The Kiwi pit: a novel codend from New Zealand via the Netherlands

A collaboration between Dutch fishermen and scientists has seen very encouraging results from what seems at first glance a very strange type of net, originally developed in New Zealand by Precision Seafood Harvesting. **Pieke Molenaar** from Wageningen Marine Research explains the concept and the results of trials on two vessels, a Eurocutter and a larger beamer. Skipper Geert van der Plas of the Catherina KW-145 played an active part in the research and trials, which after some tweaks at sea moved quickly from 'very poor' to 'very promising'

The Kiwi pit looks entirely different from a normal tunnel and codend! There is a small chafer, but no dolly ropes. After initial scepticism, though, and a tweak to the layout and towing speed, the new design performed way better than many skippers had expected. *(Photo: Pieke Molenaar)*

Dutch beam trawl fishermen have once again, it seems, adapted technology from elsewhere in the world and applied it to the North Sea beam trawl fishery, with encouraging early results. The Sumwing evolved from a concept developed in the USA and trialed, unsuccessfully, for queenies in the Isle of Man. This latest innovation, as is hinted at in the name, comes from a concept originally tested in New Zealand. ('Pit' is the Dutch word for codend.)

The Kiwi pit concept was developed in New Zealand by Precision Seafood Harvesting. After a two-year process involving consultation, collaboration agreements, secrecy, co-ordinating the design with sole fishing, and production in New Zealand, the Kiwi codend for sole fishing was flown to Schiphol airport in June 2022.

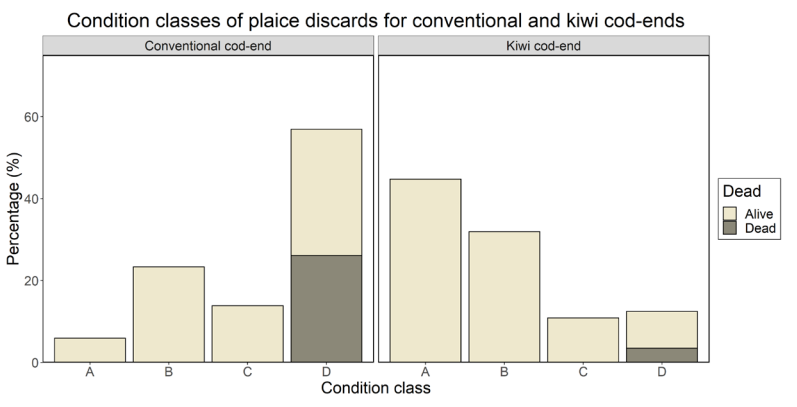
It doesn't look in any way like a conventional codend! Many would have written the whole idea off before putting it in the water. Thankfully, skipper Geert van der Plas was made of sterner stuff, and used his own experience to help overcome initial qualms and produce results from these initial trials that could lead to huge benefits for fishermen and the marine environment.

The work was planned as part of moves to reduce bycatch and discards or mortality, with resultant benefits for vessel owners subject to the EU landings obligations for bycatch species not expected to survive. However, other benefits became apparent during the trials, including significant reductions in catches of fauna from the seabed, and a marked improvement in the quality of the catch.

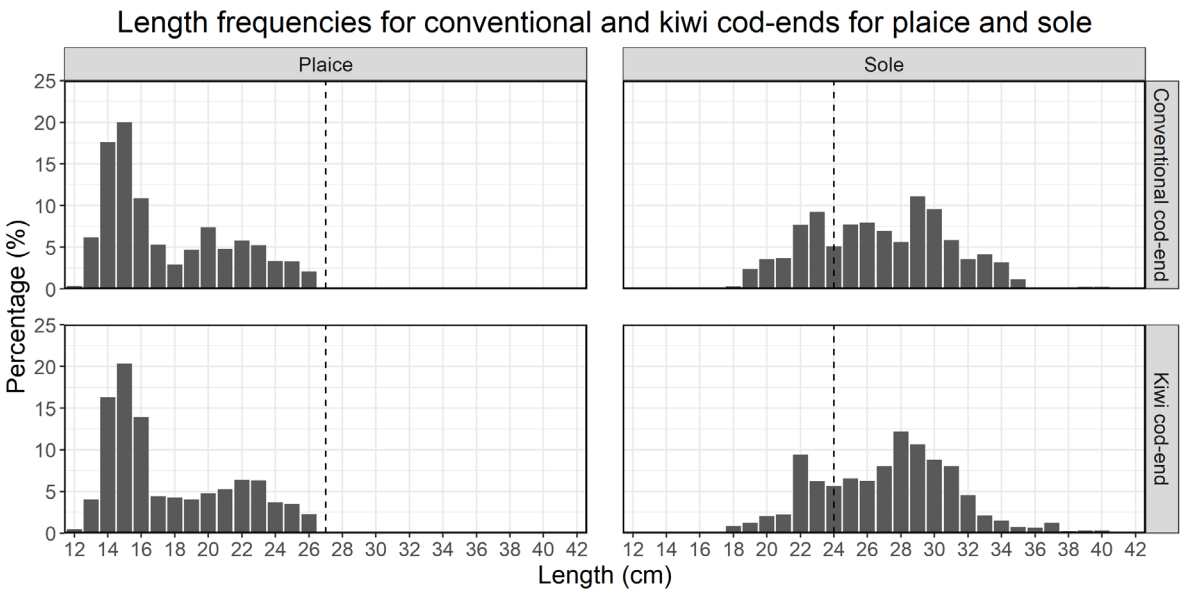
Research into the survival chances of discards clearly shows that they are strongly related to how damaged fish are when they are brought on deck. In a regular net codend, fish tend to swim until they are exhausted, and are damaged by the 'washing machine effect' of being tumbled in the codend.

Then, when hauling, the entire catch is compressed. As a result, many of the fish suffer damage that includes loss of the slime layer and scales, and bruising. This has a major impact on the survival chances of discards, so preventing such damage is the most effective way to increase their survival chances.

In a Kiwi codend, waterflow gradually decreases to standing water in the codend during fishing in the back net and tunnel. The caught fish stays in the relatively calm water in the codend during the haul, and is lifted onboard still supported by the water retained within it. Due to the lack of waterflow, the fish is not exhausted by swimming



Damage to both sole and undersized plaice was scored during the research trip – there was a remarkable difference in condition compared to conventional nets. "I have never seen the fish on deck look so alive!" was one comment from scientists aboard, as they watched juvenile plaice returned to the sea immediately swimming strongly back down to the seabed.



Perhaps surprisingly, no significant differences were seen between the size composition of sole and undersized plaice caught in the trials, indicating that the two very different nets were seeing an identical composition of fish entering them.

Wonderful sole...

against the current, and sustains considerably less damage than in a regular codend.

The entire concept seems counter-intuitive! Pulling a bag of water along the seabed hardly seems to be environmentally friendly – or commercially viable. There are no chafer mats. The bag has openings that are 62mm long and 12mm high, designed to retain sole above the minimum landing size. The Kiwi codend itself is made from high-tensile material, 13m long, with a strength of 22t per square metre.

We have yet to see the full commercial life of the new gear, but during trials they managed 51 tows, with a standard tickler chain on the starboard side for comparison. The codend itself has a volume of about $2m^3$.

The Kiwi codend can be mended by punching holes in the material and repairing with conventional twine. Experience will show whether repair will often be necessary. What is certain is that the material is very strong and will not break with the first fastener or incident. In one of the tows a 4m wooden beam was caught – it came onboard without damage to the Kiwi codend.

The resistance of the codend, which fills with water when shot, is such that it remains constant during the tow, rather than slowly increasing drag, as would be the case with a conventional codend that is slowly filling up. This will, of course, increase fuel consumption slightly. Offset against this is the potential to use a slower towing speed, without collapsing the codend, and a marked increase in the quality of the catch retained.

Emptying the Kiwi pit – basically a sack full of water, with fish still swimming around in it – into the pounds. *(Photo: Pieke Molenaar)*

... and plaice! "I have to say: I have never seen such beautiful fish in the box," says skipper Geert van der Plas. A bonus from the trials was the realisation that fish caught with the Kiwi pit will get the very best prices at auction.

Condition and survival of discards

Wageningen Marine Research has developed a protocol with which the condition of bycatch or discards at sea can be quickly judged, allowing us to estimate the survival rate of undersized plaice released from the codend. Each fish is assigned a score based on a combination of the presence of reflexes and damage. The beam trawler was double-rigged, with one Kiwi codend and one conventional, which allowed full comparison of condition scores during the trials.

Simply explained: a very lively undamaged fish scores an 'A', a lively fish with some damage gets a 'B'. A sluggish fish with moderate damage that doesn't seem immediately fatal scores a 'C', and fish that are very badly damaged and are estimated to have no chance of survival score a 'D'. Fish that are already dead on the sorting belt after the catch also score a 'D'.

During the trials, these scores were also assigned to undersized plaice randomly collected in the same haul from the Kiwi codend and from the conventional codend. In total, the condition score of undersized plaice was determined for 16 tows in the trials, in this case using 4.5m beams with one conventional chain mat trawl and one with the new Kiwi gear.

The graph opposite shows the frequency per condition score for both the conventional codend and the Kiwi codend. In the conventional codend, 20% of the undersized plaice was already dead onboard; in the Kiwi codend, this was less than 10%. More than 70% of the undersized plaice caught with the Kiwi codend scored an 'A' or 'B'; in the conventional codend, 70% scored a 'C' or 'D'.

The results show that fish caught in a Kiwi codend are significantly more lively and have less damage. This most likely translates into a significantly higher survival rate after return to the sea. The scores in the Kiwi codend are striking, because they show that the damage that fish incur during the catching process mainly occurs in the codend.

The results indicate that chain mats and chain ticklers themselves do little damage to the fish – it is what happens in the codend that counts. The condition of the fish in the Kiwi codend was excellent – significantly better than those in the conventional chain mat ticklers used on the other side of the boat as a comparison.

Another remarkable detail: a few large weevers were caught as bycatch. Those in the Kiwi codend were so lively that the crew couldn't grab them from the sorting belt without being stung! The eventual solution was to scoop them into a basket from the belt with an aquarium net. The striped red mullet – a really sensitive species and easily damaged – caught with the Kiwi codend were also very lively, and still had all their scales. This is a real sign of the potential benefits of this gear for survival rates.

To determine the selectivity of the Kiwi codend for sole, all sole caught during the two test trips were measured from both the novel and the conventional codends. There was no significant difference between selectivity in the Kiwi pit and the conventional 82mm codend.

Debris in the net

During the experiments on the Dirkje TH-10, the Kiwi codend usually caught remarkably few or no bryozoans, while after the same tow, the conventional trawl was completely full of them. The underwater images showed that the bryozoans were blown out in phases through the openings in the Kiwi.

Due to the diamond meshes in a regular codend, many bryozoans remain trapped, adding drag and reducing selectivity. The Kiwi has U-shaped openings in which the bryozoans do not get stuck, so that they are regularly blown out.

Potential improvements

A number of potential points for improvement have emerged from the trials undertaken so far. Firstly, work is being done on a system that opens and closes the

Katwijk skipper upbeat about new gear

Geert van der Plas, skipper of the Catharina KW-145, 'has a very good feeling about the follow-up trial on a large beamer, his first test trip with the Kiwi pit', he told Dutch fishing paper *Visserij Nieuws*.

Further sea trials are planned for the end of April, and the Katwijker skipper-owner has more ideas to tweak the concept for beam trawl/sole fishing.

Although the trial was started with the aim of increasing discard survival, a huge improvement in the quality of the catch was also immediately apparent.

Geert van der Plas had already made himself available for so-called 'survival trips' – research trips with scientists in which the survival rates of sole, plaice and turbot discards are measured. This research is a prerequisite for exemptions to the European landing obligation. Special bins were placed aboard to assist the scientists with measurements.

When researcher Pieke Molenaar came onboard in preparation for the trials and Geert van der Plas was asked to test the Kiwi pit on the boat, he had initial reservations, including about the cameras on deck to record activities. Once these were resolved, however, progress happened quickly.

The first large beamer used for the research, Catharina KW-145, shot the test gear on the port side, with standard 12m ticklers on the starboard side as a control, just two hours' steam from its home port of IJmuiden.

The initial result? Geert van der Plas said: "There was actually nothing in it on the port side! So that didn't look good at all. It turned out that the belly in front of the Kiwi pit was not properly straight. After removing the slack, we moved on. But at our normal speed of 5.6 knots, we filled the bag full of sand, which cannot be discharged with a closed bag. Not good either."

Geert van der Plas, skipper of the Catharina, was initially sceptical about the new design, but was soon won over. The first trials were carried out on the Eurocutter Dirkje with skipper Albert Baaj. *(Photo: Michel Verschoor)*

But when Geert van der Plas reduced the speed to five knots, it started to look better and better: as much sole and plaice was caught on the port side as on the starboard side, at a time when the fleet in general was reporting poor fishing.

"To be honest, I could hardly believe beforehand that you can catch fish with such a plastic net and dense bag. Well, that turns out to be possible. There is 2t of water in that bag, and because of the need to retain all the fish in the codend, we had applied extra Dyneema slings for retrieval.

"But what I was mainly concerned about on this test trip was the chance of survival of the small plaice in particular as an alternative to the landing obligation. And I have to say: I have never seen such beautiful fish in the box.

"They shot down like comets in the sea when returned! It looked really beautiful!" he told *Visserij Nieuws* the day after returning to port.

Geert Van der Plas wants to continue with the trials – and definitely for the sole fishery. He is working on another innovation that will reduce drag on sole nets, but also has learned from the first trip with the Kiwi pit that there is 'profit' to be made with a lower fishing speed.

"That would be great, saving fuel. Let's go for it! We also have the data system from Pedro Rappé at De Boer Marine onboard to help us fish even smarter. With all these innovations added up, we should hopefully be able to have a viable future in the sole fishery."

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codend much faster. The tested codend, with a volume of 2m^3, was too large for a Eurocutter. A smaller design is more suitable for small vessels.

In addition, the choker needs to be placed further forward to prevent fish swimming back into the net after being retrieved. The sealing of the various panels and codend could also be improved – a single crack allows sole to escape.

Follow-up research

A second trial is being prepared within the Fishery Mortality Project, in which Wageningen Marine Research will test the Kiwi codend on a large cutter with 12m of rigs and a speed of around six knots. Here, the condition score of undersized plaice and the catch efficiency for sole will be re-examined.

After that, further research trips will probably be made in 2023 to measure the survival of undersized plaice from both the Kiwi codend and the regular codend. It is planned to retain and observe captured fish to measure and compare actual survival rates. In addition, consideration is being given to the application of the Kiwi codend concept in flyshooter, twin-rig and shrimp fisheries.

The trials with the Kiwi codend are being carried out in collaboration with Precision Seafood Harvesting in the context of the research collaboration project on fisheries mortality of unwanted bycatches. This is a collaborative project carried out by Wageningen Marine Research, the Nederlandse Vissersbond and VisNed.

Interested in learning more?

In New Zealand, where the idea was developed by Precision Seafood Harvesting, the Kiwi pit is known as the Modular Harvest System. Martin de Beer of the company can be contacted at: Martin@precisionseafoodharvesting.co.nz

Research scientist Pieke Molenaar can be contacted at: pieke.molenaar@wur.nl ■

Fathom podcast puts safety first with premiere of latest series

FATHOM
The podcast for UK commercial fishermen
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Fathom, the commercial fishing podcast produced by the Cornish Fish Producers' Organisation (CFPO), is back with a new series.

The podcast – which first landed on streaming platforms in late 2019 – has produced 45 episodes with over 14,000 downloads between them, exploring the latest challenges facing UK fisheries, with a focus on disentangling the complex web of legislation and policy impacting the industry.

The first episode of the fourth series takes a dive into the unsettled waters of health and safety regulation. Since the last episode on the topic nearly two years ago, the implementation of ILO188 and the small vessel safety code has led to a stream of new requirements being brought in.

To help steer the conversation and shed light on these new regulations, Chris Ranford, Fathom's host and the CEO of the CFPO, was joined by two of the foremost marine safety experts in the country: Clive Palfrey, ex-fisherman and now safety advisor for Seafood Cornwall Training and Charles Blyth, a former marine surveyor for the MCA and now the risk, safety and training lead at the NFFO.

The episode covers changes in requirements to medical examinations that are coming into effect in November, with all fishermen – not just those out at sea for 72 hours – requiring a certificate. Clive and Charles talk through the options available to give fishermen a clear idea of what would suit them best.

Another deadline, this time the end of the phase-in period to comply with regulations on enclosed spaces, is coming up this May. Chris, Charles and Clive highlight the host of grants, logistical support and training opportunities available to help fishermen 'get ahead of compliance'.

In a bid to further improve vessel safety, Charles and Clive offer some sage advice on how to properly inspect lifting equipment to ensure fishermen are safe while using it out at sea.

The whole episode is a health and safety checklist, and while Clive notes that some of this can seem quite daunting, 'if you actually pick the phone up and ask for help, there's a lot of help to be had'. "If your boat's in good working order, you're already halfway there," he says.

With deadlines on the horizon, this is a perfect time to listen in to the episode to check that you're all up to date. Fathom is available across all major streaming platforms and on the CFPO website at: **cfpo.org.uk/the-fathom-podcast**

For further support on any of the issues raised in the episode or to receive advice on accessing support, get in touch with your local producers' organisation or contact the NFFO via: **nffo.org.uk/contact**