat** ***(Information)*** What do we already know about whales, dolphins and dugongs?
Blue Hat ***(What thinking is needed)*** Think of ways to use various mediums to depict, represent or display the special characteristics of whales, dolphins and dugongs.	**Green Hat** ***(New ideas)*** How else could we use various forms of text to represent and display how humans can better protect whales, dolphins and dugongs?
Black Hat ***(Weaknesses)*** What questions or issues could our writing raise about the threats to whales, dolphins and dugongs caused by humans?	**Yellow Hat** ***(Strengths)*** What key messages could our various text modes deliver about the importance of whales, dolphins and dugongs to the marine environment?



Threats to Survival

Choose your favourite species of marine mammal and complete the following table. List all the threats to the survival of this species. For each threat describe the effect that it has on the species.

Threats	Effects
1.	1.
2.	2.
3.	3.

a. Which threat to the survival of your marine mammal do you think is most serious? Why?
b. What major threats to your marine mammals survival do humans cause?
c. Suggest possible ways these dangers to your marine mammals survival could be reduced?
d. In small groups, design a poster to warn people of one of the dangers to your marine mammal. Your poster should include some constructive information to help people look after and protect your marine species. Make a classroom display of your posters.

Dugong Sharing Circle

Good props for this activity are the facemasks students may have made. These will help students get into roles quickly and feel less inhibited about sharing.

Sitting in a circle, ask students to imagine they have become a whale, dolphin or dugong that is being threatened by the activities of humans. They should think about why they are an important part of the ecosystem and what makes them special.

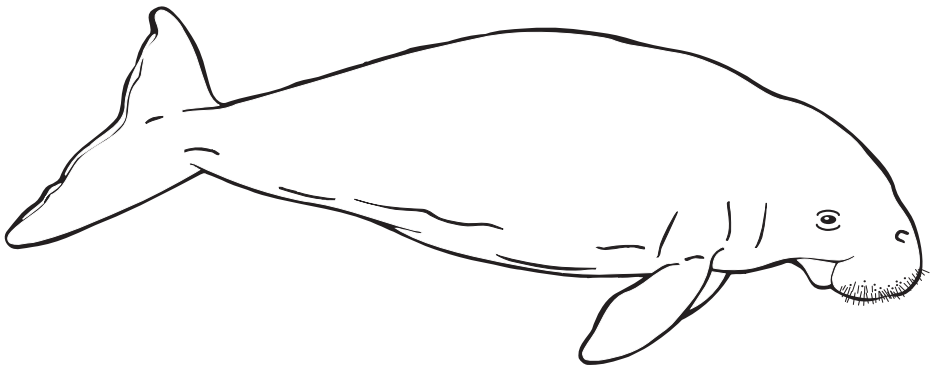
Ask someone to speak for that species as it cannot speak for itself, and to sit inside the middle of the circle, for example 'I speak for the dugong'. The other students represent humankind.

Students on the outer circle ask questions of the species, for example 'Tell us about yourself dugong. Where do you live? Why are you special?' The student in the middle talks about the species it represents.

Ask additional questions, for example 'What troubles you dugong?' The dugong tells the humans of its plight and may ask them questions: 'Why have you impacted on things we like to eat?' The humans listen and respond if they wish.

Another student then enters the circle to speak on behalf of another species and the process continues.

Afterwards, debrief by talking about the way the students felt as the threatened species and as the humans.



Poster 6
Crustaceans and Molluscs

Creating Crustaceans

Paper mache or clay (3D, sculpture and texture)

Students design and create their favourite type of crustacean out of paper mache or clay. Once all students have created their crustaceans use the school library to showcase an exhibition entitled The Ocean's Crusty Demons. Each piece of artwork should have a nametag that tells the viewer about the particular species of crustacean that it represents, its special characteristics, and the things that make it unique.

Amazing Molluscs

The molluscs are a highly diverse group of animals, which include shells, nudibranchs, clams, nautilus, octopus, cuttle fish and squids. Some molluscs have shells that are internal, others are external with one or two parts, and other molluscs have no shell at all.

Have students research the different classes of molluscs using the GBR Explorer found at www.reefED.edu.au to complete the following table.

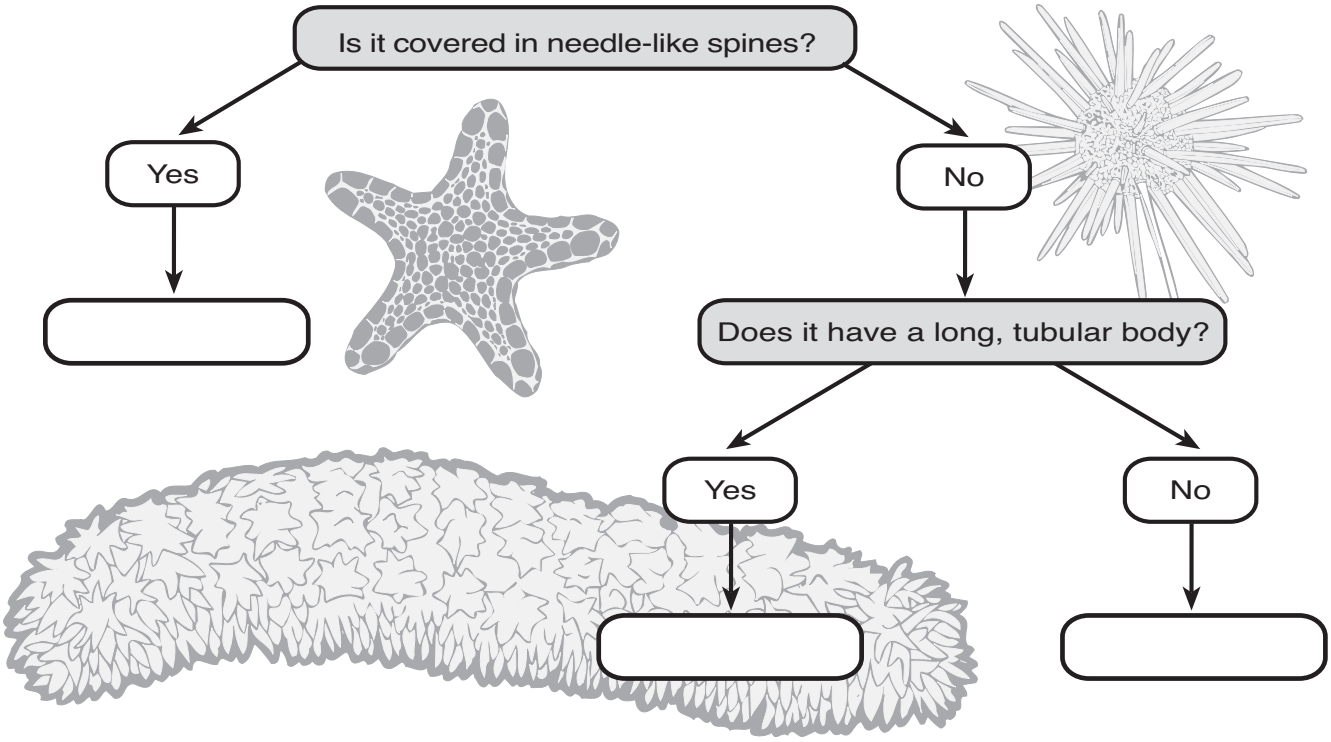
Mollusc	Shell type	How does it feed?	Locomotion
Spider Shell 	single		
Clam 			
Trochus 			Muscular foot
Nudibranch 			

Poster 7
Echinoderms

What makes them different?

Seastars, sea cucumbers and sea urchins are the major groups of animals known as echinoderms. They are grouped together because of the characteristics they have in common, even though each animal looks very different to the other.

Scientists use dichotomous keys to correctly identify the different species of plants and animals found on the Reef. Use the key below to identify the three major groups of echinoderms.



The names of some reef inhabitants are weird and wonderful. Many people may never have heard of them. Hearing their names could dream up all sorts of imaginary creatures and critters. Read students some of the names of different echinoderms found on the Reef (see below). Ask them to draw and write down any special characteristics that they think these animals have. Reinforce that this is not an activity where there is a right or wrong, it's an activity that stimulates their imagination.

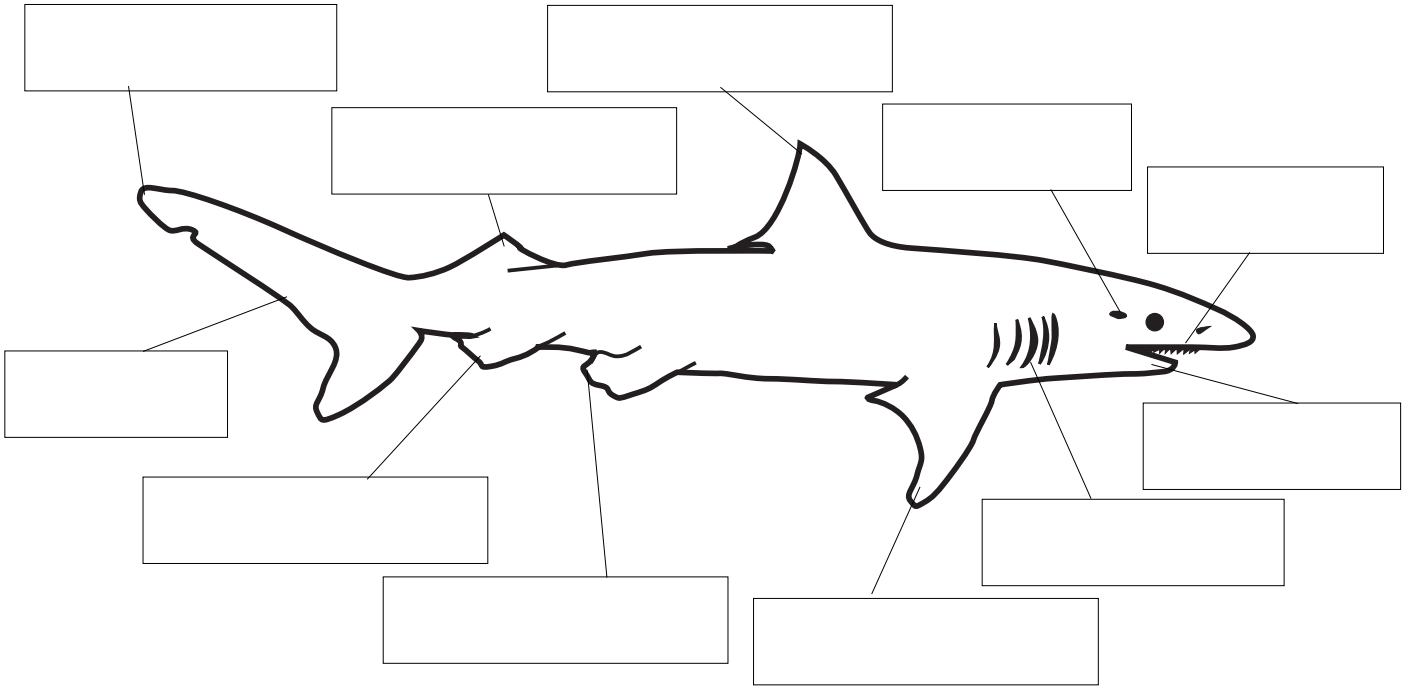
Share student's drawings and explanations, and show pictures/video/images of the real reef creatures.

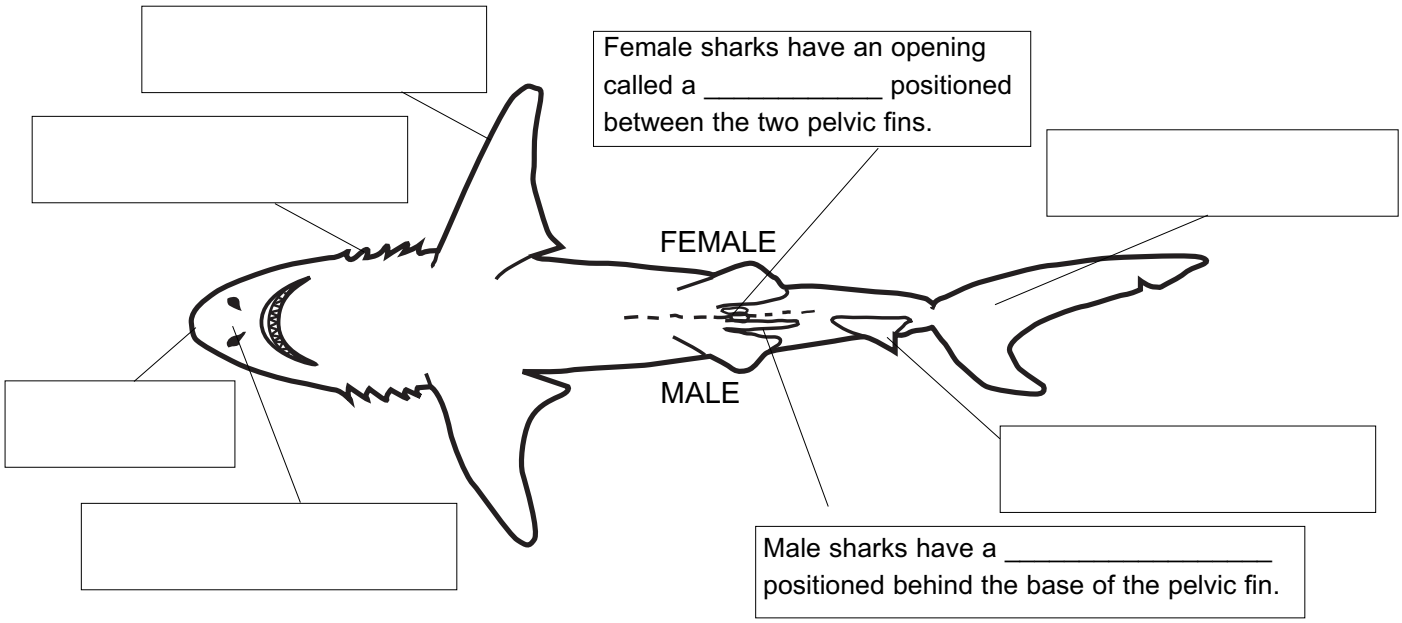
- Rhino seastar
- Loaf of Bread sea cucumber
- Crown-of-thorns seastar
- Burnt sausage sea cucumber
- Beach ball sea cucumber
- Sand Dollar
- Pencil Urchin
- Decorator Urchin

Poster 8
Sharks and Rays

Shark Bits

Sharks have been evolving for millions of years. They have an amazing body structure also known as anatomy. The following two diagrams show the typical external anatomy of mid-water sharks. Use the following web addresses (see next page) to correctly name the external body parts and also learn more about the anatomy of sharks. Write down two interesting facts about a shark's internal anatomy.





Seaworld.org “Shark Anatomy”
http://www.seaworld.org/infobooks/Sharks&Rays/sharkanatomy.htm

Florida Museum of Natural History “Body Features and Measurements of Sharks”
http://www.flmnh.ufl.edu/fish/Education/Diagrams/SharkParts.html

NOVA Clickable Shark
http://www.pbs.org/wgbh/nova/sharks/world/clickable.html

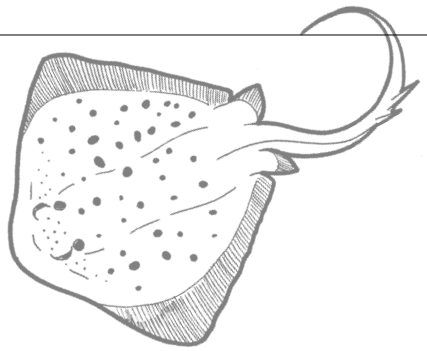
Cultural Connections

Aboriginal and Torres Strait Islander people are the Traditional Owners of the Great Barrier Reef region. For over 60 000 years, their traditional connections have been part of the unique living maritime culture, and today their traditional customs and spiritual lore continue to be practised in their use of sea country and natural resources. Sea country refers to areas of sea that Aboriginal and/or Torres Strait Islander groups are traditionally affiliated with. Sharks and rays are culturally important to many Traditional Owner clan groups.

Use the following path on www.reefED.edu.au
Students >> **Web Quest** >> **Save our Sharks** >> **Cultural Connections**

Read the information contained on this page and complete the following table:

Cultural Connection	***Why sharks and rays are important to Traditional Owners (Examples)***
Food	
Tools	
Totems	
Stories	**Read the *Dhui Dhui Story* of the Bandjin People. What constellation was formed during this Dreamtime story?**



Deep Sea Detective "The Case of the Missing Sawfish"

Use the web sites provided to help you complete your ***Case File Questions*** below. Be sure to answer all the questions in your case file as this will help to develop your *Sawfish Futures Wheel.*

Case File Questions

- How many sawfish did there used to be?
- Why have sawfish been disappearing?
- What could or should be done to protect sawfish?

Department of the Environment, Water, Heritage and the Arts
http://www.environment.gov.au/coasts/species/sharks/sawfish/index.html

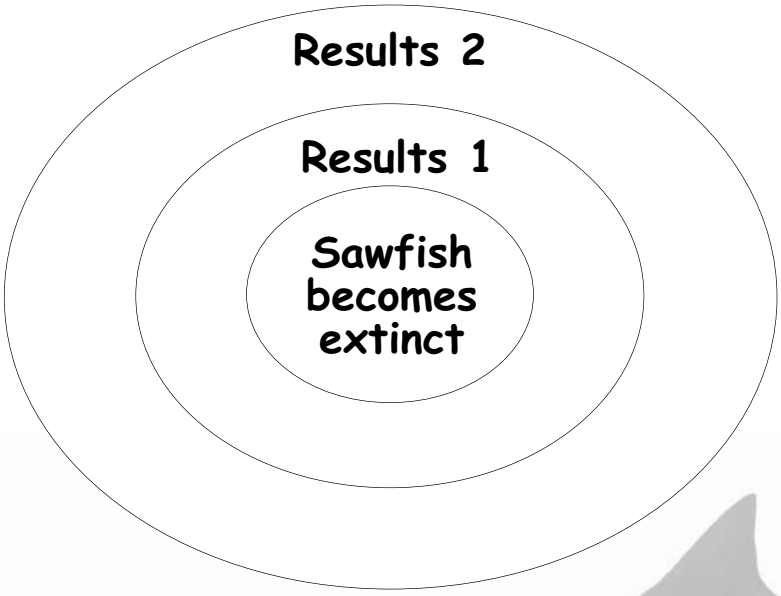
Florida Museum of Natural History "Sawfish Recovery Team"
http://www.flmnh.ufl.edu/fish/sharks/sawfish/srt/srt.htm

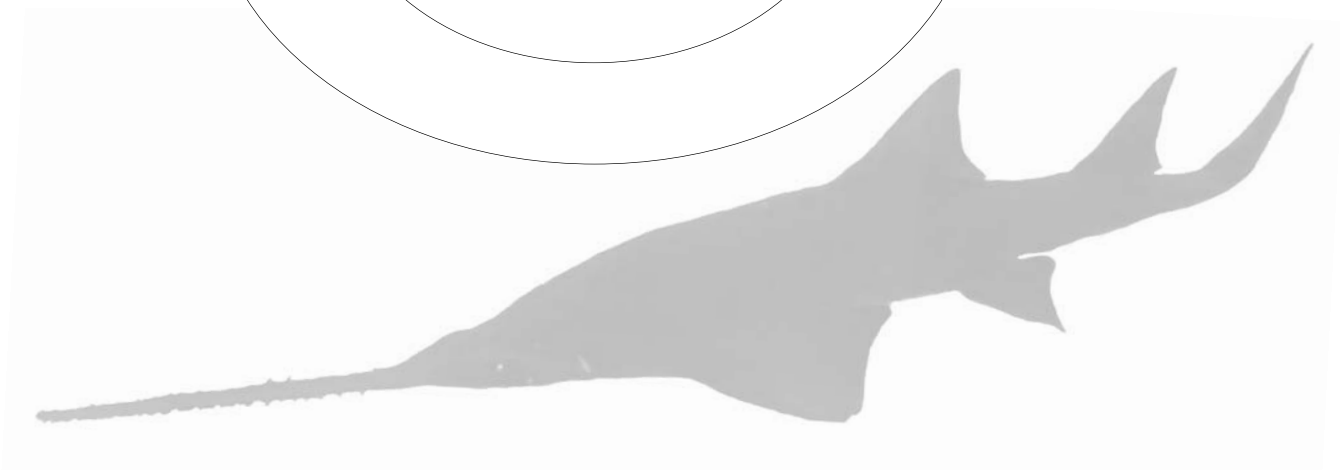
MOTE Marine Laboratory "Sawfish Conservation Biology Project"
http://www.mote.org/index.php?src=gendocs&link=sawfish-home&category=Shark%20Research

Draw a **Futures Wheel** that shows the flow-on results of the sawfish becoming extinct.

Hint: Futures wheels can have many flow-on results; they are only restricted by your imagination.

What might happen if sawfish were to become extinct?





Poster 9
Seabirds

Conflict Resolution

The Great Barrier Reef Marine Park is a multiple use resource. This means that there are many people wanting to use the Marine Park for different activities. Instead of fining people for doing the wrong thing, the Great Barrier Reef Marine Park Authority would rather people understand why it's important to do the right thing while using the Marine Park.

Write a script for a short play that depicts people doing the wrong thing near seabirds. The script should include seabirds, plants and people. After acting out the first play rewrite the script so as to depict people doing the right thing.

You may wish to choose a number of these scripts and act them out at school assembly to educate the school community on the do's and don'ts of what to do around seabirds.

Problem solving, alternative solutions and persuasive arguments

Brainstorm as many negative impacts that human activities have on seabirds within the reef environment that students can think of.

Have students select one of these negative impacts and:

- List five possible reasons why this negative impact is occurring.
- List five solutions to this negative impact.
- List five reasons why we need to stop this negative impact from continuing.
- Using all of the information gathered. Write a letter that would persuade people to change their behaviour and stop this negative impact from occurring in the future.

Poster 10
Doing your bit

Slowing the shifting baseline

Action Research Project

The Great Barrier Reef is under pressure. Everything we do on the reef, along the shore and even on the land affects this diverse and fragile ecosystem. The plant and animal communities that make up the Great Barrier Reef need to be protected for future generations.

Choose a human activity that is putting the Great Barrier Reef under pressure and research answers to the following inquiry questions:

- **What and Where**
  What type of activity is it? Where is this activity-taking place?

- **How and Why**
  How has this activity changed over the years? (consider increases in technology)
  Why is this activity important to humans?

- **The Impacts**
  What are the social, economical and environmental impacts of this activity?

- **The Future**
  What is your preferred vision of the future for this activity? How can we ensure that this activity is managed sustainably?

Compare and contrast your chosen human activity to the human activities chosen by other students.

Class Debate

Divide students into debating teams and call upon them to debate topics such as:

- Oceans are for everybody. People should be able to take as much as they want from the ocean.

- Humans need energy to survive. We should mine the Reef for oil and natural gas.

- Tourism makes money. More tourists should be allowed to travel within the Great Barrier Reef World Heritage Area.

- Biotechnology could lead to many useful and sometimes lifesaving materials and medicines being generated. The increased government funding should be given to reef biotechnology research.