Teachers' Guidelines

Title of the package: Zooplankton in the Arctic

Information about the package:

Brief description: Pakiet przedstawia wybraną grupę organizmów planktonowych - zooplankton. Materiały wyjaśniają, czym charakteryzują się te organizmy, jakie mają przystosowania do życia, jakie jest ich miejsce w sieci troficznej, a przede wszystkim – jak kluczową rolę pełnią w ekosystemach arktycznych.

How does the package relate to STEAM education: Pakiet przedstawia wiedzę z różnych dyscyplin naukowych wykorzystując interaktywne materiały edukacyjne. Ich celem jest zaangażowanie uczniów w samodzielne poszukiwanie i zrozumienie powiązań istniejących w środowisku przyrodniczym.

Keywords: zooplankton, zmiany klimatu, sieci troficzne, widłonogi, dobowa migracja pionowa

Age range: 12+

Didactical hours: 2 hours

Learning objectives:

Student:

- learns about zooplankton and what is its role in the ecosystem

- gets acquainted with the most important arctic species of copepod (*Calanus glacialis*)

- explores the relationship between climate change and zooplankton functioning

- learns record (in terms of biomass) migration of zooplankton

Content of the package:

Link to the package:

The package is divided into 4 sections.

1. **Section "Introduction"**

Short video material presenting life of zooplankton (Ted-Ed) https://youtu.be/xFQ_fO2D7f0

Quiz (3 open questions) to fill in based on video material..

ANSWER KEY:

1. phytoplankton and zooplankton
2) no, some belong to plankton only in a certain phase of the life cycle (e.g. larval stages of fish or octopuses)
3) plankton is not able to actively oppose the movement of water, it is carried by it, that is, it "drifts"

Wordsearch: the task is to find 10 terms related to zooplankton.

Exercise: assigning 4 selected wording terms to one of 2 groups (diet, groups of organisms).

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

Exercise: the student completes the diagram by naming the elements of the food web.

ANSWER KEY: The zooplankton indicated is herbivorous (1st order consumer).

Section „Inquiry”

The text and the infographic explain the division of plankton in terms of size.

QUIZ (uncover the puzzle): the solution is an illustration of a lion’s mane jellyfish - a record representative of megaplankton.

Link to online quiz: https://view.genial.ly/5fa406875ef4550d7bcc3343/game-zooplankton-uncover-the-puzzle

Exercise: the student completes the text by filling in the gaps with words from the list regarding the festoon bolt.

On the basis of the completed text, the student participated in answering 3 open-ended questions.

ANSWER KEY:

1) The lion’s mane jellyfish is a carnivorous (predatory) species

2) The lion’s mane jellyfish is not dangerous to humans

3) A large number of individuals of lion’s mane jellyfish indicate environmental pollution

Interactive image: "BIO" Calanus glacialis - characteristics, life cycle, adaptations, meaning.

The trophic web - what would happen if the zooplankton were to disappear?

Students should track food chains in which zooplankton is one of the links and assess which other animals may be at risk.

Section “Research”

Image showing the effects of mismatching of the life cycles of Calanus glacialis and little auks ("before" and "after" versions).

Activity: Build sentences out of the prepared statements explaining how climate change is affecting little auks populations.

Sample response sequence:

The climate in the Arctic is warming, the temperature is rising.

Winter / early spring temperatures are higher, sea ice melts earlier

Sea ice melts earlier, the algae "bloom" earlier

Algae bloom earlier, phytoplankton appear earlier in large numbers

The life cycle of copepods accelerates, fat-rich forms of copepods appear

Little little auks lay their eggs at a certain time, little little auks do not have enough food

Little auks do not have enough food, the weight of the chicks decreases

Chicks have a lower body weight, the survival rate of adult birds is lower

Presentation (pdf) explaining the phenomenon of diurnal vertical migration.

Exercise: assigning the 6 indicated plankton characteristics to specific adaptations.

Section „Activities"

Quiz summarizing the news about zooplankton so far.

Graphics showing the so-called light pollution and its effect on zooplankton behaviour.

QUIZ - 3 open questions about graphics.

ANSWER KEY:

1) Light makes zooplankton visible, so it tries to escape from it to protect itself from predators.

2) Light disturbs the daily cycle, which is related to gaining food and protection against predators

3) Ships emit light which, e.g. during the polar night, makes it difficult to determine whether diurnal vertical migration is taking place then

Section „Wrap-up"

Exercise: the student is to pair the effects of climate change with its impact on zooplankton.

Poster: The student is to justify the role and unusual properties of plankton by preparing a poster based on the diagram.

ANSWER KEY: humans also exploit zooplankton directly as a source of valuable fatty acids (omega-3).

Technical tips for teachers:

1. **Introduction**

   Wordsearch – when filling it in online, first enter the term in the empty field on the right, according to the numbering, and then hover over the word on the board. Terms are placed left to right horizontally, top to bottom vertically and diagonally (potentially in all directions).

   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 - "BIO" Calanus glacialis - 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, therefore it is recommended to use your browser with an ad-blocking application, e.g. adblock plus.

Activities based on GRAASP applications:

Creating sentences from elements - some terms need to be used more than once, so you should enter them yourself (the application gives you the ability to add concepts yourself).

Drag the first part (the cause) to "IF" and the second, the effect, to "THEN".

"Name the frame" - dragging terms to specific places in the picture - terms are numbered from top to bottom.

Wrap-up

Climate change phenomena are marked with orange thumbtacks and zooplankton effects with blue ones. Student must click the matching 2 pair pieces one by one. Click on the blue icon in the lower right corner to check.

Additional resources and links, references:

Additional resources:

Zooplankton and climate change:
https://academic.oup.com/icesjms/article/65/3/279/787309

Video used in the package:

Secret life of plankton
https://youtu.be/xFQ_fO2D7f0