

Teaching Unit

Adaptations for Survival

Middle School

In this Reef HQ Education Program students find out about the amazing adaptations of Great Barrier Reef creatures. Investigate the characteristics essential to their survival including feeding, reproduction, communication and camouflage adaptations.

Curriculum Links

Completing this Reef HQ Education Program will develop students' ability to:

- Examine the internal and external structure of Great Barrier Reef inhabitants and account for observed similarities and differences, in terms of adaptation;
- Identify and analyse similarities and differences in the ways Great Barrier Reef inhabitants reproduce;
- Make generalisations about the types of interactions which take place between the living and non-living parts of the Great Barrier Reef;
- Explain why some features are more useful than others when used as a basis for grouping creatures on the Great Barrier Reef; and
- Describe how body structure and behaviour assist in reducing resistance in the marine environment.

The following unit includes suggestions for activities that can be completed before and after your Reef HQ visit.



Reef HQ Visit

This teacher resource is linked to a class visit to Reef HQ. The Reef HQ visit will enable students to:

- Observe the external structure of many creatures of the Great Barrier Reef;
- Observe the different forms of locomotion used by marine animals;
- Investigate reproductive strategies used by Great Barrier Reef inhabitants; and
- Gain an appreciation for various behavioural, reproductive and structural adaptations of various marine creatures.

Theme Overview

An adaptation is a characteristic of an organism, which helps it to be well suited to the places where it lives and the kind of life it leads. Adaptations are linked to the environment conditions an animal encounters.

Competitive? You bet!

There are so many things that live in the sea; it may almost boggle your mind thinking about it. There are those things we can't see, like microscopic bacteria, to those things we'd love to see more often, like manta rays and giant whales. Coral reefs are the oldest, most diverse and complex of ecosystems. Corals are the basis of the amazing biodiversity in the Great Barrier Reef and provide food and homes for what seems an infinite number of marine animals. Competition for these resources is fierce, and therefore the diversity of adaptations is wide. To survive, the animals could deceive, confuse, mimic, intimidate, defend, scare, sense or stowaway. Their body structure, function and behaviour are adapted to the niche they occupy. Their goal is to grow and survive until a stage of their life cycle when reproduction can occur.

Diverse? Like no other!

The Reef is home to approximately:

- 1500 species of fish;
- 360 species of hard corals;
- One-third of the world's soft corals;
- 4000 species of molluscs (eg. shells);
- 1500 species of sponge;
- 800 species of echinoderms (starfish, sea urchins, etc);
- 500 species of seaweed;
- 23 species of marine mammals; and
- 6 species of marine turtles, all listed as rare or threatened.

Three broad categories of adaptations are:

Structural

Structure is the internal and external arrangement and types of body parts eg. The barbels on the chin of a dash-dot goatfish.

Behavioural

Behaviour is what the animal does in response to certain stimulus. All animals *do things*, whether they are sleeping, flying, swimming or sitting perfectly still.

Reproductive

Reproductive adaptations are those directly related to the animal's need to reproduce. They may include behavioural adaptations such as courting the opposite sex, or structural adaptations like colouration related to attracting the opposite sex.

Adaptations for Survival - Activity Ideas

Tuning In

Environmental Conditions

Encourage and assist students in gaining an understanding of the environmental conditions within the marine environment, and the special nature of characteristics required to live there, by visiting your school pool or asking the students to imagine they are swimming through water. Establish with the students what the characteristics of water are.

Ask questions, including:

- How does water feel against your body?
- What things can you do in the water?
- Can you breathe under water?
- Can you suspend yourself motionless, midway between the surface and the bottom? Can fish do this?
- Can you change colour? Can marine animals do this? If so, why?
- Can you taste underwater? Do fish taste underwater? If so, how?
- Can you smell underwater? Do fish smell underwater? If so, why?
- Can you make noises underwater? Can fish make noises underwater? If so, why would they do so?
- If you were living in a very deep sea, where very little light penetrated, would you have large eyes, small eyes or no eyes? Do fish that live in the deep sea have large, small or no eyes?
- Can you see forwards, sideways and even backwards?
- Can you move extremely quickly when underwater?
- Can you eat or see well underwater?
- Can you swim very deeply? If so, what do you need to do when going down? How far can humans dive under the water?
- What 'people-made' things could you use that would enable you to perform better underwater? If using things such as flippers, what shapes or features are they modelled on?
- If you were able to 'grow extra features or characteristics', what would they be?
- What marine animals already have these features? and
- What are *common* characteristics of animals that live in a marine environment?



Compare and Contrast

To highlight the differences between the marine environment and other environments, take the students to an area of bush located in or around the school. Talk about environmental conditions and the non-living factors that affect the survival of the plants and animals that live there.

Discuss some of the characteristics/adaptations the plants in this area have for survival. Explain that these are directly related to the environmental conditions.

Ask students what they believe the environmental conditions would be on the Great Barrier Reef.

Coral reefs need these environmental conditions to grow and survive:

- Annual mean water temperature 22^o- 29^o;
- Clear water to allow adequate light for photosynthesis;
- Firm substrate for attachment;
- Stable salinity;
- Low sedimentation: sediments reduce the amount of light; and
- Low nutrients: increased nutrients allow algae to grow over corals.

Discuss the similarities and differences between the environmental conditions in your schoolyard to those on coral reefs eg. Temperature and other fluctuating conditions, oxygen availability and pressure.

Preparing to Find Out

Questions & Concept Maps

Stimulate discussion about special characteristics of animals by posing the questions, what do reef animals do (behavioural adaptations), how do they do it (structural adaptations) and how do they reproduce?

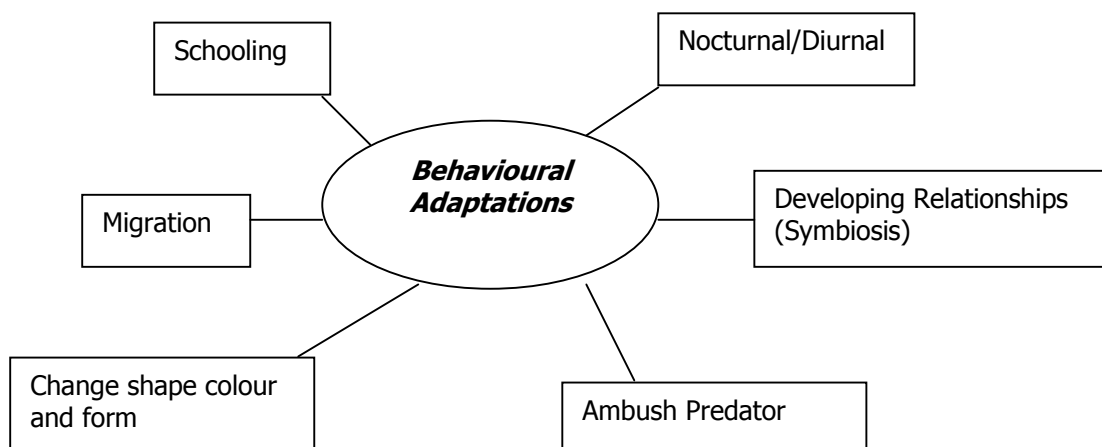
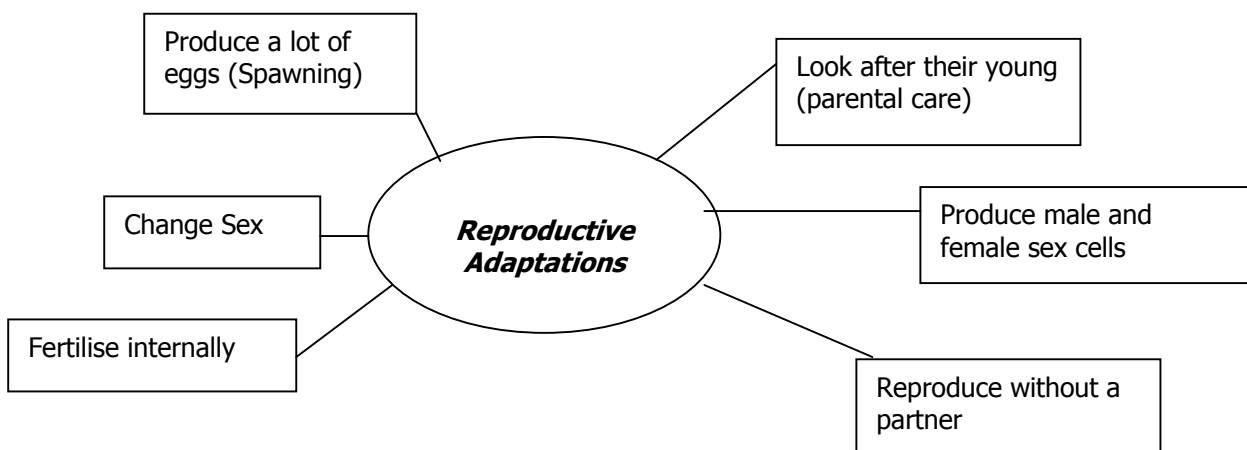
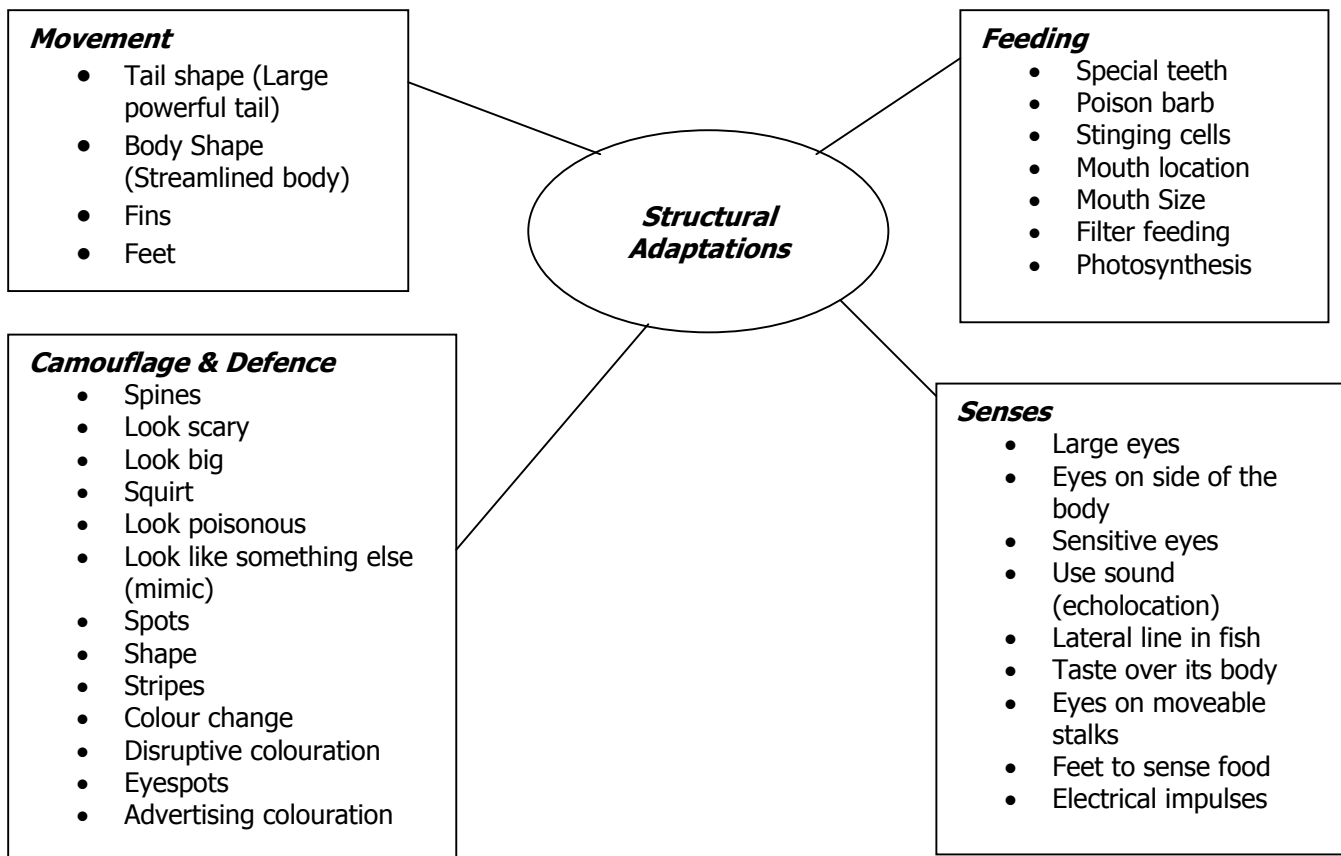
Turn suggestions into headings eg. 'animals eat', could be titled 'feeding characteristics'. A suggestion of 'animals hide' could be titled 'camouflage characteristics'. Other categories could include reproductive characteristics, hunting characteristics, movement characteristics. Explain that all of these characteristics could be placed into categories.

Introduce the term "*adaptation*". Explain its relationship to the term "*characteristics*". Discuss the three categories of adaptations you will be covering in you unit: structural (internal and external structure), behavioural (what the animal does) and reproductive (what strategies it uses to reproduce).

Clarify the categories by explaining and giving examples of each.

With the students' help, construct a simple concept map that groups their suggestions of characteristics and how those characteristics aid in the animals survival into the three categories of adaptations.

The following are *Concept Map* examples – Have students add to the map during the course of their unit.



Ask students to suggest how the concepts from their map and swimming pool activity could become questions that will help guide their study during the unit eg. Which reef animals look after their young; do large eyes help reef animals see well; and does the movement of an animal have anything to do with its shape?

List the questions under the categories of adaptations and then decide upon ways students are going to find the answers. Encourage students to use the question grid below when formulating their questions.

What is?	Where/when is?	Which is?	Who is?	Why is?	How is?
What did?	Where/when did?	Which did?	Who did?	Why did?	How did?
What can?	Where/when can?	Which can?	Who can?	Why can?	How can?
What would?	Where/when could?	Which could?	Who would?	Why would?	How would?
What will?	Where/when will?	Which will?	Who will?	Why will?	How will?
What might?	Where/when might?	Which might?	Who might?	Why might?	How might?

Reproductive Adaptations

Introduce the term 'reproduce' and its derivatives, 'reproduction' and 'reproductive'.

Ask students how it could be used in a classroom or office situation (eg. reproducing a page on the photocopier) and how could it be used in nature?

Terms that could be introduced include egg, sperm and fertilisation. Watch the video *Sex on the Reef* or *Ocean Empires* (available from the Great Barrier Reef Marine Park Authority's library).

Introduce the term 'dispersal'. Ask the students to think of ways they could describe spawning on the reef. Introduce or revise similes and metaphors. Have students describe coral spawning as a simile or metaphor. Students could then write a poem using similes and metaphors about the natural phenomenon of coral spawning.

Asexual Reproduction

Many corals are able to reproduce without spawning. They are able to clone themselves by replicating, over and over again. Many plants can also reproduce asexually. Set up a planting station to highlight forms of plant asexual reproduction including bulbs (onions), tubers (potatoes) and cuttings.

Schooling

"It's estimated that as many as 80% of all fish species school during their life cycle"
(Pepperell, J. 2001)

The main advantage of schooling is predator avoidance. Disadvantages of schooling include the fish being more visible from a distance and being prone to location by fisher people and predators.

Talk to the students about schooling behaviour and what it means. Brainstorm advantages and disadvantages of schooling behaviour.

Have students design and colour a fish tessellation to represent fish schooling. The fish should cover an A4 or A3 page evenly.

Active Research

Give students a set period of time to locate as many structural, behavioural and reproductive adaptations of Great Barrier Reef creatures as possible from books, the Internet and other information sources.

Students can illustrate structural adaptations on a large sheet of paper with a small accompanying explanation next to each. Reproductive adaptations could be typed into a document on the computer and behavioural adaptations could be acted to the class during a pre-determined time.

Finding Out

Visit Reef HQ and explore the reef up close. Encourage students to develop a list of questions they want answered about the Great Barrier Reef.

GBR Explorer

Use the Great Barrier Reef Marine Park Authority's reef education website

www.reefed.edu.au

The "GBR Explorer" is like an online encyclopaedia about the Great Barrier Reef.



Sorting Out

Coral – tree comparison

The landscape of a coral reef often reminds people of beautiful gardens. The main scenic features in an underwater coral 'garden' are the corals, in terrestrial gardens it is often the trees and shrubs which are the outstanding features. Have the students discuss the similarities between corals and trees, and then fill out a coral colony/tree comparison table.

Characteristics	Coral	Tree
Animal / Plant		
Fixed / Mobile		
Single organism / Collection of many organisms		
Material in which it lives: air and soil/water		
Has a rigid skeleton of.		
Animals that live in its branches include.		
Animals that eat it.		
How does it reproduce? Sexual or Asexual reproduction or both.		

Ask students to draw a picture of a coral colony. The colony should take a form that allows it to receive a lot of light. Ask them to repeat the exercise, this time drawing a tree. Compare them.

Although the polyps of reef-building corals are animals, they harbour within their tissues many minute single-celled green plants called zooxanthellae. These algae carry out photosynthesis. Both parties benefit from this relationship.

Ask students to draw a picture of a coral colony, which may be affected by water movement. Ask them to repeat the activity, this time drawing a tree, which is affected by air movement. Compare them.

Going Further

Structural Adaptations - Anatomy

In groups, have students research the specific external features (anatomy) of a Great Barrier Reef animal. Students could then produce a diagram, clay plate with scratched skeleton, copper impression, rubbing or giant pasta skeleton to show the internal structure of their animal. Each group should present their findings to the rest of the class. They should explain specific animal structures followed by their role.

Behavioural Adaptations – Cartoon Strip

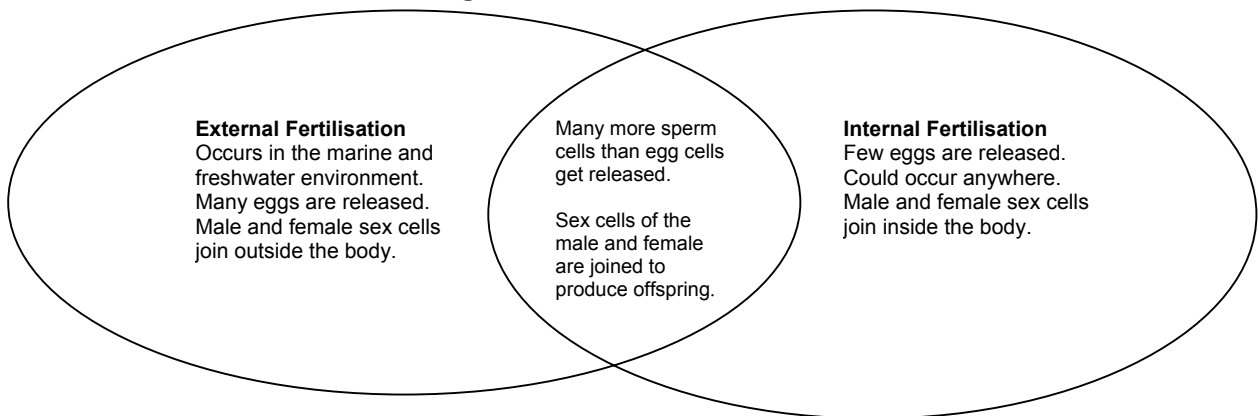
Ask students to bring in any cartoon strips and books they may have at home. Discuss the features. Ask students reflect on some of the behaviours of the reef creatures they have seen or know about. Encourage students to develop a cartoon strip outlining the behaviour/s of a reef species.

Making Connections

Reproductive Adaptations - Venn Diagram

Discuss internal and external reproduction.

Ask students to create a Venn diagram to outline differences and similarities.



Web Quests

Web Quests are inquiry oriented activities in which some or all of the information that learners interact with comes from resources on the Internet.

Challenge students to participate in and complete the *Discover me in the Sea* web quest. This web quest and others can be found at:

http://www.reefed.edu.au/students/reef_quest/index.html

Note: In situations where Internet Technology is not readily available to all students. The Web Quests could be accessed by teachers, printed out and used as action research projects in the classroom. Specific resources can be obtained by contacting the Great Barrier Reef Marine Park Authority.

Taking Actions

Reflecting

Ask the students about some of the things they have learnt during the unit. Ask them about some of the questions to which they still do not have answers

Students should now determine ways they can answer these questions, by designing an experiment. The experiment won't necessarily be conducted (could be if resources available); the point is rather to have the students thinking about ways their answers could be revealed.

Ask students to:

- Formulate or use a previous question about a reef inhabitant;
- Formulate a hypothesis;
- Write down some things they may need to know before they conduct the experiment;
- List materials needed;
- Time to be taken;
- People they need to help them;
- Procedure; and
- Conclusion.

Become a Reef Guardian School

This is an exciting, innovative program that encourages students, teachers, parents and friends to become involved in protecting our environment and the Great Barrier Reef. Reef Guardian Schools are environmentally active and participate in reef education through activities and environmentally friendly initiatives. Students and teachers promote best environmental practices and the importance of Reef protection to their communities. To find out more go to:

<http://www.reefed.edu.au/guardians/>

Websites

Queensland Studies Authority – Science Syllabus

<http://www.qsa.qld.edu.au/yrs1to10/kla/science/docs/syllabus/syllabus.pdf>

Reef ED

www.reefed.edu.au

Great Barrier Reef Marine Park Authority

<http://www.gbrmpa.gov.au>

Reef HQ

<http://www.reefHQ.com.au>

Australian Institute of Marine Science

<http://www.aims.gov.au/>

CRC Reef

<http://www.reef.crc.org.au/>

Department of Environment and Heritage

<http://www.deh.gov.au/>

Department of Primary Industries

<http://www.dpi.qld.gov.au/home/default.html>

National Geographic - Virtual World "Great Barrier Reef"

http://www.nationalgeographic.com/earthpulse/reef/reef1_flash.html

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