# LAKE LACAWAC

# REPORT ON LIMNOLOGICAL CONDITIONS IN 1992

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**POCONO COMPARATIVE LAKES PROGRAM**

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# INTRODUCTION

Personnel from Lehigh University visited Lake Lacawac on 17 dates throughout 1992 as part of a routine monitoring program of three lakes. These lakes were selected to span a trophic gradient, Lake Lacawac occupying the intermediate ("mesotrophic") position in the gradient. Similar reports will be submitted to the owners of Lake Giles, an acidic, unproductive ("oligotrophic") lake, and Lake Waynewood, a nutrient-rich, productive ("eutrophic") lake. Because Lake Lacawac has been little disturbed throughout its recent history, and is currently preserved as part of The Lacawac Sanctuary, it serves as a valuable reference lake for the region.

The monitoring of these lakes in the Pocono region of northeastern Pennsylvania is a key component of Lehigh's Pocono Comparative Lakes Program (PCLP). This program aims to better understand the natural functioning of lakes, differences in lakes that arise through natural or man-made differences in their watersheds, and long-term trends that may be occurring in northeastern Pennsylvania. Through the cooperation of lake owners, scientists from Lehigh and other institutions are obtaining basic information that provides objective documentation of current lake conditions as well as a context for more intensive studies. Financial support from the Andrew W. Mellon Foundation has made these studies possible.

1992 was the fifth consecutive year of the monitoring program, and the fifth year for summer sampling. This is the third year that winter and spring data were obtained. The present report summarizes conditions in Lake Lacawac over the full twelve-month period for 1992. Physical/chemical data are presented as tables for each date, and are summarized in figures. The following parameters were measured: **TEMPERATURE, LIGHT PENETRATION, SECCHI DEPTH, DISSOLVED OXYGEN, ALKALINITY, pH,** and algal **CHLOROPHYLL-a. ZOOPLANKTON DATA** are presented as graphs that give the concentration (number of individuals per litre) averaged over the entire water column.

During 1992 more detailed chemical sampling of the water column was continued for most of the components analyzed by Dr. Jonathan Cole and Dr. Nina Caraco (Institute of Ecosystem Studies, New York Botanical Garden, Millbrook, NY) and reported in the 1990 Report. Lake Lacawac was sampled at 5-6 depths on 5 dates (in February, April, July, September and November). Analyses at the Institute of Ecosystem Studies are underway on these and the 1991 samples. This sampling program ended with a collection in February, 1993 (giving 10 year-round samplings over a two-year period), and we hope to report all results at one time in the near future.

This report includes a newly drawn bathymetric map of Lake Lacawac based on an earlier survey by Dr. Alan Tessier and his limnology class from Swarthmore College (**APPENDIX I**).

We wish to thank the Lacawac Sanctuary for its continued support of the Pocono Comparative Lakes Program. The Sanctuary plays a major role in this program as the field laboratory and summer residence for the investigators. We especially appreciate the interest and cheerful assistance of its director, Sally Jones, and of Arthur Watres and other Board members and volunteers whose efforts to improve the Sanctuary's research facilities are much appreciated.

# 1992 METHODS AND RESULTS

Data included in this report are extracted from an electronic database maintained at Lehigh University by Dr. Craig Williamson. The field sampling, laboratory analyses, and computer data entry were supervised by Dr. Robert Moeller and Gina Novak. Gina Novak, Timothy Vail, and Brian Sharer carried out most of the field sampling and laboratory analyses. Tim Vail counted macrozooplankton in samples from January through May, and Paul Stutzman counted samples from June through December. Natasha Vinogradova counted microzooplankton. Gina managed all aspects of the computer database including data entry, data analysis, and printing of zooplankton graphs. Dr. Bruce Hargreaves has continued to oversee maintenance of the computerized database, which he and Scott Carpenter developed. Natasha Vinogradova and Brian Sharer checked the zooplankton data entries. Brian Sharer analyzed chlorophyll samples. Alkalinity and pH were determined by Gina Novak and Tim Vail. Gina entered the physical/chemical data into the database, which Robert Moeller checked and abstracted as tables and graphs for this report.

Although efforts have been made to assure the accuracy of data included in the database, and compiled in this report, we cannot guarantee complete accuracy and do not claim specific levels of accuracy or precision. The data have been collected as part of a lake characterization program and may not be suitable for uses not envisioned by the investigators. A brief description of sampling and analytical techniques is included here; a more complete description has been prepared for later distribution.

Information acquired through the Pocono Comparative Lakes Program is to be shared among scientists desiring to make broad comparative studies or considering research projects in these lakes. Inquiries to examine or use the data are invited. Of course, the primary right to publish extensive extracts from the database, or from this unpublished report to the lake owners, resides with the PCLP cooperating investigators and students who generated the data. As of June, 1993, most of the existing information is accessible through the software program Reflex™ (version 2, Borland International, copyright 1989) running on IBM PC-type microcomputers.

## SAMPLING PROGRAM

On each sampling occasion, Lake Lacawac was visited twice, once during the day (the nominal date) and again after dark (sometimes the previous night). The night-time visit was required for zooplankton sampling. Usually, other parameters were measured, and samples were collected, during the day. Sampling was carried out at a fixed station (site "A") near the deepest part of the lake (about 13 metres or 43 feet). The thermal stratification existing on any date dictated the depths from which other samples were collected **(Figure 1)**. The lake was sampled twice monthly when surficial water temperature stayed above 20°C, (June through September), then once monthly during cooler times.

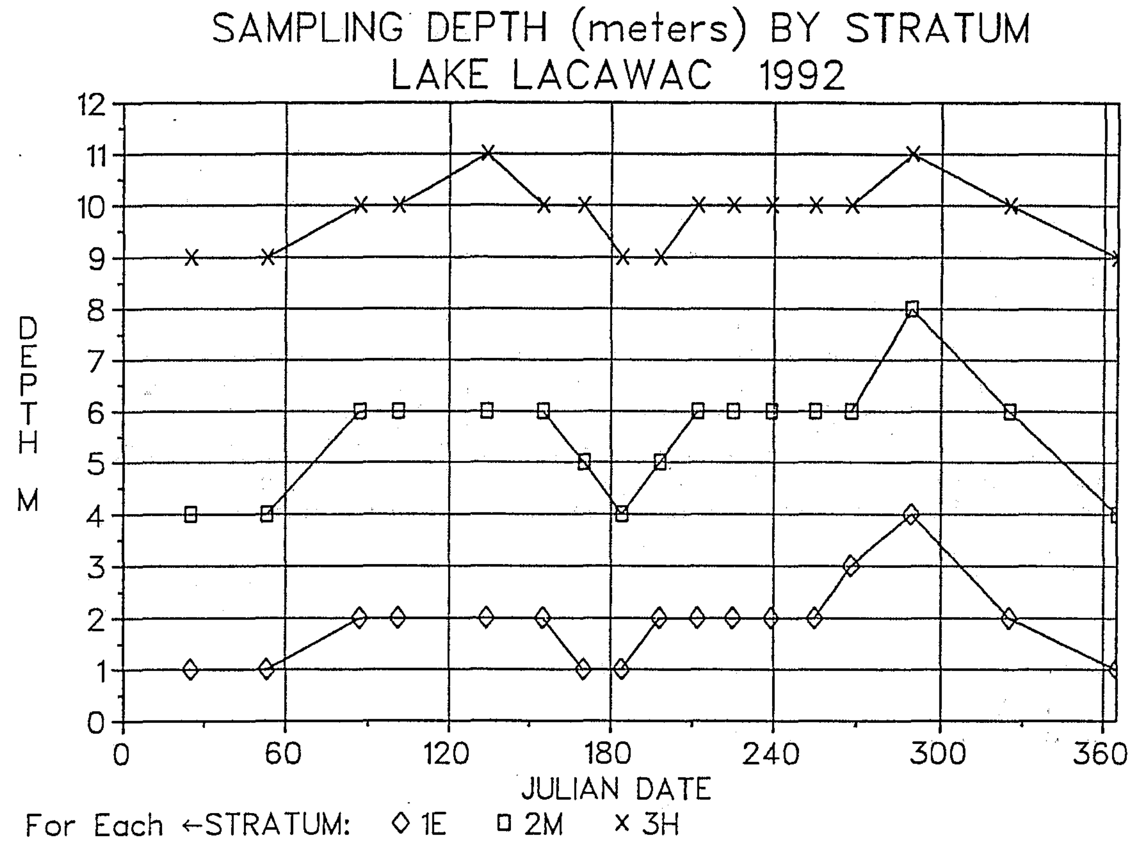



**Figure 1. Depths of "EPI", "META", and "HYPO" samples from Lake Lacawac, 1992.**

Sampling depths were selected by the field sampling crew based on the temperature profile on each date (see text for discussion).

## TEMPERATURE AND PHYSICAL STRATIFICATION

Temperature was measured at 1-metre intervals with the thermister of a YSI™ oxygen meter, in degrees Celsius. Accuracy should be within 1 degree. (This is **Method #10.**)

**Figure 2** shows the thermal stratification that develops during late spring and summer, then breaks down in the autumn. On day 25 (25 January) the lake was ice-covered, and displayed a "reverse stratification". After ice-out (ca. 10 March) the water column circulated from top to bottom during "spring turnover", as evident in the nearly isothermal (4-6°C) water column of day 101 (10 April). By day 184 (2 July), heating of the surface waters had produced a strong thermal stratification. This is recognized as the differentiation of the water column into a thin upper warm water layer which periodically circulated in contact with the atmosphere (the **EPILIMNION**, 0-2.5 metres, temperature 21-24°C; an intermediate layer of rapid temperature decrease with depth (the **METALIMNION**, 2.5-7 metres); and a deep layer of cold water (the **HYPOLIMNION**, 7-13 metres, temperature 6-8°C).

The usual course of thermal stratification is that of slow, gradual thickening of an epilimnion during the late summer. By day 268 (24 September) Lake Lacawac's epilimnion extended to 5 metres. As the lake cooled during the autumn, the epilimnion thickened more rapidly until the lakewater was circulating from top to bottom. This period of full circulation, or "fall turnover", was in progress on day 325 (20 November). The lake continued to cool, down to 3°C, until it froze over--sometime in December. **Figure 3** presents the detailed trends of water temperature at three fixed depths (2,6,10 metres) for comparison with other years.

The temperature pattern in the lake is controlled by climate, and will differ only slightly from year to year. Two major variables are the durations of winter ice-cover (ca. 12 weeks in 1991-92, from 18 December to ca. 10 March) and the completeness of spring turnover. During an especially warm spring, Lake Lacawac might stratify quickly without a thorough mixing of deep and surficial layers, leaving the winter bottom waters incompletely reoxygenated and their nutrients only partially mixed into the surface waters. This might lead to some differences in the biology and chemistry of the summer plankton community. Spring turnover was complete in 1992, however, as it also was in 1990 and 1991.

Although the winter of 1991-92 was relatively warm, air temperatures from March through December returned to the long-term means (**Figure 10**). As a result, the lake was somewhat cooler than in 1991, an especially warm year. The maximal midsummer epilimnial temperature (ca. 24-25°C) was the same as in earlier years (1989-1991), but was reached more slowly than in 1991, and the epilimnial layer itself was a little thinner.

Water samples for **pH**, **alkalinity**, **chlorophyll**, and **algae** were collected from mid-depths of the three layers when thermal stratification was well developed. During turnover periods, the lake was divided into three equal layers. Under ice-cover (e.g. 25 January), the topmost layer was 0-1m, and the remaining depths were divided at the Secchi depth (see **SECCHI DEPTH** below)

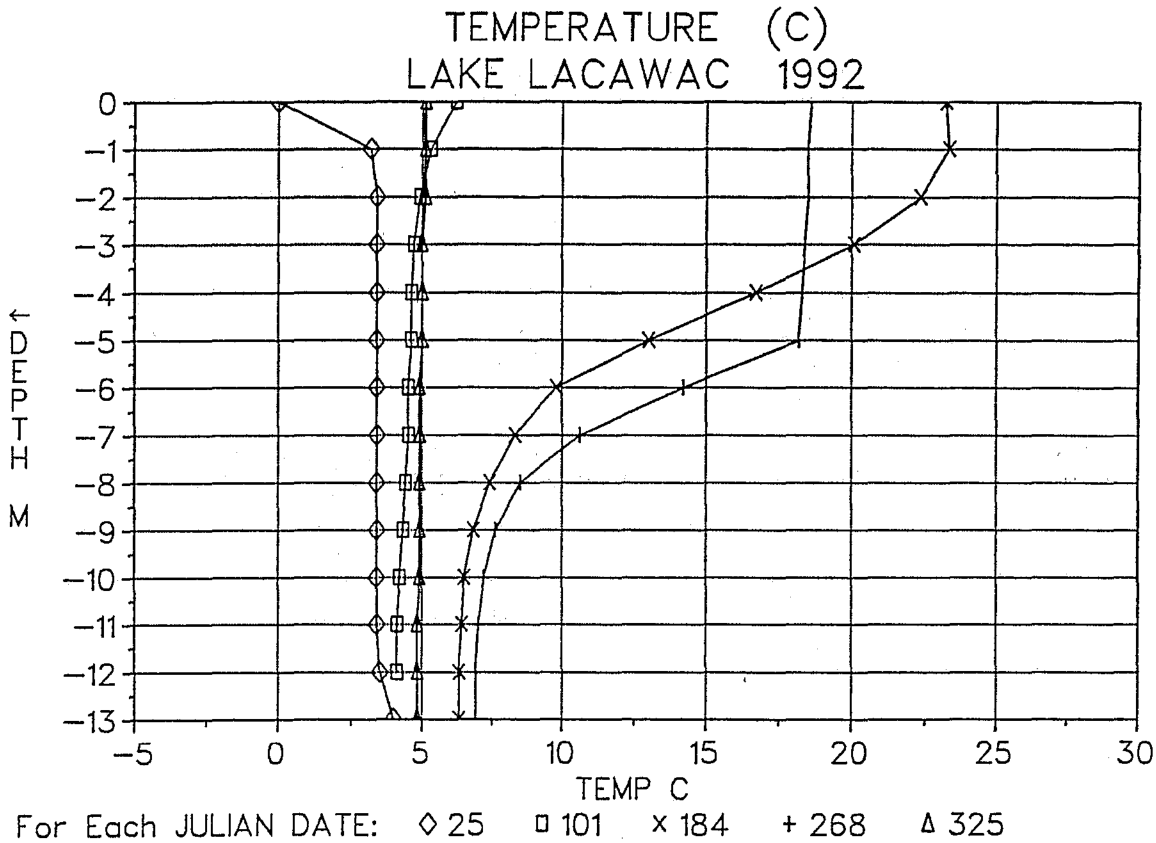



**Figure 2. Temperature profiles in Lake Lacawac, 1992.**

Values (°C) are plotted for five dates: **25 January** (day 25 --winter ice cover), **10 April** (day 101 --spring turnover), **2 July** (day 184 --midsummer stratification), **24 September** (day 268 --late stratification), **20 November** (day 325 --fall turnover).

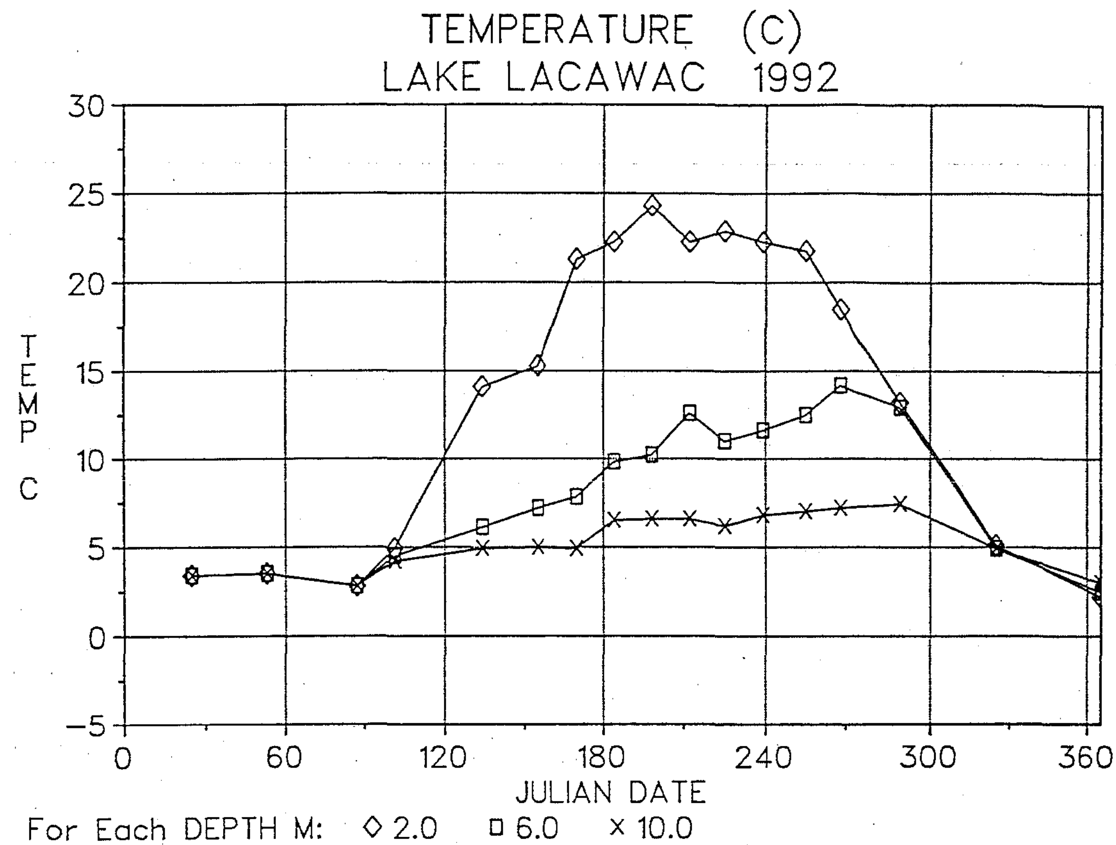



**Figure 3. Temperature trends within Lake Lacawac, 1992.**

Values (°C) are plotted for three fixed depths.

## LIGHT PENETRATION

Light intensity at 1-metre intervals was calculated as a percentage of the light just below the lake surface (10 cm). Since 1988, three slightly different methods have been used to construct a 0-12 m profile of light penetration; method #12 (numbers correspond to codes from data tables) was used on all dates in 1992:

**Method 12.** Two Licor quantum sensors, mounted 1-m apart on a common line, electronically computed the ratio of quantum intensities between the nominal depth and the depth above it. The percentage penetration profile was constructed from these ratios.

Light penetration is plotted on a logarithmic scale for five dates **(Figure 4)**. During the summer, depths above 3.5 m (i.e. all of the epilimnion) received 5-10% of the light penetrating the lake surface. The metalimnion received 0.4-10% of surface light, enough for algal growth. In 1992 we did not encounter especially high spring or fall algal populations with concommitant reductions in light penetration.

## SECCHI DEPTH

Secchi depth is the depth, in metres, at which a white-and-black quartered disk 20 cm in diameter just ceases to be visible to an observer lowering it from a boat. It is a measure of water transparency. We observed the Secchi disk with a small glass-bottomed viewing box to reduce glare from the lake surface.

The pattern of transparency **(Figure 5)** followed a common pattern in temperate lakes. Transparency was greatest during late spring (reaching 7 metres) as zooplankton grazed down the spring algal populations. During June and July, however, relatively inedible algae became established, reducing transparency to less than 4 metres. Transparency increased again during the fall to 5-6 metres.

## OXYGEN CONTENT OF THE LAKEWATER

Dissolved oxygen was measured polarographically using a YSI™ submersible temperature-compensating oxygen meter. The meter was calibrated in air to 100% saturation immediately before use in the lake. The effect of Lake Lacawac's elevation above sea-level (1439 feet) was not taken into account when calibrating the meter, so all compiled values are roughly 5% too high. Units are mg $O_2$ per litre. (This is **Method #10.**)

Often the meter did not give a true "zero" when dropped into definitely anoxic (oxygen-free) water. Values flagged with error code "4" in the data tables should be treated as true zeros.

During winter ice cover, oxygen became only partly depleted, then was completely recharged during spring turnover. In combination with little snow cover (as in winter 1991 and 1992), good light penetration helped offset oxygen depletion by supporting moderate levels of algal growth deep into the water column. In any case, at sampling dates in mid-to-late February, oxygen has been depleted below 5 mg/L only in the very deepest waters (12-13 metres) during our 3 years of winter-spring observations.

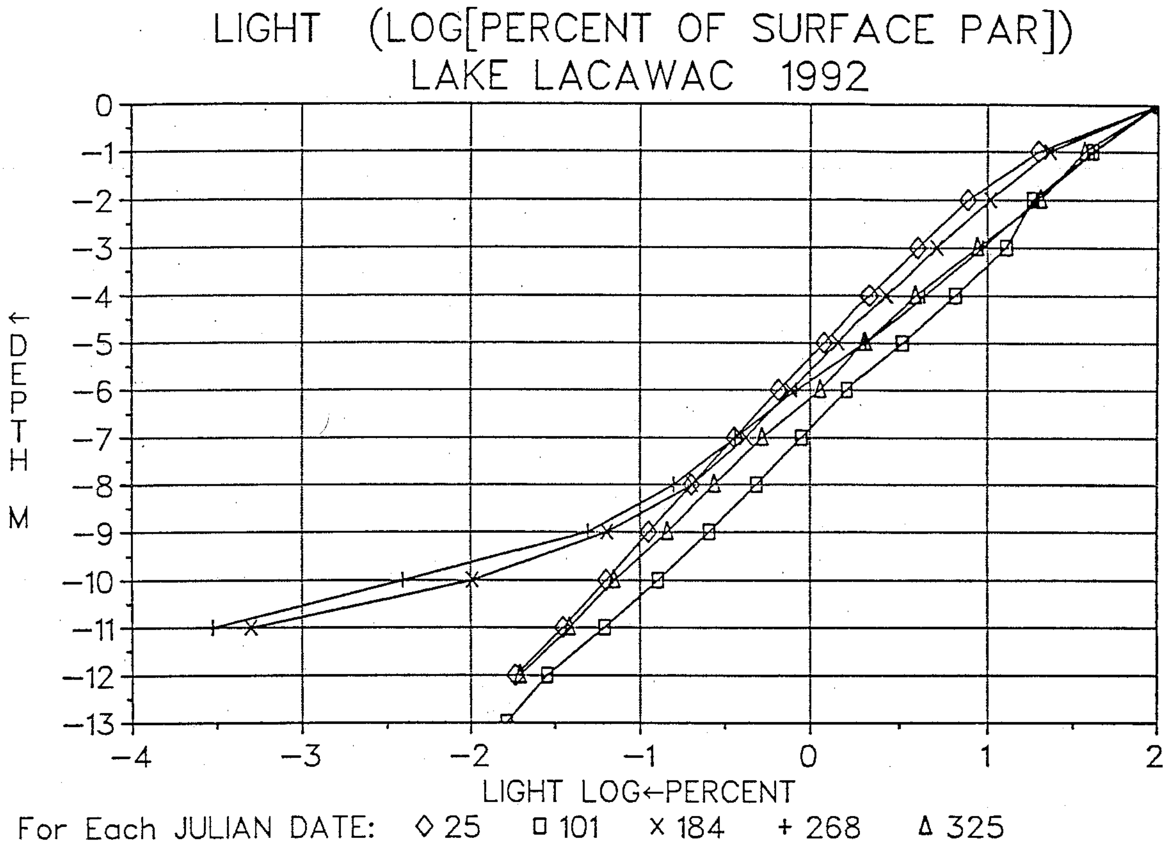



**Figure 4. Light penetration in Lake Lacawac, 1992.**

Values are percentages of the light at 0.1 m depth and are graphed on a logarithmic scale (i.e., 100% ="2", 10% ="1", 1% ="0", etc.) for five dates: **25 January** (day 25 --winter ice cover), **10 April** (day 101 --spring turnover), **2 July** (day 184 --midsummer stratification), **24 September** (day 268 --late stratification), **20 November** (day 325 --fall turnover).

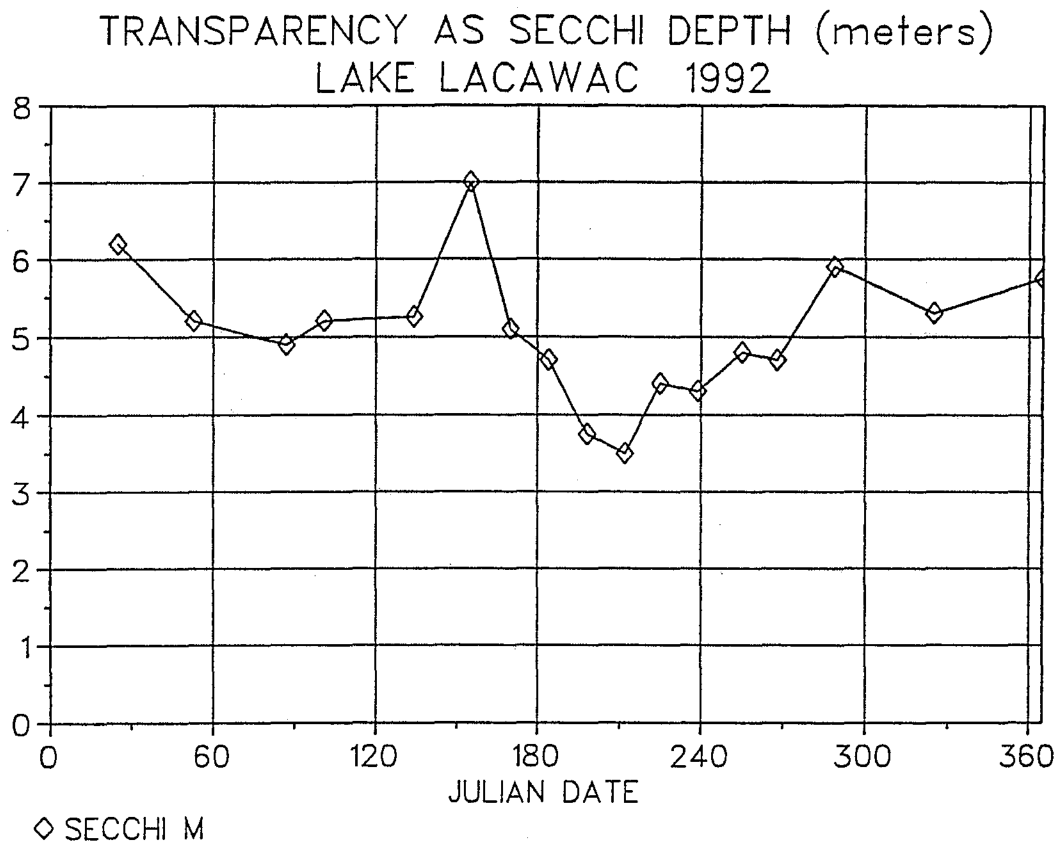



**Figure 5. Transparency in Lake Lacawac, 1992.**

Values plotted are the Secchi depths, in metres.

The onset of thermal stratification in mid-spring marked the onset of gradual depletion of oxygen within the hypolimnion. By day 184 (2 July) the hypolimnion was still substantially oxygenated, though oxygen concentrations were strongly depleted in the lower hypolimnion (**Figure 6**). Hypolimnetic oxygen depletion in 1992 lagged behind the trends of preceding years. In the epilimnion in summer, oxygen was maintained slightly above atmospheric saturation, at least during the day, by algal photosynthesis (usually oxygen was sampled in late morning or early afternoon). During autumn turnover the deeper water column was progressively recharged with atmospheric oxygen. On day 325 (20 November), halfway through the turnover period, the oxygen content of 0-12 m water was already almost 11 mg/L, approaching full saturation with respect to the atmosphere (12.2 mg/L at Lacawac's elevation for 5°C).

## ALKALINITY AND pH

Alkalinity is a measure of the acid neutralizing, or buffering capacity. Alkalinity was determined by potentiometric titration of a 100-ml sample using 0.01 or 0.1 N sulfuric acid as titrant and monitoring pH change with an Orion™ model SA250 pH meter and Ross™ epoxy-body combination electrode. Titration points between pH 4.4 and 3.7 were plotted, after Gran transformation, to give alkalinity in microequivalents per litre ($\mu$eq/L). (This is **Method #11**.) Alkalinity was analyzed monthly, on alternate sampling dates during summer.

Samples for alkalinity and pH were taken from duplicate water collections (acrylic plastic Van Dorn bottle) at three depths, designated "**E**" (epilimnion), "**M**" (metalimnion), and "**H**" (hypolimnion). Selection of these depths is described in the section **TEMPERATURE AND THERMAL STRATIFICATION**. Samples were stored in air-tight polypropylene bottles for up to 24 hr (refrigerated) before analysis. Samples were warmed to room temperature before analysis. The pH meter and electrode described above were calibrated with commercial high ionic strength buffers. The pH was measured in 50-ml aliquots of sample with gentle mixing. The following variant of the method was employed on all dates in 1992:

**Method 11.** As above with 0.5 ml salt solution (Orion™ pHisa™ solution) added to increase ionic strength. Usually, this had little or no effect on the sample (pH change $<0.1$ unit). Also, a quality assurance protocol was followed, verifying electrode performance in distilled water and the stability of calibration.

Trends of pH are plotted for each layer in **Figure 7**. In the absence of intense biological activity, the pH of Lacawac would be about 6 with an alkalinity of about 30 ueq/L (**Figure 8**), judging from values in late spring. These values portray a softwater, slightly acidic lake with little bicarbonate buffering capacity. Microbial metabolism generated substantial alkalinity in the anoxic hypolimnion (**Figure 8**), but this was lost upon reoxidation of the water column during fall turnover and subsequent winter stratification.

## ALGAL CHLOROPHYLL-a

Chlorophyll-a is a measure of algal mass, since all algae contain this pigment. It is a widely used parameter for comparisons of lake trophic conditions.

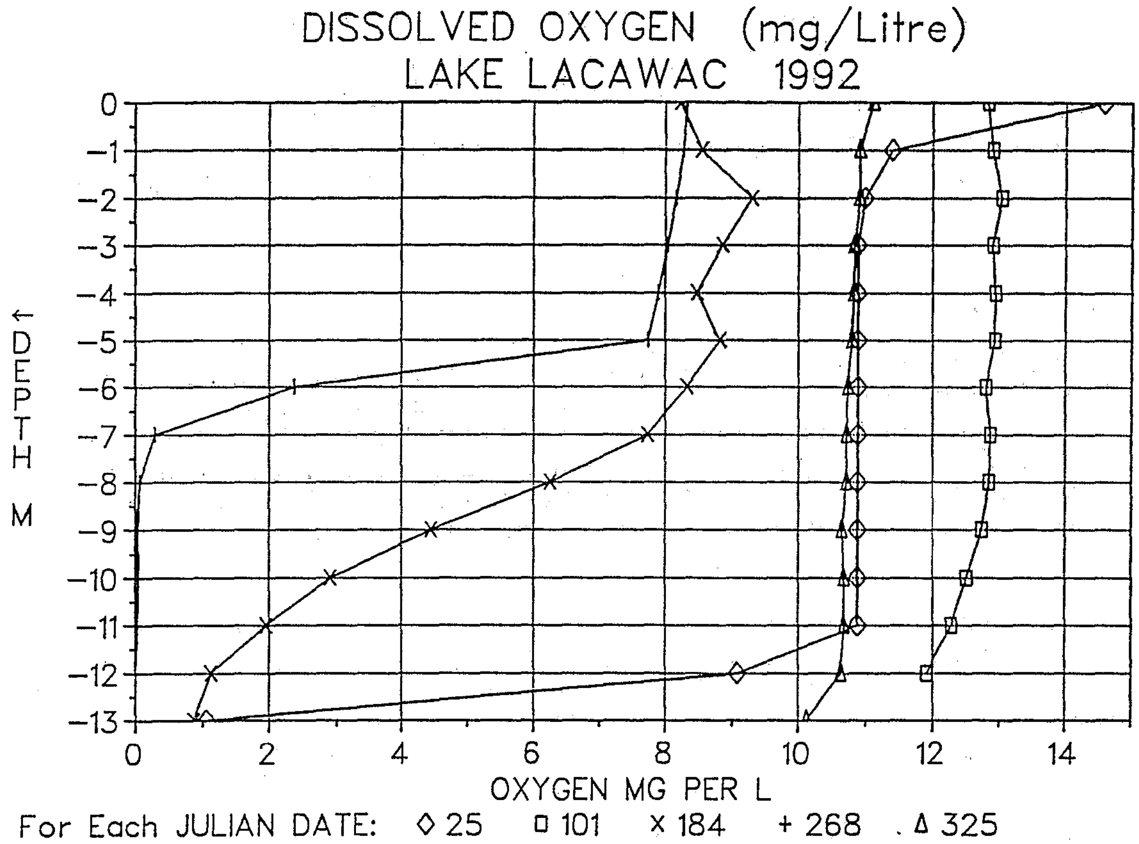



**Figure 6. Dissolved oxygen in Lake Lacawac, 1992.**

Values (mg oxygen per litre) are plotted for five dates: **25 January** (day 25 --winter ice cover), **10 April** (day 101 --spring turnover), **2 July** (day 184 --midsummer stratification), **24 September** (day 268 --late stratification), **20 November** (day 325 --fall turnover).

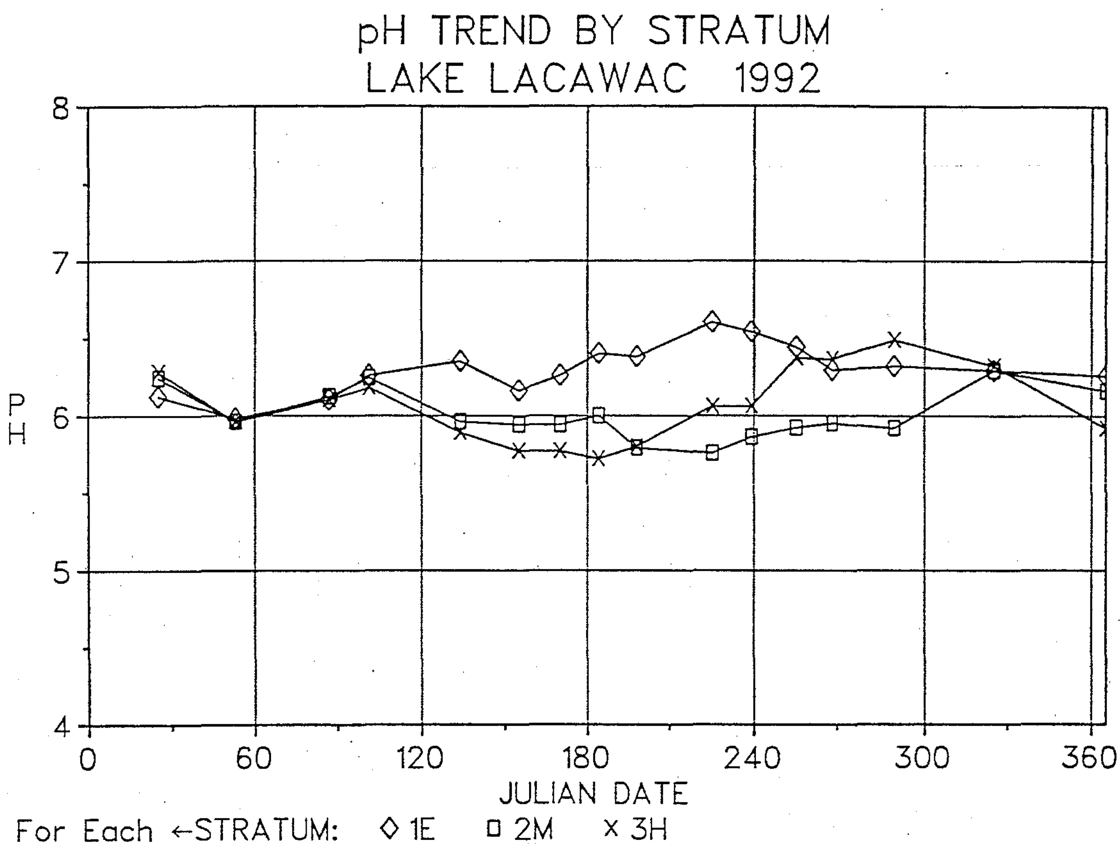



**Figure 7. Trends of pH in Lake Lacawac, 1992.**

Values are plotted for the mid-depths of the three layers, Epilimnion (1E), Metalimnion (2M), and Hypolimnion (3H). In autumn and winter, when these layers are not developed, samples are collected as described in **RESULTS AND METHODS.**

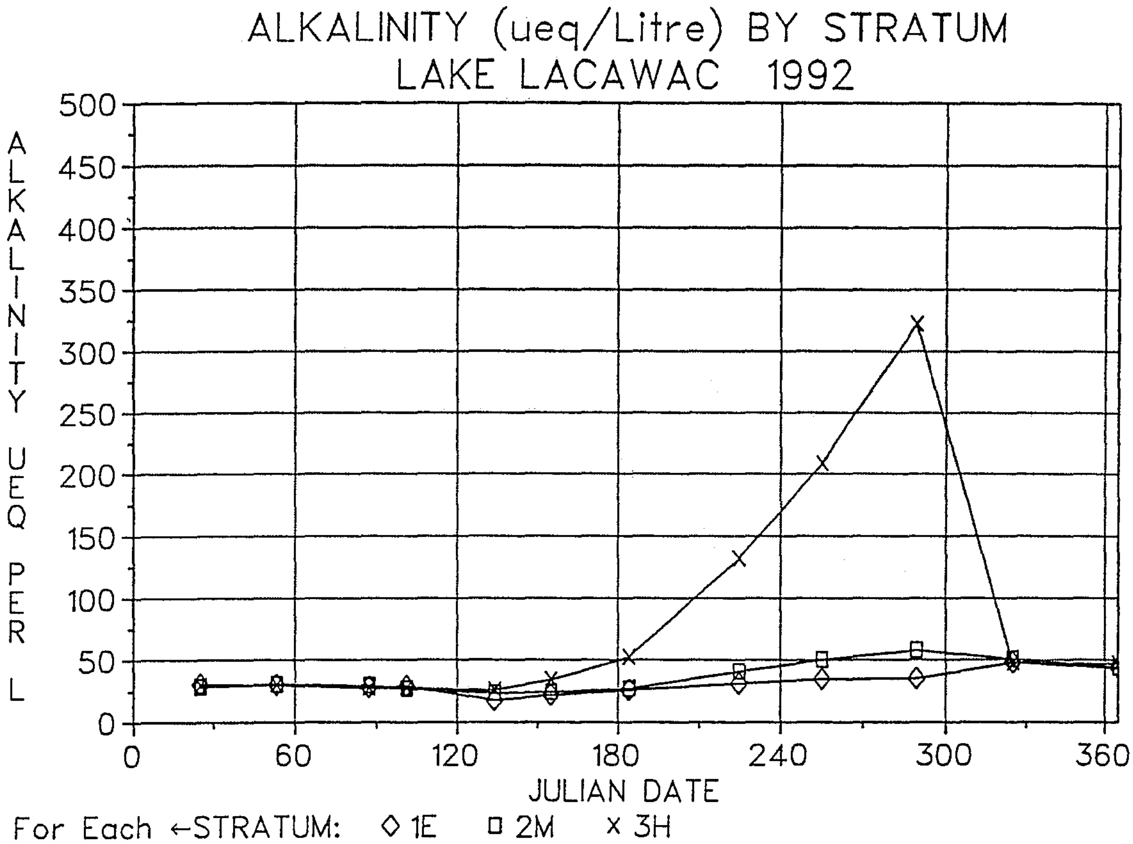



**Figure 8. Trends of Alkalinity in Lake Lacawac, 1992.**

Values are plotted for the mid-depths of the three layers, Epilimnion (1E), Metalimnion (2M), and Hypolimnion (3H). In autumn and winter, when these layers are not developed, samples are collected as described in **RESULTS AND METHODS**.

Chlorophyll samples came from the same Van Dorn collections used for pH and alkalinity. Samples were stored in 1-L polyethylene bottles for 2-24 hr (refrigerated in darkness) before being filtered (0.5 L onto Gelman™ A/E filters) and frozen. Two samples were analyzed from each depth: a whole-water sample (for total chlorophyll-a) and a sample fractionated with a 22-$\mu$m nitex net. Recovery of algae from the fractionated samples was often incomplete. This sum was treated as a replicate for total chlorophyll-a only if it was greater than or equal to 85% of the whole sample. The percentage of chlorophyll passing the 22-$\mu$m net (percent of the summed fractions) is presented in the data tables (**CHLAC P**). **Method 12** was used for all chlorophyll extractions:

**Method 12.** Intact filters were extracted overnight at 2-4°C, in darkness, in 12 ml of a 5:1 (vol/vol) mixture of 90% basic acetone and methanol. Extracts were centrifuged and read in a Sequoia-Turner™ model 112 fluorometer equipped with F4T5/B lamp, red-sensitive photomultiplier, 5-60 excitation filter and 2-64 emission filter. The meter was calibrated with dilutions of pure chlorophyll-a or chlorophyll-a,b extracts from higher plants; these were assayed first by standard spectrophotometric techniques. Each sample was reread after acidification (to 0.03 N) to allow correction for pheopigments. We verified that chlorophyll behaves virtually the same in the mixed solvent as in 90% acetone alone, and that the extractions gave similar results. Two values are presented: Chlorophyll-a corrected for pheopigments (**CHLAC** in data tables and **Figure 9**) and Chlorophyll-a including pheopigments (**CHLASUM** in data tables).

Chlorophyll trends in Lake Lacawac (**Figure 9**) displayed the moderate summer levels characteristic of a "mesotrophic" lake (2-6 ug/L). Metalimnetic peaks were not pronounced, or, if present, were missed in sampling There was a pronounced late winter peak under the ice at all three depths (15-21 ug/L) that must reflect relatively good light penetration through a snow-less ice cover. As in 1989 and 1990--but in contrast to 1991--there was not a fall peak in algae.

**ZOOPLANKTON**

Zooplankton receive a major emphasis in the PCLP program. These animals represent the key link between algal primary producers and fish populations. The intensity of grazing by herbivorous zooplankton strongly affects the kind of algae that dominate, and potentially can control (i.e. reduce) algal populations even in the face of abundant nutrient supply. Consequently the kinds and abundances of zooplankton have important implications for the perceived recreational quality of a lake.

Zooplankton were sampled at day and night, but only the nighttime data are presented here. Some species avoid the water column during the day. Zooplankton were collected with closing-style plankton nets that could be pulled through part of the water column open, collecting animals, then closed and pulled the rest of the way to the surface. In this way the water column was sampled as the three layers defined by temperature. In the present report, data are calculated as mean concentrations (numbers of individuals per litre) over the entire 12.5-m water column. Details of the depth-distributions, and daily patterns of vertical movement, are still being analyzed.

Two sizes of nets were used: a 30-cm diameter net with a mesh of 202 $\mu$m, for some macrozooplankton; and a 15-cm diameter Wisconsin-style net with a 48-$\mu$m mesh for microzooplankton as well as other macrozooplankton. These were mounted side-by-side in

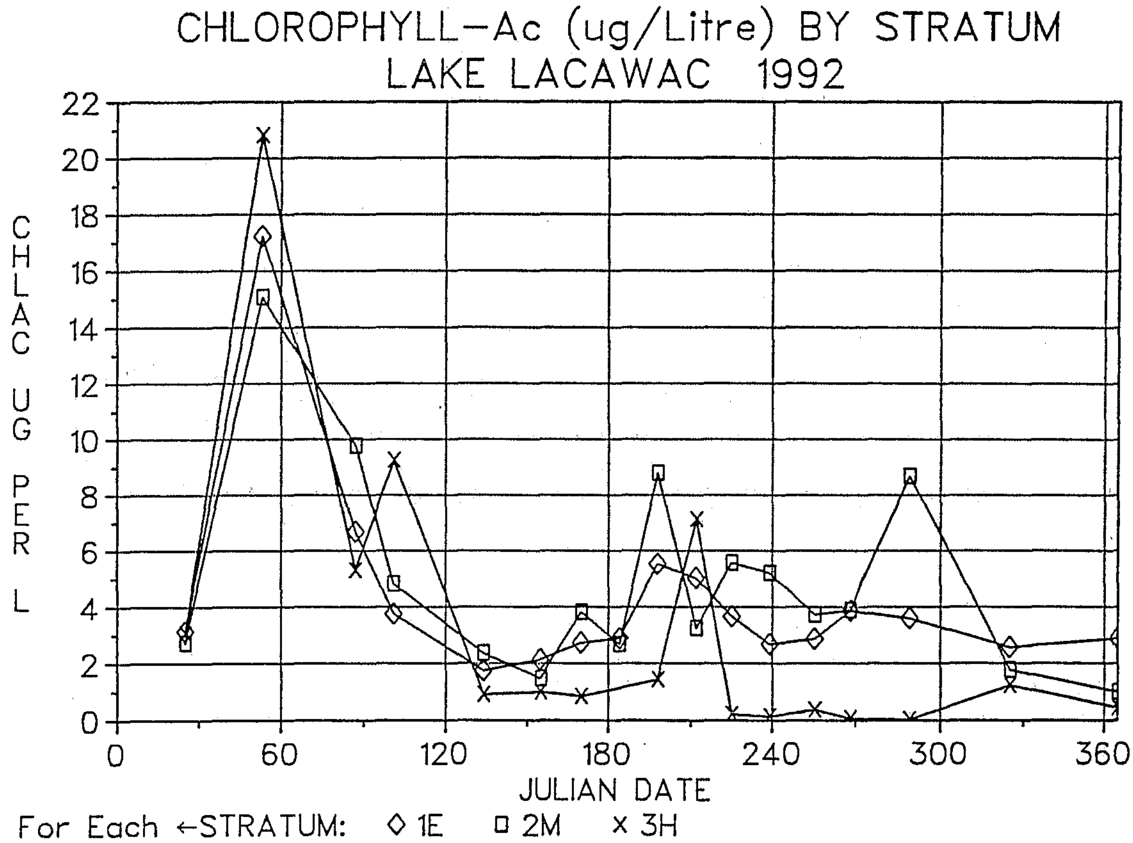



**Figure 9. Trends of Chlorophyll-a in Lake Lacawac, 1992.**

Values are plotted for the mid-depths of the three layers, Epilimnion (1E), Metalimnion (2M), and Hypolimnion (3H). In autumn and winter, when these layers are not developed, samples are collected as described in **RESULTS AND METHODS**. Chlorophyll-a values are corrected for pheopigments. Values of "0.0" for hypolimnia samples in late summer are underestimates caused by an interference in the fluorimetric analysis.

"bongo" configuration. Microzooplankton includes mainly rotifers, but some copepods and small Cladocera also were counted from these samples. Our counting strategy was somewhat different in 1991-92 from that used in 1989 or 1990, with *Chaoborus* and some copepods (including *Diaptomus minutus*) being counted from the 48-$\mu$m sample that had been counted from 202-$\mu$m samples in previous years. This change was made to increase collection efficiency of forms (e.g. small instar *Chaoborus*, copepodids, male copepods, etc.) that were going through the 202-$\mu$m mesh net. Collections were duplicated for each depth range. Mean values are presented.

Seasonal trends in abundance are presented as a series of graphs for the most frequently encountered zooplankton, identified to genus and sometimes to species (**Figures 11-37**). **Table 1** lists the zooplankton identified to date. Several points can be highlighted about 1992 compared to previous years:

(1) Although most features of the zooplankton trends are repeated each year, a couple of variations in 1992 warrant mention. 1992 was a poor year for the predatory cyclopoid copepod *Mesocyclops edax*. Usually an important species in late summer and early fall (typically ca. 0.5 adults/L), fewer copepodids appeared in spring than previously, and the summer population only reached ca. 0.1/L. In Lake Waynewood, too, this was a poor year for *Mesocyclops edax*. In Lacawac, two other cyclopoids were correspondingly more common than previously: *Orthocyclops modestus* in winter (>1 adult/L) and *Tropocyclops prasinus* in spring through late summer (2-3 adults/L).

(2) The abundance of *Orthocyclops modestus* is an example of an erratic appearance by a potentially relatively abundant species. The population developed during summer and fall 1991, overwintered as copepodids (ca. 5/L) with subsequent spring adults at 2-3/L, but then disappeared. The rotifer *Keratella crassa* followed a similar pattern.

(3) Rotifers reached a spring peak (500-1000/L) similar to those in previous years. The summer population was suppressed to ca. 200/L, as in 1991.

(4) *Daphnia* counts were somewhat erratic, but showed the usual late spring and fall peaks, with especially low summer levels (<1/L from late July into September). An especially high population of overwintering, but non-reproductive, adults (5-10/L) may have reflected high algal concentration under the clear ice (15-21 ug chlorophyll-a/L). These adults largely disappeared before reproduction resumed with increasing water temperatures.

(5) *Holopedium* displayed spring and fall peaks (3-8/L) not unlike those of *Daphnia*. It declined to ca. 1/L during the summer, again like *Daphnia*, and unlike its relatively high summer populations of previous years. As in previous years, much of the summer population was aggregated into a small patch of high concentration, which may or may not have been proportionately represented in our samples from the mid-lake buoy. The size of this patch seemed to decrease as the summer progressed, and there was little prevalence of degenerate eggs, unlike 1990 and 1991 (R. Moeller, personal observation).

(6) *Diaptomus minutus* reached peak concentrations in winter and spring (ca. 5 adult females/L) when chlorophyll was high, and subsequently declined to especially low concentrations throughout summer and fall (1-2 females/L). The population was twice this level in 1991; in fact the fall population of adults was only one-fifth of those in 1989-91.

**Table 1.** Zooplankton species recorded from open-water samples in Lake Lacawac 1988-1992. Seasons of especially high or low abundance in 1992 are indicated.

| | Taxon | Seasonal Abundance in 1992 High | Low |
|---|---|---|---|
| Diptera | | | |
| ** | *Chaoborus* spp. | Su | [W] |
| | *C. flavicans* | | |
| | *C. punctipennis* | | |
| Cyclopoid Copepoda | | | |
| ** | *Cyclops scutifer* | | |
| | *Eucyclops agilis* (rare) | | |
| * | *Mesocyclops edax* | | |
| ** | *Orthocyclops modestus* | W | [Sp,Su,F] |
| ** | *Tropocyclops prasinus* | Sp | [F,W] |
| Calanoid Copepoda | | | |
| ** | *Diaptomus minutus* | W,Sp | [Su] |
| Cladocera | | | |
| | *Bosmina* sp. | | |
| | *Chydorus* spp. | | |
| ** | *Daphnia* spp. | W,Sp,F | [Su] |
| | *D. catawba* | | |
| * | *Diaphanosoma* spp. | late Su,F | [W,Sp] |
| ** | *Holopedium gibberum* | late Sp, early F | [Su,W] |
| * | *Leptodora kindtii* | | |
| Rotifera | | | |
| | *Ascomorpha* spp. | | |
| * | *A. ovalis* | | [W] |
| * | *Asplanchna* spp. | | [W] |
| * | *Collotheca* spp. | | |
| * | *C. mutabilis* | F | [W,Sp] |
| ** | *Conochilus* spp. | Sp | [W,Su] |
| | *Gastropus* spp. | | |
| * | *G. hyptopus* | Sp | [F] |
| * | *G. stylifer* | Sp | [F] |
| | *Kellicottia* spp. | | |
| * | *K. bostoniensis* | | |
| ** | *K. longispina* | late Sp, early Su | [F] |

continued next page

**Table 1.** Zooplankton in Lake Waynewood, 1988-1992 (continued)

| | Taxon | Seasonal Abundance in 1992 High | Low |
|---|---|---|---|
| | *Keratella* spp. | | |
| * | *K. cochlearis* | | |
| ** | *K. crassa* | W,Sp | [F] |
| * | *K. hiemalis* | W,Sp | [late Su,F] |
| * | *K. taurocephala* | W | |
| | *Lecane* spp. | | |
| | *L. flexilis* | | |
| | *L. signifera* | | |
| | *L. tenuiseta* | | |
| | *Monommata* | | |
| | *Monostyla* spp. | | |
| | *M. closterocerca* | | |
| | *M. copeis* | | |
| | *M. lunaris* | | |
| | *Notholca* spp. | | |
| | *N. squamula* | | |
| | *Notommata* spp. | | |
| | *Ploesoma* spp. | | |
| * | *P. truncatum* | Su | |
| | *Polyarthra* spp. | | |
| ** | *Polyarthra* ("large") | | |
| * | *Polyarthra* ("small") | | |
| * | *Synchaeta* spp. | | |
| | *Trichocerca* spp. | | |
| | *Trichocerca* ("small") | | |
| * | *T. cylindrica* | | |
| * | *T. multicrinus* | | |
| | *T. porcellus* | | |
| * | *T. rousseleti* | | |
| * | *T. similis* | Su | |

Abbreviations for seasons of maximal or [minimal] abundance:
W (winter), Sp (spring), Su (summer), F (fall).

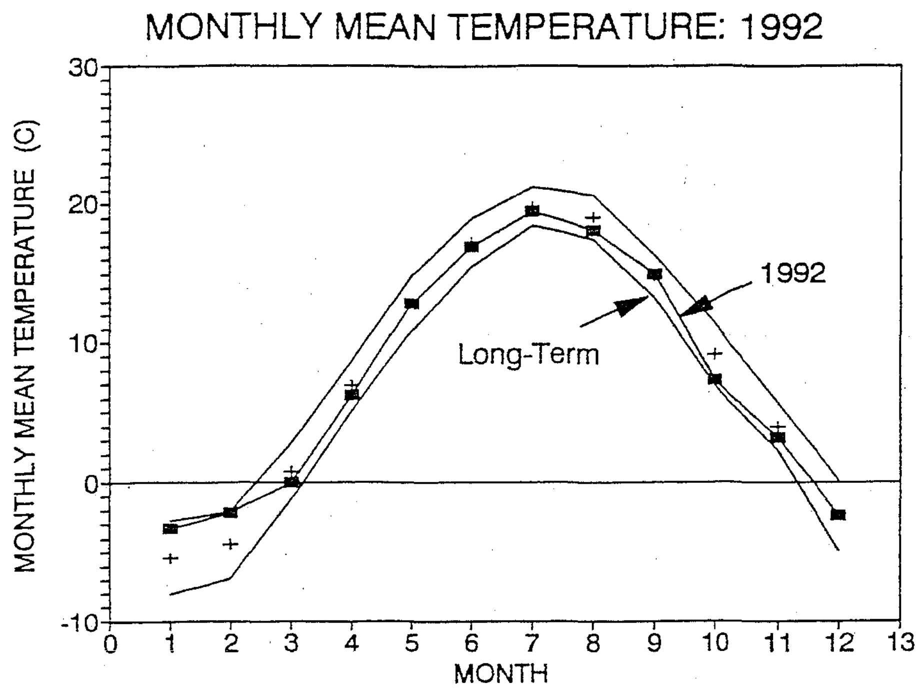
** Dominant species included in Figures
* Other common species included in Figures

(7) Several major zooplankton grazers (*Daphnia*, *Holopedium*, *Diaptomus*, as well as some rotifers) were less abundant in summer 1992 than in immediately preceding summers. Two other predatory macrozooplankton were at similar levels, however: *Leptodora* at 0.02-0.05/L and *Chaoborus* at 0.2-0.5/L.

(8) *Leptodora* is strictly a summer species, building up quickly during July and disappearing (to overwintering eggs?) quite suddenly in early October. Several of the rotifers display equally strong seasonal populations, especially in spring, e.g. *Kellicottia longispina* and *Gastropus* spp.).

## CLIMATE IN 1992

Weather data from Hawley, PA (20 km N of Lake Lacawac) have been compiled for 1992 and the previous 30 years **(Figure 10)**. These data are from a NOAA cooperator's station. Mean temperature is the monthly mean of daily mean temperatures, whereas precipitation is the monthly total of daily total recorded amounts. After a relatively warm, dry winter, 1992 was a pretty normal year overall for both temperature and precipitation, and thus cooler and moister than 1991.



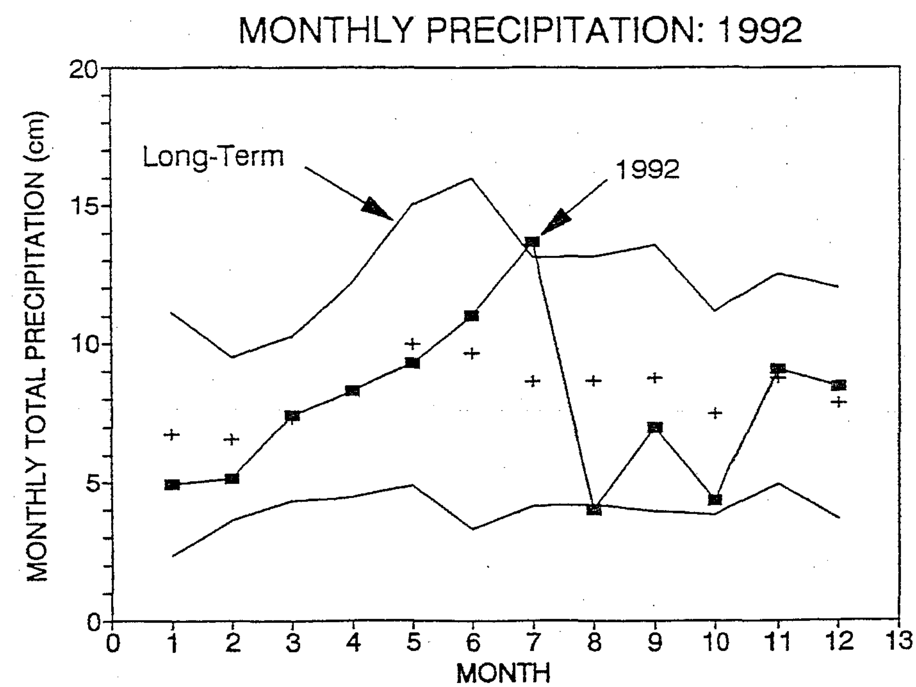



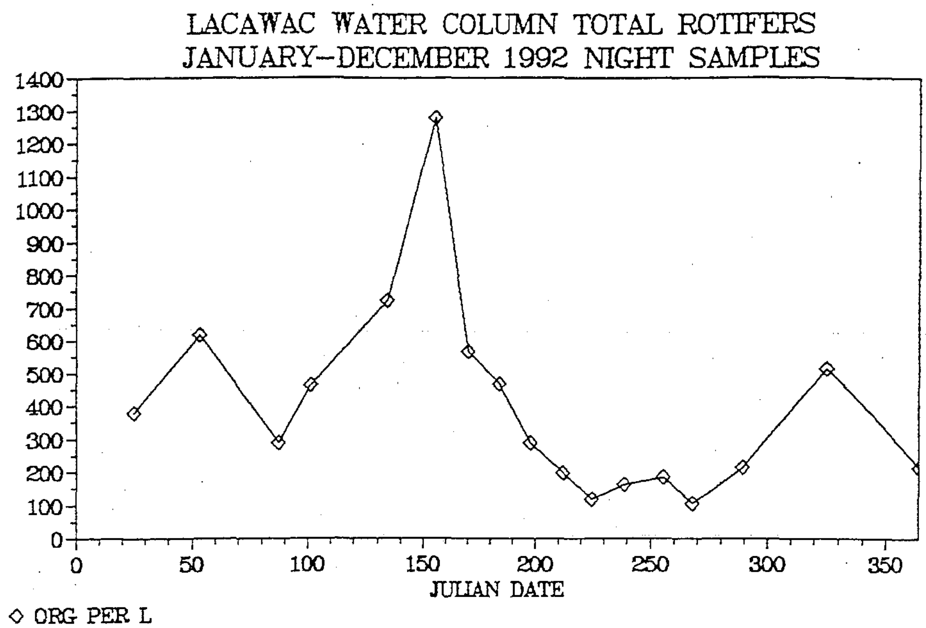

**Figure 10. Monthly climate in 1992 compared to the 31-year averages.**

**(Top)** Mean temperature (degrees Celsius). **(Bottom)** Monthly mean precipitation (cm rain or thawed snow). Data are from the NOAA cooperator's station at Hawley, PA. Long-term values (+) are enclosed in an envelope defined by one standard deviation of the monthly values.

# ZOOPLANKTON GRAPHS

The following graphs present water-column mean nighttime concentrations of the common zooplankton at the main sampling station. Each data point was calculated by weighting concentrations in the three layers (EPI, META, HYPO) on each date by the relative thickness of the layer at the station, which was in the deepest part of the lake. Two replicate samples were taken in quick succession.

The electronic database contains the component concentratons within the three layers, separate counts for the two replicates, and similarly complete data from the comparable daytime sampling.



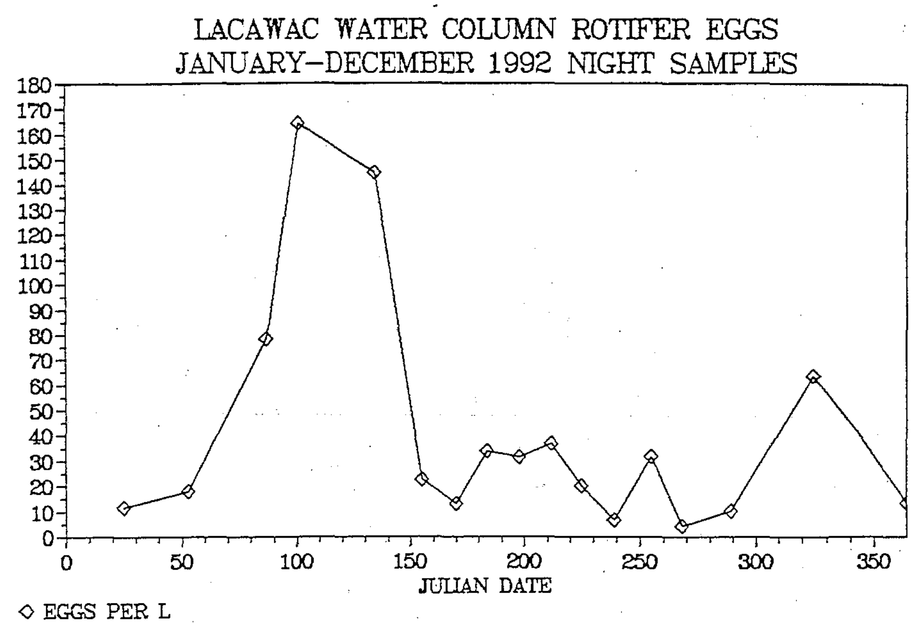
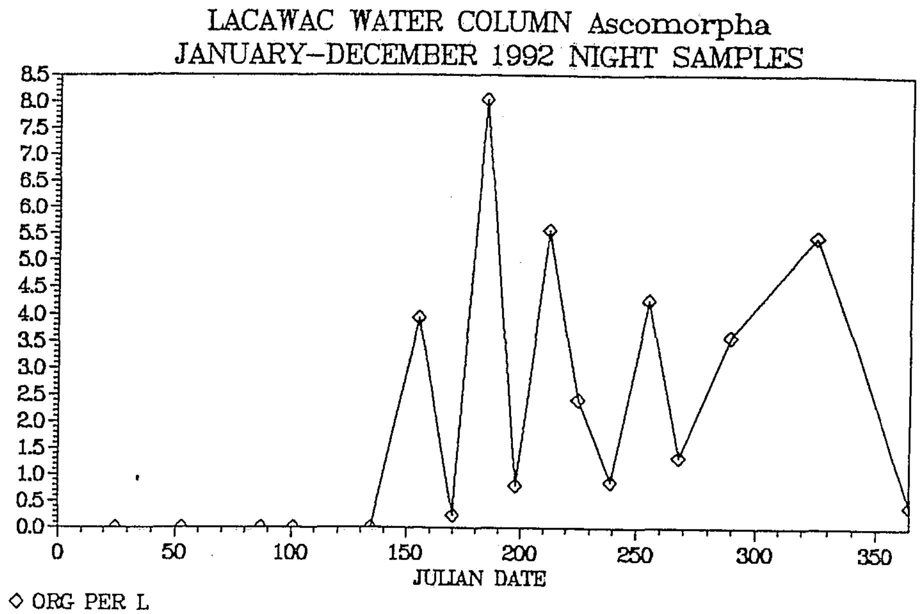




**Figure 11. Rotifers in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** Rotifer eggs per litre.



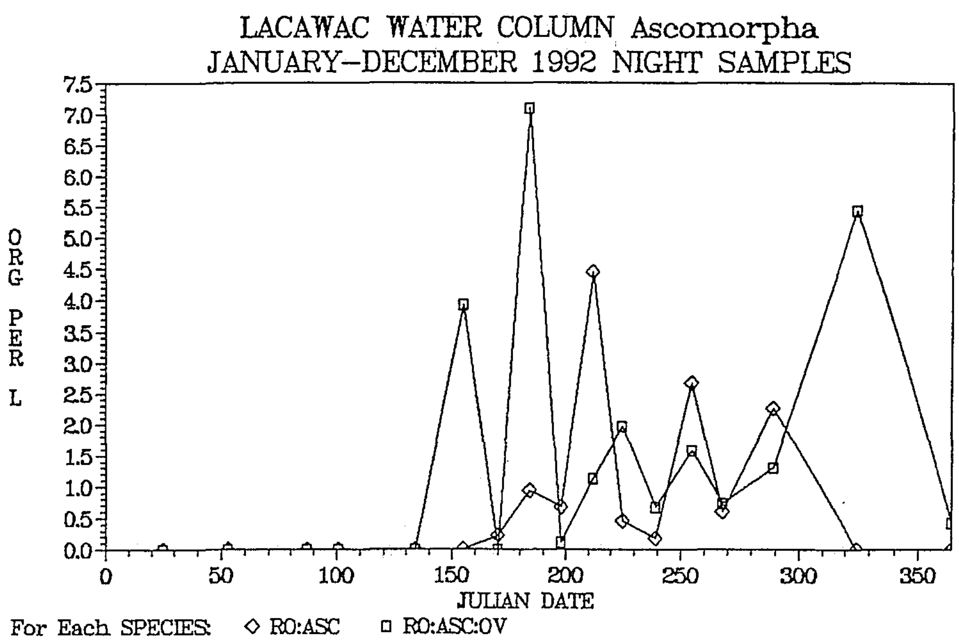




**Figure 12. The rotifer *Ascomorpha* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per litre. **(Bottom)** *Ascomorpha* by species: **ASC** undifferentiated species, **OV** *A. ovalis*.

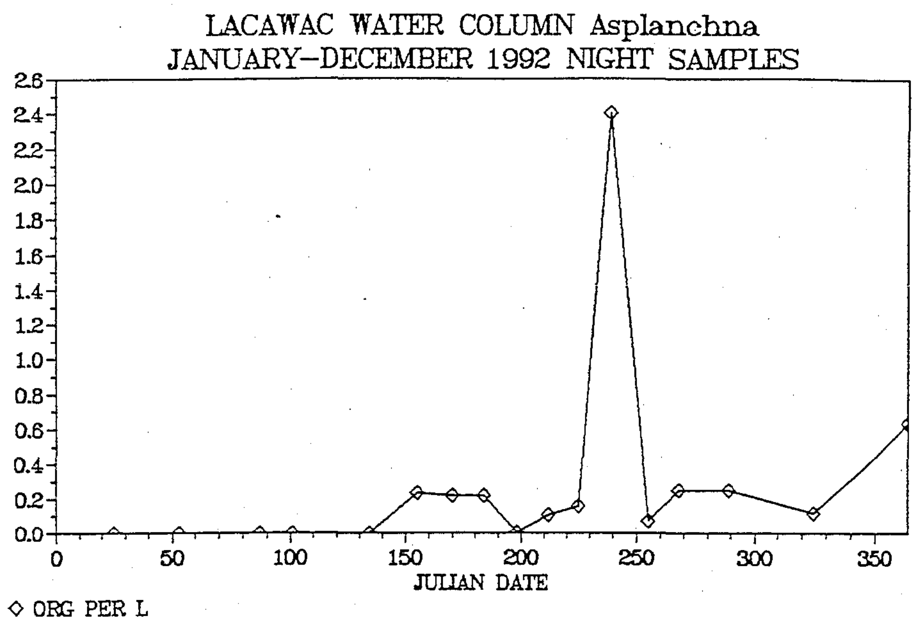
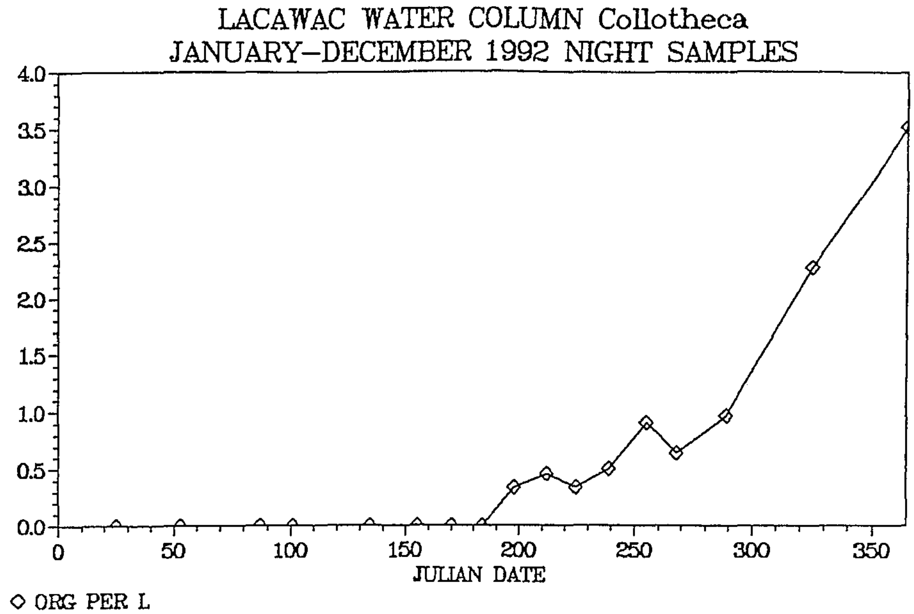



**Figure 13. The rotifer *Asplanchna* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean.



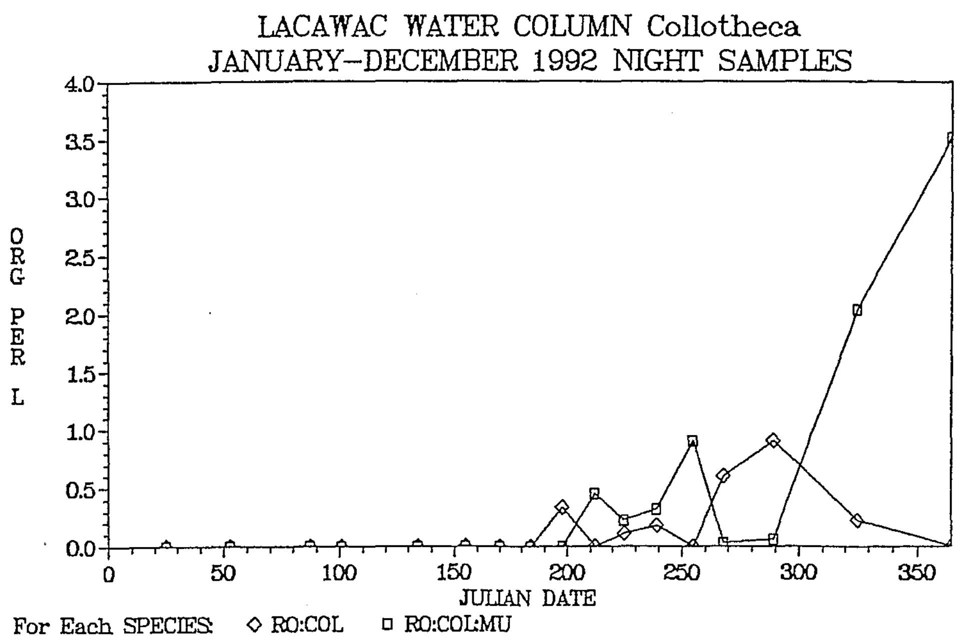
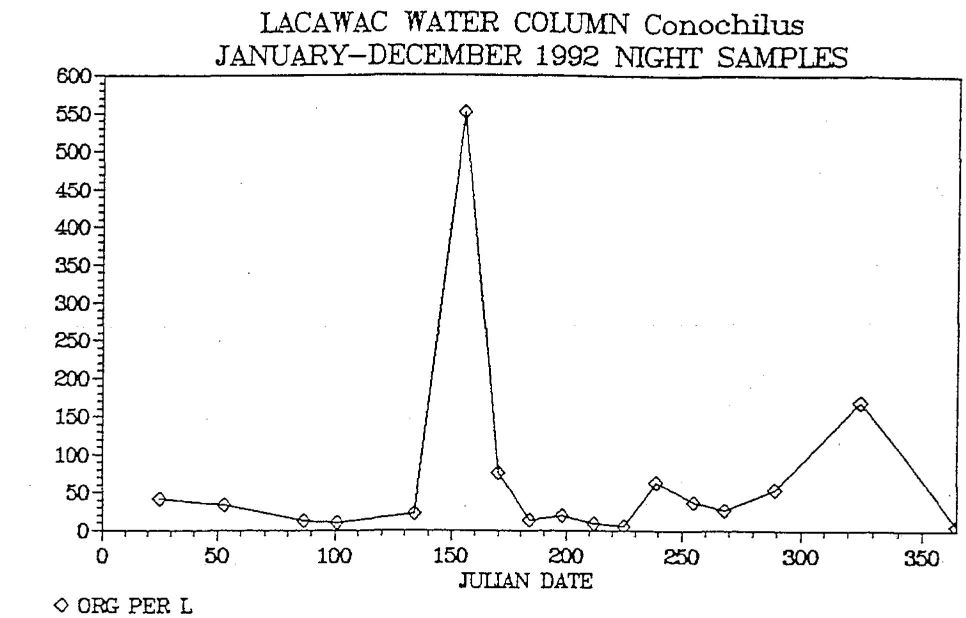




**Figure 14. The rotifer *Collotheca* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per litre. **(Bottom)** *Collotheca* by species: **COL** undifferentiated species, **MU** *C. mutabilis*.



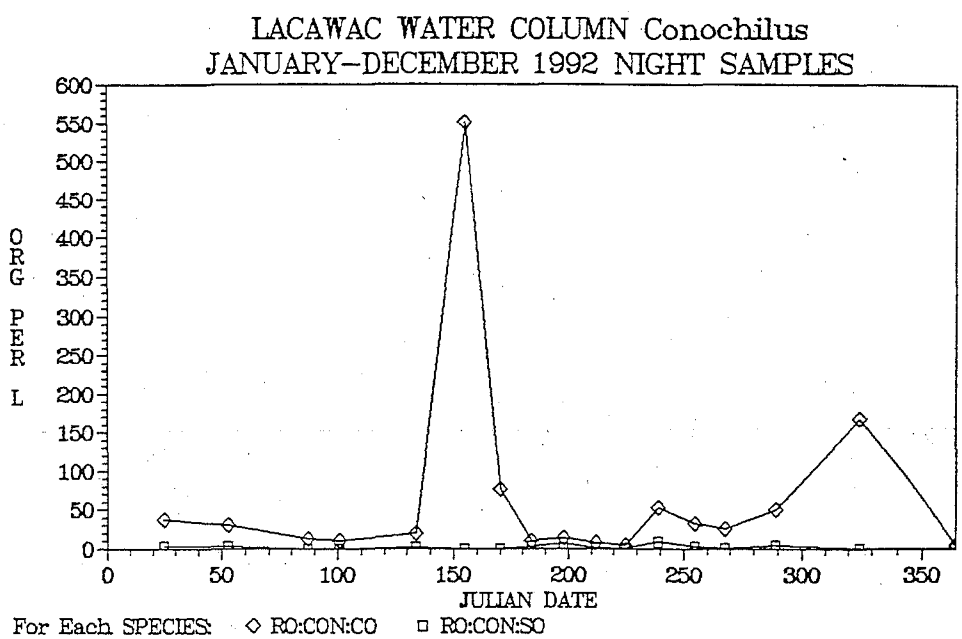
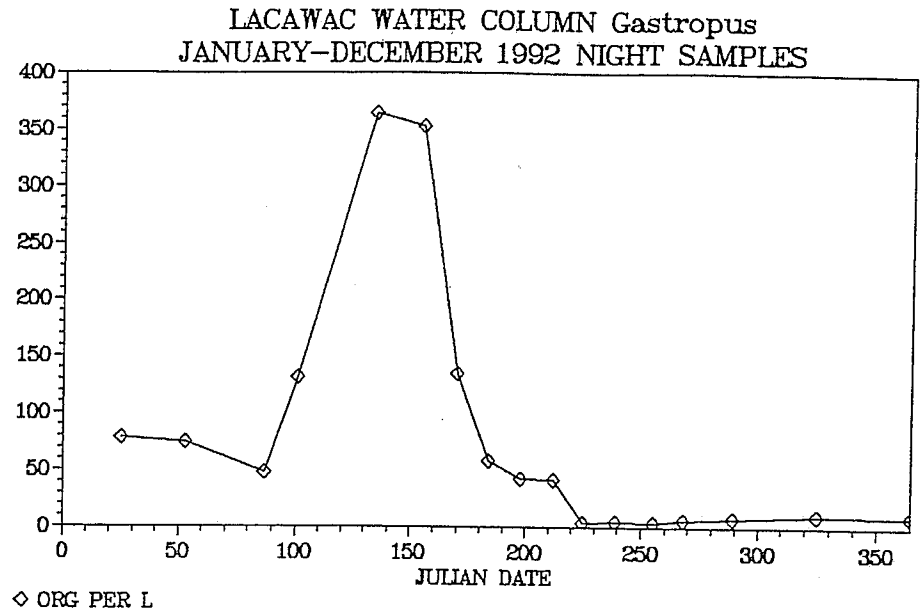




**Figure 15. The rotifer *Conochilus* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per litre. **(Bottom)** *Conochilus* by species: **CO** colonial spp., **SO** solitary spp.



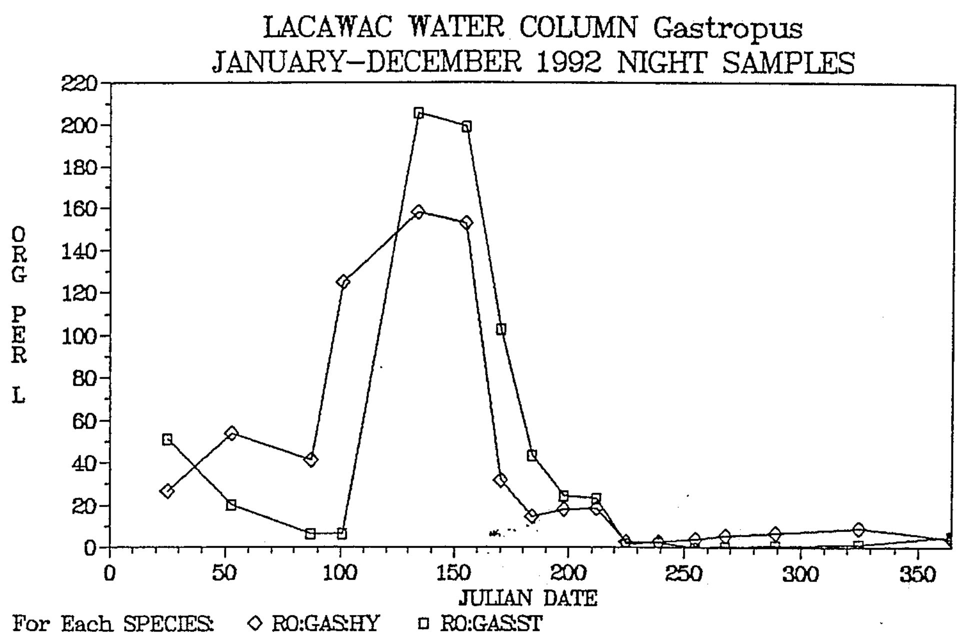
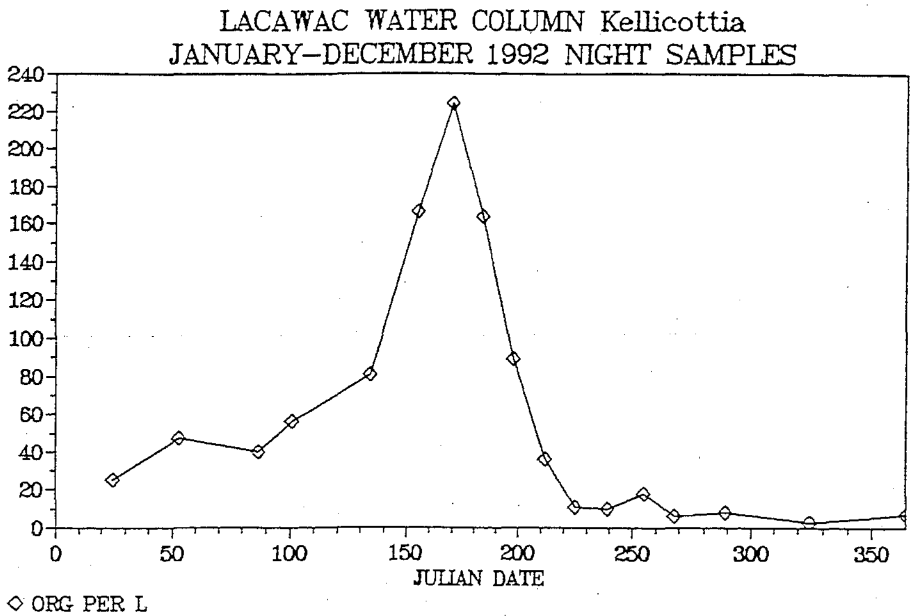




**Figure 16. The rotifer *Gastropus* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per litre. **(Bottom)** *Gastropus* by species: **HY** *G. hyptopus*, **ST** *G. stylifer*.



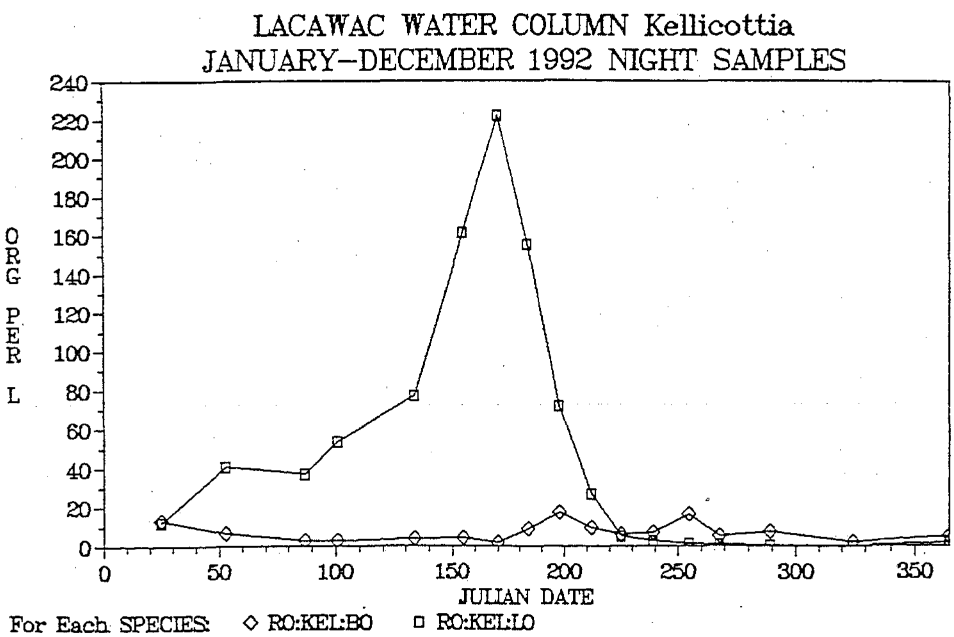
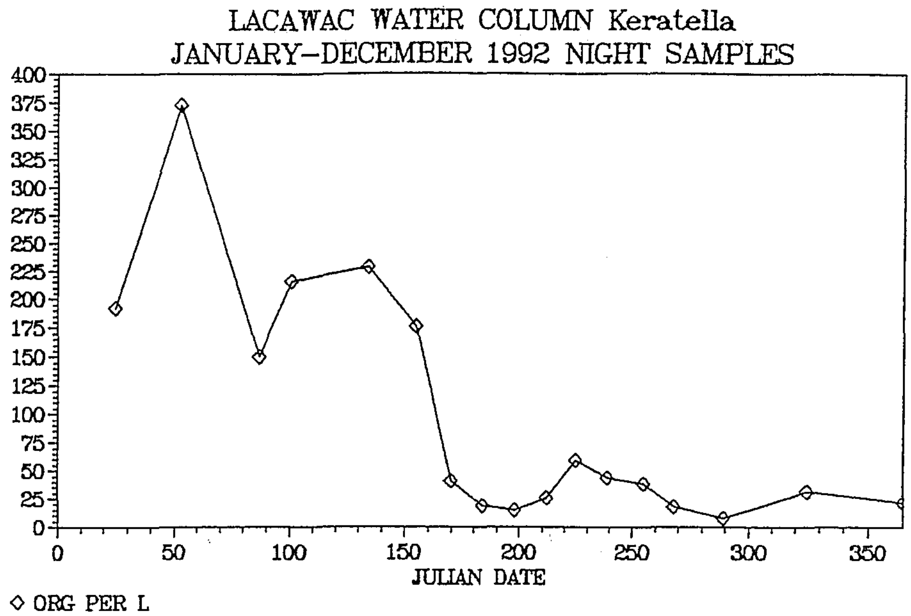




**Figure 17. The rotifer *Kellicottia* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** *Kellicottia* by species: **BO** *K. bostoniensis* and **LO** *K. longispina*.



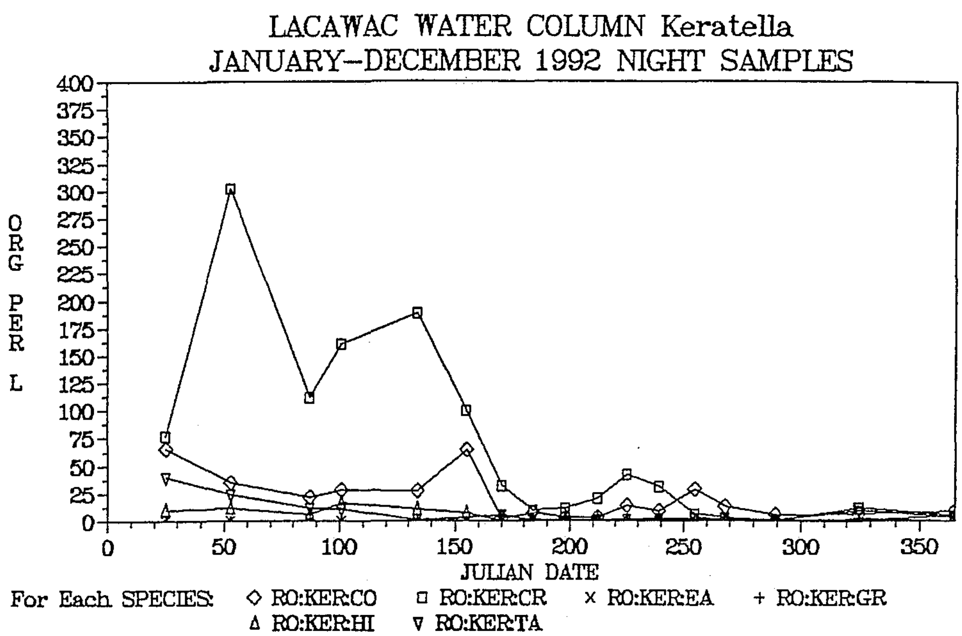




**Figure 18. The rotifer *Keratella* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** *Keratella* by species:
**CO** *K. cochlearis*, **CR** *K. crassa*, **EA** *K. earlinae*, **GR** *K. gracilenta*, **HE** *K. hiemalis*, and **TA** *K. taurocephala*.

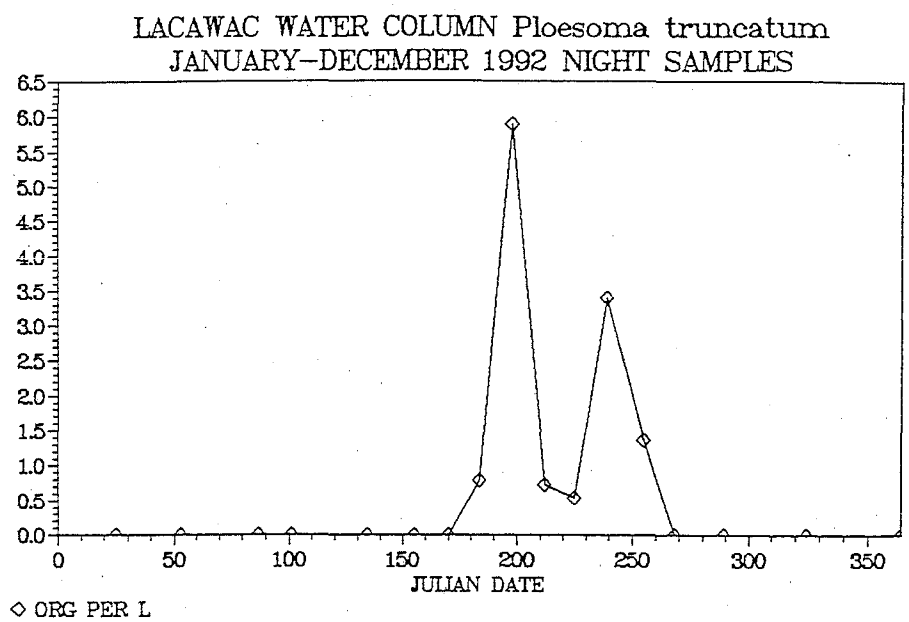
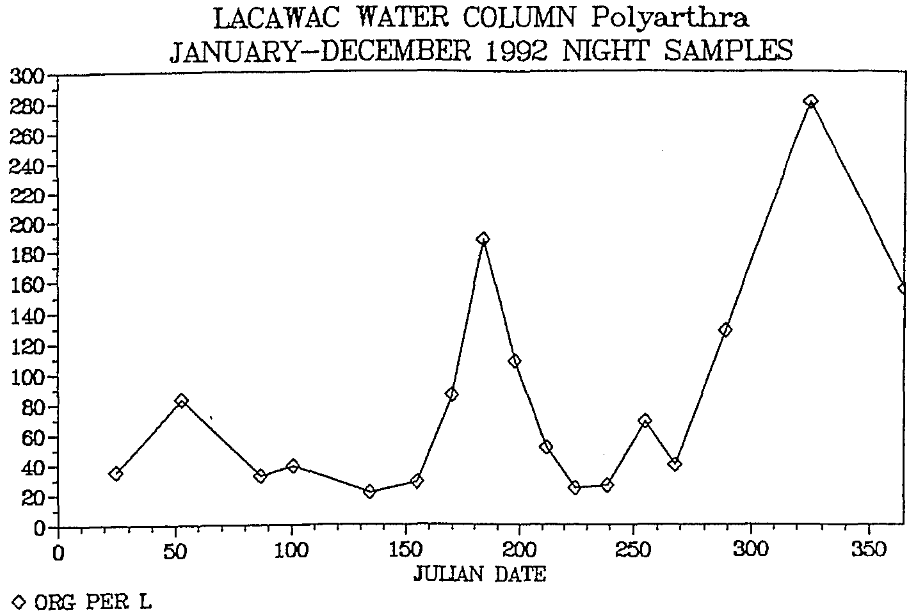



**Figure 19. The rotifer *Ploesoma truncatum* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean.



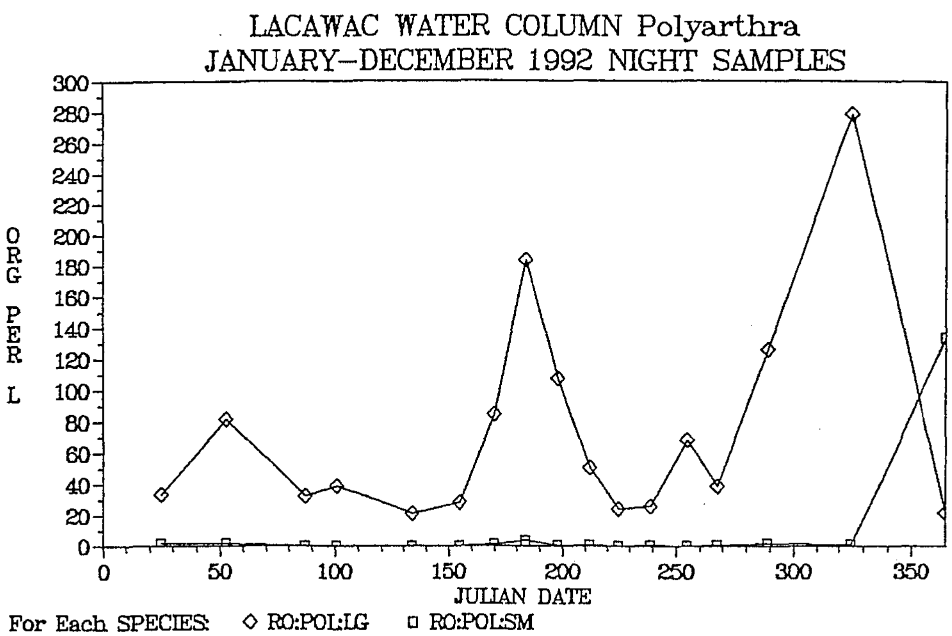




**Figure 20. The rotifer *Polyarthra* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** *Polyarthra* by size classes: **LG** large and **SM** small.

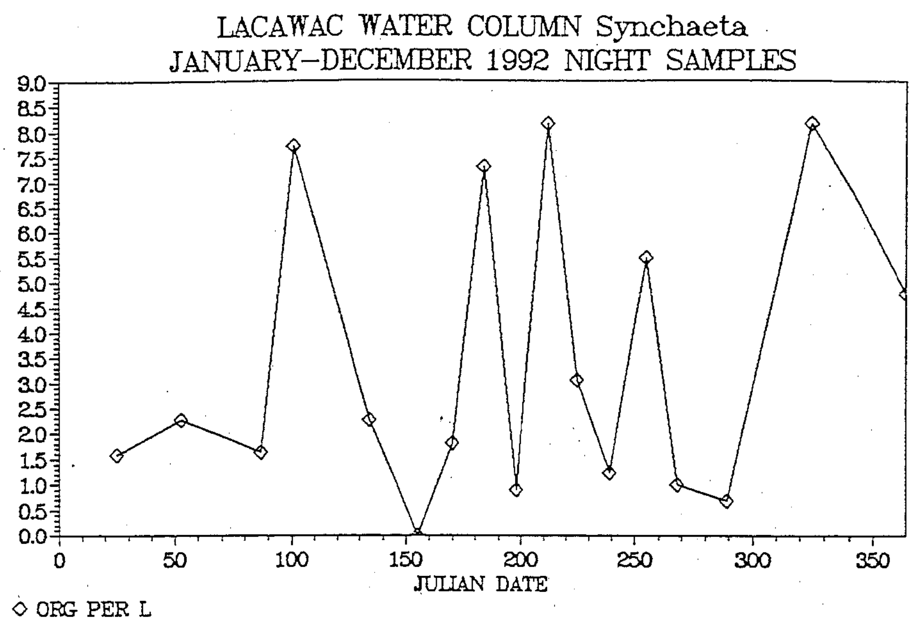
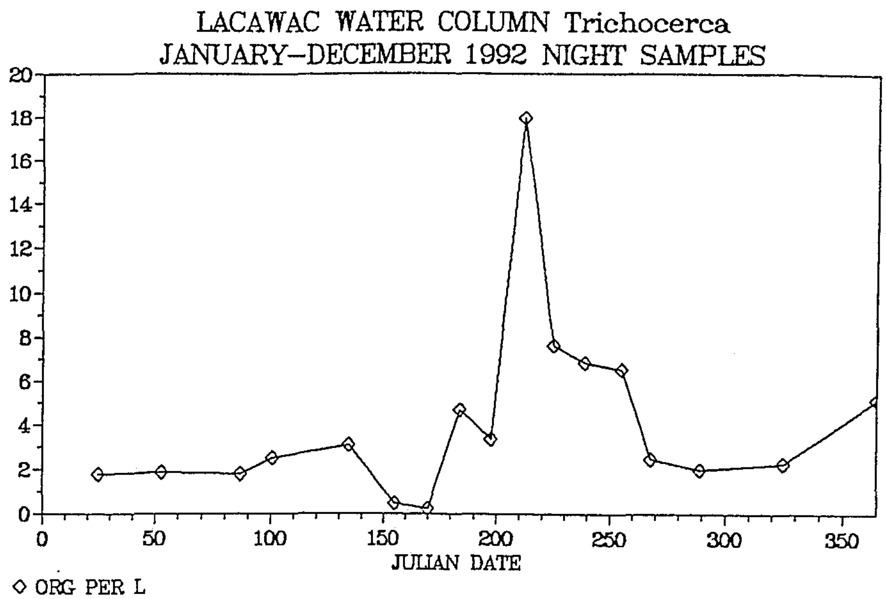



**Figure 21. The rotifer *Synchaeta* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean.



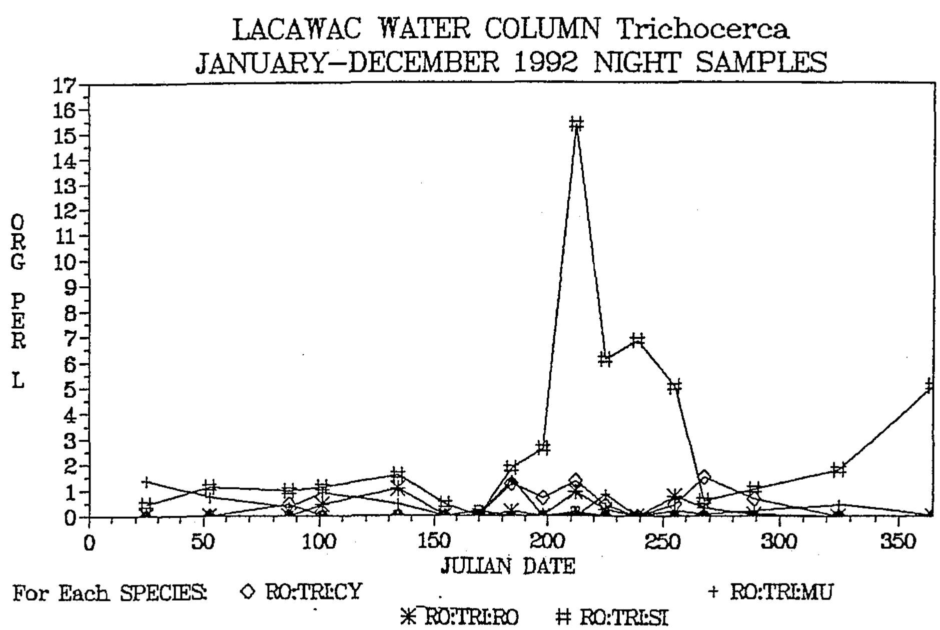




**Figure 22. The rotifer *Trichocerca* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** *Trichocerca* by species: **CY** *T. cylindrica*, **MU** *T. multicrinus*, **RO** *T. rousseleti*, **SI** *T. similis*.

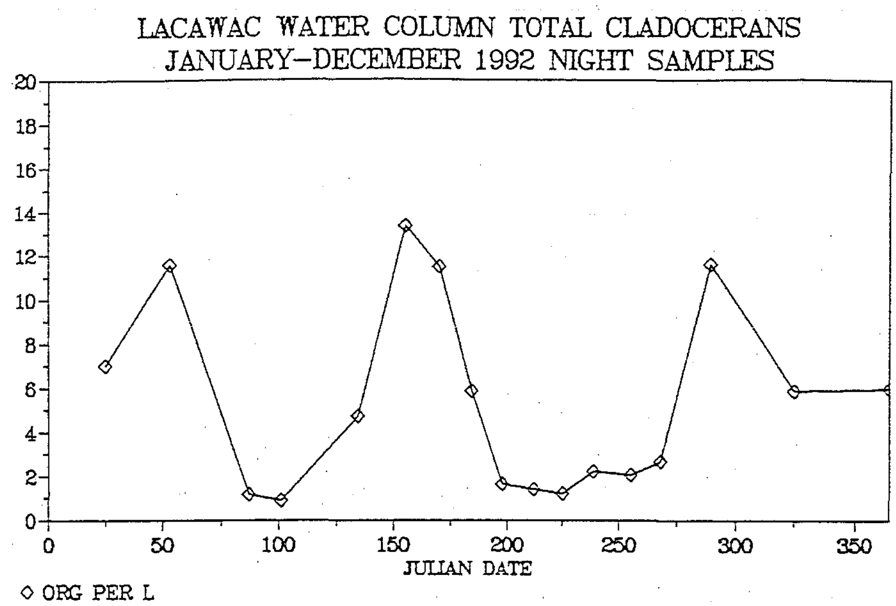
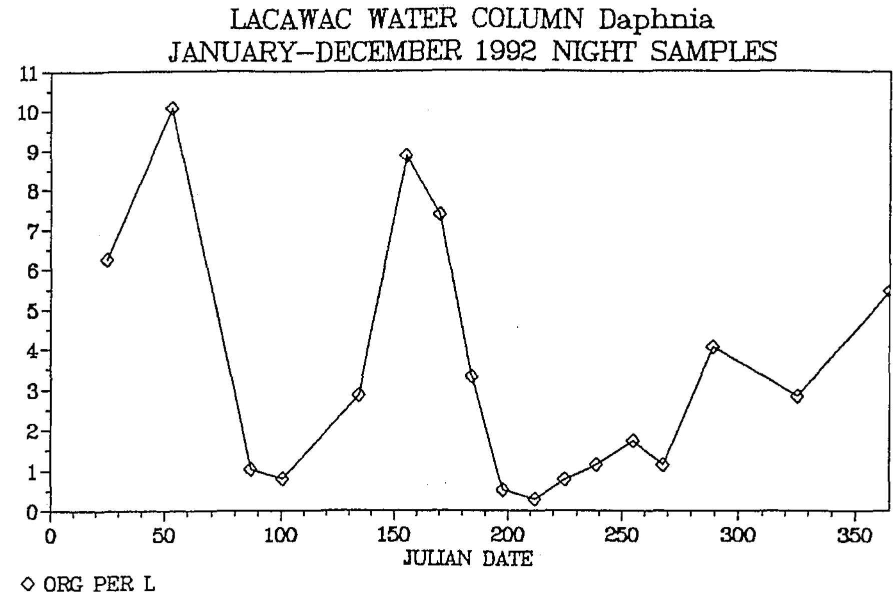



**Figure 23. Cladocera in Lake Lacawac, 1992.**

Nighttime net collections (202$\mu$m) from three depths have been combined to give a water column mean.



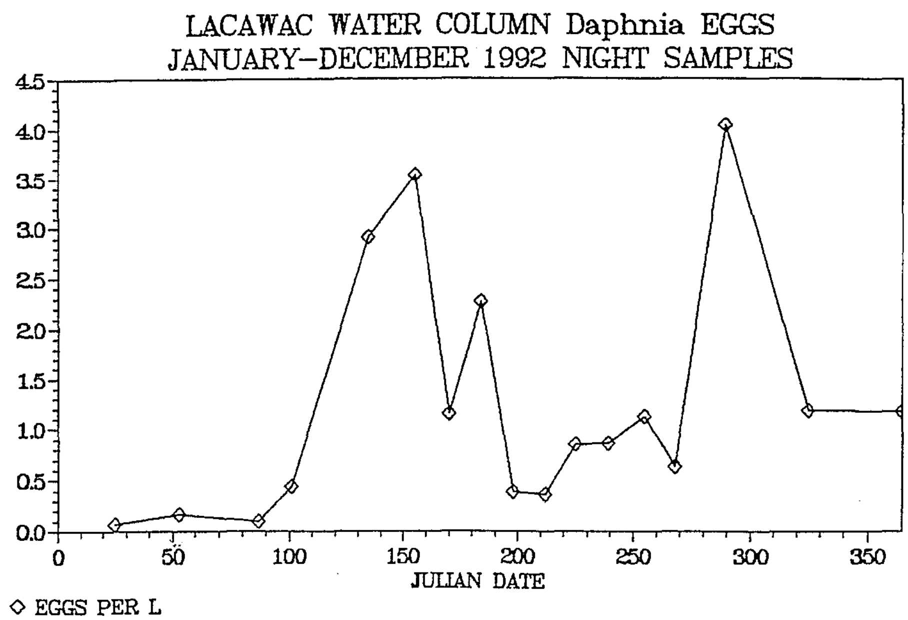




**Figure 24. The cladoceran *Daphnia* in Lake Lacawac, 1992.**

Nighttime net collections (202$\mu$m) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** Total eggs per litre.

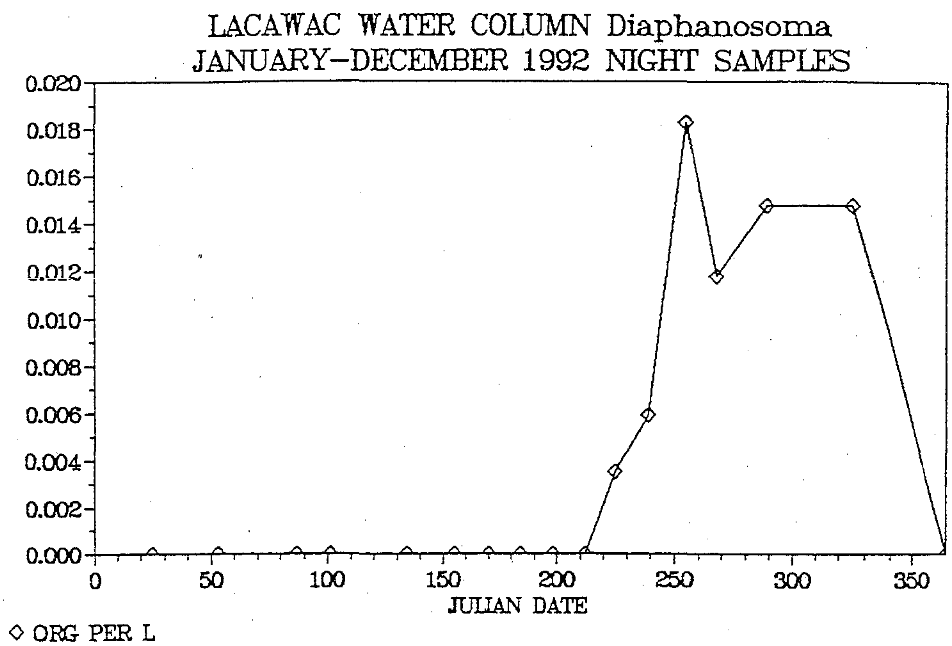
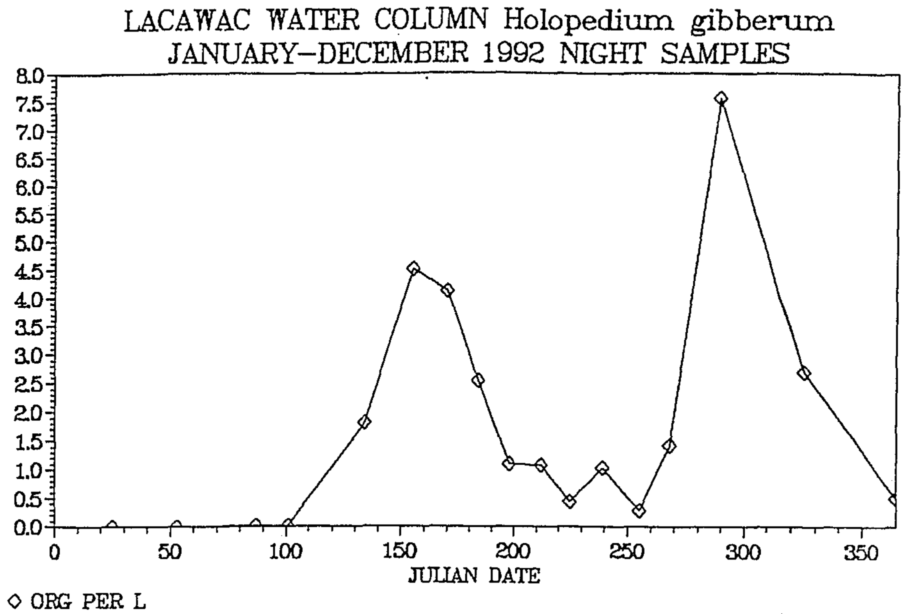



**Figure 25. The cladoceran *Diaphanosoma* sp in Lake Lacawac, 1992.**

Nighttime net collections (202$\mu$m) from three depths have been combined to give a water column mean as individuals per litre.



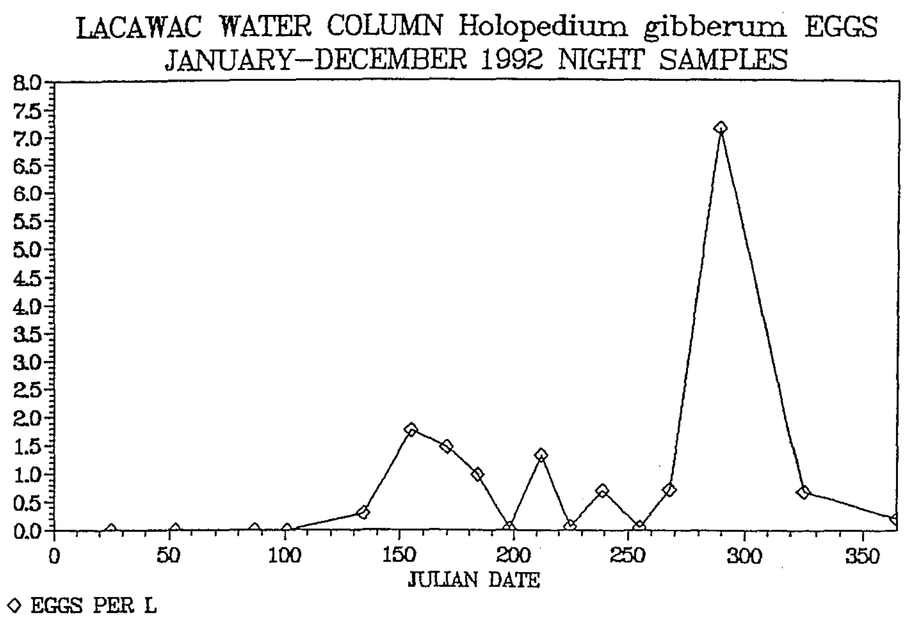




**Figure 26. The cladoceran *Holopedium gibberum* in Lake Lacawac, 1992.**

Nighttime net collections (202μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre. **(Bottom)** Total eggs per litre.

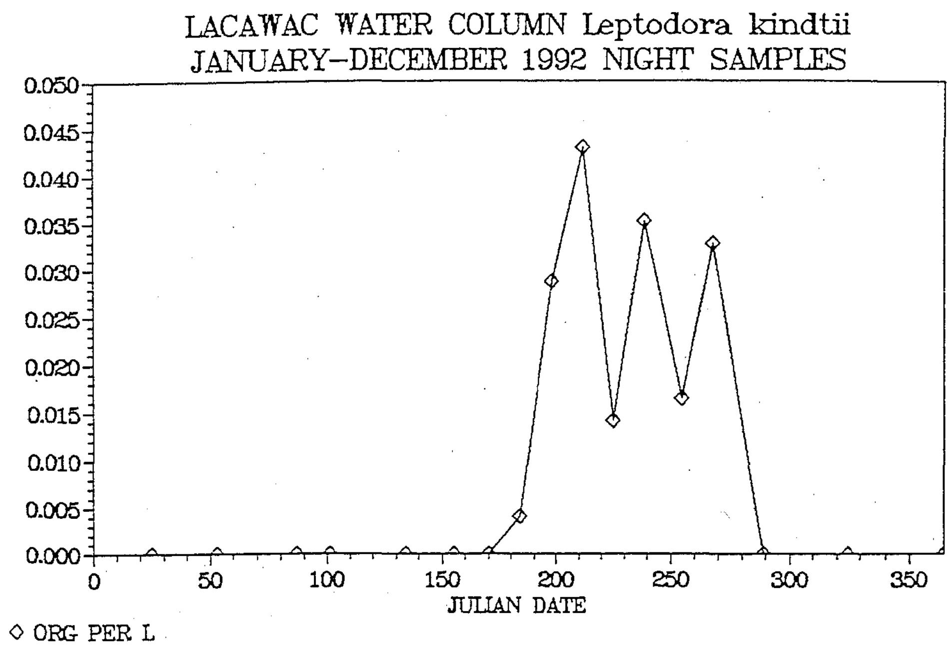



**Figure 27. The cladoceran *Leptodora kindti* in Lake Lacawac, 1992.**

Nighttime net collections (202$\mu$m) from three depths have been combined to give a water column mean.

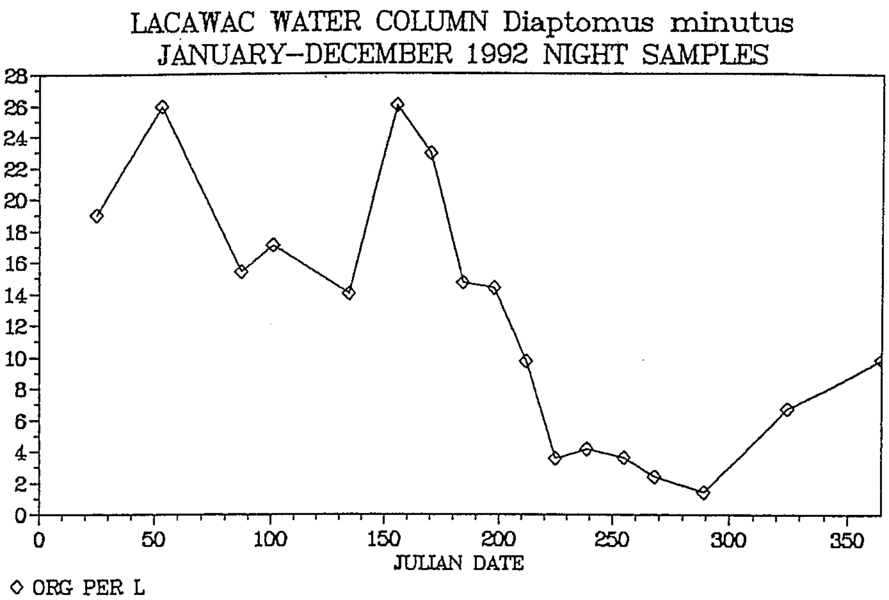
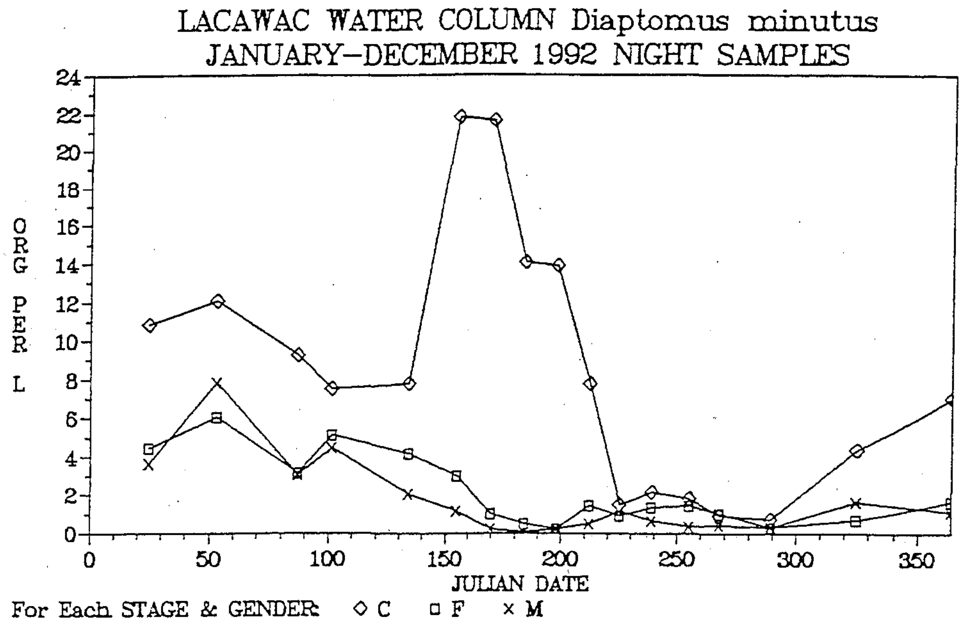



**Figure 28. The calanoid copepod *Diaptomus minutus* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean of individuals per litre, excluding nauplii. *D. minutus* was the only calanoid present.



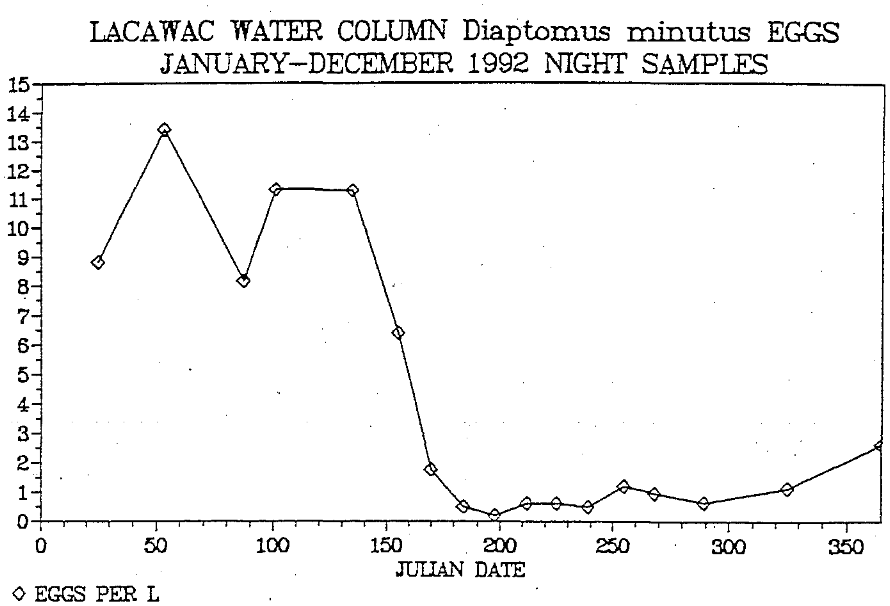




**Figure 29. The calanoid copepod *Diaptomus minutus* in Lake Lacawac, 1992, by stage and gender.**

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Adults (males and females separately) and copepodids. **(Bottom)** *D. minutus* total eggs per litre.

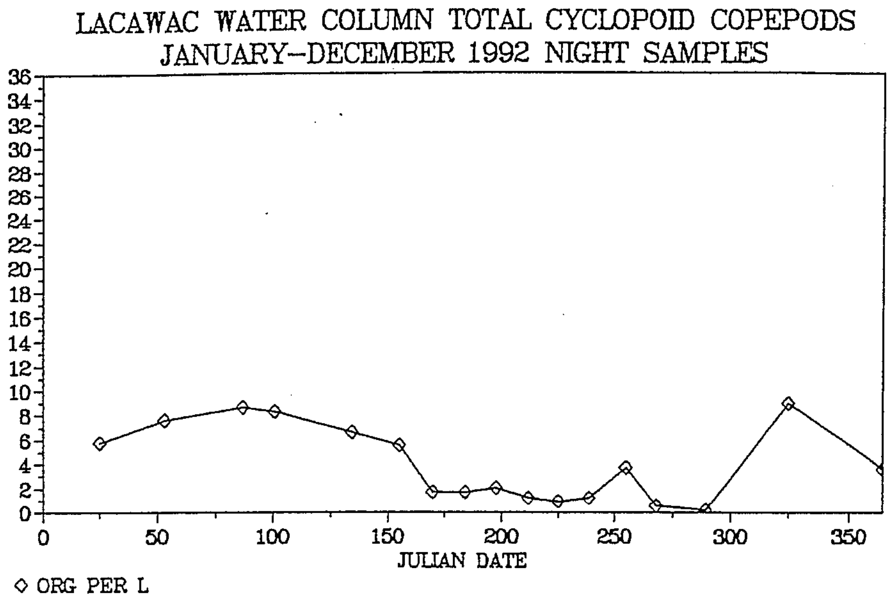



**Figure 30. Total cyclopoid copepods in Lake Lacawac, 1992.**

Nighttime net collections from three depths have been combined to give a water column mean as individuals per litre. Adult females were counted from the 202$\mu$m net samples, other stages from 48$\mu$m samples (nauplii are not included).

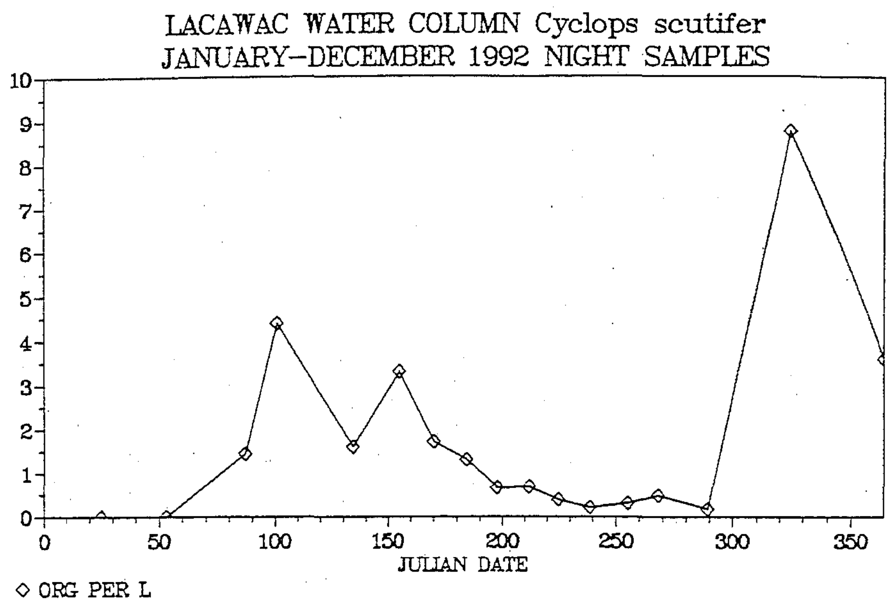
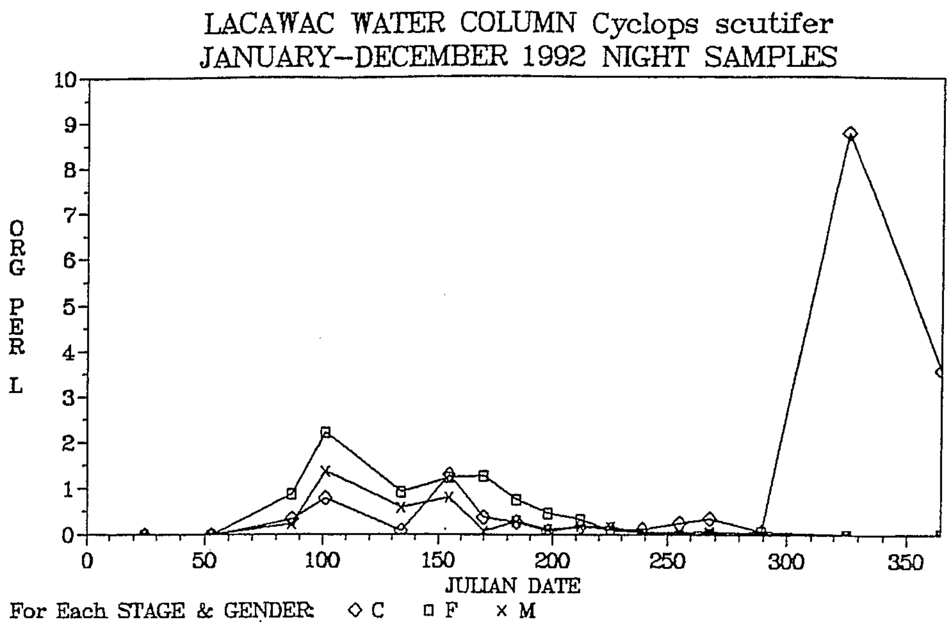



**Figure 31. The cyclopoid copepod *Cyclops scutifer* in Lake Lacawac, 1992.**

Nighttime net collections from three depths have been combined to give a water column mean. Adult females were counted from 202$\mu$m net samples, males and copepodids from 48$\mu$m net samples (nauplii are not included).



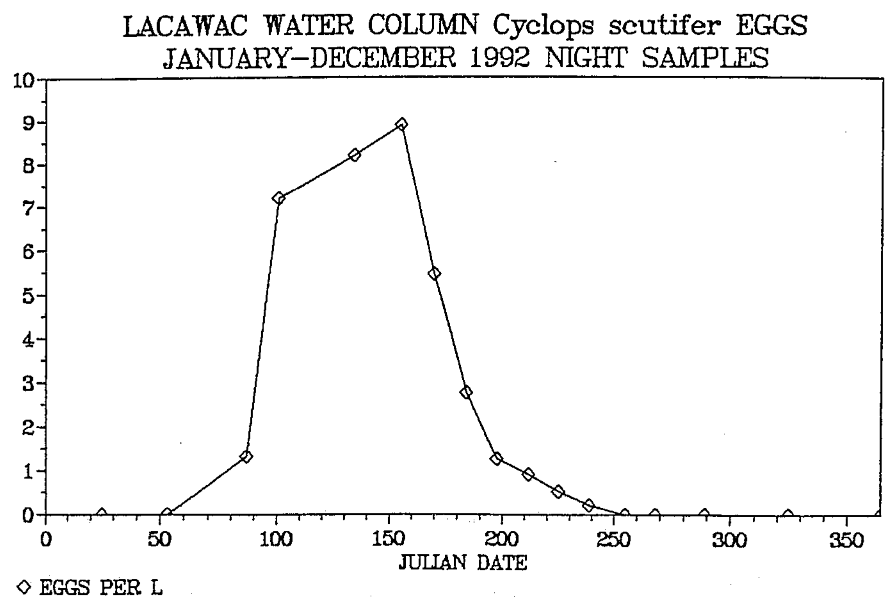
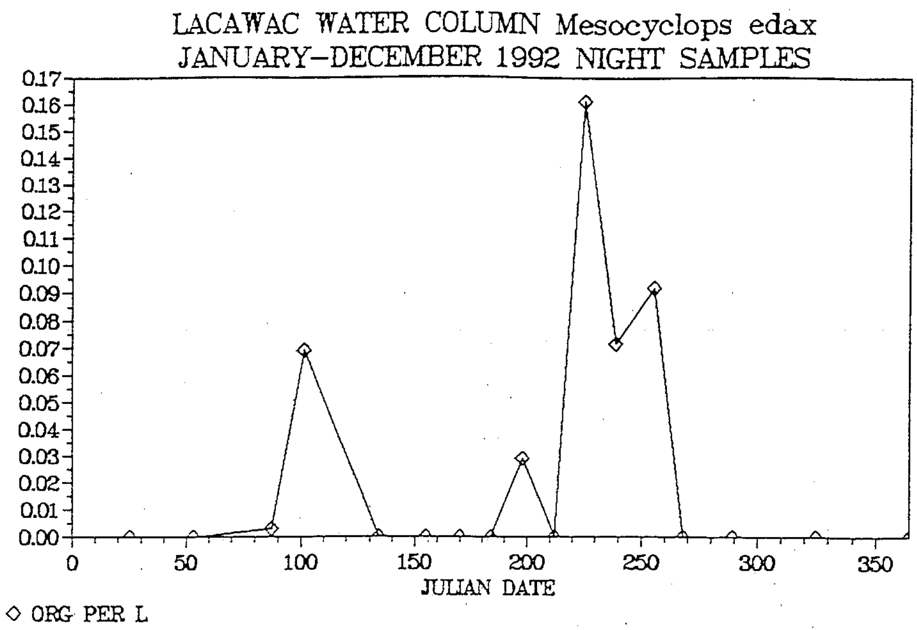




**Figure 32. The cyclopoid copepod *Cyclops scutifer* in Lake Lacawac, 1992, by stage and gender.**

Nightime net collections from three depths have been combined to give a water column mean. **(Top)** Adults (males and females separately) and copepodids. **(Bottom)** *C. scutifer* eggs per litre. Adult females were counted from 202$\mu$m net samples, males and copepodids from 48$\mu$m net samples (nauplii are not included).



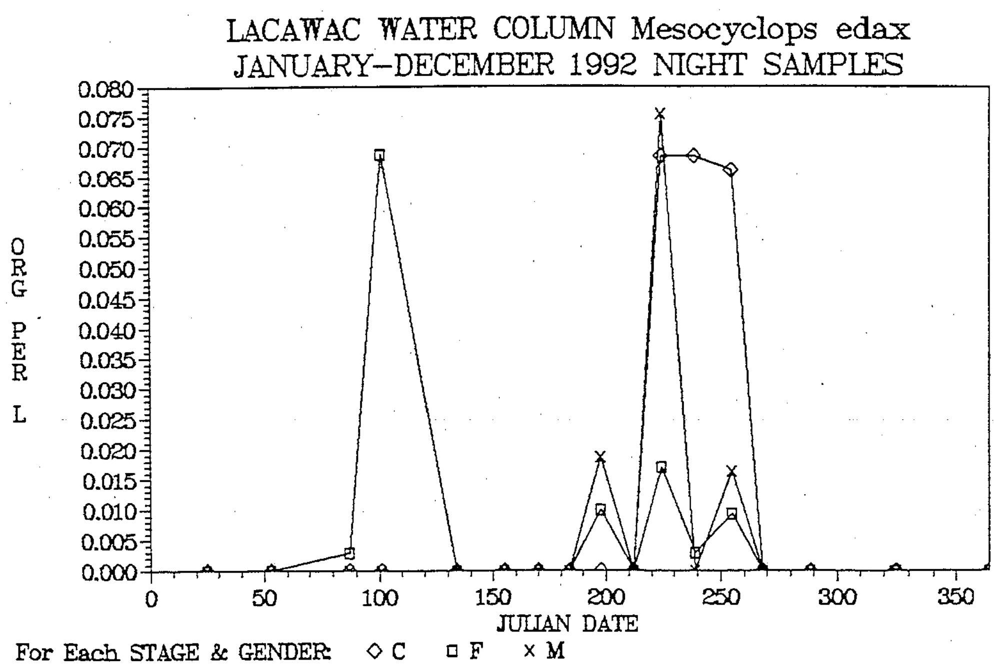
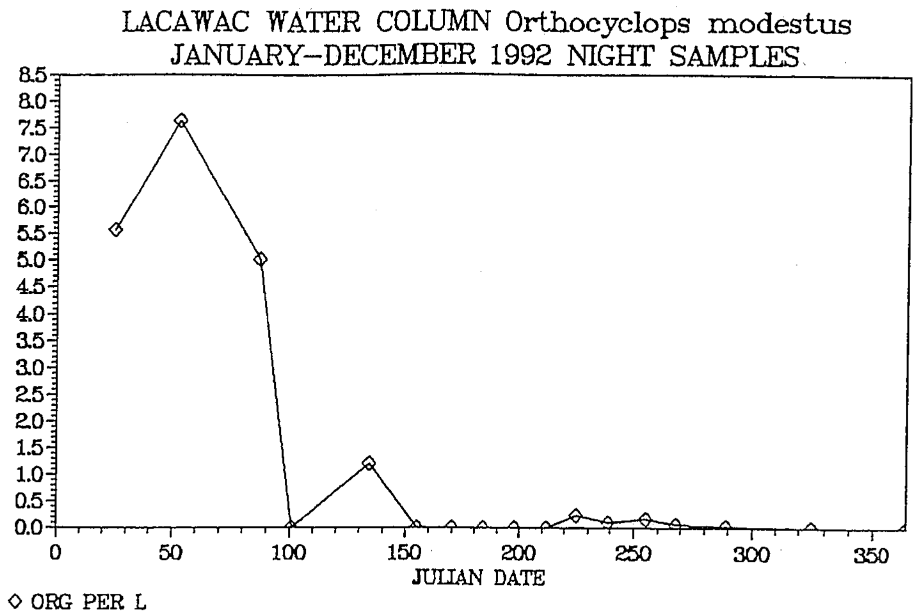




**Figure 33. The cyclopoid copepod *Mesocyclops edax* in Lake Lacawac, 1992.**

Nightime net collections from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre (nauplii excluded). **(Bottom)** Adults (males and females separately) and copepodids. Adult females were counted from 202$\mu$m net samples, males and copepodids from 48$\mu$m net samples.



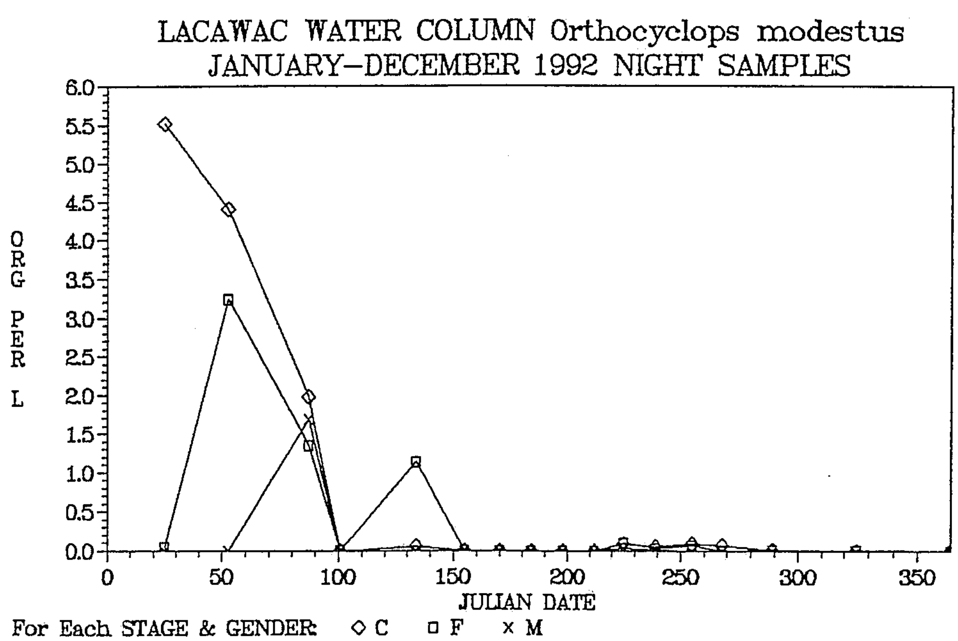
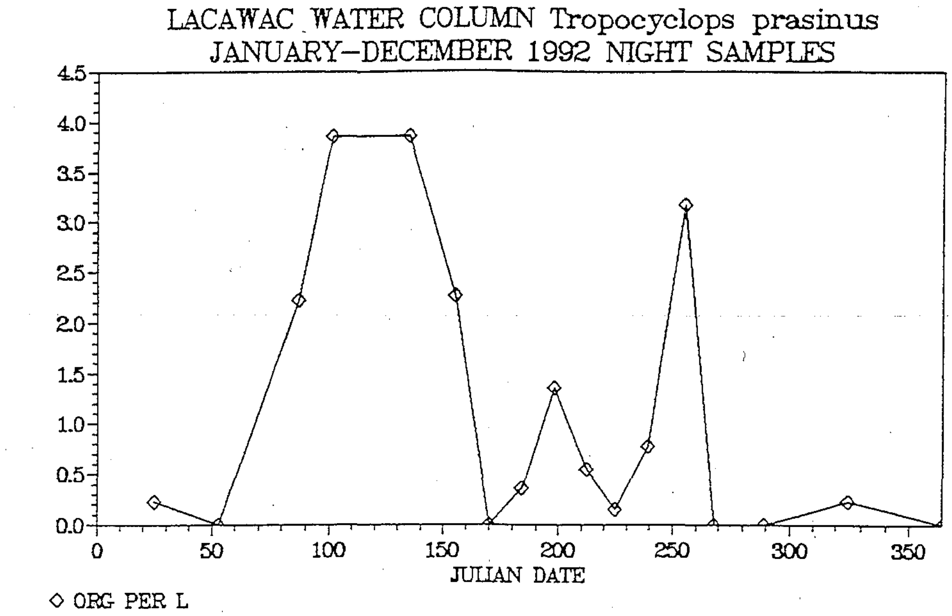




**Figure 34. The cyclopoid copepod *Orthocyclops modestus* in Lake Lacawac, 1992.**

Nightime net collections from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre (nauplii excluded). **(Bottom)** Adults (males and females separately) and copepodids. Adult females were counted from 202$\mu$m net samples, males and copepodids from 48$\mu$m net samples.



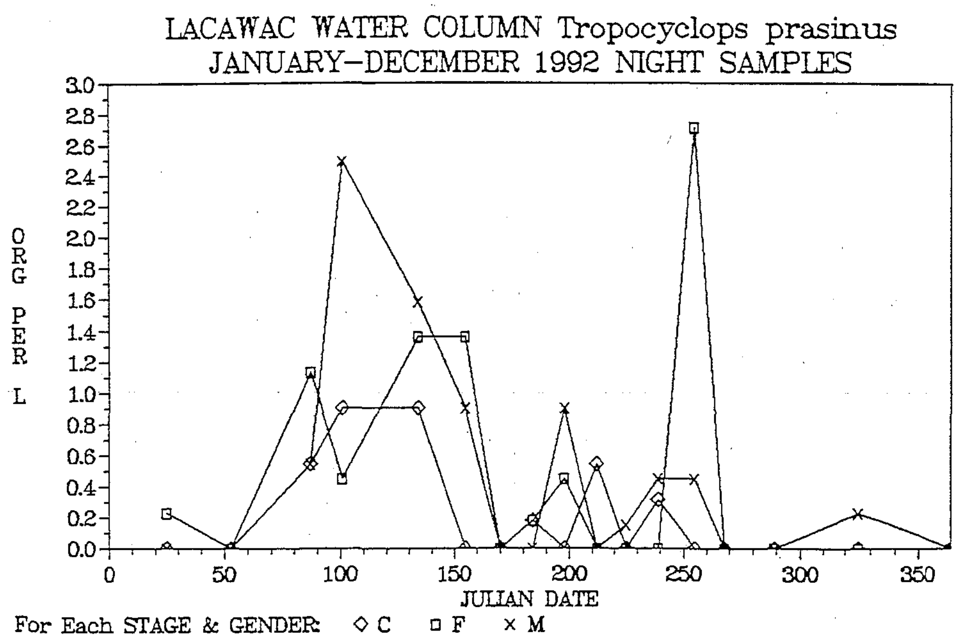




**Figure 35. The cyclopoid copepod *Tropocyclops prasinus* in Lake Lacawac, 1992.**

Nightime net collections from three depths have been combined to give a water column mean. **(Top)** Total individuals per litre (nauplii excluded). **(Bottom)** Adults (males and females separately) and copepodids all counted from 48$\mu$m net samples.

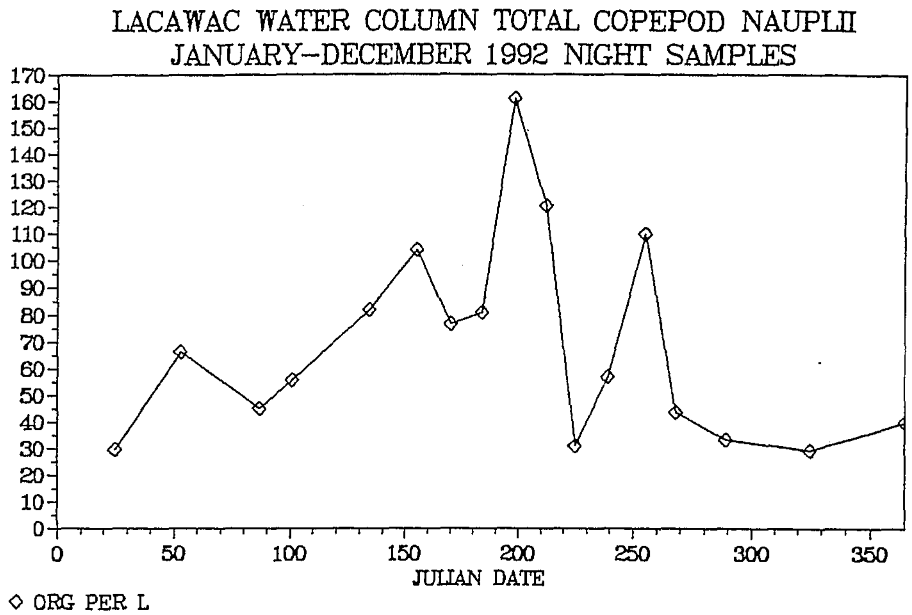



**Figure 36. Total copepod nauplii in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean. Nauplii of calanoid and cyclopoid species were not differentiated.

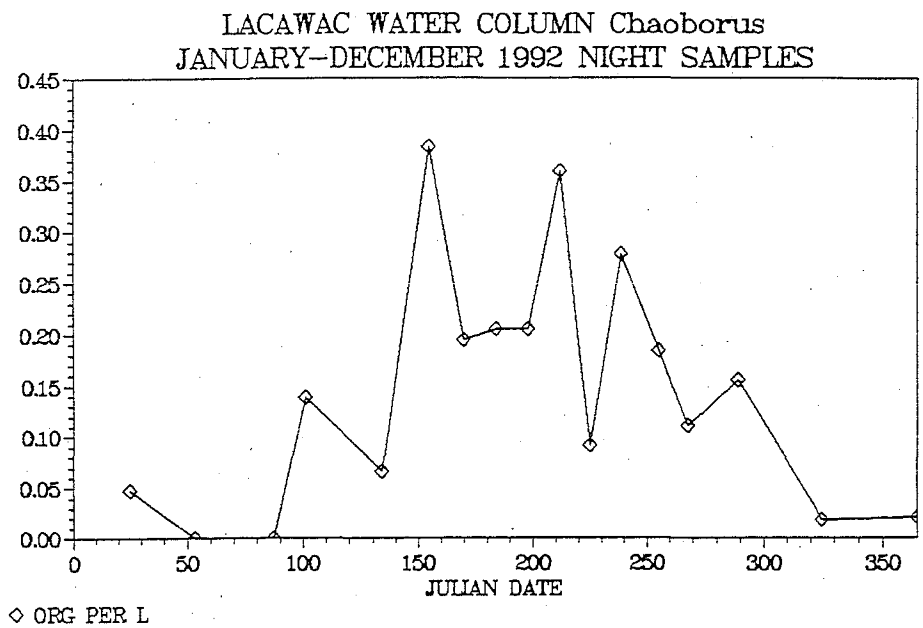



**Figure 37. The dipteran *Chaoborus* in Lake Lacawac, 1992.**

Nighttime net collections (48$\mu$m) from three depths have been combined to give a water column mean.

## EXPLANATION OF DATA TABLES

The following 17 tables present the physical/chemical information acquired on each date in 1992. The headings, abbreviations, and analytical units are explained here.

**DATE OF SAMPLE:** Date of the daytime visit, as month/day/year.

**JULIAN DATE:** Day of the year, from 1-366.

**TIME:** Approximate start or mid-time of sampling, 24-hr clock in decimal format (e.g. 1:30 PM is "13.50").

**SECCHI M:** Secchi depth in metres (m).

**WEATHER:** Brief comments on weather, especially cloudiness.

**PERSONNEL:** Initials of sampling crew (see names below).

**TMETHOD:** Temperature method #10 (see **METHODS AND RESULTS**).

**LMETHOD:** Light method #12 (see **METHODS AND RESULTS**).

**AMETHOD:** Alkalinity method #11 (see **METHODS AND RESULTS**).

**OMETHOD:** Oxygen method #10 (see **METHODS AND RESULTS**).

**PHMETHOD:** pH method #11 (see **METHODS AND RESULTS**).

**CAMETHOD:** Chlorophyll-a method #12 (see **METHODS AND RESULTS**).

**COMMENTS:** Notes on unusual procedures, also ice thickness.

**DATE OF:** Date of sample (month/day/year).

**JULIAN:** Julian date.

**STRA:** Stratum or layer: **S** (air above surface), **E** (epilimnion), M(metalimnion), **H** (hypolimnion).

**REP:** Replicate (1 or 2); Replicates were usually analyzed for pH, alkalinity, chlorophyll--other data are merely repeated on rep 2 line for convenience in graphing.

**DEPTH:** Depth of sample (metres); **-1** for air above surface.

**TEMP C:** Temperature in degrees Celsius (°C).

**OXYGEN:** Dissolved oxygen (mg per litre--not corrected for elevation).

**OFLAG:** Error flag for oxygen; "4" means reported value should be interpreted as a true "zero".

**LIGHT PC:** Light as percent of intensity at 0.1-m depth.

**pH:** pH.

**ALKAL:** Alkalinity as microequivalents per litre (μeq/L).

**CHLAC:** Chlorophyll-a, corrected for pheopigments (μg/L).

**CHLASUM:** Chlorophyll-a, including pheopigments (μg/L).

**CHLAC P:** Percentage of CHLAC passing 22-μm net.

**Names of Sampling Personnel:**

| | |
|---|---|
| KYG (?KHA) | Kurt Andersson |
| JM, JLM | Jeanette Miller |
| REM | Robert Moeller |
| SKN (?SKM) | Shannon McGinnis |
| EMN | Gina Novak |
| JVO | Joe Ortelli |
| BKS | Brian Sharer |
| TLV | Tim Vail |
| NKW | Narissa Willever |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 1/25/92 JULIAN DATE: 25 TIME: 10.25

SECCHI M: 6.2 WEATHER: Clear, cold

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Ice cover 15 cm, no snow

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/25/92 | 25 | S | 1 | -1.0 | -1.6 | | | | | | | | |
| 1/25/92 | 25 | | 1 | 0.0 | 0.0 | 14.58 | | 100.0000 | | | | | |
| 1/25/92 | 25 | E | 1 | 1.0 | 3.2 | 11.38 | | 19.8216 | 6.10 | 31 | 3.16 | 3.70 | |
| 1/25/92 | 25 | E | 2 | 1.0 | 3.2 | 11.38 | | 19.8216 | 6.15 | 30 | 3.13 | 3.64 | 28.10 |
| 1/25/92 | 25 | | 1 | 2.0 | 3.4 | 10.98 | | 7.7976 | | | | | |
| 1/25/92 | 25 | | 1 | 3.0 | 3.4 | 10.88 | | 4.0277 | | | | | |
| 1/25/92 | 25 | M | 1 | 4.0 | 3.4 | 10.88 | | 2.1866 | 6.23 | 28 | 2.87 | 3.41 | |
| 1/25/92 | 25 | M | 2 | 4.0 | 3.4 | 10.88 | | 2.1866 | 6.26 | 29 | 2.56 | 3.08 | 28.10 |
| 1/25/92 | 25 | | 1 | 5.0 | 3.4 | 10.88 | | 1.1949 | | | | | |
| 1/25/92 | 25 | | 1 | 6.0 | 3.4 | 10.88 | | 0.6554 | | | | | |
| 1/25/92 | 25 | | 1 | 7.0 | 3.4 | 10.88 | | 0.3609 | | | | | |
| 1/25/92 | 25 | | 1 | 8.0 | 3.4 | 10.88 | | 0.2017 | | | | | |
| 1/25/92 | 25 | H | 1 | 9.0 | 3.4 | 10.88 | | 0.1126 | 6.27 | 29 | 3.06 | 3.38 | |
| 1/25/92 | 25 | H | 2 | 9.0 | 3.4 | 10.88 | | 0.1126 | 6.29 | 30 | 1.76 | 2.58 | 40.90 |
| 1/25/92 | 25 | | 1 | 10.0 | 3.4 | 10.88 | | 0.0635 | | | | | |
| 1/25/92 | 25 | | 1 | 11.0 | 3.4 | 10.88 | | 0.0352 | | | | | |
| 1/25/92 | 25 | | 1 | 12.0 | 3.5 | 9.08 | | 0.0184 | | | | | |
| 1/25/92 | 25 | | 1 | 13.0 | 4.0 | 1.06 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 2/22/92 JULIAN DATE: 53 TIME: 13.58

SECCHI M: 5.2 WEATHER: Overcast

PERSONNEL: EMN TLV REM

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Ice cover 20 cm, no snow

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/22/92 | 53 | S | 1 | -1.0 | | | | | | | | | |
| 2/22/92 | 53 | | 1 | 0.0 | 3.4 | 11.20 | | 100.0000 | | | | | |
| 2/22/92 | 53 | E | 1 | 1.0 | 3.4 | 11.18 | | 34.0500 | 5.99 | 31 | 16.55 | 16.55 | |
| 2/22/92 | 53 | E | 2 | 1.0 | 3.4 | 11.18 | | 34.0500 | 5.96 | 29 | 17.94 | 18.07 | 10.00 |
| 2/22/92 | 53 | | 1 | 2.0 | 3.5 | 11.18 | | 13.5400 | | | | | |
| 2/22/92 | 53 | | 1 | 3.0 | 3.5 | 11.15 | | 6.2360 | | | | | |
| 2/22/92 | 53 | M | 1 | 4.0 | 3.5 | 11.15 | | 3.1340 | 5.96 | 30 | 15.18 | 15.18 | |
| 2/22/92 | 53 | M | 2 | 4.0 | 3.5 | 11.15 | | 3.1340 | 5.96 | 31 | 14.92 | 14.92 | 16.60 |
| 2/22/92 | 53 | | 1 | 5.0 | 3.5 | 11.15 | | 1.6520 | | | | | |
| 2/22/92 | 53 | | 1 | 6.0 | 3.5 | 11.15 | | 0.7060 | | | | | |
| 2/22/92 | 53 | | 1 | 7.0 | 3.5 | 11.12 | | 0.5180 | | | | | |
| 2/22/92 | 53 | | 1 | 8.0 | 3.5 | 11.15 | | | | | | | |
| 2/22/92 | 53 | H | 1 | 9.0 | 3.5 | 11.15 | | | 5.96 | 29 | 20.81 | 20.81 | |
| 2/22/92 | 53 | H | 2 | 9.0 | 3.5 | 11.15 | | | 5.95 | 31 | 16.47 | 16.47 | 4.90 |
| 2/22/92 | 53 | | 1 | 10.0 | 3.5 | 11.15 | | | | | | | |
| 2/22/92 | 53 | | 1 | 11.0 | 3.5 | 11.15 | | | | | | | |
| 2/22/92 | 53 | | 1 | 12.0 | 3.5 | 11.15 | | | | | | | |
| 2/22/92 | 53 | | 1 | 13.0 | | | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 3/27/92 JULIAN DATE: 87 TIME: 14.33

SECCHI M: 4.9 WEATHER: Overcast with rain

PERSONNEL: EMN TLV BKS

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Ice only around edges of lake

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/27/92 | 87 | S | 1 | -1.0 | 4.5 | | | | | | | | |
| 3/27/92 | 87 | | 1 | 0.0 | 2.8 | 12.78 | | 100.0000 | | | | | |
| 3/27/92 | 87 | | 1 | 1.0 | 2.8 | 12.58 | | 28.1928 | | | | | |
| 3/27/92 | 87 | E | 1 | 2.0 | 2.8 | 12.39 | | 10.9148 | 6.08 | 27 | 5.64 | 5.64 | |
| 3/27/92 | 87 | E | 2 | 2.0 | 2.8 | 12.39 | | 10.9148 | 6.11 | 28 | 7.76 | 7.76 | 49.10 |
| 3/27/92 | 87 | | 1 | 3.0 | 2.8 | 12.38 | | 6.0336 | | | | | |
| 3/27/92 | 87 | | 1 | 4.0 | 2.8 | 12.29 | | 2.9664 | | | | | |
| 3/27/92 | 87 | | 1 | 5.0 | 2.8 | 12.26 | | 1.5948 | | | | | |
| 3/27/92 | 87 | M | 1 | 6.0 | 2.8 | 12.23 | | 0.8510 | 6.10 | 31 | 9.79 | 9.79 | |
| 3/27/92 | 87 | M | 2 | 6.0 | 2.8 | 12.23 | | 0.8510 | 6.14 | 28 | 6.62 | 8.89 | 21.50 |
| 3/27/92 | 87 | | 1 | 7.0 | 2.8 | 12.18 | | 0.4500 | | | | | |
| 3/27/92 | 87 | | 1 | 8.0 | 2.8 | 12.16 | | 0.2362 | | | | | |
| 3/27/92 | 87 | | 1 | 9.0 | 2.8 | 12.15 | | 0.1214 | | | | | |
| 3/27/92 | 87 | H | 1 | 10.0 | 2.8 | 12.15 | | 0.0630 | 6.10 | 28 | 3.62 | 3.62 | |
| 3/27/92 | 87 | H | 2 | 10.0 | 2.8 | 12.15 | | 0.0630 | 6.09 | 27 | 7.00 | 7.00 | 35.10 |
| 3/27/92 | 87 | | 1 | 11.0 | 2.8 | 12.09 | | 0.0316 | | | | | |
| 3/27/92 | 87 | | 1 | 12.0 | 2.8 | 12.08 | | | | | | | |
| 3/27/92 | 87 | | 1 | 13.0 | 2.8 | 11.99 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 4/10/92 JULIAN DATE: 101 TIME: 13.00

SECCHI M: 5.2 WEATHER: Partly sunny

PERSONNEL: TLV BKS EMN

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Ice free since 9 March

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/10/92 | 101 | S | 1 | -1.0 | 15.9 | | | | | | | | |
| 4/10/92 | 101 | | 1 | 0.0 | 6.2 | 12.82 | | 100.0000 | | | | | |
| 4/10/92 | 101 | | 1 | 1.0 | 5.3 | 12.89 | | 41.1862 | | | | | |
| 4/10/92 | 101 | E | 1 | 2.0 | 4.9 | 13.03 | | 18.1998 | 6.27 | 29 | 4.06 | 4.06 | |
| 4/10/92 | 101 | E | 2 | 2.0 | 4.9 | 13.03 | | 18.1998 | 6.25 | 28 | 3.45 | 3.45 | 56.80 |
| 4/10/92 | 101 | | 1 | 3.0 | 4.7 | 12.89 | | 12.8258 | | | | | |
| 4/10/92 | 101 | | 1 | 4.0 | 4.6 | 12.93 | | 6.5706 | | | | | |
| 4/10/92 | 101 | | 1 | 5.0 | 4.6 | 12.92 | | 3.2738 | | | | | |
| 4/10/92 | 101 | M | 1 | 6.0 | 4.5 | 12.79 | | 1.6386 | 6.25 | 28 | 4.83 | 4.83 | |
| 4/10/92 | 101 | M | 2 | 6.0 | 4.5 | 12.79 | | 1.6386 | 6.22 | 26 | 3.70 | 3.88 | 55.10 |
| 4/10/92 | 101 | | 1 | 7.0 | 4.5 | 12.85 | | 0.8848 | | | | | |
| 4/10/92 | 101 | | 1 | 8.0 | 4.4 | 12.83 | | 0.4848 | | | | | |
| 4/10/92 | 101 | | 1 | 9.0 | 4.3 | 12.73 | | 0.2568 | | | | | |
| 4/10/92 | 101 | H | 1 | 10.0 | 4.2 | 12.50 | | 0.1274 | 6.18 | 28 | 8.87 | 8.87 | |
| 4/10/92 | 101 | H | 2 | 10.0 | 4.2 | 12.50 | | 0.1274 | 6.18 | 27 | 9.66 | 9.98 | 21.00 |
| 4/10/92 | 101 | | 1 | 11.0 | 4.1 | 12.28 | | 0.0615 | | | | | |
| 4/10/92 | 101 | | 1 | 12.0 | 4.1 | 11.90 | | 0.0280 | | | | | |
| 4/10/92 | 101 | | 1 | 13.0 | | | | 0.0163 | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 5/13/92 JULIAN DATE: 134 TIME: 12.25

SECCHI M: 5.3 WEATHER: Sunny

PERSONNEL: TLV BKS

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/13/92 | 134 | S | 1 | -1.0 | 23.7 | | | | | | | | |
| 5/13/92 | 134 | | 1 | 0.0 | 18.4 | 9.96 | | 100.0000 | | | | | |
| 5/13/92 | 134 | | 1 | 1.0 | 17.0 | 10.15 | | 40.4531 | | | | | |
| 5/13/92 | 134 | E | 1 | 2.0 | 14.1 | 10.82 | | 17.3693 | 6.32 | 16 | 1.76 | 1.88 | |
| 5/13/92 | 134 | E | 2 | 2.0 | 14.1 | 10.82 | | 17.3693 | 6.38 | 20 | 1.07 | 1.17 | 72.90 |
| 5/13/92 | 134 | | 1 | 3.0 | 12.7 | 10.66 | | 8.8982 | | | | | |
| 5/13/92 | 134 | | 1 | 4.0 | 10.8 | 10.65 | | 4.4558 | | | | | |
| 5/13/92 | 134 | | 1 | 5.0 | 7.6 | 11.28 | | 2.4865 | | | | | |
| 5/13/92 | 134 | M | 1 | 6.0 | 6.1 | 10.98 | | 1.4356 | 5.93 | 20 | 2.37 | 3.61 | |
| 5/13/92 | 134 | M | 2 | 6.0 | 6.1 | 10.98 | | 1.4356 | 5.99 | 27 | 2.00 | 3.02 | 83.00 |
| 5/13/92 | 134 | | 1 | 7.0 | 5.5 | 10.47 | | 0.8007 | | | | | |
| 5/13/92 | 134 | | 1 | 8.0 | 5.2 | 9.43 | | 0.4071 | | | | | |
| 5/13/92 | 134 | | 1 | 9.0 | 5.0 | 8.60 | | 0.2063 | | | | | |
| 5/13/92 | 134 | | 1 | 10.0 | 4.9 | 7.78 | | 0.1095 | | | | | |
| 5/13/92 | 134 | H | 1 | 11.0 | 4.9 | 6.75 | | 0.0515 | 5.84 | 27 | 0.88 | 2.97 | |
| 5/13/92 | 134 | H | 2 | 11.0 | 4.9 | 6.75 | | 0.0515 | 5.94 | 25 | 0.92 | 2.42 | 81.50 |
| 5/13/92 | 134 | | 1 | 12.0 | 4.8 | 6.23 | | 0.0225 | | | | | |
| 5/13/92 | 134 | | 1 | 13.0 | 4.8 | 4.88 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/03/92 JULIAN DATE: 155 TIME: 10.42

SECCHI M: 7.0 WEATHER: Sunny, windy

PERSONNEL: EMN TLV NW SKN JM

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Light profile distorted by shading from boat

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/03/92 | 155 | S | 1 | -1.0 | 17.1 | | | | | | | | |
| 6/03/92 | 155 | | 1 | 0.0 | 16.2 | 9.17 | | 100.0000 | | | | | |
| 6/03/92 | 155 | | 1 | 1.0 | 16.0 | 9.03 | | 42.0875 | | | | | |
| 6/03/92 | 155 | E | 1 | 2.0 | 15.3 | 8.96 | | 17.8186 | 6.15 | 21 | 2.19 | 2.69 | |
| 6/03/92 | 155 | E | 2 | 2.0 | 15.3 | 8.96 | | 17.8186 | 6.16 | 22 | 2.09 | 2.36 | 63.20 |
| 6/03/92 | 155 | | 1 | 3.0 | 14.9 | 8.85 | | 2.6324 | | | | | |
| 6/03/92 | 155 | | 1 | 4.0 | 14.1 | 8.23 | | 1.2967 | | | | | |
| 6/03/92 | 155 | | 1 | 5.0 | 9.5 | 9.68 | | 0.8019 | | | | | |
| 6/03/92 | 155 | M | 1 | 6.0 | 7.2 | 9.51 | | 0.6819 | 5.98 | 26 | 1.48 | 1.67 | |
| 6/03/92 | 155 | M | 2 | 6.0 | 7.2 | 9.51 | | 0.6819 | 5.90 | 23 | 0.99 | 1.34 | 31.30 |
| 6/03/92 | 155 | | 1 | 7.0 | 6.1 | 8.72 | | 0.3080 | | | | | |
| 6/03/92 | 155 | | 1 | 8.0 | 5.5 | 6.97 | | 0.1256 | | | | | |
| 6/03/92 | 155 | | 1 | 9.0 | 5.1 | 5.61 | | 0.0501 | | | | | |
| 6/03/92 | 155 | H | 1 | 10.0 | 5.0 | 5.09 | | 0.0206 | 5.78 | 33 | 1.02 | 2.66 | |
| 6/03/92 | 155 | H | 2 | 10.0 | 5.0 | 5.09 | | 0.0206 | 5.76 | 35 | 0.99 | 1.99 | 72.70 |
| 6/03/92 | 155 | | 1 | 11.0 | 5.0 | 4.38 | | 0.0086 | | | | | |
| 6/03/92 | 155 | | 1 | 12.0 | 4.9 | 3.49 | | 0.0030 | | | | | |
| 6/03/92 | 155 | | 1 | 13.0 | 4.9 | 3.09 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/18/92 JULIAN DATE: 170 TIME: 10.58

SECCHI M: 5.1 WEATHER: Overcast, windy (S)

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD:
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/18/92 | 170 | S | 1 | -1.0 | 18.4 | | | | | | | | |
| 6/18/92 | 170 | | 1 | 0.0 | 21.4 | 11.24 | | 100.0000 | | | | | |
| 6/18/92 | 170 | E | 1 | 1.0 | 21.4 | 11.08 | | 22.7687 | 6.25 | | 2.99 | 3.43 | |
| 6/18/92 | 170 | E | 2 | 1.0 | 21.4 | 11.08 | | 22.7687 | 6.28 | | 2.49 | 2.94 | 36.90 |
| 6/18/92 | 170 | | 1 | 2.0 | 21.3 | 11.09 | | 8.7910 | | | | | |
| 6/18/92 | 170 | | 1 | 3.0 | 18.0 | 12.36 | | 4.9527 | | | | | |
| 6/18/92 | 170 | | 1 | 4.0 | 14.2 | 11.99 | | 2.6713 | | | | | |
| 6/18/92 | 170 | M | 1 | 5.0 | 10.2 | 13.36 | | 1.4949 | 5.94 | | 3.82 | 4.80 | |
| 6/18/92 | 170 | M | 2 | 5.0 | 10.2 | 13.36 | | 1.4949 | 5.93 | | 2.64 | 3.01 | 19.70 |
| 6/18/92 | 170 | | 1 | 6.0 | 7.8 | 12.69 | | 0.8494 | | | | | |
| 6/18/92 | 170 | | 1 | 7.0 | 6.5 | 11.12 | | 0.4734 | | | | | |
| 6/18/92 | 170 | | 1 | 8.0 | 5.5 | 8.54 | | 0.2533 | | | | | |
| 6/18/92 | 170 | | 1 | 9.0 | 5.1 | 5.28 | | 0.1159 | | | | | |
| 6/18/92 | 170 | H | 1 | 10.0 | 4.9 | 3.77 | | 0.0392 | 5.77 | | 0.85 | 3.41 | |
| 6/18/92 | 170 | H | 2 | 10.0 | 4.9 | 3.77 | | 0.0392 | 5.77 | | 0.71 | 2.95 | 56.30 |
| 6/18/92 | 170 | | 1 | 11.0 | 4.9 | 3.03 | | 0.0093 | | | | | |
| 6/18/92 | 170 | | 1 | 12.0 | 4.8 | 1.97 | | | | | | | |
| 6/18/92 | 170 | | 1 | 13.0 | 4.8 | 0.73 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/02/92 JULIAN DATE: 184 TIME: 10.33

SECCHI M: 4.7 WEATHER: Mostly cloudy, windy (NE)

PERSONNEL: EMN TLV JVO

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/02/92 | 184 | S | 1 | -1.0 | 20.1 | | | | | | | | |
| 7/02/92 | 184 | | 1 | 0.0 | 23.2 | 8.22 | | 100.0000 | | | | | |
| 7/02/92 | 184 | E | 1 | 1.0 | 23.3 | 8.54 | | 23.0415 | 6.43 | 27 | 2.82 | 3.48 | |
| 7/02/92 | 184 | E | 2 | 1.0 | 23.3 | 8.54 | | 23.0415 | 6.38 | 24 | 2.97 | 3.50 | 9.80 |
| 7/02/92 | 184 | | 1 | 2.0 | 22.3 | 9.29 | | 10.3604 | | | | | |
| 7/02/92 | 184 | | 1 | 3.0 | 20.1 | 8.86 | | 5.1289 | | | | | |
| 7/02/92 | 184 | M | 1 | 4.0 | 16.7 | 8.48 | | 2.6644 | 5.94 | 28 | 2.57 | 3.16 | |
| 7/02/92 | 184 | M | 2 | 4.0 | 16.7 | 8.48 | | 2.6644 | 6.07 | 26 | 2.81 | 3.56 | 25.60 |
| 7/02/92 | 184 | | 1 | 5.0 | 13.0 | 8.82 | | 1.4418 | | | | | |
| 7/02/92 | 184 | | 1 | 6.0 | 9.8 | 8.32 | | 0.7677 | | | | | |
| 7/02/92 | 184 | | 1 | 7.0 | 8.3 | 7.72 | | 0.4204 | | | | | |
| 7/02/92 | 184 | | 1 | 8.0 | 7.4 | 6.25 | | 0.2050 | | | | | |
| 7/02/92 | 184 | H | 1 | 9.0 | 6.8 | 4.45 | | 0.0639 | 5.72 | 55 | | | |
| 7/02/92 | 184 | H | 2 | 9.0 | 6.8 | 4.45 | | 0.0639 | 5.72 | 50 | 0.80 | 2.40 | 58.70 |
| 7/02/92 | 184 | | 1 | 10.0 | 6.5 | 2.91 | | 0.0102 | | | | | |
| 7/02/92 | 184 | | 1 | 11.0 | 6.4 | 1.95 | | 0.0005 | | | | | |
| 7/02/92 | 184 | | 1 | 12.0 | 6.3 | 1.12 | | | | | | | |
| 7/02/92 | 184 | | 1 | 13.0 | 6.3 | 0.88 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/16/92 JULIAN DATE: 198 TIME: 11.50

SECCHI M: 3.8 WEATHER: Partly cloudy, windy (SE)

PERSONNEL: TLV BKS JLM

TMETHOD: 10 LMETHOD: 12 AMETHOD:
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Light at 11:30am; temp/O2 at 3:00pm

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/16/92 | 198 | S | 1 | -1.0 | 24.9 | | | | | | | | |
| 7/16/92 | 198 | | 1 | 0.0 | 24.7 | 8.01 | | 100.0000 | | | | | |
| 7/16/92 | 198 | | 1 | 1.0 | 24.6 | 7.70 | | 38.3142 | | | | | |
| 7/16/92 | 198 | E | 1 | 2.0 | 24.3 | 7.71 | | 15.1499 | 6.35 | | 5.16 | 6.69 | |
| 7/16/92 | 198 | E | 2 | 2.0 | 24.3 | 7.71 | | 15.1499 | 6.42 | | 5.89 | 6.95 | 35.70 |
| 7/16/92 | 198 | | 1 | 3.0 | 23.1 | 7.80 | | 6.3469 | | | | | |
| 7/16/92 | 198 | | 1 | 4.0 | 18.0 | 7.52 | | 2.7193 | | | | | |
| 7/16/92 | 198 | M | 1 | 5.0 | 13.4 | 7.59 | | 1.3874 | 5.80 | | 8.99 | 11.66 | |
| 7/16/92 | 198 | M | 2 | 5.0 | 13.4 | 7.59 | | 1.3874 | 5.78 | | 8.62 | 12.19 | 15.90 |
| 7/16/92 | 198 | | 1 | 6.0 | 10.2 | 6.51 | | 0.7035 | | | | | |
| 7/16/92 | 198 | | 1 | 7.0 | 8.5 | 5.56 | | 0.3584 | | | | | |
| 7/16/92 | 198 | | 1 | 8.0 | 7.5 | 4.60 | | 0.1687 | | | | | |
| 7/16/92 | 198 | H | 1 | 9.0 | 6.8 | 2.13 | | 0.0586 | 5.78 | | 1.54 | 4.37 | |
| 7/16/92 | 198 | H | 2 | 9.0 | 6.8 | 2.13 | | 0.0586 | 5.81 | | 1.33 | 4.20 | 74.40 |
| 7/16/92 | 198 | | 1 | 10.0 | 6.6 | 0.98 | | 0.0125 | | | | | |
| 7/16/92 | 198 | | 1 | 11.0 | 6.4 | 0.73 | 4 | | | | | | |
| 7/16/92 | 198 | | 1 | 12.0 | 6.4 | 0.62 | 4 | | | | | | |
| 7/16/92 | 198 | | 1 | 13.0 | 6.3 | 0.62 | 4 | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/30/92 JULIAN DATE: 212 TIME: 10.92

SECCHI M: 3.5 WEATHER: Cloudy, slight wind (W)

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD:
OMETHOD: 10 PHMETHOD: CAMETHOD: 12

COMMENTS: pH electrode malfunction; hypolimnetic O2 doubtful

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/30/92 | 212 | S | 1 | -1.0 | 22.8 | | 10 | | | | | | |
| 7/30/92 | 212 | | 1 | 0.0 | 22.6 | 8.17 | 10 | 100.0000 | | | | | |
| 7/30/92 | 212 | | 1 | 1.0 | 22.5 | 8.45 | | 27.9330 | | | | | |
| 7/30/92 | 212 | E | 1 | 2.0 | 22.3 | 9.02 | | 13.7195 | | | 5.14 | 6.05 | |
| 7/30/92 | 212 | E | 2 | 2.0 | 22.3 | 9.02 | | 13.7195 | | | 4.91 | 5.99 | 54.60 |
| 7/30/92 | 212 | | 1 | 3.0 | 21.9 | 9.80 | | 7.1493 | | | | | |
| 7/30/92 | 212 | | 1 | 4.0 | 20.7 | 8.68 | | 3.2161 | | | | | |
| 7/30/92 | 212 | | 1 | 5.0 | 15.5 | 9.20 | | 1.6926 | | | | | |
| 7/30/92 | 212 | M | 1 | 6.0 | 12.6 | 9.11 | | 0.8723 | | | 3.33 | 5.42 | |
| 7/30/92 | 212 | M | 2 | 6.0 | 12.6 | 9.11 | | 0.8723 | | | 3.17 | 4.78 | 36.30 |
| 7/30/92 | 212 | | 1 | 7.0 | 10.5 | 8.07 | | 0.4214 | | | | | |
| 7/30/92 | 212 | | 1 | 8.0 | 8.9 | 7.17 | | 0.1710 | | | | | |
| 7/30/92 | 212 | | 1 | 9.0 | 7.3 | 6.36 | | 0.0595 | | | | | |
| 7/30/92 | 212 | H | 1 | 10.0 | 6.6 | 3.60 | 2 | 0.0166 | | | 5.61 | 5.63 | |
| 7/30/92 | 212 | H | 2 | 10.0 | 6.6 | 3.60 | 2 | 0.0166 | | | 8.68 | 13.80 | 77.40 |
| 7/30/92 | 212 | | 1 | 11.0 | 6.5 | 3.74 | 2 | 0.0050 | | | | | |
| 7/30/92 | 212 | | 1 | 12.0 | 6.4 | 3.41 | 2 | 0.0014 | | | | | |
| 7/30/92 | 212 | | 1 | 13.0 | 6.4 | 3.23 | 2 | 0.0000 | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/12/92 JULIAN DATE: 225 TIME: 12.17

SECCHI M: 4.4 WEATHER: Sunny, slight wind (NW)

PERSONNEL: EMN TLV KYG

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8/12/92 | 225 | S | 1 | -1.0 | 26.2 | | | | | | | | |
| 8/12/92 | 225 | | 1 | 0.0 | 23.0 | 11.00 | | 100.0000 | | | | | |
| 8/12/92 | 225 | | 1 | 1.0 | 23.0 | 11.10 | | 40.7000 | | | | | |
| 8/12/92 | 225 | E | 1 | 2.0 | 22.9 | 11.00 | | 22.5986 | 6.59 | 32 | 3.59 | 4.20 | |
| 8/12/92 | 225 | E | 2 | 2.0 | 22.9 | 11.00 | | 22.5986 | 6.60 | 30 | 3.73 | 4.44 | 56.30 |
| 8/12/92 | 225 | | 1 | 3.0 | 22.9 | 11.00 | | 11.7824 | | | | | |
| 8/12/92 | 225 | | 1 | 4.0 | 20.1 | 9.40 | | 5.1859 | | | | | |
| 8/12/92 | 225 | | 1 | 5.0 | 15.1 | 8.50 | | 2.5609 | | | | | |
| 8/12/92 | 225 | M | 1 | 6.0 | 11.0 | 6.70 | | 1.4634 | 5.74 | 41 | 5.72 | 8.26 | |
| 8/12/92 | 225 | M | 2 | 6.0 | 11.0 | 6.70 | | 1.4634 | 5.79 | 40 | 5.44 | 7.35 | 29.60 |
| 8/12/92 | 225 | | 1 | 7.0 | 8.5 | 4.70 | | 0.6658 | | | | | |
| 8/12/92 | 225 | | 1 | 8.0 | 7.2 | 1.90 | | 0.2887 | | | | | |
| 8/12/92 | 225 | | 1 | 9.0 | 6.8 | 0.50 | 4 | 0.1179 | | | | | |
| 8/12/92 | 225 | H | 1 | 10.0 | 6.2 | 0.40 | 4 | 0.0395 | 6.05 | 128 | 0.00 | 30.04 | |
| 8/12/92 | 225 | H | 2 | 10.0 | 6.2 | 0.40 | 4 | 0.0395 | 6.08 | 136 | 0.42 | 17.32 | |
| 8/12/92 | 225 | | 1 | 11.0 | 6.1 | 0.40 | 4 | 0.0120 | | | | | |
| 8/12/92 | 225 | | 1 | 12.0 | 6.1 | 0.31 | 4 | 0.0037 | | | | | |
| 8/12/92 | 225 | | 1 | 13.0 | 6.0 | 0.39 | 4 | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/26/92 JULIAN DATE: 239 TIME: 10.17

SECCHI M: 4.3 WEATHER: Sunny

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD:
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8/26/92 | 239 | S | 1 | -1.0 | 24.8 | | | | | | | | |
| 8/26/92 | 239 | | 1 | 0.0 | 23.7 | 8.62 | | 100.0000 | | | | | |
| 8/26/92 | 239 | | 1 | 1.0 | 23.5 | 8.66 | | 42.7899 | | | | | |
| 8/26/92 | 239 | E | 1 | 2.0 | 22.3 | 9.01 | | 21.7871 | 6.54 | | 2.55 | 3.33 | |
| 8/26/92 | 239 | E | 2 | 2.0 | 22.3 | 9.01 | | 21.7871 | 6.54 | | 2.82 | 3.21 | 52.10 |
| 8/26/92 | 239 | | 1 | 3.0 | 21.2 | 9.19 | | 10.7432 | | | | | |
| 8/26/92 | 239 | | 1 | 4.0 | 20.1 | 8.54 | | 4.8678 | | | | | |
| 8/26/92 | 239 | | 1 | 5.0 | 15.7 | 5.83 | | 2.1606 | | | | | |
| 8/26/92 | 239 | M | 1 | 6.0 | 11.6 | 5.32 | | 0.9821 | 5.88 | | 5.42 | 6.95 | |
| 8/26/92 | 239 | M | 2 | 6.0 | 11.6 | 5.32 | | 0.9821 | 5.82 | | 4.97 | 6.17 | 30.60 |
| 8/26/92 | 239 | | 1 | 7.0 | 9.1 | 1.82 | | 0.4424 | | | | | |
| 8/26/92 | 239 | | 1 | 8.0 | 7.6 | 0.35 | 4 | 0.1838 | | | | | |
| 8/26/92 | 239 | | 1 | 9.0 | 7.0 | 0.32 | 4 | 0.0592 | | | | | |
| 8/26/92 | 239 | H | 1 | 10.0 | 6.8 | 0.30 | 4 | 0.0129 | 6.04 | | 0.00 | 166.63 | |
| 8/26/92 | 239 | H | 2 | 10.0 | 6.8 | 0.30 | 4 | 0.0129 | 6.07 | | 0.27 | 123.40 | |
| 8/26/92 | 239 | | 1 | 11.0 | 6.7 | 0.29 | 4 | 0.0036 | | | | | |
| 8/26/92 | 239 | | 1 | 12.0 | 6.7 | 0.29 | 4 | 0.0009 | | | | | |
| 8/26/92 | 239 | | 1 | 13.0 | 6.6 | 0.27 | 4 | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/11/92 JULIAN DATE: 255 TIME: 11.83

SECCHI M: 4.8 WEATHER: Mostly sunny, slight wind (NW)

PERSONNEL: TLV EMN

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Heavy thunderstorms last night

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/11/92 | 255 | S | 1 | -1.0 | 19.7 | | | | | | | | |
| 9/11/92 | 255 | | 1 | 0.0 | 21.9 | 10.79 | | 100.0000 | | | | | |
| 9/11/92 | 255 | | 1 | 1.0 | 21.9 | 9.25 | | 35.9842 | | | | | |
| 9/11/92 | 255 | E | 1 | 2.0 | 21.8 | 9.21 | | 16.0357 | 6.40 | 35 | 2.63 | 3.17 | |
| 9/11/92 | 255 | E | 2 | 2.0 | 21.8 | 9.21 | | 16.0357 | 6.48 | 33 | 3.10 | 3.53 | 67.10 |
| 9/11/92 | 255 | | 1 | 3.0 | 21.1 | 9.29 | | 7.5891 | | | | | |
| 9/11/92 | 255 | | 1 | 4.0 | 20.1 | 8.36 | | 3.6398 | | | | | |
| 9/11/92 | 255 | | 1 | 5.0 | 16.9 | 4.34 | | 1.8208 | | | | | |
| 9/11/92 | 255 | M | 1 | 6.0 | 12.5 | 3.28 | | 0.8992 | 5.90 | 55 | 3.59 | 5.21 | |
| 9/11/92 | 255 | M | 2 | 6.0 | 12.5 | 3.28 | | 0.8992 | 5.94 | 46 | 3.84 | 4.89 | 31.20 |
| 9/11/92 | 255 | | 1 | 7.0 | 10.0 | 1.32 | | 0.4014 | | | | | |
| 9/11/92 | 255 | | 1 | 8.0 | 8.2 | 0.37 | 4 | 0.1525 | | | | | |
| 9/11/92 | 255 | | 1 | 9.0 | 7.3 | 0.36 | 4 | 0.0366 | | | | | |
| 9/11/92 | 255 | H | 1 | 10.0 | 7.0 | 0.28 | 4 | 0.0056 | 6.38 | 207 | 0.00 | 142.35 | |
| 9/11/92 | 255 | H | 2 | 10.0 | 7.0 | 0.28 | 4 | 0.0056 | 6.36 | 210 | 0.71 | 150.04 | |
| 9/11/92 | 255 | | 1 | 11.0 | 6.9 | 0.26 | 4 | 0.0003 | | | | | |
| 9/11/92 | 255 | | 1 | 12.0 | 6.8 | 0.27 | 4 | | | | | | |
| 9/11/92 | 255 | | 1 | 13.0 | 6.8 | 0.25 | 4 | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/24/92 JULIAN DATE: 268 TIME: 12.00

SECCHI M: 4.7 WEATHER: Sunny, slight wind

PERSONNEL: EMN BKS

TMETHOD: 10 LMETHOD: 12 AMETHOD:
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/24/92 | 268 | S | 1 | -1.0 | 18.9 | | | | | | | | |
| 9/24/92 | 268 | | 1 | 0.0 | 18.6 | 8.32 | | 100.0000 | | | | | |
| 9/24/92 | 268 | | 1 | 1.0 | 18.5 | 8.27 | | 41.6493 | | | | | |
| 9/24/92 | 268 | | 1 | 2.0 | 18.5 | 8.16 | | 19.2464 | | | | | |
| 9/24/92 | 268 | E | 1 | 3.0 | 18.4 | 8.04 | | 9.4577 | 6.30 | | 4.09 | 4.83 | |
| 9/24/92 | 268 | E | 2 | 3.0 | 18.4 | 8.04 | | 9.4577 | 6.28 | | 3.65 | 4.40 | 40.80 |
| 9/24/92 | 268 | | 1 | 4.0 | 18.3 | 7.89 | | 4.3685 | | | | | |
| 9/24/92 | 268 | | 1 | 5.0 | 18.2 | 7.73 | | 2.0822 | | | | | |
| 9/24/92 | 268 | M | 1 | 6.0 | 14.2 | 2.37 | | 0.8319 | 6.02 | | 3.88 | 6.04 | |
| 9/24/92 | 268 | M | 2 | 6.0 | 14.2 | 2.37 | | 0.8319 | 5.88 | | 2.76 | 3.83 | 40.90 |
| 9/24/92 | 268 | | 1 | 7.0 | 10.6 | 0.29 | 4 | 0.3663 | | | | | |
| 9/24/92 | 268 | | 1 | 8.0 | 8.5 | 0.07 | 4 | 0.1580 | | | | | |
| 9/24/92 | 268 | | 1 | 9.0 | 7.6 | 0.04 | 4 | 0.0493 | | | | | |
| 9/24/92 | 268 | H | 1 | 10.0 | 7.2 | 0.05 | 4 | 0.0039 | 6.31 | | 0.00 | 185.51 | |
| 9/24/92 | 268 | H | 2 | 10.0 | 7.2 | 0.05 | 4 | 0.0039 | 6.42 | | 0.12 | 182.06 | |
| 9/24/92 | 268 | | 1 | 11.0 | 7.0 | 0.03 | 4 | 0.0003 | | | | | |
| 9/24/92 | 268 | | 1 | 12.0 | 6.9 | 0.00 | | | | | | | |
| 9/24/92 | 268 | | 1 | 13.0 | 6.9 | 0.00 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 10/15/92 JULIAN DATE: 289 TIME: 14.00

SECCHI M: 5.9 WEATHER: Partly cloudy, slight wind

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: Chlorophyll filters thawed overnight before extraction

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/15/92 | 289 | S | 1 | -1.0 | 17.5 | | | | | | | | |
| 10/15/92 | 289 | | 1 | 0.0 | 13.8 | 9.51 | | 100.0000 | | | | | |
| 10/15/92 | 289 | | 1 | 1.0 | 13.6 | 9.42 | | 39.5883 | | | | | |
| 10/15/92 | 289 | | 1 | 2.0 | 13.2 | 9.38 | | 15.6785 | | | | | |
| 10/15/92 | 289 | | 1 | 3.0 | 13.1 | 9.37 | | 7.8787 | | | | | |
| 10/15/92 | 289 | E | 1 | 4.0 | 13.1 | 9.33 | | 3.6008 | 6.33 | 37 | 3.59 | 3.91 | |
| 10/15/92 | 289 | E | 2 | 4.0 | 13.1 | 9.33 | | 3.6008 | 6.30 | 34 | 2.90 | 3.51 | 65.20 |
| 10/15/92 | 289 | | 1 | 5.0 | 13.0 | 9.32 | | 1.7599 | | | | | |
| 10/15/92 | 289 | | 1 | 6.0 | 12.9 | 9.25 | | 0.9633 | | | | | |
| 10/15/92 | 289 | | 1 | 7.0 | 12.8 | 8.71 | | 0.4788 | | | | | |
| 10/15/92 | 289 | M | 1 | 8.0 | 9.9 | 0.20 | 4 | 0.1976 | 5.90 | 59 | 8.55 | 8.67 | |
| 10/15/92 | 289 | M | 2 | 8.0 | 9.9 | 0.20 | 4 | 0.1976 | 5.94 | 57 | 8.83 | 9.46 | 83.70 |
| 10/15/92 | 289 | | 1 | 9.0 | 7.9 | 0.16 | 4 | 0.0483 | | | | | |
| 10/15/92 | 289 | | 1 | 10.0 | 7.4 | 0.14 | 4 | 0.0039 | | | | | |
| 10/15/92 | 289 | H | 1 | 11.0 | 7.2 | 0.13 | 4 | 0.0004 | 6.48 | 321 | 0.00 | 127.44 | |
| 10/15/92 | 289 | H | 2 | 11.0 | 7.2 | 0.13 | 4 | 0.0004 | 6.50 | 324 | 0.05 | 102.45 | |
| 10/15/92 | 289 | | 1 | 12.0 | 7.1 | 0.13 | 4 | | | | | | |
| 10/15/92 | 289 | | 1 | 13.0 | 7.1 | 0.11 | 4 | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 11/20/92     JULIAN DATE: 325     TIME: 11.25

SECCHI M: 5.3     WEATHER: Sunny, windy (SE)

PERSONNEL: TLV BKS

TMETHOD: 10     LMETHOD: 12     AMETHOD: 11
OMETHOD: 10     PHMETHOD: 12     CAMETHOD: 12

COMMENTS:

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/20/92 | 325 | S | 1 | -1.0 | 7.0 | | | | | | | | |
| 11/20/92 | 325 | | 1 | 0.0 | 5.1 | 11.10 | | 100.0000 | | | | | |
| 11/20/92 | 325 | | 1 | 1.0 | 5.1 | 10.90 | | 36.5097 | | | | | |
| 11/20/92 | 325 | E | 1 | 2.0 | 5.1 | 10.90 | | 20.3170 | 6.30 | 49 | 2.56 | 2.56 | |
| 11/20/92 | 325 | E | 2 | 2.0 | 5.1 | 10.90 | | 20.3170 | 6.28 | 47 | 1.88 | 2.28 | 73.90 |
| 11/20/92 | 325 | | 1 | 3.0 | 5.0 | 10.84 | | 8.7498 | | | | | |
| 11/20/92 | 325 | | 1 | 4.0 | 5.0 | 10.83 | | 3.8716 | | | | | |
| 11/20/92 | 325 | | 1 | 5.0 | 5.0 | 10.80 | | 2.0637 | | | | | |
| 11/20/92 | 325 | M | 1 | 6.0 | 4.9 | 10.74 | | 1.1421 | 6.28 | 52 | 1.78 | 1.78 | |
| 11/20/92 | 325 | M | 2 | 6.0 | 4.9 | 10.74 | | 1.1421 | 6.30 | 49 | 1.27 | 1.68 | 58.30 |
| 11/20/92 | 325 | | 1 | 7.0 | 4.9 | 10.72 | | 0.5261 | | | | | |
| 11/20/92 | 325 | | 1 | 8.0 | 4.9 | 10.72 | | 0.2761 | | | | | |
| 11/20/92 | 325 | | 1 | 9.0 | 4.9 | 10.65 | | 0.1451 | | | | | |
| 11/20/92 | 325 | H | 1 | 10.0 | 4.9 | 10.68 | | 0.0705 | 6.33 | 47 | 1.34 | 1.85 | |
| 11/20/92 | 325 | H | 2 | 10.0 | 4.9 | 10.68 | | 0.0705 | 6.31 | 48 | 1.10 | 1.52 | 68.20 |
| 11/20/92 | 325 | | 1 | 11.0 | 4.8 | 10.68 | | 0.0382 | | | | | |
| 11/20/92 | 325 | | 1 | 12.0 | 4.8 | 10.63 | | 0.0196 | | | | | |
| 11/20/92 | 325 | | 1 | 13.0 | 4.8 | 10.12 | | | | | | | |

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 12/30/92 JULIAN DATE: 365 TIME: 11.08

SECCHI M: 5.8 WEATHER: Thick fog & rain

PERSONNEL: EMN TLV

TMETHOD: 10 LMETHOD: 12 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 12 CAMETHOD: 12

COMMENTS: 11 cm frozen slush on 13 cm ice

| DATE OF | JULIAN | STRA | REP | DEPTH | TEMP C | OXYGEN | OFLAG | LIGHT PC | PH | ALKAL | CHLAC U | CHLASUM | CHLAC P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/30/92 | 365 | S | 1 | -1.0 | 8.8 | | | | | | | | |
| 12/30/92 | 365 | | 1 | 0.0 | 2.0 | 16.50 | | 100.0000 | | | | | |
| 12/30/92 | 365 | E | 1 | 1.0 | 2.0 | 15.00 | | 20.8377 | 6.26 | 43 | 3.03 | 3.09 | |
| 12/30/92 | 365 | E | 2 | 1.0 | 2.0 | 15.00 | | 20.8377 | 6.26 | 45 | 2.72 | 2.72 | 56.60 |
| 12/30/92 | 365 | | 1 | 2.0 | 2.2 | 14.40 | | 6.7175 | | | | | |
| 12/30/92 | 365 | | 1 | 3.0 | 2.2 | 13.90 | | 2.9909 | | | | | |
| 12/30/92 | 365 | M | 1 | 4.0 | 2.2 | 13.40 | | 1.3713 | 6.15 | 44 | 1.03 | 1.40 | |
| 12/30/92 | 365 | M | 2 | 4.0 | 2.2 | 13.40 | | 1.3713 | 6.16 | 44 | 0.98 | 1.27 | 49.00 |
| 12/30/92 | 365 | | 1 | 5.0 | 2.2 | 12.50 | | 0.6683 | | | | | |
| 12/30/92 | 365 | | 1 | 6.0 | 2.5 | 12.40 | | 0.3282 | | | | | |
| 12/30/92 | 365 | | 1 | 7.0 | 2.5 | 11.70 | | 0.1651 | | | | | |
| 12/30/92 | 365 | | 1 | 8.0 | 2.8 | 11.70 | | 0.0812 | | | | | |
| 12/30/92 | 365 | H | 1 | 9.0 | 3.0 | 10.00 | | 0.0382 | 5.92 | 48 | 0.46 | 2.16 | |
| 12/30/92 | 365 | H | 2 | 9.0 | 3.0 | 10.00 | | 0.0382 | 5.92 | 46 | 0.33 | 1.65 | 72.70 |
| 12/30/92 | 365 | | 1 | 10.0 | 3.0 | 9.60 | | 0.0169 | | | | | |
| 12/30/92 | 365 | | 1 | 11.0 | 3.0 | 7.70 | | 0.0062 | | | | | |
| 12/30/92 | 365 | | 1 | 12.0 | 3.0 | 5.90 | | 0.0020 | | | | | |
| 12/30/92 | 365 | | 1 | 13.0 | 3.0 | 1.20 | | | | | | | |

# APPENDIX I

# BATHYMETRY OF LAKE LACAWAC

In 1992, Robert Moeller drafted an updated bathymetric map of Lake Lacawac, included with this report. Information was derived from three sources: (1) an aerial photograph for lake outline, (2) USGS topographic sheets for scale and north orientation, and (3) a bathymetric survey.

The 24"x24" aerial photograph (Soil Conservation Service, summer circa 1975-1980) was assumed to present an accurate, undistorted image of the lake (8.5x6.5 cm). This was enlarged xerographically to 16x13 cm (EW x NS) without distortion. The topographic sheet (Lakeville 1966 7.5 minute series) provided N-S orientation--transferred to the new map with an accuracy of about $\pm$1.5 degree--and scale, which was established by measuring ca. 8 shore-to-shore distances on both the topographic map and on the new map.

The bathymetric survey, by Dr. Alan J. Tessier and students from Swarthmore College, was carried out during the winter of 1987. Soundings were made with a weighted line through 94 holes cut in the ice according to a professionally surveyed grid. The resulting plot of depths (A. Tessier, 1990, personal communication to R. Moeller) was converted to the present bathymetric map by (1) adding shoreline detail and very slightly adjusting nearshore contours to correspond to the photo-derived outline, and (2) drafting (by eye) contours at 2-m intervals.

The scale on the new map is believed correct to within 1% (relative to USGS topographic map). It is well within 1% of the scale of the original map by A. Tessier. Lake area and volume are considered accurate to 2% and 5%, respectively, and area and volume of 2-m contour subsections to ca. 10%

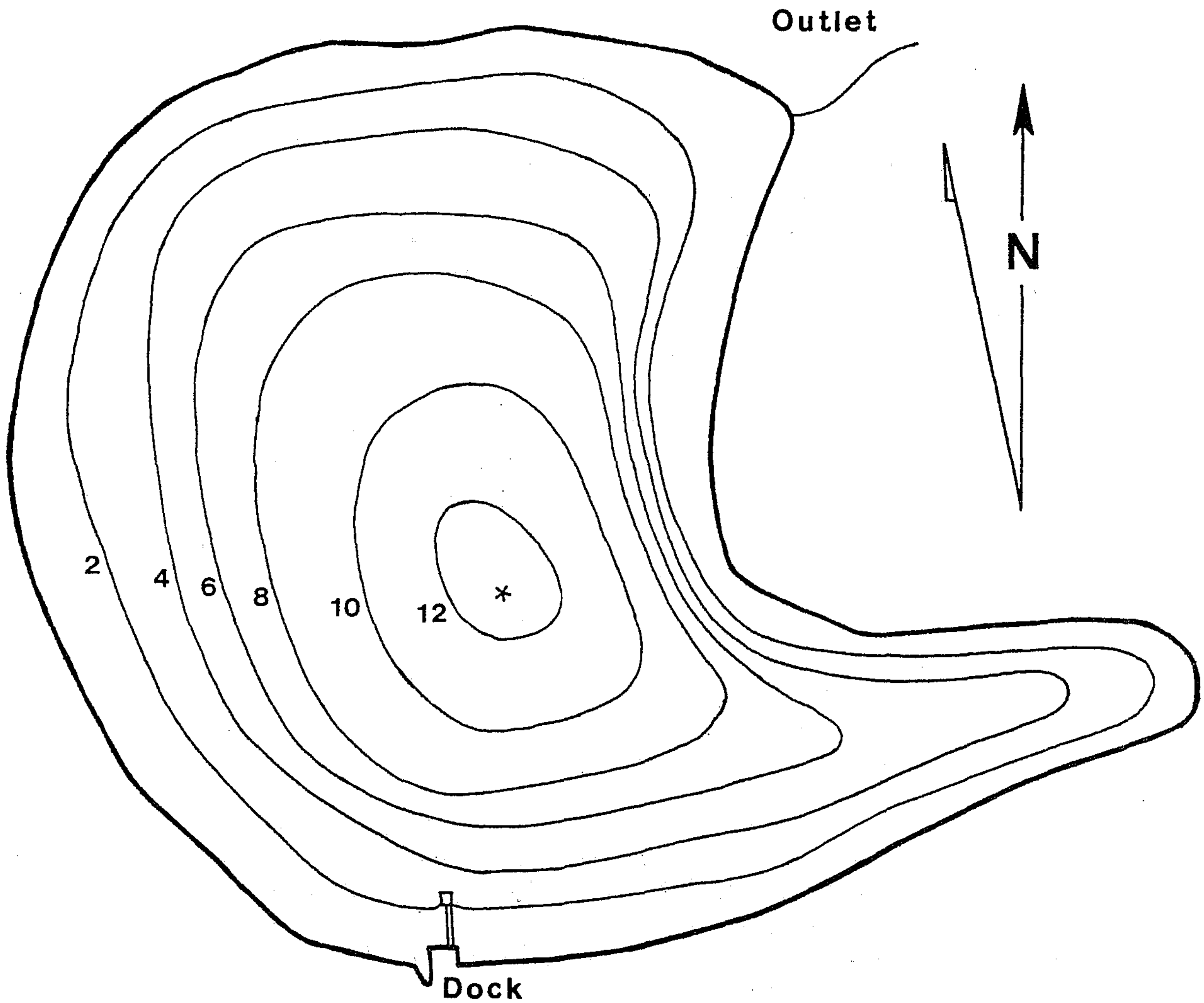
This 1992 map differs only insignificantly from earlier versions published by Tessier and in circulation as xerox copies of final and preliminary drafts, which are recognizable by their contour intervals at 2.5, 5, 7.5, 10 and 12m. The maximum depth of 13.5 m indicated on these maps has proved elusive on intensive resounding. A maximum of 13.0 m has been found in 1989-1992 during early summer water levels (with beaver dam breached!).

No water level datum was established for the present survey, and data are not available for the aerial photograph or earlier maps. They are assumed to be comparable, probably within 0.3 metre, however lake levels are affected by beaver activities.

On the next page is the 1992 PCLP map, with a border of 50-metre grid marks to control for distortion in future copying. The routine PCLP sampling station is located with an asterisk. Hypsographic and bathymetric curves (cumulative area and cumulative volume, respectively, versus depth) are plotted on the following page.

# LAKE LACAWAC

## Wayne County, Pennsylvania




**Depth Contours in Meters**

**Meters**

**0 100 200 300 400 500**

POCONO COMPARATIVE LAKES PROGRAM ------------ LEHIGH UNIVERSITY ------------ 1992
Map drawn by R. Moeller from survey data of A. Tessier

# LAKE LACAWAC BATHYMETRY

PCLP MAP OF OCTOBER 1992