Fishing with electricity

Does fishing using electric pulses have advantages over beam trawling? It saves energy and is probably less damaging to the seabed, but is it also better for nature in the longer term? And is it animal friendly? 'The pulse makes beach crabs stiffen.'

TEXT TESSA LOUWERENS **PHOTO** HOLLANDSE HOOGTE

Two electrodes suspended in a bucket of water send electrical pulses through the water. It tingles a bit if you put your hand in, but there is no pain. 'Now it's at about half strength,' says Pim Boute, PhD candidate in the Experimental Zoology group at Wageningen University & Research.

Boute is researching the effect of electric pulse trawling on various sea creatures. Pulse trawling is a method that can be used to catch flatfish, for example. Flatfish such as sole and plaice bury themselves in the seabed so they first have to be flushed out before they can be caught in a net. Traditionally, this is done with a beam trawl that drags heavy 'tickler chains' across the seabed. These chains plough up the seabed, injuring or ensnaring a lot of other creatures, including starfish, crabs and shellfish, in the process.

Scientists and fishing businesses are looking for more sustainable methods for catching flatfish and are therefore experimenting with pulse trawling. This method involves replacing the tickler chains by electrodes that emit electric pulses — the pulse trawl. Boute: 'The >

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electrical pulses induce brief convulsions in the muscles of the fish, making them rise up from the seabed and get caught in the net.’

DAMAGE TO THE SEABED

Earlier studies showed that pulse trawling has several advantages compared to beam trawling. In the FP-7 BENTHIS project, for instance, research has been taking place since 2012 into the mechanical effects on the seabed of dragnets, including those used in pulse trawling and beam trawling. ‘The nets are dragged across the sea floor in both cases, but the pulse trawl is lighter and the electric wires don’t dig so deep into the floor as the beam trawl’s tickler chains, which means they don’t cause so much damage,’ explains project manager Adriaan Rijnsdorp of Wageningen Marine Research. Fewer benthic creatures are caught in the net as well. It also depends on what part of the sea you are fishing in, says Rijnsdorp. ‘In shallower areas, the seabed is regularly churned up by strong tides or when a storm rages. The sea creatures that live there are better adapted to a turbulent sea floor, so the effect of fishing is less there than in the deep seas, where you can still see the tracks of the dragnets on the bed one year later.’

Another advantage of the pulse trawl is that boats can catch just as much sole as with the beam trawl while sailing at a slower pace, and therefore travelling less of a distance. ‘So the pulse trawl covers a smaller area to catch the same volume of sole.’

That, coupled with the fact that the pulse trawl is lighter and has less drag resistance, means the ships consume less fuel. This in turn means lower CO_2 emissions and lower costs for fishers. The fish that are caught are also better quality on average because they have suffered less damage.

The initial impression is therefore that pulse trawling should be a good alternative to beam trawling. However, in principle the method is still not allowed in Europe. Since 2009, Member States have been able to grant an exemption for up to five percent of their fleet to use this new fishing method in the southern part of the North Sea. The Netherlands has granted 84 such exemptions.

To get a better picture of the long-term effects of pulse fishing in the North Sea, the Dutch Ministry of Economic Affairs commissioned the Pulse Trawl Impact Assessment Project, which started in early 2016. ‘We want to use that research to predict the effects of pulse fishing on a large scale,’ says Rijnsdorp. ‘We are expecting this technique to be an improvement, but it’s important to investigate the possible downsides thoroughly so that we can make a well-considered decision.’ The research is a joint project with the Netherlands Institute for Sea Research (NIOZ) and the Institute for Agricultural and Fisheries Research (ILVO). The research results from the two projects will eventually form part of the scientific basis for a future decision by the EU on pulse fishing.

ANAESTHETIZED FISH

PhD candidate Pim Boute’s experiments in the Zodiac lab in Wageningen are part of the Pulse Trawl Impact Assessment Project. He has created a setup that will let him accurately measure the effects of exposing fish to electric pulses. ‘Some fish are affected by the pulse trawl but not caught in the net, for example, so we can’t examine them on board a fishing boat.’ By simulating the real-life situation in the lab, Boute can still see what the pulses do to the fish.

A tangle of cables connects an aquarium full of electrodes to the computer. The aquarium is about one and a half metres long and wrapped in a thick layer of polystyrene. ‘The fish we are investigating live in the North Sea and it’s colder there,’ explains Boute. ‘We keep the tank cold to stay as close as possible to the natural situation.’ The fish will be anaesthetized first to prevent any distress. Then Boute will measure their muscle activity under different settings for the electrical pulses.

In the Zodiac basement, Boute shows us the X-ray room. X-rays are taken here of fish

TENSION

The Netherlands has made use of the option of granting up to five percent of its fishers an exemption to the EU ban on pulse trawling. Many other EU Member States have not done so and have taken a critical stance. Earlier this year, the French Minister for the Environment called on the European Commissioner for Fisheries to maintain the ban on electrical stimulation in fishing and revoke the exemptions that have been granted. According to the minister, there are far too many ships taking part in pilot projects, not enough is known about the impact and risks, and there is insufficient monitoring. VisNed, the Dutch trawlers’ association, is working hard on getting pulse trawling accepted in Europe. The organization feels that the opposition is fuelled in part by other countries’ desire to bolster their competitive position.

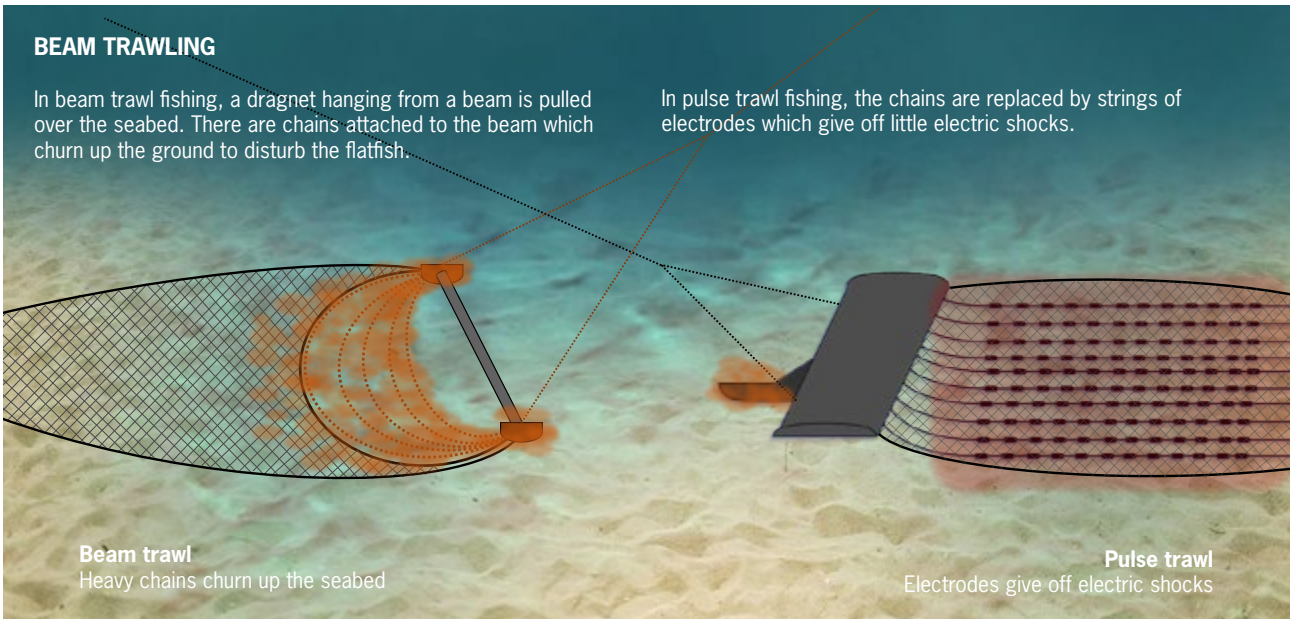

ILLUSTRATION WUR / JUSTIN TIANO

that have been caught by a pulse trawl. Fish can break their backs when their muscles convulse powerfully. Boute: 'That is not animal friendly. Previous studies showed this happening to cod, for instance, but the results weren't consistent. That's why we want to investigate more broadly how often this occurs in commercial catches.'

The aim of Boute's study is to determine the sensitivity of different sizes and species of fish to the pulses. That is because previous research has shown that the effect of the pulses depends on the size and species of fish. Boute: 'The landing obligation means that fishers now also have to bring back undersized fish and species that don't make much money. It might be possible to fish more selectively by choosing the right settings in a way that will let fishers mainly catch their target fish.'

He also wants to look at the behavioural effects of pulses on sea creatures that are not being fished. 'Sharks and rays, for example, can sense electricity. In theory, the pulses could either attract them or repel them, so they could equally well end up in the net. Or not.' Invertebrates such as beach crabs also react to the electricity. 'The pulse makes them stiffen. Then they are unable to feed properly and run a greater risk of being eaten. You don't always see them in the nets but what happens to these creatures could well affect the population and the ecosystem.'

EATING SAND

PhD candidate Justin Tiano at NIOZ is also investigating the effects of pulse fishing on the marine ecosystem, and in particular life in the sediment. That is because the electrical field from the pulse trawl permeates the top layers of the seabed. Tiano does his research in a lab at the other end of the country, in the coastal village of Yerseke in Zeeland. He has a row of 30-centimetre glass test tubes with sediment samples. He took those samples from the seabed using a hollow drill. A tiny tunnel runs through the sand in one of the test tubes. Tiano explains that it was made by a lugworm. 'It eats sand, then excretes it at the other end as the worm digs deeper. That process mixes up the sediment.' Lugworms and other creatures on the seabed play an important role in the exchange of nutrients and oxygen between the sea floor and the seawater, explains Tiano. They also help remove nitrogen and phosphate from the water. 'Too much nitrogen can lead to excessive algal growth, making oxygen levels in the water fall. This then affects the entire ecosystem.'

Tiano will be comparing the effects of beam trawl fishing and pulse trawl fishing on the seabed. First, he disturbed his sediment samples to simulate the effect of the chains on the beam trawl. Then he measured the impact this had on the biochemical processes in the sediment. He is currently working on the data analysis. He plans to carry out another test in which he exposes the sediment samples to electrical pulses to see what happens. That will let him determine which method of fishing is least disruptive for the marine ecosystem.

LIMITING THE DAMAGE

The WUR, NIOZ and ILVO research project is scheduled to run until 2019, and the researchers still have a lot of work to do. The results will be combined with the results from the FP7-BENTHIS project. Project manager Adriaan Rijnsdorp: 'To have sustainable fishing, it's important to find out what method and which settings should be used to catch the fish as efficiently as possible, with minimum damage to other creatures and the environment. Our research results will help us get a better estimate of the effect of a switch from beam trawling to pulse trawling.' ■

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