

# Applicable standards

## Next Generation Science Standards (NGSS)

High School Life Science	Lessons						
	1	2	3	4	5	6	7
<b>Element of the curriculum</b>							
<b>Ecosystems: Interactions, Energy and Dynamics</b>							
<ul style="list-style-type: none"> <li>• <b>HS-LS2-6.</b> Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem</li> </ul>	✓	✓	✓				
<ul style="list-style-type: none"> <li>• <b>HS-LS2-7.</b> Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</li> </ul>				✓	✓	✓	✓
<ul style="list-style-type: none"> <li>• <b>HS-LS2-8.</b> Evaluate evidence for the role of group behaviour on individual and species' chances to survive and reproduce.</li> </ul>			✓				
<b>Interdependent Relationships in Ecosystems</b>							
<ul style="list-style-type: none"> <li>• <b>HS-LS4-6.</b> Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.</li> </ul>					✓	✓	✓
<b>Weather and Climate</b>							
<ul style="list-style-type: none"> <li>• <b>HS-ESS3-5.</b> Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.</li> </ul>			✓	✓			
<b>Human Sustainability</b>							
<ul style="list-style-type: none"> <li>• <b>HS-ESS3-1.</b> Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.</li> </ul>	✓	✓	✓				
<ul style="list-style-type: none"> <li>• <b>HS-ESS3-3.</b> Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.</li> </ul>		✓	✓	✓			
<ul style="list-style-type: none"> <li>• <b>HS-ESS3-4.</b> Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</li> </ul>					✓	✓	✓

## Lesson 1: How is coral reef biodiversity useful and important?

### Overview

This lesson begins by establishing the aims of the unit. The students will use the information in this unit to select and justify a site for a Marine Protected Area (MPA) off the coast of Belize. This lesson will cover the importance of coral reefs, the so called 'rain forests of the sea', to a local community in Timor-Leste. Students develop their understanding of mutualism, biodiversity and how it is useful and important to us and the Earth as a whole.

### Learning outcomes

- Say what a coral reef is and identify locations
- Outline the structure and scale of a coral reef
- Define the key terms 'mutualism' and 'biodiversity'.
- Explain the importance of biodiversity to resilience

### Resources



#### Slideshow 1:

How is coral reef biodiversity useful and important?



#### Student Sheet 1a:

Coral reef scales card sort

#### Student Sheet 1b:

Coral and biodiversity summary



#### Answer Sheet 1b:

Coral and biodiversity summary



#### Video:

Welcome to Timor-Leste



#### 360 Gallery:

The Great Barrier Reef



#### Activity:

Incredible edible polyps



#### Subject Update:

Learn more: Coral reefs

#### Subject Update:

Learn more: Why use 360VR in the classroom

#### Subject Update:

How to: Quick Start to 360VR in the classroom

## Lesson 2: How can humans directly threaten reefs?

### Overview

In this lesson students will develop their understanding of how humans present direct threats to biodiversity, and how to write a logical explanation. This idea is then developed further in the next lesson. The context of the lesson is how the villagers of Com could be harming their reef by using it.

### Learning outcomes

- Describe the importance of all animals within the coral reef ecosystem
- Describe threats to the reef
- Define and use the terms 'overfishing', 'destructive fishing', and 'trophic cascade' correctly

### Resources



#### Slideshow 2:

How can humans directly threaten reefs?



#### Student Sheet 2a:

Species card sort

#### Student Sheet 2b:

Reef uses

#### Student Sheet 2c:

Threats to reef information sheet

#### Student Sheet 2d:

Threats table



#### Subject Update:

Learn more: Human activity on the reef

#### Subject Update:

Learn more: Coral futures

## Lesson 3: How can humans indirectly threaten reefs?

### Overview

In this lesson students will develop their understanding of indirect threats to coral reefs, such as climate change, which causes the sea temperatures to rise and coral bleaching to occur. The context of the lesson is how human activities outside of Com village could be harming the local reef.

### Learning outcomes

- List human actions which can have an indirect impact on reefs
- Define and use the terms 'coral bleaching', 'sedimentation', 'turbidity' 'global warming' and 'ocean acidification' correctly
- Explain the cause and impact of a range of threats

### Resources



#### Slideshow 3:

How can humans indirectly threaten reefs?



#### Student Sheet 3a:

Crown-of-thorns starfish information clues

#### Student Sheet 3b:

Coral threat activities



#### Answer Sheet 3a:

Crown-of-thorns starfish answers

#### Answer Sheet 3b:

Coral threat activities answers

#### Answer Sheet 3c:

Mark Scheme



#### Activity Overview 3a:

Sedimentation

#### Activity Overview 3b:

Ocean acidification



#### Activity:

Cloudy waters

#### Activity:

Ocean acidification in a cup



#### Video:

Underwater classroom: Coral bleaching



#### Subject Update:

Learn more: Corals in a high CO<sub>2</sub> world

## Lesson 4: How do we decide which areas to protect?

### Overview

The aim of this lesson is for students to develop their understanding of how to complete a transect and to investigate the impact of abiotic factors on distribution and abundance of biodiversity on reefs. The context of the lesson is the work of the XL Catlin Seaview Survey which aims to compile a global reef record using 360 imagery.

### Learning outcomes

- Describe what a transect is
- Describe how to complete a transect
- Explain reasons for completing a transect

### Resources



#### Slideshow 4:

How do we decide which areas to protect?



#### Student Sheet 4a:

Investigating information

#### Student Sheet 4b:

Investigation tasks



#### Video:

Snorkels and science

#### Video:

Seaview Science: Monitoring the reef



#### Subject Update:

About: XL Catlin Seaview Survey

### Lesson 5: How can we protect the reef?

#### Overview

In this lesson students will start of by looking at the life cycle on coral reefs and the importance of mangrove forests and sea grass to the biodiversity of coral reefs. Following that students learn what MPAs are and decide where they would locate the four different MPAs in Com. The context of the lesson is the proposal for a new community marine protected area in Com.

#### Learning outcomes

- Describe the need for a variety of habitats in the lifecycle of a species
- Give some examples of how to protect reefs
- Explain why the location of an MPA has been chosen and justify with ecological reasons

#### Resources

**Slideshow 5:**

How can we protect the reef?

**Student Sheet 5a:**

Threats and solutions card sort

**Student Sheet 5b:**

Map to sketch MPA

**Student Sheet 5c:**

Timor-Leste MPA

**Map:**

Timor-Leste Google Map

**Subject Update:**

Learn more: Conservation on the Great Barrier Reef

**Subject Update:**

How to: Create a placemark on Google Earth Pro

**Subject Update:**

How to: Open saved placemarks in Google Earth Pro

## SCHEME OF WORK

### Lesson 6: How are members of the community affected by MPAs?

#### Overview

Following on from last lesson, students consider the impact of biodiversity protection methods on different groups of people by watching a series of stakeholder videos. They go on to prepare arguments for a debate in the next lesson. The context of the lesson is the proposal for a new Community marine protected area in Com and what different people think about this.

#### Learning outcomes

- Describe how different people use the reef
- Describe how an MPA would affect different stakeholders
- Explain why a stakeholder might be for or against an MPA on the reef
- Justify the decision to place an MPA in Com, Timor-Leste

#### Resources



##### **Slideshow 6:**

How are members of the community affected by MPAs?



##### **Student Sheet 6a:**

Stakeholders

##### **Student Sheet 6b:**

Preparing arguments



##### **Video:**

Stakeholder on the reef:  
Community

##### **Video:**

Stakeholder on the reef:  
Fishermen

##### **Video:**

Stakeholder on the reef:  
Government

##### **Video:**

Stakeholder on the reef:  
Local Tourism

##### **Video:**

Stakeholder on the reef:  
Tourism Operator

### Lesson 7: Which MPA proposal is the best?

#### Overview

Following on from last lesson, students have a debate from the perspective of the different stakeholders. After this students' will demonstrate their learning from lessons 5-7 by completing a long answer question evaluating two proposals for a new community Marine Protected Area in Com. The context of the lesson is to bring the learning from previous lessons together in order to help decide where the students might place their MPA in their final lesson.

#### Learning outcomes

- Describe positive and negative features of a proposed MPA
- Compare two proposed MPA giving positive and negative features of each
- Select the best site for the proposed MPA and justify your choice

#### Resources



##### **Slideshow 7:**

Which MPA proposal is the best?



##### **Student Sheet 7a:**

Long answer question

##### **Student Sheet 7b:**

GCSE style exam questions



##### **Answer Sheet 7a:**

Long answer question

##### **Answer Sheet 7b:**

GCSE style exam questions