Scientists worry about ocean energy's effect on sea-creature migration

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Without maps or GPS, great white sharks travel thousand of miles roundtrip from California to Hawaii or Australia to South Africa. Sea turtles hatched on the beaches of Florida travel the currents of the North Atlantic Gyre to Europe, Africa and South America before heading home.

And in one of the most mysterious and epic journeys of all, salmon from the streams and rivers of the Pacific Northwest head to sea and swim into the far reaches of the North Pacific before returning to spawn.

Scientists increasingly believe these marine creatures and others use the earth's magnetic fields to navigate vast distances.

But as the search for green energy turns to the oceans, there are concerns that tidal and wave-powered generators, and the cables that bring their electricity to shore, could interfere with the internal compasses of sea creatures.

The fear isn't that the fish and other marine life will get chewed up in revolving turbine blades or other machinery. It's that the generators and the cables to shore produce electromagnetic fields that could interfere with their natural guidance systems, which use the earth's magnetic fields. In addition, there are some worries the machines may produce a low-level hum that interfere with such marine mammals as whales.

"Before we put these power generating devices in the water, we need to

know how they will affect the marine environment," said Andrea Copping an oceanographer with Pacific Northwest National Laboratory's Marine Sciences Lab in Sequim, Wash.

Though the Europeans are far ahead, Copping said widespread commercial development of generating stations using tidal and wave power may be 10 years off in the United States.

Even so, projects have begun, and the Northwest has become a center for their development.

The Snohomish Public Utility District has received a $10 million grant from the federal Energy Department install two tidal turbines in Admiralty Inlet west of Whidbey Island in Puget Sound. The current through Admiralty Inlet can flow at up to 8 knots, or 9 miles per hour.

The 400-ton tidal turbines resemble fans and will sit on platforms 200 feet deep. The turbines will generate enough electricity to supply 700 homes.

Several years ago, Tacoma Power explored placing tidal generators in the Tacoma Narrows in southern Puget Sound. The Navy also has explored the possibility of placing generators in the Sound. Tacoma Power decided not to proceed with a pilot project, and the Navy project is on hold, Copping said.

Off the Oregon Coast, a company has a license to move forward with a commercial scale wave project, Copping said. The waves along the coast of Washington state and Oregon are considered among the best energy producing waves in the world as they roll in from the deep Pacific.

The Northwest Power Planning Council has estimated that wave-powered generators off the coasts of Washington State, Oregon and

northern California eventually could produce 50,000 megawatts of electricity, roughly the output of 50 nuclear power plants.

In addition to the Northwest, possible sites are being studied off Hawaii, in Alaska's Cook Inlet and off Florida and Maine. There is a study underway on installing hydrokinetic turbines in the Mississippi River near Baton Rouge, she said.

Along the shores of Puget Sound, Copping and her colleagues at the Marine Sciences Laboratory are trying to determine exactly what effect electro-magnetic fields may have on salmon, Dungeness crab, halibut and American lobsters.

"We picked EMF (electromagnetic fields) because there is no scientific literature," she said.

In the lab, two specially designed coils each containing 200 pounds of copper wiring have been wrapped inside what looks like window frames. When electricity is fed into the coils, an electro-magnetic field is created with a magnetic flux roughly the power of a small bar magnet. Aquarium tanks filled with marine species are placed near the coils and scientists study their reaction when the coil is energized.

Different marine species have different ways of detecting the earth's magnetic field to navigate and even to track prey.

Sharks have little black pores near their snouts that are filled with a conductive jelly-like substance and serve as external magnetic receptors, said Stephen Kajiura, an associate professor in the Department of Biological Sciences at Florida Atlantic University. Sharks can even determine when they are moving north and south or east and west. Rays have a similar detection system.

Turtles have magnetic receptors connected to their central nervous system.

"This mechanism allows them to have long ocean migrations in an environment where everything is blue, there are no landmarks and you can't tell east from west and north from south," Kajiura said.

Lobsters, crabs, tuna and other species are thought to have similar guidance systems.

Salmon may have some type of chemicals in their brains that detect the earth's magnetic fields, though Kajiura and Copping cautioned that more research is needed to be certain.

"We are not sure about salmon," Copping said. "No one has ever been able to show how they navigate back to their streams."

Kajiura has studied how underwater electric cables can affect a shark's behavior. The cables can create electromagnetic fields.

"Sharks will bite at them (the cables), thinking they are prey," he said. "It's not a new phenomenon. The cables may very well produce magnetic fields that could disrupt behavior."

Copping said some preliminary results from her lab's experiments should be available in the coming weeks.

"We won't have definitive answers, but we should know whether it is a problem or not," she said.

Both Copping and Kajiura said it was important to have some scientific answers to questions regulators are sure to ask.

"It's coming so fast, regulators are asking questions we don't have answers to," said Kajiura. "It would be nice to have some baseline research before we move ahead."

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