Minnesota Aquatic Invasive Species Research Center

Preventing the overland spread of aquatic invasive species
Evaluating CD3 Station efficacy on the removal of residual water from recreational boats

FINAL REPORT

Introduction

Preventing the spread of aquatic invasive species (AIS) is essential to maintaining the ecological and economic integrity of waterbodies for generations to come. One risk factor that has received considerable attention is the residual (e.g. remaining) water left in a watercraft after it leaves a waterbody and can be transported and potentially released into another waterbody. Zebra mussel (*Dreissena polymorpha*) veligers are particularly concerning for this pathway given that they are microscopic, planktonic, and have been found in the residual water of recreational boats leaving infested waterbodies in previous research. While regulations (e.g. pulling drain plugs) have been developed to reduce this risk, residual water often remains in the watercraft despite regulatory compliance. While the volume and location of the residual water can be highly variable and watercraft-specific, methods to further reduce the risk of moving residual water in recreational watercraft is warranted.

Many options may exist for reducing residual water in recreational watercraft, including watercraft re-designs that improve drainage, thorough decontamination practices, watercraft inspection and enforcement, and education/outreach that supports the clean, drain, dry message. One option that is gaining popularity is the CD3 Station (https://www.cd3station.com). These stations are multifunctional units permanently installed at boat launches that offer boaters the opportunity to, among other things, remove residual water from watercraft with a vacuum. The purpose of this project was to perform a preliminary evaluation of the practicality and effectiveness of a CD3 Station vacuum for removing residual water from various recreational boats. This study is not intended to be an endorsement of CD3 Stations.

Methods

Three different boats were used for this project: A) 16 foot fishing boat with hand tiller motor and one water holding compartment (livewell); B) 18 foot fishing boat with single console, outboard motor, and one water holding compartment (livewell) and a; C) 20 foot ski boat with inboard/outboard motor. During each trial, lake water was deliberately introduced to each watercraft to represent common scenarios of watercraft use, such as filling the livewell, spilling a bait bucket, recreational equipment pulled from the water, etc.

Watercraft A | **Watercraft B** | **Watercraft C**

16’ Fishing Boat | **18’ Fishing Boat** | **20’ Ski Boat**

Watercraft A - 16 Foot Fishing Boat

Boat A was launched at the Bryant Lake Regional Park public boat launch on Bryant Lake in Eden Prairie, MN a total of 40 times between September 12-21, 2018. On each of the 40 launches, the boat was driven around the lake for up to 10 minutes. 3,785 mL was added to the bottom of the boat and 11,355 mL was added to the livewell each time while the boat was on the water. Upon trailering the boat, the main hull drain and livewell drain plugs were removed.

For trials 1-20, the residual water remaining in the livewell and in the bilge was quantified. For trials 21-40, the CD3 Station vacuum was used for up to 10 minutes per trial to remove as much of the residual water as possible. Use of the CD3 Station was done by both an AIS expert with experience using the CD3 Station vacuum (trials 21-30) and a non-expert volunteer who followed the posted instructions (trials 31-40). The remaining water in the livewell and bilge was then collected using a 100 mL plastic syringe and flex tubing, and then quantified.

Watercraft B - 18 Foot Fishing Boat

Boat B was launched at the Spring Park public boat launch on Lake Minnetonka in Spring Park, MN a total of 40 times between October 4-17, 2018. On each of the 40 launches, the boat was driven around the lake for up to 10 minutes. 3,785 mL was added to the bottom of the boat and 11,355 mL was added to the livewell each time while the boat was on the water. Upon trailering the boat, the main hull drain and livewell drain plugs were removed.

For trials 1-20, the residual water remaining in the livewell and in the bilge was quantified. For trials 21-40, the CD3 Station vacuum was used for up to 10 minutes per trial to remove as much of the residual water as possible. Use of the CD3 Station was done by both an AIS expert with experience using the CD3 Station vacuum (trials 21-30) and a non-expert volunteer who followed the posted instructions (trials 31-40). The remaining water in the livewell and bilge was then collected using a 100 mL plastic syringe and flex tubing, and then quantified.

Watercraft C - 20 Foot Ski Boat

Boat C was launched at the Spring Park public boat launch on Lake Minnetonka in Spring Park, MN a total of 20 times between September 26-27, 2018. On each of the 20 launches, the boat was driven around the lake for up to 10 minutes. 3,785 mL was added to the bottom of the boat each time while the boat was on the water. There was no livewell in Boat C. Upon trailering the boat, the main hull drain plug was removed.

For trials 1-10, the residual water remaining in the bilge was quantified. For trials 11-20, the CD3 Station vacuum was used for up to 10 minutes per trial to remove as much of the residual water as possible. Use of the CD3 Station was only done by an AIS expert with experience using the CD3 Station vacuum. No volunteers were used for Boat C. The remaining water in the livewell and bilge was then collected using a 100 mL plastic syringe and flex tubing, and then quantified.

Results

Tables 1 and 2 summarize the results for the bilge and livewell areas, respectively. The amounts of residual water that could be removed from the bilge varied between boat type and operator. For example, Boat A (avg 35% water removal) had difficult to access floor compartments, while the bilge of Boat C (avg 100% water removal) was easy to access. In contrast, all or nearly all of the residual water could be removed from the livewells.

Table 1
Water Associated With Watercraft Bilges

	Bilge			
	Boat A	Boat B	Boat C	Average
Avg resid water after plugs pulled (mL)	631.4	1497.1	193.0	773.8
Std dev resid water after plugs pulled (mL)	521.6	94.2	30.2	215.3
Avg resid water removed, overall (%)	35.3	83.0	100.0	72.7
Avg resid water removed by expert (%)	51.7	89.3	100.0	80.3
Avg resid water removed by non-expert (%)	18.9	76.4	N/A	47.6

Table 2
Water Associated With Watercraft Livewells

	Livewell		
	Boat A	Boat B	Average
Avg resid water after plugs pulled (mL)	1578.9	810.8	1194.8
Std dev resid water after plugs pulled (mL)	575.8	220.7	398.2
Avg resid water removed, overall (%)	98.2	100.0	99.1
Avg resid water removed by expert (%)	100.0	100.0	100.0
Avg resid water removed by non-expert (%)	96.4	100.0	98.2

Conclusions

Despite compliance with standard drain plug regulations, residual water remained in all boat types and in all compartments examined; however, the risk of residual water was reduced by using the CD3 Station vacuum. More specifically, the bilge areas of the three boat types averaged 193-1497mL of residual water, but 19-100% of that water could be removed with the vacuum. The livewell areas for the two boat types averaged 810-1578mL of residual water, but 96.4-100% of the water could be removed with the vacuum. While not 100% effective for all boat types, this demonstrates potential value to reduce the risk of AIS spread between lakes by promoting a more extensive and comprehensive approach to water removal. Given the variability between boat types, extrapolation of these results to all boats is not advised.

It is important to note however that despite the use of the CD3 Station vacuum, there are compartments within the boat that remain difficult for water removal. Even the experienced AIS expert was unable to remove all of the residual water from the bilge compartments in two of the three boats used in the study. It is recommended that if water removal methods are being developed or considered for implementation, manufacturers and/or managers have a variety of vacuum sizes or attachments available to access hard-to-reach areas of the boat, to further reduce the risk of residual water moving overland. Furthermore, for all boat types, some amount of water was 'lost' and not recoverable. In other words, the percent of residual water removed only accounted for what could be accessed - there was additional water that could not be quantified and would remain a risk for overland transport regardless of the vacuum method used.

Use of the CD3 Station vacuum seemed practical for removal of reasonably easy-to-access residual water. While up to 10 minutes was allowed for using the CD3 station for each trial, less time was actually needed by the AIS expert and volunteers. There were differences in the amount of residual water removed between the AIS expert and untrained volunteers, with the AIS expert performing better or equal to the volunteers in all treatments. It is possible that the CD3 was challenging for first-time users; however, these results are confounded by the fact that they were unfamiliar with the boats. Regardless, these results emphasize the importance of education and clear instructions that address the wide range of boater experience.

This preliminary study suggests that the use of a vacuum to remove residual water may be an effective method for further reducing the risk of overland transport of residual water. The overall effectiveness of this approach is likely dependent on the accessibility of units like the CD3 Station, public awareness, and cooperation by relevant stakeholders to support proactive adoption by boaters. Further research is needed to better quantify the effectiveness of this approach with larger sample sizes, and additional boat designs and currently available tools for residual water removal.

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