

S.E.A. AQUARIUM EDUCATOR RESOURCES

SECONDARY SCHOOL
Biodiversity

What is Biodiversity?

LIFE

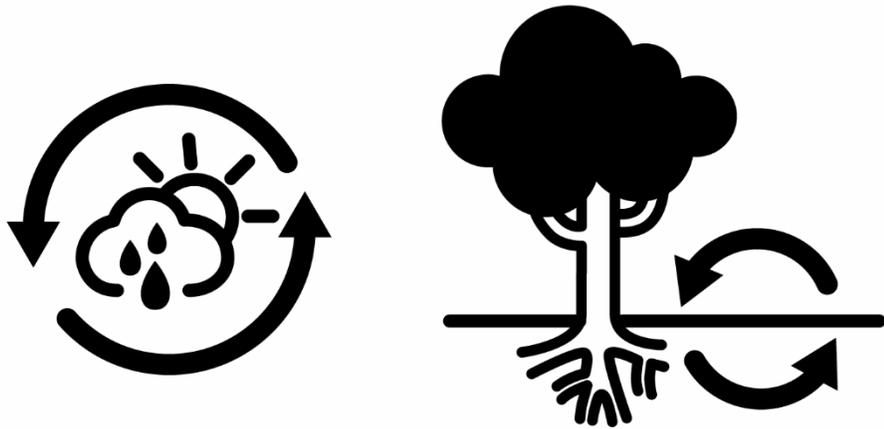
VARIETY

- ❑ Includes variety within and between species
- ❑ Indicates health of the environment



Importance of Biodiversity

Ecological services



Recycling of nutrients, water filtration, decompose pollutants

Provision of resources



Food, medicine, fuel, raw materials





**Let us take a look at how is
biodiversity important when there
are environmental changes**



Activity Brief

- Aim: compare a highly biodiverse and less biodiverse ecosystem
- 2 parts to the activity:
 - Part 1: Scenario of Ecosystem A with low biodiversity
 - Part 2: Scenario of Ecosystem B with high biodiversity
- You will represent the organism on the playing card received
- Listen closely to environmental cues

What will happen to your organism?



ACTIVITY TIME!

Part 1



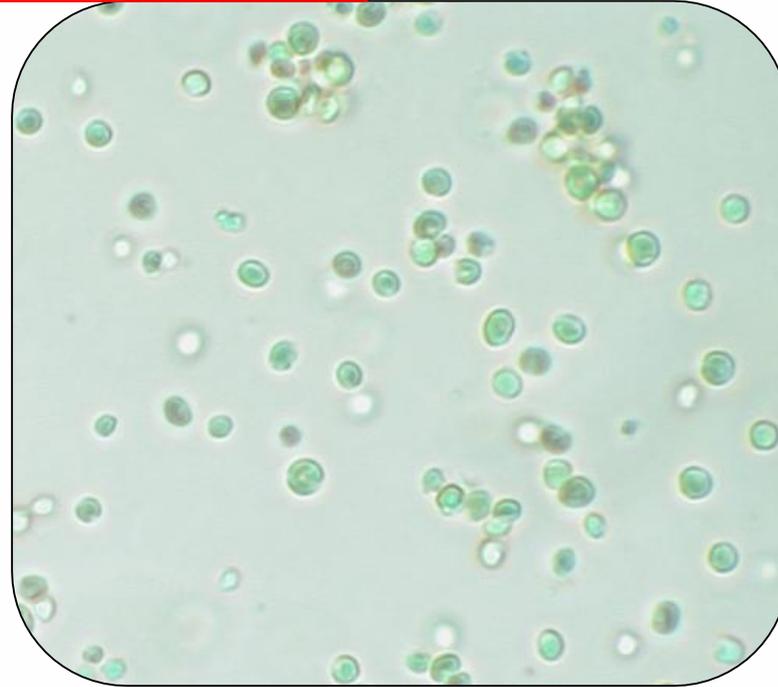
Common name and Scientific name

Phytoplankton
Nanochloropsis spp.

1

Trophic level

- 1: Primary producer
- 2: Primary consumer
- 3: Secondary consumer
- 4: Tertiary consumer
- 5: Apex predator



Fact/Adaptation

Fact: These are single-celled organisms that can make their own food using sunlight by undergoing photosynthesis.

Gives indication if organism will be affected by environmental cues

Diet: Produces its own food

Vulnerability: Lack of sunlight

Organism's diet

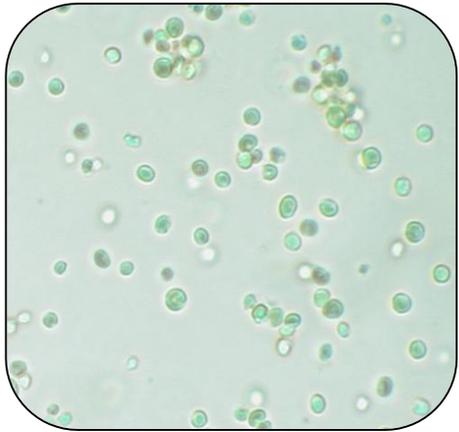
*Note: Small fishes refer to fishes in the trophic level numbered 3 and below



Ecosystem A (4 species)

Phytoplankton
Nanochloropsis spp.

1



Fact: These are single-celled organisms that can make their own food using sunlight by undergoing photosynthesis.

Diet: Produces its own food

Vulnerability: Lack of sunlight

Zooplankton
Krill

2



Fact: Krill are small shrimp-like crustaceans that are important food sources for animals of various sizes.

Diet: Phytoplankton & other zooplankton

Vulnerability: Warmer oceans

Indian Mackerel
Rastrelliger kanagurta

3



Fact: Found swimming in schools, and feeds mainly on plankton and small fish larvae. Its forked tail and streamlined body help it to swim quickly.

Diet: Zooplankton/shrimp & fish larvae

Vulnerability: Overfishing

Pickhandle Barracuda
Sphyræna jello

4



Fact: Possess a forked tail and an elongated body shaped like a torpedo to cut through the water in sprints of high speeds

Diet: Small fishes/smaller barracudas

Vulnerability: Exploited for sport fishing



Instructions

- Listen to the environmental cues given.
- Consider how it affects the species that you are representing.
- Respond accordingly:
 - Species become extinct – All students to sit
 - Species does not become extinct but population decreases – half of students assigned to sit while the rest remain standing
 - Species largely not affected and survives – All students remain standing



Effects of environmental cue

- Which species will be directly affected? Why?
- Which other species will be affected subsequently?
- How many species and organisms survived?
- Can this ecosystem still sustain itself?





Overfishing of the Indian mackerel has caused the species to be considered extinct as they are rarely found in the ocean.





Sudden increase in **sport fishing** and fishermen are catching the largest fish as trophies.



Think about it!

- What happens when 1 species is no longer present in Ecosystem A?
- Does it have a great impact on the rest of the organisms? How so?
- Is it healthy for an ecosystem with low biodiversity but high population numbers? Why?
- How did human actions change Ecosystem A?



ACTIVITY TIME!

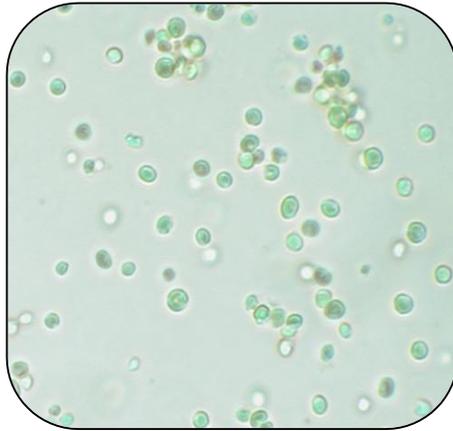
Part 2



Ecosystem B (15 species)

Phytoplankton
Nanochloropsis spp.

1



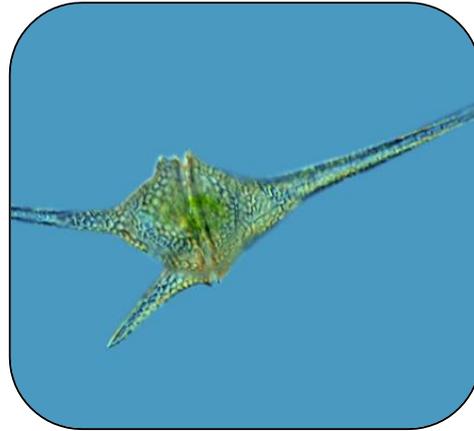
Fact: These are single-celled organisms that can make their own food using sunlight by undergoing photosynthesis.

Diet: Produces its own food

Vulnerability: Lack of sunlight

Phytoplankton
Dinoflagellate

1



Fact: These are single-celled organisms that can make their own food using sunlight by undergoing photosynthesis.

Diet: Produces its own food

Vulnerability: Lack of sunlight

Brown Algae

1



Fact: This algae not only serves as food but also shelter for marine organisms. Some species have holdfast which act as anchors to the sea floor.

Diet: Produces its own food

Vulnerability: Lack of sunlight



Ecosystem B (15 species)

Zooplankton

Krill

2



Fact: Krill are small shrimp-like crustaceans that are important food sources for animals of various sizes.

Diet: Phytoplankton & other zooplankton

Vulnerability: Warmer oceans

Bluespine Unicornfish

Naso unicornis

2



Fact: Named after horn-like protrusion on its head. This herbivorous fish also has tiny spines near their tails for defense.

Diet: Primarily algae

Vulnerability: Overfishing

Zooplankton

Copepod

2



Fact: Commonly found plankton in the ocean that is an important food source for many animals. A pair of prominent antennules allows it to avoid predators efficiently.

Diet: Phytoplankton & other zooplankton

Vulnerability: Warmer oceans

Blue tang

Paracanthurus hepatus

2



Fact: A Flat-bodied grazer that is important to coral reef health. By feeding on algae, it prevents algae overgrowth, which is detrimental to reef health.

Diet: Primarily algae/phytoplankton

Vulnerability: Habitat loss (coral reef)



Ecosystem B (15 species)

Indian Mackerel
Rastrelliger kanagurta

3



Fact: Found swimming in schools, and feeds mainly on plankton and small fish larvae. Its forked tail and streamlined body help it to swim quickly.

Diet: Zooplankton/shrimp & fish larvae

Vulnerability: Overfishing

Orange-striped Hermit Crab
Clibanarius infraspinus

3



Fact: A type of crustacean that seeks shells along the coast for protection. As it grows, it needs to constantly look for larger shells.

Diet: Zooplankton/shrimp & fish larvae

Vulnerability: Aquarium trade

Copperband Butterfly Fish
Chelmon rostratus

3



Fact: A brightly coloured fish with an elongated mouth. This mouth shape allows it to capture prey in small reef crevices that are hard to reach.

Diet: Zooplankton & algae

Vulnerability: Diseases and parasites



Ecosystem B (15 species)

Pickhandle Barracuda
Sphyraena jello

4



Fact: Possess a forked tail and an elongated body shaped like a torpedo to cut through the water in sprints of high speeds

Diet: Small fishes/smaller barracudas

Vulnerability: Exploited for sport fishing

Spotted Eagle Ray
Aetobatus narinari

4



Fact: A cartilaginous fish with a flattened body and is a type of ray. It possesses 1 or more stinging barbs on top of its tail to defend itself.

Diet: Small fishes/crustaceans

Vulnerability: Overfishing

Spotted Moray Eel
Gymnothorax isingteena

4



Fact: It has a snake-like body and does not have scales. A protective mucus layer on its skin enables it to slide and hide in tight crevices and caves.

Diet: Small fishes/crustaceans/molluscs

Vulnerability: Habitat destruction



Ecosystem B (15 species)

Scalloped Hammerhead Shark

Sphyrna lewini

5



Fact: Named after its hammer-shaped head, this shark is an efficient apex predator. It actively hunts its prey and can use its head to pin down prey.

Diet: Fishes/crustaceans/cephalopods

Vulnerability: Overfishing/bycatch

Sand Tiger Shark

Carcharias taurus

5



Fact: A predator with long and sharp teeth that protrude from its mouth even when its jaws are closed. It usually hunts at night and sometimes observed to hunt in groups

Diet: Fishes/rays/cephalopods

Vulnerability: Overfishing/bycatch





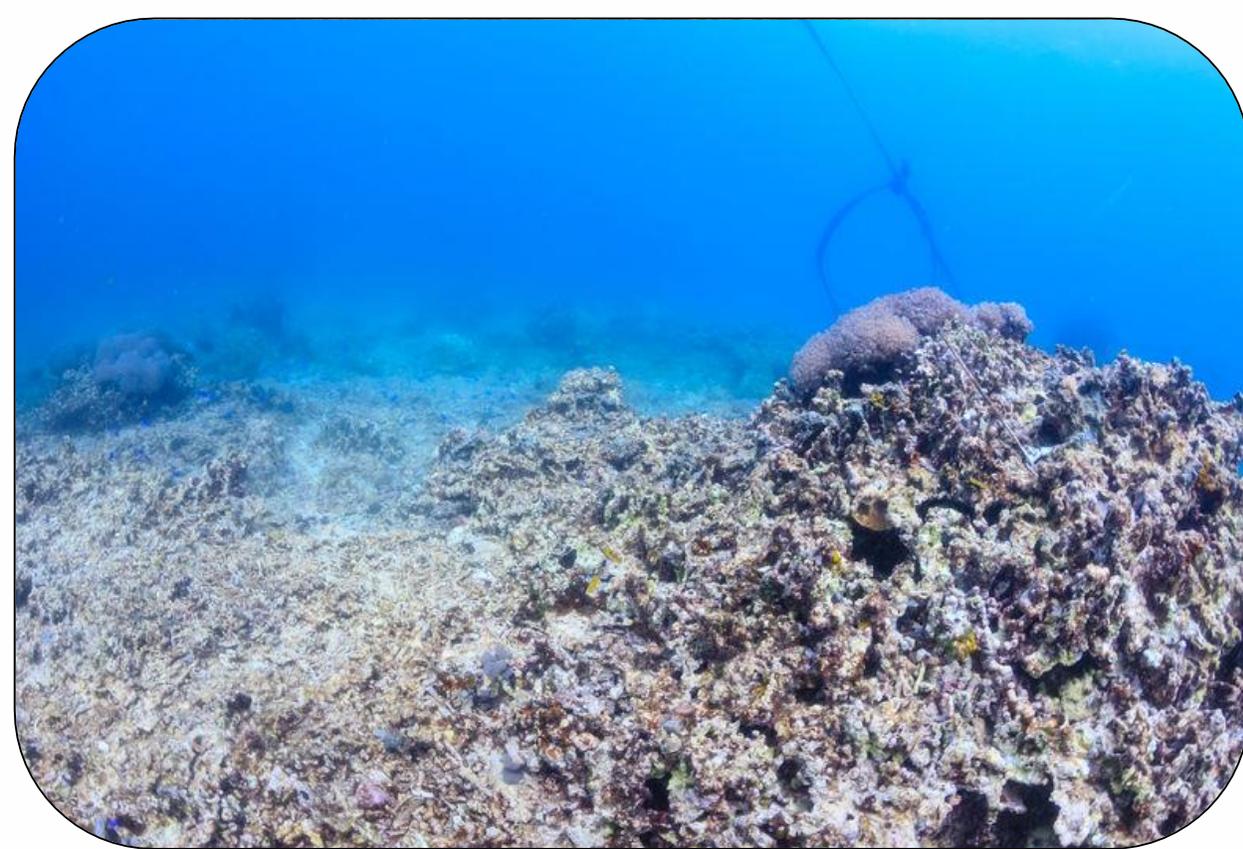
Overfishing of the Indian mackerel has caused the species to be considered extinct as they are rarely found in the ocean.





Global warming increases **light intensity** and **water temperature** in the ocean.





Dynamite fishing is increasingly being used by fishermen to harvest **Indian mackerel and bluespine unicornfish** in Ecosystem B.

- An efficient fishing method that uses explosives to stun schools of fish
- Most underwater caves and other structures are also destroyed





Red lionfish, a non-native species in Ecosystem B, has been **increasingly introduced** into the habitat.

- Brought in for aquarium trade
- Now released into the habitat after injuring many owners with their venomous spines.





Background information of red lionfish:

- Predator of small fishes and crustaceans
- Possess venomous spines on dorsal and pelvic fins
- Sharks are known to be their natural predators



Think about it!

- Was the outcome in Part 2 different from that in Part 1?
- Is having high biodiversity important for an ecosystem to be resilient against environmental changes? Why?
- Will there be any situation where human actions can significantly affect ecosystems with high biodiversity?



Summary

- Having high biodiversity allows ecosystems to be resilient against environmental changes.
- Every species has its role in an ecosystem and can influence the survival of other species.
- Human actions can accelerate environmental changes and affect biodiversity.

