

Biologists discover deep-sea fish living where there is virtually no oxygen

January 18 2019, by Kim Fulton-Bennett



Cusk eels such as this one seem to prefer seafloor areas where oxygen concentrations are extremely low. Credit: MBARI

Oxygen—it's a basic necessity for animal life. But marine biologists recently discovered large schools of fishes living in the dark depths of the Gulf of California where there is virtually no oxygen. Using an underwater robot, the scientists observed these fishes thriving in low-oxygen conditions that would be deadly to most other fish. This discovery could help scientists understand how other marine animals

might cope with ongoing changes in the chemistry of the ocean.

The researchers described their discovery in a recent article in the journal *Ecology*. The lead author of the article, Natalya Gallo, is a graduate student at the Scripps Institution of Oceanography. She worked closely with other Scripps researchers on the paper, as well as with MBARI biologist Jim Barry, who led the research cruise.

In 2015, Barry, Gallo, and eight other researchers conducted a series of dives in several deep ocean basins in the Gulf of California using MBARI's remotely operated vehicle (ROV) Doc Ricketts—a state-of-the-art underwater robot. Gallo was particularly interested in these areas because her Ph.D. thesis focuses on animals that live in very [low-oxygen environments](#). The deep waters of the Gulf of California have some of the most extreme low-[oxygen](#) habitats in the world.

"I could hardly believe my eyes," Gallo wrote in MBARI's cruise blog following an ROV dive in the Cerralvo Trough. "We observed cusk eels, grenadiers, and lollipop sharks actively swimming around in areas where the [oxygen concentration](#) was less than one percent of typical surface oxygen concentrations. We were in a suboxic habitat, which should exclude [fish](#), but instead there were hundreds of fish. I immediately knew this was something special that challenged our existing understanding of the limits of hypoxia [low-oxygen] tolerance."



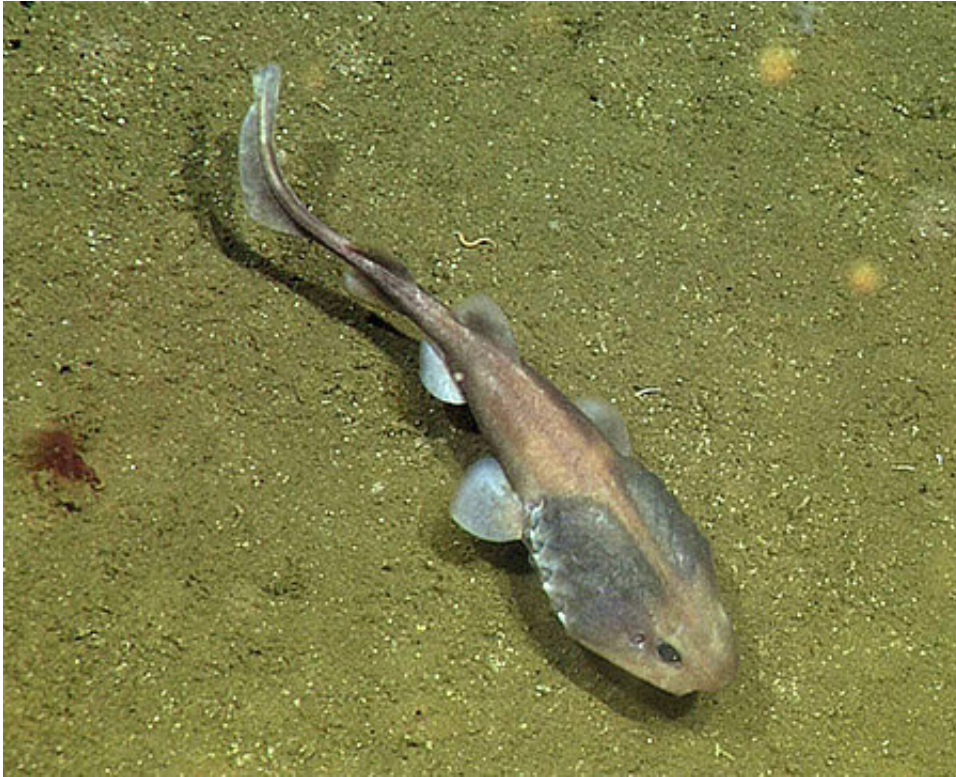
Cusk eels, lollipop sharks, and grenadiers congregate on the seafloor in the Gulf of California. Credit: MBARI

In fact, instruments on the ROV showed that these fish were living in an environment where oxygen concentrations were one-tenth to one-fortieth as low as those tolerated by other low-oxygen fish. In fact, two species of fish—cusk eels and lollipop sharks—seemed to prefer these low-oxygen areas over areas where oxygen concentrations were higher.

"Many other types of fish are considered tolerant of [low-oxygen conditions](#)," Barry commented. "But the fish in these parts of the Gulf are like the winners among a group of elite Olympic athletes."

One of Barry's goals of the cruise was to use the large natural variations in oxygen and temperature found in the Gulf to study how seafloor animal communities might change in response to warmer and reduced-

oxygen conditions that have been predicted by some climate models



Lollipop sharks have large heads and gills, which may help them absorb oxygen in low-oxygen environments. Credit: MBARI

The researchers still don't know exactly how these fish are able to survive, and even thrive, under such harsh conditions. Both the cusk eels and cat sharks have large heads with vibrant red gills, which may be particularly good at absorbing oxygen from the surrounding water. The fish are also small—less than 30 centimeters (one foot) long—with soft flabby bodies and thin, weakly developed bones—all traits that might help them conserve energy.

Why the fish congregate in these particular areas is another mystery.

Barry speculates that they might be finding food or avoiding predators. In some low-oxygen areas the researchers saw snails, sea stars, and sea pens on the seafloor. But in the lowest-oxygen areas, the muddy seafloor looked like a barren moonscape, suggesting that even small invertebrates had a hard time surviving.

"We hope to go back to the Gulf soon to try and address some of these questions," Barry said.



Graduate student Natalya Gallo holds a lollipop shark that researchers collected in the Gulf of California. Credit: MBARI

More information: Natalya D. Gallo et al. Home sweet suboxic home: remarkable hypoxia tolerance in two demersal fish species in the Gulf of California, *Ecology* (2018). [DOI: 10.1002/ecy.2539](https://doi.org/10.1002/ecy.2539)

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