

SARGSNAP!

Sargassum Lesson

Teachers Booklet



**UNIVERSITY
OF GHANA**



Learning Objectives

In this lesson, students will learn...

1. What sargassum is
2. How to identify different species of sargassum
3. The challenges and opportunities of sargassum

Lesson Plan



LO	Overview	Teachers Instructions
Learning objectives (10 minutes)	Teacher to go through the learning objectives with student	Anything in this booklet in red is just for the teacher, such as answers!
1 What is Sargassum (30 minutes)	1. Activity 1: what do you think sargassum is? 2. Listening exercise 1 3. Activity 2 on matching keywords	Give students a few minutes to have a go and ask them to volunteer their answers and why they think it is what it is Teacher to share the information on Learning Objective 1 (either by reading or in their own words) and give the students opportunity to ask any questions, before starting to read/share the information on learning objective 2. Students should attempt the activity independently to match the letters and numbers, and then the teacher should go over the answers.
2 How to identify different species of sargassum (30 minutes)	4. Listening Exercise 2 5. Classification 6. Features of sargassum 7. Activity 3: Identify the sargassum in the photos	Same as listening exercise 1 Look at organism classification of sargassum and humans together, allow students some time to read the extra information on classification/taxonomy. Look at the 3 morphotypes of sargassum together and point out the different features highlighted in each image. Students should have a go at this independently and then go over the answers together.
3 The challenges and opportunities of sargassum (30minutes)	8. Activity 4: Definitions from pictures 9. Activity 5: negative and positive impact table and debate 10. Listening exercise 3	Students should write down what they think the words might mean using the pictures as a clue, before going through the answers together. Students should draw the table and put the 5 words where they think they should go for both floating and beached sargassum. The teacher should then ask the students where they put the word and why, it is expected that students will have mixed answers and they should critically debate/discuss (soe suggested answers are provided). Same as listening exercise 1
Conclusions (15 minutes)	11. Activity 6 & 7: students will recap what they have learnt and fill in the gaps. 12. Additional materials / information	Students should do these independently and the teacher can go over the answers at the end if needed. Some pages of extra information students can read if they wish.



Learning Objective 1

In this lesson, students will learn what sargassum is

Activity 1: What do you think sargassum is?

Sargassum is...?

A plant

An animal

Other type of
living thing

Give a reason for your answer

This question is for students to think, the next listening exercise answers the question.

Sargassum is 'another type of living thing' (seaweed/algae).

The teacher can check afterwards and ask students to raise their hand if they got it correct, help the teacher to ascertain the average students' knowledge of sargassum in the class.

Listening Exercise 1

Information on seaweed, algae and sargassum transport

The type of sargassum we see on the beach in Ghana are brown algae, seaweed is a type of algae. Other types of algae include green algae and red algae.

Sargassum fluitans and natans are the names of the species we see in Ghana, they are **holopelagic** which means they spend their entire lives floating (*etymology: holo: whole (Greek); pelagic: relating to the top layer of the sea/ocean (Greek/Latin)*).

There are over 300 other species of sargassum, some of these are **benthic** species which means they **do not** spend their whole life floating and they grow roots or a holdfast and live at the bottom of the water in sea beds.

The winds and ocean currents move the holopelagic sargassum blooms around the water and closer to land so they can be deposited on beaches. **You can see this in the photos in the booklet.**

We can see on the **map** that it is moved across the Atlantic region and affects many countries, including Ghana. Take some time to look at the map. The blue arrows show the predominant ocean currents which operate with the wind to push sargassum around the ocean allowing sargassum to be transported to many places.

Suggested informal questions the teacher can choose to ask students to help them interpret the map:

- Can you find Ghana on the map?
- Can you count how many countries are affected by sargassum?
- Which countries can you name?





West of Barbados, Caribbean Sea
March 2022



Tema, Ghana
June 2022

Sargassum 'floating' on the ocean surface

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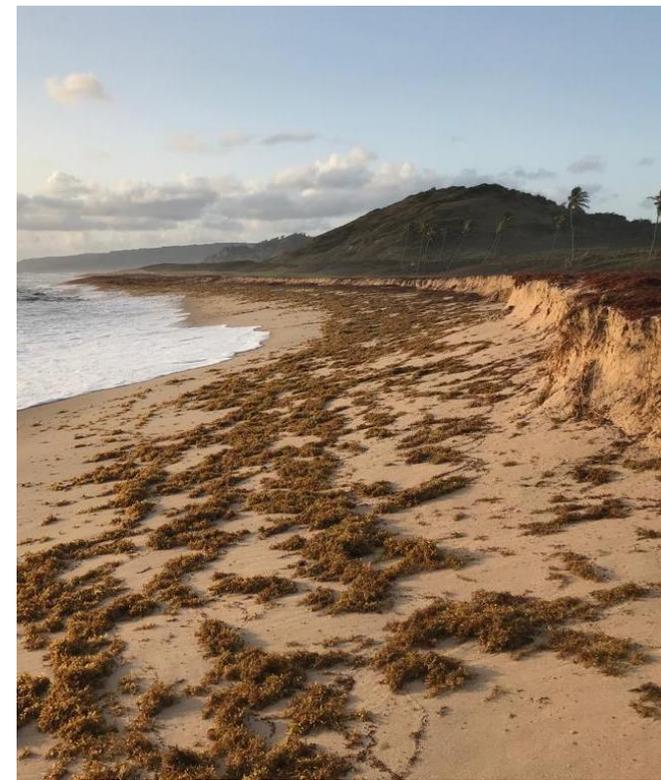




Esiama, Ghana
September 2021



Beyin, Ghana
September 2021

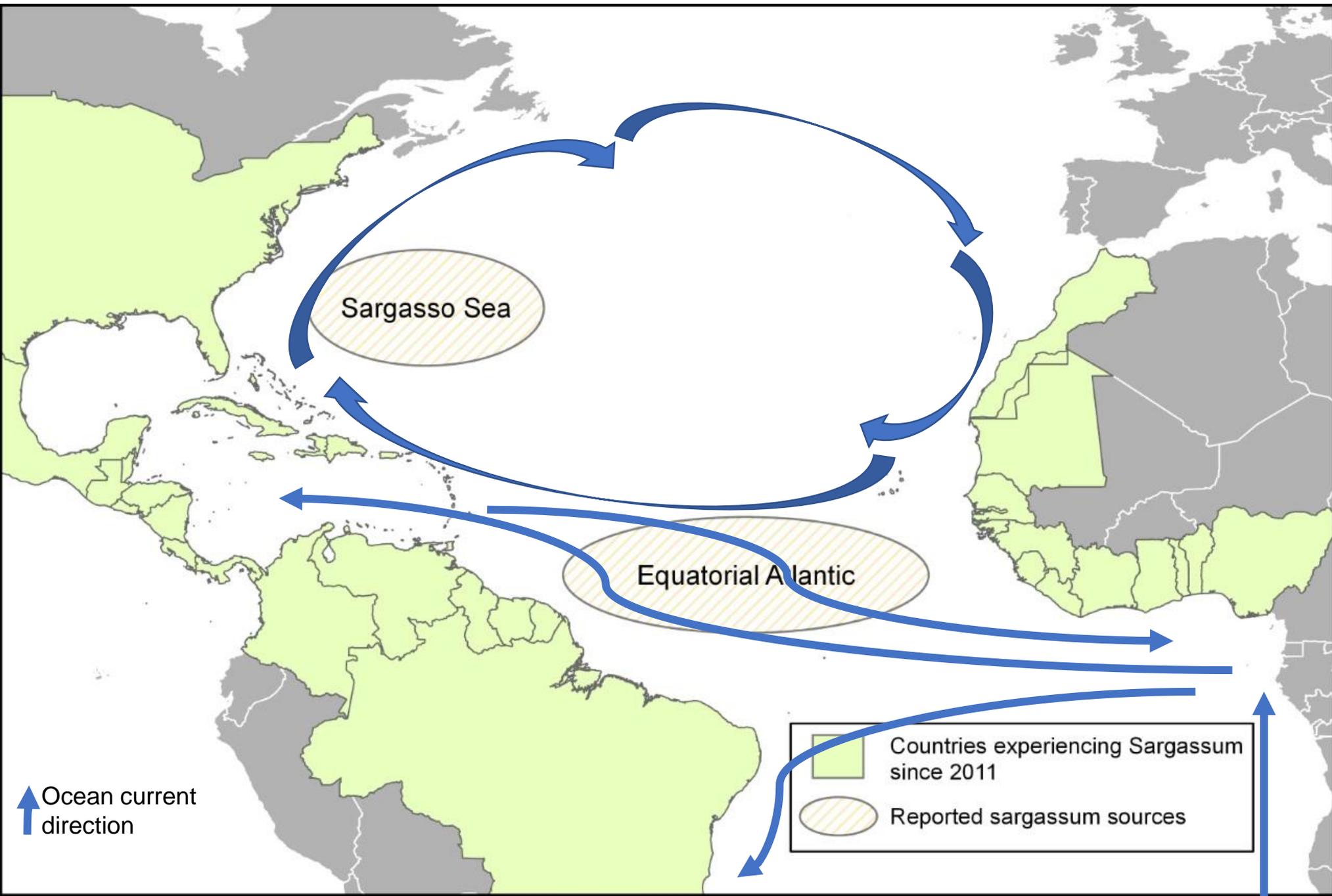


Barbados, Morgan Lewis
March 2022

Sargassum deposited on beaches.

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Activity 2: Sargassum Key Words

Can you match the pairs?

1. Seaweed

a. When the sea loses energy and it drops things it has been carrying

2. Benthic

b. The arrival of a large amount of something

3. Algae

c. Type of algae growing in the sea

4. Influx

d. Living at the bottom of the water

5. Deposit

e. Living organism without stems, roots and flowers

6. Holopelagic

f. rapid, massive and uncontrolled growth of algae

7. Natural Resource

g. A naturally occurring source of wealth or revenue

8. Bloom

h. A body of water or air moving or flowing in a definite direction

9. Currents

i. Floats in the sea for a lifetime

Teachers Answers!

- 1. C
- 2. D
- 3. E
- 4. B
- 5. A
- 6. I
- 7. G
- 8. F
- 9. H



Learning Objective 2

In this lesson, students will learn how to identify different species of sargassum.

Listening Exercise 2

Information on species and morphotypes

The image illustrates how we categorise all living things on our planet. It shows how we can categorise both humans and sargassum morphotypes.

Take some time to have a look at the diagram.

There are 5 kingdoms, these are: animals (multicellular animals), plants (green plants), fungi (moulds, mushroom yeast), protists (phytoplankton), prokaryotes (bacteria). From the image we can see that humans are animals and sargassum are protists. Protists are a diverse collection of organisms that do not fit into animal, plant, bacteria or fungi groups.

The classification system is made of ranks, these are: kingdom, class, order, family, genus and species. Kingdom is the least specific way to describe an organism and species is the most specific way to identify an organism.

An organism is grouped into these ranks based on their characteristics and genetics.

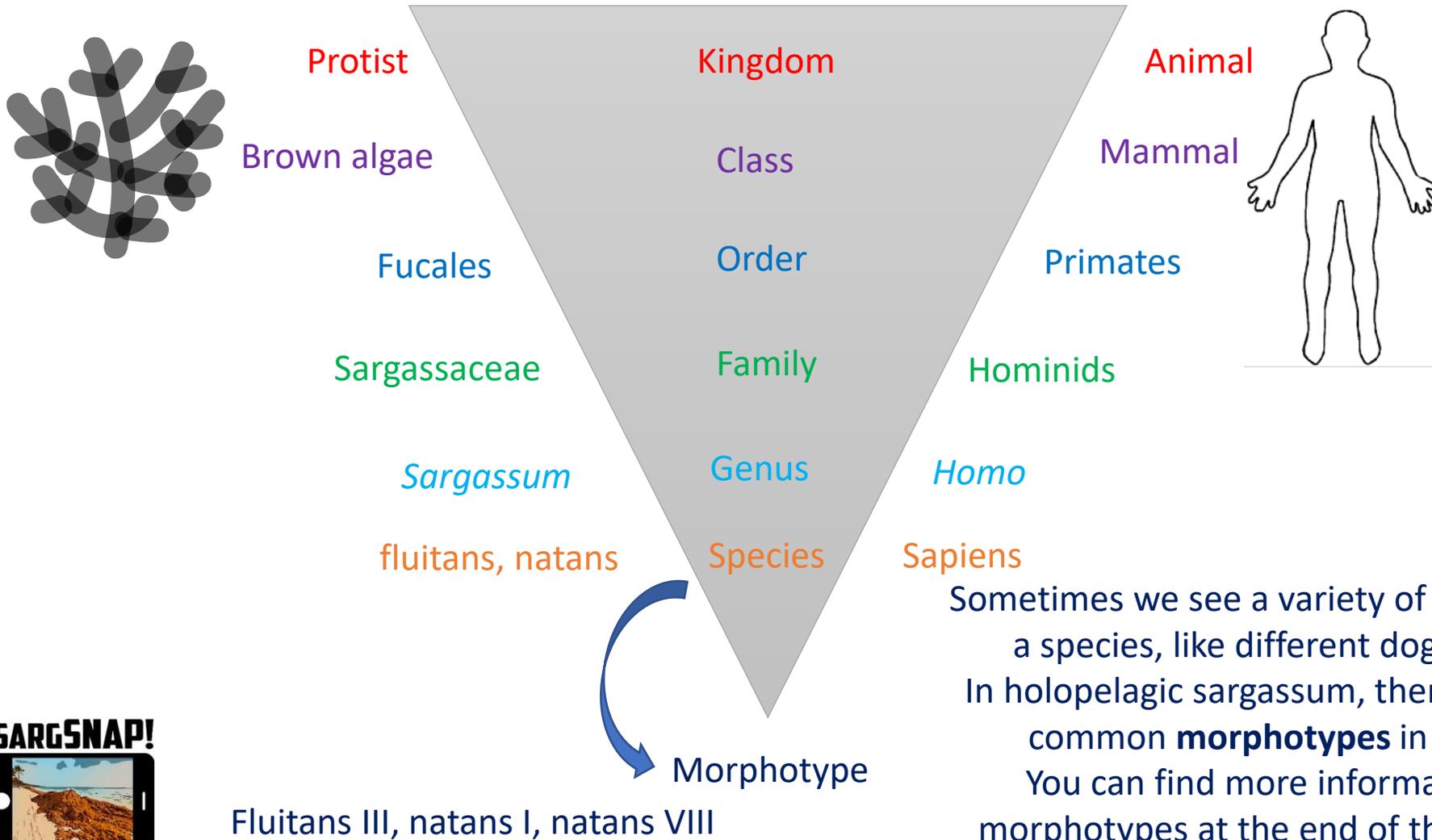
For some organisms we can be even more specific and we can identify morphotypes. A morphotype is a different type of the same species. There are 3 morphotypes of sargassum which we find in Ghana, these are *Sargassum fluitans* III, *Sargassum natans* I and *Sargassum natans* VIII.

For more information about morphotypes see the end of the booklet.



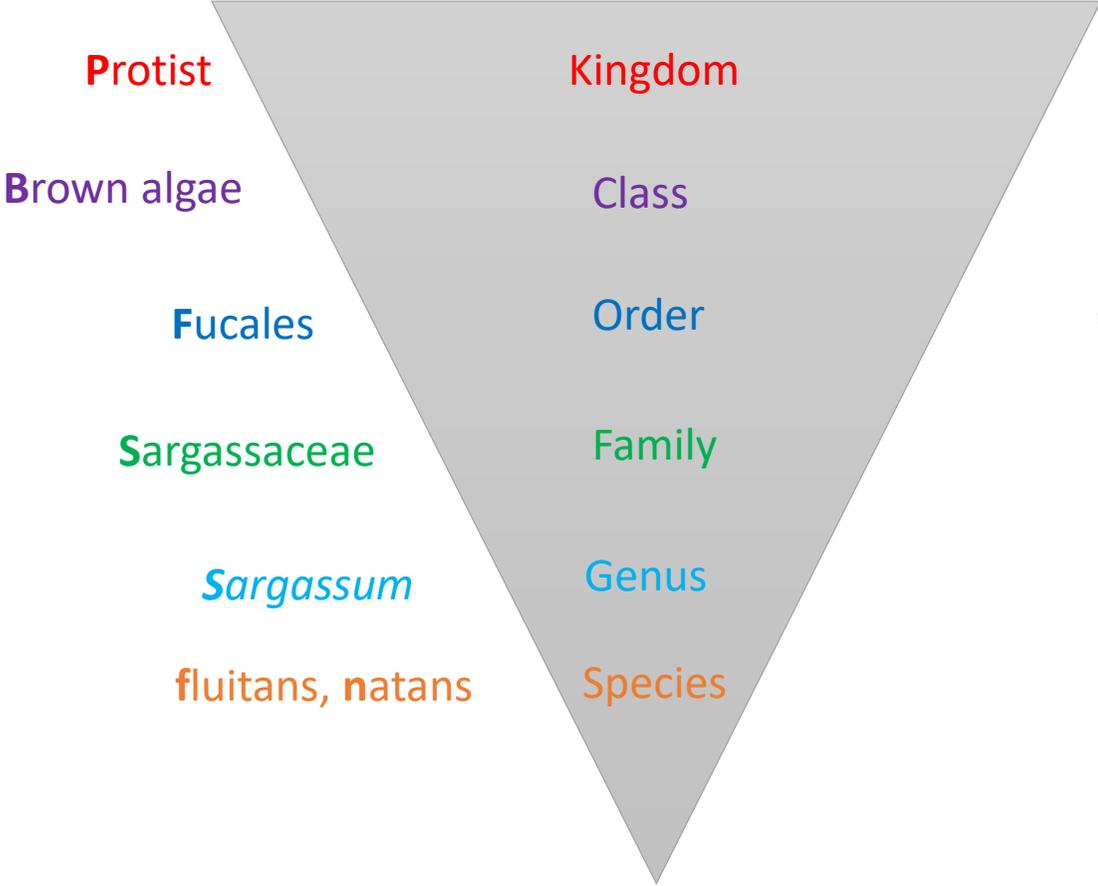
Classification of Sargassum

All fauna (animals) and flora (plants) have a taxonomic classification. See the diagram below showing the classification of *Homo sapiens* (humans) and *Sargassum fluitans* and *natans*.





A mnemonic to help you remember

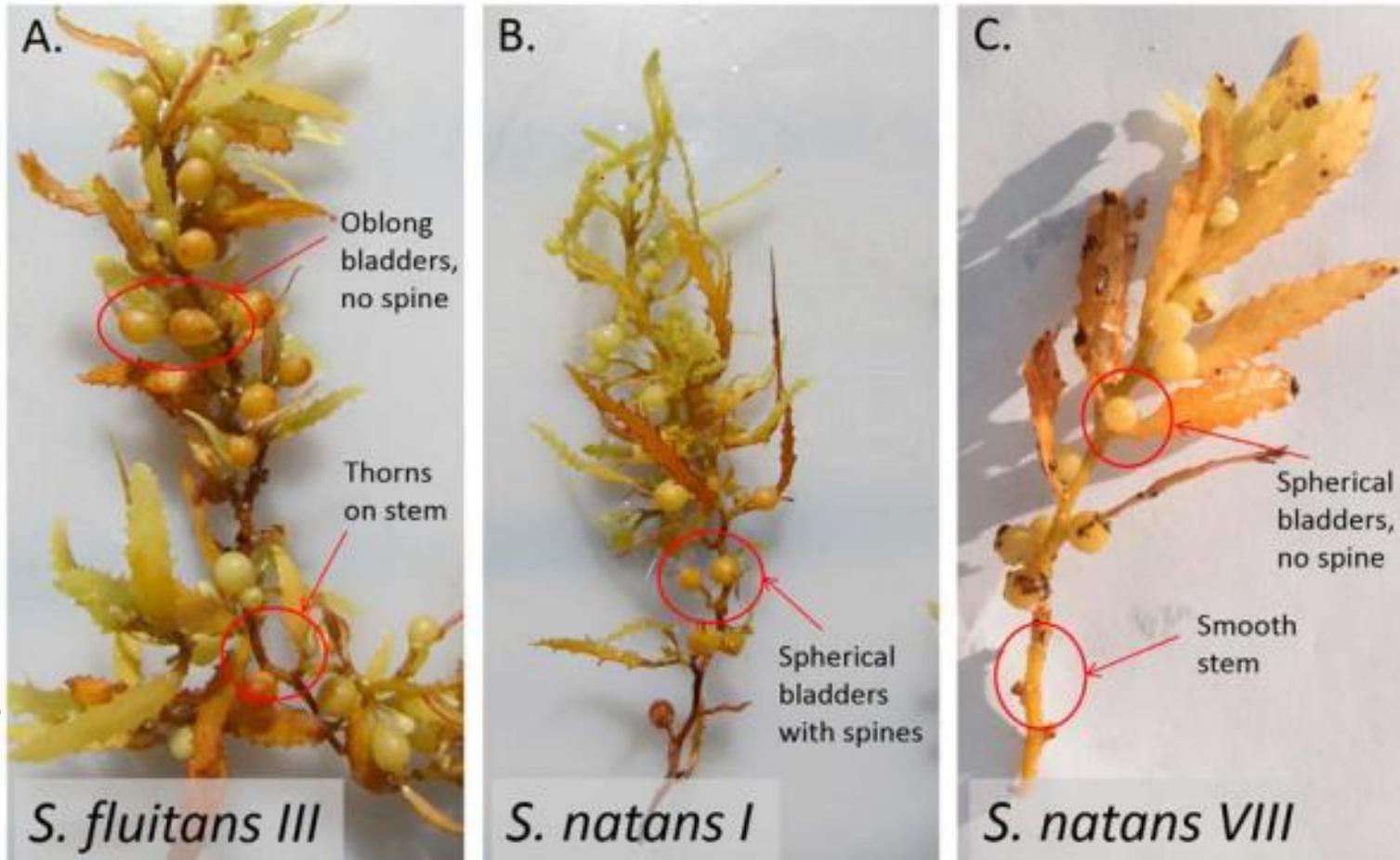


Please Bring Four Silly Shoes For Nana

Learning Objective 2

Teacher's notes:

The teacher should point out the different annotations on these images and highlight the different features that distinguish the morphotypes.



Source: DOI: 10.7717/peerj.7814/fig-1

We can see differences in the three morphotypes.
Next time when you're at the beach see if you can identify the different morphotypes by their characteristics.

Spines are soft spikes attached to the stem or bladders of sargassum.

Simple guide to identifying sargassum morphotypes by bladders



Step 1: Does it have **spherical (football/soccer)** or **oblong (rugby/American football)** shape bladders?

Red arrow pointing to this box from the text above.

A red-bordered box containing two images. On the left is a photograph of a sargassum branch with several small, round, yellowish bladders circled in red. A red arrow points from the text 'Spherical bladders' to these bladders. On the right is a black and white soccer ball.

Blue arrow pointing to this box from the text above.

A blue-bordered box containing two images. On the left is a brown and white American football. On the right is a photograph of a sargassum branch with several small, oblong, yellowish bladders circled in red. A red arrow points from the text 'Oblong bladders, no spine' to these bladders.

Step 2: Are the bladders **smooth** or do they have **spines**?

fluitans III

Purple arrow pointing to this box from the text above.

A purple-bordered box containing a photograph of sargassum bladders that are smooth and spherical. A purple-bordered box with the text 'natans VIII' is overlaid on the right side of the image.

Green arrow pointing to this box from the text above.

A green-bordered box containing a photograph of sargassum bladders that are oblong and have small spines. A green-bordered box with the text 'natans I' is overlaid on the top part of the image.

Activity 3 Answers

- A) *Sargassum fluitans* III (can also be written as *S. fluitans* III)
- B) *Sargassum natans* VIII (can also be written as *S. natans* VIII)
- C) *Sargassum natans* I (or *S. natans* I)
- D) *Sargassum natans* VIII (or *S. natans* VIII)





Learning Objective 3

In this lesson, students will learn the challenges and opportunities of sargassum.

Activity 4: Challenges and opportunities keywords

Write a sentence to describe what you think each keyword means using the picture as a hint.



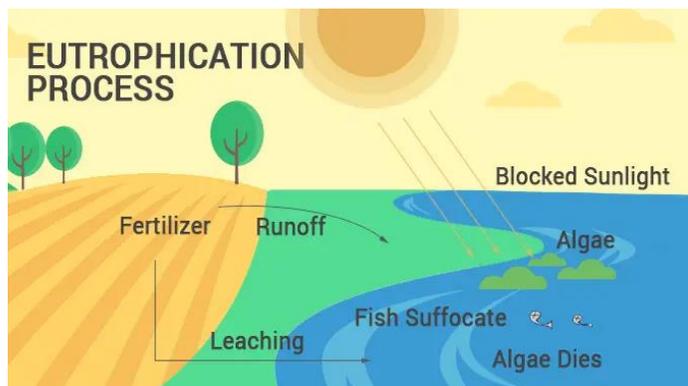
Biodiversity



Tourism



Fisheries



Eutrophication

Beach erosion



Types of Fisheries practiced in Ghana

Industrial:
Large steel-hulled (usually imported from abroad) and stay at sea for long periods of time as they have freezers for the fish.



Fisheries

Lagoon:
This can include using cast nets, small canoes, line fishing and using traps.

Inshore / Semi-Industrial:
Planked wooden-hulled vessels with more powerful diesel engines, usual used for trawling to catch small fish.

Canoe:
Can be small (1-2 fishers) or mid-size (2-11 fishers) either propelled by sail/paddle or low horsepower outboards, they harvest a variety of fish including large and small.

Activity 4: Challenges and opportunities

keywords

Biodiversity

The variety of plant and animal life (in the world, or in a particular habitat).

Ghana, as a country, has very high biodiversity with 3,600 species of plants. It has many animals including 221 species of amphibians and reptiles, 728 species of bird, 225 species of mammals, 347 marine fish, and 157 freshwater fish.

However, there are threats to this biodiversity, for example mangroves are in decline and there are polluted waterways which are causing a decline in populations of freshwater fish and other species. Changes in biodiversity has impacts on food supply so it is crucial to maintain it.

Eutrophication

This is excessive nutrients in a body of water, frequently due to run-off from the land, which causes a dense growth of algae.

Extra nutrients in the Atlantic ocean is a possible cause of sargassum blooms.

Teachers Answers!

Note: we do not expect students to get this exactly word-for-word, but to understand what each term means. The text in smaller font has extra information beyond the definition.

Fisheries

Process where fish are bred, grown and harvested and reared for commercial or subsistence purposes.

Beach erosion

This is the breaking down and carrying away of beach materials by the sea.

Depending on the amount and the location of sargassum deposited on the beach it can either help protect beaches from erosion and encourage sand build-up on beaches, or can increase beach erosion and cause more beach material to be carried away by the sea.

Note: Lots of erosion means the beach is not stable and will be getting smaller.

Tourism

This is a phenomenon which entails the movement of people to places outside their usual environment for personal or business/professional purposes.



Learning Objective 3

Activity 5: Do you think the following things are impacted by floating sargassum negatively, positively or have no impact? Put the words and a reason in the table where you think they go.

- Biodiversity
- Tourism
- Fishing industry
- Human health
- Local economy

	Negative	Positive	No impact
Floating in the ocean			



Learning Objective 3

Activity 5: Do you think the following things are impacted by sargassum deposited on the beach negatively, positively or have no impact? Put the words and a reason in the table where you think they go.

Biodiversity Tourism Fishing industry
Human health Local economy

	Negative	Positive	No impact
Deposited on the beach			



Activity 5:

The teacher should ask students for their answer to each word in each scenario and should discuss the answers and any differing opinions. There is no definitely correct answers, please see potential answers and reasoning. This exercise is intended to challenge students to think and debate.

	Floating in the ocean	Deposited on the beach
Biodiversity	<p>Positive: floating sargassum is a refuge for crustaceans and small fish and can boost their populations</p> <p>Negative: floating sargassum can reduce the availability of prey for predators and impact population size of different species.</p>	<p>Positive: small bugs, flies, bacteria and larvae can live on beached sargassum.</p> <p>Negative: Animals residing in the same can become trapped for example, baby turtles nesting on beaches have to dig out of the sargassum and can get tired, reducing their chances of survival.</p>
Tourism	<p>No impact?</p> <p>Negative: cruise ships and sailors may avoid the region if there is lots of floating sargassum so less tourist may travel.</p>	<p>Negative: tourists want to see clean beaches and may be deterred from visiting the area.</p>
Fishing	<p>Positive: pelagic fishers will have more fish supply from those species seeking refuge in sargassum</p> <p>Negative: it gets caught in nets and reduces catch.</p>	<p>Negative: can reduce access to the water for fishers.</p>
Human health	<p>No impact.</p>	<p>Negative: decomposing sargassum releases harmful gasses that can cause lung diseases .</p>
Local Economy	<p>Negative: affects fishers and tourism industry so causes a reduction in income.</p> <p>Positive: Sargassum can be harvested for various different uses.</p>	<p>Negative: affects fishers, tourism and health of local people and therefore reduces income.</p> <p>Positive: Sargassum can be harvested for various uses. Provides beach cleaning jobs.</p>

Listening Exercise 3

Sargassum can pose threats to the environment and the communities and the economy. But, it can also present opportunities. It can be viewed as a resource which can be used for the benefit of local people. In your booklets you can see examples of this, including:

- in Mexico they are making sargassum into construction blocks,
- in the Caribbean they are refining it and using it as plant fertiliser to increase crop growth.
- Others are making plates and cosmetics from chemicals found in sargassum.

There is lots to be learnt about sargassum still, and monitoring when it comes in on the local beaches will help us understand more about it and find more uses for it.





Sargassum mixed with soil for fertilising **non-food** plants for landscaping.



Sargassum mixed with sand for fertilising mangrove plants.

Uses of Sargassum
which can be done immediately after
harvesting





Sargassum construction blocks.



Cosmetics containing alginate, a chemical found in algae like sargassum.



Algas, a fertiliser made to increase crop growth. Made from sargassum.

Uses of Sargassum
which require treatment or processing





Activity 6:

Use the keywords you learnt to fill in the gaps

Sargassum is a s_____, which is type of brown a_____. It forms b_____ in the ocean, aggregating in large mats and is moved by w_____ and c_____. An i_____ of sargassum happens when lots of sargassum is deposited on beaches. Sargassum that is always floating is called h_____. There are three main species and m_____ of sargassum found in Ghana, these are *S. fluitans* III, *S. natans* I, *S. natans* VIII.

Sargassum is a potential threat to the e_____ as it can affect other animals and plants negatively. It also has e_____ impacts on industries such as fishing and tourism.

But, it is also a natural r_____ and there are many o_____ for using sargassum.

To be able to use sargassum we must first monitor and understand it.

Activity 6:

Use the keywords you learnt to fill in the gaps

Sargassum is a seaweed, which is type of brown algae. It forms blooms in the ocean, aggregating in large mats and is moved by wind and currents . An influx of sargassum happens when lots of sargassum is deposited on beaches. Sargassum that is always floating is called holopelagic. There are three main species and morphotypes of sargassum found in Ghana, these are *S. fluitans* III, *S. natans* I, *S. natans* VIII.

Sargassum is a potential threat to the environment as it can affect other animals and plants negatively. It also has economic impacts on industries such as fishing and tourism.

But, it is also a natural resource and there are many opportunities for using sargassum.

To be able to use sargassum we must first monitor and understand it.



Activity 7: What have you learned today?

- a. Name two things you have learnt.
- b. Has your opinion on sargassum being good or bad changed? Why?
- c. Do you feel confident to sort sargassum into the three morphotypes?
Give it a go:
Can you find the different species on the beach?
Can you draw the different species and their distinct characteristics?

You are now the local sargassum scientists in the Western
Region of Ghana!





Word Glossary

Here is a list of some words which may have come up in this lesson but haven't been explained yet.

You can find more words and definitions in the matching activity 2 and picture activity 4.

Word	Definition
Economic	Relating to trade, industry, or money.
Environmental	Relating to the air, water, and land in or on which people, animals, and plants live.
Opportunity	A circumstance that makes it possible to do something.
Epiphyte	A plant that grows on another plant.
Characteristics	A feature or quality belonging typically to a person, place, or thing and serving to identify them.

The rest of the booklet is extra information the students can read in their own time or you can use for clarification and look at the links and videos if they would like to.

Further information on classification and taxonomy

- Sorting all living things similar groups (kingdoms of life)
- Done first by Carl Linnaeus (Swedish scientist). *Species plantarum* (1753) and *Systema naturae* (1758)
- Early books on taxonomy contained names for 12,000 species of plants and animals (there are now many more)
- Robert Whittaker (American scientist) identified 5 main kingdoms (in 1969): animals, plants, fungi, protista, prokaryotes.
- Here are some videos you can watch:

The 5 Kingdoms of Living Things Rap by Songs for Schools:

<https://www.youtube.com/watch?v=eo9HkVhb76w>

Kingdoms of Life Explained, Sort Of by Science Trek:

<https://www.youtube.com/watch?v=mnAnsRa7SI4>





More information on morphotypes

A morphotype is an infrasubspecific (*meaning a more specific classification than species*) group of animals or plants that can be distinguished by differing shapes, features and characteristics that show they are different but still belong to the same species.

For example a sheepdog and a spaniel, whilst both dogs are very different. They have different ears, snouts, sizes, colours and personalities. Sheepdogs are used on farms for herding cattle and spaniels are used as hunting companions, they are both still types of dog but can be considered to be morphotypes. The word 'morphotype' was first used to describe dog breeds by Brothwell et al. (1979).





Acknowledgements

Photos

Sargassum beach and floating images were taken by team members Philip-Neri Jayson Quashigah and Yanna Fidai.

Sargassum identification images (activity 3) were taken by Emma Tompkins, Amaral-Zettler et al., (2016) and Martine et al. (2021).

Other photos and images used have a creative commons license.

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