

A photograph of a sunset over a large body of water, likely Lake Manitoba. The sun is a bright, glowing orb on the horizon, casting a long, shimmering path of light across the water's surface. The sky is filled with soft, orange and yellow hues, with some light clouds. In the foreground, there is a dark, rocky shoreline with some sparse vegetation.

Lake Manitoba Stewardship Board

Science Workshops Report

Delta Marsh Field Station

May 12, 2008

St. Laurent

June 24, 2008

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Introduction

On 27 February 2007, the Honourable Christine Melnick announced the formation of the Lake Manitoba Stewardship Board. Formation of this Board was recommended by the Lake Manitoba Regulation Review Advisory Committee (LMRRAC), which functioned between 2001 and 2003.

It is within the Lake Manitoba Stewardship Board's (LMSB) terms of reference "to advocate long-term monitoring and research on the water levels and the health of Lake Manitoba, Lake Pineimuta and Lake St. Martin, including coastal marshlands along these water bodies." To achieve this, the LMSB requires a solid foundation of knowledge on the Lake.

The LMSB held Science Workshops on May 12, 2008 and the June 24, 2008 to establish what is known about Lake Manitoba and also to identify knowledge gaps. To effectively manage the lake, the LMSB must understand how the lake may be affected by climate change and associated changes in water supply, lake level regulation, invasive species, present and future agricultural and residential land use in the watershed, and other potential threats to water quality and fisheries.

The Board invited technical experts (Appendix A) from a wide range of fields including remote sensing, water quality, hydrology, fisheries, farming and cottage development to the Science Workshop. Invited experts were from federal, provincial, academic and non-government organizations. The meeting was facilitated by the Chair of the Lake Manitoba Stewardship Board, Gordon Goldsborough.

The Science Workshop focused on a number of topics including remote sensing, water quality, hydrology, wetlands, farming and cottaging.

Remote Sensing & Satellite Imagery

In a presentation to the Board, Greg McCullough (Center for Earth Observation Science, University of Manitoba) suggested that data on the magnitude, frequency, and extent of algal blooms, suspended sediment concentrations, carbon concentrations, and surface temperature could be obtained through remote sensing and satellite imagery.

McCullough also explained that the rate of evaporation could be calculated with data collected from remote sensing. Evaporation rate is a vital piece of information required to prepare a detailed water budget for Lake Manitoba. Satellite images and remote sensing allow good estimates of water quality.

Satellite imagery is currently being used to determine concentrations of algae and suspended sediments in Lake Winnipeg. McCullough indicated that these types of images could also be used to estimate concentrations of algae and suspended sediments in Lake Manitoba but that appropriate algorithms would need to be developed.

Manitoba Water Stewardship discussed the possibility of assessing these images on a regular basis to provide more routine, spatial information on the concentration of algae and suspended sediments. For this to transpire, further discussions between McCullough, Manitoba Water Stewardship and Manitoba Conservation's Geomatics Branch are required.

Shoal Lakes Drainage Proposal

In a presentation to the Board, Frieda Krpan (Vice-Chair – Board of Directors, Manitoba Agricultural Services Corporation) provided information on the Shoal Lakes Drainage Proposal to divert water from the Shoal Lakes into Lake Manitoba via a drainage channel. Krpan claimed that a number rural municipalities have been continuously draining into the lakes, and that grazing cattle have direct access to the lakes. Krpan

proposed that as a result of these activities, the water quality in the Shoal Lakes has declined.

Krpan argued against the Shoal Lakes Drainage Proposal, due to the potential decline in water quality in Lake Manitoba, the possible introduction of invasive species, and the potential for increases in lake levels.

Krpan suggested that an economic assessment would be less costly than an environmental assessment, and would demonstrate that the Shoal Lakes Drainage Proposal is not feasible.

Drainage

Agriculture and other developments have impacted the rate at which drainage around the lake has changed. The drains in Manitoba have been mapped and classified by habitat type (Fisheries & Oceans, unpublished data). In the same study, water quality in the drains was assessed. The results of this study have not yet been published. This information is vital to the understanding of changes in Lake Manitoba and its watershed over the past century.

Water Quality

Water quality is the physical, chemical and biological characteristics of water in relation to a set of standards. The water quality dataset for Lake Manitoba is fairly limited. In partnership with staff at the University of Manitoba Delta Marsh Field Station, Manitoba Water Stewardship has monitored water quality monthly since 1991 at a station located 1 km offshore from the Delta Marsh Field Station. Since 2004 and 2006, the province has also monitored water quality quarterly at Lake Manitoba Narrows and

at the outlet of Lake Manitoba at the Fairford River respectively. In addition, a recent Masters Thesis project by Elaine Shipley (University of Manitoba) has contributed to the current understanding of water quality in Lake Manitoba. It was agreed that a commitment to long-term monitoring of water quality is important.

Lake Manitoba is generally well mixed, so depth gradients are not expected; surface water quality monitoring should be sufficient. Further investigation and discussion will be required to determine the variables that should be assessed and whether flow data should also be collected. The value of using volunteers to collect water samples was recognized, given the large size of the lake. Volunteer citizens and fishers could help to collect samples if standard protocols and training were provided. The use of volunteers is often cost effective and improves the connection between local residents and their interests in the lake health.

More information is required on the impacts of the operation of the Portage Diversion on water quality in Lake Manitoba. For example, the south basin of Lake Manitoba seems to be becoming less saline and it has been speculated that this is due to the operation of the Portage Diversion. The Portage Diversion has operated 23 times since its completion in 1970.

Paleolimnology could be used to hindcast historical phosphorus and nitrogen concentrations and the trophic status of Lake Manitoba. Since the sediment in Lake Manitoba is often resuspended, the cores would probably indicate changes over decades and not years. Since paleolimnology and the associated coring can be very expensive, it may be appropriate to start with a smaller scale study on one or two cores. Further studies could be undertaken, if required, based on the results from the initial cores.

The landscape surrounding Lake Manitoba has changed substantially over the past 130 years, greatly impacting the water quality of the lake. Due to the potential impact of drains, it may be important to determine the number of drains per square kilometer in the Lake Manitoba watershed. A 2005 report titled *Summary of Resources and Land Use Issues Related to Riparian Areas in the Lake Manitoba Watershed Study Area* by Agriculture and Agri-Food Canada – Prairie Farm Rehabilitation Administration looked at land use change around the south basin of Lake Manitoba from 1992 to 2003. This report may assist in quantifying the increase in drainage surrounding the lake. The Dominion Land Survey Maps for the Red River Valley, south of Winnipeg were shown to the Board and guests. A comparison of wetland coverage between 1870s and mid-1990s showed that the amount of wetland coverage has decreased immensely (Irene Hanuta, *Land Cover and Climate for Part of Southern Manitoba: A Reconstruction from Dominion Land Survey Maps and Historical Records of the 1870s*, PhD Dissertation, University of Manitoba, 2006).

Hydrology

Since the late 1800s, attempts have been made to control the water level of Lake Manitoba, in response to high lake levels in the early 1880s, low levels in the 1930s, and high levels in the mid-1950s. The lake is currently regulated by the Fairford River Water Control Structure (FRWSC) which was installed in 1961. In 1961, operating rules were put in place to regulate the elevation of Lake Manitoba to 810.87 – 812.87 ft with a target elevation of 812 ft. In 2003, the LMRRAC recommended that the provincial government allow the lake levels to fluctuate more to protect the marshlands surrounding the lake. Lake Manitoba is now permitted to fluctuate naturally between 810.5 and 812.5 feet above sea level. This is a result of Manitoba Water Stewardship accepting the recommendation made by the LMRRAC in 2003.

A number of knowledge gaps on hydrological issues in Lake Manitoba were identified. The lack of a detailed water budget makes it difficult to understand water flows and water quantity in the lake. There is also a lack of information on water flow through the Lake Manitoba Narrows and the water exchange between the north and south basins of the lake. The largest inflows and outflows from the lake occur in the north basin, however, it is not known to what extent water from the south basin mixes with water from the north basin. Finally, attempts to model Lake Manitoba would benefit from an accurate bathymetric map, but it is not known if one exists. Hydrographic maps were generated for Lake Manitoba in the mid 1980s. These maps could be digitized and worked into contours to obtain more accurate bathymetry for the lake. Manitoba Water Stewardship will follow up with other provincial agencies such as the Geomatics Branch to see if other bathymetric information exists for Lake Manitoba.

Fisheries

The Lake Manitoba fishery is the largest winter fishery in the province and the third most important fishery in the Province of Manitoba.

The group suggested that the natural spawning habitat surrounding the lake may not be sufficient to support the modern fishery. To support the fishery, hatcheries in St. Laurent, Swan Creek and Lonely Lake are used for restocking the lake with walleye. Anecdotal evidence from Lake Manitoba fishers indicate that when the lake water levels are higher, there is often a better yield. Higher water levels may improve accessibility of the lake to the hatchlings, such that they do not get caught inland during high spring run-off.

The Fairford Fishway may be impeding the passage of fish from Lake St. Martin and the Dauphin and Fairford Rivers into Lake Manitoba as well as in the opposite direction. In

October of 2007, North/South Consultants completed a study of the Fairford fishway, which was criticized as too short and open-ended. It was suggested that a spring study on the fishway would be critical to better understand the effects that the fishway has on the movement of fish. The fishway is often clogged with debris that impedes fish passage and only a certified hoist operator can remove the debris. This debris can sit for a lengthy period of time before being removed since someone from Winnipeg or Dauphin must come out to operate the hoist. Training local residents as hoist operators would allow the fishway to be cleared in a timely manner, thus reducing the impact on the movement of fish.

The group stressed the importance of knowing whether the Lake Manitoba fishery is sustainable. It was indicated that fisheries management in Manitoba is based on maximum sustainable yield (MSY). Obtaining the history of index netting on Lake Manitoba in conjunction with a summary and interpretation of the data is essential.

The group indicated a lack of knowledge regarding fish habitat surrounding Lake Manitoba. The impacts on fish habitat as a result of the building of stream crossings and the straightening of streams due to agriculture are not well known around Lake Manitoba (Rod Drummond, Fisheries & Oceans). It is known that in some instances, these practices, as well as beaver dams and lodges, can result in loss of fish habitat. Improved enforcement of Best Management Practices (BMPs) for stream crossings is expected as a result of an increase in fisheries officers in Manitoba.

Wetlands

Wetlands are among the least studied aquatic ecosystems in the province, with almost no ongoing long term monitoring. There is an estimated 236, 700 hectares (ha) of marshland in the area surrounding Lake Manitoba, Pineimuta Lake and Lake St. Martin,

with more than 121, 400 of those hectares having high to moderate capability of supporting waterfowl. Since Lake Manitoba is surrounded by an abundance of marshland it is vital to learn about the interrelatedness of the marshes and the lake. Wetlands are water bodies that require variation in water level for marsh regeneration and to support and maintain aquatic life. Variation in water levels on Lake Manitoba is important for maintaining the health of marshes and wetlands surrounding the lake. Wetlands and marshes are an important source of native hay and provide grazing, for cattle and are therefore of economic importance as well.

Wildlife

Marshlands surrounding the lake provide vital habitat for a variety of species. Invasive species present a risk to native species in the lake and the marshlands that surround it. The invasive species of most concern to the group was carp. Carp have completely altered many of the marshes and wetlands surrounding Lake Manitoba, therefore affecting many other species including muskrats and waterfowl.

The effect of carp on wetlands and marshes is well demonstrated in the Lake Francis management area, where carp have uprooted many native plant species and destroyed habitat for water fowl, muskrats and various invertebrates. When water levels on Lake Manitoba were high an emergency discharge channel was built on Lake Francis, which allowed passage of carp into the Lake Francis management area (Greg Sugget, Manitoba Conservation). Hunters and trappers from the area have voiced their concerns regarding the channel, associating the channel with the disappearance of waterfowl and muskrats in the area. In 2005 Manitoba Conservation placed screens on the culvert that links the channel to Lake Francis in order to prevent the carp from entering Lake Francis. Shortly after installing the screens, the waterfowl and muskrat populations rebounded to what they were prior to the channel being constructed (Greg Sugget, Manitoba Conservation).

Farming

Agriculture surrounding Lake Manitoba is greatly influenced by the soil capability and limitations imposed by natural conditions. Agriculture varies markedly from south to north along the lake. Approximately 40 percent of the total acreage of the farms adjacent to Lake Manitoba consists of lands from which native hay is harvested. The remaining acreages on these farms are predominately used for pasture.

Agricultural activities have been underway in the Lake Manitoba watershed for the last century and during this time the landscape has changed immensely. Cattle ranching dominates agriculture along Lake Manitoba. Due to economic conditions, cattle ranching is becoming less profitable, which may lead to a change in the type of farming around the lake and therefore associated changes on impacts to Lake Manitoba. The land north of Lundar and Amaranth is not suitable for crops so cattle ranching will likely continue in that region and will continue to be sustainable in the long term. The group emphasized that the LMSB needs to stay informed of changing agricultural practices since this may lead to a change in the composition of run off that enters the lake. This may include increases in pesticides, nutrients and suspended solids. Manitoba Water Stewardship currently monitors pesticide concentrations at long-term monitoring stations across Manitoba including sites within the Lake Manitoba watershed. The group expressed a desire to obtain further information on the use of pesticides throughout the watershed.

There are incentives, such as the Environmental Farm Plan, that are important in encouraging farmers to improve their practices to reduce potential impacts on water quality. An example of an improved practice is to fence off water ways and instead use solar powered water pumps to water livestock.

Cottaging

There are approximately 2,000 cottage properties along the shores of Lake Manitoba. Although cottaging is an important use of the Lake Manitoba shoreline, recreational activities can impact water quality and quantity. The group stressed the importance of advocating water conservation to the local cottage associations. Seasonal cottages are becoming full-time residences, leading to higher water use year round and potentially resulting in greater impacts on the lake and local resources. It is important to ensure that appropriate wastewater treatment technologies are employed by cottagers, and also to have sufficient enforcement to ensure that treatment is adequate. The group expressed an interest in surveying cottages surrounding the lake in order to compile information of water and land use.

Development around Lake Manitoba is occurring at a rapid rate. The LMSB should keep informed about proposed development projects around the lake, since this will affect many of the issues discussed at the Lake Manitoba Science Workshop.

Conclusion

The LMSB is the most recent government appointed group to examine Lake Manitoba and the impact on the land and water courses downstream of the Fairford River Water Control Structure. Through discussions at the May 12, 2008 and June 24, 2008 Science Workshops, the Board has become aware of a number of facts or findings related to Lake Manitoba and areas downstream. The Board established what is known about Lake Manitoba and has also identified knowledge gaps.

Established Knowledge

- Lake Manitoba is quite shallow and well mixed, so surface water sampling is probably adequate.
- The major input and output of Lake Manitoba are both located in the North basin.
- Drainage surrounding the lake has changed due to development and this has increased the rate, composition and quantity of run-off each spring.
- Lake levels have been regulated by the Fairford River Water Control Structure since 1961.
- Lake levels must be allowed to vary to maintain healthy marshes that surround the lake.
- Carp are detrimental to marshlands and species that inhabit them.
- Lake Manitoba has the largest winter fishery in the province; however the natural spawning habitat may not be sufficient to support the modern fishery.
- The construction of stream crossings and straightening of streams reduces and obstructs fish habitat.
- Approximately 40 percent of the total acreage of the farms adjacent to Lake Manitoba consists of lands from which native hay is harvested. The remaining acreages of these farms are predominately utilized for pasture.
- Environmental Farm Plan offers farmers incentives to farm sustainably around the lake.
- The number of cottages surrounding the lake is increasing and more of them are becoming full-time homes.
- Development surrounding the lake will continue to impact it.

Knowledge Gaps Identified

- There is no detailed water budget for Lake Manitoba, but satellite imagery could be used to estimate such parameters as evaporation.
- Does a lake bathymetric map exist in a digital format?
- How much water flows through the Narrows and to what extent is water exchanged between the North and South basins?
- It is speculated but not known to what extent the input from the Portage Diversion impacts the south basin.
- What are the impacts of land drainage on water quality and quantity? Can drain classification data help us to better understand the impacts of land drainage?
- Could a paleolimnological investigation of Lake Manitoba provide useful information?
- Do higher lake levels improve its accessibility to fish hatchlings in the spring?
- Does the Fairford fishway impede the passage of fish?
- How sustainable is the Lake Manitoba fishery?
- Do inputs of marsh water have an impact on lake water quality?
- Do pesticides used on farms surrounding Lake Manitoba enter the lake?
- What types of wastewater treatment are required in different areas surrounding the lake?
- What future developments will occur around the lake and what are their potential impacts?

Appendix A: Attendees

Lake Manitoba Stewardship Board

Gordon Goldsborough (Chair)
Bill Finney
Allan Gaudry
Donald Smith
David Milani
Rae Trimble-Olson
Linda Schroedter
Tracy Fillion
Dan Coyle
Gary Morlock
Bob Harrison
Laura Manson (Technical Secretariat)

Technical Experts

Dwight Williamson (Manitoba Water Stewardship)
Elaine Shipley (Manitoba Water Stewardship)
Nicole Armstrong (Manitoba Water Stewardship)
Greg McCullough (University of Manitoba)
Don Sexton (Ducks Unlimited)
Pascal Badiou (Ducks Unlimited)
Greg Bruce (Ducks Unlimited)
Chelsey Lumb (Manitoba Water Stewardship)
Glen Sugget (Manitoba Conservation)
Rod Drummond (Fisheries & Oceans Canada)
Frieda Krpan (Manitoba Agricultural Services Corporation)