Ocean sound: The Oregon Coast rules when it comes to ambient noise

August 21 2013

Blue whale vocalizations are second loudest.

For more than a year, scientists at Oregon State University's Hatfield Marine Science Center deployed a hydrophone in 50 meters of water just off the coast of Newport, Ore., so they could listen to the natural and human-induced sounds emanating from the Pacific Ocean environment.

Their recently published analysis has a simple conclusion: It's really noisy out there.

There are ships, including container shipping traffic, commercial fishers and recreationalists. There are environmental sounds, from waves pounding the beach, to sounds generating by heavy winds. And there are biological sounds, especially the vocalizations of blue whales and fin whales. And not only is Oregon's ocean sound budget varied, it is quite robust.

"We recorded noise generated from local vessels during 66 percent of all hours during the course of a year," said Joe Haxel, an OSU doctoral student who is affiliated with both the Cooperative Institute for Marine Resources Studies (CIMRS) and NOAA's Pacific Marine Environmental Laboratory acoustics program at the Hatfield center. "In fact, there is an acoustic spike during the opening of the commercial crabbing season related to the high number of boats working the shallow coastal waters at the same time.

"But, at times, the biggest contributor to the low-frequency sound budget is from the surf breaking on the beach a few kilometers away," he added. "That's where Oregon trumps most other places. There haven't been a lot of studies targeting surf-generated sound and its effect on ambient noise levels in the coastal ocean, but the few that are out there show a lot less noise than we have. Our waves are off the charts."

The year-long study of noise, which was published in the *Journal of the Acoustical Society of America*, was supported by the Department of Energy, the Oregon Wave Energy Trust, NOAA and OSU.

The study is about more than scientific curiosity, researchers say. The research was carried out in support of OSU's Northwest National Marine Renewable Energy Center and will play an important role in determining

whether testing of wave energy devices off the Oregon coast may have environmental impacts.

Breaking surf tops the charts for noise.

Scientists must know what naturally occurring sounds exist, and at what levels, so when new sounds are introduced, there is some context for evaluating their intensity and impact.

Documenting marine noises for an entire year isn't easy, the researchers pointed out. First, the equipment must withstand the rugged Pacific Ocean, so the OSU researchers deployed the hydrophone near the seafloor in about 50 meters of water so violent winter storms wouldn't destroy the instrumentation. They focused on low-frequency sounds, where the majority of noise emitted by wave energy converters is expected to occur.

After combing through an entire year of data, they determined that Oregon's low-frequency noise budget is often dominated by the constant sounds of breaking surf. These weren't necessarily the loudest noises, though.

"The strongest signal we got during the course of the year came from a boat that drove right over our mooring," said Haxel, who is pursuing his doctorate through OSU's College of Earth, Ocean, and Atmospheric Sciences. "The second loudest sound came from the vocalizations of a blue whale, which can be incredibly loud. We were told by colleagues at the Marine Mammal Institute that blue whales have been sighted close to shore in recent years and it was probably within several kilometers of the hydrophone."

Haxel said the OSU researchers also recorded numerous vocalizations of fin whales and humpback whales, but a startling omission was that of gray whales, one of the most common West Coast whales.

"We didn't document a single gray whale sound during the entire year, which was really surprising," Haxel said. "Even during times when gray whales were visually sighted from shore within close proximity of the hydrophone, we never recorded any vocalizations. One theory is that they are trying to keep as quiet as possible so they don't give away their location to orcas, which target their calves."

Another unusual source of noise was the wind. Even at 50 meters below the surface, the hydrophone picked up sound from the wind – but not in the way one might think. It wasn't the howling of the wind that was noticeable, Haxel said, but the ensuing waves, known as "whitecaps" or "wind chop," and the clouds of bubbles that were injected into the water column.

Haxel compared his data on Oregon sounds to a handful of studies in the literature associated with high-energy environmental conditions to see how the region fared. All of the other studies were limited: a Monterey Bay, Calif., survey focused only on surf noises. A study off the Florida coast examined wind-generated sounds. And a study of the Scotia Shelf in Canada looked at wind and surf.

Oregon noise levels were similar to other regions for frequencies above 100 Hz, Haxel said, but rose sharply for frequencies affected by surf-generated noise – generally below 100 Hz.

"The bottom line is that the Pacific Ocean in the Northwest can be a remarkably loud environment and our wave climate in particular is amazing," Haxel said. "That's why wave energy is being targeted for this region in the first place. The study will provide some valuable information as the wave energy industry goes forward.

"We will be able to measure noise levels from the testing, or even the loading and unloading of equipment from the vessels, and compare those measurements with the range of background ambient sound levels already occurring in the area," he added.

"It is a balancing act as some noise from the testing sites may serve as a warning signal for whales and other animals to avoid the area, helping to reduce the risk for collision or entanglement," Haxel said. "But adding too much noise can be harmful, disrupting their communication or navigation."

More information: Sound file of breaking surf: oregonstate.edu/dept/ncs/media/wave-breaking.wav
Sound file of boat motors: oregonstate.edu/dept/ncs/media/boat-noise.wav

Provided by Oregon State University

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