LAKE LACAWAC

REPORT ON LIMNOLOGICAL CONDITIONS IN 1989

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POCONO COMPARATIVE LAKES PROGRAM

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INTRODUCTION

Personnel from Lehigh University sampled Lake Lacawac on 12 dates between 1 June and 31 December, 1989 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.

The present report summarizes conditions in Lake Lacawac during 1989. Physical or 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 liter) averaged over the entire water column.

The Lacawac Sanctuary plays a major role in the PCLP program as the field laboratory and summer residence for the investigators. We especially appreciate the interest and cheerful assistance of its curator, Sally Jones.

1989 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 most of the macrozooplankton samples from Lake Lacawac, including all of the nighttime samples. A. McDuff Sheehy counted daytime samples from June and July. Paul Stutzman and Karen checked the zooplankton data entries. Robert Moeller and Janet Hiscock analyzed chlorophyll samples. Gina Novak entered the physical/chemical data, which Robert Moeller checked.

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 included with the 1990 report.

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 nighttime 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 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. Units are degrees Celsius. Accuracy should be within 1 degree.

Figure 1 shows the thermal stratification that develops during late spring and summer, then breaks down in the autumn. On day 184 (3 July) stratification was well developed, producing an upper warm water layer circulating in contact with the atmosphere (the **EPILIMNION**, 0-2 meters, temperature 25 °C); an intermediate layer of rapid temperature decrease with depth (the **METALIMNION**, 2-6 meters); and a deep layer of cold water (the **HYPOLIMNION**, 6-13 meters, temperature 8-11 °C).

The usual course of thermal stratification is that of slow, gradual thickening of an epilimnion during the summer. By day 252 (9 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 "turnover", was in progress by day 316 (12 November). The lake would have cooled further, close to 4 °C, before freezing.

The thermal stratification existing on any date dictated the depths from which other samples were collected. Water samples for **pH**, **alkalinity**, **chlorophyll**, and **algae** were collected from mid-depths of the three layers when thermal stratification was well developed. During fall turnover, the lake was divided into three equal layers. Under ice-cover (e.g. 27 December), the topmost layer was 0-1m, and the remaining depths were divided at the Secchi depth (see **SECCHI DEPTH** below).

LIGHT PENETRATION

Light intensity at 1-meter intervals was calculated as a percentage of the light just below the lake surface (10 cm). Three slightly different methods were used to construct a 0-12 m profile of light penetration (method numbers correspond to codes from data tables):

Method 9. A Protomatic™ submersible selenium-cell photometer, with hemispheric diffusion dome, calibrated in foot-candles. Replicate profiles were obtained and averaged when the sky brightness varied because of clouds.
Method 10. A Licor™ submersible flat-plate sensor filtered to give a quantal response to photosynthetically available radiation ("PAR"), reading μEinsteins/m^2.sec. Profiles were obtained as in method 9.
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 three dates **(Figure 2)**. During the summer, depths above 3.5 m (i.e. all of the epilimnion) received at least 10% of the light penetrating the lake surface. The metalimnion received 0.5-10% of surface light, enough for at least low rates of algal growth. During autumn turnover light penetration was only slightly decreased, though the total amount of light entering the lake would have been decreasing seasonally.

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 depth was typically about 4 meters (13 feet) **(Figure 3)**. The lake was slightly clearer in early July (Secchi depth of 5.5 meters) and again during October.

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.

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 depths greater than 11 meters on day 184 (3 July) or greater than 7 meters on day 252 (9 September) in **Figure 4**, should be treated as true zeros.

The onset of thermal stratification in mid-spring marked the onset of gradual depletion of oxygen within the hypolimnion. By day 184 (3 July) the hypolimnion was anoxic below 11 meters **(Figure 4)**. By day 252 (9 September) the hypolimnion was anoxic throughout, and partial deoxygenation was evident within the metalimnion. Oxygen content of the epilimnion in summer was maintained near atmospheric saturation. During turnover the water column was progressively recharged with oxygen; on day 316 (12 November), early in the turnover period, the oxygen content at 10 meters (ca. 8 mg/L) was only 70% of the saturation level for that temperature (11 mg/L at 8.7 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 0.1 or 0.01 N sulfuric acid as titrant and monitoring pH change with an Orion™ model SA250 pH meter and Ross™ epoxy-body combination electrode. Alkalinity is reported in units of microequivalents per liter (μeq./L).

Method 9. Alkalinity was calculated from the volume of acid required to reach an a priori established pH of 5.2--established as the pH at the equivalence point for the typical Lacawac epilimnetic sample. This procedure was used for epilimnial or metalimnial samples when alkalinity was not inflated by anerobic processes and when the titration had not been continued far enough to give points in the pH 4.5-3.7 range for method 11.

Method 10. The equivalence point was estimated from the slope of pH plotted against volume of acid added. This procedure was occasionally used for hypolimnetic samples with high alkalinity--and therefore uncertain equivalence-point pH--when data points in the range pH 4.5-3.7 were not obtained. This means of identifying the equivalence point is imprecise in waters of such low alkalinity as Lake Lacawac, especially if data points are not numerous enough near the equivalence point.

Method 11. Titration points between pH 4.4 and 3.7 were plotted, after Gran transformation, to give alkalinity as the regressed intercept. This is currently our most precise, preferred method.

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. Values of pH reported are averages of values in 50-ml aliquots of sample with and without mixing, which had no consistent effect on readings.

Trends of pH are plotted for each layer in **Figure 5**. In the absence of intense biological activity, the pH of Lake Lacawac would be about 6.0 with an alkalinity of about 30 μeq./L (**Figure 6**), judging from values in late spring and late autumn. These values portray a very softwater lake.

During summer, pH of the epilimnion fluctuated from pH 6.1 to pH 6.6. Algal photosynthesis presumably forced pH up slightly. Microbial activities imposed a seasonal cycle to hypolimnetic pH: initially lower in early June (ca. 5.7), it rose to epilimnetic levels as the hypolimnion became anoxic, but declined again as the lake circulated during fall turnover and then slowly began a winter trend toward anoxia. Alkalinity increased dramatically in the hypolimnion during summer (**Figure 6**). This is a common reflection of anerobic microbial metabolism, with the alkalinity rapidly disappearing upon reoxidation of the chemical products of this metabolism as the water column circulated during fall turnover.

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 alkalinity. Samples were stored in 1-L polyethylene bottles for 2-24 hr (refrigerated in darkness) before being filtered (Gelman™ A/E filters) and frozen. Filters were ground in 90% basic acetone, extracted overnight at 2 °C in darkness, then centrifuged and read in a Sequoia-Turner™ model 112 fluorometer equipped with F4TB/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. Two values are presented: Chlorophyll-a corrected for pheopigments (**CHLAC** in data tables and **Figure 7**) and Chlorophyll-a including pheopigments (**CHLASUM** in data tables).

In Lake Lacawac, hypolimnetic samples taken after anoxia is established (late July through October) show a puzzling artifact. When the extracts are acidified, fluorescence increases instead of decreasing. Evidently an interference, probably a bacterial chlorophyll, is present. The values of total chlorophyll-a (see Tables) are consequently inflated, and the corrected chlorophyll-a is indeterminable by the method employed. Since microscopic examination reveals few if any live algae, the arbitrary assignment of "0" to corrected values of chlorophyll-a during this period (**Figure 7**) is not unreasonable, though certainly an underestimate.

Chlorophyll levels in Lake Lacawac (**Figure 7**) were characteristic of a moderately mesotrophic lake (1-8 μg/L in the epilimnion and the metalimnion). Metalimnetic values were consistently somewhat higher than epilimnetic values during summer stratification. Adequate light reached the mid-metalimnion to support algal growth, and algae growing under low-light conditions tend to contain higher concentrations of chlorophyll than those from light-saturated depths.

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 all of the frequently encountered zooplankton, identified to genus and sometimes to species (**Figures 8-33**). Several points can be highlighted:

(1) Although rotifers (included in "microzooplankton") were numerically abundant, by mass the larger "macrozooplankton" predominated, especially the Cladocera: in summer mainly *Holopedium gibberum*, in autumn mainly *Daphnia catawba*. In summer the cladocerans occurred in both the epilimnion and metalimnion, but avoided the anoxic hypolimnion. In the upper layers concentrations must have averaged ca. 10-15/L.

(2) The various rotifers displayed pronounced seasonalities, which differed among species. There were also pronounced differences in distribution among the three layers. Whole water-column densities were quite high in June (600-1200/L), but were lower in summer and autumn (ca. 300/L). August through September was a period of relatively low rotifer density (ca. 200/L).

(3) In general hard-bodied rotifers (e.g. *Keratella*), rotifers with swift escape reactions (e.g. *Polyarthra*), or colonial forms (e.g. *Conochilus*) were most common, perhaps implying heavy predation pressure. Several potential invertebrate predators occurred in Lacawac: the large dipteran *Chaoborus* (up to 0.5/L in early summer), the cyclopoid copepods *Cyclops scutifer* and *Mesocyclops edax* (1-2 adults/L in early summer), and the predatory cladoceran *Leptodora kindti* (a maximum of only 0.03/L in late summer).

(4) Calanoid copepods were represented by *Diaptomus minutus* (3-6/L in late spring and autumn), but these clearly played a subordinate role in the plankton community, especially during the summer.

(5) Conditions during fall turnover favored some zooplankton, including *Daphnia catawba* and *Diaptomus minutus*, which maintained relatively high population levels through December, when the lake froze over. Copepodids of *Cyclops scutifer* apparently reentered the water column in November after a summer diapause; copepodids reached 7/L even though adults had been virtually absent since the end of July.

EXPLANATION OF DATA TABLES

The following 12 tables present the physical/chemical information acquired on each date in 1989. 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 (#9,10,11,12: see **METHODS AND RESULTS**).

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

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

PHMETHOD: pH method #10 (see **METHODS AND RESULTS**).

CAMETHOD: Chlorophyll-a method (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--other data are merely repeated on rep 2 line for convenience in graphing.

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

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

OXYGEN: Dissolved oxygen (mg per liter).

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, JA	John Aufderheide
AC, ADC	Andy Chapman
SC, SRC	Scott Carpenter
JF, JMF	Janet Fischer
TH, TWH	Timothy Houck
SJJ, SJN	Sally Jones
DL, DML	Donna Lesch
REM	Robert Moeller
DS	McDuff Sheehy
MS, MLS	Marc Stifelman
CEW, CW	Craig Williamson

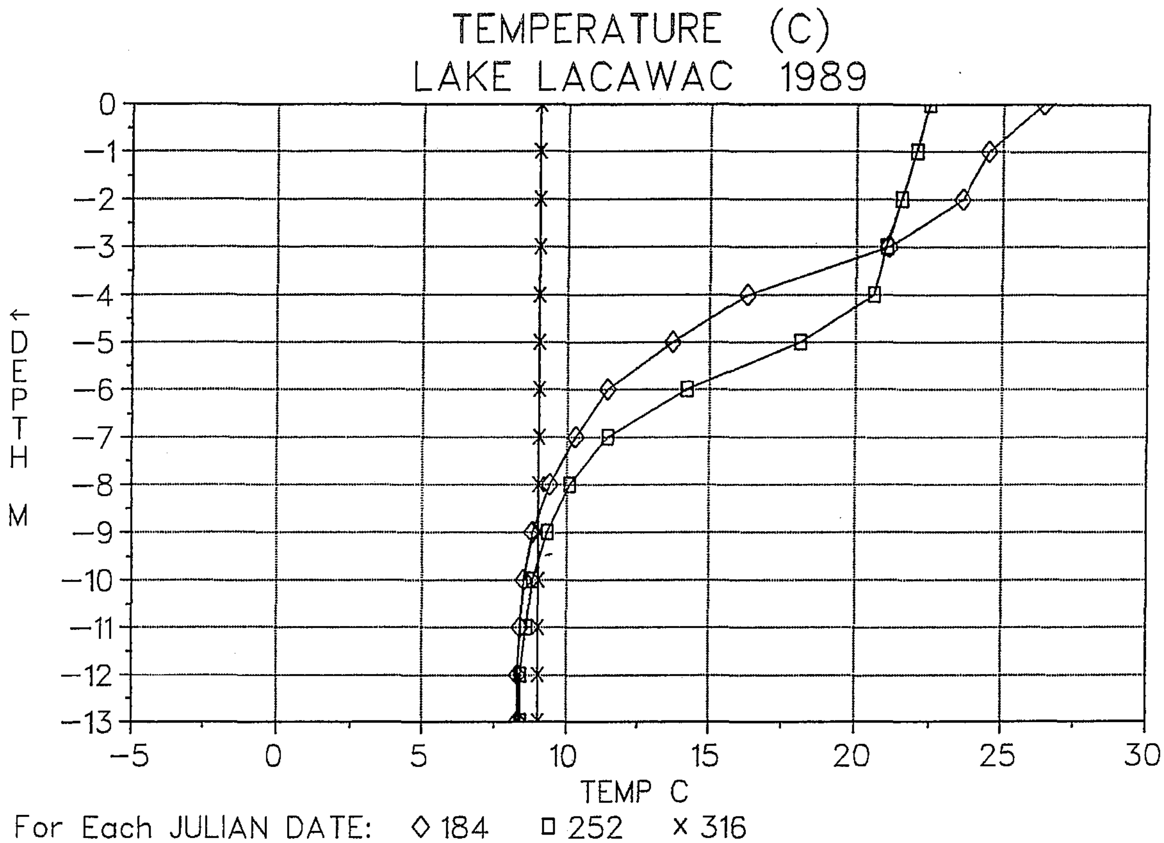


Figure 1. Temperature (degrees Celsius) in Lake Lacawac, 1989.

Values are plotted for three dates: **3 July** (day 184), **9 September** (day 252), **12 November** (day 316).

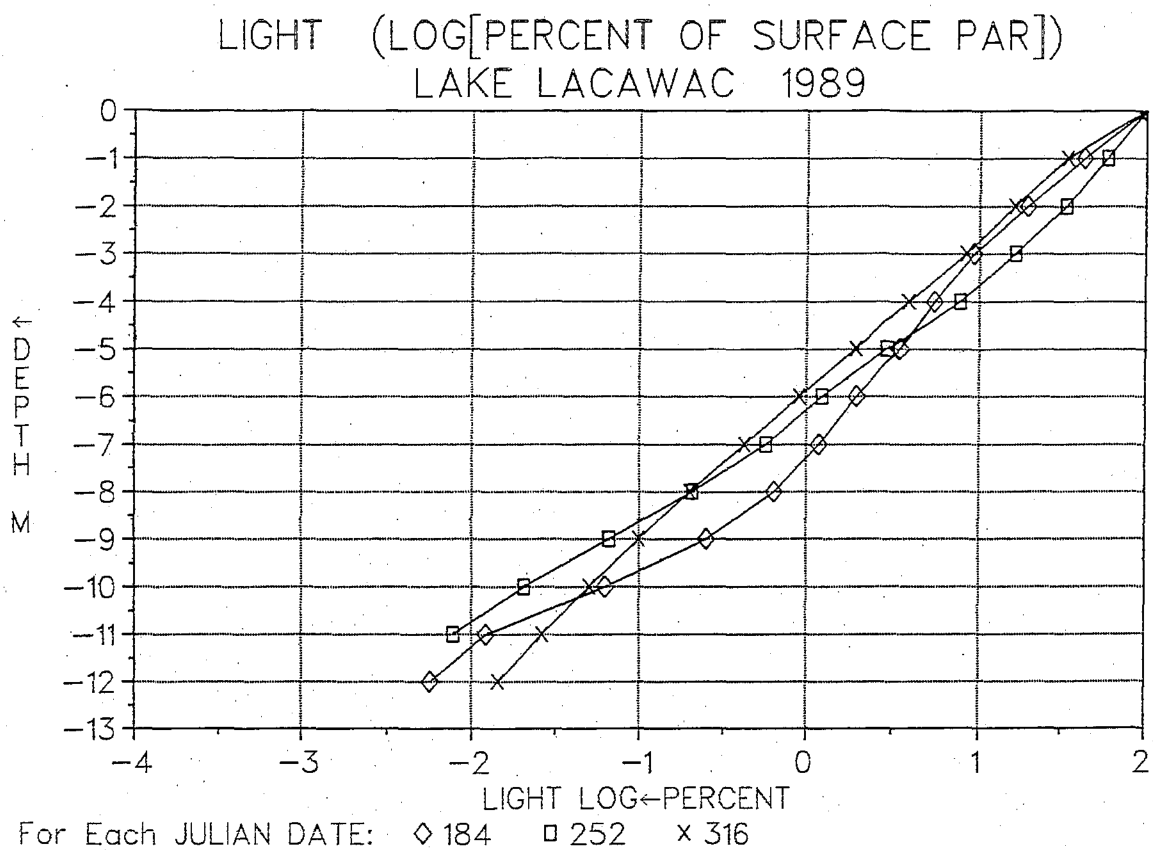


Figure 2. Light penetration in Lake Lacawac, 1989.

Values plotted for three dates: **3 July** (day 184), **9 September** (day 252), and **12 November** (day 316) 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.)

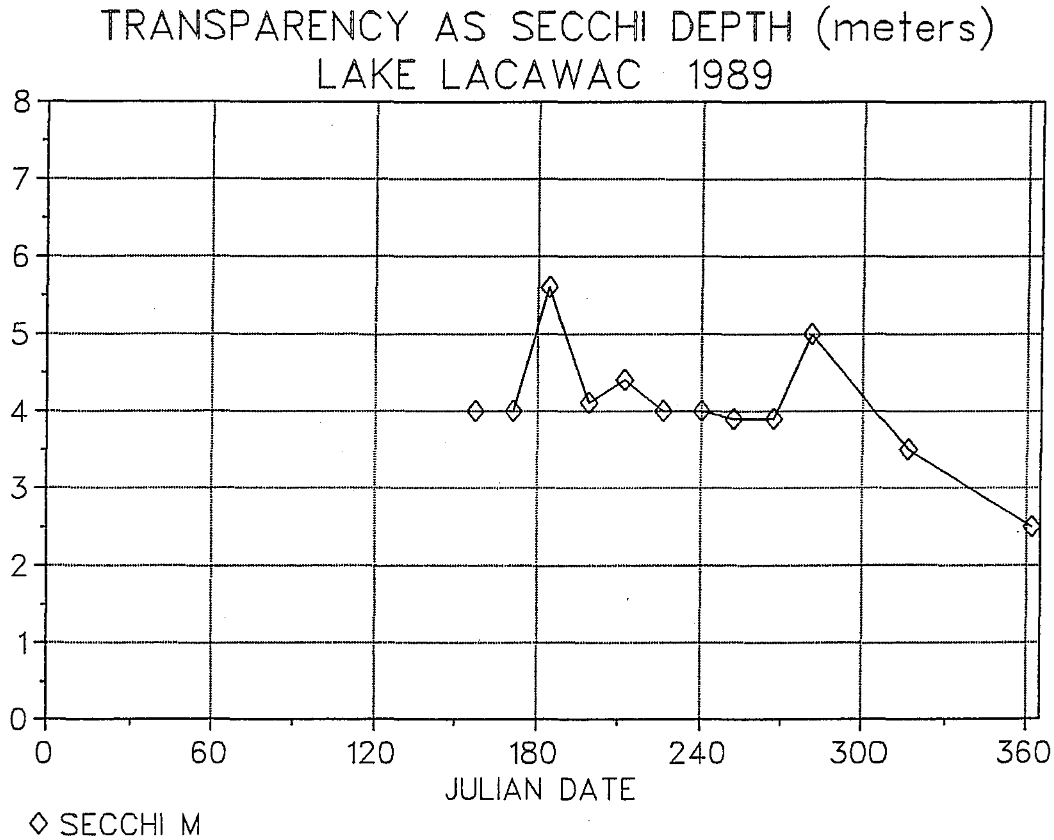


Figure 3. Transparency in Lake Lacawac, 1989.

Values plotted are the Secchi depths, in meters.

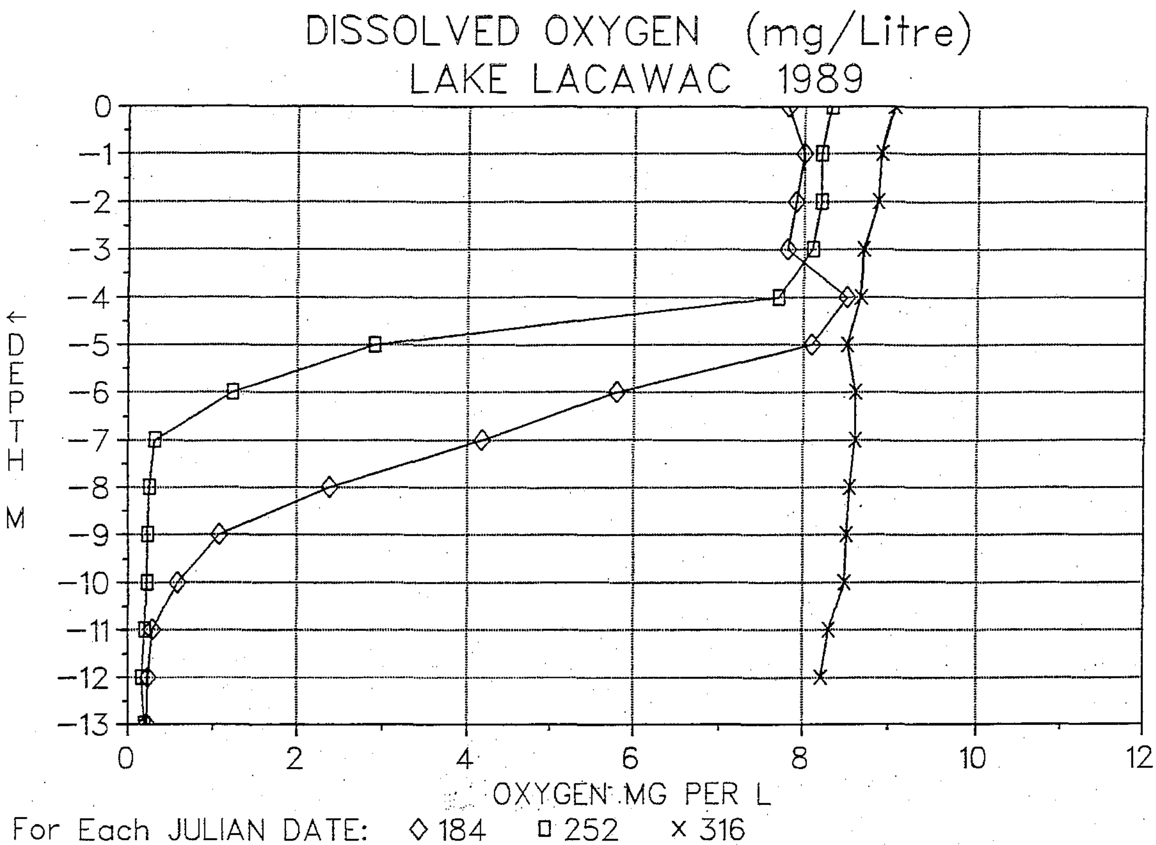


Figure 4. Dissolved oxygen in Lake Lacawac, 1989.

Values are plotted for three dates: **3 July** (day 184), **9 September** (day 252), and **12 November** (day 316). Residual hypolimnetic concentrations <0.4 mg/L on days 184 and 252 are really "0.0".

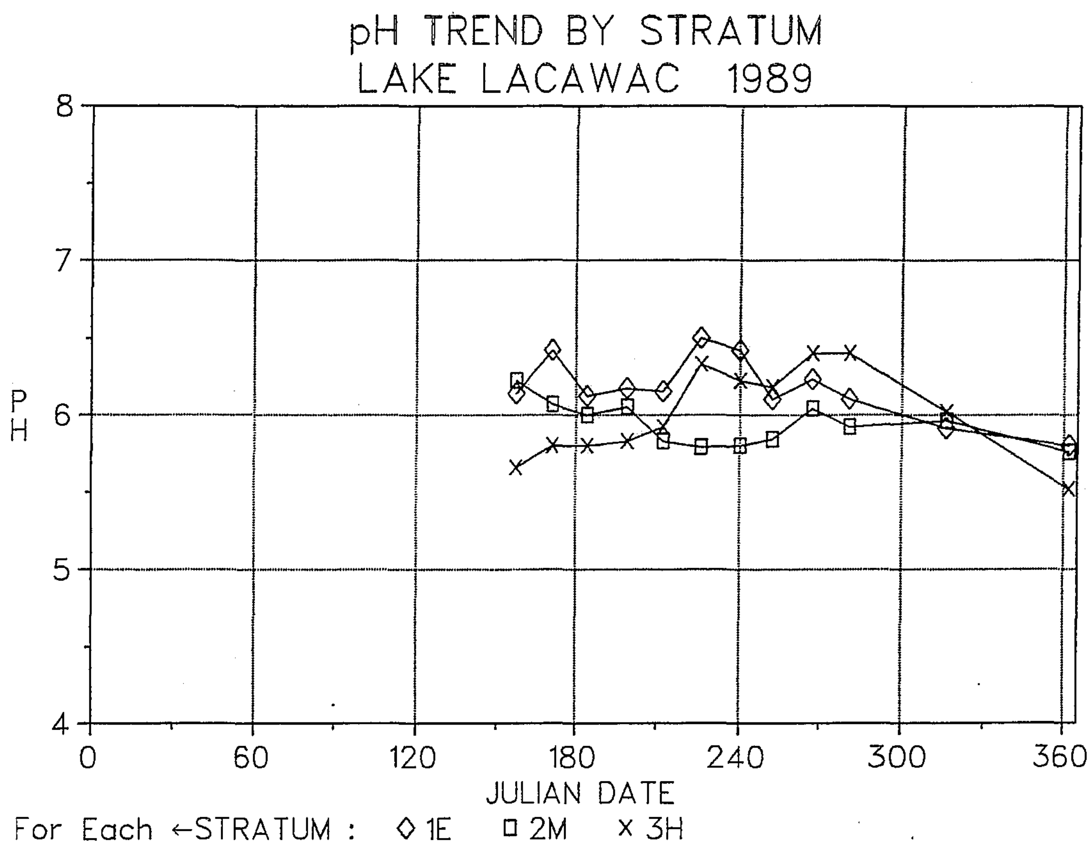


Figure 5. Trends of pH in Lake Lacawac, 1989.

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**.

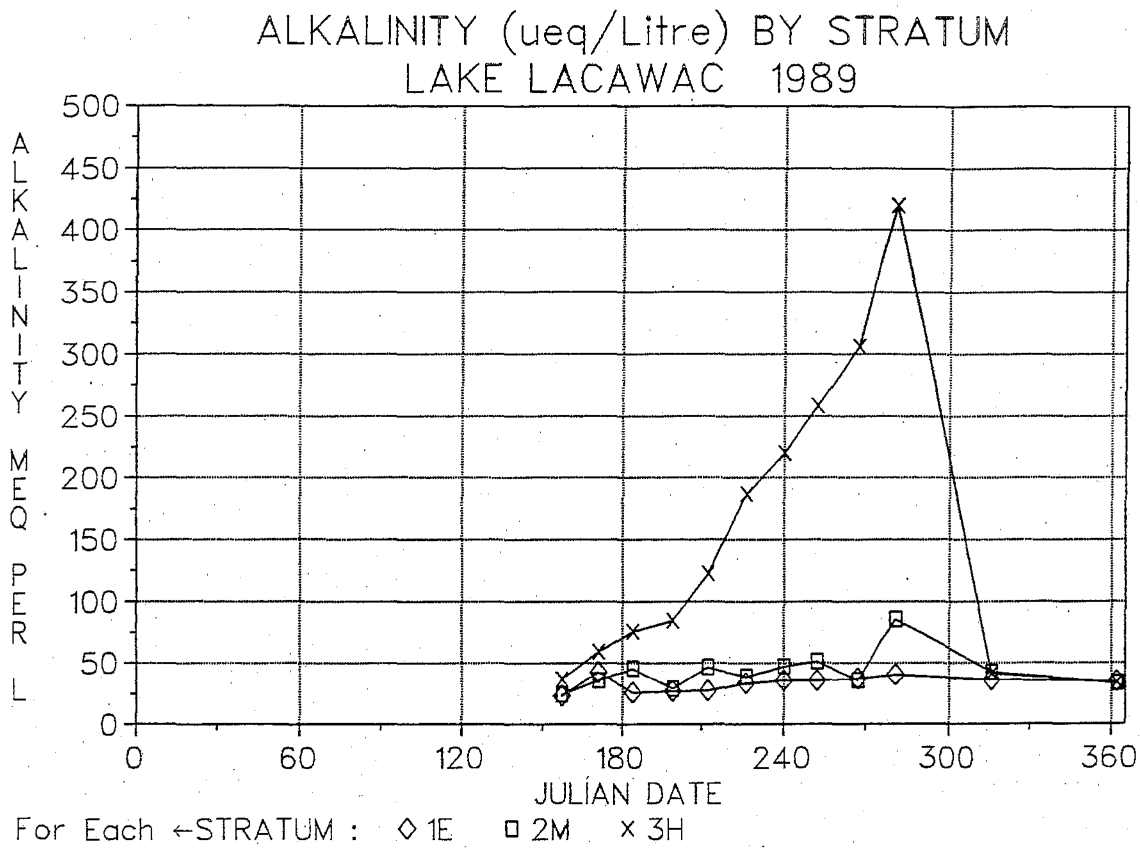


Figure 6. Trends of Alkalinity in Lake Lacawac, 1989.

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**.

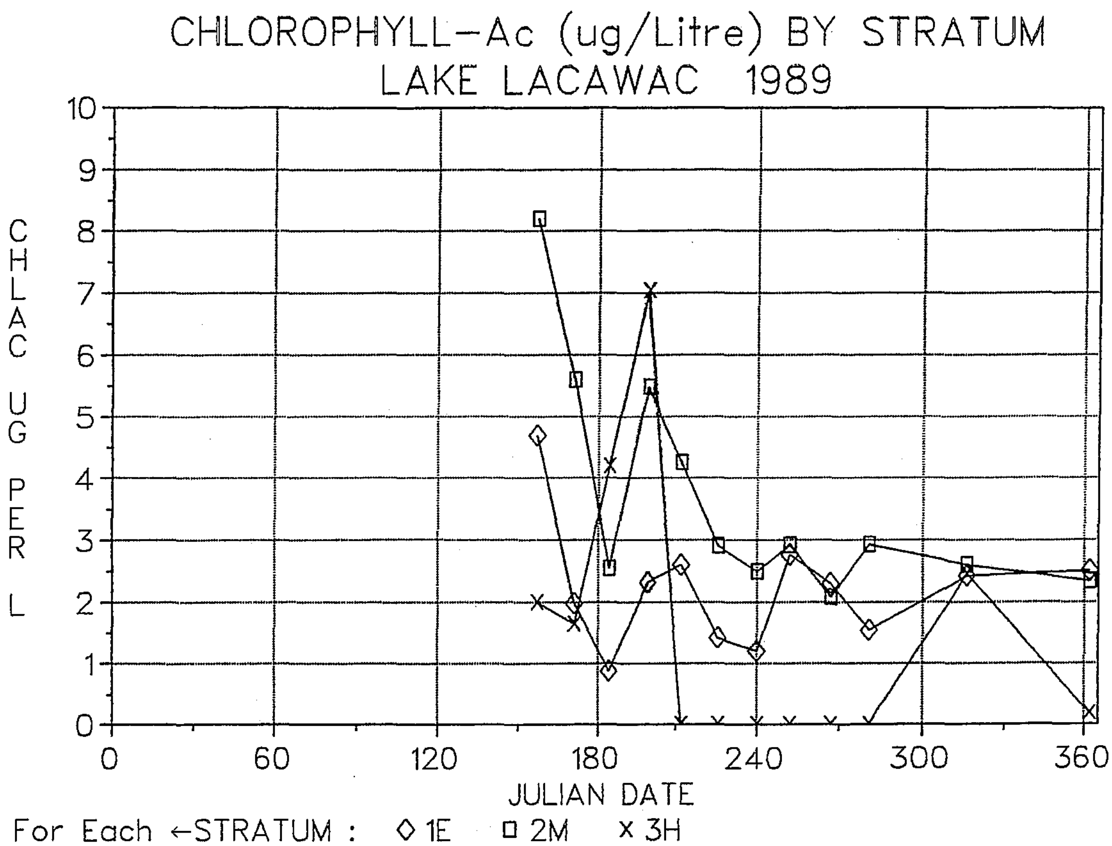
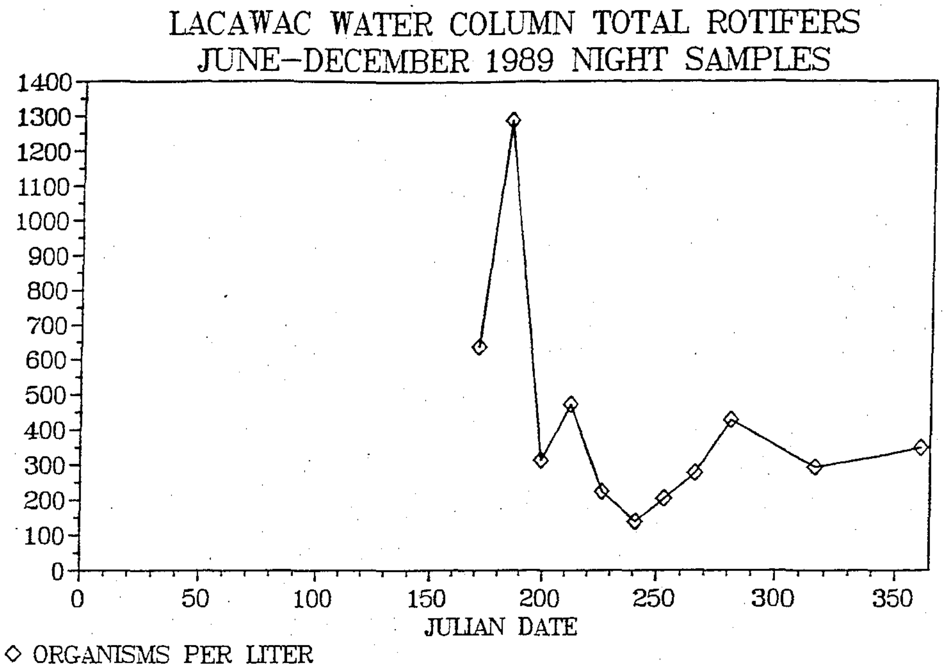


Figure 7. Trends of Chlorophyll-a in Lake Lacawac, 1989.

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" for late summer hypolimnial samples are underestimates caused by an interference in the fluorimetric analysis.



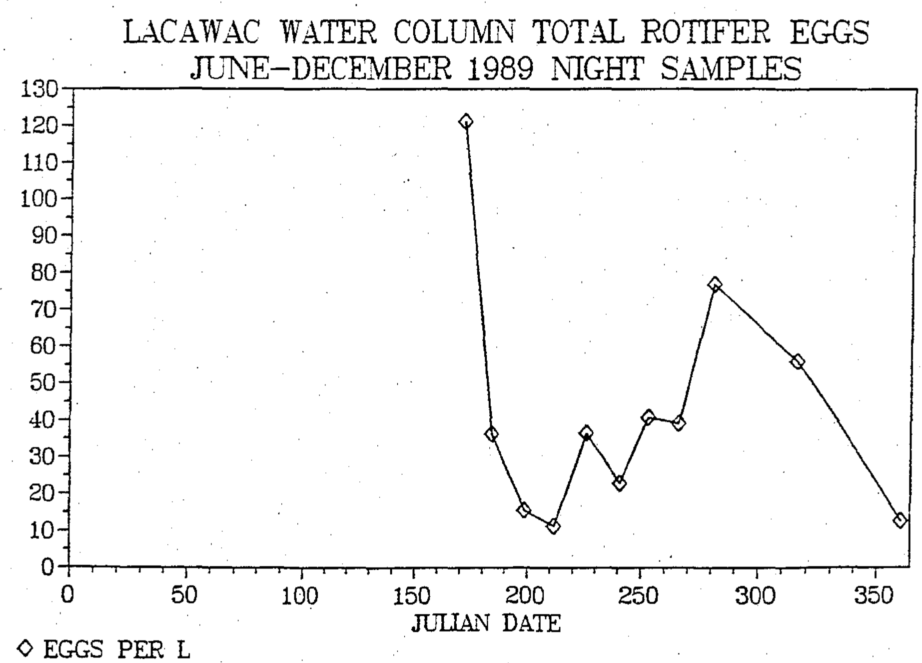


Figure 8. Rotifers in Lake Lacawac, 1989.

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.

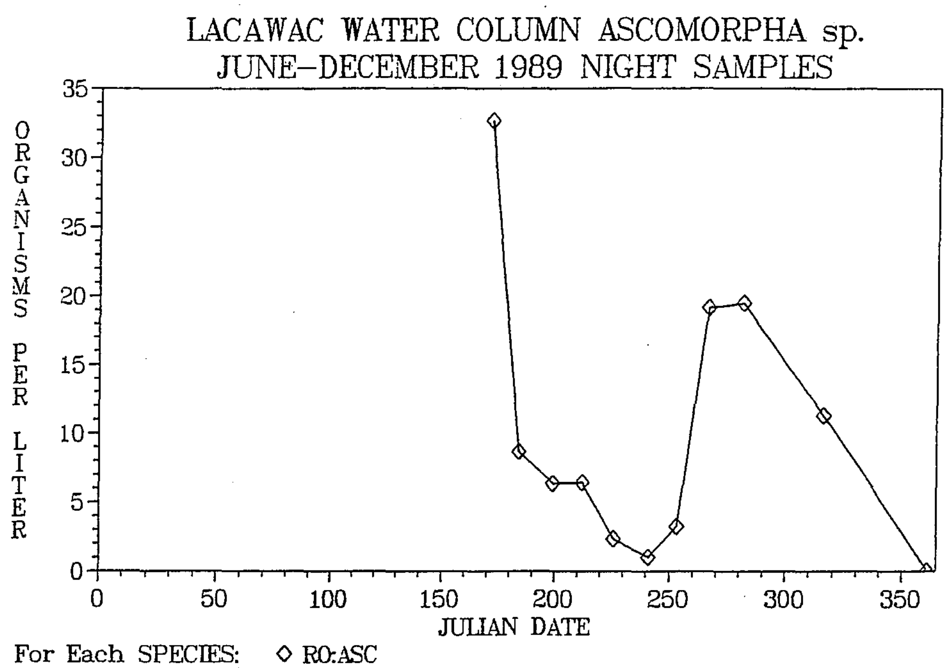


Figure 9. The rotifer *Ascomorpha* spp. in Lake Lacawac, 1989.

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

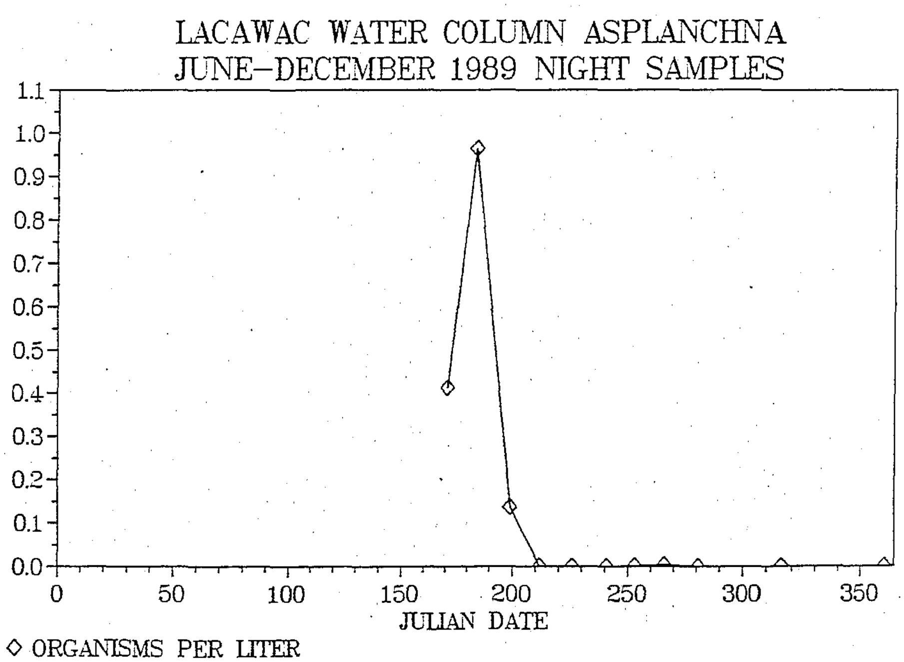


Figure 10. The rotifer *Asplanchna* spp. in Lake Lacawac, 1989.

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

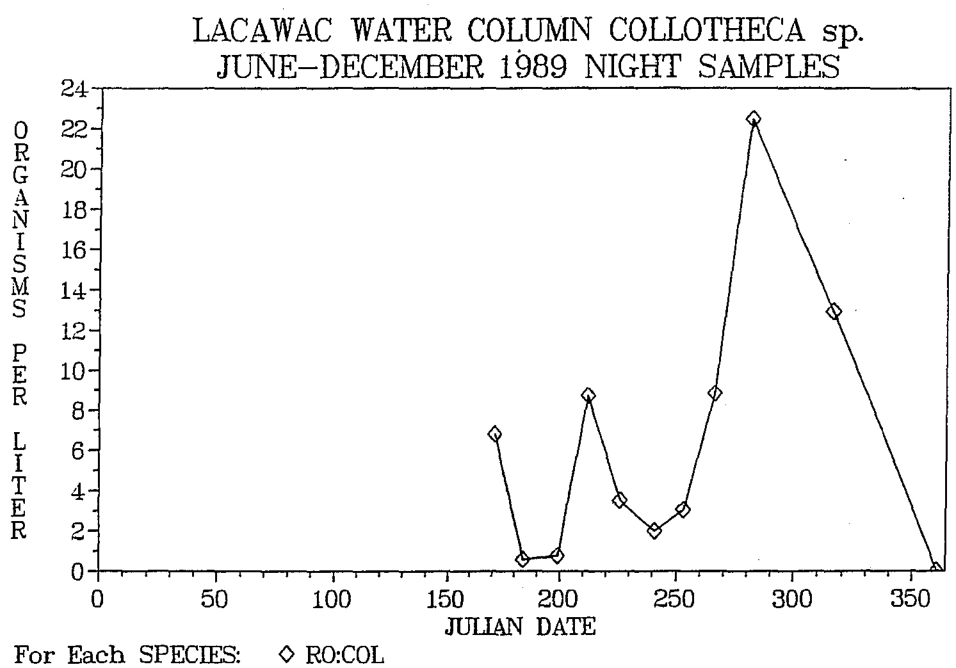


Figure 11. The rotifer *Collotheca* spp. in Lake Lacawac, 1989.

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

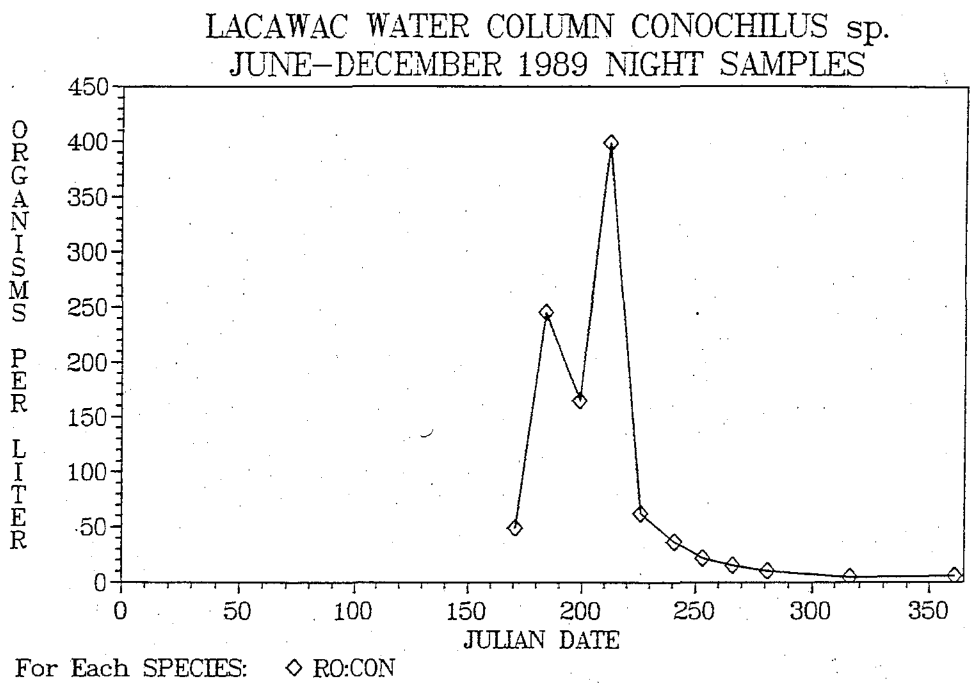


Figure 12. The rotifer *Conochilus* spp. in Lake Lacawac, 1989.

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

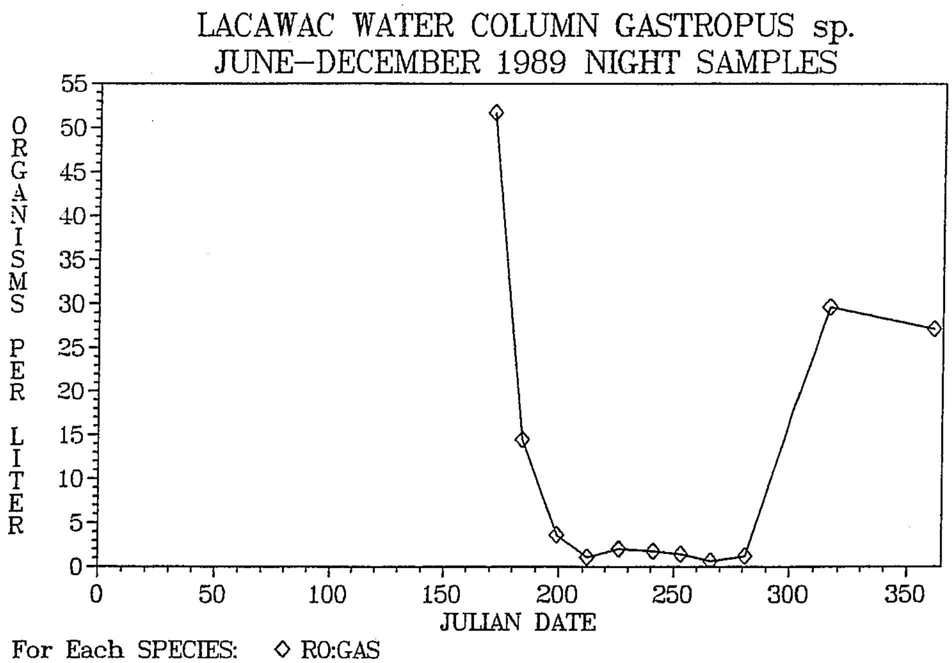
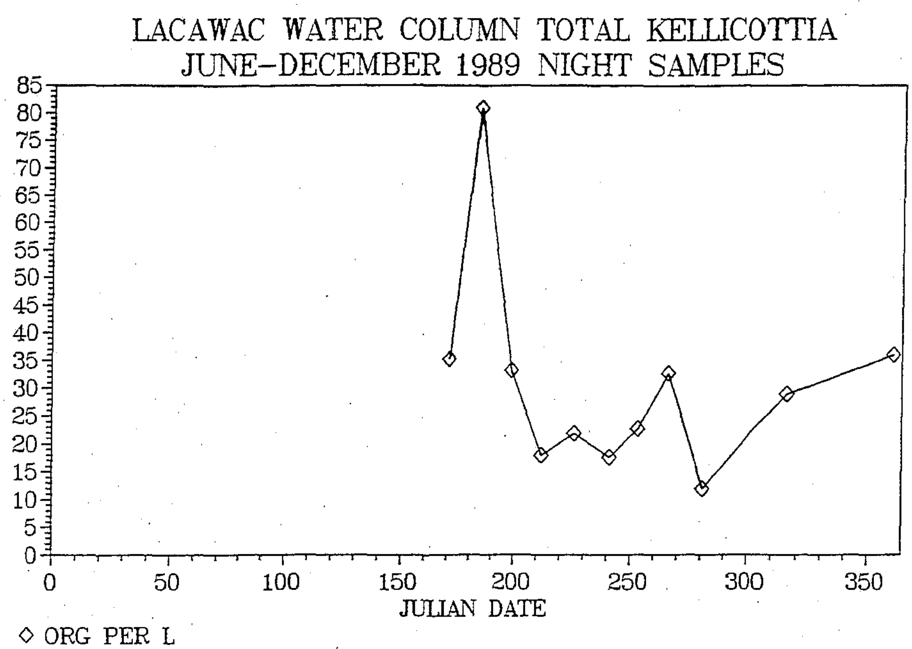


Figure 13. The rotifer *Gastropus* in Lake Lacawac, 1989.

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



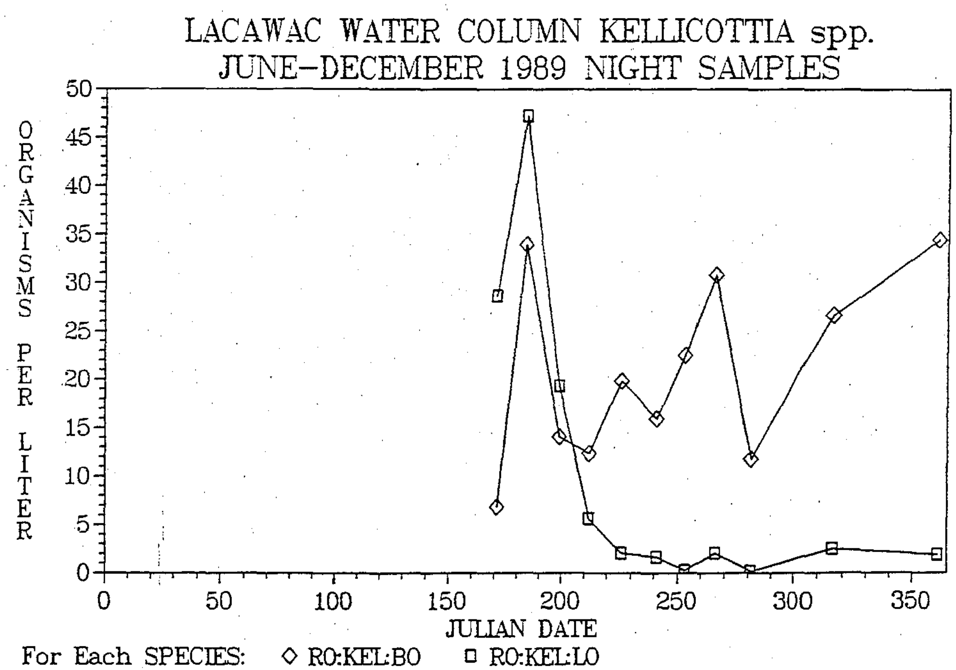
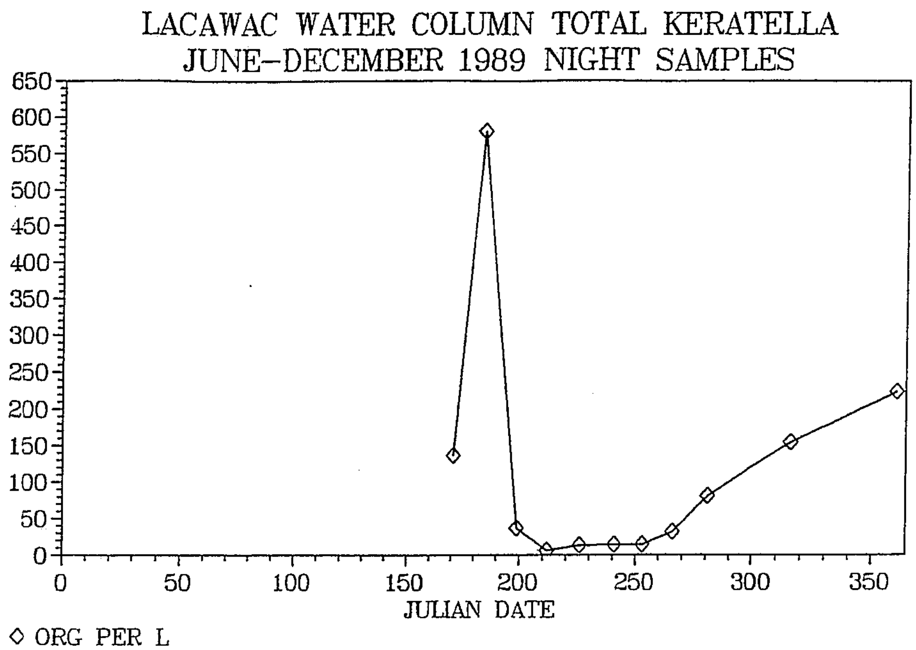


Figure 14. The rotifer *Kellicottia* spp. in Lake Lacawac, 1989.

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.*



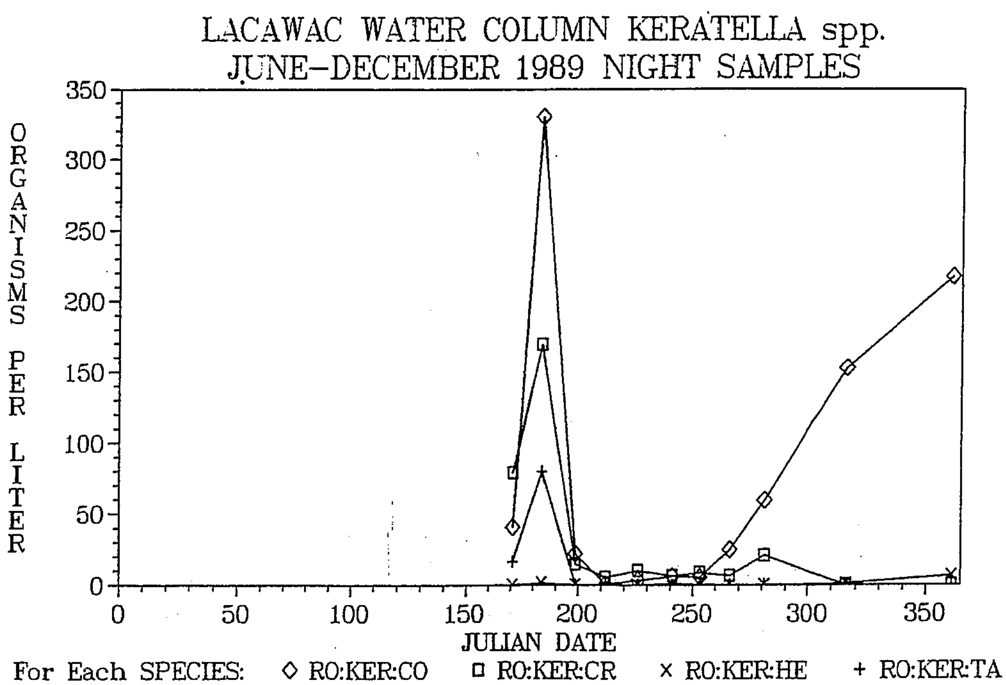


Figure 15. The rotifer *Keratella* spp. in Lake Lacawac, 1989.

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*, and **TA** *K. taurocephala*.

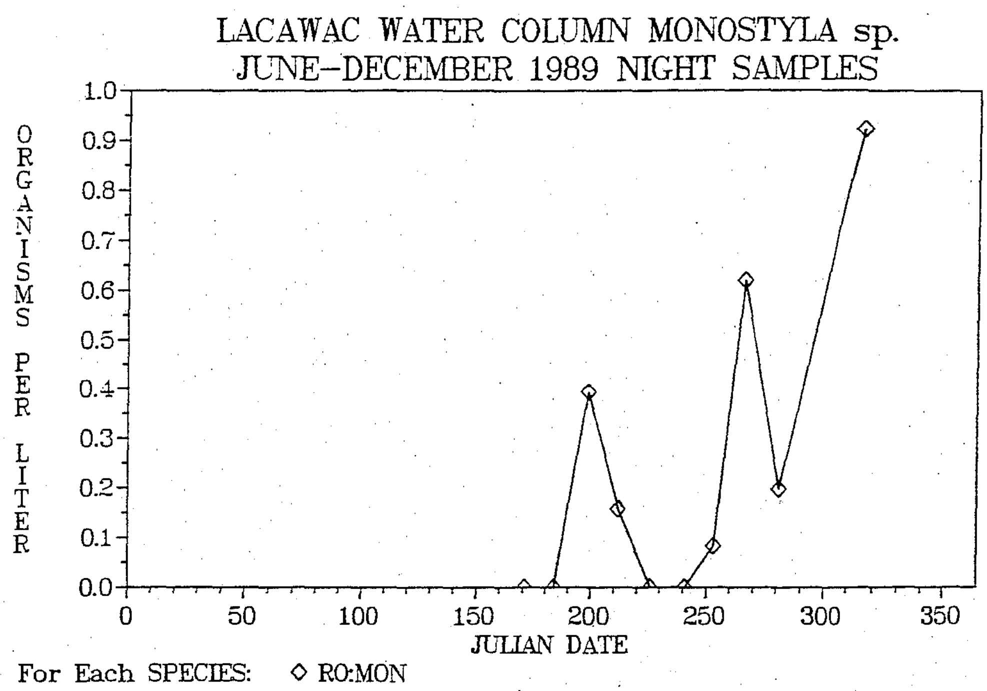


Figure 16. The rotifer *Monostyla* spp. in Lake Lacawac, 1989.

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

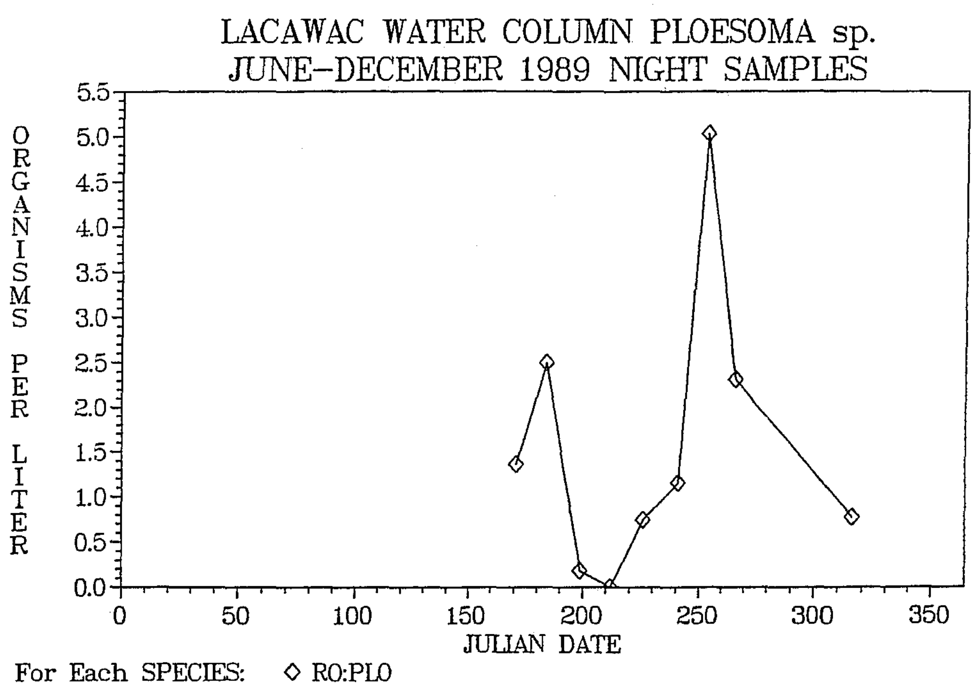
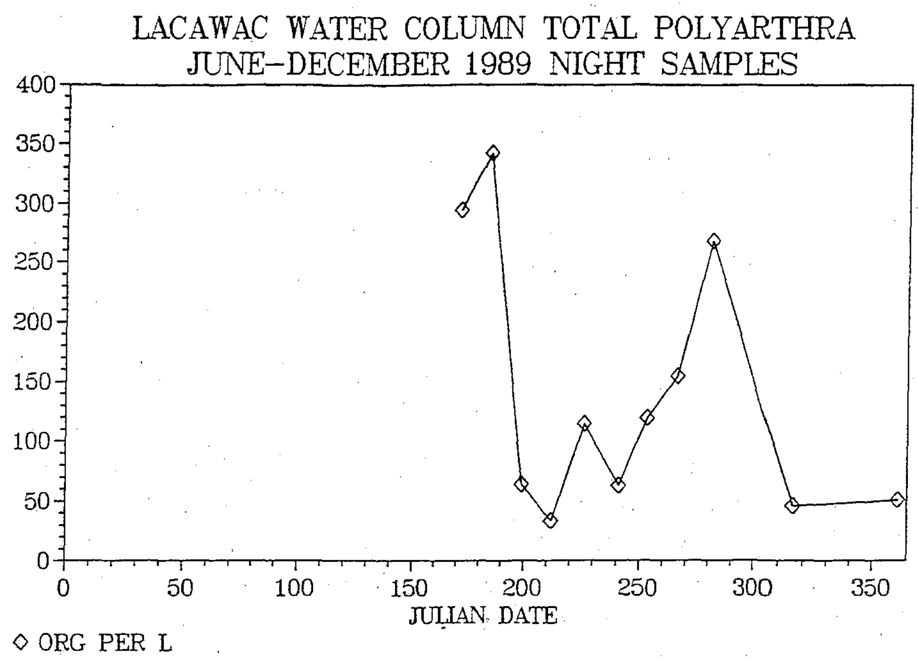


Figure 17. The rotifer *Ploesoma* spp. in Lake Lacawac, 1989.

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



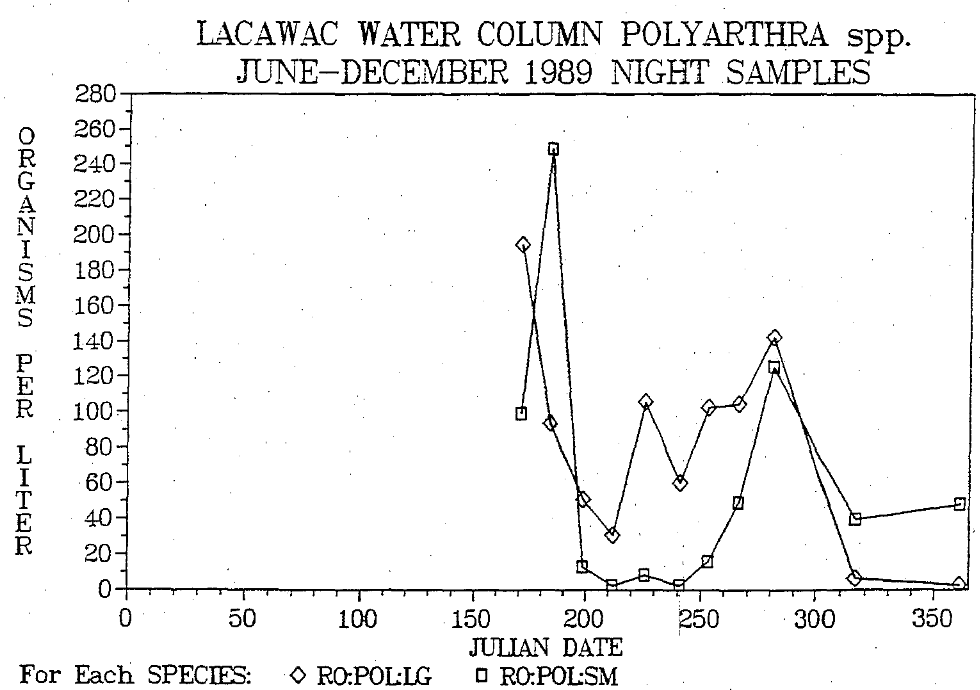


Figure 18. The rotifer *Polyarthra* spp. in Lake Lacawac, 1989.

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.

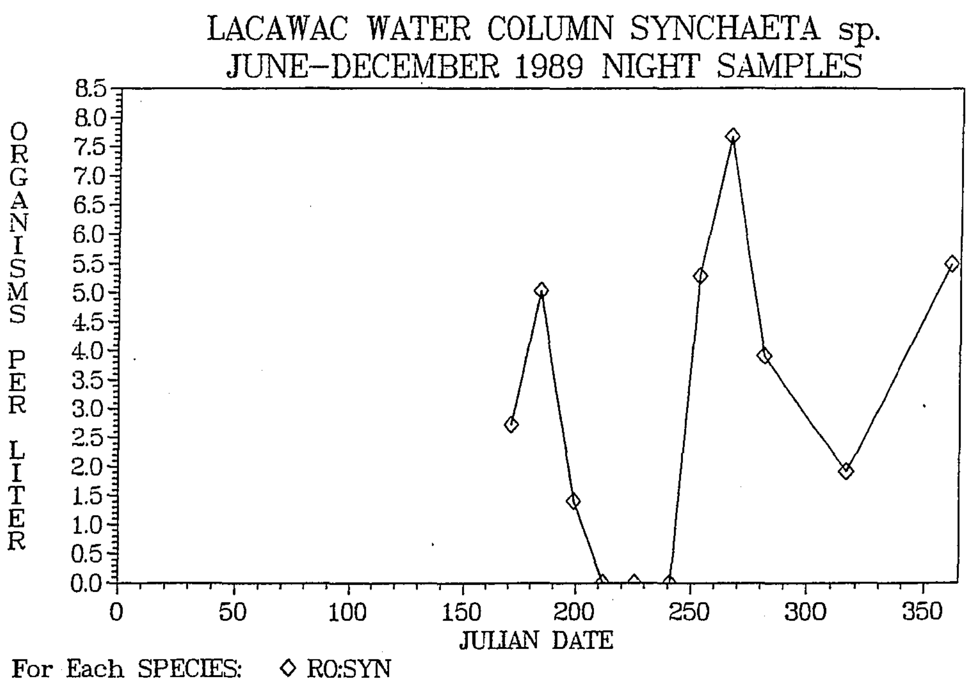
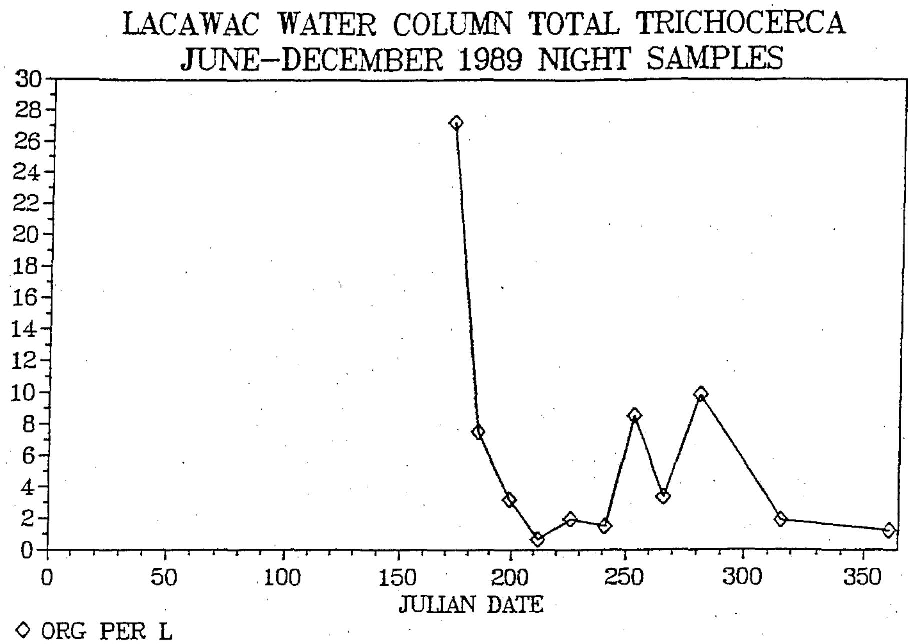


Figure 19. The rotifer *Synchaeta* spp. in Lake Lacawac, 1989.

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



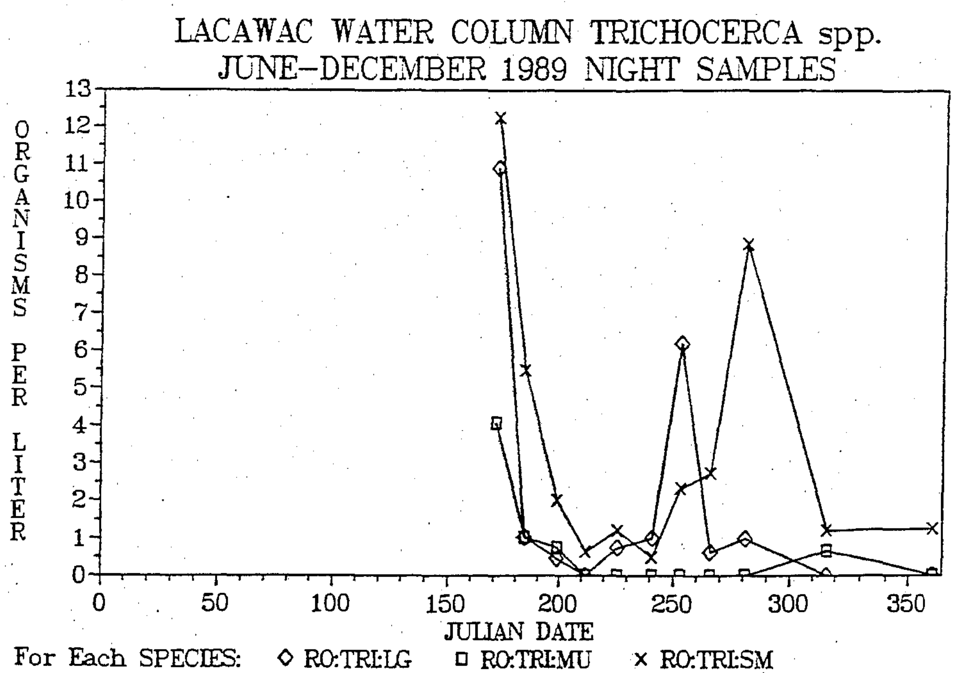


Figure 20. The rotifer *Trichocerca* spp. in Lake Lacawac, 1989.

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: **LG** large sp. (*T. cylindrica*), **MU** *T. multicrinus*, and **SM** small spp. (predominantly *T. similis*).

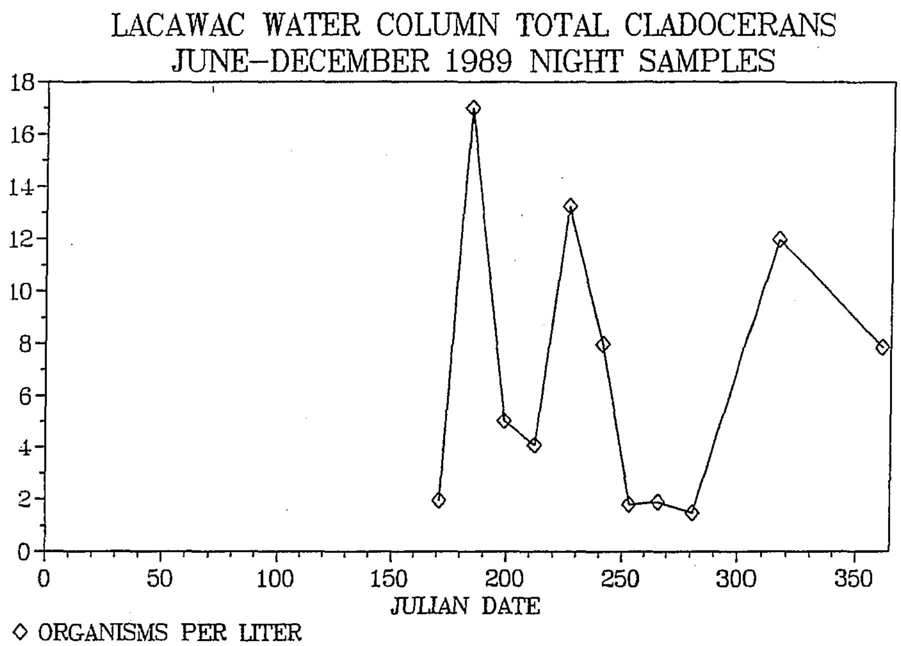
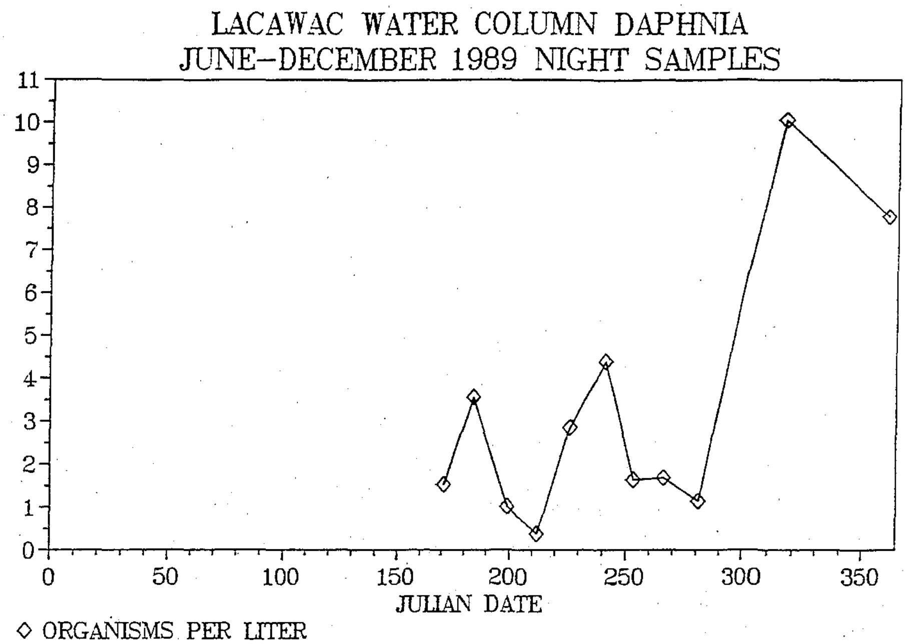


Figure 21. Cladocera in Lake Lacawac, 1989.

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



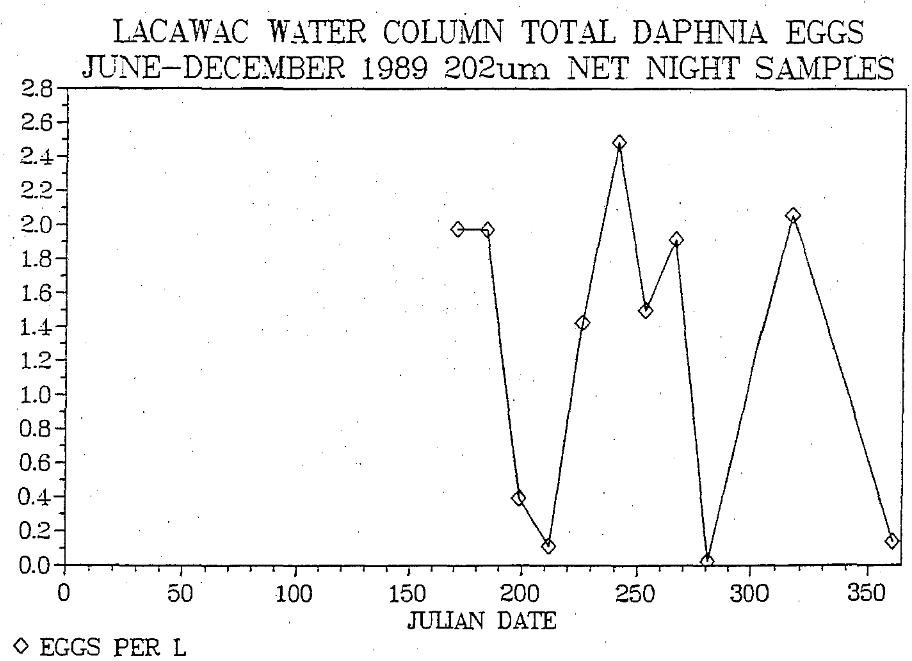
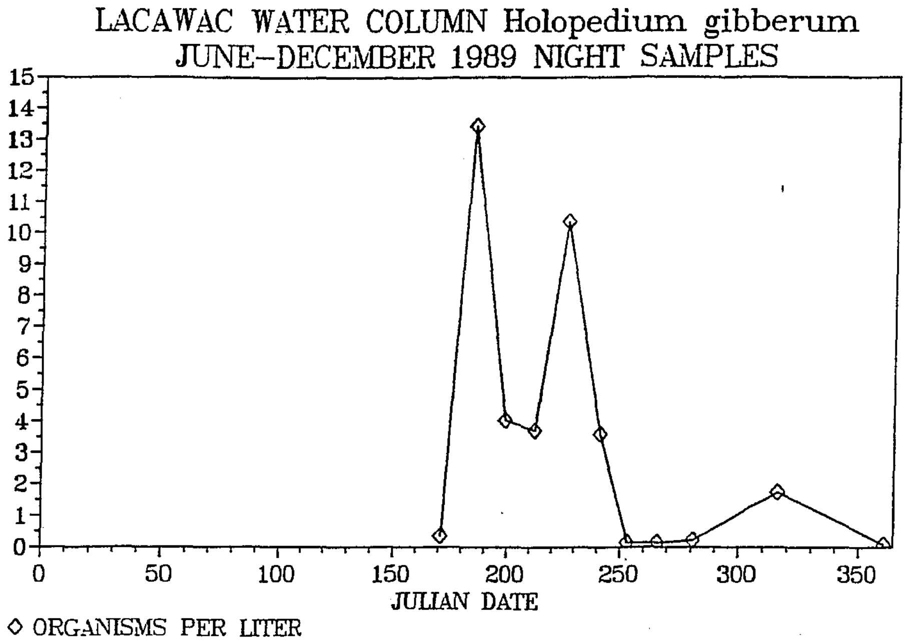


Figure 22. The cladoceran *Daphnia* spp. in Lake Lacawac, 1989.

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.



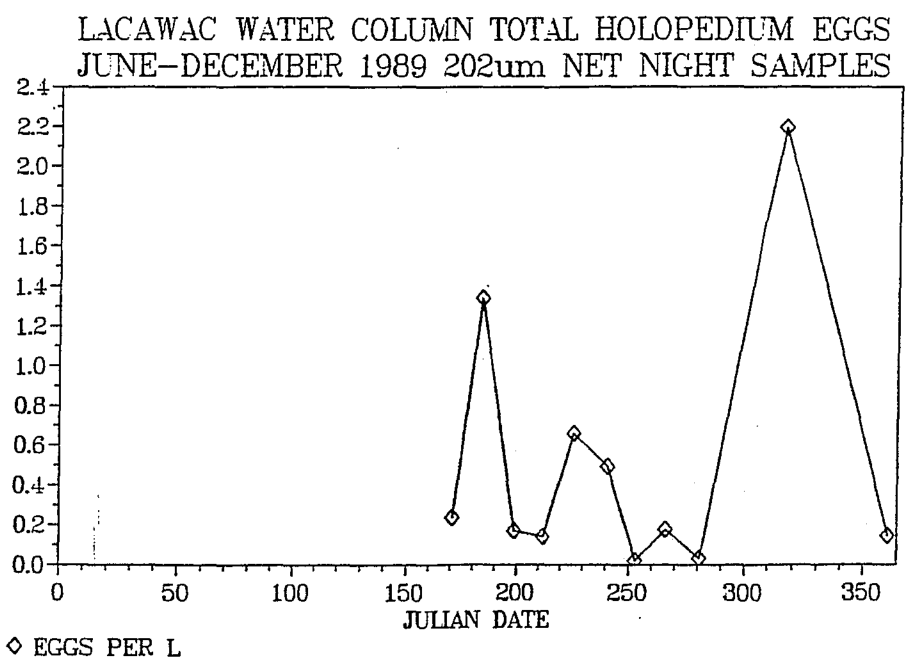


Figure 23. The cladoceran *Holopedium gibberum* in Lake Lacawac, 1989.

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.

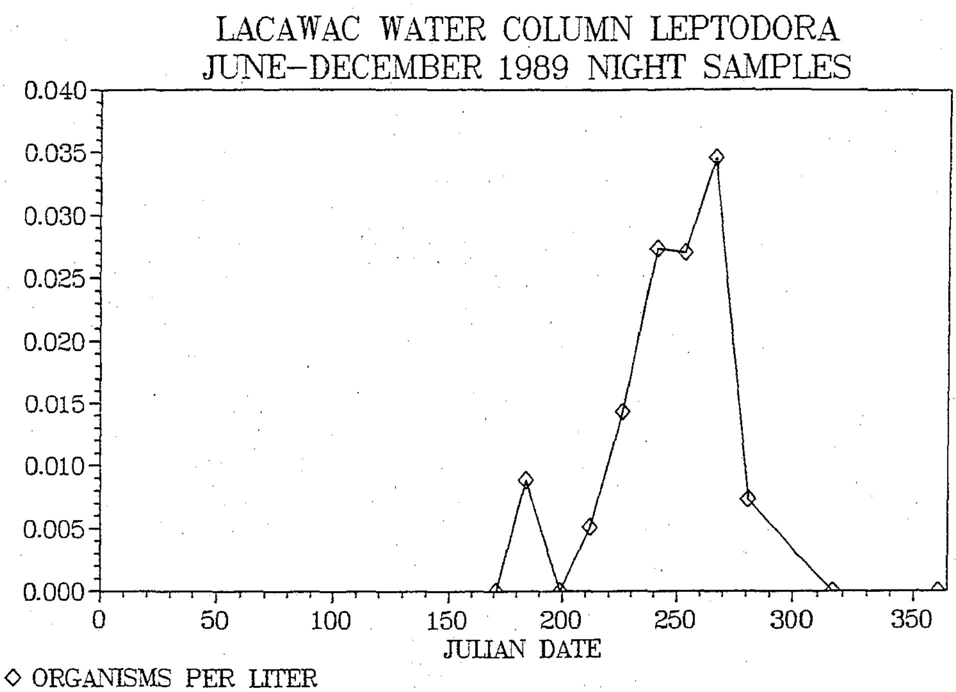
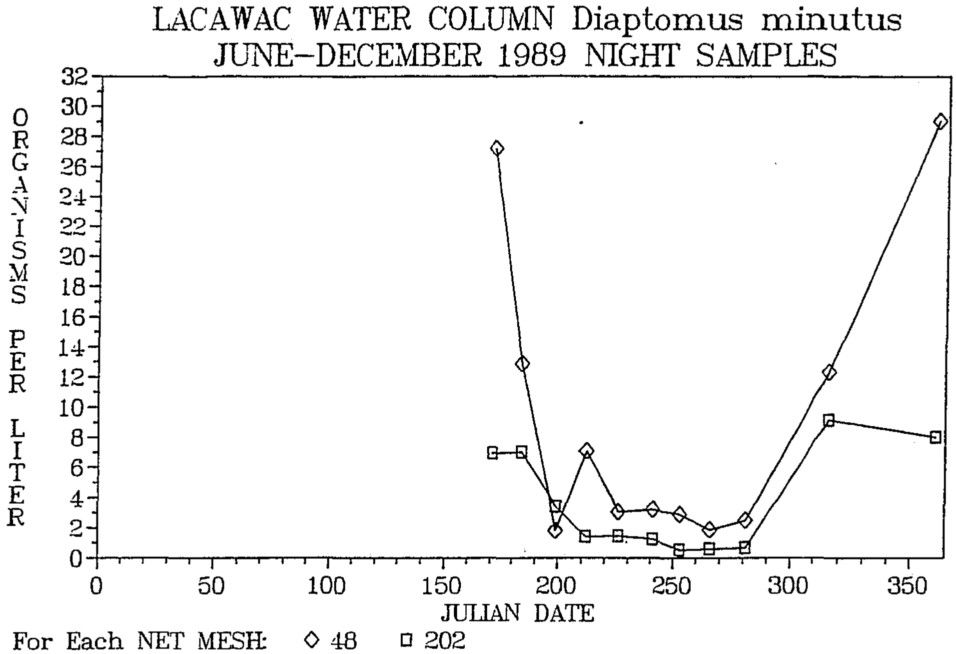


Figure 24. The cladoceran *Leptodora kindti* in Lake Lacawac, 1989.

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



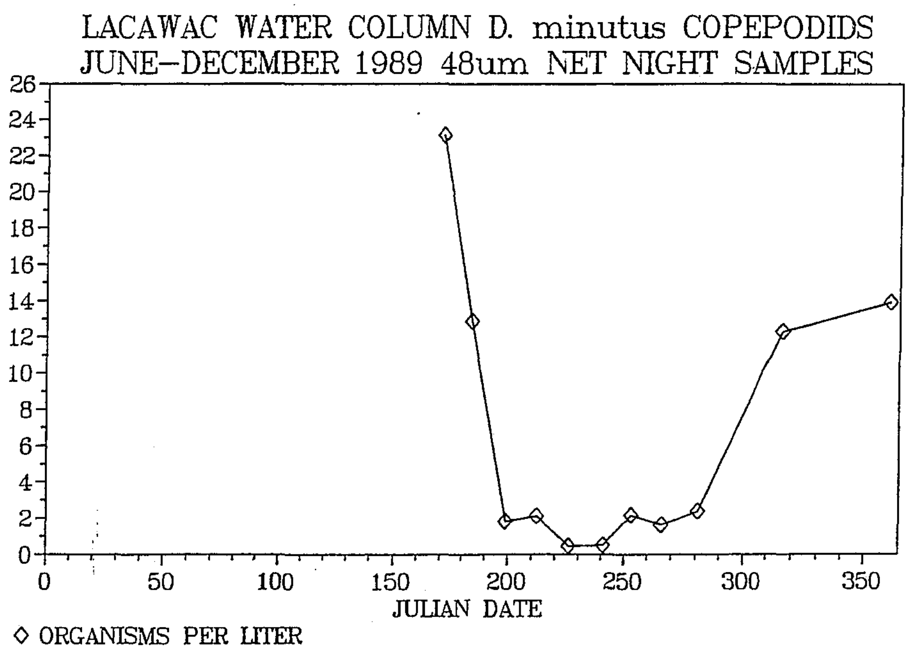
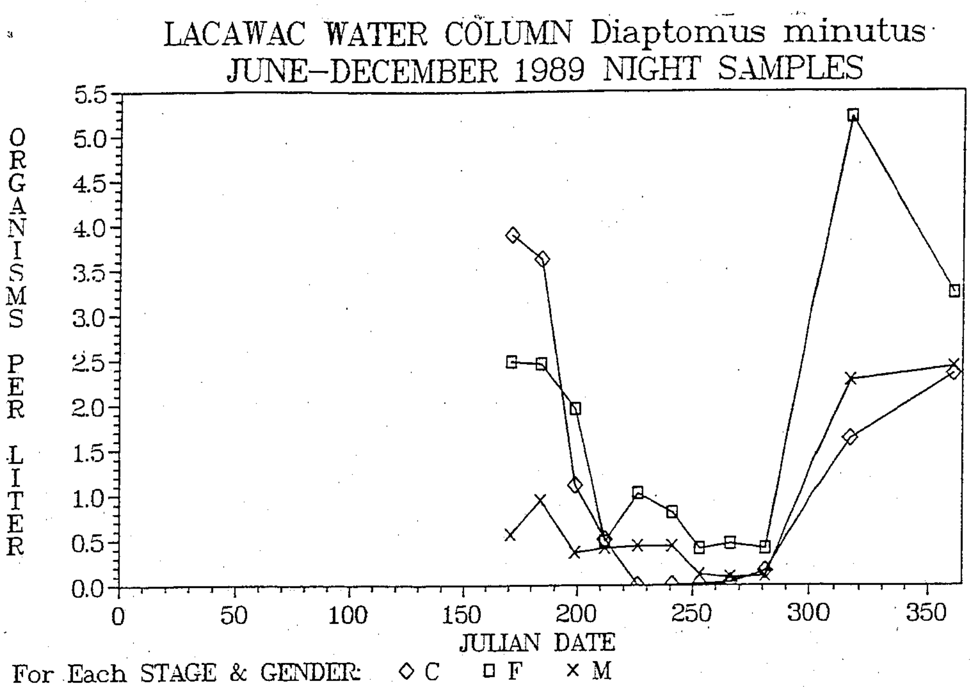


Figure 25. Calanoid copepods (*Diaptomus minutus*) in Lake Lacawac, 1989.

Nighttime net collections from three depths have been combined to give a water column mean. *D. minutus* was the only calanoid present. **(Top)** Total individuals per liter; the 48μm mesh net collects copepodids effectively, which the 202μm net does not. **(Bottom)** *D. minutus* copepodids from the 48μm net.



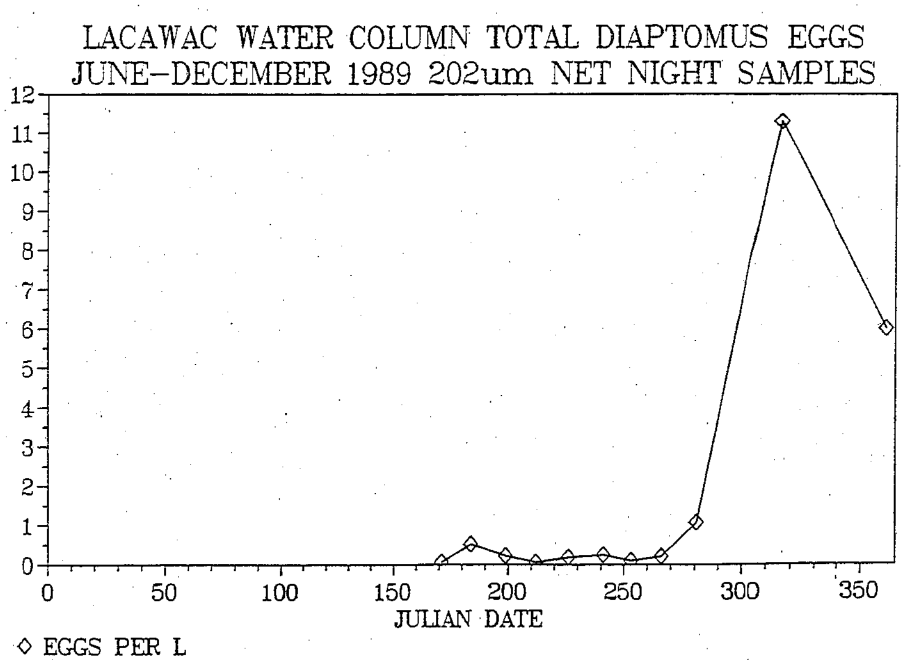
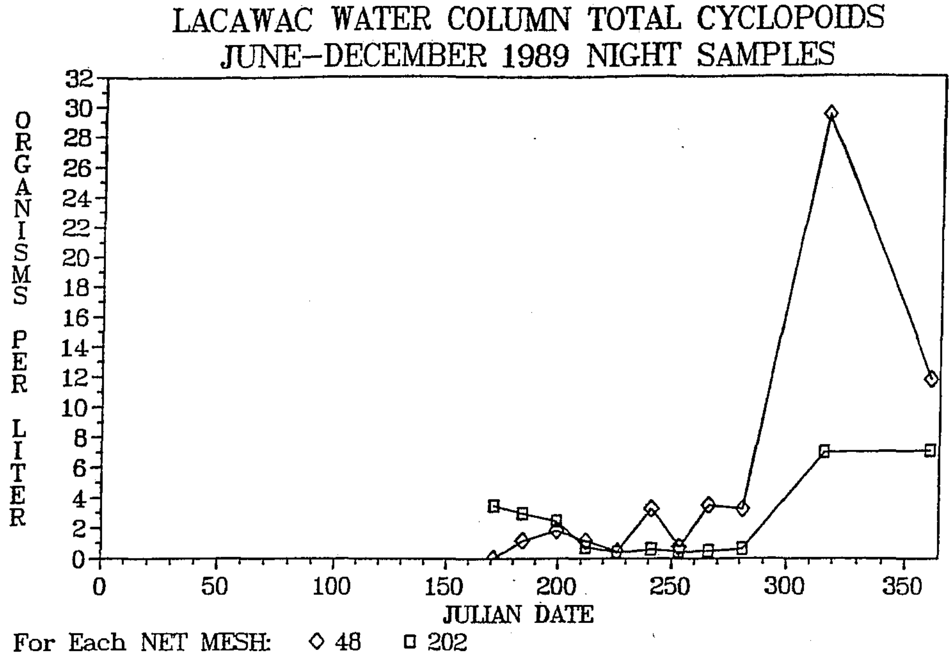


Figure 26. The calanoid copepod *Diaptomus minutus* in Lake Lacawac, 1989, by stage and gender.

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 from the 202μm net. **(Bottom)** *D. minutus* eggs per liter (202μm).



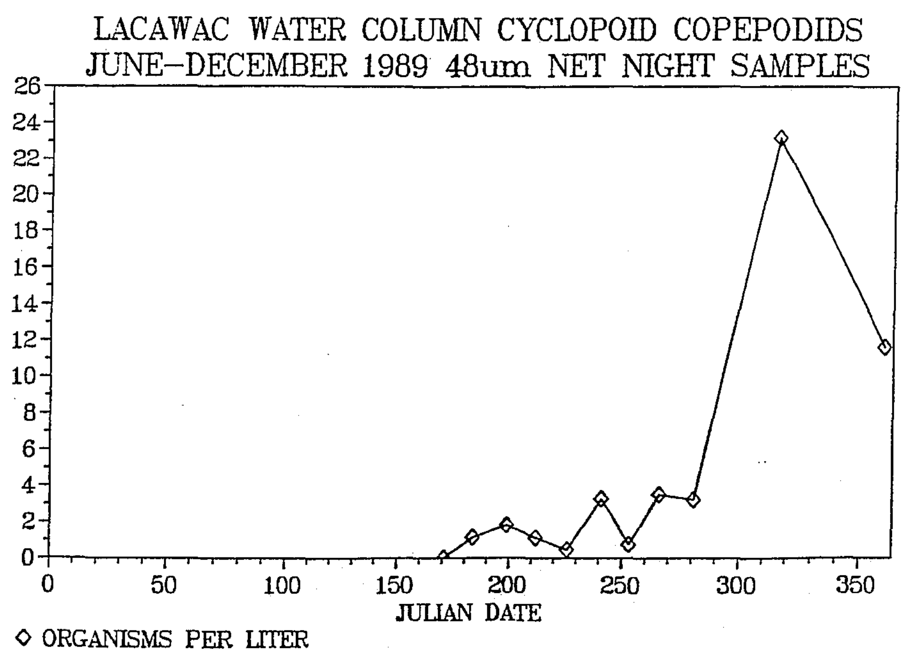


Figure 27. Cyclopoid copepods in Lake Lacawac, 1989.

Nighttime net collections from three depths have been combined to give a water column mean. **(Top)** Total individuals per liter. The 48μm net collects *Cyclops* and copepodids at a higher efficiency than the 202μm net. **(Bottom)** Total cyclopoid copepodids per liter (48μm).

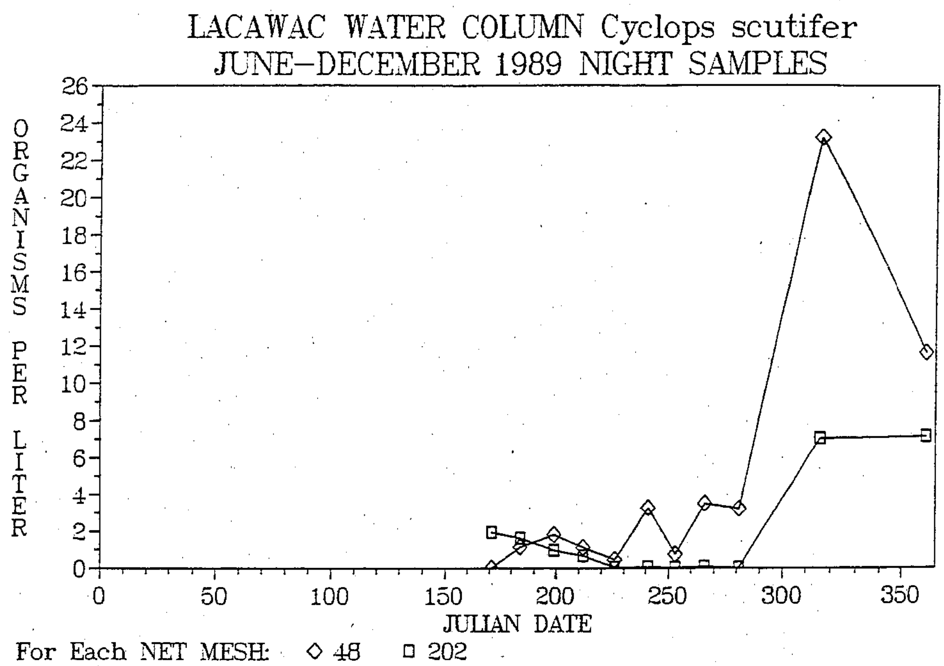
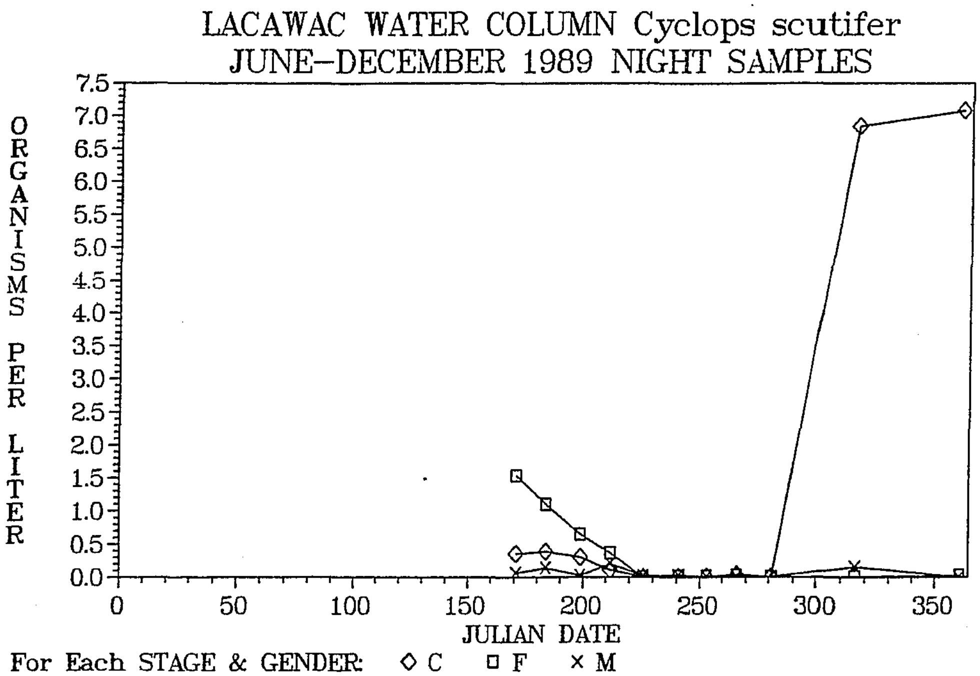


Figure 28. The cyclopoid copepod *Cyclops scutifer* in Lake Lacawac, 1989.

Nighttime net collections from three depths have been combined to give a water column mean. The 48μm net collects copepodids at a higher efficiency than the 202μm net.



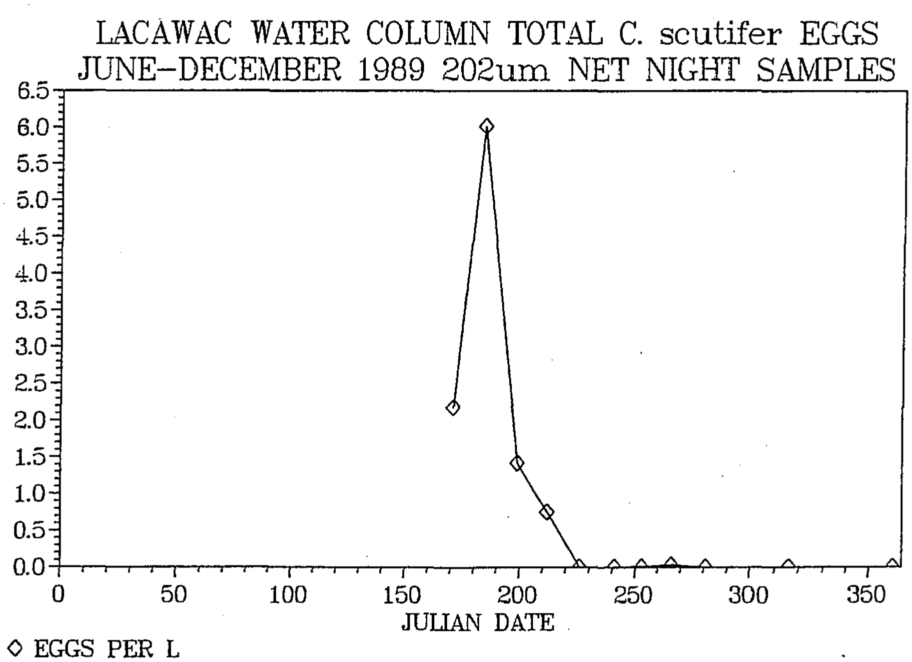


Figure 29. The cyclopoid copepod *Cyclops scutifer* in Lake Lacawac, 1989, by stage and gender.

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)** *C. scutifer* eggs per liter.

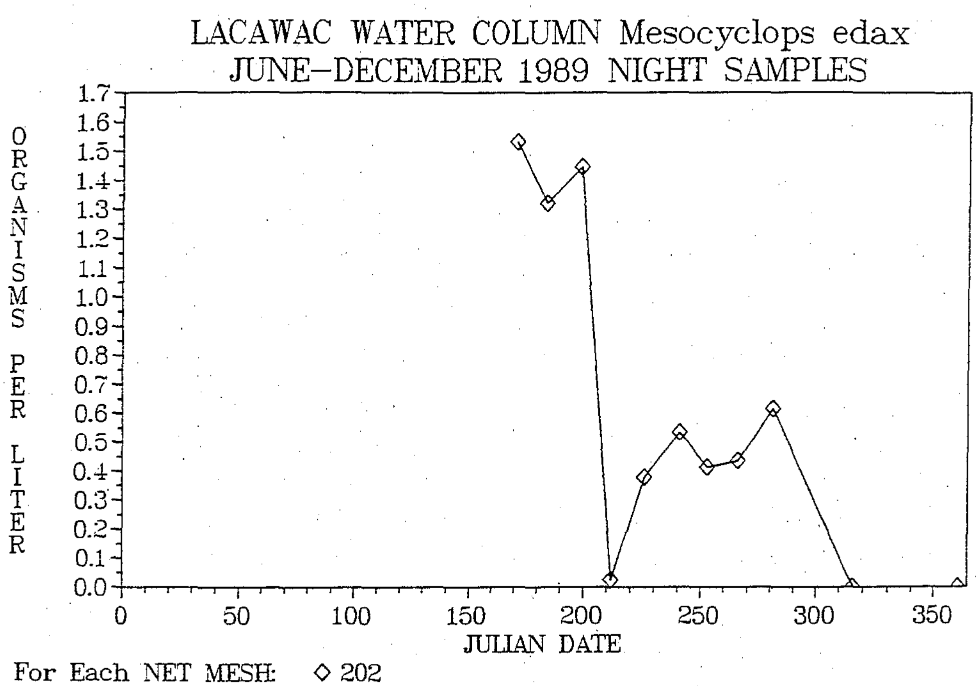
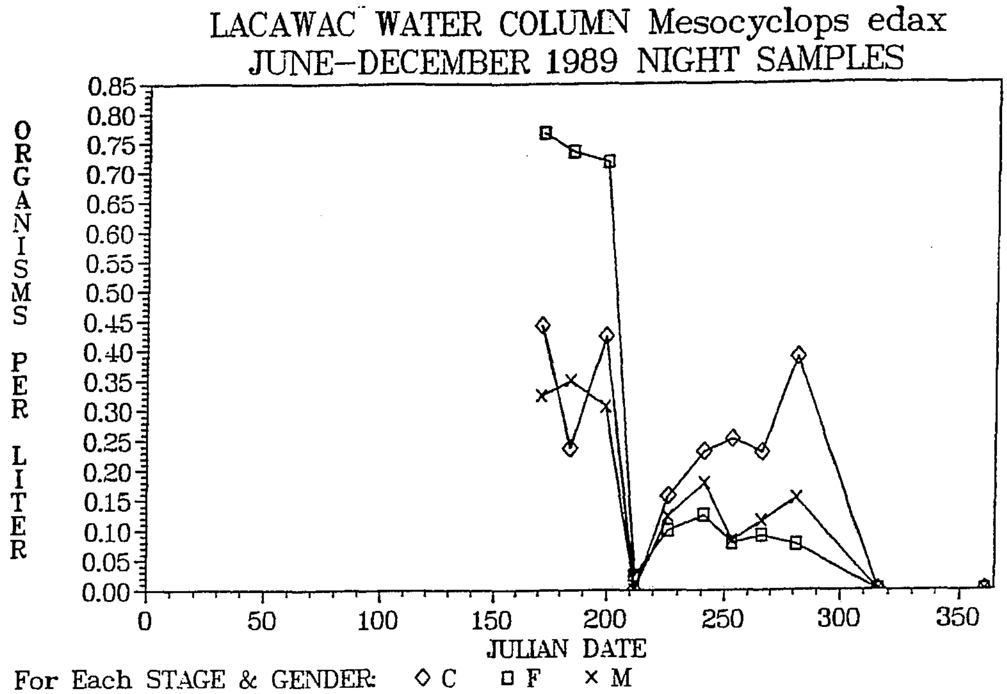


Figure 30. The cyclopoid copepod *Mesocyclops edax* in Lake Lacawac, 1989.

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



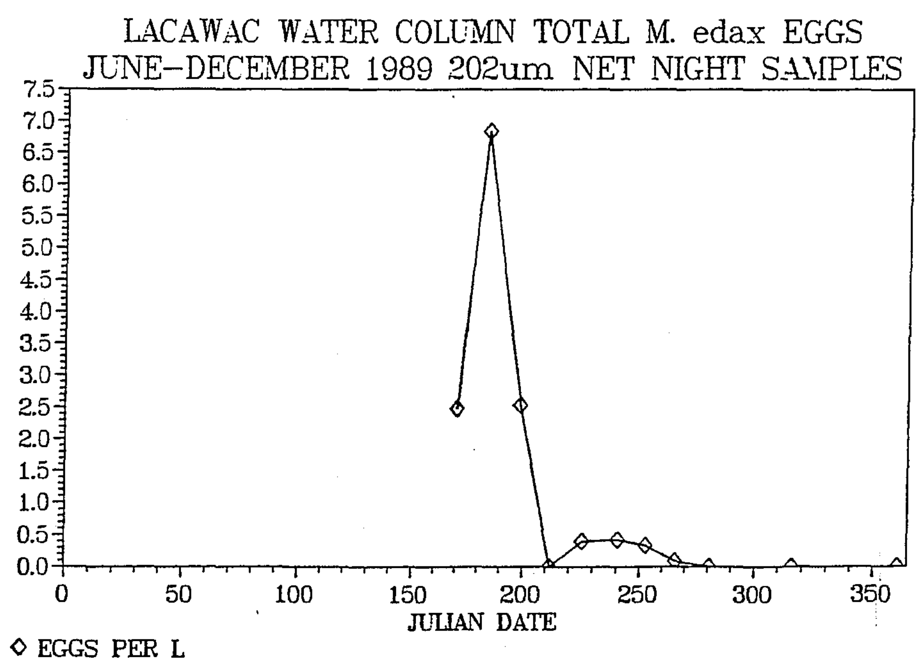


Figure 31. The cyclopoid copepod *Mesocyclops edax* in Lake Lacawac, 1989, by stage and gender.

Nighttime net collections (202μm) from three depths have been combined to give a water column mean. **(Top)** Adults (males and females separately) and copepodids per liter. **(Bottom)** *M. edax* eggs per liter.

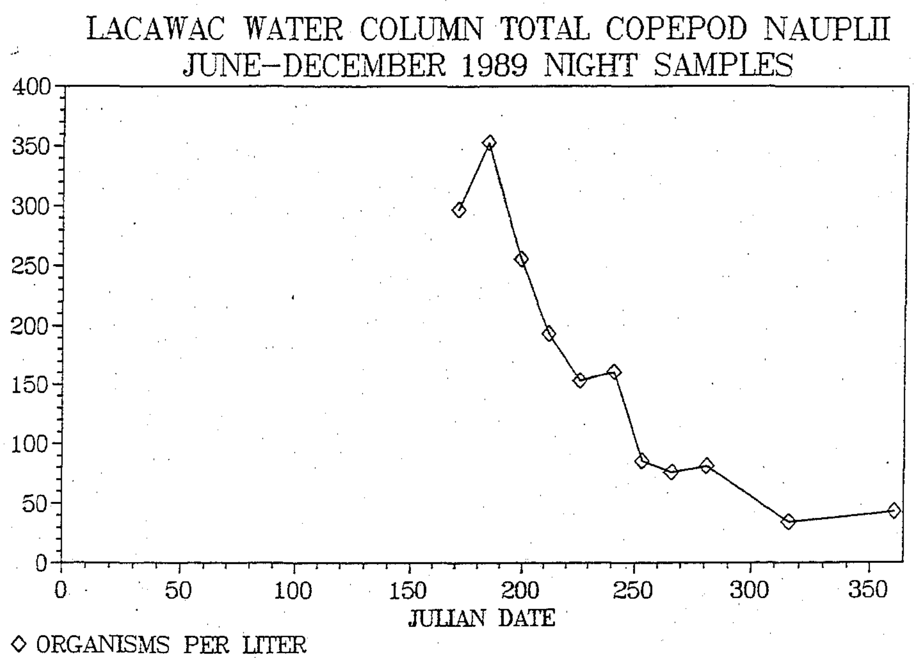


Figure 32. Total copepod nauplii in Lake Lacawac, 1989.

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.

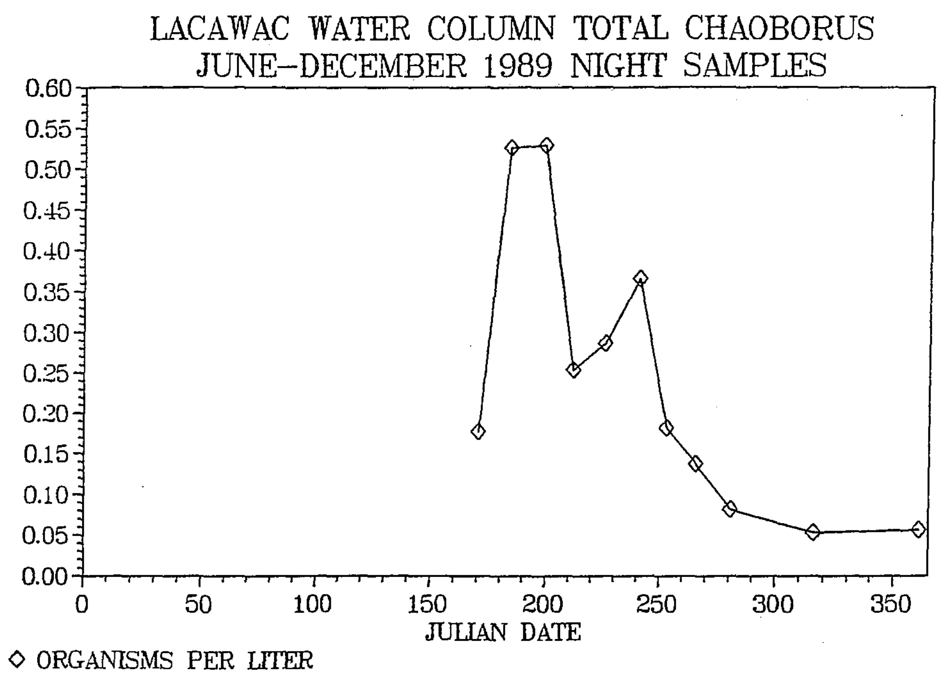


Figure 33. The dipteran *Chaoborus* spp. in Lake Lacawac, 1989.

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

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/06/89 JULIAN DATE: 157 TIME: 16.50

SECCHI M: 4.0 WEATHER: heavy overcast, breezy PERSONNEL: CEW AMS

TMETHOD: 10 LMETHOD: 9 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 10

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
6/06/89	157	S	1	16.50	-1.0				235.0000				
6/06/89	157		1	16.50	0.0	21.0	8.90		100.0000				
6/06/89	157	E	1	16.50	1.0	21.0	8.90		32.3529	6.12	22.2	4.68	5.37
6/06/89	157	E	2	16.50	1.0	21.0	8.90		32.3529	6.16	24.0		
6/06/89	157		1	16.50	2.0	21.0	9.00		15.2353				
6/06/89	157	M	1	16.50	3.0	16.5	10.60		7.0588	6.24	26.4	8.20	10.28
6/06/89	157	M	2	16.50	3.0	16.5	10.60		7.0588	6.21	24.6		
6/06/89	157		1	16.50	4.0	13.0	10.40		3.4706				
6/06/89	157		1	16.50	5.0	11.5	9.00		1.4412				
6/06/89	157		1	16.50	6.0	11.0	8.20		0.6529				
6/06/89	157		1	16.50	7.0	10.0	6.90		0.4059				
6/06/89	157		1	16.50	8.0	9.0	5.60		0.2412				
6/06/89	157	H	1	16.50	9.0	8.5	4.20		0.1406	5.66	36.9	2.00	4.67
6/06/89	157	H	2	16.50	9.0	8.5	4.20		0.1406	5.67	36.9		
6/06/89	157		1	16.50	10.0	8.0	3.60		0.0747				
6/06/89	157		1	16.50	11.0	8.0	3.20		0.0365				
6/06/89	157		1	16.50	12.0	8.0	2.80		0.0165				
6/06/89	157		1	16.50	13.0	8.0	1.60						

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 6/20/89 JULIAN DATE: 171 TIME: 17.75

SECCHI M: 4.0 WEATHER: Cloudy, breezy PERSONNEL: SRC AC AMS

TMETHOD: 10 LMETHOD: 9 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 11

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
6/20/89	171	S	1	17.75	-1.0	23.1							
6/20/89	171		1	17.75	0.0	22.7	8.77		100.0000				
6/20/89	171	E	1	17.75	1.0	22.7	8.72		28.7066	6.47	38	1.98	2.74
6/20/89	171	E	2	17.75	1.0	22.7	8.72		28.7066	6.38	47		
6/20/89	171		1	17.75	2.0	21.1	9.09		18.6120				
6/20/89	171		1	17.75	3.0	18.8	8.30		7.6972				
6/20/89	171	M	1	17.75	4.0	15.1	9.50		4.0063	6.06	37	5.59	7.05
6/20/89	171	M	2	17.75	4.0	15.1	9.50		4.0063	6.08	34		
6/20/89	171		1	17.75	5.0	12.4	8.20		2.1451				
6/20/89	171		1	17.75	6.0	10.9	6.90		1.1073				
6/20/89	171		1	17.75	7.0	10.2	6.00		0.6088				
6/20/89	171		1	17.75	8.0	9.3	4.00		0.3407				
6/20/89	171		1	17.75	9.0	8.8	2.50		0.1798				
6/20/89	171	H	1	17.75	10.0	8.5	2.00		0.0688	5.83	59	1.64	4.67
6/20/89	171	H	2	17.75	10.0	8.5	2.00		0.0688	5.77	58		
6/20/89	171		1	17.75	11.0	8.4	1.40		0.0315				
6/20/89	171		1	17.75	12.0	8.3	1.00		0.0145				
6/20/89	171		1	17.75	13.0	8.3	0.50						

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/03/89 JULIAN DATE: 184 TIME: 14.00

SECCHI M: 5.6 WEATHER: mostly sunny, light breeze PERSONNEL: CW SC AC DS

TMETHOD: 10 LMETHOD: 9 AMETHOD: 11
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 11

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
7/03/89	184	S	1	14.00	-1.0	34.7							
7/03/89	184		1	14.00	0.0	26.4	7.80		100.0000				
7/03/89	184	E	1	14.00	1.0	24.5	8.00		43.0556	6.18	27	0.88	1.21
7/03/89	184	E	2	14.00	1.0	24.5	8.00		43.0556	6.07	26		
7/03/89	184		1	14.00	2.0	23.6	7.90		19.7222				
7/03/89	184		1	14.00	3.0	21.1	7.80		9.3056				
7/03/89	184	M	1	14.00	4.0	16.3	8.50		5.4167	5.98	47	2.54	3.33
7/03/89	184	M	2	14.00	4.0	16.3	8.50		5.4167	6.02	44		
7/03/89	184		1	14.00	5.0	13.7	8.10		3.4722				
7/03/89	184		1	14.00	6.0	11.4	5.80		1.9861				
7/03/89	184		1	14.00	7.0	10.3	4.17		1.1944				
7/03/89	184		1	14.00	8.0	9.4	2.38		0.6389				
7/03/89	184		1	14.00	9.0	8.8	1.08		0.2514				
7/03/89	184	H	1	14.00	10.0	8.5	0.58		0.0625	5.78	74	4.20	9.40
7/03/89	184	H	2	14.00	10.0	8.5	0.58		0.0625	5.82	77		
7/03/89	184		1	14.00	11.0	8.4	0.29	4	0.0122				
7/03/89	184		1	14.00	12.0	8.3	0.24	4	0.0057				
7/03/89	184		1	14.00	13.0	8.3	0.22	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/18/89 JULIAN DATE: 199 TIME: 14.25

SECCHI M: 4.1 WEATHER: Partly cloudy, slight breeze PERSONNEL: JAA AMS JF

TMETHOD: 10 LMETHOD: AMETHOD: 9
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 11

COMMENTS: Light data lost

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
7/18/89	199	S	1	14.25	-1.0	28.3							
7/18/89	199		1	14.25	0.0	24.2	8.10						
7/18/89	199		1	14.25	1.0	23.0	8.20						
7/18/89	199	E	1	14.25	2.0	22.6	8.10			6.14	27	2.32	3.06
7/18/89	199	E	2	14.25	2.0	22.6	8.10			6.20	27		
7/18/89	199		1	14.25	3.0	22.2	7.90						
7/18/89	199	M	1	14.25	4.0	17.1	8.60			6.08	29	5.48	6.43
7/18/89	199	M	2	14.25	4.0	17.1	8.60			6.02	29		
7/18/89	199		1	14.25	5.0	13.2	7.30						
7/18/89	199		1	14.25	6.0	11.4	5.80						
7/18/89	199		1	14.25	7.0	10.3	3.10						
7/18/89	199		1	14.25	8.0	9.2	0.93						
7/18/89	199		1	14.25	9.0	8.7	0.14	4					
7/18/89	199	H	1	14.25	10.0	8.4	0.10	4		5.82	84	7.04	11.10
7/18/89	199	H	2	14.25	10.0	8.4	0.10	4		5.84	85		
7/18/89	199		1	14.25	11.0	8.3	0.09	4					
7/18/89	199		1	14.25	12.0	8.2	0.09	4					
7/18/89	199		1	14.25	13.0	8.2							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 7/31/89 JULIAN DATE: 212 TIME: 10.75

SECCHI M: 4.4 WEATHER: Overcast, cool, breezy PERSONNEL: JMF AMS CEW TWH

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
7/31/89	212	S	1	10.75	-1.0	19.2							
7/31/89	212		1	10.75	0.0	23.5	7.83		100.0000				
7/31/89	212		1	10.75	1.0	23.5	7.80		36.2497				
7/31/89	212	E	1	10.75	2.0	23.5	7.79		15.0418	6.10	28	2.60	3.67
7/31/89	212	E	2	10.75	2.0	23.5	7.79		15.0418	6.20	27		
7/31/89	212		1	10.75	3.0	23.4	7.79		8.9879				
7/31/89	212		1	10.75	4.0	18.0	7.76		3.9851				
7/31/89	212	M	1	10.75	5.0	13.7	6.02		1.9576	5.82	48	4.25	6.74
7/31/89	212	M	2	10.75	5.0	13.7	6.02		1.9576	5.84	45		
7/31/89	212		1	10.75	6.0	11.6	3.44		0.9541				
7/31/89	212		1	10.75	7.0	10.3	1.48		0.4332				
7/31/89	212		1	10.75	8.0	9.2	0.17	4	0.1665				
7/31/89	212	H	1	10.75	9.0	8.7	0.17	4	0.0643	5.94	122	0.00	22.77
7/31/89	212	H	2	10.75	9.0	8.7	0.17	4	0.0643	5.90	122		
7/31/89	212		1	10.75	10.0	8.4	0.15	4	0.0233				
7/31/89	212		1	10.75	11.0	8.3	0.15	4	0.0059				
7/31/89	212		1	10.75	12.0	8.3	0.14	4					
7/31/89	212		1	10.75	13.0								

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/14/89 JULIAN DATE: 226 TIME: 14.00

SECCHI M: 4.0 WEATHER: Sunny, calm PERSONNEL: AC JAA TH

TMETHOD: 10 LMETHOD: 12 AMETHOD: 9
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 11

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
8/14/89	226	S	1	14.00	-1.0	30.1							
8/14/89	226		1	14.00	0.0	24.3	8.81		100.0000				
8/14/89	226		1	14.00	1.0	22.6	8.82		53.9374				
8/14/89	226	E	1	14.00	2.0	22.1	8.78		33.7742	6.50	33	1.42	2.35
8/14/89	226	E	2	14.00	2.0	22.1	8.78		33.7742	6.49	35		
8/14/89	226		1	14.00	3.0	21.8	8.54		16.6212				
8/14/89	226		1	14.00	4.0	20.6	7.65		8.2120				
8/14/89	226	M	1	14.00	5.0	15.2	5.78		4.2995	5.80	40	2.91	5.45
8/14/89	226	M	2	14.00	5.0	15.2	5.78		4.2995	5.78	38		
8/14/89	226		1	14.00	6.0	12.0	3.32		2.3572				
8/14/89	226		1	14.00	7.0	10.4	1.40		1.7156				
8/14/89	226		1	14.00	8.0	9.4	0.43	4					
8/14/89	226		1	14.00	9.0	8.8	0.27	4					
8/14/89	226	H	1	14.00	10.0	8.5	0.23	4		6.31	193	0.00	12.14
8/14/89	226	H	2	14.00	10.0	8.5	0.23	4		6.35	180		
8/14/89	226		1	14.00	11.0	8.4	0.22	4					
8/14/89	226		1	14.00	12.0	8.3	0.20	4					
8/14/89	226		1	14.00	13.0								

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 8/28/89 JULIAN DATE: 240 TIME: 14.25

SECCHI M: 4.0 WEATHER: Overcast, slight breeze PERSONNEL: REM JMF TWH

TMETHOD: 10 LMETHOD: 10 AMETHOD: 9
OMETHOD: 10 PHMETHOD: 10 CAMETHOD: 11

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
8/28/89	240	S	1	14.25	-1.0	24.0							
8/28/89	240		1	14.25	0.0	23.9	8.64		100.0000				
8/28/89	240		1	14.25	1.0	23.0	8.75		29.2878				
8/28/89	240	E	1	14.25	2.0	22.5	8.70		19.2021	6.43	35	1.20	1.89
8/28/89	240	E	2	14.25	2.0	22.5	8.70		19.2021	6.42	36		
8/28/89	240		1	14.25	3.0	22.3	8.45		11.9109				
8/28/89	240		1	14.25	4.0	21.2	7.30		6.2267				
8/28/89	240		1	14.25	5.0	16.8	4.10		2.7703				
8/28/89	240	M	1	14.25	6.0	12.8	2.20		1.1903	5.79	45	2.49	4.87
8/28/89	240	M	2	14.25	6.0	12.8	2.20		1.1903	5.82	49		
8/28/89	240		1	14.25	7.0	10.8	0.45	4	0.5026				
8/28/89	240		1	14.25	8.0	9.4	0.18	4	0.2045				
8/28/89	240		1	14.25	9.0	8.9	0.16	4	0.0818				
8/28/89	240	H	1	14.25	10.0	8.6	0.15	4	0.0265	6.33	204	0.00	25.31
8/28/89	240	H	2	14.25	10.0	8.6	0.15	4	0.0265	6.12	235		
8/28/89	240		1	14.25	11.0	8.4	0.15	4	0.0071				
8/28/89	240		1	14.25	12.0	8.3	0.15	4	0.0012				
8/28/89	240		1	14.25	13.0								

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/09/89 JULIAN DATE: 252 TIME: 11.25

SECCHI M: 3.9 WEATHER: Clear, sunny PERSONNEL: JAA SRC SJN

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

COMMENTS: Sampled 9/9 and 9/10 days

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
9/09/89	252	S	1	11.25	-1.0								
9/09/89	252		1	11.25	0.0	22.4	8.30		100.0000				
9/09/89	252		1	11.25	1.0	22.0	8.20		59.0319				
9/09/89	252	E	1	11.25	2.0	21.5	8.20		33.4648	6.16	37	2.76	3.95
9/09/89	252	E	2	11.25	2.0	21.5	8.20		33.4648	6.04	34		
9/09/89	252		1	11.25	3.0	21.0	8.10		16.5667				
9/09/89	252		1	11.25	4.0	20.6	7.70		7.6099				
9/09/89	252	M	1	11.25	5.0	18.1	2.90		2.9703	5.83	53	2.92	3.91
9/09/89	252	M	2	11.25	5.0	18.1	2.90		2.9703	5.85	49		
9/09/89	252		1	11.25	6.0	14.2	1.23		1.2294				
9/09/89	252		1	11.25	7.0	11.4	0.31	4	0.5671				
9/09/89	252		1	11.25	8.0	10.1	0.25	4	0.2067				
9/09/89	252		1	11.25	9.0	9.3	0.23	4	0.0662				
9/09/89	252	H	1	11.25	10.0	8.8	0.22	4	0.0203	6.20	295	0.00	47.73
9/09/89	252	H	2	11.25	10.0	8.8	0.22	4	0.0203	6.15	221		
9/09/89	252		1	11.25	11.0	8.6	0.20	4	0.0078				
9/09/89	252		1	11.25	12.0	8.4	0.16	4					
9/09/89	252		1	11.25	13.0	8.4	0.19	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 9/24/89 JULIAN DATE: 267 TIME: 12.50

SECCHI M: 3.9 WEATHER: Windy, partly cloudy, cold PERSONNEL: JAA SRC SJJ

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
9/24/89	267	S	1	12.50	-1.0	10.7							
9/24/89	267		1	12.50	0.0	17.5	7.69		100.0000				
9/24/89	267		1	12.50	1.0	17.6	7.58		44.5831				
9/24/89	267		1	12.50	2.0	17.6	6.90		21.4962				
9/24/89	267	E	1	12.50	3.0	17.6	7.18		10.5788	6.32	37	2.30	3.46
9/24/89	267	E	2	12.50	3.0	17.6	7.18		10.5788	6.14	38		
9/24/89	267		1	12.50	4.0	17.6	7.13		5.2657				
9/24/89	267		1	12.50	5.0	17.5	7.12		2.9902				
9/24/89	267	M	1	12.50	6.0	14.5	2.22		1.3598	6.08	35	2.08	3.24
9/24/89	267	M	2	12.50	6.0	14.5	2.22		1.3598	6.00	37		
9/24/89	267		1	12.50	7.0	11.4	0.57		0.6454				
9/24/89	267		1	12.50	8.0	10.1	0.48	4	0.1915				
9/24/89	267		1	12.50	9.0	9.1	0.40	4	0.0570				
9/24/89	267	H	1	12.50	10.0	8.7	0.39	4	0.0173	6.41	302	0.00	40.76
9/24/89	267	H	2	12.50	10.0	8.7	0.39	4	0.0173	6.38	310		
9/24/89	267		1	12.50	11.0	8.5	0.38	4	0.0034				
9/24/89	267		1	12.50	12.0	8.4	0.38	4					
9/24/89	267		1	12.50	13.0								

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 10/08/89 JULIAN DATE: 281 TIME: 12.50

SECCHI M: 5.0 WEATHER: Cloudy, cool PERSONNEL: JAA SJJ

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
10/08/89	281	S	1	12.50	-1.0	8.2							
10/08/89	281		1	12.50	0.0	13.6	7.81		100.0000				
10/08/89	281		1	12.50	1.0	13.7	7.83		29.9043				
10/08/89	281		1	12.50	2.0	13.7	7.88		13.6549				
10/08/89	281	E	1	12.50	3.0	13.7	8.01		7.2058	6.13	44	1.54	2.39
10/08/89	281	E	2	12.50	3.0	13.7	8.01		7.2058	6.06	36		
10/08/89	281		1	12.50	4.0	13.7	7.92		4.2090				
10/08/89	281		1	12.50	5.0	13.7	7.93		2.4890				
10/08/89	281		1	12.50	6.0	13.7	7.92		1.4659				
10/08/89	281		1	12.50	7.0	13.7	7.92		0.8493				
10/08/89	281	M	1	12.50	8.0	11.4	3.76		0.4268	5.90	85	2.93	6.43
10/08/89	281	M	2	12.50	8.0	11.4	3.76		0.4268	5.93	86		
10/08/89	281		1	12.50	9.0	9.4	0.60		0.1420				
10/08/89	281		1	12.50	10.0	8.8	0.49	4	0.0356				
10/08/89	281	H	1	12.50	11.0	8.6	0.41	4	0.0110	6.38	431	0.00	32.26
10/08/89	281	H	2	12.50	11.0	8.6	0.41	4	0.0110	6.42	409		
10/08/89	281		1	12.50	12.0	8.5	0.38	4	0.0028				
10/08/89	281		1	12.50	13.0	8.5	0.35	4					

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 11/12/89 JULIAN DATE: 316 TIME: 12.55

SECCHI M: 3.5 WEATHER: Partly cloudy, windy, cold PERSONNEL: JA SJN SC AC

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

COMMENTS:

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
11/12/89	316	S	1	12.55	-1.0	7.1							
11/12/89	316		1	12.55	0.0	9.0	9.03		100.0000				
11/12/89	316		1	12.55	1.0	9.0	8.90		33.9789				
11/12/89	316	E	1	12.55	2.0	9.0	8.86		16.3714	5.98	38	2.42	3.28
11/12/89	316	E	2	12.55	2.0	9.0	8.86		16.3714	5.84	35		
11/12/89	316		1	12.55	3.0	9.0	8.69		8.2538				
11/12/89	316	M	1	12.55	4.0	9.0	8.66		3.8878	5.92	40	2.60	3.50
11/12/89	316	M	2	12.55	4.0	9.0	8.66		3.8878	6.00	45		
11/12/89	316		1	12.55	5.0	9.0	8.50		1.9488				
11/12/89	316		1	12.55	6.0	9.0	8.60		0.9003				
11/12/89	316		1	12.55	7.0	9.0	8.60		0.4229				
11/12/89	316		1	12.55	8.0	9.0	8.54		0.1997				
11/12/89	316		1	12.55	9.0	9.0	8.50		0.0995				
11/12/89	316	H	1	12.55	10.0	9.0	8.48		0.0502	6.02	43	2.46	3.38
11/12/89	316	H	2	12.55	10.0	9.0	8.48		0.0502	5.98	41		
11/12/89	316		1	12.55	11.0	9.0	8.30		0.0263				
11/12/89	316		1	12.55	12.0	9.0	8.21		0.0143				
11/12/89	316		1	12.55	13.0	9.0							

LAKE LACAWAC: SUMMARY OF PHYSICAL/CHEMICAL DATA

DATE OF SAMPLE: 12/28/89 JULIAN DATE: 362 TIME: 13.75

SECCHI M: 2.5 WEATHER: Partly cloudy, windy, cold PERSONNEL: JAA SJJ

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

COMMENTS: 13" ice cover

DATE OF	JULIAN	STRA	REP	TIME	DEPTH	TEMP C	OXYGEN	OFLAG	LIGHT PC	PH	ALKAL	CHLAC U	CHLASUM
12/28/89	362	S	1	13.75	-1.0	-3.7							
12/28/89	362		1	13.75	0.0	0.1	13.90		100.0000				
12/28/89	362	E	1	13.75	1.0	2.9	11.50		35.8551	5.79	35	2.50	2.88
12/28/89	362	E	2	13.75	1.0	2.9	11.50		35.8551	5.82	36		
12/28/89	362		1	13.75	2.0	3.3	10.40		13.5149				
12/28/89	362	M	1	13.75	3.0	3.4	10.30		5.0504	5.80	33	2.34	2.76
12/28/89	362	M	2	13.75	3.0	3.4	10.30		5.0504	5.72	35		
12/28/89	362		1	13.75	4.0	3.4	10.00		2.2112				
12/28/89	362		1	13.75	5.0	3.5	9.60		0.9902				
12/28/89	362		1	13.75	6.0	3.6	9.29		0.5231				
12/28/89	362		1	13.75	7.0	3.7	9.08						
12/28/89	362		1	13.75	8.0	3.8	8.60						
12/28/89	362		1	13.75	9.0	3.8	7.99						
12/28/89	362	H	1	13.75	10.0	3.9	7.29			5.54	35	0.19	2.11
12/28/89	362	H	2	13.75	10.0	3.9	7.29			5.50	33		
12/28/89	362		1	13.75	11.0	4.1	5.29						
12/28/89	362		1	13.75	12.0	4.2	3.89						
12/28/89	362		1	13.75	13.0								