THE INSHORE GREAT BARRIER REEF - Bursting with Biodiversity

REEF Beat

Australian Government
Great Barrier Reef Marine Park Authority

ACTIVITY BOOK

An initiative of the Great Barrier Reef Marine Park Authority

CONTENTS

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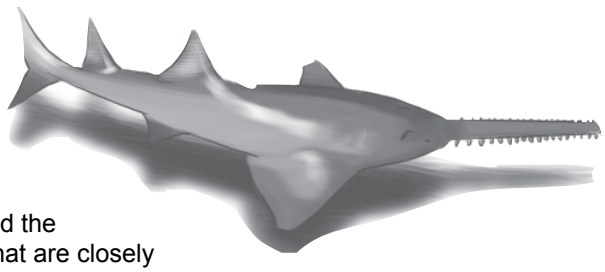
INTRODUCTION

The Great Barrier Reef Marine Park Authority's 2012 Reef Beat education series, **The Inshore Great Barrier Reef – Bursting with Biodiversity**, explores how the inshore marine, coastal and Great Barrier Reef catchment ecosystems are interconnected and reliant on one another to function. This education series identifies and outlines biodiversity of the marine and coastal ecosystems and Great Barrier Reef catchments and key threats to biodiversity using best science available at the time of production. This innovative teaching resource includes curriculum activities linked to the poster series. It is designed to assist teachers in providing opportunities for students to explore the biodiversity of the inshore Great Barrier Reef, linkages between marine, coastal and catchment ecosystems and encourage them to take action to protect biodiversity now and into the future.

Biodiversity is the variety of life on Earth at all its levels. It includes all living things and the way they interact with each other and their environment. Globally, biodiversity is under threat from human-related pressures such as habitat loss driven by coastal development and population growth. A changing climate also adds further stress on the ecosystem. The inshore ecosystems and species of the Great Barrier Reef are under pressure and their long-term health and resilience are threatened. Conserving biodiversity is essential for safe-guarding the resilience of the Earth's biological resources. The Great Barrier Reef is listed as a World Heritage Area partly due to its extraordinary biodiversity; recognised by the international community for its Outstanding Universal Value. The connectedness of its species and habitats makes it one of the most complex natural ecosystems found on Earth. *The Great Barrier Reef Outlook Report 2009* identified that the Great Barrier Reef ecosystem is at a crossroads and decisions made now are likely to determine its long-term future. Climate change, coastal development, declining water quality, illegal fishing and hunting, and some remaining impacts from lawful fishing were identified in the *Outlook Report 2009* as key priority issues affecting the Reef. The Great Barrier Reef Marine Park Authority (GBRMPA) is using a collaborative approach to develop a biodiversity conservation strategy for the Great Barrier Reef that will assist in guiding and coordinating management actions to protect biodiversity and increase the health and resilience of the Reef.

The species and ecosystems in the inshore Great Barrier Reef have strong physical, chemical and ecological links across the landscape from catchment to reef. The adjacent Great Barrier Reef catchment covers an area of 424,000 km^2 and contains a diverse range of landscapes and land uses. Since European settlement, there have been significant changes to coastal and catchment ecosystems due to land use practices such as cattle grazing, cropping, horticulture, forestry, dairying, urban development and damming and channelling of rivers and streams for water extraction and flood control. Inshore and coastal ecosystems are most at-risk from pressures such as coastal development. This is in part because the Reef ecosystem is a complex interconnected system made up of many parts, including inshore marine areas closely linked to adjacent coastal ecosystems such as freshwater wetlands and flood plains. It is for this reason that protecting the health and resilience of the inshore Great Barrier Reef is a key priority management focus for the GBRMPA. While efforts are being made to better understand the biodiversity of species and habitats of the inshore Great Barrier Reef, there is an urgent need for a coordinated, large–scale approach to addressing the cumulative impacts of development on inshore biodiversity. We need to halt and reverse the declines in biodiversity, remove or reduce pressures and restore and rehabilitate ecosystems and the species that use them. **The time to focus on threats to inshore biodiversity is now.**

At-risk inshore habitats and species



The majority of the most vulnerable habitats and species of the Great Barrier Reef occur in inshore areas. Inshore ecosystems cover approximately 10 per cent of the Great Barrier Reef and are made up of five distinct components: coral reefs, the lagoon floor (shoals and soft bottom ecosystems), islands, seagrass meadows and the water column (pelagic). The important parts of the lower catchment that are closely connected to the inshore ecosystems include areas such as wetlands, forests, salt marshes, mangroves, estuaries and beaches. These ecosystems are unique, interconnected and collectively vulnerable to a variety of pressures from human activities.

Some inshore species of the Great Barrier Reef such as the Australian snubfin dolphin and the king threadfin salmon, are particularly vulnerable to threats due to their life history traits (e.g. long-living), food requirements and small home ranges. At-risk species include several species of bony fish (e.g. snapper, grey mackerel, king and blue threadfin salmon), dugong, dwarf minke and humpback whales, sea cucumbers, inshore dolphins, marine turtles, sawfish, sea snakes, seabirds, sharks and rays. These species rely on healthy ecosystem conditions to breed, survive and thrive. Many at-risk species are featured in the *GBRMPA 2012 Reef Beat posters* 1-9. It is not just animals that rely on biodiversity; maintenance of biodiversity is critical for the provision of ecosystem services including maintaining healthy fish stocks to support commercial and recreational fishing and the role wetlands play in cleaning water before it gets to the Reef.

reef guardians

The GBRMPA's Reef Guardians program includes schools, councils, fishers, farmers and graziers. Reef Guardians is a voluntary stewardship program showcasing the environmental actions already being undertaken within coastal communities, government and industries both in the Marine Park and the adjacent Great Barrier Reef catchment. Stewardship means taking care of something you don't own. The Reef Guardian Schools program encourages students, teachers and their communities to instigate positive change for the environment in the face of emerging threats such as a changing climate. Everyone can become involved in protecting the Reef; from students adopting and protecting local beaches, to councils planting trees to stabilise the foreshore. This Reef Beat 2012 education series highlights that through working together today we can improve the health and resilience of the Great Barrier Reef for tomorrow.

To find out more about Reef Guardians go to www.gbrmpa.gov.au.

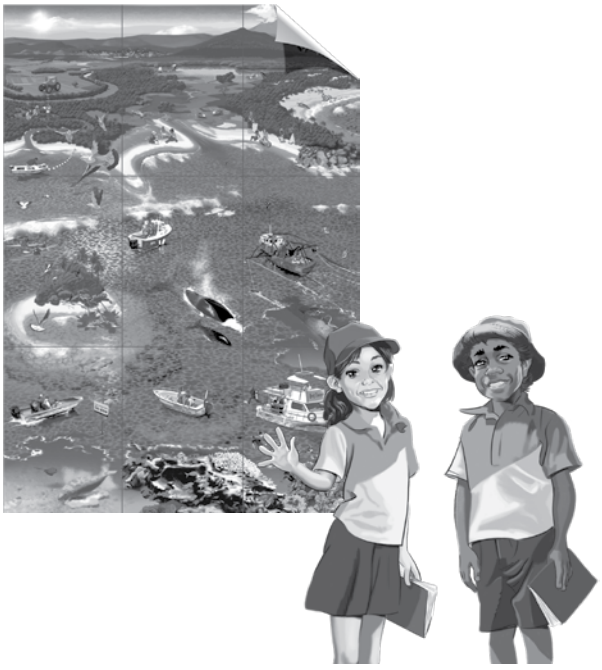
How to use this resource

This resource is designed to be used as a teaching tool in the classroom. We have linked the activities to the Australian Curriculum Science Version 3.0 which defines how they might be completed but all activities can be done at any learning stage, with any group. The curriculum content was correct at the time of production (April 2012) but may change. Check www.australiancurriculum.edu.au for current content. We have provided a range of accompanying activities in this book that are linked to the posters, across multiple year levels from Early Years to Year 12. The cross-curriculum priorities **Aboriginal and Torres Strait Islander histories and cultures** and **Sustainability** also feature in the posters and activity book, as does building students' scientific investigation skills.

The *GBRMPA 2012 Reef Beat posters* and activity book are designed to encourage students to use inquiry-based learning. The activities are also linked to the GBRMPA Science Teaching Units so teachers can extend on certain topics using the five E's inquiry-based approach to teaching science. The activities encourage students to explore and implement everyday actions to protect the Reef.

The *GBRMPA 2012 Reef Beat posters* include an introductory poster and posters 1-9. Posters 1-9 can be viewed alone but, when displayed together, make a whole picture of the inshore Great Barrier Reef. We encourage you to display posters 1-9 together so students can see how the functions of the inshore Reef are interconnected and rely on the ecosystem being healthy as a whole. As different parts of the ecosystem rely on other parts that may be impacted by multiple users and uses, it is important to take a whole-of-ecosystem approach to exploring, managing and protecting biodiversity.
The *GBRMPA 2012 Reef Beat posters*, activity book and additional resources are available online on the GBRMPA website (www.gbrmpa.gov.au).

Join two school students, Tiho and Mindi, as they explore the biodiversity of the inshore Great Barrier Reef, meet the people who use and enjoy the Reef and connected ecosystems and find out how we can all protect biodiversity.



POSTER 1

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include sandy beaches, mangroves, forests and tidal salt marshes.
The poster shows pied imperial pigeons migrating between the mainland and the island (in poster 4).

Key messages:

- The Reef receives run-off from 38 major basins (catchments, rivers and estuarine systems) that drain an area of 424,000 km^2 of coastal Queensland.
- Activities in these catchments, such as land clearing, damming of rivers and streams and coastal development, affect the health of rivers, floodplains, freshwater wetlands, estuarine and inshore systems and ultimately the Great Barrier Reef.
- Many inshore species such as seabirds are exposed to multiple pressures including climate change, declining water quality, coastal development and some commercial fishing.
- Many farmers and graziers are doing great work on their properties to conserve and rehabilitate the environment. The Reef Guardian Farmers and Graziers programs are about implementing sustainable and productive farming practices that are economically viable as well as environmentally sound. Farmers and graziers are improving the water quality of their local waterways by taking steps such as implementing practices to minimise run-off and improve water quality and putting in place or protecting natural filters (e.g. vegetation) to clean the water draining from the land before it gets to the Reef.
- Pied imperial pigeons roost on islands within the Great Barrier Reef at night and feed in mainland rainforests during the day. They are a good example of the connectivity between catchment and coastal ecosystems.
- Aboriginal and Torres Strait Islander people are the Traditional Owners of the Great Barrier Reef Region. They have used the reefs, islands and mainland to support them for thousands of years and their cultural connections to land and sea country remain strong today. There are more than 70 Traditional Owner groups along the Great Barrier Reef coastline that identify with a particular area of land or sea country where their ancestors lived. For more information on Traditional Owners of the Great Barrier Reef please see the GBRMPA *2010 Reef Beat - Sea Country Connections* and information on Traditional Owners of the Great Barrier Reef provided by GBRMPA (www.gbrmpa.gov.au).

Linked activities

Year 3 – Waste in water

Overview: Students investigate how pollution can impact animals on the Great Barrier Reef through a simulation experiment. They investigate how they can reduce waste impacting the Reef.

Links with Year 3, GBRMPA Science Teaching Unit – Exploring the Reef

Content Descriptions:
Science Understanding
Biological sciences (ACSSU044)
Science as a Human Endeavour
Nature and development of science (ACSHE050)
Use and influence of science (ACSHE051)
Science Inquiry Skills
Questioning and predicting (ACSIS053)
Planning and conducting (ACSIS054)
Processing and analysing data and information (ACSIS215)

Inquiry questions:

- What sort of pollution is found in waters on the Great Barrier Reef?
- What do you think will happen to the animals on the Reef because of pollution?
- Who or what do you think causes the pollution?
- How can you reduce pollution in local waterways through actions you take?

What you will need:

- One large bowl.
- One measuring cup.
- Water.
- Cooking oil.
- Old toys (variety of plastic toys to simulate real animals).
- A feather if possible.
- Tray for catching water.
- Paper towels or a piece of cloth.

What to do:

1. Put together some photos of pollution to generate discussion about pollution on the Great Barrier Reef.
2. Explain to the students they are going to conduct an experiment to see what happens to living things when there is pollution in the water. Ask them to predict what will happen to each item in clean water versus the polluted water. How would different animals react or adapt to pollution?
3. Begin the experiment:
    - Fill half of the bowl with water and ¼ cup of oil.
    - Put a toy into the water and gently shake the bowl. Does the toy float or sink?
    - Place the feather in the bowl. What happens to the feather?
    - Take the feather and toys out and place on paper towels. Can you get them clean again?
4. Ask students, would you like to live in water like that? Who or what do you think causes pollution of the Great Barrier Reef? What impact does bad water quality have on humans and our uses of the Reef?
5. What actions can students take to protect water quality on the Reef?

Year 9 – Ecosystems of the Great Barrier Reef

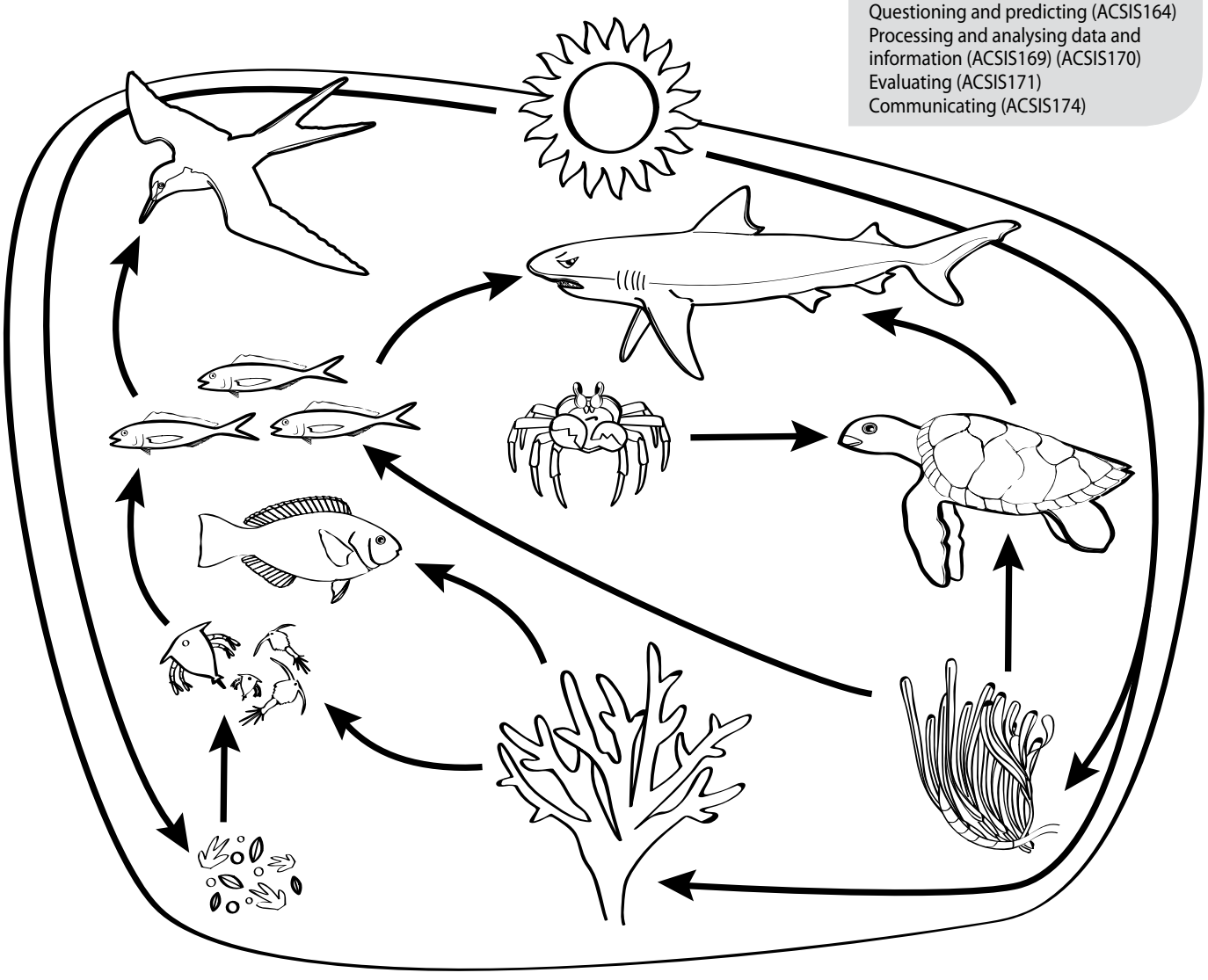
Overview: Students explore different ecosystems of the Great Barrier Reef and what makes these ecosystems unique. Students define and discuss different ways that humans impact on ecosystems. They then create a food web to examine the interactions that take place between ecosystems and discuss what would happen if a part of the ecosystem was taken away. Students propose solutions to protect the health of ecosystems.

Links with Year 9, GBRMPA Science Teaching Unit – Ecosystems

Content Descriptions:
Science Understanding
Biological sciences (ACSSU175) (ACSSU176)

Science as a Human Endeavour
Nature and development of science (ACSHE157)
Use and influence of science (ACSHE160)

Science Inquiry Skills
Questioning and predicting (ACSIS164)
Processing and analysing data and information (ACSIS169) (ACSIS170)
Evaluating (ACSIS171)
Communicating (ACSIS174)



Inquiry questions:

- What makes an ecosystem?
- How does energy flow through an ecosystem to maintain the sustainability of the ecosystem?
- What happens when components of an ecosystem are changed?
- At what scale are these ecosystem changes occurring? Are there far-reaching effects of changes in ecosystems?
- What ecosystems, habitats and species might be at risk from changes?

What you need:

- Examples of food webs e.g. pictures or videos.
- The *GBRMPA 2012 Reef Beat posters* 1-9 displayed together.
- A ball of string and blue tack or a thumb tack.
- Labels to identify biotic and abiotic features of the ecosystem.

What to do:

1. Have students brainstorm what an ecosystem is, its parts (e.g. where photosynthesis occurs, producers and consumers) and how they all link together to make the ecosystem work. Display this information on a board or place sticky notes on the *GBRMPA 2012 Reef Beat posters*. As a class, create a definition of an ecosystem.
2. Have students review biotic and abiotic features of the ecosystem.
3. Discuss with students how energy flows through an ecosystem. Teachers could use images of food webs or videos.
4. Using the *GBRMPA 2012 Reef Beat posters* 1-9, ask students to create a simple food web on the posters with string (this can be done as a class activity or in pairs).
5. Get students to label the abiotic and biotic features of their ecosystem. Ask students to explain how abiotic parts of an ecosystem might help or hinder the flow of energy. What happens when a biotic feature is removed from the food web? Can the ecosystem adapt or recover from this event?
6. Are there any economic, cultural or social impacts from this? Whose job is it to fix it?
7. How can we build resilience of the ecosystem so that habitats and species can adapt to threats such as climate change?
8. Have students report on their findings.

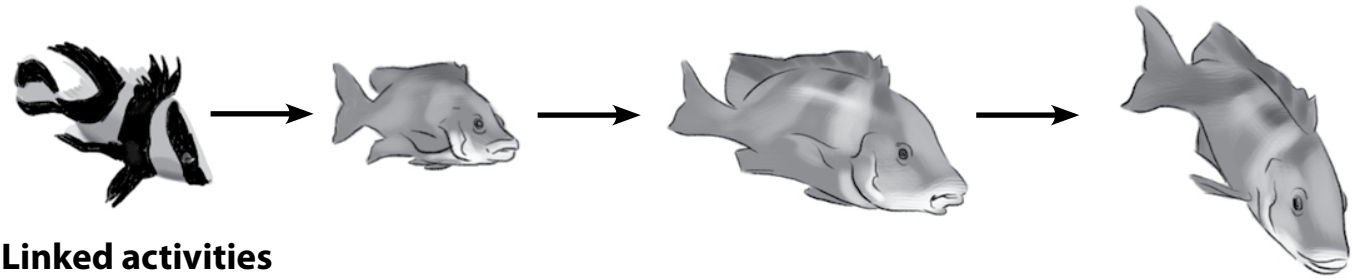
POSTER 2

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

This poster highlights several key habitats including sandy beaches, mangroves, tidal salt marshes and wetlands. Species featured in poster 2 include the red emperor, a freshwater sawfish, estuarine crocodiles and barramundi.

Key messages:

- Mangroves are exposed to multiple pressures including climate change, declining water quality and coastal development.
- The mangrove forests located in and adjacent to the Great Barrier Reef are some of the healthiest in the world.
- Wetlands areas e.g. salt marshes, salt flats and mud flats, are either temporarily or permanently covered by water (natural or artificial) that can be still, flowing, fresh, brackish or salty. These areas are hugely productive, producing algae, bacteria and other microorganisms that form the basis of food chains. For more information on wetlands see the *GBRMPA 2006 Reef Beat* education series (www.gbrmpa.gov.au).
- Wetlands have the ability to filter and remove some pollutants from run-off waters and improve the water quality.
- Wetlands provide a vital habitat for many species including freshwater and marine fish species and crustaceans. They are also breeding and nesting sites for migratory and local water birds.
- The Great Barrier Reef Marine Park Authority is working with Reef Guardian Councils on their land, water and waste management, climate change actions and community participation to address potential impacts on the Reef.
- Freshwater sawfish are exposed to multiple pressures including climate change, declining water quality, coastal development and commercial and recreational fishing. All sawfish are protected species in the Great Barrier Reef Marine Park and listed as 'no-take' species under Queensland fisheries regulations because of population declines.
- The inshore Great Barrier Reef habitats play a critical role in the life cycle stages of many species such as the red emperor and the mangrove jack.
- The life cycle of the red emperor on the posters shows the importance of the variety of coastal and Reef ecosystems and their relationship to the fish's lifecycle. Adult red emperors spawn on the outer reefs and the drifting larval fish find their way inshore to nursery habitats to feed and grow before beginning the cycle again on the Reef as adults. See if you and your students can spot the different stages of the red emperor life cycle in posters 1-9!



Linked activities

Year 7 – What do wetlands do?

Overview: Students are able to identify the role wetlands play in water quality throughout ecosystems which have direct and indirect impacts on the Great Barrier Reef.

Links with Year 7, GBRMPA Science Teaching Unit – Wetlands

Inquiry questions:

- What is the importance of water cycles in wetlands?
- Why are wetlands such an important part of the Australian and Great Barrier Reef environment?
- How does nature impact the water cycle in different wetlands?
- How do humans impact the water cycle in different wetlands?
- What recommendations can be made to care for and improve the quality of wetlands in and adjacent to the Great Barrier Reef?

Content Descriptions:
Science Understanding
Chemical sciences (ACSSU113)
Earth and space sciences (ACSSU222)
Science as a Human Endeavour
Use and influence of science (ACSHE120) (ACSHE121)
Science Inquiry Skills
Questioning and predicting (ACSIS124)
Planning and conducting (ACSIS125) (ACSIS126)
Processing and analysing data and information (ACSIS130)
Evaluating (ACSIS131)
Communicating (ACSIS133)

What you need:

- Water.
- Items to be washed into the wetland e.g. sediment (pebbles, stones, dirt, grass clippings and leaves).
- Items to act as wetland filters e.g. sponges, coffee filters, old socks or pieces of cloth.
- A large container to mix the water.
- A sink or tray to catch the water.
- *GBRMPA 2006 Reef Beat* education series on wetlands to assist research (www.gbrmpa.gov.au).

What to do:

1. Ask students to research the role of wetlands (use the *GBRMPA 2006 Reef Beat* education series for more information on wetlands.)
2. Tell the students they are going to recreate the role of wetlands for improving water quality using different items to filter the sediment from the water.
3. Mix your chosen sediment and water in your container.
4. Tip the mixed solution through the chosen filter into the sink or tray.
5. Record what sediment is caught by the filter. For larger items you may be able to count the amount of sediment caught and the amount that got through.
6. Repeat the investigation for different types of sediment and different types of filters and record you observations.
7. Share you results with the class. Discuss what would happen on the Great Barrier Reef if we didn't have wetlands?

Year 11/12 investigation task – the Great Barrier Reef catchment area

Overview: Students gather data about a catchment area (local or other catchment area of the Great Barrier Reef) to assess its health and its impacts on the Great Barrier Reef. Students devise management strategies to promote a healthy catchment area considering economic, environmental, cultural and social implications.

Links with GBRMPA Science Teaching Units – Year 11/12 Investigation Tasks

Queensland sciences senior syllabus

Go to http://www.qsa.qld.edu.au/1941.html for more information on links to senior science subjects.

Inquiry questions:

- What are the different types of ecosystems within your chosen catchment area e.g. freshwater wetlands, rainforests or estuaries?
- What are the different types of land uses and activities within your catchment? Do some land uses cover a larger area than others within the catchment? What are the implications of this?
- What is the water quality of your local catchment?
- What are the threats to water quality and the Great Barrier Reef from the land uses and activities occurring in your catchment?
- What management strategies could you put in place to reduce negative effects on both the catchment area and the Reef?

What you need:

- Information on your chosen catchment region. Information is available from www.gbrmpa.gov.au, your local council or your local Regional Natural Resource Management Body.
- Information on water quality, land uses and other activities of your catchment e.g. from your local council.

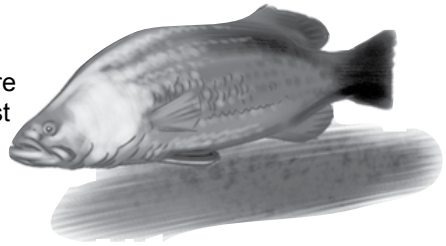
What to do:

1. Ask students to write a brief report:
    - o Provide a summary of the health of your chosen catchment area backed up by data.
    - o Compare the major factors affecting the health of the catchment area.
    - o Identify the flow-on effects of the catchment area to the Great Barrier Reef and discuss the implications.
    - o Describe management strategies (economic, environmental, social and cultural) to improve the health of your catchment and protect the Reef.

POSTER 3

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

This poster highlights several key habitats including sandy beaches, rocky coasts, mangroves, tidal salt marshes, freshwater wetlands, forests, woodlands and rainforest. Species featured in this poster include flatback turtles, barramundi and prawns.



Key messages:

- Rainforest areas located close to the Great Barrier Reef (e.g. the Daintree) are critical for the Reef's health, stabilising coastal soils, providing a buffer against forces such as wind and rain and regulating nutrients.
- Coastal areas adjacent to the Reef include a variety of aquatic ecosystems - streams, rapid rivers rushing over waterfalls, coastal rivers and associated freshwater wetlands, mangrove communities and estuaries.
- Many of the Great Barrier Reef's 38 basins (catchments, rivers and estuarine systems) have been cleared and developed. As a result, they are in poor condition and contribute to the decline in the health and function of our coastal and inshore ecosystems and species reliant on them.
- How you dispose of wastewater, chemicals or litter can make a big difference to the water quality of the Great Barrier Reef.
- Many of Australia's native fish (e.g. barramundi) move between freshwater, riverine and floodplain habitats to estuarine and marine ecosystems during their life cycle.
- Modifying how water flows through a catchment affects the health and resilience of plants and animals reliant on these flows for food, breeding, recruitment and migration.
- Barriers to fish movement such as dams, lakes and weirs can prevent fish from migrating up or down steam and affect critical stages of their life cycles.
- The Great Barrier Reef Marine Park Authority's Reef Guardian Schools program encourages schools and their communities to take a leading role in caring for the Great Barrier Reef. Some schools adopt local wetlands or beaches and conduct regular clean-ups to make sure that rubbish does not end up on the Reef or ingested by marine animals.
- Six of the world's seven marine turtle species are found in the Great Barrier Reef Marine Park: loggerhead turtle, olive ridley turtle, leatherback turtle, hawksbill turtle, flatback turtle and the green turtle. All six species are protected and need special management because of threats to their populations.
- Human-related threats that impact marine turtles include habitat loss from coastal development, incidental catch in fishing gear, boat strike, ingestion of marine debris, declining water quality and climate change.
- Turtle hatchlings may become confused by artificial lighting, decreasing their chances of getting to the ocean and surviving.

Linked activities

Year 1 – How do humans affect habitats?

Overview: Students are able to define a habitat, identify ways that humans impact these habitats and classify those impacts (natural, managed, and constructed/modified). Students sort the impacts into positive and negative and reflect on ways to improve negative impacts on habitats of the Great Barrier Reef.

Links with Year 1, GBRMPA Science Teaching Unit – Habitat Investigations

Content Descriptions:
Science Understanding
Biological sciences (ACSSU211)
Earth and space sciences (ACSSU019)
Science as a Human Endeavour
Nature and development of science (ACSHE021)
Use and influence of science (ACSHE022)
Science Inquiry Skills
Questioning and predicting (ACSIS024)
Planning and conducting (ACSIS025)
Processing and analysing data and information (ACSIS027) (ACSIS212)
Evaluating (ACSIS213)
Communicating (ACSIS029)

Inquiry questions:

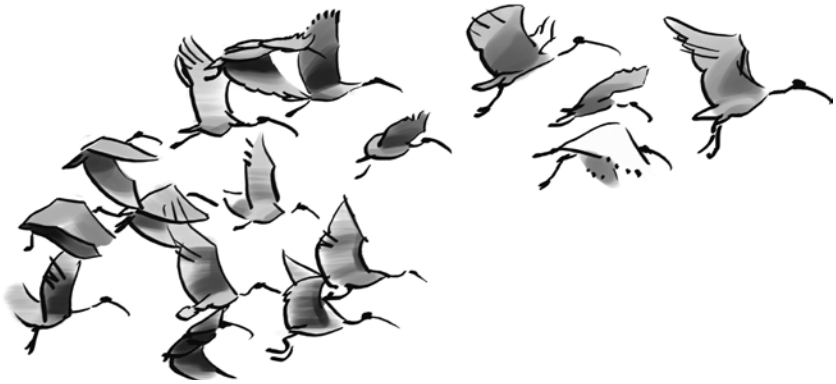
- What are habitats?
- What are the different features that define habitats?
- What are the impacts on habitats and surrounding areas from humans?
- How can we care for our local habitats to protect the Great Barrier Reef?

What you need:

- *GBRMPA 2012 Reef Beat* posters 1-9 displayed together.
- Sticky notes.
- Pictures of different habitats and different impacts to these habitats.
- Pictures of different features of habitats e.g. man made, natural or constructed.

What to do:

1. As a class, review and discuss what a habitat is.
2. Have students identify the different habitats on posters 1-9 such as rivers, wetlands and coral reefs. Students could add words to the posters to define these habitats using sticky notes.
3. Have students chose a marine, coastal or catchment habitat that they have identified.
4. What are the features of the habitat – is it natural, man made or modified (constructed)?
5. Ask students to identify ways that humans have impacted the habitat. Are there people living in or using the habitat? Are there structures such as dams or weirs that have changed the way water flows through the catchment?
6. Students could also explore the school habitat or look at pictures of habitats in their local area to identify other ways that humans impact habitats.
7. Ask students to sort the impacts to their chosen habitat into positive and negative impacts.
8. As a class, students should discuss and record ways to improve the negative impacts.



Year 4 – Travelling turtles

Overview: Students develop an understanding of marine turtle species, their features and their life cycles. They identify threats to marine turtles during their life cycles and to their populations and discuss solutions to minimise or remove the threats.

Links with Year 4, GBRMPA Science Teaching Unit – Endangered Species – Marine Turtles

Content Descriptions:
Science Understanding
Biological sciences (ACSSU072) (ACSSU073)
Science as a Human Endeavour
Use and influence of science (ACSHE062)
Science Inquiry Skills
Questioning and predicting (ACSIS064)
Processing and analysing data and information (ACSIS216)
Communicating (ACSIS071)

Inquiry Questions:

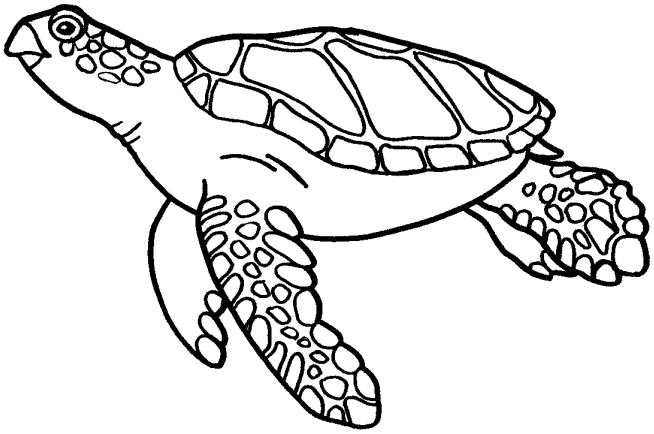
- What are the survival needs of marine turtles?
- What is the life cycle of a marine turtle?
- What species of marine turtles are found on the Great Barrier Reef?
- What are the threats to marine turtles during their life cycle?
- How can these threats affect the marine turtle's population on the Reef?
- What can we do to conserve marine turtles and their habitats?

What you need:

- YouTube clips or videos of marine turtle life cycles (e.g. several species).
- Pictures of the six different species of marine turtles found on the Great Barrier Reef. For more information on marine turtles, see the *2009 Reef Beat – Climate Change and the Reef* (poster 7, sea turtles).
- Blank paper to create diagrams.

What to do:

1. Explain to students that they are going to find out more about marine turtles and the habitats they live in. To save the students research time, break students into small groups with one or two questions each group to investigate.
2. Questions could include:
    - What do marine turtles eat?
    - Where do marine turtles live?
    - What are the different types of marine turtles found on the Great Barrier Reef?
    - Do all species of marine turtles live in the same place?
    - How do turtles spend their days?
    - How do turtles hold their breath under water?
    - What threatens marine turtles?
3. Students should share their information, answer questions from the class and reflect on their findings.
4. View YouTube clips or a video of the marine turtle life cycle and ask students to identify the different stages of its life cycle (use pictures of the six different species of marine turtles found on the Reef to help students identify species).
5. From the information gathered, discuss the life cycle of a chosen marine turtle (e.g. flatback turtle) and create a diagram to show its life cycle.
6. On the diagram, label the different parts of the life cycle. Compare this to a human life cycle. Label the threats marine turtles face at different points of their lives. When turtles hatch, what might stop them from reaching the shore? If they reach the ocean, what might stop them from coming back to nest?
7. After completing the labelled diagram have students discuss how threats could affect the turtle populations, where these threats occur in their life cycle and solutions to these threats.



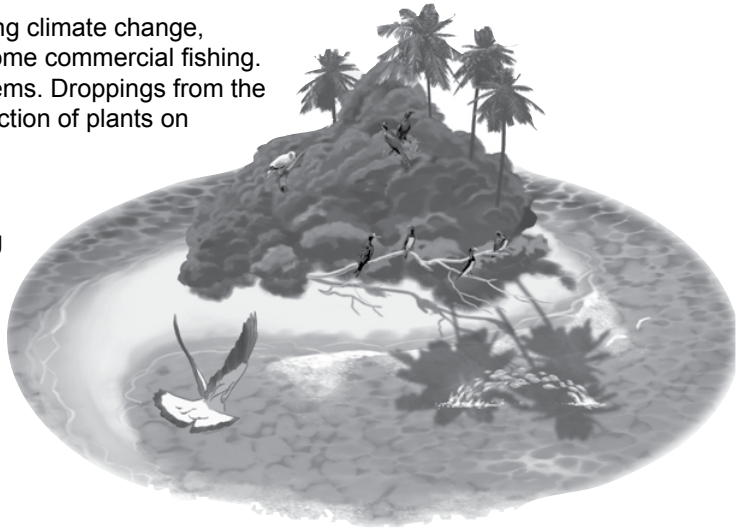
POSTER 4

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats on this poster include shoals, an island, fringing reef, the water column, the lagoon floor and sandy beaches. The species on this poster include pied imperial pigeons (continued from poster 1), brown boobies, metallic starlings, a frigate bird and baitfish.

Key messages:

- There are approximately 900 islands within the Great Barrier Reef Marine Park with approximately 152 more islands located within the larger Great Barrier Reef World Heritage Area.
- There are different types of islands including continental islands, coral cays and mangrove islands.
- Islands provide habitats for many endemic terrestrial plants and animals in the Great Barrier Reef and play a critical role in providing breeding habitat for species such as marine turtles and birds.
- Islands are important places for fringing reef; coral reefs that are attached to the mainland or, particularly within the Great Barrier Reef, found attached to continental islands. Most of this habitat has been lost from the mainland coast south of Port Douglas.
- Shoals are submerged seafloor features that attract significant marine life including fish that are important food for animals e.g. seabirds and for human uses such as commercial and recreational fishing.
- There are three different types of birds found in the Great Barrier Reef World Heritage Area: shorebirds, land birds and seabirds.
- Seabirds are exposed to multiple pressures including climate change, declining water quality, coastal development and some commercial fishing.
- Seabirds have a major influence on island ecosystems. Droppings from the birds (guano) fertilise plants and assists the introduction of plants on coral cays.
- During the breeding season, some islands of the Great Barrier Reef are closed to all vistors. People must keep their distance from islands during important roosting and nesting periods for sea birds so they don't disturb these activities.
- Baitfish such as sardines, pilchards or herrings, are often found in the rich waters around islands, providing food for many animals.



Linked activities

Year 2 – Living things grow

Overview: Students develop an understanding of animals' habitats on the Great Barrier Reef and what conditions animals need to survive. Students create a life cycle of their animal, discuss threats to the animal during its life cycle and reflect on what they can do to help protect the animal.

Links with GBRMPA Science Teaching Units – Early Years Activities

Content Descriptions:
Science Understanding
Biological sciences (ACSSU030)
Science as a Human Endeavour
Nature and development of science (ACSHE034)
Use and influence of science (ACSHE035)
Science Inquiry Skills
Questioning and predicting (ACSIS037)
Planning and conducting (ACSIS038)
Processing and analysing data and information (ACSIS040)
Evaluating (ACSIS041)
Communicating (ACSIS042)

Inquiry questions:

- Do living things all have the same external features?
- What are the different life cycles of different animals?
- What do animals need to survive?
- Do the offspring look similar to the parents?
- What impacts are there on animals in the inshore Great Barrier Reef?
- What can you do to protect animals of the Great Barrier Reef?

What you need:

- *GBRMPA 2012 Reef Beat* posters 1-9.
- Materials to create posters.
- Pictures of animals from books, magazines or the Internet.

What to do:

1. Ask students to identify the animals in poster 4 and the other posters on display.
2. Discuss with students what they know about animals (e.g. their features, behaviours and food requirements).
3. Students can decide to choose an animal featured in poster 4 or another animal from the Great Barrier Reef that they would like to learn about (use posters 1-9 for inspiration). This can be done in pairs, groups or individually.
4. Create a list of questions with students to find out more about their chosen animal. Questions could include:
    - What does the animal look like? What are the external features of your animal?
    - Where is its habitat?
    - What are its activities in one day?
    - How does it move?
    - What is the life cycle of your animal?
    - Does it look different during its life cycle e.g. young and old?
    - What can make the animal and its habitats unhealthy?
    - What can we do to help keep animals on the Reef safe?
5. Students need to collate this information beside a picture of their animal onto a poster in a few sentences, keywords or pictures.
6. Have students share their posters with others in the class, describe what they learnt about their animal and what they can do to help protect the animal in the Great Barrier Reef.
7. You can display the finished posters in the classroom or as a school display.

Year 5 – Animals adapt

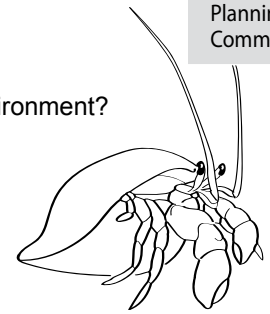
Overview: This activity is structured to build students' knowledge of how animals in the Great Barrier Reef adapt to survive in their environment. This knowledge will create links between the needs of animals to survive in their environment and how people can impact the environment and the survival of animals.

Content Descriptions:
Science Understanding
Biological sciences (ACSSU043)
Science as a Human Endeavour
Nature and development of science (ACSHE081)
Use and influence of science (ACSHE217)
Science Inquiry Skills
Planning and conducting (ACSIS086)
Communicating (ACSIS093)

Links with Year 5, GBRMPA Science Teaching Unit – Animal Adaptations

Inquiry questions:

- What are adaptations?
- How are animals adapted to survive in the Great Barrier Reef environment?
- How can people protect the animals of the Great Barrier Reef?



What you need:

- The *GBRMPA 2012 Reef Beat* posters 1-9.
- Access to the Internet or books for research.

What to do:

1. Take students on a walk around the school to look at how animals and/or plants are suited to survive in their natural environment. Give an example such as how a fish is suited to the ocean as it has gills and has a body suitable for swimming. What features do the animals have that make them suited to their environment? You can also do this exercise looking at pictures of animals in the classroom.
2. Introduce the term adaptation. Explain to students that animals are suited to their environment because of adaptations that allow them to survive.
3. Discuss with students:
    - What are physical adaptations?
    - What are behavioural adaptations?
    - How does an animal adapt to living on land compared to in water?
    - What do you think animals of the Great Barrier Reef need to survive and be healthy?
4. Explain to students that there are two types of behavioural adaptations: instinctive and learned behaviour. Learned behaviour is when an animal or even a person learns to behave in a certain way e.g. an animal may go back to a habitat if there is more food available. Instinctive behaviour is when an animal is born with knowledge to do something in a certain way e.g. when a marine turtle hatches, the young turtles try to head straight to the shore and into the ocean.
5. Ask students to look at the animals in poster 4 and list their behavioural and structural adaptations in a table. Why do they think the pied imperial pigeons fly between the island and the mainland? What benefit could this have for the bird? What challenges might it face?
6. Explain to students that they are going to research different animals to find their behavioural adaptations. Students could choose an animal from the *GBRMPA 2012 Reef Beat* posters 1-9 or they could research an animal using the Internet or books available. Ask students to also think about how humans might impact or change the behaviour of their chosen animal.
7. When students are finished, ask them to share their findings with the class (this can be an informal discussion or displayed by students as multi-modal texts). What can students do to help protect animals of the Great Barrier Reef?

POSTER 5
THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include shoals, fringing reefs, the water column and the lagoon floor. The featured species of this poster include the Australian snubfin dolphin and humpback whales.

Key messages:

- The inshore water column of the Great Barrier Reef is a soup of nutrients. Nutrients are taken up by microorganisms such as phytoplankton, zooplankton and bacteria that form the basis of many food chains.
- The humpback whale is protected in the waters of the Great Barrier Reef World Heritage Area.
- Without the pressure of whaling (which ceased in the early 1960s), humpback whale populations are recovering throughout the world, including the population that migrates to spend each winter in the Great Barrier Reef World Heritage Area.
- Humpback whales migrate from Antarctic waters to the Great Barrier Reef World Heritage Area from May to September to calve before they return to the Antarctic for summer.
- It's critical for the survival of whales and dolphins that their activities remain free from human harassment that may lead to calf mortality.
- When operating a vessel on the Great Barrier Reef you must follow responsible practices when boating around whales or dolphins, including keeping a safe distance to minimise the risks to you and these iconic marine mammals.
- Australian snubfin dolphins are mostly found in the inshore waters off the coast of Queensland.
- While all species of dolphin are protected in the Great Barrier Reef Marine Park, the Australian snubfin dolphin (formerly known as the Irrawaddy dolphin) requires special management due to multiple threats such as climate change, declining water quality, habitat loss and incidental capture in set mesh nets.
- The Australian snubfin dolphin's reliance on a small home range with little intermixing between different populations, means that they are arguably the Reef's most threatened marine mammal.
- So little is known about the Australian snubfin dolphin that its conservation status cannot be assessed under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Large groups of Australian snubfin dolphins have been recorded in only three areas: Princess Charlotte Bay and Bathurst Bay on Cape York Peninsula, Cleveland Bay near Townsville and Keppel Bay at the mouth of the Fitzroy River.

Linked activities

Year 4 – Endangered!

Overview: Students develop an understanding of threats to species of the Great Barrier Reef with a focus on whales and dolphins, classify these threats and discuss possible solutions to increase the population of species and improve the ecosystem health.

Links with Year 4, GBRMPA Science Teaching Unit – Endangered Species – Marine Turtles

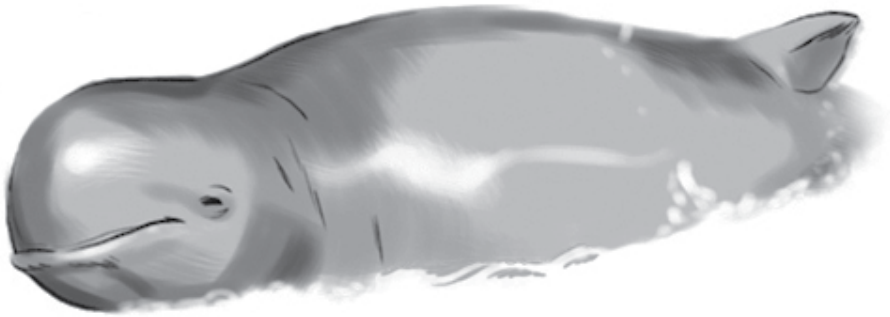
Content Descriptions:
Science Understanding
Biological sciences (ACSSU073)
Science as a Human Endeavour
Nature and development of science (ACSHE061)
Use and influence of science (ACSHE062)
Science Inquiry Skills
Questioning and predicting (ACSIS064)
Planning and conducting (ACSIS065)
Processing and analysing data and information (ACSIS068) (ACSIS216)
Communicating (ACSIS071)

Inquiry questions:

- What are the survival needs of whales and dolphins?
- What threatens whales and dolphins found in the Great Barrier Reef?
- What can we do to conserve whales, dolphins and their habitats?

What you need:

- *GBRMPA 2012 Reef Beat* posters 1-9.
- Access to books and the Internet.



What to do:

1. Explain to students they are going to investigate species that are threatened in the inshore Great Barrier Reef. Focus on the species featured in poster 5 to discuss where animals live, what they need to survive and what human-related threats have reduced the abundance and range of many marine species. Why are humpback whale populations increasing on the Great Barrier Reef? Why are the Australian snubfin dolphin populations decreasing?
2. Examine the *GBRMPA 2012 Reef Beat* posters 1-9 and give students the opportunity to choose an animal that they would like to investigate. Students need to identify the natural and human-related threats to their chosen animal and what can be done to help protect the animal. If this species was to become extinct, what impact would this have on the ecosystem?
3. Students need to graph the population numbers of their chosen species over time on the Great Barrier Reef.
4. Have students share their learning and reflections with the class and discuss what they can do to help protect these amazing animals.

Year 7 – Chains of food

Overview: Students develop an understanding of the interactions between organisms through researching and creating food chains of the Great Barrier Reef. Students discuss how natural and human activities can impact food chains and devise solutions to protect food chains and the ecosystem.

Links with Year 7, GBRMPA Science Teaching Unit – Wetlands

Content Descriptions:
Science Understanding
Biological sciences (ACSSU112)
Science as a Human Endeavour
Use and influence of science (ACSHE120) (ACSHE121)
Science Inquiry Skills
Questioning and predicting (ACSIS124)
Processing and analysing data and information (ACSIS129) (ACSIS130)
Evaluating (ACSIS132)
Communicating (ACSIS133)

Inquiry questions:

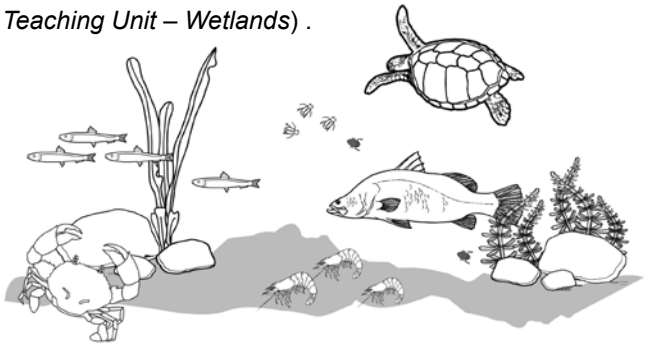
- What are food chains and how are they used to describe interactions between organisms?
- What is the role and importance of each organism in a food chain?
- What are the natural and human impacts that may impact on a food chain?

What you need:

- The *GBRMPA 2012 Reef Beat* posters.
- Paper or recycled materials.
- Scissors, sticky tape and a stapler.
- String to hang the food chains.

What to do:

1. Discuss what food chains are (how each living organism gets its food). As a class using the *GBRMPA 2012 Reef Beat posters* 1-9, find an example of a food chain e.g. sun > algae > water invertebrates > small fish > snubfin dolphins.
2. Discuss with students the role of the sun and plants in the food chain. Ask students if a food chain can exist without the sun or without plants?
3. Explain to students that they are going to make an example of a food chain that exists in the Great Barrier Reef. Students can develop a food chain using the *GBRMPA 2012 Reef Beat posters* or researching books and the Internet.
4. To make food chains:
    - Get students to cut several strips of paper approximately 5 cm wide by 20 cm long to make paper chains. You could also make the chains from recycled materials.
    - On each of strip of paper get students to write in large letters and draw the specific element of a food chain in the Great Barrier Reef that they decide on.
    - Link the chains together using sticky tape or staples and hang the food chains (animals at the top of the food chain should be positioned highest.)
5. Discuss with students what happens to the balance of the food chain when one element is taken out (physically demonstrate this with an example food chain already prepared) or if there is too much of one element e.g. nutrients.
6. As a class make a list of things, both natural and human, that would impact the food chains in the Great Barrier Reef.
7. Create a 'Futures Circle' (pg 26, Year 7, *GBRMPA Science Teaching Unit – Wetlands*) .



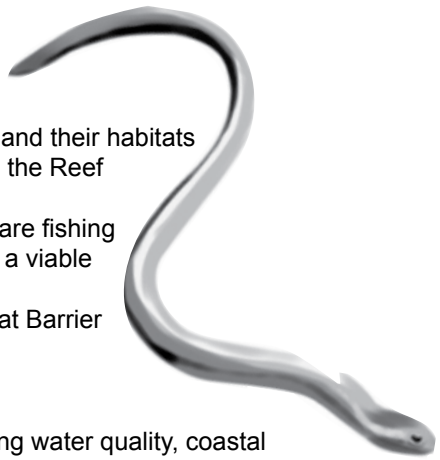
POSTER 6

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include shoals, the water column and the lagoon floor. The featured species of this poster include the red emperor, a sea snake, prawns and a marine turtle.

Key messages:

- There are approximately 1500 different species of fish found in the Great Barrier Reef Marine Park. These fish are essential to the health of the Great Barrier Reef ecosystem.
- The Great Barrier Reef Marine Park Authority (GBRMPA) aims to protect the natural qualities of the Great Barrier Reef while providing for reasonable use of the region. GBRMPA contributes to fisheries management through collaborative planning and management with the Queensland Government focused on maintaining healthy and productive ecosystems and species populations.
- The GBRMPA recognises the harvesting of fisheries resources is an important and reasonable use of the Marine Park and consistent with the use of the Great Barrier Reef World Heritage Area.
- The GBRMPA also recognise fishing affects target species, non-target species and their habitats and has the potential to produce ecological effects in both the fished areas and the Reef system as a whole.
- The GBRMPA is working with Reef Guardian Fishers to showcase fishers who are fishing sustainably and maintaining the health of the Great Barrier Reef whilst building a viable future for their fishery.
- A large percentage of the East Coast Otter Trawl Fishery occurs within the Great Barrier Reef Marine Park.
- All Otter Trawl vessels must have by-catch reduction devices in their trawl nets to minimise the catch of non-target species.
- Sea snakes are exposed to multiple pressure including climate change, declining water quality, coastal development and commercial fishing.
- Two species of sea snake, the elegant sea snake and the ornate sea snake, have been identified as 'high-risk' species in the Trawl Ecological Risk Assessment.



Linked activities

Year 6 – Sustainable fishing activity

Overview: Students will explore how unregulated fishing combined with other threats can lead to depletion of fish stocks. They will also discuss the factors that may contribute to the depletion of fish populations and ways to protect fish populations for the future.

Links with Year 6, GBRMPA Science Teaching Units – Let's go fishing!

Content Descriptions:
Science Understanding
Biological sciences (ACSSU094)
Science as a Human Endeavour
Use and influence of science (ACSHE100) (ACSHE220)
Science Inquiry Skills
Questioning and predicting (ACSIS232)
Communicating (ACSIS110)

Inquiry questions:

- What human activities affect fish?
- How do these impacts affect fish populations?
- What are sustainable fishing practices and why are they important in the Great Barrier Reef?

What you will need:

- A large area to run around.
- Markers to identify the two 'fish safe' sides of the game.
- A whistle.

What to do:

1. Have a discussion with students about fishing e.g. reasons, rules, different types of fish and fishing. The following questions could be used as a guide:
    - Why do we go fishing? Why do people like fishing?
    - What different sorts of fishing are there?
    - Do you have a favourite fishing spot or type of fish you like to eat?

2. Ask students if they know of any rules for fishing e.g. fishing requirements in the Zoning Plan, size and bag limits, protected species, tackle restrictions and seasonal/area closures.
3. Discuss with students why there are rules in place for fishing.
4. Discuss with students what sustainable means in different contexts e.g. sustainable fishing, sustainable farming or sustainable living. Create a definition of sustainable fishing.
5. Explain to students they are going to play the sustainable fishing game:
    - Outline the two 'safe sides' of the game with markers on opposite sides of an area.
    - Choose five students to depict a different type of fishing e.g. trawling, recreational fishing, spear fishing. These students will be in the middle of the playing field.
    - The other students will be the fish and will be together on one side of the field.
    - When the whistle blows the fish have to get safely to the other side, around the fishing activity. If fish get caught, they join the team in the middle.
    - Ask these students who have joined the middle to become other threats such as climate change, declining water quality or habitat loss. Run the game again. Can fish survive so many threats? What are the impacts on the fish population if too many fish are threatened?
    - Discuss with students how they can implement sustainable fishing activities to protect future fish populations.

Year 11/12 – Design a by-catch reduction device

Overview: Students will investigate how to make fishing more sustainable. Students will need to design and conduct an experiment to investigate methods that will promote more sustainable fishing in the Great Barrier Reef Marine Park.

Links with GBRMPA Science Teaching Units – Year 11/12 Investigation Tasks

Queensland sciences senior syllabus:

Go to http://www.qsa.qld.edu.au/1941.html for more information on links to senior science subjects.

Inquiry questions:

- What are sustainable fishing practices and why are they important on the Great Barrier Reef?
- What species can benefit from more sustainable fishing practices?

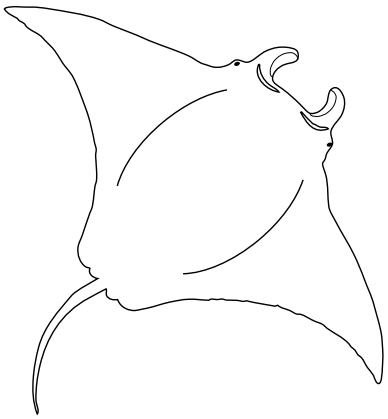
What you need:

- Students will need access to equipment to create sustainable fishing practices/equipment (students can also portray their sustainable fishing invention using drawings or diagrams if equipment is not available).

What to do:

1. Students will need to conduct one of the following investigations:
    - Develop a new by-catch reduction device (an example of a successful by-catch reduction device is the turtle exclusion device).
    - Develop a catch and release cast net.
    - Develop a fishing method using lures or hooks to catch a specific target species (as identified by the student).

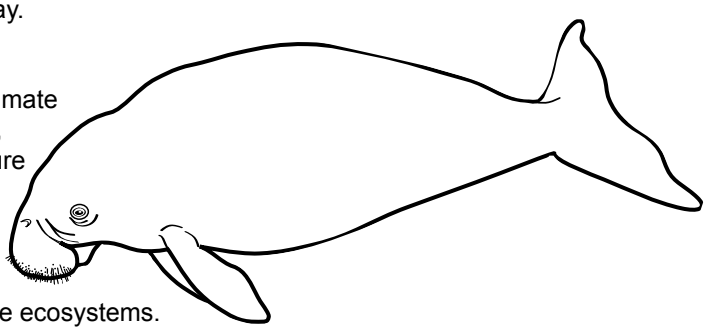
2. Students will need to:
    - Form a hypothesis.
    - Design a sustainable fishing method and conduct an experiment.
    - Collect, analyse and evaluate their data.
    - Explain how the new device could influence management of fishing in the Great Barrier Reef Marine Park.



POSTER 7

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include shoals, fringing reefs, the water column, seagrass meadows and the lagoon floor. The featured species of this poster are dugong and a stingray.



Key messages:

- Dugong are exposed to multiple pressures including climate change, declining water quality from catchment run-off, habitat loss from coastal development, incidental capture in mesh nets, boat strike, disease and unsustainable traditional hunting and illegal hunting.
- Dugong are the only marine mammals in Australia that feed mainly on plants.
- They play an important ecological role in coastal marine ecosystems.
- There has been a significant decline in dugong populations along the urban coast of Queensland in recent times. Historically, the dugong population along the coast south of Cooktown has reduced by more than 90 per cent since the early 1960s.
- In 2011, following a series of extreme weather events, extensive reduction or loss of seagrass meadows between Cairns and Hervey Bay was reported. This resulted in the number of dugong deaths more than doubling in the southern Great Barrier Reef compared with any other year since stranding recordings commenced in the mid 1990s.
- Seagrass meadows provide structural foundation for diverse communities. They also capture and recycle nutrients, are primary producers, provide food for many species and are an important nursery ground for prawns and fish.
- Seagrass meadows are exposed to a number of pressures including climate change, declining water quality and coastal development as well as being susceptible to impacts from extreme weather events e.g. cyclones.
- Surface-breathing animals such as turtles and dugong are vulnerable to disturbance, injury or death from boat strike. It is now more important than ever to be careful when boating in the Marine Park, especially when travelling over shallow reef flats or seagrass meadows. Travel slowly with no wake in dugong and turtle areas.

Linked activities

Year 2 – What do plants need to grow?

Overview: Students conduct an experiment to investigate the needs of plants, cause-and-effect relationships between plants, humans and natural impacts. Students gain an understanding of how to care for plants.

Links with GBRMPA Science Teaching Units – Early Years Activities

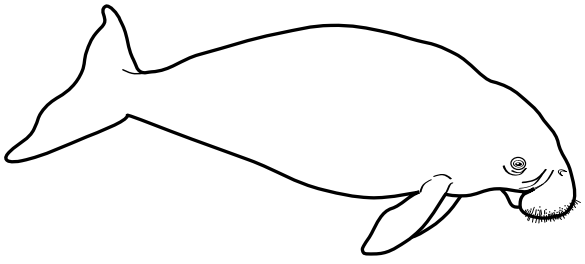
Content Descriptions:
Science Understanding
Biological sciences (ACSSU030)
Science as a Human Endeavour
Nature and development of science (ACSHE034)
Use and influence of science (ACSHE035)
Science Inquiry Skills
Questioning and predicting (ACSIS037)
Planning and conducting (ACSIS038) (ACSIS039)
Processing and analysing data and information (ACSIS214)
Evaluating (ACSIS041)
Communicating (ACSIS042)

Inquiry questions:

- What do plants need to survive?
- What is the life cycle of different plants?
- How can we protect plants in the Great Barrier Reef Marine Park?

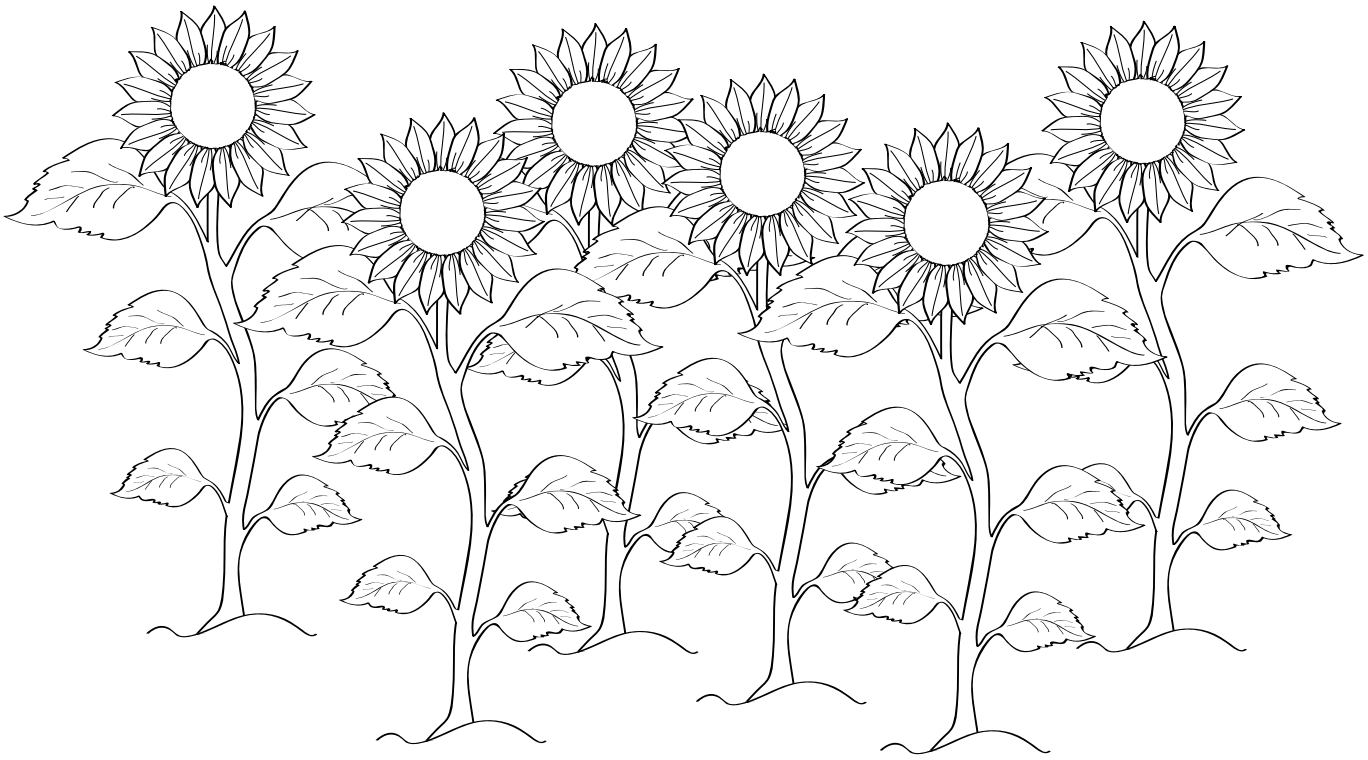
What you need:

- Seeds (discuss with students to see what they would like to grow e.g. sunflowers).
- Soil.
- Pots, test tubes or a garden bed.
- Water cans, hose or bucket for watering.
- Camera.
- Pictures of seagrass at different stages of its life cycle.



What to do:

1. Explain to students that they are going to create a book or stop animation of the complete life cycle of a plant.
2. Discuss with students their experiences of growing plants at home and ask students to share their stories.
3. Ask students what do plants need to grow?
4. Plant one seed and plan with students who is responsible for looking after the plant e.g. watering. Put the plant in a safe place and suitable environment. Ask students to predict the growth of the plant.
5. *Optional* – plant more than one seed under different conditions e.g. in sunlight or without water. Ask students to predict what will happen. Are there any changes in growth or health?
6. Take photos of the seedlings every day to record growth. Reflect at the end of the experiment – did the students predictions match the actual growth patterns?
7. After the experiment, show pictures of seagrass at different stages of its life cycle. Discuss with students what seagrass needs to grow. What other animals rely on seagrass to grow?
8. Ask students how they can keep plants such as seagrass healthy in the Great Barrier Reef?



Year 9 – Sediments and seagrass

Overview: Students use the *GBRMPA 2012 Reef Beat* posters to investigate ecosystem health. Using a model from the *Great Barrier Reef Outlook Report 2009*, students explore sediment models and relate this back to impacts on the Reef.

Links with Year 9, GBRMPA Science Teaching Units – Ecosystems

Inquiry questions:

- What makes an ecosystem?
- How do energy flows through an ecosystem maintain the sustainability of the system?
- What happens when components of an ecosystem are changed?
- Are there large-scale or long-term effects of changes to ecosystems?
- How are scientific models used to track and predict these effects?

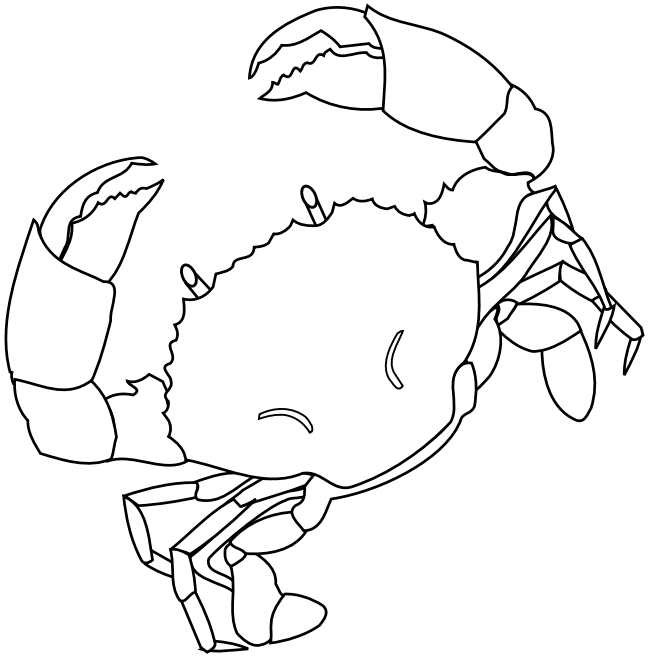
Content Descriptions:
Science Understanding
Biological sciences (ACSSU175) (ACSSU176)
Science as a Human Endeavour
Nature and development of science (ACSHE157)
Use and influence of science (ACSHE160)
Science Inquiry Skills
Questioning and predicting (ACSIS164)
Processing and analysing data and information (ACSIS169) (ACSIS170)
Evaluating (ACSIS171)
Communicating (ACSIS174)

What you need:

- *GBRMPA 2012 Reef Beat* posters.
- Access to the *Great Barrier Reef Outlook Report 2009* (www.gbrmpa.gov.au).
- Sticky notes.

What to do:

1. Review activities about ecosystems from poster 1 – Ecosystems of the Great Barrier Reef (page 4).
2. Look at the *GBRMPA 2012 Reef Beat* posters. Identify and discuss the abiotic and biotic features, food webs and energy flows
   within the ecosystem. Students can display their answer as sticky notes on the posters if they haven't done this in the previous Year 9 activity about ecosystems.
3. Explain to students they are going to research sediment models and how they can be used to predict changes.
4. Look at the model from the *Great Barrier Reef Outlook Report 2009*, Ecosystem Health, page 41, Figure 3.7 (read section 3.2.4 on sedimentation).
5. Discuss what the model is showing (changes in exposure to sediment on the Great Barrier Reef). Ask students questions including:
   - What is the model telling us?
   - Is it a natural or human impact?
   - Why has the GBRMPA identified this as an area of concern?
   - What will an increase in sediment do to energy flow through an ecosystem?
   - What changes does the model show?
   - How can the model be used to predict further changes?
   - How are scientists using models to predict sedimentation after flooding events?
   - Why are they doing this e.g. how can this improve management of at-risk species and/or habitats?
6. Students should record their learning and their reflections.



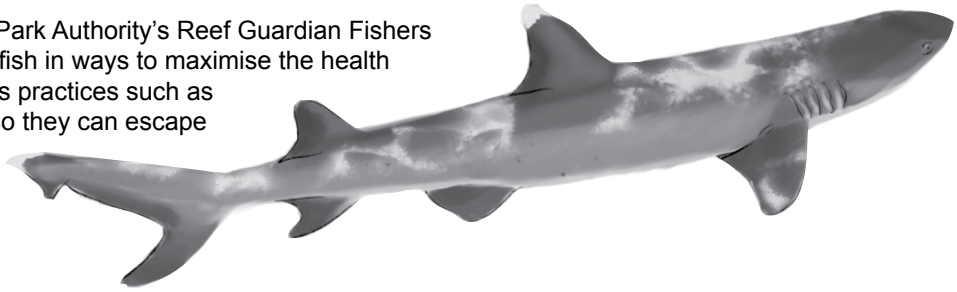
POSTER 8

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include shoals, fringing reefs, the water column, platform or patch reefs and the lagoon floor. The featured species of this poster are a whitetip reef shark, coral and a diversity of Reef marine life.

Key messages:

- There are over 2900 individual reefs in the Great Barrier Reef with approximately 670 reefs located within coastal areas that are most affected by water quality and coastal development.
- Corals provide important habitat for diverse and complex biological communities, including a variety of fish and other species.
- Coral reefs are exposed to multiple pressures including climate change, extreme weather events, declining water quality and coastal development. They are also at risk from crown-of-thorns starfish that feed on live coral tissue.
- Impacts from climate change affect all parts of the Great Barrier Reef ecosystem, with coral reef habitats the most vulnerable.
- Corals are made up of colonies of animals called polyps.
- Microscopic algae called zooxanthellae live in the flesh of most corals, transferring energy to the coral through photosynthesis.
- Sharks are predators that help to control populations of prey species maintaining the important ecological balance between interacting species and communities. If shark numbers are reduced this can have significant and unpredictable impacts on other parts of the ecosystem.
- Reef line fishing is one of the main commercial and recreational fishing activities occurring in the waters of the Great Barrier Reef.
- Reef line fishing targets fish such as coral trout, red throat emperor, Spanish mackerel and red emperor caught by hook and line.
- The Great Barrier Reef Marine Park Authority's Reef Guardian Fishers program recognises those who fish in ways to maximise the health of fish populations. This includes practices such as releasing fish close to the reef so they can escape predators and ensuring fuel transfer procedures follow best practice to minimise pollution on the Reef.



Linked activities

Year 6 – Fish survival needs

Overview: Students gain an understanding of different kinds of fish, their characteristics and their survival needs. Students discuss how fish survival is affected by the health of their habitat.

Links with Year 6, GBRMPA Science Teaching Units – Let's go fishing!

Content Descriptions:
Science Understanding
Biological sciences (ACSSU094)
Science as a Human Endeavour
Nature and development of science (ACSHE098)
Use and influence of science (ACSHE220)
Science Inquiry Skills
Questioning and predicting (ACSIS232)
Planning and conducting (ACSIS103) (ACSIS104) (ACSIS105)
Processing and analysing data and information (ACSIS107) (ACSIS221)
Communicating (ACSIS110)

Inquiry questions:

- How do fish work?
- What are the survival needs of fish?
- What happens when their habitats are polluted or modified?
- What role do we play in this?

What you need:

- Pictures of different types of fish for discussion activity.
- Books, Internet, fact sheets and the *GBRMPA 2012 Reef Beat posters* for research.
- Two tanks to represent fish habitat.
- Water.
- Sand or dirt (to represent the bottom of the habitat where fish live).
- Rubbish or liquids to act as pollution in the water.
- Toy animals (optional).

What to do:

1. Ask students to explain what fish need to survive and record this to refer back to. Students should have an awareness of what living things need to survive. This exercise focuses on the specific survival needs of fish.
2. Have pictures of fish available to discuss their features and how they help the fish survive in their habitat. What do fish on the Great Barrier Reef need to survive?
3. Have students draw their own picture of a fish with labelled external features.
4. Discuss with students how fish breathe. Use pictures or YouTube clips to stimulate discussion.
5. Explain to students they are going to conduct an experiment to see what happens when a fish has to breathe in polluted water.
6. Fish Gill Experiment:
    - o Put a layer of sand or dirt into each tank.
    - o Discuss with students which variable will be changed to ensure it is a fair test.
    - o Fill one tank with water. This tank is your control with no pollution being put into this tank. Label it 'control'.
    - o Fill the other tank with water and different types of pollution e.g. rubbish or different types of liquids. Label this tank 'pollution'.
    - o Students should predict what will happen to the water in each tank.
    - o If available, you can add toy animals into the tanks to depict real animals.
    - o Monitor the tanks over a period (either a few days or a week) and observe and record what occurs.
    - o Ask students to record their results in a table with headings. This could include headings such as:
        - Water clarity (turbidity)
        - Sediment
        - Extra observations e.g. water condition (does it smell?).
    - o Draw conclusions about how pollution might affect fish in their habitat.
    - o Discuss with students how other activities e.g. fishing, climate change or extreme weather, might affect the fish's habitat and health.
    - o What can students do to minimise the threats they have on fish habitats?
    - o How do impacts on fish health and their habitats impact people?

Year 8 – Zooxanthellae – the quiet achievers

Overview: Students gain an understanding of zooxanthellae and the role they play in keeping corals healthy. They explore how coral bleaching is related to climate change. Students propose ways to reduce their impacts on coral reefs.

Links with Year 8, GBRMPA Science Teaching Units – Coral bleaching

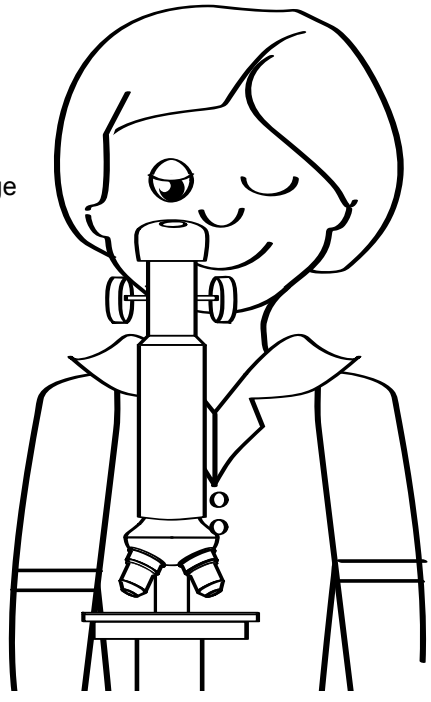
Content Descriptions:
Science Understanding
Biological sciences (ACSSU149)
Science as a Human Endeavour
Use and influence of science (ACSHE136)
Science Inquiry Skills
Questioning and predicting (ACSIS139)
Planning and conducting (ACSIS140)
Evaluating (ACSIS234)
Communicating (ACSIS148)

Inquiry questions:

- What are the features of plant cells?
- What are the roles of chloroplasts?
- What are zooxanthellae and why are they important to coral?
- How is coral bleaching related to climate change?
- How can we change our behaviours to help look after corals and zooxanthellae?

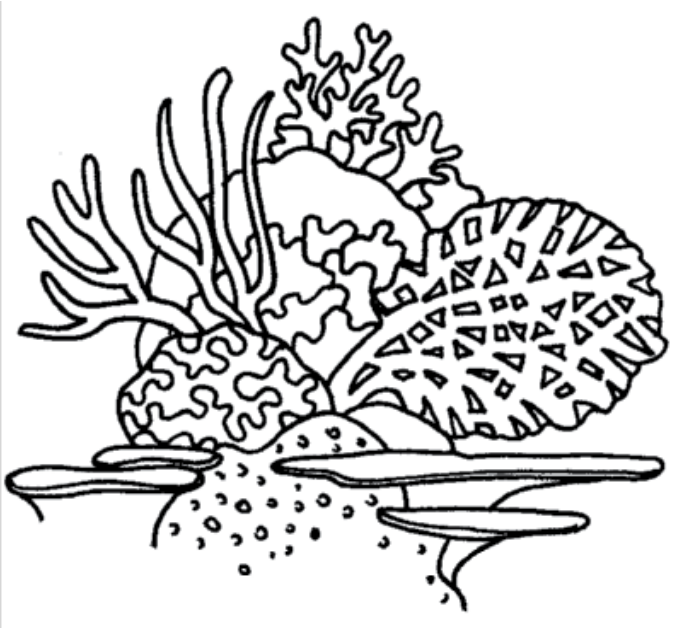
What you need:

- Information from GBRMPA about zooxanthellae www.youtube.com/watch?v=u4R0FqkywxE.
- *GBRMPA 2009 Reef Beat* education series and animations on climate change www.gbrmpa.gov.au.
- Tweezers.
- Moss or *Spirogyra* (pond algae).
- Zooxanthellae (if available).
- Water.
- Microscope (with light if not installed).
- Slides and cover slips.
- Dilute iodine solution.
- Droppers.



What to do:

1. Discuss with students what they know about cells.
2. Discuss with students what chloroplasts do in plant cells. Explain to students they are going to be looking for chloroplasts in plants cells under a microscope. If zooxanthellae are available use these for the investigation.
3. Searching for chloroplasts investigation:
    - Explain to students that they will need to predict, observe and record results during the investigation as they write up a scientific report.
    - Use tweezers to take a leaf from a moss plant of a small piece of *Spirogyra* (pond algae).
    - Place the leaf into a drop of water on a microscope slide.
    - Cover the leaf with a cover slip.
    - Use the microscope to observe the leaf.
    - Scientifically draw in your science journal what you see (including the magnification).
    - Label any chloroplasts that are present in your drawing.
    - What do you think gives chloroplasts their colour?
    - Put a drop of dilute iodine solution under the cover slip (iodine stains starch a blue-black colour.)
    - Did the iodine stain any part of the leaf a dark colour?
    - If so, what does this suggest about these chloroplasts?
4. Discuss with students what they know about zooxanthellae and what role they play in maintaining healthy corals. How are zooxanthellae similar or different to chloroplasts?
5. How can coral bleaching affect the Great Barrier Reef ecosystem?
6. How can students help to reduce their impact on coral reefs?

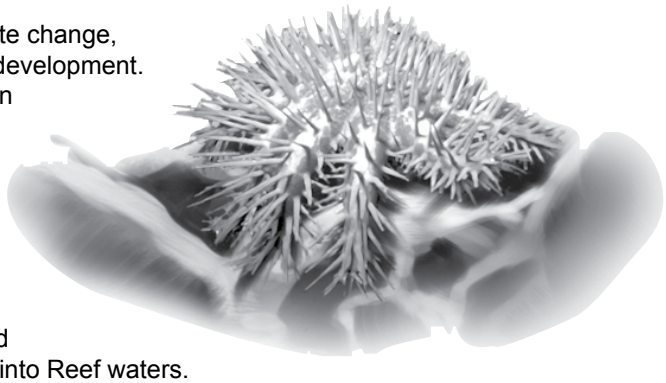


POSTER 9

THE INSHORE GREAT BARRIER REEF – Bursting with Biodiversity

The key habitats of this poster include shoals, the water column, platform or patch reefs and the lagoon floor. The featured species of this poster include the red emperor, crown-of-thorn starfish, coral and a diversity of Reef marine life.

Key messages:



- Coral reefs are exposed to multiple pressures including climate change, extreme weather events, declining water quality and coastal development. They are also at risk from crown-of-thorns starfish that feed on live coral tissue.
- Crown-of-thorns starfish are marine invertebrates that occur naturally on reefs throughout the Indo-Pacific region.
- When conditions are right for crown-of-thorns starfish to multiply, they can reach plague proportions and devastate the hard coral population on reefs.
- Land clearing, coastal development, agricultural fertilisers and sewarage discharges increase the amount of nutrients going into Reef waters.
- It is believed this increase in nutrient load might cause an outbreak of crown-of-thorns starfish allowing the population to increase dramatically and move throughout the Great Barrier Reef on currents.
- Diving and snorkelling are some of the best ways to take in the spectacular underwater views the Reef has to offer and come face-to-face with its captivating marine life.
- While it is fun to explore the Reef underwater, you need to be careful that you don't get too close and damage coral or scare animals.
- There are many high standard tourism operators that are recognised by the Great Barrier Reef Marine Park Authority for their ecologically sustainable standards www.gbrmpa.gov.au.
- It is not just plants and animals that rely on biodiversity. The biodiversity of the Reef provides goods and services that sustain our wellbeing and our economy.
- Through working together today, we can all help to protect the inshore biodiversity of the Great Barrier Reef for the future. Everyone can get involved in protecting the Reef through recycling, reducing your carbon footprint or planting trees to filter water run-off before it gets to Reef.

Linked activities

Year 10 – Ocean acidification

Overview: This activity aims to build students' knowledge on climate change. Students will investigate and build their knowledge about climate change through conducting an experiment to research how water absorbs carbon dioxide. Students discuss the impacts of ocean acidification on the Great Barrier Reef habitats and species. Students identify what behaviours they can change to reduce the impacts of climate change.

Links with Year 10, GBRMPA Science Teaching Units – Climate Change

Content Descriptions:
Science Understanding
Earth and space sciences (ACSSU189)
Science as a Human Endeavour
Use and influence of science (ACSHE194)
Science Inquiry Skills
Questioning and predicting (ACSIS198)
Planning and conducting (ACSIS199) (ACSIS200)
Processing and analysing data and information (ACSIS204)
Evaluating (ACSIS205)
Communicating (ACSIS208)

Inquiry questions:

- What is the carbon cycle?
- What are the four global systems?
- How can humans impact the carbon cycle and the flow-on effects for biodiversity?
- What is climate change?
- How are marine, coastal or inshore Great Barrier Reef ecosystems affected by climate change?
- How is biodiversity affected by climate change?
- What species are likely to be affected by ocean acidification?
- What behaviours can we implement to reduce the impacts of climate change?

What you need:

- Access to the *GBRMPA 2009 Reef Beat* education series and animations on climate change (www.gbrmpa.gov.au and http://www.youtube.com/user/TheGBRMPA).
- A cause-and-effect chart (optional).
- Access to the Internet.
- One glass jar or beaker (per student, group or demonstrator).
- Water.
- Bromothymol blue.
- One straw (per jar/beaker).

What to do:

1. Have students watch clips of the carbon cycle on YouTube.
2. Discuss with students how the carbon cycle relates to the four global systems - biosphere, lithosphere, hydrosphere and the atmosphere. Ask students to answer questions about carbon including:
    - Name three places where carbon is found?
    - What would happen to plants if the things that eat them did not breathe out carbon dioxide?
    - What natural processes or things use up carbon dioxide in the atmosphere?
    - Algae in the ocean are like grass and plants on land. What consumes algae?
3. Discuss and clarify students understanding of the carbon cycle and how it relates to climate change.
4. For more information on climate change, access the GBRMPA 2009 Reef Beat education series and animations and the climate change web pages from GBRMPA www.gbrmpa.gov.au.
5. Tell students they are going to investigate how water absorbs carbon dioxide. Discuss with students how increasing carbon dioxide levels and therefore acid levels in the water might affect animals e.g. hard corals or molluscs? What impact might that have for ecosystems? Students could use a cause-and-effects chart to display this information.
6. Begin the short experiment:
    - Fill the glass with water and add bromothymol blue to the water until you get a blue colour. The water will turn blue if it is alkaline, green if it is neutral and yellow if it is acidic.
    - Have students gently blow into the water using a straw. What happens to the colour of the water? Explain changes to the water.
7. Ask students to explain what this means for our oceans given the increase in carbon dioxide being released into the atmosphere by the burning of fossil fuels.
8. How will an increase in acidity of waters affect animals e.g. those with shells?
9. Discuss what students can do to help minimise the impacts of climate change on the Great Barrier Reef.

Year 11/12 – Climate change report

Overview: This activity is aimed to increase students' knowledge of climate change and its effect on coral reef habitats with flow on effects throughout the whole system. Students investigate climate change, predict future effects of climate change on biodiversity of the Great Barrier Reef and propose future local management strategies to reduce the impacts of climate change on the Great Barrier Reef.

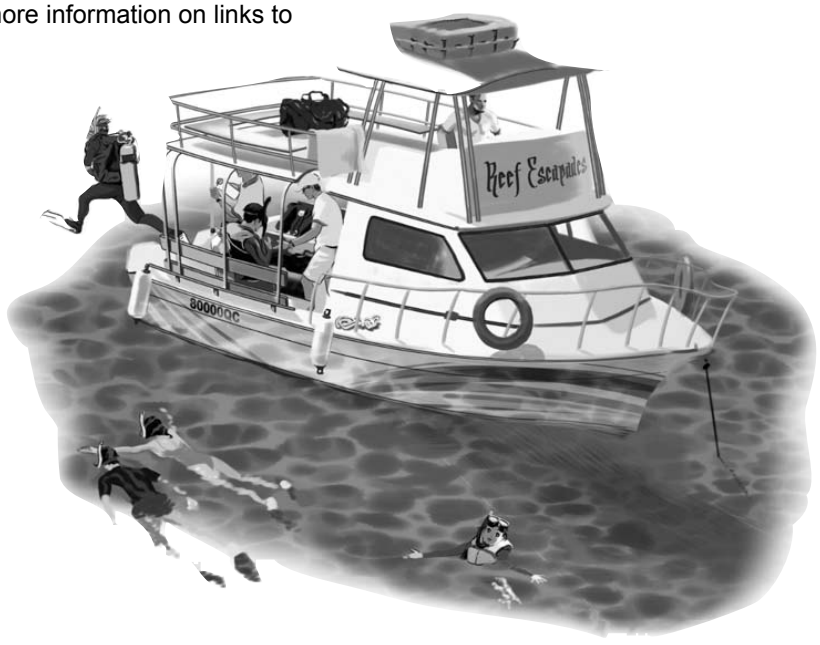
Links with GBRMPA Science Teaching Units – Year 11/12 Investigation Tasks

Queensland sciences senior syllabus

Go to http://www.qsa.qld.edu.au/1941.html for more information on links to senior science subjects.

Inquiry questions:

- What is climate change?
- How is climate change affecting the Reef?
- What impact can climate change have on the ecosystems in and adjacent to the Great Barrier Reef?
- What strategies are there to reduce the impact of climate change on the Great Barrier Reef and surrounding areas?

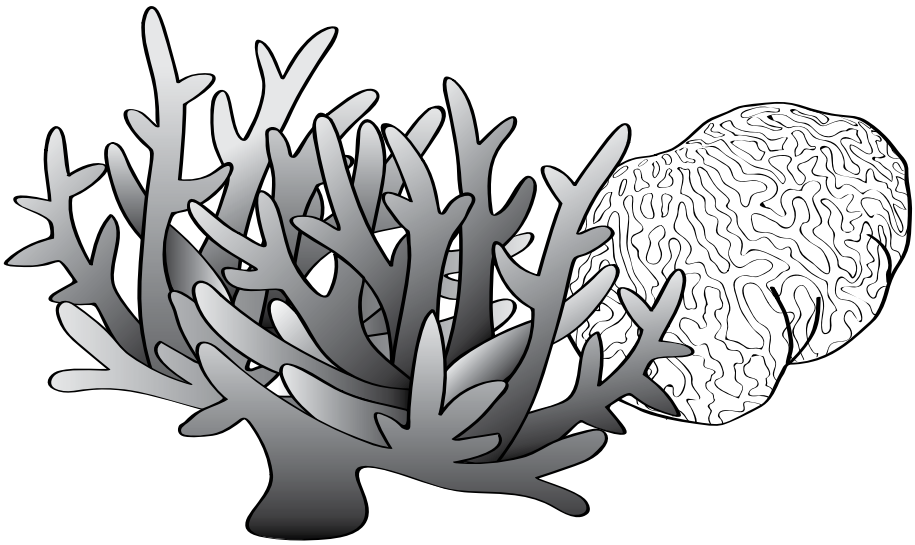


What you need:

- Access to the *Great Barrier Reef Outlook Report 2009* www.gbrmpa.gov.au.
- The *GBRMPA 2009 Reef Beat posters*, activity book and animations on climate change for research information (www.gbrmpa.gov.au and http://www.youtube.com/user/TheGBRMPA).
- Books, research papers, Internet, YouTube or other research materials.

Climate Change report:

1. The *Great Barrier Reef Outlook Report 2009*, section 5.2 Climate Change, states:
   "Increasing sea temperature is a significant risk factor for the Great Barrier Reef over the short term to medium term (decades) because of its effect on coral reef habitats, with flow-on effects throughout the entire ecosystem" (p93).
2. You are to use the data in the *Great Barrier Reef Outlook Report 2009*, as well as other data to gather various sources to investigate and write a report on climate change.
3. You may like to use the *GBRMPA 2012 Reef Beat posters* to stimulate questions and answers.
4. Your report will focus on three areas:
   - Climate change:
     - What is it?
     - How is climate change affecting ecosystems in and adjacent to the Great Barrier Reef?
   - Future predictions:
     - Use researched data to present future predictions for biodiversity on the Great Barrier Reef
   - Management:
     - What are the current management strategies to reduce the impact of climate change on the Great Barrier Reef?
     - Analyse the effectiveness of current management strategies
     - Propose future individual and local management strategies to reduce the impact of climate change on the Great Barrier Reef
     - Justify your strategies.



Australian Government

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