



The aim of this activity is to monitor the health of corals using the Coral Health Chart. During a reef walk, snorkel or dive you will match the colour and type of randomly selected corals to the categories on the chart, record this with water temperature and site details and plot the results. Please report real data to www.coralwatch.org

Time

Two hours field and
two hours classroom

Teacher Hint

If you don't have access directly to the reef you can use the virtual transect.

Tools

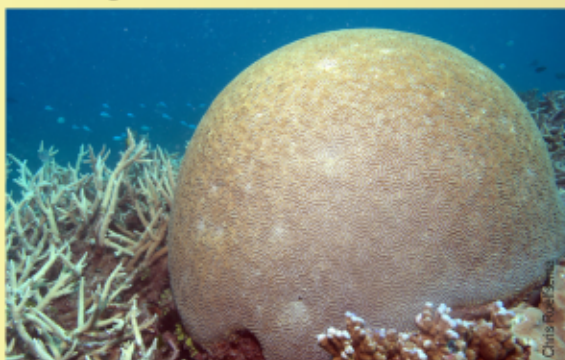
- Coral Health Chart
- Slate
- Pencil
- Viewing tube
- Mask and snorkel
- Computer
- Internet



Branching coral



Plate coral



Boulder coral



Soft coral

Background

Classifying corals at the species level is very difficult, so easily identified groups are often used when recording data about coral cover or general coral health. For this purpose, coral types are described simply by the basic growth forms or shapes of coral colonies.

The Coral Health Chart uses four coral types to classify corals. Branching refers to any branching coral such as *Acropora* 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 formation such as tabular *Acropora* species, and the soft category refers to corals lacking a hard skeleton, such as the *Xenia* species.

Due to the dynamic nature of coral morphology, these categories are not strict, as there are many forms that do not fit into one 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.





The Coral Health Chart

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. The concentration of symbionts is directly linked to the health of the coral.

In the field, all you need to do is match the colour of the coral with one of the colours on the Coral Health Chart. You then record the lightest and darkest colour score for each coral on the data sheet provided. The lightest and darkest colours are recorded to allow for the natural colour variation within a coral. The averaged value is used during the spreadsheet and website analyses.

Waterproof data slates can be created by simply copying the data sheet onto a piece of hard white plastic. Pre-printed waterproof slates can also be purchased through CoralWatch by emailing info@coralwatch.org.

You can scratch up smooth plastic surfaces to make a better surface to write on.

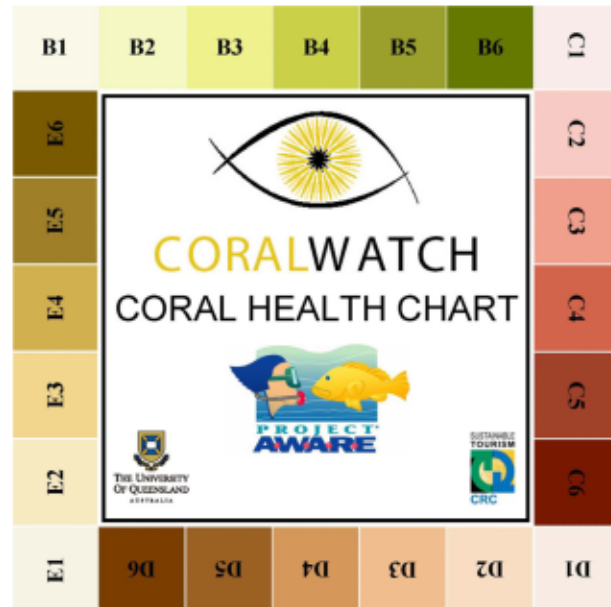
If the chart is used below five metres you need to use a source of illumination, like an underwater torch, to shine on both the chart and the coral. This is to counteract the changing spectral properties of water with increased depth.

The Activity CD contains two Microsoft Excel spreadsheets that provide a range of data collection and analysis options.

- The Reef Fingerprint© spreadsheet is designed to be used with randomly collected data. This spreadsheet provides a graphical and numerical summary of your data, showing information such as average coral colour scores, the percentage of different coral types and the overall colour of the reef. Detailed instructions can be found on the first page of the spreadsheet.
- The Reef Transect© spreadsheet is designed for data collected using belt or line transects, and requires additional information such as water temperature and depth. This spreadsheet therefore provides a more comprehensive analysis, i.e., information about the relationship between coral colour and water depth. Once again, detailed instructions can be found on the first page of the spreadsheet.

Once you have collected your data please remember to forward it to CoralWatch.

You can enter your data directly onto the website www.coralwatch.org or email your spreadsheet to info@coralwatch.org and we'll upload your data for you. The website also produces graphs for different reefs across the world – don't forget to check out your reef!



Coral Health Chart.



Healthy coral



Bleached coral





How to use the Coral Health Chart

1. **Be an AWARE diver.** Be sure to secure equipment, be properly weighted and move slowly through the water in a neutrally buoyant state. Dive carefully to avoid any reef contact as reefs are extremely fragile to even the slightest touch.
2. **If snorkelling or walking alongside the coral (reef walking),** ensure all movements avoid any contact with live coral.
3. **Select a coral.** The chart may be used with branching, boulder, plate or soft coral. It may not be used with blue/purple corals or fire coral as these do not vary during bleaching events.

Survey methods include (depending on experience and location):

a. random survey - select corals randomly, such as every second fin kick.

b. quadrant or transect survey - select your corals by marking a square area or following a transect line. Make sure your markings have no affect on marine life in the area. Then assess corals within the quadrant or along the transect line.

c. easily identified corals - select corals that are easy to identify and return to on each dive.

4. **Look down at the coral and select the overall lightest area, avoiding the tips of branching corals.**

Due to colour loss at depth, use a torch/flashlight at depths below 5 metres/15 feet. For some corals it will be difficult to match the colour exactly. Simply pick the closest colour, paying particular attention to brightness.

5. **Hold the Chart next to the lightest area and rotate it until you find the closest colour match.**
6. **Record the matching colour code and coral type on the data sheet.**
7. **Repeat steps 2 to 5 for the overall darkest area of the coral.**
8. **Submit your data at www.projectaware.org or www.coralwatch.org.**



Measuring coral colours on Heron Island reef flat, QLD, Australia.



Record lightest and darkest colours scores for each coral colony.

Coral types



Br=Branching



Bo=Boulder



Pl=Plate



So=Soft

www.coralwatch.org





Field activity

During this activity you will spend time with each type of coral and observe what is taking place on, in and around the colonies as well as measuring coral health in the area. Ensure you wear appropriate safety equipment (sun protection, enclosed shoes or booties).

1. Select an area of reef suitable for a reef walk or snorkel.
2. Locate a colony of coral, observe it for about five minutes and record:
 - a. what type it is (branching, boulder, soft or plate)
 - b. lightest and darkest coral colour scores for the colony
 - c. a sketch of the colony
 - d. a list of any other marine organism that you observe on, in and around the coral
3. Repeat this with colonies of the three other coral types (or as many types as you can find).
4. Following the instructions on the Coral Health Chart, measure the health of at least 20 coral colonies in your reef area and record the data on the datasheet or slate. You can visit several areas to compare coral health between different zones on your reef.

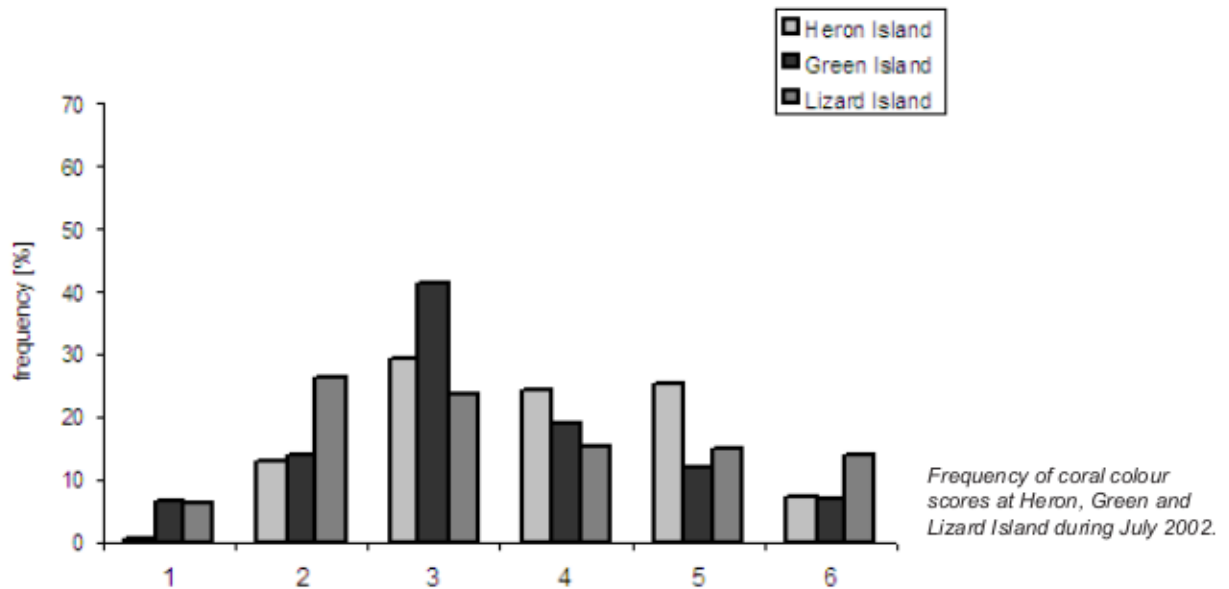
Coral types	
Branching	Boulder
Plate	Soft





Classroom activity

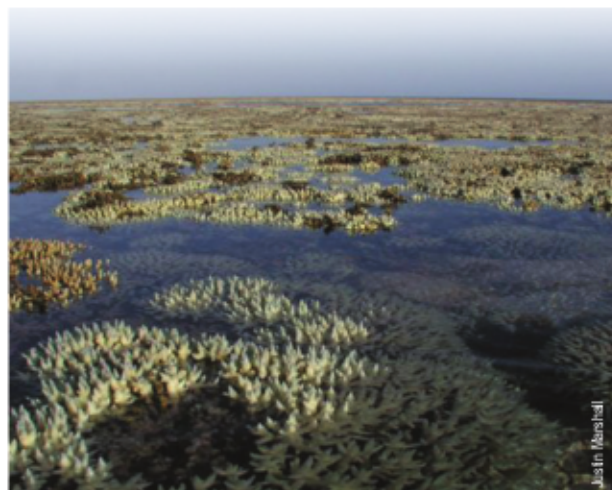
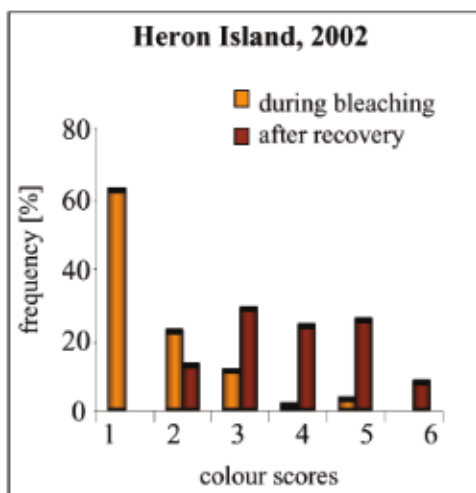
1. Enter your data into a spreadsheet supplied on your Activity CD or straight into the online database at www.coralwatch.org.
2. Take note of the graph showing coral colour score frequencies and compare it to the coral colour scores obtained by researchers on three healthy reefs during July 2002.



3. Use the online database and compare the data you collected to:
 - a. past data on your reef
 - b. a nearby reef
 - c. a reef in another country

For each, take note of the date, time, weather conditions and water temperature and whether the graphs appear similar or different from yours. Note, you may have to download the raw data for this.

4. A healthy reef would be expected to have a majority of corals with scores over 3, a few corals with scores of 2 and a very small number of corals with a colour score of 1. A reef experiencing a bleaching event has coral colour scores typically below 3. Rate the health of each of the reefs you have data for.





1. In this activity you will use the Coral Health Chart to determine the health of a virtual reef.
2. Following the instructions on the back of chart, match the colours of printed coral photographs or the virtual transect poster (supplied on the Activity CD) with the colour scores on the Coral Health Chart.
Note: that these colours will change depending on the printer used and may not represent the original colour of corals at the time photos were taken.
3. Record your scores on a data sheet.
4. Compare and explain any differences you find between the average colours of:
 - a. bleached coral versus healthy coral
 - b. corals observed in full sunshine versus shade
 - c. corals observed through sunglasses versus no sunglasses
 - d. corals on a computer screen versus printed copy

CORALWATCH VIRTUAL TRANSECT

The virtual transect is a selection of coral photos taken along an imaginary transect. It is designed to illustrate (i) the difference between bleached and healthy corals and (ii) morphological coral types.

Healthy corals (top row of photos) are generally darker in colour due to the presence of symbiotic zooxanthellae (pigment) in the coral tissues. Bleached corals (second row of photos) are generally lighter or white because they contain fewer symbionts.

You can use the CoralWatch Coral Health Chart to compare the colours of the corals on this poster. The colour squares on the Chart (pictured below) correspond to concentrations of symbionts. The chart is based on the predictable relationship between symbiont concentration and temperature.

Blue corals (like that pictured to the right) cannot be seen using the charts because the colour is associated with coral pigments, rather than symbionts, and the relationship between pigments and temperature is different to that between symbionts and temperature.

Light conditions change with depth. The above photos have been digitally modified to illustrate the difference in light conditions at depths of one and five metres. If you are using the charts below five metres you need to show a transect on the coral and the Chart. The photo is supported by the transect data from the CoralWatch project. The photo is supported by the transect data from the CoralWatch project. The photo is supported by the transect data from the CoralWatch project.



CORALWATCH

DATA SHEET

Group name: _____ Your name: _____

Email address: _____

Participation field: dive centre / scientist / environmental / school or university / tourist

Country of reef: _____ Reef name: _____

GPS if possible: _____ Sea temperature: _____ °C

Date of survey: _____ / _____ / _____ Time collected: (ie.14:00 or 2pm) _____
Day Month Year

Weather: sunny / cloudy / raining Your activity: reef walking / snorkelling / diving

Coral Number	Colour Code		Coral Type			
	L=Lightest	D=Darkest	Br=Branching	Bo=Boulder	Pl=Plate	So=Soft
example	L: D2	D: E5	Br	Bo	Pl	So
1	L:	D:	Br	Bo	Pl	So
2	L:	D:	Br	Bo	Pl	So
3	L:	D:	Br	Bo	Pl	So
4	L:	D:	Br	Bo	Pl	So
5	L:	D:	Br	Bo	Pl	So
6	L:	D:	Br	Bo	Pl	So
7	L:	D:	Br	Bo	Pl	So
8	L:	D:	Br	Bo	Pl	So
9	L:	D:	Br	Bo	Pl	So
10	L:	D:	Br	Bo	Pl	So
11	L:	D:	Br	Bo	Pl	So
12	L:	D:	Br	Bo	Pl	So
13	L:	D:	Br	Bo	Pl	So
14	L:	D:	Br	Bo	Pl	So
15	L:	D:	Br	Bo	Pl	So
16	L:	D:	Br	Bo	Pl	So
17	L:	D:	Br	Bo	Pl	So
18	L:	D:	Br	Bo	Pl	So
19	L:	D:	Br	Bo	Pl	So
20	L:	D:	Br	Bo	Pl	So

Any other relevant information, e.g. average diving depth, species of coral, pollution, long term weather such as drought, flood, heat-wave.

Any comments or enquiries.

Please use one of the following options to enter your data:

i) directly onto the CoralWatch website (www.coralwatch.org)

ii) by fax: +61 7 3365 4522 to the attention of Dave Logan

iii) by post: Dave Logan, Sensory Neurobiology Group (formerly known as VTHRC), SBMS, University of Queensland, Brisbane Queensland 4072 Australia.

Thank you very much for participating! Check our website for survey results and global bleaching trends.





Questions

1. State which coral type in your survey:
a. was the most abundant b. was the least abundant
2. Describe how the growth form of a colony could help a coral survive against physical damage and other organisms competing for space and food.
3. What was the average colour score for each coral type?

Coral Type	Colour Score
Branching	
Boulder	
Plate	
Soft	

4. Which colour score had the highest frequency?
5. Natural variation in coral colour occurs as a result of environmental conditions. For example, elevated temperature and intense rainfall can reduce a coral's symbiont concentration, thereby affecting its colour. Check what the weather conditions were like at your location before you arrived. State any unusual weather patterns experienced at your location recently and what impact you think they had on the reef.
6. Based on the above table, which of the coral types appears to be more resilient to coral bleaching? Why do you think this is the case?
7. What is the importance of collecting baseline data on coral colours before a bleaching event takes place?
8. How would you rate the general health of the reef at this point, based on the data you have collected and analysed together with your general observations? Explain your reasoning.
9. How could your data help researchers get a more accurate picture of coral bleaching and reef health?
10. List some other features of reefs you could measure to determine their health.

Research projects

1. Explain, with the aid of a diagram, the possible effects of bleaching on the future growth rate of the reef.
2. Assume that sea surface temperatures and coral bleaching will increase in frequency and intensity over the next 50 years. What are the likely long term impacts on the marine life of the coral reefs?
3. Investigate the benefits and limitations of data collected by untrained volunteer observers.

References

- Reid et al. (2009) Coral Reefs and Climate Change: The guide for education and awareness CoralWatch, The University of Queensland, Brisbane. (See Coral Bleaching page 128 and Changing Perspectives page 206)
- Siebeck UE, Marshall NJ, Klüter A, Hoegh-Guldberg O (2006) Monitoring coral bleaching using a colour reference card. Coral Reefs 25:453-460 (supplied on CD)
- Veron JEN (2000) Corals of the World. Australian Institute of Marine Science, Townsville
- CoralWatch, www.coralwatch.org
- Project Aware Foundation; www.projectaware.org
- Reef Check - Saving Reefs Worldwide; www.reefcheck.org
- Reef Check Australia; www.reefcheckaustralia.org
- The University of Queensland, Australia; www.uq.edu.au

