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THE GLOBE AND MAIL

'We don't know what's in the ocean'

With enhanced technology, the Ocean Tracking Network plans to tag hundreds of thousands of fish -- turning them into bio-probes that could unlock the mysteries of the sea. CHARLES MANDEL reports

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When marine biologist Ron O'Dor hauled in a 15-kilogram squid from the Sea of Cortez in Mexico this month, he knew he had a big one: The animal had been tagged by his team with a tiny electronic sensor that collects detailed data about squid movement -- a boon to understanding secretive cephalopod behaviour, as well as unlocking the larger mysteries of the world's oceans.

Overfishing and climate change are altering oceans and their fish populations, but scientists aren't certain to what extent. Tagging will provide vital data for restoring balance to the challenged environment.

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Until now, much of the sea has been like a vast black box where fish simply disappear. As David Welch, a marine scientist who works with Dr. O'Dor, puts it: "We've had absolutely no technical ability to understand where [fish] go, how fast, where they die, and yet we're supposed to be managing these populations, whether it's cod on the East Coast or salmon on the West."

But using newly enhanced tagging technology, the Ocean Tracking Network aims to change all that. Announced in June by Dr. O'Dor and 35 other scientists, the OTN is a groundbreaking $150-million proposal to tag tens of thousands of fish across 14 ocean regions. The goal: to transform the world's marine life into bio-probes that will reveal the secrets of the sea and revolutionize fisheries management over the next five to 10 years.

While this may sound ambitious, in an OTN pilot project, Stanford University professor Barbara Block used similar technology to track yellowfin tunas diving 60 times daily to a depth as great as 1,000 metres. The tags deliver data on the fish's migration and diving behaviour, allowing researchers to make valuable comparisons with bluefin tuna and how the survival strategies and habitats of the two fish differ.

"We've quickly learned the animals are very good oceanographers," Prof. Block says. "They're going to a lot of interesting places that instruments we put out as humans don't go. They become what I call autonomous ocean critters instead of autonomous ocean vehicles."

Projects putting fish to work have become increasingly vital. According to the Washington, D.C.-based Census of Marine Life, which is spearheading the OTN proposal, as many as one million species of higher organisms in the oceans have never been described in scientifically peer-reviewed papers or officially recognized in zoological literature -- just one indication of how little is known about the animals inhabiting the waters.

At the same time, scientists contend that 90 per cent of the world's large fish are gone as the result of industrial overfishing globally. Overfishing and climate change are altering the oceans and their populations, but scientists aren't certain to what extent. Tagging will provide new information that could help them restore balance to the challenged environment.

"We don't know what's in the ocean," Dr. O'Dor says. "Everything is changing. We depend more and more on protein from the ocean to feed people and we depend on the ocean as a source of oxygen. There's a whole lot of what we call essential services, ecosystem services, that come from the ocean. We just feel the time had to be now."

Researchers on seven continents taking part in the OTN agree. Already, Chile, Japan, South Africa and Europe are interested in the project. And Spain and Morocco are willing to place a line of receivers to read data collected by tagged fish across the Strait of Gibraltar.

Ultimately, all of the network's participants believe the project will offer new value in terms of fisheries management, both for sustainable management and for conservation of at-risk species. Tagging will assist researchers in understanding where fish travel, providing countries with information that could help them do everything from allocating fish quotas to closing fisheries if necessary.

Now, Dr. O' Dor and his fellow scientists need to sell OTN to the Canada Foundation for Innovation, which will make a decision in December as to whether they'll provide $35-million to kick-start the program.

The seeds of OTN started with Dr. Welch, a marine scientist who runs a private consulting company. Inspired by low-voltage, low-current electronics of the sort used by cellphone companies, he and a team of scientists surgically implanted small acoustic tags into the abdominal cavities of salmon and placed what they call "acoustic curtains" -- soda-can-sized receivers -- in a line along the sea bed in 2001.

As salmon swam by acoustic curtains, data were picked from the tags implanted in their bellies, somewhat like a scanner at a grocery store picking up information from tagged packages as they pass through a checkout counter. To upload the information stored in acoustic curtains (including the direction and speed of the fish and the temperature and depth of the water), scientists simply had to position their boats nearby.

Early experiments with fish tagging proved so successful that last year the Pacific Ocean Shelf Tracking project led by Dr. Welch used the technology on 2,400 salmon along 1,750 kilometres from Oregon to north of the Alaska panhandle. And what the salmon are revealing about their behaviour will have a real impact on the management of fish stock. According to Dr. Welch, this is the first time that scientists have been able to accurately measure the survival rate of migrating salmon directly at sea.

Another pilot project proving the merits of tagging techniques is the Tagging of Pacific Pelagics. Started by a consortium of researchers from five California marine facilities in 2001, TOPP attached and implanted five-to-20-gram archival tags into bluefin tunas, leatherback turtles, elephant seals and albatrosses. These tags pop off and float to the surface at pre-set times, sending information about the animal's movements to a satellite. The drawback: tags then have to be collected by hand, leading some TOPP researchers to offer rewards up to $1,000 (U.S.) for their recovery (mainly by fishermen).

Despite the difficulties of this approach, however, Stanford University's Dr. Block says TOPP has tagged more than 2,000 animals so far -- including tuna, sharks,

whales, seals and turtles in the Atlantic and Pacific Oceans. Among the discoveries was that one tuna had crossed the Pacific three times, moving back and forth between California and Japan, in less than two years. Dr. O'Dor points out that without the tagging to properly track fish movement, management agencies would have counted this same tuna three times.

For the broader-scale Ocean Tracking Network, technologies from both pilot projects will be combined, creating a new form of tag. Overseen by Dr. O'Dor, a senior scientist at the Census for Marine Life, fish and marine life will be tracked with an archival tag that will send data to acoustic receivers rather than to satellites.

This will circumvent higher costs while making use of smaller technology that is more lightweight and capable of holding more information.

Tracking fish is not without risks to the species scientists hope to save. Tuna fishers are using similar devices to locate the animals for harvesting. TOPP has also learned not to post tracking data for certain species on-line, since it allowed fishermen to better hunt down endangered turtles.

Nonetheless, scientists believe the benefits of tracking sensors outweigh any dangers. "There's a lot we don't know," Dr. Block says. "The big story is the oceans are a bit of a mystery in the 21st century."

With tagging, researchers are now able to see "hot spots" where sea turtles, tunas and humpback whales gather. And they hope the data they are collecting will eventually explain why these places "light up" and become an area of interest or of increased habitation for the animals.

As for those who find it sad that one of the world's last unknown landscapes may soon give up its secrets?

Dr. O'Dor says, "With seven billion of us sharing the planet, we probably need to manage it, rather than imagining it's still mysterious."

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