

The background of the slide is a photograph of an industrial facility, likely a power plant or refinery, with several tall smokestacks. One stack on the left is prominently emitting a thick, dark plume of smoke that rises into the sky. The sky is filled with large, billowing clouds that are illuminated from below, giving them a warm, golden-yellow or orange hue, suggesting a sunset or sunrise. The overall atmosphere is one of industrial activity and environmental impact.

Pollution in the Baltic Sea

How European Policies, Digital Technologies and Environmental Standards Can Protect One of Europe's Most Vulnerable Marine Ecosystems

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How European Policies, Digital Technologies and Environmental Standards Can Protect One of Europe's Most Vulnerable Marine Ecosystems

The Baltic Sea is one of the most environmentally vulnerable seas in the world. Due to its geographical characteristics, pollutants remain in the water for many years, making pollution a serious environmental challenge. This presentation focuses on the causes and consequences of Baltic Sea pollution and explains how the European Union supports environmental protection through the European Green Deal, the Digital Strategy and the Standardisation Strategy. Poland plays an important role because most of its rivers discharge directly into the Baltic Sea.



The Baltic Sea – Characteristics

The Baltic Sea is located in Northern Europe and is surrounded by nine countries: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. It is a semi-enclosed sea connected to the North Sea only by the narrow Danish Straits. Because of this limited connection, water exchange is extremely slow and takes approximately **30–40 years**.

The Baltic Sea has a surface area of approximately **377,000 km²**, while its average depth is only **55 metres**. These unique characteristics make the sea particularly sensitive to pollution because harmful substances accumulate much faster than they can be naturally removed.



Why is the Baltic Sea Polluted?

The Baltic Sea receives pollution from many different human activities. The largest source is agriculture, where excessive use of fertilizers causes nitrogen and phosphorus to be washed into rivers. These rivers transport nutrients directly into the Baltic Sea.

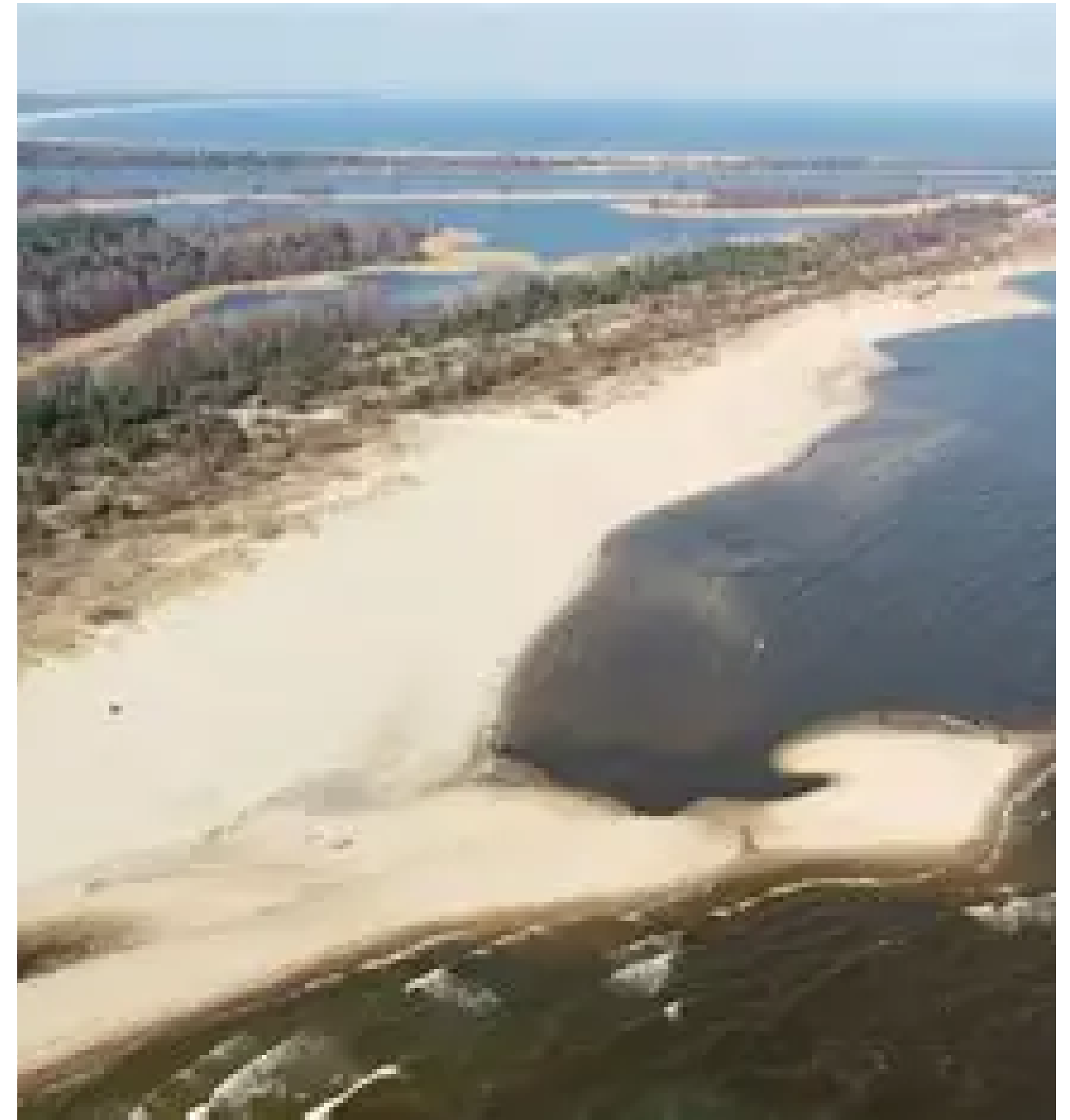
Other important pollution sources include untreated municipal wastewater, industrial discharges, maritime transport, oil spills and plastic waste. In recent years, microplastics have become an additional environmental concern because they persist in marine ecosystems for decades.



Case Study – Poland

Poland has one of the greatest impacts on the Baltic Sea because almost all of its territory belongs to the Baltic Sea drainage basin. The Vistula River, the country's longest river, drains approximately **54% of Poland's territory** before flowing into the Gulf of Gdańsk.

Agricultural runoff remains the main source of nutrient pollution in Poland. According to HELCOM, agriculture contributes around **57% of nitrogen inputs** reaching the Baltic Sea from Polish territory. Although wastewater treatment has improved significantly, agriculture remains the greatest challenge for protecting marine ecosystems.



Poland: Threat lurking in the Baltic | DW Documentary



Eutrophication – The Biggest Problem

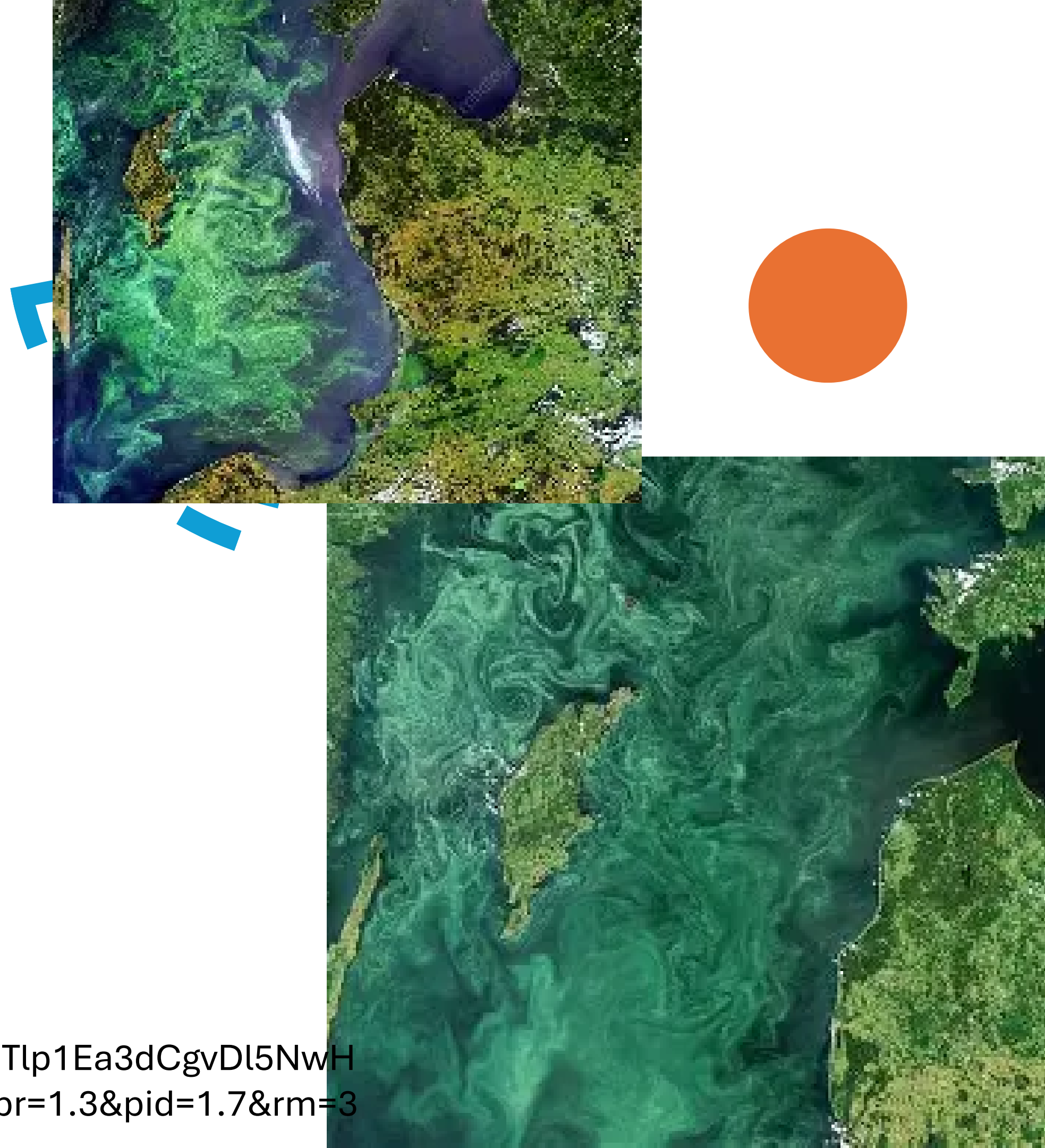
Eutrophication is the process caused by excessive amounts of nitrogen and phosphorus entering the sea. These nutrients stimulate rapid algae growth, known as algal blooms. When algae die, they decompose and consume oxygen from the water, creating so-called "dead zones" where fish and other marine organisms cannot survive. According to HELCOM, approximately **94% of the Baltic Sea** is still affected by eutrophication despite decades of environmental protection measures.

Effects:

- Algal blooms
- Dead zones
- Fish mortality
- Biodiversity loss
- Poor water quality



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State of the Baltic Sea 2023



Environmental Consequences

Pollution has severe consequences for both ecosystems and people. Oxygen depletion reduces fish populations, especially cod, while toxic algal blooms threaten tourism and public health. Plastic waste and microplastics accumulate in marine organisms and enter the food chain. Coastal habitats are gradually degraded, leading to biodiversity loss and weakening the resilience of marine ecosystems.



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Economic and Social Impact

The Baltic Sea supports millions of people living along its coastline. Tourism, fisheries and maritime transport are essential sectors of the regional economy. Poor water quality, beach closures and declining fish stocks generate significant economic losses every year. Protecting the Baltic Sea is therefore not only an environmental issue but also an economic and social priority.



Mussel farms fight against pollution in the Baltic;
one of the most polluted seas in the world



Ethics and European Values in Baltic Sea Protection

Why is this more than an environmental problem?

- **Responsibility for future generations:** Protecting marine ecosystems ensures that future Europeans inherit healthy seas.
- **Solidarity:** The Baltic Sea is shared by nine countries, so effective protection requires international cooperation.
- **Scientific integrity:** Environmental decisions must be based on accurate, transparent and standardized data.
- **Professional ethics:** Scientists, engineers and public authorities have a duty to monitor pollution honestly and apply environmental standards consistently.
- **Citizen engagement:** Every individual can contribute by reducing pollution, reporting environmental incidents and supporting sustainable practices.



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https://c.pxhere.com/photos/3f/58/baltic_sea_beach_dunes_r_gen_cliff_sand_marram_grass_baltic_sea_wave-620408.jpg!d





The European Green Deal – A Strategy for a Cleaner Baltic Sea

The **European Green Deal**, introduced in 2019, is the European Union's long-term strategy for achieving climate neutrality by 2050 while protecting natural ecosystems.

One of its main objectives is the **Zero Pollution Action Plan**, which aims to reduce pollution in air, soil and water.

For the Baltic Sea, the Green Deal promotes sustainable agriculture, improved wastewater treatment and the restoration of aquatic ecosystems. It also supports reducing nutrient losses from farming, encouraging environmentally friendly practices and protecting biodiversity in coastal areas. These actions are essential for limiting eutrophication and improving water quality.



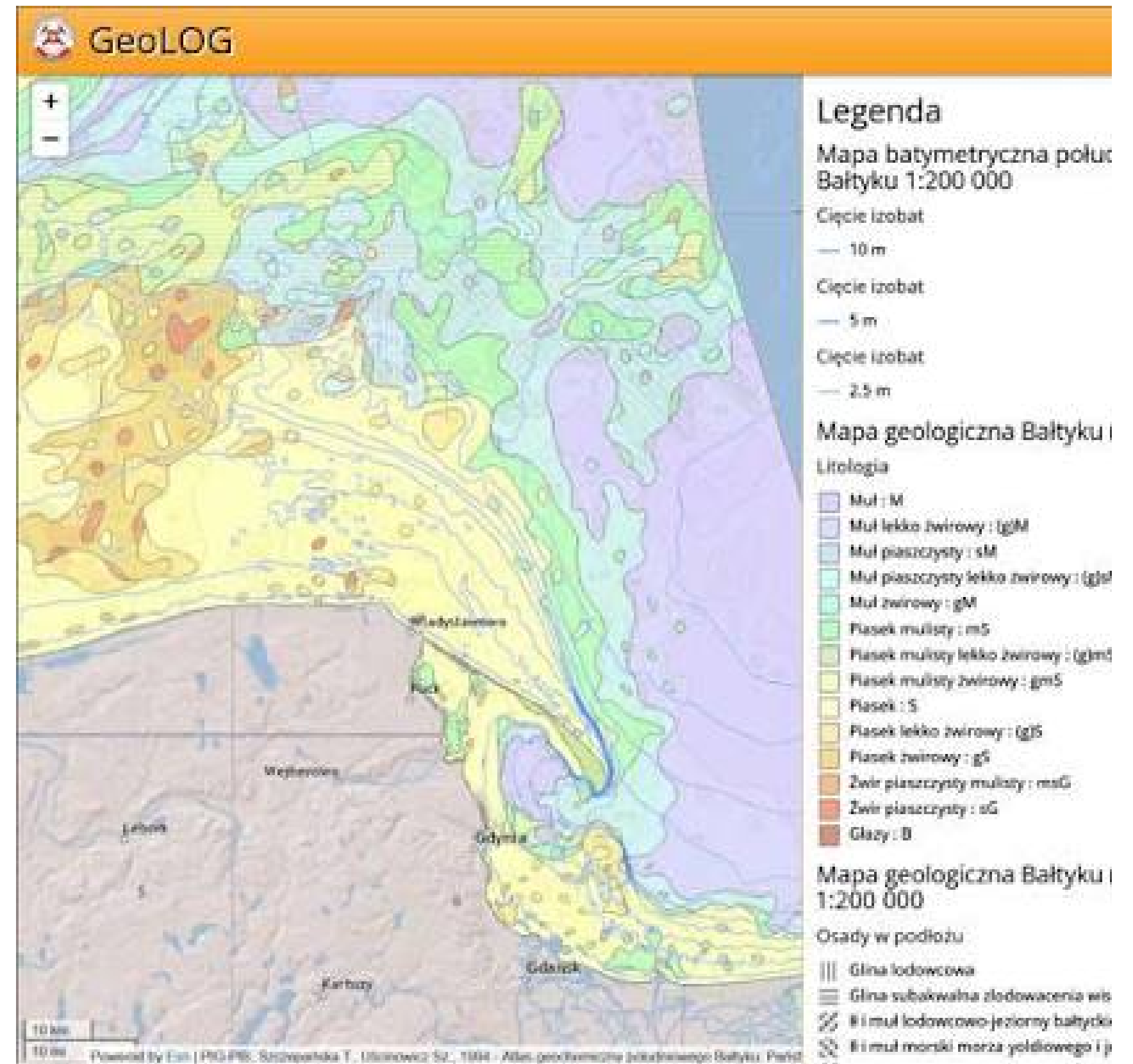
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EU Digital Strategy – Using Technology to Protect the Baltic Sea

The **EU Digital Strategy** promotes the use of advanced technologies to improve environmental protection and decision-making. In the Baltic Sea region, digital tools help scientists and public authorities monitor pollution in real time and respond more effectively to environmental threats.

Digital technologies:

- Copernicus satellites
- AI
- IoT sensors
- Drones
- GIS mapping



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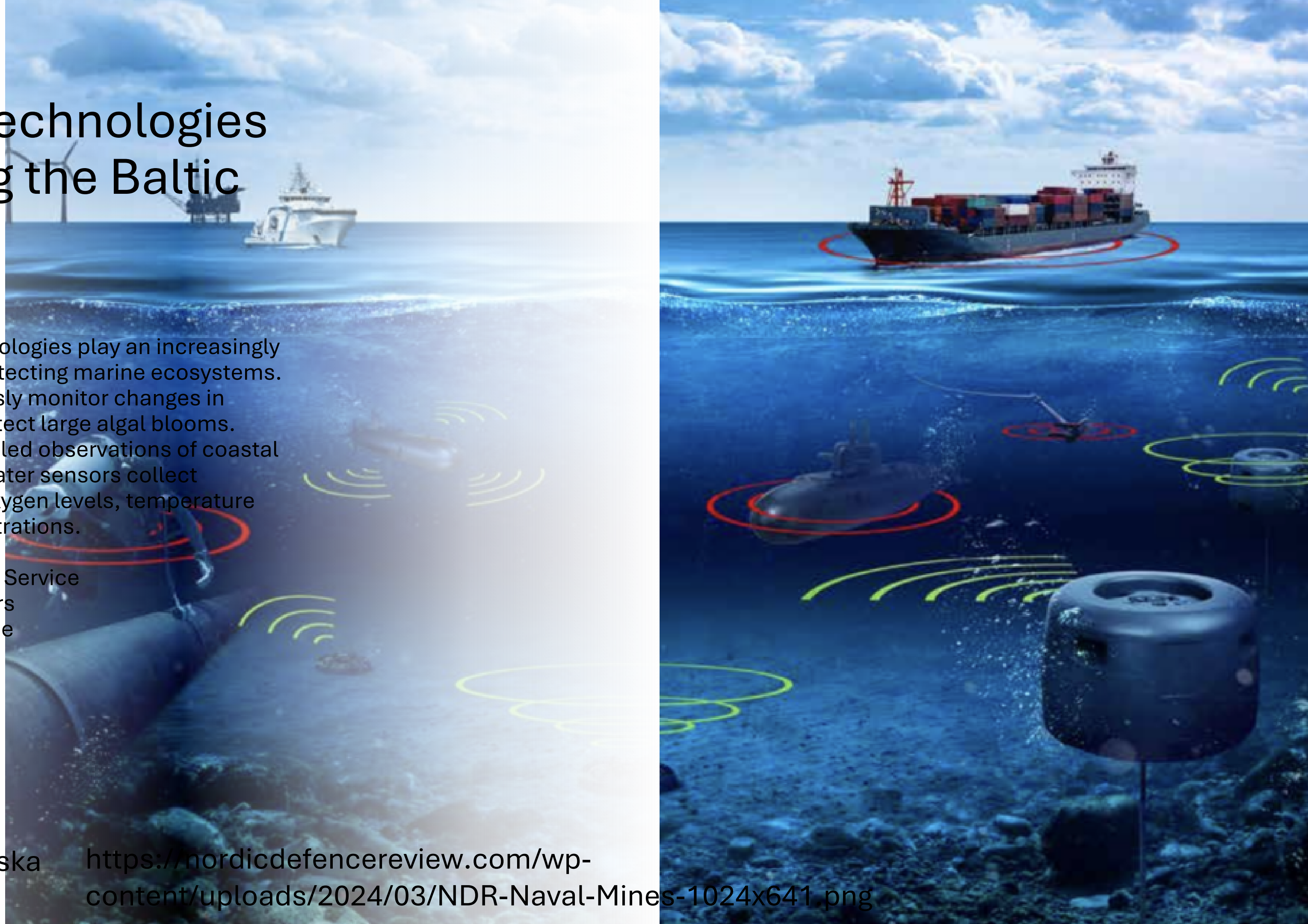
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Modern Technologies Protecting the Baltic Sea

Modern digital technologies play an increasingly important role in protecting marine ecosystems. Satellites continuously monitor changes in water quality and detect large algal blooms. Drones provide detailed observations of coastal areas, while underwater sensors collect information about oxygen levels, temperature and nutrient concentrations.

Examples:

- Copernicus Marine Service
- Smart water sensors
- Artificial Intelligence
- Remote sensing
- Digital Twins



EU Standardisation Strategy – Why Standards Matter

Environmental protection requires reliable and comparable data. The **EU Standardisation Strategy** supports the development of common standards for monitoring water quality, laboratory analysis and environmental reporting across all Member States.

Benefits:

- Reliable measurements
- Comparable environmental data
- Better international cooperation
- Improved decision-making



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Examples of Standards Supporting Baltic Sea Protection

EN ISO 5667-9 – Marine Water Quality Sampling

It covers selection of sampling locations and depths, sampling techniques and equipment, sample preservation and storage, quality assurance and contamination prevention, safety considerations during marine sampling

Purpose:

Provides standardized procedures for collecting, preserving and transporting seawater samples.

Why it matters:

Scientists from different Baltic countries collect samples using the same methods, ensuring pollution data are accurate, reliable and directly comparable.

EN ISO 15681 – Determination of Orthophosphate

The method is based on the reaction of orthophosphate with molybdate reagent to form a blue-colored complex, which is measured photometrically. The color intensity is proportional to the orthophosphate concentration.

Purpose:

Specifies standardized methods for measuring orthophosphate concentrations in water.

Why it matters:

Phosphorus is one of the main causes of eutrophication in the Baltic Sea. Standardized measurements help monitor nutrient pollution and evaluate the effectiveness of environmental protection measures.



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Examples of Standards Supporting Baltic Sea Protection

EN ISO 13395 – Determination of Nitrite and Nitrate Nitrogen

The method works by reducing nitrate to nitrite (when total nitrate + nitrite is measured), reacting nitrite with specific reagents to form a colored azo dye and lastly measuring the color intensity photometrically, which is proportional to the nitrogen concentration.

Purpose:

Defines methods for determining nitrate and nitrite concentrations in water.

Why it matters:

Nitrogen is another major nutrient responsible for algal blooms. Using common analytical methods allows Baltic countries to compare nutrient loads and identify pollution sources.

EN ISO 5814 / EN ISO 5815 – Dissolved Oxygen and Biological Oxygen Demand (BOD)

Purpose:

Provides standardized methods for measuring dissolved oxygen and biological oxygen demand in water.

Why it matters:

These parameters are essential for detecting oxygen depletion ("dead zones") caused by eutrophication and assessing the ecological condition of the Baltic Sea.



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Examples of Standards Supporting Baltic Sea Protection

EN ISO 14001 – Environmental Management Systems

It includes topics such environmental policy and objectives, identification of environmental impacts, legal compliance, risk and opportunity management, performance monitoring and continual improvement

Purpose:

Provides a framework for organizations to identify, manage and reduce their environmental impacts.

Why it matters:

Ports, wastewater treatment plants, industries and other organizations around the Baltic Sea use this standard to improve environmental performance and reduce pollution entering the marine ecosystem.

Unlike the previous ISO standards, which focus on **monitoring pollution**, ISO 14001 focuses on **preventing pollution before it occurs**. Unlike the other ISO standards, which focus on **monitoring pollution**, ISO 14001 focuses on **preventing pollution before it occurs**.

Ports, wastewater treatment plants, industries and shipping companies around the Baltic Sea use Environmental Management Systems to reduce pollution, improve resource efficiency, comply with environmental regulations and prevent accidental environmental incidents.



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Explanation of an Environmental Management System ISO 14001 in a simplified way.



What Is Poland Already Doing?

Poland has introduced several measures to improve the ecological condition of the Baltic Sea. Significant investments have been made in modern wastewater treatment plants, reducing pollution from municipalities. Water quality is regularly monitored by the **Chief Inspectorate of Environmental Protection (GIOŚ)** and the **Institute of Meteorology and Water Management (IMGW)**.

Examp

- Wastewater treatment
- Water quality monitoring
- HELCOM cooperation
- Sustainable agriculture



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<https://www.radiomaryja.pl/wp-content/uploads/2021/11/Komisja-Helsinska-HELCOM.jpg>

What Can You do as Citizen to Protect the Baltic Sea?

Everyone Can Make a Difference

Reduce nutrient pollution

- Use fertilizers responsibly in gardens.
- Choose environmentally friendly products.

Reduce plastic pollution

- Avoid single-use plastics.
- Recycle waste correctly.
- Participate in local beach and river clean-up events.

Report environmental problems

- Report illegal waste dumping or sewage discharge to local authorities.
- Notify environmental agencies about fish deaths, oil spills or water pollution.

Protect rivers

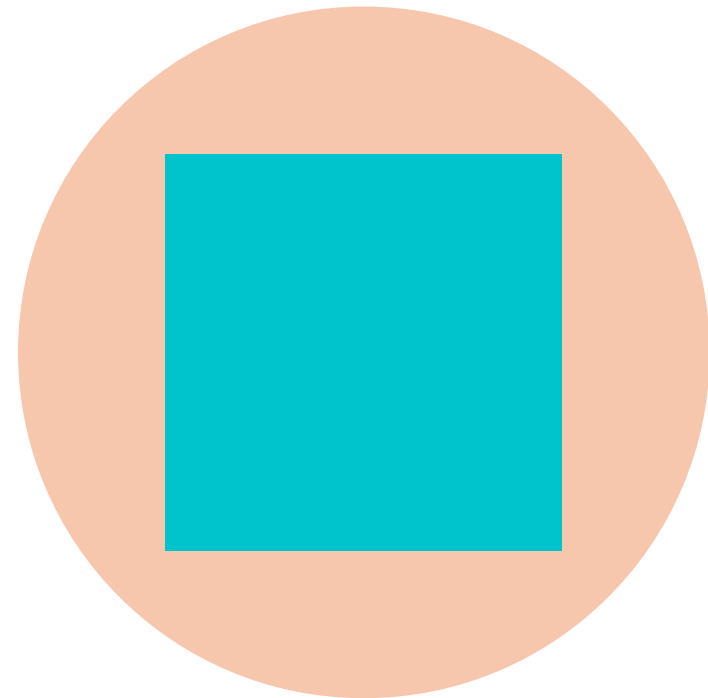
- Remembering that rivers carry pollution directly to the Baltic Sea.
- Support local initiatives that improve river and wetland protection.

Raise awareness

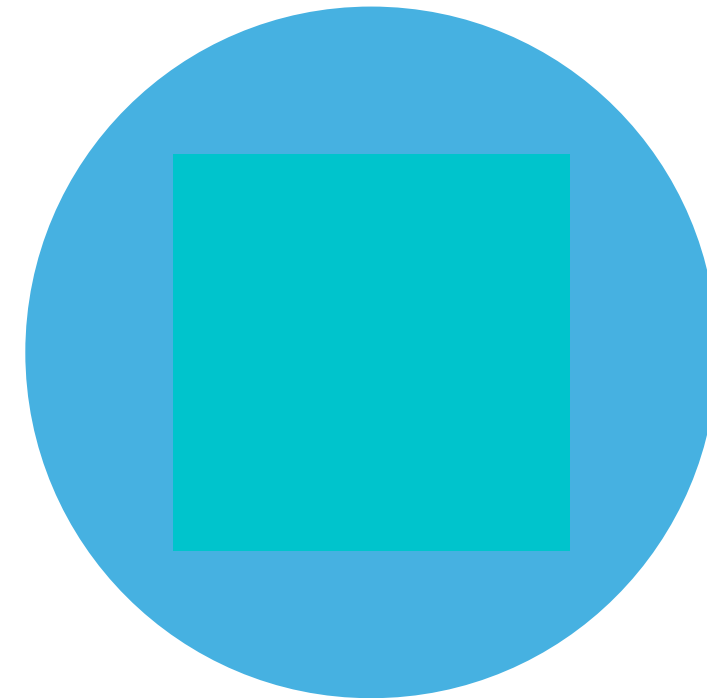
- Share reliable environmental information.
- Encourage sustainable habits within your community.



Recommendations for the Future



. Further improvements require cooperation between governments, scientists, businesses and citizens. The most effective actions include reducing fertilizer use through precision agriculture, expanding digital monitoring systems, restoring wetlands and improving wastewater treatment infrastructure.



Public education is equally important because reducing plastic consumption, recycling correctly and protecting rivers all contribute to cleaner marine ecosystems. International cooperation between Baltic countries will remain essential for achieving long-term environmental goals.



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Conclusion

The Baltic Sea remains one of Europe's most environmentally threatened marine ecosystems. Pollution caused mainly by agriculture, wastewater and plastic waste continues to affect biodiversity, water quality and local economies. The European Green Deal, the EU Digital Strategy and the EU Standardisation Strategy provide important tools for addressing these challenges. However, long-term success depends on cooperation between governments, scientists, businesses and society. Protecting the Baltic Sea today means protecting future generations and ensuring sustainable development for the entire region.



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