

# Here's why shark researchers are concerned about a potential COVID-19 vaccine

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Science's steady march to find a vaccine capable of ending the coronavirus pandemic may come at the expense of another species: sharks.

Miami shark researchers say they're concerned about a key ingredient used to make vaccines more effective, squalene—an oily substance found in plants and even human skin—but is particularly concentrated in shark livers.

The practice of using shark-derived squalene as a booster to stimulate a stronger immune response to a [vaccine](#) is not unique to the coronavirus vaccine. The compound has been shown to be safe and effective in millions of doses of vaccines, primarily in Europe, said Liza Merly, a shark immunologist at the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

"We don't exactly know what it is about this oil that allows that to work the way it does," Merly said.

But squalene in vaccines has been shown to create more robust immune responses, and there are a handful of COVID-19 vaccine candidates that use it for that purpose, most of them partnered with GlaxoSmithKline, which manufactures a squalene-derived component for vaccines.

If one of the vaccine candidates using that component proves to be effective, it could create a [global demand](#) for squalene that might threaten wild shark populations, according to Shark Allies, a nonprofit dedicated to protecting wild sharks.

The nonprofit produced a crude estimate: It would take about 500,000 sharks to produce squalene for the billions of vaccine doses needed to inoculate everyone on the planet twice. That spurred international headlines and prompted push back from GSK, which has argued that the estimate is far too high. But the company has declined to identify the source of its squalene, other than to say that it's harvested from sharks that were fished for other purposes, and that is what worries shark experts.

Catherine Macdonald, a marine conservation biologist and ecologist at UM's Rosenstiel School, calculated a more advanced estimate and arrived at a slightly lower projection of 360,000 sharks needed to produce enough squalene to power the billions of vaccine doses.

But Macdonald said the number matters less than the lack of transparency in the shark-fishing industry, which is under-regulated. Shark fishing has been known to harm wild populations, Macdonald said, primarily in search of fins, but also while hunting for squalene, which is commonly used in cosmetics.

A sudden spike in squalene demand would be a significant concern, she said, in part because the liver oil is more abundant in deep sea sharks that are vulnerable to overfishing.

Though GSK says it's using sharks that were fished for other purposes, Macdonald said "asking for greater supply chain transparency is still a reasonable thing to do."

"Some fisheries associated with squalene production are targeting deep sea sharks," Macdonald said. " ... We know that deep sea environments are evolved with very low natural levels of disturbance, so any time we are having meaningful effects on deep sea populations, we know less about them, and we're less able to detect the effects we're having."

## **Why sharks?**

Though squalene is plentiful in the natural world, sharks are a favored target for industries because it doesn't take much effort to purify the substance out of shark livers.

"It's easier and cheaper than if you wanted to get squalene from, say, olive oil," said Merly, who did her doctoral work on the medicinal value,

or lack thereof, of shark cartilage.

As part of her research, Merly discovered a wide-ranging realm of products that are derived from sharks.

"That's why I know squalene so well," she said. "But if you try to find out from these companies how they source these things, they are really reticent to tell you."

There are sustainable ways to harvest squalene from sharks, Merly said, such as taking it from dogfish sharks, which are actively fished and managed. Those methods have less of an environmental impact than other shark species that are less abundant and targeted for squalene.

Merly said Scandinavian countries, in particular, have been known to fish for deep water sharks in order to obtain squalene. And Macdonald, the other UM shark researcher, said DNA from threatened shark species has been identified in cosmetic products using squalene, including products that claimed to be vegan.

Squalene is used in a wide range of cosmetics and skin care products, such as moisturizers, lipsticks, sunscreens, bath oils, foundations, eye makeup, body creams, etc.

Because of the lack of transparency in the supply chain, Merly said, "you don't want to incentivize or add value to a dead shark if you don't have to."

"Shark cartilage has no value for human medicine, so it's a bad thing," Merly said. "In the case of squalene, it's a little more complicated, because there is the potential for it to be useful in human medicine."

## **Finding an alternative**

The initial controversy over whether shark-derived squalene in COVID vaccines would result in the slaughter of half a million [sharks](#) did miss the nuance of the situation, said Stefanie Brendl, the founder and executive director of Shark Allies, the group that produced the estimate that led to the news coverage.

Brendl said she was hesitant to have Shark Allies weigh in on shark-derived squalene because she didn't want to be seen as calling a crucial public health need into question. But the organization, Brendl said, needed to "get ahead of a problem which could potentially take us in a really bad direction."

"Is this a hill we want to die on? Do we want to fight COVID vaccines when we have so many other problems? No," Brendl said. "But we don't want it to turn into another hill."

Brendl's group has identified Amyris, a company that manufactures a plant-derived squalene component for vaccines that would be regulated in the same way as shark-derived squalene by the U.S. Food and Drug Administration, as a potential alternative to shark-derived products.

"We've tried to chip away at every excuse: It's not different, it's just as available, and with plants, you can grow it at whatever scale you want to grow it—it's a secure supply chain," Brendl said.

While GSK has maintained that the amount of squalene it would need to manufacture COVID vaccine doses is a "very small proportion of the animal-derived squalene used worldwide," it also said it is "actively exploring the potential for alternative sources of its raw materials when possible."

"These efforts include exploration of non-animal-derived sources of squalene for future use in the ... manufacturing process," the company

said in a statement.

Macdonald acknowledged that she is not a vaccine expert but said she's found no compelling reason why pharmaceutical companies can't switch to plant-derived squalene, which she said is still low-cost, just as effective, and presents no additional regulatory hurdles.

Given the threats to marine environments from deep sea ocean ecosystems to Biscayne Bay, Macdonald said plant-derived [squalene](#) was a cause that should be easy to get behind.

"There aren't that many times where I can look at a marine conservation problem and say, 'Actually, this looks very solvable,'" she said.

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