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Outreach and Education

The relationship between brand awareness and action for two national aquatic invasive species prevention brands

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Abstract

Awareness and behavior change campaigns are key tools in efforts to manage environmental problems, including the unwanted impacts of aquatic invasive species (AIS). *Stop Aquatic Hitchhikers!* and *Clean Drain Dry* are two common, nationally recognized brands used to target recreational boaters with an AIS-prevention messages within the United States. Despite how often these AIS awareness brands are used, though, there is limited evidence that these brands are associated with boaters performing AIS-prevention behaviors. To investigate the impact of these brands, we used data from a national survey to determine factors that are related to boaters' self-reported frequency of performing AIS-prevention behaviors. Of the measured factors, overall awareness of AIS and awareness of *Stop Aquatic Hitchhikers!* and *Clean Drain Dry* were the most significant variables in predicting performance of AIS-prevention behaviors. This suggests that awareness of these commonly used brands is having a desirable impact on recreational boaters performing AIS-prevention actions and leveraging these brands and associated outreach materials is an effective method of outreach.

Key words: outreach, evaluation, education, Stop Aquatic Hitchhikers, Clean Drain Dry, biosecurity

Introduction

An obvious strategy for reducing the unwanted impacts of aquatic invasive species (AIS, also known as invasive alien species/IAS) is preventing their spread in the first place. This helps reduce unwanted impacts while also being more efficient than managing the impacts once an invasive species is present (Leung et al. 2002; Vander Zanden et al. 2010). A key aspect of this strategy is managing human behavior so that people perform the necessary prevention actions.

One primary vector for the spread of AIS consists of boaters and other recreational watercraft users who move between water bodies carrying organisms posing risks to new water bodies (Drake 2017; Johnson et al. 2001; Kelly et al. 2013; Rothlisberger et al. 2011). Many AIS-prevention educational efforts target transient boaters, defined as those who visit

multiple water bodies in a short time frame (Witzling et al. 2016) and can serve as a mechanism for transporting AIS long distances (Rothlisberger et al. 2011), to encourage behaviors that decrease the likelihood of spreading AIS to other water bodies (Western Regional Panel on Aquatic Nuisance Species 2021). These behaviors include inspecting for and removing aquatic plants, animals and mud from the watercraft, including motors, trailers and equipment (Seekamp et al. 2016; Aquatic Nuisance Species Task Force 2011), draining any water present on the boat, removing the drain plug, and then power washing or letting the boat dry for five days.

AIS managers and outreach professionals have used multiple communication channels to reach transient boaters with AIS-prevention messages, including fishing clubs, signs at landings (Witzling et al. 2015), and social media (Campbell et al. 2019, 2024; Shaw et al. 2021). Cinema advertisements placed in recreational areas where higher densities of transient boaters can be found (Shaw et al. 2014) and working with bait shop owners/managers to communicate with their customers where they buy live bait (Dalrymple et al. 2013; Howell et al. 2014) have also been successful. In-person outreach at water access points is also a commonly used communication channel (Bleitz et al. 2024).

AIS-prevention outreach materials (e.g., print, posters, signs, social media, giveaway towels) are an integral part of engaging with audiences across channels and can also support the promotion and marketing strategy for specific AIS-prevention brands. While these communication activities ultimately help create guidance for AIS prevention, they also work to develop and reinforce strong, favorable associations with specific brands that audiences can recall from memory. For aquatic invasive species prevention there are two national brands in the United States, *Stop Aquatic Hitchhikers!*™ (SAH) and the *Clean Drain Dry Initiative*™ (CDD). Both of these outreach brands contain a similar "Clean Drain Dry" prevention message based on the *Aquatic Nuisance Species Task Force's Voluntary Guidelines to Prevent the Introduction and Spread of Aquatic Nuisance Species Through Recreational Activities* document. Each message describes a key action or benefit associated with the brand and can serve as a recall mechanism for the broader set of AIS-prevention behaviors. While these brands are adaptable to many recreational water users, their primary use within the United States has been to target recreational boaters with AIS-prevention messages.

For the purposes of this project, we consider invasive species prevention *brands* and *campaigns* to be two separate things. Brands are socially constructed "containers of popular meaning" (O'Guinn et al. 2019). A brand is what an audience thinks of (both factual and emotional) when they hear the brand name (Newman and Newman 2018). A brand is long lasting and focuses on what an effort stands for and why people should care. The consistent visibility of a brand, which includes the associated messaging

and visual materials, can create a heuristic that helps the intended audience recall and perform AIS-prevention actions and can make invasive species managers more efficient with their outreach dollars. Additionally, when brand use is consistent, there is a lot of outreach material that exists and can be used or modified for new purposes. A campaign is a more specific marketing effort that may leverage an existing brand to promote a specific product, service, or behavior over a specified period of time and can be evaluated using standard marketing metrics, such as impressions, cost per click, and site visits. A recent example of a campaign promoting a brand is the Great Lakes AIS Landing Blitz Project, which is a short two-week outreach event that educates boaters across the Laurentian Great Lakes at water access points. This time-limited campaign leverages both SAH and CDD brands and messaging (Campbell and Otts 2024).

Evaluating the success of AIS outreach efforts is important yet rarely done (Haley et al. 2023). If evaluations are done, they are often completed at a state level as technical reports used by AIS managers and may not be published in peer-reviewed journals (e.g., Hammond et al. 2019; Jensen 2010). This makes them difficult for researchers and program managers to discover, and these reports can provide valuable insights but don't provide the same reassurance that comes from the rigor of peer-reviewed articles in an academic journal. Many social science studies focusing on recreational boaters suggest means of improving communications to boaters. Some recommend adjustments in messaging (Shaw et al. 2021; Wallen and Kyle 2018) and others investigate the effectiveness of different communication channels (Witzling et al. 2015). Several studies test theories that try to explain what situational and psychological factors predict attitudes and behaviors that prevent the spread of AIS (Golebie et al. 2023; Golebie and Van Riper 2023; Hutchins et al. 2023; Witzling et al. 2015). As it relates to research on AIS-prevention brands, one previous study (Seekamp et al. 2016) linked southern Lake Michigan boater awareness of SAH to the performance of prevention behaviors, finding that boaters who are more aware of SAH more frequently performed prevention behaviors and had increased knowledge and feelings of personal responsibility for AIS prevention. Another study indicated that canoeists in the UK who had heard of AIS-prevention guidance had lower AIS introduction risk (Anderson et al. 2014). However, similar studies focused on recreational anglers found that there were anglers who performed prevention behaviors that were unaware of prevention messaging, suggesting that there are multiple factors that influence recreational water user AIS-prevention behaviors (Smith et al. 2023) and that while prevention campaigns and brands can work, there still is room for improvement (Smith et al. 2020).

All of the mentioned studies are valuable forms of evaluation or assessment to inform program improvement. Our study aims to augment

Logo	Tested Slogan	Primary Audiences	Managed By
STOP AQUATIC HITCHHIKERS! Be A Good Steward. Clean. Drain. Dry. StopAquaticHitchhikers.org	Stop Aquatic Hitchhikers	Recreational boaters Anglers In use nationally	ANS Task Force US Fish and Wildlife Service NOAA Sea Grant Founded in 2002
CLEAN DRAIN DRY INITIATIVE CLEAN DRAIN DRY Prevent the Spread of Aquatic Invasive Species	Clean Drain Dry	Recreational boaters Anglers In use nationally	Wildlife Forever There is also general CDD messaging promoted by the ANSTF, but not managed by a specific entity Phrase developed in 2008, brand developed in 2015

Figure 1. The two invasive species outreach brands used in this research. Stop Aquatic Hitchhikers and Clean Drain Dry are both targeted primarily at boaters and anglers and are used across the United States.

these evaluations by evaluating the two national AIS-prevention campaigns that have been in use since the mid-2000s using a dataset that is more representative of recreational watercraft users in the United States to provide a clearer answer to the common question of many AIS managers who may be responsible for AIS outreach programs while not having specific training in optimizing outreach to influence behavioral outcomes. Many simply want to know, "Are our outreach efforts working?"

While there are a number of ways to answer this question, one way to think about AIS outreach success is if the targets of AIS outreach are aware of the different AIS-prevention brands (Figure 1) and if familiarity with these brands relates to higher likelihood of performing AIS-prevention behaviors. These AIS outreach brands and associated guidance are the foundation of many prevention programs. If we can understand how AIS outreach brands relate to AIS-prevention behaviors, we can be more confident in our collective investments in branded AIS-prevention efforts. Therefore, in this study we test the hypothesis that greater awareness of AIS-prevention outreach brands will be positively related to recreational boaters performing AIS-prevention actions.

Materials

To achieve a national understanding in the United States of AIS-prevention behaviors and AIS-prevention brand awareness across recreational water user groups, the Aquatic Nuisance Species Task Force, which coordinates AIS work done by federal agencies and regional AIS panels, worked with

Responsive Management, a survey research firm specializing in natural resource issues, to develop an online survey. The survey instrument was developed using questions from similar projects surveying recreational boaters that were done on state or regional scales (Jensen 2010; Witzling et al. 2015, 2016; Kyle et al. 2022). The questions assessed awareness of AIS issues, attitudes towards AIS issues, frequency of engaging in AIS-prevention behaviors, and awareness of AIS-prevention brands and messages. A complete version of the survey instrument is included as supplemental material.

The survey was sent to an online sample, purchased through Marketing Systems Group, of United States residents who engaged in at least one of seven water-based outdoor recreational activities: freshwater fishing, saltwater fishing, motorboating, non-motorized boating, scuba diving, snorkeling, and waterfowl hunting. Respondents could select multiple activities. The survey was framed as a questionnaire on environmental issues and a screener question ensured that respondents had participated in at least one of the qualifying recreational activities within the previous 12 months. The sampling was stratified by the four Association of Fish and Wildlife Agencies regions to ensure enough respondents in each of the regions for statistical power at the regional level (at least 1,250 completed surveys in each region). All respondents were 18 years old or older. Questions unrelated to the survey content were used as attention checks to help ensure response quality and respondents who completed the survey were given a small compensation through Marketing Systems Group.

The online survey was conducted in May and June 2022. After the data from completed surveys were obtained, Responsive Management's Survey Center managers and statisticians checked each completed survey to ensure clarity and completeness and to remove any invalid respondents. Analysts also reviewed all individual survey responses to identify other potential red flags. This entailed a review of survey responses to identify potentially invalid submittals, such as surveys that were completed in an unrealistically brief time frame, suggesting that some respondents were clicking through responses without reading and evaluating the questions, or "straight-lining" of responses, which is when respondents select (for example) the first or same response options throughout the survey. Finally, IP addresses of online survey respondents were reviewed to remove any responses from computers located outside of the United States. Any completed surveys not meeting quality checks were removed prior to the data analysis. This resulted in 5,082 completed surveys across all recreational activities.

For this analysis, we limited our sample to people who indicated they had engaged in recreational boating, including motor and/or non-motorized boating, in the year prior to the survey (n = 2975). This was done because recreational boaters are noted as a common vector of invasive species (Kelly et al. 2013; Johnson et al. 2001) and tens of millions of dollars each year are spent as part of outreach and prevention campaigns targeted to

recreational boaters in the United States through federal grants (e.g., Quagga/Zebra Mussel Action Plan funding) or state programs (e.g., Wisconsin's Clean Boats Clean Waters, Montana Watercraft Inspection Program). Additionally, outreach to these audiences has been delivered in multiple forms (e.g., watercraft inspection, ads, behavioral prompts like stickers and towels) for more than twenty years, with SAH founded in 2002 and the CDD language developed in 2008. For the purpose of this study, we analyzed recreational boaters as a whole as opposed to splitting the group into motorized and non-motorized boaters, so we could more holistically examine the impacts of the brands on AIS-prevention activities.

All data used for these analyses are available on the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS) Social Science Data Hub (https://www.glerl.noaa.gov/glansis/socialScienceData.html).

Variable descriptions

Dependent Variable: Prevention index for motorized and non-motorized boaters

One dependent variable, an AIS-prevention index, was developed based on frequency of actions taken to mitigate the spread of AIS during recreational boating activities. To limit choice bias, activities were presented in a random order to each respondent. For each activity, respondents were asked, "How often do you do each of the following when participating in [motorboating/non-motorized boating]? Please indicate whether you do each of the following: (1) always, (2) often, (3) sometimes, (4) rarely, (5) never or (6) don't know (N/A)." Individuals who answered "don't know" were removed, creating a 5-point scale. The "Don't Know" option was included in all relevant questions to allow respondents to more precisely reflect their actions and opinions, in alignment with practice from the Pew Research Center (2023). "Don't know" responses were all less than 6.2% of the responses for any question in the prevention index. A limitation of this approach could be that we removed individuals that might have otherwise responded to infrequently performing behaviors if not provided the "don't know" option.

All items were coded so a higher score indicated greater frequency of performing the AIS-prevention behaviors. The measured AIS-prevention actions included (Table 1): "Clean off visible aquatic plants, animals, and mud from watercraft, motor, trailer, and/or equipment before leaving water access" (M = 4.1, SD = 1.0); "Scrub hull using a stiff brush" (M = 3.2, SD = 1.2); "Drain water from watercraft before leaving water access" (M = 4.3, SD = .95); "Dry all gear and equipment five days or more when moving between waters or wipe with a towel before reuse" (M = 3.8, SD = 1.2); "Rinse watercraft, trailer, and equipment yourself (for example, with a garden hose)" (M = 4.0, SD = 1.0). All items were combined to create an AIS-prevention index for recreational boating activities (alpha = .84; M = 3.9, SD = .84).

Table 1. Descriptive statistics for the prevention index (dependent variable) from most to least compliant. For each activity, respondents were asked, "How often do you do each of the following when participating in [motorboating/non-motorized boating]? Please indicate whether you do each of the following: (5) always, (4) often, (3) sometimes, (2) rarely, (1) never or (0) don't know (N/A)." Individuals who answered "don't know" were removed, creating a 5-point scale.

	Recreational boaters	
	M	S.D
Drain water from watercraft before leaving water access	4.3	.95
Clean off visible aquatic plants, animals, and mud from watercraft, motor, trailer, and/or equipment before leaving water access	4.1	1.0
Rinse watercraft, trailer, and equipment yourself (for example, with a garden hose)	4.0	1.0
Dry all gear and equipment five days or more when moving between waters or wipe with a towel before reuse	3.8	1.2
Scrub hull using a stiff brush	3.2	1.2

Independent Variables

Boater education. Boater education was measured by asking respondents, "Have you ever completed a state boater education course?" Responses included (1) Yes (29%), (2) No (69%), and (3) Don't know (2%). Those who answered "Don't know" were excluded from the analysis. We included boater education as many states offer boater education courses that include information about AIS, and we wanted to know how much boater education independently contributed to our model relative to awareness of AIS-prevention brands. Online training has been shown to have positive effects on AIS knowledge and reported AIS-prevention behaviors (Shannon et al. 2020), and AIS information is often included in required boater education courses that focus on safety information.

AIS awareness. AIS awareness was measured by first presenting respondents with a definition of AIS, and then asking, "In the past few years, how much have you heard about aquatic invasive species in [STATE]?" Response choices included: (4) a great deal, (3) a moderate amount, (2) a little, (1) nothing, and (0) don't know. Those who answered "Don't know" were removed, creating a 4-point scale (M = 2.5, SD = .97). We included AIS awareness to account for how much respondents had heard about AIS overall and how this contributed to self-reported AIS-prevention behaviors independent of hearing about specific AIS-prevention brands because general awareness has been found to correlate with the adoption of AIS-prevention behaviors (Dalrymple et al. 2013).

Specific brand awareness. Respondents were asked the following question regarding awareness of specific branded AIS-prevention campaigns: "We are interested in your awareness of some specific campaigns related to aquatic invasive species. Please indicate whether you are (4) very familiar, (3) somewhat familiar, (2) a little familiar, (1) not at all familiar, or (0) don't know with *Stop Aquatic Hitchhikers* (M = 2.1, SD = 1.1) and (2) *Clean, Drain, Dry* (M = 2.2, SD = 1.2). The word "campaign" was used

since brands are often communicated through campaigns and because "campaign" is more common language. Those who answered "Don't know" were excluded from the analysis, creating a 4-point scale. These two brands were selected because they are part of national outreach campaigns that have recreational boaters as an audience. State-level branded campaigns that were measured in the original survey instrument were not included in the analysis due to insufficient sample sizes. Other national outreach brands (e.g., Play.Clean.Go, Don't Let It Loose) included in the original survey were also not included in this analysis given their broader audiences (e.g., terrestrial recreationists, aquarium hobbyists).

Demographics. Gender was measured as a dichotomized variable (1) Female (62%) and (2) Male (38%). Education was measured by asking respondents, "What is the highest level of education you have completed?" (1) Not a high school graduate (2%), (2) High school graduate or equivalent (17%), (3) Some college or trade school, no degree (25%), (4) Associate degree or trade school degree (15%), (5) Bachelor's degree (26%), (6) Master's degree (12%), or (7) Professional or doctorate degree (e.g., M.D. or Ph.D.) (2%). This item was trichotomized by combining response choices 1 and 2 ("no college"), 3 and 4 ("some college"), and 5, 6, and 7 ("4-year degree or more"). A dummy variable was created for "no college" and another created for "4-year degree or more," with "some college" serving as the reference category. Age was measured by respondents entering their numeric age (M = 42, SD = 14.6). Two dummy variables were created with individuals 30–49 years (47%) serving as the reference group: ≤ 29 years (24%) and ≥ 50 (29%). Place of residence was measured by asking respondents, "Do you consider your place of residence to be (1) Large city or urban area (19%), (2) Suburban area (36%), (3) Small city or town (22%), (4) Rural area on a farm (7%), or Rural area not on a farm (17%)." Those who answered "Don't Know" (.5%) were removed. Two dummy variables were created with suburban and small city or town as the reference category: urban (19%) and rural (23%). Number of children in the household was measured by asking respondents to enter the number of children, age 17 or younger, living in their household. This item was dichotomized as no children (55%) and children (1 child or more) (45%). These numbers can also all be found in Table 2.

Given that this study is interested in all boaters—primary and secondary users, motorized and non-motorized—and previous work that has used a similar population (Golebie et al. 2023), we elected to not use any data weighting for our analysis and report on the data as is. However, other studies of recreational boaters have reported different demographics. A 2021 USFWS report on recreational motorized boating demographics reported a more male sample, as did random samples of registered boaters in Wisconsin (Hammond et al. 2019; Witzling et al. 2016).

Table 2. Descriptive statistics for independent variables For the AIS awareness question, response choices included: (4) a great deal, (3) a moderate amount, (2) a little, (1) nothing, and (0) don't know. Those who answered "Don't know" were removed, creating a 4-point scale. For the specific campaign awareness question, response choices included: (4) Very familiar, (3) Somewhat familiar, (2) A little familiar, (1) Not at all familiar, or (0) Don't know with each of the following. Those who answered "Don't know" were excluded from the analysis, creating a 4-point scale.

Gender	
Male	38%
Female	62%
Education	
No college	19%
Some college	40%
4-year degree or more	41%
Age	M = 42, SD = 16
Residence	
Suburban area or small city or town	58%
Large city or urban area	19%
Rural area or on farm	23%
Has child or children 17 and under	Yes – 45%
Boater education	
Have you ever completed a state boater education course?	Yes – 29%
AIS awareness[1]	
In the past few years, how much have you heard about aquatic invasive species in [STATE]?	M = 2.5, S.D. = .97
Specific campaign awareness	
Stop Aquatic Hitchhikers	M = 2.1, SD = 1.1
Clean, Drain, Dry	M = 2.2, SD = 1.2

We used hierarchical linear regression to predict frequency of prevention behaviors for recreational boating. We entered the independent variables sequentially in the following order: 1) demographics, 2) boater education and AIS awareness, 3) awareness of SAH and awareness of CDD. Boater education and AIS awareness were placed in block two given past research that supports a relationship between these variables and behavior (Shannon et al. 2020; Darylmple et al. 2013). All data were analyzed using SPSS v.29. Multiple imputation with SPSS was used to handle missing data for our dependent variable. Values were predicted using demographics, boater education, and AIS awareness. All assumption of regression were met, including normality (indicated by P-P plot), independent errors (Durbin-Watson value between 1.5 and 2.5), multicollinearity (VIF < .10 for all variables), and linearity (indicated by scatterplot of standardized residuals).

Data reported are pooled results from five iterations.

We relied on the following guidelines for interpreting R2 values: $R2 < .02$ indicated a very weak effect; $.02 \leq R2 < .13$ indicated a weak effect; $.13 \leq R2 < 0.26$ indicated a moderate effect, and values of 0.26 or greater represented substantial effects (Cohen 1988).

Table 3. OLS regression predicting AIS-prevention behaviors for motorized and non-motorized recreational watercraft (n = 2692). Cell entries are unstandardized regression coefficients and standard deviations. *p ≤ .05, **p ≤ .01, ***p ≤ .001.

	Model 1	Model 2	Model 3
Block 1			
Gender (1 = Male)	−.03 (.07)	−.14 (.08)	−.19 (.07)*
Education (1 = No college)	−.09 (.102)	−.05 (.10)	−.08 (.10)
Education (1 = 4-year degree or more)	−.15 (.08)	−.19 (.08)	−.15 (.08)
Age (1 =≤29 years)	−.24 (.08)**	−.25 (.09)**	−.26 (.08)**
Age (1 =≥50 years)	−.10 (.09)	−.13 (.09)	−.10 (.09)
Residence (1 = Large city or urban area)	.27 (.12)	.21 (.12)	.14 (.12)
Residence (1 = rural area or farm)	.01 (.09)	−.03 (.09)	−.04 (.09)
Children (1 = Yes)	.14 (.08)	.12 (.08)	.05 (.07)
	1.8%		
Block 2			
Boater education		.21 (.06)***	.10 (.06)
AIS awareness		.25 (.03)	.12 (.04)**
		6.0%	
Block 3			
SAH			.13 (.03)***
CDD			.20 (.03)***
			10.15%

Results

The regression model for the prevention index was significant (t = 68.90, p < 0.001) and explained 9–11% of the variation in our dependent variable (Table 3; Model 3). Looking at the pooled results across the five imputations, there is a consistent pattern of substantial R^2 increases across the three-block hierarchical model. Model 1 (demographic variables) accounts for approximately 1.4–2.3% of the variance in the outcome (R^2 range: .012–.023). Model 2, which adds the predictor variables including having participated in a boater education course, shows a dramatic improvement, explaining approximately 4.6–7.4% of the variance (R^2 range: .046–.074), representing roughly a 3–5 percentage point increase from Model 1. Model 3, incorporating the final block of variables, further increases explained variance to approximately 8.9–11.4% (R^2 range: .089–.114), adding another 3–4 percentage points beyond Model 2. This pattern demonstrates that while the demographic variables provide minimal predictive power, the successive addition of the predictors in Models 2 and 3 improves the model's ability to explain variance in the outcome, with each block contributing to the overall explained variance.

The more someone heard about AIS (b = .12, SD = .04), p ≤ .010), the more likely they were to engage in preventative behaviors. In addition, familiarity with Stop Aquatic Hitchhikers (b = .13, SD= .03), p ≤ .001) and Clean Drain Dry (b = .20, SD = (.03), p ≤ .001) were also significantly and positively associated with preventative behaviors. Finally, males (compared to females) (b = −.19, p ≤ .05) and those younger than 29 years old (compared to individuals 30–49 years old) (b = −.26, p ≤ .01) were less likely to engage in preventative behaviors.

Discussion

The positive relationship between *Stop Aquatic Hitchhikers!*, *Clean Drain Dry*, and self-reported compliance with AIS-prevention behaviors suggests that these outreach brands are contributing positively to national efforts to reduce the spread of AIS. Awareness of these brands appears to influence boaters' self-reported compliance with AIS-prevention behaviors, controlling for demographics and other variables. This aligns with previous studies that found brand awareness was linked to AIS-prevention behaviors (Smith et al. 2023; Seekamp et al. 2016). Leveraging these brands in communication materials and outreach can provide value to AIS-prevention outreach programs. Using them can be an efficient use of time and financial resources, thereby allowing for more AIS-prevention programming. Results of this study provide reassurance to AIS managers and outreach professionals that their use of national AIS-prevention branded materials are linked to desirable behavioral outcomes.

General awareness of invasive species also significantly influenced self-reported compliance with AIS-prevention behaviors. This suggests that no matter the branding used, efforts to educate boaters on AIS prevention have a positive impact and that these efforts should continue. Using the "right" branding should not be a barrier to engaging in any boater education and prevention efforts.

While some of the demographic variables were significant, demographics explained little variance in boaters' self-reported actions. Of note, women were more likely than men to perform AIS-prevention behaviors, which is in-line with prior research indicating that women tend to report stronger environmental attitudes and be more likely to perform environmental behaviors compared to men (Gifford and Nilsson 2014). Younger boaters were also less likely to report performing AIS-prevention behaviors.

Our model at most explained 10% of the variability in predicting AIS-prevention actions, with most factors having a weak effect, suggesting that there are numerous potential factors that were not measured in this research that could influence boater behavior in regard to AIS-prevention actions. Previous work has provided insights about how constructs related to the Theory of Planned Behavior (Ajzen 2011; Gill et al. 2020), such as self-efficacy and social norms, as well as exposure to communication sources such as signs and other media are associated with self-reported compliance with behaviors to prevent the spread of AIS (Witzling et al. 2015). Prior research has also linked how different value systems (Golebie et al. 2023) and trust in organizations (Joffe-Nelson et al. 2024) can influence recreational water users' intention to perform invasive species prevention actions. Message framing can also have an impact. For example, one study found law-focused messages to be effective (Wallen and Kyle 2018) while another determined that science frames were as effective as other more inflammatory

nativist or militaristic metaphors (Shaw et al. 2021). Research has also found that there can be a difference in retained knowledge among boaters when using narrative storytelling approaches as compared with more traditional, didactic forms of outreach (Campbell et al. 2024). The use of brands can be integrated into many of these approaches and would help us understand more specifically how brands are influential, not just that they are.

Efforts to combine the most meaningful factors together into comprehensive outreach campaigns are needed to impact boater behavior and to achieve greater AIS-prevention outcomes. The Great Lakes Sea Grant Network's efforts to implement SAH through the Great Lakes Restoration Initiative (Campbell and Otts 2024) and Wildlife Forever's coordinated advertising for the Clean Drain Dry Initiative (Wildlife Forever 2024) are good examples of this type of approach. Both brands have and do utilize multiple communication channels and approaches with effective and consistent messaging. Evaluating the impact of individual interventions that are part of these larger campaigns, much like Ovenden and Studholme (2021), would be useful to see how each of these programmatic aspects add to an overall prevention program and how programs could be tailored for different target audiences to achieve maximum impact.

As highlighted in the introduction, a brand name can convey substantial meaning with a slogan like *Stop Aquatic Hitchhikers!* or *Clean Drain Dry*. The name can communicate information beyond what is explicitly conveyed visually or textually, and include meanings that individuals associate with the brand. While findings from this study can only demonstrate correlations between specific AIS brands and self-reported AIS-prevention behaviors, it is important to unpack how these brands, both individually and collectively, relate to preventative AIS behaviors. For example, there may be more meaning attached to these brands beyond a reminder to perform AIS-prevention behaviors. These messages are often received while people are out boating, enjoying the company of others, and visiting locations in which they feel a sense of place. When reinforced through consistent messaging via trusted channels, this could provide additional motivations for boaters to perform AIS-prevention actions when they are reminded of these brands.

Both SAH and CDD have an influence on AIS-prevention behaviors, with each explaining unique variance among boater behavior in our models. Future research might seek to identify the potential ways different audiences associate value or benefit (i.e., brand equity) with specific AIS brands. Given the influence of SAH and CDD, it would be prudent for other AIS brands to develop strategic alliances, or engage in communication "co-branding" (Besharat and Langan 2014). This can lead to enhanced awareness and resource sharing, thereby expanding the potential reach and credibility of less recognizable AIS-prevention brands. SAH and CDD are already co-branded to some extent, with the CDD

guidance being part of the broader SAH brand and communication materials, which could explain some of their shared influence in our models.

There were some limitations of our study. The online survey tool used did not allow for images to be placed alongside text, so the brand awareness question was asked only using the name of the branded campaign and did not include the brand mark, which can be the most recognizable aspect of a brand. While not having the brand mark likely underestimated how familiar people were with these brands, future work on investigating AIS-prevention brands should incorporate the brand marks with the names. We would also be more purposeful with language regarding brands and campaigns given how we have separated them out in this analysis.

Another aspect of the larger national survey that this analysis did not investigate was awareness of state-level AIS brands and campaigns. There are states that promote their own AIS-prevention brands, including Be A Hero in Illinois, Protect the Lakes You Love in Texas, and Clean Boats Clean Waters in Wisconsin. Unfortunately, since this was a national sample, the number of respondents per state was too low to meaningfully include data regarding these brands in our analysis. However, the limited data suggest that people in states with state-specific brands are at least as aware of them as SAH and CDD (Responsive Management 2022; Campbell and Carlton 2024), indicating there may be useful insights to learn from these efforts. Future efforts could investigate the roles of investment, strategies and consistency in the effectiveness of state brands.

Other areas of future research could include trying to understand if brand awareness in this context is a proxy for other relevant variables not measured (e.g., environmental values, norms). However, even if it is, brand awareness is an easily measurable metric and something for which outreach programs can manage. Audience segmentation is also another potential area for research. Boating audiences could be segmented numerous ways, including by boat type, transience (Witzling et al. 2016), values (Golebie et al. 2023), activity frequency (Smith et al 2023), or unique risk factors (Campbell et al. 2016). Various segments of the boating population may respond differently to certain brands and messages, which could be a useful future area of research.

Research has found that many boaters do not fully implement best practices in preventing the spread of AIS, suggesting that AIS outreach could help them better perform the actions (Angel et al. 2024). Better and more consistent use of SAH and CDD, AIS outreach brands that have been linked to boaters performing AIS-prevention actions, may be one such mechanism for improvement. Similarly, repeated messages are known to aid in behavior change and may improve AIS communication goals through AIS-prevention brands. AIS outreach professionals and natural resource

leaders making decisions on how to invest AIS-prevention funding can feel secure knowing there is some empirical evidence supporting the effectiveness of the most commonly used national AIS-prevention brands. Any AIS-prevention program stands to benefit from the use of these brands, from the established program trying to reach additional boaters to a newer program with limited funds attempting to make the most impact with finite resources. Our results suggest that *Stop Aquatic Hitchhikers!* and *Clean Drain Dry* can be effective at encouraging boaters to perform AIS-prevention actions.

Authors' contribution

Todd Newman: research conceptualization, data analysis and interpretation, ethics approval, roles/writing – original draft, writing – review and editing; Tim Campbell: research conceptualization, sample design and methodology, investigation and data collection, data analysis and interpretation, ethics approval, funding provision, roles/writing – original draft, writing – review and editing; Bret Shaw: research conceptualization, data analysis and interpretation, ethics approval, roles/writing – original draft, writing – review and editing; Tom Beppler: sample design and methodology, investigation and data collection, funding provision, roles/writing – original draft, writing – review and editing; Mark Damian Duda: sample design and methodology, investigation and data collection, funding provision, roles/writing – original draft, writing – review and editing.

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Conflict of interest/Declaration of interests

Author Tim Campbell helps coordinate the national Stop Aquatic Hitchhikers! campaign in partnership with the USFWS and NOAA Sea Grant as part of his position as his position with Wisconsin Sea Grant.

Ethics and permits

The data for this project were collected by Responsive Management and outside of the University IRB process.

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