Bay Journal

Turns out that when the going got tough, Bay's oysters got tougher

Faced with MSX threat, dermo became more deadly while oysters shifted their spawning to resist both.

- Karl Blankenship May 30, 2014 modified by Janel McPhillips for readability

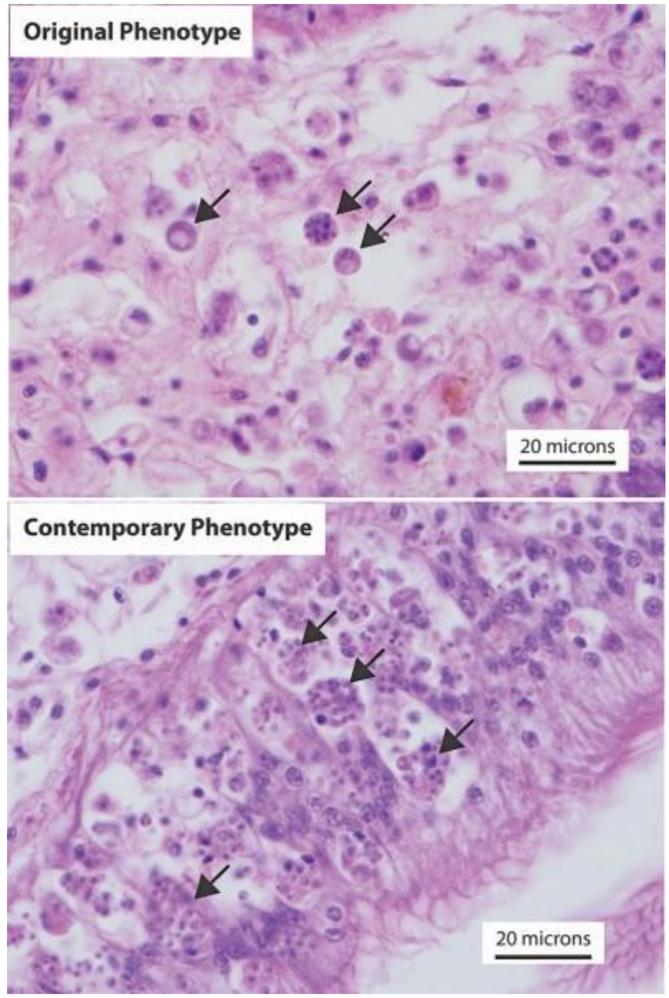
VIMS researchers wash, sort and classify dredged-up oyster shells. One of the organisms dredged up with the oysters is redbeard sponge. (Virginia Institute of Marine Science)

Not long ago, Ryan Carnegie decided to take a look at some old samples of the oyster parasite dermo. These samples had been archived for decades at the Virginia Institute of Marine Science.

What the shellfish pathologist saw when he peered at dermo through the microscope may change the way people look at oyster disease in the Chesapeake Bay.

"The first sample I looked at was like, 'Wow, this is not our dermo,'" Carnegie recalled.

Dermo cells collected from oysters in the 1960s were a great deal larger than those found today. Also, there were fewer parasites.



A new theory about this change suggests that the native parasite, dermo, "won" the battle against the nonnative parasite, MSX. Dermo then became the Bay's primary oyster parasite. Dermo "won" the battle after it changed to become much more deadly to the native oyster.

At the same time, oysters may be adapting to the disease. It seems they may be reducing their period of spawning but still increasing reproductive success. That's a risky strategy, but over the last decade it has resulted in more young oysters being added into the population. This has created a small population rebound from historic lows.

If correct the theory suggest that both the diseases, and the oysters, have adapted to changes. The oysters and diseases have changed more quickly and in ways few would have predicted.

Researchers caution that the data is drawn mostly from Virginia. It might be that some of their conclusions will not hold for Maryland. The disease might behave differently because of lower-salinity water.

Oysters, and the towering reefs they built, were once a major features of the Chesapeake. But overharvesting in the late 1800s and early 1900s destroyed their habitat and reduced their numbers.

By the mid-1900s, they faced the added challenge posed by two parasites.

Dermo has long been present in the lower Chesapeake. There it was found at low levels and with low rates of mortality. When dermo killed oysters, it usually took years to do so.

Then, in the 1950s, MSX, a new parasite from Asia, suddenly emerged. It was first detected in Delaware Bay. It quickly began killing huge numbers of oysters there. In 1959 it reached the Chesapeake.

MSX thrived in high salinity Virginia waters. There it killed more than 90 percent of the oysters on many reefs. MSX killed them quickly, often within a few months.

Both MSX and dermo like warm water and high salinities. Dermo can survive in lower salinities than MSX. So the disease situation got worse in the mid-1980s when warm, dry years increased salinities. This increase allowed the diseases to reach many of Maryland's reefs.

Oyster populations dropped to less than 1 percent of historic levels. Harvests collapsed. Oysters that once lived 6–8 years struggled to survive the 2–3 years it took to reach the 3-inch market size.

Many watermen, fishery managers and scientists began calling for introducing a nonnative oyster that could withstand the diseases. In meetings, the native oyster was sometimes called a "wimp."

That's where the change Carnegie saw under the microscope comes in.

Carnegie believes the reason the oyster situation looked so poor in the Bay was because dermo changed. In the 1960s and '70s, MSX was the Bay's primary killer. It often killed oysters before dermo could even be detected. But in the 1980s, dermo also became a major killer.

Scientists at the time thought warmer, saltier conditions allowed dermo to become more deadly. But Carnegie's new look at the archived dermo samples tells a different story.

The parasite physically changed its appearance at about that time. It became about a third smaller and much more numerous in samples observed under the microscope.

Carnegie believes dermo changed both its appearance and became more deadly because of competition with MSX.

He points to several pieces of evidence that suggest dermo began behaving differently.

In the 1960s, populations of dermo in Virginia oysters were mainly found in the connective tissue of the oysters. Dermo was released into the water when the bivalve died. Infections were limited to nearby oysters.

Because of MSX, most oysters died before large concentrations of dermo could build up and be released. Dermo changed in the 1980s to infect the oyster's gut. Dermo was then more likely to be released with feces. This allows parasites to escape quickly and find other hosts.

A parasite doesn't want to kill its host because that threatens the parasite, too. Dermo, a parasite that evolved with the native oyster, originally acted the way one would expect: If it killed, it did so slowly.

MSX didn't co-evolve with the native oyster. This meant oysters had no defense against MSX. Oysters died in huge numbers from MSX infections. Oysters being killed by MSX posed a threat to dermo, which needs oysters as hosts.

Dermo had to adapt or vanish from the Bay. The result, Carnegie said, was that MSX forced dermo parasites to select toward a more deadly parasite.

MSX, has largely left the Bay as a major killer. Infections mainly turn up in young oysters, or in low-salinity areas. An infection is most likely to occur where oysters are not routinely exposed to MSX. But dermo remains widespread.

The parasites' attack may have helped produce a more robust oyster. In Virginia, infection levels of dermo have remained the same since the 1980s. Mortality caused by the parasite in Virginia has decreased from about 70 percent to 15–20 percent a year. "There are still high levels of infections, but the oysters are tolerating them better than they were," Carnegie said.

Virginia monitoring data hints that oysters may also be adapting to disease pressure through a significant change in spawning over the last decade. Data compiled by Mann from the James, Piankatank and Great Wicomico rivers show that oysters are spawning much earlier than in 2000.

The fall oyster surveys find larger oyster spat. Finding larger spat indicates that they've had more time to grow. A decade ago, a large spat in the survey was about 25 millimeters. Now, 35–40 mm spat are common.

"This is an enormous change in a 10-year period," Mann said.

The reason, Mann believes, is dermo. Oysters historically spawned from spring to fall. With some of the largest spawns taking place later in the season. But that's also the time when dermo infections reach their peak. Several studies show that oysters produce significantly fewer larvae when battling infections.

By breeding earlier, the oysters are producing more offspring. In fact, the amount of larvae produced early in the year today is about the same as was produced by similar size oysters in the early 1900s, Mann said.

Earlier reproduction has another benefit, he said. The oysters are larger the next spring, giving them protection from predators such as blue crabs.

The change connects with a period of increased reproductive success and an increasing number of oysters.

Decreasing the time when oysters spawn also means they spawn less often. "In the 1980s, we would record as many as five recruitment events per year in these oysters," Mann said. "Now, rarely do we see evidence of more than two."

While that appears to have paid off, Mann said it could be risky over time. Oysters, he said, are reproductive "gamblers" that produce huge amounts of larvae in several spawns in the hope that some will occur when conditions best promote larval survival.

(In Maryland, surveys that monitor the time of spawning have only been conducted during the last few years. Because of this, there is no data as to whether it has had a similar change.)

Carnegie and Mann don't think that oysters are ready to return to former levels of abundance. Disease mortality, though greatly reduced, remains great. And so much of the Bay's reef habitat has disappeared that many oyster larvae literally have no place to go. Abundant habitat could take many decades, if not centuries, to come back.

But the changes suggest that the native oyster is not as wimpy as many had thought. They have survived numerous insults from humans. Insults including overharvesting, wholesale habitat destruction and surmounting the challenges of a human-introduced nonnative parasite. And then, an unexpected challenge from the parasite dermo. Rather than disappear, oysters have shown signs of adapting.

"Oysters are actually doing things," Mann said. "They are not just dumb rocks that are sitting on the bottom. They are, in fact, doing some interesting things on their own."

About Karl Blankenship

Karl Blankenship is editor of the Bay Journal and Executive Director of Chesapeake Media Service. He has served as editor of the Bay Journal since its inception in 1991.