# BALTIC SEA OUTDOOR Classroom

NORRTÄLJE NATURCENTRUM
ekologiskt science center

# TEACHER´s Guide

GLOBALA MÅLEN
för hållbar utveckling

Nordplus

The purpose of this teaching material is to aid teachers who want to move their teaching outside of the classroom. There are lessons with materials for primary schools themed around the Baltic Sea. We know that students learn in different ways and that through outdoor education under conscious leadership, their knowledge about life in the sea and along the shore can increase. By engaging all their senses and being by the Baltic Sea they will gain their own unique knowledge and experiences. Primary school students should have a good understanding of the Baltic Sea, one of our closest seas. The aim of this box is to improve students' understanding of ecology and the connections between the sea and the surrounding landscape. The material is designed to be a foundation that can be adapted to the current learning objectives and students' abilities and prior knowledge. The teacher actively participates as a co-explorer and investigator, sharing their students' curiosity and wonder. Divide the students into pairs or small groups to encourage greater participation. You can read more about outdoor education in tab 2. The following is a suggested approach to the classroom activities before and after using the material in the field.

**Preparatory work in the classroom**

- Introduce central concepts in ecology
- Read about the Baltic Sea and marine life
- Show on a map or chart where the field work is taking place

**Hands-on exploration outdoors at the shore**

- Go through the boxes and select the elements that best support your outdoor teaching. Choose things that complement your teaching and help you achieve your goals.

**Follow-up work in the classroom**

- Review and let the students tell each other what they did in the field.
- Process and validate knowledge, impressions and feelings from the excursion through various presentation techniques, games, and creative activities.

- Expand your knowledge about marine life in the Baltic Sea, the challenges it faces and the research and concrete projects that impact it.
- Encourage students to visit the sea and archipelago.

This box is about exploring the Baltic Sea and marine environments. There are also boxes for exploring the ecological connections in meadows, forests and lakes and rivers. All of these can be borrowed for free from Norrtälje Nature Center for 3 weeks.

The mobile classrooms have been developed by Norrtälje Nature Center in a Nordplus Horizontal project where the nature school in Tartu, Estonia along with the organization Håll Litauen Rent, Lithuania have been project partners.

**Target audience**

The primary target audience for the mobile classrooms is primary school students and teachers. Nonetheless, there are others who can also use and be inspired by the material in the box and the teacher's guide, such as teacher education and nature and environmental organizations. The boxes are also well-suited for activities with the general public aimed at improving understanding of ecology and the connections in nature, so that we can work together for more sustainable systems.

***Definition of outdoor education***

*Outdoor education is an approach that aims at learning in an interplay between experience and reflection, based on concrete experiences in authentic situations. Outdoor education is also an interdisciplinary field of research and education which, among other things, involves:*

*• that the learning space is also moved out into social life, natural and cultural landscapes,*

*• that the interplay between sensual experience and bookish education is emphasized,*

*• that the importance of the place for learning is highlighted,*

*to interact between outdoors and indoors in teaching and learning.*

*(cf. the definition in the National Encyclopedia NE, online version 2021, Dahlgren, and Szczepanski, 1998, Dahlgren et al., 2007, p. 11, Szczepanski, 2008, p. 15, Szczepanski, 2024 under publication at IBL, Linköping University)*



Outdoor education is a teaching approach where the personal experience, active learning and sensory impressions are central. By immersing students in diverse outdoor environments, this approach promotes deeper engagement and helps students remember what they have learned, as the knowledge is anchored in real-world experiences. The location is significant as an educational space from a learning and teaching perspective, and opens up more possibilities for different ways of learning. The didactic question of WHERE the teaching should take place is central. At the same time, it is important that the learning takes place alongside more traditional indoor teaching, in order to connect theory and practice.

Outdoor education is not only about nature, ecology and outdoor recreation, but equally about social studies, history, geography, sustainability and language. Outdoor education aims to highlight connections, making it well-suited for interdisciplinary studies. In an outdoor setting, with mindful leadership, students work toward many learning goals simultaneously. This is essential if schools and students are to achieve the ambitious goals and guidelines set out in the curriculum. However, this requires teachers to collaborate across subjects in order to give students a comprehensive view. Together with other

students and the teacher, the students experience first-hand, and experiences form a basis for comparison, analysis, reflection and conclusions. The best learning is that which resonates and engages, a learning that is grounded in reality and facilitates the encounter between the student and the real world. It promotes questions about the content and meaning of the material.

The learning occurs in the interaction between the indoor and outdoor environments, the method, the leadership, and the interactions between students. The investigative work outdoors should be followed by a processing phase. How do we manage the students' new knowledge, experiences and insights? The indoor processing phase, which includes seeking new knowledge from books or online sources, reflection and analysis, can take various forms. Reflection is central in the process of learning, and is essential to convert experiences and activities to self-formulated knowledge. There are different ways to describe the learning processes of outdoor education. The following model is inspired by Arne Nikolaisen Jordet, *Klasserommet utenfor tilpasset opplæring i det utvidet læringsrom*[1]. The goal of the teaching should always be clear to the student.

**A. Introduction phase**
Purpose and goal is made clear. The teacher presents the material to the students. Preparations.

**B. Practical teaching in groups outdoors**
B1. The students work in groups, in pairs or individually.
B2. Presentation of the groups' work – walking from group to group.

The teacher leads conversations and reflections and concludes by giving an oral summary (auditory structure).

[1] Nikolaisen Jordet Arne, *Klasserommet utenfor tilpasset opplæring i det utvidet læringsrom, Cappelen Akademisk forlag, 2010*

**C. Processing phase**

Further work indoors in a classroom based on the students' new experiences, knowledge and questions.
Reading, writing and in-depth study. Reflection, analysis. Formulate one's knowledge.
Presentation/application.

... and then it starts over ...

It is important to make use of the student's earlier experiences and knowledge. The student must be actively involved in their learning. The group is significant in outdoor education. Conversation and communication are central for learning. Especially important are conversations that build chains of knowledge, conversations that train students' ability to reason and argue, as well as exchanges of experience of various kinds. It is important to succeed together, as well as being allowed to fail. The social climate in the group is crucial for a good learning environment. Hattie argues in his study *Visible learning*[2] that if the classroom environment is not only tolerant of, but also welcomes mistakes, is characterized by challenging tasks and supports engagement and perseverance, then successful learning can be further strengthened. Building an open climate in the classroom requires a conscious effort in leadership. Continuous outdoor education through the school years is a way to build strong relationships between students, as well as between students and teachers. In diverse environments students are provided with good opportunities to demonstrate different abilities and aspects, which builds self-esteem and helps foster a safe environment in the group.

In summary, outdoor education is about learning both indoors and outdoors in interaction, aimed at improving curriculum goal attainment and making teaching more accessible, as outdoor education naturally offers varied teaching in diverse environments. Moreover, outdoor education provides an active education that incorporates physical activity and movement in every subject, which is beneficial for students' health. Spending time in green

[2] Hattie John. *Visible learning: a synthesis of over 800 meta analyses relation to achievement*, Routledge, 2009

environments also has a positive impact on students' mental health, which is very important today. Dare to step out of the classroom with your students!

**For more information**

Research overview Outdoor Education, Linköping University
Teaching with the Sky as a Ceiling (2018)

## Positive effects of outdoor education with students in conscious leadership

- Increased knowledge of nature and a greater connection to it
- Diverse learning environments
- Opportunity to see connections and the bigger picture
- Opportunity to connect theory and practice
- Personal first-hand experiences
- Exercise, fitness, movement and pulse
- Physical and mental health
- Excitement, adventure and play
- Social and emotional competence
- Community
- Happiness, well-being
- Self-esteem through choosing one's own challenges

## Helpful considerations for outdoor education

Here are some tips and support to increase confidence in leadership during outdoor education and ensure successful outdoor lessons;

- Strong subject, nature and outdoor skills increase confidence in leadership.
- The outdoor learning environment should be carefully chosen. If you have not been at the location before, it is always a good idea to go there in advance so you know how you can organize the teaching in relation to the environment. For younger children in preschool or students in the lower grades of primary school, it is beneficial to often return to the same location as it builds a sense of security and makes it easier to focus on the teaching. On the other hand, for older students new and unknown environments can lead to increased focus in investigative work.
- Prepare the students carefully for what you will be doing when you go outside. What rules should apply?
- Respect any fears in the group (for example fire, water or insects).
- The teacher should always be a good role model when it comes to clothes, safety and attitude.
- The teaching should be adapted to the season and weather conditions. Gather the students in a circle for briefings and find shelter so that the voices can be heard clearly. On sunny days it is best to stand so that the students have the sun behind them and do not have to squint.
- Have good safety routines and equipment with you (see the section on Safety in outdoor education)
- Remind the students to wear appropriate clothing and durable shoes/boots.
- Aim for long outdoor sessions to avoid stress. The best approach is to collaborate with other teachers to integrate subjects, allowing you to spend a half day or full day outdoors.

The work with the mobile outdoors classroom covers multiple different subjects in the curriculum, and subject integration takes place with biology, language, art and physical education. It is beneficial for multiple subjects to collaborate, enabling outdoor education for a full day. The hope is that through outdoor education in different biotopes you will be able to concretize and provide students with first-hand experiences both related to both core content and knowledge requirements.

The following are connections between the mobile classroom and Swedish *the Curriculum for Compulsory School, Preschool Class and School-Age Educare* (lgr22);

### 2.1 Norms and values

*Schools shall actively and consciously influence and stimulate pupils to embrace the common values of our society and express them in practical everyday action in different contexts.*

### Objectives

*The school's objectives are that each pupil*

- *shows respect and care for the local environment as well as the environment from a broader perspective.*

### 2.2 Knowledge

*Schools are responsible for ensuring that pupils acquire and develop the knowledge necessary for each individual and member of society. This knowledge also provides a foundation for further education. Schools shall contribute to the harmonious development of pupils. A sense of discovery, curiosity and the desire to learn shall form the basis of the school's activities.*

*The natural sciences evolved from people's curiosity and need to know more about themselves and the world around them. Knowledge of biology is of great importance for the development of society in areas as diverse as the use of natural resources, the environment, and health. Knowledge of nature and humans gives people the tools to not only shape their own well-being, but also promote sustainable development.*

Core content f-3

- *Animals, plants and fungi in the local environment, how they can be grouped, and the names of some common species. (Biology)*
- *Simple food chains that describe relationships between organisms in ecosystems. (Biology)*
- *Simple field studies, observations and experiments. Performing and documenting the investigations with words, images and digital tools. (Biology)*
- *Oral presentations and oral narration. Objects. (Swedish)*
- *Active listening and retelling important parts of the content.(Swedish)*
- *Exploration of possibilities for and realisation of games, physical activities and spending time in nature and other outdoor environments. (Physical education and health)*
- *The basics of the right of public access. (Physical education and health)*

Core content 4-6

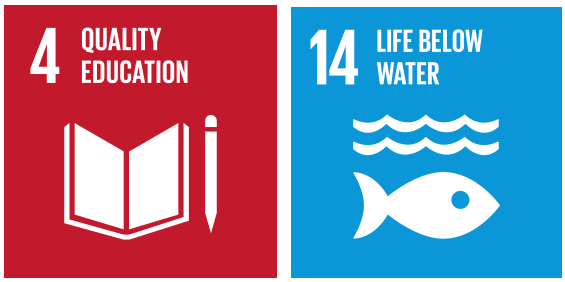
- *Food chains and cycles in the local environment. The interplay between animals, plants and fungi, and how some environmental factors affect them. Photosynthesis and cellular respiration. (Biology)*
- *How animals, plants and fungi can be identified and grouped in a systematic way, and the names of some common species. (Biology)*
- *Human dependence on and impact on nature, with links to the use of natural resources, sustainable development and ecosystem services. Nature as a resource and our responsibilities when using it. (Biology)*
- *Field studies and experiments using both analogue and digital tools. Planning, performance, evaluation of results and documentation with words, images and tables. (Biology)*
- *Oral presentations and oral narration for different listeners. Organisation, with introduction, content and conclusion. Key words, images, digital media, tools and other aids for planning and delivering an oral presentation. How gestures and body language can affect a presentation. (Swedish)*
- *Exploration of possibilities for and realisation of outdoor activities, games and physical activities in various nature and outdoor environments during different seasons. (Physical education and health)*
- *Rights and obligations in nature according to the right of public access and its application in practice. (Physical education and health)*

Core content 7-9

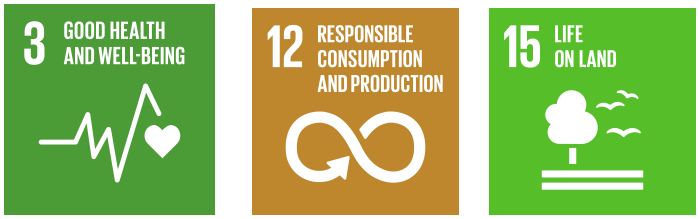
- *Local and global ecosystems. The relationships between populations and available resources. Photosynthesis, cellular respiration, material cycles and energy flows. (Biology)*
- *Human impact on nature locally and globally, and how to promote sustainable development at the individual and societal level. The importance of biodiversity and ecosystem services.(Biology)*
- *Field studies and experiments using both analogue and digital tools. Formulation of research questions, planning, performance, evaluation of results and documentation with images, tables, diagrams and reports.(Biology)*
- *Different forms of dialogue. Active participation; expressing feelings, thoughts and knowledge; listening; asking questions; making inferences; and expressing and responding to arguments.(Swedish)*
- *Oral presentations and oral narration for different listeners. Adapting language, content and organisation to the purpose, listener and context. Speech scripts and various tools for planning and delivering oral presentations, both with and without digital technolog.(Swedish)*
- *Planning and performing outdoor activities in different environments during different seasons. (Physical education and health)*
- *Rights and obligations in nature according to the right of public access and its application in practice.(Physical education and health)*
- *Cultural traditions in outdoor life and other outdoor activities.(Physical education and health)*

Agenda 2030 and the Global Goals were established in 2015 by leaders from around the world. The goals aim to help us achieve social, ecological and economic sustainability. The goals are to be reached by 2030. Agenda 2030 and the Global Goals aim to foster sustainable development. This means we must live in a way today that ensures future generations will have the same opportunities as we do. The Global Goals are indivisible and interconnected. It is best to use the Global Goals as a starting point for learning about sustainable development in schools. Working with sustainable development should not be seen as something separate, but as something that permeates all subjects in school.

According to the curriculum, one of the school's missions is to "provide students with the opportunity to develop knowledge about how the various choices people make can contribute to sustainable development". Everyone knows we face major challenges, and by providing all students with a good education, we contribute to Goal 4. This is the school's primary mission in working towards achieving the Global Goals. The materials in the boxes are a step towards more outdoor education in schools and giving more students knowledge about ecology and science, as well as their own personal experiences of nature and scientific phenomena. All activities are linked to the curriculum and the Global Goals.




By teaching at and about the Baltic Sea, we have the opportunity to develop awareness and knowledge about marine life. The sea hosts a great diversity of life and ecosystems and provides various ecosystem services. Among the Global Goals, it is of course Goal 14, *Life Below Water*, that is the primary focus here. In the process, we also create opportunities to reflect on several other goals, such as Goal 15, *Life on Land*, Goal 12, *Responsible Consumption and Production*, and Goal 3, *Good Health and Well-being*.




Read more about the Global Goals;

https://www.globalgoals.org/goals/

https://www.un.org/sustainabledevelopment/sustainable-development-goals/

To teach in the local environment and in different biotopes, it is important to think about safety. Thinking through the planned teaching situation and carrying out a risk assessment with associated measures to mitigate risks enables the teacher to teach effectively and be present.

Having a well-prepared backpack specifically for outdoor teaching is highly recommended.

**Suggested contents;**

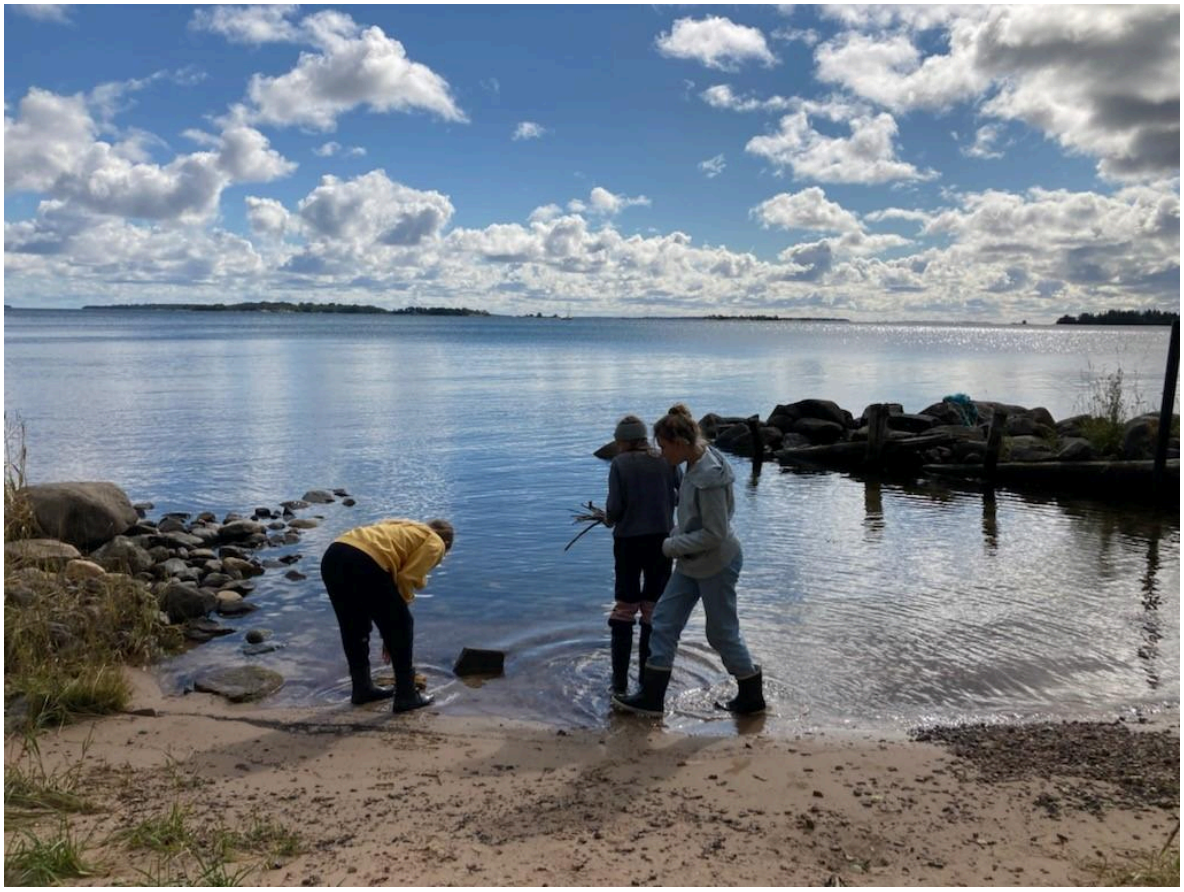
- First aid kit
- Bag with hygiene items such as toilet paper, hand sanitizer, and garbage bags
- Water
- Consider creating safety cards with action plans for emergencies, such as accidents, a missing student, or any other potential risks.

Always bring a fully charged phone to use in emergencies. If a child goes missing, immediately call 112. A child can move far in just 15 minutes, and the search radius expands quickly. If a child/student is seriously injured, stung by a wasp, or similar, call 112 or the medical advice line for guidance. If an emergency response is required, the responsibility lies with the emergency operator. Other useful numbers to have include those for the school, students' guardians, the poison information center, and local healthcare clinics.

When conducting outdoor lessons near the shore, water, or natural ice, it is especially important to conduct a thorough risk assessment and prepare as much as possible to prevent accidents.

With these preparations, we hope you have exciting, meaningful and high-quality school days.

Good luck!



The Right of Public Access (“Allemansrätten”) gives us a unique opportunity to experience nature in Sweden. All nature is owned by someone, so we are visitors and must show consideration and respect, both for animals and plants, as well as for other visitors and landowners. The Right of Public Access applies both on land and water. We use the Right of Public Access when we hike in the forest, climb, play in nature, pick berries, kayak, or sit on a rock in the archipelago and watch the sunset. The Right of Public Access is freedom with responsibility. It is not a law, but guidelines for how we should behave in nature. A good summary is “do not disturb, do not destroy”. Remember that fishing and hunting are not included in the Right of Public Access, nor is driving motor vehicles off-road. If you're unsure about what you're allowed to do in a specific area, ask the landowner.

- **Be considerate of those who live or work at a location** - you are free to roam in forests and nature. You use the Right of Public Access when you pass houses from a distance and take a detour around fields or newly planted forests. If you're unsure whether you're disturbing someone, feel free to ask. Remember to keep your distance from grazing animals and always close gates.
- **Make safe fires** - you can make a fire in nature under safe conditions. It's best to always choose a designated fire site, or select gravel or sand if you need to make a fire in other places. Always keep an eye on the fire and put it out properly. It's your responsibility to check if there's a fire ban in the municipality or county and, if so, bring food that doesn't require a fire.
- **Pick berries, flowers, and mushrooms** - the Right of Public Access gives you the opportunity to enjoy what nature offers. You can take branches, pine cones and nuts that are already on the ground. You may pick berries, as well as flowers and mushrooms that are not protected by law.
- **Take your trash home** - leave no trace of your presence in nature.
- **Cycling** - adjust your riding style to the terrain and avoid areas that are wet or sensitive. If many of you cycle frequently in the same area, remember to talk to the landowners.

The Right of Public Access does not apply in all areas. In nature reserves, parks, golf courses, beaches and national parks, the Right of Public Access is often restricted. You need to find out for yourself what rules apply in these areas. Learn more about the Right of Public Access:

The Swedish Environmental Protection Agency website:
https://www.naturvardsverket.se/en/topics/the-right-of-public-access/

Norrtälje Nature Center's website: https://norrtaljenaturcentrum.se/allemansratten/

Do not disturb, do not destroy – go out and enjoy!

The world's oceans are probably our oldest ecosystems. The Baltic Sea, on the other hand, is one of our youngest ecosystems. The Baltic Sea is an inland sea stretching from the Gulf of Bothnia in the north to Öresund in the south, and is bordered by Denmark and Sweden to the west, Finland, Russia, Estonia, Latvia and Lithuania to the east, and Poland and Germany to the south.

The water of the Baltic Sea is brackish, which means that it has a lower salinity than the world's oceans. Saltwater from the North Sea flows into the Baltic Sea through the narrow Danish straits, which is mixed with freshwater coming from rivers and streams. Because of this, the salinity of the brackish Baltic Sea water varies in different locations. The closer you get to Öresund in the south, the saltier the water becomes, and the farther north, where more rivers flow into the sea, the less salty it becomes.

This unique salinity presents a challenge for the plants and organisms living here. Most species probably originate from either marine or freshwater environments and have over thousands of years adapted and found their niche in the Baltic Sea. This makes the life in the Baltic Sea unique and particularly exciting to study, but it also makes the species relatively sensitive to changes and environmental impact. The Baltic Sea has relatively low species diversity compared to other seas, a situation made worse by significant pollution from shipping and surrounding countries, as well as poor water circulation and limited influx of fresh seawater.

Climate change and the greenhouse effect are significantly impacting the Baltic Sea ecosystem, by reduced salinity due to increased rainfall, eutrophication and murky water from higher runoff, algal blooms due to eutrophication, less sunlight for photosynthesizing plants due to murkiness, and oxygen-depleted seabeds due to the large amounts of oxygen consumed by algae that sink to the bottom and decompose. These environmental changes affect fish and other organisms in the sea. For example, one major challenge for cod is to find places in the Baltic Sea where they can still lay eggs in sufficiently salty and oxygen-rich water.

The life in the Baltic Sea is unique and unlike life in any other marine environment, but at the same time there are many similarities with species from both the world's oceans and freshwater lakes. Dive in and be amazed!

The mobile classroom aims to spark curiosity and inspire exploration of the coastal life in the Baltic Sea and near your school. Through practical investigations involving all the senses we gain first-hand experiences and develop knowledge about the Baltic Sea's organisms and ecology. It is also important for students to get a sense of the place – to experience the shore and the sea with all their senses. The Baltic Sea is a special sea. There are many challenges for all living things, whether you are a fish, a clam or a human. Through wonder, knowledge and awareness we create engagement for a vibrant Baltic Sea.

There is a lot of great material available for schools about the Baltic Sea and marine environments. Below are some websites, links, literature, etc.

**Websites**

| | |
|---|---|
| Östersjöcentrum, University of Stockholm | https://www.su.se/stockholms-universitets-ostersjocentrum/ |
| Tångbloggen or Baltic Seaweed | https://tangbloggen.com/ https://balticseaweed.com/ |
| Baltic Sea center | https://www.su.se/stockholm-university-baltic-sea-centre/ |
| Vattenriket | https://vattenriket.kristianstad.se/other-languages/ |
| Havet.nu | https://www.havet.nu/ |
| Naturskyddsföreningen | https://www.naturskyddsforeningen.se/skola/hav-och-vatten/ |
| Naturvårdsverket | https://www.naturvardsverket.se/ |
| Världsnaturfonden | https://www.wwf.se/ |

**Literature**

*Östersjökompassen,* Vattenriket Kristianstad

*Vatten och land- för det vilda,* Redaktion Lars-Erik Nilsson, Bo Nilsson, Lennart Stensson, Umeå University

Pedagagogical materials and tools - Vattenriket i Kristianstad. Vattenriket.kristianstad.se/pedagogiskt-material

Bokserien *Lära in ute, Naturskoleföreningen* *https://www.outdoorteaching.com/sv/vara-bocker/serien-att-lara-in-ute/*

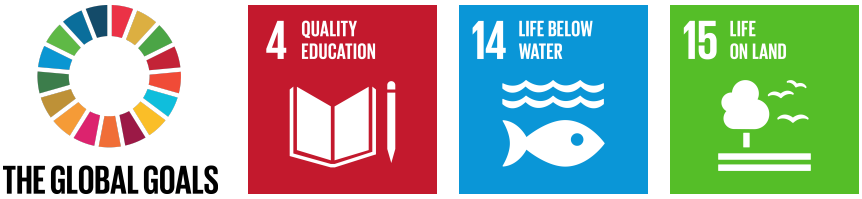
*Växter och djur i Östersjön, Stockholms Universitet Östersjöcentrum, 2023*

Utställningsblad. Vattenriket https://vattenriket.kristianstad.se/wp-content/uploads/2022/08/UK-Ostersjon_utstallning.pdf

**Mobile-app**

Seek

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 9 EXERCISE 1 LIFE IN THE SEAWEED | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | f-3 | 4-6 | 7-9 |
| | Purpose: To explore and learn more about seaweed and investigate which animals live in it. | | | |
| Page **1** of **1** | Curriculum Biology | | Version: 1 | |



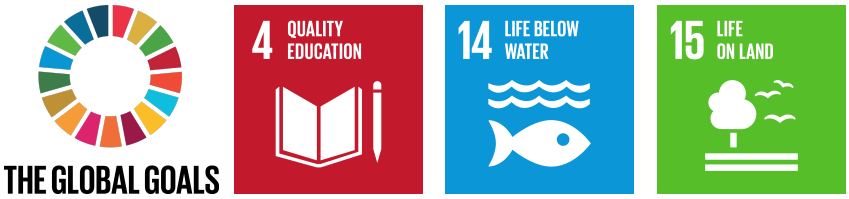

**MATERIALS** Hand nets, white plastic trays, small containers, iPad or phone for photographing organisms, or alternatively, sketch pads and pencils to draw them on-site.

**INSTRUCTIONS**

- Begin the lesson at a shore where the water is shallow.
- Divide the class into small groups of about 4 students per group. Let them carefully pick up some seaweed using their hands or a net.
- Gently shake the seaweed over an open bag or tray, or alternatively over a rock.
- Let the students sort all the animals they see into plastic bowls filled with seawater.
- Try to name the animals using a field guide or species identification key, or search on www.havet.nu.
- Ask the students to study the animals. They can use a loupe or magnifying glass and answer the following questions:
    - Are there many of the same kind?
    - Why do they thrive in the seaweed?
    - Are they fast?
    - Do they have legs?
- Empty the containers and release all organisms back into the sea. Clean up the materials and the environment.

Gather the students in a circle at the end of the lesson and let them share their findings and reflections. The teacher summarizes.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 10 EXERCISE 2 NETTING ON THE BEACH | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | f-3 | 4-6 | 7-9 |
| | Purpose: To explore and learn more about the animals and fish species living in the Baltic Sea. | | | |
| Page **1** of **2** | Curriculum Biology, English | | Version: 1 | |




**MATERIALS** Hand nets, aquascope, sieves, large and small containers, plastic aquarium, large white plastic trays, laminated species images (A4), reference books, iPad or phone for photographing organisms, or alternatively, sketch pads and pencils to draw them on-site, student log sheets with clipboards (there is a template behind the tab).

**INSTRUCTIONS**

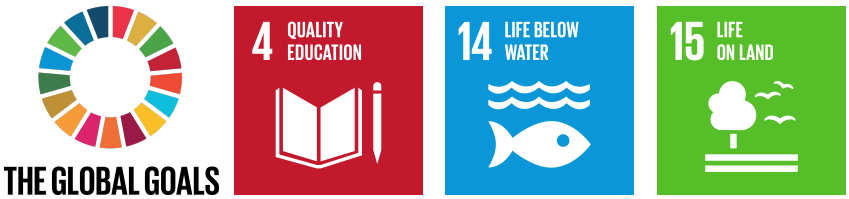
- Begin the lesson at a shore where the water is shallow.
- Divide the class into small groups of about 4 students per group. Distribute the nets and sieves.
- Fill trays and large containers with seawater.
- Let the students first empty their findings into the large, wide trays.
- Arrange the large water-filled containers in a row and place different species images beneath them. Have the students sort all animals, plants, and fish as they are discovered, carefully placing them into the corresponding containers.
- Use a field guide, species identification key or search havet.nu to name the animals.
- Let the students record their findings in a log sheet (see the template behind the tab).
- Ask the students to consider the following questions:
    - Which findings were most common?
    - Which was the smallest?
    - Which was the largest?
    - Do they have anything in common?

- Gently return all water and findings to the sea. Clean up and restore the outdoor classroom, ensuring both the environment and materials are left in good condition.

Gather the students in a circle at the end of the lesson and let them share their findings and reflections. The teacher summarizes.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 11 EXERCISE 3 INVESTIGATING SEAWEED | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | | 4-6 | 7-9 |
| | Purpose: To investigate and learn more about seaweed, and to understand the role of chlorophyll in marine plants. | | | |
| Page **1** of **2** | Curriculum Biology | | Version: 1 | |

Beneath the surface of the sea lies a myriad of different types of seaweed. Most plants need chlorophyll, the green pigment in their leaves, to capture energy from the sun's rays. But what about seaweed? Does it contain chlorophyll?




**MATERIALS** Thermos with hot water, brown algae: for example bladderwrack, plastic jars, species identification keys, iPad or phone for photographing before and after the experiment, or sketch pads and pencils for drawing illustrations on-site, student log sheets with clipboards.

**INSTRUCTIONS**

- Begin the lesson at a shore where the water is shallow.
- Divide the class into small groups of about 4 students per group. Let them carefully collect a piece of seaweed with their hands or a net. A small piece floating in the water is sufficient.
- PART 1
    - The Different Parts of Seaweed - Let the students examine the seaweed and document their findings on the log sheets:
    - Describe the seaweed. Why does some bladderwrack have bladders? What do you think is inside the bladderwrack's bladders?
    - Discuss and investigate!

It becomes evident quite quickly that the bladders contain air. The seaweed produces these gases itself. Why does it have air bladders? Discuss! Most plants need sunlight, and so does bladderwrack. The bladders act as buoyancy aids, helping the algae stay as close to the water's surface as possible. Sometimes, the top parts even break the surface. Thanks to these bladders, bladderwrack becomes better at capturing sunlight.

- How old is the seaweed? Refer to the picture provided in the blue bags.
- Bladderwrack plants are either male or female. They produce eggs or sperm in special reproductive organs called receptacles, which are bumpy structures at the tips of the seaweed. These are distinct from the air bladders. Can you find bladderwrack with receptacles?
- Gather the students in a circle at the end of the lesson and let them share their findings and reflections. The teacher summarizes.
- PART 2
    - Does Brown Algae Contain Chlorophyll?
    - Chlorophyll Experiment: Have the students fill a plastic jar with about 1 dl of hot water from the thermos. Dip one end of a fresh piece of bladderwrack into the jar for approximately 15 seconds.
    - What happens?

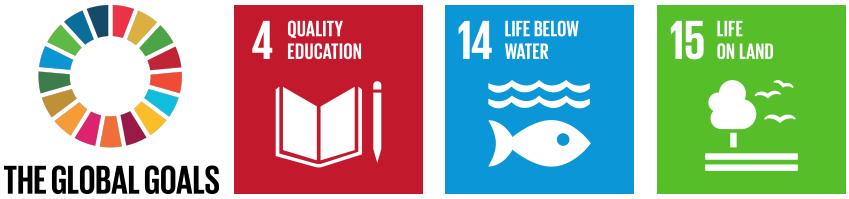
When the bladerwrack is removed, you will see a clear boundary. The part submerged in hot water turns bright green. This reveals that even brown algae contain chlorophyll, but it is masked by other pigments. These pigments dissolve in the hot water, allowing the underlying green chlorophyll pigments to become visible after heating.

- Gather the students in a circle at the end of the lesson and let them share their findings and reflections. The teacher summarizes.

NOTE! If the seaweed is still alive or attached to a rock,

return it to its original place.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 12 EXERCISE 4 SEAWEED ART | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | | 4-6 | 7-9 |
| | Purpose: To learn more about seaweed and its various species, while marveling at the biodiversity and ecosystems of the sea. | | | |
| Page **1** of **1** | Curriculum Biology | | Version: 1 | |



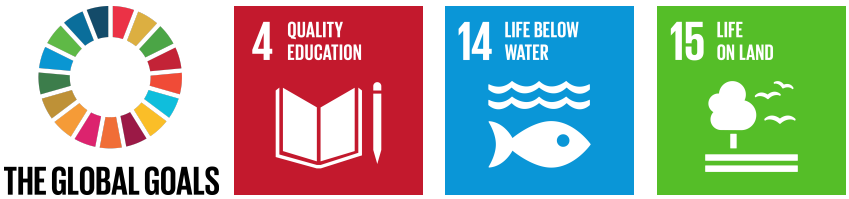

**MATERIALS** Hand nets, seaweed, wide tubs, flat trays, sturdy white paper, pieces of fiber cloth/newspaper, brown/kraft paper, 2 plant presses.

**INSTRUCTIONS**

- Start the lesson by the sea.
- Divide the class into pairs.
- Each student pair collects a piece of seaweed using a net or their hands.
- Place the seaweed in the large white tubs filled with water. Place a sheet of paper on a tray and gently submerge it under the water in the tub. Choose a piece of seaweed and position it on the paper while it's submerged. Carefully lift the paper and let it drip dry.
- Open the plant press. Layer as follows: brown paper, fiber cloth, the paper with seaweed, fiber cloth, and another sheet of brown paper. Students can arrange multiple pieces of seaweed on one sheet to create a design and later cut the dried result into smaller art pieces.
- Bring the press back to the classroom.
- Replace the fiber cloth/newspaper daily until the seaweed is dry. Assign some students to manage this task. Once dried, the seaweed will adhere to the paper.
- Students label their sheets with the species, collection location, date and their name.
- Create an exhibit about marine biodiversity.
- Keep all the pieces as a class herbarium, or allow students to take their pieces home as artwork.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 13 EXERCISE 5 MUSSELS IN THE BALTIC SEA | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | F-3 | 4-6 | 7-9 |
| | Purpose: To learn more about mussels, marine ecology and ecosystem services in the sea. | | | |
| Page **1** of **2** | Curriculum Biology, Crafts | | Version: 1 | |

Mussels naturally grow among seaweed, on rocks, cliffs, and solid surfaces like bridges and docks. Together, they can form large mussel communities known as mussel beds. Blue mussels and other species are filter feeders, consuming phytoplankton by filtering water through their siphons. A large blue mussel can filter several liters of water per hour. If there are plenty of mussels, they can process large amounts of phytoplankton. In this way mussels can help to reduce the negative effects of eutrophication, such as oxygen depletion and algal blooms. In doing so, mussels provide an important ecosystem service.




**MATERIALS** Plastic trays, large containers, hand nets, aquascope, species identification keys, reference books, iPad or phone for photographing, or sketch pads and pencils for drawing illustrations on-site.

**INSTRUCTIONS**

- Begin the lesson outdoors at the shore.
- Divide the class into small groups and distribute the nets and other tools.
- Search for different types of mussels and place them on a tray.
- How many species can you find? (Examples: Baltic clam, blue mussel, softshell clams, and cockle.)
- Photograph the different mussels or draw/paint them.

Gather the students in a circle at the end of the lesson and let them share their findings and reflections. The teacher summarizes.

Tips! Let the students paint the different mussels they found during the outdoor lesson. This activity enhances long-term understanding of the various mussel species in the Baltic Sea, their biology, and their role in the marine ecosystem.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 14 EXERCISE 6 BIRDWATCHING | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | f-3 | 4-6 | 7-9 |
| | Purpose: To learn more about birds, which ones thrive in the archipelago and how they are part of the ecosystem. | | | |
| Page **1** of **2** | Curriculum Biology | | Version: 1 | |

In the spring nature is alive with bird activity, making it an ideal time for birdwatching. Along the coast, you can observe migratory birds passing by and spot various waterfowl and birds of prey. Allowing students to birdwatch in pairs is an exciting experience. Even if they don't see many birds, they can listen for different bird calls. It is guaranteed to be a rich and memorable nature experience.

In the archipelago, it is often colder in spring compared to inland areas, as the sea's low water temperature affects the air temperature. Warm clothing is essential!

THE GLOBAL GOALS

4 QUALITY EDUCATION

14 LIFE BELOW WATER

15 LIFE ON LAND

**MATERIALS** Binoculars, (Spotting scopes), seat pads, notebooks for documentation and sketches, field guides on birds, laminated overview charts of common bird species.

**INSTRUCTIONS**

- Begin the lesson by the sea. Choose a sheltered spot if possible.
- Divide the class into pairs and spread them along the shoreline, or go to different locations if there are multiple adults. Distribute equipment such as binoculars, seat pads, field guides and laminated bird identification materials (available as copy material ).
- Start observing. To maximize success, it's essential to remain still and quiet. This activity requires patience and focus. Suggested strategies for birdwatching:
    - Some birds can be seen far out at sea.
    - Eagles and other birds of prey often fly high in the sky.
    - Waders, such as curlews and oystercatchers, prefer the water's edge and wet meadows.
    - Small birds often rest in bushes and trees.
- Ask the students to note the birds they identify. Those who want can also make simple sketches of the birds. Encourage them to discuss which birds seems to be most common in the area and why.

Gather the students in a circle at the end of the lesson. Let them share their observations, experiences and questions. The teacher summarizes.

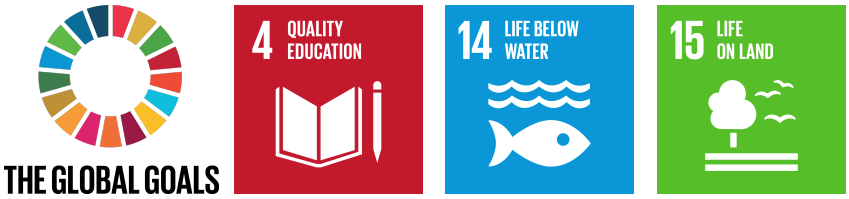
Follow-up in the classroom: Students can research one bird species, write facts, paint a watercolor and participate in a school exhibit.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 15 EXERCISE 7 WHAT HAPPENS BY THE SEA? | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | | 4-6 | 7-9 |
| | Purpose: To foster a sense of connection to the sea and marine environments using all the senses. | | | |
| Page **1** of **2** | Curriculum Biology | | Version: 1 | |

A stormy day or a perfectly calm day by the sea can feel completely different depending on who experiences it. There is something truly special about gazing out at the horizon over the ocean. But what happens when you do so? What does it sound like? How does it feel? How does it smell? What do you see?

Let the students listen, watch and reflect on their own. This activity focuses on pausing and observing, but it also gives students the opportunity to explore what they experience with all their senses. Perhaps it will spark questions about the sea, the rocks, the beach, the climate, history or the future. Maybe they will feel awe and fascination for the ocean and the powerful ecosystem it represents.

These sensory experiences often evoke a connection to nature and the local environment, fostering engagement and inspiring deeper knowledge, further study and motivation to make sustainable choices.




**MATERIALS** Seat pads.

**INSTRUCTIONS**

- If students have mobile phones, collect them before starting.
- Provide instructions to the students before they head off and ensure that everyone understands the task. Distribute seat pads. Explain that they will be sitting alone. Younger students should be placed at different spots with enough distance so they

can't communicate with each other. Older students can choose their own spots, under the same conditions.

- Instructions for the students:

> Sit (or stand) completely still and quiet. Start by closing your eyes and listening. What sounds do you hear? Then open your eyes and look, listen, feel the wind, smell the air and observe your surroundings. Can you hear or see any animals, insects, fish or birds? What does the sea look like near the shore? What about far out there? Can you hear the sea?

- Allow the students to walk off with their seat pads and choose individual spots.
- After some time, the teacher should gather the students, one at a time, in silence, and form a circle.
- Let the students share what they saw, heard, felt and smelled. What emotions did they experience? Capture any questions they might have.

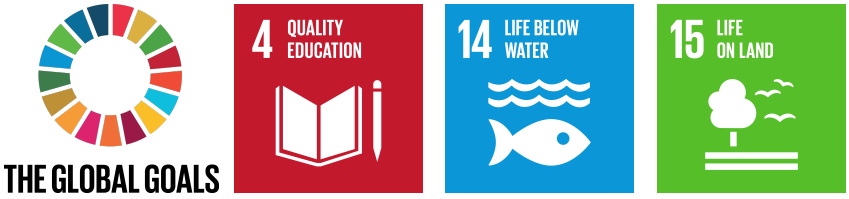
| NORRTÄLJE NATURCENTRUM ekologiskt science center | 16 EXERCISE 8 POETRY BY THE BALTIC SEA | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | | 4-6 | 7-9 |
| | Purpose: To think and dream about the Baltic Sea and the archipelago. To connect emotionally to the sea and marine environments, locally and globally. To express oneself in writing. | | | |
| Page **1** of **2** | Curriculum Language, Biology | | Version: 1 | |

The archipelago and nature are important sources of inspiration for many people. Artists, writers, designers and engineers often draw ideas from nature. Students can write any verses or poems that capture what they see, feel, wonder, think or dream. Haiku is a simple form of poetry from Japan. It consists of seventeen syllables across three lines: five syllables in the first line, seven in the second, and five in the third. However, the exact syllable count isn't the most important aspect—it's about capturing profound beauty and truth in something small. Haikus typically relate to nature, making them particularly fitting for a day by the sea. A haiku is a short, unrhymed poem that often captures a moment, emotion or thought. For example:

*The sound of waves*

*The scent of seaweed and stone*

*Alone at dusk*




**MATERIALS** Writing materials with clipboards and seat pads.

**INSTRUCTIONS**

- Divide the class into small groups of 2–3 students. Hand out clipboards, paper, and pens.

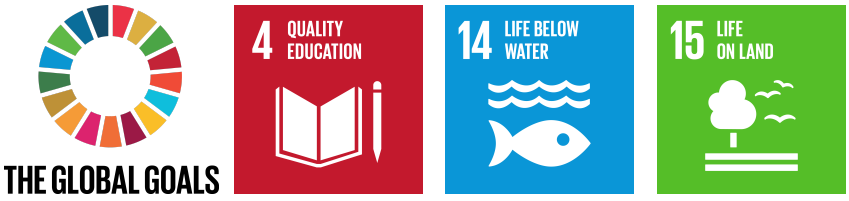
- Let students write verses that describe their emotions by the sea, their questions, dreams and reflections on the Baltic Sea, the ocean, nature and the climate. They may write simple poems, such as haikus. Students decide whether to share their poems with their group or keep them private.
- Back in the classroom, have students write out their poems neatly and compile them into a collective poetry collection about the sea and nature. Consider translating the poems into English and sharing them with school classes on the other side of the Baltic Sea. Young voices sharing thoughts and feelings about our shared ocean—the Baltic Sea.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 17 EXERCISE 9 ECOSYSTEM SERVICES | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | | 6 | 7-9 |
| | Purpose: To understand more about the Baltic Sea and the ocean's ecosystem services. | | | |
| Page **1** of **2** | Curriculum Biology, Language | | Version: 1 | |

Nature provides us with a number of free services, collectively called ecosystem services. These are often categorized into four groups, though they are interconnected and some ecosystem services may belong to multiple groups:

| |
|---|
| Provisioning (producing) - Services that fulfill our material needs, such as food, materials and energy. These include industries like tourism and hospitality that generate income and jobs. |
| Regulating - Services that help maintain balance, such as climate regulation, protection against erosion and wave exposure, as well as predators that control the number of herbivores. |
| Supporting - Foundational services that enable other ecosystem services to function, like habitats, photosynthesis, decomposition, nutrient cycles and food webs. |
| Cultural – Things we need to feel good and thrive. This can include things like peace, quiet and beauty, but also activities and experiences that enrich life. |

Then what are the ecosystem services of the sea? Mussels, for instance, act as the ocean's natural purification system, making them vital to ecosystem health. But do they contribute with anything else as well?




**MATERIALS** Laminated cards and whiteboard markers.

**INSTRUCTIONS**

- Initiate a discussion with the students about the benefits and joys of the sea. Why is the Baltic Sea important? Reflect from your own perspective. How do you

benefit from the sea?
Let students discuss briefly in pairs.

- Write down the students' suggestions on the laminated cards. Work together to select five key ecosystem services (one per card). Examples include:
    - Swimming
    - Fishing
    - Outdoor recreation
    - Drinking water
    - Non-drinkable water
    - Research resources
    - Aesthetic value
    - Health benefits
    - Biogas production from seaweed
    - Seafood (fish, mussels, shellfish, etc.)
    - Climate regulation by the sea absorbing large amounts of carbon dioxide.
    - Mussels as a water purification system

<u>FULL CLASS VALUE EXERCISE – OCEAN ECOSYSTEM SERVICES</u>

- Place the pictures on the beach. Read one question at a time (see below). Ask students to stand by the service they feel fits best. Let a student explain their choice. Move on to the next question.
    - Which ecosystem service is most important to you?
    - Which ecosystem service is most important for Sweden?
    - Which ecosystem service is most important for all people on Earth?
- Divide the students into 5 groups and give each group a card with an ecosystem service. Now they should discuss the threats to the ecosystem service and what humans and societies can do to protect that service, both locally and globally.
- Gather the class in a circle and have each group present what they have discussed and their thoughts. Reflection. Finish with a round where every student names one ecosystem service they believe is important that the ocean provides.

| NORRTÄLJE NATURCENTRUM ekologiskt science center | 18 EXERCISE 10 THE OLD PIKE | | | |
|---|---|---|---|---|
| | BOX 1 Baltic Sea | | | |
| | GRADES | f-3 | 4-6 | 7-9 |
| | Purpose: To learn more about ecological connections, participate in physical activity and enjoy movement. | | | |
| Page **1** of **1** | Curriculum Biology, PEaH | | Version: 1 | |

GAME TO LEARN MORE ABOUT ECOLOGY

On an outdoor school day, it's good to get the body moving and the heart rate up. This ecological game is suitable for all ages and allows students to experience ecology with their whole body.


**INSTRUCTIONS**

- One participant is chosen to be the "old pike" (gammelgädda). The other students line up; they are either perch or any other fish they choose to be.
- The teacher calls out: "The old pike is coming!" At this point, the perch must swim across to the other side as quickly as possible. When the pike touches a fish, it gets stuck at the bottom of the lake and turns into seaweed. Fish that successfully reach the other side are still free in the sea.
- The teacher calls again: "The old pike is coming!" Now, the perch must not only avoid the pike but also avoid the seaweed that is swaying at the bottom. Again, if a perch is touched it also becomes stuck and turns into seaweed.
- The game continues until there is only one perch left. This last perch becomes the new "old pike", and the game starts over.
- Gather the students in a circle. Time for reflection. Ask questions like:
    - What did we learn from this activity?
    - How did it feel to be a predator (the old pike)?
    - What happens in an ecosystem if predators increase dramatically?
    - How did the last perch feel at the end? Why did that particular perch survive so long?

| | |
|---|---|
| 8 | Hand nets |
| 8 | Handles for nets |
| 2 | Large white plastic trays |
| 2 | Small jars |
| 2 | Smaller plastic trays |
| 1 | Aquarium |
| 10 | Empty candy jars |
| 1 | Aquascope |
| 8 | Binoculars |
| 15 | Clipboards |
| | Paper for herbarium |
| 1 | Plant press |
| 1 | Species identification keys & Field guides |
| 8 | Loupes |
| 6 | Whiteboardpencils & Cards |
| 6 | Blue bags-Birds, Seaweed, Species identification keys |

**Norrtälje Nature Center is an ecological, outdoor-based science center.** We work with knowledge development, experiences and learning through nature conservation, outdoor educational activities and the management of Färsna Gård in Norrtälje. The work is carried out through projects and initiatives at local, regional and national levels. Norrtälje Nature Center has many different collaborations and initiatives with Norrtälje Municipality. This material has been developed by our outdoor education program as a resource for schools and preschools to increase students' interest in science and sustainable development.

**The loan boxes have been made possible through a Nordplus Horizontal project,** which in 2024 aimed to highlight the unique status and challenges of the Baltic Sea. The project was conducted in partnership with organizations in Norrtälje (Sweden), Tartu (Estonia), and Vilnius (Lithuania). The purpose of the boxes, or "mobile classrooms", is to lower the barriers for teachers and simplify teaching with outdoor teaching methods in the school's local environment, providing more varied instruction.

**Nordplus is the Nordic Council of Ministers' program for cooperation between the Nordic and Baltic countries, as well as Åland, the Faroe Islands and Greenland.** Through Nordplus, organizations across the educational sector can apply for funding for various types of exchanges and collaborations.

Nordplus