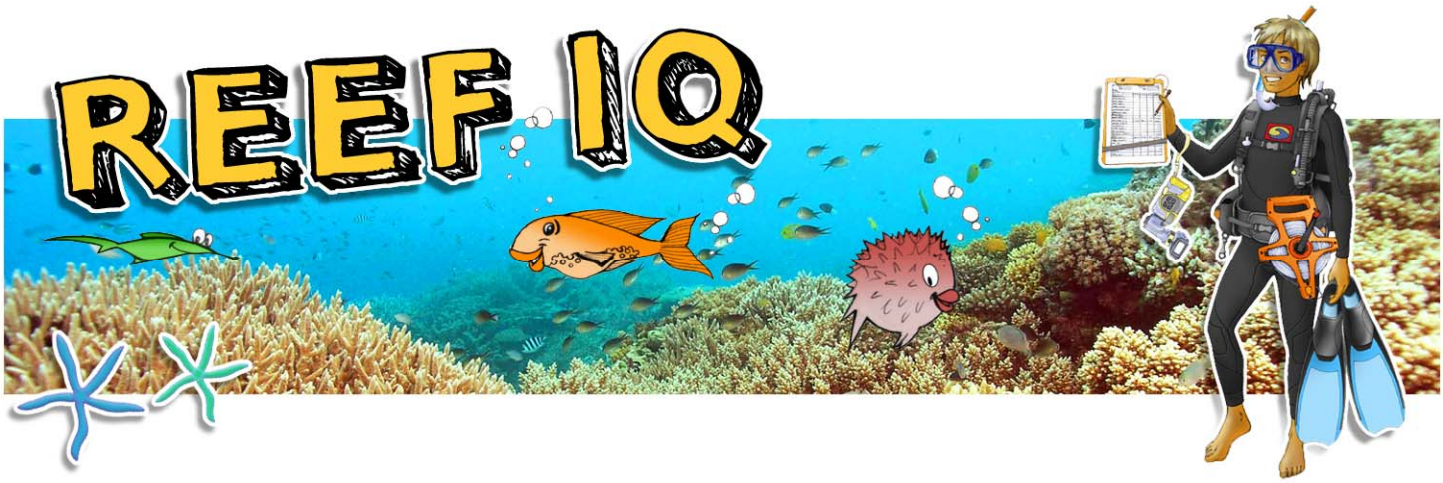

Reef IQ: Teacher Facilitation and Information Guide

Reef IQ

An initiative of Reef Check Australia

Contents Page

Reef IQ

Reef Check Australia's Education Program

Teacher Information and Facilitation Guide

Introduction to Reef Check Australia and Reef IQ:

Reef Check Australia is part of a global network of organisations that involves community volunteers in coral reef monitoring in order to report on coral reef health worldwide. Reef Check Australia's vision is to see healthy coral reefs in Australia and the Indo-Pacific supported by an engaged community.

Our educational program (**Reef IQ)** allows Reef Check Australia to use its unique position, as part of the largest community-based coral reef surveying program in the world, to introduce young people to an environmental monitoring program that is carried out and used by scientists and the community today. This provides young people with a unique learning opportunity to get close to scientific research, with the potential in the near future to actively contribute to it. To this end we have provided online information on the health of individual coral reefs in Australia (with the aim of updating them as often as possible) with data collected by Reef Check Australia volunteers. This allows young people to build a connection with particular reefs and potentially visit the reef if the opportunity exists. The program described below provides a broad range of interactive learning experiences (including suggested field trips) to support the introduction of coral reef monitoring with the aim of raising awareness amongst young people of the value of coral reefs and increasing their participation in the conservation of these precious natural resources.

These materials aim to fit in with the Australian Government's '*Education for a Sustainable Future: A National Environmental Education Statement for Schools'* framework using a combination of the suggested *Inquiry Based Learning* teaching methodology and more traditional approaches. This program also aims to get young people thinking **about** the environment, actively learning **in** the environment, and undertaking activities that are **for** the environment. The lesson plans are organised around the following Inquiry Based Learning framework:

1. Tuning In
2. Finding Out
3. Drawing Conclusions
4. Considering Social Action
5. Reflection and Evaluation

Overview of Reef IQ:

The activities presented in the **Reef IQ Educational Program** provide a simple and exciting way of achieving a large number of Science, SOSE, Geography, and Environment curriculum outcomes while educating students about coral reefs, sustainability, and environmental monitoring (please see supporting curriculum document for more information on links to each state's curriculum). The program content contains all the information, and activities that Teachers need to run the courses. There are 2 courses or sessions within the pack; the '*Coral Reefs and Sustainability*' course and the '*Coral Reef Monitoring for Management*' course. The former focuses on finding out about coral reefs and the marine animals that inhabit them, exploring the coral reef ecosystem and the different roles of the varied coral reef creatures, and finishes by investigating the concept of sustainability encouraging students to carry out sustainable activities in the school, at home or in the community. The latter focuses on investigating the threats to coral reefs and then introduces students to coral reef monitoring and management following Reef Check procedures. Each course is designed to last approximately 8 teaching hours with additional suggestions and materials for homework and field activities supplied. These courses are aimed at Years 4 to 7 (although there is potential for adaptation and use by other age groups) and can be used separately or together, and are an extremely useful resource for enhancing school trips to coral reefs, aquariums or marine environments.

Primary Learning Objectives of Reef IQ Educational Program:

1. To increase awareness, knowledge and interest in coral reefs, the marine creatures that inhabit them and the workings of the coral reef ecosystem. (**Coral Reefs and Sustainability** and **Coral Reef Monitoring for Management**).

2. To increase awareness of the impacts of human activities (on land and at sea) on coral reef ecosystems and encourage sustainable behaviours that minimise these. (**Coral Reefs and Sustainability** and **Coral Reef Monitoring for Management).**

3. To foster connection and raise stewardship of Australia's coral reefs through awareness of an individual coral reef's health, and understanding and potential participation in Reef Check Australia community programs. (**Coral Reef Monitoring for Management**).

4. To begin to understand the processes involved in managing our environment in a sustainable manner, including some of the many issues and challenges. (**Coral Reef Monitoring for Management**).

Provided in this Facilitation and Information Guide:

Each Reef Check Australia Teacher's Facilitation and Information Guide includes the following information on each of the 2 courses:

1. *Session Overview*: provides an overview of the lessons, facilities, equipment and Reef IQ materials required for the session.
2. *Session Plan:* provides detailed instructions on how to conduct each lesson.

Documents provided in the Reef IQ Educational Program Pack:

1. PowerPoint Presentations:

- *'Coral Reefs and their Marine Families'*
- *'Exploring Reef Food Webs'*
- *'Threats and Dangers to Coral Reefs'*
- *'Coral Reef Detective'*

2. Fact Sheets

Organism Fact Sheets		Impact Fact Sheets	How we use coral reefs	Other Fact Sheets
1. Algae	11. Parrotfish	21. Climate Change	28. Aquaculture	35. Healthy Coral Reefs
2. Anemones	12. Sea Cucumber	22. Coral Diseases	29. Culture and Heritage	36. Catchment to Reef
3. Butterflyfish	13. Sea Urchin	23. Crown-of-Thorns starfish	30. Coastal Protection	37. Reef Check Surveys
4. Crayfish	14. Sharks	24. Over-fishing	31. Fishing	38. Reef Food Webs
5. Cleaner Shrimp	15. Snappers	25. Physical Damage	32. Science and Research	39. Sustainability
6. Coral Trout	16. Soft Coral	26. Reef Water Quality	33. Tourism and Recreation	40. What is Reef Check?
7. Damselfish and Anemonefish	17. Sponges	27. Sedimentation	34. Indigenous Knowledge and Uses of coral reefs	
8. Giant Clam	18. Surgeonfish			
9. Hard Coral	19. Sweetlips			
10. Moray Eels	20. Wrasse			

These fact sheets supply the Teacher with general, supplementary information on all of the topics covered in the courses. They can be used by students also but have been designed by for educators and therefore may include terminology not readily understood by children.

3. *Coral Reefs versus Cities* **Activity (2 versions)**

4. *Food Web* **templates (2 versions)**

5. *My Sustainability Action Plan* **templates**

6. *Coral Reef Detective Resources;* **includes coral reef photocard sites, detective notepad and detective results)**

7. *Environmental Management Plan* **template**

8. Knowledge Reviews (one for each course)

Assessment Methods

There are Knowledge Reviews at the end of each course but teachers can use a number of different methods to assess students' progress and knowledge, including contributions to class and group discussions, students' ability to complete activities, general observation, and individual participation levels in group projects.

1. Session Overview

Coral Reefs and Sustainability (Y4-7)

Year Group:	Years 4,5,6 and 7
Location:	Classroom (with outdoor activities suggested)
Time:	8 approximately 1 hour classes
Session Outline	**Tuning In** 1. **Bundling Activity:** Students write on strips of paper all the words they can think of relating to *Coral Reefs and their Marine Families.* These are then grouped into categories and made into a chart which can be changed throughout the course as further knowledge and concepts are accrued. **Finding Out** 2. **Teacher Facilitation**: *'Coral Reefs and their Marine Families'* accompanied by PowerPoint Presentation. This aims to provide the students and teacher with a good foundation of knowledge for building their upcoming research and investigations upon. 3. **Discussion Activity**: Children discuss their indirect and direct experiences of coral reefs and what they already know about them. Visual materials should be used, such as magazines, brochures, and photos from students' visits to reefs. 4. **Student Investigation '***Coral Reef Creature Investigation'*: Students choose and research a creature from the list for the next class. 5. **Student Presentations**: Each student presents their coral reef organism to the class. 6. **Reef Check Game:** Students play the *Reef Check Game* online to see who can identify the marine creatures they have learnt about the quickest. 7. **Student Activity** *'Coral Reef versus Cities':* Students fill in the *Coral Reefs versus City* activity sheets with a brief introduction from the Teacher. 8. **Student Discussion:** Teacher facilitates a discussion revolving around the different roles each marine creature plays in the ecosystem and how the removal of one might affect the others. 9. **Teacher Facilitation**: Introduces the concept of a basic coral reef food web using the selected organisms, accompanied by the *'Exploring Reef Food Webs'* PowerPoint presentation. 10. **Student Activity**: Group or individual construction of food webs using templates provided if desired. 11. **Outdoor Activity**: Students are led on a nature walk to find plants and creatures working out their roles and links to each other within different food webs. 12. **Homework Preparation for Brainstorming**: Students find out how their families and Australians use coral reefs. 13. **Class Brainstorm**: Students discuss the many ways their families

	and other people use coral reefs with teacher facilitating and students recording all the results on the board. 14. **Indigenous Storytelling and Discussion**: Students read an indigenous story on Sea Country aloud in class or individually. Teacher facilitates discussion on story. **Drawing Conclusions** 15. **Student Investigation,** *'Search for the Meaning of Sustainability'***:** Students are either to research online or use materials supplied by the teacher to find a meaning for 'sustainability'. There is no one set definition of sustainability and students should be allowed to come up with the definition that they think best defines sustainability for their reality after conducting their research. 16. **Class Discussion/Activity**: Students review the impacts visited in the '*Coral Reef and Marine Families'* presentation, in a group or class setting. 17. **Student Research:** Students research the human activities that cause or contribute to these impacts, recording their results. **Considering Social Action** 18. **Class Waterway Audit Activity**: Students undertake an 'audit' of the school, school grounds or nearby waterways. 19. **Student Activity:** Students choose sustainable actions to undertake for the term. Students are presented with their *My Sustainability Action Plans* to fill in their proposed actions and personalise. Once filled in these should be put up on the classroom walls. **Reflection and Evaluation** 20. **Knowledge Reviews:** Teachers can use the Knowledge Review provided to assess students' knowledge of the topics studied. 21. **Reflection:** Students should try and follow their My *Sustainability Action Plans* as best as possible with encouragement from the Teacher throughout the term with awards/rewards for those who the Teacher deems most dedicated to completing their plans. At the end of the term, an evaluation class should be held with students discussing how they think they did following their plans, what they found difficult etc.
New vocabulary and concepts:	Coral reef, coral polyps, temperate, zooxanthellae, zooplankton, tentacles, microscopic, algae, habitat, ecosystem, catchment, biodiversity, nutrients, organism, sustainability, wave erosion, sedimentation
Reef IQ materials supplied:	• *'Coral Reefs and their Marine Families'* PowerPoint Presentation • *'Exploring Reef Food Webs'* PowerPoint Presentation • All Fact Sheets (1-40) • *Coral Reefs versus Cities Activity Poster* x 1 copy per individual or group of students • *Food Web* templates • *My Sustainability Action Plan* templates • Reef Check Adventures activities online • Reef Check game online • Coral Reefs and Sustainability Knowledge Review

Equipment required:	• Data projector • Computer with a CD player and MS PowerPoint • Whiteboard and markers • Internet access for students for web-based activity • Magazines, brochures, information from the web on coral reefs etc

2. Session Plan

Coral Reefs and Sustainability (Y4-7)

(This is a suggested session plan that can be adapted to fit different class sizes, lesson times and/or extra learning.)

Class 1: Coral Reefs and their Marine Families

Duration: 1-2 hours

Learning Objectives

- To gain a good knowledge of coral reefs and their ecosystems, and some of the different organisms that live on them.
- To learn the concept of habitat and the diversity of living things within a habitat.
- To learn some of the effects of human activities on natural environments, such as coral reefs.
- To lean about some of the functions of living things.
- To understand the interrelationships between the natural and built environment, resources and systems.

Key Skills and Competencies

- To develop research and investigation skills.
- To potentially learn or improve PowerPoint skills.
- To use a variety of strategies to locate and select information.
- To encourage students to pose and refine questions for their marine investigations.
- To collect and organise information.

Reef IQ material required:

- *'Coral Reefs and their Marine Families'* PowerPoint Presentation.
- Fact Sheets to support any questions on coral reefs.
- Organism Fact Sheets (1-20).

Equipment/ facilities required:

- Computer with a CD player and MS PowerPoint
- Internet (if available) for marine organism research
- Images of coral reefs and their marine families from magazines, brochures, websites etc.
- Individual students' tangible evidence of trips to coral reefs such as photos, brochures, souvenirs etc.
- Paper and pens for drawing coral reefs

Class Overview:

1. *Bundling Activity:* This popular strategy is an excellent way to assess the related vocabulary students bring to a topic. It can form the basis for concept development throughout a unit.
    - Provide groups of students with a set of small cards or paper strips. Ask students to brainstorm words about the topic *Coral Reefs and their Marine Families* and then write them on the strips of paper in their groups.
    - The cards are then bundled to classify ideas that belong together. Ask students to group the words into bundles that seem to 'belong together'.
    - Each bundle is given a heading or label.
    - Bundles can be displayed by pasting words in groups to a large *Coral Reefs and their Marine Families* chart. This chart can be amended or added to during the course.

2. *Teacher presentation*: '*Coral Reefs and their Marine Families*' PowerPoint Presentation
    a. What is coral?

b. Where do they live?
c. What do they eat and how do they function?
d. Why are coral reefs important?
e. What is a healthy environment for coral reefs?
f. What are the man-made threats to coral reefs?
g. What marine organisms live in the coral reef community?

This should be followed by any queries from students, and then questions led by the teacher to understand what students learnt from the presentation.

3. *Discussion Activity*: The teacher should then facilitate a discussion on students' direct and indirect experiences of coral reefs. If students have not visited coral reefs the teacher should facilitate a discussion on what students imagine they are like with the opportunity for students to draw what they believe coral reefs look like. Ask students what they think coral reefs look like; feel like; sound like; and smell like? Any visual images of reefs from magazines, brochures etc can be used to help. If students are likely to have visited coral reefs, photos from their experiences (or brochures, souvenirs etc) can be brought in to show to the class, and potentially build a classroom display.

4. *Homework Activity 'Coral Reef Creature Investigation':* Student investigation (can be web-based) into a coral reef organism from the list provided below. Information can be obtained from the internet, the school library, and/or any other resources that might be available to them. Students should prepare a presentation lasting between 3-5 minutes on their selected organism, either individually or in pairs. Fact Sheets are available on each organism for the Teacher with suggested websites for resources. Students should be encouraged to find information on what they consider to be of value and interest to the rest of the class. They should be encouraged to research the role of their creature in a coral reef ecosystem as this will help them fulfil their next activity. These marine organisms have been chosen for one or a combination of the following reasons:
   - their inclusion in Reef Check surveys
   - their general appeal to young audiences
   - their relative abundance on coral reefs

Organism list:

1. Algae
2. Anemone
3. Butterflyfish
4. Crayfish
5. Cleaner Shrimp
6. Coral Trout
7. Damselfish
8. Giant Clam
9. Hard coral
10. Moray Eel
11. Parrotfish
12. Sea Cucumber
13. Sea Urchins
14. Sharks
15. Snappers
16. Soft Coral
17. Sponges
18. Surgeonfish
19. Sweetlips
20. Wrasse

The teacher can use the following questions to prompt and guide the students in their research, although they should make sure that each pair or individual tries to answer question (e) as this will help students complete the next activity:

a. Why did you choose this organism?
b. How does it feed? And what does it eat?
c. Does it have any predators?
d. Whereabouts on the reef do they live?
e. What is their role in a coral reef society and within the ecosystem?
f. Can you find any more strange or weird facts about the organism that other students might not know?
g. Do humans use them in any way?

Class **2-3: Marine Organisms Presentations**
Duration: **1-2 hours (depending upon number of pupils).**

Learning Objectives:

- To understand some of the functions of living things.
- To learn some of the interactions between living things, and living things, and their environment.
- To understand the concept of ecosystems and the value of each marine organism's role within the coral reef ecosystem.
- To understand the concept of habitat and the diversity of living things within a habitat.

Keys Skills and Competencies

- To use a variety of strategies to locate and select information.
- To collect and organise information.
- To use a variety of strategies to organise and communicate information.
- To develop research and presentation skills.
- To learn to communicate effectively.
- To work in collaboration with others.

Reef IQ material required:

- Organism Fact Sheets (1-20)
- *Reef Check Game* online

Equipment/ facilities required:

- Computer with MS PowerPoint if available
- Computers with internet if available

Class Overview

1. Student Presentations: Each student creates and gives a presentation on their coral reef organism. The presentation can be PowerPoint or as the teacher sees fit. Presentations can be made in groups or individually. We recommend requesting presentations last between 3-5 minutes per student. The students should be asked to include what their marine organisms' role in a coral reef ecosystem is.

Suggestion: Get students to discuss how well they thought each other did using the WIN method of evaluation. For each student's presentation other students should say something they thought was Wonderful, something they thought could be Improved and something they thought was Nice. The teacher should add comments if necessary.

2. Reef Check Game: Students can play the *Reef Check Game* online, competing against each other to see who can identify the marine creatures that they have learnt about the quickest.

Class 4: The Roles of Marine Organisms within a Coral Reef Ecosystem
Duration: Approx 1 hour

Learning Objectives:
- To understand some of the functions of living things.
- To learn some of the interactions between living things, and living things and their environment.
- To understand the concept of ecosystems and the value of each marine organisms role within the coral reef ecosystem.
- To understand the concept of habitat and the diversity of living things within a habitat.

Key Skills and Competencies:
- To work in collaboration with others
- Problem solving
- To communicate ideas and information
- To contribute to discussions

Reef IQ Materials required:
- *Coral Reefs versus Cities* Activity Sheets (2 versions)
- Marine Organism Fact Sheets (1-20)

Equipment/ facilities required:
- Black or white board
- Computers with internet if available

Class Overview:
1. Brief Teacher Facilitation: The Teacher should briefly explain how the students are going to explore ecosystems and the role of different marine creatures in the coral reef ecosystem. Provide a definition of 'ecosystem; '*the interaction between animals and plants and their natural environment'* explaining that each marine creature plays a vital role in the ecosystem that keeps it in balance. Hand out the *Coral Reefs versus Cities* activity sheets and encourage students to fill it in as best as they can.

2. *Student Activity:* Students fill in the *Coral Reefs versus Cities* activity sheets individually or in pairs**.** This activity will help encourage students to think about the importance of the roles of each marine organism and how these are vital within the ecosystem as are the illustrated roles in a human system. There are two different versions of this activity available with the harder versions requiring more research and investigation skills. For the harder version, making the Marine Organism Fact Sheets available will help with the research.

Marine Organism	Key role on coral reef	Why is this a key role on a coral reef?	Similar role in City
Sea cucumbers, sponges, crayfish and giant clams.	Filter and recycle the water to keep it clean and clear.	Waste in the water creates "dirty water" full of nutrients from dead matter which promotes algae growth and reduces both light penetration and space for coral building.	Garbage men who keep the city clean and recycle the appropriate rubbish.
Hard Coral	Builders of the coral reef.	Corals need to keep building to stay near the sea surface where the light is.	Construction Workers who build the buildings in the city.
Parrotfish, surgeonfish, damselfish and butterflyfish.	Graze on algae keeping it in check.	If algae are not eaten its growth is not kept in check and it will smother the coral and kill it by blocking its access to light. It will also prevent settlement of new baby coral by covering any available space on the coral reef.	City Gardeners who help keep the city beautiful and stop it being overrun by plants and the natural environment.
Cleaner wrasse and cleaner shrimp	Help keep marine organisms healthy by removing and eating parasites from them.	If not removed parasites can cause sickness in their host organism.	Doctors who help keep people healthy.
Sharks and Coral Trout	Help keep fish populations under control by predating on them.	Sharks and coral trouts are predators. If their populations are depleted there can be serious consequences. This will cause the populations of their main prey to explode which will have a substantial effect on the whole ecosystem.	Policemen who help control the population.
Algae	Algae	Algae on coral reefs provides food and energy for many of the fish that live on these reefs. Without the algae there would be no fish to help keep the reef ecosystem healthy.	Grocers who provide food and energy for the population.

3**. Review and Discussion:** Answers should be reviewed in class and amendments made. Teacher should facilitate a discussion on how each marine organism's role is connected within the coral reef ecosystem. Discuss what might happen if one of these roles was taken away and try and follow the chain of impacts (this can be compared with how removing a role from the human system, such as a doctor, might impact the system). It would be useful to also bring up how the coral reef ecosystem does not exist independently but is affected by other ecosystems (Fact Sheet 36: Catchment to Reef). This discussion can result in a map on the board with all the creatures showing the different links between them. It can include some of the following questions:

- What would happen to the smaller fish if the protection of the hard coral was removed? *Fish are more likely to be eaten by predators. Evidence has shown that fish populations appear highly sensitive to changes in coral cover, with 62% of fish species declining in abundance within 3 years of disturbances that resulted in a greater than 10% decrease in coral cover* (Pat Hutchings, Mike Kingsford and Ove Hoegh-Guldberg, *The Great Barrier Reef: Biology, Environment and Management,* 2008).
- What would happen to the hard coral if the water cleaners, such as sea cucumbers and giant clams were removed? *The hard coral needs the sea cucumbers to keep the water clean and clear so that they can obtain energy from photosynthesis (or more simply they need the sunlight to grow and therefore they need the water to be clear for the sunlight to reach them).*
- What would happen to the hard coral if the herbivorous fish (algae grazers) were removed? *Butterflyfish, clownfish and surgeonfish help keep algae growth to a minimum so that it does not outgrow coral and smother it.*

- What would happen if the sharks were removed? *Sharks keep the populations of smaller predators under control.*
- What would happen if algae were removed as a source of energy from the coral reef ecosystem? *Algae are a source of food for many of the herbivorous fish.*
- What would happen if cleaner creatures, such as cleaner shrimp and cleaner wrasse, were removed from the ecosystem? *Cleaner creatures keep many of the larger marine creatures healthy.*

Suggestion: If there is time, students can once again play the Reef Check Game to see if they can better their previous scores. If there is time for more practical activities, the Teacher can organise students to do some of the marine creatures activities suggested on the website, such as the squid or sponge experiment.

Class 5: Introduction to Food Webs

Duration: Approx 1 hour

Learning Objectives:
- To learn how the organisms the students have been studying fit into a food web.
- To learn how to construct a simple food web.
- To understand the different relationships between the marine organisms on a coral reef.
- To gain an understanding of the holistic nature of ecosystems.
- To understand natural cycles and systems in the environment.
- To learn some of the interactions between living things, and living things and their environment.

Key Skills and Competencies
- To apply understandings to different situations
- To develop research and investigation skills

Reef IQ materials required:
- '*Exploring Reef Food Webs*' PowerPoint Presentation.
- Reef Food Webs Fact Sheet (38)
- *Food Web* Templates

Equipment/ facilities:
Computer with CD player and MS PowerPoint

Class Overview:
1. *Teacher Presentation:* The teacher uses the PowerPoint presentation '*Exploring Reef Food Webs*' to introduce food webs. *A food chain shows the transfer of energy (food) between animals and plants with a food web showing how these chains are connected*. Each slide can be pre-empted by students with the teacher asking them which creatures feed on what.

2. *Student Activity*: The students create their own food webs for other organisms, either independently or using the Food Web template which looks at a how a number of Australian land creatures fit into a food web. This can be done in pairs or individually.

Suggestion: Students can draw all the different organisms and create different pathways for the food webs turning it into a mini art project. These can be done using other materials such as wool for the links.

3. *Outdoor Activity:* The Teacher should lead students on a nature walk where they can point out different plants and animals and work out how they fit into different food webs and link to each other. Students should be encouraged to find plants and creatures whose roles they do not know and work out what roles they might play in a food web. If possible, unidentified plants or animals should be researched once back in the classroom to find out what they are and to find information on the parts they might play in different food webs.

3. *Student Homework:* Students investigate how their families and Australians use coral reefs. They should each be told to arrive at the next class with 3 different ways of how Australians use coral reefs.

Class 6: How we Use Coral Reefs (including Traditional Owner's Knowledge and Uses)

Duration: Approx 1 hour

Learning Objectives:

- To understand the value of coral reefs to different cultures.
- To understand the ways different cultures view the importance of sacredness in the environment.
- To understand some of the effects of human activities on the environment.
- To understand the different consequences of environmental degradation to different people and cultures.
- To understand the concept of sustainability.

Key Skills and Competencies:

- To develop research skills
- To use a variety of sources to find answers
- To collect and organise information

Reef IQ materials required:

- How we use coral reefs in Australia Fact Sheets (28-34)

Equipment/ facilities required:

- Internet for *Story* search.
- Black or white board.

Class Overview:

1. *Classroom Brainstorm:* Each student should be encouraged to tell the class what they found out about how Australians (and potentially, if the information is brought up, other nationalities) use coral reefs. Students can then brainstorm other ways that they think coral reefs might be used in Australia as well as different countries with all answers being written up on the board. Each topic in Fact Sheets 28-34 should be touched upon.

2. *Indigenous Storytelling Activity and Discussion***:** Find an indigenous story on sea country (or another culture's story) at www.reefed.edu.au/ and discuss different culture's views of the marine environment.

Teacher should facilitate a discussion on what the students felt about the story, including discussing:

- What the kids felt about the story and whether they have done any of the things in the story or know any places like those described in the story.
- How the people in the story see coral reefs and the sea.
- How the people in the story use coral reefs and the sea.
- What words in the story are unfamiliar to the students?
- How important they think the coral reefs and sea are to the peoples' lives in the story. Do they respect the reefs?
- What might happen to the people in the story if the coral reefs were to exist no more?

- Whether they think the people in the story were using the reefs in a way that they can keep on doing indefinitely without affecting the reefs. (*This can lead onto the next activity to find out the meaning of sustainability).*

3. **Student Investigation:** *'The Search for the Meaning of Sustainability'.* So we have found out the ways we use coral reefs. Now we need to investigate whether our human activities are going to let us carry on using these reefs or not, whether we are acting in a sustainable manner or not. But first let's investigate the meaning of this word, 'sustainability' that some students may have heard. Students search for the meaning of 'sustainability' using the resources suggested below. It is important to understand that there is no one definition of sustainability and that it can mean different things to different people. It may be useful for the students to come up with a definition of 'sustainability' as a class or in groups defining what it means to them and their lives.

Suggestion: To take this activity further the teacher can pick different people (or use the list suggested below)) and ask students to discuss or write how they think these people would define 'sustainability' in relation to their lives taking into account such things as their livelihoods, their knowledge, their use of resources, and the effect of a non-sustainable future on their lives.

a. *A sheep farmer with a large station in the Pilbara in Western Australia.*
b. *A Traditional Owner from Palm Island.*
c. *A subsistence fisherman living with his family on an island in the Maldives.*
d. *A rich businesswoman living in New York.*
e. *A factory worker living in the slums in Bangladesh.*
f. *A young person working as a snorkel guide on the Great Barrier Reef and living in Cairns.*
g. *A kid living in a house near the beach in Ayr.*

One definition of Sustainability: The characteristic of a process or state that can be maintained at a certain level indefinitely. In recent years sustainability is often used in reference to our environment as it now widely understood that our current way of living can not be carried on indefinitely due to its impact on the natural environment. Therefore we need to make our activities more *sustainable* in order to survive.

Class 7-8: Waterway Audit and Sustainability Action Plans

Duration: Approx 1-2 hours

Learning Objectives:
- To understand further the threats to coral reefs and how human activities affect these.
- To understand the connectivity between waterways and oceans including coral reefs.
- To learn more about local environments.
- To take action to shape the world we live in.

Key Skills and Competencies:
- To apply understanding and skills to own lives
- To develop research and investigation skills
- To plan and organise activities
- To develop attitudes and skills which are conducive to the achievement of a sustainable future

Reef IQ materials required:
- *My Sustainability Action Plans*
- Coral Reef Impact Fact Sheets

Equipment/ facilities required:
- Black or white board, or pens and paper
- Computer with internet

- Research materials for causes of impacts

1. *Class Discussion Activity:* First of all revisit the current, major threats to coral reefs which were mentioned in the first presentation. See how many students can remember. These include:

- Global Climate Change leading to coral bleaching (and ocean acidification among other things) *caused by human activities that increase carbon dioxide emissions such as the burning of fossil fuels for electricity and fuel use in vehicles.*
- Bad water quality/runoff from chemicals and nutrients *caused by leakage into waterways from farms and gardeners using fertilisers and chemicals.*
- Physical Damage *caused by breaking and destroying of coral from visitors, fishers and boats*.
- Rubbish from the mainland, such as cigarette butts and plastic bags can hurt coral reefs and their marine families *caused by littering and blow aways from landfills.*
- Overfishing which reduces fish stocks which has a number of effects including the increased growth of algae leading to potential smothering of coral reefs (in some countries destructive fishing practices, such as dynamite fishing, also occur, destroying coral reef).
- COTS/Coral disease, with increasing evidence that these may be more prevalent if there are more nutrients in the water.
- Sedimentation where sediments or suspended water particles enter the water making it murky and unsuitable for coral survival. *Increased sedimentation occurs due to deforestation, coastal development and certain farming practices.*
- Pollution from *oil, untreated sewage and marine debris that leaks into the sea.*

2**. Student Research**: Many of the threats to coral reefs are caused by human activities. These practices are not contributing to sustainability as eventually coral reefs will become extinct if these activities are not changed. The students should research the human activities that cause each of these impacts and record them down for use in their Sustainability Action Plans.

3. *Outdoor Activity: Waterway Audit*
After looking at what causes the threats to coral reefs, students should look at what they can do to help protect coral reefs. Emphasize that you can help protect coral reefs from anywhere as impacts such as climate change are intensified by the activities of humans all over the world. First undertake a 'waterway audit' of your school, grounds or a waterway near you school. Investigate a waterway near you, what rubbish can you find in it? Are there any drains that lead into it? What about the school drains in the grounds? Where do they go? What about the drains in the street outside? Is there rubbish in them? What chemicals might go into these drains? What chemicals do you throw down the drains in the school? Students should investigate their classroom, school grounds and waterways to investigate ways to make their school more sustainable and stop waste falling in the waterways. Ensure the students write down all the different things they find to consider for incorporation into their Sustainability Action Plans in the next section**.** (More information and data sheets on waterway audits can be found at www.reefed.edu.au).

4. Student Action Plans
Students are presented with their *My Sustainability Action Plans* to colour and fill in. These can be done individually, in pairs or in groups. Students should pick actions derived from their prior investigations and research that they are going to carry out to help protect coral reefs. Once filled in these should be personalised through colouring in and decoration and then should be put up on the classroom walls.

Suggestion: Students can form 'clubs' to fill in their Action Plan and then concentrate on a certain area and work together to complete their activities.

Review and Evaluation

1. *Knowledge Reviews*: The Teacher can use the '*Coral Reefs and Sustainability'* Knowledge Review to assess students knowledge of the areas studied. This should only be used as a guide to students' progress.

2. *Reflection***:** Students should try and follow their 'My Sustainability Action Plans' as best as possible with encouragement from the Teacher throughout the term with awards/rewards for those who the Teacher deems most dedicated to completing their plans. At the end of the term, an evaluation class should be held with students discussing how they think they did following their plans, what they found difficult and what they enjoyed most etc.

Suggested Further Activities for Coral Reef and Sustainability:

- Take a trip to a coral reef. Find out more about the activities available for young people and schools to undertake monitoring activities on coral reefs from Reef Check Australia available in 2010.
- Visit our supporter and partner *Sea World.* There you can see Reef Check Australia volunteers training in the tank or undertake a snorkel survey looking out for the creatures you have learnt about.
- Clean Up Days (school grounds, local parks, waterways).
- Become a Reef Guardian School and help protect the coral reef at www.reefed.edu.au/home/guardians
- Create a learnscape in the school grounds to help the kids learn about catchments and waterways and how these can eventually affect sea life and coral reefs. www.learnscapes.org

1. Session Overview:

Coral Reef Monitoring for Management: (Y4-7)

Year Group:	Years 4,5,6 and 7
Location:	Classroom (with outdoor activities suggested)
Time:	8 approx 1 hour classes
Session Outline:	**Tuning In** 1. **Paired Interviews:** Students interview each other in pairs finding out what they know about coral reefs and the impacts that might be threatening them. Students then record their findings to class. **Finding Out** 2. **Teacher Facilitation:** '*Threats and Dangers to Coral Reefs*' accompanied by PowerPoint Presentation, providing a good knowledge foundation with which to build further student investigations and research upon. 3. **Student Investigation 'Threats to Coral Reefs'**: Students research the different impacts that affect a coral reef in preparation for their presentations (can be web-based). 4. **Student Presentations**: Individual (or in pairs) presentations on the impacts and what causes these impacts. 5. **Student Debate/ Discussion**: *Do you think everyone has a responsibility to help protect coral reefs, even those people who do not directly use them or live near them*? Facilitate a discussion on how a number of these impacts are not done by the activities of humans on reefs but rather the activities of humans on land and even from quite far inland. 6. **Reef Game:** Students play the *Reef Check Game* identifying creatures that live on the reef and impacts that negatively affect it. 7**. Teacher Facilitation**: '*Coral Reef Detective*' accompanied by PowerPoint presentation. This should provide a good knowledge base for the classroom monitoring or 'coral reef detective' activities. 8. **Classroom activity**, *Coral Reef Detective:* Students conduct coral reef surveys using the coral reef photocard sites, and collate and analyse their findings. **Drawing Conclusions** 9. **Classroom discussion**: Students present and discuss their findings. Discussion around results. 10. **Student Research**: Students research courses of action to mitigate the threats that their findings identified, within their school or community. 11. **Student Activity**; Development of simple management plan for a local school or community situation using the Environmental Management Plan template (if desired). **Considering Social Action** 12. **Classroom Discussion**: How effective are management plans in real life and what might help improve their efficacy? 13. **Student Activity 'Sustainability Club'**: In groups students decide on an activity that they wish to pursue for the term to help mitigate one of the impacts that they have learnt about, and form a club to carry out their activity. **Reflection and Evaluation** 14. **Knowledge Reviews**: Teachers can use the Knowledge Review on '*Coral*

	Reef Monitoring for Management' provided to assess students' knowledge of the topics studied. 15. **Reflection:** Students' should run their environmental group throughout the term with encouragement from the Teacher and time set aside. At the end of the term they should reflect on their achievements and the difficulties they encountered. *Ideally this course would end in a trip to a coral reef or to an aquarium where students can practice their newly acquired monitoring skills.*
New Vocabulary and Concepts	Coral polyps, zooxanthellae, habitat, ecosystem, biodiversity, wave erosion, nutrient, ocean acidification, sedimentation, over fishing, substrate survey (Reef Check terminology), invertebrates, transect lines (Reef Check terminology), replicates (Reef Check terminology)
Reef IQ materials supplied:	• '*Threats and Dangers to Coral Reefs*' PowerPoint Presentation • '*Coral Reef Detective*' PowerPoint Presentation • Coral Reef Photocard Sites (8 sites plus 4x10 missing codes) • Coral Reef Detective Notepad • Coral Reef Detective Results • Fact Sheets 1-40 • *Environmental Management Plan* Templates • Reef IQ game online • Reef IQ activities online • Coral Reef Monitoring for Management Knowledge Review
Equipment required:	• Data projector • Computer with a CD player and MS PowerPoint • Whiteboard and markers • Internet access for students for web-based activity

2. Session Plan

Coral Reef Monitoring for Management (Y4, 5, 6 and 7)

(This is a suggested session plan that can be adapted to fit different class sizes, lesson times and/or extra learning.)

Class 1: Coral Reef Impacts

Duration: Approx 1-2 hours

Learning Objectives:

- To learn the basics about coral reefs.
- To understand why they are important.
- To learn about the threats that coral reefs are facing.
- To investigate one of these threats in depth.

Key Skills and Competencies

- To collect and organise information
- To develop research and presentation skills
- To communicate ideas and information

Reef IQ materials required:

- PowerPoint Presentation '*Threats and Dangers to Coral Reefs*'
- Impact Fact Sheets (21-27)

Equipment/ facilities required:

- Computer with CD drive and MS PowerPoint
- Internet for research

Classroom Overview:

1. *Paired Interviews:* Students conduct interviews in pairs to find out how much they know about coral reefs and the threats facing them. They can be encouraged to conduct them like a news interview or TV interview. Students should be given some tips on interviewing such as eye contact, nodding, not interrupting etc.

- Explain to the students that they are going to find out what someone else knows about coral reefs and the threats facing them.
- As a class list some of the questions that students should ask each other. These questions should come from the students themselves.
- Organise the students into pairs and give each one a time limit to interview their partner. The information should be recorded on notepads.
- Students should reveal what they found out either orally or in written form to the rest of the class.

Suggestion: If a video camera is available the interviews can be recorded and the best ones played back to the class.

2. *Teacher Presentation:* '*Threats and Dangers to Coral Reefs*'

- What is a coral?
- What are coral reefs?
- Why are coral reefs important?
- What is a healthy environment for coral reefs?
- What are the threats to coral reefs?

3. *Student Research (in class or for homework):* Students research a different impact from the following list in preparation for a 5 minute presentation to the rest of the class. This should include researching what causes or contributes to these impacts. This can be done individually or in pairs. Students can do the same topic but all topics should be covered.

- 2 Climate Change topics; Coral Bleaching and Ocean Acidification
- Coral Diseases
- Physical Damage
- Pollution and Rubbish
- Sedimentation
- Fishing (overfishing and destructive fishing practices)
- Reef Water Quality (focusing on nutrient runoff)
- Crown of Thorns Starfish

Suggested research:

a. *Describe the impact including its origins.*
b. *Do Australian coral reefs suffer this type of impact?*
c. *What human activity (if any) causes or contributes to the impact?*
d. *Describe the effect of the impact on the health of the coral reef?*
e. *Describe the long-term effects on human use of those coral reefs should the impact continue?*
f. *Suggest possible ways of reducing the threat.*

Classes 2-3: Impact Presentations and Class Discussion/Debate

Duration: Approx 1-2 hours depending on the number of students.

Learning Objectives:

- To gain more in-depth knowledge about the threats facing coral reefs.
- To understand the human activities that cause or contribute to these impacts.

Keys Skills and Competencies

- To develop research and investigation skills
- To collect and organise information
- To locate information from a variety of sources
- To develop effective communication skills; debating, discussion and presentation skills

Reef IQ materials required:

- Impact Fact Sheets (21-27)

Equipment/ facilities required:

- Computer with MS PowerPoint
- Internet

Classroom Overview:

1**.** *Student Presentations***:** Each student creates and gives a presentation on their impact. The presentation can be PowerPoint or as the teacher sees fit. Presentations can be made in groups or individually. We recommend requesting presentations last approximately 5 minutes per student.

Suggestion: Encourage students to discuss how well they thought each other did using the WIN method of evaluation. For each student's presentation other students should say something they thought was Wonderful, something they thought could be Improved and something they thought was Nice. The teacher should add comments if necessary.

2**.** *Classroom Discussion/Debate***:** Teacher facilitates a discussion on how many of these impacts are not done by the

activities of humans on reefs but rather the activities of humans on land and even from quite far inland. Explain how some water catchments lead eventually to the reef. Can you name some of the ways people far away from reefs can still harm them? Why might reefs be important to people who do not live near them? (Use the Fact Sheets 'How we use coral reefs', the Impact Fact Sheets, and Fact Sheet 36: Catchment to Reef to help with this discussion).

Suggested Debate Question: Do you think everyone has a responsibility to help protect coral reefs, even those people who do not directly use them or live near them?

3. *Reef Check Game:* Students can play the *Reef Check Game* online to see who can identify the marine creatures and impacts to coral reefs the quickest.

Class 4-6: Coral Reef Monitoring

Duration: 2-3 hours

Learning Objectives:

- To learn to survey a coral reef using Reef Check procedures.
- To carry out classroom monitoring surveys.
- To work effectively together in teams.
- To learn to record data accurately.
- To learn to analyse and interpret quantitative data.

Key Skills and Competencies

- To collect, analyse and organise information
- To plan and organise activities
- To collaborate with others in teams
- To draw and justify conclusions based on information and evidence

Reef IQ materials required:

- '*Coral Reef Detective*' PowerPoint
- *Coral Reef Detective Pack* (includes photocards, Detective Notepads and survey results)

Equipment/ facilities required:

- Floor space
- Measuring Tape (for Reef Check Investigation)

Classroom Overview:

1**.** ***Teacher Facilitation*****:** *'Coral Reef Detective'* accompanied by PowerPoint presentation. This presentation leads the students though the classroom monitoring activity, including conducting the survey and entering and analysing the data. There are 2 main new words to learn here which are associated with scientific monitoring and used in the Reef Check monitoring protocol, *transect* and *substrate.*

Substrate definition: In biology substrate is the surface that a plant or animal lives on. For Reef Check Australia the substrate is any surface that the plumb line lands upon, so this can be coral, sponge, algae, other marine organisms, rock, silt, sand or rubble.

Transect Definition: In science a transect is a line or narrow belt (measured by the transect or measuring tape) that is used to survey a sample of the distribution of organisms across the given area.

2. *Student Activity***, '***Coral Reef Detective':* Students should become 'coral reef detectives' and undertake investigations (or surveys) of different Australian coral reefs. There are a number of different investigation activities that can be done using the coral reef photocard sites and coral reef detective notepads. There are 8 coral reef photocard sites in total (with 40 cards in each) with 4 impacts sites and 4 coral reef sites. There are also an extra 40 coral reef photocards without substrate codes that can be incorporated into each of the 4 coral reef sites.

- *Impact Investigation:* Students should become 'coral reef detectives' to find out what impact may be harming their coral reef. Each group of students should be handed an *Impact Photocard Site* (40 cards) to lay out in 4 transects with 10 cards in each (imitating a Reef Check survey). They should then investigate their reef filling in their *Coral Reef Detective Notepad.* Depending on the age group and abilities each group can do just their reef or swap around investigating other groups' reefs as well. A healthy reef unaffected by an impact can be added into this activity.
- *Coral Reef Health Investigation:* Students should become 'coral reef detectives' to investigate the health of their coral reef. Each group of students should be handed a *Coral Reef Photocard Site* (40 cards) to lay out in 4 transects with 10 cards in each (imitating a Reef Check survey). They should then investigate their reef filling in their *Coral Reef Detective Notepad.* Depending on the age group and abilities each group can do just their reef or swap around investigating other groups' reefs as well. There is also the option to include some identification in these surveys by adding the photocards with missing substrate codes (and taking out the ones with codes). Students should fill in these codes in their *Coral Reef Detective Notebooks* with a different coloured pen/pencil.
- *Reef Check Investigation*: Students should lay out as many photocards as possible to create a large coral reef site. Students should then act as *Reef Check scientists* to undertake a Reef Check survey using a transect or measuring tape. Students should randomly survey areas of the reef noting 40 different cards. Results are not fixed and students should analyse their results according to knowledge gained so far.

3. *Student Analysis***:** Students analyse their findings and write up their results. Students should focus on answering the following questions for each reef:
    - Do you think this is a very healthy reef?
    - Do you think there is a particular threat harming this reef?
    - What do you think this threat is?
    - What other comments can you make about this reef?

4. *Classroom Discussion***:** Students discuss and compare results according to the selected investigation discussing what impacts might be affecting each reef, what activities might be causing or contributing to these impacts, how healthy each reef is and comparing different reef sites. If substrate identification activities were carried out, students should compare their answers. (*N.B Results are available for teachers in the Coral Reef Results. For answers to missing substrate codes look at the full version photocard sites).*

Suggested Bonus Activity: Kids can play the Reef Check Game online to compete against each other to see who is the best at identifying creatures and dangers to coral reefs! This will help build upon their identification techniques (Suggestion: this game can be used as a bonus at the end of class or as a reward to kids for working hard).

Class 7-8: Coral Reef Monitoring for Management

Duration: 1-2 hours

Learning Objectives:

- To further understand the human activities that are negatively impacting coral reefs.
- To learn how to construct a simple environmental management plan.
- To understand the limits of a management plan and what can potentially make them more effective.
- To work in a team to develop ideas to help protect the environment in the school or the local community.

Key Skills and Competencies:

- Collect and organise information
- Develop research and investigation skills
- Plan and organise activities
- Collaborate with others in a team
- Apply understanding and skills to own lives

- To be innovative and devise creative solutions
- To develop attitudes and skills which are conducive to the achievement of a sustainable future

Reef IQ materials required:

- *Environmental Management Plan* templates

Classroom Overview:

1. *Student Investigation***:** Students choose some of the human activities that are contributing to the identified impacts to coral reefs, and research which activities they can focus on to mitigate within their own school or community. This should involve students developing the questions needed to find out what activities in their school or community might contribute to threats to coral reefs and find out what actions can be taken to mitigate the effects of these human activities.

2. *Student Activity*: Students use their investigation results to fill in a simple Environmental Management Plan, using the templates if desired. This activity is to help students to begin to understand how environmental impacts are addressed. These plans can be used to help students decided and plan their activities for their 'Sustainability Club'.

3**.** *Class Discussion***:** Students should discuss any difficulties they had filling in their Environmental Management Plans. What problems do they think might environmental agencies encounter in developing and implementing Environmental Management Plans on a much larger scale? Students discuss the effectiveness of environmental management plans, how difficult it is to implement them, what might be the main problems impeding their success, who should implement them and what factors would help to achieve their objectives. It is important for young people to understand that additions to our knowledge are resulting in constant updating of management strategies and that is therefore a dynamic process rather than a static one. Knowledge and science is an ever changing area with how we study and what we consider important to study periodically undergoing change.

4**.** *Student Activity 'Sustainability Club'*: Students should get into groups and choose one of the human activities within their school or community that they have researched that is detrimental to coral reefs. This can include activities that affect coral reefs indirectly, such as those that contribute to climate change, or those that affect coral reefs directly, such as rubbish in drains and waterways leading to coral reefs. The students form a club in their group and decide on a course of action to mitigate the impact of these activities. Examples include forming a School Climate Change Club promoting ways the school can decrease their carbon dioxide emissions, organising to introduce compost bins into the school, increasing recycling in the community, developing an online car pooling site for parents, campaigning to stop littering, or trying to encourage the banning of plastic bags in the local supermarkets. The Environmental Management Plans can be used once again to help the groups develop and plan their activities.

Review and Evaluation

1. Knowledge Review: Teacher can use the *Coral Reef Monitoring for Management* Knowledge Reviews to assess students knowledge of the areas studied. This should only be used as a guide to assess students' progress.

2. Reflection: Students should carry out their club activity throughout the term. At the end of the term they reflect on what they have learnt, the difficulties they encountered, what they enjoyed most, how their learning could be improved etc.

Suggested further activities for coral reef monitoring for management:

- Sea World Visit: Organise a **Sea World** visit for your class where they can undertake a snorkel tour and try out some of their newly acquired skills.
- Coral Reef Field Trip: Students can identify the creatures they have learnt about and practice their coral reef survey skills whilst snorkelling (and in 2010 Reef Check Australia practical materials will be available which will allow kids to undertake simple surveys and input their data into our database for use by coral reef scientists).

- Aquarium: Monitor fish and coral at your local aquarium (such as the Reef HQ in Townsville) using Reef Check's Underwater Reef Guide.
- Video-conferencing at Reef HQ: Participate in a video-conference with other schools both in Australia and overseas to discuss the results of classroom monitoring of a local coral reef, or experiences of coral reefs and marine life. People use coral reefs differently in different places. It is extremely valuable to link children from different cultures to increase understanding about issues outside their own experiences and to reflect on local human use and coral reef management in Australia.
- Create a learnscape on the school grounds using recycled products depicting coral reefs and the impacts that are affecting them. Or create a recycled image of coral reefs showing the links between inland waterways and coral reefs, depicting the journey of a piece of rubbish and how this can eventually end up harming a coral reef creature (see www.learnscapes.org for more information on learnscapes).

Additional Resources

Marine Education Websites:

- Reef HQ: Reef HQ is the National Education Centre for the Great Barrier Reef and is based in Townsville. This site contains information about the Reef HQ and fun games related to marine life. www.reefhq.com.au
- ReefED: This website is supported by GBRMPA (Great Barrier Reef Marine Park Authority) and provides a wealth of resources about the animals, plants, habitats and the features of the Great Barrier Reef including a range of free teaching resources. www.reefed.edu.au
- Project Aware: The AWARE Kids site provides different interactive marine games as well as sustainable missions for kids to participate in. You can also download a Teachers' Guide that helps actively teach primary schools kids about issues facing the underwater world and provides hands-on opportunities to participate in solutions. www.projectaware.org/kids/

Environmental Education Websites

- MESA (Marine Society of Australasia): www.mesa.edu.org
- MTAQ (Marine Teachers Association of Queensland): http://www.marineteachers.org.au/
- SEMPS (School Environmental Management Plans): http://www.curriculumsupport.education.nsw.gov.au/policies/envired/implement/implement/index.htm
- Learnscape: www.learnscapes.org
- Australian Sustainable Schools Initiative: http://www.environment.gov.au/education/aussi/index.html
- Education for Sustainability: http://www.environment.gov.au/education/index.html

Other useful websites:

- http://seaworld.myfun.com.au/ Arrange your visit to **Sea World** as a great way to reward the students for their hard work.
- www.reefcheck.org Website of the international **Reef Check** based in California. This site also gives information on other Reef Checks around the world.
- www.gcrmn.org Website of the **Global Coral Reef Monitoring Network**
- www.icran.org Website of the **International Coral Reef Action Network**
- www.icriforum.org Website of the **International Coral Reef Initiative**

References and Supporters

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