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Exploring the Knowledge Commons of Lakes

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Abstract - In the Great Lakes states it is common for lakeshore residents to self-organize into a lake association, particularly in the time of a perceived crisis. Generally, the crisis passes after a couple of years, but the lake association continues to function. These lake associations could be thought of as the start of collective action to governing a lake as a common but the terminology is unfamiliar and rarely embraced by the residents. In fact, the uneasiness with the term *governing* is strong. Given this disregard for the practice of governance, it is interesting how much data about their lakes is accumulated over time and how this data becomes information and shared knowledge that is incorporated into decision-making about the lakes by the lake association, lake visitors, and local/state government. The presentation and paper are a first attempt to present to a coalition of lake associations how they influence the co-management of their lakes between lake associations, various government agencies and other interested partners through the wide array of knowledge they create and/or have access to.

Keywords – Lakes, Lake Associations, Environmental Common, Knowledge Common, Co-Management

Introduction

Commons are defined as a shared resource 'governed' (both formal and informal rules) by the community of actors (not solely state or private market) who depend on or are affected by that resource. Lakes can be thought of as commons, particularly if the lake residents have organized through collective action to 'govern' the commons. **Collective action refers to action taken together by a group of people whose goal is to enhance their condition and achieve a common objective. Co-management** is 'the **sharing of responsibilities, rights, and duties between the primary stakeholders**, in a decentralized approach to decision-making that involves the local users in the decision-making process as equals with the city-township-county-state government

In the Great Lakes states it is rather standard practice for lakeshore residents to self-organize into a lake association (LA), particularly in a time of perceived crisis. Examples of crises include a sudden change in water quality, an invasion of non-native species, a decline in the fish population or maybe the threat of rogue development of the lakeshore. Such crises generally are addressed over time but the lake association may continue to function in some manner, many times as a social organization.

These lake associations (LAs) could be thought of as the start of governing a lake as a common but the terminology is unfamiliar and rarely embraced by the communities. In fact, my experience in northern Minnesota is that the aversion to 'governing' is strong. And instead, the lake associations want that responsibility to reside with the local county government and the various responsible state agencies – Natural Resources, Environmental Quality, etc. Interestingly, in many counties, at least 21 in Minnesota, local lake associations have banded together to form Coalitions of Lake Associations (MNCOLA) to better interact with these government agencies. And more recently the Minnesota Lake and Rivers (MLR) Organization (https://mnlakesandrivers.org/lake-associations/) has formed to be the statewide lobbying organization. Maybe LAs are more comfortable with the idea of "co-management" between community or interest groups and public authorities and the coordinated discussion between various players is a better way to look at things.

For example, in Minnesota the Hubbard County Coalition of Lake Associations (HCCOLA) was formed in 1988 and currently has 31 lake association members with the most recently created Garfield Lake Association in 2018 (https://hubbardcolamn.org/index.html). Big Mantrap Lake (BML) Association is one of the oldest lake associations, formed in 1956 (https://mantraplake.org/). Many of the lake associations are now nonprofits so that they can more easily raise monies for projects, particularly aquatic invasive species (AIS) monitoring and control.

I have been involved in both the BML and the HCCOLA since our purchase of a lake front property in 2011. In 2012 I was asked to take over the BML water clarity and water quality monitoring program. This involves me recording water clarity data at two sites on weekly basis from May-Sept and physically taking monthly water quality samples that are sent to a lab for analysis. Similar data collection takes place for each member of the HCCOLA. The results are collected by the MN Department of Environmental Quality and posted on a website (LakeFinder | Minnesota DNR (state.mn.us)). Also, beginning in 2013 I became the BML Association's board representative to the HCCOLA. I have served on several HCCOLA committees. I have been one of the few career academics on the HCCOLA Board and periodically relied upon for my expertise. In 2013 and 2014 at the request of the HCCOLA Board I organized two IUB SPEA master's Capstone Courses – "Guidelines for Sustainable Lake Associations and Coalitions of Lake Associations" and "Enhancing Hubbard County COLA's Lake Monitoring Program". I have also given a couple of more recent presentations including one on thinking of lakeshores as a series of neighborhoods. (Articles , Studies & Reports - Hubbard COLA (hubbardcolamn.org)

In the Fall of 2023, I was having a discussion with the HCCOLA leadership about lakes as commons and the Ostrom concept of Governing the Commons (Ostrom, Elinor (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press. ISBN 978-0-521-40599-7). There was some push back but also an interest in learning more about commons and I was asked to present something at a monthly HCCOA Board meeting in 2024. I since have more clearly recognized that individual LAs as well as the HCCOLA collect lots of data about their lakes over time, and that this data is synthesized into information and then into knowledge, which may be used in stewardship of lakes by LA's. So, two specific questions about this data>information>knowledge situation need to be addressed. First how many distinct types of data are we talking about? Second, how might this data be better shared with all the interested players – lakeshore residents, lake visitors, county, and state government, etc., so that the lake commons are better served.

Lake-Based Data and Information

As a start I compiled a description of various categories of lake-based data. I then asked whether LAs are knowledgeable of this data and do they use it to create information that is shared with their membership, lake visitors and others. My list of lake-base data is not complete but includes the following:

- Aquatic Invasive Species (AIS) data, status, etc.
- Land use history of lake watersheds
- Hubbard County septic tank survey and upgrades
- Lake water quality and clarity monitoring databases
- Lake fishery status

AIS status of a lake is clearly something that LA's work with county government officials to maintain current. This is done through several strategies. Public boat launches are staffed with inspectors, paid for by a combination of state, county-township, and LA's monies. The inspectors monitor each boat that

launches both into and out of the lake, and record/report any finding of AIS. New AIS findings are then followed up upon by county/state officials. Lakes with AIS are then added to the active listing of AIS infected lakes and listed on websites like the MNAIS AIS Explorer - AIS Explorer | Minnesota Aquatic Invasive Species Research Center (MAISRC) (umn.edu). Figure 1 shows Hubbard County with lakes color-coded for Zebra Mussels with red meaning infested, yellow threatened, all the way to green – very unlikely to be infested.

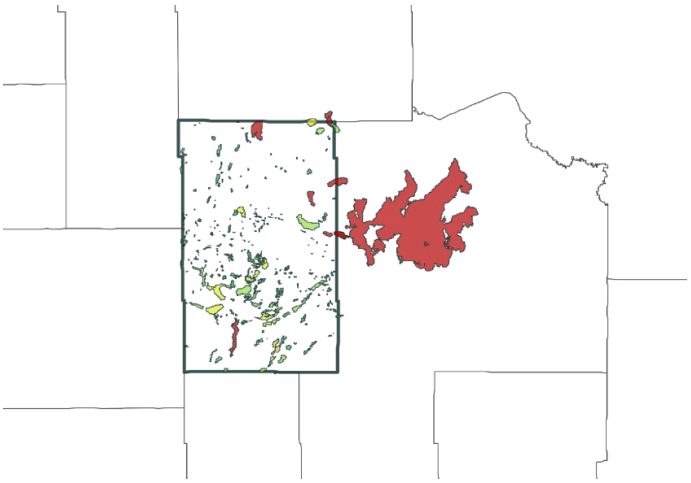

Figure 1. Hubbard County AIS Risk Map for Zebra Mussels. From MAISRC – AIS Explorer AIS Explorer | Minnesota Aquatic Invasive Species Research Center (MAISRC) (umn.edu)

Land Use History surrounding a lake is everchanging. Substantial changes like the clearing of large, forested area to become agricultural lands might be noted by LAs and nearby lakeshore residents but the more subtle changes of land use over time are less likely to be recognized. A straightforward way to explore land use change over time is to compare arial photography over time. This has not been done but could show changes in whole lake watershed land use. A is primary focus would be on the conversion of natural habitat to agricultural land, housing, etc. Specific lakeshore land use change which more directly impacts a lake might be seen in the conversion of resorts to planned unit developments or a campground, vacation cabins replaced by larger residences or VRBOs, etc. Some resources to view the change include Minnesota Historical Aerial Photos (U of M product) which has some good imagery from the 1930-1978 for the areas at https://apps.lib.umn.edu/mhapo/. The Hubbard County GIS has imagery from 1991- 2020 at https://hubbardcounty.maps.arcgis.com/apps/webappviewer/index.html?id=405588666bba4397982b98b3fd382f62. Figure 2 is an example of comparing land use and how it has changed from 1978 to 2023 for the lower section of Long Land in Hubbard County. The change of intensity of agriculture is seen in the 2023 photo by the irrigation circles. (Adapted from correspondence with Jake Shaughnessy & Eric Buitenwerf, 2023)

Figure 2. Land use aerial photography – lower Long Lake, Hubbard County. From UM photo archives (1978, left) and Hubbard County GIS (2023, right).

- 1990s Hubbard County septic system survey & upgrades – LAs as well as most of the newer lakeshore residents do not know of Hubbard County's highly successful septic system lake survey program. It began in 1992 and was completed around 2004-05. Most of the larger lakes were surveyed. The County Board in the mid-2000s decided not to continue the survey on rivers, creeks, and streams. This county run program was successful in that today the county rarely encounters a shoreland area septic system deemed failing in a submitted compliance inspection report for reasons that were common early in the program such as tanks without bottoms, 55-gallon steel drums, straight pipes, etc. This program generally resulted in a trend toward improved water quality/clarity data over a brief time period. (Adapted from correspondence with Eric Buitenwerf, 2023)

- LA water quality/clarity over time – LA's have a long history of monitoring their lakes for both water quality and clarity. Water clarity is generally monitored weekly throughout the whole summer season (May-September) and the data is reported to the MN Pollution Control Agency (Minnesota Pollution Control Agency (state.mn.us)). Water quality samples are taken once a month (May-September) by the same individuals and delivered to RMB Environmental Lab at Detroit Lakes (https://lakes.rmbel.info/). The data is available at https://www.rmbel.com/lakes-monitoring-database and some lakes have as much as 30 or more years of data recorded. How the summaries and trend of this data are presented to lakeshore residents is unknown. An example of lake data is presented by RMB and MN Pollution Control Agency is presented in Table 1.

  Table 1. Water Quality Characteristics - Big Mantrap Lake, Hubbard County (2023 summary) *(data from RMB monitoring database only).*

Parameters	Primary Site 201	Site 202	Site 205
Total Phosphorus Mean:	17.2	19.6	21.6
Total Phosphorus Min:	2.5	16	13
Total Phosphorus Max:	44	24	40
Number of Observations:	139	5	10
Chlorophyll-a Mean:	5.4	6.4	6.5
Chlorophyll-a Min:	0.4	3	3
Chlorophyll-a Max:	20	10	14
Number of Observations:	138	5	10
Secchi Depth Mean:	13.5	11.9	9.3

Secchi Depth Min:	6	9	5
Secchi Depth Max:	23	17	14
Number of Observations:	132	5	10
Trophic State Index Mean:	42.9	45.6	46.9

Trophic State: Mesotrophic

This type of data presentation is not very meaningful to most LA members. RMB Labs has developed Table 2 which shows a much clear status report on lake water quality for Big Mantrap Lake. BML is very stable and not changing. Table 3 shows two other Hubbard County lakes with Stony Lake showing improvement and Fish Hook Lake declining.

Table 2. Water Quality Monitoring Summary for Big Mantrap Lake (from https://lakes.rmbel.info/OnePageSummary.aspx?LakeID=26)

Trends

Years Monitored: 1997 - 2023
Total Phosphorus: No significant trend exists.
Chlorophyll-a: No significant trend exists.
Secchi Depth: No significant trend exists.
Trophic State Index: No significant trend exists.

Ecoregion Comparison

Ecoregion: NLF
Total phosphorus: Within Expected Range
Chlorophyll-a: Within Expected Range
Secchi depth: Within Expected Range

Table 3. Water Quality Monitoring Summaries for Stony Lake (from https://lakes.rmbel.info/OnePageSummary.aspx?LakeID=213 and Fish Hook Lake (https://lakes.rmbel.info/OnePageSummary.aspx?LakeID=86)

Trends – Stony Lake	**Trends – Fish Hook Lake**
Years Monitored: 1997 - 2023 **Total Phosphorus:** Improving with 99.9% confidence. **Chlorophyll-a:** Improving with 99% confidence. **Secchi Depth:** Improving with 95% confidence. **Trophic State Index:** Improving with 99.9% confidence.	**Years Monitored:** 1999 - 2023 **Total Phosphorus:** Declining with 90% confidence. **Chlorophyll-a:** No significant trend exists. **Secchi Depth:** Improving with 80% confidence. **Trophic State Index:** Declining with 80% confidence.
Ecoregion Comparison	**Ecoregion**
Ecoregion: NLF **Total phosphorus:** Better Than Expected Range **Chlorophyll-a:** Within Expected Range **Secchi depth:** Within Expected Range	**Ecoregion:** NLF **Total phosphorus:** Within Expected Range **Chlorophyll-a:** Within Expected Range **Secchi depth:** Within Expected Range

Could LAs make this type of data even more useful to their members? Maybe an accompanying explanation of terminology? For example, what to minimum and maximum mean, what does improving and declining imply and when does a number become problematic?

- Lake fishery status over time – The MDNR Division of Fisheries (https://www.dnr.state.mn.us/fisheries/index.html) monitors lake fish populations and periodically may suggest changes in local lake fishing rules (catch and fish size limits) or modify fish stocking cycles to address fish population problems. Fishing regulations outside the normal are posted annually for each lake in the state. The kinds of lake data that is generally available for any lake includes the following: Lake depth/size, Fisheries lake surveys, Water access sites, Fish stocking, Ice In/Out, Fish consumption concerns, Water levels, Lake health and Aquatic Plant surveys. Below is an example of some common lake data available for Big Mantrap:

  Area: 1617.69 acres
  Littoral Area: 849.45 acres
  Shore length: 26.3 miles
  Mean depth: 17 feet
  Maximum depth: 68 feet

  Fish species: black bullhead, black crappie, bluegill, brown bullhead, hybrid sunfish, largemouth bass, muskellunge, northern pike, pumpkinseed, rock bass, smallmouth bass, sunfish, tiger muskellunge, tullibee (cisco), walleye, yellow bullhead, yellow perch, shorthead redhorse, white sucker, banded killifish, blackchin shiner, blacknose shiner, bluntnose minnow, brook stickleback, central mudminnow, golden shiner, Iowa darter, Johnny darter, spottail shiner

Specific Fishing regulations for Big Mantrap Lake (LakeFinder | Minnesota DNR (state.mn.us)): This lake has special fishing regulations that differ from statewide or border water regulations for those species identified below and take precedence. Regulations listed below are currently in place. Visit the fishing regulations page for links to upcoming regulations for specific lakes.

- **Black and White Crappie**: Daily limit five
- **Northern Pike**: All from 24-36" must be immediately released. Possession limit three, only one over 36"
- **Invasive species**: Eurasian watermilfoil

Emerging issues without data sources

A new MN law – **Keep It Clean** (2023) regarding storing garbage and other waste (all forms) left on the ice will affect all ice anglers regardless of the type of shelter they use. The impetus was increased dumping of sewage from permanent fish houses. Specifically, people using an ice shelter, vehicle or other conveyance on the ice may not deposit "garbage, rubbish, cigarette filters, debris from fireworks, offal, the body of a dead animal, litter, sewage or any other waste outside the shelter, motor vehicle or conveyance, unless the material is placed in a container that is secured to the shelter, motor vehicle or conveyance, and not placed directly on the ice or in state waters" (https://bringmethenews.com/minnesota-living/heres-what-minnesotas-new-lake-littering-law-means-for-ice-fishing)

The law is aimed at ensuring everyone who uses the ice can do so without encountering garbage and other substances that are not only a potential environmental concern, but an eyesore that takes away from a quality experience for all winter recreationists. During the winter, complaints about litter left on the ice are among the most common that DNR conservation officers receive. They take these complaints seriously and work to locate violators. The penalty for a violation is a petty misdemeanor and carries a fine of $100.

The new law appears to be the result of collective action by locals on particularly popular ice fishing lakes in very northern MN. There is no data reported on the size or history of the problem, whether the problem results in lake pollution or whatever, yet the story is not a new one. Reporting by LAs on adherence to the new lake to law enforcement should result in better compliance and how the law might be updated in future years.

Figure 3. An example of trash and waste on lake ice (https://www.revisor.mn.gov/statutes/cite/97C.363)

Data on historic lake water levels (highs, lows, and the average) and their associated aquifer (ground water) are available but are not easily accessible for lake residents. There are other surely other types of data or information that may be available for specific lakes but hard to find. And there is surely data that would be interesting to consider but has never been collected. What might be missing is something each LA should explore. For example, some lakes monitor Loon populations and other types of wildlife.

Knowledge applications

The data/information outlined in the preceding section can be used by a LA for a variety of purposes. Some of these uses are obvious and already in place while there are surely other and unknown uses that can be explored. Some examples are as follows.

An increased knowledge about AIS generally leads Counties and Lake Associations to increase launch site monitoring which means an increase in funding is needed. There is also a need to monitor AIS across lakes through a lake wide monitoring program. Such program needs to be coordinated to be effective, so leadership is necessary either by qualified volunteers or the hiring of a contractor. Many Lake Associations are starting to develop a volunteer-based monitoring program. However once AIS presence is identified it generally becomes more likely that there will be a need to periodically hire a qualified consultant to survey a lake for specific AIS introductions and identify possible control treatments.

Lake fisheries are generally monitored by DNR Fisheries and if there is a specific concern, they may try to address it with fish stocking or changes in fishing regulations (size limits, creel limits and seasonality) There are recent examples (Garfield Lake – panfish size decreasing over time) where a LA might specifically request the DNR address a local concern.

Lake water quality changes over time are generally slow unless there is a specific new input/inflow to the lake usually from identified sources such as a change/increase in agricultural intensification, clearing of natural forests/wetlands for economic development, etc. A recent goal-setting standard for lake watersheds is for 75% of the watershed. Fisheries research shows that healthy watersheds with intact forests are fundamental to good fish habitat and that conservation easements and other land protections on sensitive shoreland and private forests are an effective approach to protecting water quality. Kabekona Lake is the first Hubbard County Lake to achieve this standard. (Clean Water Critical Habitat Program - Northern Waters Land Trust)

Whatever the data > information > knowledge scenario a key step for the actors (government, lake associations, etc.) is to make knowledge available in a clear, concise format to all interested parties. This can be done via news stories, government announcements (county, DNR, etc.), and lake associations newsletters/annual meetings. Lake associations are particularly important in these knowledge transfers because they are non-government and may relate better to their members, non-members, lake visitors, etc. This sharing of knowledge may lead to how discussions on how it can used to benefit the lake and possibly start a discussion on proposed decisions regarding actions to be proposed and rules make.

Finally, thinking about the governance of lakes, LAs should consider the various activities that already take place that impact their lakes. Anglers and boaters are already licensed. Boat inspections have become a reality for public launch sites to monitor for AIS and 'control' access. Laws like Shoreland Ordinances regulate lake shore development. LA's collect dues and raise monies for AIS inspections, monitoring and treatments. There are surely other examples but the fact is that governance is a part of the co-management of lakes by the various players associated with any lake.