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Casting a wider net: digital tools bring Europe's fisheries into sharper focus

Researchers are combining AI, cameras and DNA traces in seawater to build a transparent picture of what is being caught, and support more sustainable fisheries.

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Europe's fishing fleets land 3.2 million tonnes of fish a year, worth €5.5 billion. Yet fishers, scientists and regulators still lack a complete picture of what is happening at sea.

In Belgium, for example, which has only around 60 fishing vessels, onboard scientific sampling currently covers just 1.5% of fishing trips, said Els Torreele. She leads fisheries research at the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO) in Belgium.

"We don't have enough data to cover all we need to know about what is going on in the sea or with the stock," she said.

Fishers heading out to sea, just like the managers overseeing them, rarely know for certain what they will catch. Traditional monitoring relies on scientific observers on board vessels, a limited, labour-intensive approach that captures only a fraction of activity at sea.

This gap can breed mistrust between fishers and scientists. When data is incomplete, regulators can apply a precautionary cut to quotas – better safe than sorry – but fishers often experience these cuts as arbitrary when they clash with what they see at sea.

This same gap in knowledge extends to discards and unreported catches, a small piece of the wider data problem that researchers such as Torreele are trying to solve with a new generation of digital tools.

Smart tech

Since 2024, Torreele has led OptiFish, an EU-funded initiative developing technology that can automatically recognise fish species and improve how catches are monitored.

The four-year collaboration involves researchers from eight countries working to improve fisheries monitoring and management across Europe. They combine AI, computer vision, electronic monitoring, genetic analysis and robotic systems to build an integrated digital monitoring system.

“The better your data is, the clearer your story is and the more complete your picture becomes of what is happening in your marine environment,” Torreele said.

The timing matters. The EU introduced rules to close enforcement gaps that let illegal and unreported fishing go undetected, on the logic that quotas only protect fish stocks if they are being followed. Under the revised Fisheries Control Regulation, electronic reporting is already mandatory for most vessels, with tracking extending to smaller boats by 2028 and digital traceability rules reaching processed fish by 2029.

Data gap

But digital reporting alone will not close the information gap. Without detailed data on which species are being caught, where and in what quantities, fisheries managers cannot make sound decisions about sustainable catch limits, trace seafood through the supply chain, or help fishers plan fishing trips.

“Everything starts with your data,” said Sander Delacauw, a marine biologist at ILVO. “If you want to manage sustainable fisheries, you need to make sure that all the data you collect is high quality and sufficient for stock assessments that feed into quotas and management decisions.”

“But the problem is that a lot of sampling is currently manual, and you cannot send observers to sea 24/7,” he added. “When cameras are used, people often need to watch footage manually, which takes enormous amounts of time.”

OptiFish is tackling this by developing a suite of technologies, such as cameras paired with AI algorithms that can recognise and count fish species.

“We start by collecting a sufficient amount of training data,” Delacauw said. “It’s like teaching a child to recognise something – you need to show them enough pictures, so they actually understand.”

The team is turning this training material into high-quality image datasets that other researchers can use to teach their own AI models.

Across Europe, these AI camera systems are being tested on pumping vessels, sorting tables, beam trawlers and small-scale fishing operations. The system is trained to identify species, even when fish overlap or are partially hidden, using quality checks that flag anomalies and help assess the reliability of the result.

One early result comes from OptiFish partner DTU Aqua, which built an AI pipeline to track individual fish as they move along conveyor belts under electronic monitoring, so the same fish isn’t mistakenly counted twice. Tested on six similar-looking species, it correctly matched fish 90.43% of the time

The team is also developing a robotic arm that separates overlapping fish on sorting belts and tables. This will improve image quality for the cameras.

In the sea, fish shed DNA particles as they swim, and the project uses this environmental DNA (eDNA) to sample the water and estimate the biomass of a particular stock.

“It’s like humans shedding hair,” Delacauw said. “By collecting water samples or deploying special probes attached to fishing nets, we can identify which species are present in the water.”

GPS sensors, water current monitors and fuel consumption data add further context, such as location and sea conditions.

Delacauw explained the logic of combining several technologies.

“Manual sampling gives very high-quality data on individual fish, but only occasionally. Cameras can measure 24/7, but are limited to what’s visible. eDNA can indicate what species are present in an area. By bringing all these methods together, we take the best of each approach to create an overall picture.”

OptiFish is now testing and refining these systems across five pilot sites spanning different fisheries and European regions, from the North Sea and the Mediterranean to the Black Sea.

Wide-reaching benefits

For fishers, more accurate data about fish stocks and catch composition could support more targeted fishing strategies. This would help them plan trips, cut fuel use and costs, reduce emissions, and avoid catching too many juvenile fish or overfishing vulnerable stocks.

There is a practical upside, too. Fishers currently log catches by hand, and automated reporting through digital monitoring systems would simplify this slow process and help ensure compliance.

For consumers and EU citizens, better monitoring means more transparent seafood supply chains and greater assurance that fish has been caught legally and sustainably.

More accurate data also helps fisheries managers make better decisions, supporting healthy fish stocks for generations to come.

Beyond its own four-year run, OptiFish aims to lay the groundwork others can build on. Its consortium is building a shared data platform, a tool that gives fishers real-time updates on their catches, discards, fuel costs and quota use, and a template for building AI-based monitoring into official fisheries monitoring frameworks.

“Sustainable fisheries management depends on accurate information,” said Torreele. “Our work is about building a system that gives us that information in a way that benefits everyone, marine ecosystems, fishers and citizens who want to know where their food comes from.”

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More info

- OptiFish (CORDIS)
- OptiFish project website
- Common Fisheries Policy
- Fisheries statistics – catches and landings