

The Jockey Club “Ridge to Reef” Environmental Education Programme Geography (Junior Secondary) lesson plan – Ocean and sustainable development

- (1) Topic: Unit 8 Oceans in Trouble
 (2) Duration: 4 lessons (40 mins per lesson)
 (3) Venue: normal classroom setting

Related Sustainable development goals

SDG 12
SDG 14



(4) Teaching Procedures:

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
Sub-topic:	Oyster Reef, mudflat environment	Functions of oyster and oyster reefs towards environment and human being	Distribution of and threats to oyster reefs	Make oyster farming in Hong Kong sustainable
Core question:	A. What is an oyster reef? What is the living habitat of an oyster reef?	B. Why are oyster reefs important? How do oysters benefit the environment and human beings?	C. What challenges do oyster reefs face?	D. Sustainable development
Prior knowledge:	Students acquired some basic knowledge about the marine ecosystem and the ocean benefits.	Students have acquired basic knowledge about the ecosystem in mudflat, the living habitat of oysters and the formation of oyster reefs.	Students have acquired knowledge about features and functions of oyster reefs.	Students have acquired basic knowledge about sustainable development.
Key Concepts:	A1 Characteristics of oyster reefs A2 Formation of oyster reefs A3 Mudflat ecosystem and characteristics	B1 Oyster reef B2 Ecosystem B3 Ecosystem services B4 Sustainable development	C1 Water pollution C2 Agricultural activities/ farming C3 Industrial activities C4 Reclamation C5 Overharvesting C6 Environmental and economic impacts	D1 Sustainable development D2 Oyster farming

Aims and objectives	Knowledge	1. To understand the features of oyster reef 2. To acknowledge and understand the mudflat as the living habitat of oyster 3. To understand the ecosystem in mudflat 4. To understand the process and favorable conditions of oyster reef formation	1. Describe the functions of oyster and oyster reefs 1. Identify the ecosystem services and benefits towards human being brought by oyster reefs	1. Describe the world distribution and condition of oyster reefs 2. Understand the challenges and threats for oyster reefs 3. Understand the interconnections of different ecosystems through the “Ridge to Reef” concept 1. Explain the impacts of diminishing oyster reefs	1. Explain the concept of sustainable development 2. Evaluable the sustainability of oyster farming from economic, social and environmental perspectives

The Jockey Club "Ridge to Reef" Environmental Education Programme Geography (Junior Secondary) lesson plan – Ocean and sustainable development

Aims and objectives	Skills (subject/ generic skills)	<ol style="list-style-type: none"> 1. To interpret and organize geographical data from video 2. To enhance photo interpretation skills 3. To explain the relationship within an ecosystem using geographical terms 	<ol style="list-style-type: none"> 1. Organize and categorize geographical data from photos 	<ol style="list-style-type: none"> 1. Extract and interpret geographical information from the graphs, passages and photographs. 2. Organize and summarize information by tables and flow charts 3. Develop English language skills across the curriculum. 	<ol style="list-style-type: none"> 1. Extract and interpret geographical information from the graphs, passages and photographs. 2. Analyse a geographical issue from different perspectives 3. Develop English language skills across the curriculum.
	Value/ Attitude	<ol style="list-style-type: none"> 1. To appreciate the beauty of oyster reef and its living habitat 2. To appreciate the interlocking relationship among geographical processes and species in mudflat 	<ol style="list-style-type: none"> 1. Develop a sense of protecting oyster reefs 2. Understand the interdependence between human beings and oyster reef 	<ol style="list-style-type: none"> 1. Understand the adverse impacts caused by human activities to nature 2. Realize the interdependence of human, oyster reefs and ocean 3. Appreciate the important role of oyster reefs in the ocean 	<ol style="list-style-type: none"> 1. Realize the interdependence of human, oyster reefs and ocean 2. Develop a sense of responsibility to protect the nature

Lesson 1

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
Setting			
5min	<p>The teacher recalls students' memories about the functions and benefits of the ocean, as well as their experience with oysters through questioning.</p> <p>Q. What are the functions and benefits of the ocean?</p> <p>Q. Have you tried oysters before? Do you like oyster</p> <p>The teacher introduces the lesson theme: An important ocean resource in Hong Kong – Oyster</p>	<p>Students are invited to identify the functions and benefits of the ocean and respond to the teacher's questions.</p> <p>Students are invited to share their previous experience of oysters.</p>	<ul style="list-style-type: none"> ● PPT
Development			
15min	<p>1.1 Oyster Reef</p> <p>The teacher introduces some basic knowledge of oyster reefs, including their characteristics, formation process and living habitat.</p> <p>Q. What is an oyster?</p> <p>Q. What is an oyster reef?</p> <p>Q. Where are oyster reefs found?</p> <p>Q. How do oyster reefs form?</p>	<p>Students refer to the PPT, learning materials and teacher's explanation to complete the worksheet p.</p>	<ul style="list-style-type: none"> ● PPT ● Video about formation of oyster reef ● Worksheet p.
15min	<p>1.2 Living Habitat of Oyster Reef</p> <p>The teacher introduces the characteristics of the living habitat of oyster reefs (the mudflat) and explains the favorable factors of the mudflat for the growth of oyster reefs.</p> <p>Q. What are some commonly found living organisms in mudflat?</p> <p>Q. How do they form the ecosystem in mudflat?</p> <p>Q. Why is mudflat a suitable place for nurturing oyster reefs?</p>	<p>Students refer to the PPT and learning materials to respond to the teacher's questions.</p> <p>Students refer to the PPT, learning materials and teacher's explanation to complete the worksheet p</p>	<ul style="list-style-type: none"> ● PPT ● Worksheet p. ●
Conclusion			
5min	<p>The teacher summarizes the characteristics, formation process and living habitat of oyster reefs.</p> <p>The teacher asks students to complete a short quiz to ensure their understanding of lesson contents.</p>	<p>Students complete the short quiz to conclude what they have learnt in the lesson</p>	<ul style="list-style-type: none"> ● PPT ● Short quiz*

(* https://docs.google.com/forms/d/1WPgj8_b0OmTbveQ8j2pR-vukm7MuKmKvprUE924wqrA/edit)

Lesson 2

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
Setting			
5min	To distribute learning materials to students. The teacher reminds students about the features of oysters and ecosystem of mudflats The teacher clearly explains the relationship between this lesson and the previous lesson: What is the role and function of oysters in the ecosystem?	Students receive the course booklet/worksheet.	Worksheet
Development			
10min	The teacher divides students into groups. The teacher guides and encourages students to identify the functions of oyster reefs in the environmental aspect from the photos. The teacher invites some groups to present their ideas and summarises the functions of oyster reefs in the environmental aspect. Q: How important are oysters and oyster reefs to the ecosystem?	Group discussion section 1 <ul style="list-style-type: none"> Students work in groups formed Photos of environmental aspect are given to each group of students Students can discuss and jot down a short caption under the photos Students categorize the relevant photos and then post them on blackboard 	<ul style="list-style-type: none"> Worksheet Photos PPT (To show answers)
10min	The teacher asks students to return to their groups. The teacher guides and encourages students to indicate the functions of oyster reefs in social and economic aspects from the photos. The teacher invites some groups to present their ideas and summarises the functions of oyster reefs in social and economic aspects. Q: How important are oysters and oyster reefs to human beings?	Group discussion section 2 <ul style="list-style-type: none"> Students continue to work in groups formed Photos of economic and social aspect are given to each group of students Students can discuss and jot down a short caption under the photos Students categorize the relevant photos and then post them on blackboard 	<ul style="list-style-type: none"> Worksheet Photos PPT (To show answers)
Conclusion			
15min	The teachers plays the TNC video The teachers ask students to complete the unfinished mind map as formative assessment and give hints to students if needed. The teacher checks the answers with students after they have finished their work to ensure their understanding of the lesson contents.	Students watch the video. Students complete the unfinished mindmap in the course booklet by filling in some key usages of oyster/ oyster reef with reference to the previous activity and the video Students check their answers with the teacher and conclude what they have learnt in the lesson. •	<ul style="list-style-type: none"> TNC Video (Part 3) Worksheet PPT (To show answers)

Lesson 3

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
Setting			
5min	<p>Recall students' knowledge about the function and ecosystem services of oyster reefs</p> <p>Link previous content to this lesson</p> <p>Introduce the learning objectives of the lesson</p> <p>Hold a quick vote on the importance and condition of oyster reefs</p> <p>Q: Do you think oyster reefs play an indispensable role in the ecosystem?</p> <p>Q: Do you think oyster reefs are under threat or in good condition?</p>	<ul style="list-style-type: none"> • Raise hands to show their opinions and explain their ideas 	
Development			
10min	<p>Describe the distribution and condition of major oyster reefs around the globe</p> <p>Guide students to complete Task 3.1</p> <p>Q: Where are the oyster reefs?</p> <p>Q: How are the conditions of oyster reefs?</p> <p>Q: Are oyster reefs commonly under threats?</p>	<ul style="list-style-type: none"> • Refer to the PowerPoint and course booklet, interpret the data and map provided • Complete Workbook Section 3.1 	<ul style="list-style-type: none"> • PowerPoint • Workbook
15min	<p>Play TNC Videos (Part 1 & Part 2) to illustrate the factors interrupting mudflat habitat</p> <p>Walk around to offer assistance to students during group discussion</p> <p>Introduce the causes of declining oyster reefs: (i) water pollution; (ii) over-harvesting; and (iii) destruction of coast (i.e. reclamation)</p> <p>Q: What human activities threaten the lives of oyster reefs?</p> <p>Q: How do human activities on land affect oyster reefs? (i.e. water pollution)</p>	<ul style="list-style-type: none"> • Jot note on the course booklet while watching videos • Share briefly with the class about the information observed from the videos • Group discussion & sharing: study several sets of resources and discuss the key threats for oyster reefs • Complete Workbook Section 3.2 as a group work 	<ul style="list-style-type: none"> • PowerPoint • Workbook • TNC Video (Part 1 & 2)
5min	<p>Guide students to point out the impacts of declining or extinct oyster reefs (in relation to the ecosystem services of oyster reefs)</p> <p>Q: What functions or benefits of oyster reefs will decrease if the survival of oyster reefs is threatened?</p> <p>Q: How do these impacts affect human lives?</p>	<ul style="list-style-type: none"> • Describe and explain the impacts of declining oyster reefs • Complete Workbook Section 3.3 	<ul style="list-style-type: none"> • PowerPoint • Workbook
Conclusion			
5min	<p>Conclude the lesson</p> <p>Check answers of MCQs</p>	<ul style="list-style-type: none"> • Finish MCQs as assessment for learning 	<ul style="list-style-type: none"> • Workbook

Lesson 4

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
Setting			
5min	Recall students' knowledge about the functions of and threats to oyster reefs Introduce oyster farming as a means of conservation Watch TNC video as to arouse interest Q: What are the importance of oyster reefs? Q: What are threats for oyster reefs? Q: What can we do to help conserve oyster reefs?	<ul style="list-style-type: none"> Briefly summarize the ideas of video / share their thoughts about the video 	<ul style="list-style-type: none"> TNC video (Part 2) https://youtu.be/XZocxB-J-YU
Development			
20min	Explain the concept of sustainable development: balance economic, social and environmental needs and sustainability at the same time. Three aspects are mutually beneficial because of their interdependence Guide students to complete Task 4.1 Q: What is sustainable development? Q: Why is sustainable development necessary? Q: Is oyster farming in Hong Kong sustainable?	<ul style="list-style-type: none"> Share their understanding/ opinions about sustainable development Complete Task 4.1 	<ul style="list-style-type: none"> PowerPoint Workbook
20min	Watch TNC video Guide students to complete Task 4.2 through group discussion/ work Invite several groups to present their ideas Q: Is oyster farming in Hong Kong sustainable? Why? Q: How to make oyster farming in Hong Kong (more) sustainable?	<ul style="list-style-type: none"> Group discussion: discuss the sustainability of oyster farming from economic, social and environmental perspectives Share with the class about their discussion outcomes Complete Task 4.2 as a group work 	<ul style="list-style-type: none"> PowerPoint Workbook TNC Video
Conclusion			
5min	Conclude the whole module		

What is an oyster reef?

What is the living habitat of oyster reef?



Lesson 1

— **Characteristics** & **Living habitat** of Oyster Reefs

1.1

Oyster Reefs

Q1. What is an oyster?

An oyster is a:

Bivalves mollusks
(雙殼軟體動物)

Oyster shell:

- **opens** during high tide to filter out plankton (浮游生物)
- **closes** during low tide to minimize water evaporate from its body



Q2. What is the characteristics of an oyster reef?



- Large number of oyster **aggregated together**
- Oysters grow **on hard debris or stones**
- Usually in the form of a **large oyster community**

Q3. What is the formation process of an oyster reef?

- An oyster reef is the cluster of oyster
- The oysters cluster on **hard, submerged surfaces**, and **fuse together** when they grow.
- Oysters grows **on their older generations** and form oyster reefs.



Q4. Where do oyster reefs grow?



Oyster reefs grow in **brackish** (鹹淡水交界) habitats. **Mudflat** is the habitat where oyster reefs grow.

1.2

Living habitat of oyster reefs

Q1. What is a mudflat?

A mudflat is a coastal **wetland** found at **intertidal** area (潮間帶)

It is a deposition feature where sediments are deposited by **tides** or **rivers**.



Q1. What is a mudflat?

- It is intermittently (間歇地) being flooded by **seawater**
 - the time that mudflat is being flooded is called **high tide**
 - the time that mudflat emerges is called **low tide**



Q2. What are the characteristics of mudflats?



Characteristics	Description
Location	<u>Brackish area</u> (鹹淡水交界)
Relief	<u>Gentle</u>
Texture of deposited materials	<u>Coarse</u> (粗糙的) <u>fine</u> (幼細的)
Biodiversity	<u>High</u>

Q3. What are the species found in mudflat?

- ▷ Watch the video and find out the species in the mudflat!
- ▷ <https://www.youtube.com/watch?v=4ijh-kp4uhk> (00:00 - 2:15)

Q3. What are the species found in mudflat?



Sea snail



Fiddler crab



Hermit crab

Q3. What are the species found in mudflat?



Mangrove



Oyster



Horseshoe crab

Q4. Why is mudflat a suitable habitat for oyster reefs to grow?

- A mudflat is rich in **organic matter** → favours growth of **algae**
- Fine sediment size → development of an anoxia deposition layer → favoring the growth of **bacteria**
- **Algae + bacterias + organic matter = food** for oysters

Why are oyster reefs important?
How do oyster reef benefit the
environment and human?

Lesson 2

— **Functions** of Oyster Reefs towards **environment** and **human** beings

2.1

Group discussion: Functions of Oyster Reefs

Discussion 1:

How important are oyster reefs towards the ecosystem?

Environmental

● Provides habitat for marine/ mudflat species
● Trap sediments
● Traps sediments/ Protect mudflat or coastal area
● Provides places of forage for species
● Purifying water
● Neutralize acids

Discussion 2:

How important are oyster reefs towards human being?

Economic

Social

<ul style="list-style-type: none">● As food/ Aquaculture	<ul style="list-style-type: none">● As a special landscape for tourists and photographers
<ul style="list-style-type: none">● Makes processed oyster products	<ul style="list-style-type: none">● For scientific investigation
<ul style="list-style-type: none">● Tourism/ As tourist spot/ Provides job opportunities	<ul style="list-style-type: none">● Provides educational resources
<ul style="list-style-type: none">● Lime industry	<ul style="list-style-type: none">● As artwork
<ul style="list-style-type: none">● Increase commercial fish catches	
<ul style="list-style-type: none">● Protect the property and lives of people who live in coastal area	

2.2

Individual task: Functions of Oyster Reefs

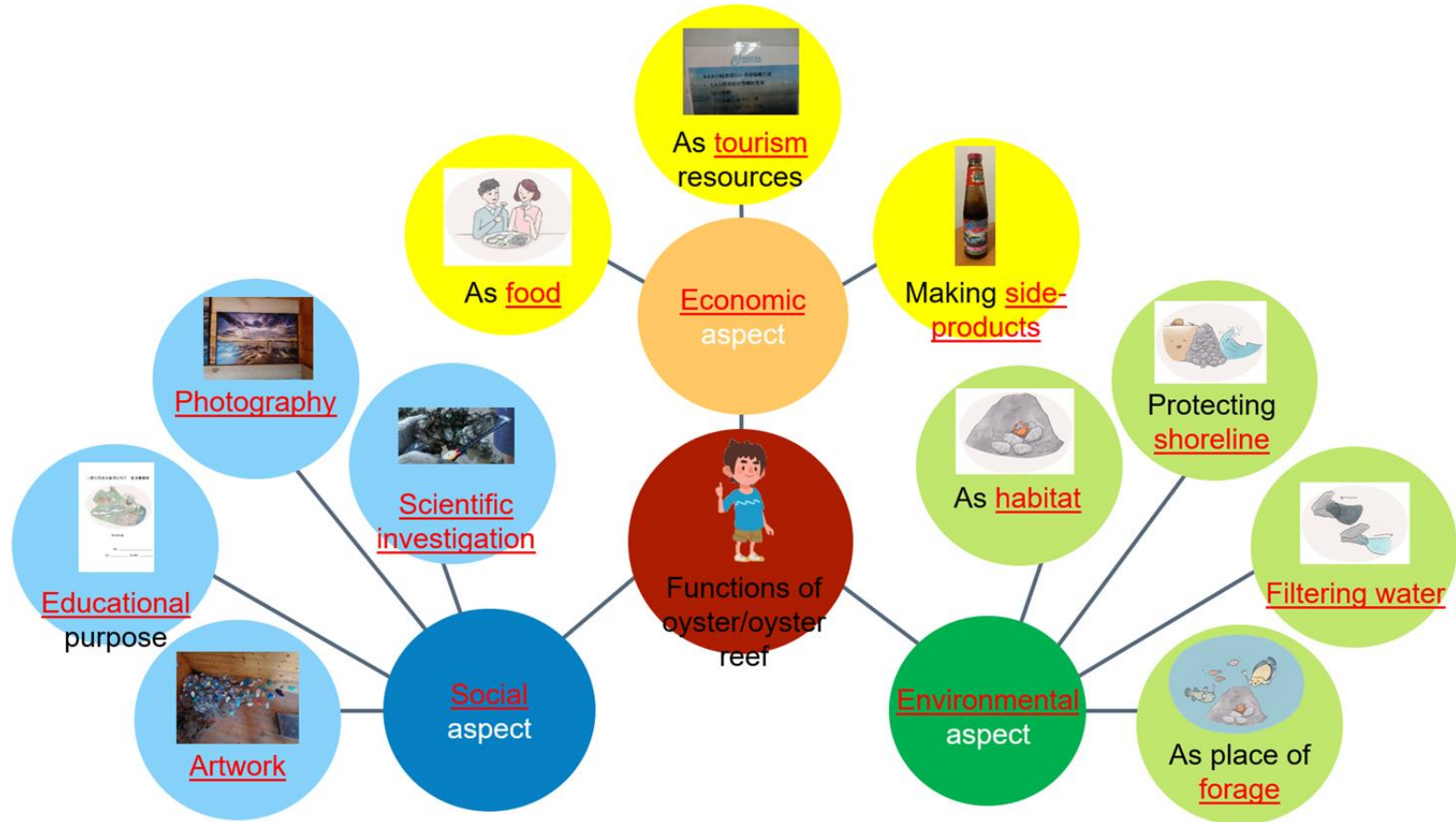
Video Time

Jot down the functions of oyster reefs



<https://youtu.be/ShfIXOu4o-E> (Part 3)

Complete the mind-map below!



Where are oyster reefs located?
Why are they declining?



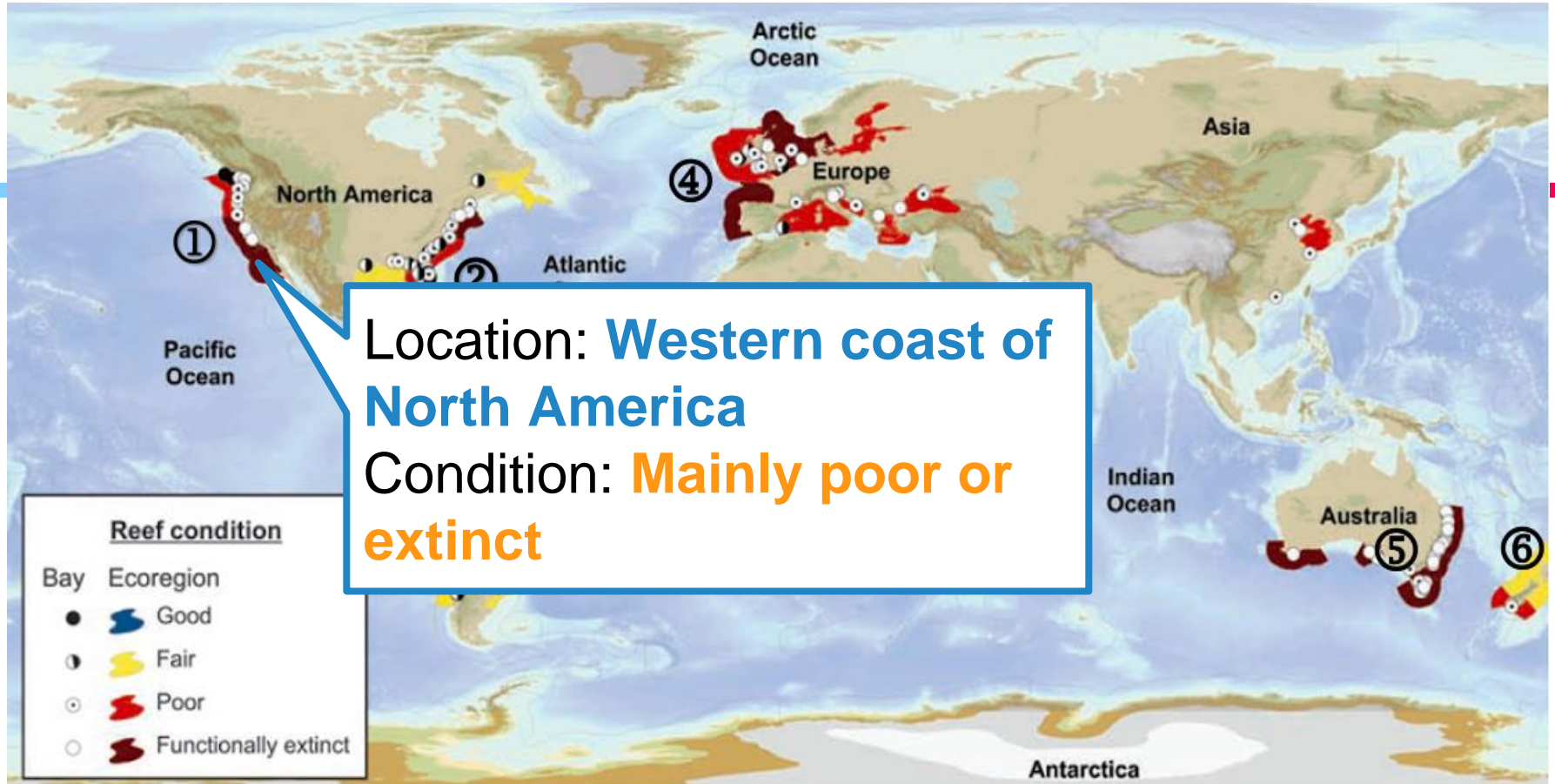
Lesson 3

— **Distribution** of & **Threats** to Oyster Reefs

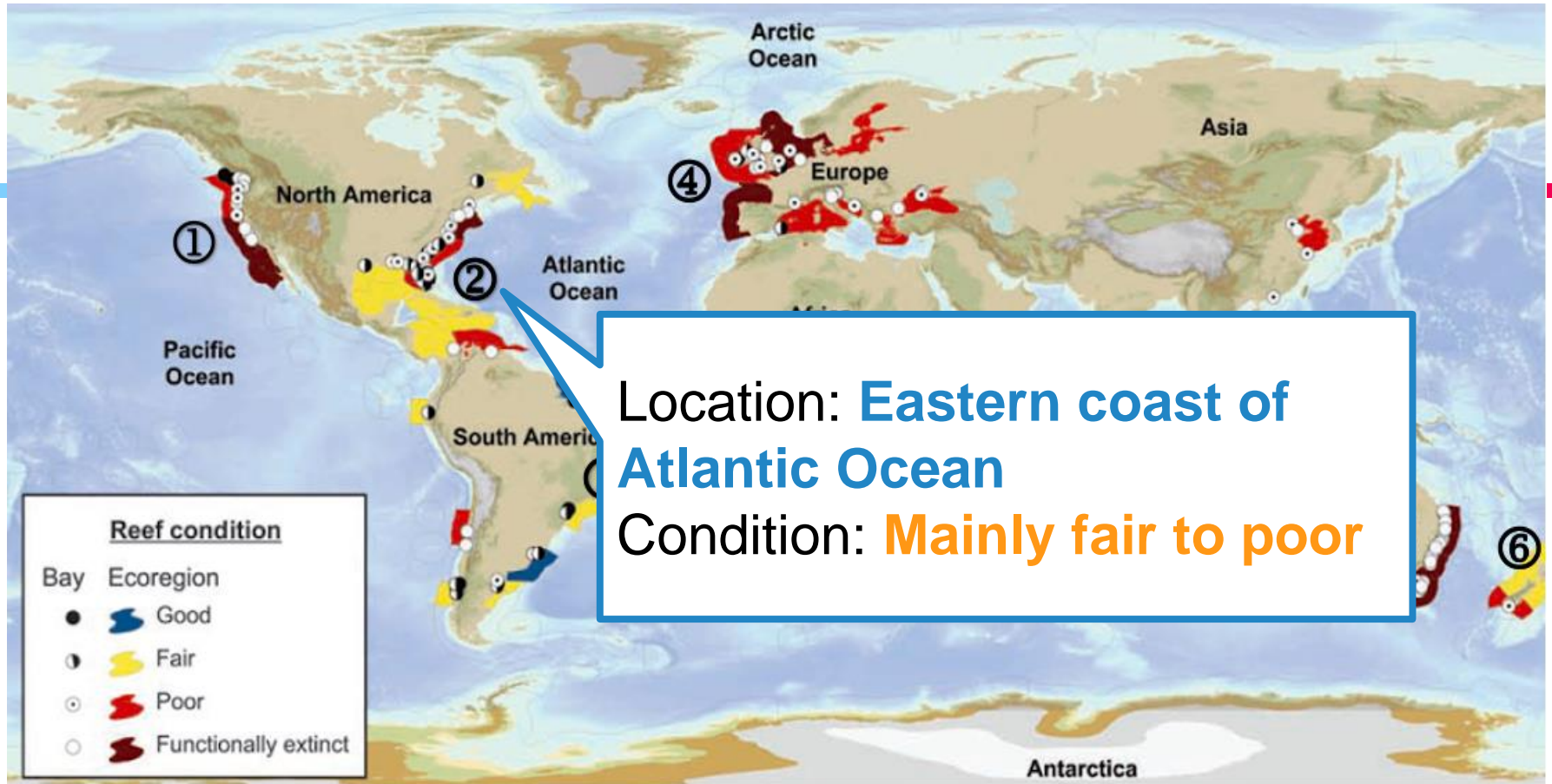
3.1

Distribution of Oyster Reefs

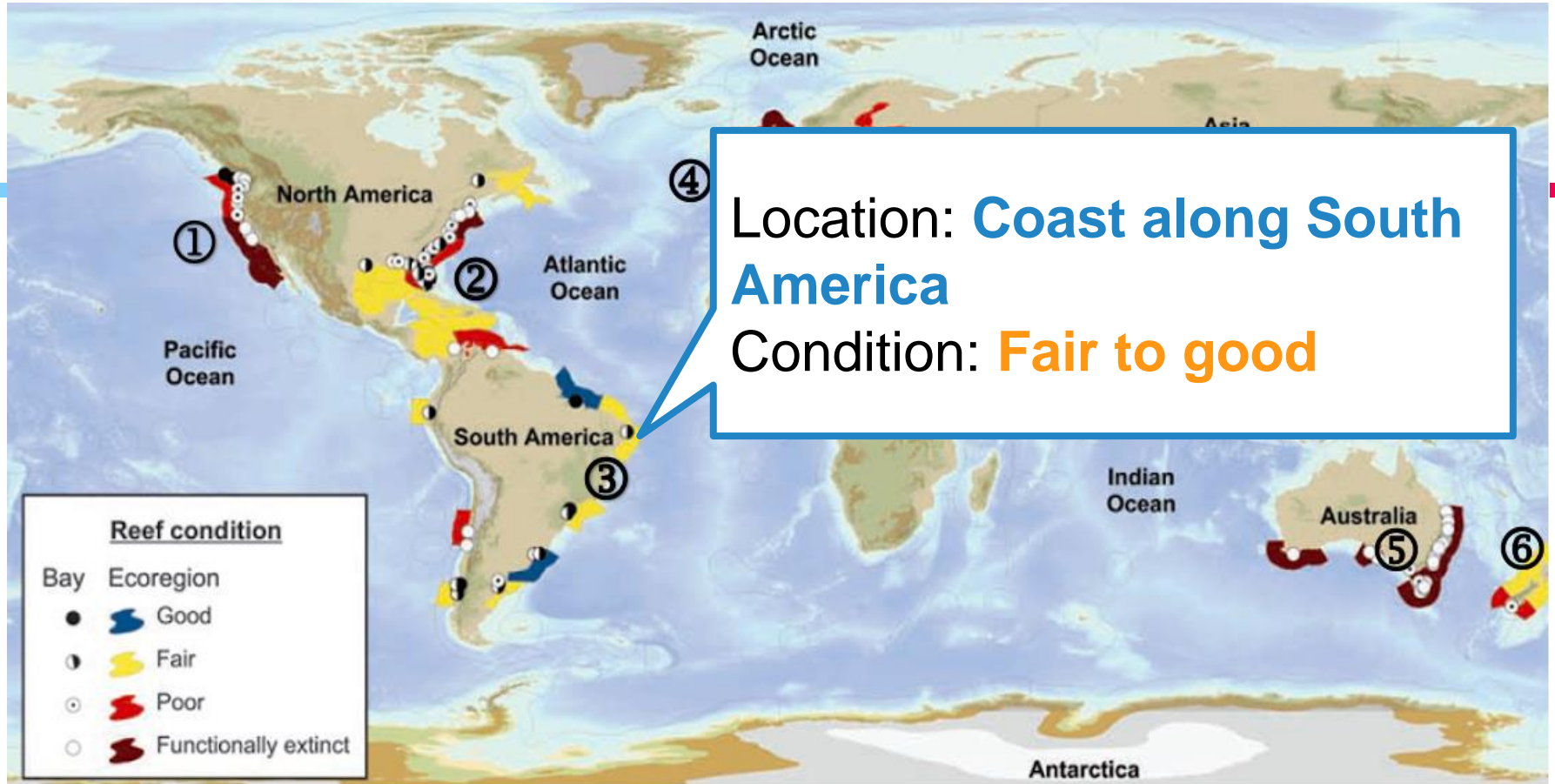
Q1. Where are the oyster reefs located? What are their conditions?



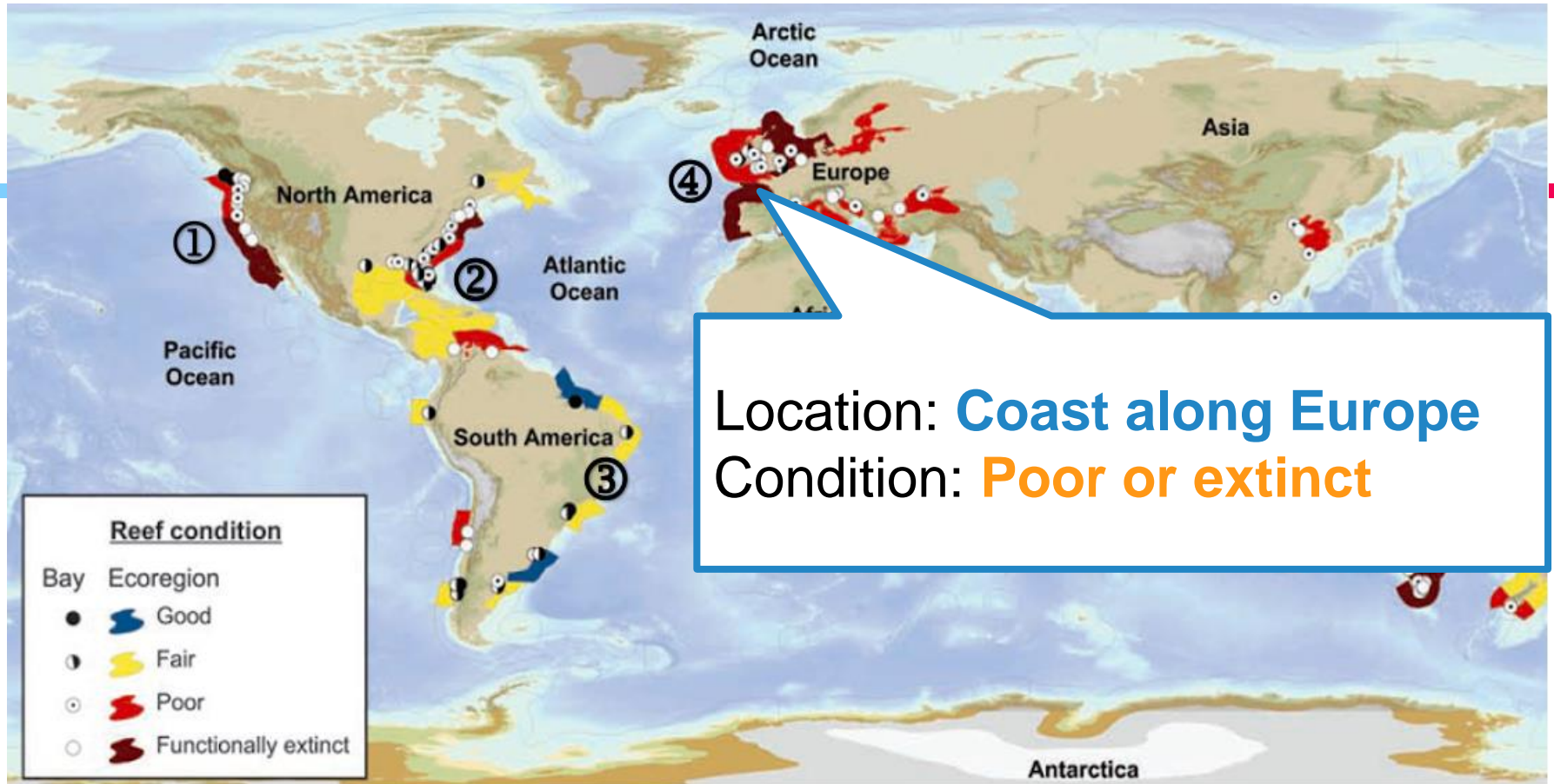
Q1. Where are the oyster reefs located? What are their conditions?



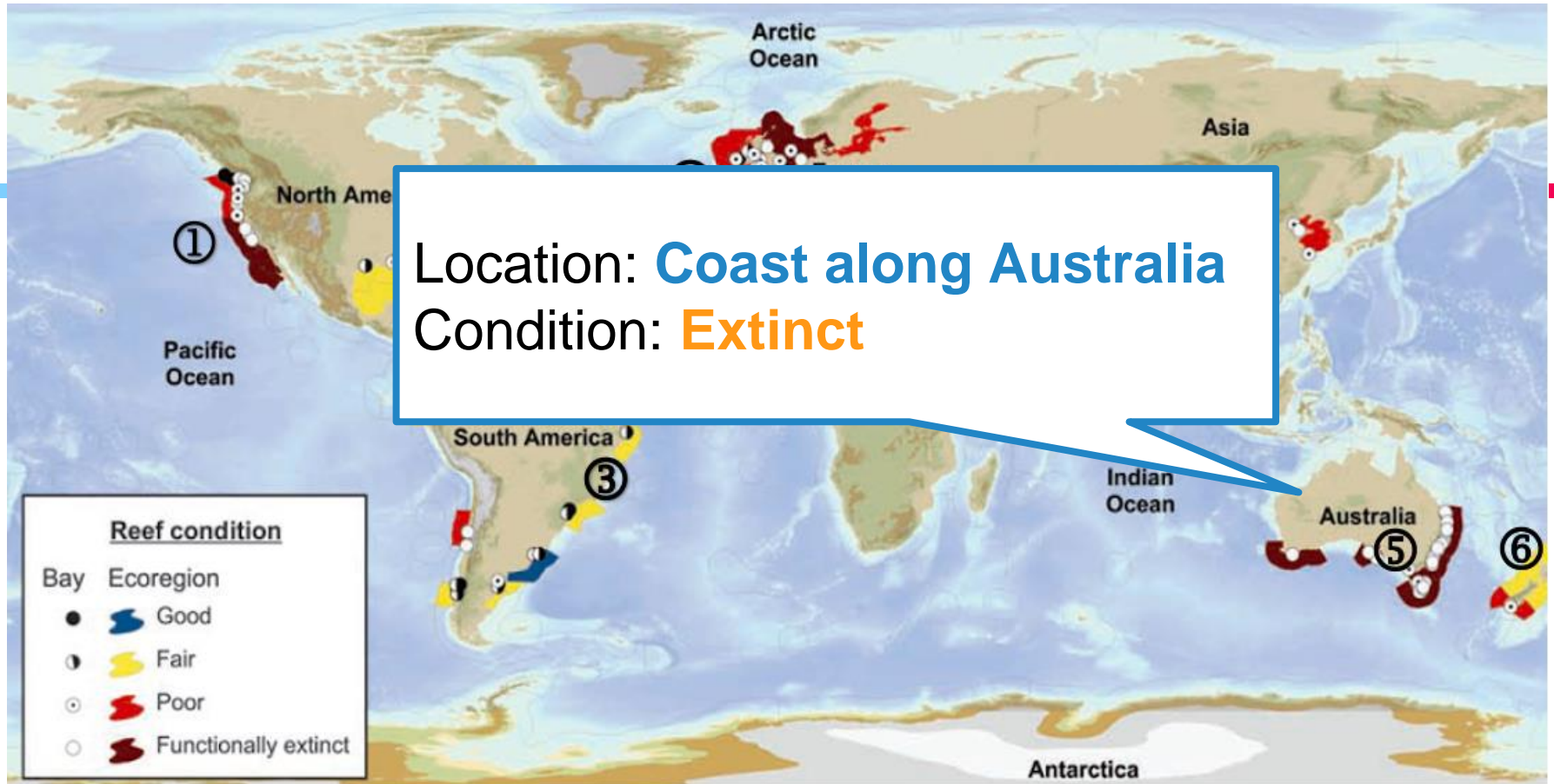
Q1. Where are the oyster reefs located? What are their conditions?



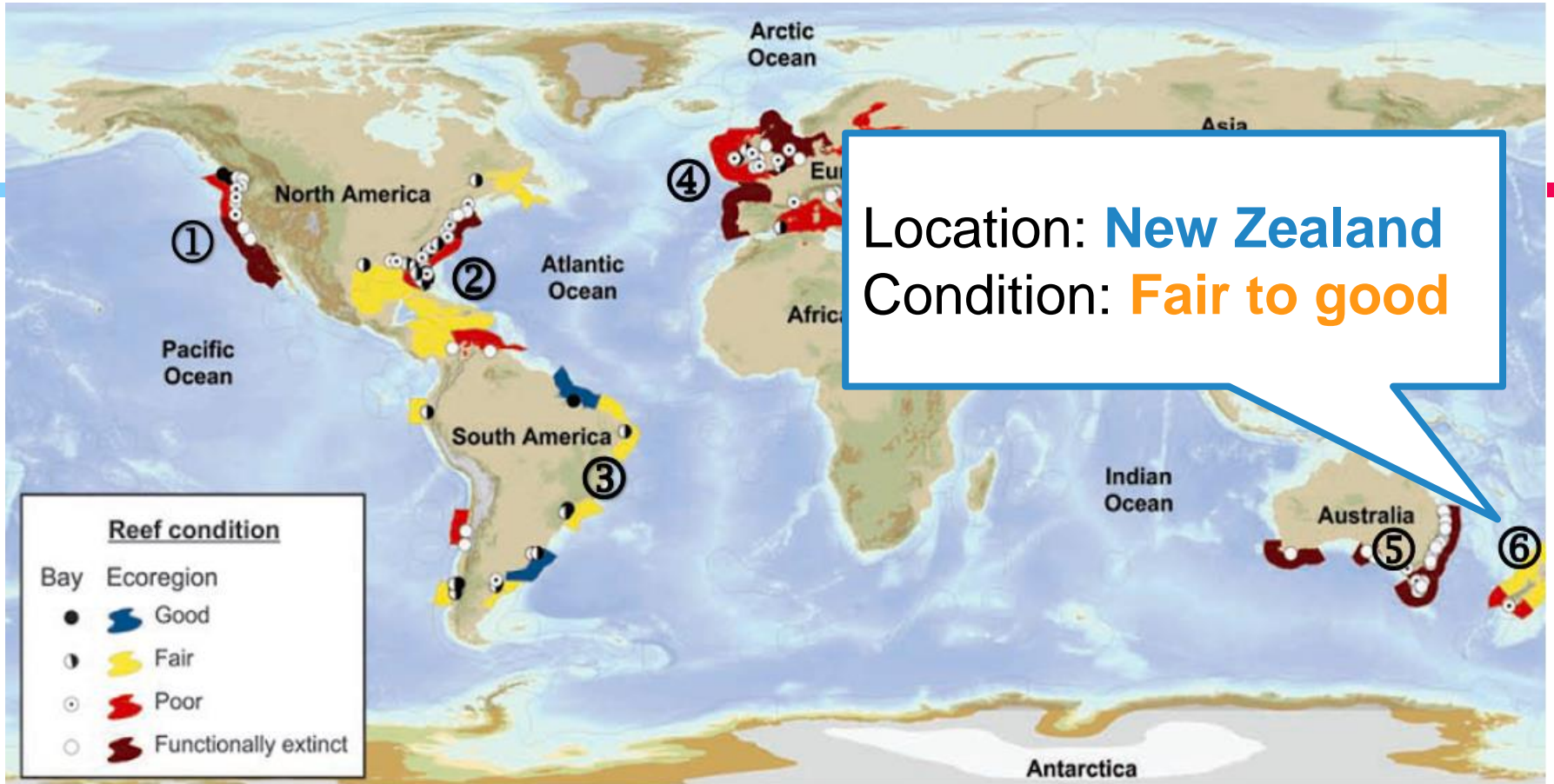
Q1. Where are the oyster reefs located? What are their conditions?



Q1. Where are the oyster reefs located? What are their conditions?



Q1. Where are the oyster reefs located? What are their conditions?



3.2

Threats to Oyster Reefs

Video Time

Jot down the causes of declining oyster reefs



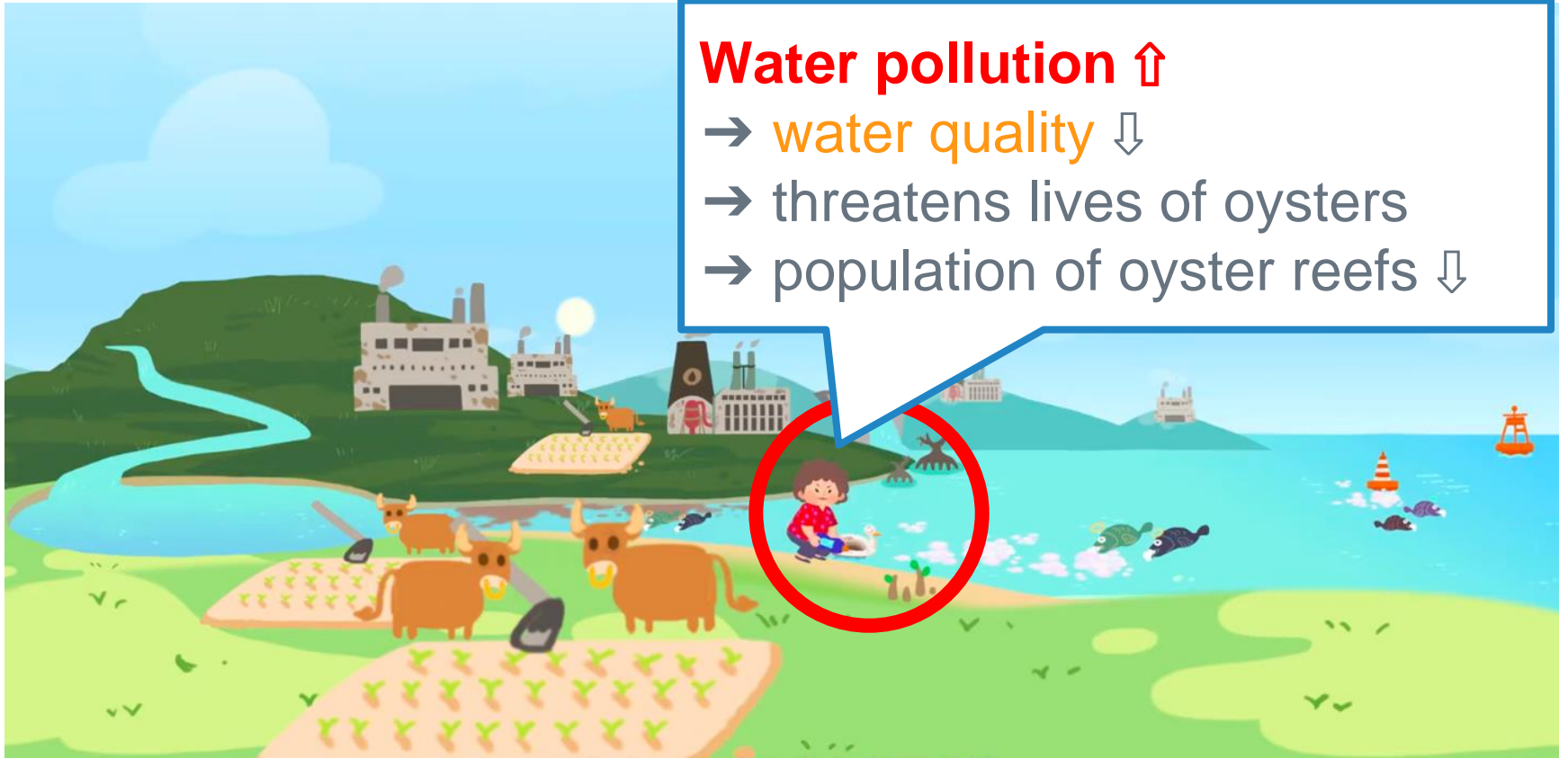
<https://www.youtube.com/watch?v=qXYXEjd8-EA> (Part 1)

<https://youtu.be/fnkxJiYbPx4> (Part 2)

Q3. What are the causes leading to declining oyster reefs?

Water pollution ↑

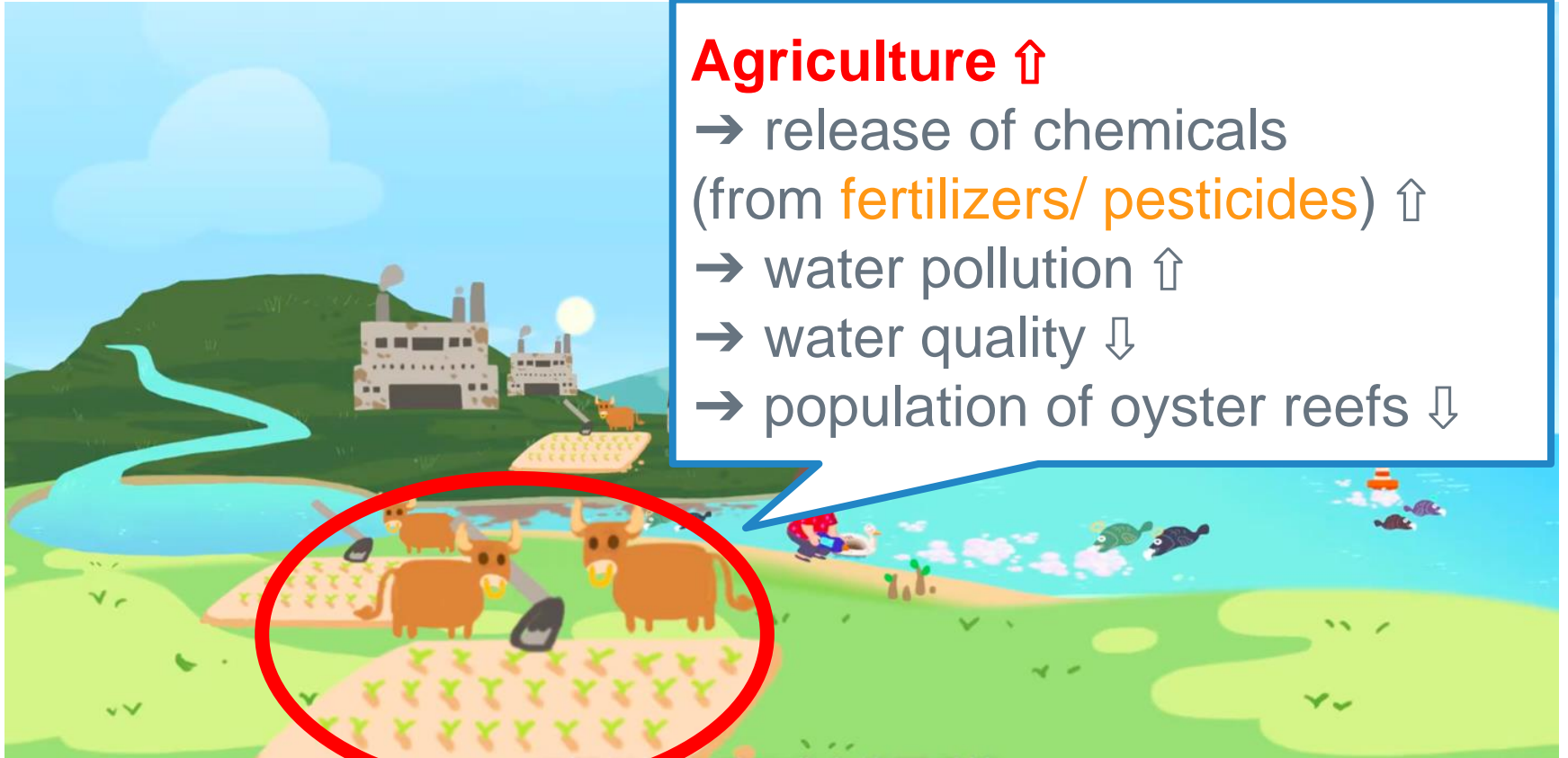
- water quality ↓
- threatens lives of oysters
- population of oyster reefs ↓



Q3. What are the causes leading to declining oyster reefs?

Agriculture ↑

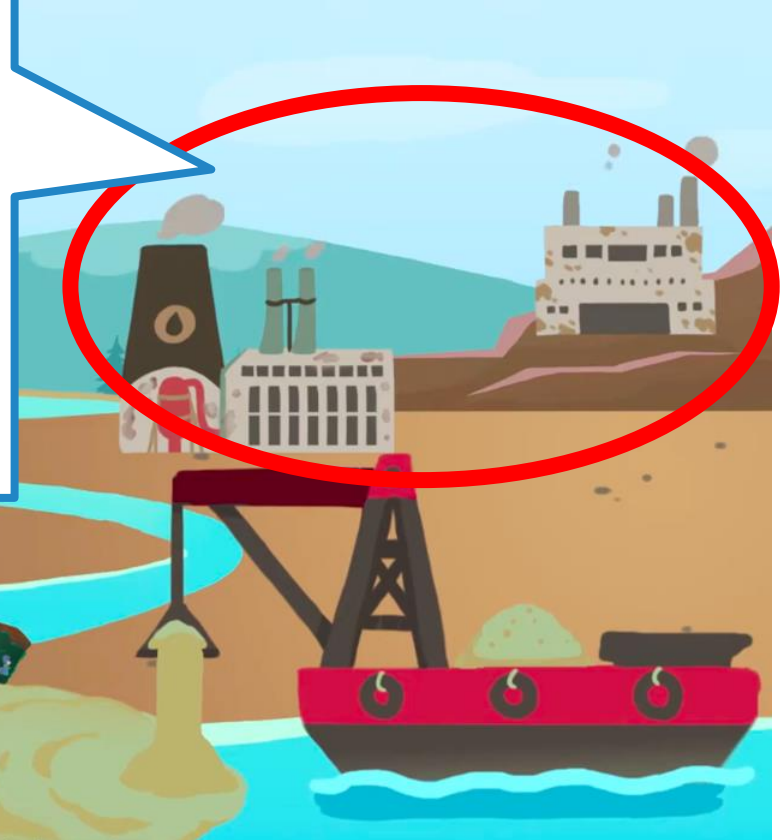
- release of chemicals (from **fertilizers/ pesticides**) ↑
- water pollution ↑
- water quality ↓
- population of oyster reefs ↓



Q3. What are the causes leading to declining oyster reefs?

Industrial activities ↑

- discharge of sewage ↑
- water pollution ↑
- water quality ↓
- population of oyster reefs ↓



Q3. What are the causes leading to declining oyster reefs?

Over-harvesting

- consumption > regeneration
- population of oyster reefs ↓



Q3. What are the causes leading to declining oyster reefs?

Reclamation

- destroy habitats of oysters
- water pollution ↑
- population of oyster reefs ↓



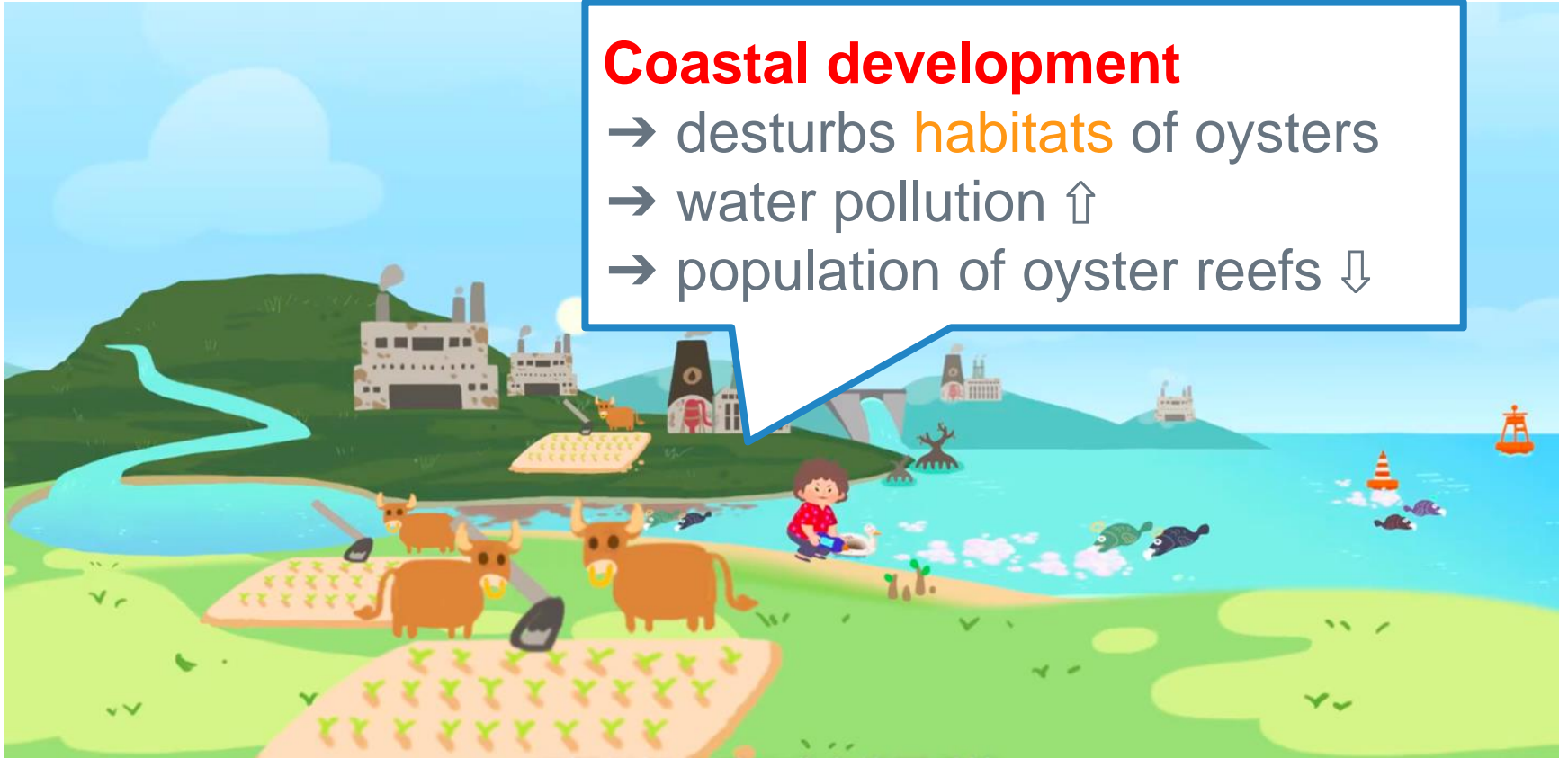
Q3. What are the causes leading to declining oyster reefs?



Q3. What are the causes leading to declining oyster reefs?

Coastal development

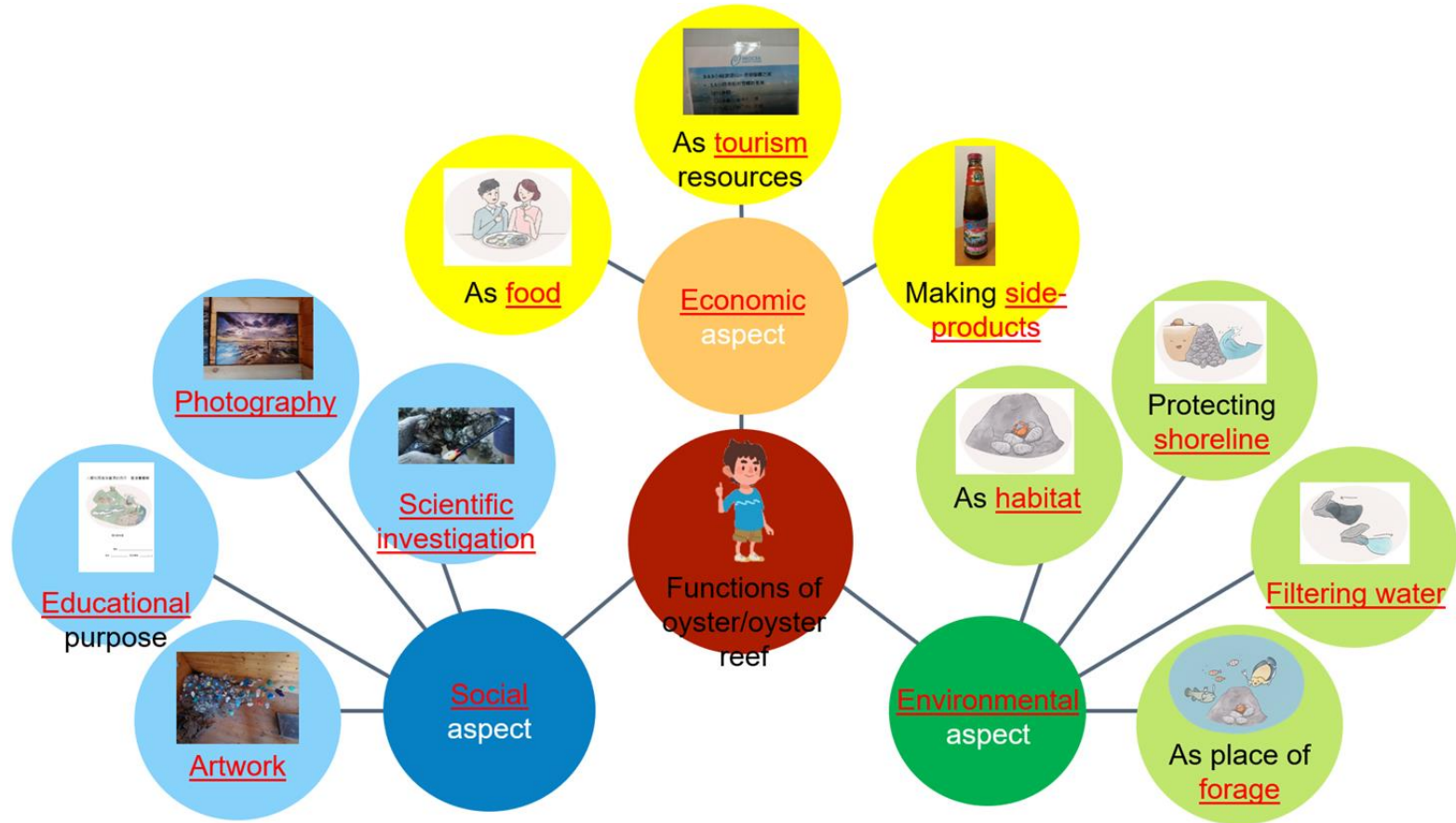
- disturbs **habitats** of oysters
- water pollution ↑
- population of oyster reefs ↓



3.3

Impacts of Declining Oyster Reefs

Let's recall what we have learnt previously!



How do the declining oyster reefs affect their functioning?



What challenges do oyster reef face?



Lesson 4

— Make **Oyster Farming** in Hong Kong **sustainable**

4.1

Sustainable Development

Q1. What is sustainable development?



For sustainable development to be achieved, it is crucial to harmonise three core elements: economic growth, social inclusion and environmental protection. (Environmental Bureau)

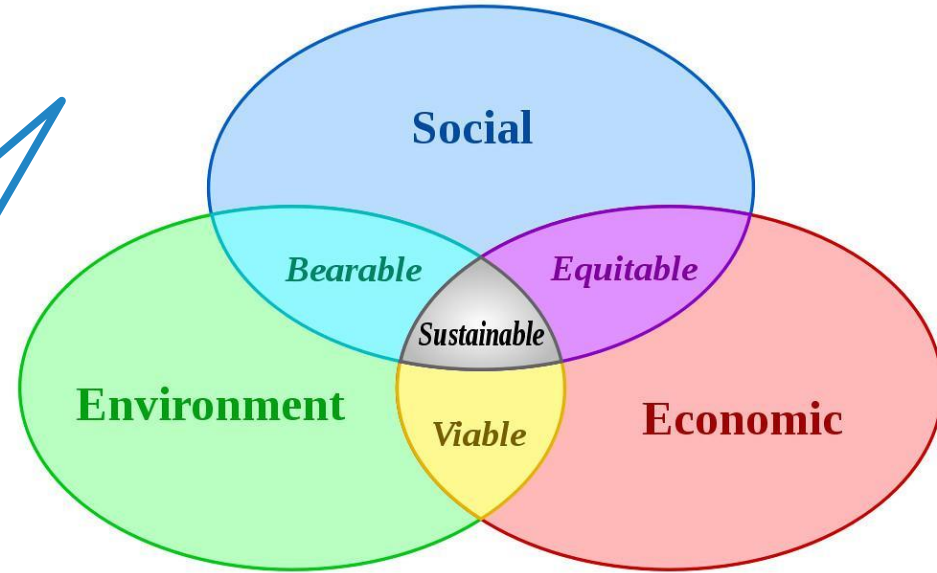
Q1. What is sustainable development?



The Sustainable Development Goals are a call for action by all countries...to promote prosperity while protecting the planet...build economic growth and address a range of social needs...while tackling climate change and environmental protection. (United Nations)

Q1. What is sustainable development?

Q2. Try to write out the definition of sustainable development in **your own words!**



Q3. Why is sustainable development so important?



Sustainable development:

- 1. Protects our ecosystem*
 - 2. enhances our quality of life*
 - 3. preserves the natural resources for our future generation*
- brings both short-term and long-term benefits*

Sustainable development therefore helps to satisfy our living without sacrificing the environment and resources of our future generation.

4.2

Group Discussion: Sustainable Oyster Farming

Video Time

Oyster Farming In Hong Kong



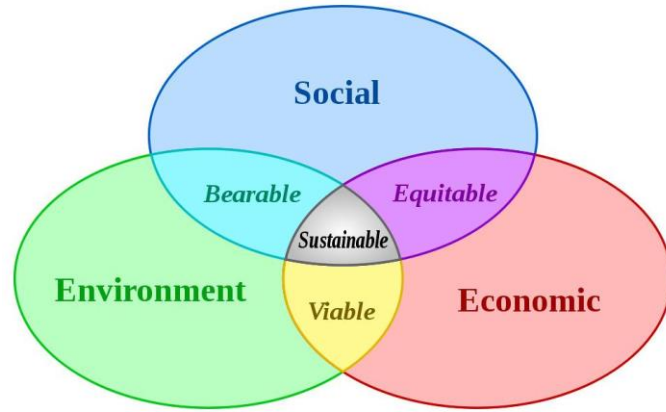
Chinese Version:

<https://www.youtube.com/watch?v=DNOeqtgMVNA>

English Version: <https://www.youtube.com/watch?v=1QaB12zzXgl>

Discussion 1:

Is oyster farming in Hong Kong sustainable?

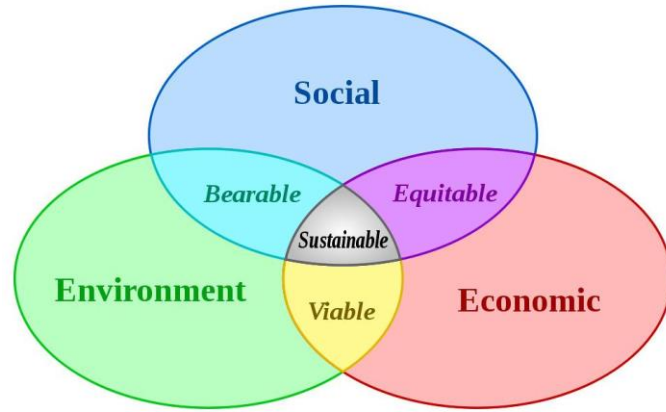


Guiding Questions:

- *What benefits does oyster farming bring to the economy and society?*
- *How does oyster farming cope with the environmental challenges?*
- *Does oyster farming balance the needs of different stakeholders and aspects?*
- *Are there any setbacks and limitations of oyster farming?*

Discussion 2:

How to make oyster farming in Hong Kong more sustainable?



Guiding Questions:

- *What are the threats towards sustainability of oyster farming?*
- *What stakeholders are involved in the threats?*
- *What measures and practices can the stakeholder adopt to create a more sustainable environment for oyster farming?*
- *Is the measure long-term or short-term? a hard or soft approach?*

Unit 8
Oceans in Trouble
(Worksheet_Teacher's version)

Lesson 1 - Understanding Oyster Reef and Its Living Habitat

Q. What is an oyster reef? What is the living habitat of oyster reef?

Lesson objectives:

- To understand the features of oyster reef
- To acknowledge and understand the mudflat as the living habitat of oyster
- To understand the ecosystem in mudflat
- To understand the process and favorable conditions of oyster reef formation

Key concept:

Characteristics of oyster reefs; Formation of oyster reefs; Mudflat ecosystem and characteristics

1.1

Oyster Reef

Oyster reef is an important species to the ecosystem. Photo 1 shows an oyster reef. Answer question 1-3.



Photo 1

Q1. What is an oyster?

- Oyster is a **bivalves mollusks** (雙殼類軟體動物).
- Oyster shell (**opens** / closes) during high tide to filter out plankton (浮游生物) and would (**open** / **close**) during low tide to minimize water evaporate from its body.

Q2. Photo 1 shows an oyster reef. Refer to Photo 1, describe the characteristics of an oyster reef.

There is a large number of oysters aggregated together in an oyster reef. These oysters are usually grown on stones or debris as shown in Photo 1. Also, they usually appear in a large oyster community.

Q3. Describe the formation process of an oyster reef.

An oyster reef refers to a cluster of oysters. The oysters cluster on hard, submerged surfaces, and fuse together when they grow. Oysters grows on their older generations and form oyster reefs.

Q.4 Where do oyster reefs grow?

- Oyster reefs grow in **brackish** (鹹淡水交界) habitats. **Mudflat** is the habitat where oyster reefs grow.

1.2

Living Habitat of Oyster Reef

Mudflat provides a unique habitat for many wildlife, which also includes oyster reef. Refer to Photo 2, observe the characteristics of a mudflat and answer question 1-2.



Photo 2 Mudflat

Q1. What is a mudflat?







- A mudflat is a coastal wetland found at intertidal area (潮間帶).
- It is a deposition feature where sediments are deposited by tides or rivers.
- It is intermittently (間歇地) being flooded by seawater
 - the time that mudflat is being flooded is called high tide
 - the time that mudflat emerges is called low tide

Q2. What are the characteristics of mudflats? Finish the table below.

Characteristics	Description
Location	<u>Brackish area</u> (鹹淡水交界)
Relief	<u>Gentle</u>
Texture of deposited materials	<u>Coarse</u> (粗糙的) / <u>fine</u> (幼細的)
Biodiversity	<u>High</u>

Q3. What are the species found in mudflat? Watch the VR video and match the name of the species with their photos.

Hermit crab (寄居蟹)	Mangrove (紅樹 / 「水筆仔」)	Horseshoe crab (馬蹄蟹)
Oyster (蠔)	Fiddler crab (招潮蟹)	Sea snail (灘棲螺)

<i>Species in the mudflat</i>		
		
Sea snail	Fiddler crab	Hermit crab
		
Mangrove	Oyster	Horseshoe crab

Q4. Why is mudflat a suitable habitat for oyster reefs to grow?

A mudflat is rich in organic matter, where a lot of algae are grown. Since the sediment size is fine, an anoxia deposition layer is formed, favoring the growth of bacteria. These algae, bacteria, together with the organic matter provide food for oysters, favoring the development of oyster reefs in mudflat.

Lesson 2 - Functions of Oyster and Oyster Reef

Q. Why are oyster reefs important? How do oysters benefit the environment and human beings?

Lesson objectives:

- To describe the functions of oyster and oyster reefs
- To identify the ecosystem services and benefits towards human being brought by oyster reefs
- To understand the interdependence between human beings and oyster reef

Key concept:

Functions of oyster reefs; Sustainable Development

2.1

Group discussion: What are the functions of oyster reefs?

(Details and task materials provided in 'Teacher's handbook')

According to the instructions below, finish the discussion and group presentations.

- Photos would be distributed to each group. They show the functions of oyster/ oyster reef.
- There are two sections of the discussion. 5 minutes is given for discussions for each section.
- In section 1, you need to identify the functions of oyster/ oyster reef that the photos show **in the environmental aspect**.
- In section 2, you need to distinguish the relevant photos and identify the functions of oyster/ oyster reef that the photos show **in economic and social aspects**.
- Teacher may pick some groups to present their ideas, you can jot some notes in the following boxes

Section 1: Environmental benefits

Environmental

Suggested Answers

- *Provides habitat for marine/ mudflat species*
- *Trap sediments*
- *Traps sediments/ Protect mudflat or coastal area*
- *Provides places of forage for species*
- *Purifying water*
- *Neutralize acids*

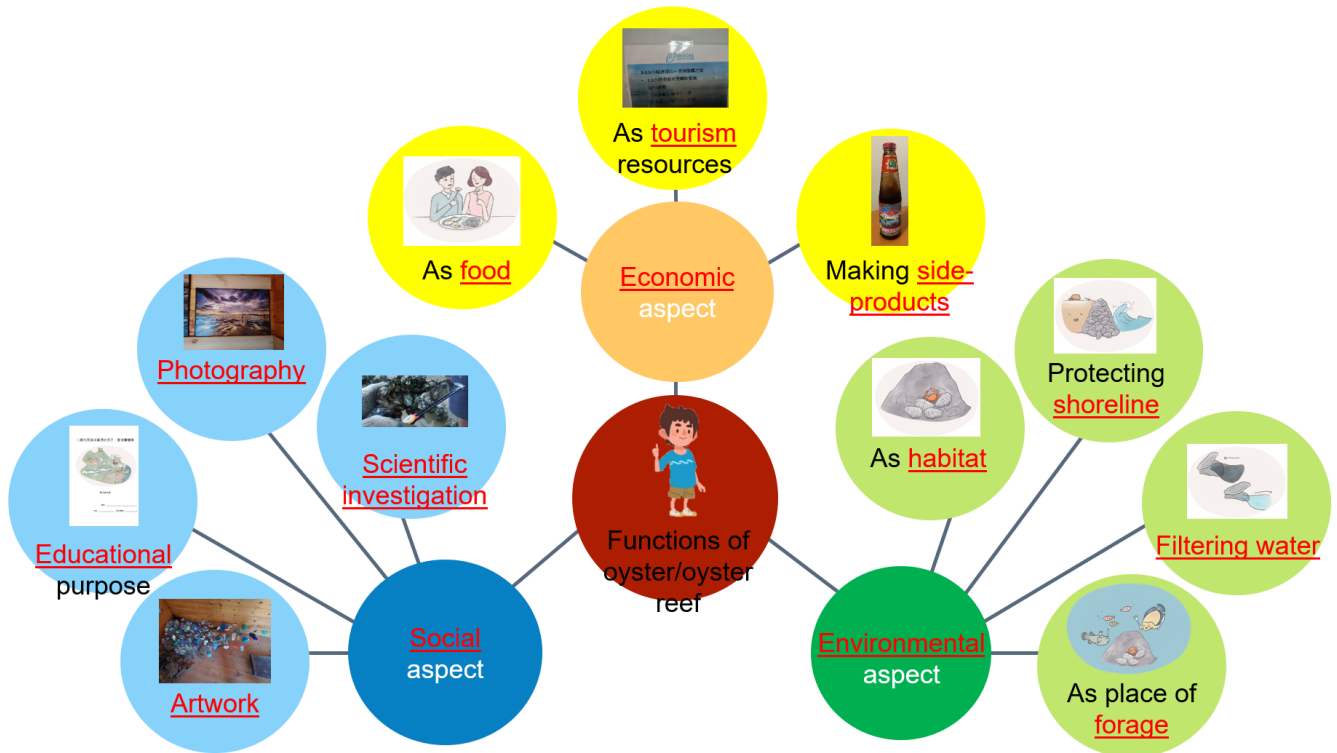
Section 2: Economic and Social benefits

<u>Economic</u>	<u>Social</u>
<p><u>Suggested Answers</u></p> <ul style="list-style-type: none"> ● <i>As food/ Aquaculture</i> ● <i>Makes processed oyster products</i> ● <i>Tourism/ As tourist spot/ Provides job opportunities</i> ● <i>Lime industry</i> ● <i>Increase commercial fish catches</i> ● <i>Protect the property and lives of people who live in coastal area</i> 	<p><u>Suggested Answers</u></p> <ul style="list-style-type: none"> ● <i>As a special landscape for tourists and photographers</i> ● <i>For scientific investigation</i> ● <i>Provides educational resources</i> ● <i>As artwork</i>

2.2

Individual task: What are the functions of oyster reefs?

The mind map below shows some functions of oyster/ oyster reef. Finish the mind map with the information from ‘Ridge to reef’ video (Part 3) and what you learnt from the group discussion.



Lesson 3 – Distribution of and threats to oyster reefs

Where are oyster reefs located? Why are they declining?

Lesson objectives:

1. To describe the distribution and conditions of oyster reefs in the world.
2. To understand the challenges and threats for oyster reefs.

Key concept:

- Water pollution, reclamation, overharvesting, environmental and economic impacts

3.1 Distribution & conditions of oyster reefs

Figure 3a shows the distribution and conditions of major oyster reefs in the world.

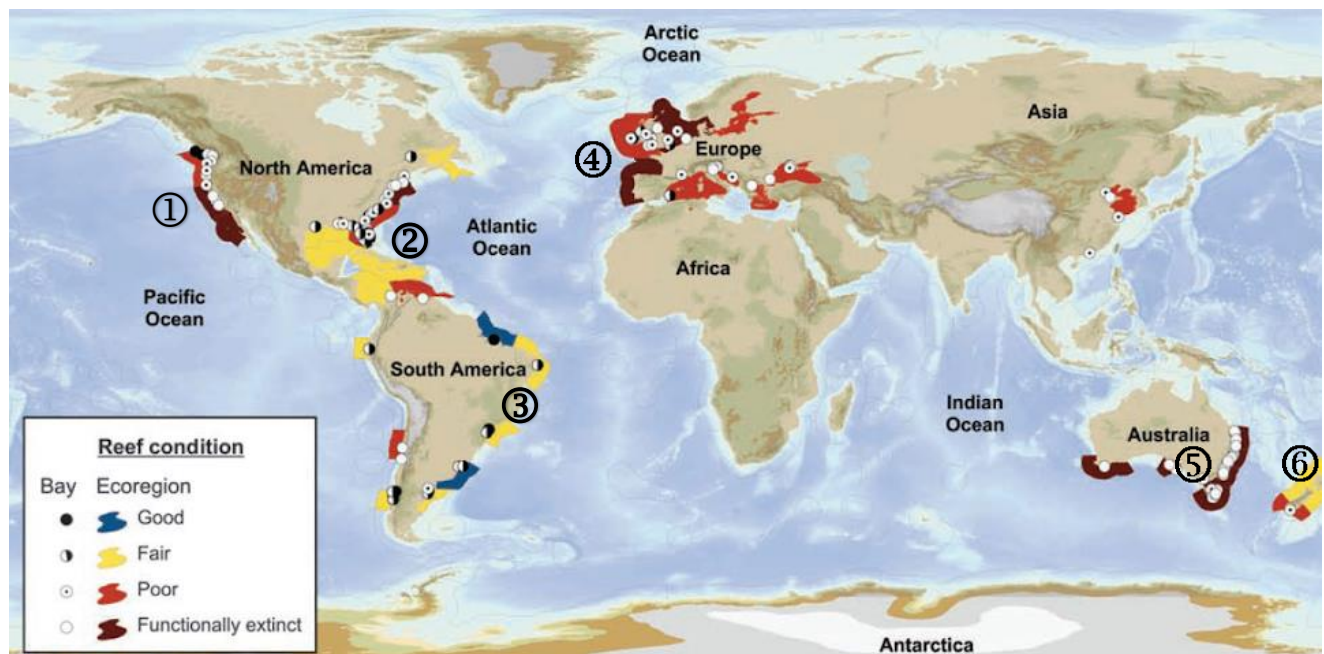


Figure 3a.

Q1. Refer to Figure 3a. Where are the oyster reefs located? What are their conditions?

Location		Condition
①	Western coast of North America	Mainly poor or extinct
②	Eastern coast of Atlantic Ocean	Mainly fair to poor
③	Coast along South America	Fair to good
④	Coast along Europe	Poor or extinct
⑤	Coast along Australia	Extinct
⑥	New Zealand	Fair to poor

Q2. Describe the overall conditions of oyster reefs in the world.

Poor / Declining / Decreasing

3.2

Major threats to oyster reefs

Watch a video about oyster reefs. Try to jot down the causes of declining oyster reefs.

Figures 3b and 3c shows some major threats to oyster reefs.

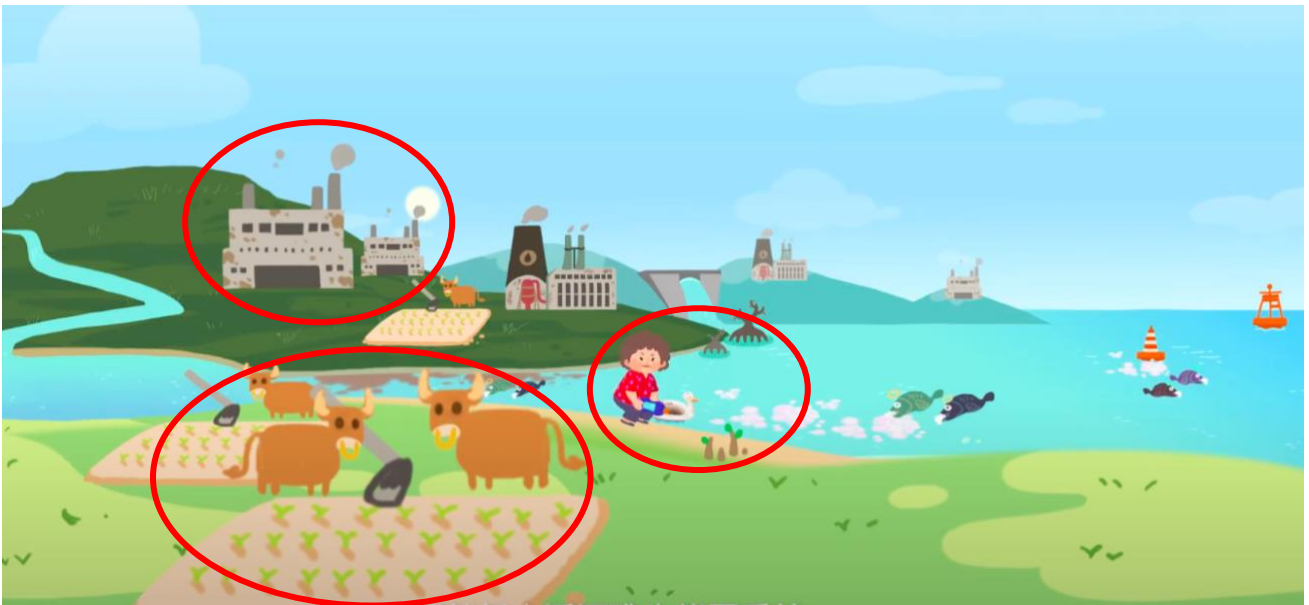


Figure 3b.

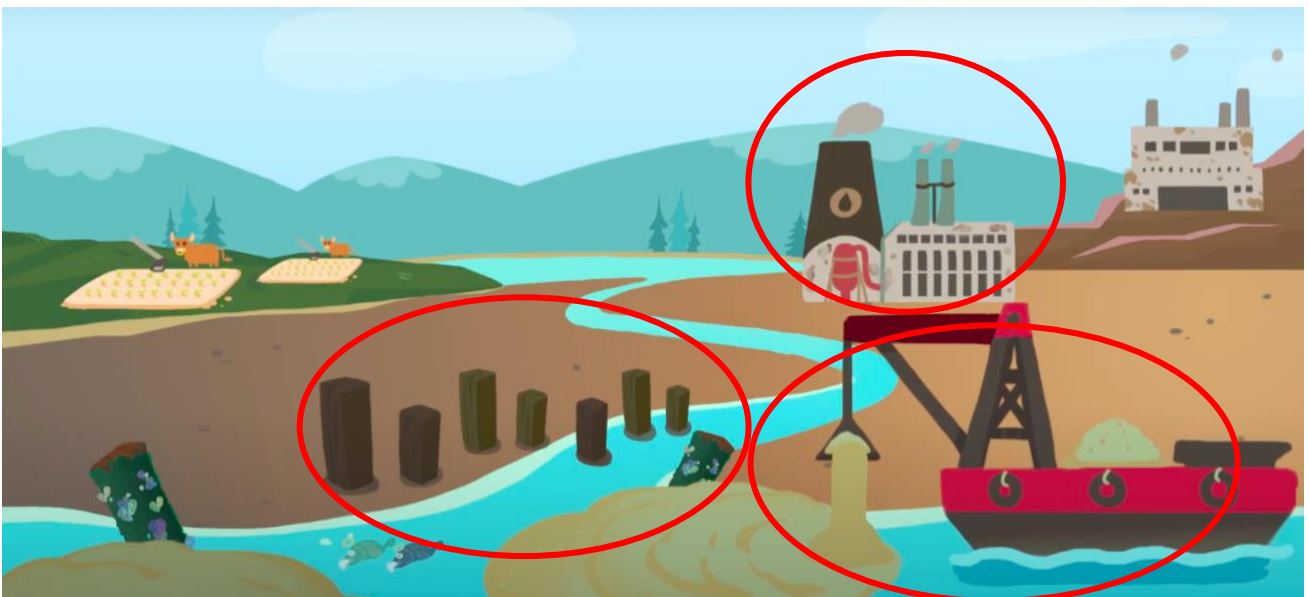


Figure 3c.

Q1. Refer to Figures 3b and 3c below. What are major causes leading to declining oyster reefs?
Circle them in the figures and complete the following table.

Cause		Explanation
1.	Water pollution	Declining water quality threatens the lives of oysters.
2.	Agriculture / farming	Chemicals (e.g. fertilizers and <u>pesticides</u>) from farmland causes water pollution in rivers.
3.	Industrial activities	Sewage discharged from <u>factories</u> causes water pollution in rivers and coasts.
4.	Overharvesting of oyster	Consumption rate of oysters is (<u>higher</u> / lower) than their regeneration rate. The population of oyster reef (increases / <u>decreases</u>).
5.	Reclamation	<u>Reclamation destroys the habitats of oyster reefs and causes pollution along the coasts.</u>
6.	Dredging	Dredging of sea sand destroys the <u>habitats</u> of oyster reefs.
7.	Coastal development	Development along the coast disturb the habitats of oyster reefs and causes water pollution.

Q2. Explain how human activities upstream cause declining population of oyster reefs. (5 marks)

Agricultural activities release chemicals (1) and industrial activities discharge sewage (1) into rivers. Water pollution occurs (1) and water quality declines (1). The living condition of oysters declines (1). Oysters are killed/ cannot survive in severely polluted water, so their population declines (1).

3.3 Impacts of declining oyster reefs

Hint: Recall what you have learnt in Section 2.1. What are the functions of oyster reefs?



Q1. What are the impacts of declining oyster reefs?

Impact	Aspect
The function of filtering water weakens. Water pollution may worsen.	Social / Economic / <u>Environmental</u>
Oysters as food supply decrease	Social / <u>Economic</u> / Environmental
Less oyster reefs can protect the shorelines. Coastal erosion may increase.	Social / Economic / <u>Environmental</u>

Lesson 4 - Make Oyster Farming in Hong Kong Sustainable

Q. What challenges do oyster reefs face?

Lesson objectives:

To explain the concept of sustainable development

To evaluate the sustainability of oyster farming from economic, social and environmental perspectives

Key concept:

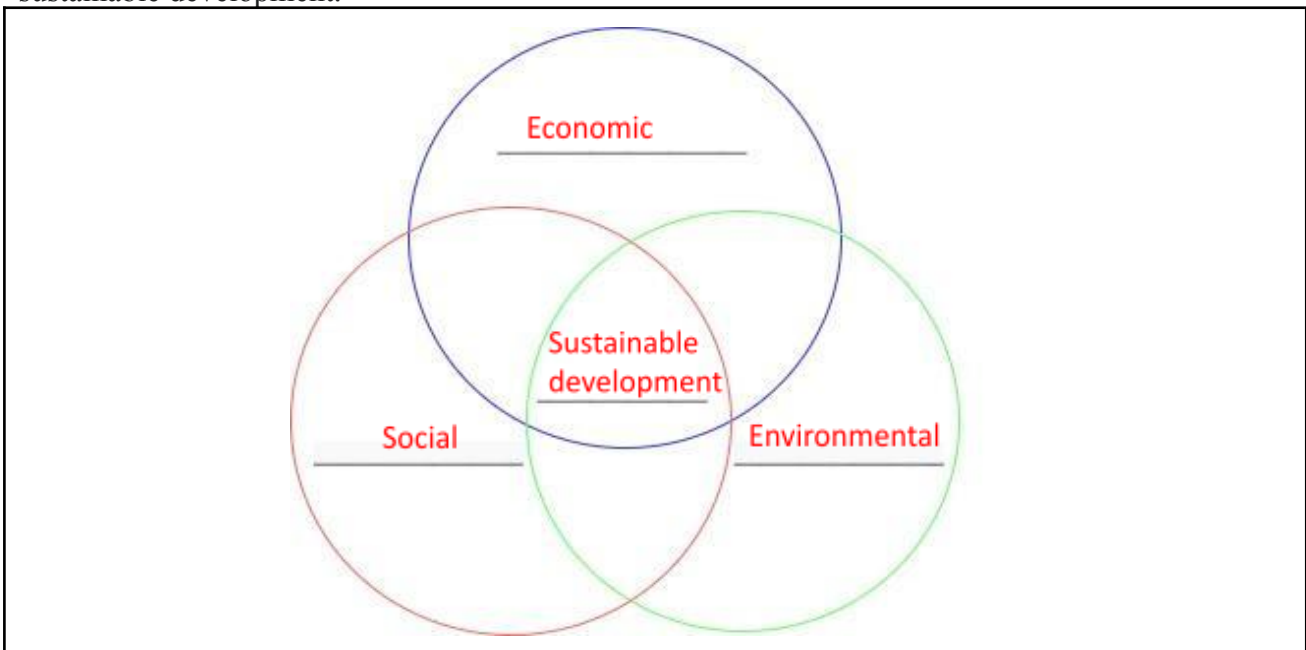
Sustainable development; oyster farming

4.1 Sustainable Development

“For sustainable development to be achieved, it is crucial to harmonise three core elements: economic growth, social inclusion and environmental protection.” (Environmental Bureau)

“The Sustainable Development Goals are a call for action by all countries...to promote prosperity while protecting the planet...build economic growth and address a range of social needs...while tackling climate change and environmental protection” (United Nations)¹

Q1. Refer to the above description to sustainable development, complete the figure below about sustainable development.



¹ In 2015, United Nation set 17 sustainable development goals and aimed to achieve them by 2030. The details can be found at <https://www.un.org/sustainabledevelopment/>

Q2. With reference to the description of sustainable development and the figure in Q1, use your own words to describe sustainable development.

Q3. Why is sustainable development so important?

Sustainable development protects our ecosystem, enhances our quality of life, and preserves the natural resources for our future generation, which brings both short-term and long-term benefits. Sustainable development therefore helps to satisfy our living without sacrificing the environment and resources of our future generation.

4.2

Group discussion: Sustainable Oyster Farming

(Details and task materials provided in 'Teacher's handbook')

Watch the video by TNC and complete the group discussions related to Sustainable Oyster Farming in Hong Kong. There are some guiding questions for reference for each discussion, and the teacher may pick some groups to present their ideas after discussion.

(Link of the video: <https://www.youtube.com/watch?v=1QaB12zzX9I>)

Discussion 1- Is oyster farming in Hong Kong sustainable?

Guiding Questions:

- *What benefits does oyster farming bring to the economy and society?*
- *How does oyster farming cope with the environmental challenges?*
- *Does oyster farming balance the needs of different stakeholders and aspects?*
- *What are the setbacks and limitations of oyster farming?*
- *Which aspect is your argument related to? (Put a tick next to the respective boxes)*

		Econ-omic	Social	Environ-mental
Arguments	<p><i>E.g. Increase harvest and income of farmers</i></p> <p><u><i>Suggested answers:</i></u></p> <ul style="list-style-type: none"> • <i>filter impurities in water</i> → <i>improves water quality</i> • <i>withstand waves during storm surges</i> → <i>protect properties and lives of coastal residence</i> <p><i>(or any other acceptable answers)</i></p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>	<p>✓</p> <p>✓</p>

Discussion 2 - How to make oyster farming in Hong Kong more sustainable?

Guiding Questions:

- *What are the threats towards sustainability of oyster farming?*
- *What stakeholders are involved in the threats?*
- *What measures and practices can the stakeholder adopt to create a more sustainable environment for oyster farming?*
- *Is the measure long-term or short-term?*
- *Is the measure a hard or soft approach?*

Suggested answers

	Economic	Social	Environmental
Challenges & Stakeholders	<i>Indigenous residence:</i> <ul style="list-style-type: none"> ● <i>Too dependent on harvest of oyster as income</i> 	<i>The public</i> <ul style="list-style-type: none"> ● <i>Insufficient knowledge and low awareness towards the value of oyster reefs</i> 	<i>The public</i> <ul style="list-style-type: none"> ● <i>Insufficient knowledge and low awareness towards the protection of oyster reefs</i>
Measures & practices	<i>Ecotourism</i> <ul style="list-style-type: none"> ● <i>residences organise local tours by leading tourists to visit mudflats and offshore oyster reefs, and dining at local seafood restaurants</i> 	<i>Cultural fair</i> <ul style="list-style-type: none"> ● <i>Showing and selling local oyster products, artwork made by oyster and books that introduce the local oyster farming industry.</i> ● <i>Visitors may understand the culture and sustainability of Hong Kong oyster farming.</i> 	<i>Ecotourism</i> <ul style="list-style-type: none"> ● <i>residences lead tourist to visit mudflats and offshore oyster reefs</i> ● <i>educate visitors on the importance of oysters reef towards the environment</i>