

# Minnesota Aquatic Invasive Species Research Center (MAISRC)

Zebra mussels' best friend:  
wakeboard boats, new U study  
finds. Livewells also tested.



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The best way for invasive zebra mussel larvae to get from one Minnesota lake to another is aboard wakeboard boats, a new study has found.

The ballast tanks of recreational wakeboard boats beat out other leading stowaway suspect, including sterndrive inboard/outboard engines, bilges and livewells — all of which can harbor the larvae — according to a study by the University of Minnesota's Aquatic Invasive Species Research Center.

Moreover, zebra mussel larvae that make their way into wakeboard ballast tanks take longer to die than those that stow away in smaller areas, such as livewells, according to the study, which analyzed water samples from 379 boats on Lake Minnetonka and Gull Lake in Cass County over two years.

In fact, the study found, it looks like standard minimal tactics for reducing zebra mussel spread — cleaning the exterior of a boat and removing the drain plug — won't be enough for wakeboard boat ballast tanks and some other large-volume water-holding areas. A hot-water flush or five days of drying are the most practical surefire ways to ensure no larvae survive.

To be clear, the study found that the larvae can hitch a ride in all sorts of boats, but because wakeboard boats generally take on the most water, they have the greatest chances to transport the greatest numbers of invaders.

## Why is this a big deal?

Here's why this is news.

- Wakeboard boats have long been suspected of being especially vulnerable to zebra mussel infiltration, but until now, no scientific study had actually tested that hypothesis in the real world, or examined how prevalent larvae really are in various boat compartments that take on water.
- Zebra mussels, bluntly put, are bad for our native ecosystem. They're not native, and they're seen as a major culprit in crowding out native forms of mussels, extinguishing some from entire lake and river systems. By filtering huge volumes of water as they feed on the smallest forms of life, they fundamentally change the character of a lake, clarifying the water and altering the woods and fish that live in the lake. A bad infestation can ruin swimming beaches, as feet-slicing shells from the mollusks cover the bottom.
- Zebra mussels are spreading across the state, generally infesting lakes popular with boaters first. (Yes, the data is clear on this: People are the biggest vector for their spread, and boats are the most common means.)
- For years, the Minnesota Department of Natural Resources and lawmakers have struggled with how strict to be with boaters pulling their boats in and out of different lakes. Some boaters have been skeptical, questioning whether the ["clean, drain, dry" legal requirement](#) is even effective, since boats are not designed to completely evacuate all the water that accumulates in various place in the hull. There's been an undercurrent of tension on this issue, as some groups of lake users suspect another group is the most culpable.
- This study's findings are not expected to result in immediate policy changes, but they provide important scientific data to backup policies and laws already in place.

## What's a wakeboard boat?

To the untrained eye, a wakeboard boat, or wake boat, looks like a speedy motorboat. But wakeboard boats specifically contain ballast tanks that are designed to have water pumped into them to make the boat heavier. The heavier boat displaces more water. Thus, wakeboard boats can create substantial waves for the pleasure of those on water skis or a wakeboard, which is like a surfboard towed behind a boat.

The big waves have created minor stirs on various lakes for years, but those dust-ups have primarily been over safety and the compatibility of, say, power boaters and kayakers. As wakeboard boats have proliferated, so has concern that they would provide safe transport for

zebra mussel larvae, known as veligers. The logic is obvious: Zebra mussels and other invasive species first arrived in the Midwest from Europe aboard ballast tanks of international vessels that steamed from the Atlantic Ocean into the Great Lakes. The ballast tanks on wakeboard boats could do the same thing, on a smaller scale — as could livewells, bilges and any part of a boat that collects lake water.

## Key findings of the study

Both Gull Lake and Lake Minnetonka are infested with zebra mussels, so every boat pulled out of either lake could be transporting the mussels or, more likely, their larvae.

But how often does that happen?

About half the time, according to the study, which was authored by graduate student Adam Doll and submitted for his master's thesis in December. On the bright side, only one in four boats were found to have more than five veligers — a quantity seen as too few for a likely lakewide infestation to result.

In those boats that had more than five larvae on board, here's how the various compartments of various boats stacked up, ranked from most likely to least likely: ballast, sterndrive engine, outboard motor, livewell, foot well (where occupants' feet go in some boats), splash well (open basin right behind the outboard in some boats), bilge, and jet. The bigger the compartment, the more larvae were found.

There are a number of other subtle factors that make ballast tanks and large motors more likely to pick up larvae than other areas. Veligers generally hang out a short ways under the surface of the water. Many areas, such as the bilge, only accumulate water that splashes up, while motors, livewells and ballast tanks actively pump water in. The lower units of motors reach the deepest into the water column, and ballast pumps generally pull water in from close to the bottom of the hull.

Large sterndrive engines — those that contain a motor inside the hull and a lower unit and propeller that sticks off the rear of the boat, pull large amounts of water inside to keep the engine cool. As such, they were the number two culprit.

Once the little buggers are inside, the simplest way to kill them is to subject them to hot water. Even a cold-water flush can reduce the risk of veligers surviving.

However, many boaters simply let the boat dry out. Researchers have known for years that five days is enough to kill all zebra mussels. When the weather outside is hot, such as during the summer boating season, the larvae generally die sooner. Curiously, Ball's research found that it takes significantly longer — sometimes days longer — for veligers to die inside ballast tanks than in livewells, presumably because there's more water to heat up and dry out.


A number of government agencies, including the Minnesota DNR, are working with boat manufacturers to try to change how ballast tanks and other water-holding compartments are designed so they can be more easily drained and cleaned.

## What to do?

Heidi Wolf, invasive species supervisor for the DNR, underscored that the name of the game with invasive species is to reduce the likelihood of transport.

Under that strategy, wakeboard boats shouldn't be singled out, as much as the boat operators should be urged to be vigilant.

"There are really simple measures to reduce the risk," Wolf said. "The boat user can interrupt the pathway. It doesn't mean that a wakeboard boat is a higher risk if it's drained, compared to another boat that isn't drained. Every step reduces the risk."



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