Guidelines for Sustainable Lake Associations and Coalitions of Lake Associations

Research and Recommendations

Prepared for:

Hubbard County COLA
Park Rapids, MN
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SPEA CAPSTONE INDIANA UNIVERSITY | Lake Association Sustainability

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EXECUTIVE SUMMARY

This report, prepared by Indiana University's School of Public and Environmental Affairs (SPEA) Master's Capstone Course for the Hubbard County Coalition of Lake Associations (COLA), provides research and recommendations related to increasing lake association sustainability. As a framework for the report, lakes are viewed as common-pool resources, and COLA and Lake Associations (LAs) as common-pool resource managers. Lake association sustainability will have a direct and positive effect on lake sustainability, as more effective common-pool resource management organizations are better equipped to maintain their managed resources. Through communication with COLA, three research questions were addressed:

1. How do the actions of the LAs/COLA affect their public image?
2. What is the best way to get people to engage in best practices in lake management, and how does this relate to lake-water quality?
3. What are the ways to aid in the recruitment and retention of members?

To answer these questions, geospatial, interview, and survey data (from COLA and selected LA members, as well as non-member lake residents) were collected, and literature review was utilized to provide a theoretical background for recommendations. Research questions were addressed in terms of the LA's and COLA's public image, water quality engagement, membership, leadership, volunteering, and fundraising.

Major research findings of this report are as follows:

- COLA and LAs are viewed positively by LA members, but evidence from the COLA survey and local media reviews indicates that a public relations campaign would be beneficial for the COLA.
- Lake eutrophication and aquatic invasive species are common problems for many lakes.
- Improved lake conditions are correlated with both higher property values on lakes and the presence of LAs.
- Lake residents are more concerned about water quality and fishery management issues than COLA members.

- People residing on the lakes for six months or more are most likely to be involved with LA and become engaged in water quality-related activities.
- Fifty-nine percent of COLA respondents say that they currently use a lake management plan (LMP) of some type.
- According to the lake resident survey, most residents prefer e-mail contact as their primary method of communication with lake associations.
- Both the lake resident and COLA surveys indicated that management and succession of leadership are important issues.
- Residents over the age of 50 may be more likely to volunteer.
- For effective fundraising, identify target audiences, a unique case for support, and develop a determination of the organization's strengths, weaknesses, opportunities, and threats (SWOT analysis).

Recommendations related to the above findings are presented in this report. Along with this information, we created the following products for COLA (see Appendix 1 for a detailed description):

- Pamphlet summarizing research findings;
- Videoconference presentation of research findings (April 22, 2013) to COLA; subsequent presentation is planned for July 27, 2012, to COLA Board Meeting, Park Rapids, MN, by Professor Fischer;
- Facebook page and guidance for its maintenance;
- Data set and geospatial database with a summary of lake conditions;
- Lake association brochure template;
- Sample COLA brochure template; and
- Advertisements related to aquatic invasive species (AIS) and volunteering.

CAPSTONE INTRODUCTION

SPEA's spring 2013 Capstone class, entitled "Lake Management Associations: Developing Sustainability Guidelines," was formed to address the needs and issues of its client, the Hubbard County Coalition of Lake Associations (COLA). Led by Professor Burney Fischer and assisted by Professor James Farmer and Visiting Lecturer Sarah Mincey, the class met once per week at the Vincent and Elinor Ostrom Workshop in Political Theory and Policy Analysis, and was divided into different working groups to accomplish the various tasks associated with identification of COLA's most urgent issues. The class timeline was divided into two distinct stages in which different working groups assembled. In the first stage, the groups were divided into the literature review team, data and GIS analysis team, communication team, survey analysis team, and interview analysis team. In the second stage, groups were divided into the report-writing team, presentation team, and outreach team.

Each group in each of the two stages worked to compile information, data, and scholarly resources relating to its specific goals. This information was then synthesized to address three important questions identified by the class as a whole, and based upon information provided by the client. These three questions were:

1. How do the actions of the LAs/COLA affect their public image?
2. What is the best way to get people to engage in best practices in lake management, and how does this relate to lake-water quality?
3. What are the ways to aid in the recruitment and retention of members?

Through answering these questions, we provide information and strategies designed to increase lake association sustainability. Sustaining organizations like COLA and LAs will depend on public image, leadership, membership, volunteers, and proper funding. These factors directly impact lake sustainability, as strong associations will be able to manage their resources more effectively.

The culmination of the project consisted of a live videoconference presentation to the client, as well as this written report, a pamphlet, and web deliverables (see Appendix 1).

THEORETICAL BACKGROUND

COMMON-POOL RESOURCES

To begin to address the complex issues faced by COLA, it is helpful to define and classify the resource with which it deals. Lakes provide both ecological and recreational benefits for the environment and the people around them, are available for public use, and are used for a variety of different purposes such as boating, fishing, and swimming. As such, lakes are a prime example of a common-pool resource (CPR), which is a finite resource, "natural or man-made . . . that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use" (Ostrom 1990: 30). Thus, CPRs can suffer from overextraction or underprovision. Through this lens, COLA itself can be viewed as a CPR, in that it is a voluntary association of people who are gathering to deal with issues relating to the utilization of its natural resources.

The process of taking resource units, or flow variables, from the resource stock can be undertaken by multiple appropriators, either at once or sequentially (Ostrom 1990). However, the resource units themselves are not subject to joint use or appropriation, meaning that once a flow unit or variable is taken, it is not available for use by someone else (Ostrom 1990). In the case of a lake or other body of water, the stock variable is the lake itself, and it contains individual flow variables such as fish and water quality that can be appropriated to individual users. For example, in regard to extraction problems, when a fisherman catches a fish, the fish can only be used (consumed) by him, and is no longer part of the stock of the lake. Similarly, in terms of provision problems, when water in the lake is used by people, the quality of the water naturally declines from its previous, pristine state. An example of this might be a boat owner who does not practice proper aquatic invasive species (AIS) management practices for his boat, and thus may be introducing AIS to a lake, thereby lowering the water quality for other users and failing to provide for its sustainability. These examples illustrate the concept that the lake's stock is subtractable, or detracts from the stock available to be used by other people (Ostrom et al. 1994).

Garrett Hardin's (1968) well-known essay, "The Tragedy of the Commons," describes one of the common problems pertaining to CPRs, which is the overexploitation of shared

resources. It asks the readers to call to mind a public pasture of grazing cattle, in which each herdsman will naturally attempt to graze as many cattle as possible in order to maximize his gain in the future, when the cows are taken to market. Hardin states that this then leads to overgrazing of the pasture, resulting in overexploitation of the resource (grass) available to the cattle. Before they realize it, the herdsmen can no longer graze any of their cattle in the pasture, because the pasture grass is depleted. Therein, Hardin argues, lay the tragedy of the commons.

Another well-known example of CPR exploitation is given by the Prisoner's Dilemma, wherein individuals drawing from the same CPR are unable to communicate with each other, and thus are unable to communicate regarding any agreed-upon rules or strategies governing resource withdrawal or management provisions. This leads to suboptimal use of the resources, because "users will overappropriate, individuals will defect on one another, and potential collective benefits will not be achieved" (Ostrom et al. 1994: 5). However, given these cautionary tales of resource destruction and exploitation, the work of the late Indiana University Professor Elinor Ostrom provides a note of optimism. She states that there are certain characteristics of CPRs that enable long-enduring use over long periods of time (Ostrom et al. 1994).

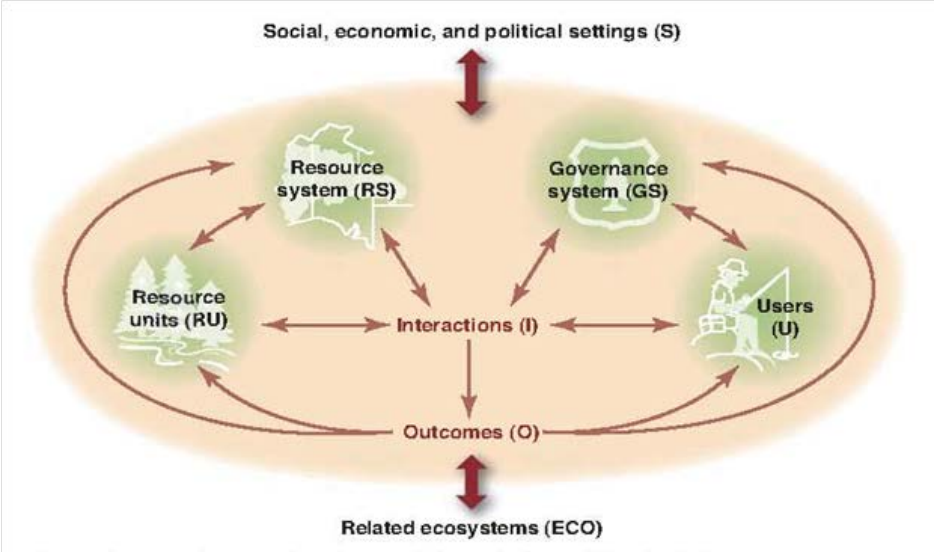
INTRODUCTION TO OSTROM'S FRAMEWORK AND THEORY

Elinor Ostrom's book, *Governing the Commons* (1990), identified eight design principles, developed through international case studies, associated with sustainable CPR management. As an introduction to the principles, CPRs used and managed by people can be first analyzed as social-ecological systems (SESs). SESs encompass social and ecological variables, and their interactions allow for a better understanding of how seemingly autonomous systems can affect outcomes on a larger scale (Appendices 2–3).

The success or failure of SESs and CPR management is complex. Various scientific, social, economic, and political disciplines use different language and concepts to describe and analyze complex SESs. Therefore, a general framework is needed to compile, organize, and integrate isolated information from the scientific, social, economic, and political disciplines involved in the analysis of CPRs.

The SES framework by Ostrom (2009) offers such a solution. It consists of first-level systems containing: resource systems, resource units, users, and governance systems (Figure 1). These categories contain multiple second-level variables. Within these systems and variables,

Ostrom's design principles can be applied and integrated where appropriate. This SES framework has guided the Capstone project in identifying key systems and themes in order to better inform our recommendations to COLA.



Resource Units, Resource Systems, Governance Systems, and Users interact to produce outcomes and, in turn, those outcomes affect each unit.

Figure 1. Social-ecological system framework.
Source: Ostrom (2009: 420).

The Capstone project's predominant focus was on the governance and user systems associated with lake association management sustainability. Collective action and operational interactions between COLA and individual lake associations can produce outcomes for the overall welfare of the lake associations, and in turn, lake sustainability. A discussion of Ostrom's design principles follows below.

DESIGN PRINCIPLES EXHIBITED BY SUCCESSFUL CPR INSTITUTIONS

Ostrom's design principles are particularly applicable in determining how to successfully manage lakes, lake associations, and COLA. The eight design principles include:

1A&B. Clearly defined user and resource boundaries: Boundaries must be clearly defined in regard to the lakes themselves, as well as who is able to utilize the lakes.

2A&B. Congruence between appropriation and provision rules and local conditions: People utilizing the lakes will obtain benefits in proportion to the amount of labor input required, and resource rules must fit for both local social and environmental conditions.

3. Collective-choice arrangements: Those people who are most involved in the stewardship of the lakes will be most able to participate in modifying its rules.

4A&B. Monitoring users and the resource: Effective monitoring of users and the lakes leads to more effective management of the resource itself, and contributes positively to user accountability.

5. Graduated sanctions: Appropriators who violate use-rules will be assessed gradually increasing and harsher sanctions in accordance with the violation.

6. Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

7. Recognition of rights to organize: Minimal rights to organize are recognized, and not challenged by, government authorities.

8. Nested enterprises: Efforts related to management are organized into multiple layers of nested initiatives between different organizations.

Ostrom also states that it is unlikely for all CPR institutions to exemplify all eight design principles, indicating that only a few principles may be relevant to a specific institution (Ostrom 1990), and she demonstrated that CPR management can sometimes fail due to a lack of trust and efficient communication, along with a lack of institutional innovation and successful monitoring and enforcement (Ostrom 1998).

In 2010, a group of Ostrom's colleagues reviewed 91 studies that utilized her eight design principles. The results of the evaluation showed that the design principles are empirically well-supported. The article also suggests reformulation of the eight design principles by dividing Principle 1: Clearly defined boundaries, Principle 2: Congruence between appropriation and

provision rules and local conditions, and Principle 4: Monitoring, into two parts each, thereby creating eleven design principles. These principles were found to make significant contributions to the outcomes of various cases and studies, and are important in determining success in managing a CPR. Ostrom's eight design principles, including the three additions from Cox et al. (2010), are described above and in Appendix 2. Again, not all of the eleven design principles may be relevant to all CPR institutions. Significantly, these authors also cite the results of a CPR study by Harkes, stating that "it has become clear that the real 'glue' that keeps an institution alive over time are the social mechanisms, i.e., trust, legitimacy and transparency."

LAKE ASSOCIATION CASE STUDIES: IMPORTANT FINDINGS

Several studies have sought to determine why some lake associations are successful and others have failed as effective organizations. Important findings of these studies are listed below.

Kramer (2007): In a study of Minnesota lake associations, survey and physical data were analyzed to determine several variables that have either a positive or negative relationship with lake association participation rates. Kramer used lake association participation rates as a proxy for social capital, defined as a system of networks, norms, and trust, which improves the probability that effective self-governance will occur. Significant variables that were associated with impacts on lake association participation can be seen in Table 1.

Table 1. Variables affecting lake association participation rates

Variables measured	**Percent change in participation**
Having a lake association newsletter	+23%
Maintaining good relationships with local officials	+14%
Amount of non-motorized recreation	+13.7%
Consistently swimmable lakes	+5%
Proportion of agricultural land in watershed	+2.9%
Secchi depth reading	+2.4%
$10 increase in annual dues	+1.7%
Percentage of seasonal resident homes on lake	+1.6%
Total number of homes on the lake	-0.02%
Larger lake area	-0.7%
Amount of motorized lake recreation	-1.6%

Source: Based on Kramer (2007).

The negative impacts of larger lakes and total number of homes support Olson's (1965) theory that smaller groups are more likely to engage in CPR institutions. The importance of a newsletter and good relationships with local officials supports Ostrom's theory that communication is an important part of successful CPR institutions, as greater communication can involve more individuals in association decisions (Principle 3). One outcome that did not align with Kramer's expectations was the positive association of higher seasonal residency with increased participation. This result may be due to seasonal residents' presence in the summer months when most lake association meetings take place. Kramer also found that among other variables, lake association participation had a small positive effect on water clarity.

Arnold (2003): In a study of the effectiveness of Michigan lake associations, public access and large lake size were identified as variables associated with unsuccessful regulation attempts. Public access represented a free-rider problem, common to CPRs, where people utilized the lake but did not contribute to its maintenance (Principle 1A). Larger lakes hindered communication and increased the amount of time and resources spent cooperating in CPR management, again reflecting Olson's (1965) findings. The study also noted the importance of regular verbal communication facilitated by lake associations (e.g., face-to-face encounters) in successful cases. Proper framing of an issue is also important. Because people are more likely to respond to the threat of loss than potential gains, focusing on preventing that loss is a worthwhile strategy. Strong leaders that could mobilize group sentiment were associated with successful cases. Public access issues also reflect the importance of clearly defined boundaries, and large lake size reflects Olson's (1965) theory that larger CPR institutions will have a more difficult time organizing.

Gabriel and Lancaster (2004): In a state-wide survey of Wisconsin lake associations and lake districts (special-purpose units of local government, established by local officials and residents that include all property owners that benefit from the lake—both riparian and off-lake owners), the authors used variables including "number of management activities undertaken" and "number of management activities implemented" as proxies for successful lake association and district management. Factors that positively influenced lake management activities (for associations and districts) included greater numbers of cottages, greater percentage of permanent residents, higher price of shoreline per foot, greater membership size, and higher membership fees. The results from this study reflect the importance of resident participation in decision-

making (Principle 3), budgetary sufficiency, and clearly-defined boundaries regarding membership (allowing members to participate in managing the lakes [Principle 3]). Ostrom's nested-enterprise principle (Principle 8) is also relevant because there are multiple levels of governance and a variety of actors influencing management of the lakes.

Snell et al. (2010): In a study combining survey and biophysical data, the authors attempted to uncover variables that relate to successful lake management in Maine. Success was measured through survey responses regarding management of water quality, invasive plants, recreation, development, and road-management questions. Successes were grouped into resource, institutional, community, and organizational factors. Resource characteristics that negatively impacted management were greater length of shoreline and the hosting of key game species. This result could be explained by the fact that larger resources are harder to manage (Principle 3; Olson 1965), and lakes that contain game species typically have extensive public use (Principle 1A). Community characteristics that impacted management success were housing values and housing density. Higher housing values were correlated with successful management of invasive plants, and higher housing densities were correlated with successful road management. From an institutional/organizational perspective, seasonal residency was negatively correlated with management success, opposing Kramer's (2007) findings. Good relationships with local, state, and non-governmental organizations (land trusts, sporting groups) were positively correlated with management success, reflecting Ostrom's nested-enterprise principle (Principle 8).

The most common variables mentioned in these studies include lake size or shoreline length, communication (newsletters), good relationships with local officials, and public use. Ostrom's principles reflected in the studies include clearly-defined boundaries (Principle 1A), collective-choice arrangements (Principle 3), and nested enterprises (Principle 8).

We created a model for sustainable lake management by lake associations based on Ostrom's principles, the SES framework, and research related to sustainable lake associations (Appendix 4). This model synthesizes our literature review, and provides a theoretical lens to view our following recommendations. Although we did not have optimal data to validate this model within the confines of the Capstone class, it provides a starting point for future research into sustainable lake associations. Further use of the model would benefit from tailoring data

collection to theoretical findings, a reexamination of second-level variables, and an expanded literature search.

METHODS

Building upon previous studies and Ostrom's SES framework and design principles, a project design was developed (Figure 2). Besides building upon SES and design principles theory, we utilized theory from the field of public relations. Four data sets were collected during the initial stage of the project. The following paragraphs give a brief introduction to the data sets and procedures utilized:

Lake condition, lake management plans, and property values data set

Data characterizing the physical, biological, and chemical condition of 41 lakes, such as lake size, lake area, trophic state, and transparency, were sourced from the MN Pollution Control agency and the MN Department of Natural Resources websites and combined into a GIS geodatabase. The table was joined with data on property values and parcel characteristics for 35 lakes received through Kevin Trappe from the GIS Department of Hubbard County. Also, 13 lake-management plans for 22 lakes were provided by COLA and reviewed during analysis. The relationship between different variables within the data sets was tested using SAS software. Results were visualized using MS Excel. Detailed descriptions of data fields and sources for each field are presented in Appendix 5.

Survey analysis data set

For this project, we used two online surveys[1]: one to solicit data from COLA representatives and a second to collect data from individuals living on seven lakes in Hubbard County.

Initially, a 46-question survey was developed by the Capstone instructors and refined by the enrolled students and the COLA leaders. This survey was converted for online distribution using Qualtrics software (Qualtrics, Provo, UT). We used a modified Dillman Tailored Design for soliciting data, which included a four-part mailing with each distribution spaced one week apart (Dillman et al. 2009).

[1] Surveys and interviewers' questions used are available upon request.

The first mailing was a letter noting that an online survey was ensuing within the next week; the second mailing provided a link to the survey; the third was a reminder/thank you, which also contained a link to the survey; and the fourth and final mailing was a final solicitation that contained the survey link. The COLA survey was distributed to 104 COLA representatives by one of the course instructors beginning on Tuesday, January 29, 2013, with the final mailing distributed on Tuesday, February 19, 2013.

The second 26–question survey[2] was developed and refined by the Capstone students and instructors, and distributed to residents living on one of the seven lakes. The seven lakes were chosen by COLA to represent a cross-section of lakes in the coalition. This survey was also converted for online distribution using Qualtrics (Qualtrics, Provo, UT) and employed a modified Dillman Tailored Design (Dillman et al. 2009) for distribution using similar mailings.

Mailings occurred over a two-week period, with the first occurring on a Thursday, the second on the following Tuesday, the third on the next Thursday, and the final mailing on the Tuesday of the third week. Correspondence began on Thursday, February 21, 2013, and ended on Tuesday, March 5, 2013. This survey was distributed directly to the residents on four of the seven lakes, while being distributed via the e-mail coordinators on the remaining three lakes for whom we did not have access to their e-mail lists. The lake resident survey was sent to more than 716 residents.

For the COLA survey, we mainly employed descriptive statistical methods to analyze these responses. Since there are many open-ended questions, we coded them and derived some basic statistics such as frequency, mean, and standard deviation to provide a clearer picture of this survey.

For the lake resident survey, we employed some inferential statistical methods, as the larger sample provides a large enough sample size to make a valid statistical inference. ANOVA and simple linear regression models were employed to provide statistical significance tests with more precision in our lake resident survey analysis. These statistical tests were conducted with statistical package software such as SPSS and SAS.

[2] Surveys and interviewers' questions used are available upon request.

Interview data set

In order to gain more depth from the survey, we provided a space for respondents to leave their phone number for follow-up interviews. We received 30 phone numbers from the COLA survey, and 113 phone numbers from the lake resident survey that expressed an interest in being interviewed. We called and interviewed a total of 10 COLA members and 10 lake residents whose phone numbers we received from these surveys. In accordance with Patton (2002), 10 interviews were sufficient for the analysis type employed and the objective of using the data to seek in-depth insight to the phenomenon under study. While this is a small subset of the total potential interviewee pool, the objective of using the interviews was to have qualitative information that would add depth and clarify the quantitative findings of the survey analysis. The results of the interviews are not necessarily representative, and cannot be generalized to all COLA members and lake residents in Hubbard County.

Both the COLA and lake resident interviews consisted of 13 questions.[3] Two students were present at each phone interview, with one student conducting the interview and taking brief notes while the other took more detailed notes. Interviews were not recorded. After the final interview was complete, results were thematically coded for emergent themes (Creswell 2007). For each question, all answers received from the 10 interviewees were combined. Common references, which were those mentioned by multiple interviewees, were grouped together into themes.

[3] Questionnaires used are available upon request.

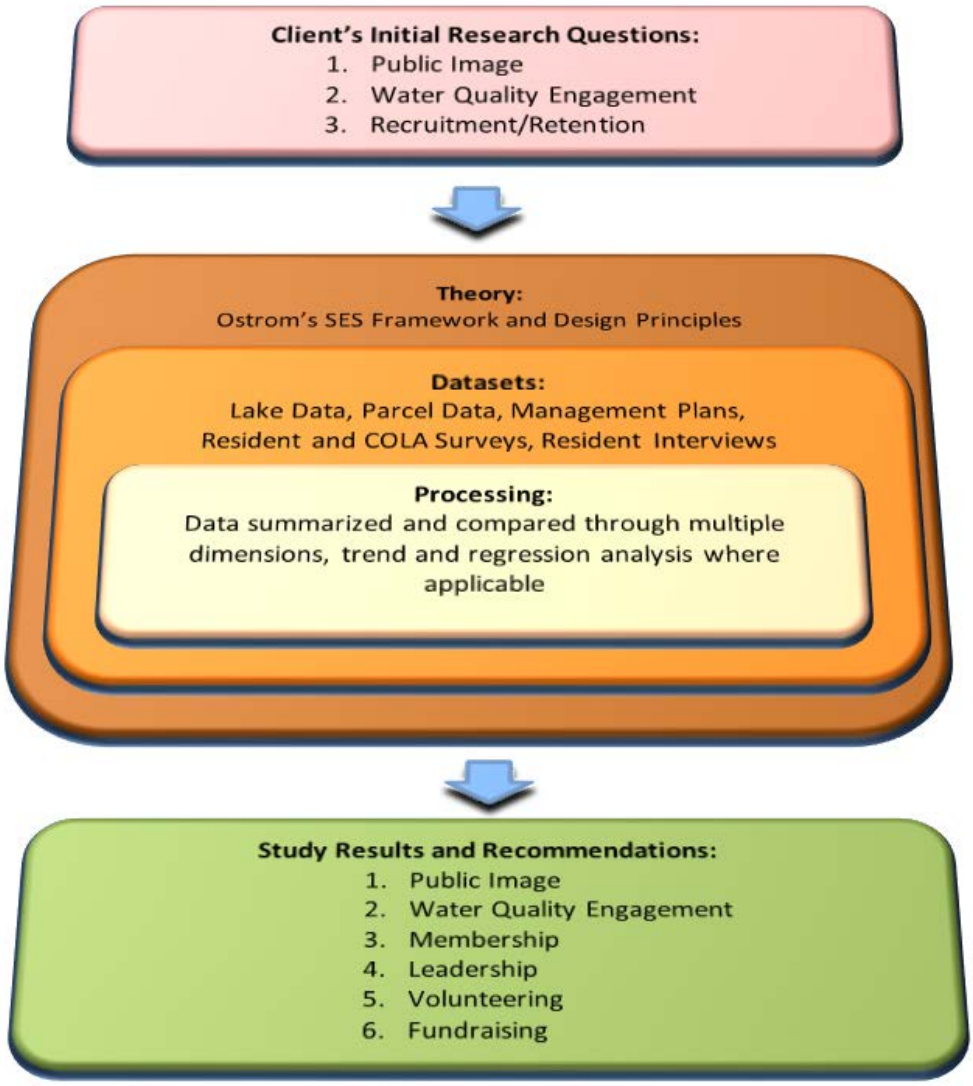
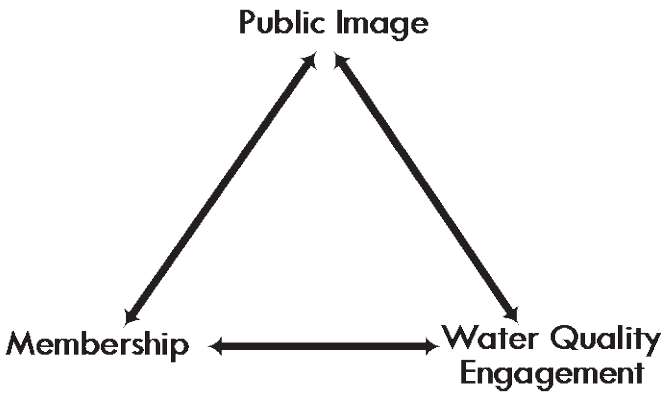


Figure 2. General project design for Lake Association Sustainability Study for Hubbard County COLA by Indiana University SPEA Capstone, Spring 2013.

FINDINGS AND RECOMMENDATIONS

Initial discussions with the client led to the formulation of the following questions:

1. How do the actions of COLA and LAs affect their public image?
2. What is the best way to get people to engage in best practices in lake management, and how does this relate to lake-water quality?
3. What are the ways to aid in the recruitment and retention of members?



In total, 44 individuals responded to the COLA survey (42.31% response rate). Alternatively, the lake resident survey was sent to 716 residents and received 299 responses (41.76% response rate). Approximately 95% of these respondents were lake association members. Among all the lake resident respondents, 8 lake residents were from 8th/9th Crow Wing Lake, 44 were from Big Mantrap Lake, 25 were from Little Sand Lake, 123 were from Long Lake, 17 were from Middle Crow Wing Lake, 20 were from Palmer Lake, 53 were from Potato Lake, and 9 did not respond about which lake they were from. After research and data analysis, the following important categories emerged: public image, water quality engagement, membership, leadership, volunteering, and fundraising. These themes are presented in the following sets of findings and recommendations.

PUBLIC IMAGE

Addressing COLA's Public Image: Why It's An Issue

For any organization that works with the public, maintaining a positive image can help ensure the success of its mission. For an organization like COLA, which aims to work with local residents to protect the environment and property values, a lack of support or trust could mean reduced participation and ultimately reduced lake quality.

Public image a high concern among COLA

As demonstrated by our survey with COLA representatives, public image is a pressing concern. It ranks as the most highly cited issue facing COLA, followed by AIS, and then volunteer and public engagement (Figure 3). As expressed in the initial discussions with COLA (January videoconference), there is a concern over the impact of the recent lawsuit (Ed Mutsch, Hubbard County COLA, and the Middle Crow Wing Lake Association have vs. the County of Hubbard, the Hubbard County Board of Adjustment, Daniel J. Rehkamp, and Donna M. Rehkamp http://www.minnesotawaters.org/group/hccola/cola-vs-hubbard-county.) on the perception of COLA as being too "radical," which could detrimentally affect involvement with COLA and lake associations generally.

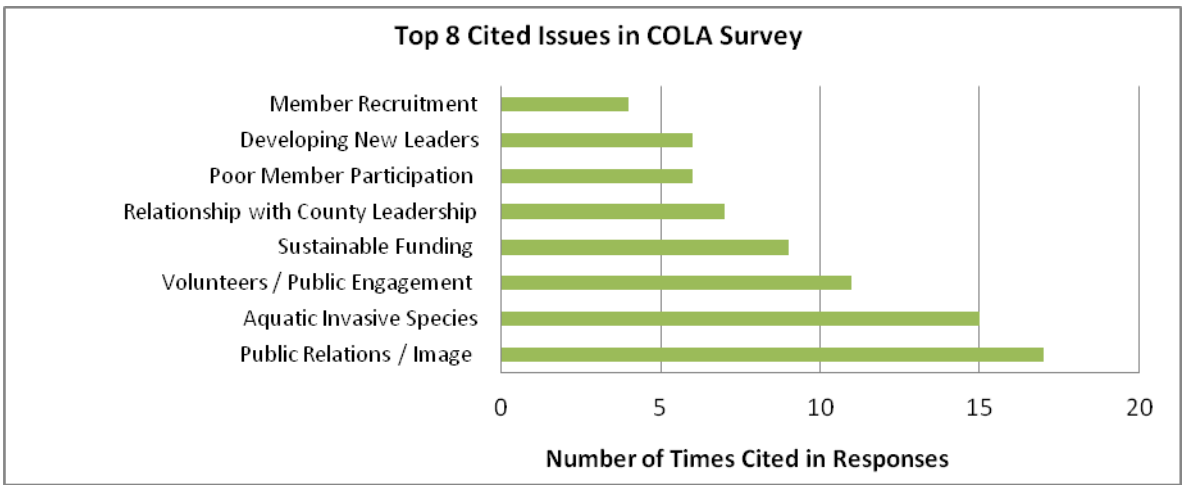


Figure 3. Frequency of most important issues' citation in COLA survey (n=44).

A major public image problem, however, does not appear in the views of lake residents surveyed (95% were LA members). Our sample of lake residents holds a positive view of COLA, with 69% of respondents viewing COLA positively, including 38% who view them very positively. Only 10% of respondents view COLA negatively (Figure 4).

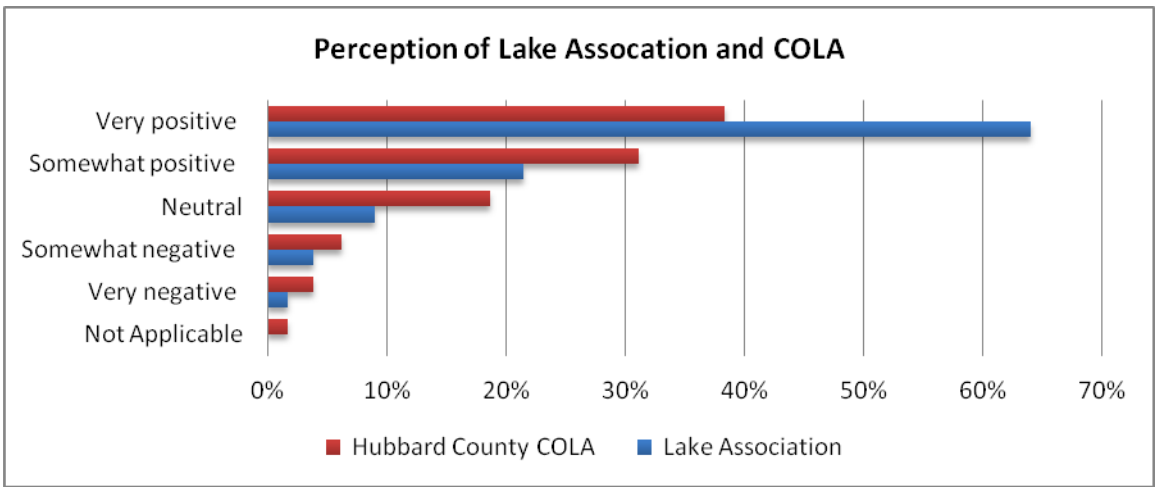


Figure 4. Perception of lake associations and COLA by lake residents (n=290).

COLA viewed positively by lake residents

This generally positive perception of COLA was also reflected in interviews of lake residents; many interviewees discussed how COLA was a positive force in maintaining lake quality even without an appropriate amount of funding. This fact is not surprising, as the vast majority of respondents are members of their lake association, so they will likely have more positive views than the general population. Additionally, most respondents in the lake resident survey had high approval of their own lake association, with more than 60% of those surveyed viewing the organization very positively.

In comparison to COLA, fewer people view the DNR very positively, 28%, but an equal number, 69%, view them as very or somewhat positively. This implies that while the DNR has high approval among our sample, COLA has somewhat higher support. This also reflects elements from Ostrom's Principle 8. COLA's working relationship with the DNR represents a nested enterprise of organizations working together to address community issues, and would seem to support this principle given the positive survey results.

Recent media stories highlight public concerns

To gain further understanding of the public image issue, a review of recent articles in the local media was undertaken. These articles were primarily from the Park Rapids Enterprise, as other local sources are restricted by subscription. Recent articles do present a public image concern, as reflected in the February 2, 2013, Park Rapids Enterprise commentary, "AIS prevention needs to be a team effort." While it represents only one person's opinion, the article may provide

evidence for a broader perception problem shared by others, and moreover, the article itself can create this perception for residents. Generally, the author believes that COLA "works tirelessly," but that leaving the state association was disappointing, as AIS needs to be a "team effort," requiring greater collaboration with fishing groups, broader focus on AIS problems, and that there are concerns that this "radical" group could put lake access in jeopardy. Another Park Rapids Enterprise article describes how "citizen board members tire of being browbeaten" by COLA, and that the article did not contain a comment from COLA. In the past, however, positive stories in this newspaper have detailed how COLA's work was a "poster child" in the state, which may suggest a recent trend toward negative media. In summary, COLA should both monitor media stories and respond when appropriate.

Strategies for improving public image

While there appears to be strong support for COLA among lake association members, evidence from COLA representatives and local media supports the notion that a public relations campaign would benefit the organization. The articles present two predominant issues to address:

- COLA should work effectively with stakeholder groups, and
- Should COLA reflect the values of just lake residents or also include the broader community?

Even if these sentiments are held by only a minority of residents, addressing these issues will help COLA meet its goals. As Ostrom's research and other CPR case studies have concluded, mutual trust and effective communication are keys to the voluntary management of natural resources. To address these issues, we present strategies that can help to build trust in COLA and a positive public image through additional media relations, public outreach, an expanded online presence, and focused messaging. Generally, a public relations campaign that personalizes COLA, engages with additional stakeholders, and keys in on universal values may provide a solution to this issue.

Media strategies

As the Jossey-Bass Guide to Strategic Communications for Non-Profits states, "media relations should be managed as carefully as finances," as it can lead to substantial payoff with public opinion and policy changes (Bonk et al. 1999). While a full communications planning session

with a written report is recommended, a few guidelines from this source can help direct this process. The first basic principle of communications, as they state, is that people are more likely to attach weight to messages from people they trust, so family, followed by friends, are the most effective messengers. Thus, organizations can either build stronger direct relationships or work indirectly by building relationships with people and groups that are trusted. This principle also demonstrates that media stories are not a catch-all solution. However, the authors do state that it is "impossible to overstate the importance of cultivating relationships with reporters," as this often leads to more desirable media coverage.

In creating a plan, clarifying goals is the first necessary step. The Sierra Club's strategy presents a useful example. It states:

> "*Our goals are to educate and persuade people who are not normally activists to act. To succeed we must work from an understanding of the public's values and concerns, and develop and use messages and stories that speak to them."*

Next, methods for measuring success should be determined, which may include the amount of media stories, increases in new members, or progress in fundraising. A key element of the plan involves understanding the audience. The surveys in this report help to outline the audience, but further research, through additional surveys or focus groups, can help define the general public, beyond COLA and lake association members. Deciding who is trying to be reached and which messages will appeal to them are the critical components.

Regarding negative media, a proactive approach is recommended, by engaging directly with reporters and editorial writers. In these cases, it is useful to present one's side of the story rather than not commenting on the issue (Bonk et al. 1999).

Outreach and events

Building trust by expanding relationships with stakeholders, including residents and organizations, can also be accomplished through social events. Community events create an atmosphere for people to build dialogue and relationships. According to our COLA survey, of the types of events held annually, 22% of respondents participated in community events, and 10% reported participation in community projects, so expanded events may represent an opportunity. In interviews with lake residents, participants cited social events as the most common way they were involved with their lake associations. Fourth of July parades, Christmas

parties, and welcome-back events for seasonal residents were some specific activities mentioned. Several interviewees suggested that more of these events could build a stronger sense of community, as well as encourage participation in lake associations. The events do not necessarily have to relate to COLA or lake association initiatives, but fun activities that bring the community together allow a chance for COLA members to interact with residents and groups to improve relationships. As research from Bussel and Forbes (2003) illustrates, the best place to have positive interactions with the public is where individuals participate in leisure activities. Events such as an electric light boat parade, holiday decoration contests, floating classrooms, and a summer gala and auction could bring people together in a community-building manner. This increase in interaction is a viable strategy that could also potentially increase the amount of volunteers within lake associations.

Partnering with popular non-lake associations and community groups in joint events will increase residents' familiarity with their lake associations and COLA and leverage the popularity of existing community groups, which enhances the positive perception of lake associations and COLA. Work by Everett Rogers (2010) in diffusion theory, as well as by Malcolm Gladwell (2006) in the Tipping Point, has demonstrated that targeting respected individuals and groups, sometimes known as "opinion leaders" or "flagship" groups, will lead to effective change, especially for those who are less likely to be influenced by COLA's message directly. These partnerships can also be media events that highlight the collaboration.

Online presence

Research shows that an expanded online presence can aid in improving public image (Province 2012). A Facebook page and continually enhancing the COLA website are great avenues toward building a better public image, as they create expanded opportunities to reach out to current and prospective members and create potential partnerships.

Facebook page

As Argenti (2011: 61) wrote, "embracing social media is no longer a strategic business option, but a necessity, and a huge opportunity." Certainly, COLA and lake associations are not traditional businesses, and their effectiveness depends on how often residents use the Internet, Facebook, and other social media. Only a few respondents in the lake resident survey preferred

Facebook as a means of communication. Nevertheless, it represents an important opportunity. While it may seem that older residents may not utilize Facebook, a 2012 Pew survey revealed that 56% of Internet users age 50–64, and 40% of Internet users over 65, use Facebook (McGee 2012). Numbers increase with younger age, so as time passes, more residents will likely be using Facebook, and it shows no sign of diminishing. The appendix material regarding Facebook utilization describes some of the key factors, but the recommendations below reflect methods for addressing public image with this tool:

- Post pictures of events hosted by the COLA
  - This personalizes the group, allowing people to relate to the members
- Use Facebook to answer lake owner questions and concerns
  - This helps make COLA more accessible for stakeholders
- Interact with local organizations and promote them by "sharing" their events and "like" their pictures
  - This may help improve relationships with stakeholders, such as fishing, riding (watercraft), or other groups

COLA website

Some of these recommendations can be applied to the COLA website as well. As the AMA Handbook of Public Relations writes, "Digital sites are all about putting a human face on leadership, companies, causes" and more (Dilenschneider 2010. Thus, modifying the website may include adding bios and/or stories from COLA representatives. It also may include providing a convenient contact system for residents to provide feedback, and providing up-to-date news and information regarding the actions initiated by the group. The website can be one space to explain some of the more controversial actions, such as the recent lawsuit, since it allows your side of the story to be described in detail. Additionally, creating a Wikipedia page may present an opportunity to frame the organization in an effective manner, so that people searching for COLA online would have access to a quick description and background of the organization that clearly explains the mission.

Messaging and advertisements

Changes in communication strategy could help to improve COLA's overall image and public perceptions.

1. Highlight a desire to work together. As the recent Park Rapids Enterprise article noted, there is an impression that COLA is not working closely enough with the community. A public relations campaign should start with an effort that demonstrates a commitment to working together with residents and organizations to find common solutions and openness to hearing their ideas. Messaging such as "We want to hear from you!" and "Let's work together for our lakes," may help change the impression that COLA is isolated.

2. Emphasize property values and common values. As mentioned by COLA members, communicating the connection between water quality and property values can help change the image for some people that COLA is a radical environmental organization. A tagline such as "Working to protect lake property values since 1988," may assist in this effort. Branding the organization in the resemblance of a homeowner's association could reduce controversy and add to public support for those who do not share the concerns and knowledge related to environmental issues. As the Jossey-Bass Guide notes, messaging is successful when it represents common values (Bonk et al. 1999). Studies have shown that the most commonly held values are responsibility for one's family, caring for oneself, personal liberty, fairness, and equality. Protecting the lakes falls under these categories, as it involves issues such as SHEE (public safety, health, education, and economics) and providing a resource for our children's future.

3. Personalize COLA. Sharing the personal stories of COLA members may go a long way toward improving public image. The COLA leaders have interesting stories about how they came to be involved with lake associations. Residents may relate to these stories and find that there are strong reasons to be involved. Telling these stories in advertisements, media communications, and at events may improve interactions with residents and other organizations.

4. Communicate a non-politicized sentiment. On both sides of the political spectrum, there is support for a grassroots element of managing natural resources, and as Elinor Ostrom's research demonstrates, it can be effective as well. Messages that highlight COLA's non-governmental role and the encouragement of people to help manage the lakes themselves will appeal to many people who may view COLA as too authoritative.

WATER QUALITY ENGAGEMENT

In the human-modified environment of Minnesota lakes, sustainability without human engagement is nearly impossible. Data from the MN Pollution Control Agency and Department of Natural Resources (DNR) on lake conditions reveal that eutrophication and pollution are a common problem for Minnesota lakes, and the problem of AIS applies to 12 of the 35 COLA lakes studied. A quick summary of lake condition dynamics is presented in Figure 6, and detailed information on lake condition is presented in Appendix 6. While a majority of lakes are maintaining water transparency (25), more lakes are trending toward greater transparency (10) than are declining (5).

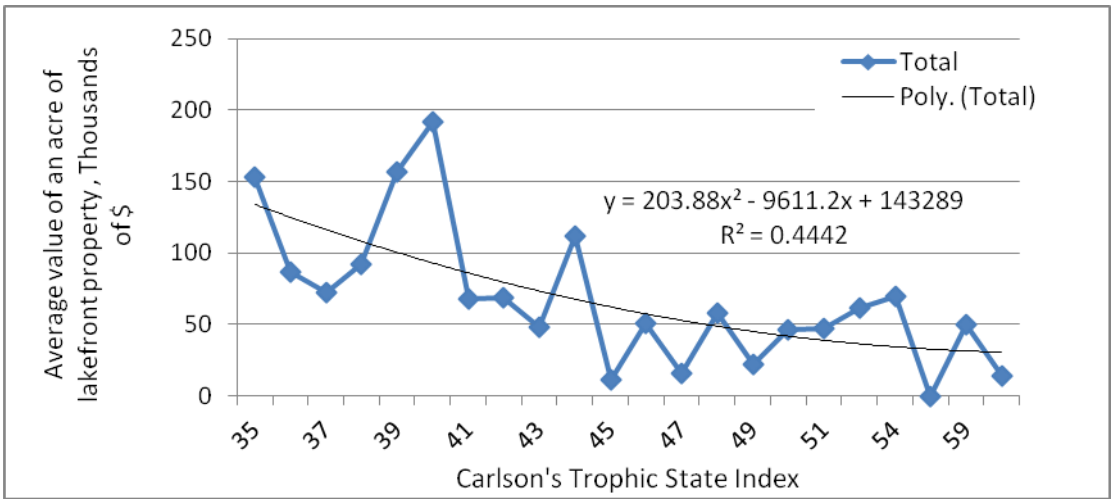


Figure 5. Lakefront property value (per acre) plotted against lake trophic state index.

Potentially, water quality-sensitive activities such as motor boating, fishing, and swimming engaged in by lake residents (Appendix 7) reinforce the need for lake management. Activities that some users prefer may be in conflict with other users' preferences.

INSERT PAGE 26A

Addition submitted by Ken Grob, Hubbard County COLA (10/27/13)

Readers of the Capstone Report Section on Water Quality Engagement have expressed some confusion over the statement on page 26, "AIS applies to 12 of the 35 COLA lakes studied," and the referenced summary Table 4 on page 32. The confusion originates from the fact that the Hubbard COLA AIS Committee states that Hubbard County does not have any "major" AIS species, while the report indicates that 12 lakes are infested with AIS (also see Appendix 6 Map for distribution and Appendices 9, 11, and 12 for more info).

The "major" Aquatic Invasive Species (AIS) that threaten Minnesota today are Zebra Mussels, Eurasian Watermilfoil, and Asian Carp (four species). They are considered major because they have the most potential to have significant economic, recreational, fishing, and ecological impact to a lake or watershed. Hubbard County does not have a waterbody infested with these major species. However, Hubbard County does have some varieties of AIS. Namely, there are Faucet Snails, Curly-Leaf Pondweed, and Purple Loosestrife in some of the lakes. Hubbard County has three lakes with Faucet Snails (Upper Twin & 1st/2nd Crow Wing and River), and three lakes with Curly-Leaf Pondweed (Portage, 11th Crow Wing, and Upper Twin). However, Purple Loosestrife infests about 20 lakes in Hubbard County and it is listed as a Prohibited Species in Minnesota Statutes 84D and in Rules 6216 Language (AIS regulations). Herein lies the confusion. Purple Loosestrife is a hardy perennial that degrades wetlands and very shallow sections of a lake. The infested lakes in Hubbard County have small sections of loosestrife and therefore are listed in the state AIS list of lakes. The Capstone Team searched several sources of information for their analysis, but could not discern between the "major" AIS and all other AIS species. Thus they reported the findings in the report. A key message here is that waterbody users must be concerned about all species of AIS, not focus on just the "major" species. Residents of the lakes coded in Appendix 6 should be aware of the loosestrife infestation and monitor it.

With the above information, the statement on page 26 might better be written as "AIS applies to 5 of the 35 COLA lakes studied. None of these lakes have "major" AIS infestations." (It should be noted that 11th CW and Upper Twin were not identified as having an AIS on Appendix 6 Map, which adds to the confusion, and the Stony Lake identified on the Map is not the one that is a COLA member.)

In addition, **Table 4 on page 32** might best be displayed as:

Variables/LMP existence	Number of Lakes	Sum of lakes w/AIS	Avg increase in transparency, ft	Avg TSI	Avg 10-yr transparency, m
Lakes with LMP	22	3*	0.23	46.64	3.23
Lakes w/o LMP	15	2**	0.07	44.57	3.50

* Portage, 1st CW, 2nd CW ** 11th CW and Upper Twin

The significant participation in boating and personal watercraft usage reinforces the importance of AIS management, since watercrafts often serve as a transport for aquatic invasive species (Johnson et al. 2001). The relevance of Principles 4A and 4B (monitoring users and the resource) is also implied here. Community members who enjoy similar activities on the lake can serve as friendly monitors to each other, giving helpful reminders to clean out their boats and watch for AIS. In addition to self-monitoring for AIS and other breaches of lake-use rules, monitoring serves as a type of social sanction, in that users abide by the community's established social norms in cleaning their boats. This in turn makes it easier for the DNR to enforce formal sanctions, as the community is continuing to act on these social norms when participating in activities on the water.

Based on this information, our statistical analysis revealed some key relationships. Figure 5 presents an analysis of a property values data set that illustrates that better lake conditions appear to be correlated with higher property values, using a 10–year average of Carlson's Trophic State Index (TSI) for the water quality variable (Carlson and Simpson 1996). These findings may also provide a direction for further analysis. This may include the use of an increased sample size, application of the model to preclassified lakes, using other metrics for property value and water quality, and controlling for other factors influencing property values. While TSI is generally a convenient and accurate metric describing lake eutrophication, it is important to note that certain projected uses of the lake, such as fishing, require higher eutrophication levels than otherwise expected (see Appendix 6).

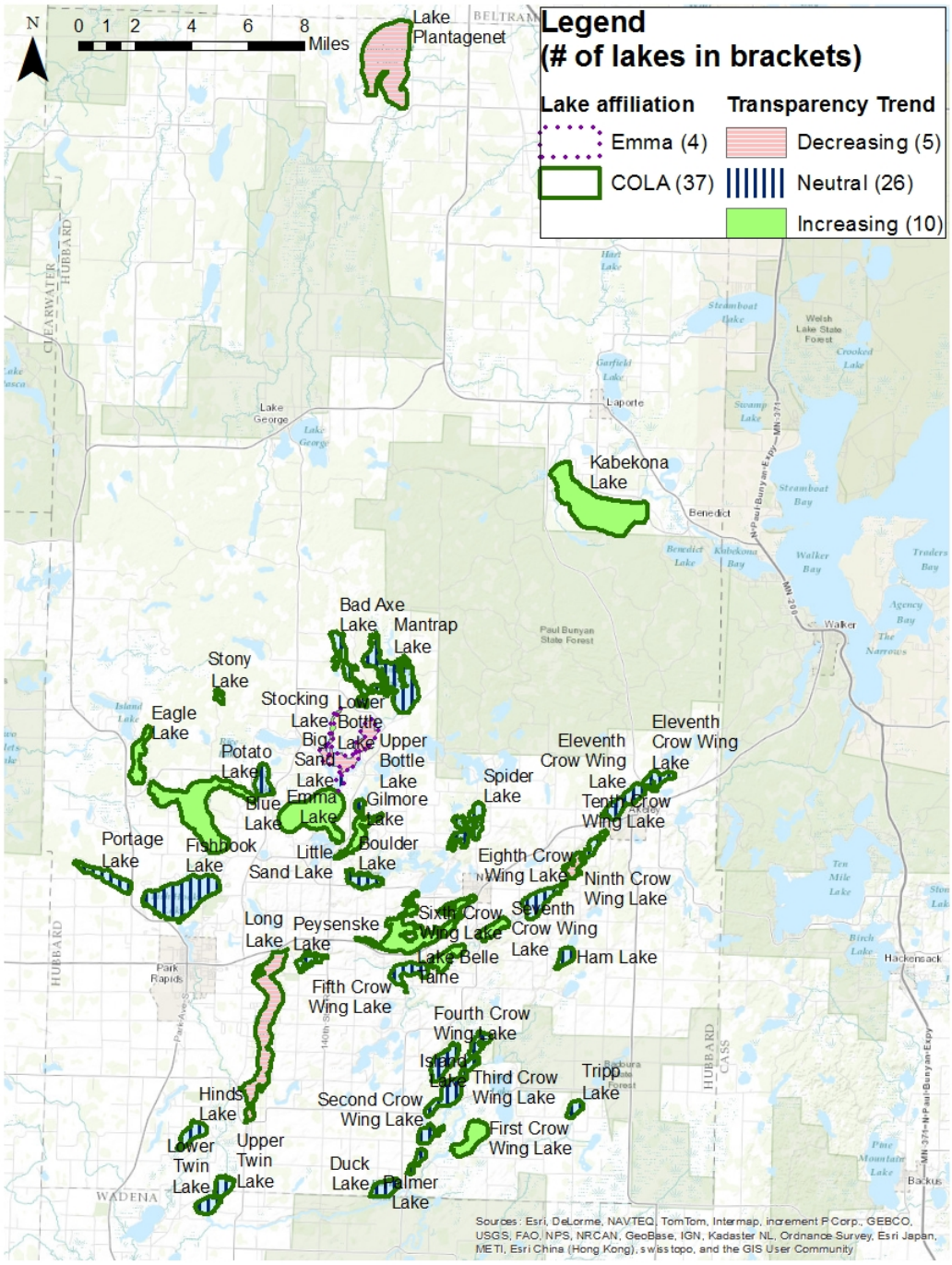


Figure 6. Lake condition summary map.

The importance of water quality engagement is well-understood by COLA board members (Appendix 8) and is confirmed by the data from the MN Pollution Control Agency: lakes that have lake associations are more likely to show an increase in water transparency (Table 2), though the emergence of LAs is also associated with other lake issues and increased human activity.

Table 2. COLA affiliation and water quality indicators

COLA affiliation	Average TSI	10–year transparency average (meters)	Average change in the 10–year trend in transparency (ft)
Non-COLA lakes (4)	43.5	3.75	-0.23 feet
COLA lakes (37)	45.8	3.33	0.43 feet

From the analyzed population of 41 lakes in Hubbard and Wadena counties, all lakes with the best TSI values (TSI<40) are managed by COLA members, and only 3 of the COLA lakes (of 37 total COLA lakes) show a decreasing 10–year trend of water quality. This information may suggest further in-depth analysis of connections between lake management and lake condition.

Water quality-related issues are among the top concerns for COLA members and lake property owners (Table 3 and Appendix 9). While AIS present the main issue for all respondent groups, lake residents seem to be more concerned with lake pollution and fisheries management issues than COLA members.

Most lake resident survey respondents are engaged in water quality enhancement practices (Appendix 10), but the average involvement may show need for improvement (both per lake and per practice). Though this number cannot be extrapolated on the whole population of lake users, it may suggest an opportunity for increasing public engagement into “easy” practices. According to the lake resident survey results, the primary reason for not being engaged is “not knowing what to do.”

Table 3. Ranking of concerns by COLA and lake residents (LR)

Lake concern	COLA rank	LR rank
Aquatic invasive species	1	1
Shoreline owners understanding issues	2	3
Shoreline development	3	4
Effectiveness of the lake association	4	8
Lack of volunteers	5	15
Participation/membership among lake residents	6	14
Pollution from shoreline residences (i.e., failing septic systems, lawns, etc.)	7	2
Development in the lake watershed	8	7
Collaboration and knowledge sharing	9	10
Fisheries management	10	5
Funding for lake association	11	12
Native plant restoration	12	11
Boating practices/etiquette	13	9
Recreation user conflicts (i.e., fishermen, sailors vs. motor boaters, etc.)	14	16
Lake pollution from agricultural runoff	15	6
Lake pollution from forestry operations	16	13

Figure 7 illustrates the relationship between the amount of participation with lake associations and the amount of activities people are engaged in relating to improving water quality. The numbers come from a checkbox question in the lake resident survey, where residents can select various activities. It implies that residents who are already engaged in these practices may be more likely to be involved with their lake association. On the other hand, this could also mean that being involved with lake associations could lead to increased water quality practices. It also shows that longer-term residents are engaged in slightly more water quality practices than shorter-term residents, for the same level of involvement with LAs.

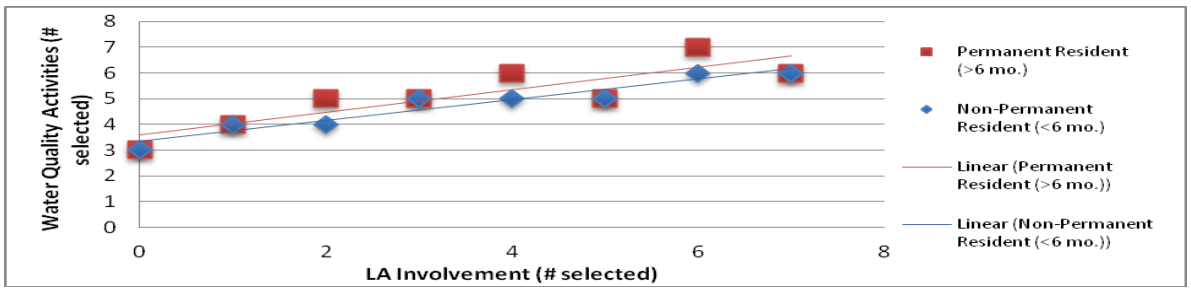


Figure 7. Water quality engagement depending on residence time.

Figure 8 demonstrates that longer-term residents are engaged in slightly more water quality practices than short-term residents. On three lakes, permanent residents on average engage in one more type of practice, on two lakes they are the same, and on one lake, short-term residents engage in one more type of practice.

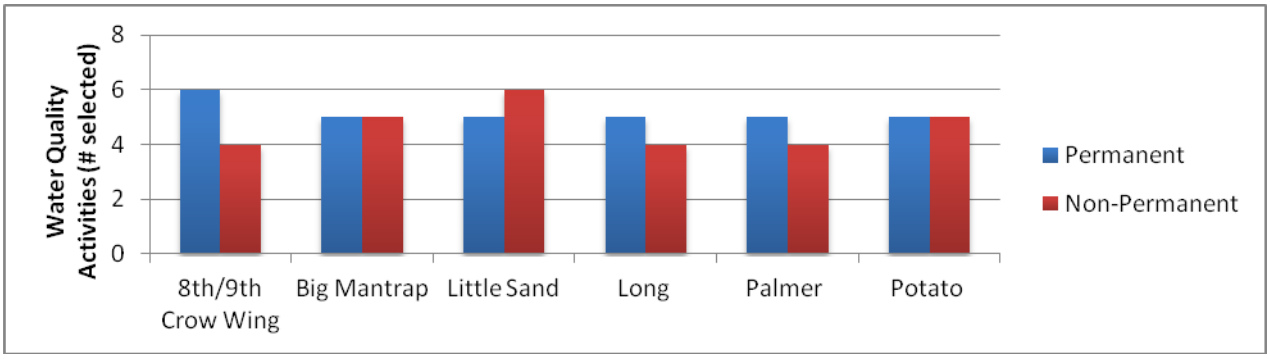


Figure 8. Water quality engagement depending on residence time.

Data from the lake resident survey outlines the involvement of lake residents in AIS prevention practices. Appendix 11 shows the percentage of respondents who identified themselves as being involved with each practice always or most of the time. In comparing lake resident participant involvement in AIS reduction practices with water quality enhance practices as a whole, we find noteworthy differences of between -4 to 34% between these two activities, with AIS more important on six of seven lakes (Appendix 12).

In the COLA survey, we asked about the usage of LMPs by COLA members. These plans were initially created as visionary documents, and are supposed to serve as guidance in lake management practices. However, only about 59% of COLA respondents claimed that they use LMP, which were primarily used for project selection, decision-making, and goal setting. This may suggest further promotion of LMPs among COLA boards and members. Comparison of COLA lakes with and without LMPs may suggest that LMPs may influence water quality and AIS management (Table 4).

Table 4. Comparison of COLA lakes with and without lake management plans

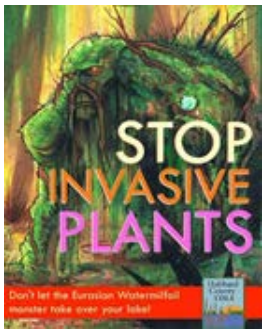
Variable/ LMP existence	Number of lakes	Sum of lakes w/AIS	Avg increase in transparency, ft	Avg TSI	Avg 10–yr transparency, m
Lakes with LMP	22	9	0.23	46.64	3.23
Lakes w/o LMP	15	3	0.07	44.57	3.50

Recommendations

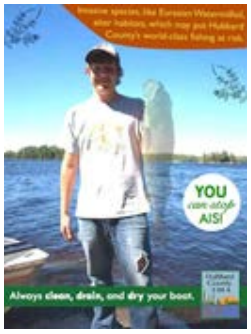
Increase awareness about water quality practices

Expanding awareness of water quality issues is certainly a primary goal for LAs and COLA. At the same time, the lake resident survey data suggest that most of the residents are well-informed and concerned with these issues and involved in AIS reduction practices. Given the survey information and the results of our research, we may conclude that COLA has been able to succeed in its public education on AIS. Awareness campaigns through signage are an important first step in achieving engagement, and COLA's current "Stop Aquatic Hitchhikers" ad campaign, and the numerous billboards and signs installed are the key in bringing attention to this problem. Additional signs near lakes, in businesses, and along roads could capture attention through creative messaging, eye-catching design, and mascots. Effective messaging should be vivid, concrete, and personalized in order to stick with individuals (McKenzie-Mohr 2010). Many opportunities exist for surprising and compelling ads that may educate those who lack information, lead some to pursue additional information, or prompt good practices. Examples of these campaigns are provided in Figure 9.

1. **"Swamp Thing" mascot.** Mascots help create a lasting association with an idea, and they may spur word-of-mouth discussion, leading to greater recognition of the product or issue. The GEICO gecko, for example, reportedly led to an increase in sales of about 17%, and the AFLAC duck led to the highest name recognition in the industry (Kalb 2012). To help bring attention to AIS, anthropomorphizing them as a Swamp Thing-type character may be both a vivid representation of the swamp-like consequences of species like Eurasian Watermilfoil and create an appropriately somewhat-frightful yet also amusing image. Local residents, including students or children of part-time residents, could possibly be involved in creating a mascot through a contest. The idea could also be applied to in-person costumes, where a person dressed in a costume made to look like an invasive species could appear at events to draw attention to this problem.



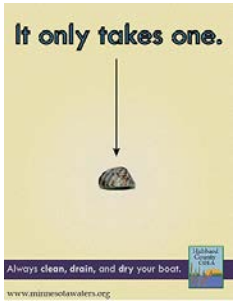
2. **Disappearing fish photos**. One way to make invasive species vivid, concrete, and personalized is to illustrate the potential devastating effects that they may have on the county's treasured fish populations. This idea is a send-up on the ubiquitous catch photo, with two variations. The first involves showing a fish disappearing from a photo, with a message detailing how AIS can alter habitats. Another possibility would involve a fishing photo that has no fish at all. This could easily be done by taking a picture of someone in a boat as if they were holding a fish, accompanied by a message. As shown in the image to the right, ads that have warnings should be complemented with an empowering message, or people may become complacent (McKenzie-Mohr, 2010). The tagline—"YOU can stop AIS!" —could help counteract the warning.



3. **AIS takeover ads**. A potentially more captivating, yet more ambitious idea to complete in terms of the design process, would involve creating either a computer-generated or physically installed image in which species such as Eurasian Watermilfoil or Zebra Mussels have taken over everything in the room of the house. This creates a vivid and personalized image of how AIS drastically changes the lake, and thus, the homes of many species. An alternate and more provocative ad could have a person completely covered in one or more of these species while engaged in an everyday activity, such as sitting down at dinner or watching television. These ads could include a message such as "AIS interrupts daily life."

4. **AIS quiz**. Another way to get people engaged with understanding AIS may be to present ads, either in print or on a Facebook page, as a quiz to ask residents to identify which species is invasive, among other native plants. The winner could receive a prize from a local business, for example.

5. **Additional AIS ads**. Captivating, yet simple ads such as these to the right, could present another opportunity to disseminate information in an eye-catching way. Phrases such as "It only takes one," and "Help stop the spread of zebra mussels before it starts" emphasize the immediate nature of the problem.



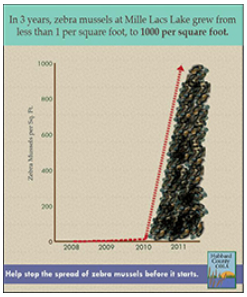


Figure 9. Examples of advertising campaign ideas for AIS engagement.

Provide clear and constant communication

The amount of participation in water quality education and activities can increase with well-constructed communication by utilizing COLA email newsletters, the website, and a Facebook page. Summary of the preferred information channels for residents suggests email correspondence as the most preferred channel (Appendix 13). Though it may not be representative, as we only contacted people with email addresses, concordance between answers allows us to suggest a web-centered strategy of use for different digital media (Table 5).

Table 5. Proposed strategy of water quality-related content update for different digital media

Media/content	COLA website	Facebook page	Email newsletter
Announcements about upcoming water quality education and volunteering engagements	Publish, at least a month in advance	Publish and create events, invite people	Briefly announce (what/where/when), reference website/Facebook for additional information
Educational articles on water quality issues for owners	Publish, at least once in three months	Share	Reference (hyperlink)
How-to videos on how to keep the lake clean	Publish originals /Reference (hyperlink) side content	Share	Reference (hyperlink)
Water quality activity flyers	Publish	Share	Attach

We also recommend using a lag between the website, Facebook, and newsletters: information may appear on the website and newsletter simultaneously, while Facebook may be updated 2–3 days later so that people are reminded about actions regularly and at the same time are not irritated by excessive repetition.

Target lake residents and motivated youth

The lake resident survey indicates that six-month to full-year residents are more likely to be involved in water quality activities than shorter-term seasonal residents. Expanding involvement to all lake residents and lake users in helping to restore, maintain, and improve water quality by stopping the spread of aquatic invasive species and reducing property runoff would help to achieve the highest-cited goal in the COLA survey. This may also result in more lake resident engagement in lake associations. In addition, current literature indicates that individuals become more aware of water quality issues and are more likely to partake in the rectification of water

quality problems, when they are actively participating in water-related activities (Pendall and Schmidt 2011).

Also, youth may be interested in water quality-related volunteering by gaining experience for resumes and college applications. For example, a COLA "committee" might become involved in developing volunteer school projects to study and make recommendations to solve very local water quality issues. Local science teachers might be a great starting point for this type of initiative. Obviously, younger students might be more interested to begin with entertaining projects such as poster contests, water recreational activities, etc., to get them interested.

Revise lake management plans

Lake management plans may serve as a useful tool for lake management and the lake community. Publication of plans for LA members on the website, Facebook, or through e-mail may help to share information about lake conditions, promote a vision of the lake's future and increase involvement with lake issues. Lake management plans also may help to run meetings in a more consistent and effective way. So, updating existing LMPs so that they are both current and more visible is an obvious recommendation to each LA. Distributing them via communication channels can help inform and engage the public.

Utilize behavior-change techniques

Presenting information through advertisements, while important in overcoming some barriers regarding a lack of knowledge or unsupportive attitudes, often does not lead to behavior change. Numerous studies have confirmed this problem. For example, comprehensive energy conservation workshops increased awareness of the problem and the solutions, but only 1 of 40 participants followed up with action (Geller 1981). This study and others, cited by Douglas McKenzie-Mohr, an expert in behavior psychology related to sustainable practices, led him to recommend a number of tools using community-based social marketing that can be applied to COLA. Additionally, the recent book, *Nudge,* by Richard Thaler and Cass Sunstein (2008), outlines similar tools to help guide people toward making good decisions that are in their self-interest.

1. Commitments. By committing to an action, we change our self-perception so that we behave in a way consistent with the pledge. Studies have found that small commitments can also lead to larger commitments with surprising results. In one experiment, 76% of those who agreed to install a window decal about car safety later agreed to have a massive billboard about car safety installed in their yard, while very few obliged without the agreement to install the decal (Freedman and Fraser 1966). Second, after asking if a stranger would watch their things at a beach, 19 of 20 people then chased a "thief" who tried to steal the items, while only 4 of 20 chased the "thief" when people were not asked (Moriarty 1975). Third, public commitments can be effective, as those who publicly committed to reducing energy use did ultimately reduce their usage by 20% (Pallak et al. 1980). COLA could utilize this strategy by having lake residents commit to engaging in good practices involving AIS, such as the Clean, Drain, and Dry campaign. Residents could sign written pledges that could then be displayed publicly at a local business in exchange for a discount at the business, for example. COLA could also partner with local organizations that would collect signatures on their own. Respected organizations such as church groups, Boy Scouts, or boating and fishing groups could be involved in the effort. Additionally, these commitments could be displayed in the form of a bumper sticker on one's boat. This type of strategy also leads to creating new social norms.

2. Changing social norms. In a famous study by Solomon Asch (1951), participants were asked to pick the longest of three lines on a screen—a seemingly straightforward task. However, before they answered, researchers said that most people picked one of the shortest lines. Afterward, 75% of participants chose an obviously incorrect answer, which is indicative of a group think mentality- exemplifying how others may pattern behavior off of a few In another study related to reducing water use during showering at athletic facilities, those who turned off the shower while washing increased from 4% to 67% after seeing that those around them did (Aronson and O'Leary 1982–83). Both of these studies highlight the strength and power those around us have on our behavior, even those we do not know, as we have an innate need to conform, even against our own judgment. Consequently, changing social norms related to water quality engagement can be an effective tool even for those not predisposed to agreeing with the effort.

One way to pursue this strategy involves highlighting local residents who are modeling good behavior, especially those who are well respected in the community. These can be stand-

alone ads, or they could be part of a COLA-produced booklet. The idea can also be translated to radio spots, in which residents talk about their own practices, or at in-person events.

This strategy should also involve highlighting survey results. For example, messages and ads could point to the fact that 90% of surveyed residents from 8th and 9th Crow Wing said they always check their boats for AIS after use. Similar campaigns have been effective for tax compliance. Messages that said that 90% of people comply with tax laws was the only effective strategy for increasing compliance, while messages that contained information on why it is beneficial, or detailing threats for non-compliance, did not work (Thaler and Sunstein 2008).

3. Channeling. Additional research has found techniques for solving the problem of information not leading to behavior change. In a study, participants attended a lecture on the importance of having a tetanus shot, but only 3% of the attendants followed through and had one. However, when participants were given a map to the health center, asked them to take a minute to look at their schedule, make a plan, and create a route to the health center, 28% of participants followed through (Thaler and Sunstein 2008). Information should thus be channeled into action by giving people the materials and routes to desired behavior.

For water quality practices, this could mean anything from channeling information about native planting and shoreline buffers in yards by handing out seeds with clear guidance on when and where they should be planted. For AIS, providing free materials such as branded towels for drying boats and equipment, as just one example, may channel information into behavior. Also, in interactions with residents, asking people to mentally channel the information by walking through the specific desired behaviors, similarly to the planning and route-making in the tetanus example, may lead to positive results.

MEMBERSHIP AND RECRUITMENT

Membership is one of the most crucial issues for lake association management. The results from the COLA and lake resident surveys provide a clear picture of the perception of membership in their organizations.

According to the COLA survey, membership dues are the number one funding source relied on by lake associations, which means the operation of the lake association heavily relies on its membership. Without sufficient membership, it would be very difficult for lake associations to sustain activities such as AIS prevention, the protection of shoreline, and fisheries

management. This is why the highest number of responses (about 46%) from the COLA survey defined lake association sustainability as "sustaining membership." When asked about concerns facing lake associations, respondents in this survey ranked membership among lake residents as the sixth most important issue, following AIS and shoreline protection (Appendix 9). In terms of the major organizational problems facing lake associations, more than 50% of responses regard membership as the top issue. Specifically, 31% of the responses think low membership is the most significant concern, while 21% think poor membership participation is the largest problem. Apathetic residents and lack of participation in lake associations were mentioned repeatedly in lake resident interviews. One interviewee specifically mentioned that the "same people do all the work" in her lake association. In sum, low membership and poor membership participation are concerns for the sustainability of lake associations and COLA.

However, according to the responses in the COLA survey, there may be opportunities to facilitate membership and participation. Only 14% of the COLA respondents indicated that member support and education are their major goals. The methods that lake associations employ to recruit lake residents as their members are mainly traditional and may not provide sufficient support to help them expand membership. Forty-nine percent of the responses say they use direct mailing as their approach to recruit new members, and 62% say they use direct personal recruitment, but only 20% say they use the Internet to recruit members. It is important to use new media to recruit lake residents as their members, since not all lake residents are permanent ones and many of them are seasonal. Therefore, it is not possible for lake associations to reach them by direct personal recruitment, and direct mailing also may be inefficient due to the seasonality of lake residents.

According to the lake resident survey, we found that lake residents and COLA members have significantly different opinions on membership. Lake residents on all lakes did not think membership is an important issue facing COLA. The divergence regarding this issue could reflect a lack of communication between COLA and lake residents, which may contribute to low participation and membership.

Recommendations

1. **Broaden and specify communications strategies.** Increased communication channels should be established so that lake residents have a greater understanding of

the activities and goals of the lake associations. Lake associations' goals, such as increased membership, may be broken down into specific initiatives, including greater communication with lake residents in order to understand their views about the lake association and their activities.

2. **Expand recruitment mechanisms.** As web-based tools continue to emerge, new media and new communication methods should be employed in recruitment.
3. **Broaden funding resources**. Most lake associations rely heavily on membership dues, which impede their functions when membership is low, leading to feedback cycles of both reduced activity and membership. A broadened funding resource can help alleviate the burden brought by low membership; however, maintaining the financial support of members can be critical in maintaining the other types of support, such as volunteering, which is necessary to maintain a viable lake association. So, maintaining a low dues structure, with options for contributing beyond the basic membership dues level, could be an effective strategy to retain members who can then possibly contribute in other ways such as volunteering.

SUSTAINABLE LEADERSHIP

Lake Resident and COLA survey results both demonstrated that lake association and COLA management are important concerns and that there are obstacles facing each. Building leadership, leadership skills, and a formulated succession plan are important ways to improve lake association and COLA management. Increasing lake association membership and membership participation is important for future lake association and COLA leadership because it builds engagement and increases the pool of potential leaders. Studies have demonstrated that having a shared purpose or vision allows followers to become more involved in reaching shared goals. Therefore, lake association leaders and followers must see one another as allies and collaborators with a mutual purpose so that all parties have a stake in achieving the mission (Ricketts 2005). This means that leaders must be accessible and that there are forums for leaders and members to have a dialogue and work together toward organizational objectives. One strategy for accomplishing this goal is to hold meetings more frequently where lake residents can voice their comments and concerns, and have a dialogue about the issues. Another strategy may be to have a listserv, which is an e-mail service that broadcasts messages to everyone on an e-mail list, to allow for easy and frequent contact with lake residents, informing them of new issues, upcoming meetings and events, and other important information.

Research shows that building partnerships with other community groups is a useful way to use shared interests to build membership and increase current member participation by leveraging people's other interests. Social events are also effective to attract new members and provide opportunities for current ones to get more involved (Ricketts 2005). Essentially, getting people interested and involved will ultimately foster leadership.

Leadership can also be further developed through leadership training. Leadership training should include the development of effective communication strategies, methods for building positive interpersonal relationships within the community (as well as outside of the community), and working within cooperative situations. These strategies will build strong future leadership and secure succession (Ricketts 2005).

One idea, to start grooming effective leaders, emerged from interviews. It suggested reforming the structure of larger lake associations to allow for "neighborhood captains" to manage neighborhoods of 10–20 residences. It is hoped that neighborhood captains would have

close day-to-day interactions with the residents they represent, and that the association members tapped for these positions would go on to serve in further leadership roles in their respective lake associations and COLA.

As the lake resident survey results demonstrated, the majority of people involved in lake associations and COLA are above the age of 65. Alternatively, individuals younger than 65 are less involved due to family commitments, infrequent presence, monetary concerns, full-time work schedules, etc. The same age divide in participation was noted by lake residents during interviews. While this younger age group is not likely to be current leadership candidates, they can still be engaged in smaller ways so that when they have retired and/or their kids have grown, they will be suitable for leadership roles. For now, lake associations and COLA should be looking toward the 50+ age groups to groom as their future leaders. Additionally, this finding correlates with Principle 3: people who spend the most time on the lake, such as older generations and full-time residents, are more likely to be affected by the rules of the lake (laws, ordinances, lake association/COLA guidelines, informal community-acceptable practices) and, thus, have the most stake in ensuring an effective lake association/COLA and being in a position to change the rules if necessary.

VOLUNTEERING

Increasing volunteerism is a key component to the success of lake associations, including increasing membership recruitment. Identifying the motives and characteristics that make someone more likely to volunteer for a specific type of activity can help determine the best methods of increasing resident involvement within a lake association.

It is important when recruiting volunteers to realize that not all individuals will have the same motivation to participate, such as the sustainability of water quality. Research has indicated that individuals who volunteer their time do so for a variety of reasons, with both altruistic and non-altruistic intentions, and that there is no single volunteer type (Green 1984). Volunteers may choose to dedicate their free time for reasons such as feeling a sense of duty, fulfilling a desire to feel useful, for career enhancement purposes, or to gain social rewards (Moskell 2010). The lake residents who were interviewed believed that volunteering would increase if the lake associations addressed specific problems that were brought to attention at meetings. This finding reflects the concept contained in Principle 2B. The benefits enjoyed by lake users may be shown to increase if proper attention is paid to addressing current problems. It may be possible that, as input is utilized to address problems within lake associations, volunteering may rise in proportion to the input.

The role of demographic characteristics is another important factor to consider in deciding which individuals to target. Results from our lake resident survey link involvement to two demographic categories: gender and seasonality of residence (Table 6).

Research demonstrates that women are more likely to volunteer for social reasons, whereas men are most likely to volunteer because they desire completing a specific task (Karl et al. 2008). Age is an additional factor to consider when targeting individuals for volunteer recruitment. Studies have shown that individuals over 50 years old are more likely to volunteer than younger individuals (Bissell and Forbes 2003). This was supported by the lake resident interviews, as a number of people rationalized that there were simply fewer young people available to participate since young individuals are less likely to own lake property for financial reasons. Interviewed individuals also explained that younger individuals prioritize spending time with family during their vacation time on the lake and are not interested in volunteering (Table 7). This may explain why the lake associations have a difficult time recruiting younger

individuals to volunteer. In addition to demographics, personal background can play a role in whether someone chooses to volunteer. For example, individuals are more likely to volunteer if a family member or friend is part of the organization (Bissell and Forbes 2003).

Table 6. Demographic characteristics of LA involvement from lake resident survey

Involvement by gender	**% Male**	**% Female**	**Involvement by length of time on lake**	**Long-term (over 5 months)**	**Short-term (under 5 months)**
Leadership position	65%	35%	Assist with lake association projects	74%	26%
Attend meetings	60%	40%	Leadership position	70%	30%
Donated to lake association fundraisers	60%	40%	Volunteer	68%	32%
Attend lake association events	58%	42%	Attend lake association events	63%	37%
Learn from lake association guidelines	58%	42%	Attend meetings	57%	43%
Volunteer	56%	44%	Donated to lake association fundraisers	52%	48%
Assist with lake association projects	55%	45%	Learn from lake association guidelines	42%	58%
None of the above	55%	45%	None of the above	26%	74%

Table 7. The Volunteer Functions Inventory (VFI) and conceptual definitions of the possible psychological functions served for individual volunteers

Function	Conceptual definition
Values	The individual volunteers in order to express or act upon important values that are important to them, like humanitarianism
Understanding	The volunteer is seeking to learn more about the world or exercise skills that are often unused
Enhancement	The volunteer can grow and develop psychologically through volunteer activities
Career	The volunteer has the goal of gaining career-related experience through volunteering
Social	Volunteering allows an individual to strengthen his or her social relationships
Protective	The individual uses volunteering to reduce negative feelings, such as guilt, or to address personal problems

Source: Adapted from Clary and Snyder (1999: 157).

People who choose to volunteer are very diverse in their interests, characteristics, and motives. Understanding what motivates individuals to volunteer, and the goals they want to accomplish, helps target the best type of individuals for a specific task, increasing the likelihood of volunteer recruitment.

Recommendations

There are a variety of methods to improve volunteer participation within the COLA and other lake associations of Hubbard County. When initially selecting individuals for volunteer recruitment, it is important to keep in mind that there is a multitude of reasons people volunteer. Some individuals will be more likely to participate in certain volunteer activities than others based on the inherent benefits that an activity offers. Targeting specific characteristics of individuals to correlate with the type of volunteer activity will promote a sustainable relationship between the volunteer and the organization (Green 1984; Moskell 2010).

COLA and many Hubbard County Lake Associations have expressed that they are lacking in volunteers. This concern, coupled with the fact that residents demonstrate a concern with water quality issues, suggests that lake residents are aware of problems like AIS and shoreline development, but they may need to be more aware that there is an opportunity to take

action. Those already interested in helping the environment should not require persuasion to participate in water quality enhancement but they may need to be made aware that there is an opportunity to do so. For example, the lake resident survey provided evidence that the majority of lake residents feel strongly about AIS (Appendix 9). Planning and effectively advertising AIS monitoring or clean-up opportunities for lake residents provides them with an opportunity to combat an issue of great concern and is a way to involve those who are already interested in improving environmental conditions of their lake. Lake residents who were interviewed said they would partake in DNR training events in order to fight the growing issue of AIS. Once they become involved, they may be more likely to participate in other volunteer activities that they may not have initially felt as strongly about.

Volunteers will come and go as lifestyles and priorities change. When choosing a target audience for recruiting, it is important to understand that those most willing to give up their time are going to be individuals with free time to spare, such as those who work part-time or are retired (Bussel and Forbes 2001). Lake associations might consider focusing their recruiting efforts toward individuals that no longer have young children and therefore have more free time to dedicate to lake quality-improvement activities. Other options for increasing volunteerism might be to encourage entire families to participate in fun educational activities, or to target high school or college students who want to develop their resume. Volunteers are often more likely to continue volunteering if they experience tangible benefits such as gaining experience or recommendations for the future (Green 1984). Additionally, research has shown that residents are more likely than those on vacation to engage in environmentally-friendly practices, as they may feel more responsible for the place they live (Dolnicar and Grűn 2009). Our survey results confirm this finding, as 74% of those who have assisted with lake association projects are longer-term residents. Each category of involvement reveals that residents participate more, except for the educational component of learning from lake associations, which also shows that non-residents may require more information related to lake quality.

Behavior-change techniques

The behavior-change tools as described in the community-based social marketing research, along with those described in Thaler and Sunstein's book *Nudge* (2008) can also be useful for these purposes.

1. Commitments. This technique can be utilized to increase membership and volunteerism. In one study, after researchers hypothetically asked if participants would consider volunteering, 31% agreed to later volunteer, while 4% of those who were not first hypothetically asked agreed to volunteer (Sherman 1980). COLA and lake associations can utilize this technique by asking members, preferably directly and in-person, if they would like to potentially volunteer, without having them first make a commitment. Asking an individual to commit in a face-to-face situation has been shown to be one of the most influential ways of increasing volunteer participation (Green 1984). Later, they should be directly asked again to make a commitment as they will likely be more willing to participate. In order to keep volunteers from backing out of the commitment, the organization must frequently acknowledge the volunteer's hard work and dedicated time in order to show them their actions are appreciated.

2. Social norms. Emphasizing social norms for increasing involvement with lake associations can also be an effective technique. On lakes that have high membership, communications should highlight the high participation. E-mails and brochures may state that, for example, "75% of Potato Lake residents are members of the lake association. Join your neighbors in helping to protect our property values, fishing, and boating." Residents may be more likely to join if they learn that everyone around them is doing so.

3. Defaults. As described by Thaler and Sunstein (2008), defaults can be a powerful tool for nudging behavior toward desired results. Defaults could be applied toward membership issues with automatic renewals of membership or automatic sign-ups for volunteering. These would certainly need to be initially approved by residents, but studies in areas such as magazine subscriptions demonstrate that people are willing to engage in auto-enrolling, with easy opt-outs, which has high benefits for organizations.

4. Anchors. This technique follows a simple rule: the more you ask for, the more you get. Anchors are starting points for thoughts, and when the starting point is closest to the desired behavior, it is more likely it will be achieved. This explains why organizations seeking donations start with a high range of options, and why jury settlements are often absurdly high, as lawyers anchor them with the possibility by starting at that number (Thaler and Sunstein 2008).

FUNDRAISING

Diversification of funding sources is vital for the long-term sustainability of a non-profit organization. Fundraising principles and concepts can be readily applied to the current practices in place in an organization to help clarify the organization's goals and identify areas of relative strength and weakness. According to Indiana professors and fundraising experts Adrian Sargeant and Jen Shang, as described in their book *Fundraising Principles and Practice* (2010), there are three key questions a nonprofit organization should consider when attempting to build up their fundraising program:

1. Where are we now?
2. Where do we want to be?
3. How are we going to get there?

Although these questions seem intuitive, the concepts behind them provide more detailed directives. One of the first components in tackling this effort, and in answering the question of where the organization is now, is to conduct a SWOT analysis. A SWOT analysis is the determination of the organization's strengths, weaknesses, opportunities, and threats. It must consider such aspects as the areas in which the organization succeeds, its general weaknesses, new funding opportunities or audiences, and threats or areas of uncertainty that may make donors scarce (Sargeant and Shang 2010).

Once this basic but extremely important analysis has been conducted, it is up to the organization to take the next steps in progressing toward its goals. Basic fundraising objectives and strategies of the organization should be determined, with the overall goal of identifying a target audience, or demographic, toward which to tailor the message. One of the key strategies in this stage is to thoroughly develop the organization's case for support. This involves reviewing its mission, vision, and value statements in order to develop its programs and services, and also to help distinguish it from other non-profits in the area that might have similar goals. The importance of distinguishing your organizations' mission and goals from other similar organizations is heavily emphasized by Sargeant and Shang, who state that distinctiveness forms the case for support, and helps people understand why they should give to your organization as opposed to others. They also suggest reviewing the organization's current finances, governance, staffing, facilities, service delivery, planning, evaluation, and history as a further means of

strengthening the case for support and reinforcing the unique need or service that the organization fills within the community.

There are several suggestions posed by Sargeant and Shang in terms of specific fundraising events that may help organizations get their efforts up and running. Among the most relevant fundraising suggestions for the COLA are hosting meals that could include dinners, dances, or testimonial lunches, as well as participatory events such as boat decorating and parades, lawn or house decorating contests during holidays, or simply increasing door-to-door fundraising efforts. Additionally, partnering with other organizations in the area, such as boating clubs, animal shelters, wildlife organizations, or even churches, is highly recommended as a means of increasing group resources, fundraising efforts, and manpower during fundraising events. Especially for organizations with limited financial means like the COLA, partnerships with other community organizations present an opportunity to make your organization known to a larger and more diverse audience than would normally be reached through lake-associated activities and communications.

CONCLUSION

Creating sustainable lake associations, and coalitions of lake associations, entails the utilization of numerous strategies. Maintaining a positive public image; expanding good water-quality practices; building membership, leadership, and a volunteer base; and increasing fundraising, are strategies that can help lead to strong organizations.

These strategies should be couched within the framework created by Elinor Ostrom for the successful voluntary management of common-property resources. Ostrom found that resources can be sustainably managed under certain conditions, such as under consistent monitoring and with graduated sanctions for rule breaking, but she also found that effective resource management requires effective institutions. These institutions could not be successful without consistent communication and public trust. Case studies provided additional support for these ideas, showing that communication strategies such as newsletters and face-to-face interactions led to more effective lake associations. These social mechanisms allow organizations to succeed. To paraphrase a quote from the beginning of the report, as Cox et al. (2010) noted, three factors are critical for successful CPR-institutions: trust, legitimacy, and transparency.

Based on this framework, and the two surveys and additional research into the six major categories described above, it is apparent that COLA and lake associations can benefit through broad yet targeted communication that reflects the values and motivations of residents in order to expand public trust and build social capital. Broader communication may include additional community events, partnerships, advertisements, and the utilization of social media to reach new audiences. Targeted communication includes, for example, gaining an understanding of the motivations of volunteers. The surveys and research illustrate that focusing on those groups that are already most likely to volunteer will be most effective, which includes longer-term residents and residents that are near or in retirement. Those near retirement can also be looked to for the next generation of leaders. Also, advertisements for encouraging good lake practices and volunteering should reflect the values of residents, but advertisements alone usually do not change behavior, so utilizing behavior change tools such as commitments and changing social norms can lead to lasting impacts.

The water quality trends of Hubbard County suggest that COLA and the Hubbard County lake associations have been effective in maintaining and improving their lakes. Continuing this trend requires the input of everyone in and around the lakes. COLA and government agencies cannot manage this resource on their own. By expanding communication, engagement, and public trust, more residents may become more involved in helping to manage their lake resource by not only increasing their participation with lake association activities but also by engaging in best practices in their everyday actions that ultimately determine lake quality. As lake associations then become more sustainable, the lakes will therefore be sustained for residents and visitors to continue the use of this invaluable resource.

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Appendix 1. Capstone Outreach Materials for COLA

Outreach Materials	Description
Capstone Pamphlet	The pamphlet has been designed as a tool for the COLA to use to inform other Lake Association leaders and members of the results of the Capstone course. The pamphlet includes important information about the survey results and recommendations involving Public Image, Water Quality Engagement, Volunteering and Membership, and Leadership.
COLA Brochure Template	The COLA brochure was created for the COLA to use as a tool to spread information and increase visibility in the county. It is meant to use as a template that can be altered and then distributed outside of the COLA. When the file opens in Publisher use the "1" and "2" tabs in the bottom of the window to switch between the inside and outside panels.
LA Brochure Template	The Lake Association brochure matches the design of the COLA brochure and is intended to be used in the same way. Each Lake Association can use this template to make their own personalized brochure to distribute around their lake. When the file opens in Publisher use the "1" and "2" tabs in the bottom of the window to switch between the inside and outside panels.
Lakes conditions dataset	The dataset in Excel format summarizes the information about physical condition of 41 lakes in Hubbard County (Hubbard_LA_Dataset.xlsx).
Facebook with Instructions	In an effort to increase the COLA's membership and audience, a Facebook page for the COLA was developed. In addition, a Facebook instructions guide was created to help with using the website and understanding the benefits of expanding COLA's web presence. COLA members can log onto www.facebook.com to practice using the basic site functions. The log-on information for the COLA page is included at the very top of the Facebook instructions guide.
Advertisements related to AIS and volunteering	Set of sample advertisement graphics were presented to give the idea of the scope of the projects that may be done to involve public.

Appendix 2. Ostrom Design Principles as modified by Cox et al. (2010) and adapted for capstone

Principle	Description
1A	User boundaries: Boundaries between legitimate resource users and nonusers must be clearly defined.
1B	Resource boundaries: Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.
2A	Congruence with local conditions: Rules fit local social and environmental conditions.
2B	Appropriation and provision: The benefits obtained by users from a common-pool resource (CPR), as determined by use rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules.
3	Collective-choice arrangements: Most individuals affected by rules can participate in modifying rules.
4A	Monitoring users: Monitors, accountable to the users, monitor the use levels of the users.
4B	Monitoring the resource: Monitors, accountable to the users, monitor resource condition.
5	Graduated sanctions: Appropriators who violate rules are likely to be assessed increasingly harsh sanctions by other appropriators, by officials accountable to the appropriators, or by both.
6	Conflict-resolution mechanisms: Users and their officials have rapid access to low-cost local arenas to resolve conflicts among users or between users and officials.
7	Recognition of rights to organize: The rights of users to devise their own policies are not challenged by external governmental authorities.
8	Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested initiatives.

Appendix 3. Listing of Ostrom's second-level variables

Not all apply in every situation, and starred variables are especially common in organizations that self-organize to manage a CPR.

Social, economic, and political settings (S)

S1 Economic development. S2 Demographic trends. S3 Political stability. S4 Government resource policies. S5 Market incentives. S6 Media organization.

Resource systems (RS)

RS1 Sector (e.g., water, forests, pasture, fish)
RS2 Clarity of system boundaries
RS3 Size of resource system*
RS4 Human-constructed facilities
RS5 Productivity of system*
RS6 Equilibrium properties
RS7 Predictability of system dynamics*
RS8 Storage characteristics
RS9 Location

Resource units (RU)

RU1 Resource unit mobility*
RU2 Growth or replacement rate
RU3 Interaction among resource units
RU4 Economic value
RU5 Number of units
RU6 Distinctive markings
RU7 Spatial and temporal distribution

Governance systems (GS)

GS1 Government organizations
GS2 Nongovernment organizations
GS3 Network structure
GS4 Property-rights systems
GS5 Operational rules
GS6 Collective-choice rules*
GS7 Constitutional rules
GS8 Monitoring and sanctioning processes

Users (U)

U1 Number of users*
U2 Socioeconomic attributes of users
U3 History of use
U4 Location
U5 Leadership/entrepreneurship*
U6 Norms/social capital*
U7 Knowledge of SES/mental models*
U8 Importance of resource*
U9 Technology used

Appendix 4. Model for sustainable lake management from the perspective of a lake association

	1st Level	2nd Level	Operationalize	Theory
Resource System	*Inland Lake*	RS1: System	Lake/Watershed System	N/A
		RS3: Size	Lake Size: larger lakes harder to manage	Olson 1965, Kramer 2007, Snell et al. 2010, Arnold 2003
Resource Units	*Water*	RU1: Resource Unit Mobility	Isolated lakes (not chain-lakes) will be easier to manage	Principle 1B
	Fishing/Recreation regarding AIS	RU4: Economic Value	Lakes that have valuable fisheries will be harder to manage because of increased public use	Snell et al. 2010
Users	*Lakeshore Owners*	U1: Number of Users	Parcel Number: more properties make management harder	Principle 3
	Public Access	U1: Number of Users	Access Sites: more public access makes management harder	Principle 1A, Arnold 2003
	Lakeshore Owners	U2: Socioeconomic Attributes of Users	Lakes with wealthier users will be easier to manage	Gabriel & Lancaster 2004, Snell et al. 2010
	Lake Association	U5: Leadership	Strong leadership facilitates management	Arnold 2003
	Lakeshore Owners	U6: Norms/Social Capital	High social capital facilitates management	Principle 2B, Kramer 2007
Governance	*Lake Association*	GS1: Government Organizations	LAs that have a good relationship with government (MDNR, County) will be easier to manage	Principle 8, Kramer 2007, Snell et al. 2010
	Lake Association	GS2: Non-Government Organizations	Lakes with strong Associations will be more effectively managed	Kramer 2007, Gabriel & Lancaster 2004
	Lake Association	GS6: Collective Choice Rules	Greater involvement in rule-making by those affected will facilitate management	Principle 3
	Lake Association	GS8: Monitoring and Sanctioning Process	LAs that have strong monitoring abilities will see more effective management	Principles 4 and 5

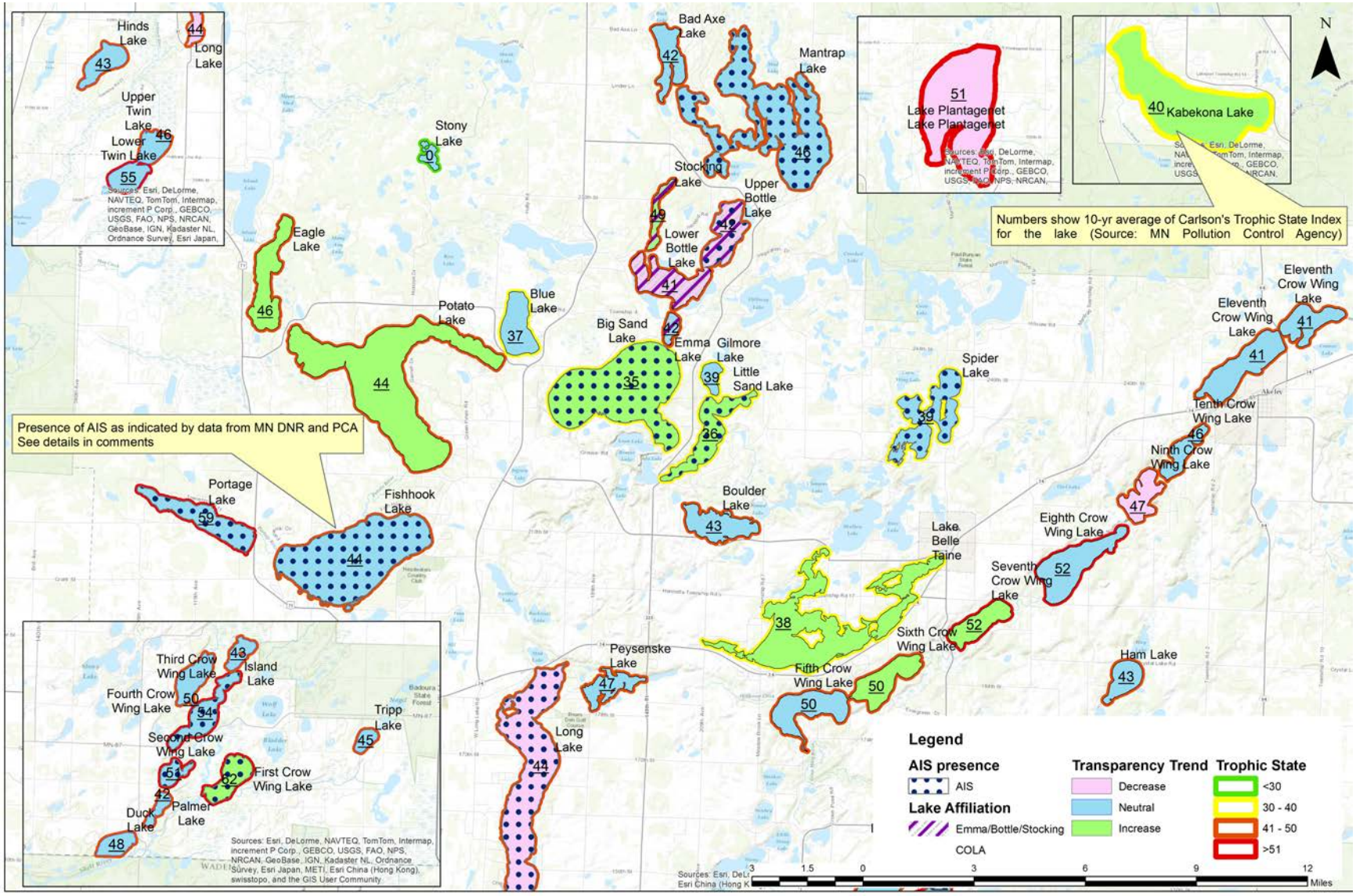
Appendix 5. Lake condition dataset description
(The dataset is provided to COLA by email: Hubbard_LA_Dataset.xlsx)

Field ID	Field value	Source	Comments/Processing notes
GNIS_ID	GNIS Id number – unique identifier of lake in MN DNR Geodatabase (amended)	http://www.mngeo.state.mn.us/chouse/metadata/nhd_24k.html	2 11th Crow wing lakes combined to form 1
GNIS_Name	GNIS lake name	http://www.mngeo.state.mn.us/chouse/metadata/nhd_24k.html	2 11th Crow wing lakes combined to form 1
LMPs	Availability of lake management plan (1 - available/exists, 0 - doesn't exist/not used)	COLA	We assumed that only LMP that were presented to capstone group were used actively
Shape_Leng	Lake perimeter (meters)	http://www.mngeo.state.mn.us/chouse/metadata/nhd_24k.html	ArcGIS calculation
Shape_Area	Lake area (meters squared)	http://www.mngeo.state.mn.us/chouse/metadata/nhd_24k.html	ArcGIS calculation
SHDEV	Shoreline development index	http://www.mngeo.state.mn.us/chouse/metadata/nhd_24k.html	Calculated as Lake perimeter/(2*PI*SQRT(Lake area))
COLA	Lake affiliation with COLA (0-Emma/Bottle/Stocking LA, 1 - COLA lake)	COLA	
WSAREA	watershed area, meters squared	http://deli.dnr.state.mn.us/metadata/wshd_lev08py3.html	Used same values for Lower Bottle Lake + Stocking Lake because they share same WS. Some lakes don't have delineated watersheds
LUCULT	Percentage of watershed land in the agriculture	National Land Cover Dataset 2006: http://www.mrlc.gov/nlcd2006.php	Reclassified (see tab in Excel)
LUBOG	Percentage of watershed land in the lake's watershed in bog	National Land Cover Dataset 2006: http://www.mrlc.gov/nlcd2006.php	Reclassified (see tab in Excel)
LUBRUSH	Percentage of watershed land in the lake's watershed in brush	National Land Cover Dataset 2006: http://www.mrlc.gov/nlcd2006.php	Reclassified (see tab in Excel)
LUFOREST	Percentage of watershed land in the lake's watershed in the forest	National Land Cover Dataset 2006: http://www.mrlc.gov/nlcd2006.php	Reclassified (see tab in Excel)
LUURBAN	Percentage of watershed land in the lake's watershed in urban land use	National Land Cover Dataset 2006: http://www.mrlc.gov/nlcd2006.php	Reclassified (see tab in Excel)
MAXDEP	Maximum Depth (feet)	https://www.dnr.state.mn.us/lakefind/index.html	
TSI_PCA	Overall Carson's Trophic State Index for Lake	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TRANSP10	Transparency, meters - 10-Year Average of All Summer Samples	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	

CHLOR10	Chlorophyll-a (parts per billion) - 10-Year Average of All Summer Samples	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TOTPHOS10	Total Phosphorus (parts per billion) - 10-Year Average of All Summer Samples	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TRTRTXT	Transparency Trend (as described on the DNR website)	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
USECLASS	**Use Classification**	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
AQREC	Aquatic Recreation	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
AQCONS	Aquatic Consumption	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
PACCESS	Number of public access points		
AIS_SCI_NAME	Scientific name of AIS	http://deli.dnr.state.mn.us/metadata.html?id=L390007760203 and http://files.dnr.state.mn.us/eco/invasives/infested_waters.pdf	
AIS_FIRST_OBS	First observation of AIS	http://deli.dnr.state.mn.us/metadata.html?id=L390007760203 and http://files.dnr.state.mn.us/eco/invasives/infested_waters.pdf	
AIS_NUM_OBS	Number of observations of AIS	http://deli.dnr.state.mn.us/metadata.html?id=L390007760203 and http://files.dnr.state.mn.us/eco/invasives/infested_waters.pdf	
AIS_PRES	Presence of AIS on the lake (0 - never present, 1 - known instances)	http://deli.dnr.state.mn.us/metadata.html?id=L390007760203 and http://files.dnr.state.mn.us/eco/invasives/infested_waters.pdf	
TOT_MON	Total number of observations for lake monitoring (CLMP + COLA)	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
COLA_MON	Total number of observations for lake monitoring made by Hubbard County COLA specifically	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
CLMP_MON	Total number of observations for lake monitoring within Citizen lake Monitoring program	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TRNUM	Change in 10year transparemcy trend, feet	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TRINC	Transparency trend tendency (number: -1 - decrease, 0 - no evidence, 1 - increase)	http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm	
TOTACRES	Total number of acres for lakefront property	COLA-Assessors Database	

LVAL	Total land value (lakefront property), dollars	COLA-Assessors Database	
BVAL	Total building value (lakefront property), dollars	COLA-Assessors Database	
TOTVAL	Total land and building value (lakefront property), dollars	COLA-Assessors Database	
AVVAL	Average value, dollars per acre of total property value (lakefront property)	COLA-Assessors Database	TOTVAL divided by TOTACRES
NOP	Number of parcels	COLA-Assessors Database	

Appendix 6. Detailed lake conditions summary map



Comments to the map:

The map summarizes the data on lake conditions taken from MN Department of Natural Resources and MN Pollution Control Agency websites:

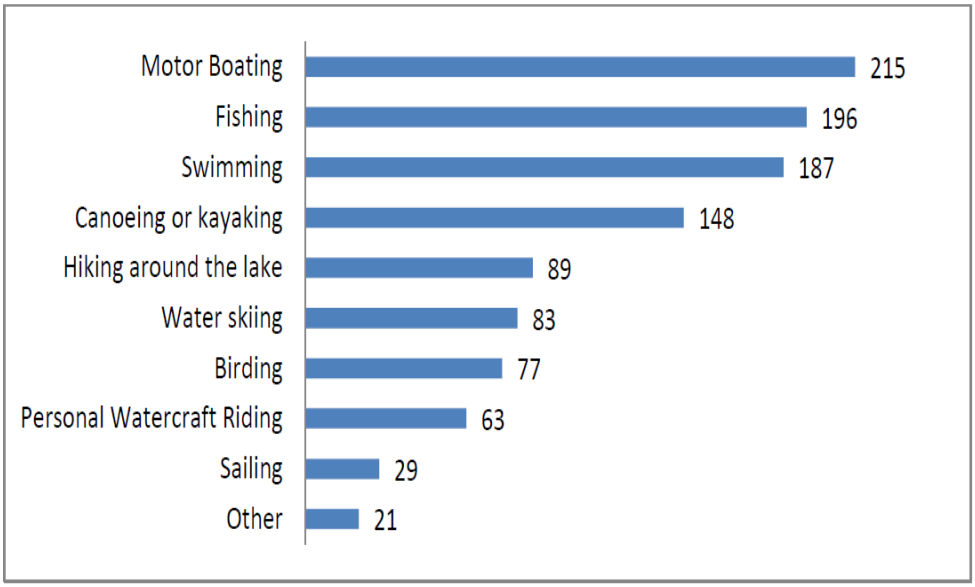
1. AIS presence is pooled together from Department of Natural Resources Designation of Infested Waters (February 11, 2013) and DNR Invasive Species - Aquatic Observations geospatial dataset (6/1/2010).
2. Non-COLA lakes belong to Emma/Stocking/Bottle LA.
3. Numbers on the lake represent the 10-yr average of Carlson's Trophic State Index (TSI). Transparency 10-year trend (increasing, decreasing or no evidence/neutral) and Trophic State Index (TSI) are taken from MN Pollution Control Agency website.
4. Lakes within the tabs are not up to scale. The following table may be useful for interpreting TSI values:

TSI	Chl (ug/L)	SD (m)	TP (ug/L)	Attributes	Water Supply	Fisheries & Recreation
<30	<0.95	>8	<6	**Oligotrophy:** Clear water, oxygen throughout the year in the hypolimnion	Water may be suitable for an unfiltered water supply.	Salmonid fisheries dominate
30-40	0.95-2.6	8-4	6-12	Hypolimnia of shallower lakes may become anoxic		Salmonid fisheries in deep lakes only
40-50	2.6-7.3	4-2	12-24	**Mesotrophy:** Water moderately clear; increasing probability of hypolimnetic anoxia during summer	Iron, manganese, taste, and odor problems worsen. Raw water turbidity requires filtration.	Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate
50-60	7.3-20	2-1	24-48	**Eutrophy:** Anoxic hypolimnia, macrophyte problems possible		Warm-water fisheries only. Bass may dominate.
60-70	20-56	0.5-1	48-96	Blue-green algae dominate, algal scums and macrophyte problems	Episodes of severe taste and odor possible.	Nuisance macrophytes, algal scums, and low transparency may discourage swimming and boating.
70-80	56-155	0.25-0.5	96-192	**Hypereutrophy:** (light limited productivity). Dense algae and macrophytes		
>80	>155	<0.25	192-384	Algal scums, few macrophytes		Rough fish dominate; summer fish kills possible

Taken from: Carlson, R.E. and J. Simpson. 1996. *A Coordinator's Guide to Volunteer Lake Monitoring Methods*. North American Lake Management Society. 96 pp.

Chl represents Chlorophyll-a concentration, SD – is a lake transparency in meters measured with Secchi Disk, TP represents total phosphorus concentration in the lake.

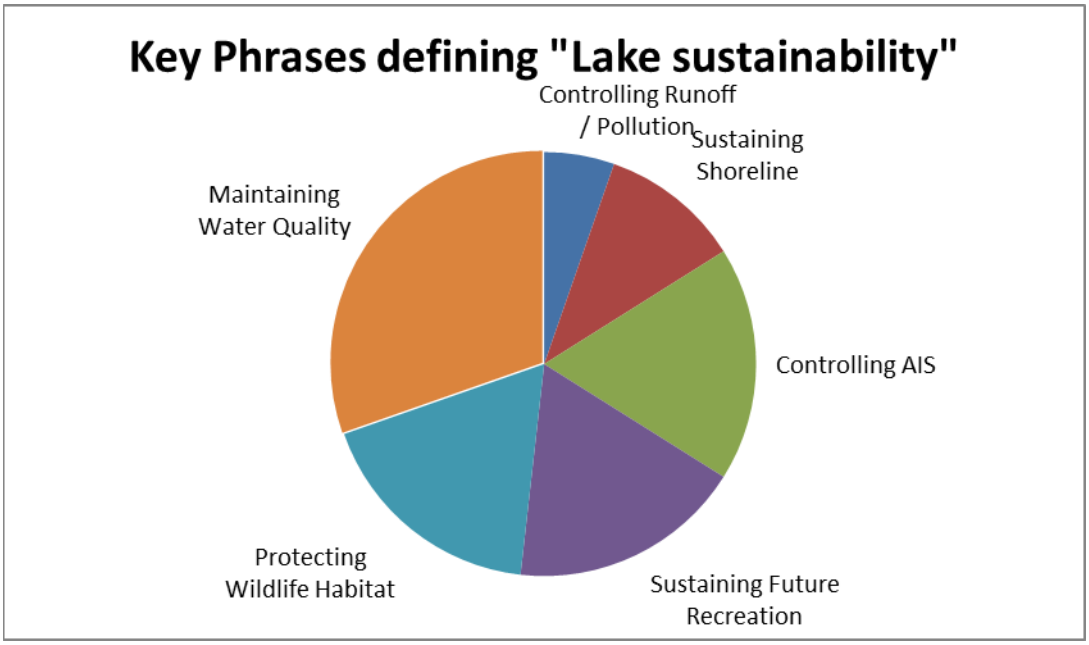
Appendix 7. Distribution of lake resident responses on engagement in recreational activities



The question (multiple choice):
What type of recreational activities do you most engage in on or around the lake?
Possible answers:

- *Sailing*
- *Motor Boating*
- *Water skiing*
- *Personal Watercraft Riding*
- *Fishing*
- *Birding*
- *Hiking around the lake*
- *Canoeing or kayaking*
- *Swimming*
- *Other*

Appendix 8. Key phrases used to define “Lake Sustainability” by COLA members



Survey Question: What does the phrase “Lake Association Sustainability” mean to you?

Sample Responses:

- “It means the ability of the association to continue to exist and function as a group to influence issues regarding lake quality.”
- “Have an organization that meets regularly, has a mission and has members that are both financially and emotionally involved in the association.”
- “Maintaining an active, healthy lake association with stable or growing membership”

Inputs from COLA members were categorized into 6 broad categories.

Appendix 9. Ranking of concerns by COLA and lake associations

Lake association /Concern	**COLA Rank**	**LAs summary**	**8th/9th Crow Wing Lake**	**Big Mantrap Lake**	**Little Sand Lake**	**Long Lake**	**Middle Crow Wing Lake**	**Palmer Lake**	**Potato Lake**
Aquatic invasive species	**1**	**1**	1	1	1	1	1	1	1
Shoreline owners understanding issues	**2**	**3**	3	3	3	4	7	3	3
Shoreline development	**3**	**4**	2	5	4	5	3	4	4
Effectiveness of the lake association	**4**	**8**	16	10	9	7	15	7	7
Lack of volunteers	**5**	**15**	7	15	16	15	14	13	15
Participation/membership among lake residents	**6**	**14**	11	14	13	14	13	10	10
Pollution from shoreline residences (i.e. failing septic systems, lawns, etc.)	**7**	**2**	4	2	2	3	2	2	2
Development in the lake watershed	**8**	**7**	6	6	8	8	5	9	5
Collaboration and knowledge sharing	**9**	**10**	9	11	10	10	12	5	8
Fisheries management	**10**	**5**	15	4	7	6	6	11	6
Funding for lake association	**11**	**12**	13	12	12	11	16	15	9
Native plant restoration	**12**	**11**	10	9	11	12	9	8	11
Boating practices/etiquette	**13**	**9**	5	7	15	9	8	12	14
Recreation user conflicts (i.e. fishermen vs. motor boaters, sailors vs. motor boaters, etc.)	**14**	**16**	12	16	14	16	11	14	16
Lake pollution from agricultural runoff	**15**	**6**	14	8	5	2	4	6	12
Lake pollution from forestry operations	**16**	**13**	8	13	6	13	10	16	13

Appendix 10. Number of respondents engaged in water quality enhancement practices

Number (people):

LA (number of responses)/Water quality practice	8th/9th Crow Wing (n=8)	Big Mantrap (n=44)	Little Sand (n=25)	Long (n=123)	Middle Crow Wing (n=17)	Palmer (n=20)	Potato (n=53)	Average involvement in practice, %
Create shoreline buffer(s)	4	27	16	76	11	13	34	61.57
Natural or low fertilizer use on lawn	4	14	11	58	6	2	29	39.00
No fertilizer use on lawn	4	31	13	57	9	14	20	54.21
Proper pet waste management	1	17	9	47	7	3	16	30.24
Proper maintenance of septic system	8	36	21	99	16	16	41	85.40
Porous parking/driving surfaces	3	28	17	65	7	13	25	53.62
Planting of native plants	5	19	15	53	8	10	23	49.89
Reduced yard mowing	3	26	10	60	6	12	22	46.02
Naturalized landscaping	4	26	15	70	16	16	38	67.40
Other	0	1	0	0	0	3	0	2.47
None of the above	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0.98**
Average involvement per lake, %	**45**	**51.14**	**50.8**	**47.56**	**50.59**	**51**	**46.79**	

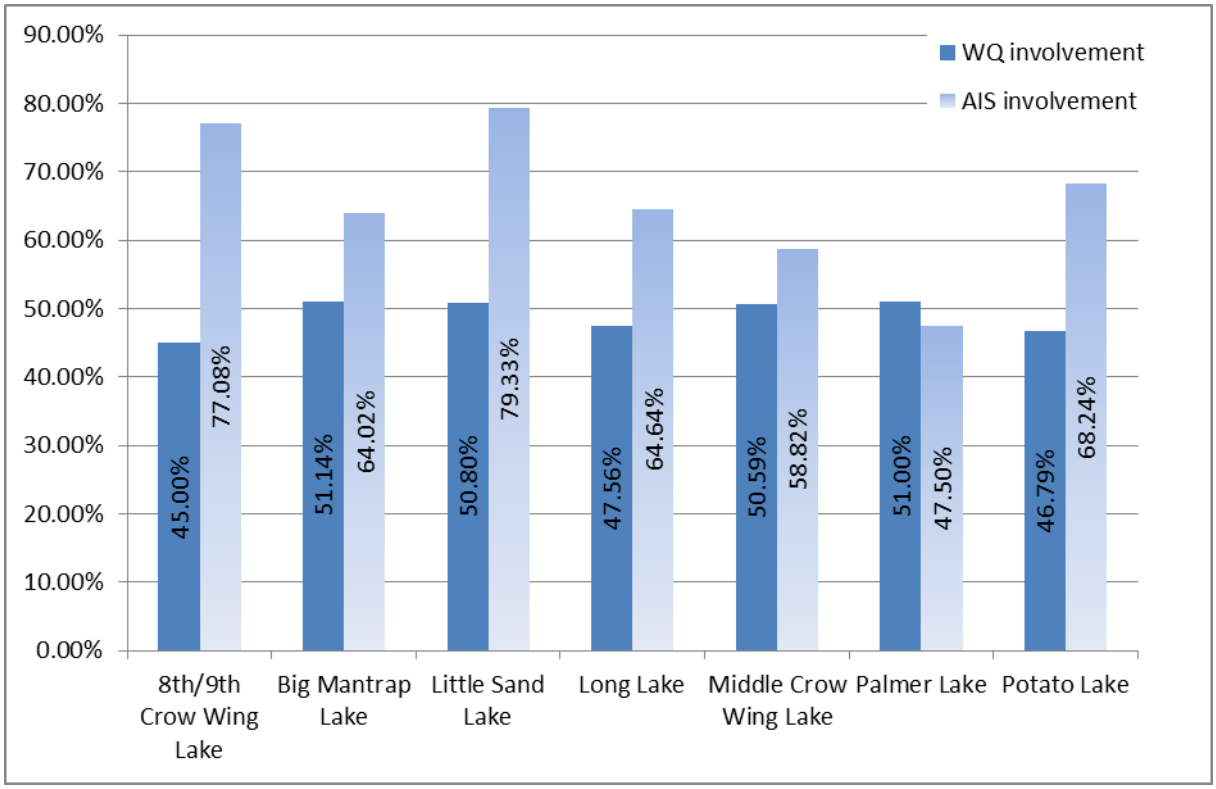
Note:
% respondents involved into practice per lake = Number of respondents involved into practice/Total number of respondents per lake (n)
So, for example for 8th/9th Crow Wing (n=8):

% respondents involved into “Create shoreline buffer(s)” practice = 4/8 = 50%
Average involvement per lake = (% respondents involved into practice per lake)/ 10 (number of practices incl. other)
Average involvement in practice = (% respondents involved into practice per lake)/7(number of lakes)

Appendix 11. Percentage of respondents involved in AIS activities on regular basis

LA/AIS reduction practice	8th/9th Crow Wing (n=8)	Big Mantrap (n=44)	Little Sand (n=25)	Long (n=123)	Middle Crow Wing (n=17)	Palmer (n=20)	Potato (n=53)
Checking for exotic plants/animals on your boat, trailer, motor, etc.	87.50	68.18	80.00	64.23	58.82	50.00	69.81
Collecting and removing exotic plants/animals from your boat, trailer, motor, etc.	87.50	59.09	72.00	58.54	47.06	30.00	62.26
Draining water from livewell, bilge, and engine prior to leaving the lake / dock area.	62.50	59.09	76.00	61.79	52.94	35.00	64.15
Disposing of bait in the trash	62.50	56.82	88.00	58.54	70.59	45.00	64.15
Washing/rinsing boating equipment	75.00	50.00	64.00	59.35	41.18	30.00	60.38
Staying current with invasive species news	87.50	90.91	96.00	85.37	82.35	95.00	88.68
Average involvement	**77.08**	**64.02**	**79.33**	**64.64**	**58.82**	**47.50**	**68.24**

Appendix 12. Comparison of involvement into water quality and AIS related practices



Appendix 13. Preferred information channel (multiple choice), number of answers

LA/Channel	8th/9th Crow Wing	Big Mantrap	Little Sand	Long	Middle Crow Wing	Palmer	Potato
Open meetings	1	18	11	47	6	13	17
Brochures	0	3	2	13	3	2	4
Newsletters	3	34	13	61	12	13	23
Email	8	35	24	110	15	18	48
Facebook	1	0	3	6	1	1	4
Phone calls	0	4	5	7	2	2	3
In-person contact	1	7	5	10	4	5	4
LA workshops	1	10	10	33	3	5	9