CyanoHAB Outreach in Michigan: Survey Report

Jenna A. Van Fossen[1], John W. Ropp[2], Kathleen Darcy[2], Zachary Woessner[1], Amanda Isabel Osuna[2], Elizabeth Meier[3], and Joseph A. Hamm[2,4,*]

[1]*Department of Psychology;* [2]*School of Criminal Justice;* [3]*Department of Social Work;*
[4]*Environmental Science and Policy Program*

Michigan State University

12/27/2020

Report Prepared for:

The Michigan Department of Health and Human Services

CORRESPONDING AUTHOR
Joseph A. Hamm
Associate Professor
Michigan State University
Email: jhamm@msu.edu

EXECUTIVE SUMMARY

Harmful Algal Blooms (HABs) can lead to health problems in people and animals. The number of HAB outbreaks has increased in Michigan over the last few years, and this survey study was conducted to assess the perceptions held by people who live in and/or recreate on bodies of water in Michigan towards HABs and agencies tasked with managing HABs.

Participants were recruited during late summer and early fall of 2020. A Facebook sample ($n = 383$) was recruited via closed Facebook Groups for lakes that had experienced a HAB, and a Listserv sample ($n = 113$) was recruited via email listservs held by MDHHS. Participants were predominantly white, educated, and liberal. Most participants reported spending at least one month staying on waterfront property during the year and spending time participating in a variety of recreational activities on Michigan lakes or rivers (swimming, fishing, boating, etc.). Half of the participants had some previous exposure to HABs.

Regarding subjective knowledge of HABs, the majority of the sample felt that they had at least some degree of knowledge about HABs and felt at least somewhat confident in their ability to identify and keep themselves safe from HABs. Nonetheless, most respondents did not correctly answer objective knowledge questions about the number of HABs in Michigan or change in HABs in Michigan and were unable to correctly identify HABs in a photo identification task.

In terms of perceptions of risk from HABs, participants were only somewhat concerned and up to one-third of participants did not perceive any risk. These individuals were more likely to feel they know more about HABs, be older, less educated, have a lower income, and be more politically conservative. The majority of participants, however, thought that HABs were at least somewhat likely to cause various complications. HABs were thought to present the greatest risk to tourism and the environment.

Concerning perceptions of agencies, respondents generally viewed the Michigan Department of Health and Human Services (MDHHS) as at least somewhat trustworthy across six dimensions. They held the most positive perceptions of MDHHS' concern for them but had lower perceptions of MDHHS' communication, fairness, and shared values. A subset of participants (one-fifth) were especially negative regarding the MDHHS' trustworthiness. These participants were more likely to be white, conservative, and perceive less risk from HABs. Participants similarly tended to view local health departments and lake associations as at least somewhat trustworthy across dimensions but had lower estimations of their ability as compared to MDHHS. Regarding the agencies most trusted to manage HABs, participants generally reported the most positive responses for the Michigan Department of Natural Resources (MDNR) and Environment, Great Lakes, and Energy (EGLE).

For cooperation with management efforts, participants who perceived more the risk from HABs, were older, and white were more likely to report greater intentions to cooperate with HABs management in the future. White participants and those who claimed greater subjective knowledge were more likely to cooperate with cooperation requests within the survey itself.

CONTENTS

BACKGROUND

Harmful algal blooms (HABs), alternately known as cyanobacterial blooms, may produce cyanotoxins that pose a threat to the health of humans and animals[1]. In August of 2014, a large-scale bloom in Lake Erie disrupted access to clean drinking water for hundreds of thousands of people in neighboring Ohio[2]. HAB outbreaks have been relatively fewer in Michigan but have increased in frequency over the past decade, bringing an increased risk of negative health and economic impacts. In response, governance organizations in Michigan have devoted greater attention to the issue, especially through increased sampling and efforts to improve public awareness. The current survey was conducted to elicit Michigan residents' and visitors' perceptions of HABs, as well as their thoughts about HAB management in the state.

METHOD

Participants were recruited via two waves in fall of 2020.

Facebook Sample. In the first wave of data collection, the study team identified closed Facebook groups with more than 50 members that were focused on a lake that had experienced a HAB within the last 3 years. Closed groups were selected because they require members to request admission to the group by identifying themselves to administrators as having some kind of connection to the lake. Five Facebook groups were selected and contacted by the study team. Two groups, focused on Black Lake and Pleasant Lake (approximately 3,800 total members), agreed to post the survey link in the first week of September. The first 435 survey respondents received $10 for completing the survey. All other respondents were entered into one of 80 drawings for the chance to win a $25 gift card.

Listserv Sample. In the second wave of data collection, the Michigan Department of Health and Human Services circulated a survey link through various email listservs. Participation was incentivized by entering participants into a drawing for one of 80 $25 gift card drawings. Data collection for this wave began in the second week of September (approximately one week after the Facebook Sample survey link was posted) and concluded in the third week of October.

Materials

All participants completed the same online survey which began by eliciting informed consent[3]. Participants then answered questions about whether they live, visit, and recreate on lakes and rivers in Michigan to determine eligibility. Participants were eligible if their primary residence was in Michigan, they owned a secondary residence located in Michigan, or they reported recreating on Michigan lakes or rivers. Ineligible participants were redirected to the end of the survey. Eligible participants then completed questions assessing their knowledge about and perceptions of HABs, MDHHS, and HABs management generally. To address survey length, participants were randomly assigned to also report their perceptions of either lake associations or local health departments.

---

[1] Carmichael, W. W., & Boyer, G. L. (2016). Health impacts from cyanobacteria harmful algae blooms: Implications for the North American Great Lakes. *Harmful Algae*, *54*, 194-212.

[2] Kohlhepp, G. (2015). *Harmful Algal Bloom Monitoring and Assessment in Michigan Waters* (pp. 1-13, Rep. No. MI/DEQ/WRD-15/013). Lansing, MI: Michigan Department of Environmental Quality-Water Resources Division. Retrieved October 06, 2020, from https://www.michigan.gov/documents/deq/wrd-swas-algae-HABsummary_551207_7.pdf

[3] All procedures were approved by Internal Review Boards at Michigan State University (Study 00004216) and the Michigan Department of Health and Human Services (202004-11-XA).

The median time to complete the survey was 11 minutes and most of the sample (> 90%) completed the survey in less than 30 minutes.

Participants

Recruitment resulted in 2,478 at least partially completed surveys but evaluation of the responses suggested a large number of duplicate or falsified responses. Problematic responses were identified in three ways. First, we eliminated cases with IP addresses, email addresses, or full names (first and last with identical spelling) that appeared in the dataset more than once. We also evaluated all open-ended responses and eliminated cases in which these responses were clearly falsified (*e.g.*, nonsensical responses). Finally, we eliminated all cases that completed less than 50% of the survey. The final sample of 496 responses included 383 participants from the Facebook Sample and 113 participants from the Listserv Sample.

Demographics. Participants reported an average age of 39.7 years (SD = 12.72; Min = 21; Max = 83). A majority of the final sample self-identified as male (59.5%; Female = 35.5%) and White/Caucasian (72.8%), but a notable percentage of the sample self-identified as Black/African American (16.3%; other racial groups accounted for less than 5% of the final sample). Regarding ethnicity, 15.6% of the sample reported identifying as Mexican, Mexican American, Chicano, Puerto Rican, Cuban, or other. Most of the final sample completed at least a two-year college degree (two-year degree = 28.2%; four-year degree = 32.9%; graduate degree or equivalent = 29.8%). Less than 5% held less than a college degree. The majority of the sample reported a household income of more than $60,000/year (37.0%; > $90,000 = 43.8%; < $60,000 = 17.5%). Participants were slightly more liberal than conservative on economic issues (52.2%; conservative = 31.7%), social issues (52.2%; conservative = 33.3%) and in general (50.5%; conservative = 32.6%). Most had two or fewer children living at home (88.6%; no children at home = 38.3%). Participants were asked whether they had any of four pets and indoor dogs were most common (31.3%; indoor cats = 25.6%; outdoor dogs = 20.6%; outdoor cats =13.9%).

Connection to Michigan Lakes and Rivers. All but five respondents reported having a primary home in Michigan and every county in the state was represented with the exception of Osceola. The majority of the final sample also reported having a second home in Michigan (78.2%). Most counties were again represented with the exception of Huron and Wexford. All but three respondents (99.4%) of the sample reported primarily recreating in a county in Michigan, all of which were again represented except Dickinson, Ionia, Macomb, Mecosta, and Wexford. Alger County was the most common county for primary residence (7.9%), secondary residence (6.3%), and recreation (6.7%). Ingham County was the next most common for primary residence (5.6%) while Cheboygan (3.2%) was the next most reported secondary residence county. Cheboygan and Bay County tied for the second most reported county for recreation (both 4.2%).

Most participants reported staying at waterfront property in Michigan for at least a month in an average year (71.4%; > 9 months/year = 26.6%) and actively recreating on lakes or rivers in Michigan for more than six days per year (77.2%; > 21 days/year = 25.2%). Regarding the specific activities they had engaged in during the last year, most reported swimming/wading/floating (83.9%), boating/kayaking/paddling (76.6%), or fishing (73.6%). Only 1.2% reported that they had not taken part in any of these activities in Michigan lakes or rivers during the last year.

KNOWLEDGE

Previous Experience with HABs. Approximately half of the sample reported personally having previous experience with HABs (56.7%) or knowing someone who had (56.9%). The majority of participants did not provide descriptions of these experiences (90.3%) but those who did described personally seeing or interacting with a HAB, being told about a local exposure, or having professional knowledge about them.

Information Sources. The most common source of HAB information for participants was EGLE (41.1%) followed by MDNR (37.5%), then lake associations (28.6%), MDHHS (24.6%), and finally, local health departments (18.3%). Only 13.3% reported never having received information about HABs.

Subjective Knowledge. Most participants reported knowing "a little" or more about HABs (88.5%; "a great deal" = 18.2%)[4] and were "somewhat" or more confident[5] in their ability to identify HABs (75.1%; "extremely confident" = 16.9%), keep themselves safe from HABs (78.3%; "extremely confident" = 25.8%), and identify whether they had gotten sick because of a HAB (66.0%; "extremely confident" = 22.4%). These four items were averaged to form a reliable subjective knowledge scale (α = .75; M = 3.41; SD = 0.86).

Objective Knowledge. Despite this moderate level of subjective knowledge about HABs, participants did relatively poorly on objective knowledge assessments with only 30.0% correctly noting that Michigan experienced more than 20 HABs in the last year. A slightly higher percent correctly indicated that HABs have increased in Michigan over time (47.6%; don't know = 7.7%) but only 17.9% were able to correctly identify two HAB pictures from among two distractors in a HAB identification task.

Health Impacts of HABs. Participants were asked to complete an open-ended question regarding the health impacts that they believed could be connected to HABs. A little less than half of the sample provided responses (42.9%) and a large number of the responses stated that participants did not know. Of the responses that were provided, the most common focus was skin irritation, but respiratory and digestive issues were also mentioned.

PERCEPTIONS OF RISK FROM HABs

General Risk Perception. Participants were asked to report their risk perception regarding HABs generally. Average participant responses to the three statements were approximately at their midpoint (3) suggesting relatively neutral attitudes[6]: "if a HAB were to occur, it would be likely to cause problems" (vulnerability; M = 3.46); "if a HAB were to occur, the problems it caused would be serious" (severity; M = 3.13); and "if a HAB occurred near me, I would be worried" (emotion; M = 3.24). Mean levels of vulnerability were significantly higher than severity but not emotion and the three items were averaged to form a reliable scale (α = .67; M = 3.28; SD = 0.96).

Across risk questions, between 20 and 30% of participants indicated that they strongly or somewhat disagreed with each question: vulnerability (21.1%), severity (30.7%), and emotion (30.4%). To understand the factors associated with disagreement, a variable was created which

---

[4] Nothing/I have never heard of HABs = 1; not very much = 2; a little = 3; a lot = 4; a great deal = 5
[5] Not at all confident = 1; not very confident = 2; somewhat confident = 3; pretty confident = 4; extremely confident = 5
[6] Strongly disagree = 1; disagree = 2; neither disagree or agree = 3; agree = 4; strongly agree = 5

indicated the number of times a participant disagreed or strongly disagreed with one of the risk perception variables. Participants disagreed an average of .82 times and 51.4% never disagreed. Disagreement was significantly associated[7] with participants' subjective knowledge ($r = .13$), confidence in their ability to keep themselves safe from HABs ($r = .11$), and their ability to identify that they had become sick because of a HAB ($r = .18$) such that participants who reported higher knowledge and confidence values also reported more disagreement, that is, lower risk. Note that confidence in the participant's ability to identify a HAB was not significantly related to disagreement. Older ($r = .28$), less educated ($\tau = -.10$), lower income ($\tau = -.21$) and more conservative participants ($\tau = .22$) were also more likely to disagree.

Specific Risk to the Participant. Participants next responded to a series of questions regarding how likely they felt it was that they personally would experience six specific harms because of HABs. Levels of risk were relatively consistent across types of harm with participants reporting that they felt it "somewhat likely"[8] that each would happen. Being prevented from doing something they wanted to do was most likely ($M = 2.93$) but was only significantly more likely than their pets getting sick ($M = 2.59$; all other comparisons were not significant at $p < .05$). Personally getting sick ($M = 2.80$) or having a family member get sick ($M = 2.76$), experiencing a reduction in property values ($M = 2.79$), and otherwise being financially impacted by HABs ($M = 2.80$) were more moderate.

Risk to Specific Targets. Participants were also asked about the extent to which they felt that HABs pose a risk to nine potential targets. The level of risk was largely consistent across them: Responses suggested that participants generally "agree"[9] that HABs pose a risk to people who swim ($M = 2.83$), boaters ($M = 2.60$), individuals who live on ($M = 2.83$) or eat fish from Michigan lakes and rivers ($M = 2.63$), pets ($M = 2.88$), tourism ($M = 2.93$), property values ($M = 2.75$), commercial fishing ($M = 2.77$), and the environment ($M = 2.99$). Participants reported the highest risk to the environment and tourism, both of which were believed to be significantly more at risk than people who eat fish and boaters. Risk to the remaining targets was more moderate.

HAB MANAGEMENT

Michigan Department of Health and Human Services. All participants next completed a series of measures addressing their relationship with the MDHHS. Most of the final sample reported feeling like they know "a little" (30.6%), "a lot" (27.8%), or "a great deal" (15.3%) about the MDHHS (5% reported having never heard of the MDHHS)[10].

Participants then completed a series of questions regarding six dimensions of the MDHHS' trustworthiness[11] (see Figure 1). Responses suggested they generally "agreed"[12] that the MDHHS has a positive reputation (reputation; $M = 3.74$), has the ability to do what needs to be done (ability; $M = 3.79$), is concerned about the welfare of people like the participant (concern; $M = 3.92$), communicates effectively with the public (communication; $M = 3.63$), shares the participant's

---

[7] Association was tested using Pearson's Correlation (parametric correlation), Kendall's τ (non-parametric correlation), and ANOVA (mean's test). Significance was set at p < .05.

[8] Not applicable = 1; not at all likely = 2; somewhat likely = 3; pretty likely = 4; extremely likely = 5

[9] Strongly disagree = 1; disagree = 2; agree = 3; strongly agree = 4

[10] Nothing/I have never heard of the Michigan Department of Health and Human Services = 1; not very much = 2; a little = 3; a lot = 4; a great deal = 5

[11] Ford, J. K., Riley, S. J., Lauricella, T. K., & Van Fossen, J. A. (2020). Factors affecting trust among natural resources stakeholders, partners, and strategic alliance members: A meta-analytic investigation. *Frontiers in Communication, 5*. https://www.frontiersin.org/article/10.3389/fcomm.2020.00009

[12] Strongly disagree = 1; disagree = 2; neither disagree or agree = 3; agree = 4; strongly agree = 5

values (values; $M = 3.56$), and makes decisions in a fair and consistent manner (fairness; $M = 3.66$). Participants were most positive regarding the MDHHS' concern and significantly less positive regarding its communication, values, and fairness. Reputation and ability were more moderate.

As shown in Figure 1, approximately 20% of responses indicated disagreement or strong disagreement regarding the MDHHS' reputation (22.1%), ability (18.1%), concern (18.3%), communication (18.8%), values (27.6%), and fairness (25.2%). To understand the factors related to disagreement, a variable was computed that indicated the number of times each participant disagreed across the trustworthiness dimensions. Participants disagreed or strongly disagreed an average of .82 times and 64.8% never disagreed. Disagreement was statistically significantly associated[13] with vulnerability ($r = -.32$), severity ($r = -.33$), and emotion ($r = -.34$) such that those who perceived less risk were more likely to disagree. Race and political ideology were also statistically significantly associated such that white participants ($M = 1.06$) reported more disagreement than non-white participants ($M = 0.28$). More conservative participants also reported more disagreement ($\tau = .17$).

Figure 1 - MDHHS Trustworthiness

Legend: Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree

Categories: Reputation, Ability, Concern, Communication, Values, Fairness

Local Health Departments. To keep the length of the survey manageable, one half of participants were randomly assigned to complete questions regarding their relationship with local health departments. Most of the sample reported feeling like they know "a little" (28.3%), "a lot" (28.3%), or "a great deal" (14.3%; 3.6% reported never having heard of them).

Regarding local health departments' trustworthiness, participants generally "agreed" that they have positive reputations ($M = 3.66$; "somewhat" or "strongly disagree" = 19.0%), the ability to do what needs to be done ($M = 3.45$; "somewhat" or "strongly disagree" = 30.6%), are concerned about the welfare of people like the participant ($M = 3.67$; "somewhat" or "strongly disagree" = 22.7%), communicate effectively with the public ($M = 3.53$; "somewhat" or "strongly disagree" = 24.8%), share the participant's values ($M = 3.56$; "somewhat" or "strongly disagree" = 21.3%), and make decisions in a fair and consistent manner ($M = 3.60$; "somewhat" or "strongly disagree" = 22.7%). No significant differences across domains were identified.
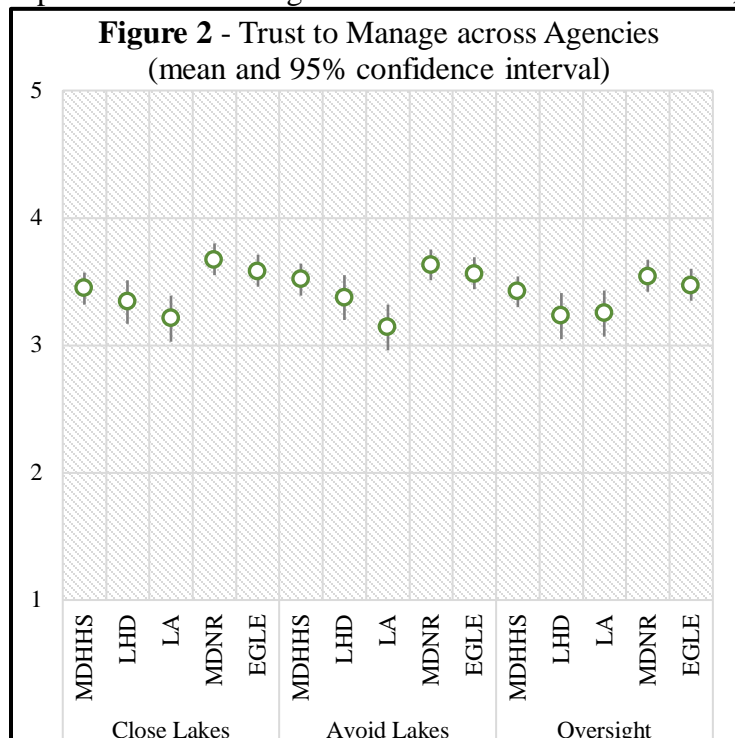
Lake Associations. The other half of the sample was randomly assigned to complete questions regarding lake associations. Most of the sample reported feeling like they know "a little" (32.4%), "a lot" (26.3%), or "a great deal" (23.3%) about lake associations (2% reported having never heard of them).

---
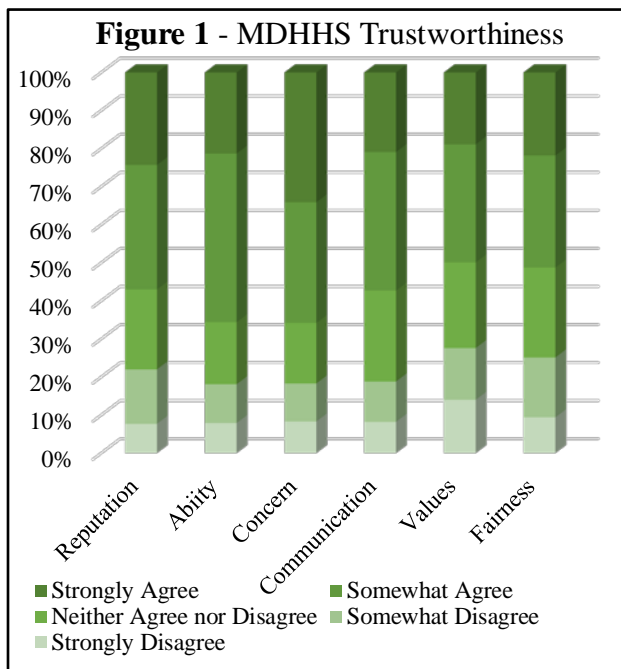
[13] Association was tested using Pearson's Correlation (parametric correlation), Kendall's τ (non-parametric correlation), and ANOVA (mean's test). Significance was set at p < .05.

Regarding lake associations' trustworthiness, participants generally "agreed" that they have positive reputations ($M = 3.72$; "somewhat" or "strongly disagree" = 18.8%), the ability to do what needs to be done ($M = 3.28$; "somewhat" or "strongly disagree" = 33.8%), are concerned about the welfare of people like the participant ($M = 3.69$; "somewhat" or "strongly disagree" = 28.6%), communicate effectively with the public ($M = 3.37$; "somewhat" or "strongly disagree" = 30.0%), share the participant's values ($M = 3.47$; "somewhat" or "strongly disagree" = 29.0%), and make decisions in a fair and consistent manner ($M = 3.45$; 29.6%). Participants were most positive regarding lake associations' reputation and concern and were significantly less positive regarding their ability. Communication, values, and fairness were more moderate.

Trust across Agencies. Participants also completed a series of three questions regarding the extent to which they trusted the MDHHS, local health departments, and lake associations to handle three aspects of HAB management. Because of their relevance, participants were also asked to complete the same questions addressing the MDNR and EGLE. Specifically, participants were asked about the extent to which they felt comfortable letting the agency close lakes because of HABs, relying on the agency to know when to avoid lakes, and allowing the agency to do its job without oversight. In general participant responses suggested that they "agree" but, when there were significant differences, responses regarding the state agencies were generally more positive (see Figure 2; non-overlapping confidence intervals are significantly different at $p < .05$).

Figure 2 - Trust to Manage across Agencies (mean and 95% confidence interval)

Participants also completed three questions that asked which of the five agencies they most trusted to test lakes for HABs, to make determinations about closing lakes due to HABs, and to communicate with the public about HABs. EGLE was most often selected as most trusted to test for HABs (30.2%) and make decisions about lake closures (24.4%). Local health departments were also often selected for both testing (22.4%) and closure (20.0%) but MDNR was more often selected as most trusted for closure (22.4%). Local health departments were most selected for communicating with the public about HABs (24.6%) followed by MDHHS (23.0%).

Communicating with the Public. Participants were then asked about the extent to which they thought several methods of communicating with the public about HABs would be effective. Responses generally suggested that participants felt that each approach would be "somewhat effective"[14]. Responses were most positive for mailings to lakefront properties ($M = 3.41$) which was significantly more positive than website announcements ($M = 3.15$). Signs at the lake ($M =$

---

[14] Not at all effective = 1; not very effective = 2; somewhat effective = 3; pretty effective = 4; extremely effective = 5

3.34), social media postings ($M = 3.18$), and an opt-in email listserv were more moderate ($M = 3.35$).

COOPERATION WITH HAB MANAGEMENT

Projected Cooperation. Participants completed two questions to assess the extent to which they were willing to cooperate with the Michigan Department of Health and Human Services' efforts to manage HABs in the future. Participants were generally "somewhat" willing to cooperate by avoiding a lake if MDHHS said it was unsafe ($M = 3.46$) and paying more in taxes and fees to support MDHHS' efforts to manage HABs ($M = 3.10$).

To determine the factors most associated with increasing cooperation with MDHHS, we next conducted a series of linear regressions predicting participants' willingness to cooperate with the six trustworthiness domains, perceived knowledge about HABs, risk perception, age, gender, education, race (white vs non-white), children living at home, and income. Cooperation was most associated with risk perception for both avoiding lakes and paying increased fees and taxes. Age and race were also consistent predictors: White participants reported more willingness to cooperate on both variables but the relationship with age reversed. Older participants were more willing to avoid lakes MDHHS identified as unsafe but younger participants were more willing to pay more in taxes and fees.

In-Survey Cooperation. In order to measure cooperation as behavior within the survey, we also included three opportunities to cooperate with MDHHS' efforts to manage HABs by learning more about HABs (78.7% agreed), signing up to join focus groups to discuss HAB management (69.2% agreed), and completing an additional set of survey questions (71.4% agreed).

We again conducted a set of regressions with learning more, focus groups, and the additional questions predicted by trustworthiness, perceived knowledge about HABs, risk perception, age, gender, education, race (white vs non-white), children living at home, and income. Subjective knowledge and race were consistent predictors such that participants who reported more knowledge and self-reported as white were more likely to cooperate.

SUMMARY OF FINDINGS

The current survey sheds light on public perceptions regarding HABs and HAB management in Michigan and has implications for management agencies.

Who This Data Reflects. The sampling methodology focused on individuals who had strong connections to Michigan lakes and rivers, and this was reflected in the final sample. Most participants lived in Michigan and spent a considerable amount of time recreating on lakes and rivers in the state. Participants were generally relatively affluent, well-educated, and liberal. Most felt they had some level of knowledge and experience with HABs, but it is important to note that the sample was not especially likely to get factual questions correct. This suggests a more general and potentially less technical knowledge of the blooms.

Risk Posed by HABs. Participants were generally neutral about the extent to which they felt that HABs pose a risk with responses clustering around the midpoint (labelled "neither agree nor disagree"). Nonetheless, participants did report somewhat higher levels of vulnerability, being prevented from doing something they wanted to do because of a HAB, and potential for harm to the environment and tourism. Together, these results suggest a general awareness that HABs can be problematic but stop short of suggesting that participants personally feel considerable potential for experiencing those problems.

Managing HABs. Participants were somewhat positive regarding the organizations responsible for managing HABs. Regarding MDHHS itself, participants generally agreed that it was trustworthy across all six domains but were most positive regarding the extent to which it is concerned about the public. Evaluations of its communication, the extent to which it shares the participants' values, and its fairness were also positive overall but were significantly less so, suggesting opportunities for improvement. Responses regarding local health departments and lake associations were generally similar but were significantly lower on ability as compared to MDHHS. Similarly, results suggested more positive responses regarding the extent to which participants felt comfortable letting MDHHS decide to close lakes, relying on MDHHS to know to avoid lakes, and allowing MDHHS to operate without oversight. Importantly, however, these increases were generally not significant and MDNR and EGLE were even more trusted in all three areas (though again, these comparisons were not always significant).

Who Cooperates? In order to assess who was most likely to cooperate with MDHHS' efforts to manage HABs, participants completed measures of projected and behavioral cooperation. Regarding projected cooperation, participants were mildly positive but were more likely to cooperate when they perceived greater risk and were white. Age was also predictive, but its effect flipped across cooperation variables. Although interesting, these measures of projected cooperation do not require participants to do anything and thus may over- (or under-) estimate the extent to which participants actually will cooperate when given the opportunity. We therefore included three smaller but real cooperation opportunities. We asked participants to take additional time to learn more about HABs, to sign up for a focus group to provide their thoughts on HABs management, or to complete an additional set of survey questions. Cooperation was again high but was more likely among white participants who reported greater subjective knowledge.

RECOMMENDATIONS AND CAVEATS

The current survey sheds light on public perceptions of HABs and their management in Michigan. Overall, our participants recognize risk from HABs but tended to provide less evidence that they felt significant potential for personal harm. On the whole, they suggested positive evaluations of current HAB management in the state. In general, state agencies are perceived slightly more positively, and the most positive evaluations tended to be for the Michigan Department of Natural Resources.

Our results highlight two potential opportunities for improving HAB management in Michigan. The first opportunity is specific to MDHHS. Although it was positively evaluated, Figure 1 suggests that participants were notably less positive about some of the domains, especially the extent to which MDHHS communicates effectively, shares the participants' values, and makes fair decisions. As an agency focused on information sharing with the public, this makes some sense and may reflect a relative lack of effective bi-directional engagement. Thus, while Michiganders may be able to assess the extent to which the agency is concerned for their welfare from fliers or billboards with information intended to help them make informed decisions about their health, it may be more difficult to see how those efforts reflect shared values or fairness in decision making, both of which may be easier to signal in deeper engagement. Again, it is important to note that the responses here do not suggest a problem as mean values were moderate (though it is worthy to note that approximately 20% of the sample disagreed regarding their trust in the agency and its trustworthiness) but they may highlight an opportunity for growth.

The second opportunity concerns the delegation of responsibility for management decisions regarding HABs. The evaluation of Figure 2 suggests that our participants were consistently most positive regarding the state agencies and especially MDNR. Across management responsibilities, the local health departments and lake associations were least trusted but it is important to note that the confidence intervals around these mean estimates were relatively larger, suggesting greater variability in responses. A best guess from our data would suggest that management efforts would be best served by leaning more heavily on MDNR but there may be important factors pushing on the level of trust afforded the more local organizations. Our survey collapsed across lake associations and local health departments and so may have unintentionally combined agencies that participants had more positive perceptions of with those that were less well evaluated.

A potentially profitable step forward would therefore involve more geographically specific efforts to understand perceptions of specifically identified communities. Indeed, one course of action that may address both this and the previous opportunity highlighted by this survey would be the initiation of small group discussions with individuals from discrete communities at heightened risk of experiencing HABs. These discussions could help to elucidate management preferences that may be specific to these communities while allowing opportunities to signal MDHHS' values and the fairness of its decision making.

Despite the potential contribution of this work, there are important limitations and key among them is the fact that our sampling was based on convenience. Our sampling methods emphasized individuals who have identified themselves as having a strong interest in specific lakes in the state. Thus, our data are not necessarily representative of the state. Indeed, our final sample was relatively highly educated, affluent, and liberal.