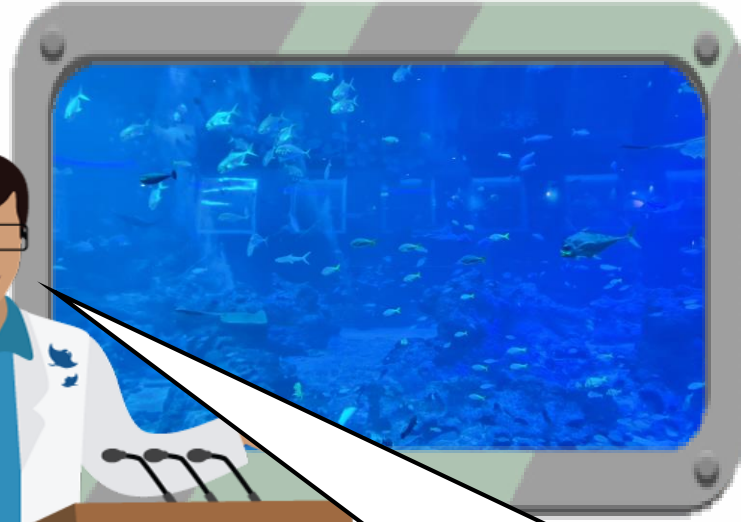


# S.E.A. AQUARIUM EDUCATOR RESOURCES

SECONDARY SCHOOL  
Create a Marine Organism



A new marine habitat has been discovered on earth!  
There are no living organisms in this habitat yet so we are looking at introducing some.





Invitation for Project: Create a Marine Organism  
<createamarineorganism@email.com>



## YOU ARE INVITED!

### YOUR MISSION:

Create a marine organism best adapted to the habitat

### REQUIREMENT:

1. Marine organism created must adapt to the habitat and any potential environmental changes.
2. Creation needs to pass a series of tests before submission.

**Be creative and think out of the box!**

[Accept invitation](#)



# INVESTIGATE PHYSICAL FACTORS OF A MARINE HABITAT

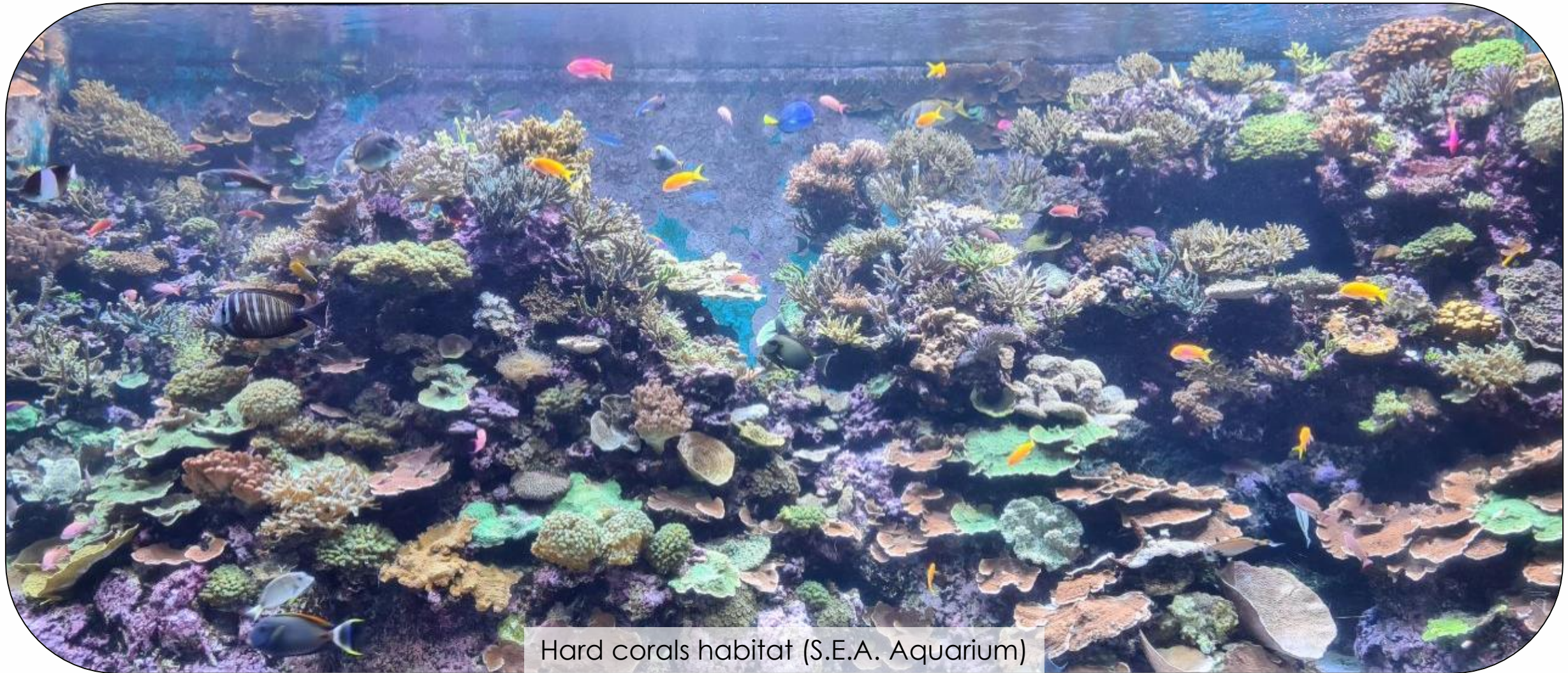
**DESCRIBE THESE PHYSICAL FACTORS IN THE FOLLOWING HABITATS**

- Temperature
- Light availability
- Water clarity
- Oxygen availability
- Other features that may affect survival  
(e.g. environment colours, vegetation cover)



# CORAL REEFS

Describe the physical factors in coral reefs.



Hard corals habitat (S.E.A. Aquarium)



# PHYSICAL FACTORS OF CORAL REEFS



**Water temperature:**  
Relatively warm  
(23 to 27°C)

**Light availability:**  
Sufficient light for  
photosynthesis

**Water clarity:**  
Relatively  
clear water

**Other features:**  
Coral and rock  
structures of various  
shapes and sizes

**Environment  
colours:**  
Variety of  
colours



# ANIMALS IN CORAL REEFS

How do these animals adapt to the physical factors in coral reefs?

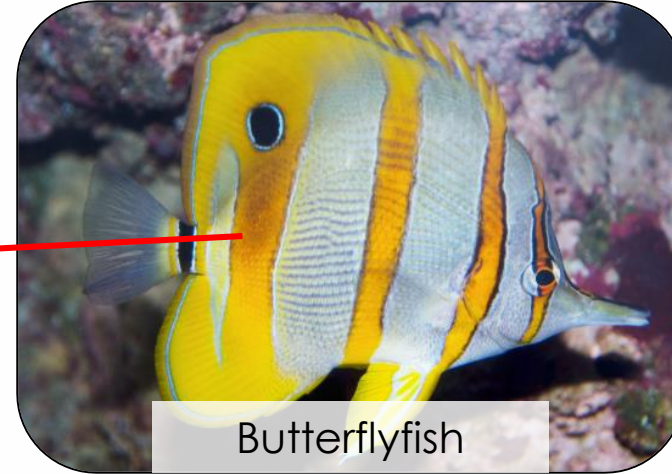


# ANIMALS IN CORAL REEFS

Vibrantly-coloured  
body camouflage  
amongst corals

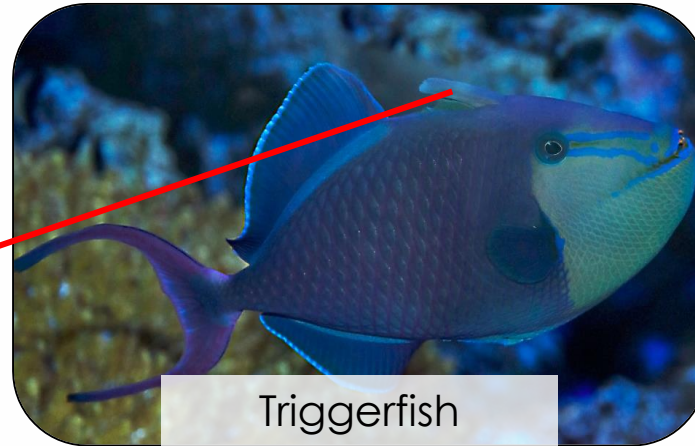


Surgeonfish



Butterflyfish

Spines to anchor  
in crevices



Triggerfish

Layer of protective  
mucus on skin



Moray Eel





# OPEN OCEAN

Describe the physical factors in the open ocean.



Open Ocean Habitat (S.E.A. Aquarium)



# PHYSICAL FACTORS OF OPEN OCEAN

## Water temperature:

30°C in tropical surfaces, 4°C in deeper waters

## Light availability:

Most light at surface and amount decreases with depth

## Environment colours:

Monotonous environment

## Other features:

Mostly featureless, with rocks on the seabed



# APADTATIONS IN OPEN OCEAN

How do these animals adapt to physical factors in the open ocean?



# APADTATIONS IN OPEN OCEAN



Manta Ray

Flat body, large pectoral fins and mouth located at the front



Shark

Dark and light body colouration for countershading



Grouper

Dull-coloured body and hover motionlessly in water column and near the seabed



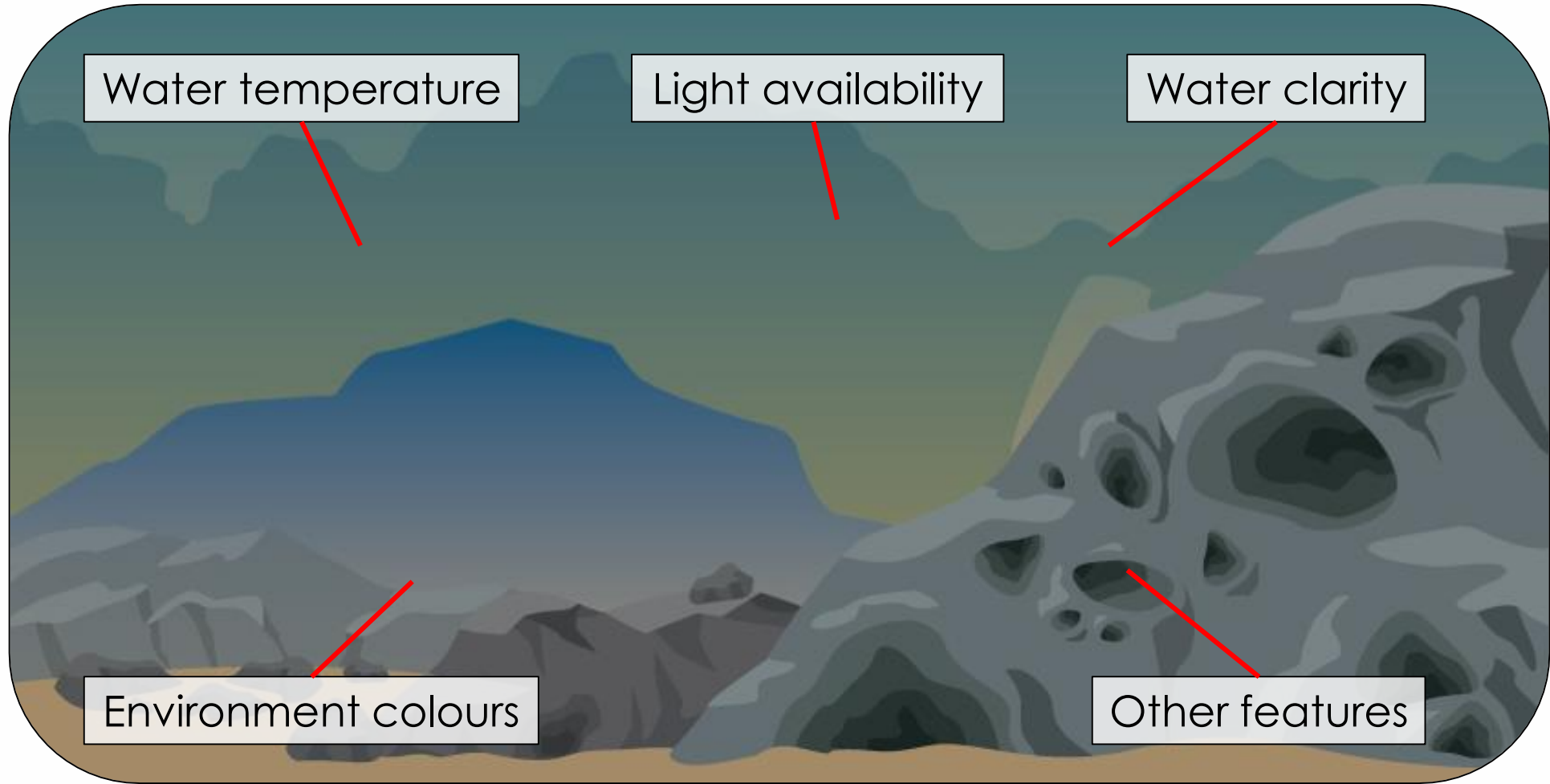
# YOUR MISSION:

Examine the new habitat



# YOUR MISSION:

## Examine the new habitat



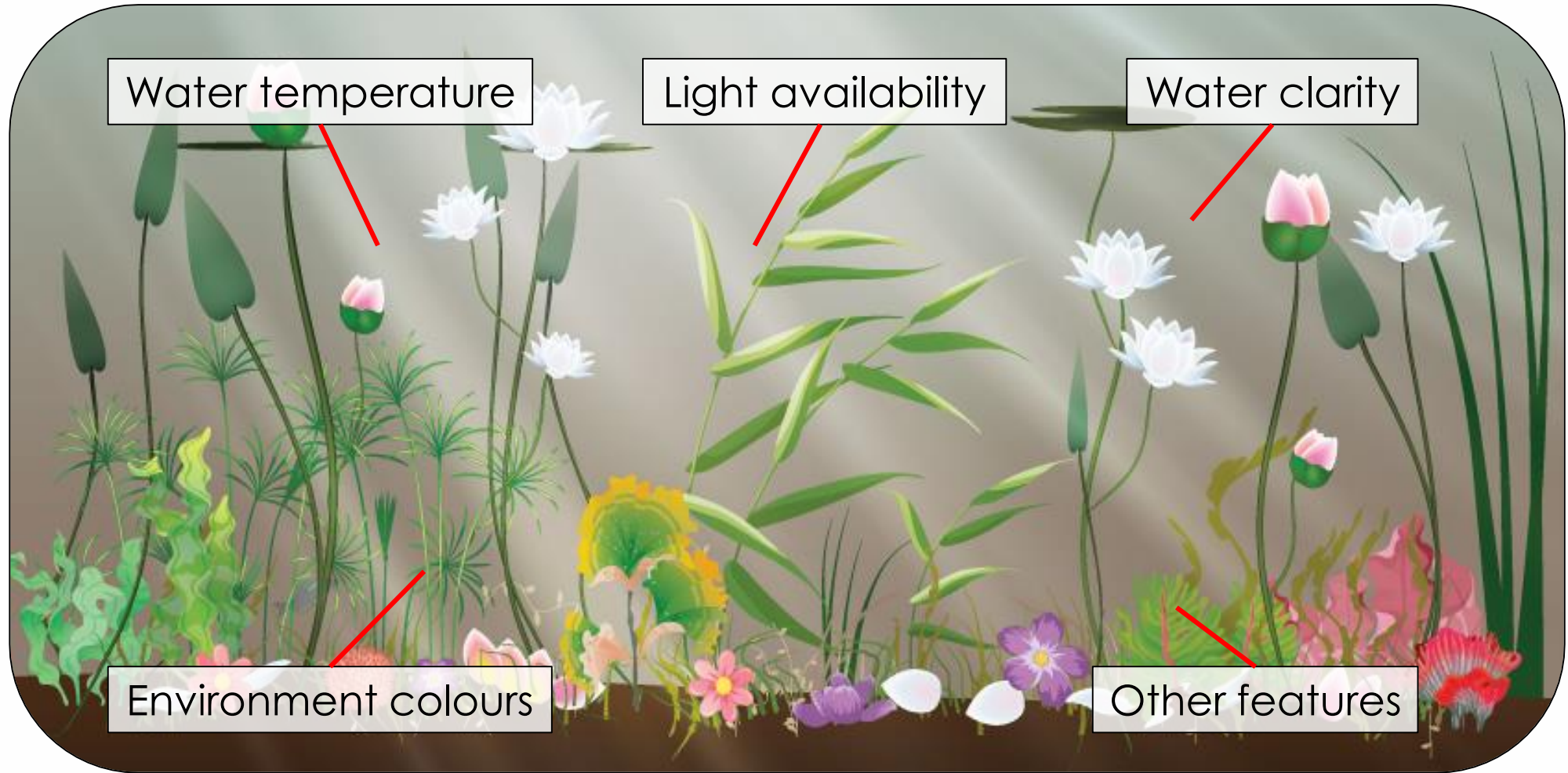
# YOUR MISSION:

Examine the new habitat



# YOUR MISSION:

## Examine the new habitat





# NEXT MISSION:

Create a marine organism

**QUESTIONS TO  
CONSIDER**



Why do living organisms require adaptations?

What are some adaptive traits that can help them to survive?

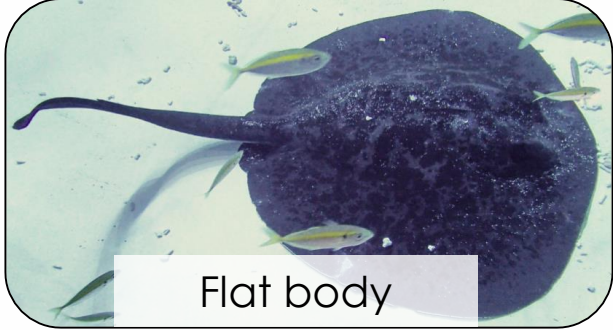


# ADAPTIVE TRAITS

## MOUTH TYPE



## BODY SHAPE



## BODY PATTERN



# TIME FOR YOUR CREATION!

**PLEASE INCLUDE THESE DETAILS FOR YOUR CREATION! 😊**

- Name
- Type of organism (e.g. animal, microorganism, plant, algae)
- Size
- Location within habitat (e.g. in sediments, on vegetation, open ocean)
- Diet
- Fun fact
- Adaptive traits
- Labelled illustration



# CAN YOUR MARINE ORGANISMS ADAPT WELL?

- Describe how your marine organism can adapt to the given physical factors.
- Assess the following environmental events and describe the corresponding changes in physical factors.



# ENVIRONMENTAL CHANGES

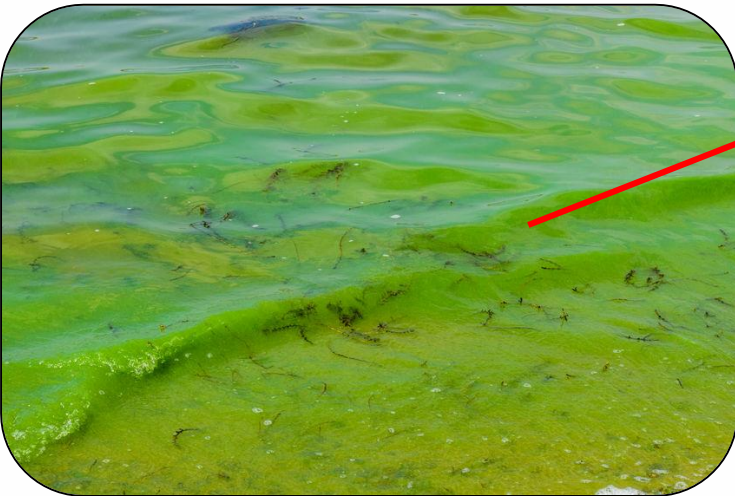
## WATER POLLUTION

Water clarity



Light availability

Chemical composition



Oxygen availability

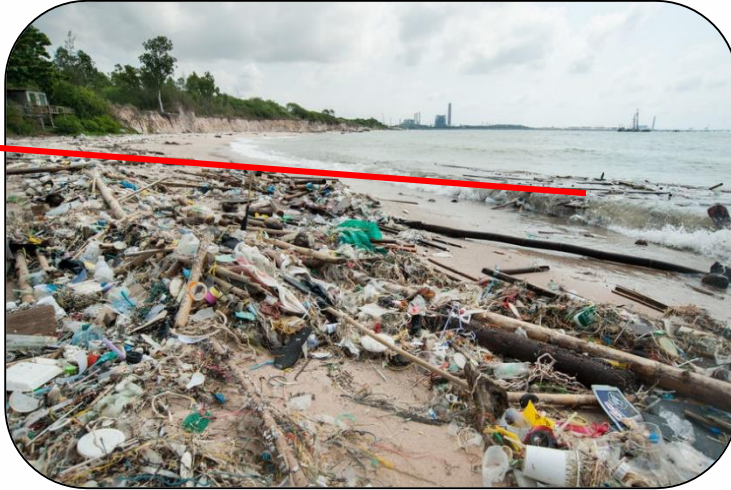
Vegetation cover



# CHANGES IN PHYSICAL FACTORS

## WATER POLLUTION

**Water clarity:**  
Reduce visibility



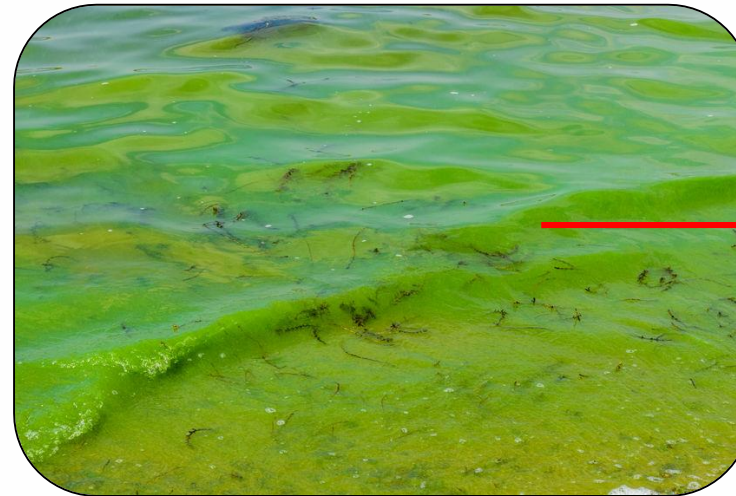
**Light availability:**  
Reduce light penetration



**Chemical composition:**  
Introduce toxic chemicals



**Oxygen availability:**  
Plankton bloom reduces amount of oxygen

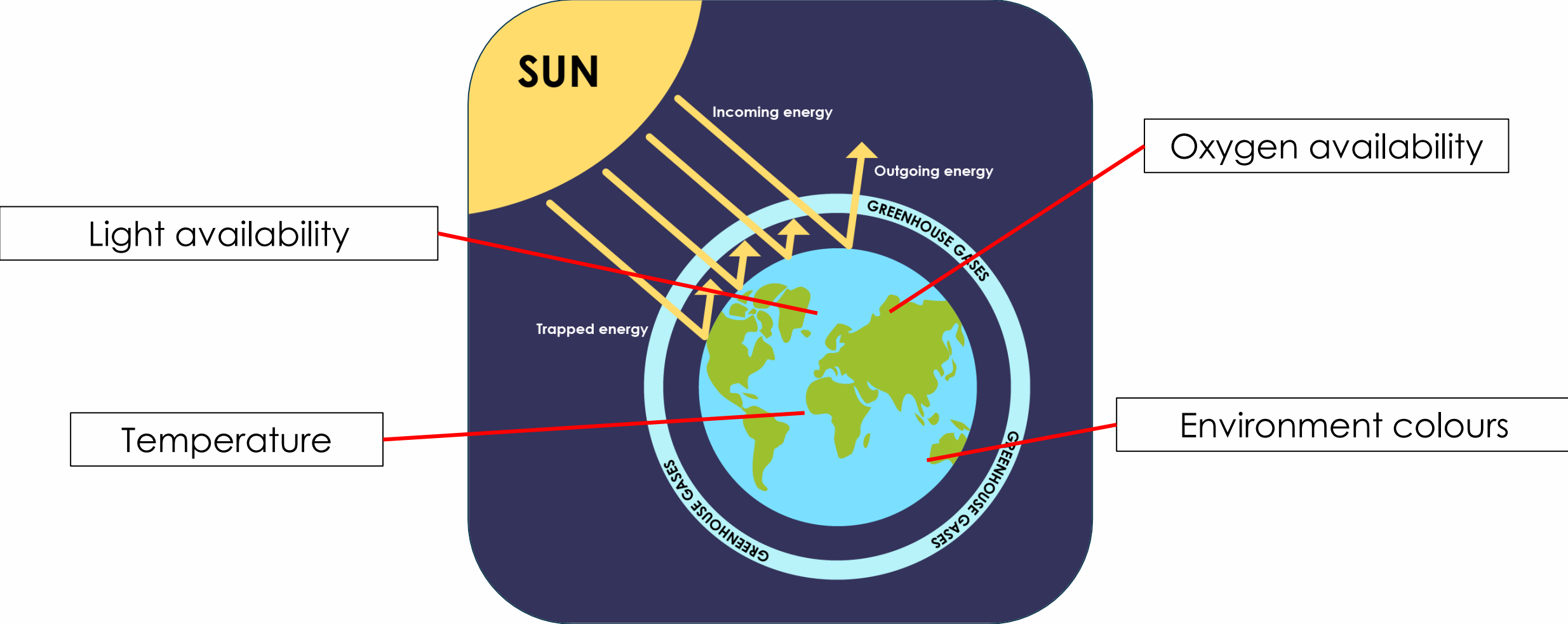


**Vegetation cover:**  
Reduce due to toxic components



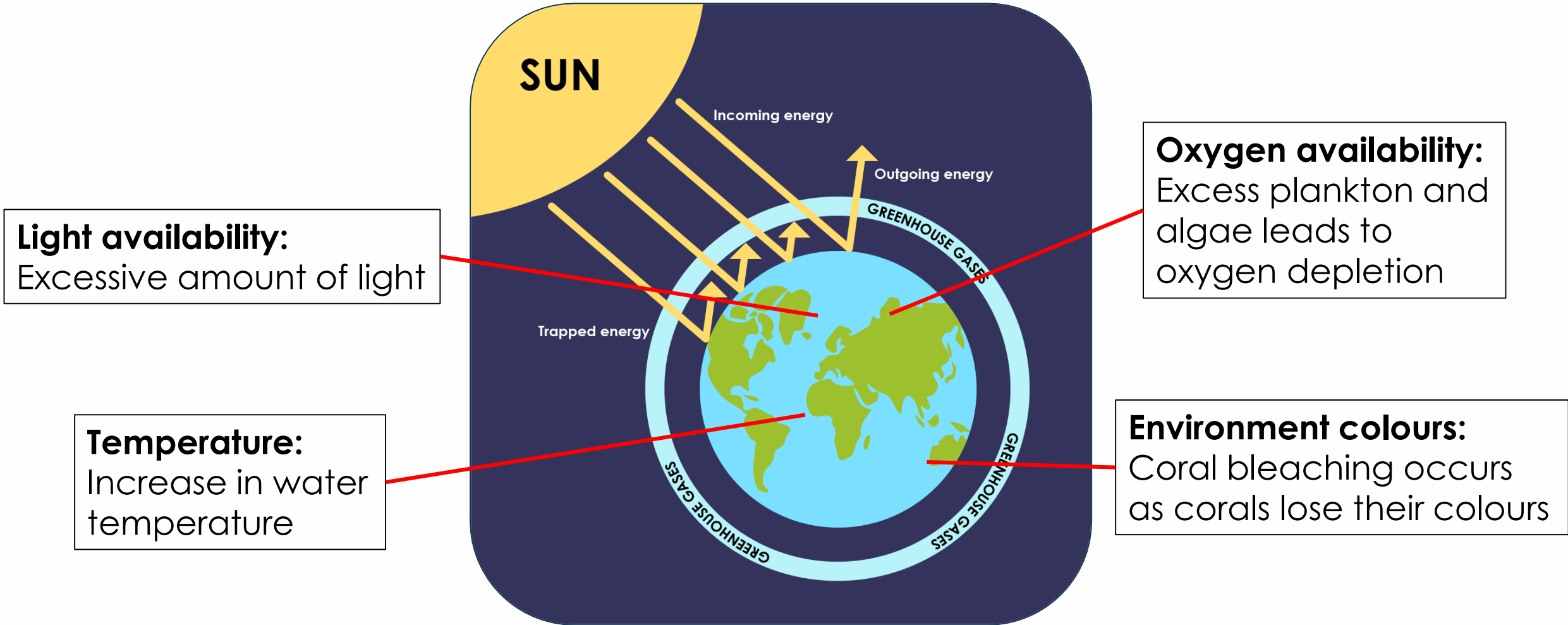
# ENVIRONMENTAL CHANGES

## GLOBAL WARMING



# CHANGES IN PHYSICAL FACTORS

## GLOBAL WARMING





# ENVIRONMENTAL CHANGES

## OCEAN ACIDIFICATION



Other features

Acidity



# CHANGES IN PHYSICAL FACTORS

## OCEAN ACIDIFICATION



**Other features:**  
Less coral structures  
for shelter

**Acidity:**  
Increase weakens coral  
skeletons and animal shells



# CAN YOUR MARINE ORGANISMS SURVIVE THE ENVIRONMENTAL CHANGES?

- Based on the changes in physical factors you have identified, can your organisms adapt and survive?
- How can they respond in order to adapt?
- How many of your creations can pass the tests and survive?



# THINK ABOUT IT!

- Do you think the original adaptations you have thought of are still effective after the environmental changes?
- Do the environmental changes only affect certain organisms?



# IMPORTANCE OF CONSERVATION

**Think of a plan to protect the species that cannot survive!**

- Why is conservation essential?
- How effective are conservation efforts?



# SANCTUARY

## SISTERS' ISLANDS MARINE PARK

As Singapore's first marine park, the waters and reefs are legally protected.



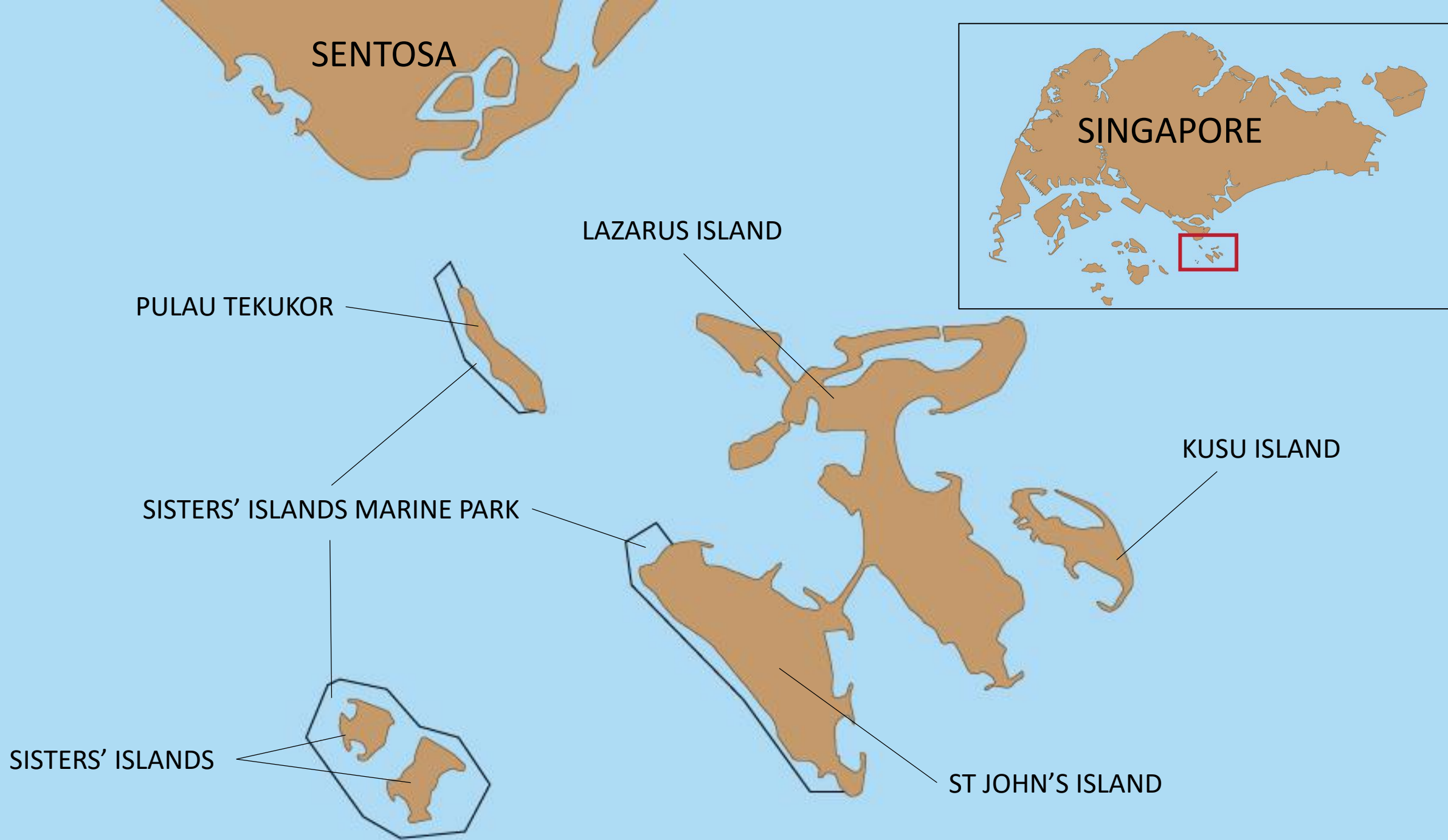
A platform for researchers to monitor changes in the marine environment.



The protected area provides a safe refuge for marine biodiversity.

Photo credit: National Parks Board





SENTOSA

SINGAPORE

LAZARUS ISLAND

PULAU TEKUKOR

KUSU ISLAND

SISTERS' ISLANDS MARINE PARK

SISTERS' ISLANDS

ST JOHN'S ISLAND

# POPULATION RESTORATION SINGAPORE'S CORAL REEFS



Photo credit: The Straits Times

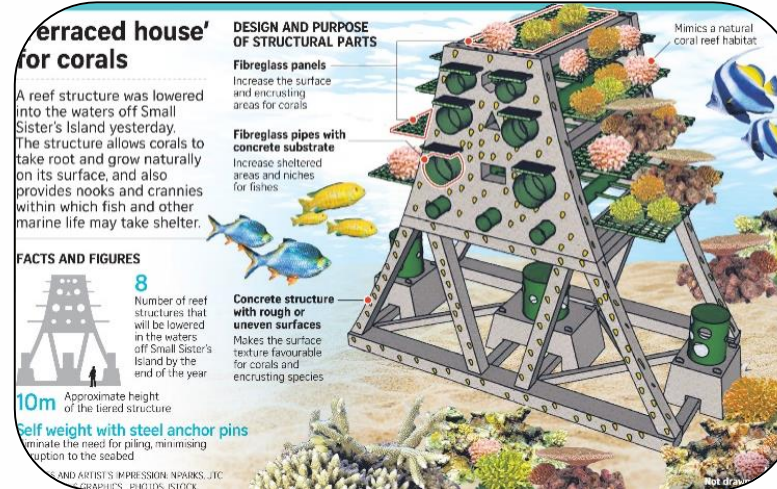


Photo credit: The Straits Times

Artificial structures were placed in the waters to encourage coral growth.

Just like coral reefs globally, Singapore corals are exposed to coral bleaching too.



Corals are grown in an external nursery and transplanted to the structures when they are of suitable size.

Photo credit: National Parks Board





# BREEDING PROGRAMMES



Bowmouth Guitarfish



Corals

Aquariums provide safe and controlled environments for breeding.



Juvenile zebra shark



Juvenile zebra shark

Exchange with other aquariums after successful breeding ensures genetic diversity.



# BREEDING PROGRAMMES



Research on animals that are difficult to study in nature can be conducted.



# IMPORTANCE OF CONSERVATION

- What would happen to vulnerable species if these efforts are not initiated?
- If some species become extinct, what are the effects on other species and ecosystem?





# MISSION COMPLETED

THIS ACKNOWLEDGES THAT

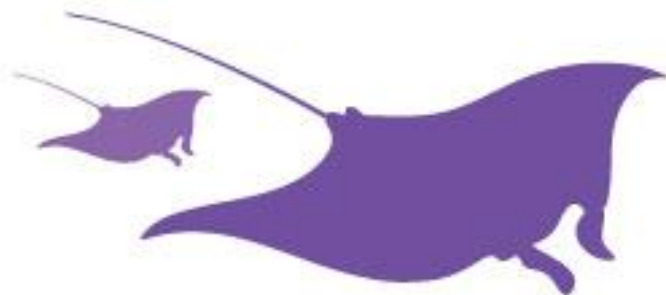
---

**YOU**

---

HAVE SUCCESSFULLY COMPLETED

● **CREATE A MARINE ORGANISM** ●



THANK YOU FOR YOUR PARTICIPATION AND HELPING US TO  
INTRODUCE NEW MARINE ORGANISMS TO THIS NEW HABITAT!

ALL EXISTING HABITATS ARE HOMES TO MANY ORGANISMS  
TOO SO DON'T FORGET TO CONTINUE PROTECTING THEM!