Cancer to the Rescue?

A potential solution to invasive mussels

The wording of this article has been adjusted to a 7-8th grade reading level. Andrea Barbknecht of the Wyoming Wildlife Federation made the revisions as part of the organization's curricula to engage kids in exploring their Wyoming landscape.

The original article, written by Kristen Pope for Western Confluence *magazine, can be found here.*

By Kristen Pope (May 2020)

One hundred thousand quagga mussels can live on a single square-meter surface. Four hundred fifty trillion of them infest Lake Michigan alone. Quagga and closely related zebra mussels spread quickly. They damage ecosystems, reduce water quality, and lead to **algal blooms**. They also clog boat motors, irrigation systems, and **hydropower** facilities. These mussels consume massive amounts of **plankton**, which means less food for the rest of the **food web**. Their sharp shells rip up beachgoers' feet. They have had large impacts in the Great Lakes, and they are moving west.

Scientists first found quagga mussels in Lake Mead, Nevada, in 2007. Now the species are common in Lake Mead and Lake Mohave and found in other lakes and rivers. Once the mussels invade a lake or river, there is no way for managers to get rid of them without killing other species.

Officials are on the hunt for solutions. Currently, most efforts focus on preventing mussels from invading. Researchers are also looking for solutions to remove infestations. In 2018, the Bureau of Reclamation held a prize competition that offered $100,000 for the best solution to removing zebra and quagga mussels. Good solutions don't kill other species or ruin the environment and don't cost too much. The winning solution is a bit of a wild idea.

Zebra and quagga mussels come from eastern Europe. Predators there eat them and keep their populations low. In the 1980s, some mussels were carried to the Great Lakes in **ballast water**. They now live in many areas of the eastern US and are spreading west.

Mussels are small shellfish that attach to surfaces.

"Reclamation is really concerned about the mussels," say Bureau of Reclamation biologist Sherri Purcell. She describes how the mussels are special because they can attach to underwater structures. The

mussels form a layer that clogs pipes and disrupts power plant operation.

The chemical Zequanox kills up to 90 percent of invasive mussels according to Beth Bear, a Wyoming Game and Fish employee. Mussels have not yet been found in Wyoming. Ninety percent may not be good enough though. “Ninety percent helps, but there are still so many of them that we really need something close to 100 percent,” Bear says. She also points out that it is hard to treat big lakes and other areas and species might be hurt by the chemical moving in the water.

To address this enormous problem, the Bureau of Reclamation offered a prize to help find a solution. Over 100 teams submitted entries. The judging panel reviewed 67. Steven Suhr and Marie-Claude Senut of Biomilab received the top $80,000 prize. The winning entry proposed a controversial solution. Their solution was to create a **cancer** in the laboratory that killed mussels and could be spread between individuals. There were also runner-up proposals. Wen Chen received $10,000 for his idea to keep the mussels from attaching to surfaces. The team of Absar Alum and Stephanie Bone also received $10,000 for their idea to change mussel **genes** so the eggs would die in the sunlight.

Suhr and Senut are both **molecular biologists**. They came up with their idea based on a type of cancer that can spread between dogs. A similar cancer is threatening populations of Tasmanian devils in Australia. When the team heard of a version of the disease in other shellfish,

A mussel shell.

they decided to investigate. Their work was

to explore whether a similar disease could wipe out zebra and quagga mussels.

Their solution is only an idea for now. Suhr explains that it is weird to try to use cancer rather than trying to prevent it.

Before releasing a disease into the wild, a number of steps must take place. First, they will need to collect invasive mussel cells and grow them in a lab. The cells must not be contaminated with any **bacteria** or **fungi**. Second, they will mutate a gene called P53 which controls cell division. They chose this gene because many forms of cancer are caused by too much cell division. The changed genes would affect the individual but could not be passed by reproduction to their offspring. Next, they will expose live mussels in the laboratory to the modified cells. This step will test whether the mussels can pass the cancer and whether it kills them. They must also test to make sure the cancer does not harm other organisms. Finally, if the idea works in the lab, regulatory agencies will study the plan. They need to make sure the plan is safe and effective before allowing any experiments in the wild.

Extreme caution is required since no experiment is foolproof. Any solution could have unexpected consequences when used in an ecosystem. When we change genes, one possible problem is that the changed genes could spread to other species. Also, if the cancer was spread to Europe, it could kill **native** zebra and quagga mussels. “It takes time to develop because you also have to be careful with it,” Suhr says. He says their idea will take four years of work in the lab. It might be ten years before their idea would be ready to try in a whole ecosystem.

Suhr explains that many people worry about releasing diseases, because they don’t want to hurt local shellfish or other organisms. “So, there is going to have to be a lot of testing in advance,” he says.

While it seems like a wild idea to use cancer to kill an invasive species, Suhr says sometimes the wild card option is the best one. He thinks that the problem of killing all zebra and quagga mussels in an ecosystem is so big, the crazy ideas might be best.

Glossary

Algal blooms Overgrowth of algae, plant-like microscopic organisms

Hydropower Using water to generate electricity

Plankton Tiny plant-like and animal-like organisms that drift in water

Food web All of the relationships in an ecosystem based on who eats who

Ballast water Water let into or out of the bottom of a ship to help keep it stable in the water

Cancer A disease caused by uncontrolled division of cells

Genes The sequence of DNA that codes for a trait

Molecular biologists Scientists that study the molecules that are important for life

Bacteria A member of a large group of unicellular microorganisms

Fungus Any of a group of spore-producing organisms that feed on organic matter, including molds and yeasts

Native Organisms that normally belong in a particular ecosystem