Could active sonar systems, trained by humans, help unlock tidal energy in the UK? **Lesley Riddoch** finds out

listening in

ACTIVE SONAR is being 'trained' to identify sea mammals in a bid to cut the costs of monitoring tidal turbines and speed up the development of marine energy in Britain. The sonar is just one part of the technological response to a very human – and animal – problem. Will underwater turbines harm seals, dolphins and sea birds? And how would we know if they did?

The world's largest environmental marine-energy monitoring project in Northern Ireland has not found that tidal turbines are having a measurable impact on seals, dolphins and sea-birds after three years of a five-year study. But, while marine biologists say it could take a decade to be sure, developers say more expensive monitoring could cripple the fledgling tidal energy industry. Academics are hoping technology might offer a compromise.

Bristol-based tidal energy developer Marine Current Turbines (MCT) has already spent £3m on detailed monitoring work around its twin-turbine SeaGen device, installed last year in Strangford Lough near Belfast.

The monitoring work was agreed with the Northern Ireland Environment Agency to ameliorate the impact of locating turbines in a national nature reserve with nine EU habitat and wildlife designations and an established seal colony, and it is largely visual in its method. A marine mammal observer stands on SeaGen's bridge, ready to hit an 'off' button if a seal appears within 50m. A colleague sits in the stem using sonar to spot seals underwater, although it's hard to distinguish the sonar signals created by a seal pup from those created by a clump of seaweed.

Meanwhile, experts from the St Andrews-based Sea Mammal Research Unit (SMRU) have attached transmitters to the hair on seals' heads to help track their movements. The devices – which use mobile phone technology – come off when the animals moult.

Finally, biologist Daryl Birkett has conducted eight surveys a month for the past three years from a grassy knoll opposite SeaGen, using range-finding binoculars to note every sea mammal, sea bird, or human movement in the Narrows.

Queens University marine biologist Graham Savidge says the half million movements recorded so far suggest turbines and seals avoid one another:

"Few seals are found in the fast currents that turbines need – on the surface at least. The majority prefer the lower water speeds of the lough's margins."

EU RULES ON ENDANGERED SPECIES

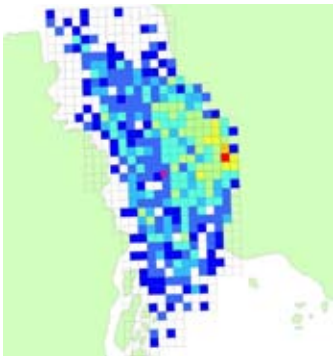
Martin Wright, managing director of MCT is "profoundly pleased and relieved" the turbines have not had any measurable impact on Strangford wildlife, but says the cost of proving that has been onerous.

"There will be no further tidal projects with this level of monitoring. Tidal energy will not happen if an embryonic industry is made to carry such burdens – it's like guinea pigs having to jump Beecher's Brook."

Professor Ian Boyd of SMRU disagrees: "The effect of turbines on sea mammals will only become apparent over a period of ten years. We know that porpoises, for example, are already spending less time in the Strangford narrows and there may be other effects that are not measurable using current

The SeaGen turbine in the fast-running waters of Strangford Loch

The distribution of seals around the SeaGen location (marked in red)



Seals have had transmitters attached to the hair on their heads to enable tracking

methods. So monitoring must continue – at test sites and at sea. The marine [energy] industry is not viable unless it can carry these costs."

No seal appears to have been injured by the turbines, fishing boats, yachts or the Portaferry-Strangford ferry, which makes 64 crossings per day.

But common seal numbers around Britain are 30-40 per cent down in a decade, so just one turbine-related death would be serious for tidal developers, because EU rules ban developments that pose new threats to endangered species.

ACTIVE SONAR TRACKS

St Andrews-based SMRU believes the solution could be the development of active sonar, as is already used to find undersea objects such as pipelines, in naval tracking and in ultrasound for expectant mothers. But none of the sonar kits currently in use offer all the features needed to monitor a tidal turbine. So SMRU and the Orkney-based European Marine Energy Centre (EMEC) are 'training' DT-X sonar technology from Seattle-based BioSonics, using 'spotter' sightings to corroborate and improve recognition.

This summer marine biologists will collect data on the swimming and diving behaviour of marine mammals. This will provide the basis for BioSonics' engineering staff to program their classification software to differentiate between swimming animals and other targets such as seaweed or submerged logs. They will use 'detection matrices' – software processes that try to classify moving blob on a sonar screen into categories such as 'marine mammal', 'debris', or 'seabird', based on factors such as its acoustic target strength, size, swimming speed and diving behaviour. It's hoped that this will allow the sonar to automatically detect and track animals in 3D around tidal turbines.

But Wright at turbine company MCT questions the utility of 'seal sonar'.

"Seals are high-order predators adapted to their environment, a bit like taxis in central London, which come within inches of passers-by but there are no body bags at the end of the day. Seals appear to understand the tidal turbines and if there is no measurable impact then no further mitigation – human monitoring or sonar – should be needed."

Jenny Norris from EMEC believes seal sonar will be helpful to those who believe seals aren't at risk from turbines at all.

"The sonar's primary use is to see what animals actually do near turbines. It's quite possible seals may be attracted, get close and then swim safely away, without any physical interaction," she says. "If devices are always shut down when animals are sighted, we will never know what seals do next. The sonar will help us find out and that's why it will probably trigger an alarm – not go for automatic shutdown."

An EU marine research project could help settle the issue. Equimar involves 61 scientists, developers, engineers and conservationists from 11 European countries finding ways to measure and compare tidal and wave-energy devices so governments can back the best models.

According to its Edinburgh-based coordinator, Dr David Ingram: "Early devices need extensive tests and test sites should be as highly instrumented as possible. But if tests demonstrate turbines have no measurable impact on sea mammals, then the monitoring and observation burden for future projects has to be much lower. If 'seal sonar' works, our protocols could require its use in test sites – sonar wouldn't then be needed for successfully tested devices at sea."

Wright may take some convincing: "Computers are not good at pattern recognition – I fear that if sonar is made compulsory for tidal turbines at sea it will cause shutdowns all the time. No human surveillance will be possible there. So monitoring will cause chaos when we deploy arrays of turbines to generate substantial tidal energy."

Professor Boyd concedes active sonar is sensitive to air bubbles in the water column and doesn't currently work as well near the surface. But since tidal devices are underwater, sonar is most accurate where seals might be in most danger of collision.

"I hope by next year, accurate sonar at £15,000 per turbine will be on the market ... for marine developers that isn't going to break the bank." ■