



CORALS
AT YOUR DOORSTEP



Coral Coast

Bundaberg - Queensland - Australia



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

**Year 7 Science
Lessons & resources**



CORALWATCH

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CoralWatch - 'Corals at Your Doorstep' education materials are supported by:



Great Barrier
Reef Foundation



Coral Coast - Corals at Your Doorstep

The Coral Coast is the gateway to the Southern Great Barrier Reef and is located along the coastline of Bundaberg in Queensland, Australia. With volcanic rock formations, beautiful beaches, national parks, coral reefs and a rich history it is an international tourist destination. This region is famous for its marine turtle nesting and inter-nesting habitats, shorebird feeding and nesting habitats, and important fish habitat values.

The Coral Coast has rocky reefs, tide pools, coral reefs, mangrove forests, saltmarshes, seagrass beds, tidal flats and diverse fish and other marine populations. There is an abundance of coral growing in various habitats along the coast, some of which are easily accessible from the shore. The Coral Coast also offers easy access to the southern-most coral cays of the Great Barrier Reef, Lady Musgrave Island by boat and Lady Elliot Island by plane.

A coral's health is extremely susceptible to changes in the environment. This makes coral an important species to monitor and use to indicate a decline in environmental conditions. The Coral Coast is a precious environment which needs to be protected from environmental damage caused by anthropogenic pressures - created by humans and their activities.



Marine turtle nesting.

Rebecca Coulombe



Anemone and anemonefish.

Natalie Lobartolo



Coastal tidal pool.

Natalie Lobartolo



Barolin Rock's corals.

CoralWatch education

The lessons and resources of this 'Corals at Your Doorstep' booklet are developed for high schools in the Coral Coast area and is part of the CoralWatch 'Coral Coast Education Package'. The lessons and activities in the booklet are aimed at Year 7 Science and are linked to the Australian Curriculum v8.3.

CoralWatch also produced **'Marine Ecosystems'** for year 7 with many more classroom worksheets focussing on Classification, Food Web, Rhythm and Flow, and the Water Cycle. If you would like more background to the worksheets or need additional resources please contact CoralWatch for a free digital copy of this document.

CoralWatch is a not-for-profit organisation based at The University of Queensland. CoralWatch uses the Coral Health Chart to promote active learning opportunities for citizen scientists of all ages. The content of this booklet extends beyond monitoring, and provides worksheets to bring reef science into the classroom. Most lessons relate to chapters in the education guide and DVD series, **'Coral Reefs and Climate Change – The Guide for Education and Awareness'** published by CoralWatch. The Virtual Reef tools, provide a real opportunity to learn about coral bleaching and reef monitoring in the classroom. They can be used to assist student preparations for a field trip, or can provide a valuable alternative to a field trip. However, we encourage you to take students in the field since this is the most valuable and intense experience learning about our beautiful coral reefs. All CoralWatch materials can be ordered from CoralWatch (www.coralwatch.org).



'Corals at Your Doorstep' Coral Coast QLD Australia Year 7 Science, lessons and resources.

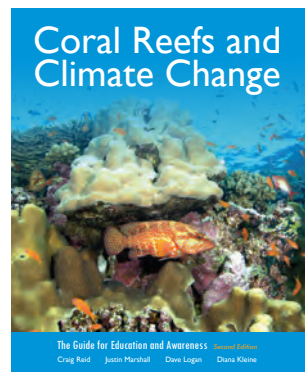


'Marine Ecosystems' Year 7 Science, lessons and resources.



'Coral Coast education package' Includes: Coral Coast curriculum linked year 7 Science lessons and resources, coral ID sheet, info leaflet, Coral Health Chart with slate and DIY monitoring instructions.

The production of these materials has been provided by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.



'Coral Reefs and Climate Change' book.

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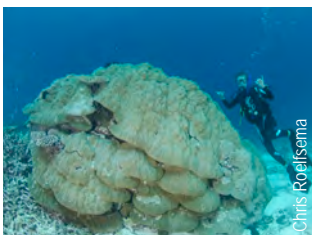
CORALWATCH MONITORING

CoralWatch uses the Coral Health Chart as a cheap, simple, non-invasive method for the monitoring of coral bleaching and the assessment of coral health. In the field, users simply compare colours of corals with colours on the chart and record matching codes. In addition, we ask you to record coral type.



The Coral Health Chart uses four coral types to classify corals. **Boulder** refers to any massive or rounded coral such as some *Platygyra* and *Porites* species. **Branching** refers to any branching coral such as *Acropora* and *Pocillopora* species. **Plate** refers to any coral that forms a plate-like formation such as tabular *Acropora* species, and the **Soft** category refers to corals lacking a hard skeleton, such as *Xenia* species.

Corals can exist in many shapes, and some corals may not clearly match any of these categories. Our aim is to keep the chart and survey as simple as possible, so if you're experiencing difficulties when classifying your corals, please simply choose the closest coral type.



Boulder (BO)

Any massive or rounded coral, such as some *Porites* species.



Branching (BR)

Any branching coral, such as some *Acropora* species.



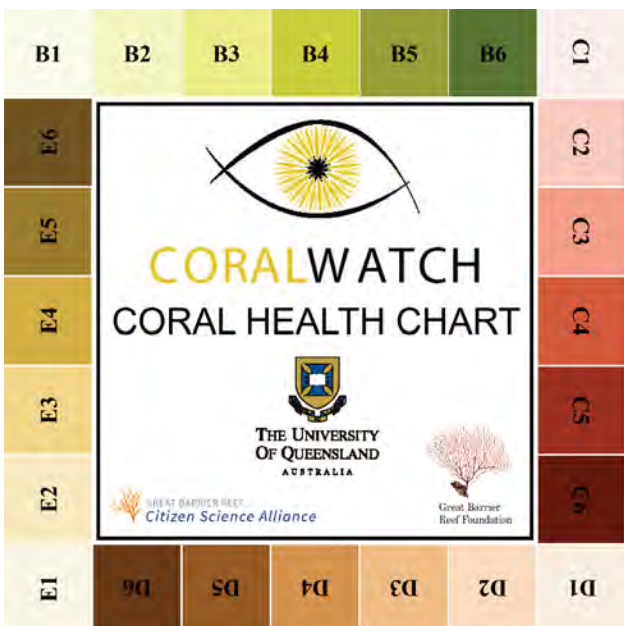
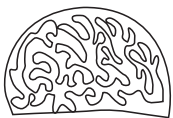
Plate (PL)

Any plate-like shape coral, such as tabular *Acropora* species.



Soft (SO)

Any corals lacking a hard skeleton, such as *Sarcophyton* species.



How to Use the Coral Health Chart

1. Choose a random coral and select the lightest area.
2. Rotate the chart to find the closest colour match.
3. Record the colour code on a data slate.
4. Select the darkest area of the coral and record the matching colour code.
5. Record the coral type.
6. Continue your survey with other corals. Record at least 20 corals.
7. Submit your data using the CoralWatch Data Entry Apps or enter online at www.coralwatch.org.

Survey Methods include (depending on experience and location):

- **Random Survey** – Select corals randomly, such as the closest coral after every second fin kick.
- **Transect Survey** – Select corals by following a line (transect) and record every few meters.
- **Easily Identified Corals** – Select corals you can recognise and return to (permanent transect).

Tips

- Corals are fragile animals, make sure your survey has no affect on marine life.
- Due to colour loss at depth, use a torch when diving below 5 metres/15 feet.
- Avoid measuring growing tips of branching and plate corals since they are naturally white.
- Do not monitor blue or purple corals because they have a different bleaching response.
- Some corals are naturally lighter than others. Regular surveys are needed to look at coral health over time or pick up trends of bleaching and recovery.

Coral Types



Boulder (BO)



Branching (BR)



Plate (PL)



Soft (SO)

Instructions on how to use the Coral Health Chart can be found on the back of the chart.

CoralWatch in the classroom

Learning objectives

At the end of this session, students will be able to:

- Describe simple biology of corals.
- Identify different growth forms of corals.
- Understand how to use the Coral Health Chart.
- Describe the different coral types.
- Enter virtual data in Excel and analyse the results.

Key learning points

- Corals are animals, related to jellyfish.
- Corals build calcium carbonate skeletons that create reef structures.
- Corals need energy to build reefs. Corals obtain most of their energy via small symbiotic algae (zooxanthellae) that live inside the coral tissue. These algae generate energy via photosynthesis.
- Because corals require sunlight for energy, they are mainly found in shallow tropical and subtropical waters.
- Most corals live within a narrow temperature range. Some corals have adapted to different temperatures. Corals in the Kimberley (northwestern Australia) have adapted to higher temperatures, whereas Coral Coast corals (Queensland) have adapted to lower temperatures.
- The Coral Health Chart is a simple, non-invasive tool that can be used for reef walking, snorkelling or diving.
- The colour chart standardises changes in coral colour, providing a simple way to quantify bleaching and monitor coral health.
- The colour charts are based on the actual colours of bleached and healthy corals. Each colour square corresponds to a concentration of symbionts contained in the coral tissue. This is directly linked to the health of the coral.
- The Coral Health Chart can be used in different survey methods, including random and transect surveys, and monitoring easy to identify corals.

Background

Corals – From polyp to reef

Corals are living animals and are part of the same invertebrate phylum as jellyfish, known as Cnidaria. Reef-building corals are part of the class Anthozoa, and order Scleractinia.

A single animal is called a coral polyp. Polyps can range in size from less than 1mm to more than 15cm. Most corals form colonies, where thousands of polyps share the same physical skeleton. Some corals are solitary and live as a single polyp. Corals absorb calcium and carbonate molecules from the seawater to construct a skeleton. Tiny algae, called zooxanthellae (or symbiotic algae), live within the coral tissue. Zooxanthellae provide the coral with colour and the energy they need to grow and receive a safe home in return.

Using the sun for energy

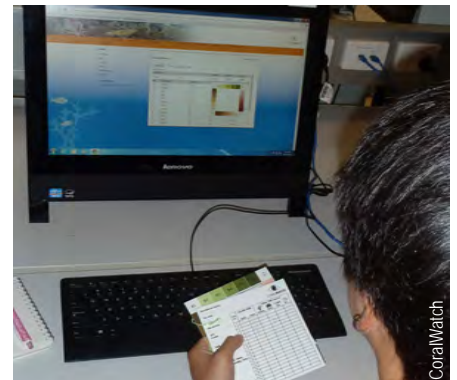
Zooxanthellae are located within the inner cells of the coral tissue. Zooxanthellae are plants and photosynthesise, i.e. they use energy from sunlight to convert the coral's waste products into energy that the coral needs to grow. This is why healthy corals need sunlight and clean water. Most reef-building corals grow most effectively when the ocean temperature is between 18°C and 29°C.



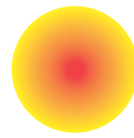
Soft coral.



Practice monitoring using the virtual reef.

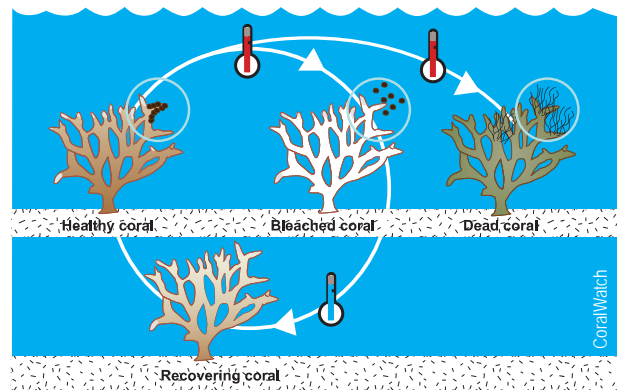


Entering CoralWatch data in the global database.



Coral bleaching

In a symbiotic relationship, the organisms live together with one another to the benefit of both. This relationship has happened over such a long period that many corals now cannot survive for very long without their algal partners. When coral becomes stressed from high sediment loads or high water temperatures, it can kick out the algae living inside. This process is known as coral bleaching. Bleaching is the term used because the algae are often what give the coral their brown or green appearance and when gone the white skeleton is visible underneath. If the corals cannot recover and get the algae back into their cells in time, they can die.



Coral bleaching cycle.

Coral growth forms

There are more than 800 known species of hard corals. The skeleton of each species is unique. Corals come in many different shapes and sizes - these are called coral growth forms. Branching corals are fast-growing and provide a home for many different types of reef fish. Large boulder corals grow more slowly and some may be more than 100 years old.



Partly bleached reef.

What is CoralWatch?

CoralWatch is a not-for-profit organisation, based at The University of Queensland in Brisbane, Australia. CoralWatch integrates global volunteer monitoring of coral bleaching with education about coral reef conservation. In 2002, CoralWatch developed and validated the Coral Health Chart (Siebeck et al. 2006, Monitoring coral bleaching using a colour reference card. Coral Reefs 25:453-460). The chart standardises changes in coral colour, providing a simple way to quantify bleaching and monitor coral health. The Coral Health Chart is used by dive centres, scientists, school and conservation groups, management and tourists. Anyone can contribute to our global database! Collecting data is easy - you just compare colours of corals with colours on the chart and record matching codes. You don't need to wait until coral bleaching occurs - monitoring healthy reefs is also important. You can monitor any reef, any time, while diving, snorkelling or reef walking. Get involved in CoralWatch to monitor and protect reefs around the world.

CoralWatch promotes healthy reefs by

- Raising public awareness about importance of reefs, conservation, sustainability, and climate change.
- Developing and distributing education materials for diverse audiences.
- Engaging the global community in monitoring coral health and coral bleaching.

Why we need your help?

Very little is known about coral bleaching trends on a global scale. Monitoring is most effective when conducted regularly. But, there are not enough scientists to monitor all the world's reefs. This is where you can help! If many people around the world, like you, contribute to our global database, we will be able to answer questions about patterns of coral bleaching, severity of coral bleaching, and trends in recovery. All data is publicly available and forms a great resource for student projects.

Find out more visit **WWW.CORALWATCH.ORG**

Identifying coral types

Instructions

Corals around the Coral Coast can appear in different shapes. For each coral pictured, identify the coral type and write this underneath.



Boulder



Branching



Plate



Soft



Natalie Lobartolo



Natalie Lobartolo



Natalie Lobartolo



Natalie Lobartolo



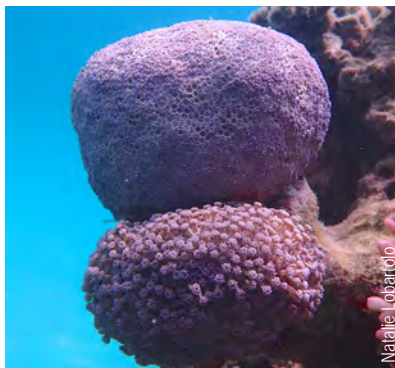
Natalie Lobartolo



Natalie Lobartolo



Natalie Lobartolo



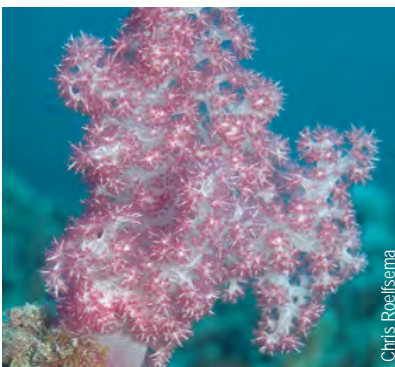
Natalie Lobartolo



Natalie Lobartolo



Chris Roelisema



Chris Roelisema



Natalie Lobartolo

Coral Coast corals

The diverse fringing reefs close to the Coral Coast differ from the offshore reefs of Lady Musgrave Island and Lady Elliot Island in that they are dominated by soft coral species. Environmental conditions vary greatly between these reefs and each reef hosts a coral community that is specialised for its conditions. The reefs and coral communities of the Coral Coast are of high ecological, economic and recreational importance and require our care.

In coastal areas water has lots of nutrient and sediment runoff. The main cause of high nutrient and sediment levels is from soil erosion from creeks and rivers, farming land and construction sites via our catchment and river systems. Too much sediment in the water column can limit sunlight that corals and their zooxanthellae need for energy. Sediment settling on corals can have an adverse effect as it can clog feeding structures and smother them which often leads to starvation and death. Some corals can trap sediment in its mucous and use ciliary action to carry it off. Hard corals are more vulnerable as heavy sedimentation can overpower their mucous-ciliary action. Because of this, only some species of coral can live in these inshore areas that are more prone to sedimentation. Corals that can tolerate murky water tend to be small, round corals. As you travel away from the mainland, you can see changes in water quality, coral diversity and coral growth forms.



Monitoring coral health

Scientists monitor the health of corals to determine the health of the marine environment they are in. The health of a coral is determined by the number of symbiotic algae inside the coral cells. The zooxanthellae give the coral its brown/green colour. When corals are stressed they have less zooxanthellae and become pale or even white in colour, this is called coral bleaching. You can measure the level of coral bleaching by using the CoralWatch Coral Health Chart to identify its colour.

Saving our corals

For the latest Reef Water Quality Report Card for sediment in the Burnett Mary region, go to:
<https://reportcard.reefplan.qld.gov.au>

One way to reduce stress to corals is to reduce the amount of sediment in the water. To see what the Burnett Mary Regional Group is doing to improve coastal and reef water quality, go to:

<https://bmrq.org.au/portfolio-items/burnett-mary-streambank-and-wetland-recovery-for-reef-water-quality/>
https://bmrq.org.au/portfolio_tags/reef/

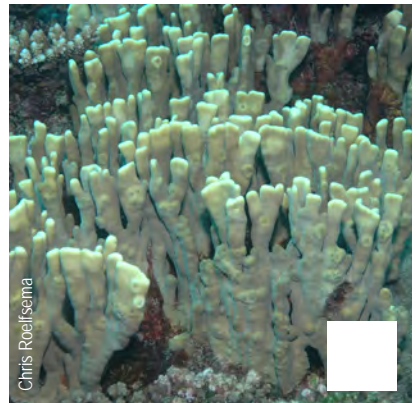
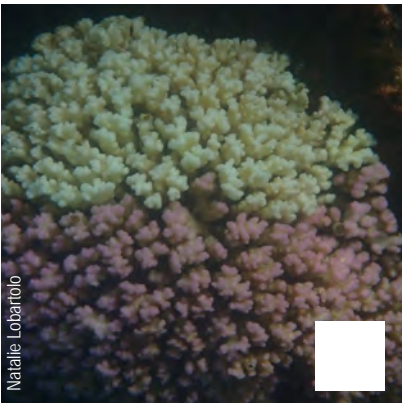
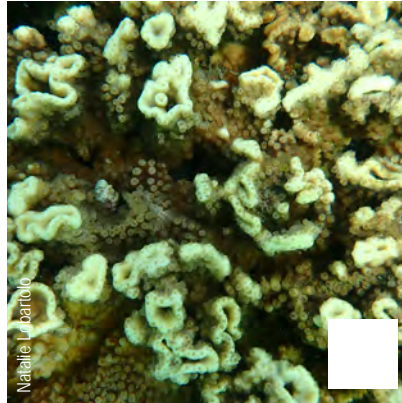
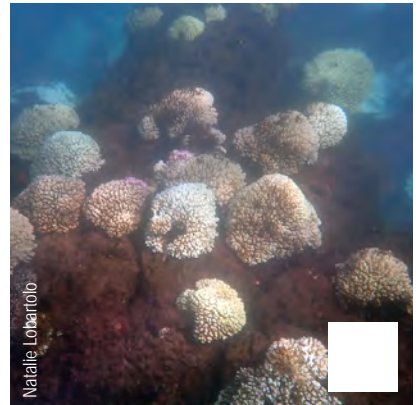
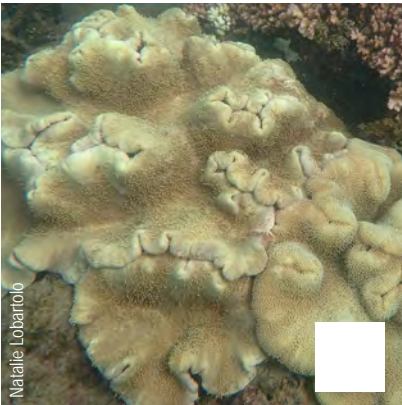
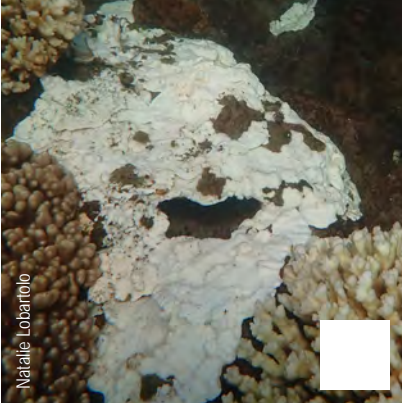
Questions

1. Draw and label features of the coral including the following labels: mouth, tentacles & zooxanthellae.
2. Why are corals important?
3. What is a symbiotic relationship? Explain the relationship associated with corals.
4. What is coral bleaching?
5. How can scientists measure coral health?

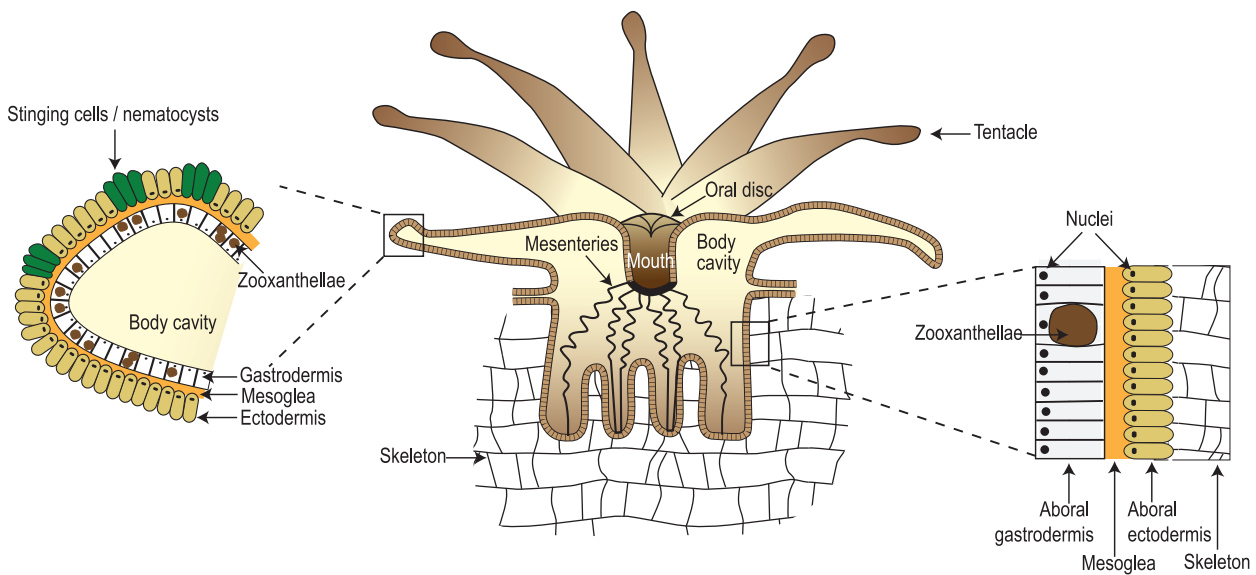
Coral bleaching - sign of stress

Instructions

For each picture, decide if the coral is healthy or bleached. Tick the boxes if the coral is bleached or unhealthy.



Corals - consumer or producer?



CoralWatch

Corals build hard structures that can be seen from the air and even from space. Corals are animals. They build reefs by secreting a skeleton which the animal uses to hold itself in place. When viewed close up, **tentacles** and a **mouth** are visible. Corals use these structures at night to capture **plankton** and feed. However, during the day something very different occurs. Corals often have a relationship with a special type of algae called **zooxanthellae** (pronounced 'zoo-zan-thel-ay'). The algae actually live inside cells in the inner cell layer of the coral. When exposed to sunlight, just like other algae, the zooxanthellae are able to produce their own food through photosynthesis. In fact, they are so good at producing their food that they have enough left over for the coral to share. In turn, the coral shares nutrients with the algae and provides a safe home. This type of relationship is called a **symbiosis**. In a symbiotic relationship, the organisms live together with one another to the benefit of both. This relationship has happened over such a long period that many corals now cannot survive very long without their algal partners. When coral becomes stressed, it can kick out the algae living inside. This process is known as **coral bleaching**. Bleaching is the term used, because the algae are often what give the coral their brown or green appearance and when gone the white skeleton is visible underneath. If corals cannot recover and get the algae back into their cells in time, they can die.



Chris Roelfsema

Corals - consumer or producer?

Some fish eat the coral polyps such as angelfish, butterflyfish and blennies. Other fish eat plankton such as damselfish and fusiliers. Sharks eat fish.

Instructions

1. Identify the primary producer in the coral-algae relationship.
2. Draw a food web on the worksheet with coral, plankton, zooxanthellae, coral-eating fish, plankton-eating fish and sharks.

Do other marine invertebrates bleach?

Symbiotic zooxanthellae live in the tissues of corals, as well as in other marine invertebrates such as sea anemones, giant clams and some tropical jellyfish. Corals, sea anemones, giant clams and upside-down jellyfish have a symbiotic relationship with zooxanthellae in which they both benefit.

Coral polyps, sea anemones and jellyfish are all cnidarians which have a radial symmetry and mouths surrounded by tentacles with nematocysts (stinging cells). There are two cnidarian body forms: medusae which have an umbrella shape, e.g. marine jellies; and polyps which have a cylindrical body with tentacles on one end, e.g. coral polyps and sea anemones.

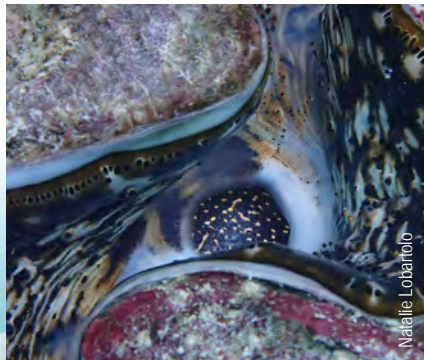
Tropical jellyfish with zooxanthellae need to find ways to provide light for photosynthesis by their zooxanthellae. The upside-down jellyfish rests upside-down on the bottom of shallow waters to allow light into the tissue of the arms where the zooxanthellae live. Upside-down jellyfish are still capable of swimming. Coral polyps are a bit like an upside-down jellyfish and sit in a limestone cup (corallite) in the coral skeleton and sea anemones are the similar but attached to the substrate.



Healthy giant clam.

Giant clams are a bivalve mollusc, meaning they have hinged double shells and a skin-like mantle (tissue at the opening). Like coral polyps, sea anemones and the upside-down jellyfish, giant clams are also “upside-down”. Other bivalves usually rest against or are embedded in the substrate with their foot, whereas giant clams lie on the bottom or bore into hard reef substrate with the mantle facing up. This allows for light into the tissue of the mantle where the zooxanthellae live.

Sea anemones, upside-down jellyfish and giant clams also experience bleaching due to zooxanthellae loss from stress, like elevated sea temperatures from climate change.



Close-up bleached giant clam.



Bleached coral polyps.



Upside down jellyfish, *Cassiopeia*.



Bleached anemone.

Do other marine invertebrates bleach?

Instructions

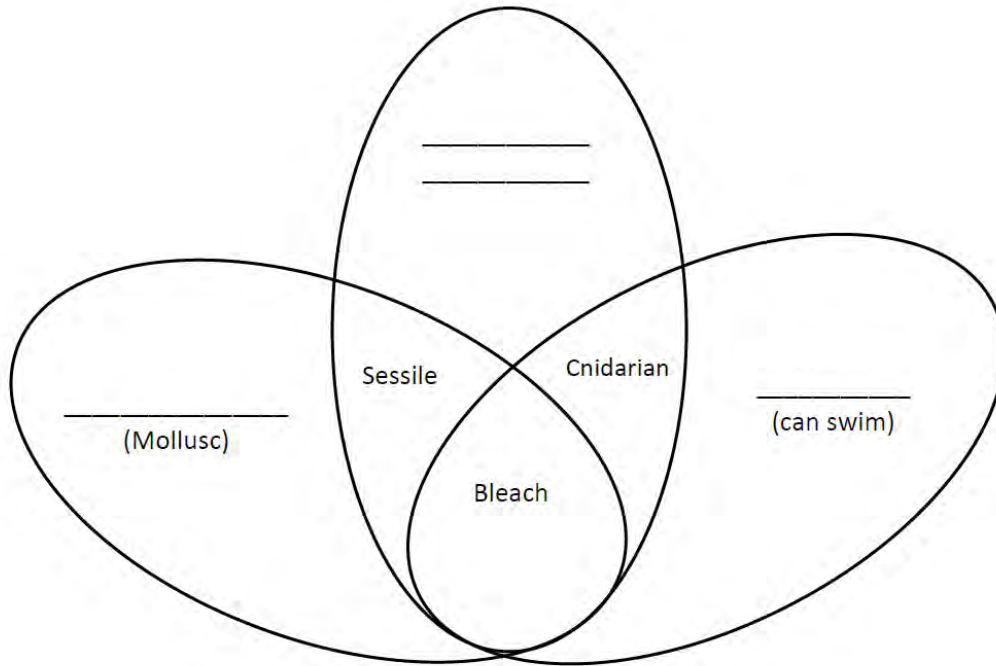
- The following Venn diagram shows similarities and differences between marine invertebrates with symbiotic zooxanthellae. Place the following labels into the diagram:

CORAL POLYPS

SEA ANEMONES

UPSIDE-DOWN JELLYFISH

GIANT CLAMS



- Fill out the following diagram

Do other marine invertebrates bleach?

- Tick each characteristic for each species (there will be more than one for each).
- Discuss these similarities and difference.

| | Phylum Cnidaria | Phylum Mollusca | Polyp | Medusa | Upside-down | Sessile | Can swim | Bleaching |
|-----------------------|-----------------|-----------------|-------|--------|-------------|---------|----------|-----------|
| Coral polyp | | | | | | | | |
| Sea anemone | | | | | | | | |
| Upside-down jellyfish | | | | | | | | |
| Giant clam | | | | | | | | |

Measuring coral health using the virtual reef poster

CORALWATCH Virtual Reef

This virtual reef shows you different coral types and the difference between bleached and healthy corals. You can use the Coral Health Chart to measure the health of these corals.

CORAL HEALTH CHART
The Coral Health Chart is based on the actual colours of bleached and healthy corals. Each square on the Chart corresponds to the concentrations of symbiotic algae which live in the coral tissue.

INSTRUCTIONS
For each coral, use the Coral Health Chart to record:
• darkest and lightest colour scores
• coral type

WWW.CORALWATCH.ORG
Visit our website to see worldwide data for reefs and compare coral health scores between reefs and over time.

CORAL TYPE (please tick)
Boulder (BO) Branching (BR) Plate (PL) Soft (SO)

TIP
Avoid touching or grabbing coral because they are naturally white.

CORALWATCH
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The University of Queensland
This poster is part of the
CoralWatch Reef Education Package
to order contact CoralWatch: info@coralwatch.org
Prof Evans, Julia Marshall, Craig Wood
Derek Stammers & Corinne Lewis

Instructions

- Following the instructions on the back of the Coral Health Chart, match the coral colours on the virtual reef poster with the colour scores on the chart.
- Record your colour scores and coral types on a data sheet.

Additional resources

CoralWatch virtual reef instructional video, paper data sheets and excell data entry sheets can be found on our website in the education section (home education/coral colour and types).



Your name:

Reef name:

Country:

| Coral NO. | COLOUR CODE | | CORAL TYPE (please tick) | | | |
|-----------|-------------|---------|--------------------------|-----------|-------|------|
| | Lightest | Darkest | Boulder | Branching | Plate | Soft |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
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| 19 | | | | | | |
| 20 | | | | | | |

GPS coordinates (if available):

Date:

Time:

Depth:
m / feet

Sea temp:
°C / °F

Sunny / cloudy / raining
Walking / snorkelling / diving
(please circle)

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transfer your findings using
CoralWatch Data Entry Apps
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Coral colour and types

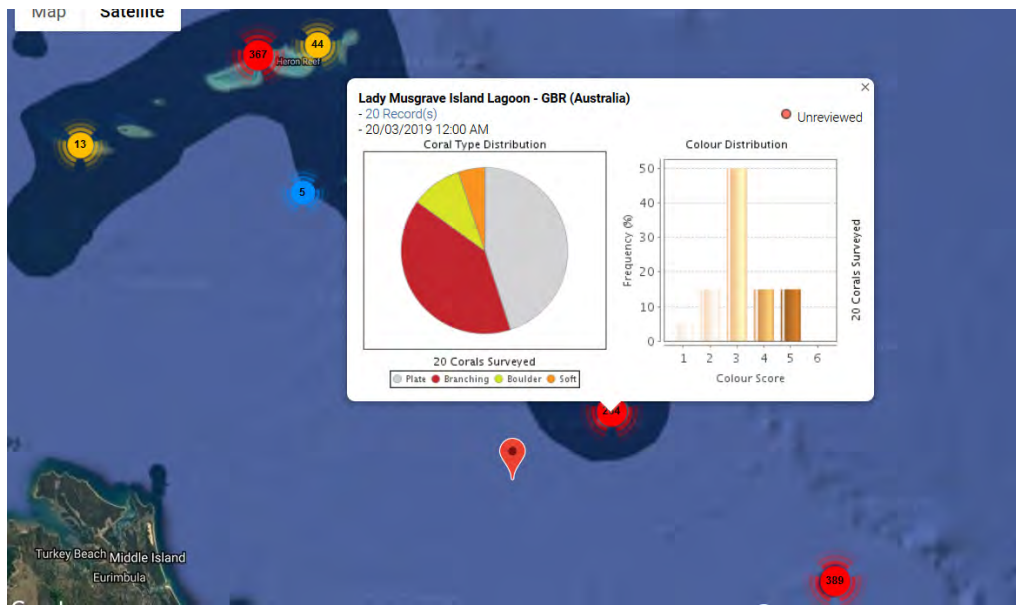
Watch Youtube instructional video
Use the virtual reef to practice reef monitoring in the classroom or in preparation of your fieldtrip. Learn about coral bleaching, coral types and data collection using the Coral Health Chart.

Print your own resources:
- Coral Health Charts (only for this exercise)
- Data slates
- Coral photos
- Excell data entry sheet for virtual reef exercise
- Virtual reef poster
Printed copies (72 x 36 cm) are available for purchase.

ALWAYS use the original Coral Health Chart available from CoralWatch for monitoring corals in the field.



Interpreting real data from the Coral Coast

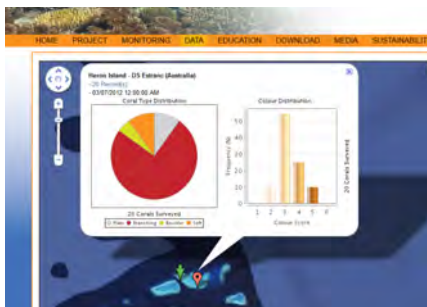


Inshore and offshore reef sites at the Coral Coast. Data shows average colour score and coral type distribution for a selected reef, in this case Lady Musgrave Island Lagoon.

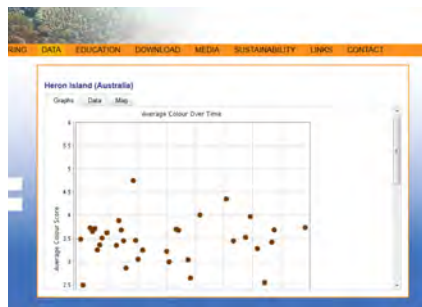
Instructions

In this activity you will analyse and compare data results from the CoralWatch website.

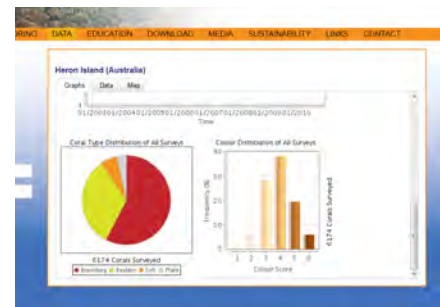
- Go to **www.coralwatch.org** and find 'map' under the 'data' tab showing field data. Find the Coral Coast. Visit a site inshore the Coral Coast or one of the offshore islands and choose one survey.
 - What is the name of your reef?
 - Which coral type was most abundant?
 - Which coral type was the least abundant?
 - Which colour score had the highest frequency?
 - Who collected this data? Circle the answer.
 dive centre / scientist / conservation group / school or university / tourist / other
- Compare all surveys conducted on this reef by various people. Go to 'reefs' under the 'data' tab and search for the reef name of your previous reef. Select 'graphs'.
 - What is the average colour over time?
 - Which coral type was the most abundant at this reef?
 - Which colour score has the highest frequency?
 - How many corals have been surveyed in total?
 - When was the last survey?



Data results single survey.

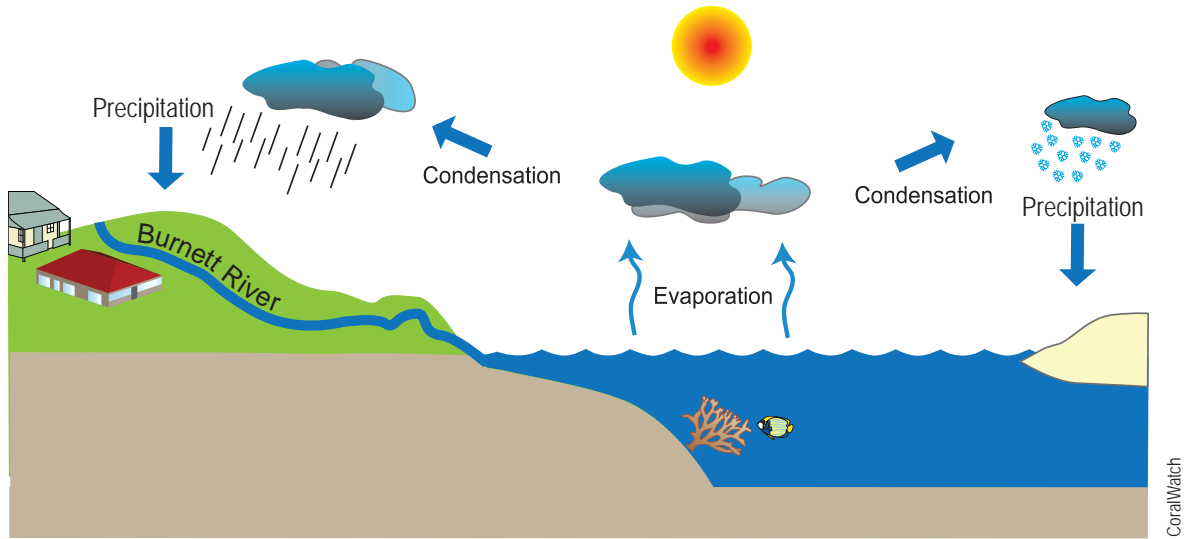


Average colour score over time comparing all surveys for one reef.



Average colour and coral type distribution comparing all surveys for one reef.

The water cycle of the Coral Coast



The water cycle of the Coral Coast begins with liquid water molecules on the surface of the land, rivers and coastal waters in the Burnett Basin heating up from the sun and evaporating into the air as a gas called water vapour. Here they rise up and enter the cool air high in the atmosphere. Once cool, the gaseous water molecules condense to form small liquid water droplets creating clouds. When the water droplets in clouds get too heavy, they fall to the ground as precipitation (rain). Often the precipitation will be deposited on land hundreds of kilometres away. When precipitation occurs in the Burnett Basin, some liquid water is absorbed into the ground and excess surface water drains into local creeks. Water in hundreds of small creeks travel long distances and drain into the Burnett and Elliott Rivers or straight into coastal waters. The 'catchment area' of the Burnett Basin is the land area where excess water drains into the rivers and includes 33,195.4 km² stretching from northwest near Cania Gorge to southwest near Nanango. The Burnett and Elliott Rivers and coastal creeks drain their collection of fresh water into the salty waters of the Coral Coast. Water that has fallen on the land hundreds of kilometres away will travel via creeks and the Burnett and Elliott Rivers and eventually into the waters off the Coral Coast. This completes the cycle of the Coral Coast water cycle.

Questions

1. Look in a dictionary and write the definition for the words in bold.

| | | | |
|-----------------------|----------------------|----------------------|--------------------|
| Liquid | Precipitation | Condense | Evaporating |
| Catchment area | Water cycle | Burnett River | |

2. Complete the table below listing water cycle stages. Fill in the physical states of water molecules and the location it can be found.

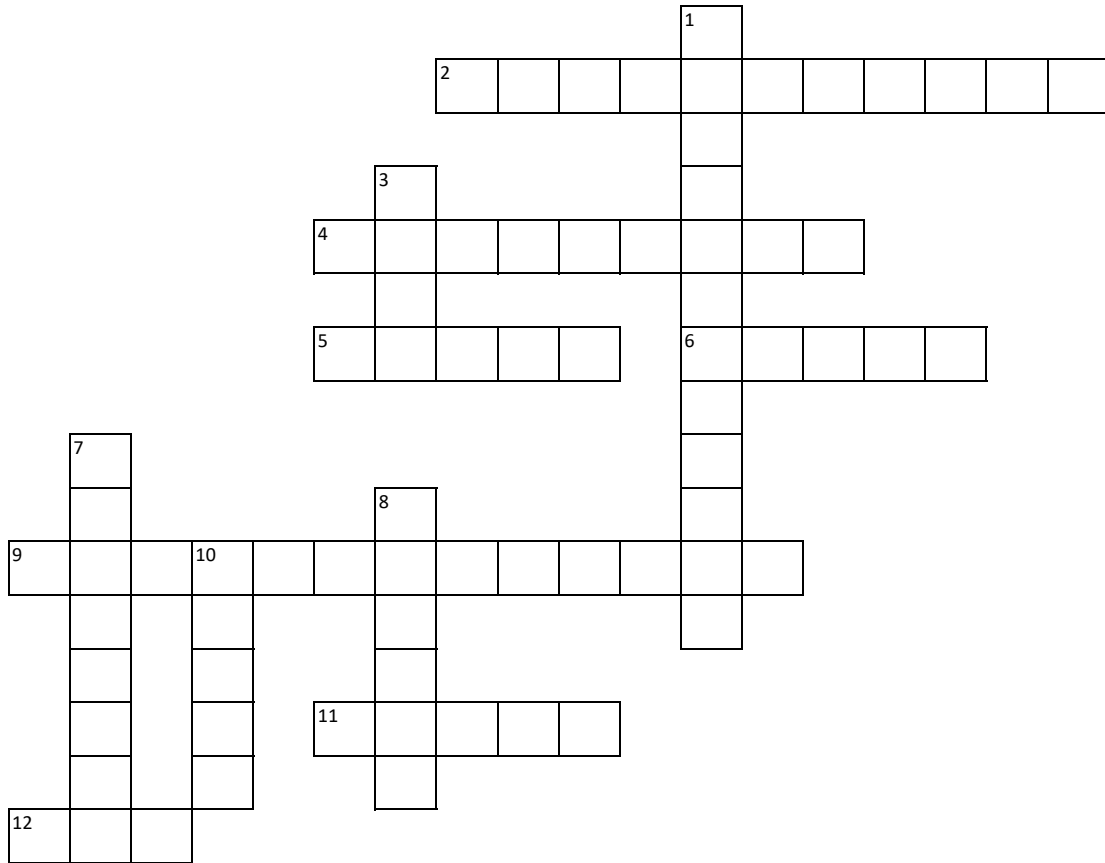
| | | | | | | | |
|---------------------------|-----------|--------------|--|------|-------------|-------|-----------|
| Water cycle stages | Sea water | Water vapour | | Rain | Flood water | | Sea water |
| Location | Ocean | | | | | River | |

Water cycle crossword

Name: _____

The Water Cycle Crossword

Complete the crossword below



Across

- 2. When water molecules in a liquid changes to a gas.
- 4. The land area where excess water drains into creeks
- 5. When rivers and creeks are unable to carry all the excess water this causes?
- 6. The physical state of water when it gets very cold.
- 9. When water vapour in the sky forms water droplets and falls to the ground.
- 11. Large drainage channel where all water in a catchment eventually goes through before entering the ocean.
- 12. The physical state of water when it moves into the atmosphere

Down

- 1. The process which leads to clouds forming.
- 3. Sometimes thunderstorms lead to precipitation of water in a solid state.
- 7. Which sea does the Burnett Basin drain to?
- 8. The physical state of water in rivers, creeks and the ocean is?
- 10. Small channel where water drains and feeds into larger bodies of water.

Sediment runoff - water turbidity



Sediment coming out of the Burnett River

What is sediment?

Sediment is soil particles that are washed off the land into creeks and rivers. Sediment can be a range of different sizes including large sand particles and smaller fine mud or clay particles.

Sediment along the Coral Coast

High levels of sediment entering waterways are a major environmental concern. The main cause of high sediment levels in rivers is soil erosion from creeks and rivers, farming land and construction sites. The Coral Coast is vulnerable to high sediment loads entering it through the Burnett and Elliott Rivers. The high amount of soil particles suspended in the water causes the water to become cloudy which is called water turbidity. High water turbidity along the Coral Coast is harmful to its inhabitants by blocking sunlight and smothering seagrasses and corals that require light to grow, consequently reducing the amount of food available for turtles, dugongs and fish.

Think, Pair, Share Activity

Pair up with a friend and discuss the following.
Make sure you write down your ideas!

- Fast moving water carries sediment with it.
Imagine running the hose with the tap fully opened in a sand pit.
What happens to the sand? Where does it move to?
- What do you think happens when there is heavy precipitation and flooding in the Burnett River catchment? Where does the sediment end up?
How does this sediment affect the Coral Coast inhabitants?

Instructions turbidity activity

1. Label 3 identical bottles with lids with 'fine', 'medium' and 'course'.
2. Fill all bottles with equal amounts of water up to 3cm from the top.
3. Collect equal volumes of 3 types of sediment. Use course sand for course type sediment, fine sand for medium type sediment and super fine dust-like soil for fine type sediment (look for this in high traffic areas around your school). If you cannot find super fine sediment, use talcum powder.
4. Add a different sediment type to each of the 3 bottles corresponding to your sediment labels.
5. Shake vigorously for 30 seconds and place in a location where they will not be moved.
6. Observe the water turbidity and record the time it takes for the water to become clear.
7. Discuss your results.
 - a. Which sediment size settled to the bottom first? How long did it take?
 - b. Which sediment size settled to the bottom last? How long did it take?
 - c. What implications does sediment particle size have on Coral Coast inhabitants?
 - d. What inhabitants of the Coral Coast need light to survive? Why?
 - e. How are these inhabitants affected by high turbidity?

Sediment runoff - altered food webs

Whilst providing a variety of habitats and food sources, like seagrass meadows for turtles and dugongs, and mangroves for fish, the Coral Coast gains its name because it provides important habitat for corals all along the coast. Corals are important because they provide food and shelter for fish and other marine creatures. A coral's health is extremely susceptible to changes in the environment. This makes coral an important species to monitor and is used to indicate environmental conditions. The Coral Coast is part of a precious environment which needs to be protected from environmental damage caused by humans and their activities.

High sediment levels entering our waterways is a major environmental concern. Floods, river bank erosion and soil washed into rivers and creeks from farmland and construction sites are some of the many causes. Sediment suspended in the water causes high water turbidity reducing sunlight penetrating through the water column and smothering benthic organisms such as seagrass and corals. With this, other organisms down the food chain are affected. The loss of seagrass and corals results in less food available for many animals such as fish, turtles and dugongs. Additionally, the break down of the coral's structure affects small organisms such as crabs and snails that seek shelter in and between corals.

This exercise will examine the effects on a food web when the community structure and biodiversity in the ecosystem is altered.

Questions

1. Draw a food web including, coral, seagrass, turtles, dugongs, coral-eating fish, plankton, plankton-eating fish, and sharks. Sharks are predators of fish, turtles and dugongs.
2. Consider what would happen to the food web in the event of large amounts of rain pushing extra sediment into the Coral Coast inshore waters and how it may affect the system. Put a red cross through the organisms directly affected by the sediment in your food web.
3. Describe what effect this would have to all organisms in your food web. What about organisms at higher orders of consumption? Would anything happen to those organisms?
4. Draw a new food web for the ecosystem based on the alterations you have described for the first food web. How has the large amount of rain falling on the city effected biodiversity?
5. In groups of three consider some ways to help reduce the sediment running into the area. Describe what this may do in the short, medium and long term and report this back to the class.
6. Consider what your area may have looked like prior to European settlement.
7. How do corals and coral bleaching fit into your food web and discussions? Can you think of any events that may have caused coral bleaching and or smothering with sediment that may have been observed by Indigenous groups in the area at the time? Are these events still a possibility today?



CoralWatch

VENOMOUS MARINE ANIMALS – CORAL COAST / BUNDABERG

Tips for avoiding marine injuries

- Don't touch any marine organisms and avoid picking up shells
- When in the water, always be aware of your surroundings
- Shuffle your feet when walking into the water in sandy areas

Before you go out into the field, always take a first aid kit, a manual for marine stings and make sure you have access to up-to-date first aid advice. When in doubt, seek medical care.



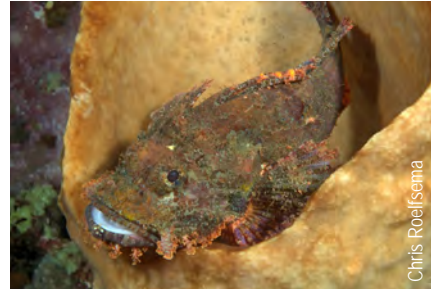
Chris Roelfsema

Stingrays - When stepped upon, spine can cause immediate pain.



Chris Roelfsema

Stonefish - Dorsal spines capable of piercing through shoes.



Chris Roelfsema

Scorpionfish - Tips of fins carry poisonous venom and can affect body part in minutes.



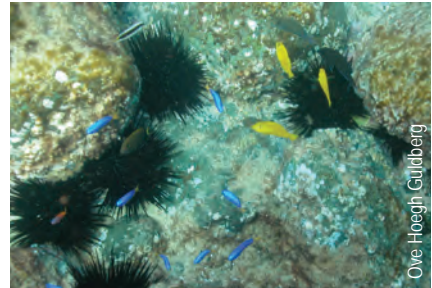
Chris Roelfsema

Lionfish - Spines have venom and can cause severe pain after a sting.



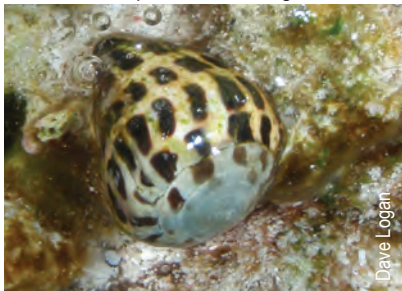
Dave Logan

Blue bottle jellyfish - Discharge nematocysts that can present complications.



Ove Hoegh Guldberg

Sea urchin - Sharp and brittle spines which can inject poison. Painful.



Dave Logan

Cone shell - Shoots tiny harpoon (venomous). Painless to excruciating.



Chris Roelfsema

Fire coral - Tentacles with nematocysts. Prickling sensation to extreme pain.



Chris Roelfsema

Hydroids - Nematocysts. Stinging sensation to extreme pain.



Chris Roelfsema

Blue ringed octopus - Serious bite. Painful, can be fatal and needs treatment.



Lisa Gershwin

Box jellyfish - Nematocysts. Serious sting which is painful and can be fatal.



Chris Roelfsema

Fire urchin - Stinging sensation to extreme pain.



Merrick Ekins, QLD museum

Fire Jelly - Morbakka. May give mild Irukandji Syndrome.



www.aithm.jcu.edu.au/

Irukandji - Nematocysts. Initial minor sting, serious reactions, can be life threatening.



Maile Trobarolo

Seasnake - Painless bite, highly toxic/ fast-acting venom.

Thorough planning is required to make your fieldtrip successful.

Create a fieldplan including

- Risk assessments
- Safety and Code of Conduct
- Emergency procedures
- Snorkelling and reef walking procedures
- A list of animals that are dangerous/venomous and an up-to-date first aid guide for treatment of contact with venomous marine creatures. Contact details for emergency.
- Checklist of items that students are required to bring such as sunscreen protection and water



Check the following

- Medical records from students
- Parent permission
- Permits, allowing you to do research

Where to go

Suitable sites for reef walking are:

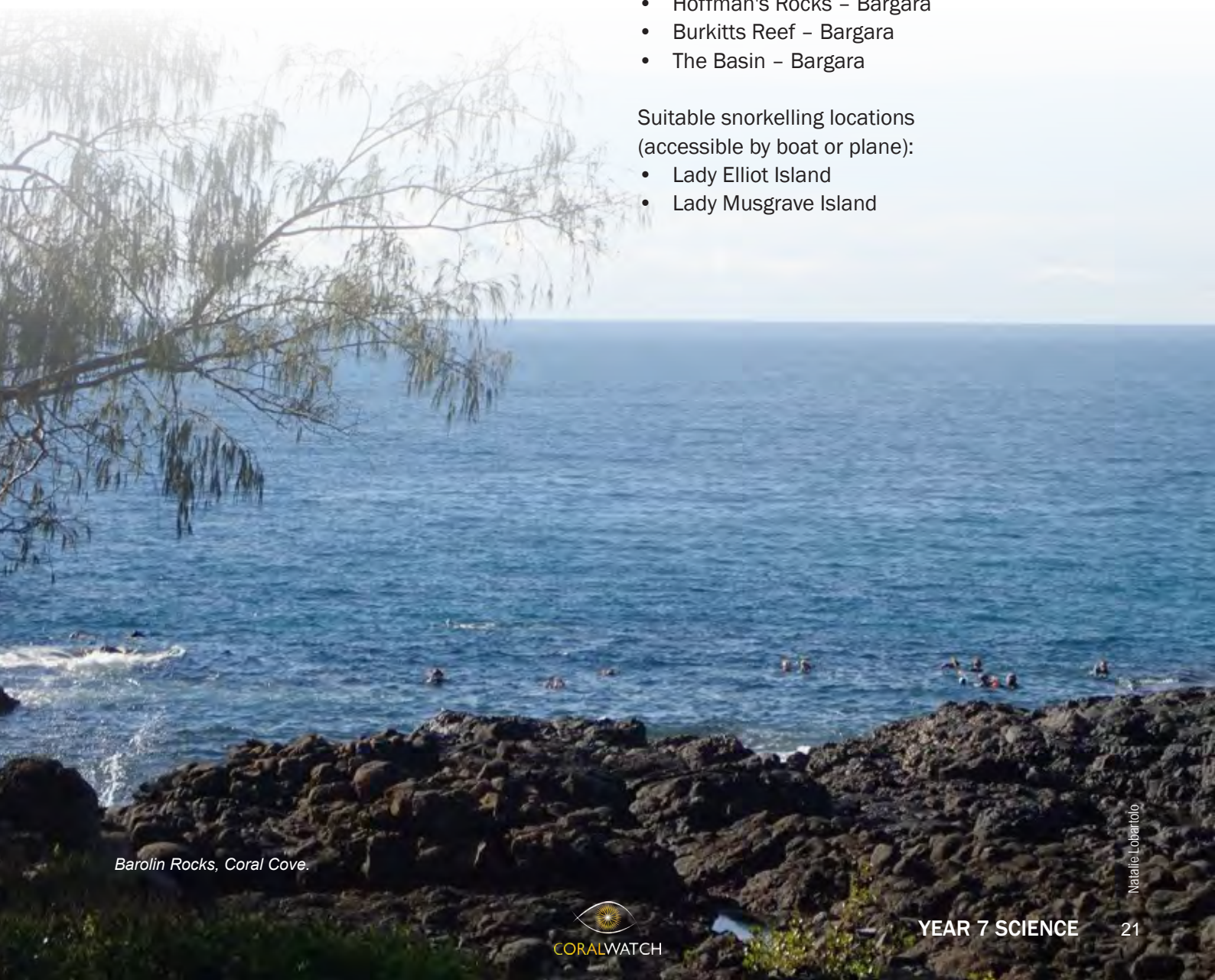
- Northern rocky shore – Mon Repos
- Oaks Beach – Burnett Heads

Suitable locations for snorkelling are:

- Barolin Rocks – Coral Cove
- Hoffman's Rocks – Bargara
- Burkitts Reef – Bargara
- The Basin – Bargara

Suitable snorkelling locations
(accessible by boat or plane):

- Lady Elliot Island
- Lady Musgrave Island



Barolin Rocks, Coral Cove.

Food webs - intertidal rocky shores

Instructions

Field Activity

1. Find an area that your teacher determines is safe to walk through.
2. Record any animals and plants observed in this location in the table as a group.
3. Refer to the field guide to help with species identification.

Questions

1. Use the information provided in the field guide to determine what animals eat plants, and identify any other animals you can observe in the area. Record this in the table.
2. Predict which species are producers or consumers.

Back in the classroom activity

1. Construct a food web using all the plants and animals recorded in the field. Try to draw representative pictures of each animal or plant in the food web.
2. What types of corals did you observe in your field study? How do they fit into the food web of the intertidal zone?
3. Suggest what may happen if one of the first order consumers is removed from the system?



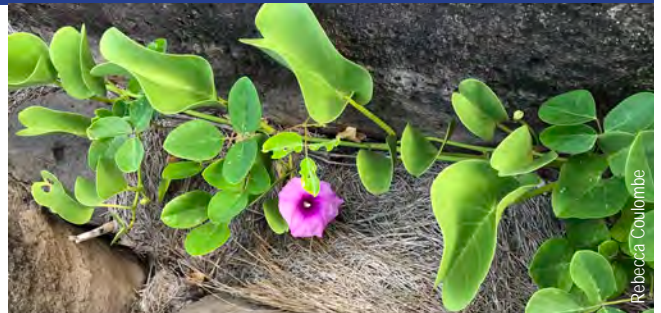
COMMON FLORA AND FAUNA – CORAL COAST / BUNDABERG



Natalie Lobarino

Rhizophora stylosa (Long-style stilt mangrove)

PLANT Distinctive stilt roots and slender aerial prop roots with white flowers. Loves muddy substrate with regular tidal flooding.



Rebecca Coulombe

Ipomoea pes-caprae subsp. *Brasiliensis* (Goat's foot)

PLANT Typically found along the rocky and sandy shores. Pink to purple bell-shaped flowers on a creeping vine. Helps to stabilise dune systems.



Rebecca Coulombe

Encrusting coralline algae

ALGAE Coloured algae that makes calcareous deposits to encrust on rocky shores and reefs which helps coral larvae to settle. Food for limpets, urchins and chitons.



Rebecca Coulombe

Lobophora variegata (brown algae)

ALGAE Brown algae with fan-shaped fronds. Food for fish and marine invertebrates.



Rebecca Coulombe

Halimeda (Green calciferous algae)

ALGAE Grows in the intertidal zone or in shallow waters. Can have curly leaves or be found encrusting to benthos. When this algae dies, it leaves calcium carbonate behind.



Rebecca Coulombe

Astroidea (Sea star)

ECHINODERM Sea stars travel using their tube feet. They can regenerate lost limbs and swallow large prey using their unusual stomachs.



Jess Firth (Pohang)

Portunus armatus (Sand crab or blue swimmer)

CRUSTACEAN Crabs eat many things including shrimps, gastropods, molluscs and even dead fish.



Natalie Lobarino

Cnidaria (Corals)

HARD AND SOFT CORALS Corals can be found in rocky shores. They can have a skeleton or may be soft. Corals have symbiotic algae that uses sunlight to generate food, corals also filter food from the water.

COMMON FLORA AND FAUNA – CORAL COAST / BUNDABERG



Aulactinia veratra (Green shore anemone)

CNIDARIAN Closely related to corals, anemones have a central mouth surrounded by stinging tentacles which they use to catch food and deter prey.



Sabella sp. (Feather duster worms)

POLYCHEATE ANNELID Burrows into rocks and lives inside a tube it creates for itself. The purple feather visible is its feeding appendage.



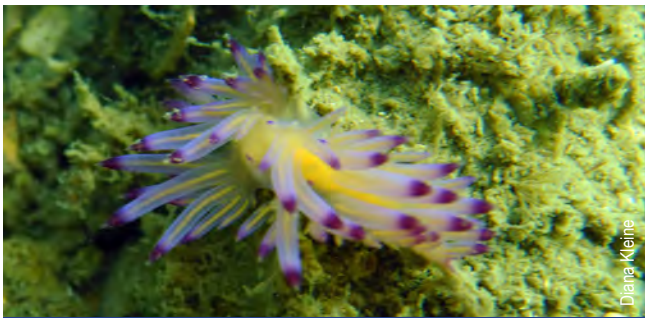
Perciformes (Blenny)

FISH Long dorsal fin extending down the length of its back. Found in rockpools, most are herbivorous or detritivorous.



Pomacentridae (Scissortail Sergeant damselfish)

FISH Found in or around reefs, feeding on plankton and algae. Males look after the clutches of eggs and are very territorial.



Aeolid Nudibranch

GASTROPOD MOLLUSC Nudibranchs are underwater snails that have lost their hard shell. Nudibranchs have their gills on their backs and feed mostly on sponges.



Morula marginalba (Mulberry whelk)

MOLLUSC Carnivorous marine snail preys on other barnacles and limpets. Uses a rasping tongue called a radula to bore a hole in its prey and suck out the insides!



Polyplacophora (Chitons)

MOLLUSC Easily identifiable by its eight overlapping plate segments which provides the animal with protection from predation. It can curl into a ball when not attached to a rock.



Tetraclita (Barnacle)

CRUSTACEAN Although one could guess they are a snail or mollusc, this is actually a crustacean! Volcano shaped creatures that have a planktonic larval stage and sessile or parasitic adult stage. They are filter feeders.

COMMON FLORA AND FAUNA – LADY MUSGRAVE ISLAND



Pisonia grandis (Broad-leaved pisonia)

PLANT Common on coral cays in the Southern Great Barrier Reef. Preferred nesting habitat for White Capped Noddy Terns.



Pandanus tectoris (Pandanus Palm)

PLANT Found in coastal areas and offshore islands along the east coast. Produces a fruit that resembles a pineapple.



Argusia argentea (Octopus bush)

PLANT One of the first colonisers on coral cays, octopus bushes have adaptations to windy conditions and a high salt environment



Casuarina equisetifolia (She Oak)

PLANT Populates coral cays and coastal areas of Australia. Important nitrogen fixers in coral cay environments.



Spirobranchus giganteus (Christmas tree worm)

POLYCHAETA Christmas tree worms come in a variety of bright colors. When startled, Christmas tree worms rapidly retract into their burrows, hiding from predators.



Thelenota ananas (Prickly redfish sea cucumber)

ECHINODERM Invertebrate with a simple water vascular system. Found on sandy shores and sea floors feeding on detritus and algae.



Tridacna sp. (Giant clam)

MOLLUSC Found on coral reefs, fixated to the substrate for the whole of their adult life. They filter the water for food, but most of their energy comes from photosynthesis via symbiotic algae (zooxanthellae) in their mantle.



Coenobita perlatus (Strawberry hermit crab)

CRABS Resembling a strawberry with its bright red colour and dotted, hairy appendages, this critter is a terrestrial hermit crab. It is possible to see the holes to their burrows along the beach.

COMMON FLORA AND FAUNA – LADY MUSGRAVE ISLAND



Amphiprion sp. (Anemonefish)

FISH They live in symbiosis with anemones and keep it clean of parasites. In return the anemone provides a safe home, free from predators. They are plankton eaters.



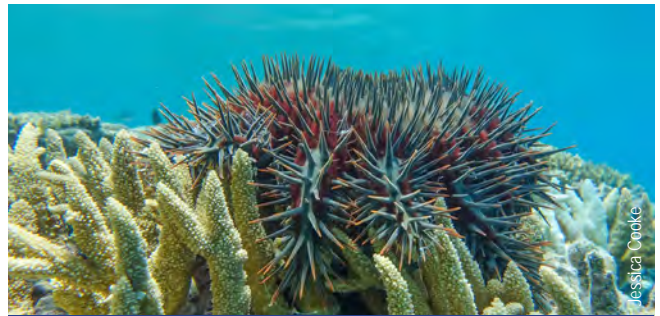
Scaridae sp. (Parrotfish)

FISH Scraping off algae from substrate with their beaks keeps algae controlled, helping corals grow. Each fish produces up to 90kg of sand each year.



Plectropomus leopardus (Coral trout)

FISH Ambush predators with large, sharp-toothed mouths and a spotted body. A popular species for commercial fisheries, no-take zones help to keep their populations healthy.



Acanthaster planci (Crown of Thorns seastar)

ECHINODERM Venomous thorn-like spines. Preys on coral polyps. Although naturally occurring on the reef, can become a threat when outbreaks occur. Each individual can spawn 40 million babies.



Chaetodon unimaculatus (Teardrop butterflyfish)

FISH Very common in the Lady Musgrave Lagoon. Use their pointy nose to feed on live coral polyps. Abundant butterflyfishes indicate lots of healthy coral to eat.



Taeniura lymma (Blue spotted lagoon ray)

RAYS Very timid creature found in shallower waters. Feed on invertebrates such as molluscs, polychaete worms, and crabs.



Chelonia mydas (Green turtle)

REPTILE Found in coastal areas and very common in Lady Musgrave Lagoon. Feeds mostly on seagrass, algae and jellies.



Triaenodon obesus (Whitetip reef shark)

SHARK Found throughout coral reefs. Important apex predators, keeping fish populations in balance.

BIRDS – LADY MUSGRAVE ISLAND

The majority of birds seen around reefs can be classed as either seabirds or shorebirds. Some are resident, many are migratory and all shorebirds depend greatly on the health of reefs and their associated ecosystems for their survival. Seabirds eat primarily fish, while shorebirds forage for invertebrates and small fish along the shoreline. Both groups have species that are able to drink saltwater and excrete excess salt out of their nasal slits. Different birds will occupy and use various habitats to partition resources and avoid competition.



Anous minutus (White-capped Noddy or Black Noddy)

These migratory birds nest in the *Pisonia* trees and can be seen at Lady Musgrave Island from September to April.



Zosterops lateralis chlorocephalus (Capricorn Silvereye)

Small finch-like birds with a silver ring around their eye. Endemic to the Capricorn Bunker region.



Sterna dougallii (Roseate Tern)

Nest in the open on coral rubble above the high tide mark. Fly over the water to fish, plunging headfirst to catch fish.



Sterna sumatrana (Black-naped Tern)

Looks like the Roseate Tern, the black-naped Tern has a black stripe across its eye and a dark beak and legs.



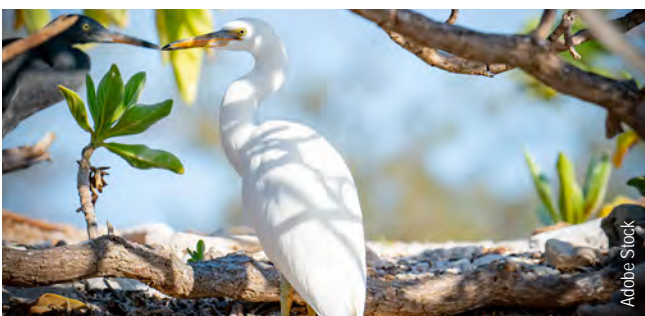
Sterna anaethetus (Bridled Tern)

Migratory birds nest on the ground amongst coral rubble and fallen branches.



Sterna bergii (Greater crested Tern)

Large Tern often observed along the water's edge. Birds have a mohawk-like breeding crest.



Egretta sacra (Eastern reef Egret)

Grey and white morphs appear different but are the same species. Ambush hunters, they feed on crabs, fish, squid.



Haematopus longirostris (Australian pied Oystercatcher)

Use long, straight red beaks and legs to probe sand for shells. Pairs mate for life and are seen together.

BIRDS – LADY MUSGRAVE ISLAND



Adobe Stock

Haliaeetus leucogaster (White-bellied sea Eagle)

Fish with their strong legs and sharp talons. Pairs mate for life.



Adobe Stock

Fregata minor (Lesser Frigatebird)

Can be seen flying high over the island, these 'pirates of the sky' chase and harass other birds to steal their food.



Adobe Stock

Arenaria interpres (Ruddy Turnstone)

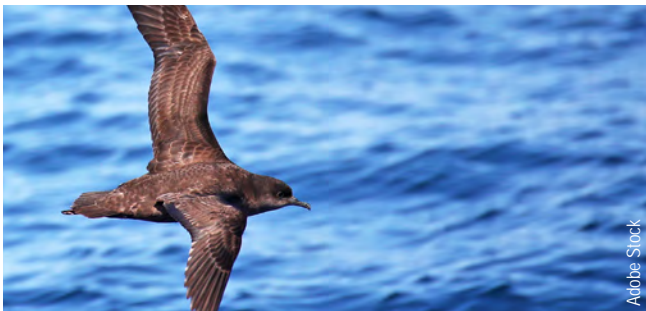
Small migrating shorebirds. Can be seen flipping over rocks and shells to forage for invertebrates.



Adobe Stock

Sula leucogaster (Brown Booby)

Often seen resting on moorings and boats. Make spectacular plunges from heights to catch fish and squid.



Adobe Stock

Puffinus pacificus (Wedgetailed Shearwater/Mutton Bird)

Nest in burrows beneath the pisonia forest during summer. Nocturnal, their ghostly wail can be heard at night.



Tracy Olive

Chroicocephalus novaehollandiae (Silver Gull)

Scavengers and one of the biggest predators of turtle hatchlings. These birds can be seen year-round.



Natalie Loharajolo

Limosa lapponica (Bar-tailed Godwit)

Probe for food in the sand using their distinctively long, slightly upturned bill. Migrate from Asia to the Pacific.



Adobe Stock

Gallirallus philippensis (Buff-banded Rail)

Scurry along and nest on the ground and very rarely fly. Well camouflaged, these scavengers will feed on anything.

WHAT YOU CAN DO TO HELP PROTECT SEABIRDS

- Never try to touch birds, chicks or eggs
- Do not feed any birds
- Avoid walking above the high tide mark where camouflaged eggs and chicks could be easily crushed
- If birds exhibit stressful behavior, back away and leave them alone
- Take care of reefs and choose sustainable seafood options

Food webs - intertidal rocky shores

Food web field activity results table

Group member names:

Location:

Date:

Time:

| Record No | Observed organism | Possibly food for? | Possibly feeds on? | Producer or Consumer |
|-----------|-------------------|--------------------|--------------------|----------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
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| 16 | | | | |
| 17 | | | | |
| 18 | | | | |

Identifying coral type using the Coral Health Chart

CoralWatch



Branching (BR)



Boulder (BO)



Plate (PL)



Soft (SO)

The Coral Health Chart uses four coral types to classify corals. **Branching** refers to any branching coral, such as *Acropora* and *Pocillopora* species. **Boulder** refers to any massive or rounded corals, such as some *Platygyra* and *Porites* species. **Plate** refers to any coral that forms a plate-like shape, such as tabular *Acropora* species, and the **soft** category refers to corals lacking a hard skeleton, e.g. *Sarcophytum* species.

Instructions

1. Copy the coral type template on a waterproof slate.
2. Locate a colony of coral, observe it and record the coral type. Use the types described on the Coral Health Chart.
3. Sketch the coral.
4. List any marine organisms that you observe near the coral.
5. Answer the following questions:
 - a. Are there mainly soft or hard corals in your local area?
 - b. In which zone do most corals appear to be?
 - c. What is the most common coral growth form?
 - d. What is the most common species of coral? Use your coral ID card.

| CORAL TYPES | |
|------------------|----------------|
| Branching | Boulder |
| Plate | Soft |

Identifying coral type using the Coral Health Chart

The **aim** of this activity is to identify coral types using the Coral Health Chart.

ACARA curriculum links

Science understanding (ACSSU111)

Science as human endeavour (ACSHE119, ACSHE223)

Science inquiry skills (AC SIS125, AC SIS126)

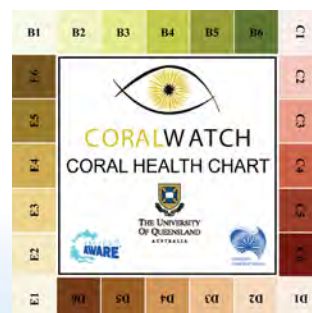


Instructions

- This activity should be conducted at low tide.
- Because identifying coral species is very difficult, CoralWatch classifies coral types in easy identifiable groups. For this purpose, coral types are described by the overall shape ('growth form') of coral colonies. There are hundreds of different coral species, each with unique shapes and colours. Sometimes the colour or shape may not clearly match the options on the Coral Health Chart. If it is difficult to select a colour or coral type, simply record the closest match. If a particular coral is too difficult to classify, just skip this coral and move on to the next one.
- CoralWatch classifies most free living, tabular, encrusting and foliaceous corals as plates.
- CoralWatch classifies most digitate, bushy and staghorn corals as branching.

Equipment

- Booties, hat and sunscreen
- Coral Health Chart
- Waterproof slate or paper with pencil
- Underwater camera (if available)
- Viewing tube (if available)
- Waterproof ID guide (if available)
- ID reference books (if available)



How to Use the Coral Health Chart

1. Choose a random coral and select the lightest area.
2. Rotate the chart to find the closest colour match.
3. Record the colour code on a data slate.
4. Select the darkest area of the coral and record the matching colour code.
5. Record the coral type.
6. Continue your survey with other corals. Record at least 20 corals.
7. Submit your data using the CoralWatch Data Entry App or enter online at www.coralwatch.org.

Survey Methods include: (depending on appearance and location)

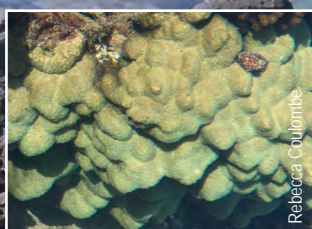
- Random Survey - Select corals randomly, such as the closest coral after every second fin kick.
- Transect Survey - Select corals by following a line (transect) and record every five meters.
- Easily Identified Corals - Select corals you can recognise and return to (permanent transect).

Tips:

- Corals are fragile animals, make sure your survey has no effect on marine life.
- Due to colour loss at death, use a brush when diving below 3 metres/10 feet.
- Avoid measuring growing tips of branching and plate corals since they are naturally white.
- Do not monitor blue or purple corals because they have a different bleaching response.
- Some corals are naturally lighter than others. Regular surveys are needed to look at coral health over time or pick up trends of bleaching and recovery.

Coral Types

CoralWatch is a non-profit global coral reef monitoring program, working with volunteers worldwide to increase understanding of coral reefs, coral bleaching and climate change. www.coralwatch.org



BOULDER CORAL



BRANCHING CORAL



PLATE CORAL



SOFT CORAL



Measuring coral health using random surveys

The **aim** of this activity is to monitor the health of corals using the Coral Health Chart in a random survey as research technique.

ACARA curriculum links

Science understanding (ACSSU116)

Science as human endeavour (ACSHE119, ACSHE223)

Science inquiry skills (AC SIS124, AC SIS125, AC SIS126)



Instructions

- The most important part of a random survey is that it is truly random: don't pick the corals you like or because they are bleached.
- This activity can be conducted snorkelling or reef walking.
- The CoralWatch virtual reef Activity is a useful preparation for using the Coral Health Chart in the field.
- The CoralWatch data slate contains all required survey details. You can also create your own data slate by transcribing all the information onto a blank waterproof slate. Make sure you don't miss any details!

Steps to take for a random survey

1. Read the instructions on the back of the Coral Health Chart.
2. Make sure you have all your equipment as listed.
3. Start with recording survey details on your data slate: name, date, time, GPS coordinates (if possible), water temperature, depth, activity and conditions.
4. Choose how often you will measure a coral colony (e.g. every 6 steps or 2 fin-kicks).
5. Begin in a clear direction drawing an imaginary line in your direction of travel.
6. Every 2 fin-kicks, measure the colour scores and coral type of the coral colony closest to you.
7. Repeat this for at least 20 coral colonies.

Equipment

- If snorkelling - mask, snorkel and fins
- If reef walking - booties, hat and sunscreen
- Coral Health Chart
- Waterproof data slate (see picture) with pencil
- Thermometer
- Underwater camera (if available)
- Viewing tube if you reef walk (if available)
- GPS to record coordinates (if available)

Reef name and country:

Your name:

Date and time:

GPS: (if possible)

Depth: m / feet

Sea temp: °C / °F

Sunny / cloudy / raining / walking / snorkelling / diving (please tick)

Enter all your data online at WWW.CORALWATCH.ORG
Your data is important to us!

| Coral No. | COLOUR CODE | | CORAL TYPE (shrub-like) | | | |
|-----------|-------------|---------|-------------------------|--------|-------|------|
| | Lightest | Darkest | Bleaching | Buzzed | Poles | Soft |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |

Example of CoralWatch data slate.



This snorkeler has chosen to survey a coral every 2 fin-kicks. You can choose to survey your corals closer together or further apart - as long as the distance you choose is consistent throughout the survey.

Measuring coral health using transect surveys

The **aim** of this activity is to monitor the health of corals using the Coral Health Chart along a transect line as research technique.

ACARA curriculum links

Science understanding (ACSSU116)

Science as human endeavour (ACSHE119, ACSHE223)

Science inquiry skills (AC SIS124, AC SIS125, AC SIS126)



Instructions

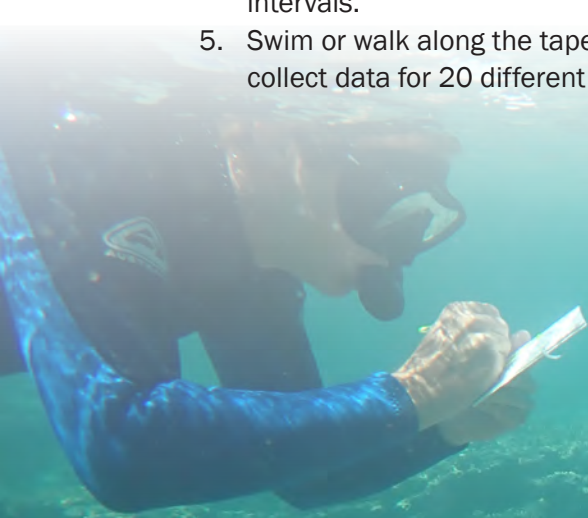
- This activity can be conducted snorkelling or reef walking.
- The CoralWatch virtual reef activity is useful preparation for using the Coral Health Chart in the field.
- The CoralWatch data slate contains all required survey details. You can also create your own data slate by transcribing all the information onto a blank waterproof slate. Make sure you don't miss any details!
- The distance along the transect line between measurements can vary depending on coral cover. If there is no coral underneath the assigned reading, students can pick the closest coral colony.
- Ensure students don't damage the coral as they lay out the tape or when taking measurements.
- For future reference, students could mark the start and end of your transect using GPS coordinates. This way you create a permanent transect that you can visit overtime and measure change over time.

Steps to take for a transect survey

1. Read the instructions on the back of the Coral Health Chart.
2. Make sure you have all your equipment as listed.
3. Start with recording survey details on your data slate: name, date, time, GPS coordinates (if possible), water temperature, depth, activity and conditions.
4. Lay out a tape measure or string with measurement points marked on it. To decide what intervals to use on the transect tape you should consider the coral cover in your area. With high coral density you could collect data every half a metre, metre or with low density it might be best to take 2 metre intervals.
5. Swim or walk along the tape, and record data every 50cm (depending on coral cover). Aim to collect data for 20 different coral colonies.

Equipment

- If snorkelling - mask, snorkel and fins
- If reef walking - booties, hat and sunscreen
- Coral Health Chart
- Waterproof data slate with pencil
- Thermometer
- Viewing tube if reef walking (if available)
- GPS to record coordinates (if available)



The **aim** of this activity is to enter CoralWatch field data into the CoralWatch online global database and compare and analyse your own data with existing data (if applicable).

ACARA curriculum links

Science understanding (ACSSU116)

Science as human endeavour (ACSHE119, ACSHE223)

Science inquiry skills (AC SIS124, AC SIS125, AC SIS126, AC SIS129, AC SIS130, AC SIS131, AC SIS132)



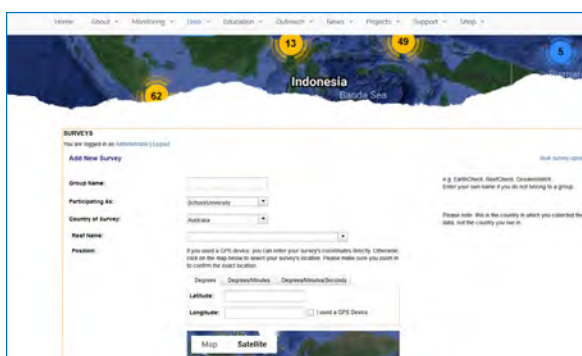
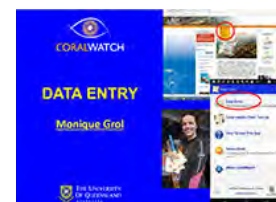
Instructions

1. Go to www.coralwatch.org
2. Go to the 'Education' tab and select 'Other materials'.
3. Under CoralWatch global database you can find guidelines with step-by-step instruction on how to enter data and how to analyse your data.
4. Go to the 'Data' tab and select 'Enter data'.
5. You need to be signed in to submit a survey: you have to become a member to be able to enter data. Membership is free.
6. Enter all your details from your data slate and submit.
7. If you don't have GPS coordinates you can find your location on the map.
8. Enter all data records and look at your results.
9. Compare and discuss the data you collected to:
 - a. Previous data on the same reef (if available).
 - b. A nearby reef.
 - c. Fellow students.

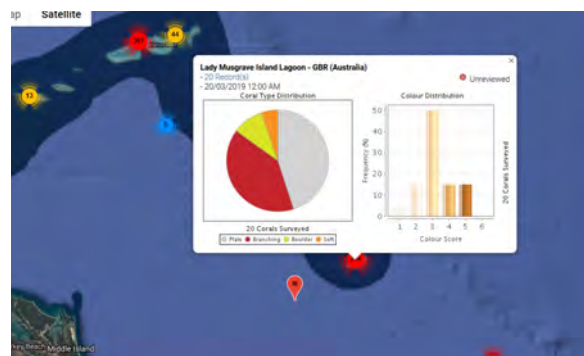
Point out the importance of entering real data. Entering survey data into the online CoralWatch global database ensures that the data can be used by reef managers and scientists studying coral bleaching.

Equipment

- Computer
- Internet access
- Your field data
- Data entry and analysis step-by-step guidelines freely to download from CoralWatch (see above)



Example of the 'enter data' page.



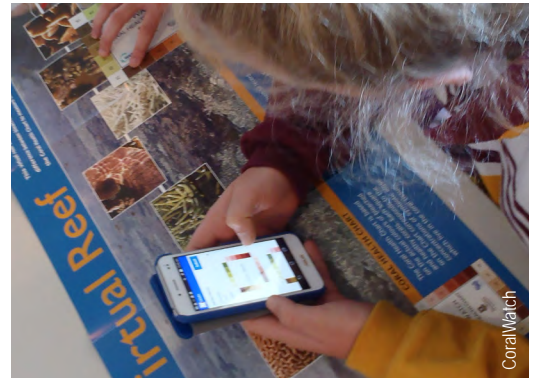
CoralWatch website allows you to view all the data recorded for a particular reef.

Entering data using the CoralWatch data entry Apps

The **aim** of this activity is to enter CoralWatch field data using CoralWatch phone apps, view and analyse survey results, and upload the data to the CoralWatch global database.

ACARA curriculum links

- Science understanding (ACSSU116)
- Science as a human endeavour (ACSHE119, ACSHE223)
- Science inquiry skills (AC SIS124, AC SIS125, AC SIS126, AC SIS129, AC SIS130, AC SIS131, AC SIS132)



Students can practice entering data on the mobile App using demo mode with the virtual reef.

Instructions

1. Download CoralWatch data entry App. Available for Android and iPhone.
2. Login/register as a member.
3. Set your phone preferences to online/offline use - you can store data and upload it later.
4. Download from the website the 'How to enter data' guideline for step-by-step instructions if needed (www.coralwatch.org/index.php/education-2/other-materials/ ; section CoralWatch global database).
5. Add a new survey and enter all details as requested.

Notes about GPS

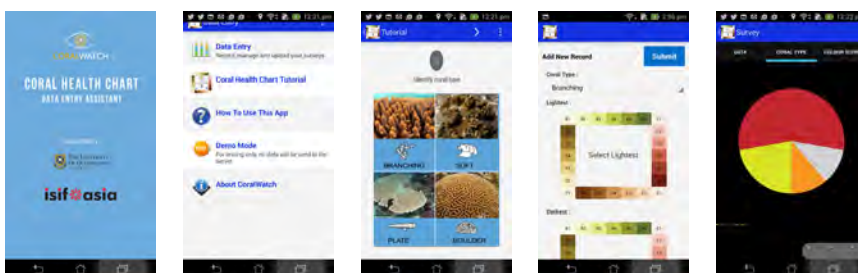
- Only select 'Use your current location' when you are at the actual field site. Don't use this option when you are back in the classroom.
 - If you revisit an existing field site - GPS coordinates will appear automatically and you can select 'Use above coordinates'.
 - Choose the 'Use map to choose location' to place a marker at your field site. This can be done in the field or classroom.
 - Or enter you coordinates manually.
6. After entering all your metadata, enter your survey data by selecting coral type, then the lightest and darkest colour for each coral.
 7. Once finished, check results and upload data to the database.

Please note

- To practice entering data use 'demo mode' - no data will be send to the global database.
- You will still need your Coral Health Chart and slate to collect your data in the field, but this App will make it quick and easy to upload your data to CoralWatch.

Equipment

- Android or Apple mobile phone or tablet
- Internet access
- Your field data



Different screen previews of the CoralWatch data entry App.

CoralWatch data entry Apps allow you to:

- Enter CoralWatch data on your phone.
- Record the GPS coordinates on the spot.
- View your survey results.
- Store your survey data, work offline and upload at a later time.



ACARA CURRICULUM LINKS

The lessons in this booklet are linked to year 7 Science: Classification – Foodwebs – Water cycle

Science understanding

- Classification helps organise the diverse group of organisms (ACSSU111)
- Some of Earth's resources are renewable, including water that cycles through the environment, but others are non-renewable (ACSSU116)







Science as a human endeavour

- Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)
- Science knowledge can develop through collaboration across the disciplines of science and contributions of people from a range of cultures (ACSHE223)

Science inquiry skills

- Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (AC SIS124)
- Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (AC SIS125)
- Measure and control variables, select equipment appropriate to the task and collect data with accuracy (AC SIS126)
- Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (AC SIS129)
- Summarise data from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (AC SIS130)
- Reflect on scientific investigations including evaluating the quality of the data collected and identifying improvements (AC SIS131)
- Use scientific knowledge and findings from investigations to evaluate claims based on evidence (AC SIS132)
- Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations using digital technologies as appropriate (AC SIS133)

General capabilities

-  Literacy
-  Numeracy
-  Information and communication technology capability
-  Critical and creative thinking
-  Personal and social capability
-  Ethical understanding
-  Intercultural understanding.

Cross-curriculum priorities

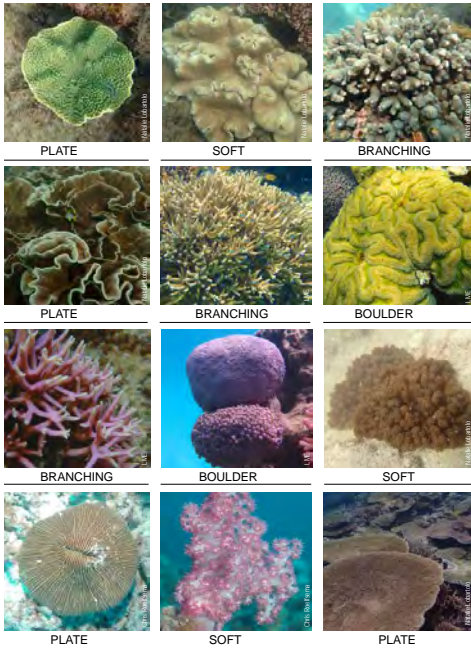
-  Aboriginal and Torres Strait Islander histories and cultures
-  Sustainability

ACARA CURRICULUM LINKS AND ANSWER KEY FOR WORKSHEETS

WORKSHEET 1 - Identifying coral types

ACARA curriculum links

Science understanding (ACSU111)



WORKSHEET 2 - Coral Coast corals

ACARA curriculum links

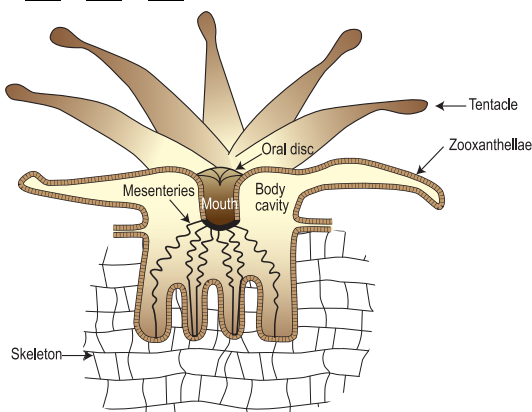
Science understanding (ACSU112)

Science inquiry skills (AC SIS124, CSIS132, ACSIS133)

Science as human endeavour (ACSHE223)



1.



- Healthy reefs produce food for millions of people and help to protect coastal land from cyclones and storm surges. Reefs support local economies, providing employment from tourism and fishing industries.
- In healthy coral, symbiotic algae (zooxanthellae) live within the coral tissue. Algae provide the coral with food and energy and give the corals their characteristic brown or green colour. In return the coral provides a home for the algae. Both parties benefit from living together.
- Stressful environmental conditions can cause the coral to expel the symbiotic algae, changing the coral colour to white. This whitening of coral is called 'coral bleaching'.
- Coral health can be measured with the CoralWatch Coral

Health Chart. CoralWatch uses colour as an indicator of coral health. However, coral colour is just one indicator of coral health. Other indicators could be % coral cover, species diversity & richness, the amount of macroalgae and fish present.

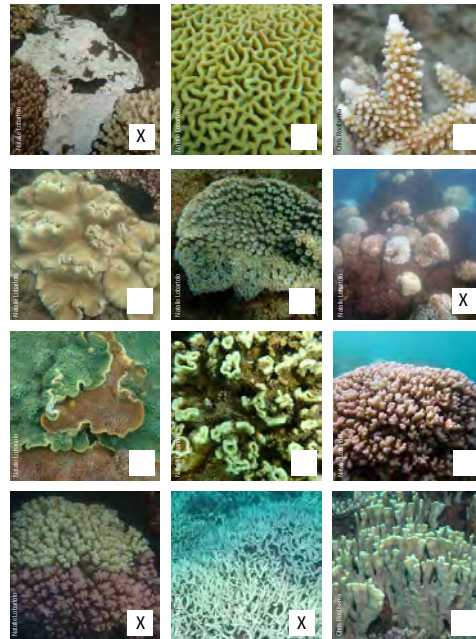
WORKSHEET 3 - Coral bleaching - sign of stress

ACARA curriculum links

Science inquiry skills (AC SIS124)



White tips are natural growing points



WORKSHEET 4 - Corals - consumer or producer

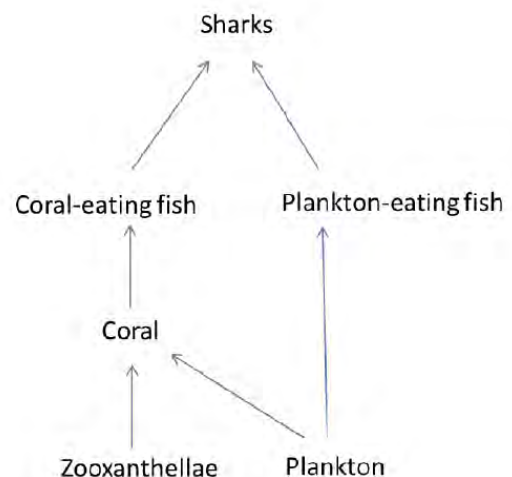
ACARA curriculum links

Science understanding (ACSU112)

Science as human endeavour (ACSHE223)



- The primary producer in the coral-algae relationship are the algae named zooxanthellae.

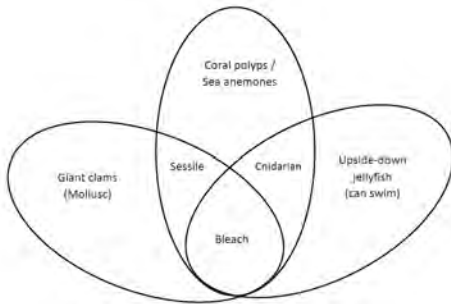


ACARA CURRICULUM LINKS AND ANSWER KEY FOR WORKSHEETS

WORKSHEET 5 - Do other marine invertebrates bleach?

ACARA curriculum links

Science understanding (ACSSU111, ACSSU112)



1. Tick each characteristic for each species (there will be more than one for each).
2. Discuss these similarities and difference.

| | Phylum Cnidaria | Phylum Mollusca | Polyp | Medusa | Upside-down | Sessile | Can swim | Bleaching |
|-----------------------|-----------------|-----------------|-------|--------|-------------|---------|----------|-----------|
| Coral polyp | ✓ | | ✓ | | ✓ | ✓ | | ✓ |
| Sea anemone | ✓ | | ✓ | | ✓ | ✓ | | ✓ |
| Upside-down jellyfish | ✓ | | | ✓ | ✓ | | ✓ | ✓ |
| Giant clam | | ✓ | | | ✓ | ✓ | | ✓ |

WORKSHEET 6 - Measuring coral health using the virtual reef poster

ACARA curriculum links

Science understanding (ACSU112)
 Science inquiry skills (AC SIS124, AC SIS125, AC SIS126, AC SIS129, AC SIS130, AC SIS131, AC SIS132, AC SIS133)
 Science as human endeavour (AC SHE119, AC SHE223)



The virtual reef provides an opportunity to learn about coral bleaching and collect scientific data without visiting the reef - it can be used to prepare for a reef field trip or as a valuable alternative.

Discuss in class the results - results may vary slightly due to the use of photos with some shading.

WORKSHEET 7 - Interpreting real data from the Coral Coast

ACARA curriculum links

Science understanding (ACSU112)
 Science inquiry skills (AC SIS124, AC SIS125, AC SIS126, AC SIS129, AC SIS130, AC SIS131, AC SIS132, AC SIS133)
 Science as human endeavour (AC SHE119, AC SHE223)



Answers will vary, depending on the reef choice

WORKSHEET 8 - The water cycle of the Coral Coast

ACARA curriculum links

Science understanding (ACSSU116)



1. **Liquid** - a runny substance composed of molecules that move freely among themselves but do not tend to separate like those of gases; neither gaseous nor solid.

Precipitation - falling products of condensation in the atmosphere, as rain, snow, or hail.

Condense - to reduce to another and denser form, as a gas or vapor to a liquid or solid state.

Evaporating - to change from a liquid or solid state into vapor.

River - a natural stream of water of fairly large size flowing in a definite course or channel or series of diverging and converging channels.

Catchment area - a drainage basin composed of the area drained by a river and all its tributaries / creeks.

Water cycle - the natural sequence through which water passes into the atmosphere as water vapor, precipitates to earth in liquid or solid form, and ultimately returns to the atmosphere through evaporation.

Please note that *Dictionary.com* was used to obtain these definitions.

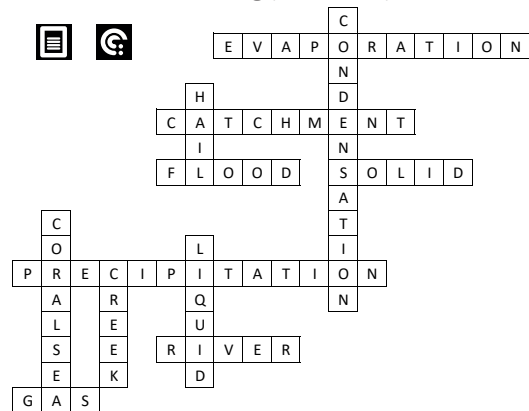
2.

| | | | | | | | |
|---------------------------|-----------|--------------|----------------|------------|----------------|-------------|-----------|
| Water cycle stages | Sea water | Water vapour | Water droplets | Rain | Flood water | River water | Sea water |
| Location | Ocean | Atmosphere | Atmosphere | Atmosphere | Catchment area | River | Ocean |

WORKSHEET 9 - Water cycle crossword

ACARA curriculum links

Science understanding (ACSSU116)



WORKSHEET 10 - Sediment runoff - water turbidity

ACARA curriculum links

Science understanding (ACSSU116)
 Science inquiry skills (AC SIS126, AC SIS130, AC SIS131, AC SIS133)



- The coarse sediment size should settle to the bottom first.
- The fine sediment size should settle to the bottom last.
- Coarse sediment will settle at the mouth of the rivers but fine sediment will stay suspended blocking sunlight and eventually settle further out to sea smothering the inhabitants on reefs.
- Aquatic plants, seagrass, algae and coral need sunlight to photosynthesise and produce the food and energy they need to survive, grow and reproduce.
- Aquatic plants, seagrass, algae and coral will die if they are consistently smothered with sediment or have the sunlight blocked from reaching their photosynthetic cells.

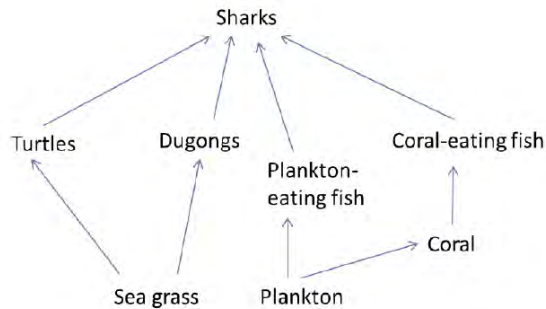
WORKSHEET 11 - Sediment runoff - altered food webs

ACARA curriculum links

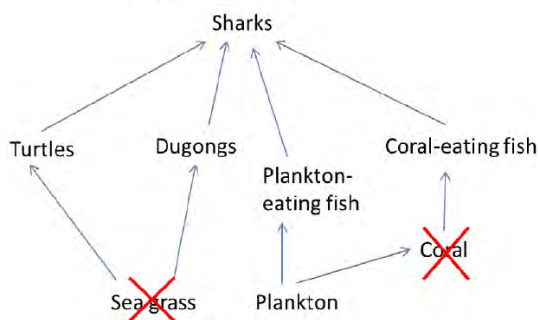
Science understanding (ACSU112)
 Science inquiry skills (ACSIS124, ACSIS129, ACSIS130, ACSIS132, ACSIS133)
 Science as human endeavour (ACSHE223)



1.



2.



- The number of turtles, dugongs and fish would reduce because they don't have enough food to eat if the seagrass and coral die from the sediment. The sharks would have less food to eat due to the reduced numbers of turtles, dugongs and fish. Therefore the number of plankton-eating fish would also reduce. The sharks would eat more clams than before to make up its diet.
- The sediment influx caused by the heavy rain and exposed soil from farming and construction has reduced the biodiversity from 8 different types of organisms to 3 types of organisms.



- The amount of sediment entering the waterways can be reduced by various means including the following:
 - Planting vegetation along river banks to stabilise the banks and stop the soil washing down stream in heavy rainfall.
 - Building a rain garden.
 - Construction sites stop exposed sediment from washing into drains by implementing 'Erosion & sediment control' (ESC) practices. These practices include covering

exposed soil and putting sediment barriers in drains at the construction site.

Preventing sediment from entering waterways by any or all of the above methods will improve the water clarity and quality. The clearer water will allow more sunlight to penetrate to the bottom and increase the number of aquatic plants and corals. With an increase of aquatic plants and corals available for animals to eat, more snails, crabs, fish, turtles and dugongs will be able to survive and thus increasing the biodiversity of the associated marine environment.

- The Coral Coast would have had clearer waters with more corals and bigger seagrass meadows. This environment would have supported a greater variety of animals and plants including turtles, dugongs and fish.
- Prior to European settlement, coral bleaching may have occurred from high sediment runoff resulting from extreme floods. Extreme floods would have occurred as a result of tropical cyclones. Unlike now, the thick vegetation around the waterways would have filtered the sediment saving the Coral Coast from severe sediment loads. Also, there was less exposed soil available for washing into waterways because Aboriginal farming and construction practices did not produce wide scale destruction of natural vegetation.

WORKSHEET FIELD 1 - Food webs - intertidal rocky shores

ACARA curriculum links

Science understanding (ACSSU116)
 Science inquiry skills (ACSIS124, ACSIS125, ACSIS129)



Answers will vary depending on the flora and fauna findings by students in the intertidal rocky shores.

Examples of producers (photosynthetic) are:
 Algae and seaweeds, seagrass, mangroves, kelp, zooxanthellae, phytoplankton.

Examples of consumers are:
 Filter feeders (e.g. sponges, sea squirts, tunicates, clams, mussels, bivalves), limpets, crabs, gastropods, corals, shrimps, stingrays.

Primary consumers are herbivores. When we remove herbivores from our food web, our next level up, secondary consumers (carnivores) may get into trouble. For example, removing zooplankton from the system will affect many filter feeders as they filter zooplankton from the water as their main/only food source.

WORKSHEET FIELD 2 - Identifying coral type

ACARA curriculum links

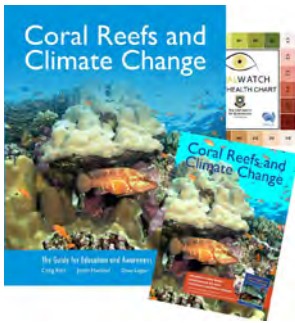
Science understanding (ACSSU116)
 Science inquiry skills (ACSIS125, ACSIS126, ACSIS129, ACSIS130, ACSIS133)



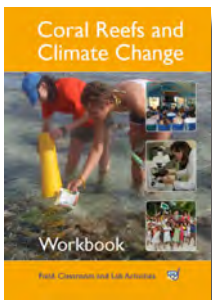
Answers will vary depending on the coral type and species the students find.

Drawings of coral types should reflect the graphics on the back of the Coral Health Chart; boulder, branching, plate and soft.

CORALWATCH RESOURCES



'Coral Reefs and Climate Change' book and DVD with free Coral Health Chart and monitoring instructions.



'Coral Reefs and Climate Change' workbook.



'DIY' kit with monitoring instructions.

CORALWATCH PACKAGES

Whether you are an individual or an educator, our education materials provide you with everything you need to get involved in protecting reefs.



Power of one package

Includes: book and DVD, Do-It-Yourself (DIY) monitoring instructions and reading materials packed in CoralWatch bag.



Raising awareness package

Includes: book and DVD, Coral Health Charts and slates, DIY monitoring instructions, promotional materials. Check our online shop for full contents.



Ultimate teaching package

Includes: book and DVD, workbook, class set of Coral Health Charts and slates, DIY monitoring instructions, virtual reef materials, posters and booklets. Check our online shop for full contents.

Coral Reefs and Climate Change The Guide for Education and Awareness - Book and DVD

CoralWatch has published the 2nd edition of the book 'Coral Reefs and Climate Change'. Beautifully illustrated, this book is targeted at students, reef enthusiasts and the general public. Chapters cover oceanography, coral reef ecology, climate change and conservation. This 2nd edition has been fully updated and includes the latest scientific findings. All books come with a Coral Health Chart and Do-It-Yourself instructions. Our educational DVD series with 22 short movies complement the book.

Published by CoralWatch, The University of Queensland - 2012

ISBN: 978-0-646-59085-1. Paperback, 264 pages

Authors: Craig Reid, Justin Marshall, Dave Logan and Diana Kleine. Edited by Angela Dean

Coral Reefs and Climate Change - Workbook

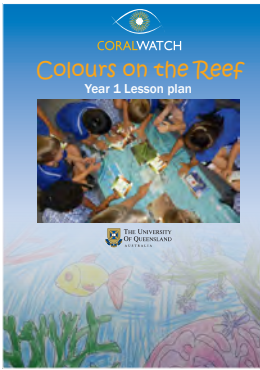
The individual, classroom, lab and field activities are designed for high school and early tertiary level students, and anyone interested in exploring coral reefs, climate change and sustainable living in more detail. Some activities make use of the Coral Health Chart. Additional virtual tools provide an opportunity to learn more about coral bleaching and active monitoring. Virtual tools can be used to prepare for a field trip or as a valuable alternative to a field trip. Away from the reef you can engage in activities in the classroom and your local environment and access recommended DVDs, books, articles and websites.

Do-It-Yourself Coral Health Monitoring kit

Includes Coral Health Chart, underwater data recording slate with pencil, instructions and information brochures. All packed in waterproof folder.

CORALWATCH RESOURCES

Australian curriculum linked lessons



'Colours on the Reef'
Year 1 Science
Lesson plan



'Marine Ecosystems'
Year 7 Science
Lessons and resources



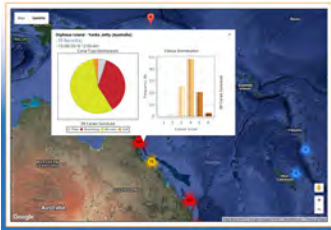
'Marine Systems -
Connections and Change'
Year 11-12 Marine Science
Lessons

Coral reef information

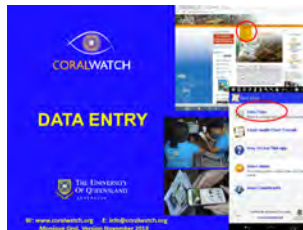


'Great Barrier Reef':
importance, threats, coral
bleaching, CoralWatch

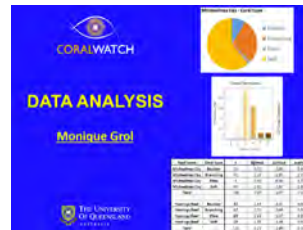
CoralWatch data



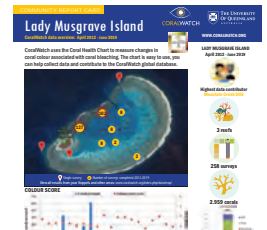
'CoralWatch global database'
Data freely available from
78 countries, >2400 reefs
and >14850 surveys



'How to enter, analyse,
search & download data'
Guide to entering
CoralWatch data on the
website or by App

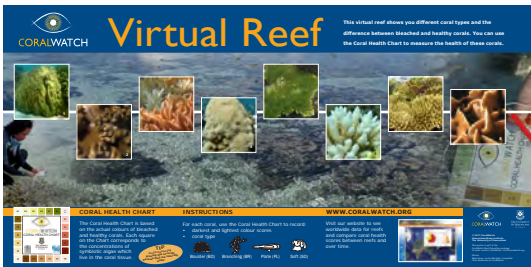


'Data analysis'
Guide outlining applications
of CoralWatch data



Community report cards
- Great Barrier Reef
- Lady Musgrave Island
- Keppel Islands
- Fitzroy Island

Virtual reef materials



'Virtual reef poster' - 3 versions
Tropical Reef / Moreton Bay / Capricorn Coast



'Virtual lab booklet' showing
chart development



'Virtual reef booklet' following the 2002
bleaching event at Lizard Island

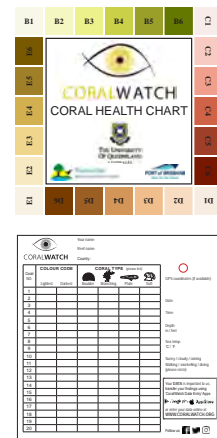


CoralWatch virtual reality (6 min)

Monitoring materials



'CoralWatch DIY instructions'
Available in 13 languages



'Coral Health
Charts'
Available in 5
languages

CoralWatch
data slates



CoralWatch instructional video (2.5 min)

CORALWATCH RESOURCES

GREAT BARRIER REEF FACTSHEET

AUSTRALIA'S JEWEL
2900 REEFS - 2300 KM
9400 CORAL SPECIES
WORLD'S LARGEST REEF

MAJOR THREATS
WARMER OCEAN TEMPERATURES
OCEAN ACIDIFICATION

CORAL BLEACHING
CORALS LOSE THEIR COLOR AND PROTECTIVE LAYER

VALUE
6.4 BILLION
56 BILLION
64,000 JOBS
2 MILLION
WORLD'S ENTERTAINMENT

CAUSES
CLIMATE CHANGE
OCEAN ACIDIFICATION
OVERFISHING
COASTAL DEVELOPMENT

IMPACTS
4 MILLION
20% LOST
2017-2018
2002-2010
40% AFFECTED

BIGGEST SOLUTION USE RENEWABLE ENERGY - LIVE CARBON NEUTRAL

YOU CAN HELP SAVE THE REEF FROM YOUR HOME
It is not too late!
make your own NATURAL WONDER for the future!

GBR Factsheet

SAVE REEFS FROM HOME

FOOD WASTE
Think before you buy
Save \$1000

ENERGY
Change electricity for solar
Save \$700

TRANSPORT
Switch to public transport, carpool, or bike
Save \$583

AIRCON
Change from 24 to 24°
Save \$208

TRANSPORT
Walkers 2 km by walking
Save \$120

TREES
Plant trees to absorb carbon dioxide
Save \$77

LIGHT
Replace 8 60-watt incandescent light bulbs with Energy Star LEDs
Save \$75

HEATING
Lower water heating by 5°C
Save \$60

WATER
Fix leaks fast
Save up to \$100
Save \$35

REDUCE CARBON EMISSIONS - SAVE \$ AND CORAL REEFS

Save Reefs from Home Factsheet



Photo series - Bleaching event Lizard Island 2016

CORALS AT YOUR DOORSTEP EDUCATION PACKAGES

Moreton Bay - Corals at Your Doorstep



Includes: curriculum linked year 7 Science lessons and resources, virtual reef, coral ID sheet, postcard, info flyers, Coral Health Chart with slate and DIY monitoring instructions.

First edition 2016, Second edition 2020.
Supported by Port of Brisbane.



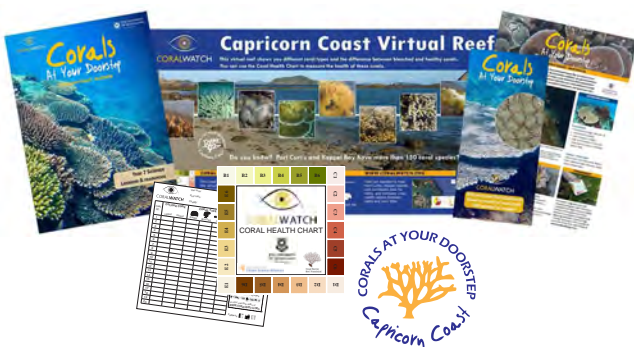
Coral Coast - Corals at Your Doorstep

create image



Includes: curriculum linked year 7 Science lessons and resources, virtual reef, coral ID sheet, info flyers, Coral Health Chart with slate and DIY monitoring instructions.

Capricorn Coast - Corals at Your Doorstep



Includes: curriculum linked year 7 Science lessons and resources, virtual reef, coral ID sheet, postcard, info flyers, Coral Health Chart with slate and DIY monitoring instructions.

First edition 2020. This package is supported by the Fitzroy Basin Association Inc., through funding from the Australian Government's National Landcare Program. Additional support has been provided by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.



Great Barrier Reef Foundation

First edition 2020. This package is supported by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.



Great Barrier Reef Foundation

The aim of CoralWatch 'Corals at Your Doorstep' education packages is to showcase local marine environments and its importance, promote everyday actions improving the coastal & marine environment, and provide opportunities for people to participate in local environmental monitoring and education activities.

Our Corals at your Doorstep materials are available for free and most of them can be downloaded from:
<https://coralwatch.org/index.php/ambassadors/corals-at-your-doorstep/>
Hard copies available upon request.



CORALWATCH

Citizen Science

for the future of our reefs



WWW.CORALWATCH.ORG



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AUSTRALIA

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