

Teacher's guidelines

Title of the package: Phytoplankton in the Arctic

Information about the package

Brief description: The package presents a selected group of planktonic organisms - phytoplankton. The materials their features, what is their position and role in the food web, and most of all - how they play a key role in arctic ecosystems and how climate change affects them.

How does the package relate to STEAM education: The package presents knowledge from various scientific disciplines using interactive educational materials. Their goal is to involve students in their independent search and understanding of the links existing in the natural environment.

Keywords: phytoplankton, climate change, food webs, photosynthesis, blooms, biological pump

Age range: 12+

Didactical hours: 2 godziny

Learning objectives:

Student:

- learns about phytoplankton and its role in the ecosystem
- learns about phytoplankton groups
- explores the relationship between climate change and zooplankton functioning
- learns the concept of primary production and compares productivity in different seas
- learns about phytoplankton testing methods, including sampling

Content of the package:

Link to the package:

<https://cloud.graasp.eu/en/pages/604a2092eea669a4f9c8b33c/subpages/604a20f1eea669a4f9c8b458>

The package is divided into 4 sections.

1. Section "Introduction"

Short video material about phytoplankton <https://youtu.be/fS422O4SLc4>

Quiz (5 open-ended questions) to be completed based on the footage you watched.

ANSWER KEY:

- 1) photosynthesis
- 2) white cliffs of Dover
- 3) there are more land plants in terms of biomass
- 4) phytoplankton absorbs more carbon dioxide

Project office: Księcia Janusza 64, 01-452, Warsaw, Poland edu-arctic2.eu edukacja@igf.edu.pl

EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland and Norway receives a grant of ca. 240 000 EUR received from Iceland, Liechtenstein and Norway under EEA funds. The purpose of the EDU-ARCTIC 2 project is to: enhance the knowledge about nature, geography, natural resources, political specificities concerning polar regions and increase awareness of environmental issues and climate change, increase of interest in pursuing STEM education and careers due to enhancement of knowledge about scientific research, and their place in the modern world, familiarizing young people with scientific career opportunities; introduce innovative tools by way of an e-learning portal and effective methods of teaching science in schools

o possibility to absorb carbon dioxide, lower solubility

Presentation: division of plankton according to various criteria, characteristics of the Arctic Ocean, stratification, phytoplankton groups.

QUIZ -3 questions

ANSWER KEY

1) phytoplankton is floating in water and depends on its movements

2) true

3) processing of nuclear waste

NASA QUIZ – „what kind of phytoplankton are you

LINK TO THE QUIZ: https://pace.oceansciences.org/phyto_quiz.cgi

2. Section „INQUIRY"

Exercise: the student completes the text by filling in the blanks with words from the list, describing the advantages of small-sized planktonic organisms.

LINK TO THE EXERCISE: <https://learningapps.org/watch?v=peaky39tc21>

Video about biological pump: <https://youtu.be/U03MUHFuO2o>

Question after the video - ANSWER:

CO₂ is absorbed by phytoplankton during photosynthesis and converted into biomass. Most of the CO₂ absorbed by phytoplankton returns to the atmosphere when it dies or becomes food, but some ends up in sediment at the bottom of the ocean. Sinking of this plant material is called a "biological pump" because CO₂ is thus "pumped" from the atmosphere into the ocean depths. This occurs mainly in high-latitude areas, because the dead phytoplankton debris there is large enough to sink to the bottom of the ocean.

Presentation about primary production

Exercise: ordering the names of the seas in order of decreasing productivity based on the diagram.

ANSWER KEY:

Greenland Sea - Barents Sea - Kara Sea - Baffin Sea - Laptev Sea - Beaufort Sea - Siberian Sea

Diagram of the annual cycle of phytoplankton development in the Arctic

EXERCISE: wykreślanka, znalezienie 2 czynników ograniczających wzrost fitoplanktonu

ANSWER KEY:

Sunlight, nutrients

EXERCISE: matching names to phases.

Video about DMS (dimethyl sulphate): <https://youtu.be/2uZNMK10dGc>

Mind map - preparation of a diagram on the basis of prepared concepts.

ANSWER KEY: negative feedback loop

3. Section „Research”

Images showing satellite observations of phytoplankton and sampling equipment.

EXERCISE: connecting columns - formulating sentences; description of the sampling procedure.

Video about plankton blooms in the Arctic: <https://youtu.be/cpUf2EAmHxk>

Interactive graphics on the relationship between phytoplankton and climate change:
<https://view.genial.ly/602958b72ea5b30d6689d189/vertical-infographic-list-climate-change-and-phytoplankton>

4. Section „Activities”

QUIZ - 4 TRUE/FALSE on the basis of a graph on the composition of the phytoplankton community in Svalbard (Kongsfjorden).

QUIZ checking the level of knowledge <https://view.genial.ly/602beb38740fca0db8ff64b4/game-phytoplakton-wheel-of-fortune>

Name the frame: matching the terms to the picture of the coal flow.

Exercise "What a distracted polar researcher" - students are to match the descriptions of the days of sampling to the conditions prevailing on a given day, described in the table.

ANSWER KEY:

Day # 2, Day # 6, Day # 5, Day # 3, Day # 7,

5. Section „Wrap-up”

Task: the student should identify 3 main reasons that make phytoplankton an important part of the Earth's ecosystem.

SUGGESTED ANSWERS: the basis of the food chain, oxygen production, carbon dioxide absorption.

Online microscopic observations of phytoplankton representatives – link:
<https://askabiologist.asu.edu/sites/default/files/ZoomifyHTML5/fragilariopsisCylindrusPhytoplankton.html>

1. Inquiry

Fill in the gaps in the text - when filling in online, click on the gap and select the correct word from the drop-down list. To validate, click the blue icon in the lower right corner.

Interactive graphics - Climate change and phytoplankton - click on the icons next to individual elements (characteristics)

2. Research

Presentation and longer materials are not fully displayed on the screen - you have to scroll them using separate scroll bars (or with the mouse wheel on hover). Links to external sources are not free from personalized ads, so it is recommended to use your browser with an ad-blocking application, e.g. adblock plus.

Additional resources

Videos:

Phytoplankton: arguably the most important life on Earth

<https://www.youtube.com/watch?v=fS422O4SLc4>

The biological pump

<https://www.youtube.com/watch?v=U03MUHFuO2o>

DMS – dimethylsulfide

<https://www.youtube.com/watch?v=2uZNMK10dGc>