

Fish Farmer

VOLUME 53 NUMBER 11 NOVEMBER 2010

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New chain-free anchors will help farmers move to exposed sites

Lawrie Stove, managing director of Oban based AquaMoor, is behind several new products that could help companies expand into offshore locations. With a background in the marine industry, as well as in salmon farming, and as a member of the steering group that devised the Scottish Technical Standard, he understands the demands of the aquaculture market.

When it comes to fish farm moorings, current technology is very basic, he says, using a chain catenary, which is just a big curve under the water that the chain assumes under its own weight.

Right: The Raptor anchor



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The chain passes a load along the seabed to the anchor, dragging it in a horizontal direction. But when it takes off from the seabed it comes up to wherever the object is being moored, which in aquaculture is a cage grid or a feed barge.

The current industry standard fish farm mooring anchor is an inefficient design, said Stove, that relies heavily on the dead weight of steel in the anchor shank to provide gravity based holding power.

'The fluke of these anchors is so small that the design does not scale up well. On larger anchors – one tonne, two tonnes and three tonnes, for example- the fluke can be less than 40 per cent of the anchor mass so both the weight and the centre of gravity are in the wrong place to generate fast setting, deep penetration and high holding power.'

It is a system, he believes, that has not kept pace with technical innovation in other areas of the industry.

'As sites have got larger, so cages and nets have got larger and the biomass on the sites is much greater. Bigger nets create more drag and so the mooring loads are higher. So suppliers are specifying heavier weight of chain and a lot more of it,' said Stove.

'And there are new sites that have greater tide and wind driven currents as well as larger potential waves. A harsher and more energetic environment altogether,' said Stove.

These can also be deeper sites. In the last year, Stove has looked at farms on the west coast of Scotland and in Orkney and Shetland that are over 60m deep.

'To safely and securely moor fish farm cages and barges at these sites

"I've looked for transferable technologies from other industries that have performance in excess of what is currently available in aquaculture"



we're proposing a different sort of mooring system.

'If the farm infrastructure being moored is rising up and down on a 7m or 8m wave height and backwards and forwards 25m or 26m, that's an awful lot of movement and in an agitated sea state that can be quite a rapid movement,' said Stove.

'Conventional chain catenary can't respond fast enough to that so it generates big shock loads in the system.'

AquaMoor's aim is to introduce and develop short scope tension mooring systems that have higher performance anchors, synthetic fibre ropes and peak load absorbing devices, eliminating the need for a lot of chain lying on the seabed.

'It's possible to not have a chain and move to high performance synthetic fibre ropes, but when you do that you still need two things, a reactive force on the seabed and a replacement for the spring self weight of chain. In this instance the Raptor rock anchor is the enabling technol-

ogy. It can have a mooring line coming off it at 22 degrees so you don't need anything on the seabed. This type of short scope mooring system has a number of additional benefits, but chief among those is the ability to put fish farms in more energetic and exposed sites, or on rock seabeds that were previously off limits to farmers.

'And it can do this while keeping the structural security of the installation intact in all weather conditions, thus providing a reduction in containment risk when compared to traditional technologies.

'The Raptor rock anchor is pretty much like the principle of a rawplug – it's a direct embedment at a specific point and you can take a load off it. In effect, the Raptor does the same thing.

'With a conventional anchor, you drag it along the seabed and the further you drag it, the deeper it penetrates and the more holding power it generates.

'The Raptor is self-drilling. While drilling itself into the rock, it reams out the top and bottom of the bore and then expands into that bore, creating a mechanical fastening. It will provide very high holding power immediately from installation at a precise location in certain seabeds.'

Holding power is a function of anchor design and seabed composition. In oil and gas and renewables applications, high performance anchors have to be used. At 80:1 holding power, the Stingray is an impressive four times more efficient than any other fish farm anchors; however, the Raptor rock anchor is in a different league altogether – it has a holding power of 450:1.

AquaMoor has an exclusive distribution agreement in place with Raptor for the aquaculture sector – the anchor is a newly developed product that has been successfully installed this year for the marine renewables industry in Orkney.

'This is a high energy site with nine or ten knots of current, which is almost ten times more than you would get at an average fish farm,' said Stove 'so installation is not a problem, and Raptor offer the anchors up to 150 tonnes of holding power.

'At AquaMoor I've looked for transferable technologies from other



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industries that have performance in excess of what is currently available in aquaculture.'

He was at the recent Aquaculture Europe conference in Edinburgh to launch the Raptor anchor into the fish farming market. There was a lot of interest from the industry, he said, but the technology hasn't yet been tested in the aquaculture industry. Now, though, there is a pilot project getting underway, at an undisclosed farm on the Atlantic coast. Once in place, it will be monitored by the farm company.

'Everyone is interested in what it can do – it's an enabling technology that will allow farmers to go to sites they haven't gone to before because they are too wild. The anchoring technology is proven so it's more about convincing farmers now.'

'A 150 tonne Raptor anchor will weigh 350kg compared to between two to six tonnes for a conventional anchor of the same holding power, with chain being in addition to this.'

Raptor anchors only work in rock so they are not suitable for all farms. Their use, said Stove, will depend on the seabed.

'In Argyll, where it's gentle rolling hills and fertile soils, you can assume the seabeds will be of a similar nature – plenty of sediment. The Raptor wouldn't work there, but it is perfect for the geology found in the Outer Hebrides and Sutherland.'

Aqua Moor distributes other products, including the Stingray, a high performance conventional anchor produced by Jeyco, an Australian oil and gas equipment supplier. Stove has secured UK distribution for that product for aquaculture. It's a horizontal drag embedment anchor and is a solution for sandy seabeds where there is no rock. He is also the UK manager for TFI Marine (see page 59).

Aqua Moor also has an R&D programme in conjunction with Dundee University to look at developing another, completely new type of anchor.

'One of the key drivers is to try to make moorings more sustainable and environmentally friendly because at the moment, at a big farm site, they can have huge quantities of chain on the seabed – seven to eight kilometres. That is all interacting with the seabed so it is damaging the



Above: The Stingray anchor. Opposite page: Raptor being deployed

benthic environment. We can reduce direct environmental impact on the seabed while also indirectly reducing the carbon footprint of aquaculture moorings, by using smaller amounts of materials in far more efficient ways than they have been previously.

'An awful lot of effort has gone into making salmon farming sustainable but what goes on under the water in terms of mooring has not received much attention to date.'

'There are solutions available that are smarter and more environmentally friendly than what we currently have and are not necessarily going to cost the earth in comparison with existing technology.' 



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