

Fish kills in the Oder River: Interaction of climate change and systematic pollution

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In the past weeks, the public has been shocked by images showing masses of dead fish floating in the Oder River, on the German-Polish border. Recent reports speak of 150 to 200 tons of fish killed. As the fish kill continues to grow in scale, scientists are slowly unraveling the background to the ecological tragedy. The focus is on the explosive spread of a species of algae.

Currently, there is concern of a second wave of die-off. Due to rainfall in the upstream Silesia region, the Oder rose briefly there by a meter. Now that wave of water is washing everything downstream that the otherwise low water levels had kept there. The wave could reach the lower course of the river within the next three days.

The dead fish collecting downstream are developing into a new death trap. Before the Oder River enters the Szczecin Lagoon, it branches into tributaries and Lake D^obie, located near Szczecin. Disposal of the carcasses is carried out mainly by volunteers, local fire departments and authorities, who are unable to cover the extensive terrain.

Decomposition of large quantities of dead fish removes oxygen from the water and at the same time forms ammonia in saline water. Together with the typical summer oxidation, due to high water temperatures and slowed photosynthesis because of the turbidity of the water, there is a dramatic lack of oxygen with a simultaneous danger of ammonia poisoning. Near Szczecin, 0.6 milligrams of oxygen per liter were measured last weekend in the western arm of the Oder River. The normal level is 4 milligrams.

The *Gazeta Wyborcza* reported about the shocking conditions in Szczecin: The smell of death and decay lies over the Oder promenade. Hundreds of dead fish are floating in the water. Three fire department boats and the volunteer water rescue service try to haul in fish with landing nets, but their forces are too modest. The day before, the local anglers association reported having removed 20 tons in one day.

Fish that have so far survived the poisoning are now in danger of suffocating due to the decomposition of the dead fish. Currently, north winds are preventing rapid flow into Lake D^obie, which has not yet been affected. Attempts are being made to artificially increase the oxygen level by means of around 30 pumps, aeration machines and an ozone maker from Warsaw. On Wednesday, the oxygen content at one point was 1.72 mg/l. But in the end, this is only a drop in the bucket, ensuring the survival of only a few fish.

The ensuing second wave of decay compounds the danger and could spoil the entire lake.

"Lake D^obie is now the last bastion for surviving fish to find refuge. There is oxygen there, there is life! If the wave along the East Oder comes directly toward D^obie, there is a serious risk that dozens of tons of dead fish and other organisms, including decomposing organisms,

as well as other organic matter that consumes oxygen or releases toxins, will go directly into the lake. We can't let that happen!" warned scientists Dr. Sylwia Horska-Schwarz of the University of Wrocław and Miko^oaj Adamczyk and Pawe^o Prus of the Institute of Inland Fisheries in Olsztyn.

Scientists uncover origins of die-off

While facing the threat of a growing disaster on the Oder River, scientists are steadily uncovering the origin of the original die-off.

In summer, the artificial supply of nutrients, especially from agriculture, often results in the rapid growth of algae, which deprives the water of too much oxygen and leads to fish kills. Recently, this happened in Lake Niepruszewskie, killing a half-ton of fish, and probably also caused the fish kill in the Stever River in North Rhine-Westphalia.

However, the Oder River is faced with a particular alga, the golden alga (*Prymnesium parvum*). The Polish Institute of Inland Fisheries detected its presence in the Oder, as announced by Climate and Environment Minister Anna Moskwa on August 18. Later, the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) confirmed that a high concentration of the associated algal toxin *Prymnesium* had also been detected "beyond doubt and indeed in significant amounts in Oder River samples from various locations."

"Since all samples were taken at an advanced stage of the algal bloom, a direct link to fish and mollusk mortality can be assumed," said scientist Dr. Elisabeth Varga of the University of Vienna, where the mass spectrometry was performed.

According to Dr. Jan Köhler, head of the Photosynthesis and Growth of Phytoplankton and Macrophytes working group at IGB, the Oder River is "currently experiencing an extreme mass development of planktonic algae." *Prymnesium parvum* has been very dominant in all samples since August 8, he said, with that alga accounting for at least half of the total algal biomass. Even after dilution by influx from the Warta River, at present it still makes up 36 percent, he said.

"To my knowledge, such a bloom has never been observed in our waters. It was probably made possible by salt discharges, abundant nutrients, high water temperatures and long residence times in barrages and in the developed river," added the IGB scientist.

Although research is still needed on the toxicity of *prymnesins*, their lethal effects on fish and mollusks have been known for some time. In particular, the dissolution of the epithelial cells of the fish gills leads

to asphyxiation of the fish. This explains the many reports of fish desperately wriggling in death agony at the water surface.

The alga *Prymnesium parvum* has been known for several decades to cause drastic fish mortality in the US, Scandinavia and China. But “we’ve never had them here,” Dr. Köhler of the IGB told the German broadcaster *Deutschlandfunk*.

The spread of the algae has been reconstructed with images from the Sentinel 2 satellite, which provides data for the European earth observation program Copernicus. Due to the colored chlorophyll, the concentrations along the Oder River are visible. While there was only a slight increase near the city of Opole at the end of July, the concentration suddenly jumped in August around Wrocław and then shifted further downstream.

Salty brackish water is the normal habitat of the golden alga. However, due to the increase in near-stagnant waters created by barrages and dams, artificial lakes and ponds, it is becoming more widespread. The alga requires the nutrients nitrogen and phosphorus, which enter the rivers through otherwise harmless sewage or enters through groundwater contaminated by overfertilization in agriculture. Low water levels due to prolonged droughts or water-intensive economies create ideal water conditions for the alga, especially in summer. Salinity, fed by wastewater, is also likely to have increased in the Oder due to currently low flow and water volume.

The final ingredient, according to Dr. Köhler, is time to grow, which was provided to the algae by barrages on the Polish side and the current slow flow rate of the river. The microorganisms are growing exponentially, he said. If a cell doubles every day, it multiplies eightfold in three days. In 10 days, the biomass grows a thousandfold. Growth depends very much on the time given to it, and this time is extended by human intervention.

Government plans to develop major shipping lane

Environmental groups have already pointed out that the Oder River would face these dangers if the Polish government were to follow through on its plans to develop it into a major Class 5 European shipping lane, accessible to 50-meter vessels.

In May, the conference “Time for the Oder, three countries—one river” of German, Czech and Polish environmental associations met in Wrocław. There, Dr. Michael Tautenhahn from the Lower Oder National Park warned: “It is well known that the water of the Oder River is not sufficient for navigation, therefore locks and dams have to be built. After the expansion, the water flow will change and, as a result, the amount of toxic substances will increase.”

In addition to the effects of climate change, changes in the river’s flow due to construction and the harmless pollution of the waters in normal times, there is another factor: criminal pollution.

In a previous article we discussed the allegations against the Jack-Pol paper mill in Oświna. Since then, the authorities have had to admit to illegal wastewater discharge on an enormous scale. For example, on August 18, the Polish water authority Wody Polskie published the results of a review of illegal waste discharges in Poland according to which there were 1,432 illegal discharges, 282 of them in the Oder River area.

In inspections previous to December 2021, 7,000 illegal discharges had been detected. The declared aim of the inspection was “not only

to introduce sanctions, but also to give the owners of discharges the opportunity to legalize them.” Even though most of the cases were small private and non-industrial discharges, this obliging manner of the Polish authorities is significant. According to their own data, at that time only 10 percent of rivers in Poland were in good or very good ecological condition, 60 percent were in moderate ecological condition, and 30 percent were in poor or very poor ecological condition.

A new case of industrial pollution has been confirmed in the meantime in the Gliwice Canal, where the first dead fish were reported at the end of July. According to official data from the Polish Water Inspectorate on August 17, the salinity in the entire Oder River remains elevated by about a factor of two, and in the area of Gliwice and the Kłodzki Canal by a factor of five to six. The average water temperature was 25 to 27 degrees Celsius. Pollution with chemicals or heavy metals could no longer be detected.

One “legal” discharge was shown to have occurred downstream between July 29 and August 10. The Głogów copper smelter discharged large quantities of salt water from ore flotation into the Oder River. Environmentalists accuse the authorities of not issuing rules for low water levels.

Journalists have also reported cases of excessive pollutant concentrations. But they were not significant, according to water authority spokeswoman Małgorzata Zielenka. “Unfortunately, they are typical of surface waters in urbanized areas,” she said. High salt concentrations: chloride, sulfate and sodium are typical of the waters studied, as the Kłodnica River, which feeds both the Gliwice Canal and Lake Dzierżno Duże, is a recipient of saline groundwater from the drainage of nearby mines. It is similar for the Oder River, into which mine water from the southern part of our region is discharged through the Olza watershed.”

In other words, the authorities are aware of systematic pollution, and if now and then the limits are exceeded in the process, that is no reason for them to do more than file a memorandum. The Polish authorities have issued a reward of 1 million zloty for clues to the cause of the Oder pollution. They could transfer the money to themselves.



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