EVALUATION OF THE EFFECTIVENESS OF WESTERN STATES' AQUATIC INVASIVE SPECIES PUBLIC AWARENESS CAMPAIGNS FOR ELICITING DESIRED PREVENTION BEHAVIORS

FINAL REPORT

August 2022

Gerard Kyle, PhD
Department of Rangeland, Wildlife & Fisheries Management

Quinn Linford
Daniel Pilgreen
Trang Le
Department of Recreation, Park & Tourism Sciences

Richard Woodward
Department of Agricultural Economics

TEXAS A&M AGRILIFE RESEARCH | EXTENSION

Contact:

Gerard Kyle
Department of Rangeland, Wildlife & Fisheries Management
Texas A&M University
2138 TAMU
College Station TX 77843-2261
Email: gkyle@tamu.edu

CONTENTS

Acknowledgements

This research was funded by a U.S. Fish and Wildlife Service Quagga Zebra Mussel Action Plan implementation grant via the Invasive Species Action network (# 21-001A). We would also like to extend our appreciation to Monica McGarrity and the members of the Education and Outreach Committee for the Western Regional Panel on Aquatic Nuisance Species for their guidance and thoughtful feedback throughout the conduct of this work.

LIST OF TABLES

EXECUTIVE SUMMARY

Study Purpose

The overarching goal of this project was to collect and analyze data that would ultimately enhance the long-term success of aquatic invasive species (AIS) prevention outreach campaigns across Western Regional Panel (WRP) member states and member organizations by analyzing the effectiveness of current and potential messaging and delivery methods to elicit desired behavior change from specific demographics. However, the applicability of the results of this effort are not limited to the project's geographical area.

Design

- Thirty-one key informant interviews were conducted in the fall of 2021. Most informants had in excess of 20 years of boating experience and occupied a professional or voluntary role in the management of AIS in their communities. Analyses of the interview data provided some insight on different AIS message content, message placement, and mode of delivery. These findings were integrated into our survey questionnaire.

1. The survey questionnaire was comprised of series of items that explored an array of issues related to boaters' perceptions and actions related to AIS. It also included a messaging experiment where respondents were assigned to one of 20 message treatments and requested to indicate the message's effectiveness for encouraging Clean, Drain, Dry. The survey questionnaire took approximately 25 minutes to complete.
2. Three broad approaches were employed to contact potential respondents; 1) Texas A&M University sending emailing solicitations to potential respondents in databases provided by participating states; 2) Participating states distributing a web-link to the questionnaire hosted by Texas A&M University to their registered boater or licensed angler databases; and 3) states posting the web-link to the questionnaire on their agency website.
3. The varied methods yielded 3,900 fully completed questionnaires.

Sample Profile

The survey sample was relatively homogenous and comprised mostly of White, older men (M=58 years), residing in households with annual incomes in excess of $100,000. These demographics are consistent with other surveys of registered boaters.

Findings

- *Familiarity with AIS* - Respondents reported being broadly aware of AIS and the need to Clean, Drain, Dry. They were less familiar with specific species present in their state and locations (waterbodies) of where they have been detected.
- *Frequency of Clean, Drain, Dry* - Respondents reported that they regularly Clean, Drain, and Dry their boats prior to entering another waterbody. They are less inclined to wash their watercraft with a pressure washer or hot water.
- *Perceived Effectiveness of Clean, Drain, Dry* - Actions related to cleaning, draining, and drying respondents' watercraft were considered most effective. Considered to be less effective was washing watercraft with a pressure washer or hot water before entering another waterbody.
- *Constraints to Clean, Drain, Dry* - Twenty-five percent of respondents indicated facing some form of a constraint to undertaking Clean, Drain, Dry. The absence of cleaning stations, crowding at boat ramps, and skepticism over other boaters' undertaking Clean, Drain, Dry were the most cited reasons constraining their behavior.

- *Information about AIS* - Boat ramp signage, state agency websites, and inspection station personnel were the most commonly cited sources of information about AIS.
- *Trust in Information Providers* - State agency websites, boat ramp signage, inspection stations, and conservation organizations were the most trusted sources of AIS information.
- *Perceived Effectiveness of Information about AIS and Clean, Drain, Dry* - Respondents were requested to indicate which of the listed sources of information would be most effective at; a) preventing the spread of AIS, b) encouraging Clean, Drain, Dry, and c) reaching the population of boaters across the state. Boat ramp signage and state agency websites were considered to be most effective for accomplishing all three outcomes. Alternately, while inspection stations were considered to be effective for encouraging Clean, Drain, Dry, and preventing the spread of AIS, they were somewhat limited in their ability to reach the population of boaters.
- *Messaging Experiment to Encourage Clean, Drain, Dry* - While no single treatment message was statistically superior at encouraging Clean, Drain, Dry, seven messages scored highest. Their means of 3.4 (on a 5-point scale) or greater indicate that respondents felt the messages would be moderately to quite effective at increasing boaters' Clean, Drain, Dry behavior. The messages were designed around themes related to:
  - Militaristic, nativist, protective, and science-based metaphors;
  - Injunctive norms (i.e., encouraging the belief that other boaters expect them to Clean, Drain, Dry); and
  - Economic losses and ecological gains.

  Messages that respondents considered least effective were focused on specific identities (i.e., hunter, boater, paddler) and a combination of descriptive and injunctive norms (i.e., other boaters' expectation of them and the suggestion that other boaters conduct Clean, Drain, Dry).
  Follow-up analyses exploring variation among select groups on the most effective message revealed little variation.

Discussion/Conclusion

- Age was associated with awareness and knowledge of AIS and Clean, Drain, Dry behavior with older boaters scoring higher. Messaging toward a younger cohort ought to occur early in their boating careers. Beyond the most popular sources (i.e., boat ramps, state agency websites, and inspection stations), these messages could be delivered with boat registration and fishing license renewals.
- Familiarity with AIS (prior to taking survey) was linked to the extent to which respondents interacted with the resource (e.g., houseboat owners, tournament anglers, avid boaters). Those least familiar with AIS reported (e.g., pontoon and sailboat owners, paddlers, hunters) less concern over AIS and a lower likelihood of implementing Clean, Drain, Dry. Those most actively interacting with the resource will likely encounter AIS messaging through the most popular sources of information (boat ramp kiosks, state agency websites, inspection stations), whereas accessing infrequent boaters will be an ongoing challenge. Point of sale for non-motorized watercraft (e.g., decals placed on the watercraft) and hunting licenses provides one opportunity for agency contact.
- In terms of AIS information to which respondents had been previously exposed:
  - Most common sources were boat ramp kiosks, followed by the state's agency website, and then inspection station personnel. For these information sources, respondents indicated that their state's agency websites were most trusted, followed by boat ramp kiosks, and then state inspection personnel. AIS information should be easily accessible on agency websites. Given their broad coverage and, importantly, boaters' trust in the state to provide up to date information about AIS, access to this information on agency websites should feature prominently.

- Younger (18-25) respondents were more likely to trust conservation organizations. Conservation organizations provide an opportunity to develop strategic partners that can help amplify agency efforts through social media, their agency websites, and through members' social networks. Regular active engagement with these partners would also assist in providing up to date information.
- Similar to respondents' exposure and trust, boat ramp signage, state agency websites, and state inspection personnel were considered most effective for preventing the spread of AIS, encouraging Clean, Drain, Dry, and reaching the population of boaters. Residents of states utilizing inspection stations (e.g., California, Utah, Nevada) expressed greater trust in the information provided by inspection station personnel, considered the information more effective at preventing the spread of AIS, and more effective at encouraging Clean, Drain, Dry. While the coverage of the information provided by inspection station personnel is geographically limited, it is clearly a useful tool and one that warrants consideration/adoption.

- In terms of the messaging experiment:
  - Overall, respondents considered the identity frames least effective compared to other frames at encouraging Clean, Drain, Dry.
  - Statistically, there was no significant variation among message treatments – all moderately effective at encouraging Clean, Drain, Dry. Seven messages, however, were somewhat superior. For future messaging efforts, agencies should consider elements of each message or in combination when designing persuasive appeals. These include:
    - All metaphor themes preformed comparatively well compared to other message treatments. The science metaphor was the strongest performer in terms of respondents' reported effectiveness for encouraging Clean, Drain, Dry.
    - Framing the impact of AIS on aquatic ecosystems (i.e., health in the absence of AIS) and the state's economic health (i.e., detriment with their presence) is compelling.
    - Unlike the descriptive norm, the injunctive norm message attempts to instill a personal obligation that rests on the perception of others' expectations.
- Respondents indicated that they almost always engaged in cleaning and draining behaviors. They indicated being less likely, however, to wash their boat with a pressure washer or hot water. Not all boaters will have access to a pressure washer and washing watercraft with hot water is likely perceived to be cumbersome. Cleaning stations with pressure washers or hot water would help to address this issue.
- The installation of cleaning stations with clearly visible messaging kiosks would help negate the perception that few undertake Clean, Drain, Dry by providing evidence of others taking action. The more boaters are seen to be engaging in these actions, the more normative the behavior becomes.

1.0 INTRODUCTION

The overarching goal of this project was to collect and analyze data that would ultimately enhance the long-term success of aquatic invasive species (AIS) prevention outreach campaigns across Western Regional Panel (WRP) member states and member organizations by analyzing the effectiveness of current and potential messaging and delivery methods to elicit desired behavior change from specific demographics. However, the applicability of the results of this effort are not limited to the project's geographical area.

Objective 1: Evaluate and quantify the effectiveness of WRP states' campaign messaging, current and potential, alone or in combination, in eliciting the desired AIS prevention behavior among boaters (e.g., pull drain plugs, do not launch for a specific period of time, remove vegetation, don't dump bait, etc.) for specific boating and boater demographics. The focus will be placed on high-risk recreational user groups, in accordance with guidance from the WRP Education Outreach Committee (EOC). Past, current, and future behaviors were evaluated.

Objective 2: Evaluate and quantify the effectiveness of delivery methods currently used–or that could potentially be used–by WRP states to elicit desired AIS prevention behaviors for specific boating and boater demographics.

Objective 3: Provide a summary report/publication on the effectiveness of current and past WRP states' public outreach campaigns' messaging and delivery methods and recommendations on how to most effectively tailor campaigns to elicit specific AIS prevention behaviors overall and for specific recreational user groups and demographics which includes:

- analysis of the effectiveness of WRP states' messaging
- analysis of the effectiveness of implemented delivery methods
- recommendations on specific messaging that may be most effective
- recommendations on delivery methods that may be most effective for different demographics
- recommendations on other important considerations on how to effectively elicit specific AIS prevention behaviors

2.0 BACKGROUND

Humans have had enormous impacts on earth and its biodiversity and many of these effects are global. Lakes and streams are particularly prone to species loss (Ricciardi & Rasmussen, 1999), with the greatest threats coming from land use changes and exotic invasive species ("biotic exchange", Sala et al., 2000). Humans have been particularly effective in breaking down biogeographic barriers through long-distance trade, intentionally introducing some species and carrying others as hitchhikers (Kolar & Lodge, 2000). The result has been a translocation of numerous freshwater species (Hulme, 2009). Although most introduced species fail to establish and spread (Williamson, 1996), many freshwater species have become invasive and some have caused widespread environmental effects and economic harm (Pimentel et al., 2005).

Freshwater ecosystems have greater biodiversity per surface area than marine and terrestrial ecosystems (Dudgeon et al., 2006; Balian et al., 2008). Freshwater ecosystems also play an active role in nutrient and water cycling (Wetzel, 2001), which translate into goods and services for human societies. At the same time, freshwater ecosystems have been deeply transformed by invasive species from a wide variety of taxonomic groups (Strayer, 2010; Simberloff et al., 2013). It is thus vital to understand the factors that govern the introduction, spread, and subsequent impacts of invasive species in these ecosystems.

Recreational boating can significantly contribute to the rapid spread of AIS by unintentionally transporting species attached to hulls, props, and other submerged components attached to the watercraft, as well boat live wells or any other water-bearing compartments. Boaters often travel long distances for recreation in different freshwater bodies and can be a significant vector for spreading AIS between inland waters (Johnson et al., 2001; Robertson et al., 2020; Rothlisberger et al., 2010). This fact highlights the crucial role boaters' preventive behavior can play in controlling and reducing AIS high economic and ecological impacts. Cleaning, draining, and drying watercraft is recognized as the key desired boater behavior for AIS spread prevention and "Clean, Drain, Dry" is a central message in AIS outreach at a national scale.

Despite the significance of their role in controlling and managing the spread of AIS, our understanding of boaters' preventive behavior and the impact of possible interventions to alter behavior is, in large part, restricted to insights gleaned from studies conducted in the Eastern and Great Lakes states. Among these studies, several have explored the effectiveness of various outreach and communication strategies. For instance, Wallen and Kyle (2018) found that regulation-framed messages emphasizing the law and the possibility of fines outperformed messages referring to the norms of compliance with Clean, Drain, Dry. The results from Sharp et al.'s (2017) study also revealed the importance of educational programs tailored to specific recreational uses and recreational settings in compliance with preventive measures. Moreover, Witzling et al. (2016) and Witzling et al. (2015) evaluated the effectiveness of different communication channels and found that signs posted at boat ramps, interpersonal communications, information provided by lake associations, and direct communication between natural resource managers and boaters can all be effective to varying degrees when messaging is tailored to different groups of boaters. These findings highlight the need for communication strategies to be multi-modal in terms of the distribution of AIS information to improve the likelihood of message exposure and targeted toward different boating and aquatic recreation use groups.

Another line of research has revealed the relationship between socio-psychological factors and boater intentions, and preventive pro-environmental behavior. These studies have shown psychological drivers such as norms (personal and social), the ascription of responsibility, a concern for the environment and threats to its health, and value orientations can all shape boaters' willingness to engage in pro-environmental behavior that mitigates the threat of AIS (Kemp et al., 2017; Pradhananga et al., 2015; van Riper et al., 2019). Similarly, those who felt greater responsibility and a moral obligation to prevent the spread of ANS reported engaging in preventive measures more often (Beardmore, 2015; Mayer et al., 2015; Seekamp et al., 2016). Also, the more likely boaters were to express concern for environmental protection and an understanding of the risks posed by the spread of AIS, the more likely they were to report adopting preventive action (Connelly et al., 2016; Pavloski et al., 2019; Pradhananga et al., 2015). Moreover, boaters' perception of what their peers do and significant others expect them to do influences their behavior (Connelly et al., 2016; Wallen & Kyle, 2018; Witzling et al., 2015). Other studies have also investigated the relationship between the public's awareness and knowledge of ANS and their behavior. The findings, generally, demonstrate that residents, especially those who participate in water-based recreation, are supportive of actions to minimize the effects of AIS when they are aware of the negative consequences (e.g., Eiswerth et al., 2011; Fouts et al., 2017; Sharp et al., 2017).

There is research, however, that reveals a mismatch between boaters' AIS awareness and support for preventive measures and their willingness to adopt mitigation behavior (Cole et al., 2016; Connelly et al., 2016; Mueting & Gerstenberger, 2011). For instance, Cole et al. (2016) found that raising awareness and knowledge is a necessary but insufficient condition for the adoption of ANS prevention behaviors. Their results illustrate that awareness of AIS spread and its impact on aquatic ecosystems does not necessarily relate to an agency's investment in outreach (Cole et al., 2016). Similarly, Connelly et al. (2016) and Ventura et al. (2017) found that despite high awareness and stated support, boaters were less frequently conducting difficult preventive actions, such as drying and disinfecting, rinsing equipment with hot water, or using high-pressure washing. These findings highlight often reported gaps between individuals' awareness of environmental issues and appropriate action. These knowledge/awareness-action gaps necessitate outreach efforts focusing on strategies that facilitate behavior and remove barriers (Kollmuss & Agyeman, 2002; Lorenzoni et al., 2007; Steg et al., 2014).

Last, research on the barriers to engagement in pro-environmental behavior has also revealed that regardless of environmental concern, they have the potential to significantly constrain intent and action (Cleveland et al., 2020; Moghimehfar & Halpenny, 2016; Tanner, 1999). Broadly, two categories of constraints to pro-environmental action have been identified in the literature; subjective and objective (Tanner, 1999). Findings illustrate that objective constraints, such as time, the availability of facilities, space limitations, cost, and convenience hinder pro-environmental action (Lorenzoni et al., 2007; Moghimehfar & Halpenny, 2016). However, there is evidence suggesting that subjectively perceived barriers (e.g., perceived costliness, perceived ineffectiveness) are a more compelling obstacle for adopting pro-environmental action (Cleveland et al., 2020; Steg et al., 2014). In the context of preventing the spread of ANS, boater misconceptions on subjectively defined constraints related to perceived cost, effort, and effectiveness can negatively impact their willingness to adopt mitigation measures (Connelly et al., 2016; Ventura et al., 2017).

3.0 STUDY DESIGN AND METHOD

3.1 Key Informant Interviews

Thirty-one key informant interviews were conducted with boaters from Arkansas (3), California (4), Kansas (3), North Dakota (1), Nevada (2), South Dakota (2), Texas (4), Utah (8) and Washington (4). State AIS coordinators provided informants' contact information. Key informants are "particularly knowledgeable and articulate – people whose insights can prove particularly useful in helping the observer understand what is happening" (Patton, 1990). The key informant interviews were conducted to ensure that we were not missing content that would be crucial in the development of our survey questionnaire. The interview guide is provided in Appendix A1.

Most informants had in excess of 20 years of boating experience and occupied a professional or voluntary role in the management of AIS in their communities. Analyses of the interview data provided some insight on different AIS message content, message placement, and mode of delivery. These findings were integrated into our survey questionnaire.

3.2 Survey Questionnaire

The survey questionnaire was comprised of series of items that explored an array of issues related to boaters' perceptions and actions related to AIS and as arranged in six sections (see Appendix A3):

4. Watercraft ownership and use history;
5. Knowledge and awareness of aquatic invasive species;
6. AIS messaging awareness and preferences;
7. AIS messaging experiment;
8. Clean, drain, dry behavior, perceived effectiveness, perceived difficulty, and perceived prevalence; and
9. Socio-demographic characteristics.

For the AIS messaging experiment, respondents were presented with one of 20 messages and asked a series of questions about their perception on whether or not the image would impact Clean, Drain Dry behavior (See Table 1 and Appendix A3). The message treatments were structured around eight themes all focused on promoting Clean, Drain, Dry behavior plus a control:

1. A control message with a basic Clean, Drain, Dry statement.
2. The control in addition to the "Stop Aquatic Hitchhikers" branding.
3. The control in addition to statement about Clean, Drain, Dry being required by law.
4. The control in addition to four treatments focused on respondents' identity as a;
    a. Boater,
    b. Paddler,
    c. Hunter, and
    d. Angler.
5. The control in addition to four treatments examining ecological and economic gains and losses.
6. The control in addition to three treatments examining norms associated with Clean, Drain, Dry behavior;
    a. Injunctive – Individual perceptions of what boaters ought to do,
    b. Descriptive – Individual perceptions of what other boaters are doing, and
    c. Combination of injunctive and descriptive norm messaging.

7. The control in addition to four metaphor-themed messages focused on;
    a. Science,
    b. Protection/nurturing,
    c. Nativist, and
    d. Militaristic.
8. The control in addition to a messaging informing boaters they are entering a lake with AIS.
9. The control in addition to a message indicating boaters need to Clean, Drain, Dry their watercraft after leaving every lake, every time.

The treatments focused on identity were drawn from the work of Fielding and associates' work on social identity and its association conservation-related behaviors (Fielding & Hornsey, 2016; Schultz & Fielding, 2014; Unsworth & Fielding, 2014). This work reveals the extent to which identity salience and the norms associated with the identity gird pro-environmental behavior. The environment and economic gain/loss scenarios were drawn from Degolia, et al.'s (2019) related to wild pig management. Their work revealed that messages framed in terms of environmental outcomes, as opposed to economic, elicited more support for AIS management among a sample of California residents. Also, messages referencing economic and environmental loss drove stronger support for invasive species management compared to messages referencing gain. Normative message frames were drawn from the work of Wallen and Kyle (2018). Metaphor themed frames were drawn from Shaw, Campbell, and Radler (2021). These metaphors touched upon themes related to; a) science with objective, fact-based information, b) the protection of nature with a nurturing statement related to protecting the environment, c) non-nativist with reference to alien species, and d) militaristic with reference to battles against invasives.

Table 1. Message Treatments

Treatment	Theme	Message	Image	Header	Footer
1	**Baseline/Control**	Clean, Drain, Dry	Different boater types	ATTENTION	
2	**Stop aquatic hitchhikers branding**	Stop aquatic hitchikers brand logo	Logo	ATTENTION	Clean, Drain, Dry
3	**Legal**	IT'S THE LAW. CLEAN, DRAIN, DRY YOUR BOAT	Different boater types	ATTENTION	Clean, Drain, Dry
4	**Identity**	BOATERS - DO YOUR PART CLEAN, DRAIN, DRY YOUR BOAT	Motorboat	ATTENTION	Clean, Drain, Dry
5		PADDLERS - DO YOUR PART CLEAN, DRAIN, DRY YOUR BOAT	Paddlers	ATTENTION	Clean, Drain, Dry
6		HUNTERS - DO YOUR PART CLEAN, DRAIN, DRY YOUR BOAT	Hunters	ATTENTION	Clean, Drain, Dry
7		ANGLERS - DO YOUR PART CLEAN, DRAIN, DRY YOUR BOAT	Anglers	ATTENTION	Clean, Drain, Dry
	Loss/Gain				
8	Ecological Loss	PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. **Our aquatic ecosystems will suffer tremendously**	Different boater types	ATTENTION	Clean, Drain, Dry
9	Ecological Gain	PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. **Our aquatic ecosystems will benefit tremendously**	Different boater types	ATTENTION	Clean, Drain, Dry
10	Economic Loss	PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. **It will cost our state (YOU) $ millions**	Different boater types	ATTENTION	Clean, Drain, Dry
11	Economic Gain	PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. **It saves our state (YOU) $ millions**	Different boater types	ATTENTION	Clean, Drain, Dry

Table 1 (continued). Message Treatments

Treatment	Theme	Message	Image	Header	Footer
	Norms				
12	Descriptive	PROTECT YOUR WATERS. The **MAJORITY** of the state's boaters CLEAN, DRAIN, DRY their boats	Different boater types	ATTENTION	Clean, Drain, Dry
13	Injunctive	PROTECT YOUR WATERS. the state's boaters **EXPECT** you to CLEAN, DRAIN, DRY your boat	Different boater types	ATTENTION	Clean, Drain, Dry
14	Descriptive/injunctive	PROTECT YOUR WATERS. The **MAJORITY** of the state's boaters **EXPECT** you to CLEAN, DRAIN, DRY your boat	Different boater types	ATTENTION	Clean, Drain, Dry
	Metaphors				
15	Science	PREVENT THE SPREAD OF AQUATIC INVASIVE SPECIES. Aquatic invasive species are present in our state's lakes and rivers and can severely impact these ecosystems	Different boater types	ATTENTION	Clean, Drain, Dry
16	Protective/Nurturing	HELP PROTECT OUR WATERS. Aquatic invasive species harm our lakes and rivers.	Different boater types	ATTENTION	Clean, Drain, Dry
17	Nativist	NOT NATIVE, NOT WELCOME Keep aquatic invasive species out of our state's lakes and rivers	Different boater types	ATTENTION	Clean, Drain, Dry
18	Militaristic	STOP THE INVASION OF AQUATIC INVASIVE SPECIES Help fight the battle again aquatic invasive species	Different boater types	ATTENTION	Clean, Drain, Dry

Table 1 (continued). Message Treatments

Treatment	Theme	Message	Image	Header	Footer
19	**Entering**	You are entering a lake that has AQUATIC INVASIVE SPECIES. Be sure you CLEAN, DRAIN, DRY before re-entering another waterbody	Different boater types	ATTENTION	Clean, Drain, Dry
20	**Every lake, every time**	Every lake, every time	Different boater types	ATTENTION	Clean, Drain, Dry

3.3 Data Collection

Respondents' access to the questionnaire utilized multiple solicitation modes. The different methods of solicitation are displayed in Table 2 below. Three broad approaches were employed:

1. For solicitations management by TAMU, respondents were sent an email with an individualized URL. Two additional email reminders/thank you notes were sent four days apart.
2. For agencies electing to distribute a URL to their registered boaters of licensed anglers, multiple approaches were employed; 1) email a single URL and email a follow-up thank you reminder, 2) post a weblink on their agency website, and 3) promote the URL on the agency's social media (Facebook, Twitter).
3. States posted a URL weblink on their agency website.

Collectively, 8,135 recipients of the solicitation initiated the questionnaire. The first question respondents encountered asked if they had boated in freshwater in the previous 12 months. Only those answering "yes" proceeded with the questionnaire; 6,393 responded "yes". Of these, 3,900 completed all questions. For our AIS messaging experiment, Qualtrics® randomly assigned each respondent to one of the 20 message treatments. Responses to each treatment ranged between 201 to 226 responses.

Table 2. Solicitation, Response, and Questionnaire Completion

State/Province	Email Invitation Sent by TAMU			Email Invitation Sent by State			Weblink Posted on State Agency Website	
	Sent[a]	Initiated[b]	Complete[c]	Sent[a]	Initiated[b]	Complete[c]	Initiated	Complete
Alaska[1]	126,082	2,332	573					
Arizona[2]							13	8
California[3]							464	332
Colorado[4]							48	39
Hawaii[5]					4	3		
Idaho[6]							24	16
Kansas[7]				10,000	1,313	942		
Montana[8]	400	24	16					
Nevada[9]							100	97
Nebraska[10]							2	2
New Mexico[11]							1	1
North Dakota[12]							4	2
Oklahoma[13]	10,000	203	65					
Oregon[14]	10,000	1,007	548					
South Dakota[15]							5	3
Texas[16]	10,000	939	527					
Utah[17]				8,000	1,590	1,040		
Washington[18]				10,000	52	47		
Wyoming[19]							10	9

[a] Weblink sent to respondents.
[b] Respondents clicking on weblink to commence completing the questionnaire.
[c] Full completion of the questionnaire.
[1] Email sent to hunting and fishing license holders purchased in 2019 and 2020.
[2] Did not post weblink. Respondents reported residing outside of AZ but boat in AZ.
[3] State weblink was included in an "angler update" promotional/information email distributed to licensed anglers in additional to sharing on the Division of Boating and Waterway's Facebook Page.
[4] Weblink on agency website promoted through Colorado Department of Natural Resources social media.
[5] Twelve boaters were approached at a fishing club on Wahiawa Reservoir.
[6] Link placed on websites for Idaho Parks and Recreation Department, Idaho Department of Agriculture, and Invasive Species of Idaho.
[7] An email invitation and additional reminder was sent to a random sample of registered boaters.
[8] Three email invitations sent four days apart.
[9] Weblink on agency website promoted through Nevada Department of Wildlife social media. Two email solicitations sent to motorized and non-motorized boaters who had purchased an AIS decal.
[10] Did not participate.
[11] Did not participate.
[12] Weblink posted on agency website.
[13] Three email invitations sent four days apart.
[14] Three email invitations sent four days apart.
[15] Weblink posted on agency website.
[16] Three email invitations sent four days apart.
[17] Link distributed by Utah Division of Wildlife Resources. Link also promoted on agency Facebook page and distributed with flyers.
[18] Email invitation sent to licensed anglers.
[19] Link placed on Wyoming Game and Fish Department website.

3.4 Message Experiment - Manipulation Check

For our AIS messaging experiment, to ensure respondents had read and accurately processed the content of each image, respondents were requested to answer two questions;

1. What does this message tell you about Clean, Drain, Dry behaviors? and
2. What do you think is the intent of this message?

Responses to the first question were tailored around the content of each image/message and are displayed in Table 3. The response choice for the question was a dichotomous "yes/no" with "yes" being the correct answer. For the second question, respondents were again requested to answer "yes/no" to the question with "yes" also being the correct answer. If respondents answered "no" to either question, they were removed from the analyses. Four hundred and six respondents were removed from the analyses.

Table 3. Manipulation Check Questions

Message	What does this message tell you about Clean, Drain, Dry behaviors?[a]	What do you think is the intent of this message?[a]
1	[state] boaters should clean, drain, and dry their boats and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
2	To prevent the spread of aquatic invasive and stop aquatic hitchhikers, [state] boaters should clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
3	Cleaning, draining, and drying your watercraft and equipment is required by [state] law.	To encourage, clean, drain dry behaviors among [state] boaters.
4	It is a boater's responsibility to clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
5	It is a paddler's responsibility to clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
6	It is a hunter's responsibility to clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
7	It is an angler's responsibility to clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.

Table 3 (continued). Manipulation Check Questions

Message	What does this message tell you about Clean, Drain, Dry behaviors?[a]	What do you think is the intent of this message?[a]
8	The [state]'s aquatic ecosystems will suffer if [state] boaters do not clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
9	The [state]'s aquatic ecosystems will benefit from [state] boaters cleaning, draining, and drying their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
10	If [state] boaters fail to adopt clean, drain, and dry behaviors it will cost the state millions of dollars to mitigate damage from aquatic invasive species	To encourage, clean, drain dry behaviors among [state] boaters.
11	If [state] boaters fail to engage in clean, drain, and dry behaviors it will save the state millions of dollars from having mitigate damage from aquatic invasive species	To encourage, clean, drain dry behaviors among [state] boaters.
12	The majority of [state] boaters clean, drain, and dry their watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
13	[state] boaters expect you to clean, drain, and dry your boat and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
14	The majority of [state] boaters expect you to clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
15	Aquatic invasive species negatively impact [state] ecosystems and to prevent their spread you should clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
16	To protect [state] waters, you should clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
17	Aquatic invasive species are neither native or welcome in [state] and you need to clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
18	To prevent the invasion of aquatic invasive species in [state], you need to clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
19	You are about to enter a lake with aquatic invasive species and need to clean, drain, and dry your watercraft and equipment before entering another waterbody.	To encourage, clean, drain dry behaviors among [state] boaters.
20	You need to clean, drain, and dry your watercraft and equipment after leaving every lake, every time.	To encourage, clean, drain dry behaviors among [state] boaters.

[a] Responses choice for both questions; Yes/No

4.0 SAMPLE PROFILE

Respondents were predominantly White (85.2%; Table 6), older (M=54.99) men (85.8%; Table 5). They were relatively well educated with most having at least vocational school educational training or two-year college (83.5%: Table 7) and residing in households with moderately high annual incomes (61.6% earning ≥ $100,000; Table 8).

Table 4. Age Categories

	n	%
18-25	28	.7
26-35	136	3.5
36-45	486	12.5
46-55	854	21.9
56-65	1256	32.2
66-75	923	23.7
> 75	217	5.6
Total	3900	100.0

Table 5. Gender

	n	%
Prefer not to answer	130	3.3
Female	420	10.8
Male	3346	85.8
Nonbinary	4	.1
Total	3896	100.0

Table 6. Race

	n	%
Asian	42	1.0
Spanish/Hispanic/Latino	89	2.2
White	3447	85.2
American Indian/Alaska Native	102	2.5
Black/African American	24	.6
Native Hawaiian/Pacific Islander	18	.4
Middle Eastern	9	.2
Prefer not to Answer	226	5.6
Other	91	2.2
Total	4048	100.0

Table 7. Education

	n	%
Less than high school	32	.8
High school graduate	611	15.7
Vocational/trade school Two-year college	1031	26.4
Four-year college	1366	35.0
Graduate degree	860	22.1
Total	3900	100.0

Table 8. Household Income

	n	%
Prefer not to answer	131	3.4
Under $20,000	83	2.1
$20,000-$39,999	159	4.1
$40,000-$59,999	271	6.9
$60,000-79,999	421	10.8
$80,000-$99,999	434	11.1
$100,000-$119,999	530	13.6
$120,000-$139,999	381	9.8
$140,000-$159,999	334	8.6
$160,000 and above	1156	29.6
Total	4048	100.0

Respondents' state of residence (Table 10) and primary boating state/province (Table 9) tracked along response rates reflected in Table 2.

Table 9. Primary Boating State/Province

	n	%
British Columbia	1	.0
Nunavut	1	.0
Alaska	505	12.9
Arizona	12	.3
Arkansas	4	.1
California	305	7.8
Colorado	20	.5
Hawaii	3	.1
Idaho	33	.8
Kansas	822	21.1
Minnesota	6	.2
Missouri	31	.8
Montana	21	.5
Nebraska	3	.1
Nevada	57	1.5
New Mexico	1	.0
North Dakota	1	.0
Oklahoma	75	1.9
Oregon	508	13.0
South Dakota	3	.1
Texas	484	12.4
Utah	950	24.4
Washington	39	1.0
Wyoming	15	.4
Total	3900	100.0

Table 10. State/Province of Primary Residence

	n	%
Alberta	1	.0
Alaska	510	13.1
Arizona	8	.2
California	297	7.6
Colorado	34	.9
Hawaii	3	.1
Idaho	15	.4
Kansas	878	22.5
Montana	15	.4
Nebraska	2	.1
Nevada	72	1.8
New Mexico	1	.0
North Dakota	2	.1
Oklahoma	59	1.5
Oregon	501	12.8
South Dakota	2	.1
Texas	495	12.7
Utah	955	24.5
Washington	42	1.1
Wyoming	8	.2
Total	3900	100.0

The most commonly owned watercraft reported by respondents were ski/wakeboard boats (17.1%; Table 11), followed by kayak/canoes (15.7%), other (13.6%), and bass boats (13.3%).

Table 11. Watercraft Ownership

	n	%
Pontoon	455	7.2
Johnboat	555	8.8
Bass boat	836	13.3
Houseboat	132	2.1
Ski/Wake board	1080	17.1
Sailboat	122	1.9
Cabin Cruiser	181	2.9
Jet ski	435	6.9
Center console	336	5.3
Kayak/Canoe	988	15.7
Paddleboard	326	5.2
Other	855	13.6
Total	6301	100.0

Recreational fishing (44.0%; Table 12), pleasure cruising (27.7%), and wake sports (14.7%) were respondents' most favored activities.

Table 12. Activity Preferences

	n	%
Recreational Fishing	2804	44.0
Tournament Fishing	168	2.6
Wake Sport	935	14.7
Pleasure Cruising	1729	27.2
Hunting	465	7.3
Other	267	4.2
Total	6368	100.0

Summer (M=9.07 days; Table 13) was the most popular boating season.

Table 13. Days Boating by Season

	Spring	Summer	Fall	Winter
M	4.93	9.07	5.40	1.30
SD	5.25	6.88	5.40	3.10

Respondents indicated that lakes (77.5%; Table 14) were the freshwater waterbody they used most often.

Table 14. Primary Waterbody

	n	%
Lake	3022	77.5
River/Bayou	636	16.3
Offshore Ocean	30	.8
Inshore Bay	147	3.8
Private waterbody	65	1.7
Total	3900	100.0

Respondents had extensive boating experience, reporting almost 19 years of boating experience (M=18.76 years).

5.0 STUDY FINDINGS

5.1 Familiarity with Clean, Drain, Dry

Respondents were most familiar with the with the need for boaters to engage in Clean, Drain, Dry before entering different waterbodies (item b, M=4.58; Table 15). They were least familiar with the locations where AIS had been detected in their state (item d, M=3.54).

Table 15. Familiarity with AIS

Item	Not at all familiar		Somewhat familiar		Very Familiar	M	SD
	1	2	3	4	5		
	%						
a. How familiar were you with aquatic invasive species before taking this survey?	2.1	4.6	24.1	26.7	42.5	4.03	1.02
b. How familiar are you with the need for watercraft users to clean their boats and equipment, drain all water from the watercraft (e.g., bilges, ballasts), and dry before entering another waterbody?	1.1	1.8	7.9	16.4	72.8	4.58	.80
c. How familiar are you with the aquatic invasive species that have been detected in [state]?	4.0	8.8	27.3	26.2	33.6	3.77	1.13
d. How familiar are you with the locations (waterbodies) where aquatic invasive species have been detected in [state]?	7.8	11.3	28.7	23.3	28.8	3.54	1.23
e. How familiar are you with the problems caused by aquatic invasive species in [state]?	2.2	4.6	19.6	26.7	46.9	4.12	1.02

5.2 Awareness and Concern over Aquatic Invasive Species

In terms of respondents' awareness and concern over AIS (Table 16), most concern was expressed over the importance of preventing the spread of aquatic invasives (Item h, M=4.73) and engaging in Clean, Drain, Dry behavior (item g, M=4.66).

Table 16. Attitudes Toward AIS

Item	Not at all		Somewhat		Significant	M	SD
	1	2	3	4	5		
	%						
a. How common are AIS (in primary boating state)?	.9	8.8	32.7	33.2	24.4	3.71	.96
b. How much of a problem are AIS (in primary boating state)?	1.1	8.0	32.2	33.1	25.7	3.74	.96
c. How much of a threat do AIS pose to the economy (of primary boating state)?	1.3	7.0	24.6	31.0	36.1	3.94	1.00
d. How much of a threat do AIS pose to the health of freshwater lakes and rivers (in primary boating state)?	.5	2.5	13.1	25.5	58.4	4.39	.84
e. How much of a threat do AIS pose to the health of freshwater fish and wildlife (in primary boating state)?	.6	2.9	13.9	25.6	57.0	4.35	.87
f. How much of a threat do AIS pose to freshwater recreation (in primary boating state)?	.8	4.4	16.6	26.9	51.3	4.24	.93
g. How important is removing plants/mud/organisms, draining water from boat/compartments, drying completely?	.5	1.6	5	16.8	76.1	4.66	.70
h. How important do you think it is to prevent the spread of aquatic invasive species?	.3	.9	4.2	14.5	80.1	4.73	.61

5.3 Exposure to Aquatic Invasive Species Messaging

Respondents were asked to indicate where they had received information about AIS in their state (Table 17). They were instructed to check all that apply. The most commonly reported source of information was obtained at boat ramps or other signage (17.0%), followed by state agency websites (13.4%), and then inspection station personnel (8.3%).

Table 17. Information Source

Information Source	n	%
Billboard	1022	5.9
Boat captain or fishing guides	354	2.0
Boat ramp or other signage	2957	17.0
Boating event (e.g., sailing regatta)	105	.6
Boating or fishing show	736	4.2
Conference, Meeting	120	0.7
Conservation organization	1110	6.0
Fishing Group	807	4.6
Fishing Tournament	194	1.1
Friends or Family	886	5.1
Inspection station personnel	1441	8.3
Internet search ads (e.g., Google)	433	2.5
Lake/homeowners association	348	2.0
Magazine	855	4.9
Newsletter	485	2.8
Newspaper	585	3.4
Other boaters	869	5.0
Radio	313	1.8
State agency website	2329	13.4
Other website	512	2.9
State social media	780	4.5
Other social media (e.g., fishing clubs)	454	2.6
TV	591	3.4
Other	238	1.4
Total	18524	100.0

5.4 Trust in Information Source

Respondents reported that the most trusted source of information (Table 18) came from state agency websites (20.0%), followed by information at boat ramps or other signage (14.4%), and then inspection station personnel (11.6%).

Table 18. Trust in Source of Information about AIS

Information Source	N	%
Billboard	313	2.3
Boat captain or fishing guides	374	2.7
Boat ramp or other signage	1970	14.4
Boating event (e.g., sailing regatta)	98	.7
Boating or fishing show	452	3.3
Conference, Meeting	167	1.2
Conservation organization	1236	9.0
Fishing Group	542	4.0
Fishing Tournament	134	1.0
Friends or Family	364	2.7
Inspection station personnel	1589	11.6
Internet search ads (e.g., Google)	226	1.7
Lake/homeowners association	205	1.5
Magazine	336	2.5
Newsletter	439	3.2
Newspaper	434	3.2
Other boaters	351	2.6
Radio	230	1.7
State agency website	2798	20.5
Other website	164	1.2
State social media	686	5.0
Other social media (e.g., fishing clubs)	199	1.5
TV	246	1.8
Other	110	.8
Total	13663	100.0

5.5 Perceived Effectiveness of Clean, Drain, Dry Messaging

Respondents were requested to indicate how effective they considered information on AIS for; a) preventing the spread AIS, b) encouraging the adoption of Clean, Drain, Dry behaviors, and c) reaching the population of boaters from across the state (Table 19).

For preventing the spread of AIS, boat ramp or other signage was considered to be most effective (29.2%), followed by state agency websites (17.7%), and then inspection station personnel (16.1%).

With regard to the information source's impact on the adoption of Clean, Drain, Dry behaviors, boat ramp or other signage was again considered to be most effective (33.5%), followed by inspection station personnel (18.9%), and then stage agency websites (11.5%).

Last, with regard to reaching the state's population of boaters, boat ramp or other signage was considered to be most effective (27.6%), followed by state agency websites (15.6%), and then television (7.5%).

Table 19. Perceived Effectiveness of Information Source

Information Source	Preventing the spread of AIS		Encouraging the adoption of Clean, Drain, Dry Behaviors		Reaching the Population of Boaters	
	n	%	n	%	n	%
Inspection station personnel	629	16.1	739	18.9	407	.4
Newspaper	34	.9	25	.6	40	1.0
TV	173	4.4	169	4.3	292	7.5
Radio	48	1.2	49	1.3	85	2.2
Newsletter	66	1.7	66	1.7	128	3.3
State social media	149	3.8	129	3.3	235	6.0
Other social media (e.g., fishing clubs)	77	2.0	98	2.5	154	3.9
Internet search ads (e.g., Google)	53	1.4	44	1.1	66	1.7
Magazine	16	.4	10	.3	26	.7
State agency website	691	17.7	447	11.5	608	15.6
Other website	10	.3	10	.3	15	.4
Other boaters	79	2.0	108	2.8	69	1.8
Billboards	149	3.8	135	3.5	240	6.2
Boat captains or fishing guides	34	.9	31	.8	27	.7
Boat ramp or other signage	1138	29.2	1305	33.5	1077	27.6
Fishing groups	103	2.6	116	3.0	88	2.3
Conservation organizations	211	5.4	159	4.1	114	2.9
Friends or family	33	.8	76	1.9	28	.7
Lake/homeowners association	41	1.1	36	.9	20	.5
Fishing Tournament	11	.3	12	.3	8	.2
Boating event (e.g., sailing regatta)	5	.1	5	.1	5	.1
Conference, meetings	7	.2	4	.1	2	.1
Boating or fishing show	57	1.5	48	1.2	59	1.5
Other	86	2.2	79	2.0	107	2.7
Total	3900	100.0	3900	100.0	3900	100.0

1=Not at all effective through 5=Extremely effective.

5.6 Message Experiment – Encouraging Clean, Drain, Dry

Respondents were presented with one of 20 messages and asked a series of questions about their perception of whether or not the image would impact Clean, Drain, Dry behavior (See Appendix A3). The messages were randomly assigned across the population of respondents. After being presented with the message, respondents were then requested to respond to a series of questions concerning their; a) perceptions of the message's effectiveness for encouraging Clean, Drain, Dry behavior, b) raising their concern over AIS, and c) the likelihood they would engage in Clean, Drain, Dry behavior on their next boating trip.

We conducted an analysis of variance (ANOVA; When there was equality among the variances we used Tukey's post hoc comparisons. For unequal variances, we used Games-Howell comparisons test to examine which message treatments were most likely to increase respondents Clean, Drain, Dry behavior. While the F-value approached statistical significance ($F=1.60$ ($df=19, 3{,}880$), $p=.049$, $\eta^2=.008$), based on our post hoc message comparisons coupled with a very weak effect, we observed no statistically significant variation.

Of the messages that received strongest agreement ($M \geq 3.40$) in terms of their perceived effectiveness, however, their message content addressed (Table 20):

a. Science-based metaphor (#15; M=3.43) - "PREVENT THE SPREAD OF AQUATIC INVASIVE SPECIES. Aquatic invasive species are present in our state's lakes and rivers and can severely impact these ecosystems";
b. Ecological gain (#9; M=3.41) – "PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. Our aquatic ecosystems will benefit tremendously";
c. Protective/nurturing metaphor (#16; M=3.41) – "HELP PROTECT OUR WATERS. Aquatic invasive species harm our lakes and rivers";
d. Economic loss (#10; M=3.40) – "PROTECT YOUR WATERS. CLEAN, DRAIN, DRY. It will cost our state (YOU) $ millions";
e. Injunctive norm (#13; M=3.40) – "PROTECT YOUR WATERS. the state's boaters EXPECT you to CLEAN, DRAIN, DRY your boat";
f. Nativist metaphor (#17; M=3.40) – "NOT NATIVE, NOT WELCOME. Keep aquatic invasive species out of our state's lakes and rivers"; and
g. Militaristic metaphor (#18; M=3.40) – "STOP THE INVASION OF AQUATIC INVASIVE SPECIES. Help fight the battle against aquatic invasive species".

Table 20. Message Effect on Clean Drain Dry

In your opinion, how effective would this message be at increasing boaters' Clean, Drain, Dry behaviors?		n	M	SD
Message	1	195	3.28	.85
	2	207	3.35	.75
	3	198	3.32	.72
	4	190	3.19	.79
	5	199	3.26	.73
	6	191	3.23	.78
	7	195	3.32	.81
	8	211	3.30	.80
	9	205	3.41	.78
	10	196	3.40	.81
	11	139	3.29	.66
	12	179	3.32	.87
	13	181	3.40	.79
	14	194	3.23	.78
	15	199	3.43	.76
	16	217	3.41	.81
	17	194	3.40	.78
	18	203	3.40	.79
	19	200	3.37	.82
	20	207	3.34	.71
	Total	3900	3.33	3900

1=Not at all effective through 5=Extremely effective

5.7 Message Experiment – Perceived Severity of Aquatic Invasive Species

Following the presentation of the treatment message, respondents were also asked to indicate the extent to which they considered AIS to be a problem in their state. We conducted a chi-square test to examine the distribution of responses across each of the treatment messages. The findings presented in Table 21 illustrate proportionate distribution across the response categories (i.e., extent of problem) for each of the treatment messages. Response distributions were highly skewed; for all treatment messages, no less than 80% of respondents acknowledged that AIS is "a problem" or "a major problem" within their state.

Table 21. Perceived Problem of AIS in State

Message Treatment	Not sure		Not a problem		A slight problem		A problem		A major problem		Total	
	0		1		2		3		4			
	n	%	n	%	n	%	n	%	n	%	n	%
1	8	4.1	3	1.5	25	12.8	80	41.0	79	40.5	195	100.0
2	5	2.4	2	1.0	22	11.3	94	45.4	84	40.6	207	100.0
3	7	3.5	2	1.0	18	9.2	101	51.0	70	35.4	198	100.0
4	6	3.2	3	1.6	12	6.2	90	47.4	79	41.6	190	100.0
5	6	3.0	1	.5	20	10.3	93	46.7	79	39.7	199	100.0
6	4	2.1	2	1.0	23	11.8	93	48.7	69	36.1	191	100.0
7	5	2.6	1	.5	14	7.2	95	48.7	80	41.0	195	100.0
8	6	2.8	0	.0	29	14.9	92	43.6	84	39.8	211	100.0
9	7	3.4	2	1.0	21	10.8	88	42.9	87	42.4	205	100.0
10	5	2.6	1	0.5	18	9.2	83	42.3	89	45.4	196	100.0
11	7	5.0	1	0.7	13	6.7	72	51.8	46	33.1	139	100.0
12	5	2.8	1	.6	16	8.2	94	52.5	63	35.2	179	100.0
13	5	2.8	2	1.1	19	9.7	84	46.4	71	39.2	181	100.0
14	2	1.0	2	1.0	23	11.8	100	51.5	67	34.5	194	100.0
15	7	3.5	0	.0	18	9.2	92	46.2	82	41.2	199	100.0
16	10	4.6	3	1.4	18	9.2	100	46.1	86	39.6	217	100.0
17	8	4.1	3	1.5	25	12.8	81	41.8	77	39.7	194	100.0
18	6	3.0	1	.5	19	9.7	91	44.8	86	42.4	203	100.0
19	5	2.5	0	.0	19	9.7	91	45.5	85	42.5	200	100.0
20	8	3.9	1	.5	16	8.2	109	52.7	73	35.3	207	100.0

Pearson Chi-Square (df)=55.85 (76), p=.960, Cramer's V (φc)=.060

5.8 Message Experiment – Message Influence on Clean, Drain, Dry

Respondents were asked to indicate the likelihood that they would conduct the Clean, Drain, Dry behaviors listed in Table 22. Based on the means reported in Table 24 and ANOVA reported in Table 23, all messages were equally effective at encouraging Clean, Drain, Dry behavior. We observed no statistically significant variation in the effectiveness of one message type over another. All messages were equally effective at encouraging respondents to; a) clean mud, plants, and animals from their boats and equipment, b) wash their boats and equipment with a pressure washer or hot water, c) drain all water from their livewells, bilges, motors, and other receptacles, and d) dry their boat and equipment for at least a week.

Across the behaviors, however, respondents appear to be more inclined to clean mud, plants and animals from their boats and drain livewells, bilges, and motors rather than washing their boats and equipment with pressure washers or hot water and drying their boats for a week before entering another water body. The means for the former two behaviors hovered around 4.5 which approaches "very likely" to engage whereas the means for the latter two behaviors hovered at or slightly below 4.0 indicating "likely". Coupled with the findings presented in Tables 28, 32 and 33, respondents did indicate that these latter two actions were more challenging.

Table 22. Message Influence on Clean, Drain, Dry Behavior

Based on the message you have just read, if you saw this message, how likely would you do the following Clean, Drain, Dry behaviors the next time you go boating? (before launching in another waterbody)					
Message		Clean mud, plants, and animals from boat and equipment	Wash boat and equipment with pressure washer or hot water	Drain all water from livewells, bilges, motors, and other receptacles	Dry boat and equipment for at least a week
1	M	4.30	3.70	4.35	3.95
	SD	1.05	1.36	1.12	1.33
2	M	4.38	3.82	4.44	4.02
	SD	.99	1.27	1.00	1.18
3	M	4.41	3.71	4.46	3.98
	SD	.96	1.32	.95	1.23
4	M	4.37	3.64	4.44	4.01
	SD	1.08	1.36	1.04	1.30
5	M	4.32	3.84	4.41	3.98
	SD	1.05	1.25	1.10	1.24
6	M	4.27	3.70	4.38	3.92
	SD	1.08	1.28	1.13	1.29
7	M	4.38	3.98	4.39	3.96
	SD	1.02	1.22	1.01	1.24
8	M	4.32	3.81	4.33	3.86
	SD	1.13	1.33	1.14	1.33
9	M	4.45	3.88	4.47	4.20
	SD	1.02	1.33	1.04	1.14
10	M	4.37	3.96	4.49	4.15
	SD	.94	1.25	.94	1.13
11	M	4.22	3.84	4.25	3.98
	SD	1.22	1.27	1.26	1.23
12	M	4.39	3.56	4.47	4.06
	SD	1.00	1.37	.96	1.21
13	M	4.34	3.72	4.48	4.05
	SD	1.12	1.40	1.03	1.29

1=Not at all effective through 5=Extremely effective.

Table 22 (continued). Message Influence on Clean, Drain, Dry

Message		Clean mud, plants, and animals from boat and equipment	Wash boat and equipment with pressure washer or hot water	Drain all water from livewells, bilges, motors, and other receptacles	Dry boat and equipment for at least a week
14	M	4.36	3.69	4.43	3.94
	SD	1.02	1.32	1.03	1.30
15	M	4.45	3.80	4.51	4.14
	SD	.96	1.32	.95	1.18
16	M	4.36	3.62	4.45	3.96
	SD	1.07	1.43	1.10	1.31
17	M	4.28	3.73	4.45	4.03
	SD	1.11	1.37	1.04	1.30
18	M	4.49	3.79	4.51	4.06
	SD	.87	1.31	.89	1.18
19	M	4.28	3.85	4.41	4.05
	SD	1.20	1.30	1.14	1.33
20	M	4.40	3.75	4.48	4.09
	SD	.98	1.32	.93	1.19
Total	M	4.36	3.77	4.43	4.02
	SD	1.04	1.32	1.04	1.25

1=Not at all effective through 5=Extremely effective.

Table 23. Statistical Variation Among Message Treatments

Based on the message you have just read, if you saw this message, how likely would you do the following Clean, Drain, Dry behaviors the next time you go boating?	df	F	p
a. Clean my boat, equipment, and trailers and remove mud, plants, and animals before transporting my boat to another waterbody.	19	.79	.724
b. Wash my boat and trailer, e.g., with a pressure washer/spray nozzle or hot water, before travelling to a new waterbody.	19	1.31	.165
c. Drain all water from my livewells, bilges, motors, and other receptacles that have been in contact with water before leaving that same waterbody.	19	.67	.850
d. Dry my boat and equipment for at least a week before launching into other waters.	19	.90	.580

5.9 Frequency of Undertaking Clean, Drain, Dry

Respondents were requested to report on their Clean, Drain, Dry behavior over the past 12 months (Table 24). They indicated engaging in cleaning mud, plants and the animals from their boat (M=4.23) along with draining their livewells, bilges, and motors (M=4.45) more often than washing their boat and equipment (M=3.17) and drying their boat for a week or more before entering another lake (M=4.07). In particular, respondents were substantially less likely to report washing their boat with a pressure washer or hot water compared to all other behaviors.

Table 24. Frequency of Undertaking Clean, Drain, Dry

Over the last 12 months, I have…	Never	Sometimes	About Half the Time	Most of the Time	Always	M	SD
	1	2	3	4	5		
	%						
a. Cleaned my boat, equipment, and trailer and removed mud, plants, and animals before transporting my boat to another waterbody.	8.8	4.6	4.6	18.5	63.5	4.23	1.27
b. Washed my boat and trailer (e.g., with a pressure washer or hot water) before traveling to a new waterbody.	28.9	12.2	7.7	15.3	35.9	3.17	1.69
c. Drained all water from livewells, bilges, motors, and other receptacles that have been in contact with water before leaving that same waterbody.	7.1	3.1	2.1	13.6	74.2	4.45	1.15
d. Dried my boat for at least a week before launching into other waters.	9.7	7.6	5.5	20.1	57.1	4.07	1.34

5.10 Perceived Effectiveness of Clean, Drain, Dry

Overall, respondents considered the array of Clean, Drain, Dry behaviors presented in Table 25 to be effective in helping to minimize the spreads of AIS. The means on all items fell in the range of "quite effective" to "very effective".

Table 25. Effectiveness of Clean, Drain, Dry

How effective do you feel the following behaviors are at stopping or reducing the spread of aquatic invasive species in [state]'s freshwaters?	Not at all effective	Slightly effective	Neutral	Quite effective	Very effective	M	SD
	1	2	3	4	5		
	%						
a. Cleaning my boat, equipment, and trailer and removing mud, plants, and animals before transporting my boat to another waterbody.	8.8	4.6	4.6	18.5	63.5	4.23	1.27
b. Washing my boat and trailer (e.g., with a pressure washer or hot water) before traveling to a new waterbody.	28.9	12.2	7.7	15.3	35.9	3.17	1.69
c. Draining all water from livewells, bilges, motors, and other receptacles that have been in contact with river/lake waters before leaving that same waterbody.	7.1	3.1	2.1	13.6	74.2	4.45	1.15
d. Drying my boat for at least a week before launching into other waters.	9.7	7.6	5.5	20.1	57.1	4.07	1.34

5.11 Perceived Difficulty of Undertaking Clean, Drain, Dry

Although respondents considered Clean, Drain, Dry actions to be effective in preventing the spread of AIS, they indicated that some actions were more difficult to undertake than others (Table 26). Washing boats with a pressure washer or hot water was considered most challenging with a third of respondents (33.6%) reporting the task "difficult" to "very difficult". Similarly, drying boats for at least a week was also considered challenging for many boaters (26.8%). It is likely that many respondents do not have access to a pressure washer or outdoor hot water and consider drying their boat for a week overly burdensome. They may also not realize that drying their boat for an extended period of time is only necessary when shifting to another waterbody.

Table 26. Perceived Difficulty of Clean, Drain, Dry

Please indicate how challenging you consider each action	Extremely difficult	Difficult	Not too bad	Easy	Very easy	M	SD
	1	2	3	4	5		
	%						
a. Clean my boat, equipment, and trailers and remove any mud, plants, and animals before transporting my boat to another waterbody.	1.8	6.6	29.9	28.6	33.0	3.84	1.02
b. Wash my boat and trailer (e.g., with a pressure washer/spray nozzle or hot water), before traveling to a new waterbody.	10.9	22.7	29.3	18.5	18.6	3.11	1.26
c. Drain all water from my livewells, bilges, motors, and other receptacles that have been in contact with public waters before leaving that same waterbody.	2.2	5.3	16.3	25.0	51.1	4.17	1.03
d. Dry my boat and equipment for at least 7-10 days before launching into other waters.	10.4	16.4	21.2	19.8	32.3	3.47	1.36

5.12 Perception of Other Boaters' Clean, Drain, Dry Behavior

The statements in Table 27 assess the extent to which respondents felt other boaters engaged in Clean, Drain, Dry. Respondents did display some skepticism over other boaters' adoption of Clean, Drain, Dry behaviors. While the means in Table 27 hover around 3.0, many felt that other boaters "seldom" engaged in Clean, Drain, Dry.

Table 27. Perception of Other Boaters' Clean, Drain, Dry

How often do you think other boaters…	Never	Seldom	Occasionally	Often	Always	M	SD
	1	2	3	4	5		
	%						
a. Clean their boat, equipment, and trailers and remove mud, plants, and animals before transporting their boat to another waterbody.	5.2	28.7	35.6	26.8	3.7	2.95	0.95
b. Drain all water from their livewells, bilges, motors, and other receptacles that have been in contact with public waters before leaving that same waterbody.	4.0	24.2	28.2	36.2	6.8	3.18	1.00
c. Dry their boat and equipment for at least 7-10 days before launching into other waters.	12.5	32.8	30.8	20.8	3.1	2.69	1.03

5.13 Expectation from Others to undertake Clean, Drian, Dry Behavior

The statements in Table 28 assess the extent to which respondents felt other boaters expected them to Clean, Drain, Dry. Respondents did feel an expectation from other Boaters to Clean, Drain, Dry after boating. Most respondents (>50%) expressed agreement with the statement, while many were ambivalent (~30%) neither agreeing nor disagreeing.

Table 28. Perception of Other Boaters' Expectation of Me to Engage in Clean, Drain, Dry

Other boaters expect me to…	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	M	SD
	1	2	3	4	5		
	%						
a. Clean my boat, equipment, and trailers and remove any mud, plants, and animals before transporting my boat to another waterbody.	2.3	6.3	31.6	40.8	19.1	3.68	0.93
b. Drain all water from my livewells, bilges, motors, and other receptacles that have been in contact with public waters before leaving that same waterbody.	2.3	6.0	29.5	39.4	22.8	3.74	0.95
c. Dry my boat and equipment for at least 7-10 days before launching into other waters.	6.6	12.3	35.7	30.9	14.4	3.34	1.08

5.14 Perceived Obligation to Engage in Clean, Drain, Dry Behavior

The statements in Table 29 capture the extent to which respondents feel a personal obligation to engaging in Clean, Drain, Dry behaviors. These findings suggest that respondents do feel a personal obligation to engage in Clean, Drain, Dry action. More than 80% of respondents expressed agreement with all statements depicted in Table 29.

Table 29. Personal Obligations to Engage in Clean, Drain, Dry

Please indicate your level of agreement with each statement.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	M	SD
	1	2	3	4	5		
	%						
a. I feel a personal obligation to help reduce the spread of aquatic invasive species in [state].	.7	.6	6.5	37.1	55.2	4.45	.71
b. I feel morally obliged to help stop the spread of aquatic invasive species in [state], regardless of what others do.	.8	1.3	7.5	37.1	53.2	4.40	.76
c. I feel guilty when I do not Clean, Drain, and Dry my boat.	3.5	6.4	25.9	30.9	33.3	3.84	1.07
d. People like me should do whatever they can to stop the spread of aquatic invasive species in [state].	.7	.6	5.7	37.7	55.3	4.46	.70

5.15 Constraints to Undertaking Clean, Drain, Dry Behavior

Respondents asked if there was anything that kept them from engaging in Clean, Drain, Dry behavior. Twenty-five percent indicated "yes" (Table 30). Of those, they expressed strongest agreement on two items (Table 31); a) "There are no cleaning stations to do Clean, Drain, Dry" (M=3.93, item g), and b) "Public access points or boat ramps are too crowded" (M=3.27, item a).

Table 30. Constraints to Engaging in Clean, Drain, Dry

	n	%
No	2916	74.8
Yes	984	25.2

Table 31. Individual Behaviors - Constraints to Engaging in Clean, Drain, Dry

If yes, please indicate the extent to which any of the following keeps you from being able to do Clean, Drain, Dry.	Strongly Disagree 1	Disagree 2	Neither Agree nor Disagree 3	Agree 4	Strongly Agree 5	M	SD
	%						
a. Public access points or boat ramps are too crowded.	8.2	18.3	26.7	31.7	15.0	3.27	1.17
b. I do *not* understand what I need to do.	39.5	40.1	13.4	5.2	1.7	1.89	.94
c. I don't think that stopping the spread of aquatic invasive species is important.	59.5	32.6	4.9	2.0	1.0	1.53	.77
d. I am *not* physically able to do Clean, Drain, Dry.	38.8	36.2	13.3	8.5	3.2	2.01	1.07
e. I do *not* think Clean, Drain, Dry will stop the spread of aquatic invasive species.	34.7	39.3	14.4	8.2	3.4	2.06	1.06
f. Aquatic invasive species don't affect me.	48.3	35.9	10.5	3.7	1.7	1.75	.91
g. There are no cleaning stations to do Clean, Drain, Dry.	4.8	6.1	13.8	41.8	33.5	3.93	1.07
h. After boating, I do not have the time.	18.5	33.5	26.3	18.6	3.0	2.54	1.08
i. I do *not* know what to look for with regards to aquatic invasive species.	23.2	36.3	2.4	15.9	4.3	2.42	1.13
j. After boating, I am too tired to Clean, Drain, Dry.	21.7	36.3	24.3	15.8	1.9	2.40	1.05
k. Other boaters aren't Cleaning, Draining, and Drying their watercraft.	15.8	16.7	34.6	25.1	7.9	2.93	1.17
l. I do *not* think that anything I do will prevent the spread of aquatic invasive species.	35.6	37.9	15.0	8.5	2.9	2.05	1.05

5.16 Trust in State to Manage Aquatic Invasive Species

In the context of the management of AIS within respondents' state, there was relatively strong agreement with statements indicating that the state provides trustworthy and timely information about AIS issues, best practices for AIS prevention, and has the capacity to prevent and manage AIS (Table 32).

Table 32. Trust in State to Manage AIS

With respect to AIS management, I trust the state/province of [state] to…	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	M	SD
	1	2	3	4	5		
	%						
a. … provide the best available information on aquatic invasive species issues.	1.6	3.9	10.8	46.0	37.7	4.14	.87
b. … provide me with enough information to know what actions I should take regarding aquatic invasive species prevention.	1.6	3.6	10.9	47.9	36.1	4.13	.86
c. … to take action to prevent and manage invasive species.	2.3	5.4	12.7	44.9	34.7	4.04	.95
d. … provide timely information regarding aquatic invasive species.	1.9	4.8	11.6	46.6	35.1	4.08	.91

5.17 Comparisons of Select Variable by Boater Characteristics

In follow-up analyses, we examined variation on a number of select variables using several boater characteristics (see Appendix B). Discussion below is restricted to states where respondents had completed 50 or more questionnaires. Key findings:

1. *Familiarity with AIS.* Respondents were presented with five statements examining their familiarity with AIS in their primary boating state. The statements assessed their familiarity with AIS prior to taking the survey, Clean, Drain, Dry behavior, AIS detected in their state, locations of detection, and problems cause by AIS. The pattern of findings were generally consistent on all five statements. The following respondents reported being most aware;
    a. Residents of Nevada, and Utah.
    b. Houseboat owners.
    c. Tournament anglers.
    d. Avid boaters.
2. *Knowledge of AIS.* Respondents were presented with eight statements examining their knowledge of AIS within their primary boating state as it pertains to their prevalence, impact on the economy, ecology, and recreation in addition to the importance of preventing the spread of AIS through Clean, Drain, Dry action. The pattern of findings varied along several dimensions;
    a. In terms of prevalence, Kansas respondents considered AIS to be most prevalent and Alaskan respondents least prevalent.
    b. In terms of concern over AIS, while most respondents expressed concern over the presence of AIS, respondents from Alaska, Idaho, and Oregon were least concerned. Among other groups, hunters were also expressed less concern whereas respondents aged between 18-25 years were more concerned.
    c. With regard to AIS' impact on state's economies, there was broad concern across all segments of the boating population.
    d. For concern over the health of the state's lakes and rivers and freshwater fish and wildlife, respondents were unanimous in both the strength of their conviction and level of concern over the threat posed by AIS. All boating segments considered AIS to be a significant threat to the health of the ecosystem.
    e. All boating segments considered Clean, Drain, Dry important in addition to efforts to prevent the spread of AIS.
3. *Information Sources for AIS.* Respondents were presented with 24 information sources and requested to select all sources from which they have heard or received information about AIS. Patterns across respondent segments included:
    a. Boat ramps and other signage, and state agency website were consistently the most popular information sources.
    b. Inspection site personnel and state social media pages were more frequently reported as information sources in states that emphasized AIS education programs and were less frequently reported as information sources in states with less AIS-focused programs.
    c. Tournament anglers were more likely to report social connections as information sources about AIS.
    d. Female respondents were more likely to report friends and family as information sources about AIS, whereas male respondents were more likely to report all other sources.

4. *Trusted AIS Information Sources.* Respondents were presented with 24 information sources and requested to identify all information sources that they trusted most to provide information about AIS. Patterns in the findings included:
    a. State agency websites were selected as the most trusted information sources across all respondent segments.
    b. Boat ramp signage, inspection station personnel, and conservation organizations were also consistently selected as trusted information sources across watercraft and activity types, ages, and genders.
    c. Beyond state agency websites, state agency social media accounts were more likely to be a trusted information source about AIS for those ages 26-45. While younger (18-25) respondents were more likely to trust conservation organizations, older respondents (65+) were more likely to trust inspection station personnel.
5. *Effective AIS Information Sources.* Respondents were presented with 24 information sources and requested to report which source they perceived as most effective at; (a) preventing the spread of AIS, (b) encouraging people to adopt Clean, Drain, Dry behaviors, and (c) reaching the population of boaters across the state/province. The most prominent patterns of findings were:
    a. Boat ramps and other signage, inspection station personnel, and state agency websites were consistently found to be most effective at preventing the spread of AIS, encouraging people to adopt Clean, Drain, Dry behaviors, and reaching the population of boaters.
    b. Houseboat owners were consistently more likely to report inspection station personnel as more effective across all segments whereas john boat and bass boat owners were more likely to view boat ramps and other signage as most effective.
    c. Older respondents were more likely to view state agency websites as most effective at preventing the spread of AIS and encouraging use of Clean, Drain, Dry behaviors relative to younger respondents. Younger respondents were more likely to report conservation organizations and inspection station personnel as being most effective at preventing the spread of AIS and encouraging use of Clean, Drain, Dry behaviors.
6. *The Extent of the AIS Problem.* Respondents were presented with a question asking about the extent they feel aquatic invasive species are a problem in their primary boating state. Most notable findings were:
    a. Across all segments, respondents reported that they feel aquatic invasive species are a problem in their primary boating state.
    b. Respondents boating in Montana and respondents residing in Utah reported feeling most concerned that aquatic invasive species are a problem in their primary boating state.
    c. Respondents boating and residing in Alaska reported feeling the least concerned that aquatic invasive species are a problem in their primary boating state.
    d. Among watercraft types, houseboat owners reported feeling the most concerned that aquatic invasive species are a problem.
    e. Among activity types, wake sports participants were most likely to feel that aquatic invasive species are a problem.
    f. Among age groups, respondents 56 years and older tended to consider AIS most problematic.
7. *Likelihood of Engaging in Clean, Drain, Dry.* Respondents were presented with four statements examining how likely they would engage in different actions related to Clean, Drain, Dry practices to prevent the spread of AIS; a) cleaning their boat and equipment before transporting their boat to another waterbody, b) washing their boat and trailer (e.g., with a pressure washer

or hot water) before travelling to a new waterbody, c) draining all water from receptacles that have been in contact with public waters before leaving that same waterbody, and d)drying their boat and equipment for at least a week before launching into other waters. Most notable patterns in the findings were:

a. Likelihood of engagement in all actions pertaining to Clean, Drain, Dry behaviors was high.
b. In regard to cleaning behaviors, Arizona respondents were most likely to clean their boat and equipment before transporting to other waterbodies and Alaskan respondents were least likely.
c. For washing behaviors, Wyoming respondents were most likely to wash their boat and equipment before travelling to a new waterbody and Alaskan respondents were least likely.
d. For draining behaviors, Kansas respondents were most likely to drain water from receptacles that came in contact with public waters before leaving that waterbody and Alaskan and Washington respondents were least likely.
e. In terms of drying behaviors, Arizona respondents were most likely to dry their boats and equipment for at least a week before launching into other waters and Alaskan respondents were least likely.
f. Across all segments, respondents reported the highest likelihood of engaging in cleaning and drying behaviors and least likely to engage washing with hot water or a pressure washer.

8. *Frequency of Clean, Drain, Dry***.** Respondents were presented with four items asking about the frequency of their engagement in Clean, Drain, Dry behavior; a) cleaning their boat and equipment before transporting their boat to another waterbody, b) washing their boat and trailer (e.g., with a pressure washer or hot water) before travelling to a new waterbody, c) draining all water from receptacles that have been in contact with public waters before leaving that same waterbody, and d) drying their boat and equipment for at least a week before launching into other waters. Most notable patterns in the findings were:
    a. Across all segments, respondents reported engaging in Clean, Drain, Dry behavior. However, reported frequency of respondent's engagement in washing their boat and trailer before travelling to a new waterbody was lower than frequency of engagement in other Clean, Drain, Dry behaviors.
    b. Consistent on all Clean, Drain, Dry behaviors, both respondents boating in Alaska and residing in Alaska reported least frequent engagement.
    c. Regarding cleaning behaviors, respondents boating and residing in Montana most frequently engaged in cleaning their boat and equipment before transporting to other waterbodies.
    d. For washing behaviors, respondents boating in Arizona and respondents residing in Montana most frequently engaged in washing their boat and equipment before travelling to a new waterbody and Alaskan respondents were least frequent.
    e. For draining behaviors, respondents boating and residing in Colorado most frequently engaged in draining all water from receptacles that came in contact with public waters before leaving that waterbody and Alaskan and Washington respondents were least likely.

f. In terms of drying behaviors, respondents boating and residing in Utah most frequently engaged in drying their boats and equipment for at least a week before launching into other waters.
g. Among watercraft types, houseboat owners reported the most frequent engagement in Clean, Drain, Dry behaviors.
h. While wake sports participants reported most frequent engagement in washing and drying behaviors, tournament fishing participants reported most frequent engagement in cleaning and draining behaviors.

1. *Perceived Effectiveness of Clean, Drain, Dry.* Respondents were presented with four statements examining their perceptions of effectiveness of certain Clean, Drain, Dry behaviors. Specifically, respondents were asked judge the effectiveness of the following behaviors: cleaning their boat and equipment before transporting it to another waterbody, washing their boat and equipment (e.g., with a pressure water or hot water) before traveling to a new waterbody, draining all water from receptacles that have been in contact with public waters before leaving that same waterbody, and drying their boat for at least a week before launching into other waters. Patterns in the findings were;
    a. Across respondent segments, cleaning and draining practices, specifically, were viewed as most effective at preventing the spread of AIS. Washing actions were considered least effective.
    b. Regarding cleaning behaviors, Montana respondents viewed cleaning boats and equipment before transporting to another water to be most effective as preventing the spread of AIS and Alaskan respondents viewed cleaning practices as least effective.
    c. For washing behaviors, Arizona respondents viewed washing boats and equipment before transporting to a new waterbody as most effective in preventing the spread of AIS and Californian and Alaskan residents viewed washing practices as least effective.
    d. In terms of draining behaviors, Wyoming respondents viewed draining all water from receptacles that had been in contact with public waters before leaving that same waterbody as most effective in preventing the spread of AIS and Alaskan respondents viewed draining practices as least effective.
    e. For drying behaviors, Washington respondents viewed drying boats and equipment for at least a week before launching into other waters as most effective at preventing the spread of AIS and Alaskan respondents viewed drying practices as least effective.

10. *Perceived Difficulty of Clean, Drain, Dry.* Respondents were presented with four different actions related to Clean, Drain, Dry best practices and were asked to rate the level of difficulty for each action. The actions included cleaning boats and equipment before transporting to another waterbody, washing boats and trailers before traveling to another waterbody, draining all water from receptacles that came in contact with public waters before leaving that same waterbody, and drying boats and equipment for at least a week before launching into other waters. Prominent patterns in the findings included:
    a. Across all segments, respondents found clean and draining best practices to be easy to very easy, while washing and drying behaviors were perceived to be more difficult.
    b. Boaters in Alaska, as well as residents of Alaska, consistently perceived the most difficulty in engaging in Clean, Drain, Dry best practices across all behaviors.
    c. Across states, washing boats and equipment with a pressure washer or hot water before traveling to another waterbody was perceived to be the most difficult Clean, Drain, Dry action.

d. For all watercraft types, respondents perceived the Clean, Drain, Dry behaviors to be not too difficult to easy.
e. Overall, Clean, Drain, Dry behaviors were perceived to generally be not too difficult or easier across all respondent characteristics.

11. *Beliefs About Other Boaters' Clean, Drain, Dry Behavior.* Respondents were presented with a series of questions asking about their beliefs about the frequency of other boaters' engagement in Clean, Drain, Dry behaviors related to; a) cleaning their boat and equipment before transporting their boat to another waterbody, b) draining all water from receptacles that have been in contact with public waters before leaving that same waterbody, and c) drying their boat and equipment for at least a week before launching into other waters. Most notable patterns in the findings were:
    a. Consistent across all Clean, Drain, Dry behaviors, respondents boating and residing in Alaska believed other boaters were least often engaging in Clean, Drain, Dry behaviors.
    b. Regarding cleaning behaviors, respondents boating and residing in Colorado believed other boaters were most often engaging in cleaning their boat and equipment before transporting to other waterbodies.
    c. In terms of draining behaviors, respondents boating in Arizona and respondents residing in Colorado and Nevada believed other boaters were most often engaging in draining all water from receptacles that came in contact with public waters before leaving that waterbody.
    d. Similar to cleaning and draining behaviors, respondents boating in Arizona and respondents residing in Utah believed other boaters were most often engaging in drying their boats and equipment for at least a week before launching into other waters.
    e. Among all watercraft types, houseboat owners believed other boaters were most often engaging in Clean, Drain, Dry behaviors.
    f. Among all activity types, wake sports participants believed other boaters were most often engaging in Clean, Drain, Dry behaviors.
    g. Consistent on all Clean, Drain, Dry behaviors, as boating frequency increased in spring, summer, and fall, beliefs about the frequency of others engaging in Clean, Drain, Dry behaviors decreased.
    h. White, Spanish, Hispanic, and Latino respondents indicated that they believed other boaters engage in Clean, Drain, Dry behaviors most often.
12. *Beliefs About Other Boaters' Expectations Regarding Clean, Drain, Dry.* Respondents were presented with a series of statements relating to their beliefs about other boaters' expectations of their use of Clean, Drain, Dry. Respondents were asked to indicate their level of agreement to three statements concerning; a) cleaning their boat, equipment, and trailers and remove any mud, plants, and animals before transporting their boat to another waterbody, b) draining all water from their receptacles that have been in contact with public waters before leaving that same waterbody, and c) drying their boat and equipment for at least 7-10 days before launching into other waters. Most notable patterns in the findings were:
    a. Across all segments, respondents agreed that other boaters expected them to engage in Clean, Drain, and Dry.
    b. Consistent on all Clean, Drain, Dry behaviors, respondents boating in Alaska and residing in Alaska reported the least agreement that other boaters expect them to engage in Clean, Drain, Dry.
    c. Regarding cleaning behaviors, respondents boating and residing in Utah indicated the most agreement that other boaters expect them to clean their boat, equipment, and

trailers and remove any mud, plants, and animals before transporting their boat to another waterbody.

d. For draining behaviors, respondents boating and residing in Colorado and Utah reported the highest level of agreement about other boaters' expectations regarding draining water from all receptacles before leaving a waterbody.
e. In terms of drying behaviors, respondents boating and residing in Utah reported the highest level of agreement about other boaters' expectations regarding drying their boat and equipment for at least 7-10 days before launching into other waters.
f. Among watercraft types, houseboat owners reported the highest level of agreement about other boaters' expectations regarding Clean, Drain, Dry.
g. Among activity types, wake sports participants reported the highest level of agreement.
h. Among racial groups, White and Spanish/Hispanic/Latino reported the highest level of agreement that other boaters expect the respondent to engage in Clean, Drain, Dry.

13. *Beliefs About Clean, Drain, Dry and AIS.* Respondents were presented with four statements examining their beliefs surrounding the responsibility of engaging in Clean, Drain, Dry, and reducing the spread of AIS. Specifically, respondents were presented with each of the following statements; a) feeling a personal obligation to help reduce the spread of aquatic invasive species, b) feeling morally obliged to help stop the spread of AIS (regardless of what others do), c) feeling guilty when they do not engage in Clean, Drain, Dry, and d) that people like them should engage in Clean, Drain, Dry. Most notable patterns in the findings were:
    a. The level of agreement to these statements was generally high apart from feeling guilty when not engaging in Clean, Drain, Dry. Agreement to this statement was still moderately high, but markedly lower than the other three statements.
    b. Colorado boaters felt the strongest personal obligation to reduce the spread of AIS.
    c. Montana boaters (with Colorado close behind) felt the most obliged to stop the spread of AIS in their primary boating state.
    d. Wyoming boaters felt the guiltiest when they did not engage in Clean, Drain, Dry.
    e. Montana boaters felt that people like them should do whatever they can to stop the spread of AIS in their primary boating state.
    f. Houseboat owners were in the most agreement with all four statements.
    g. People participating in wake sports were in most agreement with all four statements.
14. Twenty five percent of respondents (n=984) indicated that some form of constraint prevented them from undertaking Clean, Drain, Dry. These respondents were requested to indicate their level of agreement with 12 statements that could potentially obstruct their ability to Clean, Drain, Dry. Below, we report highlights from boating groups with at least 10 or more responses:
    a. Access points too crowded.
        - Boaters both residing in Washington and boating in Washington.
        - Houseboat owners and ski/wakeboard boaters.
        - Wake sports participants.
    b. Not understanding what needs to be done.
        - For the most part, all respondents reported understanding what needs to be done in terms of Clean, Drain, Dry.
    c. Perception of the importance of stopping the spread of AIS.
        - For the most part, all respondents understood the importance of stopping the spread of AIS.
    d. Physical ability to Clean, Drain, Dry.
        - All respondents expressed the capacity to undertake Clean, Drain, Dry.

e. Perception that Clean, Drain, Dry will not help prevent the spread of AIS.
    - All respondents shared the belief that Clean, Drain, Dry will help prevent the spread of AIS.
f. Personal impact if AIS.
    - While all boaters were concerned about the personal impact of AIS, those expressing slightly less concern were respondents from Alaska, houseboat and ski/wakeboarders, and wake sports participants.
g. Absence of cleaning stations.
    - Most respondents agreed that the absence of cleaning stations was constraining their ability to Clean, Drain, Dry. Respondents from Alaska were most inclined to indicate this constraint.
h. Too little time.
    - While there was little variation across boating groups indicating that they had too little time to Clean, Drain, Dry, there was moderate level of agreement with the statement.
i. Not knowing what to look for.
    - Generally, most boaters reported being aware of what to look for with regard to AIS.
j. Too tired.
    - Each of the boating groups reported that fatigue was a not a substantial constraint.
k. Other boaters' behavior.
    - While there was little variation among boating groups over their concern for other boaters not undertaking Clean, Drain, Dry, there was a universal degree of skepticism over others' compliance.
l. Capacity to prevent the spread AIS.
    - All boating groups were confident in their capacity to prevent the spread of AIS.

15. *Trust in State/Province Actions.* Respondents were presented with a series of statements relating to their trust in different actions of the state/province. Respondents were asked to indicate their level of agree to four statements about state/province of state's actions. Specifically, these included; a) trusting the state/province to provide the best available information on AIS issues, b) provide people with enough information to know what actions they should take to regarding AIS prevention, c) to take action and manage invasive species, and) provide timely information regarding AIS. Comparisons were made across these statements in several domains. Most notable patterns in the findings were:
    1. Respondents generally agreed they trust the state to provide good and accurate information regarding AIS. However, trust in the state to take action to prevent and manage invasive species was the least.
    2. Wyoming and Arizona boaters trusted their states most. Whereas California, Alaska, and Oregon trusted them the least.
    3. Wake sport participants were consistently had the highest level of trust in the state.
    4. While generally expressing trust in state agencies (means of four on the five point scale), tournament anglers, hunters, cabin cruiser/center console boat owners, and younger respondents scored consistently scored lower than other groups.

5.18 Message Treatment Follow-up Analyses

To further explore variation among select groups with regard to the effectiveness of our message treatment, we conducted follow-up analyses on message treatments that respondents considered to be most effective at encouraging Clean, Drian, Dry (see Appendix C). Following the presentation of the message/image to respondents, respondents were asked, “In your opinion, how effective would this message be at increasing boaters’ Clean, Drain, Dry behaviors?” Responses ranged along a 5-point scale where 1=”not at all effective” through 5=”extremely effective”. Messages the respondents considered most effective (with means $\geq$ 3.4) consisted of all four metaphor-based messages, economic loss and ecological gain, and the injunctive norm message. For these messages, we examined variation by watercraft type, activity type, household income, and gender.

We observed statistically significant variation science- and militaristic-based metaphors only. For the science metaphor, houseboat owners and men considered the message most effective for encouraging Clean, Drain, Dry. For the militaristic metaphor, kayak/canoe//paddleboard owners considered the message least effective. We observed no variation among groups for the remaining treatment messages. All groups considered the message equally effective.

6.0 DISCUSSION & RECOMMENDATIONS

In this section of the report, we document findings stemming from analyses and offer selected recommendations. Key findings suggest:

1. Likely an artifact of our sample's homogeneity, socio-demographic variables related to education, race, and income did not consistently reveal variation or associations with factors related to familiarity with AIS, adoption of Clean, Drain, Dry, and other associated variables. The characteristics of the sample is, however, broadly reflective of the boating public. Efforts to target messaging campaigns at select groups based on these attributes would not likely produce a significant shift in boaters' awareness, knowledge, and behavior.
    a. Age, however, was more strongly associated with awareness, knowledge and Clean, Drain, Dry behavior. Likely an artifact of exposure to AIS messaging through their years of boating experience, older boaters expressed greater awareness, knowledge, and willingness to adopt Clean, Drain, Dry. **Messaging toward a younger cohort ought to occur early in their boating careers. Beyond the most popular sources (i.e., boat ramps, state agency websites, and inspection stations), these messages could be delivered with boat registration and fishing license renewals.**

2. Respondents were familiar with AIS before taking the survey along with the need to Clean, Drain, Dry. They were, however, less familiar with both the species of AIS that had been detected in the state where they primarily boat in addition to the locations (waterbodies) in the state where AIS had been detected.
    a. Familiarity with AIS (prior to taking survey) was linked to the extent to which respondents interacted with the resource (e.g., houseboat owners, tournament anglers, avid boaters). Those least familiar with AIS reported (e.g., pontoon and sailboat owners, paddlers, hunters) less concern over AIS and a lower likelihood of implementing Clean, Drain, Dry. **Those most actively interacting with the resource will likely encounter AIS messaging through the most popular sources of information (boat ramp kiosks, state agency websites, inspection stations), whereas accessing infrequent boaters will be an ongoing challenge. Point of sale for non-motorized watercraft (e.g., decals placed on the watercraft) and hunting licenses provides one opportunity for agency contact.**

3. Respondents were aware of the importance of Clean, Drain, Dry for preventing the spread of AIS. They also indicated being aware of the threat posed by AIS to the health of their state's; a) freshwater lakes and rivers, b) freshwater fish and wildlife, and c) freshwater recreation.
    a. States with invasive mussel infestations and active watercraft inspection and decontamination programs (e.g., Utah, Nevada) appear to have had most success with raising public awareness. Beyond kiosks at boat ramps and their state agency websites, respondents from these states were also more likely to report receiving information from inspection stations. **Inspection stations provide an opportunity for agencies to directly communicate with boaters, dispel myths and misinformation, and provide up to date information about the health of specific lakes and necessary precautions.**
    b. Among use groups, houseboat owners and wakesports users expressed greatest awareness for the need for Clean, Drain, Dry whereas non-motorized users and hunters expressed the greatest ambivalence. **For non-motorized users, information about AIS and Clean, Drain, Dry could be placed on the product at the point of sale. For hunters,**

principally waterfowl, information about AIS and Clean, Drain, Dry could also be shared with the purchase of duck stamps and hunting licenses.

4. In terms of AIS information to which respondents had been previously exposed:
   a. Most common sources were boat ramp kiosks, followed by the state's agency website, and then inspection station personnel. For these information sources, respondents indicated that their state's agency websites were most trusted, followed by boat ramp kiosks, and then state inspection personnel. **AIS information should be easily accessible on agency websites. Given their broad coverage and, importantly, boaters' trust in the state to provide up to date information about AIS, access to this information on agency websites should feature prominently.**
   b. Referencing the same information sources, respondents were asked to indicate how effective the information was for preventing the spread of AIS, encouraging Clean, Drain, Dry, and reaching the population of boaters. Similar to respondents' exposure and trust, boat ramp signage, state agency websites, and state inspection personnel were considered most effective for preventing the spread of AIS, encouraging Clean, Drain, Dry, and reaching the population of boaters. **Residents of states utilizing inspection stations (e.g., California, Utah, Nevada) expressed greater trust in the information provided by inspection station personnel, considered the information more effective at preventing the spread of AIS, and more effective at encouraging Clean, Drain, Dry. While the coverage of the information provided by inspection station personnel is geographically limited, it is clearly a useful tool and one that warrants consideration/adoption.**
   c. Beyond state agency websites, state agency social media accounts were more likely to be a trusted information source about AIS for those aged 26-45. While younger (18-25) respondents were more likely to trust conservation organizations. **Conservation organizations (e.g., CCA) provide an opportunity to develop strategic partners that can help amplify agency efforts through social media, their agency websites, and through members' social networks. Regular active engagement with these partners would also assist in providing up to date information.**

5. With regard to our messaging experiment, following the presentation of the image/message to respondents, they were requested to:
   a. Indicate the extent to which the message would encourage others to engage in Clean, Drain, Dry – Respondents indicated that the messages would have modest impact on encouraging others' Clean, Drain, Dry behavior. While all messages were equally effective, there was some ambivalence over the messages' potential to shift others' behavior.
   b. Indicate the extent to which they considered AIS to be a problem in their state – Message treatments had equal influence on the extent to which respondents considered AIS to be a problem. For all messages, over 80% of respondents considered AIS "a problem".
   c. Indicate the extent to which they would engage in Clean, Drain, Dry – All message treatments were equally effective at encouraging respondents to engage in Clean, Drain, Dry on their next boating trip. Actions considered most effective related to cleaning and draining boats. The message's influence on washing and drying actions were considered to be less effective.

While we observed no statistically significant variation among message treatments – all moderately effective at encouraging Clean, Drain, Dry – seven messages were somewhat superior. For future messaging efforts, agencies should consider elements of each message or in combination when designing persuasive appeals.

As previously noted, a number of the message treatments were drawn from past work conducted in the context of the human dimensions of aquatic invasive species and conservation behavior. For the identify frames, Fielding and associates' work on social identity and its association conservation-related behaviors (Fielding & Hornsey, 2016; Schultz & Fielding, 2014; Unsworth & Fielding, 2014) revealed that messages that make salient an individual's ingroup membership (e.g., boater, hunter, paddler, angler) have greater persuasive power than messages to which the individual has no affiliation. While statistically significant variation was not observed across the different identities, respondents receiving the message identifying "anglers" considered the message to be most effective at encouraging Clean, Drain, Dry behaviors among the four identify frames. **Overall, respondents considered the identity frames least effective compared to other frames at encouraging Clean, Drain, Dry.**

Similarly, the environment and economic gain/loss scenarios were drawn from Degolia, et al.'s (2019) work within the context of wild pig management. Their work revealed that messages framed in terms of environmental outcomes, as opposed to economic, elicited more support for AIS management among a sample of California residents. Also, messages referencing economic and environmental loss drove stronger support for AIS management compared to messages referencing gain. While we did not observe statistically significant variation across these message frames, respondents receiving the economic loss and ecological gain messages were most inclined to indicate that the message would encourage Clean, Drain, Dry. Research in behavioral economics (Kahneman & Tversky, 1977) has consistently shown that consumers are less accepting losing economic standing (loss aversion) than of gaining. Alternately, the prospect of an ecological gain reflected in the ecological treatment was perceived to be influential in encouraging Clean, Drain, Dry. **Framing the impact of AIS on aquatic ecosystems and the state's economic health is compelling.**

Economic Loss

Ecological Gain

The normative message frames were drawn from the work of Wallen and Kyle (2018) who explored the effective of normative message framing and its impact on Clean, Drain, Dry among Texas boaters. Like Wallen and Kyle, we observed no statistically significant variation among the different types of normative frames. However, respondents receiving the injunctive normative message considered the message to be most effective at encouraging Clean, Drain, Dry. **Unlike the descriptive norm, the injunctive norm message attempts to instill a personal obligation that rests on the perception of others' expectations.**

Injunctive Norm

Last, metaphor themed frames were drawn from Shaw et al.'s (2021) and their work relating to messaging to prevent the spread of zebra mussels. These metaphors touched upon themes related to; a) science with objective, fact-based information, b) the protection of nature with a nurturing statement related to protecting the environment, c) non-nativist with reference to alien species, and d) militaristic with reference to battles against invasives. While we did not observe statistically significant variation, **all metaphor themes performed comparatively well compared to other message treatments. The science metaphor, like Shaw et al., was the strongest performer in terms of respondents' reported effectiveness for encouraging Clean, Drain, Dry.**

Militaristic Metaphor

Protective Metaphor

Nativist Metaphor

Science Metaphor

6. For the follow-up analyses where we examined variation across groups (activity type, watercraft type, gender, and household income) for the best performing message treatments, we saw little variation across groups. The science-based metaphor was considered most effective for houseboat owners and men whereas the militaristic metaphor was considered least effective by kayak/canoe/paddleboard owners. **Broadly, subgroups consider these messages to be equally effective.**

7. In terms of the extent to which respondents considered AIS a problem in their state, concern varied in ways similar to their perceptions of the effectiveness of information about AIS and their perceived effectiveness and willingness to implement Clean, Drain, Dry. Alaskans were less concerned whereas houseboat owners and wakesports participants were most concerned. **For states where respondents expressed least concern, it is likely an artifact of the state's willingness to promote information about AIS and/or the extent to which AIS is a problem within the state. For non-motorized users (e.g., paddle boards, kayaks) the ambivalence might relate to the perception that these types of watercraft are unlikely to be problematic owing to the (mis)perception that they don't hold water in volumes that could be problematic (e.g., absence of bilges or bait tanks). Placing stickers with Clean, Drain, Dry messaging on the watercraft at sale may be one way to advance messaging.** Similar groups' familiarity, boaters with extensive interaction with the resource (e.g., houseboat owners, wakesports participants) considered AIS most problematic. Older respondents (> 55 years) also considered AIS more problematic than younger respondents. **For those respondents most extensively interacting with the resource they are witnessing, firsthand, the impact of AIS. For younger respondents, however, the problem of a shifting baseline (Soga & Gaston, 2018) that allows for greater tolerance of AIS might underlie greater acceptance due to a lack prior experience of past conditions. For younger respondents, the normative condition may well be the present condition.** Follow-up analyses (Appendix C) examining variation in respondents' perceived effectiveness of our message treatments for encouraging Clean, Drain, Dry also revealed younger respondents were more ambivalent about the messages compared to older cohorts. **Communicating the importance of Clean, Drain, Dry will remain imperative.**

8. Respondents indicated that they almost always engaged in cleaning and draining behaviors. They indicated being less likely, however, to wash their boat with a pressure washer or hot water. This pattern of findings was repeated when respondents were presented with questions asking about their perceived effectiveness of Clean, Drain, Dry, and the perceived difficulty associated with these behaviors. Pressure washing and the use of hot water are behaviors that require additional effort. **Not all boaters will have access to a pressure washer and washing watercraft with hot water is likely perceived to be cumbersome. Cleaning stations with pressure washers or hot water would help to address this issue.**

9. While respondents expressed some ambivalence concerning the frequency of other boaters' Clean, Drain, Dry behavior, they indicated feeling a personal obligation to Clean, Drain, Dry. The sentiment of "personal obligation" was also reflected in the injunctive norm message experiment which elicited on of the one of the highest values in terms of the perceived effectiveness of the message for encouraging Clean, Drain, Dry. **Messages emphasizing the sentiment of personal ownership and personal obligation to protect the resource are compelling.**

10. A quarter of respondents indicated that, on occasion, they are unable to engage in Clean, Drain, Dry. Of these, the most commonly reported reasons were not having access to cleaning stations, crowding at boat ramps, and the perception that others aren't undertaking these behaviors. **While crowding at boat ramps might point toward issues of capacity, the absence of cleaning stations is something agencies can begin to directly address.** The perception of others not undertaking the behavior is prevalent and was manifested in several related questions throughout the questionnaire. The weaker performance of messaging containing the descriptive norm treatment (i.e., the suggestion that the majority of the state's boaters Clean, Drin, Dry) further underlies the challenge. **The installation of cleaning stations with clear visible messaging kiosks would help negate the perception that few undertake Clean, Drain, Dry by providing evidence of others taking action. The more boaters are seen to be engaging in these actions, the more normative the behavior becomes.**

11. **Respondents expressed strong levels of trust in state agencies' ability to provide timely and up to date information about AIS and manage AIS within their state.** While generally expressing trust in state agencies (means of four on the five point scale), tournament anglers, hunters, cabin cruiser/center console boat owners, and younger respondents scored consistently scored lower than other groups. It is likely that tournament anglers and hunters (who are also likely cabin cruiser/center console boat owners) are more guarded with regard to state agencies given their consumptive orientation. In terms of younger respondents expressing less trust in state agencies, this finding is contrary to past work illustrating the younger cohorts tend to hold a stronger pro-environmental orientation that also has them expressing more favorable attitudes toward public natural resource management agencies compared (Jones et al., 2003; Rasch, 2021). While statistically lower, managerially the variation is minor.
12. A quarter of respondents indicated that, on occasion, they are unable to engage in Clean, Drain, Dry. Of these, the most commonly reported reasons were not having access to cleaning stations, crowding at boat ramps, and the perception that others aren't undertaking these behaviors.

7.0 REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Babbie, E. (2021). *The practice of social research* (15th ed.). Cengage.

Beardmore, B. (2015). Boater perceptions of environmental issues affecting lakes in northern Wisconsin. *Journal of the American Water Resources Association*, *51*(2), 537–549. https://doi.org/10.1111/jawr.12265

Benson, A. J., & Boydstun, C. P. (1995). Invasion of the zebra mussel into the United States. *Our Living Resources: A Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals and Ecosystems* (pp. 445-446). U.S. Department of the Interior, National Biological Service, Washington, DC, 445-446.

Cleveland, M., Robertson, J. L., & Volk, V. (2020). Helping or hindering: Environmental locus of control, subjective enablers and constraints, and pro-environmental behaviors. *Journal of Cleaner Production*, *249*, 119394. https://doi.org/10.1016/j.jclepro.2019.119394

Cohen, J. (1988). Statistical power analysis for the behavioural sciences. Hillsdale, NJ: Laurence Erlbaum Associates.

Cole, E., Keller, R. P., & Garbach, K. (2016). Assessing the success of invasive species prevention efforts at changing the behaviors of recreational boaters. *Journal of Environmental Management*, *184*, 210–218. https://doi.org/10.1016/j.jenvman.2016.09.083

Connelly, N. A., Lauber, T. B., Stedman, R. C., & Knuth, B. A. (2016). The role of anglers in preventing the spread of aquatic invasive species in the Great Lakes region. *Journal of Great Lakes Research*, *42*(3), 703–707. https://doi.org/10.1016/j.jglr.2016.03.016

DeGolia, A. H., Hiroyasu, E. H. T., & Anderson, S. E. (2019). Economic losses or environmental gains? Fram,ing effects on public support for environmental management. *PLoS ONE, 14*(7). 20320. https://doi.org/10.1371/journal. pone.0220320

Eiswerth, M. E., Yen, S. T., & van Kooten, G. C. (2011). Factors determining awareness and knowledge of aquatic invasive species. *Ecological Economics*, *70*(9), 1672–1679. https://doi.org/10.1016/j.ecolecon.2011.04.012

Fielding, K. S., & Hornsey, M. J. (2016). A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. *Frontiers in psychology*, *7*, 121.

Fouts, K. L., Poudyal, N. C., Moore, R., Herrin, J., & Wilde, S. B. (2017). Informed stakeholder support for managing invasive Hydrilla verticillata linked to wildlife deaths in a Southeastern reservoir. *Lake and Reservoir Management*, *33*(3), 260–269. https://doi.org/10.1080/10402381.2017.1334017

Johnson, L. E., Ricciardi, A., & Carlton, J. T. (2001). Overland dispersal of aquatic invasive species: A risk assessment of transient recreational boating. *Ecological Applications*, *11*(6), 1789. https://doi.org/10.2307/3061096

Jones, R. E., Fly, J. M., Talley, J., & Cordell, H. K. (2003). Green migration into rural America: The new frontier of environmentalism? *Society and Natural Resources, 16*(3), 221–238. ttps://doi.org/10.1080/08941920309159

Kemp, C., van Riper, C. J., BouFajreldin, L., Stewart, W. P., Scheunemann, J., & van den Born, R. J. G. (2017). Connecting human-nature relationships to environmental behaviors that minimize the spread of aquatic invasive species. *Biological Invasions*, *19*(7), 2059–2074. https://doi.org/10.1007/s10530-017-1418-0

Keniry, T., & Marsden, J. E. (1995). Zebra mussels in southwestern Lake Michigan. *Our Living Resources: A Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals and*

Ecosystems (pp. 445-448). U.S. Department of the Interior, National Biological Service, Washington, DC.

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change*, *17*(3-4), 445–459. https://doi.org/10.1016/j.gloenvcha.2007.01.004

Mayer, J., Seekamp, E., Casper, J., & Blank, G. (2015). An examination of behavior change theories to predict behavioral intentions of organisms-in-trade hobbyists. *Human Ecology Review*, *21*(2), 65–92. https://www.jstor.org/stable/pdf/24875133.pdf?casa_token=YWlyeu0l3GgAAAAA:ae-OvRk3UTWKi0fJFCCEelkK3MMNnaJLIgowhllsobnrT983PE92McRiSHFPxiYBTRFpO9X0pTx2uWBPOw_xqPYcj5BwE9I2F_MyxXJKDl_OLBucfu7-

Moghimehfar, F., & Halpenny, E. A. (2016). How do people negotiate through their constraints to engage in pro-environmental behavior? A study of front-country campers in Alberta, Canada. *Tourism Management*, *57*, 362–372. https://doi.org/10.1016/j.tourman.2016.07.001

Mueting, S., & Gerstenberger, S. (2011). The 100th Meridian Initiative at the Lake Mead National Recreation Area, NV, USA: Differences between boater behaviors before and after a quagga mussel, Driessena rostiformis bugensis, invasion. *Aquatic Invasions*, *6*(2), 223–229. https://doi.org/10.3391/ai.2011.6.2.11

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1609406917733847.

Pavloski, E. L., Triezenberg, H. A., Takahashi, B., & Taylor, W. W. (2019). Using Risk Perceptions to Develop Effective Great Lakes Aquatic Invasive Species Outreach. *Journal of Extension*, *57*(5).

Pimentel, D., Zuniga, R., & Morrison, D. (2005). Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics*, *52*(3), 273–288. https://doi.org/10.1016/j.ecolecon.2004.10.002

Pradhananga, A., Davenport, M. A., Seekamp, E., & Bundy, D. (2015). Preventing the spread of aquatic invasive species: Boater concerns, habits, and future behaviors. *Human Dimensions of Wildlife*, *20*(5), 381–393. https://doi.org/10.1080/10871209.2015.1030479

Rasch, R. (2021). Exploring perspectives on public land management in rural Montana and Idaho. *Journal of Applied Social science, 15*(1), 12-28. https://doi.org//10.1177/1936724420980410

Robertson, J. J., Swannack, T. M., McGarrity, M., & Schwalb, A. N. (2020). Zebra mussel invasion of Texas lakes: Estimating dispersal potential via boats. *Biological Invasions*, *22*(11), 3425–3455. https://doi.org/10.1007/s10530-020-02333-2

Rothlisberger, J. D., Chadderton, W. L., McNulty, J., & Lodge, D. M. (2010). Aquatic invasive species transport via trailered boats: What is being moved, who is moving it, and what can be done. *Fisheries*, *35*(3), 121–132. https://doi.org/10.1577/1548-8446-35.3.121

Seekamp, E., McCreary, A., Mayer, J., Zack, S., Charlebois, P., & Pasternak, L. (2016). Exploring the efficacy of an aquatic invasive species prevention campaign among water recreationists. *Biological Invasions*, *18*(6), 1745–1758. https://doi.org/10.1007/s10530-016-1117-2

Schwartz, S. H. (1977). Normative influences on altruism. In *Advances in experimental social psychology* (Vol. 10, pp. 221-279). Academic Press.

Schultz, T., & Fielding, K. (2014). The common in-group identity model enhances communication about recycled water. *Journal of Environmental Psychology, 40,* 296-305. https://doi.org/10.1016/j.jenvp.2014.07.006

Sharp, R. L., Cleckner, L. B., & DePillo, S. (2017). The impact of on-site educational outreach on recreational users' perceptions of aquatic invasive species and their management. *Environmental Education Research*, *23*(8), 1200–1210. https://doi.org/10.1080/13504622.2016.1174983

Shaw, B., Campbell. T., & Radler, B. T. (2021). Testing emphasis message frames and metaphors on social media to engage boaters to learn about preventing the spread of Zebra Mussels. *Environmental Management, 68*(6), 824-834. https://doi.org//10.1007/s00267-021-01506-6

Soga, M., & Gaston, K. J. (2018). Shifting baseline syndrome: Causes, consequences, and implications. *Frontiers in Ecology and the Environment, 16*(4), 222-230. https://doi.org//10.1002/fee.1794

Stedman, R. C., Connelly, N. A., Heberlein, T. A., Decker, D. J., & Allred, S. B. (2019). The end of the (research) world as we know it? Understanding and coping with declining response rates to mail surveys. *Society & Natural Resources*, *32*(10), 1139-1154. https://doi.org/10.1080/08941920.2019.1587127

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging Pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology*, *38*, 104–115. https://doi.org/10.1016/j.jenvp.2014.01.002

Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, *2,* 81-97.

Tanner, C. (1999). Constraints on Environmental Behavior. *Journal of Environmental Psychology*, *19*, 145–157. https://doi.org/10.1006/jevp.1999.0121

Unsworth, K. L. & Fielding, K. S. (2014). It's political: How the salience of one's political identity changes climate change beliefs and policy support. *Global Environmental Change, 27*, 131-137. https://doi.org/10.1016/j.gloenvcha.2014.05.002

U.S. Geological Survey (2021). *Nonindigenous aquatic species database*. Gainesville, Florida. Accessed 3/12/2021

van der Werff, E., & Steg, L. (2016). The psychology of participation and interest in smart energy systems: Comparing the value-belief-norm theory and the value-identity-personal norm model. *Energy Research & Social Science*, *22*, 107-114.

van Riper, C. J., Browning, M., Becker, D., Stewart, W., Suski, C. D., Browning, L., & Golebie, E. (2019). Human-Nature Relationships and Normative Beliefs Influence Behaviors that Reduce the Spread of Aquatic Invasive Species. *Environmental Management*, *63*(1), 69–79. https://doi.org/10.1007/s00267-018-1111-9

Vaske, J. J. (2019). *Survey research and analysis: Applications in parks, recreation and human dimensions* (2nd ed.). Sagamore-Venture.

Ventura, L. de, Weissert, N., Tobias, R., Kopp, K., & Jokela, J. (2017). Identifying target factors for interventions to increase boat cleaning in order to prevent spread of invasive species. *Management of Biological Invasions*, *8*(1), 71–84. https://doi.org/10.3391/mbi.2017.8.1.07

Wallen, K. E., & Kyle, G. T. (2018). The efficacy of message frames on recreational boaters' aquatic invasive species mitigation behavioral intentions. *Human Dimensions of Wildlife*, *23*(4), 297–312. https://doi.org/10.1080/10871209.2018.1434705

Wallen, K. E., Landon, A. C., Kyle, G. T., Schuett, M. A., Leitz, J., & Kurzawski, K. (2016). Mode effect and response rate issues in mixed-mode survey research: implications for recreational fisheries management. *North American Journal of Fisheries Management*, *36*(4), 852-863.

Witzling, L., Shaw, B., & Amato, M. S. (2015). Incorporating information exposure Into a theory of planned behavior model to enrich understanding of proenvironmental behavior. *Science Communication*, *37*(5), 551–574. https://doi.org/10.1177/1075547015593085

Witzling, L., Shaw, B., & Seiler, D. (2016). Segmenting boaters based on level of transience: Outreach and policy implications for the prevention of aquatic invasive species. *Biological Invasions*, *18*(12), 3635–3646. https://doi.org/10.1007/s10530-016-1254-7

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913-934.