A Shoreline Survey of Douglas Lake

Tip of the Mitt Watershed Council

2002

Introduction

A shoreline survey to identify locations of Cladophora growth and other shoreline features was conducted on Douglas Lake by the Tip of the Mitt Watershed Council in July 2002.

Cladophora is a branched, filamentous green algae that occurs naturally in small amounts in Northern Michigan Lakes. Its occurrence is governed by specific environmental requirements for temperature, substrate, nutrients, and other factors. It is found most commonly in the wave splash zone and shallow shoreline areas of lakes, and can also be found in streams. It grows best on stable substrates such as rocks and logs. Artificial substrates such as concrete or wood seawalls are also suitable. The preferred water temperature is 50 to 70 degrees Fahrenheit. This means that late May to early July, and September and October are the best times for its growth in Northern Michigan lakes.

The nutrient requirements for Cladophora to achieve large, dense growths are greater than the nutrient availability in lakes with high water quality, such as Douglas Lake. Therefore, the presence of Cladophora can indicate locations where relatively high concentrations of nutrients, particularly phosphorus, are entering a lake (it has less usefulness as an indicator of nutrient pollution in streams). Sources of these nutrients can be due to natural conditions, including springs, streams, and artesian wells that are naturally high in nutrients due to the geologic strata they encounter; as well as wetland seepages which may discharge nutrients at certain times of the year. However, past experience has shown that the majority of Cladophora growths can be traced to cultural sources such as lawn fertilization, malfunctioning septic systems, poor agricultural practices, soil erosion, and wetland destruction. These nutrients can contribute to an overall decline in lake water quality. Additionally, malfunctioning septic systems pose a potential health risk due to bacterial and viral contamination.

A Cladophora survey can be a valuable lake management tool. Coupled with follow-up on-site visits and questionnaires, controllable sources of nutrients to the lake can be identified. Subsequently, a reduction in nutrient loading and other forms of pollution can often be achieved by working with homeowners to solve problems. These solutions are often simple and low cost, such as regular septic system maintenance, proper lawn care practices, and preservation or establishment of a greenbelt along the shoreline. Prevention of problem situations can also be achieved through the publicity and education associated with the survey.

The 2002 project is the first systematic lake-wide survey conducted on Douglas Lake since 1988. Periodic repetition of shoreline algal surveys are important for identifying chronic problem sites as well as recent occurrences. They are also valuable for determining long term trends of near shore nutrient inputs associated with land use changes, and for assessing the success of remedial actions.

Methods

The shoreline was surveyed to develop a database of property parcel features and their description as viewed from the water. Property features include developed platted lots, undeveloped (vacant) lots, large undeveloped parcels, parks, preserves, public access sites, and county road endings. However, it was not possible to identify every distinct parcel in this manner.

For the purposes of this survey, developed means the presence of buildings or other significant permanent structures. Included are roadways, boat launching sites, and recreational properties

(such as parks with pavilions and parking lots). Properties with only mowed or cleared areas, seasonal structures (such as docks or travel trailers), or unpaved pathways were not considered developed. Additionally, relatively large parcels which may have development in an area far from the water's edge were not considered developed. The length and area of developed versus undeveloped shoreline was not calculated.

The database field containing the property description contains a sometimes cryptic descriptive phrase up to 50 characters long. For example, *1stsmGry, wh tr, blk sh, rb chm, dck* means that the property has a small one-story gray house with white trim, black shutters, a red brick chimney, and a deck. There is a key to the abbreviations included at the end of the database. Database fields were created for names of property owners and shoreline address of properties, however, few entries were made. This information can be gathered and added at a later time.

The shoreline was also closely inspected for Cladophora growths by traveling in a small boat as close to the shoreline as possible (usually within 20 feet). The Cladophora growths observed were described by estimating the length (feet) of shoreline covered and the density or amount of available substrate that was utilized. Categories and densities are as follows:

Very Light (VL) ..... up to 25% coverage
Light (L) ..... 25-49% coverage
Light to Moderate (LM) ..... 50-59% coverage
Moderate (M) ..... 60-74% coverage
Heavy (H) ..... 75-99% coverage
Very Heavy (VH) ..... 100% coverage

For example, if Cladophora covered half the rocks along a 25 foot length of shoreline, it would be described Mx25.

Although the size of the growth on an individual basis is important in helping to interpret the cause of the growth and the severity of the problem, growth features of Cladophora are greatly influenced by such factors as current patterns, shoreline topography, size and distribution of substrate, and the amount of wave action the shoreline is subject to. Therefore, the description has limited value when making year-to-year comparisons at a single location or estimating the relative amount of shoreline nutrient input. Rather, the presence or absence of any significant growth at a single site over several years is the most valuable comparison. It can reveal the existence of chronic nutrient loading problems, and help interpret the cause of the problems and assess the effectiveness of any remedial actions. Comparisons of the total number of algal growths can reveal trends in nutrient input due to changing land use.

Many species of filamentous green algae are commonly found growing in the near shore regions of lakes. Positive identification of these species usually requires the aid of a microscope. However, Cladophora usually has an appearance and texture that is quite distinct to a trained surveyor, and these were the sole criteria upon which identification was based.

Other species of filamentous green algae can respond to an external nutrient source in much the same way as Cladophora, although their value as an indicator species is not thought to be as reliable. When other species occurred in especially noticeable, large, dense growths, they were recorded on the survey maps and described the same as those of Cladophora.

Among other things, the distribution and size of each Cladophora growth is dependant on the amount of suitable substrate present. The extent of suitable substrate should therefore be taken into account when interpreting the occurrence of individual growths, and assessing the overall distribution of Cladophora along a particular stretch of shoreline. The type of substrate present in front of each property was recorded during the survey. Substrates were broadly grouped into five categories: rocks, rock-sand mixture, sand, muck-sand mixture, and muck.

Tributaries are one of the primary conduits through which water is delivered to a lake or river from throughout its watershed. Tributaries also carry and deliver a variety of materials from throughout the watershed to the receiving water. This can include pollutants such as sediment, nutrients, bacteria, and toxins from human activities far removed from a lake or river. Since tributary streams, even very tiny ones, were readily apparent during the survey, their locations were also added to the database.

The preservation or establishment of a shoreline greenbelt (also known as a vegetated buffer strip) is considered one of the most important shoreline management techniques. A greenbelt is a strip of diverse vegetation, either naturally growing or planted, along the shoreline of a lake or stream. It usually consists of a mixture of trees, shrubs, ground cover, and wildflowers. Greenbelts minimize polluted runoff, reduce the need for lawn maintenance (including pesticide and fertilizer applications), remove nutrients from septic systems and other sources, strengthen shoreline soils and help prevent erosion, are attractive, offer privacy and dampen sound, attract wildlife, can help save energy, discourage congregations of waterfowl, and may increase property values. Mowed turf grass usually stands in stark contrast to a diverse, well-functioning greenbelt.

Information on the presence or absence of a shoreline greenbelt was also compiled during this survey. The presence and characteristics of a shoreline greenbelt was described using an index with three basic categories:

> **2.5-3.0 Excellent.** Very little disturbance of the natural vegetation outside the "footprint" of the house, especially along the shoreline (including emergent rushes and other aquatic vegetation). These properties have the appearance of a cottage tucked into the woods, and are often difficult to observe from the water during the growing season. This is the best category, one that property owners should strive to attain to ensure maximum water quality protection and biodiversity.
>
> **2.0-2.49 Good.** Although significant areas of natural vegetation remain, large areas have also been converted to lawn or other uses, especially along the shoreline. Properties in this category are generally doing a good job of managing their shoreline with respect to water quality protection, but there is room for improvement.
>
> **1.0-1.99 Poor.** The shoreline has mostly been converted to an urban setting, with little natural or woody vegetation remaining along the shore. These properties are most likely contributing nutrients from surface runoff and could use improvement.

Results and Recommendations

The survey identified approximately 341 property parcels. These included several large parcels, especially the University of Michigan Biological Station (UMBS), which contains approximately 48% of the Douglas Lake shoreline. The UMBS parcel included a large portion of shoreline on the eastern half of the lake as well as the area around Maple Bay and a small parcel of land in the northwest corner in Marl Bay. The properties on Pell's Island were also included in the survey. Also included were three road endings, one offering public access to the lake. Of the total property parcels recorded and excluding the undeveloped parcels of the UMBS, approximately 306 (or 90%) were developed.

Habitat generally considered suitable for Cladophora growth was present at 147 properties (48%). Noticeable growths of Cladophora or other filamentous green algae were found in 54 locations (slightly more than one-third of the properties). Numbers of each type of Cladophora growth are as follows:

Very Light	17
Light	21
Light to Moderate	3
Moderate	10
Moderate to Heavy	3
Heavy	6

Most of the Cladophora growths were associated with developed shoreline properties. Although some of the algae growths are undoubtedly associated with septic system leachate or other factors associated with development and human activities, most of the growths are in the very light or light category and few severe water pollution problems were evident along the Douglas Lake shoreline. However, the cumulative impact of many slight problems can be significant.

The shorelines of approximately 8.5% of developed properties were in the excellent greenbelt category, while 4% were in the good category. Most developed properties (87.5%) were in the poor category.

The attached database report contains a sequential listing of properties (as well as all the other information described) beginning at the public boat launch at the end of Bryant Road, and traveling clockwise around the entire perimeter of the lake. The Pell's Island properties are included at the end of the survey. Those properties were surveyed beginning in the southwest corner of the island and traveling in a clockwise direction.

The full value of a shoreline survey is only achieved when the information is used to educate lakefront property owners about preserving water quality, and to help them rectify any problem situations. A follow-up effort of this nature has occurred on several other lakes where the Watershed Council has conducted shoreline surveys. The following follow-up actions are recommended:

1. Keep the specific results of the survey confidential--in other words, do not publish a list of sites where Cladophora growths were found.

2. Send a general summary of the survey results to all shoreline residents, along with a packet of informational brochures produced by the Watershed Council and others to provide information about practical, feasible, effective actions to protect water quality.

This would cost approximately $5 to $25 per household, depending on complexity and type of materials distributed.

3. Inform those owners of properties with Cladophora growths of the specific results for their property, ask them to fill out a questionnaire in a attempt to interpret causes of the growth, and offer individualized recommendations for water quality protection. Following the questionnaire survey, site visits coupled with ground water testing are sometimes preformed in an effort to gain more insight into the nature of the findings. Again, it should be stressed that all information regarding names, specific locations, and findings be kept confidential to encourage property owner participation in this project.

4. Repeat some version of the survey periodically (every five years or so), coupled with the follow-up mailings described previously, in order to promote water quality awareness and good management practices in an ongoing basis. During each subsequent survey, more information about shoreline features could be added to the database. The database will greatly facilitate future surveys, resulting in a reduction of staff hours needed for repeating the survey, and can be utilized for other water resource management applications.

5. Compile more accurate parcel and ownership information for the shoreline database from either the Cheboygan County Equalization Department, or based on the knowledge of Association members or shoreline residents. When this information is added to the database, it will facilitate identifying the locations of Cladophora growths during repeat shoreline surveys and making property owner contacts. It will also be useful for empowering the lake association to monitor shoreline activities and recruit new members, and compiling and managing other water resource information. This task could also easily be accomplished by Lake Association volunteers, or be completed by Watershed Council staff.

6. Create good quality maps showing property parcels, Cladophora locations, and other resource information. Eventually, the shoreline database developed for this survey could be linked with a Geographic Information System to create this type of map. The database could also be expanded to include other shoreline features such as public access sites, shoreline erosion, wetlands, aquatic plants, and type of bottom substrate.

DOUGLAS LAKE RECOMMENDATIONS

ROAD/STREAM CROSSINGS

- Reduce the amount of sediment by establishing a road/stream crossing improvement program designed to correct identified problems
- Repair/improve crossing Douglas Lake sites recommended for treatment: 141M (McClouth Rd.) and 148M (Silverstrand Rd.)

AGRICULTURE

- Restrict livestock access to the rivers and streams; install corrective measures to reduce runoff at agricultural sites of concern; create site plan for site recommended for treatment: A128

SHORELINE

- Educate public on identification of Cladophora growths, what they indicate
- Send a general summary of the survey results to all shoreline residents, along with a packet of informational brochures to provide information about effective actions to protect water quality.
- Inform owners of properties with Cladophora growths of the specific results for their property
- Ask riparian landowners to fill out a questionnaire in an attempt to interpret cause of the growth; offer individualized recommendations for water quality protection.
- Repeat the survey periodically (every five years or so), coupled with the follow-up mailings in order to promote water quality awareness and good management practices in an ongoing basis.
- Create good quality maps showing property parcels, Cladophora locations, and other resource information by linking the shoreline database to a Geographic Information System

GENERAL EDUCATION

- Develop and assemble an Develop brochures and/or information packets that explain the importance of controlling livestock access, establishing fencing, and creating proper stream crossings for agricultural operations; include available funding sources. Develop educational packets that cover such topics as septic maintenance, developing and maintaining greenbelts, and proper fertilization application for riparian landowners. Distribute information at fairs, trade shows, and agriculture related events.
- Promote responsible use of access sites
- Develop and implement school programs concerning water quality education; make SEE-North's water quality testing kits available for classrooms and establish interactive database to which students can enter classroom data
- Facilitate participation by students in conference at U. of M. Biological Station (The conference focuses on interpreting data and reflecting on the role of inquiry in learning. Students are also introduced to potential careers in water resources and tour a facility that is actively engaged in aquatic research and water resource management. Students may explore water resources through pond studies, stream studies or in-class freshwater aquaria.)
- Conduct a water resource curriculum review: Review and compile existing instructional materials for students that focus on water resources. With input from teachers, modify selected materials in ways that make these more locally relevant
- Compile an on-line resource library for teachers on SEE-North's website for teachers; establish an on-line learning community of people involved in water resources
- Develop a lesson study project (For teachers from similar grade levels who wish to use the same instructional materials related to water resources. Teachers meet several times and 'dissect' a particular lesson about water resources. One teacher volunteers to teach the lesson while other participants observe that teacher's class. Then the group meets again to share impressions from the observation and revise the lesson. Another teacher then volunteers to teach the lesson and other teachers in the group observe. The group then meets a second time to discuss the classroom observation and revise the lesson a second time. Lesson study is a powerful form of professional development for teachers, and is one of the professional development strategies used in Japan's educational system.)

Separate Handout

Septic System Inventory

The health of a watershed is influenced by the state of the septic and sewer systems within its boundaries. When a septic system malfunctions, bacteria and nutrients are released and may contaminate the lakes, streams or groundwater of the watershed. Poorly installed or improperly sited systems, and older systems that were installed prior to the adoption of current zoning ordinances are potential contributors of this type of non-point pollution. Another problem for the watershed is the conversion of seasonal homes to year round use without updating or expanding existing systems. The increased load may cause septic system failure and as a result, contaminate area wells and waterbodies.

An inventory of septic systems within the Cheboygan River/Lower Black River Watershed was conducted by NEMCOG in the spring of 2003. Information on septic systems was compiled using data obtained from various sources such as the Emmet County and the Cheboygan County Health Departments, U.S. Bureau of Census, The Environmental Protection Agency, and the Department of Environmental Quality. By comparing data from these various sources and **Map 4: Septic System Constraints,** it was possible to discern generally which areas have the oldest systems, which are being heavily developed and areas that are most susceptible to septic problems and therefore least suitable for increased development.

Results of the inventory show that the watershed is almost entirely under severe septic system constraints. The cause for severity varies from section to section, and even from parcel to parcel. In the western portion of the watershed, particularly in Carp Lake and McKinley Townships, large areas are covered by hydric soils, which are saturated for most of the year. When soils are too wet, oxygen is not available for organisms that break down waste. Thus, septic systems constructed in hydric soils may not operate properly during wet seasons, resulting in groundwater contamination.

Hydric soils and areas of wetness also impact the effectiveness of septic systems in the eastern half of the watershed. In addition, much of this area is covered by sandy soils, which are poor filtering agents. These soils are mainly located on Mackinaw State Forest land where development isn't an issue. Several severe septic system constraints exist in Inverness Township. Along with areas of sandy soils, the Township has several sections adjacent to the Cheboygan River where severe constraints are due to wetness (see **Map 4**). These sections have seen steady development over the last thirty years. In addition, **Table 16** Shows that the Township has a substantial number of homes that were built prior to 1970, before current zoning ordinances were in place. Continued development combined with a large number of older systems create a potential risk to the future health of the watershed.

Munro Township in Cheboygan County is another area that bears watching. This Township has a large number of septic systems that were installed prior to 1970. While development has been light in much of the Township, some areas such as Section 9 adjacent to Munro Lake, and Sections 17 and 18 adjacent to Douglas Lake have seen substantial growth. Here again, the combination of older systems, heavy development, hydric soils and poor filter material create a potential problem for the watershed.

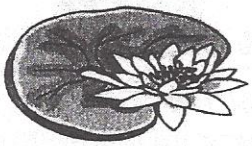
TABLE 16: SEPTIC SYSTEM INVENTORY

Township	Total Septic Systems	Installed 1970-2003	Installed before 1970
ALOHA	434	336	98
BENTON	1461	634	827
GRANT	838	388	450
INVERNESS	1215	678	537
MUNRO	637	217	420
CARP LAKE	711	516	195
McKINLEY	490	567	77

Nearly all of the lands designated residential or agricultural for the watershed lie within areas of severe septic constraints due to hydric, wet, or poor filtering soils, as can be seen when **Map 4: Septic Constraints** is compared to **Map 3: Land Use**. If the trend of expanding residential areas continues as more and more agricultural lands are parceled out for development, increased potential for contamination to the water supply is inevitable. Septic system and soil constraints will need to be considered carefully in any future development in these areas and great care will need to be taken to ensure the continued health of the Cheboygan River/Lower Black River Watershed.

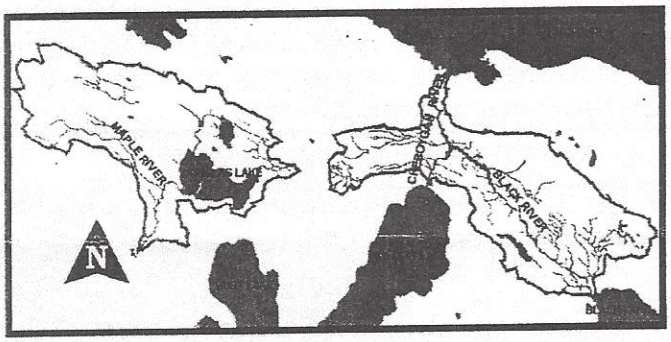
CHEBOYGAN RIVER/LOWER BLACK RIVER WATERSHED INITIATIVE NEWSLETTER

SUMMER 2003

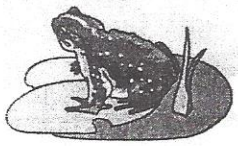


WHAT IS THE WATERSHED INITIATIVE?

The Watershed Initiative is a project funded by the Department of Environmental Quality. The purpose of the project is to develop a nonpoint source pollution management plan for the Cheboygan River/Lower Black River Watershed. The watershed area contains over fifty lakes and streams, and includes the Lower Black River, the Cheboygan River, a portion of Maple River, Cope Creek, Certon Creek, Terry Creek, Sipper Creek, Laperell Creek, Van Creek, Long Lake, Twin Lakes, and Douglas Lake.



The quality of these important waterbodies becomes increasingly at risk as development of natural areas continues and forested lands are converted to commercial and residential parcels. As these and other land use changes continue to take place, the associated pollution impacts on lakes, streams and rivers increase. By establishing goals and objectives for the watershed and by implementing *Best Management Practices* (BMPs) for the watershed critical area, the Watershed Initiative hopes to preserve high water quality today and ensure a healthy watershed for future generations.



Goals for the watershed were determined by a steering committee whose members represent various environmental and government agencies, local organizations and concerned community members. The watershed goals selected by the committee complement the seven designated uses required for all waters in the State of Michigan by The Water Resources Commission Act:

1.) Agriculture
2.) Industrial water supply
3.) Public water supply at the point of intake
4.) Navigation
5.) Warm-water fishery
6.) Habitat for indigenous aquatic and wildlife
7.) Partial or total body contact recreation

An eighth designated use, *cold water trout streams,* is applicable to a few streams and rivers in the watershed.

WATERSHED GOALS

Reduce the amount of stormwater runoff to the Cheboygan River.

Provide for the protection of the watershed through adoption and enforcement of Land Use policies and conservation practices.

Reduce the amounts of nutrients entering rivers and lakes of the watershed.

Provide for the long term protection of the watershed by addressing Land Use issues.

Involve and educate the public on actions they can take to reduce nonpoint source pollution.

Reduce the amount of erosion and sedimentation within the watershed.

Restore aquatic habitat in the watershed where impairment is suspected.

INVENTORY UPDATES

The following inventories have been completed and the information gathered will be used in the development of the nonpoint source pollution management plan.

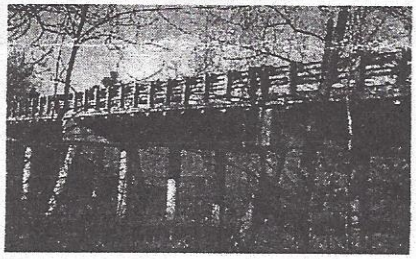
WHY INVENTORY?

Nonpoint source pollution (NPS) can find its way into a water system through various means. When streambanks and shorelines erode, sediments are deposited into lakes and rivers. Sediments and other pollutants can be washed into streams at road/stream crossings. Agricultural and residential areas contribute fertilizers and pesticides, and storm drains provide an even more direct route for pollutants to enter waterways during a storm event. To help assess the state of the watershed, inventories are needed to gather data concerning critical areas within the watershed.

AGRICULTURE

A total of 178 agricultural sites were inventoried. Each site was scored according to criteria set by the USDA-NRCS, and given a rating of **minor**, **moderate** or **severe**. The vast majority of agricultural sites in the watershed received a rating of **minor** or **moderate.** However, seven sites were rated **severe** for a variety of reasons, including cattle with access to streams and improper management of animal waste.

ROAD/STREAM CROSSINGS

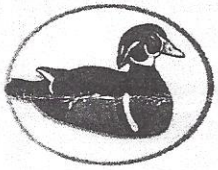


A total of 194 sites where road and stream intersect were inventoried to determine if they were contributors of NPS polution. The sites inventoried were ranked as **minor**, **moderate** or **severe** contributors of sediments to the river system. Nineteen sites were rated **minor** and 159 were given a **moderate** rating. Sixteen of the watershed's road/stream crossings ranked **severe**. Most of the severe sites were found in Inverness and Munro Townships of Cheboygan County, with only four severe sites located in Emmet County.

STORMWATER RUNOFF

Results of the studies indicate that there are 46 stormwater outfalls discharging directly to the Cheboygan River. Twenty-nine of these are part of the City's storm sewer system. Seventeen outfalls were identified as commercial/industrial, indicating that the stormwater from the commercial development along the waterfront (which is not part of the City's system) drains to the Cheboygan River. The seventeen Identified privately-owned outfalls typically drained parking areas adjacent to the Cheboygan River. It is likely that there are more of these outfalls than were discovered through the inventory process.

STREAMBANK AND SHORELINE INVENTORIES



A total of 71.2 miles of shoreline were surveyed, including shorelines of Douglas Lake, Long Lake, Munro Lake, and Twin Lake. A total of 219 erosion sites were located. Greenbelts can substantially reduce the amount of erosion contributed to a waterbody. On Douglas Lake, 87.5% of riparian homes lack an adequate greenbelt. The majority of homes on Long Lake (88.5%) and on Munro Lake (89%) have poor, or no, greenbelts. Twin Lake has the highest percentage (63%) of homes with good to excellent greenbelts, and this is reflected in its lower number of erosion sites. Fifteen streambank erosion sites were located on the rivers and tributaries of the watershed. Most sites were ranked **minor** or **moderate**, with only one erosion site requiring a rating of **severe**.

For more information on the Cheboygan River/Lower Black River Watershed Initiative, or the watershed steering committee, contact Kathryn at: NEMCOG, PO Box 457 Gaylord MI 49735 phone: (989) 732-3551 ext. 18 e-mail: karnold@nemcog.org

Cheboygan River/Lower Black River Watershed Partners: Tip of the Mitt Watershed Council * Cheboygan Conservation District * Huron Pines RC&D Council * Michigan Department of Environmental Quality * Michigan State University Extension * Little Traverse Conservancy * Douglas Lake Association * Michigan Department of Natural Resources * Northeast Michigan Council of Governments * US Fish & Wildlife Service * Michigan Groundwater Stewardship Program * Natural Resources Conservation Service * Local property owners and concerned citizens

NEMCOG

DEQ Michigan's Nonpoint Source Program