

THE CHRONOLOGY OF THE CRYSTAL LAKE WATERSHED

#	Study/Report/Event	Parameters/Events	Authors/Sponsors	Dates
*1	Water Quality	Multiprobe monitoring of D, T, DO, pH, Cond, Redox; N & P species; chlorophyll a; Secchi depth; hardness & alkalinity; major anions and cations; common & trace elements; sediment analyses.	CLWA (CLWF & CLA)	1993-05
*2	Education	The Crystal Lake <i>"Walkabout"</i> An Educational Primer; A Reference Handbook.	CLWA, GTRLC, GTB, CC, TNC, FBVT, FBB, FPBL, USCG, BCD, BCCS, FEAS, IAA, MSUE, ISEA, TOTM, TWCGTB.	1997-05
*3	Water Quality	Level monitoring of Crystal Lake.	CLWF	2000-05
*4	Watershed Management	Geographical Information Systems.	CLWF & NWMCOG & Meridian Geographics	2000-05
*5	Watershed Management	Geographic Names Information System.	CLWF & USGS	1999-05
*6	Water Quality	Monitoring of Secchi depth.	CLWF & ML&SA	1993-05
*7	Water Quality	Monitoring of P species.	CLWF & MDEQ	1993-05
*8	Water Quality	Nearshore nutrients & biological production.	CLA & CMU	2003-04
*9	Biomonitoring	Benthic macroinvertebrates and stream habitat of Cold Creek.	CLWF & GTRLC & MI DEQ	2001-03
*10	Water Quality	Chemical parameters, Cold Creek & Crystal Lake.	CLWF & IAA (ML&SA)	2001-02
*11	Water Quality	Multiprobe parameters; zooplankton.	CLWF & USGS (SBDNL NPS)	1997-99
*12	Exotic Species	Zebra mussel monitoring.	CLWF & MI Sea Grant	1994-00
*13	Water Quality	Monitoring of D, T, DO; N & P.	CLWF & WQI	1993-04
*14	Education	Crystal Lake Walkabout (EcoExplorations).	CLWF et al.	1993-96
*15	Limnology	Bathymetry of Crystal Lake.	CLWF & TetraTech-MPS	1999-00
*16	Water Quality	Water quality study.	CLA	1999
*17	Water Quality	Monitoring of D, T, DO; N & P; chlorophyll a.	CLWF & MDEQ	1997,99
*18	Water Quality	Water quality study.	CLWF & WQI	1998
*19	Sediments	Thermogravimetric analyses (LOS).	CLWF & MMI (Impact Analytical)	1998
*20	Phytoplankton	Phytoplankton survey.	CLWF & USGS	1998
*21	Water Quality	Multiprobe parameters; N & P; Secchi.	CLA	1997-98
*22	Water Quality	Monitoring of P species.	CLWF & GLERL (NOAA)	1996
*23	Global Positioning	Latitude & longitude of sampling locations.	CLWF	1996
*24	Aquatic Plants	Aquatic macrophytes survey.	CLWF & Aquest	1996
*25	Phytoplankton	Algal speciation survey.	CLWF & Phycotech	1995-96

*26	Water Quality	Multiprobe parameters.	CLWF (Murphy, MSU)	1994
27	Geology	Landforms of Northern Lower Michigan.	Knapp (NRCS)	2004
28	Water Quality	Sediment analyses: proposed MDNR boat launch.	MDNR	2004
29	Water Quality	Inland Lakes 303d program.	MI DEQ (& USGS)	2003
30	Water Quality	Mayflies indicators of aquatic ecosystem health.	USGS	2003
31	Water Quality	Satellite imagery of water clarity.	USGS	2003
32	Fish	Survey of fish population.	IFR	2003
33	Groundwater	Water table depths; piezometric data.	CRS	2001-03
34	Precipitation	Rainfall at local stations.	NWS	2001-05
35	Inland Lakes	Sediment chemistry, elemental chronology.	MSU (Long, Yohn, et al.)	2001-03
36	Water Quality	Limnetic zooplankton for bioassessment.	USGS	2002
37	Land Use	Neural networks & GIS to forecast land uses.	MSU	2002
38	Land Use	Benzie Co. 2020 Comprehensive Plan.	BCCAC	2000
39	Geology	Dune building along east shore of Lake Michigan.	MSU (USGS)	2000
40	Vegetation	Natural features inventory circa 1800's.	Corner & Albert	1998
41	Land Use	Sensitive lands and water resources.	CAC	1998
42	Water Quality	Swimmers' itch and bird population.	FSU (Blankespoor et al.)	1998
43	Septic Systems	Onsite Alternative Treatment.	BLDHD	1995-00
44	Fish	Growth and survival of perch.	Granet (CMU)	2000-02
45	Fish/Zooplankton	Perch fishery, zooplankton, chemical analyses.	McNaught et al. (CMU)	1997-03
46	Hydrology	Lake level control & outlet dam regulation.	BCRC & BCDC	1970-00
47	Water Quality	Monitoring of T, DO, pH, TP of Cold Creek.	BCCS (WaterWatch)	1996-98
48	History	Images of Benzie Co.	Bevier	1998
49	Vegetation	Vegetation of Michigan circa 1800.	Corner & Albert	1998
50	Land Use	Benzie Co. wet lands.	MLUI	1997
51	Fish	PCBs, Hg, Pesticides, DO, T.	MI DNR	1997
52	History	Flatlander in the North, Impressions of Betsie du Rivere.	Greenough	1996
53	Atmospheric Deposition	Airborne metals, TSP/TOC, specific organics.	ISWS (US EPA)	1996
54	History	Daylight in the Swamp, A Oral History of Logging in NW MI	Overlease & Overlease	1996
55	Water Quality	Swimmer's itch studies.	Blankenspore (CLA)	1993-95
56	Topography	Elevation of Trapp Farm Nature Preserve.	GTRLC	1993
57	Watershed Management	Managing and Presenting Lake Monitoring Data Effectively.	Daniels & Osborn (CLWF)	1994-5
58	Watershed Management	Preservation & protection guidelines.	PEA (CLA)	1993

59	Watershed Management	Land & water resource cooperative study.	BCSWCD	1992
60	History	The Chimney Corners Family Album, A Northern Michigan History.	Rogers	1990
61	Geology	Geomorphic features of Crystal Lake.	Taylor (Albion)	1990
62	Fish	Species & abundance.	Makowski (MDNR)	1989
63	Septic Systems	Ordinance for premises with sewage disposal systems.	BCHD	1989
64	Water Quality	Monitoring of D, T, DO, N & P; chlorophyll a.	Gehring et al. (AHC, CLA, & NSPOA)	1989
65	Aquatic Plants	Submerged & floating vegetation.	Hazlett (UM)	1988
66	Water Quality	N & P species; pH, hardness, & alkalinity; major anions & cations; common & trace elements.	Crystal Lake Clean Water Committee	1987-93
67	Water Quality	Monitoring of D, T, DO, N & P; chlorophyll a.	Gehring et al. (NSPOA & CLA)	1987
68	Watershed Management	Cold Creek development plan.	Clark	1987
	Fish	PCBs, Hg, pesticides.	MDNR	1987
69	History	Crystal Lake – Life or Death.	Decker (ad hoc Committee)	1987
70	Terrestrial Plants	Land-based vegetation.	Hazlett (UM)	1986
71	Terrestrial Plants	The flora of Benzie County.	Overlease & Overlease	1986
72	History	The Crystal Gazer.	Case, LL	1985
73	Watershed Management	Preservation & protection guidelines.	PEA (FCL)	1985
74	Aerial Survey	Photographs of weed beds.	Tanis (SWSA)	1984
75	Fish	Fish survey; D, T.	MDNR	1984
76	History	Our Land and Lakes, MI, Benzie Co.	Glarum	1983
	Topography	Land contours.	USGS	1983
77	History	View from God's Country.	Sandman	1981
78	Hydrology	Establishment of summer/winter lake levels.	Court	1980
79	Env. Impact Statement	Alternative waste systems.	US EPA	1980
80	Env. Impact Statement	Septic leachate discharges.	WAPORA	1980
81	Sand dunes	Sand dune inventory & classification.	Buckler (MDNR)	1979
82	Fish	Fishes of the Sleeping Bear Dunes National Lakeshore.	Kelly & Price	1979
83	Septic Systems	Leachate discharges.	Kerfoot (WAPORA)	1979
84	Water Quality	Water quality of selected inland lakes.	Gannon & Beeton	1978
85	Water Quality	Monitoring of P species; chlorophyll a.	Tanis et al. (CLPOA)	1978
86	Septic Systems	Coliforms from sanitary systems.	Univ. Michigan	1978
87	Hydrology	Three monuments placed at original lake level.	People of Benzie County	1978
88	Fisheries Survey	Species & abundance; D, T. DO.	Hay	1977
89	Water Quality	Facility plan: wastewater collection & treatment.	Consortium of consultants	1976

91	Atmosphere	Atmospheric deposition.	Gatz	1976
	Archaeology	Inventory of historical sites; geology, topology, soils, vegetation, fauna, climate.	Lovis, Mainfort, & Noble (SBDNL)	1976
90	Forests	Hardwoods and ground cover, Benzie Co.	Overlease & Overlease	1976
92	Fish	Sport fishery, alkalinity, pH, DO, T.	Laarman (MDNR)	1976
93	Botany	Botanical survey - Lake Huron to Lake Michigan.	Voss & Crow	1976
94	History	A Bicentennial Reader.	Case, LO	1976
	Fish	History & importance of the rainbow smelt.	Jaiven (UM)	1975
95	Water Quality	Crustacea; T, DO, pH; N & P species; others.	Gannon JE, Mazur, & Beeton	1975
96	Land Use	Ecological and sociological determinants.	Gannon JE & Paddock (UM)	1974
97	Atlas	MI Inland Lakes & Their Watersheds: An Atlas.	Marsh & Borton (MDNR)	1974
98	History	A History of Logging in Benzie County.	Overlease & Overlease	1973
99	History	Waiting for the Morning Train – An American Boyhood.	Catton	1972
100	Trace Elements	Water; sediment; zoo- & phytoplankton; benthos.	Copeland & Ayers	1972
101	Water Quality	Selected lakes and streams in GT Bay region.	MI Water Resources Commission	1970
102	Water Quality	T, DO, pH, N & P species; chlorophyll a; ions.	Gannon JJ, et al. (KCCC & UM)	1969-70
103	Sand Dunes	Sleeping Bear Dunes National Lakeshore est'd.	National Park Service	1970
104		First Earth Day.		1970
105	Eutrophication	Environment & biota.	Beeton	1969
142	Water Quality	Monitoring of T, DO, pH, TP.	MDNR	1968
106	Water Quality	Invertebrates; coliforms; phytoplankton; chem.	MDNR	1967
107	Vegetation	Vegetation & common plants of SBD region.	Thompson	1967
108	Land Survey	Composites of original land survey maps.	Trygg	1964
109	Lake	Lake inventory.	Humphrys & Green (MSU)	1962
110	History	Lake levels.	Case, LL	1962
111	History	Here I Shall Finish My Voyage (Marquette).	Stebbins	1960
112	History	Michigan's White Pine Era 1840-1900.	Maybee	1959
113	History	Benzonia-Beulah Centennial.	Sinclair, McAllister, & Case WL	1958
114	History	Michigan & Crystal Lake.	Catton	1957
115	Trees	Development of aspen, jack pine, & oak forest.	Kilburn (UM)	1957
116	Hydrology	River basins, rainfall.	USGS	1954
117	Fish	Spawning of smelt in Crystal Lake.	Lievens	1954
118	Fish	Brush shelters.	Eschmeyer (IFR)	1948
119	Fish	Summary of Twenty Months Investigation on the Platte River and Adjacent Waters. (trout & smelt)	Reynolds (IFR)	1947
120	Fish	Age and growth of lake trout.	Applegate (IFR)	1946
121	Geological Survey	Glacial & post-glacial history.	Calver (UM)	1946
122	Hydrology	Elevations, lake level control & outlet regulation.	Hanes	1946
123	Hydrology	Flow of Cold Creek.	USGS	1942-47

124	Fish	Outlet weir operation and impact on smelt.	Shetter & Reynolds (IFR)	1942
125	Hydrology	Installation of gage on outlet.	USGS	1942+
126	Hydrology	Map of Crystal Lake, Benzie County, Michigan.	McNamee	1942
127	Fish	Outlet weir and smelt spawning.	Shetter & Reynolds (IFR)	1942
128	Fish	Smelt population study.	Beckman (IFR)	1941
129	Fish	First planting of lake trout.	Applegate (IFR)	1941
130	Fisheries Survey	Species & abundance; T, DO, pH, alkalinity.	Brown & Funk (IFR, MDOC)	1940
131	Land	Perched sand dunes near Crystal Lake.	Dow	1938
132	Hydrology	The undertow of Crystal Lake.	Evans	1938
133	Fish	The dispersal of smelt in the Great Lakes.	Van Oosten	1937
134	Hydrography	First bathymetric map of Crystal Lake.	McNamee	1935
135	History	Bibliography: History of Benzie County.	Thomas	1935
136		Chimney Corners Resort.		1935
137	Soils	Benzie County land type.	Veatch	1935
138	Weather	Precipitation, air temperature.	USWB	1935-00
139	History	On the Trail of a Vision.	Case, W.L.	1933
140	History	Ye Lakes and Hills of Michigan.	Phelps	1933
141	Vegetation	Annual rings in trees of Point Betsie.	Wolfe	1932
143	Fish	The smelt of Crystal Lake.	Metzelaar & Kanglois	1930
144		Crystal Lake Yacht Club.		1931
145	Atlas	Map of Crystal Lake area.	Hale	1930
146	History	The Story of Frankfort.	Howard	1930
147	Fish	Investigations on the smelt of Crystal Lake.	Metzelaar & Langlois (IFR)	1930
148	Hydrology	Surface waters, hydrology, characteristics.	McNamee	1930
149	Forests	Trees and sand dunes.	Wolfe	1930
150	Fish	History of smelt in Crystal Lake.	Creaser	1929
151	History	Crystal Downs Country Club.		1927
152	Lake	Ice push on Crystal Lake shore.	Scott	1926
153	Ecology	Sleeping Bear region.	Waterman	1926
154	Fish	Establishment of smelt as food for lake trout.	Creaser	1925
155	Map	Sand dunes along Lake Michigan shoreline.	COE	1925
156	Map	Frankfort Harbor dredging.	COE	1924
157	History	Attractions of Crystal Lake and Vicinity.	Lee	1923
158	History	The Tragedy of Crystal Lake.	Case, WF	1922
159	History	Cherry Hut Restaurant.		1922
160	Geography, Vegetation	Forests & Dunes - Pt. Betsie to Sleeping Bear.	Waterman	1922
161	Vegetation	Development of plant communities.	Waterman	1922
162	Limnology	Inland Lakes of Michigan (inc. Crystal Lake).	Scott	1921
163	Vegetation	Perched dunes and their vegetation.	Fuller	1918
164	Vegetation	Development of root systems - dune conditions.	Waterman	1917

165	Ecological Survey	Plant & animal survey of Crystal Lake Bar region.	Waterman	1917
166	Ecological Survey	Botany field ecology trip at Crystal Lake.	Cowles et al.	1915
167	Hydrology	Survey elevations of Crystal Lake.	Leverett & Taylor	1915
168	Atlas	Standard Atlas of Benzie County.	Ogle	1915
169	Hydrology	Outlet dam constructed.		1915
170	Fish	Planting of smelt in Crystal Lake.	Van Oosten	1912
171	History	Train wreck on shores of Crystal Lake.		1911
172	Hydrology	Establishment of legal lake level.	Court	1909
173	Atlas	Map of Benzie County, MI.	Haswell	1908
174	Water Quality	Flowing wells & water supplies.	Leverett et al.	1907
175	Ecology/Geology	Ecological & geological surveys.	Lane & Adams	1906
176	Water Quality	Flowing wells and water supplies.	Leverett et al.	1906
177	Geology	Field records of soils.	Leverett	1904
178	History	Away from the Work-a-Day World: Frankfort.	Ann Arbor RR	1904
179	Sediments	Marl deposits of Benzie Co.	Hale	1903
180	Sediments	Marl deposits.	White Star Portland Cement	1902
181	Atlas	Atlas of Benzie County.	Ferris	1901
182	History	History of Benzie County.	Parker et al.	1901
183	History	Congregational Summer Assembly.		1901
184	History	Frontenau Hotel built (burned 1912).		1899
185	Ecological Survey	Ecological relations of vegetation on sand dunes.	Cowles	1899
186	Geography	Boat trip (Chicago to Mackinac).	Inglis	1898
187	History	Rail road cut at "Bay" Point on Crystal Lake.		1896
188	History	Ann Arbor Railroad Company incorporated.		1895
189	History	Resort regions.	Steele	1891
190	Land Survey	Transcriptions of original survey.	MDNR	1890
191	History	First train from Crystal City.	Hubbell	1889
192	History	Case Bros. Lumber Co. which became Case Mercantile Co., (1892), and A. B. Case Co. (1898-1924).	Case, Charles, Walter, & Will	1889
193	Botany	Botanical survey - Lake Huron to Lake Michigan.	Beal	1888
194	History	Toledo, Ann Arbor, & Northern Michigan Railway Company formed from predecessor railroads.		1884
195	History	The Traverse Region – Benzie Co.	Page	1884
196	Fish	Rainbow trout introduced into Great Lakes.		1883
197	Botany	Aquatic plants near Crystal Lake.	Hill	1881
198	History	Lakes and summer resorts.	Hallock	1878
199	Geology	Geological survey of lower MI - Marl and peat.	Romminger	1876
200	History	Pt. Betsie Light House Reservation.	MDNR	1875
201	Hydrology	Lowering of Crystal Lake - The Tragedy.	Betsie River Improvement Co.	1873

202	Hydrology	Lowering of Herdman's Bay (Round Lake).	Betsie River Improvement Co.	1873
203	Atlas	Atlas of the State of Michigan, inc. topology, hydrogeography, climate, history, railways, etc.	Winchell et al.	1873
204	History	Lake Township founded.		1873
205	History	Crystal Lake Cemetery.		1871
206	History	Coastal survey.	U.S. Lake Survey	1871
207	History	Frankfort Express established.		1870
208	History	Benzonia Citizen, 1870-72; Benzie County Journal 1872+ established.		1870
209	Forests	Vegetation, natural, and cultural features.	Ruggles & Rademaker	1868-77
210	Land Survey	Land grant plats of Benzie County.	MDNR	1868
211	History	Dredging of Frankfort Harbor.		1867
212	History	The Grand Traverse Region (including geological and industrial resources of Benzie County).	Winchell	1866
213	History	Civil War ends.		1865
214	Fish	Steelhead introduced into Great Lakes.		1864
215	History	Grand Traverse College (1863 to 1888), Benzonia College (1888 to 1900) and Benzonia Academy (1900 to 1918),		1863
216	Lakes	Levels of Great Lakes recorded.		1863
217	Land Survey	Benzie County established.	MI Legislature	1863
218	History	Road from Benzonia to Traverse City.		1863
219	History	Road from Benzonia to Manistee.		1862
220	History	Botanizing at Carp River.	Thoreau	1861
221	Forest	Logging era.		1860-90
222	History	Congregational Church in Benzonia.		1860
223	Atlas	Road map of Benzie County.	Quackenbush	1860
224	Atlas	Wetlands, dunes, & roads near Crystal Lake.	Sage	1860
225	History	Village of Frankfort.		1859
226	History	Crystal Lake Township.		1859
227	History	Construction of Pt. Betsie Light.	MDNR	1858
228	History	Benzonia Colony.	John & Charles E. Bailey	1858
229	History	Description of Sleeping Bear and river <i>Aux Becs Scies</i>	Disturnell	1857
230	Land Survey	Continuation of original survey of Benzie Co. with sketches of townships, details of lakes & rivers.	MDNR	1856
231	History	Walden (Pond).	Thoreau	1854
232	History	"Discovery" of Betsie Bay.	Snow	1854
233	History	Swamp Act.		1850
234	History	Check survey of Benzie County.	Lyon	1850

235	Land Use	Deforestation of the Lake MI basin begins.		1845
236	History	First map with Crystal Lake labeled.	Mitchell	1842
237	History	Sleeping Bear Dunes During a Storm on Lake Michigan.	Castelnau	1842
238	Land Survey	Original survey maps & field notes: land, timber, soil, water, other physical features. Unusual transparency of Cap (Crystal) Lake.	Burt & Burt	1838-39
239	Land Survey	Original land survey (Benzie Co. & Cap Lake).	Burt & Burt	1838-39
240	Geology	Peninsula coast survey (Pyramid Pt. - Portage L.).	Hubbard	1838
241	Geology	Geology of adjacent Lake Michigan shoreline.	Houghton	1838
242	History	State of Michigan established.		1837
243	History	Fur traders at Sleeping Bear.	Gurdon Hubbard	1822
244	History	First steamboat, Walk-in-the-Water.		1821
245	Exploration	Lake MI shoreline (aux Bescies – Sleeping Bear).	Cass, Doty, Douglass, Schoolcraft, Trowbridge	1820
246	History	Map of Sleeping Bear and Platte River.	McComb	1818
247	History	War of 1812.		1812
248	History	Territory of Michigan established.		1805
249	History	Northwest Territory established.		1787
250	Exploration	Lake MI shoreline (Pt. Betsie - Frankfort).	Charlevoix	1721
251	Exploration	Lake Michigan - The Griffin, first sailing ship.	LaSalle	1679
252	Exploration	Lake MI shoreline (Pt. Betsie - Frankfort).	Marquette	1675
253	Exploration	Discovery of Lake Michigan.	Nicolet	1634
254	Geology	Final signal of lower GL levels.		ca. 280 BP
255	Geology	Final embayment of Crystal Lake from Lake MI.		~ 2,000 BP
256	Geology	Gradual isolation of Crystal Lake from Lake MI.		~3900-2900 BP
257	Geology	Lake Nipissing stage.		6,000 - 4,000 BP
258	Geology	Lake Algonguin stage.		11,000 - 9,000 BP
259	Geology	Lake Chicago - Lake Maumee stage.		14,000 BP
260	Geology	Holocene period (post-glacial).		10,000 BP to present
261	Geology	Late Wisconsinan glaciations.		18,000 - 5,000 BP
262	Geology	Pleistocene epoch (extensive glaciations).		2,000,000-10,000 BP

--SLD:04/12/05

(*) Studies conducted by the CLWA; its predecessors, the CLWF and the CLA; and with cooperative organizations.