

WATER QUALITY REPORT FOR MERRYMEETING LAKE, 1982

Conducted by the

Freshwater Biology Group

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## PREFACE

This report provides a summary of the data collected during 1982 by LLMP monitors at Merrymeeting Lake. Funding for the chlorophyll a analyses, data processing, interpretation, and report generation was provided by the Merrymeeting Lake Association.

The project and report are considered to be a part of the Lakes Lay Monitoring Program (LLMP) of the Freshwater Biology Group (FBG), at the University of New Hampshire. The LLMP is jointly directed by Alan L. Baker, Department of Botany, and James F. Haney, Department of Zoology. The present report is not to be construed as equivalent to the annual reports generated in the LLMP, involving visits by the FBG field team to the lake, and including more comprehensive lake chemistry and biology. Rather it is a summary of secchi disk depths and chlorophyll a analyses.

## RESULTS AND DISCUSSION OF LAY MONITOR DATA

During 1982 no visits were planned or made to Merrymeeting Lake by the UNH Freshwater Biology Group (FBG) field team. Rather, the service of the FBG was to receive filtered chlorophyll samples and data sheets from the Merrymeeting Lay Monitors, and to compile and interpret the results in a final summary. As previously, two sites were monitored. Site 1 (Owl's Head Point) is located at the deep (120 feet) region of the north basin, and site 2 (Broad Cove) is at the deep (135 feet) region of the south basin (Fig. 1). Lay Monitoring data collected during 1982 are summarized in Appendix A.

Secchi Disk Transparency and Chlorophyll a

The transparency of lakewater is dependent on two factors -- the total amount of suspended particulate material in water, and the total dissolved coloring matter in the water. The suspended particulates generally include microscopic algae and bacteria, along with microscopic animals. In addition, non-living particles such as wind-blown dust, stream-carried sediments, and resuspended lake sediments may find their way into the water column. In extreme cases the water in lakes may be very cloudy or turbid due primarily to the non-living particulates (lakes at the snouts of glaciers, or lakes receiving a large load of suspended silt from large rivers or from sewage systems).

Normally, however, New Hampshire lakes become turbid as a result of the microscopic life present in the water column.

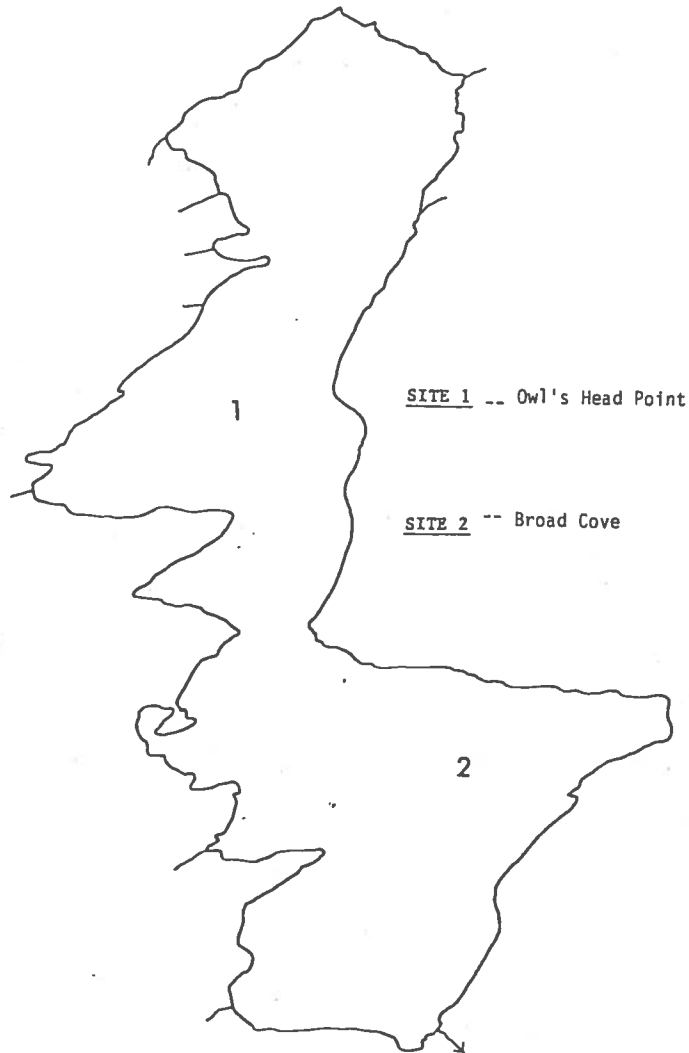


Figure 1. Merrymeeting Lake, Town of New Durham, Strafford County, New Hampshire. Outline map and location of 1982

The dissolved substances that give color to water are primarily humic acids, also called yellow organic acids or gelbstoff or gilvin. The color is similar to tea or weak coffee, and is caused by the large-scale decay of terrestrial or bog plants by fungi. The tea-colored

substance cannot be broken down easily by the fungi, so it remains in solution and enters the lake either as surface run-off, or as bog discharge via streams. Also, deciduous leaves (especially hardwoods) may be abundant in small ponds, and be a direct source of humic substances as they decay within the pond.

The presence of a large amount of suspended particles, or tea-water, or both, can have a strong influence on visibility of large objects that are placed under the surface. For example, a well-known standard test for the degree of water transparency is the visibility disc or Secchi Disk. The depth at which the 8-inch (20 cm) diameter disk disappears as it is lowered downward is called the Secchi Disk Depth, or water transparency. The numerical value of water transparency may vary from a few inches (about 0.2 meters) to more than 40 feet (12 meters), depending upon the transparency of the lakewater.

Chlorophyll a is a green pigment used in photosynthesis by plants, and present in all green plants -- including the microscopic algae suspended in the open waters of a lake (phytoplankton). The chlorophyll a concentration of lakewater is a useful estimator of phytoplankton abundance, and thus is also an indicator of the primary productivity of the lake, and of the degree of eutrophication in the lake. The range of variation of the pigment throughout the ice-free period, or at least the summer period, as well as

its average value for the same time period, is a tool useful in comparing the relative trophic state of lakes. A high maximum value of chlorophyll a, and a high variability of values, suggests that the lake is eutrophic. Low and relatively constant values indicate a low trophic state -- oligotrophy.

#### Secchi Disk Transparency and Chlorophyll a

Secchi Disk Depth (water transparency) averaged 8.9 meters at both stations during 1982 (Fig. 2). Maximum water transparency occurred at Owl's Head Point on August 29 (9.8 meters) and minimum on July 18 (8.1 meters), also at Owl's Head point. Generally the greatest transparency occurred during early August (Appendix A).

Chlorophyll a averaged 0.86 milligrams per cubic meter during 1982 at Owl's Head Point, and 1.14 mg per cubic meter at Broad Cove (Fig. 3). No seasonal trend was apparent (Appendix 1).

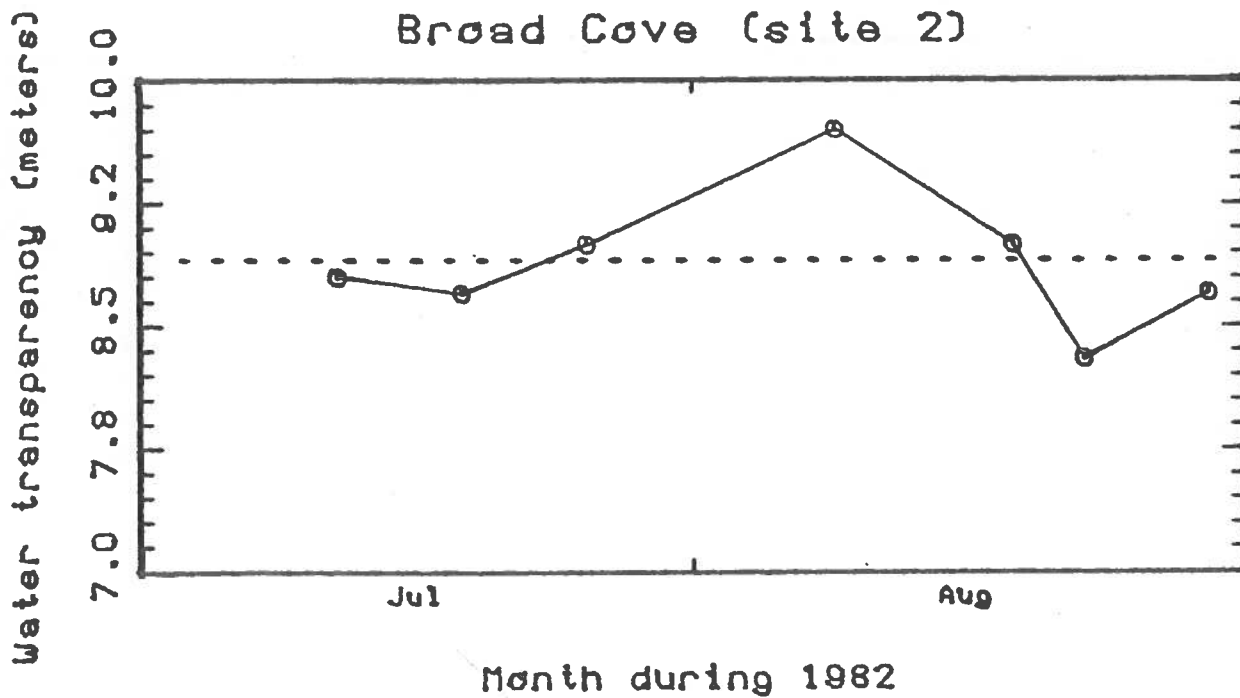
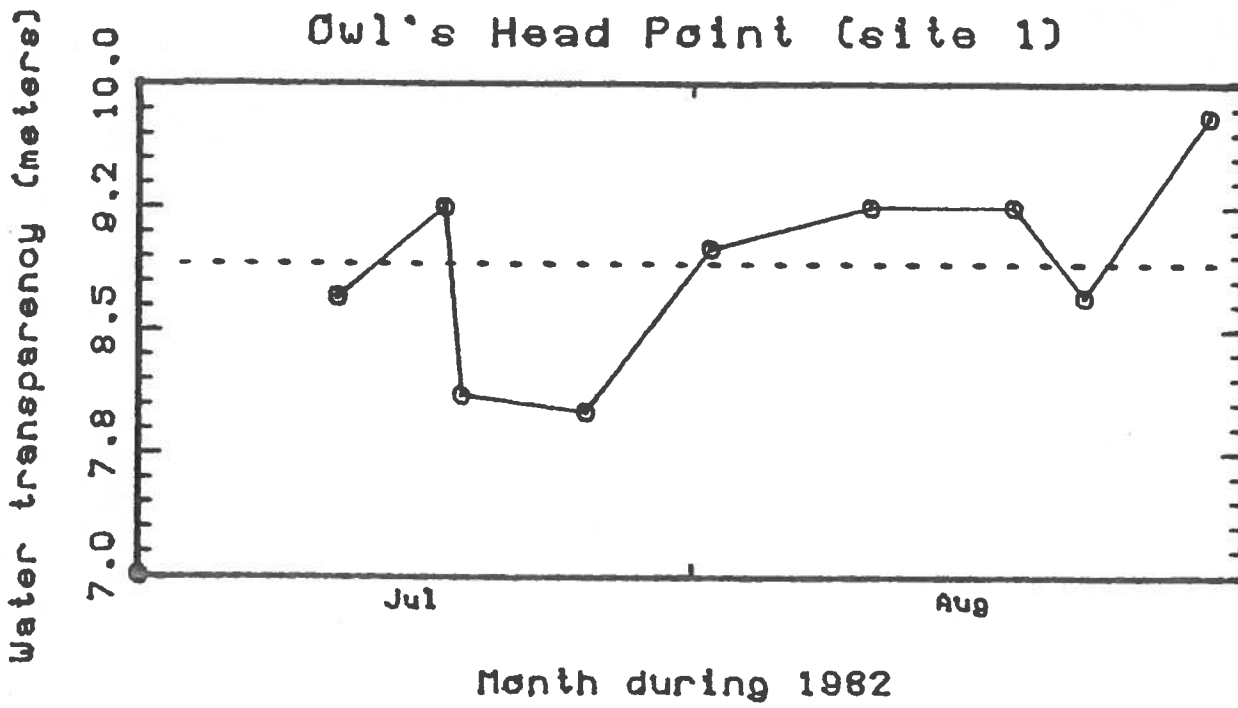


Figure 2. Water transparency (Secchi Disk Depths) through the summer of 1982 in at Owl's Head Point and Broad Cove, Merrymeeting Lake.



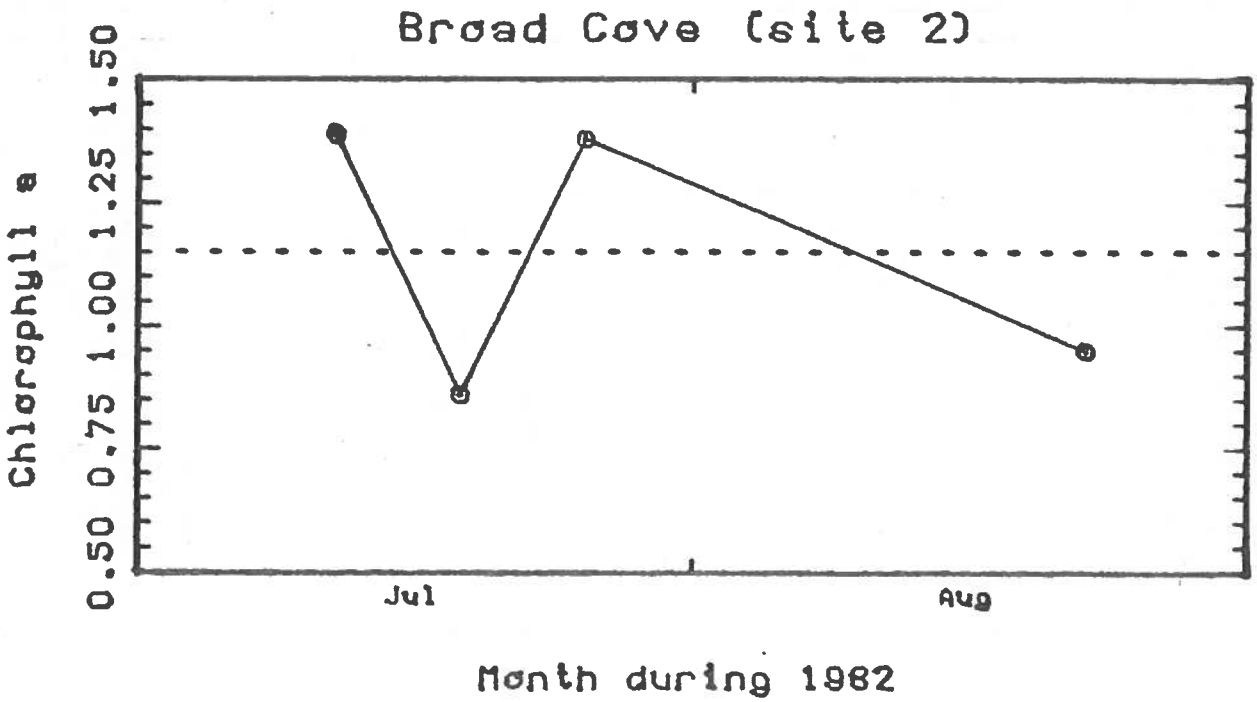
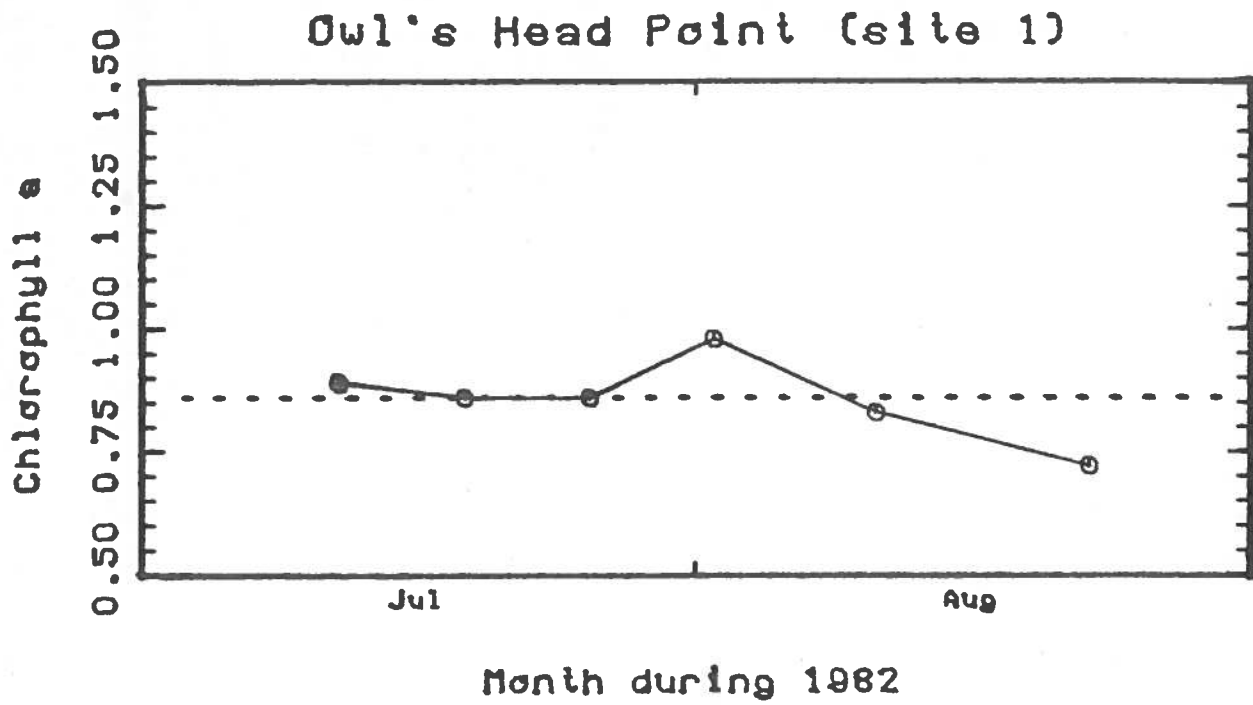


Figure 3. Chlorophyll a concentration through the summer of 1982 at Owl's Head Point and Broad Cove, Merrymeeting Lake.

### Trophic status of Merrymeeting Lake

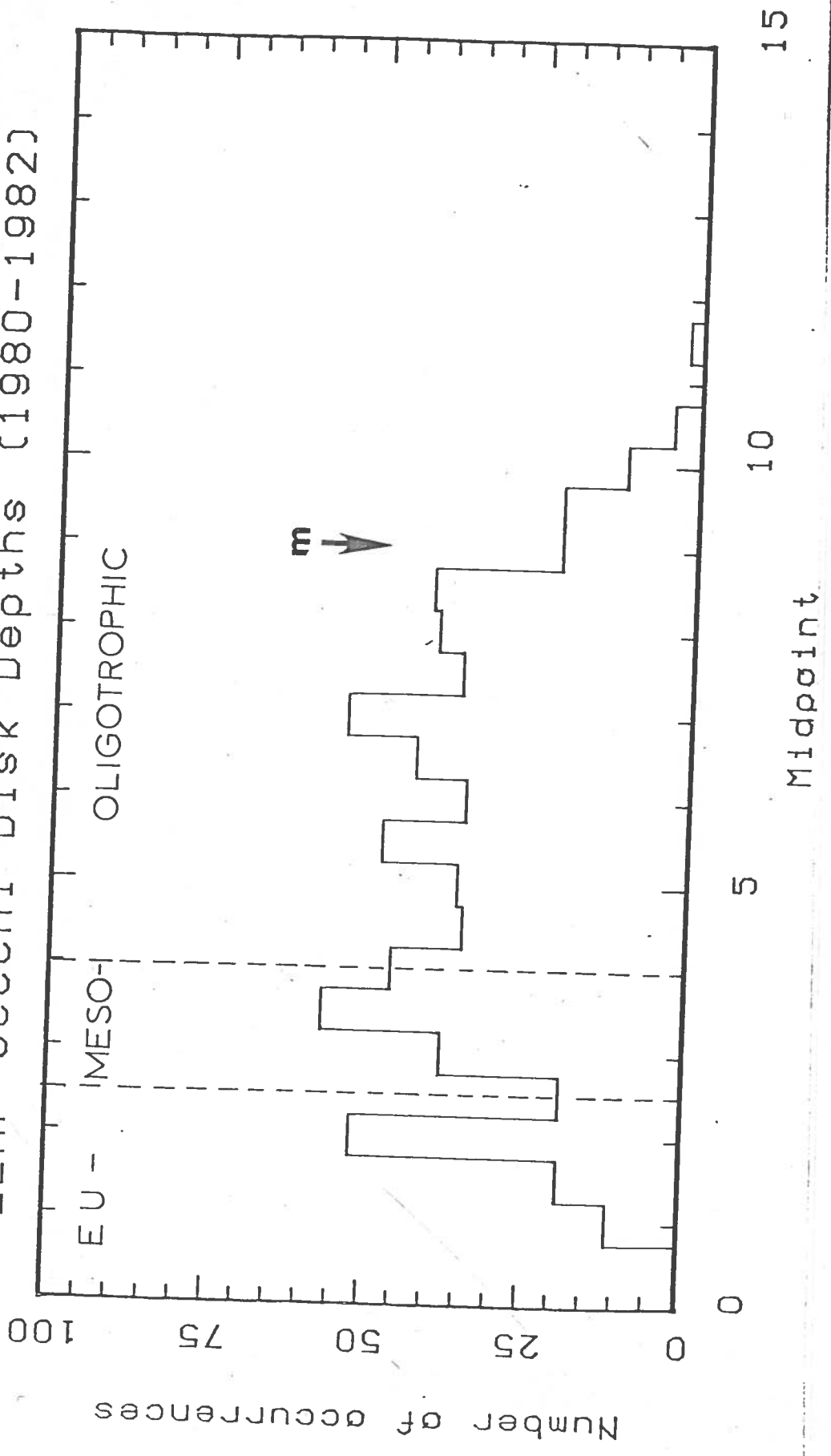
The average Secchi disk transparency of 8.9 meters in Merrymeeting Lake during 1982 indicates a status of oligotrophy. Relative to all other values of water transparency in the LLMP data bank, 8.9 meters is close to the deepest transparency (Fig. 4). More important is the trend through time of the annual or summer water transparency values. In Merrymeeting Lake, the average transparency was 9.5 meters in 1981, the first year of monitoring in the LLMP. The New Hampshire Water Supply and Pollution Control Commission (NHWSPPC) recorded a value of 9.0 meters on August 2, 1977. However, this single value cannot be directly compared with the seasonal averages of the LLMP values. Therefore, with only two years of recent data, it is apparent that the LLMP in Merrymeeting Lake cannot yet predict a tendency toward eutrophication.

The seasonal average of chlorophyll *a* in Merrymeeting Lake of 1.14 milligrams per cubic meter corresponds to some of the lowest values recorded in the LLMP in all participating lakes (Fig. 5). This is a second major indicator of the present oligotrophic (low productivity) status of Merrymeeting Lake. The WSPCC recorded a value of 1.40 milligrams per cubic meter on August 2, 1977.

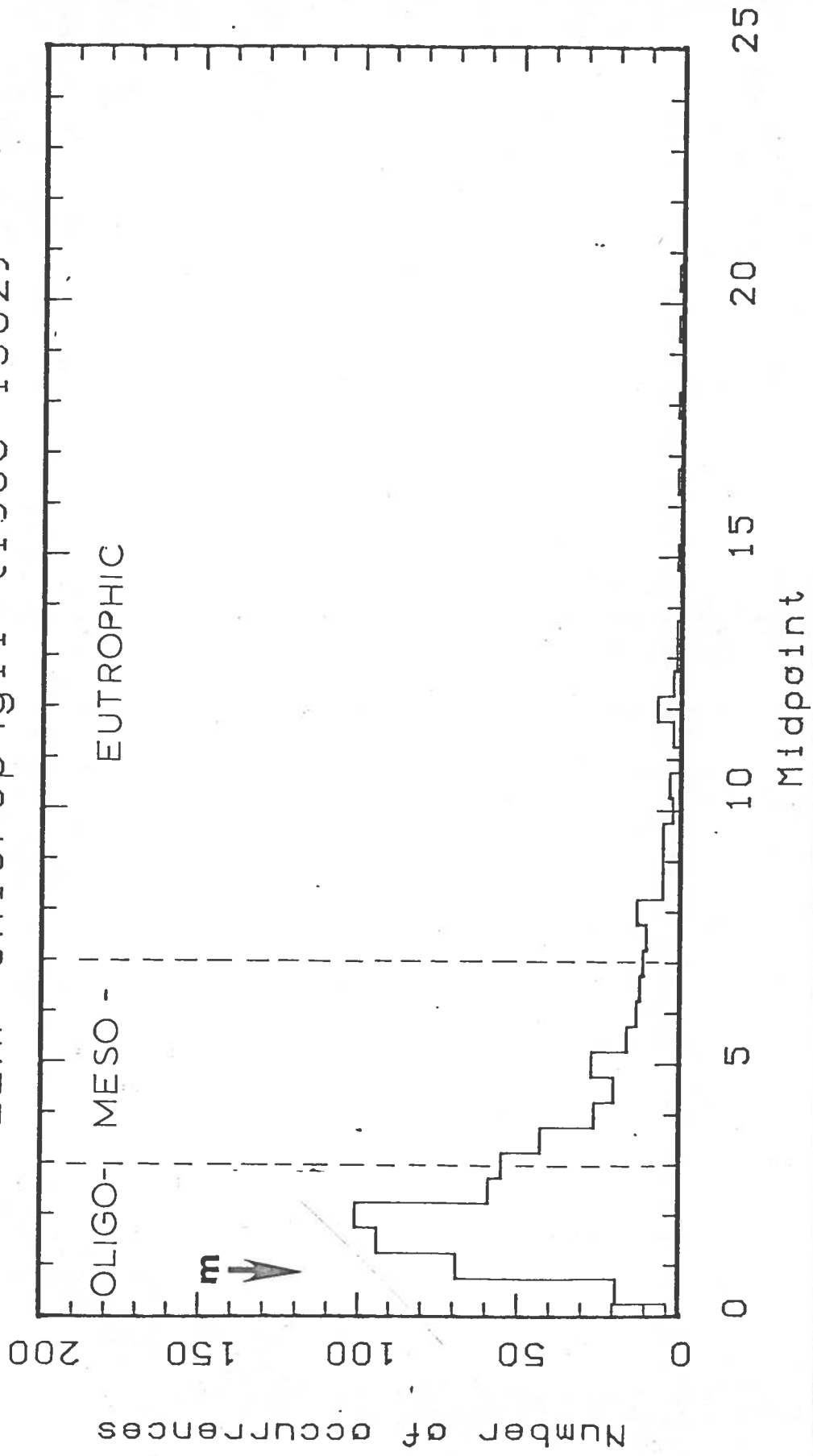
The third major indicator of the status of lakes is total phosphorus content of lakewater. More phosphorus values should be obtained from Merrymeeting Lake. The WSPCC

recorded a value of 5 micrograms per liter in August 1979, about the minimum detectable by standard methods. Again Merrymeeting Lake would be classified as oligotrophic on this basis.

# LLMP Secchi Disk Depths (1980-1982)



# LLMP Chlorophyll (1980-1982)



Summary

Merrymeeting Lake is presently oligotrophic, based on values of water transparency, chlorophyll a and total phosphorus. These values are based on mid-lake deep station analyses, and represent the condition of the lake as an entity. Any point sources of phosphorus presently entering the lake are diluted to levels that to date have prevented measurable eutrophication. With only two years of data it is not possible to predict future condition of the lake. Thus a long-term commitment to the LLMP is recommended. In addition, potential point sources of phosphorus along the shoreline should be monitored from time to time.

APPENDIX A

LLMP 1982 -- Lay Monitor Data May-16-83 16:30.42

Date	Lake	Site	SDD	Chl
Jul-11-82	Merrymeeting	Broad Cove	8.80	1.39
Jul-18-82	Merrymeeting	Broad Cove	8.70	.86
Jul-25-82	Merrymeeting	Broad Cove	9.00	1.38
Aug-08-82	Merrymeeting	Broad Cove	9.70	---
Aug-18-82	Merrymeeting	Broad Cove	9.00	---
Aug-22-82	Merrymeeting	Broad Cove	8.30	.95
Aug-29-82	Merrymeeting	Broad Cove	8.70	---
Jul-05-82	Merrymeeting	Owl's Head	---	---
Jul-11-82	Merrymeeting	Owl's Head	8.70	.89
Jul-17-82	Merrymeeting	Owl's Head	9.25	---
Jul-18-82	Merrymeeting	Owl's Head	8.10	.86
Jul-25-82	Merrymeeting	Owl's Head	8.00	.86
Aug-01-82	Merrymeeting	Owl's Head	9.00	.98
Aug-10-82	Merrymeeting	Owl's Head	9.25	.83
Aug-18-82	Merrymeeting	Owl's Head	9.25	---
Aug-22-82	Merrymeeting	Owl's Head	8.70	.72
Aug-29-82	Merrymeeting	Owl's Head	9.80	---





