Crystal Shorelines

The newsletter of the Crystal Lake Watershed Fund

UPDATE #16 WINTER 2003

HIGHLIGHTS In This Issue:

A freshwater clam under the crystal clear water of Crystal Lake

CLWF & CLA joint venture

The boat launch issue is still with us amid many rumors. In order to maintain a factual background, the request to the DNR for a meaningful dialogue which was printed in last years UPDATE #15 is reprinted here for your review. This year marks one of the most emotional topics relative to the preservation of the lake and its character for future generations. The issue of a State sponsored and constructed public boat launch ramp has evoked strong reactions. Will the number of new boat parking spaces be ruinous for the present water quality and the extant serenity of the lake?

The CLWF and the CLA have agreed to join hands in reminding the State Government that our two organizations represent upwards of 2500 residents who care deeply about the lake.

A decision was made to tabulate a representative cross section of questions and concerns which could be sent to the DNR for their consideration and response. This list was mailed in a letter to the DNR, Parks and Recreation Bureau; the board of directors of CLWF and CLA; and the Benzie Public Record before the October 22, evening public meeting held at the Benzie Central High School. **The following is a copy of the letter; a resolution agreement of the two groups; and the introductory note to Mr. William Boik of the parks department.**

To: Mr. William Boik
State of Michigan Parks Department

Dear Bill:

Here is our short list of suggestions and ideas. Thank you for your time and interest.

Sincerely,

Crystal Lake Watershed Fund	Crystal Lake Association
R. William Decker	Ron Renner
President	President

BE IT RESOLVED THAT:

"The Crystal Lake Association and the Crystal Lake Watershed Fund support open access to Crystal Lake for fishing and recreational activities consistent with retaining the ongoing natural resource of this world class lake. The organizations support the view that the lake should be protected for the benefit of future generations of Benzie County residents and others seeking the beauty of this unspoiled environment."

Ron Renner: Pres. CLA Bill Decker, Pres. CLWF

"The Michigan DNR has been planning a new boat launch complex on Crystal Lake for several years and have considered several different sites. This year they have chosen a parcel of approximately 30 acres east of Railroad Point, and have completed preliminary drawings.

Many watershed area residents have voiced concerns over the effects resulting from such an installation. The DNR has held one public meeting and plan another, on October 22, 2002 and have invited public input as usual.

The CLWF and CLA seek assurance that the DNR/DEQ will abide by the same rules and regulations as govern public citizen's endeavors.

With a combined membership of over 2000 residents, the CLWF and CLA have joined together to help provide a response to the many questions and concerns voiced by their members and others. We feel

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CLWF & CLA Have Agreed to Join Hands for Cause

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these concerns warrant more than a brief exposure at a "town meeting", and therefore we have provided a brief outline of some of the most frequently raised issues for your consideration and response. The items listed are in no particular order and may not cover all the possible subjects.

1. Boat size:

• Provide a length limitation of 23-24 feet to reduce the danger of large heavy wakes, which may swamp canoes, kayaks and smaller craft, as well as moorings, docks and piers.

• Heavy wakes near shore can accelerate shoreline erosion. Signage and enforcement of "no wake speed" might help this.

• Provide rigorous enforcement of no toilet discharges into the lake, and possibly provide a "pump-out" station at the launch site.

• Prohibit it "camping" i.e., anchoring for the weekend, as many boats may divert to Crystal Lake on stormy days when Lake Michigan is too rough.

2. Hours of operation:

• Will there be residential compatibility? (Noise and lighting from both parking lot and boat launch ramp; early AM/late PM operations?)

3. An Environmental Impact Statement is mandatory:

• Many areas will be highlighted requiring changes, and an EIS will overlap many items already on this list. However, this list is written in nontechnical terms to aid understanding.

4. Can you resolve the dispute about the Betsie Trail rights?

5. Observe adequate storm water control to prevent excessive erosion, including retention areas as required.

6. Reconsider the size of the facility:

• Subjective reasoning is involved here. Local experience suggests that 70-80 spaces would be adequate. Later expansion might be considered, if necessary. For comparison, the Frankfort launch site is about 80 spaces.

• The implied threat of dredging concerns many. Why not take a few core samples to allay such fears, and at the same time, indicate the rough cubic yardage to be removed, depth, slope gradient, spoil discharge area, and time of channel refilling by natural forces. Who will pay for channel dredging costs, channel markers etc.?

7. Almost everyone is aware of pollution dangers from unburned fuel and oil from 2 cycle engines. This danger will not be eliminated for years, as many of these motors are still in use and will contribute to the pollution of Crystal Lake for some time to come.

8. Boat launches are closer to commercial than residential zoning designation.

• What about the Crystal Lake overlay district, and the Betsie Trail overlay, which may not permit marina designation?

• Are there special rules for the DNR/DEQ?

• Can the DNR/DEQ allow a few parking spaces for trail users?

9. Some invader species have arrived in Crystal Lake through visiting boats:

• Bilge water, bait wells, trailer frames and careless disposal of bait all contribute.

• Spraying and other methods are hopelessly inefficient as safeguards.

• More boats from various locations will likely result in more undesirable species in Crystal Lake and/or accelerate the problems associated with a strained ecology from the invaders we already have.

One of the fundamental design considerations for the size of a new boat launch is based on some notion of the carrying capacity of a lake. Thus we hear of rule-of-thumb formulas: one boat per 15 acres etc. On Crystal Lake that would equal 656 boats! We feel this and other formulae cited are not sufficiently refined to arbitrarily add more boats to a given lake. The technical revolution has also affected boats: more power, speed and larger average size has occurred, including wake boarding, knee boarding, tubing, jet skis and the like.

Whereas water skiing tends to use straight travel, wake boarding and tubing operators travel in a purposely random manner, and therefore require much more area to operate safely. Some formulae may be helpful in the future, but at present the rate of change presents too many variables which are very difficult to measure and interpret.

One the criteria to regulate boat density is the size of the lake alone. The reasoning goes that the bigger the lake, the more boats it will take. We disagree based on the explanation that Crystal lake is different than most Michigan lakes. Some of these differences are as follows:

Crystal Lake experiences almost daily, steady, high winds during the warm months due to the differences in water temperature between it and Lake Michigan. This is intensified by the geography of Crystal Lake jutting out into Lake Michigan on three sides. Early surveys found the lake to be named "Cap Lake" referring to the frequency of white caps. These same winds produce high waves and generally force most boaters to the lee shore to avoid the rough water. This action reduces the usable areas of the lake by about one-half.

Another deduction is the observed tendency of boaters to avoid the middle of the lake for most operations. This reduces further the available size of the lake. These concentrating forces tend to influence many boaters to migrate to, and stay in the sheltered side and away from the middle and windward shores.

There are no features, other than fishing, to attract boaters to cruise very much. Absent are islands, deep bays, sharp peninsulas, inlets or outlets of consequence. There is only one commercial fuel dock, which is often unusable due to high winds found there. There are no harbors, moorings, marinas, or food establishments, and few, if any, public beaches.

Altogether then, it would seem that 50-60 boat spaces in addition to the needs for fishermen will be shown to be more than adequate. If experience indicates a greater need, then the launch area can be enlarged.

Again, while southern lakes become warm enough for swimming from May to October, Crystal Lake is usually swimmable only from about July 4th through Labor Day. . . a limited season at best.

We look forward to an early, positive response from your group, trusting that an equitable and prudent course of action will be forthcoming."

The next activity on the proposed boat ramp will be the preparation of working or engineered drawings of the actual site. This will carry over beyond the first of the year and we anticipate at least one public hearing prior to permit application from the DNR.

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The DNR response to this letter was not prompt and somewhat perfunctory. A listing of some of the most frequent rumors heard are as follows:

- The ramp will be constructed this year (there is set-aside money available);
- The ramp won't be constructed any time soon – there is insufficient funding;
- The Governor will probably decide;
- The merging of 115 and Mollineau Road and the launch ramp Road will cause a substantial delay since the State will be involved and some source of funding must be found as well as engineering work.
- The ramp will be smaller (about 80 boats) than originally planned.

There seems to be a consensus that an environmentally friendly ramp of some sort could be acceptable to a wide range of stakeholders. Our own long range planning includes action plan outlines for possible employment, depending on the developing situation. Please promptly forward any new data or rumors to either Amy Kinney Ad-Hoc Chair, 882-9265 or William Decker at Box 607, Frankfort, MI 49635.

We must remember that the DNR cannot regulate many issues of lake concerns which must be controlled by local municipalities. Two such examples deserve immediate attention and are: maximum boat size permitted on Crystal and regulation of personal watercraft.

Please contact the Planning Commission in your location to express your interest in having a voice in these vital decisions and attend Planning Commission meetings if possible.

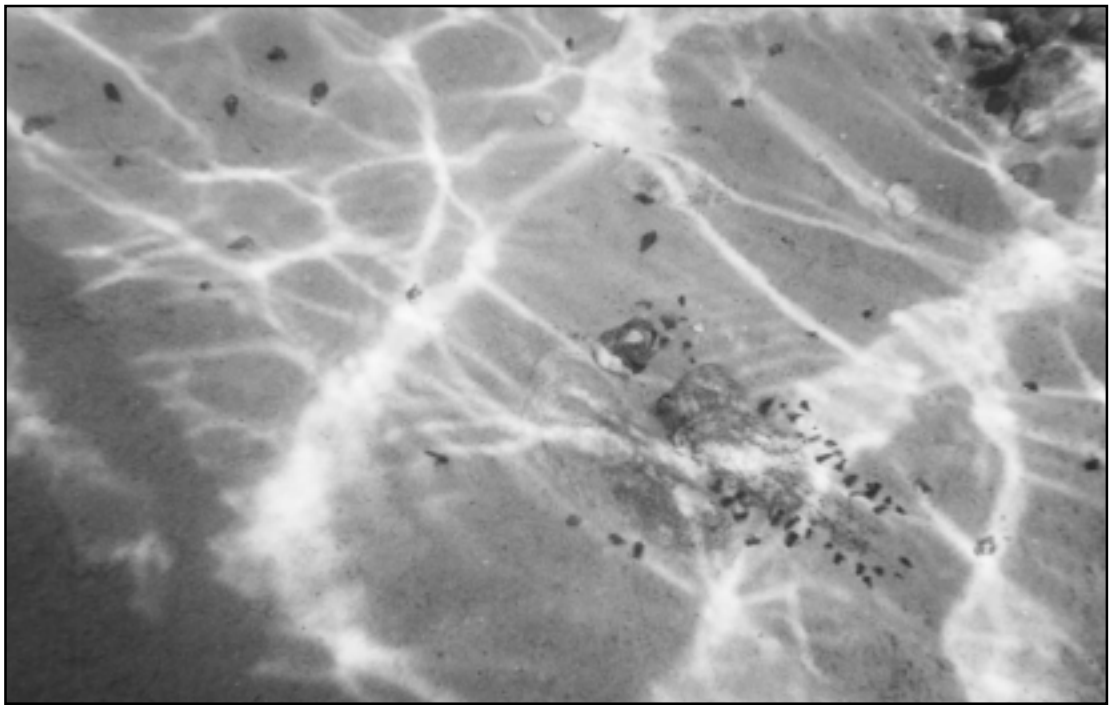
We have learned that an additional rumor has it that fishermen view the CLWF and CLA in a negative way, believing the two lake associations have an ineffective and irrelevant role. Actually, the majority of fishermen do not burden the lake whether trolling, anchored, or casting. Most fishermen revere the pristine quality of the lake and want to keep it that way.

In the meantime we are seeking options and plans which will continue to protect the lake and its Watershed from over development and overusage.

Zoning Regulations

The new county zoning regulations are still being considered which means that final decisions are yet to be made.

Depending on your locality, either county or township or village planning commission need to hear from your about the vital questions of minimum lot size, enforcement of overlay regulations, wetland management and meaningful reduction of variances. In the meantime, significant erosion is occuring with little control.



Crystal Clarity

Crystal Lake *"Walkabout"*

The **Crystal Lake *"Walkabout"*** is intended to instill and nurture in young people and adults a sense of awareness of the unique environment of the Crystal Lake Watershed (Benzie County, MI). This is done through an interactive "hands-on" program of science education involving observational monitoring and environmental exploring. It is designed to enhance community awareness of environmental issues, provide educational experiences, and promote future stewardship of water resources. It has been integrated into the curriculum of local schools.

Four Interpretive Sites are selected biennially (*) for the annual ***"Walkabout"*** from a list of nine Sites, each representing a geographically distinct location with unique hydrology (How water moves about Crystal Lake, tributaries, wetlands, high ridges, dunes, and Lake Michigan.):

A. Crystal Lake (Lake, East End)
B. Cold Creek Sediment Basin (Tributary)
C. Trapp Farm Nature Preserve (Wetlands)
D. Railroad Point Natural Area (High Ridge)
E. Crystal Lake (Lake, West End)
F. Betsie Valley Trail (Wetlands)
G. Betsie Bay (Bay)
H. Pt. Betsie (Dunes-Great Lakes)

(*) Sites A, B, C, D are selected for the 2003-2004 programs.

Environmental professionals describe each Site and conduct group activities. In addition to hydrology, other aspects of watershed management are discussed, including: water quality, ecology, land use, zoning, septic tanks, green belts, sustainable development, and watershed management. Protecting the integrity of the Crystal Lake Watershed as a valuable natural resource with its high-quality waters and unique environment is a worthy educational objective.

The Crystal Lake ***Walkabout"*** has a particular focus on interpreting of environmentally significant sites associated with the Crystal Lake Watershed. All participants receive a detailed Interpretive Manual containing the familiar Crystal Lake Watershed map and descriptions of the eight interpretive sites, and a colorful commemorative tee shirt. (The text of the Interpretive Manual is available online at www.CLWF.org.)

Cosponsors of the ***"Walkabout"***, an annual event since 1997, have included many organizations having a local presence in Benzie County. These include: the Crystal Lake Watershed Fund, Inc., (**CLWF)**; the Grand Traverse Regional Land Conservancy; the Grand Traverse Band of Ottawa and Chippewa Indians; Crystalaire Camp; The Nature Conservancy; MI Chapter; the Friends of the Betsie Valley Trail; the Friends of Betsie Bay; the Friends of Point Betsie Lighthouse; the U.S. Coast Guard- Station Frankfort; the Congregational Summer Assembly; the Benzie Conservation District; the MSUE Michigan Groundwater Stewardship Program; the MSUE Betsie Valley Trailway; the Inland Seas Education Association (*); and the Tip of the Mitt Watershed Council (*). (*) New in 2002-3. Edu

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Char Decker, Ted Bosler and Bill Decker – CLWF workers

Crystal Lake *"Walkabout"*

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cational institutions include: Benzie County Central Schools, Frankfort-Elberta Area Schools, Crystalaire Camp, and the Interlochen Arts Academy. The ***"Walkabout"*** has been financially supported by the cosponsoring organizations, and by donations, grants, and nominal fees.

The ***"Walkabout"*** has been presented to more than 1,600 participants representing the general public and visitors, and local educational institutions. The ***"Walkabout"*** has grown from 40 participants in 1997, 120 in 1998, 160 in 1999, 300 in 2000, and 440 in 2001. Beginning in 2002-3, the program was placed on a school-year basis, and split into Summer 2002, Fall 2002, and Spring 2003 event totaling 370 participants. For 2003-4, the participation is estimated at 550. The original ***"Walkabout"*** addressed a need to provide environmental education on issues specific to the Crystal Lake Watershed to young people in Grades 5-12 (ages 9-19). The program was expanded to three events in 2002-3: the Summer ***Walkabout"*** in July to the public; the Fall *"Walkabout"* in October to 8th grade classes; and the Spring *"Walkabout"* in May for 6th grade classes from Benzie Central and Frankfort/Elberta schools.

Walkabout participants and instructors learning together . . .

Stacy Daniels, our own Walkabout Director

Crystal Lake Sewage System Upgrade Progress - 2003

This report covers the continuing progress of the Benzie-Leelanau Health Department in their quest for protected surface and ground water in the two counties.

The Benzie-Leelanau District Health Department has permitted 34 upgrades of nonconforming septic systems in the Crystal Lake area this past year, This is a slight reduction over the previous year. Due to financial constraints, a part-time staff member was not rehired this past summer. This individual had the main responsibility for these upgrades. The remaining staff has done an admirable job in picking up as many of these upgrades as possible.

The BLDHD Board of Health has directed me to come up with a financial plan as to how our Department can more effectively require more upgrades in the Crystal Lake area as well as the county as a whole. We have found through a time study that it takes about 2.5 as much time to carry out a non-transfer evaluation as it does a standard sales transfer. This is due to the fact that the sites that have been prioritized for the non-transfer evaluations are in some of the most difficult areas of the county (i.e. high water table, small lots, isolation problems to wells and surface water). The financial plan will put forward a different fee schedule for those non-transfer evaluations. We hope to finalize that fee before the first of the year.

The Alternative Septic Treatment Regulations installations (adopted in June of 2002) have been slow to get off the ground. In part due to the high cost of many of the waterfront ATS units there have been no systems installed in Benzie County as of this date. There have been five systems installed in Leelanau County within the last three months, so we look forward to movement in that direction in Benzie County. As time goes on, the Health Department sees a great value in reducing the impact of nitrogen and phosphorus to our surface and ground water.

A factor that may encourage Crystal Lake area ATS unit installation is the fact that the Betsie Lake Utility Authority (BLUA) in Frankfort has begun construction on septic tank/holding tank wastewater treatment addition. When this addition is complete and operational, all septic tank and holding tank waste pumpers that pick up waste within 15 road miles of the plant will be required, by state law, to transport that waste to the (BLUA) plant. Since there will be a yet to be determined per gallon charge to dispose of the waste at BLUA, the cost of the ATS unit may become more financially viable. This may be especially true of the holding tank waste.

If you have questions regarding these issues, feel free to contact the Benzonia office of the Benzie-Leelanau District Health Department. Our phone number is (231) 882-4409. Our Environmental Sanitarian will be happy to answer your questions.

Here is the latest box score on septic systems and a report from Bill Crawford, local sanitarian.

Permits Issued

For the 2002-2003 year there were 326 septic system permits issued county-wide including 7 upgrades on Crystal Lake in accordance with the County's septic system ordinance. This brings the cumulative total of new or upgraded systems on Crystal Lake since the implementation of the ordinance to 642. The lake will increasingly benefit as the older systems are phased out.

Mission Statement

The Crystal Lake Watershed Fund, Inc. (**CLWF**), a non-profit 501(c)(3) organization, was formed in 1994 upon merging the Clean Water Committee of Crystal Lake (with focus on water quality monitoring) and the Friends of Crystal Lake (with focus on land use and zoning). Like its predecessors over the past 30 years, the **CLWF** actively supports citizen initiatives for water quality monitoring, septic system control, sustainable development, and land conservancy, through education, for watershed management.

CLWF On the Internet!!!

Please note(!) that we have a new web address (URL). It is **:http://www.clwf.org**

CLWF "Watershedwear"

Thanks to Mary Pray, the very attractive line of **CLWF** "Watershedwear" has been expanded. Items include: T-shirts and sweat-shirts, etc. The items include the distinctive wave crest of the **CLWF**. They are available through members of the **CLWF.** A special thanks to Jonathon Clark of the L'Chayim Delicatessen for continued promotion of our "Watershedwear" at his establishment. (A limited number of the colorful Crystal Lake **"Walkabout"** T-shirts are also available.

Above, Monitoring Crystal Lake. Below, more Walkabout participants

The CLWF Science Review Panel

The **CLWF** Science Review Panel (SRP) is proactive in developing consensus viewpoints by reviewing environmental issues of particular local interest and by providing scientifically sound recommendations where appropriate to the public. This involves continued review of CLWF sponsored studies, and assessment of studies conducted by other responsible organizations that have demonstrated performance in related areas. It is comprised of a cross-section of knowledgeable individuals who have contributed significantly to past studies of Crystal Lake and who have been involved in various environmental activities positively affecting the Crystal Lake Watershed. It includes the directors of all major water quality studies conducted on Crystal Lake since 1969.

Cochairs:

Dr. Stacy L. Daniels, Director of Research, Quality Air of Midland, Inc. and Adjunct Professor of Environmental Engineering, The University of Michigan;
Dr. Tom Osborn, Professor of Earth & Planetary Sciences, The John Hopkins University.

External Reviewer:

Dr. Alfred M. Beeton, Former Chief Scientist of NOAA.

Members:

Dr. John Gannon, University of Michigan, Director of the 1969 Study;
Fred Tannis, Environmental Research Institute of Michigan, Director of the 1978 Study;
John R. Gehring, Benzie Central High School, Director of the 1987 and 1989 Studies;
Heather Rigney, Grand Traverse Regional Land Conservancy;
Jack Randall, Interlochen Arts Academy;
Tom Rohrer, Chief, Surface Water Quality Division, MI DEQ;
Bill Crawford, Benzie/Leelanau District Health Department;
Dr. Eckhardt Dersch, Department of Resource Development, Michigan State University;
Dr. John C. Walton, Department of Civil Engineering, University of Texas at El Paso;
Dr. Richard Whitman, Biological Resources Division, USGS;
Andy Norman, MSU Extension Service;
Dr. Harry Blecker, Crystal Lake Association;
Douglas Gibson, Crystal Lake Elementary School;
Paul Murphy, CLWF Executive Coordinator;
Dr. A. Scott McNaught, Biology Department, Central Michigan University;
Dr. Donald Gatz, Former Chief, Air Quality & Chemistry Branch, Atmospheric Environment Section, Illinois Water Survey.
Dr. Wally Fusilier, Water Quality Investigators.
Dr. Elizabeth B. Rogers, Former TVA & NASA aquatic ecologist.

The collective expertise of the SRP bears directly on the scientific components of several environmental issues having current or potential future impact on the Crystal Lake Watershed The SRP is proactive in developing consensus viewpoints by reviewing environmental issues of particular local interest and by providing scientifically sound recommendations where appropriate to the public. This involves continued review of CLWF sponsored studies, and assessment of studies conducted by other responsible organizations that have demonstrated performance in related areas.

Some of our Accomplishments

Our goal has been to preserve the water quality of Crystal Lake and to do so without great expense to you, its property owners. Your support has permitted us to accomplish the following:

- Write, publish and distribute the book Crystal Lake-Life or Death and yearly updates 1 through 12;
- Conceive and facilitate the adoption by Benzie County of a landmark ordinance requiring inspection and updating of all septic systems in the county;
- Partially fund and promote accredited deep water testing by Benzie High School biology instructor John Gehring and his advanced course students;
- Identify the north branch of Cold Creek as a major contributor of phosphorus into Crystal Lake and start a program in cooperation with the DNR to reduce the flow of nutrients into the Lake by returning the property to a wetland which will function as a giant filter;
- Support the gift of the former Trapp celery farm of Muriel Trapp Cross and Judson Cross to the Grand Traverse Regional Land Conservancy with its stipulation of protection of the water quality of Crystal Lake as a first priority;
- Arrange to have the "Lake Lovers" zero phosphate fertilizer available in many area stores;
- Produce the Crystal Lake Water Quality Monitoring Report by Daniels and Osborn;
- Furnish the pilot study of water plants and their distribution in the lake. Establish the annual Crystal Lake "Walkabout" educational program for young people;
- Furnish an erect entering/leaving Watershed signs on public roads at watershed breaks;
- Purchase and install an electronic level gauge to assist in lake level control.

SCIENCE PAGE

For those interested in more detail

Update #16 ~ December 2003

Deep Oxygen Levels Are Up

The Hydrolab® profiles of the central basin of Crystal Lake have been a continuing monitoring project for the last ten years. The instrument measures many parameters, but the temperature and dissolved oxygen concentration as a function of depth are the most important. The data in the table below show the temperature and dissolved oxygen values from just above the bottom of the lake at the deep station we monitor in the Central basin. The average temperature for the period is 5.88 °C and the median is 5.81 °C. Notice how the temperature shows two rather cool years, 1997 and 1998, with rather 'warm' years in 1995, 2001 and 2002. This irregular nature of the temperature is a reflection of the variation in the large scale weather trends which determine the bottom temperature of the lake via the spring weather which determines the development of the thermocline. The picture in oxygen is different. There is a downward trend at the start, with a minimum in 1998 and an increase since then.

The oxygen concentration in the bottom of the central basin is related to the amount of planktonic plant material produced in the upper layer of the lake. This material can settle to the bottom of the lake in the fall, where it decomposes and consumes the oxygen in the water. If there is too much oxygen utilization, the bottom waters can become anoxic. If that happens, the conventional wisdom is that the phosphate that is trapped in the bottom sediments will be released. Since the production of plant material in lakes is usually limited by the supply of phosphorus, the release of phosphorus from the sediments in the fall followed by the lake overturning and mixing as it cools, results in even higher production the following year. This higher production leads to greater anoxia and more phosphorus release. There is a feedback mechanism resulting in ever higher plankton production and a loss of lake water clarity.

While there has been much concern about the danger to Crystal Lake from decreasing bottom oxygen concentrations, and the scenario outlined is held to be generally valid, it is important to keep some perspective. For example, Glen Lake is monitored on a regular basis with instrumentation very similar to ours. It shows anoxic conditions on the bottom of the lake in the summer and again in the winter. There is so much unsatisfied oxygen demand in the bottom sediments that it uses up all the oxygen in the bottom water during the winter after the fall overturn of the lake which brings a substantial amount of fresh oxygen to the bottom waters.

What is the cause, or what are the causes, of the improvements? Is it natural variability, the result of human activity, or the result of some natural process? We certainly see the natural variability in the temperature signal and that is why we monitor every year. We need to sample enough to know the natural variability and to separate it from trends and changes. Possibly, the effect could be due to a decrease in nutrient input to the lake. There is no real knowledge about the nutrient budget for the lake. Can it be caused by the biology of the lake? Is it due to Zebra mussels eating the plankton in the upper layer of the lake and precluding their sinking to the bottom? If so, is the improvement short term or long term? To answer that question we will continue our monitoring.

Monitoring programs derive their utility and validity from the length of the data series in time, the consistency and intercomparability of the measurements, and the reliability of their data. There is now a specific Committee of the **CLWF** responsible for the Deep Water Monitoring. This new committee is responsible for the operation and oversight of the monitoring as well as the analysis and reporting of the data and results. It is comprised of Stacy Daniels, Wally Edwards, Elizabeth Hill, Paul Murphy, Scribner Sheafor and Tom Osborn, chair.

Tom Osborn

DATE	DISSOLVED OXYGEN, MG/L	TEMPERATURE, °C
October 8, 1995	2.83	6.19
September 20, 1996	2.76	5.63
September 26, 1997	2.59	5.30
September 19, 1998	1.14	5.02
September 25, 1999	1.80	5.86
October 31, 2000	1.45	5.72
September 9, 2001	2.96	6.41
September 28, 2002	2.72	6.99
October 19, 2003	2.96	5.81

Trophic Status Monitoring

The United State Geological Survey (USGS), in cooperation with the Michigan Department of Environmental Quality (MDEQ) (under the auspices of Section 305b of the Clean Water Act) designed and implemented a statewide network to assess the current trophic status and water quality conditions of 730 lakes over 25 acres in size throughout Michigan that are publicly accessible. Over a 15-year period each lake will be sampled once in early spring and once in late summer to determine water-quality characteristics. Each year, 7 to 10 of the 45 major watersheds in Michigan will be monitored and assessed. The 45 major watersheds in Michigan are monitored on a five-year cycle in order to assist in (1) statewide water quality assessments, (2) the National Pollutant Discharge Elimination System (NPDES) permitting process, and (3) resource management decisions. Remote-sensing satellite data which correlates closely with water clarity measurements will be used to extend trophic-status assessments to other lakes and to monitor changes during the fifteen-year period. Crystal Lake was designated by MDEQ for trophic status monitoring in 2003. The **CLWF** cooperated with the USGS during this sampling and conducted parallel testings. Results will be presented at a later date.

Paul Murphy collecting the March 2003 sample through the ice.

Biomonitoring of the Cold Creek Watershed

The environmental health of a stream is evaluated in part by the type and diversity of its benthic invertebrates (mostly insect larvae). Biomonitoring of Cold Creek, the major subwatershed for Crystal Lake was the subject of a volunteer monitoring project funded by MI DEQ and directed for the **CLWF** by Stacy Daniels. The project involved (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The three wadeable branches of Cold Creek and the Cold Creek Sediment Basin were sampled in 2002-3. Special thanks are extended to Paul Murphy of **CLWF** and Abby Mahan of the Grand Traverse Regional Land Conservancy (GTRLC) for their long hours of wading Cold Creek and "picking critters" from dishes under microscopes, and to Elizabeth Rogers-Hill for her assistance in describing use of the equipment and identification of benthic invertebrates during Crystal Lake Walkabouts in 2002-3. Cold Creek, the major tributary to Crystal Lake, is a small stream in comparison to other streams and rivers in Michigan. Consequently, it does not have a large diversity of macroinvertebrates, but those that are present are indicative of a "biologically healthy" watercourse. This is supported by chemical analysis of dissolved oxygen that is sufficient to support "clean" water organisms. A final report of the project will be completed in late 2003.

Sediment Analysis

Sediment is made up of fine solid particles that are suspended in water, and settle to the bottom of the Lake. Sediment sources in the Watershed include: (a) runoff from the land, sep. from land cleared of trees and vegetation, and paved areas, and (b) natural chemical precipitation into the Lake itself. Because the Lake is filled with water of relatively high hardness and high pH, some precipitation of calcium carbonate (scale) is expected. This fine sediment is similar to the marl layers formed in geological times and found beneath surrounding hills (ancient dunes) and in the deep bottom of the Lake itself. Calcium carbonate may clog water pipes if excessive, but it is actually a good thing for lakes since it "buffers" (moderates any pH changes) and removes soluble phosphates that would otherwise be nutrients for algae and aquatic plants.

Core analyses are important for dating sediments and establishing baselines of physical conditions and chemical compositions. Since 2000, researchers from the Departments of Geological Science and Zoology at Michigan State University have been collecting and analyzing sediments from several Michigan lakes as part of an independent study on inland lake sediment trends funded by MI DEQ. Analyses of sediment cores has included: lead-210 dating, sedimentation rate determinations, sediment and pore water compositions (22 elements and selected organic compounds), and evaluations of accumulations from natural and anthropogenic (human) sources.

In 2001, Crystal Lake (Benzie Co.) was added to the MSU study (*). At the 2003 Annual Meeting of the **CLWF** Sharon Yohn, a doctoral student of Dr. David T. Long, described the procedures for collecting a sediment core, and the techniques for analysis for various chemical elements and compounds and dating them chronologically. Concentrations of individual chemical elements are influenced by their behavior before they enter a lake and after they are in a lake and becoming entrained in sediment.

Unlike the sediment cores from MI lakes, which are generally comprised of fine sediment from top to bottom, Crystal Lake contains an unusual layer of coarse sand at a depth corresponding to the late 1800's. Although this makes dating more complicating, it is thought that this anomaly represents the influx of sand that occurred during the abrupt lowering of the Lake level in 1873 when the sandbar at Outlet Creek was breached. The famous "Tragedy of Crystal Lake" appears to be forever preserved within the deep sediments of our Lake!

There are two major processes controlling loading of specific chemical elements to lakes: (1) changes in natural geochemical inputs, and (2) changes in human inputs. Changes in land use, soil erosion, and atmospheric deposition, can be affected by wind patterns and precipitation events, and by boating, farming, and development. The sedimentation rate for Crystal Lake is low (-0.5 centimeter per year). Concentrations of organic compounds of concern (PCBs, PAHs, pesticides) are very low or below detectable limits. Concentrations of elements in the sediments ranged from calcium (-200,000 mg/kg=20%) to uranium (<2 mg/kg= 0.0002%). All but magnesium (decreasing) have remained relatively constant over the past one hundred years.

(*) Yohn, Sharon S., Long, David, T., Giesy, John P., Scholle, Lydia, Patino, Lina C., Fett, Joel D., and Kannan, Kurunthachalam, Inland Lake Sediment Trends: Sediment Analysis Results for Five Michigan Lakes, Yearly Report, Department of Geological Sciences, Michigan State University, 2001-2002.

Sediment Core from Crystal Lake (2201). Note the unusual lighter sand layer below the darker marl lower indicating the 1873 draw down event.

Lake Level Gaging

The **CLWF** has continued to apply state-of-the-art probes for monitoring water level and temperature in Crystal Lake every 10 minutes during periods when the Lake is not frozen. These data are compared with weekly levels as determined by the Benzie County Drain Commission (BCDC). The legally established levels of the Lake are: summer at 600.25 feet (May 1 - Oct. 31), and winter at 599.75 feet (Nov. 1 - Apr. 30). Lake levels are being compared with records of precipitation and ground water flow.

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Ph./Fax: (231) 882-5149

Description of Who We Are, Who We Were, and Who We Are Not

The former Clean Water Committee of Crystal Lake (now merged in the **CLWF**) was instrumental in supporting the Benzie County Public Health Department in developing a model ordinance to ensure that septic tanks in proximity to Crystal Lake and other water bodies in Benzie County comply with the latest standards in design and performance. The **CLWF** is also continuing to work with the Grand Traverse Regional Land Conservancy to limit phosphorus and sediment inputs from Cold Creek into Crystal Lake.

The former Friends of Crystal Lake (now merged in the **CLWF**) was supportive of efforts by Township and County zoning boards to work with local land owners and builders to promote reasonable and consistent land use regulations which ensure that future development is sustainable and compatible with the desirable environmental qualities unique to the Crystal Lake Watershed. The **CLWF** operates independent of the Crystal Lake Association.

Memorial

Gary Gray by Lois Traunor

Dr. and Mrs. Clark Cooper by Joan and Jack Hughes

PLEASE SUPPORT YOUR CLWF

We do not invest a great deal of copy space for fund raising appeals in support of the CLWF. Most of our financial contributions are provided directly from individual active supporters. The contributions which you so generously provide are applied directly to our local efforts within the Crystal Lake Watershed. We are a non-profit organization comprised mostly of unpaid volunteers. We sincerely believe that you, our readers and supporters, are most interested in learning about our programs. Some specific items that need financial support are: lab tests, equipment repair, legal counsel, boat expense, and Walkabout items. Please feel free to offer any comments or suggestions.

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