

**2022-2023**  
SUMMARY

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# SPECIFICS FOR THE ODRA RIVER

Systemic actions  
to protect against 'golden algae' blooms



Ministry of Climate and Environment  
Republic of Poland

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# INTRODUCTION



One year after the publication of the first scientific report on the situation on the Odra River, we summarise the measures implemented. It refers to field of scientific and research activities. As a result, the Ministry of Climate and Environment issued recommendations to implement now and as long-term, systemic activities. The aim is to counteract environmental threats caused by climate change, including the development of invasive species.

# 01. RECOMMENDATIONS

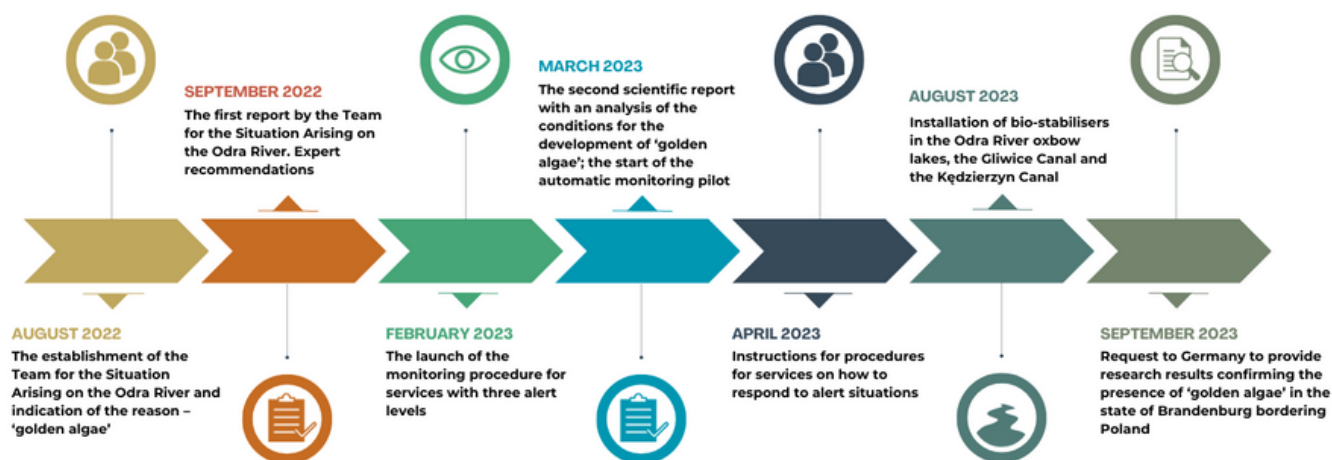
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Experts developed recommendations based on scientists' findings and analyses of the constant monitoring results. They are aimed at water users and services at the regional and central levels responsible for water management. The goal is to prevent mass blooms of 'golden algae'. The most important ones include:

- 01 Maintaining constant monitoring of the Odra River for the occurrence of 'golden algae'.
- 02 Continuation of intelligent management of discharges and implementation of investments to increase industrial water retention.
- 03 Implementation of investments related to the retention and desalination of mine water by mining plants.
- 04 Control storm overflows and local water and sewage management investments.
- 05 Further inspections and removal of illegal sewage outlets.

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- 06 Constant cooperation between services, creating an environmental hazard management centre and a special model for hazard forecasting.
  - 07 Continuation of scientific research related to the neutralisation of 'golden algae'.
  - 08 The spot application of bio-stabilisers that limit the growth of algae.
  - 09 Further implementation of the Odra River ecosystem restoration programmes, considering species typical of the Odra River basin.
  - 10 As part of further cooperation and exchange of information with neighbouring countries, including the Czech Republic and Germany, it is advisable for these countries to carry out screening tests for the presence of 'golden algae'.

## 02. KEY ACTIONS. TIMELINE



### CALENDAR 2022-2023

Remedial actions were carried out in various areas. The adopted procedures were based on the findings of scientists. Field actions were executed with the participation of provincial services, regional water management boards, representatives of the environmental protection inspection, the General Directorate for Environmental Protection, the Polish Armed Forces, the Fire Brigade and the Polish Angling Association. State research institutes supervised scientific activities. The results are summarised in reports. The calendar below complements the diagram and covers essential arrangements and activities.

**18 August 2022** – the establishment of the Team for the Situation Arising on the Odra River to explain the causes of mass fish deaths in the Odra River. On that day, the Minister of Climate and Environment allocated PLN 250 million for an automatic river monitoring system in Poland.

**19 August 2022** – the identification of the cause of mass fish deaths – 'golden algae'.

**30 September 2022** – the first scientific report by the Team for the Situation Arising on the Odra River. A group of scientists presented the research results confirming the cause of mass fish deaths. The experts also provided recommendations for further actions.

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**30 December 2022** – the publication of the report on ichthyological monitoring with an assessment of losses in the Odra River ecosystems. The study, commissioned by the Chief Inspectorate of Environmental Protection, was prepared by the Inland Fisheries Institute – National Research Institute.

**13 February 2023** – the launch of a monitoring procedure with three alert levels intended for services and water users. The Chief Inspectorate of Environmental Protection developed the procedure based on scientific research.

**31 March 2023** – the second report by the Team for the Situation Arising on the Odra River – final scientific analyses. On the same day, a pilot automatic monitoring system for the Odra River was launched.

**26 April 2023** – crisis management centres and services received instructions with detailed guidelines on what to do in the event of a mass fish die-off.

**15 May 2023** – update of the Chief Inspectorate of Environmental Protection alert procedure – after the appearance of unusual blooms in oxbow lakes, different thresholds were adopted for oxbow lakes and rivers.

**15-19 May 2023** – recruitment for the Odra River ecological diversity restoration programme implemented from the funds of five voivodeship environmental protection funds along the Odra River was announced.

**17 May 2023** – the government adopted the Odra River Revitalisation act.

**30 May 2023** – pilot automatic monitoring data was made available on the website [www.gov.pl/web/odra](http://www.gov.pl/web/odra)

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**13 June 2023** – convening of the Crisis Management Team of the Ministry of Climate and Environment – issuing recommendations to limit mass blooms of ‘golden algae’.

**26 June 2023** – activities of Polish services on the border section of the Odra River undertaken to explain the phenomenon of dead fish flowing from the Czech Republic.

**4 July 2023** – installation of a bio-stabiliser on the Czernica Reservoir in the Odra River oxbow lake.

**12 August 2023** – installation of a bio-stabiliser on the Odra River oxbow lake in Januszkowice.

**29 August 2023** – installation of a bio-stabiliser at the mouth of the Kędzierzyn Canal into the Gliwice Canal.

**6 September 2023** – the Polish side requests Germany to provide the results of research commissioned by the Brandenburg State Fishing Association, which confirmed the presence of ‘golden algae’ in Germany.

**16 September 2023** – installation of a bio-stabiliser in the Port of Koźle on the Gliwice Canal.



# 03. SHORT- AND LONG-TERM ACTIONS

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The invasive 'golden algae' has developed in the Odra River, and scientists cannot univocally indicate how it was transferred there from other regions of the world where it occurs. It could have been carried by migratory birds or ships sailing through various waters. In 2023, the 'golden algae' mainly concentrated in two oxbow lakes of the Odra River: Czernica Reservoir in Lower Silesia and Januszkowice in the Opole region, as well as in the Gliwice Canal. The single-celled algae entered the Odra River stream in small quantities, usually during temporary floods caused by rainfall. The Crisis Management Team of the Ministry of Climate and Environment issued ongoing recommendations for services and water users during the summer to stop the 'golden algae' expansion. Recommendations for further actions, including those to be implemented in the coming years, have been prepared based on the experiences and action patterns developed this season.

## PRIORITIES FOR THE SEASONS TO COME

The most important objective is **to maintain constant monitoring of the Odra River water quality.** Regular sampling and analysis of physico-chemical water tests and assessment of the number of 'golden algae' cells make it possible to take appropriate remedial actions. Water quality monitoring should be performed, as currently, by accredited laboratories. It is also necessary to expand automatic monitoring based on the experience of the pilot programme.

Continuous **monitoring of the Wisła River basin,** where there are conditions for the potential development of 'golden algae', is also necessary. The appearance of 'golden algae' in Pszczyńska in the Wisła River basin in Silesia proves that the invasive algae can develop in other rivers or water reservoirs. Further analyses are necessary, including the selection of potential 'golden algae' habitats and screening tests, especially in spring and summer, when there is a greater risk of toxic algae blooms. An important task is to **continue to manage discharges intelligently.** It will be ensured by constant cooperation between the services, creating an environmental hazard management centre, and developing a special-purpose model enabling hazard forecasting. Systemic actions, including the operation of hydrotechnical facilities, are necessary primarily during droughts, low water levels and long-term heatwaves. During these periods, it is recommended to temporarily limit industrial discharges and maintain increased flows from retention reservoirs, intended to dilute the pollution load contained in the water to prevent stagnation and sudden deterioration of water parameters.

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**Environmental services and regional water management authorities should continue to inspect water users and eliminate illegal sewage outlets.**

Unlawful sewage discharges massively pollute the Odra River, other rivers and reservoirs in Poland. This phenomenon promotes the degradation of ecosystems and algal blooms, including 'golden algae'. Therefore, services should continue inspections. Education is also necessary to raise public awareness through campaigns targeting local communities. It concerns mainly tourist regions, where periodically increased traffic intensifies the phenomenon of illegal dumping.

**The further implementation of the Odra River ecosystems** restoration programmes, which consider the scientists' recommendations, is essential for restoring the populations of fish and other aquatic organisms. Stocking, taking species typical of the Odra River basin into consideration, should be conducted in consultation with experts.

**More scientific research related to the neutralisation of 'golden algae' is necessary.** The 2023 scientific research in the Gliwice Canal showed the effectiveness of 3 preparations to neutralise golden algae. However, the preparations to improve water quality cannot be used on a large scale, in open water, in the river. Research is still ongoing and should continue. **The spot application of bio-stabilisers is advised** to stop the growth of 'golden algae'.

Photo: RZGW Gliwicie



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This method is environmentally safe and has proved effective in reducing the growth of 'golden algae'. Bio-stabilisers based on barley straw are applied in oxbow lakes: in Januszkowice, Czernica and Łacha Jelcz Reservoir. Moreover, one can find them in the Gliwice Canal at the level of the Port of Koźle and at the confluence of the Gliwice Canal and the Kędzierzyn Canal. Bio-stabilisers gradually release substances that reduce the proliferation of algae. They should be installed for up to several seasons to be effective.

Among the most critical tasks to fulfil in the years to come are **investments related to the desalination of mine water by mining plants.** In June 2023, the Management Board of KGHM Polska Miedź announced the construction of its saltworks for industrial and food-grade salt obtained during the process of mine drainage. The PLN 1 billion investment will halve the amount of salt entering the environment. Jastrzębska Spółka Węglowa also plans to invest in the further development of desalination systems for the Knurów-Szczygłowice mine. Equally crucial for improving water quality is increasing the retention capacity in systems designed for this purpose and subsequent **investments in the area of water and sewage management.**

Experts from national research institutes are also working on programmes related to establishing buffer zones around water bodies, designing and creating refugia, and increasing natural retention capacities in the Odra River basin.

The experience of September 2023, when the Brandenburg State Fishing Association reported the finding of 'golden algae' in Germany, suggests that the invasive algae is not only a Polish problem but may also affect neighbouring countries. All the more so as the 'golden algae' have been found in other European countries, including Denmark and Hungary. Therefore, one of the recommendations of the Ministry of Climate and Environment experts within the framework of international cooperation and information exchange is to perform **screening tests for the presence of 'golden algae'** on their territory, among others by Germany and the Czech Republic.

# 04. ORIGIN OF THE THREAT

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Climate change has led to the spread of an invasive species of 'golden algae'. This requires a new approach to water resources protection. One that takes environmental risks into account. In the case of the Odra River, such solutions have been implemented. They were based on analyses and recommendations by a team of scientists, also with the participation of foreign experts.

## KEY INFORMATION

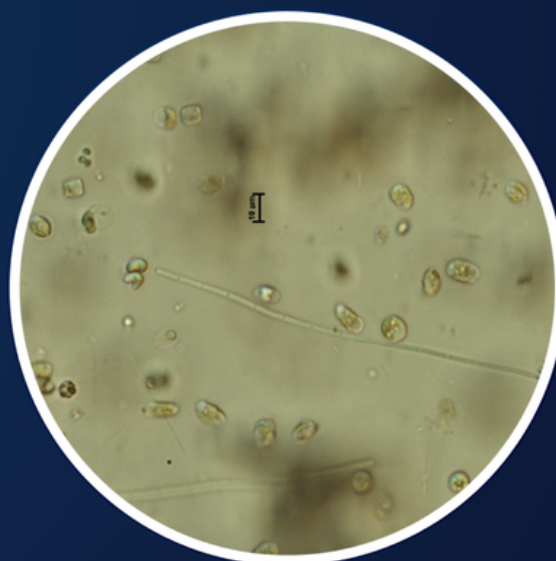
1. The extreme droughts haunting Europe for several years are a new threat to the Odra River. Low water levels, discharges from the municipal sewage treatment plants rich in nitrogen and phosphorus, combined with the river's decades-long salinity levels, have become an environment conducive to the blooming 'golden algae' whose toxins cause fish die-offs. Contrary to popular belief, the way the river has been managed has not changed for more than a century, and current salinity levels are even lower than in recent decades.

2. 'Golden algae' blooms are a problem that scientists in many countries, including the USA, the UK and Denmark, have been tackling for decades. No fully effective method of algae neutralization has been developed so far. Nevertheless, scientists, including Polish ones, are making significant progress in this field.

### 'Golden algae'

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'Golden algae' *Prymnesium parvum* are microorganisms up to 16  $\mu\text{m}$ , that is 0,016 mm



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**All available methods should be used to reduce the risk or impact of a 'golden algae' bloom.**

This is done by eliminating the drivers of the blooming. In the event of a drought, if monitoring data indicate increased algae growth, industrial discharges are either stopped or reduced so that water parameters do not deteriorate. Where possible, the water level is regulated for this purpose.

Measures are also taken to protect fish, such as nets stretched to restrict their migration to endangered areas. Bio-stabilisers are also placed locally to limit algae growth.

Continuous monitoring of the Odra River makes it the best-studied river in Europe today. Water quality is tested on an ongoing basis at 31 measuring points on the Odra River, its oxbow lakes and the Gliwice Canal. Testing is performed by the Central Research Laboratory of the Chief Inspectorate of Environmental Protection (GIOŚ), which operates seven days a week. In addition, automatic monitoring has been introduced at nine points to monitor water parameters 24/7. Among other things, temperature, dissolved oxygen content, pH and conductivity are tested. Twice a week, as part of continuous monitoring, samples are taken and analysed for the presence of 'golden algae'. The frequency of testing depends on the assigned bloom threat level.

**The recovery of the Odra River** ecosystems, which suffered enormous damage in 2022, will occur in the following years. We are optimistic about the scientists' work to implement restoration programmes for the Odra River ecosystems.

3. An emergency response procedure has been implemented in addition to system operations. It includes **#SZTABdlaODRY**—teams of environmental services at the voivodeship and central levels that share information, coordinate activities, and intervene in the event of a fish die-off on an ongoing basis.



4. The principle of a permanent, transparent information and education policy related to the situation on the Odra River has been introduced. Information about the state of the water, actions taken, curiosities and results of analyses are provided on an ongoing basis on the #SZTABdlaODRY channel run by the Institute of Environmental Protection – National Research Institute <https://www.facebook.com/SZTABdlaODRYpl> and on the website: <https://www.gov.pl/web/odra>

The screenshot shows the gov.pl website interface. At the top, there is a search bar with the text "Szukaj usługi, informacji" and buttons for "SZUKAJ" and "Zaloguj". The main content area features a large blue header with the word "Odra" and a sub-header "Zespół ds. sytuacji na rzece Odrze opublikował raport, w którym wskazał przyczynę śnięcia ryb i kierunki dalszych działań. Minister klimatu i środowiska przeznaczyła 250 mln zł na zintegrowany monitoring jakości wód w Polsce. Trwają prace nad odbudową odrzańskich ekosystemów." Below this is a banner with the text "Eksperti o złotej aldze" and a button "ZOBACZ WIĘCEJ". To the right, there is a section titled "Aktualności" with the sub-header "zobacz wszystkie" and a date "11.07.2023". The main text in this section reads "Pogłębiająca się susza wpływa na stan rzek i sprzyja zakwitom glonów". A photo of a river with a water level gauge is visible below the text.

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## SOLUTIONS INTRODUCED

To prevent a repeat of the mass fish die-offs which occurred in the Odra River in the summer of 2022, the Ministry of Climate and Environment has taken action in various areas. They included:

**REMEDIAL ACTION** – ad hoc, based on scientific conclusions, to reduce the risk of toxic ‘golden algae’ blooms;

**SCIENTIFIC ACTIVITIES** – the ‘golden algae’ is still poorly understood by the scientific world and still needs to be researched. A better understanding of these mysterious algae will enable scientists to find effective methods of combating them;

**PREVENTIVE MEASURES** – associated with the neutralisation of ‘golden algae’, allow the spread of invasive algae to be reduced;

**RECOVERY ACTIONS** – for the restoration of ecosystems, targeting, among other things, the recovery of the Odra River fish population and the restoration of biodiversity, using the latest scientific knowledge.

Photo: GIOŚ



Photo: Opolski UW



# 05. REMEDIAL ACTIONS

**Discharge management has been launched,** based on water quality monitoring data provided by the Chief Inspectorate of Environmental Protection to entities located on the Odra River and to authorised services and organisations. The discharge management makes it possible to reduce them when the results of physicochemical tests of the water show a risk of toxic 'golden algae' blooms. This applies in particular to the catchment area of the Kłodnica River, from which large loads of sulphate and chloride enter the Odra River. The retention reserve of the Dzierżno Duże Reservoir is being increased to limit this process. The guidelines also cover other retention and dosing systems, including the Olza Collector, which serves several mining sites. The mining companies have announced further investments to reduce the pollution that enters the water.

**The old riverbeds of the Odra River are temporarily fenced off.** These measures are intended to reduce the migration of fish into water bodies containing 'golden algae' or to reduce the growth of algae with the help of bio-stabilisers. The Czernica Reservoir in Lower Silesia and the Januszkowice Reservoir in the Opole region were fenced off with a mesh.

**Bio-stabilisers are installed in the oxbow lakes, which contain substances that reduce the growth of algae, including 'golden algae.'** Bio-stabilisers have been installed on the Łacha Jelcz Reservoir in Lower Silesia, in the oxbow lakes of Januszkowice and on the Czernica Reservoir, as well as on the Gliwice Canal. This solution is recommended by scientists. It is safe for the natural environment and can be used in nature reserves in Natura 2000 sites.

**Continuous monitoring of the Odra River** is in operation: water quality is tested on an ongoing basis at 31 measuring points on the Odra River, its oxbow lakes, and the Gliwice and Kędzierzyn Canals. Testing is performed by the Central Research Laboratory of the Chief Inspectorate of Environmental Protection, which operates seven days a week. In addition, automatic monitoring has been introduced to monitor water parameters 24/7 at nine points on the Odra River. Among other things, temperature, dissolved oxygen content, pH and electrolytic conductivity are examined. On the basis of the results obtained by the Central Research Laboratory, the Chief Inspectorate of Environmental Protection informs the services, including the Voivodeship Environmental Inspectorates, of altered water parameters, such as a drop in the level of dissolved oxygen in the water, with a view to remedial action being taken by the services of the voivodeship governors.



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Instructions for entities and services related to the active implementation of the alert procedure have been introduced. It covers two areas of response:

**PREVENTIVE** – if there is a risk of a potential bloom occurring and the ‘golden algae’ releasing toxins;

**CRISIS** – at the time of an ecological emergency involving the release of toxins by ‘golden algae’ and the death of fish and other aquatic organisms.

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Photo: Dolnośląski UW

#### Examples of preventive measures:

- additional monitoring analyses;
- analysis of satellite images;
- patrolling waters;
- installation of mesh, bio-stabilisers and other security features.

#### Examples of crisis actions:

- catching live fish present in the water body and its relocation to a safe place;
- making decisions regarding the prohibition of water use;
- application of preparations to neutralise ‘golden algae.’

In March 2023, a test was conducted in the Gliwice Canal using a clay-based preparation with lanthanum. The preparation has reduced the algae by 80% and can bind the toxin produced by the algae.

At the end of May 2023, neutralisation of ‘golden algae’ was conducted in the Gliwice Canal waters using two further agents: a coagulant commonly used for lake reclamation and hydrogen peroxide.

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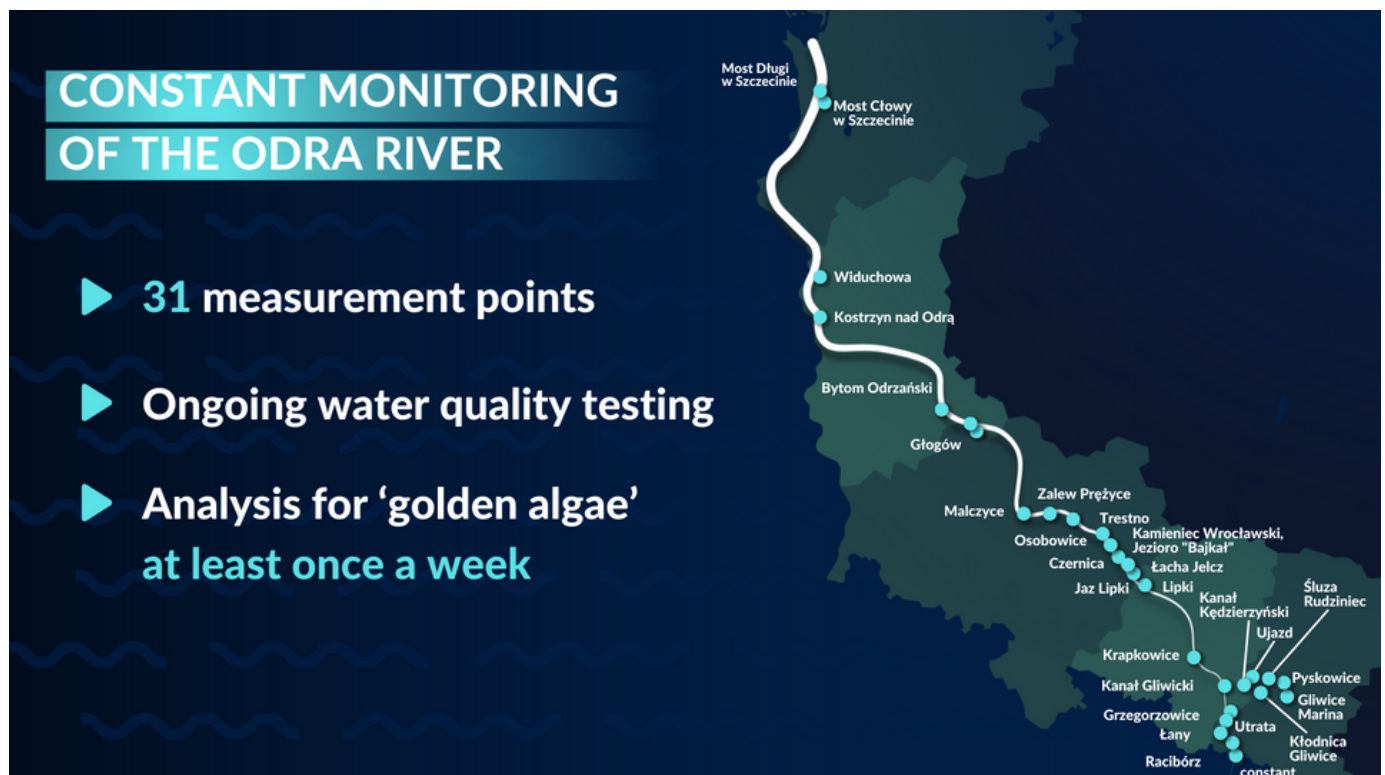
All tested agents have shown effectiveness, but research analyses indicate their suitability for local and spot applications in still or stagnant waters and under professional supervision. Using them in flowing waters and on the river is not advisable. A report with the results of the tests using all the preparations is published on the website of the Institute of Environmental Protection: [www.ios.edu.pl](http://www.ios.edu.pl)

An additional measure recommended by scientists, i.e. the installation of bio-stabilisers in the oxbow lakes of the Odra River, started in June 2023. It is a method used to improve water quality. It is environmentally safe and can be used in nature reserves in Natura 2000 sites. Special partitions using barley straw, release substances into the water that reduce algae blooms. The bio-stabiliser has been installed on the Łacha Jelcz Reservoir in Lower Silesia and the Czernica Reservoir in the oxbow lakes in Januszkowice, also on the Gliwice Canal.



Specialised units took part in the operations to neutralise 'golden algae' in the Gliwice Canal in May 2023. More than 100 people were involved, including 30 chemical troops soldiers, 36 firefighters from 14 units of the State Fire Service, as well as the services of the provincial governor and employees of the Regional Water Management Board, the Chief Inspectorate of Environmental Protection and the Voivodeship Environmental Inspectorates.

As part of constant monitoring, samples are collected and analysed for the presence of 'golden algae'. The introduction of permanent monitoring was necessary due to the fact that state environmental monitoring under current EU legislation is carried out under a different system and does not include surveys for 'golden algae.' Hence, additional monitoring had to be introduced.



The Odra River is currently the best studied river in Europe. From the end of July 2022 to the end of September 2023, the Central Research Laboratory of the Chief Inspectorate of Environmental Protection performed more than 71,000 analyses. The laboratories work seven days a week. The results of the Odra River study, including automatic monitoring data, are available at: [www.gov.pl/web/odra](http://www.gov.pl/web/odra)

# 06. SCIENTIFIC ACTIVITIES

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Scientists and experts from the Team for the Situation Arising on the Odra River, set up in August 2022 by the Minister of Climate and the Environment, have produced two scientific reports: the Preliminary Report of 30 September 2022 and the Final Report of 31 March 2023. The documents are available on the website of the Institute of Environmental Protection – National Research Institute: [www.ios.edu.pl](http://www.ios.edu.pl)



In the Preliminary Report, the experts analysed in detail the phenomenon of mass fish die-off in the Odra River, taking into account the hydrological and meteorological situation, the results of laboratory tests on water, and fish samples. They confirmed that the cause of the die-offs was a toxin produced by an invasive species of the algae *Prymnesium parvum*, the so-called 'golden algae.'

Multidirectional scientific analyses confirmed that a single factor did not cause the toxic bloom of invasive algae. It was brought about by a combination of various phenomena, with meteorological conditions such as extreme heat and one-third stronger insolation. These factors have led to a rapid change in water parameters. The water parameters have remained at similar levels in the Odra River, flowing through industrial and densely populated areas, for decades. The occurrence of extreme events has rapidly deteriorated them, contributing to the intense growth of invasive algae and its toxic bloom.



The Final Report of 31 March 2023 complements the Preliminary Report and constitutes the second part of the scientific study by Team for the Situation Arising on the Odra River. The document contains key expert findings related to the development of 'golden algae.' According to scientific analyses, the report concludes that an essential element in the intensive growth of 'golden algae' is the availability of nutrients found in the water. Scientific studies have shown that the presence of nitrogen and phosphorus compounds promotes the rapid proliferation of invasive algae. Significant sources of nutrients include municipal wastewater.

The correlation between the occurrence of nutrients from municipal wastewater and phytoplankton growth has been confirmed by scientific studies and by the 'golden algae' bloom incidents observed in spring 2023.

The blooms appeared in oxbow lakes, in water with low salinity levels, with parameters that were within environmental standards and were not characteristic of the presence of 'golden algae.' Their cases differed from those reported in the world literature analysed by the expert panel.

The analyses prompted scientists to revise the guidelines related to the 'golden algae' bloom warning system and the Chief Inspectorate of Environmental Protection to set separate cut-off parameters defining alert levels in the warning system, split between oxbow lakes and flowing waters.

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**THE SCIENTIFIC TEAM AT THE MINISTRY OF CLIMATE AND ENVIRONMENT CONTINUES ITS RESEARCH WORK. CYCLICAL EXPERT MEETINGS ARE HELD AS PART OF THE MINISTRY'S ACTIVITIES.**

Due to the multi-directional and complex nature of the phenomenon, scientific research, including field experiments, continues. A scientific study related to the neutralisation of 'golden algae' was carried out in spring 2023 with the participation of scientists and under the supervision of the Institute of Environmental Protection – National Research Institute. Tests were performed in the Gliwice and Kędzierzyn Canals.

Among other things, the scientists found that despite the 'golden algae,' belongs to a salt-loving species, it can adapt to life in freshwater. Polish scientists have also isolated the genotype of the Odra River 'golden algae.' They shared the results of their groundbreaking research with scientists from the UK and the US, where toxic *Prymnesium parvum* blooms also occur. Despite decades of research, the algae is still poorly understood by scientists. Thus, no country in the world has yet found a way to effectively and completely neutralise the 'golden algae.' Research in this direction, also involving Polish scholars, continues.

# 07. PREVENTIVE MEASURES

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Based on scientific recommendations, the Monitoring Procedure for the presence of the *Prymnesium parvum* 'golden algae' has been developed to introduce alert steps for services related to the potential occurrence of a toxic algal bloom. Instructions for the services have also been designed with detailed guidelines. Authorised services cooperate and receive continuous water quality monitoring data, reports and notifications continuously.

- In accordance with the applicable operating instructions, further inspection and supervision of discharge made by water users is recommended.

- The environmental protection inspectorates have carried out more than 300 inspections to date and continue checks and investigations on an ongoing basis, particularly at plants discharging sewage, rainwater or drainage water directly into the Odra River or its tributaries.

- As for the Odra River pollution, the control cycle consists of the implementation of directional contingency inspections at plants, with particular emphasis on those for which the concentrations of salinity-causing pollutants, i.e., chlorides and sulphates, have been established in the permits.

- In the event of identified violations, each case is referred to law enforcement authorities.

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- Regional water management authorities are carrying out a campaign to pivot illegal outlets into rivers. According to data published by PGW Wody Polskie, there are 2855 cases involving the liquidation of water facilities as part of ongoing proceedings.

- Employees of the Inspectorate of Environmental Protection and Regional Water Management Authorities conduct ongoing field inspections of the Odra River and order sampling for testing to the Central Research Laboratory of the Chief Inspectorate of Environmental Protection.

- Data on the quantity and quality of mine water entering the Odra River or its tributaries is reported and analysed continuously.





# 08. REMEDIAL ACTIONS

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Photo: IRS-PIB

The remedial action includes ecosystem restoration. In May 2023, funding was released under the 'Rebuilding the ecosystem' programme and biodiversity of the Odra River,' implemented by the five Odra River Voivodeship Funds for Environmental Protection and Water Management (WFOŚiGW). The amount of PLN 14 million has been allocated for this purpose.

**Recruitment has already been announced by all of the Odra River voivodeship funds. The programme will be implemented until 2025.**

**Selected tasks will be subsidised in the form of grants, up to 100% of the eligible costs of the task.**

**The support from the WFOŚiGW will help to carry out tasks related to, among other things, restocking, rebuilding spawning stocks and safeguarding the genetic material of the Odra River fish species. The projects will be reviewed by the Institute of Inland Fisheries – National Research Institute.**

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## Results of the nationwide ichthyological monitoring – the Odra River

- **5,500** fish were caught in the Odra River for research purposes
- An average of **309** animals were caught at each measuring and control point in 2022
- An average of **578** fish were caught in 2014–2021

A nationwide ichthyological monitoring following massive fish die-offs in the Odra River was carried out in 2022 as part of state environmental monitoring. Control catches of fish were carried out at nearly 300 survey points in various locations throughout Poland. Thirteen expert teams carried out the research in September and October 2022. Specialists caught fish on the Odra River and Parnica River at 15 measurement and control points along the river, from the Odra Ciechowice site to the border Odra in Szczecin. The data for the Odra River shows the presence of 53% fish compared to the years 2014 – 2021. Experts emphasise that ecosystems have a chance to recover within 5 to 10 years, using a dedicated recovery plan to rebuild the Odra River ecosystem. The plan includes, among other things, the establishment of a gene bank and a stocking system with species typical of the Odra River.

# WORKING TEAMS

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Several working teams, inter-ministerial groups, with representatives of central and regional units and scientific communities have worked on the Odra River issue. The aim is to act as effectively as possible to protect the Odra River from the toxic blooming of 'golden algae'. In addition to ongoing measures such as monitoring and prevention of blooms, it was necessary to develop effective remedial methods. The scientific work has resulted, among other things, in the development of Europe's first standard for the determination of *Prymnesium parvum* toxins. The outcome of the remedial action was to practically test methods to neutralise the invasive algae and to identify directions for further research.

**The Team for the Situation Arising on the Odra River** was established in August 2022 to investigate the phenomenon of mass fish die-offs in 2022. The team has held dozens of meetings and deliberations. The result is two comprehensive scientific reports, the Preliminary Report of 30 September 2022 and the Final Report of 31 March 2023, with an analysis of the phenomenon of mass fish die-offs in the Odra River, the situation in the river and recommendations to help avoid phenomena of similar magnitude in the future.

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The Team brought together dozens of experts, including representatives from scientific centres, state research institutes and units dealing with, among other things, environmental protection and water management. These were representatives of the Ministry of Climate and Environment, the General Director for Environmental Protection (acting as Team Leader), the Chief Inspector of Environmental Protection, the Chief Veterinary Inspectorate, the Institute of Meteorology and Water Management – National Research Institute, the State Council for Environmental Protection, the Warsaw University of Technology, the Wrocław University of Technology, the University of Wrocław, the University of Warmia and Mazury, the Institute of Inland Fisheries, the Department of Ichthyopathology and Fish Health Protection, the Stanisław Sakowicz Institute of Inland Fisheries, the Maritime Institute of Fisheries – National Research Institute, the West Pomeranian University of Technology in Szczecin, the Central Mining Institute – Maria Goeppert Mayer Silesian Centre for Environmental Radiometry, and the Institute for Environmental Protection – National Research Institute.

**A working team of experts from the Ministry of Climate and Environment** was established to coordinate ongoing scientific and research activities under the supervision of the Chief Inspectorate of Environmental Protection, the General Directorate for Environmental Protection and the Institute of Environmental Protection – National Research Institute. As part of the weekly meetings, with the participation of the management of the Ministry of the Environment and the representatives of, among others, the Inland Fisheries Institute – National Research Institute and the Ministry of State Assets invited for consultation, the current hydro-meteorological situation was discussed alongside proposals for direct action to minimise the risk of massive fish die-offs in the Odra River again.

**The Crisis Management Team of the Ministry of Climate and Environment** was convened in June 2023 to improve day-to-day operations at local and central levels during the summer season, at a time of increased risk of ‘golden algae’ blooms. A team with representatives from the climate and environment ministries, including experts from the Ministry of the Environment, the Chief Inspectorate of Environmental Protection, the General Directorate for Environmental Protection, and the Institute for Environmental Protection – National Research Institute, made recommendations for specific remedial measures during weekly meetings. They were submitted to the Government Security Centre, which forwarded them to the entities responsible for specific actions.

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Among the indications were the temporary cutting off of the Odra River oxbow lakes, the use of natural barriers in water bodies to stop the growth of 'golden algae,' and the systemic management of industrial wastewater discharges depending on the results of water parameters, including salinity. Controlling the nutrient content from municipal wastewater and maintaining maximum retention capacity in the Odra River basin. The recommendations are based on previously developed procedures, worked out in expert, scientific working teams, with the cooperation of the services.

**Inter-ministerial Crisis Team for the Odra River** was established in July 2023. It includes representatives from the management of ministries such as the Ministry of Climate and Environment, the Ministry of Infrastructure, the Ministry of the Interior and Administration and the Ministry of State Assets. Representatives of PGW Wody Polskie, the Institute of Meteorology and Water Management, the General Directorate for Environmental Protection, the Chief Inspectorate of Environmental Protection, the Institute for Environmental Protection – National Research Institute, and voivodeship governors from the five riverside voivodeships along the Odra River also participate in the meetings. The Team's main task refers to planning strategic, long-term actions related to environmental risks, e.g. making decisions on the intelligent management of industrial and sewage discharges or the proper control of storm overflows.

**Polish-German expert group on the situation on the Odra River** was established in August 2022 by the Ministers of the Environment of Poland and the Federal Republic of Germany, Anna Moskwa and Steffi Lemke. On the Polish side, it brings together representatives of the Ministry of Climate and Environment, Ministry of Infrastructure, Ministry of Interior and Administration and Ministry of State Assets, the Chief Inspectorate of Environmental Protection, the General Directorate for Environmental Protection, the Chief Veterinary Inspectorate, the State Water Management – Wody Polskie and the Institute of Environmental Protection – National Research Institute. The issues discussed during the meetings covered German-Polish cooperation and the exchange of information at the level of the relevant ministries in order to clarify the causes of the 'golden algae' blooming. The Team representatives also participated in an international workshop on 'golden algae.' There are presented, among other things, the results of tests and information on the factors that influenced the occurrence of massive fish die-offs in the Odra River.

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In addition to expert team meetings, dozens of **WORKING MEETINGS** have been held since August 2022, with participation from representatives of local authorities, provincial offices, the social side and the Polish Angling Association. An Odra Roundtable was held with NGOs and representatives of mining companies and enterprises. An international scientific workshop on ‘golden algae’ was also held twice.

**23 March 2023 in Katowice,** the Minister of Climate and the Environment, Anna Moskwa, met with the governors of the five Odra River voivodeships regarding the current situation on the Odra River. The discussions focused on the procedure related to permanent emergency monitoring. The meeting was also attended by representatives of the Ministry of Infrastructure, the Chief Inspectorate of Environmental Protection, the General Directorate for Environmental Protection, the Institute for Environmental Protection – National Research Institute, the State Water Management – Wody Polskie, as well as the Voivodeship Inspectorates for Environmental Protection, the Fire Service and the Police.

**13 April 2023,** the first international workshop on *Prymnesium parvum*, or ‘golden algae’ took place. The online event resulted from the decision of the Ministers of Environment of Poland and Germany. The meeting aimed to share the experience of scientists and experts dealing with toxic algal blooms. The international workshop brought together many Polish and German scientists, dozens of government and local government representatives and a group of experts from both countries. Participants were familiarised with the most important information presented in the reports on the situation on the Odra River produced by the Polish and German teams. They also discussed ongoing monitoring activities on the Odra River and possible causes of the phenomenon of mass algae blooms. The event, organised in a hybrid format, is the result of an agreement between the Ministers of Environment of Poland and Germany in 2022. The aim of the meeting was to exchange information about the state of the Odra River and ongoing investments between experts from both countries.

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**19 April 2023,** a meeting was held at the Lower Silesian Voivodeship Office in Wrocław with the participation of the Ministers of Climate and Environment, Infrastructure, State Assets and Agriculture and Rural Development, with representatives from the five Odra River voivodeships. The meeting focused on the situation on the Odra River, including the circulation of information on the threat of 'golden algae' blooming at various levels and the solutions put in place. The briefing outlined measures, implemented over the past nine months, to reduce blooms of so-called 'golden algae' in the Odra River and other Polish rivers.

**10 May 2023,** a meeting was of representatives from the Ministry of Climate and Environment, Ministry of Infrastructure and with delegates from the Polish Angling Association. It was devoted to the issue of coordinating efforts to reduce the impact of possible new 'golden algae' blooms. The main objective of the talks was to increase the effectiveness of detection and containment of 'golden algae' blooms. The meeting also outlined the government's efforts to date to counter the effects of toxic 'golden algae' blooms and its work on the biological restoration of the Odra River ecosystem.

**22 May 2023,** the Minister of Climate and the Environment, Anna Moskwa, during two field visits, met with, among others, the Voivode of Opole and the Voivode of Silesia, as well as representatives of the Polish Armed Forces. Meetings in Januszkowice and Rudziniec focused on planned measures to reduce mass blooms of 'golden algae'. Working field meetings with the Opole and Silesian Voivodeship Governors and representatives of their subordinate services, with the participation of representatives of the Polish Armed Forces, the State Water Management – Wody Polskie and the fishery guards, were further meetings recently held on the coordination of activities related to the situation on the Odra River. In Januszkowice, the Head of the Ministry of Climate and Environment assessed the effectiveness of the solutions introduced as part of active protection in oxbow lakes. Special nets restricting fish access to the tank where 'golden algae' growth have proven to be effective. A similar solution was used in Czernica Reservoir, where 'golden algae' were also found this year.

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**31 May 2023,** the second German-Polish workshop took place to discuss environmental restoration, planned and ongoing investments and maintenance measures on the Odra River resulting from the implementation of the German-Polish International Agreement. The workshop brought together numerous Polish and German academics, government and local government employees and a group of experts from Poland and Germany. Participants were given highlights of the ongoing monitoring activities on the river, and discussed preventive measures ahead of the new summer season that are currently being implemented.

**7 June 2023,** Minister of Climate and Environment Anna Moskwa met with Steffi Lemke, Federal Minister for the Environment of Germany. This was another ministerial meeting dedicated to the Odra River, during which the current remedial and restorative measures carried out by the Polish side were summarised. In addition, Minister Anna Moskwa reported on recent activities related to the neutralisation of 'golden algae' in the Gliwice Canal, coordinated by the Ministry of Climate and Environment. She also informed about other measures, including limiting pollutant discharges, pivoting illegal outlets and retaining mine waters carried out by mining companies. Restoring the Odra River ecosystems is also essential, with PLN 14 million allocated for this purpose. Five voivodeship environmental protection and water management funds have mobilised funding for related projects. The two sides handed over, among other things, reports with the results of tests performed on both sides of the border.



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**29 June 2023**, the Odra River Roundtable was held at the headquarters of the Institute of Environmental Protection – National Research Institute. The aim was to discuss current activities and develop implementable solutions to the situation on the Odra River. As the participants noted, the meeting, with the diverse group of participating representatives of NGOs, academics and the business, was a much-needed venture to discuss the problem.

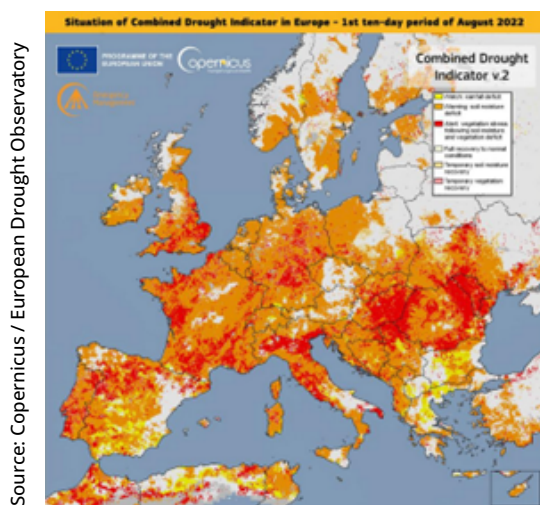
**25 July 2023**, another meeting with local authorities on the situation on the Odra River took place at the headquarters of the Lower Silesian Voivodeship Office. The leading theme was the issue of coordinating water protection measures, including the prevention of massive ‘golden algae’ blooms. The meeting in Wrocław was another Odra River debate with the participation of representatives from the Ministry of Climate and Environment, the Ministry of State Assets, the Ministry of Infrastructure and the State Water Management – Wody Polskie, as well as voivodeship governors, voivodeship marshals and city mayors, from all the voivodeships along the Odra River, together with the responsible services. During the briefing, representatives of the Ministry provided details of the remedial actions underway and key recommendations. During the meeting, the Chief Environmental Inspector presented data on the monitoring of the Odra River and the alert procedure in operation.

# 09. CLIMATE CHALLENGES

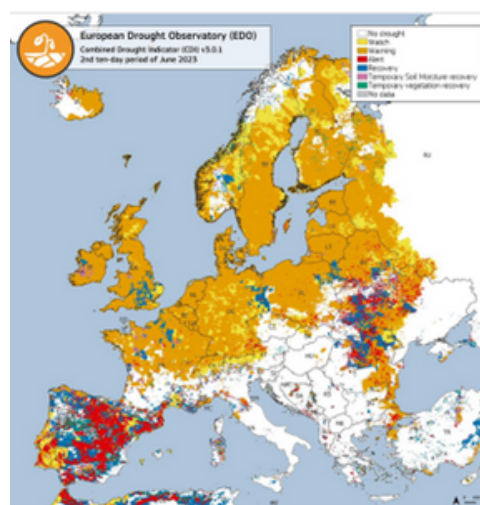
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For several years, Poland and Europe have been hit by extreme heat waves and droughts accompanied by mild winters. Climate change has a decisive impact on the state of the environment, most of all, on water resources.

## DROUGHT 2022



## DROUGHT 2023



- The year 2022 was groundbreaking as it was the hottest and driest in Europe in the history of measurements.
- Scientific analyses of the situation on the Odra River have shown that extreme weather phenomena contributed to the drastic deterioration of water parameters and the rapid growth of invasive algae in the Odra River.
- Conditions in the Odra River remained similar for decades. However, in 2022, a 30% increase in insolation and a jump in water temperature in the Odra River to 30 degrees Celsius led to a rapid deterioration of its parameters to a level found to be conducive to the growth of invasive algae.

# 10. FINAL CONCLUSIONS

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Climate changes causing increased extreme events such as drought and rising average temperatures, have a decisive impact on the state of water resources and water-dependent ecosystems. One phenomenon that accompanies climate change is the **expansion of invasive species**. This group includes the algae *Prymnesium parvum*, the so-called 'golden algae,' which have settled in the Odra River basin.

The Ministry of Climate and Environment has been carrying out intensive and multidirectional analytical and research work since the presence of the invasive algae was identified in Poland's second-largest river. On this basis, it develops indications for specific actions to reduce the risk of a repeated toxic 'golden algae' bloom. **Due to the characteristics of the algae and the current state of scientific knowledge, it is impossible to completely eliminate the 'golden algae' from the environment or to rule out a repeated massive algae bloom.** However, the continuous monitoring and other systemic solutions that have been put in place allow for identifying conditions conducive to a bloom more quickly. This provides an opportunity to take appropriate remedial action.

**Blooms of 'golden algae' have been recorded in many countries worldwide,** including the USA, the Netherlands, Denmark, the UK, Australia, Finland, and China. Generally, they occurred under certain hydro-meteorological conditions during the spring-summer season. 13 June 2023, the Minister of Climate and Environment convened the Crisis Management Team of the Ministry of the Environment and Climate, which, after analysing the hydro- and meteorological forecasts and the results of the monitoring, makes recommendations for directional actions for the services.

To date, the Ministry of Climate and Environment's analysis related to the threat of toxic 'golden algae' blooms shows that a **long-term strategy** is needed to counteract the environmental risks of increasing extreme weather events. A key element to improve the protection of water resources in this context is to create **a programme for reducing pollutant loads for individual river catchments.**

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The most important recommendation is to change **the provisions of water permits regarding the permissible concentrations of pollutants that can be discharged into water or the ground, particularly nutrients and chlorides and sulphates.** The proposal is the result of findings to date, resulting directly from the scientific and research work of the Team for the Situation Arising on the Odra River, taking into account the conclusions of field activities carried out under the supervision of the Institute of Environmental Protection – National Research Institute. Any **preventive action** to minimise the risk of invasive algal blooms will be **more beneficial, effective and less costly** – for the natural environment, society and the economy – than dealing with the effects of toxic blooms, leading to massive fish die-offs and ecosystem degradation.



The Ministry of Climate and Environment has been actively involved since August 2022 in investigating the causes of a mass fish die-off on the Odra River and developing a catalogue of remedial measures to reduce the risk of recurrence. Scientific and administrative work in this direction continues. They are carried out by Ministry teams also involved in inter-ministerial work. Working meetings and deliberations involving specialists and scientists are held periodically. The latest findings are communicated to central and regional administrative units and services. The following institutions are directly involved in all official and field activities undertaken by the Ministry of Climate and Environment:

the Ministry of Climate and Environment

the General Directorate for Environmental Protection

the Chief Inspectorate of Environmental Protection

the Institute of Environmental Protection - National Research Institute

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*Up-to-date information about the situation on the Odra River and the Ministry's activities is regularly published on websites and social media profiles. The 'SZTAB dla Odry' profiles are dedicated to the Odra River.*

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## NEWS:

**WEBSITE: [WWW.GOV.PL/WEB/ODRA](http://WWW.GOV.PL/WEB/ODRA)**

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