

Students Pursue One of the Ocean's Slimy Mysteries

By Carey Goldberg

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Not even a mother could love a hagfish. Eyeless, gray-pink and sinuous, hagfish look and writhe like overgrown earthworms. They are known to enter other fish through their mouths or digestive tracts and eat them from the inside out. And when stressed, they exude gobs of transparent slime, which is why they are also known as slime eels, or worse.

But Prof. Stacia A. Sower and her ocean technology students at the University of New Hampshire see in the humble and hideous hagfish possibilities for a bit of scientific glory, and maybe even riches. Not to mention environmental good works.

Because the hagfish, considered the most primitive of vertebrates, holds a mystery so tantalizing that in its time, a reward was even offered for its solution. And the goal of Dr. Sower's group -- to obtain a fertilized hagfish egg -- has not been attained by anyone for more than 100 years.

As Dr. Sower, a professor of biochemistry and molecular biology, heard the tale, in the mid-19th century the Royal Danish Academy of Sciences and Letters promised a gold bar to anyone who could unravel hagfish breeding behavior.

The current chief of the academy's secretariat, Pia Gruner, says the 1862 offer of the prize, which was actually a gold medal, has expired. It expired, in fact, in 1865. But no one ever claimed it, and the prize still lives, in legend at least; a 1997 issue of Canadian Sport Fishing magazine mentioned it, and others in the field say they have heard of it.

In any case, no added incentive seemed necessary for the dozen enthusiastic students who recently went on the slimiest of all possible field trips: a voyage out to the waters 20 miles off New Hampshire to capture hagfish in the 100-yard depths where they coil in the soft ocean bottom.

"Agh! I got slime all over my face!" one cried, and "Yew! It's on my ear!" complained another, as they examined the hagfish they had caught and found their gloves dripping with viscous goo.

"The slime was disgusting," said Nina Maggio, a junior, afterward. "It was cool, though."

Their plan: catch a few dozen hagfish in some Greek pickle barrels reconfigured into traps that let the fish in but not out. Leave some in the barrels to see if they breed there, but bring most back to the laboratory. After a few weeks, inject both groups with a hormone to try to stimulate them to breed.

Others have tried and failed to obtain fertilized hagfish eggs, Dr. Sower said, but she believes she has an advantage: she and her colleagues identified the type of gonadotropin-releasing hormone, a hormone that stimulates breeding, that works in hagfish. They published their finding a couple of years ago.

She can now synthesize the hormone in the laboratory, and hopes it will overcome past failures to get hagfish to breed in captivity. She and her students, under three team leaders who really did not seem to mind the slime at all, plan to start injecting the hagfish next month.

In addition, Dr. Sower has some money to bolster her efforts: a \$180,000 Sea Grant, of which half goes to the university and half to her research group. Dr. Sower, a neuroendocrinologist whose main specialty is lampreys, also sometimes supplements her research with her own money, she said, because grants can be so hard to get. Hagfish are not exactly charismatic.

They are also hard to study: they like to live in the deep and do not thrive well in sea-level laboratories.

So, aside from the dusty legend of a prize, why bother with hagfish? For Dr. Sower's students, it is a learning experience: their endeavor is meant to teach them the process of ocean-related research, from working in a team to defining the problem, preparing a budget, designing the project, gathering and analyzing the data and reporting their results at the end.

Dr. Sower has some other goals as well. Disgusting as they are, hagfish are increasingly sought by commercial fishermen, because they can be made into the butter-smooth "eel skin" wallets and belts found in leather stores. Demand has reached the point that they have been largely fished out off Korea and Japan, and overfished on the West Coast of the United States.

On the East Coast, where hagfish harvesting began in 1992, the hagfish catch amounts to more than two and a half tons per year off Massachusetts and Maine, bringing in more than \$1 million, and it is largely unregulated. (In fact, most hagfish are caught inadvertently, when they show up uninvited in nets. Fishermen tell tales of their disgust when a plump choice fish they have just caught turns out to be a hollow shell, and an unwelcome hagfish slithers out of it.)

Dr. Sower's work is aimed in part at giving regulators a better understanding of hagfish habits, so they can figure out how best to control the catch and conserve the fish. It is important, she said, to understand such issues as: How old are hagfish when they reach sexual maturity? How often do they reproduce? What in the environment could perturb their reproduction?

She first made some unsuccessful stabs at the elusive hagfish reproductive system about 20 years ago, when she was doing postdoctoral work with Dr. Aubrey Gorbman, now an emeritus professor of zoology at the University of Washington.

Dr. Gorbman said he had been on several dives in small submersibles trying to get hagfish eggs over the years, but "there isn't much you can see down there."

"The only fertilized eggs ever obtained were obtained over 100 years ago in Monterey, Calif., and no one's succeeded in getting any since then," he said. That was back in 1896, he said, when a Columbia professor hired most of the Chinese fishing community in Monterey to fish for much of the summer, and they brought up hagfish slime from the bottom that happened to have fertilized eggs in it.

"But no one's been able to duplicate that success in 100 years," he said.

Dr. Gorbman said that though the time limit on the Danish prize had run out, that did not matter. "When you're working in science, it's not a race, really," he said. "If you're interested in the evolution of the reproductive mechanism, which is what this is about, then you've added a chapter, and a very important chapter, on the very beginning of all the vertebrate animals."

And though hagfish may look ugly to most, "You can learn to love them," he said. That is, he added, "If you're similarly inclined."

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