Scientist learns population size of scallops affects fertilization success

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Credit: University of Maine

Scallop gonads may seem like fun and games to Skylar Bayer given that her missing samples landed her on "The Colbert Report" in 2013.

But scallops are no laughing matter to Bayer.

"When I was deciding on a Ph.D. project to pursue, I chose to work on a

species that is commercially important and relevant to people's daily life," says Bayer, who is based at the University of Maine Darling Marine Center in Walpole.

"Giant sea scallops in Maine seemed extraordinarily relevant."

In 2015, Maine fishermen brought in 452,672 pounds of scallop meat valued at $12.70 per pound—the highest in years. But scallops haven't always done well in Maine and beyond.

In the 1990s, after huge reductions in multiple fishery landings, including giant sea scallops, NOAA regulators instituted large fishing closures to try to bolster groundfish stocks.

After four years, scallop stocks had increased 14 times what they were prior to the closure. Seeking a similar success story, Maine followed suit in 2009 and instituted a three-year scallop fishing closure.

It's theorized that fishing closures work because the lack of fishing activity over time allows a population of animals in the area to grow in size and reproduce. For many marine organisms, Bayer says proximity is required to successfully reproduce.

And while it's a great theory, Bayer says it can be tough to demonstrate that's why a closure is successful.

"Knowing the mechanism behind a closure can be really important to making decisions about closure location and creating effective management policy," Bayer says, "and part of my research is trying to figure out what that mechanism may be for scallops."

Scallops are broadcast spawners—meaning they release sperm and eggs into the water column to meet and produce the next generation of

scallops. But sperm and egg cells can be quickly lost in currents before they meet each other.

This, says Bayer, is why reducing distance between neighbors may be important for successful reproduction. Her Ph.D. research the last five years has focused on how population size and nearest neighbor distance (or population density) in scallops affect the percentage of eggs fertilized, or fertilization success.

To learn more, she developed a way to measure fertilization success in scallops in the field, which is no easy matter. Getting giant sea scallops to spawn relatively on cue is difficult, and Bayer says it requires more than Barry White music and mood lighting.

"I think of it a bit like war; you have long periods of boredom and intense periods of panic and activity," she says.

Once female scallops start to spawn, the released eggs become less viable over time and less likely to get fertilized at all.

"It's very stressful, but it's also a bit of a rush. Scallops only spawn for maybe a few weeks, sometimes less, in the summer and if we miss that window, that's it, we have to wait another 12 months to get any data."

Bayer had only eight hours from the start of a spawn to when eggs became nonviable. With the help of lab mates, she collected eggs, piped them into chambers covered in mesh, prepared the boat, then deployed the chambers in the 19-mile long Damariscotta River estuary.

In addition, she had to simultaneously run her laboratory experiments or conduct them on days when there weren't enough eggs for a deployment.

"I'm very grateful to the help I received from my lab mates. I don't think

we could've done what we did without a well-coordinated team like we had at the time," says Bayer.

The field experiments—which included scallops of varying population sizes hanging in nets—were set up under docks of cooperative property owners, including Bigelow Laboratories for Ocean Sciences in East Boothbay.

The little mesh chambers filled with eggs collected from females in the lab were hung next to these different populations of scallops, in hopes that males might be spawning and fertilize the eggs in the chambers.

The mesh allowed sperm to enter and fertilize the eggs while still keeping the eggs within the chamber. When the chambers were collected, Bayer counted hundreds of eggs to calculate what percentage had been fertilized.

Bayer says results of the net experiments showed that population size did affect fertilization success—meaning the more scallops in the net, the higher the average percentage of eggs fertilized. Her initial paper on the research —"Measuring scallop fertilization success in the field: chamber design and tests"— was published in June in *Marine Ecology Progress Series*.

Other DMC scientists who took part in the research include Bayer's adviser Richard Wahle, as well as Damian Brady and Pete Jumars.

This is the first of several papers on the topic she plans to submit for publication. "Scallops don't live in nets, they live on the seafloor," Bayer says, adding the next paper will reflect even more realistic conditions.

Bayer says hers is the first published research about measuring fertilization success in giant sea scallops. And while it seems obvious the

meeting of sperm and egg is important to understanding population growth, she says there's much more to learn.

So, the so-called "lonely lady scientist" featured on "The Colbert Report" continues to make it her professional mission to unravel mysteries of how sperm and egg successfully meet.

Provided by University of Maine