LAKE LACAWAC

REPORT ON LIMNOLOGICAL CONDITIONS IN 1990

Robert E. Moeller
Craig E. Williamson

POCONO COMPARATIVE LAKES PROGRAM

Lehigh University

Department of Biology
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Bethlehem, Pennsylvania 18015

15 May 1991

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Moeller, R. E. and C. E. Williamson. 1991. Lake Lacawac: Report on Limnological Conditions in 1990. Unpublished Report to the Lacawac Sanctuary. Biology Department, Lehigh University, 15 May 1991.

INTRODUCTION

Personnel from Lehigh University visited Lake Lacawac on 16 dates throughout 1990 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 ("eutrophic") lake potentially affected by homes and agricultural practices within its drainage basin. 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. Additional support from the Geraldine R. Dodge Foundation funded the summer internship program at the Lacawac Sanctuary.

1990 was the third consecutive year of the monitoring program, and the third year for summer sampling. This is the first year that winter and spring data were obtained, however. The present report summarizes conditions in Lake Waynewood over the full twelve-month period for 1990. 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**. Samples for **TOTAL PHOSPHORUS** were obtained during spring turn-over and again in midsummer. **ZOOPLANKTON DATA** are presented as graphs that give the concentration (number of individuals per liter) averaged over the entire water column.

The report includes some information that will be acquired only irregularly from the core lakes, not as part of the routine monitoring:

BROAD CHEMICAL CHARACTERIZATION OF THE LAKE --A suite of chemical data from the lake on four dates in 1989, collected by Dr. Jonathan Cole and Dr. Nina Caraco of the Institute of Ecosystem Studies, New York Botanical Garden (Millbrook, NY), funded in part by a grant from the Pocono Comparative Lakes Program.

FISH SURVEY --The results of gill- and trap-netting undertaken in July by Aquatic Resource Consulting (Saylorsburg, PA), directed by Kenneth Ersbak and funded by the Pocono Comparative Lakes Project.

The Lacawac 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 curator, Sally Jones.

1990 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 analysis, and computer data entry were carried out by several graduate research assistants under the supervision of Dr. Robert Moeller. John Aufderheide and Scott Carpenter carried out most of the field sampling and laboratory analyses. John counted the microzooplankton, while Scott developed and managed all aspects of the computer database including data entry and printing of zooplankton graphs. Dr. Bruce Hargreaves played a major advisory role in the development of the computerized database. Karen Basehore counted the macrozooplankton from Lake Lacawac. John Aufderheide identified and counted the microzooplankton. Paul Stutzman and Karen checked the zooplankton data entries. Vanessa Jones and Robert Moeller analyzed chlorophyll and phosphorus samples. Scott Carpenter and Steve Gould measured pH and alkalinity. Gina Novak entered the physical/chemical data, which Robert Moeller checked and abstracted as tables and graphs.

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 will be issued later in 1991 as a special report.

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 May, 1991, most of the existing information is accessible through the software program Reflex™ (version 2, Borland International, copyright 1989) running on IBM PC-type microcomputers. Instructional workshops are offered periodically at Lehigh University.

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") at the deepest part of the lake (about 13 meters or 42 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.

TEMPERATURE AND PHYSICAL STRATIFICATION

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

Figure 2a shows the thermal stratification that develops during late spring and summer, then breaks down in the autumn. On day 26 (26 January) the lake was ice-covered, and displayed a "reverse stratification". After ice-out (sometime near 10 March) the water column circulated from top to bottom during "spring turnover" (e.g. day 84--25 March). By day 198 (17 July) the lake had warmed and become strongly stratified, producing an upper warm water layer circulating in contact with the atmosphere (the **EPILIMNION**, 0-3 meters, temperature 21-23°C; an intermediate layer of rapid temperature decrease with depth (the **METALIMNION**, 3-7 meters); and a deep layer of cold water (the **HYPOLIMNION**, 7-13 meters, temperature 7-10°C).

The usual course of thermal stratification is that of slow, gradual thickening of an epilimnion during the summer. By day 261 (18 September) Lake Lacawac's epilimnion extended to 4 meters. 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 long before day 323 (19 November). The lake continued to cool, down to 3°C, before freezing soon after day 347 (13 December).

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 1990-91) and the completeness of spring turnover. Spring turnover was complete in 1990 and lasted at least 2 weeks. During an especially warm spring, Lake Lacawac might stratify quickly without a thorough mixing of deep and surficial layers. This might lead to some differences in the biology and chemistry of the summer plankton community. **Figure 2b** presents the detailed trends of water temperature at three fixed depths (2,6,10 meters) for comparison with other years.

Water samples for **pH**, **alkalinity**, **chlorophyll**, **algae**, and **total phosphorus** 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. 26 January), the topmost layer was 0-1m, and the remaining depths were divided at the Secchi depth (see **SECCHI DEPTH** below).

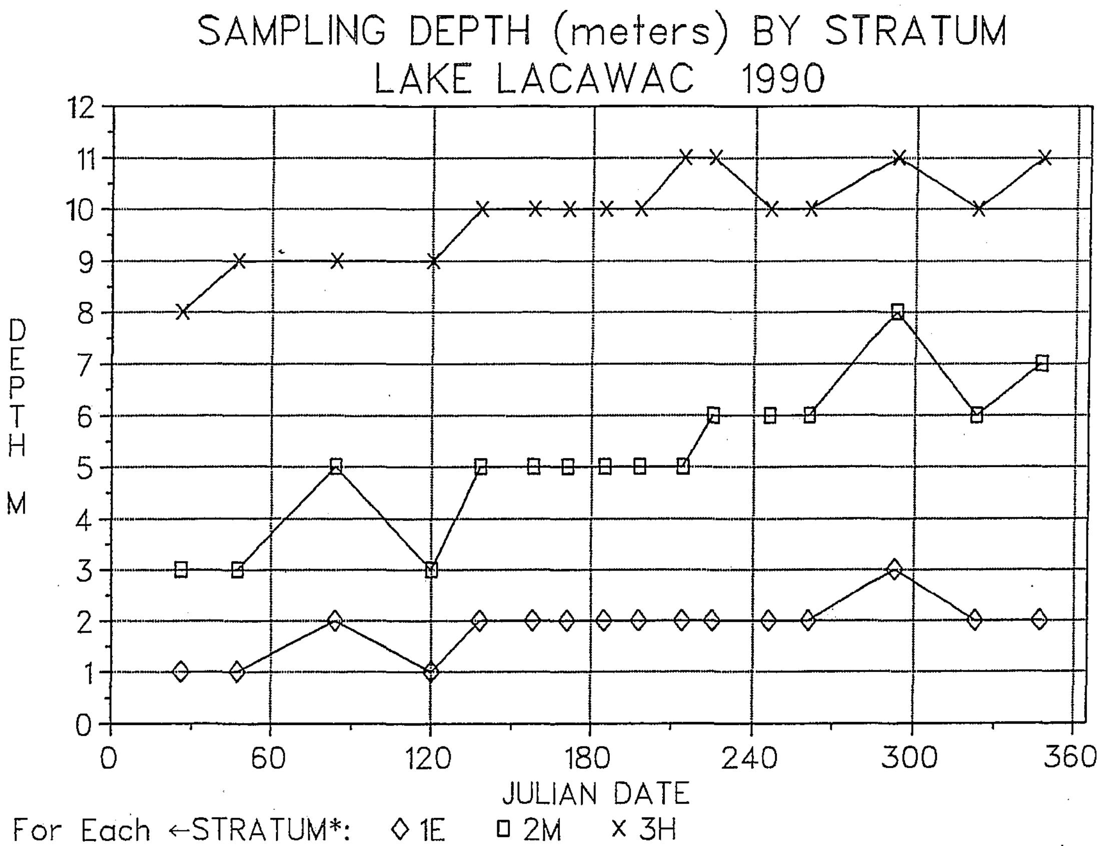


Figure 1. Depths of "EPI", "META", and "HYPO" samples from Lake Lacawac, 1990.

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

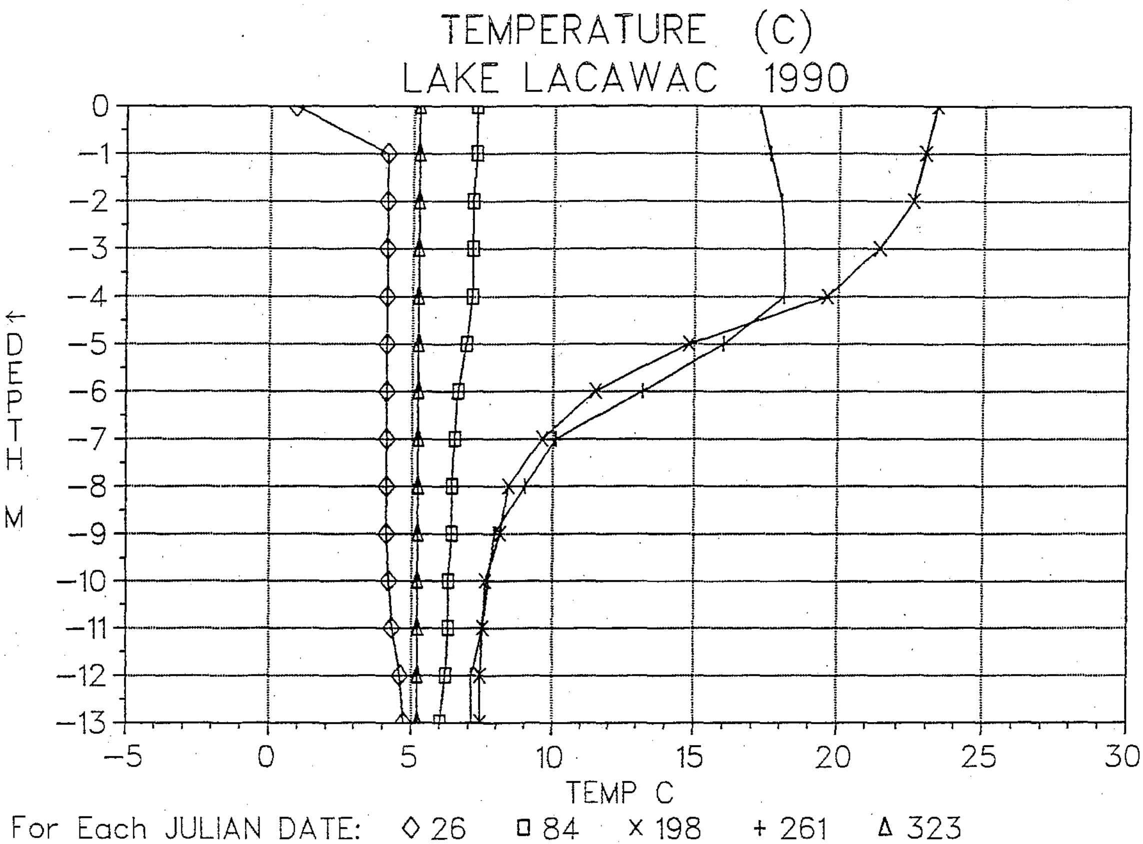


Figure 2a. Temperature profiles in Lake Lacawac, 1990.

Values (°C) are plotted for five dates: **26 January** (day 26 --winter ice cover), **25 March** (day 84 --spring turnover), **17 July** (day 198 --midsummer stratification), **18 September** (day 261 --late stratification), **19 November** (day 323 --early fall turnover).

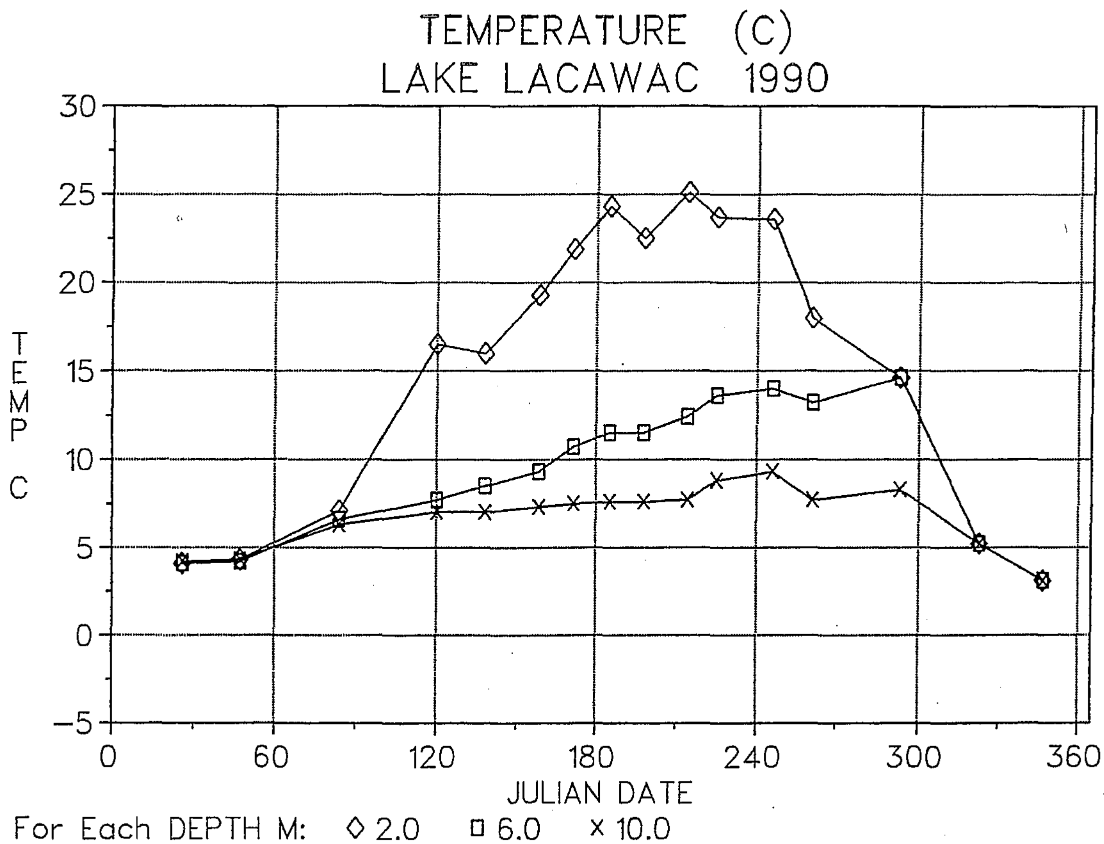


Figure 2b. Temperature trends within Lake Lacawac, 1990.

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

LIGHT PENETRATION

Light intensity at 1-meter 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 most dates in 1990:

Method 10. A Licor™ submersible flat-plate sensor filtered to give a quantal response to photosynthetically available radiation ("PAR"), reading μEinsteins/m^2.sec. Replicate profiles were obtained, and averaged, when sky brightness varied because of clouds.

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 3)**. During the summer, depths above 3.5 m (i.e. all of the epilimnion) received at least 5% of the light penetrating the lake surface. The metalimnion received 0.5-5% of surface light, enough for low-to-moderate rates of algal growth. During autumn turnover light penetration was somewhat decreased, when algal detritus and precipitated iron circulated in the water column along with the healthy fall algal community.

SECCHI DEPTH

Secchi depth is the depth, in meters, 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.

Secchi transparency was typically about 4 meters **(Figure 4)**, as it was in 1989. A modest oscillation in the range of 3-5 m in midsummer was associated with a short-lived, increase in epilimnial chlorophyll in mid-August.

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 liter. (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, and plotted at the base of the hypolimnion for days 198 (17 July) and 261 (18 September) in **Figure 5**, should be treated as true zeros.

During winter ice cover, oxygen was partly depleted, then recharged during spring turnover. The onset of thermal stratification in mid-spring marked the onset of gradual depletion of oxygen within the hypolimnion. By day 198 (17 July) the lower hypolimnion was anoxic **(Figure 5)**. By day 261 (18 September) the lower portion of the metalimnion

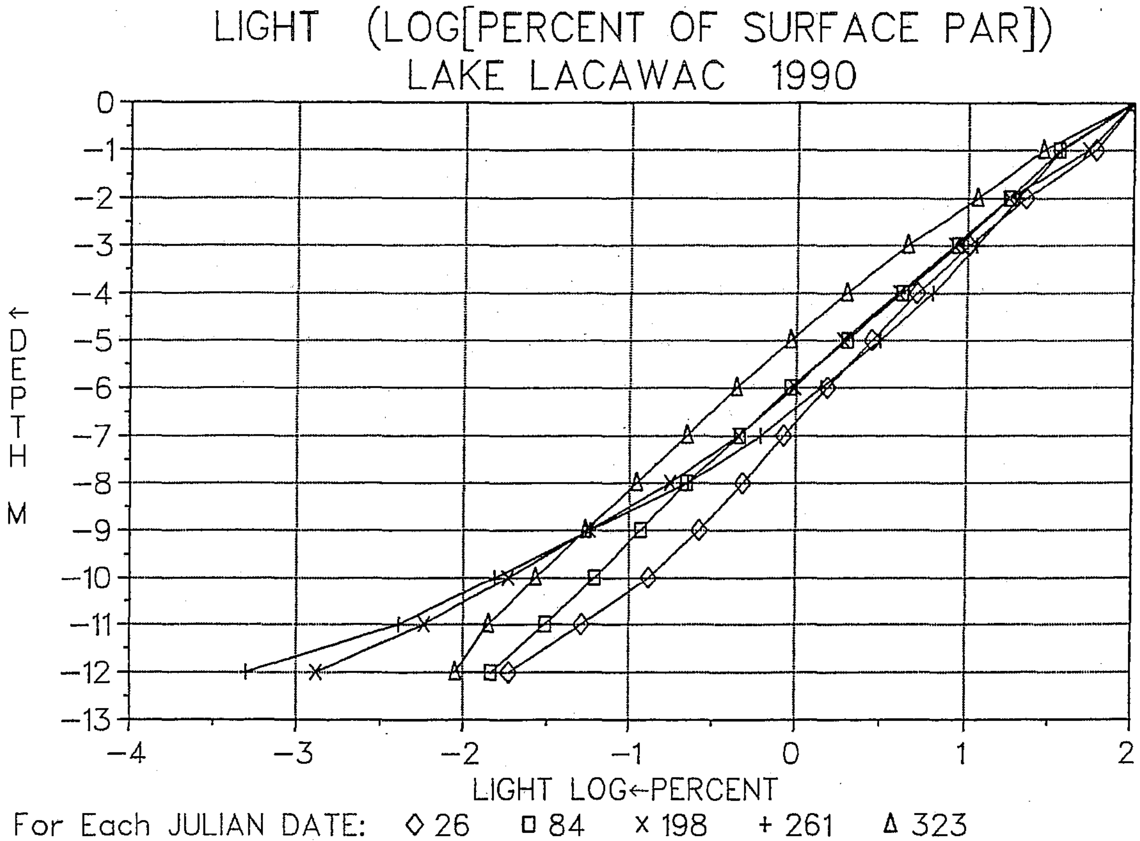


Figure 3. Light penetration in Lake Lacawac, 1990.

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: **26 January** (day 26 --winter ice cover), **25 March** (day 84 --spring turnover), **17 July** (day 198 --midsummer stratification), **18 September** (day 261 --late stratification), **19 November** (day 323 --early fall turnover).

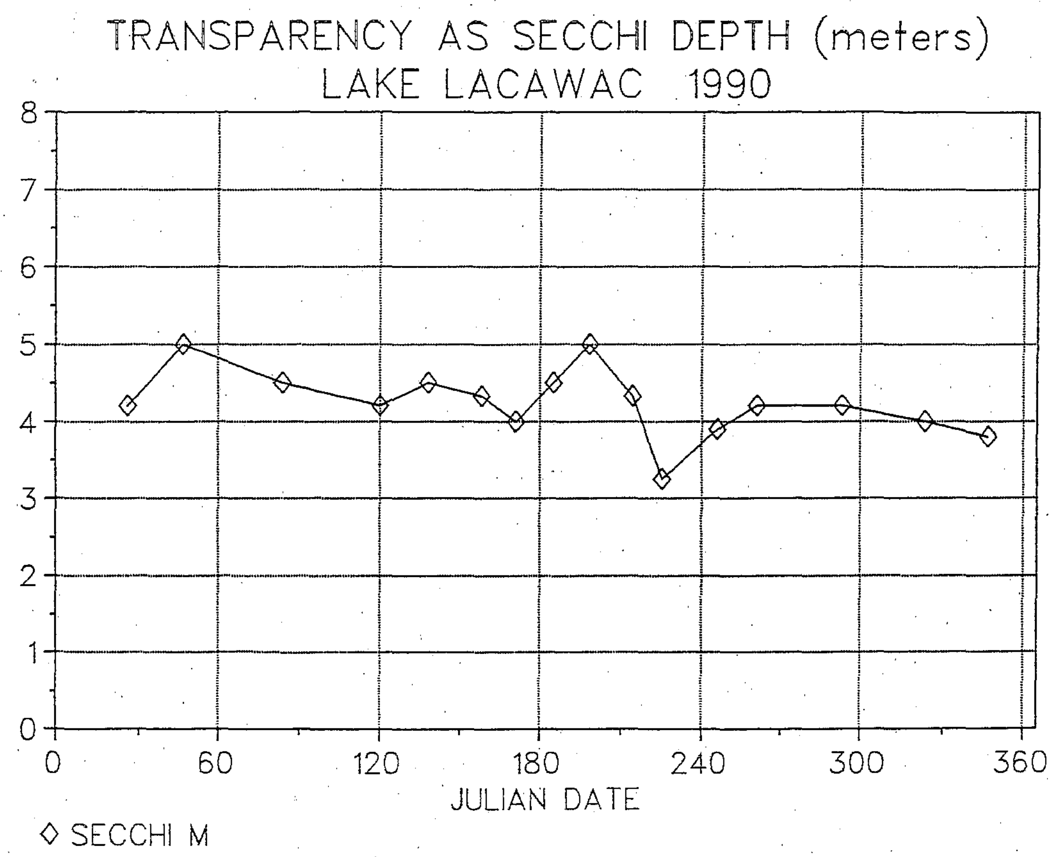


Figure 4. Transparency in Lake Lacawac, 1990.

Values plotted are the Secchi depths, in meters.

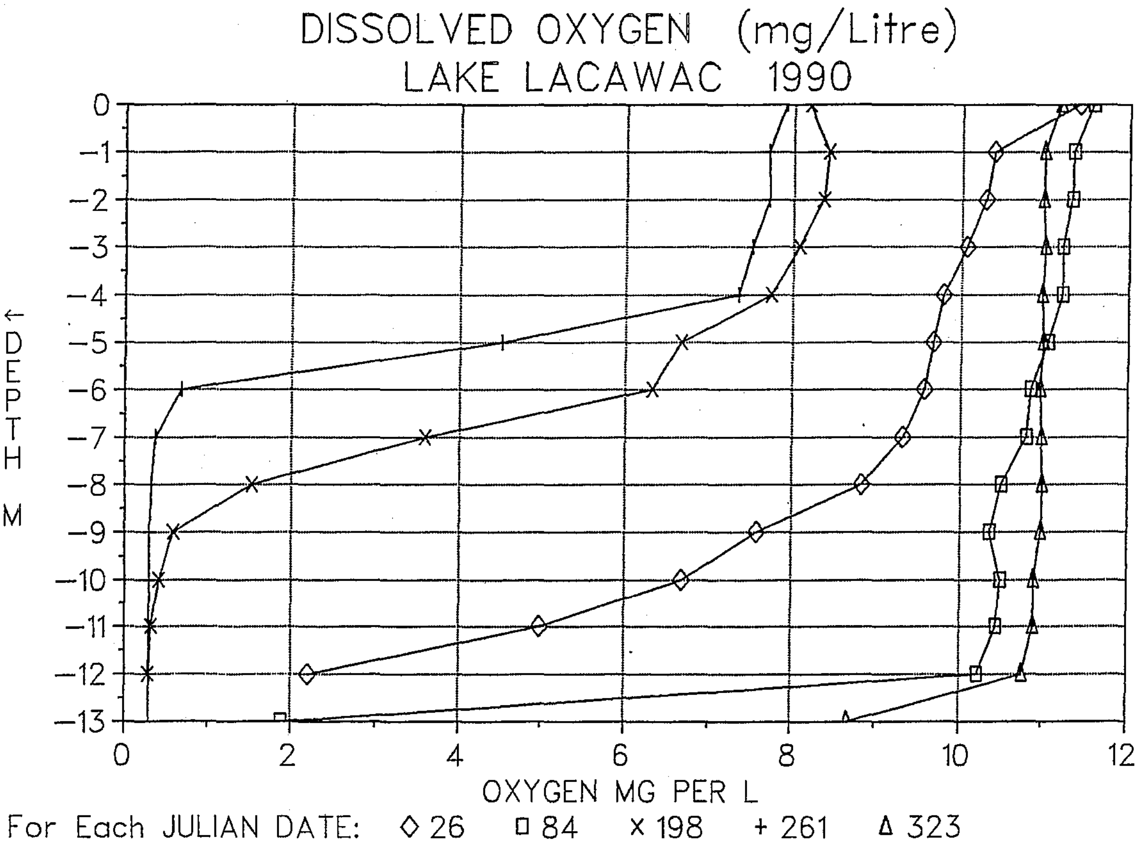


Figure 5. Dissolved oxygen in Lake Lacawac, 1990.

Values (mg oxygen per liter) are plotted for five dates: **26 January** (day 26 --winter ice cover), **25 March** (day 84 --spring turnover), **17 July** (day 198 --midsummer stratification), **14 September** (day 257 --late stratification), **19 November** (day 323 --early fall turnover). Values of <0.5 mg/L from the hypolimnion on days 198 and 261 represent anoxic conditions (oxygen = 0 mg/Liter).

also was anoxic. Oxygen content of the epilimnion in summer was maintained somewhat near atmospheric saturation. During fall turnover, anoxic water was mixed into the epilimnion, which was progressively recharged with oxygen. On day 323 (19 November), less than halfway through the turnover period, the oxygen content of about 11 mg/L was already ca. 100% of the saturation level for that temperature (5.2°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 liter (μeq./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, usually with gently mixing. Three variants of the method were employed:

Method 10. The basic procedure outlined above.
Method 11. As above, but a quality assurance protocol was followed, verifying electrode performance in distilled water and stability of calibration.
Method 12. As above, but 0.5 ml salt solution (Orion™ pHix™ solution) was added to increase ionic strength. Usually, this had little or no effect on the sample (pH change <0.1 unit).

Trends of pH are plotted for each layer in **Figure 6**. In the absence of intense biological activity, the pH of Lacawac would be about 6.0 with an alkalinity of about 30 μeq./L (**Figure 7**), judging from values in late spring and late autumn. These values portray a very softwater lake. The high pH value of almost 7.5 for the epilimnion on day 214 (2 August) is baffling. It preceded by 2 weeks a modest increase in epilimnial algal biomass. Although there is nothing in the datasheets to suggest an error, the point is suspicious.

Alkalinity increased within the hypolimnion during the summer, reaching 450 μeq./L at a depth of 11 m. The oscillation of hypolimnial values evident in **Figure 7** is an artifact of sampling inconsistently from 10 m or 11 m. As in 1989, this alkalinity was rapidly destroyed during fall turnover, as the reduced products of anaerobic metabolism (sulfide, reduced iron, ammonium) were oxidized. Alkalinity for the lake water as a whole reached a minimum of ca. 25 μeq./L before the lake froze over.

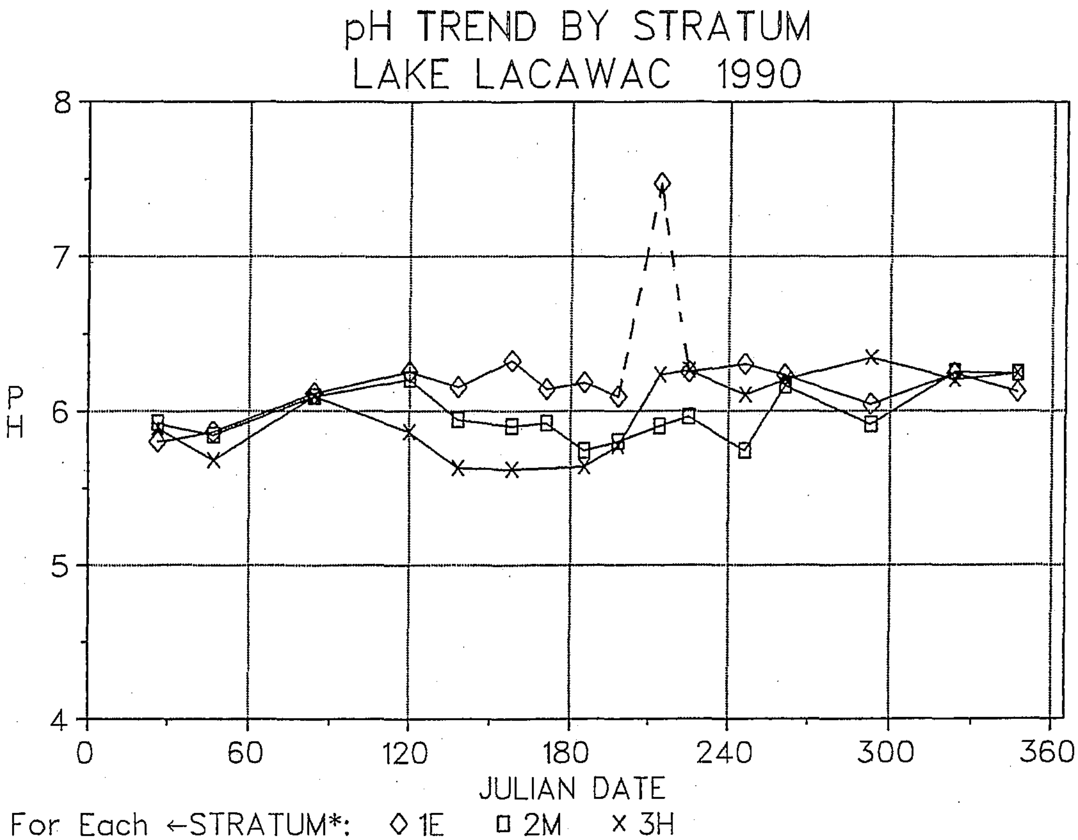


Figure 6. Trends of pH in Lake Lacawac, 1990.

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**.

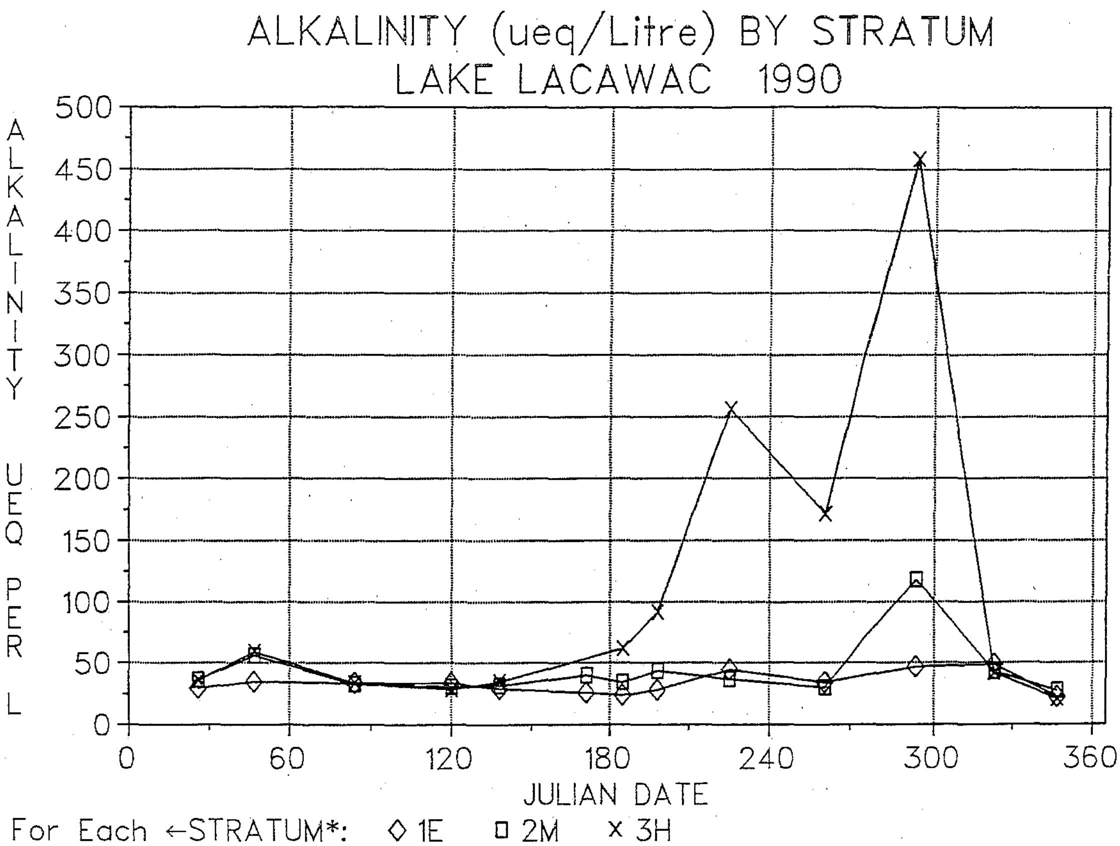


Figure 7. Trends of Alkalinity in Lake Lacawac, 1990.

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**.

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.

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 (0.5-1 L onto Gelman™ A/E filters) and frozen. Two extraction methods were used:

Method 11. Filters were ground in 90% basic acetone, then extracted overnight at 2-4°C, in darkness, in 12 ml of the solvent.
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.

In both methods the 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 both solvents, and that the extractions gave similar results. Two values are presented: Chlorophyll-a corrected for pheopigments (**CHLAC** in data tables and **Figure 8**) and Chlorophyll-a including pheopigments (**CHLASUM** in data tables).

In Lake Lacawac, hypolimnetic samples taken after anoxia is established (late July through October) are affected by an analytical interference, possibly a bacterial chlorophyll. Fluorescence increases upon acidification, leading to all chlorophyll being classed as pheopigment. This is an exaggeration, though microscopic examination verifies that algae are not present except as a few sinking cells during this period. There is a good deal of pigment in the hypolimnion at this time (see Data Tables), but we cannot distinguish between algal pheopigment and whatever the interfering pigment is.

Chlorophyll-a in Lacawac near-surface waters fluctuated around 3 ug/L, without a pronounced seasonality. Algal biomass tended to be higher in the spring and late fall, but did not exceed 5 ug/L, a level encountered occasionally during the summer. Values of 6 and 14 ug/L from the metalimnion in July represent a hold-over population of spring, cool-water algae (especially *Synura uvella*) that persisted in that low light environment.

CHEMISTRY INCLUDING TOTAL PHOSPHORUS

Table L.A.1 (Appendix I) lists data on 13 chemical parameters not routinely included in the lake sampling. These include major cations (Ca,Mg,K,Na), anions (SO4--Cl not yet available), dissolved inorganic carbon (DIC), methane (CH4), sulfide (S2-), and conductivity, as well as total dissolved iron and phosphorus (tdFe, tdP), and total iron and phosphorus (tFe, tP).

These data were obtained by Dr. Jonathan Cole and Dr. Nina Caraco of the Institute of Ecosystem Studies, New York Botanical Garden, during the summer stratification period of 1989. The analyses are part of a broader geochemical study of North American lakes that is not yet completed. The data are included here to provide a better chemical characteriza-

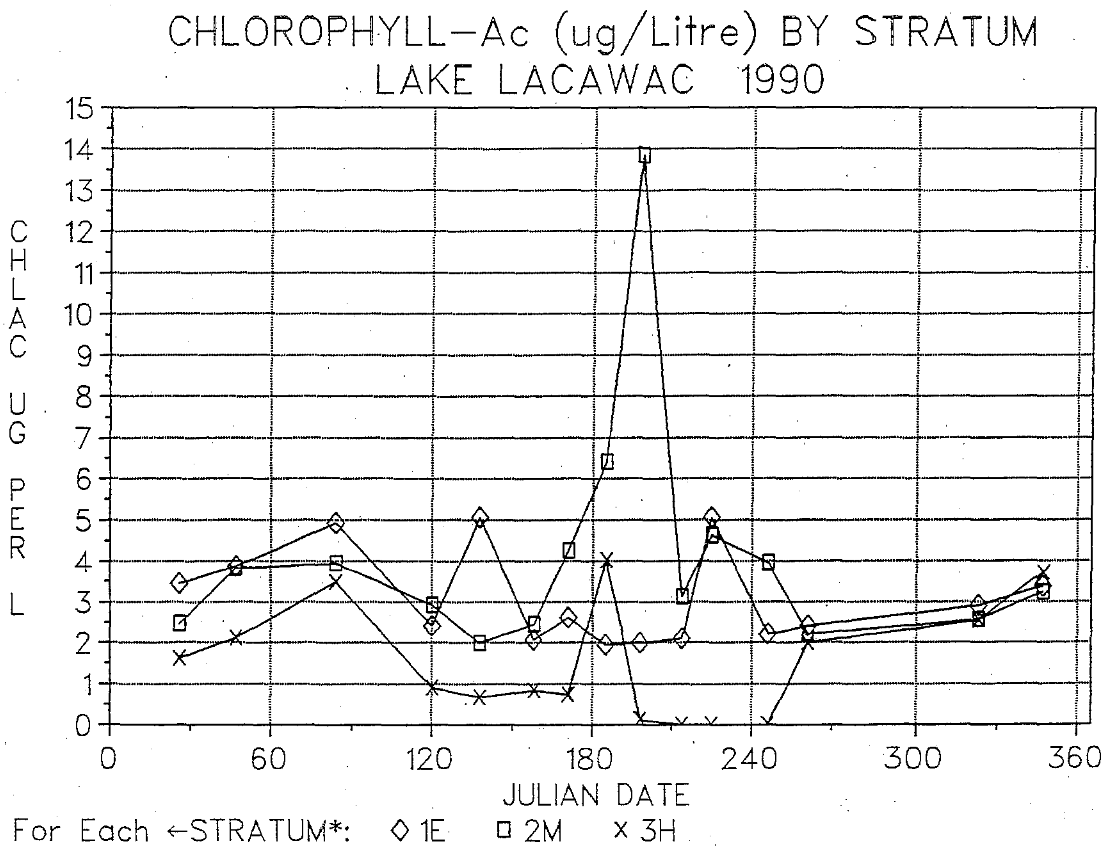


Figure 8. Trends of Chlorophyll-a in Lake Lacawac, 1990.

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.

tion of Lake Lacawac. These data should not be cited or used for critical comparisons without first consulting Jon Cole or Nina Caraco.

In addition to the total phosphorus values listed in **Table L.A.1**, total phosphorus was determined in aliquots of the regular samples from 25 March 1990 (during spring turnover) and 13 August (during summer stratification). Unfiltered samples were stored frozen, then thawed and analyzed for molybdate reactive phosphorus following acid persulfate digestion **(Table 1)**.

Table 1. TOTAL PHOSPHORUS IN LAKE LACAWAC, 1990

		Day 84 (3/25/90)		Day 225 (8/13/90)	
		Depth (m)	tP (uM)	Depth (m)	tP (uM)
EPI a		2	0.37	2	0.41
EPI b			0.35		0.37
	average		0.36		0.39
META		5	0.35	6	0.34
HYPO		9	0.40	11	3.15

These phosphorus values are consistent with Lake Lacawac's mesotrophic character. The buildup of phosphorus in the hypolimnion during summer reflects phosphate released during decomposition of settling detritus plus phosphate released chemically from the sediment under anerobic conditions.

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 liter) over the entire 13-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 μm, for macrozooplankton; and a 15-cm diameter Wisconsin-style net with a 48-μm mesh for microzooplankton. These were mounted side-by-side in "bongo" configuration. Microzooplankton includes mainly rotifers, but small copepods also were counted from these samples. Collections were duplicated from each depth. 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 9-32)**. **Table 2** lists the zooplankton identified to date. Several points can be highlighted:

(1) The cladoceran *Holopedium gibberum* was apparently the dominant grazer during summer (0.5-2.5/L), but its abundance was lower than in 1989 (4-12/L). Apparently the epilimnetic *Holopedium* patches that make up a large portion of the population were smaller in 1990, and not encountered in sampling at the main station. *Daphnia* spp., the dominant macrozooplankter from fall through late spring (up to 10/L), were reduced to low levels during late summer (1-2/L). The calanoid copepod *Diaptomus minutus* was relatively common throughout the year (5-20 adults/L), but, like *Daphnia* spp., the population of adults was greater during fall, winter, and spring.

(2) The various rotifers displayed pronounced seasonalities, which differed among species. There were also pronounced differences in distribution among the three layers. Densities varied within the range 150-600/L , which implies densities of twice this in the upper water layers during summer. A pronounced, temporary "crash" of rotifers during July involved several types, though in particular *Polyarthra*. A similar fluctuation took place in 1989. These might be related to changes in food or predators, but there is no immediate explanation in other data we collected.

(3) In general hard-bodied rotifers (e.g. *Keratella*, *Kellicottia*), those with swift escape reactions (e.g. *Polyarthra*), or those forming large colonies (e.g. *Conochilus*) were most common during the summer, perhaps implying heavy predation pressure. Seasonal patterns of rotifer distribution sometimes were similar in 1989 and 1990--e.g. sharp early summer peak and decline of *Polyarthra* and the midsummer peak of *Conochilus*; but it is evident that rotifer populations can show inconsistent patterns. For instance, *Keratella cochlearis* was a dominant species of fall 1989 and winter 1990 (100-200/L), but the population did not reappear in fall of 1990.

(4) Several potential predatory zooplankton were moderately abundant in summer: the large dipteran *Chaoborus* (ca. 0.25/L) and the cyclopoid copepod *Mesocyclops edax* (ca. 0.5 adults/L). In winter and spring *Cyclops scutifer* was common (up to 5 adults/L in spring), with the population showing an annual pattern of reproduction (late spring), diapause (summer and early autumn), and then emergence and growth of copepodids (late fall and winter).

(5) The winter zooplankton community was not strongly impoverished in species or numbers. Macrozooplankton were numerically abundant, though three common summer representatives (*Mesocyclops edax*, *Holopedium gibberum*, and *Chaoborus* spp.) were at low density or absent from the water column. *Daphnia* spp. (5-10/L), *Diaptomus minutus* (ca. 10 adults/L), and copepodids of *Cyclops scutifer* (ca. 10/L) were the important macrozooplankton. *Keratella cochlearis* (up to 100/L) and *Gastropus* spp. (ca. 30/L) were the dominant rotifers.

Table 2. Zooplankton species recorded from open-water samples in Lake Lacawac, 1988-1990. Seasons of especially high or low abundance are indicated.

	Taxon	Seasonal Abundance in 1990 High	Low
Diptera			
**	*Chaoborus* spp.		[W]
	C. flavicans		
	C. punctipennis		
Cyclopoid Copepoda			
**	*Cyclops scutifer*	Sp	[Su]
	Eucyclops agilis (rare)		
*	*Mesocyclops edax*	Su	[W,Sp]
	Tropocyclops prasinus		
Calanoid Copepoda			
**	*Diaptomus minutus*	late F,W,Sp	
Cladocera			
	Bosmina longirostris		
	Chydorus spp.		
**	*Daphnia* spp.	F,W,Sp	[Su]
	D. catawba		
	Diaphanosoma spp.		
**	*Holopedium gibberum*	Su,F	[W]
	Leptodora kindtii	Su	
Rotifera			
*	*Ascomorpha* spp.	Sp,Su	[W]
*	*A. ovalis*		
*	*Asplanchna* spp.		
*	*Collotheca* spp.	early Su	[W,Sp]
	C. mutabilis		
**	*Conochilus* spp.	Su	[W]
**	*Gastropus* spp.	Sp	[Su]
	G. hyptopus (?)		
	G. stylifer		

continued next page

Table 2. Zooplankton in Lake Lacawac, 1990 (continued)

	Taxon	Seasonal Abundance in 1990 High	Low
	Kellicottia spp.		
*	*K. bostoniensis*	late Su	[W,Sp]
**	*K. longispina*	Sp	[F,W]
	Keratella spp.		
**	*K. cochlearis*	W,Sp	[late Su,F]
*	*K. crassa*	Su	[W,Sp]
*	*K. gracilenta*		
*	*K. hiemalis*	Sp	[Su,F,W]
	K. serrulata f. *curvicornis*		
*	*K. taurocephala*	late Su	[W,Sp]
	Lecane spp.		
	L. flexilis		
	L. signifera		
	L. tenuiseta		
	Lepadella sp.		
*	*Monommata* spp.		
*	*Monostyla* spp.	Sp	
	M. closterocerca		
	M. copeis		
	M. lunaris		
	Notholca spp.		
	N. squamula		
*	*Ploesoma* spp.	Su	[F,W]
	P. truncatum		
	Polyarthra spp.		
**	*Polyarthra* ("large")	Su,F	[W]
**	*Polyarthra* ("small")	Su,F	[W,Sp]
*	*Synchaeta* spp.		
*	*Trichocerca* spp.	Su	[F,W,Sp]
	Trichocerca ("small")		
*	*T. cylindrica*		
*	*T. multicrinus*		
	T. porcellus		
*	*T. rousseleti*		
*	*T. similis*		

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

FISH

The fish survey of 16-17 July 1990 was undertaken to provide a comparative idea of the species and their abundances in Lake Lacawac and the other core lakes. This survey was designed and carried out by Kenneth Ersbak and Aquatic Resource Consulting (Saylorsburg, PA). Data summarized in **Table 3a** and listed in detail in **Appendix II** are taken from their final report (25 September 1990: "Fishery Survey of the Three 'Core' Lakes of the Pocono Comparative Lakes Program"). The sampling strategy was to set gill and trap nets at several sites around the lake, with equal day and night sampling. Details of the nets are available in the original report. The net census was supplemented with a hook-and-line survey at the same time. Several people spent a total of 64 hours using various types of bait, and released the fish after weighing them. These data are summarized in **Table 3b**.

Net surveys in general are difficult to relate to absolute population sizes, and are known to preferentially collect some species. Judging from the fish caught, the lake contains a balanced assemblage of warm-water species. Centrarchids dominate, including sunfish (bluegill and pumpkinseeds) and bass. Yellow perch and chain pickerel are additional relatively abundant predators. Golden shiners are present but not particularly abundant; this population is probably controlled by the abundant predatory fish. The hook-and-line census produced a very different relative abundance of bluegill and pumpkinseed sunfish, illustrating the sensitivity of fish surveys to the collection method employed.

Table 3a. SUMMARY OF FISH NETTED IN LAKE LACAWAC (24.3 kg total)[1]

FISH SPECIES	NUMBER	LENGTH (mm)		MASS (g)		% of TOTAL MASS
		Mean	STD	Mean	STD	
Pumpkinseed	36	200	29	165	56	24
Smallmouth bass	21	250	82	261	169	22
Yellow perch	16	302	26	316	67	21
Bluegill	15	179	45	130	77	8
Chain pickerel	8	430	22	395	80	13
Largemouth bass	6	219	86	204	163	5
Golden shiner	6	131	14	22	8	1
Rock bass	3	194	41	167	12	2
Brown bullhead	2	297	90	463	375	4

[1] Total Effort: 12 12-hr gill nets and 4 12-hr trap nets.
Masses are fresh weight in grams.

Table 3b. SUMMARY OF FISH HOOKED IN LAKE LACAWAC (31.4 kg total)[1]

FISH SPECIES	NUMBER	LENGTH (mm)		MASS (g)		% of TOTAL MASS
		Mean	STD	Mean	STD	
Bluegill	41	182	26	215	81	28
Smallmouth bass	29	233	44	257	122	24
Largemouth bass	9	308	72	726	227	21
Yellow perch	9	271	34	384	148	11
Pumpkinseed	6	176	10	221	43	4
Chain pickerel	6	379	35	443	196	8
Rock bass	3	213	15	372	119	4

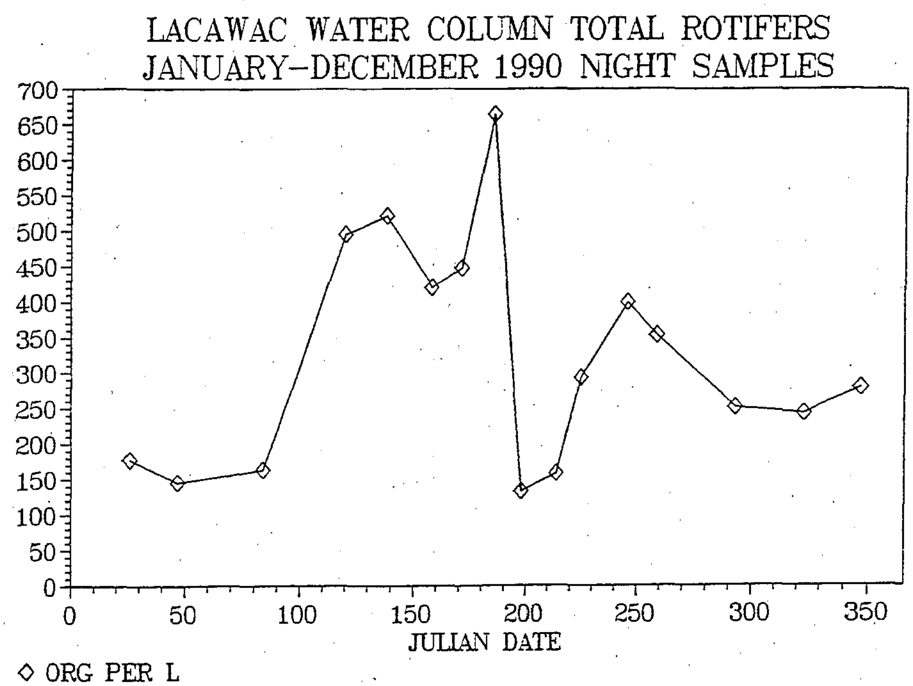
[1] Total Effort: Approximately 2.66 "hook-and-line days", where a "hook-and-line day" represents one hook and line employed 24 hours.
Masses are fresh weight in grams.

ZOOPLANKTON GRAPHS

The following graphs present water-column mean nighttime concentrations of the common zooplankton at the main sampling station. Each data point is 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 is in the deepest part of the lake. Two replicate samples were taken in quick succession.

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

For a few zooplankton species, the taxonomic resolution has been increased part way through the year. This will be evident from the plotted data (see Figures 10,12,13,14,22).



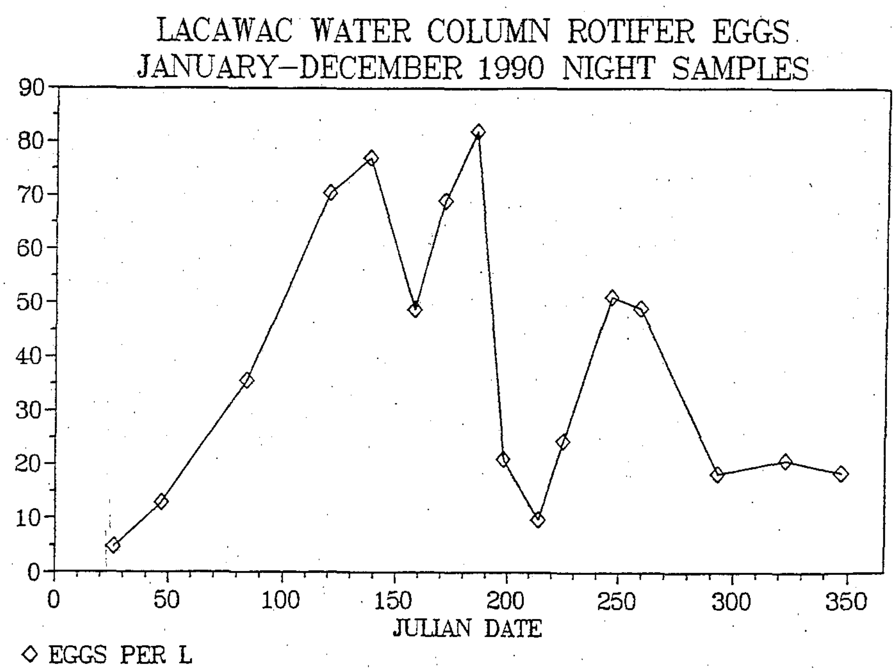
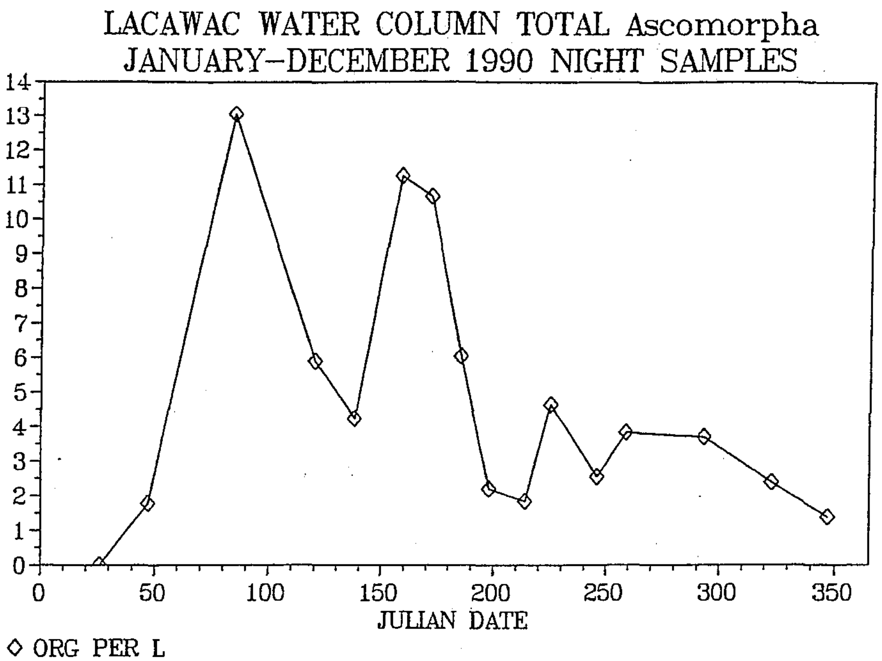


Figure 9. Rotifers in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals per liter. **(Bottom)** Rotifer eggs per liter.



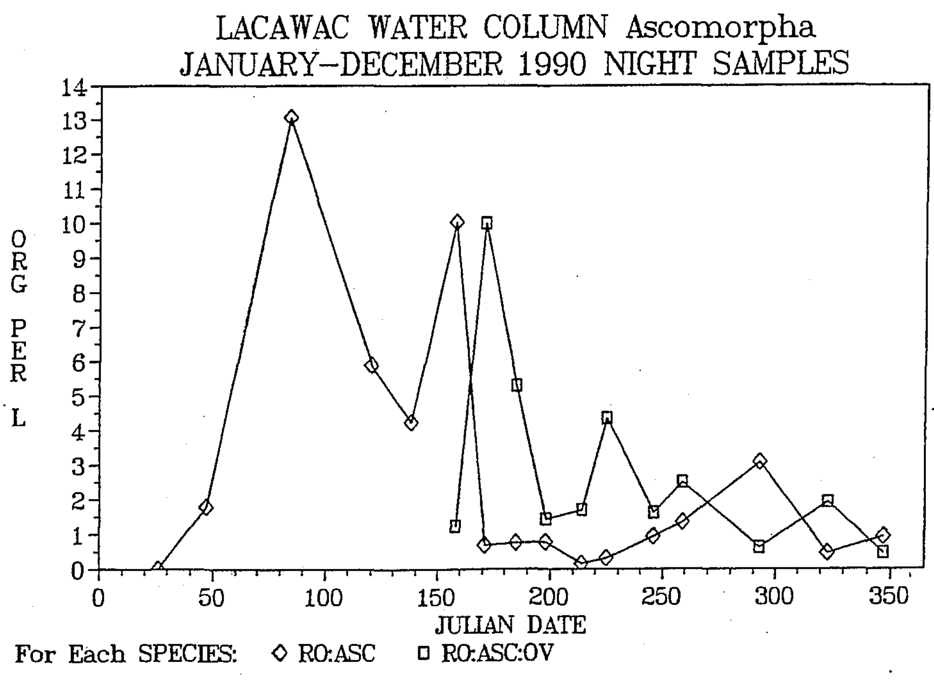


Figure 10. The rotifer *Ascomorpha* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per liter. **(Bottom)** *Ascomorpha* by species: **ASC** undifferentiated species, **OV** *A. ovalis* after day 150 only.

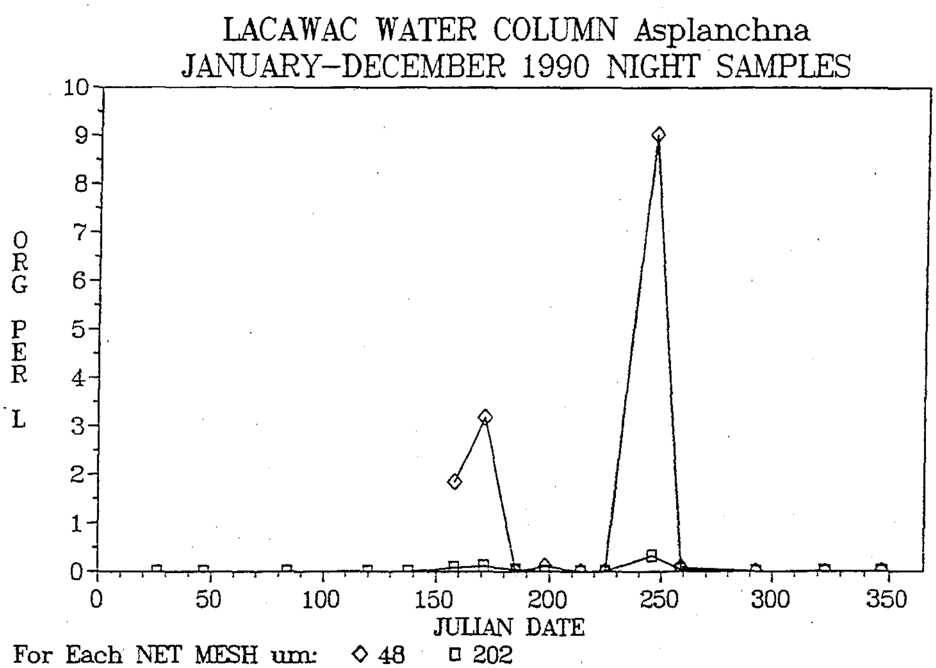
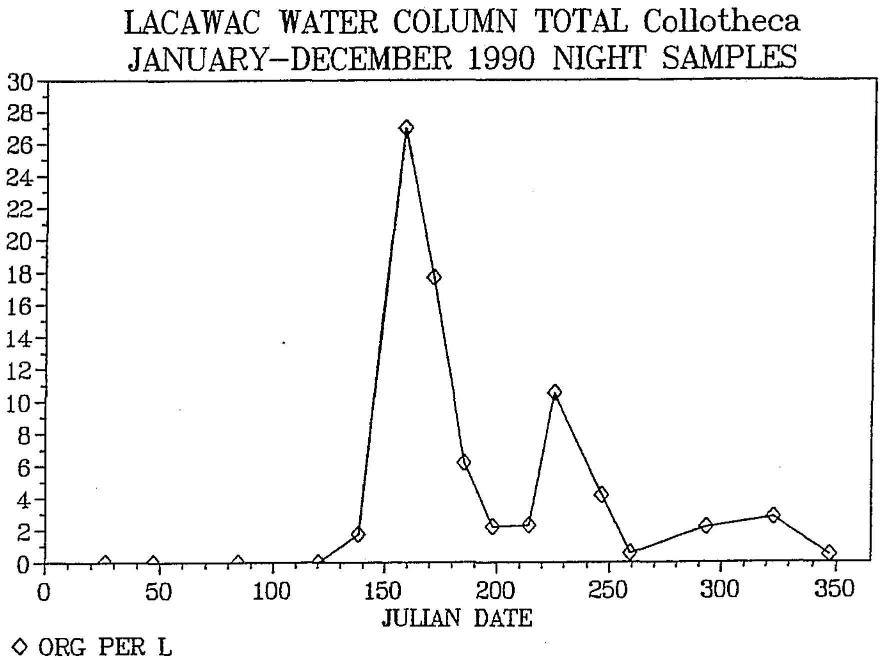


Figure 11. The rotifer *Asplanchna* in Lake Lacawac, 1990.

Nighttime net collections from three depths have been combined to give a water column mean. In June we started counting *Asplanchna* in the 48μm samples, since it was evidently being severely undercollected by the 202μm net.



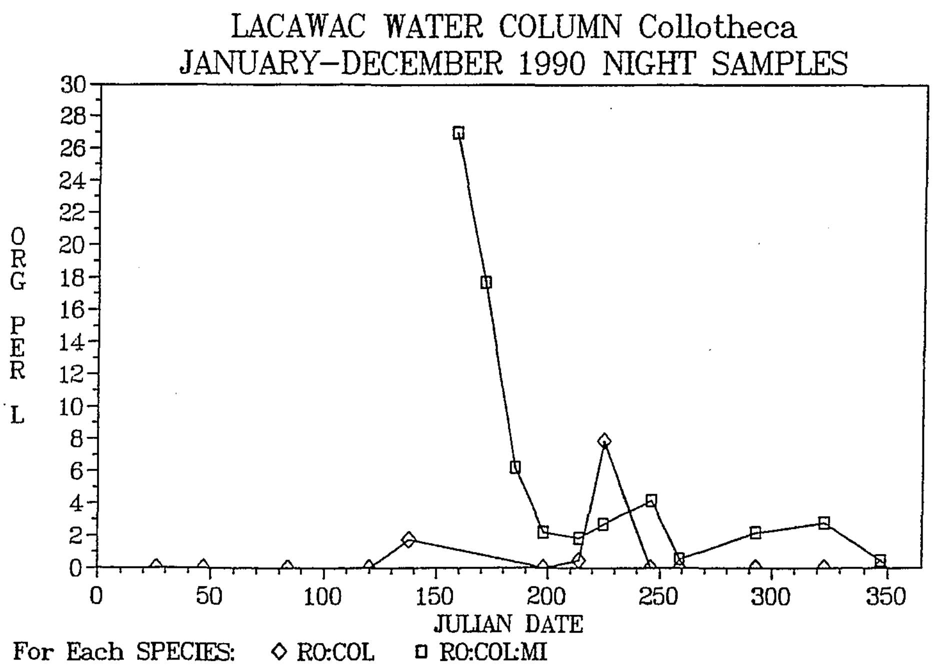
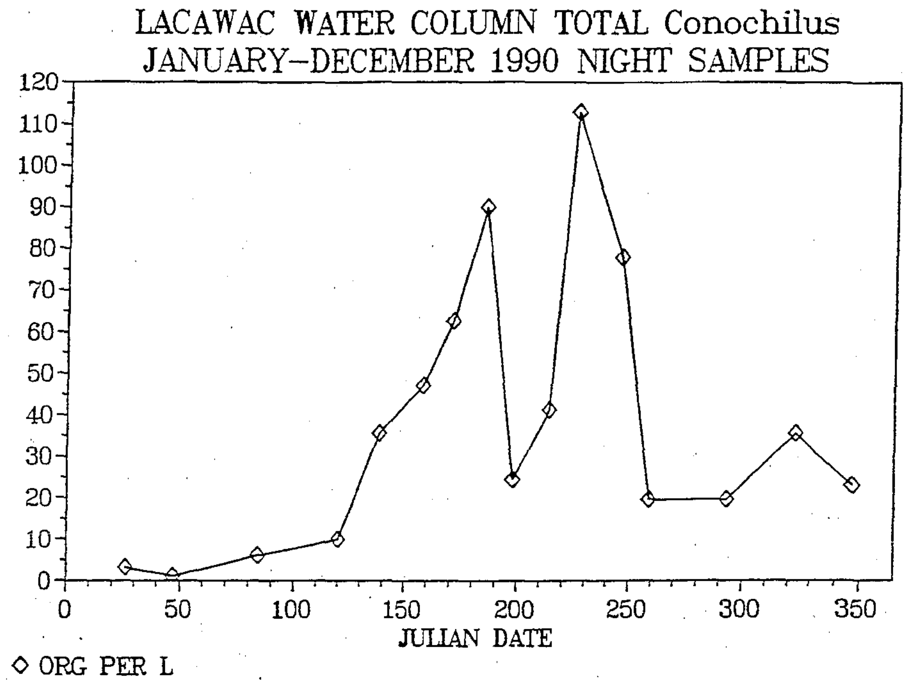


Figure 12. The rotifer *Collotheca* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per liter. **(Bottom)** *Collotheca* by species: **COL** undifferentiated species, **MI** (=MU) *C. mutabilis* after day 150 only.



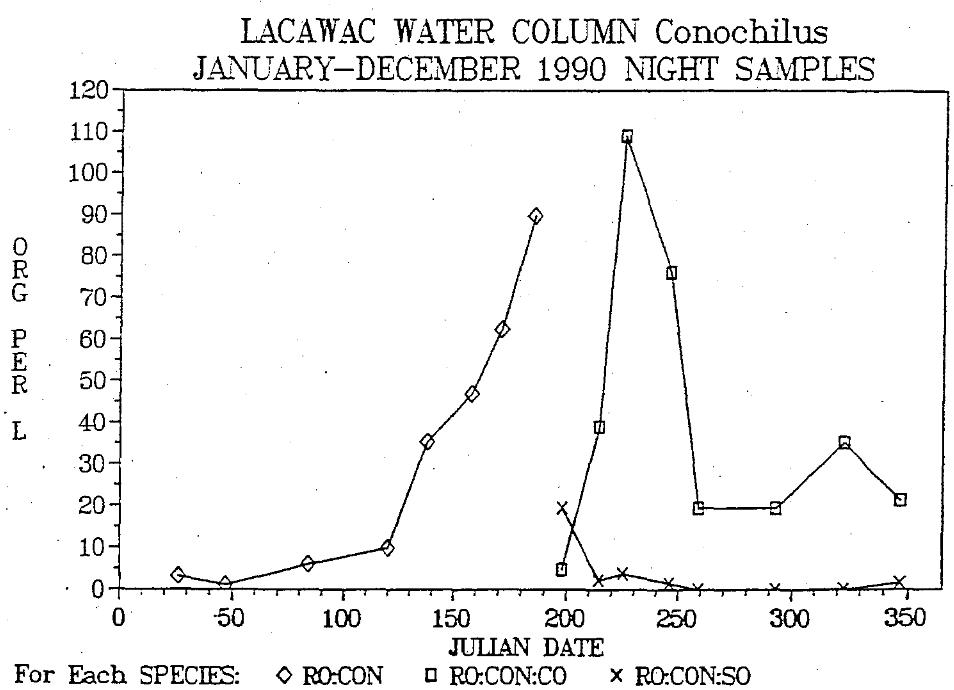
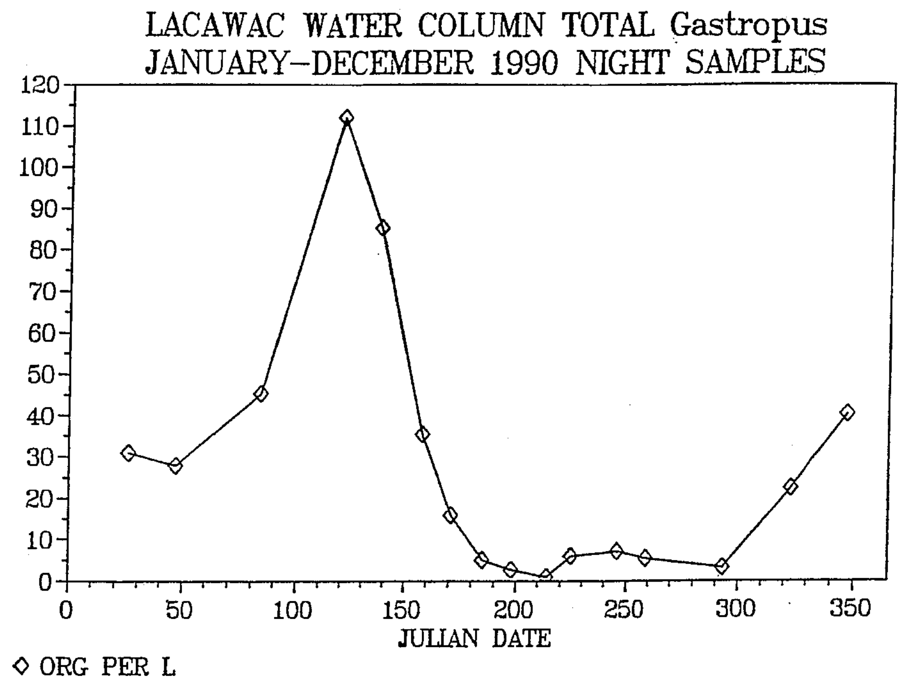


Figure 13. The rotifer *Conochilus* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. (Top) Total individuals of all species per liter. **(Bottom)** *Conochilus* by species: **CON** undifferentiated species (before day 190), **CO** colonial spp., **SO** solitary spp.



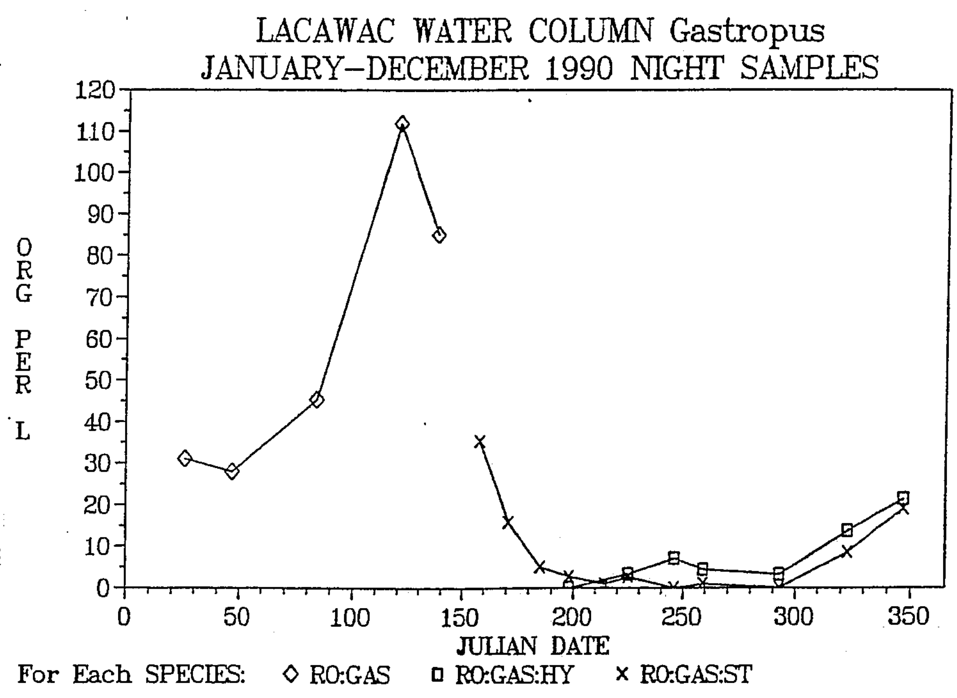
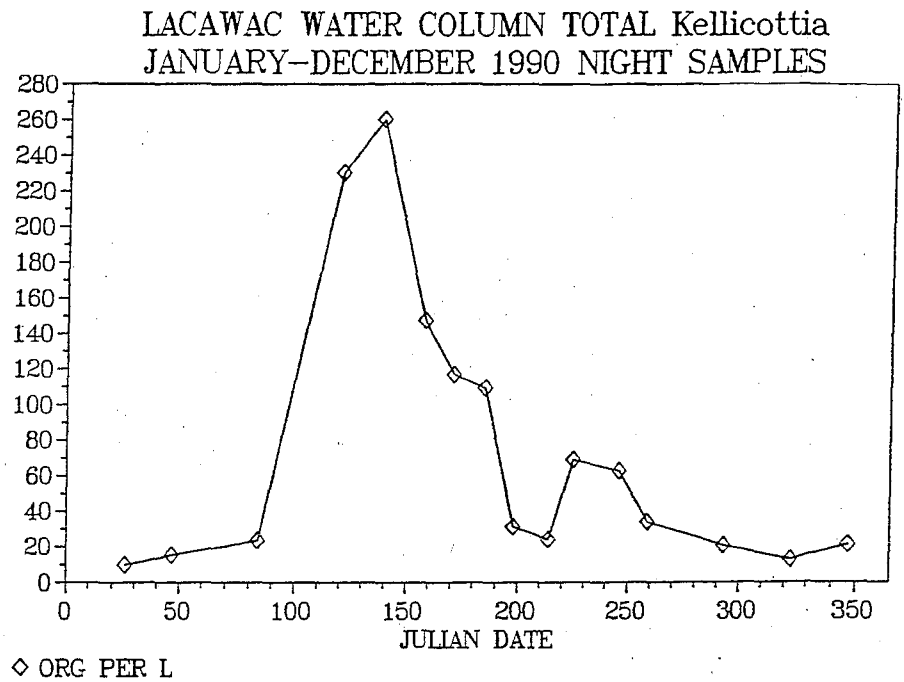


Figure 14. The rotifer *Gastropus* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals of all species per liter. **(Bottom)** *Gastropus* by species: **GAS** undifferentiated species (before day 150), **HY** *G. hyptopus*, **ST** *G. stylifer* after day 150 only.



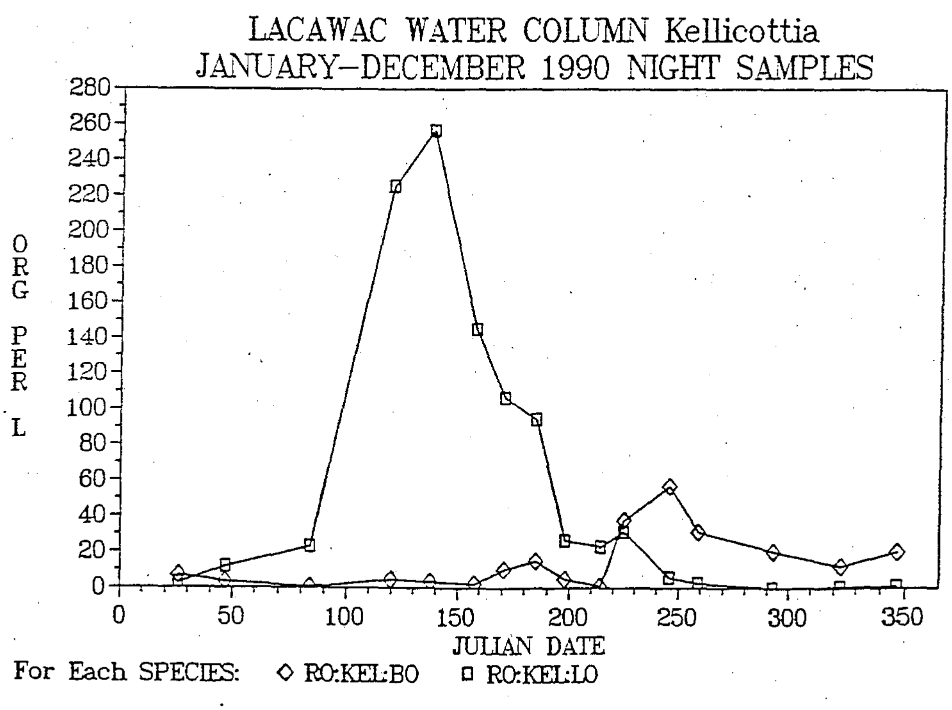
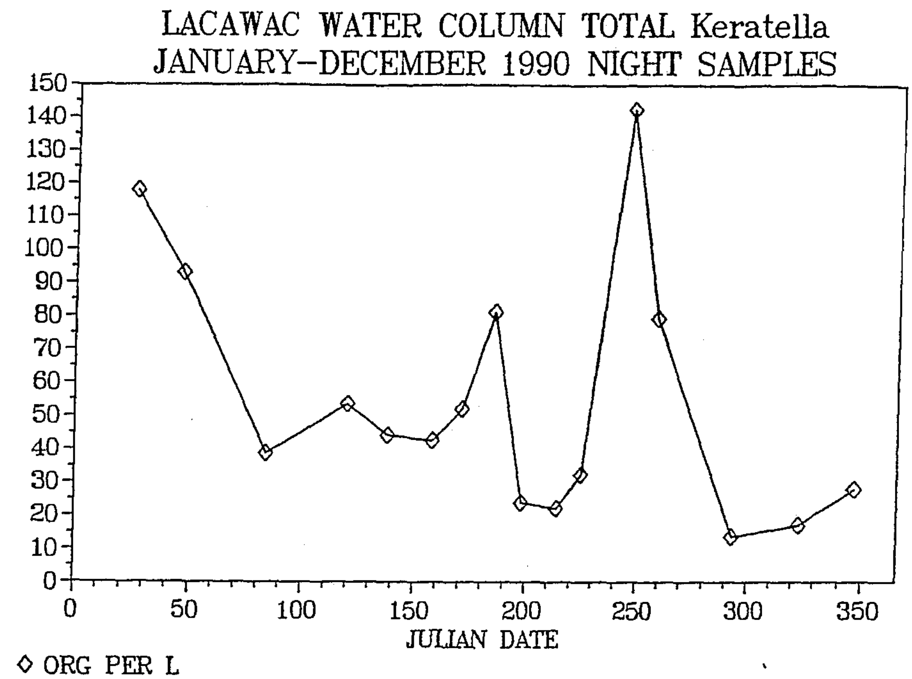


Figure 15. The rotifer *Kellicottia* in Lake Lacawac, 1990.

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



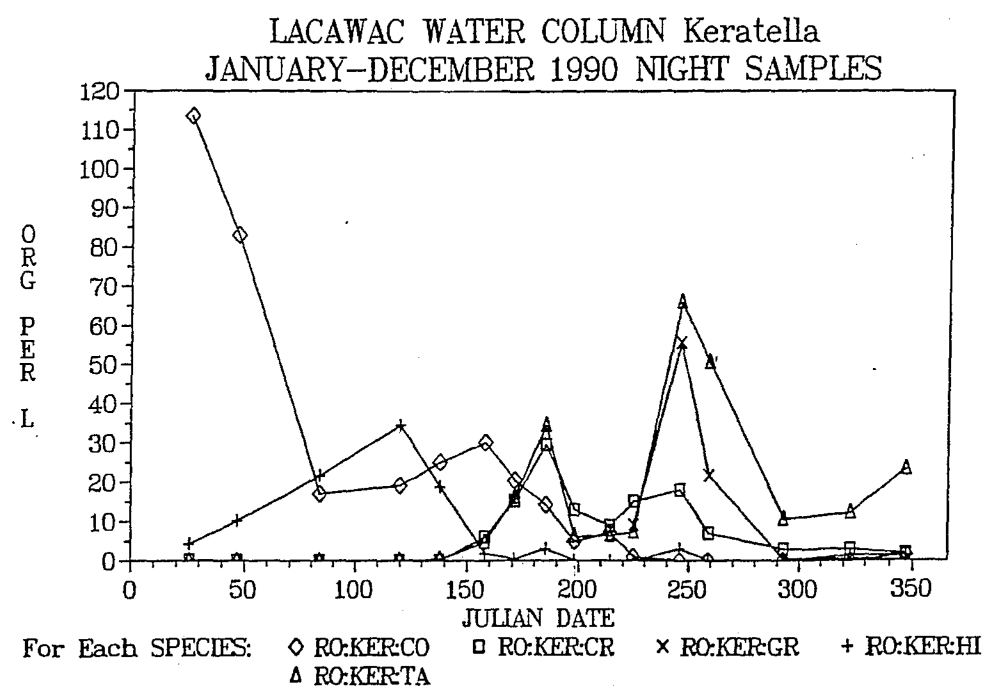


Figure 16. The rotifer *Keratella* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals per liter. **(Bottom)** *Keratella* by species: **CO** *K. cochlearis*, **CR** *K. crassa*, **HE** *K. hiemalis*, **TA** *K. taurocephala*, and **GR** *K. gracilenta* (which was only differentiated from *K. cochlearis* or other species after day 220).

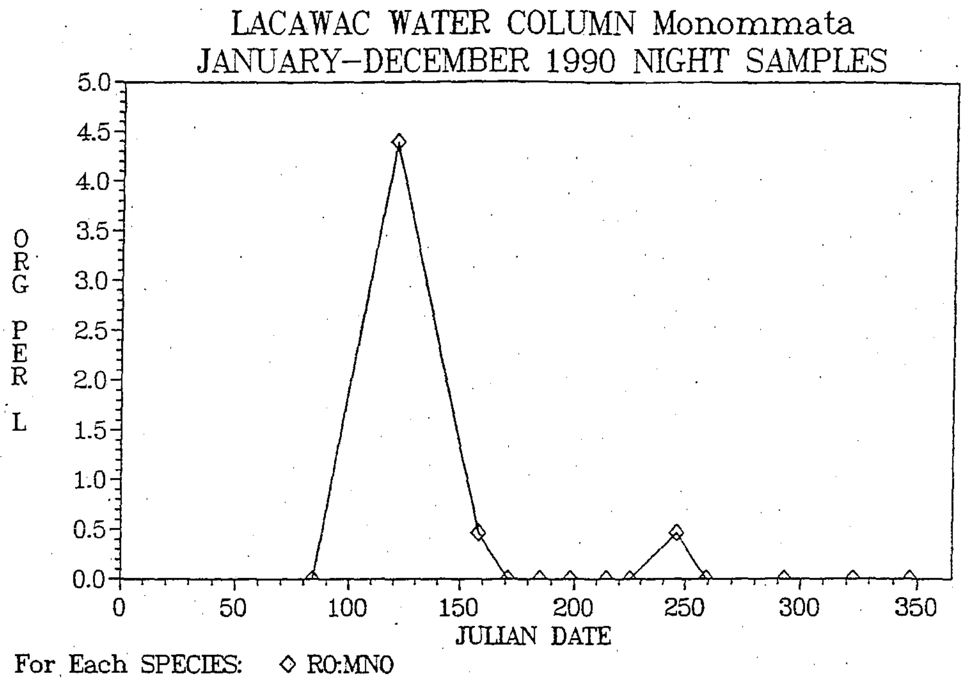


Figure 17. The rotifer *Monommata* in Lake Lacawac, 1990.

Nighttime net collections (48µm) from three depths have been combined to give a water column mean.

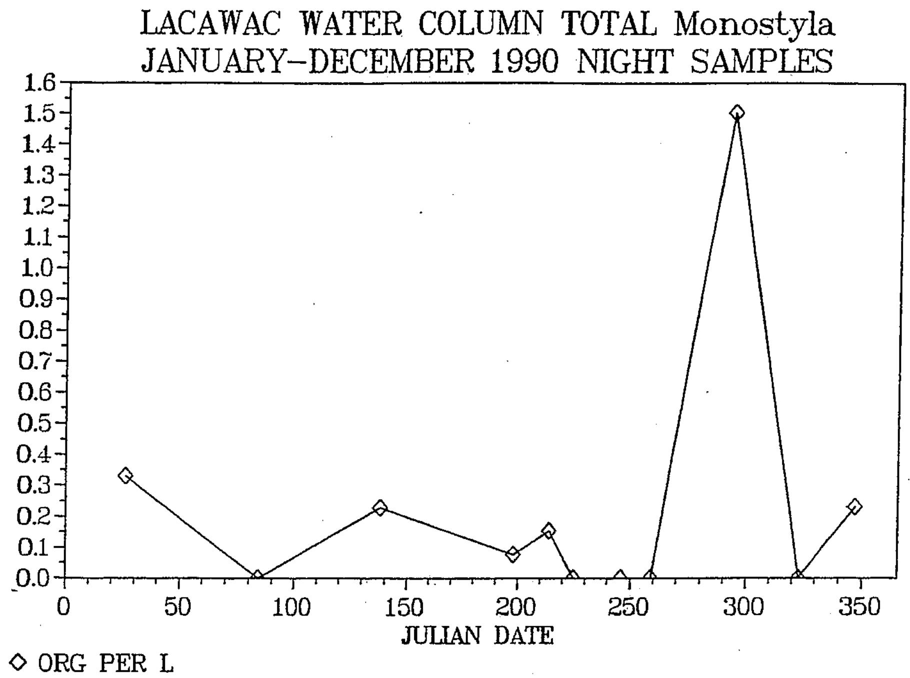


Figure 18. The rotifer *Monostyla* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean.

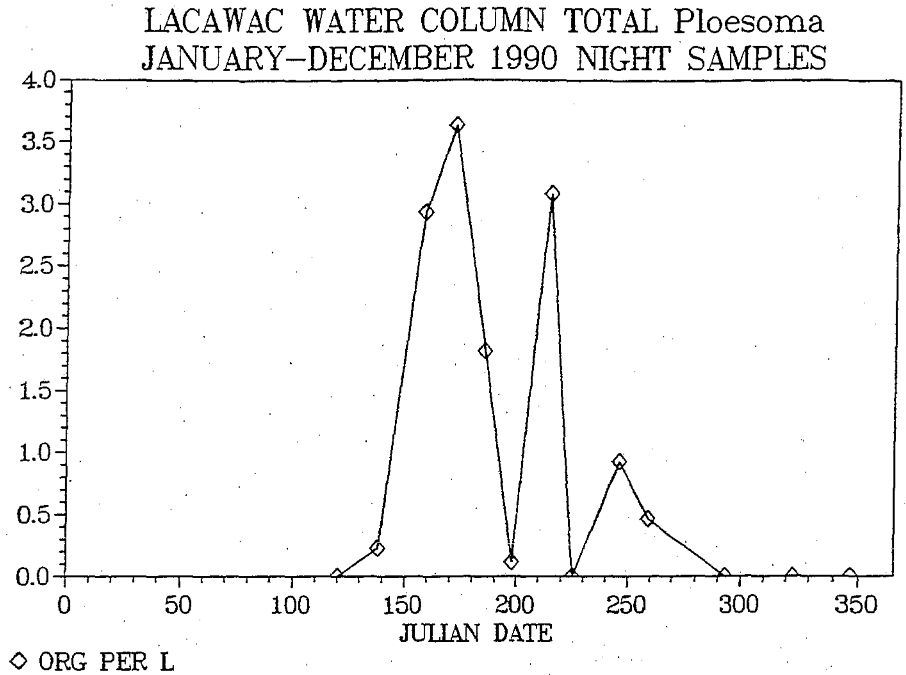
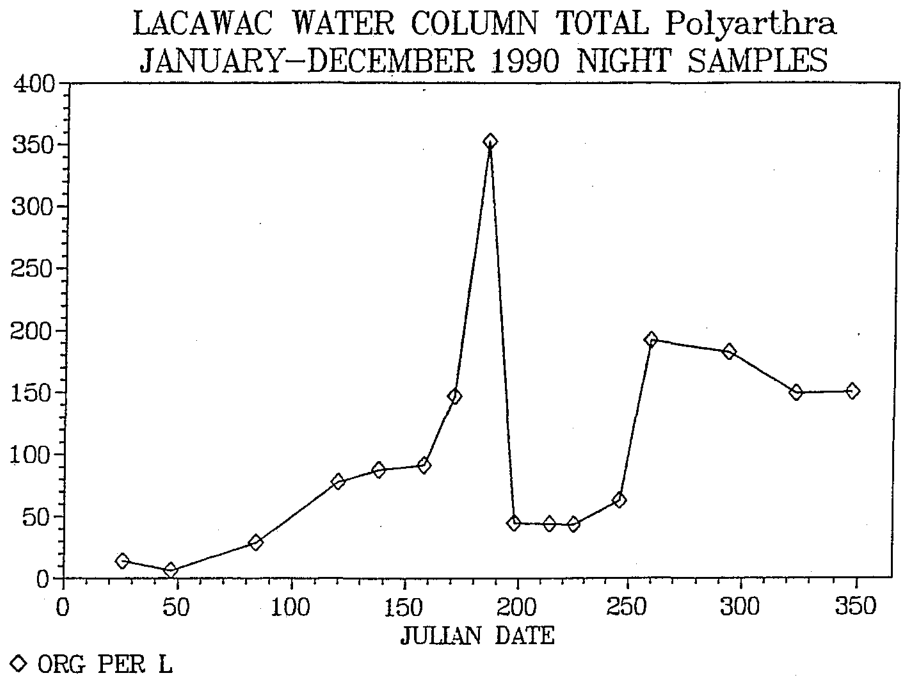


Figure 19. The rotifer *Ploesoma* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean.



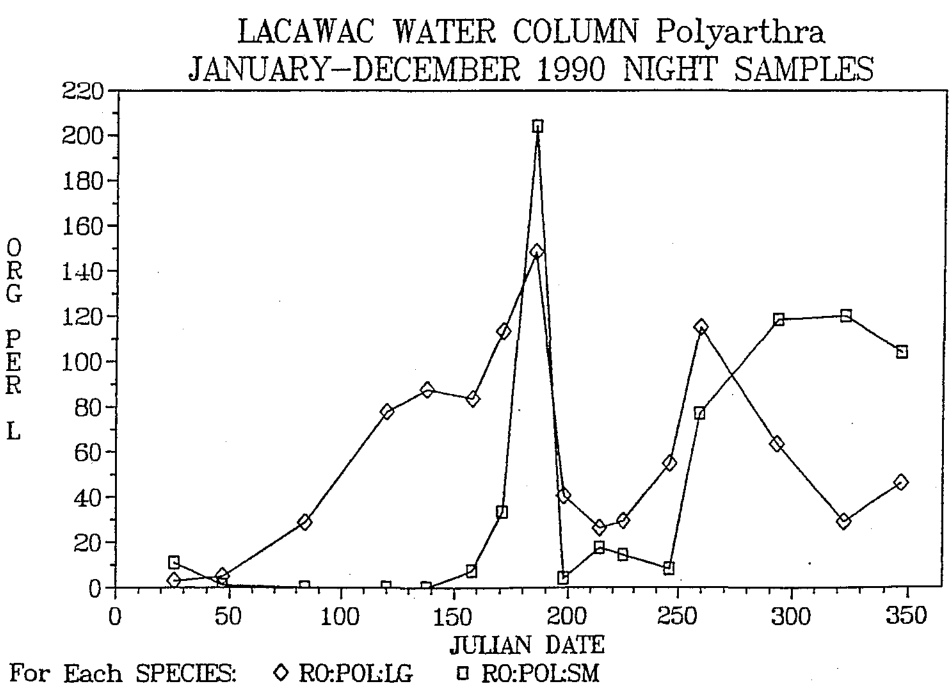


Figure 20. The rotifer *Polyarthra* in Lake Lacawac, 1990.

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

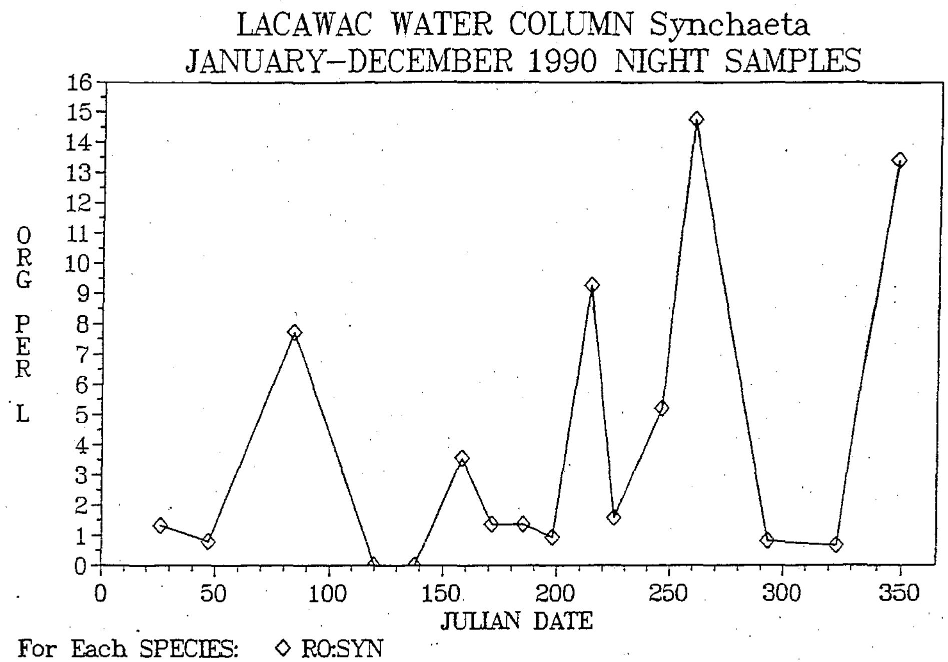
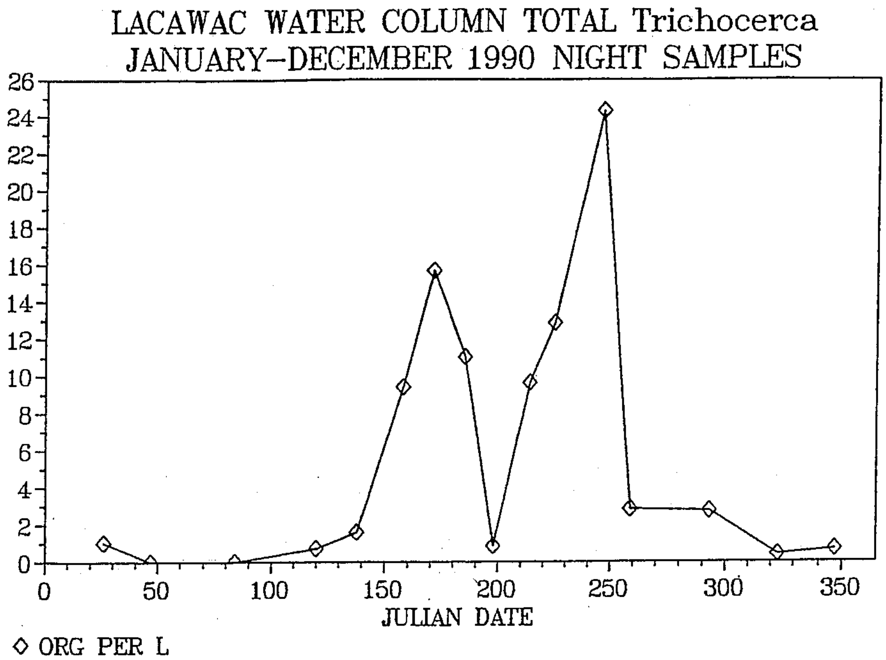


Figure 21. The rotifer *Synchaeta* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean.



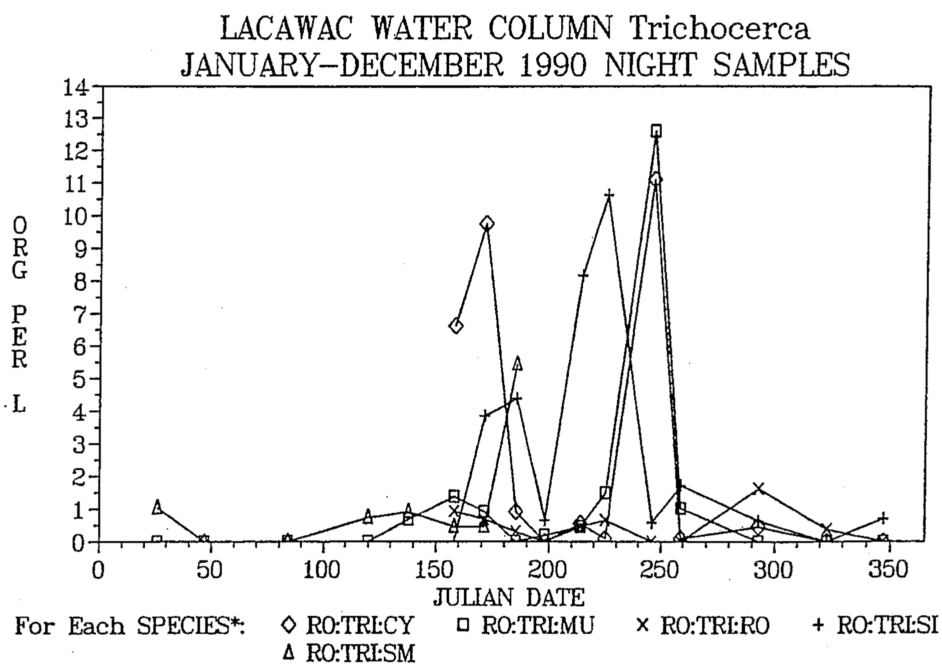


Figure 22. The rotifer *Trichocerca* in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. **(Top)** Total individuals per liter. **(Bottom)** *Trichocerca* by species: **CY** *T. cylindrica*, **MU** *T. multicrinus*, **RO** *T. rousseleti*, **SI** *T. similis*, and **SM** small spp. Note that the differentiation of these species changed during the year.

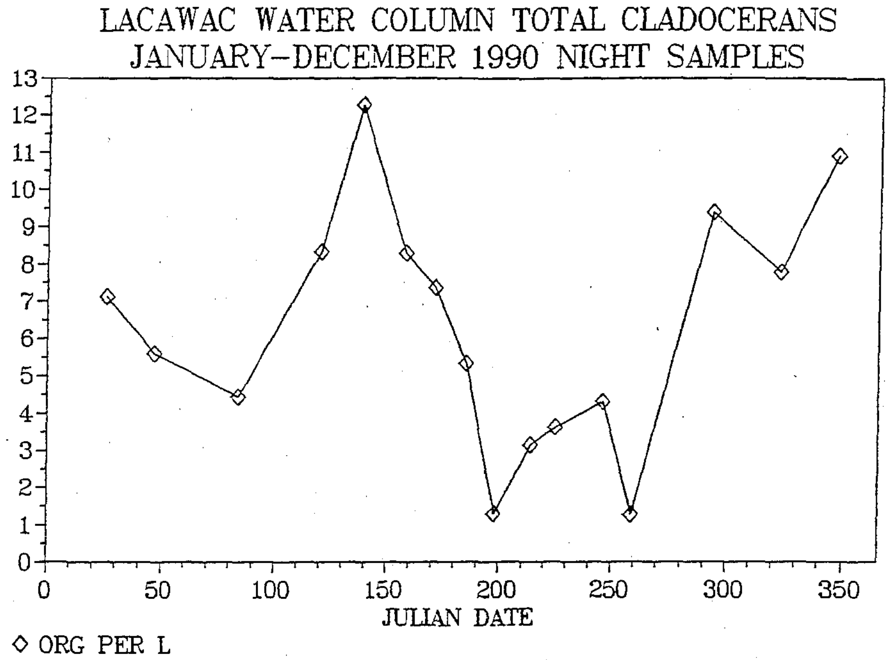
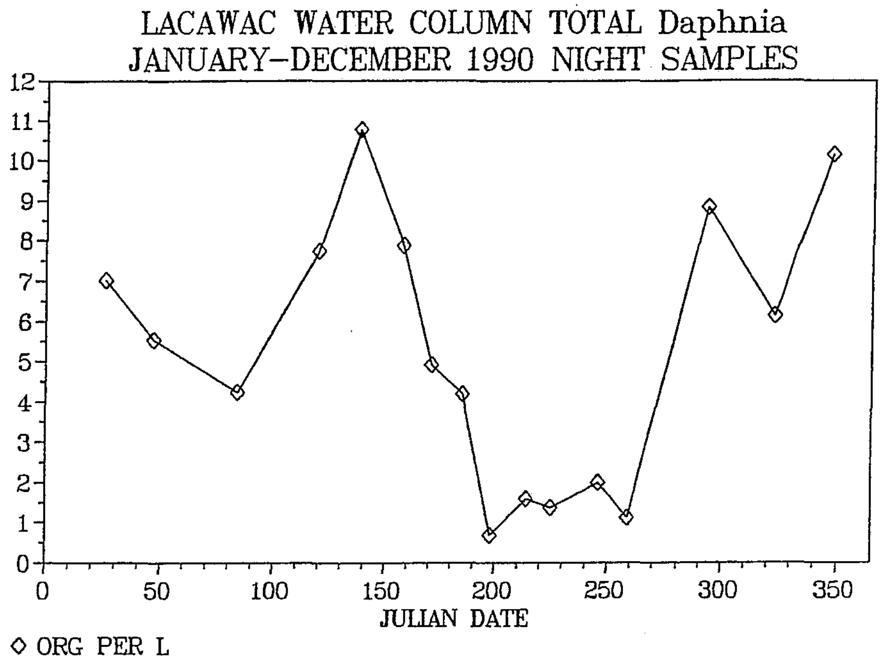


Figure 23. Cladocera in Lake Lacawac, 1990.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean.



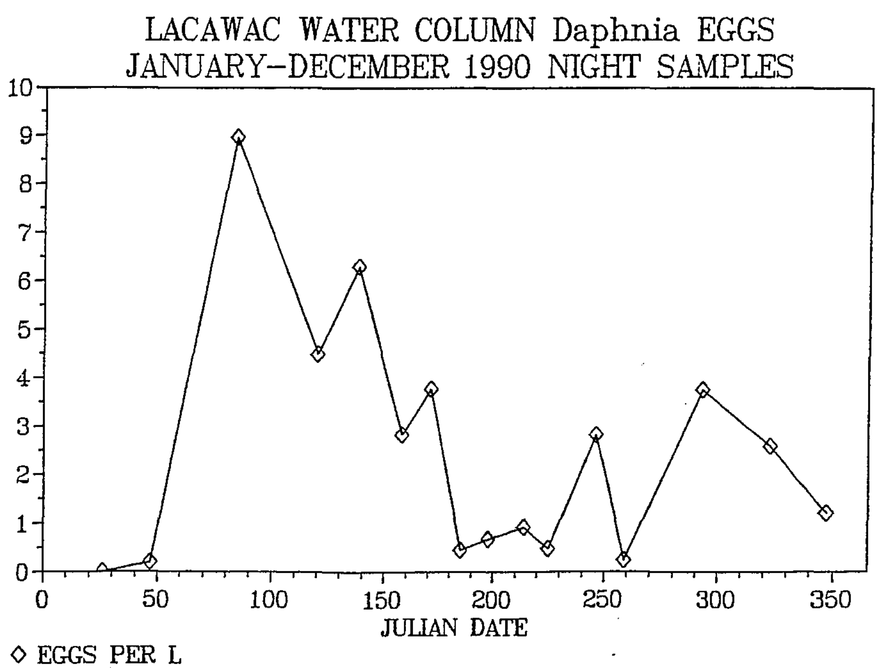
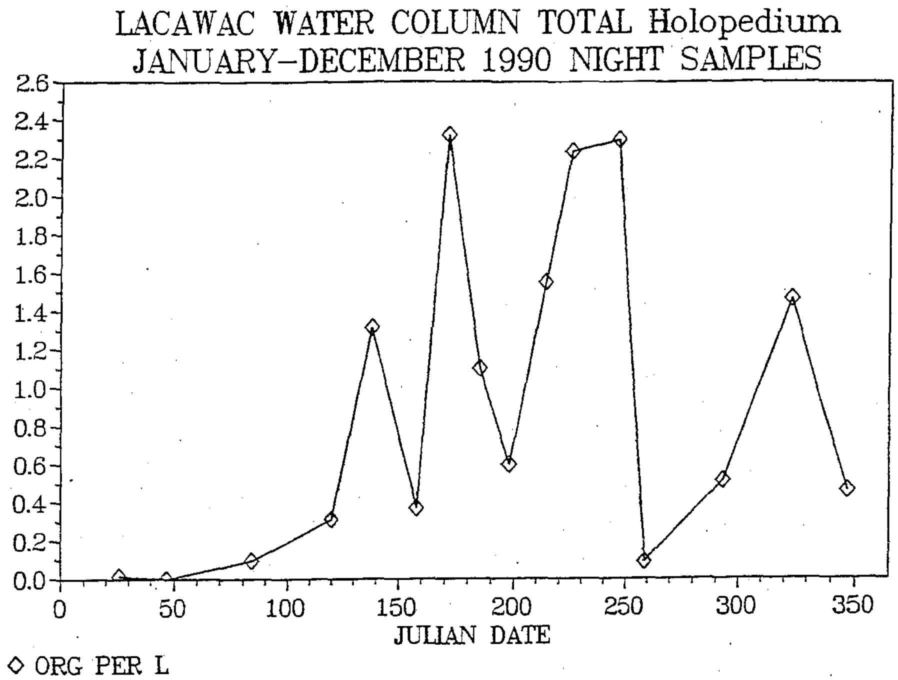


Figure 24. The cladoceran *Daphnia* in Lake Lacawac, 1990.

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



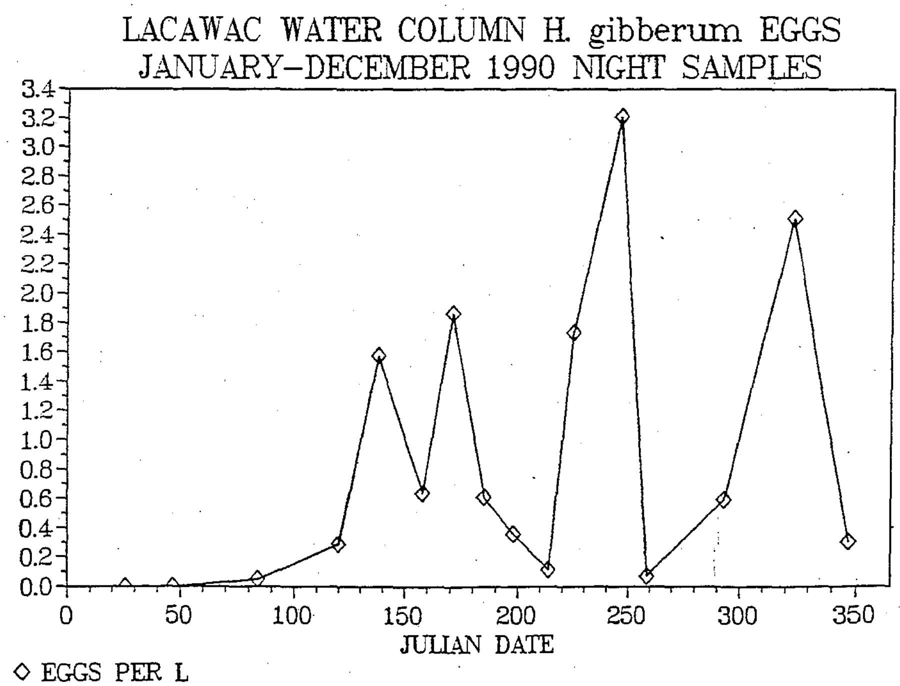


Figure 25. The cladoceran *Holopedium gibberum* in Lake Lacawac, 1990.

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

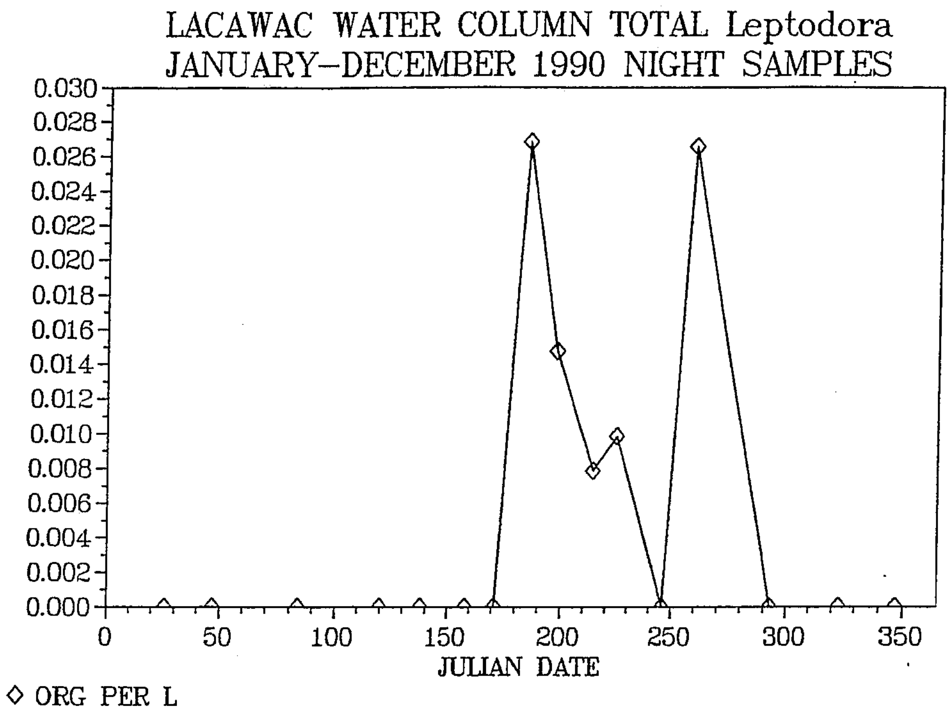
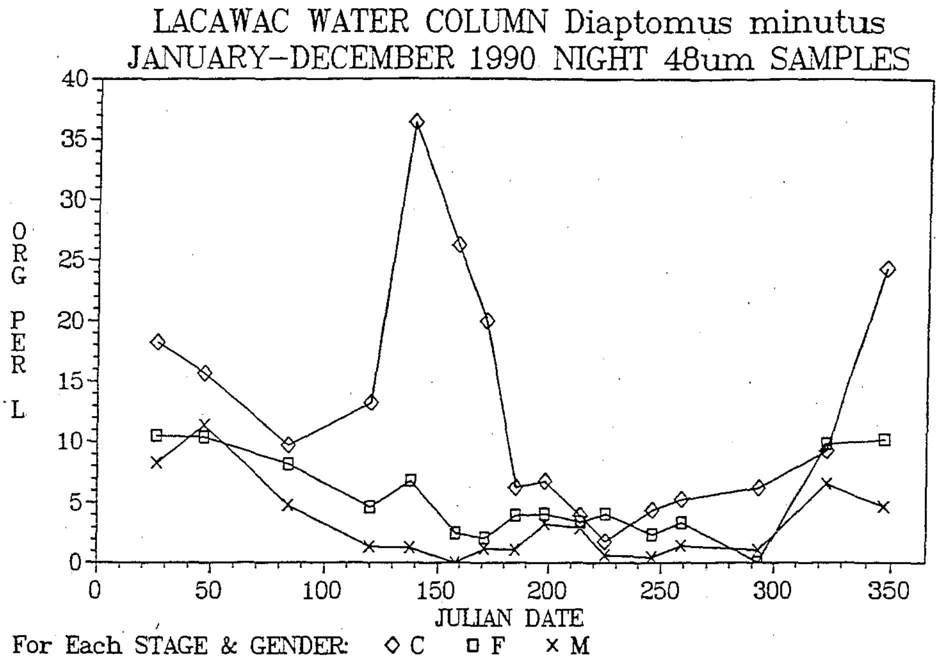


Figure 26. The cladoceran *Leptodora kindti* in Lake Lacawac, 1990.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean.



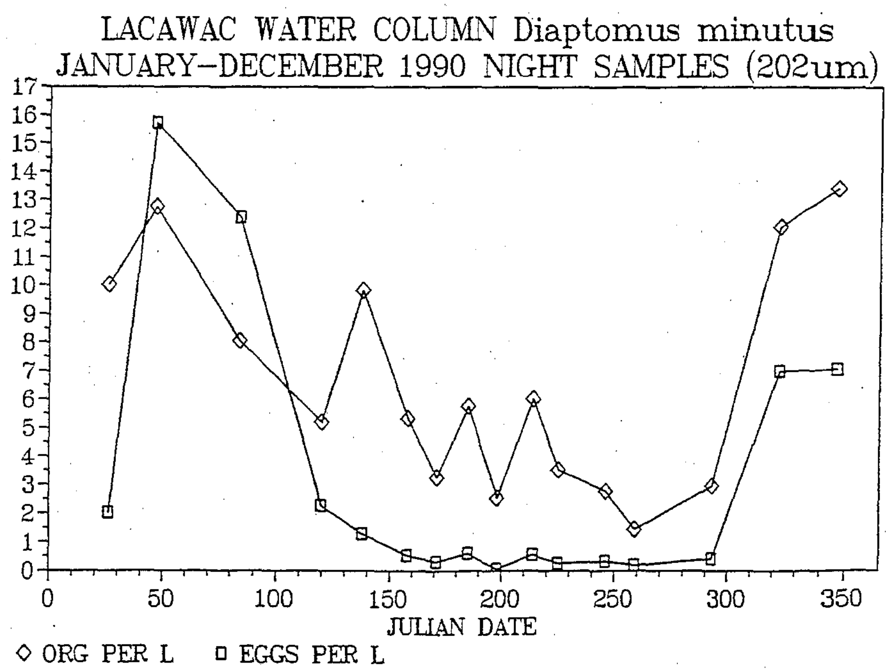
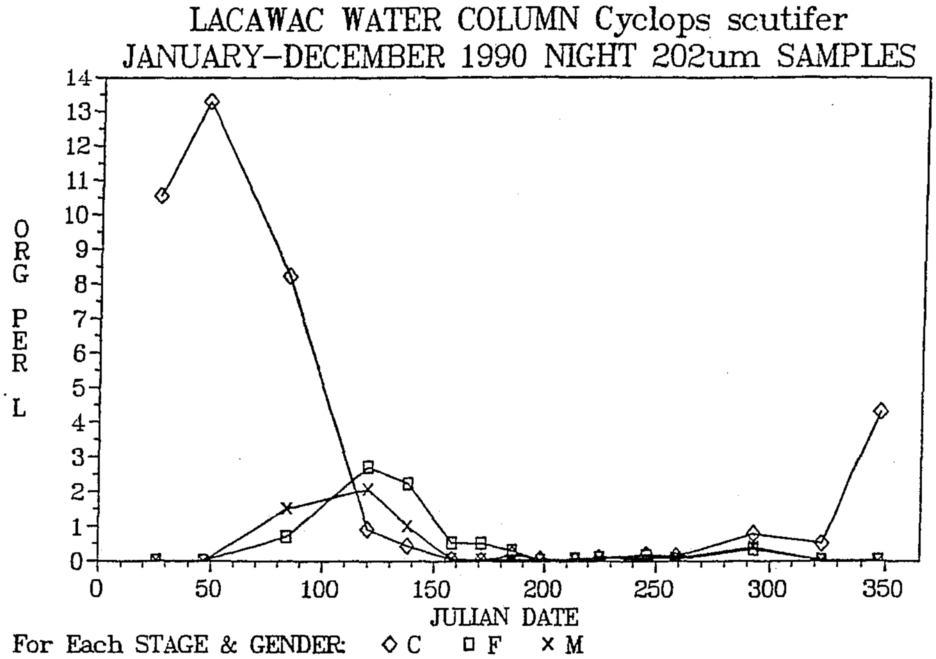


Figure 27. The calanoid copepod *Diaptomus minutus* in Lake Lacawac, 1990.

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 individuals and eggs per liter from the 202μm samples.



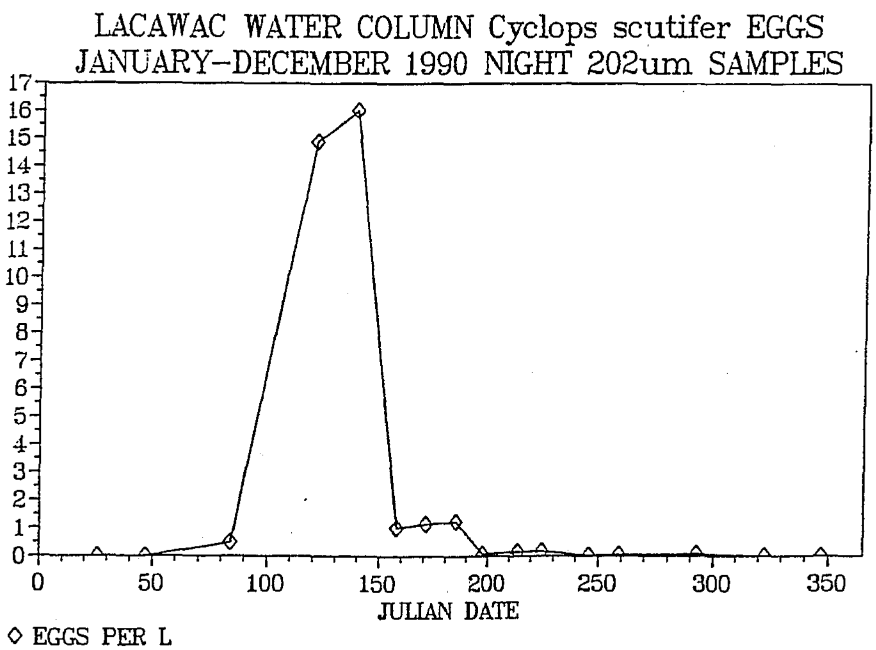
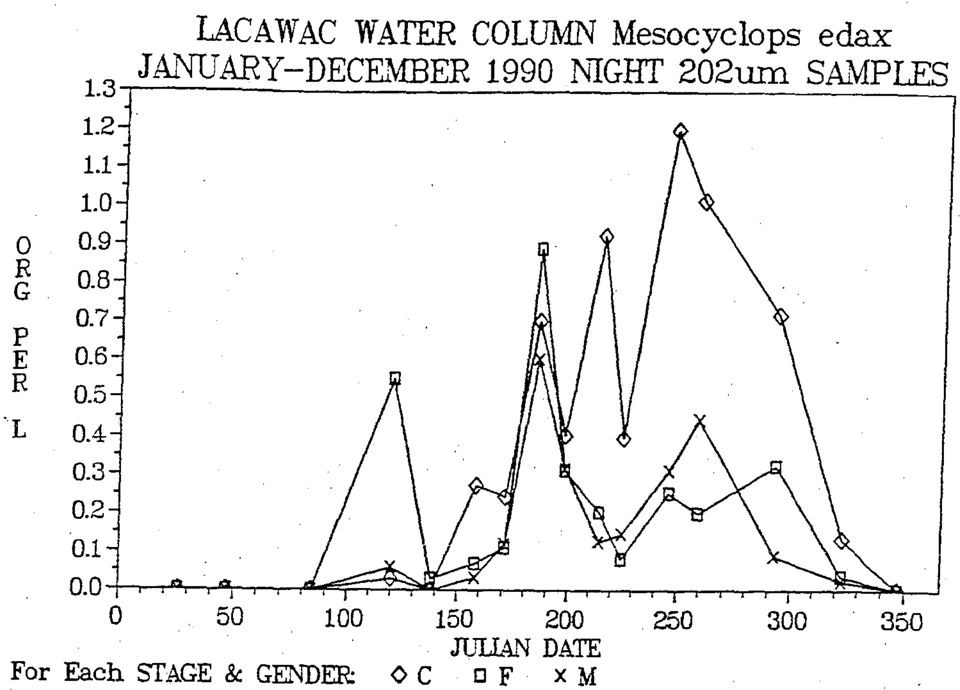


Figure 28. The cyclopoid copepod *Cyclops scutifer* in Lake Lacawac, 1990.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean. **(Top)** Adults (males and females separately) and some copepodids. Copepodids are collected at only ca. 50% efficiency by the 202μm net. **(Bottom)** *C. scutifer* total eggs per liter from the 202μm samples.



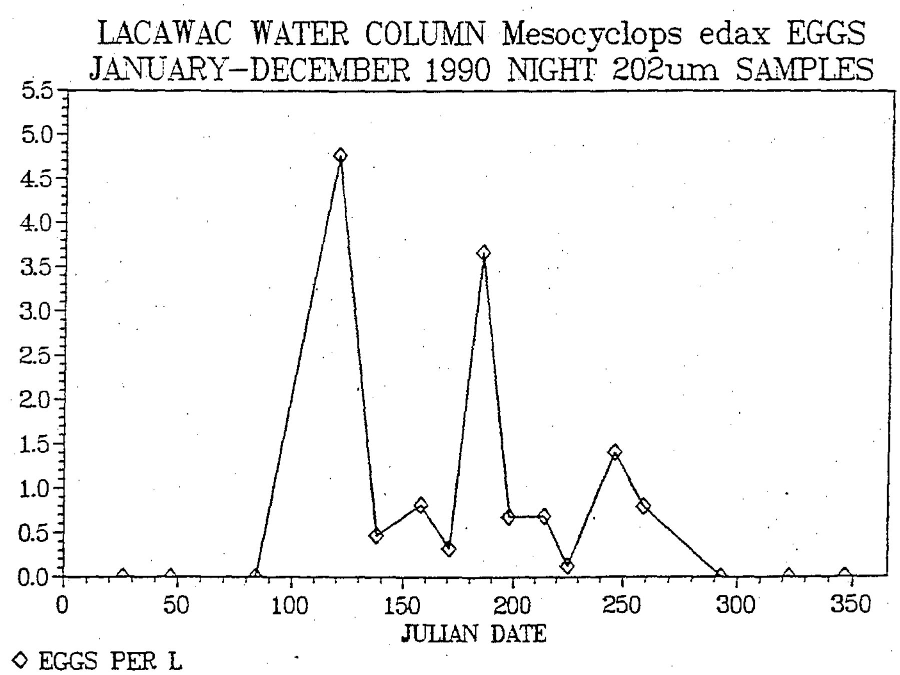


Figure 29. The cyclopoid copepod *Mesocyclops edax* in Lake Lacawac, 1990.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean, adults and copepodids together. **(Top)** Adults (males and females separately) and some copepodids. Copepodids are collected at only ca. 50% efficiency by the 202μm net. **(Bottom)** *M. edax* total eggs per liter from the 202μm samples.

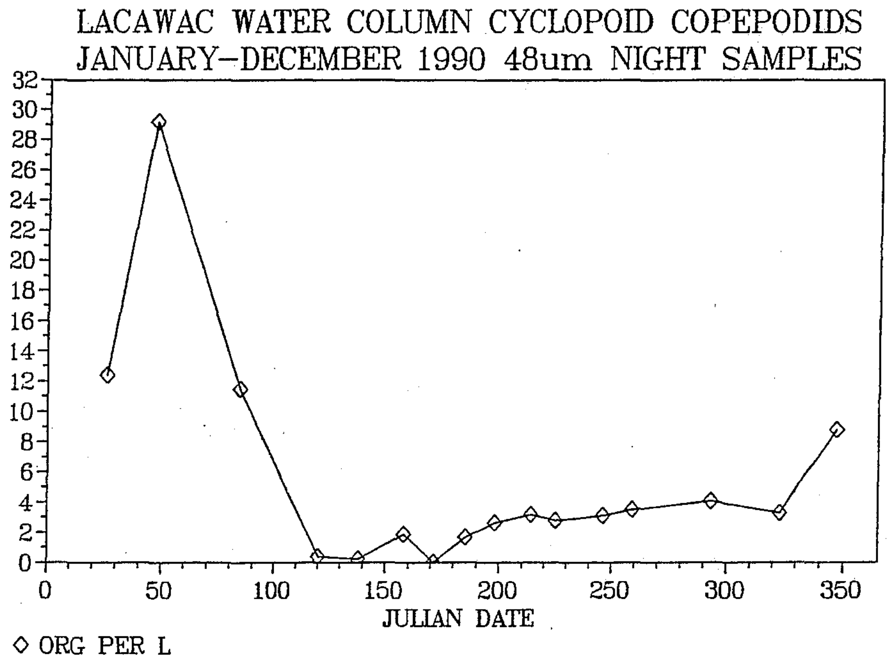


Figure 30. Cyclopoid copepodids in Lake Lacawac, 1990.

Nighttime net collections (48μm) from three depths have been combined to give a water column mean. Copepodids of *Cyclops scutifer* are not separated from those of *Mesocyclops edax*.

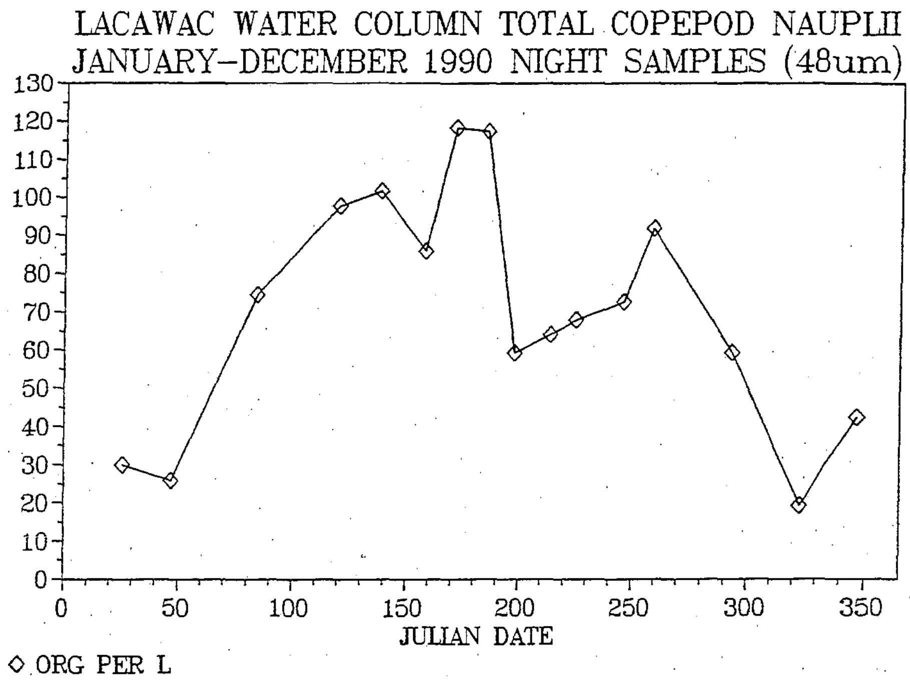


Figure 31. Total copepod nauplii in Lake Lacawac, 1990.

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

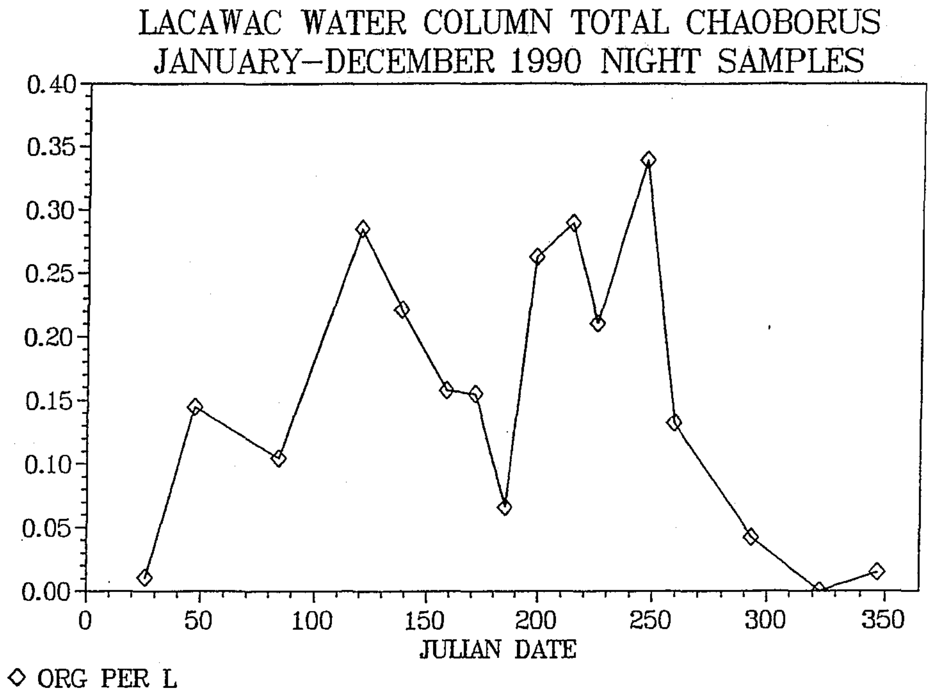


Figure 32. The dipteran *Chaoborus* in Lake Lacawac, 1990.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean.

EXPLANATION OF DATA TABLES

The following 16 tables present the physical/chemical information acquired on each date in 1990. 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 1-365.

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

SECCHI M: Secchi depth in meters (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 methods #10,12 (see **METHODS AND RESULTS**).

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

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

PHMETHOD: pH methods #10,11,12 (see **METHODS AND RESULTS**).

CAMETHOD: Chlorophyll-a methods #11,12 (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 (meters); **-1** for air above surface.
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 liter (μeq/L).
CHLAC:	Chlorophyll-a, corrected for pheopigments (μg/L).
CHLASUM:	Chlorophyll-a, including pheopigments (μg/L).

Names of Sampling Personnel:

JAA	John Aufderheide
KB	Karen Basehore
SRC,SC	Scott Carpenter
KG	Kevin Gould
SJJ,SJ	Sally Jones
DM	Donna Mensching
REM,RM	Robert Moeller
JWS,JS	John Slotterback

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 1/26/90 JULIAN DATE: 26 TIME: 14.08

SECCHI M: 4.2 WEATHER: Cloudy, cool PERSONNEL: REM SJ SC

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

COMMENTS: 21.3 cm ice cover with 1 cm snow cover

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
1/26/90	26	S	1	14.08	-1.0	1.7							
1/26/90	26		1	14.08	0.0	0.9	11.40		100.0000				
1/26/90	26	E	1	14.08	1.0	4.1	10.39		58.2181	5.81	30	3.40	4.08
1/26/90	26	E	2	14.08	1.0	4.1	10.39		58.2181	5.80	30	3.51	4.26
1/26/90	26		1	14.08	2.0	4.1	10.29		22.3165				
1/26/90	26	M	1	14.08	3.0	4.1	10.06		10.1809	5.96	36	2.84	3.72
1/26/90	26	M	2	14.08	3.0	4.1	10.06		10.1809	5.88	36	2.10	2.84
1/26/90	26		1	14.08	4.0	4.1	9.78		5.0516				
1/26/90	26		1	14.08	5.0	4.1	9.66		2.8037				
1/26/90	26		1	14.08	6.0	4.1	9.56		1.5285				
1/26/90	26		1	14.08	7.0	4.1	9.30		0.8444				
1/26/90	26	H	1	14.08	8.0	4.1	8.84		0.4794	5.88	35	1.66	2.75
1/26/90	26	H	2	14.08	8.0	4.1	8.84		0.4794	5.90	36	1.58	2.40
1/26/90	26		1	14.08	9.0	4.1	7.58		0.2650				
1/26/90	26		1	14.08	10.0	4.2	6.68		0.1310				
1/26/90	26		1	14.08	11.0	4.3	4.98		0.0513				
1/26/90	26		1	14.08	12.0	4.6	2.20		0.0187				
1/26/90	26		1	14.08	13.0	4.7							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 2/16/90 JULIAN DATE: 47 TIME: 15.58

SECCHI M: 5.0 WEATHER: Solid overcast PERSONNEL: RM SC SJ

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

COMMENTS: Ice somewhat milky, no snow, water surface at ice surface.

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
2/16/90	47	S	1	15.58	-1.0	10.3							
2/16/90	47		1	15.58	0.0	3.3	10.02		100.0000				
2/16/90	47	E	1	15.58	1.0	4.2	11.20		55.6483	5.87	34	3.86	4.71
2/16/90	47	E	2	15.58	1.0	4.2	11.20		55.6483	5.84	35		
2/16/90	47		1	15.58	2.0	4.3	11.23		29.0137				
2/16/90	47	M	1	15.58	3.0	4.2	11.11		15.2543	5.83	56	3.81	4.79
2/16/90	47	M	2	15.58	3.0	4.2	11.11		15.2543	5.84	56		
2/16/90	47		1	15.58	4.0	4.2	11.07		8.2411				
2/16/90	47		1	15.58	5.0	4.2	11.03		4.4643				
2/16/90	47		1	15.58	6.0	4.2	10.98		2.9762				
2/16/90	47		1	15.58	7.0	4.2	10.50		1.9868				
2/16/90	47		1	15.58	8.0	4.2	10.23		1.0664				
2/16/90	47	H	1	15.58	9.0	4.2	9.41		0.5452	5.68	59	2.11	3.12
2/16/90	47	H	2	15.58	9.0	4.2	9.41		0.5452				
2/16/90	47		1	15.58	10.0	4.3	8.50		0.2579				
2/16/90	47		1	15.58	11.0	4.4	5.60		0.1135				
2/16/90	47		1	15.58	12.0	4.6	3.28						
2/16/90	47		1	15.58	13.0	5.0							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 3/25/90 JULIAN DATE: 84 TIME: 16.42

SECCHI M: 4.5 WEATHER: Sunny, cool, wind PERSONNEL: SRC SJJ JAA

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

COMMENTS: Ice out 9-11 March

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
3/25/90	84	S	1	16.42	-1.0	7.8							
3/25/90	84		1	16.42	0.0	7.2	11.56		100.0000				
3/25/90	84		1	16.42	1.0	7.2	11.34		35.0263				
3/25/90	84	E	1	16.42	2.0	7.1	11.33		17.7979	6.08	32	4.92	5.65
3/25/90	84	E	2	16.42	2.0	7.1	11.33		17.7979	6.14	35		
3/25/90	84		1	16.42	3.0	7.1	11.22		8.6946				
3/25/90	84		1	16.42	4.0	7.1	11.22		4.1187				
3/25/90	84	M	1	16.42	5.0	6.9	11.05		1.9897	6.10	32	3.94	4.81
3/25/90	84	M	2	16.42	5.0	6.9	11.05		1.9897	6.08	34		
3/25/90	84		1	16.42	6.0	6.6	10.85		0.9115				
3/25/90	84		1	16.42	7.0	6.5	10.80		0.4585				
3/25/90	84		1	16.42	8.0	6.4	10.50		0.2201				
3/25/90	84	H	1	16.42	9.0	6.4	10.36		0.1171	6.10	35	3.47	4.44
3/25/90	84	H	2	16.42	9.0	6.4	10.36		0.1171	6.08	32		
3/25/90	84		1	16.42	10.0	6.3	10.49		0.0608				
3/25/90	84		1	16.42	11.0	6.3	10.45		0.0308				
3/25/90	84		1	16.42	12.0	6.2	10.22		0.0147				
3/25/90	84		1	16.42	13.0	6.0	1.88						

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 4/30/90 JULIAN DATE: 120 TIME: 14.00

SECCHI M: 4.2 WEATHER: Overcast PERSONNEL: SRC SJJ

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
4/30/90	120	S	1	14.00	-1.0	14.7							
4/30/90	120		1	14.00	0.0	16.8	9.29		100.0000				
4/30/90	120	E	1	14.00	1.0	16.8	9.37		28.5796	6.27	33	2.10	2.77
4/30/90	120	E	2	14.00	1.0	16.8	9.37		28.5796	6.23	35	2.69	3.52
4/30/90	120		1	14.00	2.0	16.5	9.42		14.7928				
4/30/90	120	M	1	14.00	3.0	11.3	11.39		9.2224	6.23	31	2.97	4.08
4/30/90	120	M	2	14.00	3.0	11.3	11.39		9.2224	6.16	30	2.85	3.56
4/30/90	120		1	14.00	4.0	8.8	11.68		5.1724				
4/30/90	120		1	14.00	5.0	8.1	11.27		2.7067				
4/30/90	120		1	14.00	6.0	7.7	10.96		1.4313				
4/30/90	120		1	14.00	7.0	7.4	10.59		0.7817				
4/30/90	120		1	14.00	8.0	7.3	10.28		0.4326				
4/30/90	120	H	1	14.00	9.0	7.1	9.30		0.2251	5.86	29	1.00	2.22
4/30/90	120	H	2	14.00	9.0	7.1	9.30		0.2251	5.87	28	0.81	1.97
4/30/90	120		1	14.00	10.0	7.0	8.76		0.1126				
4/30/90	120		1	14.00	11.0	7.0	8.20		0.0559				
4/30/90	120		1	14.00	12.0	7.0	7.80		0.0265				
4/30/90	120		1	14.00	13.0	6.9							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 5/18/90 JULIAN DATE: 138 TIME: 14.50

SECCHI M: 4.5 WEATHER: Cloudy, drizzle PERSONNEL: JAA SRC REM

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
5/18/90	138	S	1	14.50	-1.0								
5/18/90	138		1	14.50	0.0	15.9	9.75		100.0000				
5/18/90	138		1	14.50	1.0	16.0	9.75		35.2113				
5/18/90	138	E	1	14.50	2.0	16.0	9.75		14.7327	6.15	29	4.51	4.99
5/18/90	138	E	2	14.50	2.0	16.0	9.75		14.7327	6.15	28	5.62	6.45
5/18/90	138		1	14.50	3.0	14.5	9.90		7.5167				
5/18/90	138		1	14.50	4.0	12.9	10.00		4.0412				
5/18/90	138	M	1	14.50	5.0	10.7	10.10		2.2704	5.96	30	2.12	2.42
5/18/90	138	M	2	14.50	5.0	10.7	10.10		2.2704	5.93	32	1.83	1.87
5/18/90	138		1	14.50	6.0	8.5	10.10		1.3123				
5/18/90	138		1	14.50	7.0	7.8	9.70		0.7251				
5/18/90	138		1	14.50	8.0	7.4	8.80		0.4073				
5/18/90	138		1	14.50	9.0	7.2	7.70		0.2133				
5/18/90	138	H	1	14.50	10.0	7.0	6.45		0.0992	5.63	36	0.62	3.40
5/18/90	138	H	2	14.50	10.0	7.0	6.45		0.0992	5.63	33	0.72	3.19
5/18/90	138		1	14.50	11.0	7.0	6.00		0.0431				
5/18/90	138		1	14.50	12.0	7.0	5.20		0.0184				
5/18/90	138		1	14.50	13.0	7.0	1.35						

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/07/90 JULIAN DATE: 158 TIME: 10.75

SECCHI M: 4.3 WEATHER: Hazy, partly sunny PERSONNEL: JAA SRC DM

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

COMMENTS: No alkalinities; Algae lost

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
6/07/90	158	S	1	10.75	-1.0	21.8							
6/07/90	158		1	10.75	0.0	19.7	9.08		100.0000				
6/07/90	158		1	10.75	1.0	19.5	9.27		29.8597				
6/07/90	158	E	1	10.75	2.0	19.3	9.21		15.6007	6.34		2.07	2.40
6/07/90	158	E	2	10.75	2.0	19.3	9.21		15.6007	6.29			
6/07/90	158		1	10.75	3.0	18.0	9.43		7.8791				
6/07/90	158		1	10.75	4.0	15.7	9.48		3.7236				
6/07/90	158	M	1	10.75	5.0	12.5	9.29		1.9066	5.91		2.45	3.29
6/07/90	158	M	2	10.75	5.0	12.5	9.29		1.9066	5.90			
6/07/90	158		1	10.75	6.0	9.3	8.59		1.0229				
6/07/90	158		1	10.75	7.0	8.7	8.32		0.5511				
6/07/90	158		1	10.75	8.0	7.8	5.78		0.2925				
6/07/90	158		1	10.75	9.0	7.6	4.57		0.1399				
6/07/90	158	H	1	10.75	10.0	7.3	3.43		0.0593	5.63		0.84	2.59
6/07/90	158	H	2	10.75	10.0	7.3	3.43		0.0593	5.60			
6/07/90	158		1	10.75	11.0	7.2	3.13		0.0269				
6/07/90	158		1	10.75	12.0	7.1	2.27		0.0099				
6/07/90	158		1	10.75	13.0								

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/20/90 JULIAN DATE: 171 TIME: 10.75

SECCHI M: 4.0 WEATHER: Cloudy, windy PERSONNEL: KG KB SRC

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

COMMENTS: No Hypo pH, Alkalinity; Algae lost

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
6/20/90	171	S	1	10.75	-1.0	20.2							
6/20/90	171		1	10.75	0.0	21.8	8.32		100.0000				
6/20/90	171		1	10.75	1.0	21.9	7.95		29.9401				
6/20/90	171	E	1	10.75	2.0	21.9	8.05		11.5022	6.17	29	2.93	3.17
6/20/90	171	E	2	10.75	2.0	21.9	8.05		11.5022	6.11	23	2.26	2.83
6/20/90	171		1	10.75	3.0	19.3	7.75		6.5428				
6/20/90	171		1	10.75	4.0	17.4	7.00		3.3553				
6/20/90	171	M	1	10.75	5.0	13.1	7.22		1.6989	5.97	38	4.99	5.40
6/20/90	171	M	2	10.75	5.0	13.1	7.22		1.6989	5.86	41	3.51	4.44
6/20/90	171		1	10.75	6.0	10.7	7.40		0.8857				
6/20/90	171		1	10.75	7.0	8.7	5.90		0.4737				
6/20/90	171		1	10.75	8.0	8.0	3.90		0.2215				
6/20/90	171		1	10.75	9.0	7.6	3.45		0.1094				
6/20/90	171	H	1	10.75	10.0	7.5	1.80		0.0367			0.82	2.24
6/20/90	171	H	2	10.75	10.0	7.5	1.80		0.0367			0.64	2.19
6/20/90	171		1	10.75	11.0	7.3	1.35		0.0080				
6/20/90	171		1	10.75	12.0	7.3	1.15						
6/20/90	171		1	10.75	13.0	7.2							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/04/90 JULIAN DATE: 185 TIME: 14.75

SECCHI M: 4.5 WEATHER: Sunny PERSONNEL: JS SC AW K

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
7/04/90	185	S	1	14.75	-1.0	30.0							
7/04/90	185		1	14.75	0.0	24.6	8.38		100.0000				
7/04/90	185		1	14.75	1.0	24.5	8.36		47.8469				
7/04/90	185	E	1	14.75	2.0	24.3	8.32		21.2653	6.17	24	2.01	2.49
7/04/90	185	E	2	14.75	2.0	24.3	8.32		21.2653	6.20	24	1.87	2.30
7/04/90	185		1	14.75	3.0	22.8	8.17		9.8910				
7/04/90	185		1	14.75	4.0	18.3	7.05		3.9560				
7/04/90	185	M	1	14.75	5.0	14.3	7.22		1.6480	5.74	34	5.35	6.63
7/04/90	185	M	2	14.75	5.0	14.3	7.22		1.6480	5.74	35	7.46	9.00
7/04/90	185		1	14.75	6.0	11.5	6.44		1.0990				
7/04/90	185		1	14.75	7.0	10.2	5.53		0.5780				
7/04/90	185		1	14.75	8.0	8.4	3.15		0.2630				
7/04/90	185		1	14.75	9.0	8.0	1.65		0.0848				
7/04/90	185	H	1	14.75	10.0	7.6	0.97		0.0156	5.67	61	4.36	7.04
7/04/90	185	H	2	14.75	10.0	7.6	0.97		0.0156	5.62	62	3.69	5.76
7/04/90	185		1	14.75	11.0	7.5	0.53		0.0024				
7/04/90	185		1	14.75	12.0	7.4	0.38	4					
7/04/90	185		1	14.75	13.0	7.3	0.25	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/17/90 JULIAN DATE: 198 TIME: 11.75

SECCHI M: 5.0 WEATHER: Mostly sunny, breezy PERSONNEL: JS SC

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
7/17/90	198	S	1	11.75	-1.0	28.1							
7/17/90	198		1	11.75	0.0	23.3	8.19		100.0000				
7/17/90	198		1	11.75	1.0	22.9	8.42		52.5486				
7/17/90	198	E	1	11.75	2.0	22.5	8.36		17.5513	6.02	25	1.92	1.95
7/17/90	198	E	2	11.75	2.0	22.5	8.36		17.5513	6.16	31	2.07	2.78
7/17/90	198		1	11.75	3.0	21.4	8.07		8.3063				
7/17/90	198		1	11.75	4.0	19.6	7.74		3.9367				
7/17/90	198	M	1	11.75	5.0	14.8	6.66		1.8809	5.76	41	14.86	14.86
7/17/90	198	M	2	11.75	5.0	14.8	6.66		1.8809	5.83	46	12.84	13.55
7/17/90	198		1	11.75	6.0	11.5	6.32		0.9730				
7/17/90	198		1	11.75	7.0	9.6	3.58		0.4517				
7/17/90	198		1	11.75	8.0	8.4	1.52		0.1752				
7/17/90	198		1	11.75	9.0	8.1	0.59		0.0567				
7/17/90	198	H	1	11.75	10.0	7.6	0.41	4	0.0185	5.77	91	0.12	4.62
7/17/90	198	H	2	11.75	10.0	7.6	0.41	4	0.0185				
7/17/90	198		1	11.75	11.0	7.5	0.32	4	0.0058				
7/17/90	198		1	11.75	12.0	7.4	0.28	4	0.0013				
7/17/90	198		1	11.75	13.0	7.4							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/02/90 JULIAN DATE: 214 TIME: 16.75

SECCHI M: 4.3 WEATHER: Mostly sunny PERSONNEL: JWS SRC

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

COMMENTS: Epi pH's high, but no basis to doubt them

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
8/02/90	214	S	1	16.75	-1.0	31.6							
8/02/90	214		1	16.75	0.0	25.6	7.89		100.0000				
8/02/90	214		1	16.75	1.0	25.3	7.93		50.2765				
8/02/90	214	E	1	16.75	2.0	25.1	7.97		21.4765	7.50		2.12	2.74
8/02/90	214	E	2	16.75	2.0	25.1	7.97		21.4765	7.44		2.08	2.73
8/02/90	214		1	16.75	3.0	24.2	7.82		9.2972				
8/02/90	214		1	16.75	4.0	20.4	6.69		4.8575				
8/02/90	214	M	1	16.75	5.0	16.0	7.28		2.1871	5.90		3.66	4.98
8/02/90	214	M	2	16.75	5.0	16.0	7.28		2.1871	5.89		2.58	3.75
8/02/90	214		1	16.75	6.0	12.4	6.80		0.9189				
8/02/90	214		1	16.75	7.0	9.6	2.32		0.3165				
8/02/90	214		1	16.75	8.0	8.5	0.47	4	0.1394				
8/02/90	214		1	16.75	9.0	8.0	0.37	4	0.0608				
8/02/90	214		1	16.75	10.0	7.7	0.32	4	0.0201				
8/02/90	214	H	1	16.75	11.0	7.5	0.29	4	0.0065	6.20		0.00	11.23
8/02/90	214	H	2	16.75	11.0	7.5	0.29	4	0.0065	6.26		0.34	8.75
8/02/90	214		1	16.75	12.0	7.5	0.27	4	0.0016				
8/02/90	214		1	16.75	13.0	7.5	0.26	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/13/90 JULIAN DATE: 225 TIME: 11.75

SECCHI M: 3.3 WEATHER: Hazy, breeze PERSONNEL: JAA SRC

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

COMMENTS: O2 meter read "0.8" in anoxic water!

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
8/13/90	225	S	1	11.75	-1.0								
8/13/90	225		1	11.75	0.0	24.5	8.62		100.0000				
8/13/90	225		1	11.75	1.0	24.4	8.59		33.9789				
8/13/90	225	E	1	11.75	2.0	23.7	8.52		14.0991	6.25	42	3.96	5.14
8/13/90	225	E	2	11.75	2.0	23.7	8.52		14.0991	6.25	47	6.15	7.08
8/13/90	225		1	11.75	3.0	23.3	8.45		6.4233				
8/13/90	225		1	11.75	4.0	22.1	6.70		2.4897				
8/13/90	225		1	11.75	5.0	17.1	6.35		0.8804				
8/13/90	225	M	1	11.75	6.0	13.6	6.34		0.3726	5.98	39	4.32	6.02
8/13/90	225	M	2	11.75	6.0	13.6	6.34		0.3726	5.94	35	4.91	6.29
8/13/90	225		1	11.75	7.0	11.3	0.87	4	0.1535				
8/13/90	225		1	11.75	8.0	9.9	0.83	4	0.0786				
8/13/90	225		1	11.75	9.0	9.2	0.82	4	0.0328				
8/13/90	225		1	11.75	10.0	8.8	0.81	4	0.0108				
8/13/90	225	H	1	11.75	11.0	8.6	0.79	4	0.0035	6.25	255	0.00	11.46
8/13/90	225	H	2	11.75	11.0	8.6	0.79	4	0.0035	6.26	256	0.25	17.89
8/13/90	225		1	11.75	12.0	8.4	0.77	4	0.0009				
8/13/90	225		1	11.75	13.0	8.3	0.78	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/03/90 JULIAN DATE: 246 TIME: 15.50

SECCHI M: 3.9 WEATHER: Sunny, few clouds, strong wind PERSONNEL: SRC

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

COMMENTS: No Alkalinities this date

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
9/03/90	246	S	1	15.50	-1.0	22.7							
9/03/90	246		1	15.50	0.0	23.5	8.13		100.0000				
9/03/90	246		1	15.50	1.0	23.7	8.11		45.4133				
9/03/90	246	E	1	15.50	2.0	23.6	8.04		20.3282	6.26		2.53	2.94
9/03/90	246	E	2	15.50	2.0	23.6	8.04		20.3282	6.33		1.86	2.18
9/03/90	246		1	15.50	3.0	22.5	7.67		10.1641				
9/03/90	246		1	15.50	4.0	21.0	5.50		5.6342				
9/03/90	246		1	15.50	5.0	18.2	2.88		2.2261				
9/03/90	246	M	1	15.50	6.0	14.0	1.41		0.8300	5.73		4.01	6.22
9/03/90	246	M	2	15.50	6.0	14.0	1.41		0.8300	5.75		3.91	6.20
9/03/90	246		1	15.50	7.0	11.8	0.25	4	0.3221				
9/03/90	246		1	15.50	8.0	10.2	0.25	4	0.1238				
9/03/90	246		1	15.50	9.0	9.5	0.25	4	0.0423				
9/03/90	246	H	1	15.50	10.0	9.3	0.25	4	0.0135	6.11		0.00	32.52
9/03/90	246	H	2	15.50	10.0	9.3	0.25	4	0.0135	6.10		0.13	30.45
9/03/90	246		1	15.50	11.0	9.0	0.25	4	0.0042				
9/03/90	246		1	15.50	12.0	8.8	0.25	4	0.0010				
9/03/90	246		1	15.50	13.0	8.7	0.25	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/18/90 JULIAN DATE: 261 TIME: 15.75

SECCHI M: WEATHER: Partly sunny, windy PERSONNEL: SRC REM

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

COMMENTS: No secchi; E,M,H depths estimated; light 9/20/90, pH&Alk 9/16/90

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
9/18/90	261	S	1	15.75	-1.0	10.5							
9/18/90	261		1	15.75	0.0	17.2	7.90		100.0000				
9/18/90	261		1	15.75	1.0	17.6	7.70		35.9454				
9/18/90	261	E	1	15.75	2.0	18.0	7.71		20.1375	6.21	38	2.31	2.80
9/18/90	261	E	2	15.75	2.0	18.0	7.71		20.1375	6.25	31	2.51	3.18
9/18/90	261		1	15.75	3.0	18.1	7.50		11.3323				
9/18/90	261		1	15.75	4.0	18.1	7.34		6.2129				
9/18/90	261		1	15.75	5.0	16.0	4.51		3.1111				
9/18/90	261	M	1	15.75	6.0	13.2	0.68		1.4077	6.12	29	2.32	2.97
9/18/90	261	M	2	15.75	6.0	13.2	0.68		1.4077	6.20	31	2.13	2.78
9/18/90	261		1	15.75	7.0	10.1	0.37	4	0.6134				
9/18/90	261		1	15.75	8.0	9.0	0.32	4	0.2259				
9/18/90	261		1	15.75	9.0	7.9	0.30	4	0.0581				
9/18/90	261	H	1	15.75	10.0	7.7	0.30	4	0.0155	6.24	186	0.51	27.82
9/18/90	261	H	2	15.75	10.0	7.7	0.30	4	0.0155	6.15	155	3.45	26.36
9/18/90	261		1	15.75	11.0	7.5	0.30	4	0.0041				
9/18/90	261		1	15.75	12.0	7.1	0.30	4	0.0005				
9/18/90	261		1	15.75	13.0	7.1	0.30	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 10/20/90 JULIAN DATE: 293 TIME: 11.75

SECCHI M: 4.2 WEATHER: Sunny PERSONNEL: SRC

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

COMMENTS: Chlorophylls lost

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
10/20/90	293	S	1	11.75	-1.0	13.9							
10/20/90	293		1	11.75	0.0	14.5	7.98		100.0000				
10/20/90	293		1	11.75	1.0	14.6	7.84		42.9185				
10/20/90	293		1	11.75	2.0	14.6	7.90		20.0366				
10/20/90	293	E	1	11.75	3.0	14.7	7.48		10.3228	6.06	48		
10/20/90	293	E	2	11.75	3.0	14.7	7.48		10.3228	6.02	46		
10/20/90	293		1	11.75	4.0	14.7	7.68		5.2965				
10/20/90	293		1	11.75	5.0	14.6	7.83		2.7009				
10/20/90	293		1	11.75	6.0	14.6	8.03		1.7062				
10/20/90	293		1	11.75	7.0	14.4	7.59		0.9105				
10/20/90	293	M	1	11.75	8.0	9.8	0.25	4	0.2899	5.90	136		
10/20/90	293	M	2	11.75	8.0	9.8	0.25	4	0.2899	5.92	100		
10/20/90	293		1	11.75	9.0	8.6	0.23	4	0.0793				
10/20/90	293		1	11.75	10.0	8.3	0.23	4	0.0195				
10/20/90	293	H	1	11.75	11.0	8.0	0.23	4	0.0049	6.32	484		
10/20/90	293	H	2	11.75	11.0	8.0	0.23	4	0.0049	6.35	433		
10/20/90	293		1	11.75	12.0	8.0	0.23	4	0.0009				
10/20/90	293		1	11.75	13.0	8.0	0.23	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 11/19/90 JULIAN DATE: 323 TIME: 16.00

SECCHI M: 4.0 WEATHER: Sunny, windy PERSONNEL: JAA SRC

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

COMMENTS: pH may be high--electrode suboptimal and no pHix added

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
11/19/90	323	S	1	16.00	-1.0	3.6							
11/19/90	323		1	16.00	0.0	5.2	11.18		100.0000				
11/19/90	323		1	16.00	1.0	5.2	11.00		28.1136				
11/19/90	323	E	1	16.00	2.0	5.2	10.99		11.4702	6.28	56	2.94	2.94
11/19/90	323	E	2	16.00	2.0	5.2	10.99		11.4702	6.20	41	2.86	3.20
11/19/90	323		1	16.00	3.0	5.2	11.01		4.4287				
11/19/90	323		1	16.00	4.0	5.2	10.98		1.9639				
11/19/90	323		1	16.00	5.0	5.2	11.00		0.9251				
11/19/90	323	M	1	16.00	6.0	5.2	10.97		0.4374	6.29	48	2.43	2.68
11/19/90	323	M	2	16.00	6.0	5.2	10.97		0.4374	6.21	38	2.70	3.10
11/19/90	323		1	16.00	7.0	5.2	10.98		0.2236				
11/19/90	323		1	16.00	8.0	5.2	11.00		0.1098				
11/19/90	323		1	16.00	9.0	5.2	10.98		0.0539				
11/19/90	323	H	1	16.00	10.0	5.2	10.90		0.0269	6.22	42	2.53	2.87
11/19/90	323	H	2	16.00	10.0	5.2	10.90		0.0269	6.18	42	2.57	2.98
11/19/90	323		1	16.00	11.0	5.2	10.90		0.0141				
11/19/90	323		1	16.00	12.0	5.2	10.76		0.0090				
11/19/90	323		1	16.00	13.0	5.2	8.68						

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 12/13/90 JULIAN DATE: 347 TIME: 15.75

SECCHI M: 3.8 WEATHER: Partly cloudy, windy PERSONNEL: JAA SRC

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

COMMENTS: pH may be high--electrode suboptimal but no pHix added; also 48 hrs old

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
12/13/90	347	S	1	15.75	-1.0	5.9							
12/13/90	347		1	15.75	0.0	3.2	12.48		100.0000				
12/13/90	347		1	15.75	1.0	3.1	12.28		32.5839				
12/13/90	347	E	1	15.75	2.0	3.1	12.28		13.6449	6.02	23	3.64	3.80
12/13/90	347	E	2	15.75	2.0	3.1	12.28		13.6449	6.21	21	3.10	3.52
12/13/90	347		1	15.75	3.0	3.1	12.24		5.9663				
12/13/90	347		1	15.75	4.0	3.1	12.20		2.6505				
12/13/90	347		1	15.75	5.0	3.1	12.28		1.3509				
12/13/90	347		1	15.75	6.0	3.1	12.22		0.6492				
12/13/90	347	M	1	15.75	7.0	3.1	12.21		0.3265	6.22	23	3.26	3.50
12/13/90	347	M	2	15.75	7.0	3.1	12.21		0.3265	6.25	32	3.20	4.01
12/13/90	347		1	15.75	8.0	3.1	12.22		0.1727				
12/13/90	347		1	15.75	9.0	3.1	12.23		0.0843				
12/13/90	347		1	15.75	10.0	3.1	12.20		0.0405				
12/13/90	347	H	1	15.75	11.0	3.1	12.19		0.0207	6.24	20	3.31	3.81
12/13/90	347	H	2	15.75	11.0	3.1	12.19		0.0207	6.25	22	4.11	4.78
12/13/90	347		1	15.75	12.0	3.1	12.10		0.0102				
12/13/90	347		1	15.75	13.0	3.1	12.24						

APPENDIX I: CHEMISTRY

Table L.A.1 was compiled from unpublished data generated by Nina Caraco and Jon Cole at the Institute of Ecosystem Studies, New York Botanical Garden, Millbrook, New York. Note that the sampling dates were in 1989.

The analyses were not complete when this report was prepared, and all data may be subject to revision.

Table L.A.1. CHEMICAL CHARACTERIZATION OF LAKE LACAWAC (1989)

Date	Depth	Temp	O2	DIC	CH4	S2-	Cond	pH	Ca	Mg	K	Na	Cl	SO4	Fe	N	P	Fe	N	P
							umho/								tdFe	tdN	tdP	tFe	tN	tP
	m	C	mg/L	uM	uM	uM	cm		mg/L	mg/L	mg/L	mg/L	uM	uM	uM	uM	uM	uM	uM	uM
06/19/89	0.5	23.4	9.7	18	<LD	--	25	6.11	2.93	0.51	0.40	0.89	--	65.3	0.3	--	0.20	0.7	--	0.41
06/19/89	6.2	10.9	7.4	162	<LD	--	28	5.93	--	--	--	--	--	78.5	1.4	--	0.29	1.5	--	0.35
06/19/89	9.2	8.5	2.0	274	<LD	--	30	5.78	--	--	--	--	--	66.1	2.4	--	0.43	4.4	--	0.61
06/19/89	12.0	8.2	1.2	363	<LD	--	32	5.77	--	--	--	--	--	64.5	4.4	--	0.66	10.4	--	0.88
08/04/89	0.5	24.2	9.1	32	<LD	<LD	25	6.52	2.70	0.47	0.32	0.71	--	82.4	0.4	--	0.18	1.0	--	0.65
08/04/89	5.0	14.6	6.8	166	<LD	<LD	27	5.80	--	--	--	--	--	84.0	1.2	--	0.24	1.8	--	0.45
08/04/89	6.0	11.7	2.9	234	<LD	0.1	28	5.75	--	--	--	--	--	85.5	2.5	--	0.29	4.8	--	0.59
08/04/89	8.0	9.4	0.6	338	<LD	0.1	32	5.92	--	--	--	--	--	77.7	7.5	--	0.48	11.5	--	0.98
08/04/89	10.0	8.5	0.5	398	28	1.7	41	6.28	--	--	--	--	--	66.9	27.4	--	2.23	38.3	--	2.70
08/04/89	12.0	8.3	0.5	506	46	4.7	45	6.37	--	--	--	--	--	57.5	38.2	--	3.35	44.7	--	3.86
09/15/89	0.5	22.0	8.5	46	<LD	<LD	26	6.45	2.80	0.49	0.35	0.78	--	74.6	--	--	0.16	1.1	--	0.30
09/15/89	6.0	13.4	0.4	323	<LD	<LD	30	5.85	--	--	--	--	--	70.7	1.3	--	0.28	5.1	--	0.76
09/15/89	8.0	9.8	0.3	395	17	0.1	35	6.18	--	--	--	--	--	67.6	14.8	--	0.34	22.8	--	0.76
09/15/89	10.0	8.7	0.3	539	83	3.1	47	6.47	--	--	--	--	--	38.9	33.6	--	3.69	65.3	--	3.96
09/15/89	12.0	8.4	0.3	592	108	8.2	51	6.45	--	--	--	--	--	37.3	63.3	--	4.70	66.2	--	4.99
10/04/89	0.5	14.8	9.1	71	<LD	0.2	26	6.41	2.87	0.50	0.40	0.65	--	78.5	0.5	--	0.24	0.9	--	0.30
10/04/89	8.0	10.2	0.5	379	27	0.4	37	6.21	3.25	0.51	0.45	0.88	--	73.1	15.5	--	0.38	20.9	--	0.98
10/04/89	9.0	9.1	0.4	473	74	3.9	45	6.39	3.43	0.52	0.46	0.71	--	54.4	39.6	--	1.81	50.6	--	2.60
10/04/89	12.0	8.5	0.4	601	123	15.8	53	6.36	3.61	0.55	0.53	0.81	--	29.5	63.2	--	4.89	66.4	--	5.22

Sampling and analyses supervised by Jon Cole and Nina Caraco of the Institute of Ecosystem Studies (Millbrook, NY).
Abbreviations: LD--limit of detection, td--total dissolved, t--total (particulate plus dissolved).
Oxygen values < =0.5 mg/L should be interpreted as true "0.0".

APPENDIX II: FISH SURVEY

The census of fish captured in Lake Lacawac in July 1990 that follows on the next pages is reformatted from an electronic file provided by Kenneth Ersbak. It is a complete record of the fish collected by Aquatic Resource Consulting of Saylorsburg, PA. More details of this survey are contained in the final report:

Ersbak, K. 1990. Fishery Survey on the three "core" lakes of the Pocono Comparative Lakes Program. Aquatic Resources Consulting, Unpublished Report, 25 September 1990, 27 pp.

The modified electronic file will be maintained with the PCLP database. Currently it is a Quattro-Pro (vers. 1, Borland International, 1989) file called "FSH90L01.WQ1".

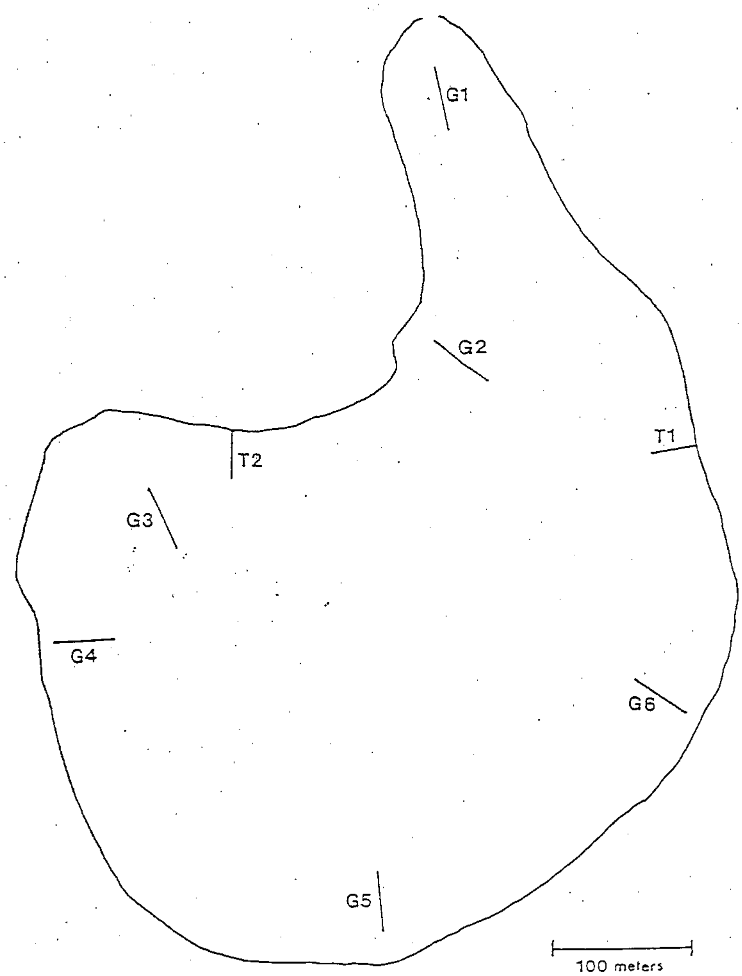
A sketch showing sampling sites is inserted below.

LAKE LACAWAC

Location of Survey Sites:

G1-G6 --Gill Nets

T1-T2 --Trap Nets



POCONO COMPARATIVE LAKES PROGRAM FISH SURVEY - DATA SHEET

<FSH90L01.WQ1> -- Quattro Pro File for Lacawac fish survey of July 1990

<04/18/91> [modified by REM 4/18/91]

OWNER OF DATA: PCLP PROJECT (for general use)
QUESTIONS TO: Kenneth Ersbak, Craig Williamson

GEAR: Gill Nets or Trap Nets
SET: Day (8am-8pm) or night (7pm-7am) deployment
SITE: Sampling location; see original Report

FISH CODE:
- BB Brown bullhead (Ictalurus nebulosus)
- BG Bluegill sunfish (Lepomis macrochirus)
- CP Chain pickerel (Esox niger)
- GS Golden shiner (Notemigonus crysoleucas)
- LMB Largemouth bass (Micropterus salmoides)
- PS Pumpkinseed sunfish (Lepomis gibbosus)
- RB Rock bass (Amblopites rupestris)
- SMB Smallmouth bass (Micropterus dolomieui)
- YP Yellow perch (Perca flavescens)

LENGTH: Length of fish in millimeters (1 inch = 25.4 mm)
WEIGHT: Weight of freshly caught fish in grams (1 pound = 454 g)
COND.: Condition according to Carlander's scale

LAKE	DATE	GEAR	SET	SITE	FISH CODE	LENGTH (mm)	WEIGHT (g wet)	COND.
LACAWAC	7/16/90	GILL	NIGHT	NET 1	PS	185	132	2.08
LACAWAC	7/16/90	GILL	NIGHT	NET 1	PS	211	186	1.98
LACAWAC	7/16/90	GILL	NIGHT	NET 1	PS	212	194	2.04
LACAWAC	7/16/90	GILL	NIGHT	NET 1	LMB	256	212	1.26
LACAWAC	7/16/90	GILL	NIGHT	NET 1	LMB	260	246	1.40
LACAWAC	7/16/90	GILL	NIGHT	NET 1	LMB	274	292	1.42
LACAWAC	7/16/90	GILL	NIGHT	NET 1	SMB	255	204	1.23
LACAWAC	7/16/90	GILL	NIGHT	NET 1	SMB	303	306	1.10
LACAWAC	7/16/90	GILL	NIGHT	NET 1	SMB	331	420	1.16
LACAWAC	7/16/90	GILL	NIGHT	NET 3	YP	277	248	1.17
LACAWAC	7/16/90	GILL	NIGHT	NET 3	YP	299	328	1.23
LACAWAC	7/16/90	GILL	NIGHT	NET 3	YP	309	322	1.09
LACAWAC	7/16/90	GILL	NIGHT	NET 3	YP	339	322	0.83
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	149	61	1.84
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	174	108	2.05
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	185	140	2.21
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	189	126	1.87
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	190	124	1.81
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	198	156	2.01
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	BG	211	174	1.85
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	161	80	1.92
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	181	118	1.99
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	185	128	2.02
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	193	142	1.98

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LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	197	142	1.86
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	205	184	2.14
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	209	176	1.93
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	210	178	1.92
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	211	202	2.15
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	214	212	2.16
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	215	174	1.75
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	230	228	1.87
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	PS	231	250	2.03
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	SMB	254	212	1.29
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	SMB	283	270	1.19
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	SMB	302	322	1.17
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	CP	394	342	0.56
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	CP	432	376	0.47
LACAWAC	7/16/90	TRAP	NIGHT	NET 1	CP	466	554	0.55
LACAWAC	7/16/90	GILL	DAY	NET 1	YP	276	244	1.16
LACAWAC	7/16/90	GILL	DAY	NET 1	YP	320	384	1.17
LACAWAC	7/16/90	GILL	DAY	NET 1	LMB	116	22	1.41
LACAWAC	7/16/90	GILL	DAY	NET 3	YP	276	256	1.22
LACAWAC	7/16/90	GILL	DAY	NET 3	SMB	211	118	1.26
LACAWAC	7/16/90	GILL	DAY	NET 3	SMB	220	120	1.13
LACAWAC	7/16/90	GILL	DAY	NET 3	SMB	241	162	1.16
LACAWAC	7/17/90	GILL	NIGHT	NET 4	BG	121	31	1.75
LACAWAC	7/17/90	GILL	NIGHT	NET 4	RB	215	180	1.81
LACAWAC	7/17/90	GILL	NIGHT	NET 4	SMB	341	440	1.11
LACAWAC	7/17/90	GILL	NIGHT	NET 4	CP	450	422	0.46
LACAWAC	7/17/90	GILL	NIGHT	NET 5	YP	262	210	1.17
LACAWAC	7/17/90	GILL	NIGHT	NET 5	YP	305	324	1.14
LACAWAC	7/17/90	GILL	NIGHT	NET 5	GS	114	13	0.88
LACAWAC	7/17/90	GILL	NIGHT	NET 5	GS	122	18	0.99
LACAWAC	7/17/90	GILL	NIGHT	NET 5	GS	125	18	0.92
LACAWAC	7/17/90	GILL	NIGHT	NET 5	GS	143	28	0.96
LACAWAC	7/17/90	GILL	NIGHT	NET 5	LMB	304	436	1.55
LACAWAC	7/17/90	GILL	NIGHT	NET 6	YP	291	285	1.16
LACAWAC	7/17/90	GILL	NIGHT	NET 6	YP	340	402	1.02
LACAWAC	7/17/90	GILL	NIGHT	NET 6	PS	218	214	2.07
LACAWAC	7/17/90	GILL	NIGHT	NET 6	PS	220	218	2.05
LACAWAC	7/17/90	GILL	NIGHT	NET 6	PS	242	260	1.83
LACAWAC	7/17/90	GILL	NIGHT	NET 6	BB	233	197	1.56
LACAWAC	7/17/90	GILL	NIGHT	NET 6	CP	420	340	0.46
LACAWAC	7/17/90	GILL	NIGHT	NET 6	CP	430	408	0.51
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	BG	185	112	1.77
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	BG	199	154	1.95
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	BG	215	202	2.03
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	BG	223	208	1.88
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	182	114	1.89
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	201	160	1.97
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	202	58	0.70
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	203	164	1.96
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	206	184	2.10
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	212	174	1.83
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	214	188	1.92
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	PS	222	214	1.96
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	RB	146	156	5.01
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	SMB	96	13	1.47

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LACAWAC	7/17/90	TRAP	NIGHT	NET 2	SMB	376	671	1.26
LACAWAC	7/17/90	TRAP	NIGHT	NET 2	CP	433	430	0.53
LACAWAC	7/17/90	GILL	DAY	NET 4	YP	308	376	1.29
LACAWAC	7/17/90	GILL	DAY	NET 4	YP	328	402	1.14
LACAWAC	7/17/90	GILL	DAY	NET 4	YP	332	412	1.13
LACAWAC	7/17/90	GILL	DAY	NET 4	BG	123	40	2.15
LACAWAC	7/17/90	GILL	DAY	NET 4	PS	106	20	1.68
LACAWAC	7/17/90	GILL	DAY	NET 4	RB	220	166	1.56
LACAWAC	7/17/90	GILL	DAY	NET 4	SMB	270	258	1.31
LACAWAC	7/17/90	GILL	DAY	NET 5	YP	260	216	1.23
LACAWAC	7/17/90	GILL	DAY	NET 5	YP	307	321	1.11
LACAWAC	7/17/90	GILL	DAY	NET 5	GS	128	21	1.00
LACAWAC	7/17/90	GILL	DAY	NET 5	GS	153	35	0.98
LACAWAC	7/17/90	GILL	DAY	NET 5	PS	97	17	1.86
LACAWAC	7/17/90	GILL	DAY	NET 5	PS	220	216	2.03
LACAWAC	7/17/90	GILL	DAY	NET 5	SMB	245	196	1.33
LACAWAC	7/17/90	GILL	DAY	NET 5	SMB	355	488	1.09
LACAWAC	7/17/90	GILL	DAY	NET 6	PS	188	134	2.02
LACAWAC	7/17/90	GILL	DAY	NET 6	PS	198	167	2.15
LACAWAC	7/17/90	GILL	DAY	NET 6	PS	201	160	1.97
LACAWAC	7/17/90	GILL	DAY	NET 6	PS	202	146	1.77
LACAWAC	7/17/90	GILL	DAY	NET 6	PS	219	204	1.94
LACAWAC	7/17/90	GILL	DAY	NET 6	SMB	111	16	1.17
LACAWAC	7/17/90	GILL	DAY	NET 6	SMB	146	36	1.16
LACAWAC	7/17/90	GILL	DAY	NET 6	SMB	193	90	1.25
LACAWAC	7/17/90	GILL	DAY	NET 6	SMB	273	207	1.02
LACAWAC	7/17/90	TRAP	DAY	NET 2	BG	74	8	1.97
LACAWAC	7/17/90	TRAP	DAY	NET 2	BG	243	306	2.13
LACAWAC	7/17/90	TRAP	DAY	NET 2	PS	213	197	2.04
LACAWAC	7/17/90	TRAP	DAY	NET 2	LMB	106	14	1.18
LACAWAC	7/17/90	TRAP	DAY	NET 2	BB	360	728	1.56
LACAWAC	7/17/90	TRAP	DAY	NET 2	SMB	107	16	1.31
LACAWAC	7/17/90	TRAP	DAY	NET 2	SMB	330	427	1.19
LACAWAC	7/17/90	TRAP	DAY	NET 2	CP	412	287	0.41

POCONO COMPARATIVE LAKES PROGRAM FISH SURVEY - DATA SHEET

SUMMARY OF FISH COLLECTED IN LAKE LACAWAC (23.9 kg total)

FISH SPECIES	NUMBER	LENGTH (mm)		MASS (g)		% of TOTAL MASS
		Mean	STD	Mean	STD	
Pumpkinseed	36	200	29	165	56	25
Smallmouth bass	21	250	82	238	177	21
Yellow perch	16	302	26	316	67	21
Bluegill	15	179	45	130	77	8
Chain pickerel	8	430	22	395	80	13
Largemouth bass	6	219	86	204	163	5
Golden shiner	6	131	14	22	8	1
Rock bass	3	194	41	167	12	2
Brown bullhead	2	297	90	463	375	4

Total Effort: 12 12-hr gill nets and 3 12-hr trap nets