



POLICY BRIEF

The future of the River Oder

Research-based recommendations for action in the wake of the man-made environmental disaster



IGB

Leibniz Institute of Freshwater Ecology
and Inland Fisheries



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Introduction and background

The man-made environmental disaster in the summer of 2022, resulting in masses of dead fish, mussels and snails, has caused severe damage to the Oder River ecosystem. Policymakers, authorities, NGOs and the public are currently discussing how the river can be helped – and how the risk of such major ecological and economic damage can be reduced in the future. This *IGB Policy Brief* provides a concise summary of what is known about the causes of the fish kill, and what measures we recommend to policymakers and authorities to restore and preserve the River Oder habitat and its important ecosystem services. The Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Germany's largest freshwater research centre, has been working on the Oder for decades. On this basis, IGB scientists identify problem areas and evidence-based recommendations for action.

Although the detailed analysis of the Oder disaster is still ongoing, IGB has been able to show that it was not a natural phenomenon, but a man-made problem. The mass development (so-called algal bloom) of the toxic brackish water alga *Prymnesium parvum* played a critical role in causing the catastrophe. This development would not have been possible under natural conditions in the River Oder. An artificial habitat for the algae was only created following effluents into the river that led to excessive salt concentrations.

High nutrient loads in the water (likewise caused by anthropogenic inputs), high water temperatures, partial damming of the river, and low water flow due to a prolonged period of drought additionally provided ideal conditions for the growth of the toxic algae. Consequently, the environmental disaster was caused by a combination of several factors that put a massive stress on the Oder River ecosystem. All these stress factors have been caused by humans.

Impoundments and regulation have weakened the natural resilience of the Oder

One reason why these stressors were able to have such an extreme impact on the Oder is that the river's natural resilience to hydrological and climate change was markedly reduced as a result of channel engineering. Acting as natural buffer systems in the river landscape, intact floodplains can mitigate flood waves, store water for dry periods, and provide refuges for aquatic fauna. River

engineering, embankment and the artificial drainage of floodplains have drastically compromised these functions. The floodplains retain less water, and many backwaters have lost their connection to the main river.

In regulated rivers, phases of drought therefore lead to longer and more pronounced periods of low water levels. The ongoing

climate change, which is also human-induced, exacerbates the situation due to extremely low water levels in summer, the absence of precipitation, or precipitation that is distributed over a small number of extreme events in the catchment area.

In addition, elevated water temperatures result in lower concentrations of dissolved oxygen. Even a temporary reduction in the availability of oxygen, combined with a temperature-induced increase in oxygen demand, puts pressure on organisms in river ecosystems during the summer half-year. If stressors such as industrial pollution or

toxins from algal blooms are added to this pressure, the entire ecosystem can collapse.

In the River Oder, the situation resulted in the mass mortality of fish and other aquatic organisms. Bacteria subsequently decompose the biomass of the perished animals in the water, consuming oxygen in the process. This can lead to extreme lack of oxygen and additional fish mortality downstream, as has been observed in various sections of the River Oder. Such population collapses also result in the loss of important genetic diversity, which has developed over long periods of time in adaptation to the habitat.

River engineering works further deteriorate the ecological status

The environmental disaster on the River Oder has also shown that existing control mechanisms are unable to prevent such fatal developments. To avoid a recurrence of such mass mortalities, significantly fewer nutrients and contaminants should be discharged into the River Oder, the adverse effects of river engineering changes need to be reduced, and the management of the river must be sustainably adapted to climate change. Only then will the river ecosystem be able to regain its natural resilience.

By contrast, river engineering works degrade the ecological status of the river. Back in late 2020, i.e. before the Oder disaster, IGB had already issued an [→ IGB Policy Brief](#) warning of the major ecological risks of developing the River Oder and emphasising the ecological value and relevance of the sustainable use of the river from a scientific perspective. According to this analysis, the planned river engineering measures can neither be justified by existing flood risks nor by an alleged

economic potential. Nevertheless – and despite the protests and legal steps taken by the German authorities and associations – the construction work has since started, and has also continued under the drought conditions in recent years.

The current dredging work in itself represents a major intervention in the riparian zones of the River Oder, which are densely populated by animals. Moreover, sediments, nutrients and legacy contaminants – such as mercury and other heavy metals – from decades of industrial pollution are deposited in the groyne fields. These pollutants are stirred up so that they can again exert their toxic effects in the river ecosystem. In addition, dredging in anoxic bank sediments further reduces the river's overall oxygen levels. For these reasons, it would have been important to put an immediate stop to the work – which was already critical from an ecological perspective – as soon as the fish kill began.

Barrages and river deepening are no sustainable solutions

Some stakeholders are currently portraying river engineering works – such as additional barrages and further deepening of the riverbed – as viable solutions for the future. Findings in freshwater ecology clearly contradict this: technical measures to regulate rivers increase the risk of such disasters occurring again. Dams do not contribute to sustainable water retention. They therefore have no role to play in a meaningful adaptation to the effects of climate change. Instead, they facilitate the mass development of algae and the evaporation of precious water, prevent the ecologically vital sediment transport and thus lead to depth erosion of the riverbed downstream, resulting in even faster drainage of the adjacent floodplains.

In 2015, Germany also committed to implementing river engineering measures on the River Oder in a bilateral agreement with Poland. In the context of the German-Polish Environment Council on 29 August 2022, Poland emphasised its expectation that Germany would fulfil the agreement. The environmental compatibility of the measures planned on the German side must be re-evaluated in view of the current population decline of many species and the already severely weakened state of the Oder ecosystem, which poses a considerable risk of renewed fish, mussel and snail mortality. This analysis process must be carried out as quickly as possible in a way that is

transparent to the public and stating all the relevant influencing factors taking into consideration climatic and economic scenarios. All measures must comply with the binding commitments resulting from the European Water Framework Directive (WFD) and the Habitats Directive (HD). Consideration should also be taken of the federal “Blue Belt Germany” programme and the National Water Strategy, which is currently being discussed in the ministries and the federal states.

In this context, it should also be noted that due to the Oder’s very low seasonal water levels and its current insignificance for inland navigation, the river has been downgraded in Germany to the network of secondary waterways. This is confirmed by official transport statistics. Even if optimistic estimates of future transport volumes are considered, there is no justification for developing the river for shipping and including it in the Trans-European Transport Network (TEN-T). Future water management measures should instead aim at better protecting the natural areas along the River Oder and developing them to recreate near-natural conditions, thus enhancing the ability of floodplains to provide natural flood protection and water retention. To achieve this, existing Natura 2000 sites must be managed coherently, effectively linked and extended to the principle stream of the Oder.

Recommendations for action to achieve an intact and resilient River Oder

IGB specifies six science-based recommendations for action for policymakers and authorities. They focus on improving the ecological status of the River Oder and its monitoring; safeguarding species and habitat diversity; and ensuring the viability of ecosystem services, including natural flood protection, for citizens on both sides of the river, and thus also supporting climate change adaptation in bordering regions.

1 River engineering works to deepen or regulate the Oder should be discontinued

To make the River Oder more resilient to the impacts of climate change and to reduce the risk of a repeat of the environmental disaster, current and planned river engineering works aimed at deepening or damming the river, or making its stream bed more homogeneous, should be suspended with immediate effect. In the light of the catastrophic events, any future river engineering work

should be re-evaluated with particular thoroughness with regard to its eligibility for exemption under Article 4 of the WFD, its environmental compatibility and, in particular, its effects on the natural resilience of freshwaters to climate change. This is a key prerequisite for the sustainable recovery of the river ecosystem and the prevention of further adverse effects.

2 Emissions should be reduced through lower threshold values and restricted cooling water use

The River Oder is exposed to a multitude of anthropogenic nutrient and pollutant effluents. Nutrients such as nitrate and phosphorus are mainly discharged from agriculture and wastewater treatment plants; chemical substances, including heavy metals and salts, stem from industrial discharges and mining. Agriculture, mining and industry must therefore significantly reduce their emissions in order to substantially reduce the nutrient and pollutant loads in the River Oder. Likewise, the degree of connection and

purification of wastewater treatment plants must be examined and, where necessary, upgraded to current standards. Since water availability in the River Oder is steadily decreasing, severely restricting the possibility of diluting effluents at times, all emissions should be adapted to the river flow, and loading thresholds should be lowered accordingly. Dynamic models based on concentrations rather than loads are conceivable, for instance. In addition, the industrial use of cooling water must be restricted owing to

the critical development of summer water temperatures. As a general rule, emissions should be limited in such a way that tolerable thresholds for maximum concentrations and water temperature are met everywhere and

at all times. The corresponding proof should be provided in real time by the discharging entity and, if possible, made publicly available.

3 The main river should be restored and reconnected to its backwaters

A resilient River Oder needs greater structural diversity: restoration measures of the river course and the barrier-free reconnection of backwaters such as oxbow lakes would ensure more water retention in the landscape, offering tremendous advantages in times of drought and flooding. Under conditions of climate change, this would benefit both nature and sustainable floodplain management. Moreover, reconnected waters provide a more diverse range of habitats, spawning grounds, maturing grounds and refuge areas, promoting self-sustaining populations of all animal and plant species, even rare ones. Reconnected floodplain waters could provide areas of refuge in the event of any future hazardous incidents, increasing

the proportion of survival of fish and other aquatic organisms.

The biodiversity associated with such structural diversity constitutes a necessary basis for the ecosystem services provided to humans, such as the provision of clean drinking water, ecological self-purification capacity, natural flood protection and fishery resources. As a nature-based solution (NBS), restoration is the best way of achieving sustainable multifunctional water management that is adapted to the effects of climate change, as already outlined in the [→ IGB Policy Brief on the occasion of the 2021 federal elections in Germany](#) (in German language only).

→ IGB scientists have drawn up concrete proposals for the restoration of sections of the River Oder in a detailed document accompanying this *IGB Policy Brief*. These measures could be implemented, for example, as part of the federal Blue Belt Germany programme, which seeks to promote the restoration of federal waterways and floodplains.

4 There should be no stocking with non-native fish

Fish stocking is currently being discussed as a potential measure in response to the mass fish die-off. However, typical river species such as the minnow, the barbel and the chub, or the maraena whitefish, which in Germany only occurs in the River Oder, have become adapted to their respective habitats and form distinct genetic units. Especially when populations have low abundances after such a fish kill event, stocking with non-native fish could compromise the genetic identity of

fish from the Oder. Genetically unique populations would then be weakened or even wiped out. For this reason, fish stocking only makes sense as a support measure if the fish originate from the same population. However, research shows that natural emergence has the highest survival rates. The sustainable recovery of stocks should therefore initially be supported by providing additional spawning and brood habitats in the River Oder, for example by creating new

gravel areas or restoring damaged ones. Fish stocking should be limited to a few, professionally well-founded and scientifically

accompanied exceptions such as the Baltic sturgeon reintroduction programme.

5 Internationally coordinated water management should be intensified

The Oder is an international river and, according to the WFD, which came into force in 2000, must be considered and managed primarily at the river basin level; national or smaller-scale administrative measures are then derived from this. The environmental disaster has shown that international cooperation with regard to the monitoring and assessment of pollutants, the communication channels and the coordination of measures were insufficient to prevent serious damage. Cooperation should therefore be expanded

with the aim of making water management more sustainable and transparent. However, this must not lead to an impasse: if no progress can be made due to international conflicts of interest, policymakers and authorities in Germany should implement the necessary and possible change processes proactively and in accordance with international agreements. Such improvements also require better interdepartmental cooperation in the German multilevel system of governance and administration.

6 A digital monitoring system with freely accessible data should be expanded

The environmental disaster has clearly shown the importance of automatic monitoring stations, allowing direct online access to the measured data. Objective and transparent data can help to ensure the protection and sustainable use of the River Oder, paving the way for a rapid response to adverse developments. Therefore, the measurement of

physical, chemical and biological parameters should be extended, harmonised and automated, both spatially and temporally, by a larger network of monitoring stations in all three Oder riparian countries – the Czech Republic, Poland and Germany. The data should then be freely and directly available to the public and, ideally, on a single platform.

Accompanying document



An → accompanying document that considers potential revitalisation areas on the border Oder has been issued alongside this *IGB Policy Brief*. The accompanying document is also available for download at no cost:
→ https://www.igb-berlin.de/sites/default/files/media-files/download-files/Begleitdokument_IGB_Policy_Brief_zur%20Oder.pdf

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"Research for the future of our freshwaters" is IGB's guiding principle. This involves giving objective and evidence-based information and advice to policymakers, authorities, associations, industry, educational institutions and the public. Within the institute's publication series called *IGB Outlines*, which includes the *IGB Policy Brief*, IGB disseminates evidence-based information to the public free of charge. Responsibility for the content of the publication rests with the respective authors. It is generally permitted to disseminate the complete *IGB Policy Brief*. If you quote from the document in other publications and formats, we would be interested in hearing about it.

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