

From: [REDACTED]
To: [REDACTED]
Cc: [REDACTED]
Subject: FW: How long can zebra and quagga mussels survive out of the water?
Date: Tuesday, April 20, 2021 9:03:08 AM
Attachments: [image001.png](#)
Importance: High

Good morning, Thatcher-

As I'm sure you found from your research, the question of zebra mussel survival out of water has been a research topic over the past ten years. As you found, available moisture/humidity and ambient temperature are key factors for adult and veliger survival. In the past, western states supported use of a "Dry Time Calculator" that was based on the best available science at the time and was accessible via the 100th Meridian website. <https://www.100thmeridian.org/emersion/> This tool provided users an estimate of the number of days a watercraft needed to be out of water after use in an infested water body to ensure any dreissenid mussels (zebra or quagga) were dead. Although the reference is still available, the calculator has been deleted, in part because it was just too difficult and risky to determine quarantine periods with any accuracy or reliability. Thus, one can find differing estimates of how long zebra mussels can survive out of water.

I'm happy to share research papers on the topic if there is interest; however, for expediency, I am sharing links and references where information is listed.

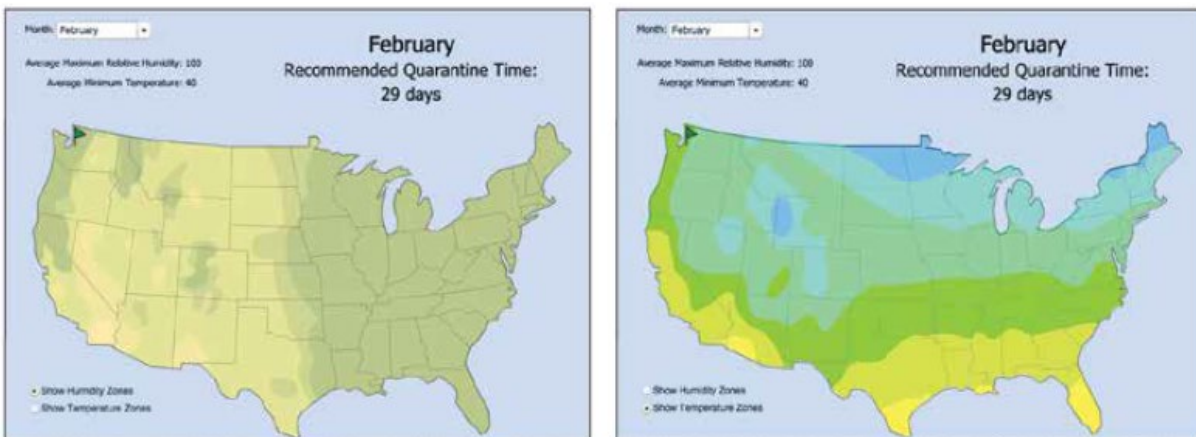
Minnesota DNR states, "Adult mussels can survive out of water – less than five days in dry conditions, but up to 21 days in very wet conditions". They go on to state, "Microscopic larvae (veligers) can survive in water contained in bait buckets, live wells, bilge areas, ballast tanks, motors and other water containing devices."

<https://www.dnr.state.mn.us/invasives/aquaticanimals/zebramussel/index.html>

According to materials developed by Lake Whatcom Management Program (WA) (- <https://whatcomboatinspections.com/aquatic-invasive-species/zebra-and-quagga-mussels>) and Oregon Sea Grant, [*Zebra mussels*] can survive out of the water up to 30 days when the air temperature and humidity are ideal.

The Sea Grant document also offers guidance that a boat heading to Seattle should quarantine for 29 days after use in infested waters based on output from the Dry Time Calculator. (Figure 1 & 2)

Figure 1 and 2.. Example from Dry Time Calculator for Seattle, WA.



Screenshots from the 100th Meridian website (<http://100thmeridian.org/emersion.asp>) showing recommended drying time in the Seattle area for zebra/quagga mussel-contaminated boats. Note that both humidity and temperature are taken into account when making these estimates. To change location, click on desired area to move flag.

Regarding your question about veliger survival, I can provide information from two research papers. According to research by Adam Doll (2018), veligers exposed to air temperatures between 20°C and 38°C over a five hour period showed an estimated 95% mortality. A separate study of quagga mussels larvae was done with veligers from Lake Mead. Snider et al. (2014) found that >60% of larvae were able to survive 20 hours of exposure to 30°C temperatures.

References:

Adam Doll (2018) Occurrence and survival of zebra mussel (*Dreissena polymorpha*) veliger larvae in residual water transported by recreational watercraft. Thesis, University of Minnesota.

Snider, J.P., Moore, J.D., Volkoff, M.C, and Byron, S.N. (2014) Assessment of quagga mussel (*Dreissena bugensis*) veliger survival under thermal, temporal and emersion conditions simulating overland transport. California Fish and Game 100(4), 640-651.

To my knowledge, a study has not been published (or completed) investigating the survival potential for adult or larval zebra or quagga mussels hitchhiking from an infested water body in the L48 and transiting to Alaska which is why I'm unable to give a clear response to your question as it pertains to our state. I hope the information I share herein is helpful. Please recognize although your questions seem simple, they have been the focus of much investigation and discussion over the past decade.

Thanks for your interest-
Tammy

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