Acting on Coral Bleaching

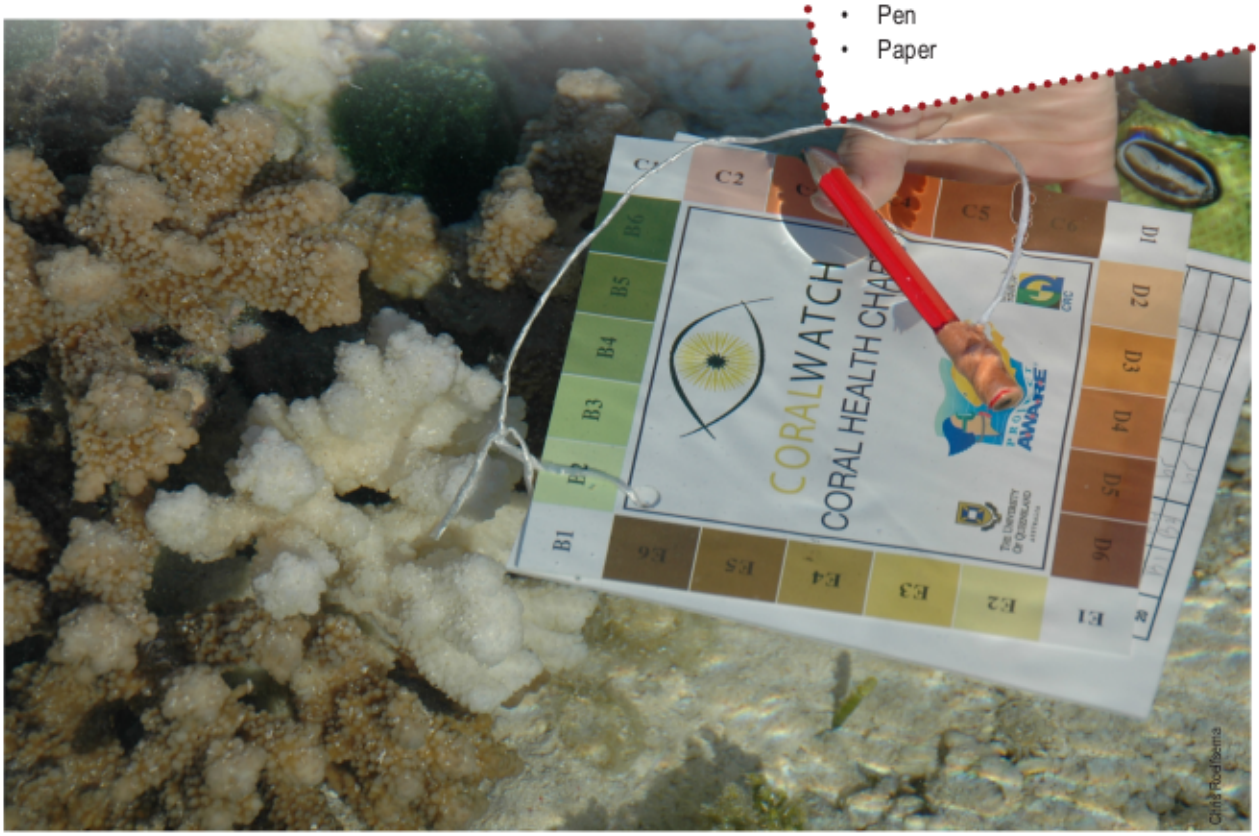
The aim of this activity is to explore how coral reefs are being impacted by climate change and envision practical ways to create a future containing healthy reefs. Using virtual tools and online data, you will identify coral bleaching trends and present your findings and possible solutions in a letter to a political leader or newspaper editor.

Time

Three hours

Tools

- Virtual reef
- Pen
- Paper



Coral bleaching

Coral bleaching occurs when corals change colour, generally from dark brown to a lighter shade of brown or white. The colour change is generally caused by a loss of symbionts from the coral's tissue, but can also be associated with a decrease in the concentration of photosynthetic pigments within the symbionts. Coral bleaching is a reaction to stress and can be caused by a variety of environmental factors including:

- elevated or decreased water temperatures
- changes in water salinity
- increased solar irradiance (both visible and ultraviolet)
- elevated exposure to chemical contaminants

It is important to understand that there are two distinctly different types of bleaching: localised and mass bleaching. Localised bleaching occurs over small geographical regions and can be caused by any of the above factors. Mass bleaching occurs over large geographical regions and is caused by increased water temperature over extended periods of time, together with increased levels of ultraviolet light. Sea temperatures are predicted to continue to rise and thus mass bleaching is expected to occur more frequently, and with greater intensity. This could lead to the death of large areas of coral reefs worldwide within a few decades.

Monitoring coral bleaching

Little is known about trends of coral bleaching on a global scale. Current attempts to monitor bleaching often involve costly satellite-born technologies, require sampling of live tissue and are restricted to the few reefs that are regularly visited by scientists. There are many questions that need to be answered in order to build a greater understanding of our reefs. This is where you can help.

By collecting bleaching data using the Coral Health Chart you will be providing valuable data to researchers. With your support it will be possible to monitor coral bleaching throughout the year, not just during bleaching events, and also across the world rather than at selected locations. Your data will help researchers answer questions related to issues such as patterns of bleaching and recovery.

Bleaching is closely linked to coral health. However, it is important to remember there are several other factors that affect the overall health of a coral reef, such as:

- Physical damage caused by storms or human impact
- Coral diseases, e.g., black band and white spot
- Over-fishing, e.g., reduced numbers of herbivorous fish provide the opportunity for algae to flourish, which can smother and kill corals
- Increased nutrient levels can also enhance algal growth
- Increased sedimentation can also smother corals
- Levels of coral diversity and reef connectivity

For people to effectively manage and reduce threats to reefs, they require community understanding and support and strong political leadership. You can help bring this about by advocating for positive change through a written letter.

Bleached coral

CoralWatch volunteer

Source: ReefBase: http://www.reefbase.org with the data from UNEP-WCMC, Institute for Marine Remote Sensing, Institute de Recherche pour le developpement, NASA and ReefBase

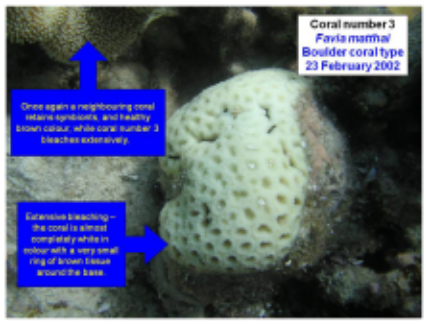
Classroom activity 1

In this activity you will investigate the consequences and frequency of coral bleaching and determine if these events seem to be increasing.

1. Using the CoralWatch *Virtual Reef*, review the power point slides/ flash presentation on the process and progression of bleached corals in the field. Take note of:
   a. how many recover
   b. how long recovery can take
   c. how many died as a result of bleaching
2. Log on to Reefbase and open the coral bleaching data set (global database –> threats -> bleaching).
3. Download the data for the world, or a region of your choice, and look at bleaching event data for the last 15 years.
4. For each year, record:
   a. how many events have been reported in total
   b. how many are severe
   c. how many are moderate
   d. how many are low
   e. coral death reported – yes or no
5. Generate a graph to show trends in bleaching data.
6. Compare this to the trends cited in the references you have access to.

Questions

1. Was there enough available data for you to come up with good conclusions?
2. Who else would you ask for current data?
3. How could you collect your own data?
4. Does the data indicate how many corals were affected in each event?
5. Does the data show recovery from bleaching?
6. What is the current state of coral reefs on a global scale?
7. List the six actions being taken by management authorities in addressing the issues of climate change?
   a. Rank these in order of what you believe will be most effective to the least effective.

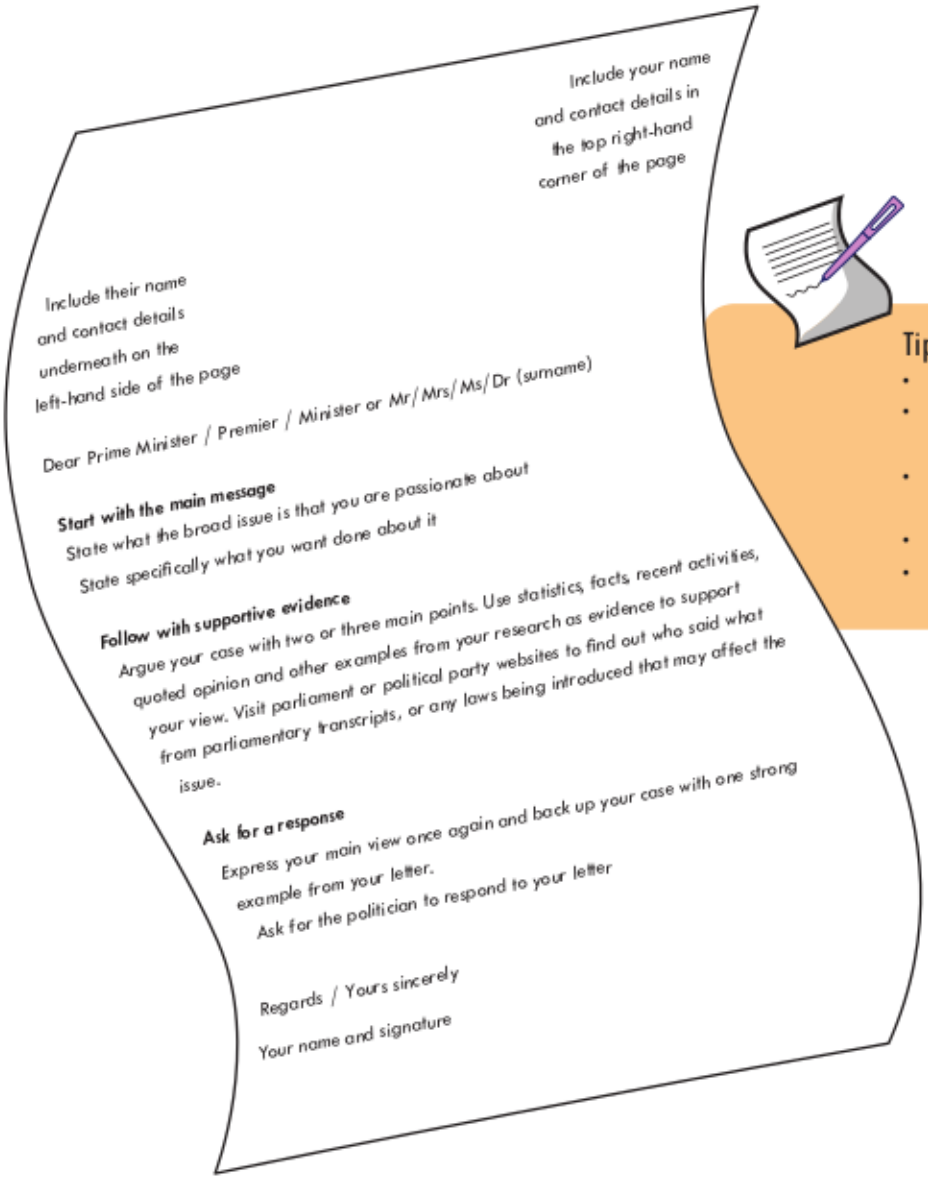


CoralWatch virtual reef.

CoralWatch activity in the classroom to prepare for a field trip.

Classroom activity 2

1. In this activity you will write two letters regarding a reef related issue and suggested solutions. Address your first letter to a suitable person in power. Your second letter will be in response to a letter written by someone else, imagining you are in a position of power.
2. Write a letter persuading a person in power to act on an identified threat. Choose an issue or reef threat that you already know a little bit about.
3. Identify your audience (minister of environment, fisheries manager, prime minister, newspaper editor, etc.).
4. Research their role, correct title and address.
5. Include in your letter:
   a. main idea – problem and solution - what do you want the person to do?
   b. reason
   c. evidence to back it up
6. Format and finish the letter appropriately.
7. Swap letters with another and write a response to their letter, pretending you are the person the letter is addressed to (you may have to research their position and possibly their opinion on the subject first – look for other projects or ideas they support).
8. Decide whether you actually want to send the letter you have written (only you can make that choice).



Tips for writing the letter

- *Use formal language*
- *Express your point of view with phrases like 'I feel' and 'I want to see'*
- *Don't expect a reply if you are rude, abusive or offensive*
- *Handwrite your letter*
- *Send your letter in the mail*

Australian Coral Reef Society
Inc.
A society promoting scientific study of Australian Coral Reefs
Address: ACRS Memberships
c/- Centre for Marine Studies
The University of Queensland
St Lucia QLD 4072
Tel: (07) 3365 1397
Fax: (07) 3365 4522
Email: Justin.marshall@uq.edu.au

9th September 2009

The Honourable Mr Peter Garrett
Minister for the Environment, Heritage and the Arts
Parliament House
Canberra
ACT

Dear Minister Garrett

Australian Coral Reef Society Comment on recent oil spills in the vicinity of Australian coral reefs and coastline.

Australia is a world leader in the call for the conservation of coral reefs and demonstrates role model management of The Great Barrier Reef (GBR). The GBR is one of the largest protected areas in the world, and was protected in its first instance when faced with the potentially high environmental risks of oil and gas exploration. With worldwide reef systems 40% destroyed or degraded to unrecognizable, Australia must continue as a world leader in protecting our less degraded reef systems and coastlines from threats such as this.

Despite the high standard of Health Safety and Environment policies promoted in the oil and gas industry, 2009 has witnessed two recent oil spills of significant threat to the marine environment.

The first in March when the Pacific Adventurer lost containers of ammonium nitrate and 270 tones of fuel oil offshore of Cape Moreton where as detailed by the Australian Marine Safety Authority (AMSA) :*"The oil impacted significant portions of the south-east Queensland coast, in particular the eastern and northern beaches and headlands of Moreton Island (a National Park), the eastern beaches of Bribie Island (north of Brisbane), the beaches and foreshores of the Sunshine Coast (north of Brisbane) and small areas of the Brisbane River."*
(AMSA:www.amsa.gov.au/Marine_Environment_Protection/Major_Oil_Spills_in_Australia/Pacific_Adventurer/index.asp)

The second spill started on the 21st of August 2009, when a leak developed in an oil well of the Montara oil field in the Timor Sea, close to world significant biodiversity hotspots (http://www.environment.gov.au/coasts/mpa/ashmore/index.html): Cartier Reef (a National Marine Reserve), 150km from the Ashmore complex a National Nature

President: Prof Justin Marshall; Tel: 07 3365 1397; Fax: 07 3365 4522 Email: justin.marshall@uq.edu.au
Hon Secretary: Dr. Ulrike Siebeck; Tel: 07 3365 4070; Fax: 07 3365 4522 Email: u.siebeck@uq.edu.au
Hon Treasurer: Dr Anna Scott; Tel: 02 6648 3923; Fax: 02 6651 6580 Email: ascott@nmsc.edu.au

Reserve; and 250km from the Kimberley coast. This is currently releasing a conservatively estimated 3000 barrels of oil or approximately 470,000 litres a day of sweet light crude, gas (including the greenhouse gas methane) and is expected not to be stopped for at least 7 weeks. In the first three days it was reported that at least 10,000 litres of dispersant, which is also toxic to the environment, where used to contain the resulting slick. These estimates are based on the information available to the public and it is also of concern that there has not been more transparency in this process. One of the learning experiences from the Pacific Adventurer disaster was that the scale of the spill was underestimated and the more rapid action commensurate with the scale of the spill was delayed.

Records show that the Montara oil field spill follows six major oil spills in Western Australia since 1975 and given the well recognized fragility of the coast and offshore reefs in this region, this history of accidents is of concern. Even more alarming is the fact that both chemicals and a new drill rig have had to be shipped from great distance to deal with the current event. This clearly foreseeable delay in treatment, demonstrates that exploitation of natural resources for short term gain is placed above our natural heritage in federal and state government priorities. (www.amsa.gov.au/Marine_Environment_Protection/Major_Oil_Spills_in_Australia/).

Coral reefs are currently declining worldwide as a result of human interaction and climate change. The remote reefs of Northern Australia will not escape the resultant threats of coral bleaching, ocean acidification and over fishing (http://royalsociety.org/page.asp ?id=3093). Added to this, the potential compounding threats of pollution from oil and gas operations must be taken more seriously than they currently are. An ever increasing suite of pressures and impacts will undermine reef resilience to the point where they will not recover (www.australiancoralreefsociety.org/ and http://www.coralcoe.org.au/).

It should be the clear duty of all nations to pass on the environment to subsequent generations in a responsible fashion. It is a responsibility of stakeholders, engaging in activities with the potential to impact the environment, to be able to contain and minimize impacts. The ways in which this will be done, should be clearly documented for the public and it is a Federal Government responsibility to ensure this sort of insurance against disaster both occurs and is taken seriously.

The Australian Coral Reef Society would therefore like to call upon the state and federal government agencies, oil and gas industry and general public, to exercise extreme caution in the ongoing developments which, although intrinsically linked to Australia's economy, should not put the Australian environment at great risk.

We call for tighter approval processes for developments on the doorstep of internationally significant wonders such as The Great Barrier Reef World Heritage Area, Cartier Island Marine Reserve, the Ashmore Reef National Nature Reserve, Hibernia Reef, Scott Reef, Rowley Shoals and the Kimberley and Pilbara coastlines. This process should include the review of major projects by independent scientific bodies and greater transparency in environmental assessments.

The Australian Coral Reef Society: 1) supports calls for an inquiry into the recent events in the Timor Sea, including the adequacy of Australia's oil spill response to major offshore oil spills; and 2) calls for increased investment and effort into understanding and protecting our coastal and offshore coral reefs in both North Eastern and North Western Australia. These ecosystems hold a wealth of biodiversity which is increasingly scarce worldwide.

Of particular concern to The Australian Coral Reef Society is that the recently green-lighted Gorgon Project in WA is Australia's largest energy resource project. Firstly, the required safety measures to deal with the spills and leaks that will occur here do not seem sufficiently advanced. Secondly, we now know that a future with 450ppm CO_2 is a future most likely containing coral reef degradation on a massive scale. We refer you in particular to Figure 5.2 in the recent "Great Barrier Reef Outlook Report 2009 In Brief", from The Great Barrier Reef Marine Park Authority and to the findings of this report. We urge the federal and state government to accelerate measures that will bring us well under this currently aimed for threshold by moving away from large scale CO_2 releasing energy projects.

The Australian Coral Reef Society would value a reply to these concerns and an outline of the new actions to be implemented in the future to prevent oil spills on or near our coastlines.

Yours sincerely

Professor Justin Marshall
President of The Australian Coral Reef Society

The Australian Coral Reef Society (ACRS) is the peak professional body representing coral reef scientists in Australia. It is the oldest coral reef organisation in the world, and its membership includes many of the world's leading experts in coral reef sciences. Since its key role in establishing the Great Barrier Reef Marine Park in 1975, the ACRS has maintained a tradition of highly regarded, science-based contributions to issues relating to Australian coral reefs. As scientists with extensive knowledge of coral reefs and the health of reef organisms, members of the Society have become increasingly concerned about the fate of these precious ecosystems in the face of current and future pressures. Australian coral reefs are critically important to Australia economically and culturally and the ACRS believes we have an international responsibility to lead the way.

Questions

1. Why is a hand written letter more effective than e-mail?
2. What is the use of a petition?
3. How would you write differently to a newspaper editor as opposed to a politician?
4. What do the vested interests stand to gain by denying climate change?
5. Evaluate the current state of international negotiations to reduce carbon emissions?
6. Why can't coral reefs adapt with the changes in sea surface temperature?
7. Will we see coral reefs migrating further south?
8. How will these scenarios impact the marine organisms that depend upon the reef ecosystem?
9. What are the social and economic implications of the degradation of coral reefs?
10. Why are coral reefs such a good indicator of the changes to other ecosystems on a global scale?

Research projects

1. How is 'uncertainty' used in the debate on climate change?
2. Why is there such a rift between the advice provided by scientists and the impetus for governments to react?
3. Are we overreacting to climate change?
4. What are the vested interests involved with the disagreement of climate change?
5. What are Australia's and the United States' arguments for not signing the Kyoto protocol?
6. Are the following justifications reasonable? Explain your answer for each.

   a. that the scientific findings on climate change are uncertain, and we cannot act on uncertainty

   b. that an individual cannot make a difference in addressing the climate change issue

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, Community Input page 198 and Changing Perspectives page 206)

CoralWatch; www.coralwatch.org
CRC Reef Research Centre; www.reef.crc.org.au
Project AWARE Foundation; www.projectaware.org
Actnow; www.actnow.com.au
11th International Coral Reef Symposium (ICRS); www.nova.edu/ncri/11icrs
ARC Centre of Excellence for Coral Reef Studies; www.coralcoe.org.au
Australian Coral Reef Society (ACRS); www.australiancoralreefsociety.org
Australian Institute of Marine Science (AIMS); www.aims.gov.au
Great Barrier Reef Marine Park Authority (GBRMPA); www.gbrmpa.gov.au
International Energy Agency (IEA); www.iea.org
Garnaut Review Web Site; www.garnautreview.org.au