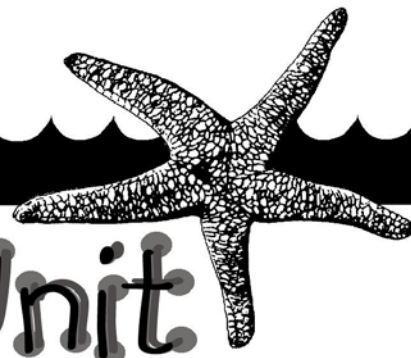


Teaching Unit



Reef at Risk

Middle School & Senior Secondary

In this Reef HQ Education Program students initiate investigations into natural and human induced threats to the Great Barrier Reef. They pursue investigations about ways individuals, communities, industry and Government can protect, manage and conserve the Great Barrier Reef Marine Park.

Curriculum Links

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

- Frame questions and identify sources of information about threats to the Great Barrier Reef;
- Present information to explore key ideas;
- Choose suitable techniques to achieve a group purpose;
- Describe how people's beliefs and practices influence the ways they interact with places;
- Describe responses of different elements (including people) to changes in natural systems;
- Interpret people's motives and actions from various perspectives;
- Identify the types of data required and sources required by a task and decide how they will be used to gain information;
- Translate information from one form into another;
- Evaluate ideas concerning sustainability to identify who may benefit and who may be disadvantaged from changes to industries and environments;
- Evaluate the relationship between an ecological system and a government and/or economic system; and
- Explore principles related to sustainable resource management.

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



Australian Government
Great Barrier Reef
Marine Park Authority



Reef HQ is the education centre for the Great Barrier Reef



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Reef HQ Visit

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

- Gain an appreciation for the complexity and fragility of the Great Barrier Reef;
- Investigate the effects of humans on the Great Barrier Reef;
- Explore sustainable reef use options; and
- Propose alternative management solutions and justify decisions with examples.

Theme Overview

The Great Barrier Reef is under pressure. Everything we do on the reef, along with the shore and even on land affects this diverse and fragile ecosystem. The plant and animal communities that make up the Great Barrier Reef need to be protected for future generations.

The Great Barrier Reef as we see it today is about 12,000 years old, and for the most of that time there has been minimal human impact. Around 1850, European settlers began populating and developing the coastal strip adjacent to the Great Barrier Reef. Since then, human settlement has impacted the Great Barrier Reef. Nowadays, the water isn't as clean, the coral isn't as healthy, there are fewer fish and some animals and birds aren't as common as they once were.

Changes that have taken place during the past 150 years include:

- Increased pollutant levels that show little sign of abatement;
- Depleted fish stocks in localised areas.
- The loss of up to 70-80% of wetlands in most of the major river catchments adjacent to the Reef; and
- An increase by 200-1500% in nutrients such as phosphate and nitrogen in river discharges.

As a result, the Great Barrier Reef is now under pressure – from fishing, from farming, from coastal development, from land-based pollution and simply from overuse. Some significant species are having difficulty adapting to these changing conditions and have now become rare or threatened. These trends are worrying indications of what may happen to other species and habitats of the Great Barrier Reef.



What are some of the things being done to help care for the reef?

- Bycatch Reduction Devices (BRDs) and Turtle Excluder Devices (TEDs) are required on all trawl nets within the World Heritage Area.
- Vessel Monitoring Systems (VMS; satellite tracking devices) are mandatory on the commercial prawn trawl fleet.
- An environmental management charge is administered by tourist operators, with a fixed proportion of the funds going towards applied research for the Great Barrier Reef.
- Limits on permitted tourism use have been introduced in some highly used areas.
- Codes of 'best practice management' have been implemented to improve agricultural practices and address environmental problems within individual industries (especially the grazing, agriculture and aquaculture industries).
- Liaison is continuing with agricultural industry peak bodies to encourage adoption of sustainable farming practices.
- A system of 16 Dugong Protection Areas has been established; a comprehensive whale and dolphin policy is being implemented for the entire Great Barrier Reef, and turtle conservation strategies are being implemented.
- The Representative Areas Program has been initiated to protect the biodiversity within the Great Barrier Reef World Heritage Area by protecting areas of the Reef that 'represent' different habitats and communities.

Reef at Risk – Activity Ideas

Tuning in

An overview of the Great Barrier Reef

Students develop a concept map describing the Great Barrier Reef – its size, what it comprises of, its biodiversity, its values, and its uses.

Talk with students about the Great Barrier Reef Marine Park and World Heritage Area covering over 348,000km², being more than 2000km long, comprising more than 2900 reefs, some 940 islands and surrounding waters. See atlases, reference books and websites for support material.

Encourage students to use "GBR Explorer" located on the Reef ED website

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



What Do We Already Know?

KWL (Know, Want to Know, Learning) Charts serve as a fabulous class shared resource. A KWL chart has three sections prior knowledge (Know), curiosity knowledge (Want to Know) and acquiring knowledge (Learning). Use a KWL chart to organise and help the children categorise their thoughts.

What do we already know about human impacts on the reef? Know	What do we want to know about human impacts on the reef? Want to Know	Where will we find the information to help us learn about human impacts on the reef? Learning

Use large poster sheets, which can be displayed in the classroom and added to as the unit of work progresses. As a class, fill in the KWL Chart at the beginning of the unit. During the unit and at the end of each session allow time to update the KWL Chart. When the unit is complete finalise the KWL Chart.

One way of adding to your chart and stimulating student's interest is to provide a range of texts on Food Webs and Interrelationships. Allow students a short period of time where they are to find an interesting fact to list in the **Learning** column of the KWL Chart. This could also be used as a time for confirming information and extending the vision of this unit of work.

Ecosystems

An ecosystem consists of all the interacting living elements (biotic) in an area together with the non-living elements (abiotic) of their environment.

Have students consider the reef ecosystem and list the major living (biotic) and non-living (abiotic) elements.

<i>Living (biotic) elements</i>	<i>Non-living (abiotic) elements</i>



Preparing to Find Out

Focus Questions

- 1) What and where are the issues or patterns being studied?
 - What and where is the Great Barrier Reef Marine Park?
 - What is a resource?
 - What is a multiple-use resource?
 - What is the pattern and distribution of resources within the Great Barrier Reef Marine Park?
 - What are the elements of the Great Barrier Reef system?
 - What patterns are associated with the Great Barrier Reef system?
- 2) How and why are they there?
 - What processes are associated with patterns within the Great Barrier Reef system?
 - What processes cause change within the Great Barrier Reef system?
 - Why do some resource issues develop into conflict?
- 3) What are their impacts or consequences?
 - What are some social, economic, political and physical impacts of change within the Great Barrier Reef system?
 - What are the social, economic, political and physical impacts of current and possible future uses of the Great Barrier Reef?
 - What consequences might arise as a result of these changes?
- 4) What is being done and could be done?
 - What is being done and could be done by individuals, groups and governments regarding the sustainable management of Great Barrier Reef Marine Park resources?

What about the future?

Ask students what they think are the most important things we need to know if we are going to ensure we have a Great Barrier Reef Marine Park for recreational and commercial fishing purposes, tourism opportunities, shipping activities and for the habitat requirements of reef animals. Visit the Great Barrier Reef Marine Park Authority Web-site and consider issues affecting the Great Barrier Reef Marine Park and find information about the need for user groups to use the Great Barrier Reef Marine Park's resources in a sustainable way.

Identifying and exploring the issues

Support students to identify and explore various pressures and threats (both natural and human induced) by undertaking one or more of the following activities:

- Develop a futures wheel and/or concept map to unearth a range of topics associated with the Great Barrier Reef, its risks and threats.
- Brainstorm issues related to the risks and threats to the Great Barrier Reef.
- Determine sources of information students have access to and are realistically likely to need.
- Express ideas with a teacher as the "devils advocate".
- Take different poles on issues, risks and threats to expose a range of views and possible starting points, e.g. overfishing, coastal development, water quality, increased shipping, global warming.
- Search the local papers and media for information about risks, threats and issues affecting the Great Barrier Reef. Find information about how these are also being managed and might be managed better.



Finding Out

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

GBR Explorer

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

www.reefed.edu.au

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

Media Investigation

Over a period of one to two weeks, students are asked to collect newspaper articles on human impacts on the environment and answer the following key questions with respect to each article:

- Who are the people involved?
- What environmental impacts are these humans causing?
- Where are these impacts occurring?
- Why are these humans causing these impacts? and
- How will these impacts affect the Great Barrier Reef?

Encourage students to review local and national newspapers the following web addresses contains a media archive of reef related stories:

http://www.gbrmpa.gov.au/corp_site/info_services/media/media_archive.html

Collate all the articles into a media folio

Sorting Out

Media centre

Sort the media articles collected during the media investigation into subject/issue specific categories. Create a media centre in their classroom displaying the major human impacts on the environment, and how they affect the Great Barrier Reef.



Multiple-use resource

Review the major user groups within the Great Barrier Reef Marine Park. Use the Great Barrier Reef Marine Park Authority's website <http://www.gbrmpa.gov.au/> as a source information to identify various user groups and pressures affecting the Great Barrier Reef Marine Park.

User Group	Area Affected	Nature of effects	Time of year	Spatial distribution	Degree of impact
Scientists	Small	Collecting animals and plants, use of chemicals and interaction with animals	All year	All areas and habitats	Usually slight but could be large if working with endangered animals.
Commercial Fishers					
Recreational Fishers					
Tourism					
Indigenous Groups					
Shipping & Energy					

Individual or Group Presentation

Encourage students/groups to prepare either a multi-media presentation, a report or a brochure which conveys detailed information about the:

- Characteristics
- Distribution
- Biodiversity
- Current use
- Threats, risks and issues affecting the Great Barrier Reef
- Future uses
- Management of the Great Barrier Reef
- Impact that human activity is having on the Great Barrier Reef
- Ecologically sustainable management.

Display these details as an on-going reference for students to use. Use brainstorming to guide the investigation and suggestions as to where relevant information might be found. Students should work in groups to prepare for their investigation.



Going Further

Making and justifying conclusions

Once investigations have been completed, and additional information has been weighed up, students could be supported to:

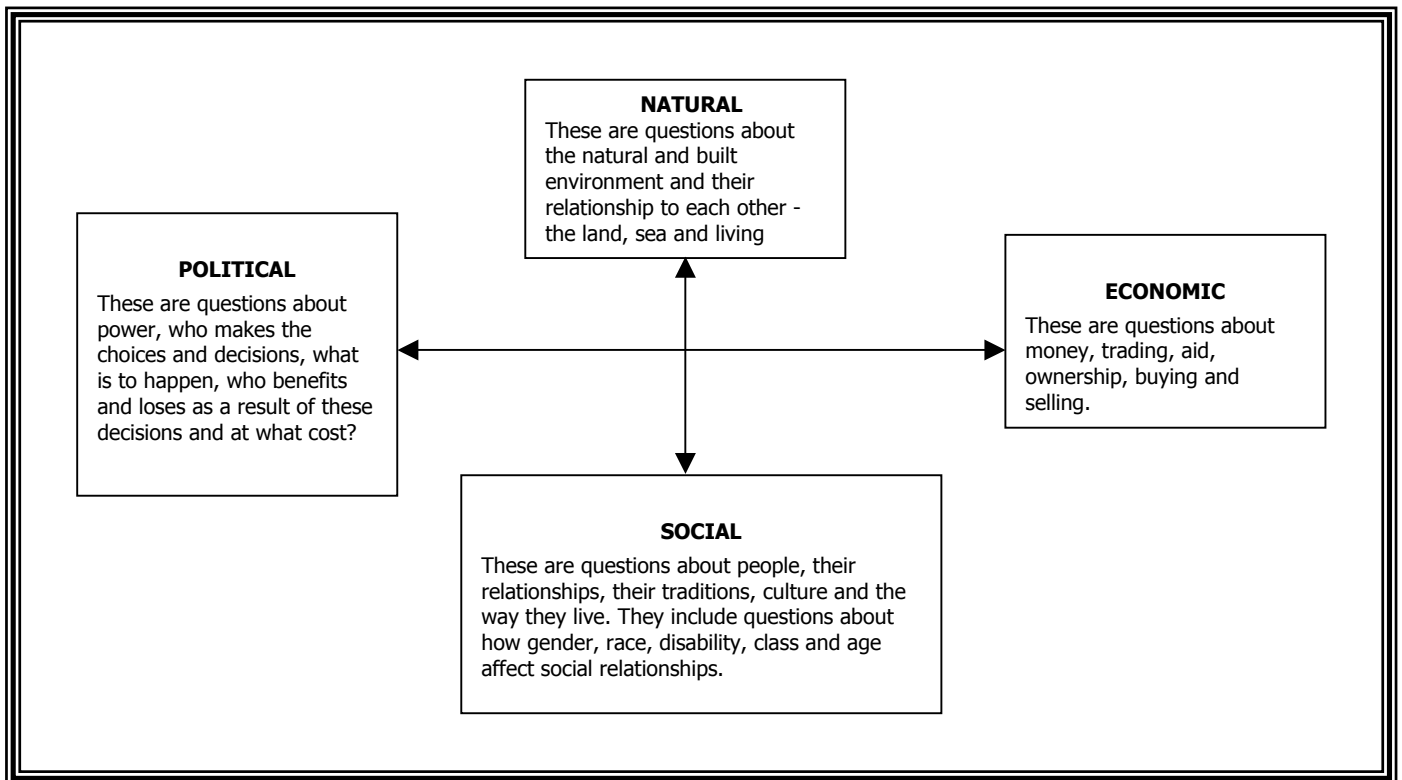
- Write a series of generalisations based on the information that has been analysed.
- Discuss conclusions with other classes and be questioned about them.
- Investigate the economic, environmental and social costs and benefits of various risks, threats, issues and solutions proposed.
- Defend their conclusions by reference to the information they have analysed.
- Consider the consequences of acting in different ways on the conclusions, and/or present the worst and best case scenarios in a persuasive genre.

Cost Benefit Analysis

Undertake a cost-benefit analysis to identify all the costs and benefits the Great Barrier Reef Marine Park makes to our society, environment or economy. If the benefits exceed the costs, the cost-benefit analysis is said to indicate an overall gain to society, or vice versa.

Choose an issue related to the Great Barrier Reef Marine Park and complete a cost-benefit analysis on it. Present your findings to the class for discussion.

Use the following key issue areas as focal points with the cost benefit analysis:



Cause and Effect Wheels

Construct a cause and effect wheel that examines and predicts what may happen to the reef if one or more of these reef creatures were to die out. For example, what could possibly happen if all crown of thorns were to die out?

Construct a cause and effect wheel that examines and predicts what may happen to the reef if one or more non-living elements were to deteriorate. For example, what could possibly happen if the amount of sunlight entering the water was reduced due to sediment run off?

Sustainable Management

Introduce the concept of 'sustainable management'. Students consider the following question.

How can we find a balance between meeting our present needs for resources from the Great Barrier Reef, and conserving and protecting its natural resources for the benefit of future generations? Why is finding this balance so important?

The following web address will provide detailed information about Great Barrier Reef Marine Park management:

http://www.gbrmpa.gov.au/corp_site/management/

Through class discussion students compare ideas, identifying similarities and differences and discuss differing opinions.

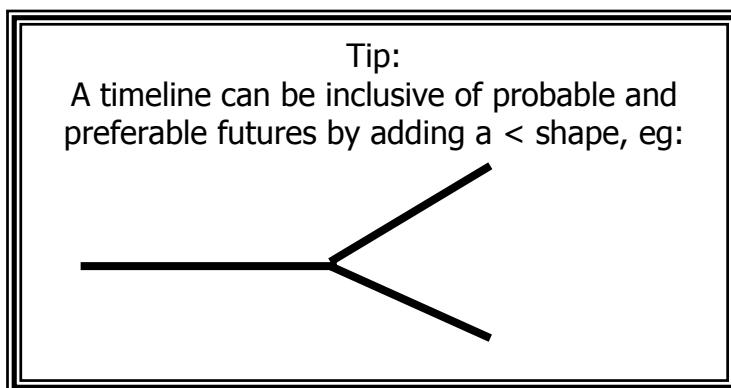
Making Connections

What does the future hold?

What are possible, probable and preferable futures for the Great Barrier Reef?

Working in small groups students plot the significant events for the Great Barrier Reef on a timeline. Students distinguish between those they think local societies had some control over and those over which they had little control.

Teachers demonstrate the continuation of the futures timeline, encouraging students to consider the probable and preferable futures of the Great Barrier Reef. In groups, students discuss the types of decisions needed if these preferable futures were to eventuate.



Students plot probable futures along the upper axis and preferable futures along the lower axis. Probable futures refer to how students expect the future to be, both in their own lives and in the wider world. Preferable futures refer to how students would like the future to be, both in their own lives and in the wider world. Suggested issues for consideration are global climate change and coral bleaching.

Action Research Project

The Great Barrier Reef is under pressure. Everything we do on the reef, along the shore and even on the land affects this diverse and fragile ecosystem. The plant and animal communities that make up the Great Barrier Reef need to be protected for future generations.

Choose a human activity that is putting the Great Barrier Reef under pressure and research answers to the following inquiry questions:

- What and Where?

What type of activity is it? Where is this activity-taking place?

- How and Why?

How activity changed over the years? (consider increases in technology) Why is this activity important to humans?

- What Impacts?

What are the social, economical and environmental impacts of this activity?

- How ought?

What is your preferred vision of the future for this activity? How can we insure that this activity is managed sustainably?

Compare and contrast your chosen human activity to the human activities chosen by other students.

Class Debate

Divide students into debating teams and call upon them to debate topics such as:

- Oceans are for everybody. People should be able to take as much as they want from the ocean;
- Humans need energy to survive. We should mine the Reef for oil and natural gas;
- Tourism makes money. More tourists should be allowed to travel within the Great Barrier Reef World Heritage Area; and
- Biotechnology could lead to many useful and sometimes lifesaving materials and medicines being generated. The increased government funding should be given to reef biotechnology research.



Environmental Impact Assessments & Management Plans

Using one of the debate topics or a current issue relating to the Great Barrier Reef, complete an **Environment Impact Assessment**. Once you have completed your Environment Impact Assessment, follow up and design a **Management Plan** for the activity.

Environmental Impact Assessment

1. **Title:** Your activity needs a title so people will recognise the area you are assessing.
2. **Description of activity:** Briefly outline the activity and when the activity will take place. (Include diagrams of facilities/structures and their location).
3. **Need:** Why is the activity necessary?
4. **Impacts:**
What are the likely impacts on the flora, fauna and ecological processes?
What will be the impacts on water, air or surface quality?
What are the likely impacts on the heritage, wilderness and/or aesthetic value of the area?
What wastes will be generated, how will they be handled and what are the impacts of handling them this way?
What cumulative impacts could arise from this activity given other existing or planned activities?
What is likely to be the most significant negative impact of this activity?
Are there any impacts not addressed above and/or are there any other comments you wish to make?
5. **Mitigation measures:** What action, if any, will be taken to mitigate the impacts of the activity?
6. **Alternatives:** What alternatives to the activity would involve less environmental impact?
7. **Conformity with management plan:** How does the activity accord with any management plan prescriptions applicable to the location?
8. **Possible public concerns:** What public concerns could be expressed about this activity?
9. The Environment Impact Assessment must then be signed and dated.
10. The Assessment will receive a negative or positive recommendation.
11. Finally, the Assessment will receive a Determination stating whether or not the activity will be allowed.



Management Plan

- **Develop** a set of criteria, which could be used to evaluate a management plan;
- **Formulate** a management plan, that is, decide how and by whom the issue should be managed; and
- **Justify** your management plan using the criteria you initially developed.

Taking Action

Community Education

Students can help increase others awareness of an endangered species by designing a poster, brochure or information sheet. This project should detail the species, why is it endangered and what people can do to help. Display these posters on school notice boards, during school assemblies or in the school library.

Submission/Proposal

Take the information gathered during the completion of this unit and develop a formal submission or proposal to be sent to local, state or federal members with regard to a human induced impact.

Creating Popular Culture

Students can develop slogans that encourage protection of the Great Barrier Reef. Screen print T-shirts or calico bags and sell them to raise money for field trip or school environment group.

Become a Reef Guardian School

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

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

Reflection on outcomes

Encourage students to:

- Check to see if their original investigation questions were answered.
- Discuss what the main obstacles and opportunities were to obtaining information about the threats, risks, issues and management practices affecting the Great Barrier Reef.
- Write an account of the investigation or recapitulate through the development of a flowchart identifying various strength and weaknesses, opportunities and threats of the management strategies used by Government to minimise threats and risks to the Great Barrier Reef.
- Reflect on how the investigation has changed students' individual attitudes to the Great Barrier Reef and its pressures.

Following a period of reflection, students could engage in group discussions about how to deal with unresolved questions and initiate further investigations.



Websites

Queensland Studies Authority – Science Syllabus

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

Queensland Studies Authority – Biology Syllabus

http://www.qsa.qld.edu.au/yrs11_12/subjects/bio_science/syllabus.pdf

Queensland Studies Authority – Multi Strand Science Syllabus

http://www.qsa.qld.edu.au/yrs11_12/subjects/multi_science/syllabus.pdf

Reef ED

www.reefed.edu.au

Great Barrier Reef Marine Park Authority

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

Reef HQ

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

Australian Institute of Marine Science

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

CRC Reef

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

Department of Environment and Heritage

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

Department of Primary Industries

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

National Geographic - Virtual World "Great Barrier Reef"

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

References & Resources

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Roberts, M. Reiss, M. & Monger, G. (1993) *BIOLOGY Principles and Processes*. South Melbourne: Thomas Nelson Australia.

Tyler Miller, G. (1994) *Living in the Environment: Principles, Connections, and Solutions 8th Edition*. United States of America: International Thomson Publishing.

Webber, H. & Thurman, H. (1991) *Marine Biology 2nd Edition*. New York: Harper Collins Publishers.

