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Microcomputer-assisted Colorimetric Determination of Iron

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General Notes

Lasionycteris noctivagans (LeConte). The silver-haried bat probably occurs statewide but has only been collected from Bradley, Craighead, Greene, Marion, Stone and Washington counties (Gardner and McDaniel, 1978; Sealander, 1979). To this list we have added: Independence, Polk and Pulaski counties.

Nycticeius humeralis (Rafinesque). The evening bat is very common in Arkansas, particularly in the southeastern corner of the state. It has been recorded from 14 counties: Ashley, Baxter, Bradley, Carroll, Craighead, Desha, Drew, Greene, Independence, Pope, Sebastian, Stone, Washington and Yell (Gardner and McDaniel, 1978; Sealander, 1979). We have collected specimens from the following 12 additional counties: Clark, Cleburne, Garland, Hempstead, Lawrence, Logan, Marion, Montgomery, Newton, Pulaski, Polk and Sharp. Thus, the evening bat has now been recorded in 26 of the 75 Arkansas counties.

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MICROCOMPUTER-ASSISTED COLORIMETRIC DETERMINATION OF IRON

Courses in quantitative analysis often include standard colorimetric procedures, in which a series of solutions is used to prepare a calibration curve, with the unknown read from the curve. An experiment of this type is the iron-phenanthroline determination which is described in the manual by Day and Underwood (Day and Underwood, *Quantitative Analysis Laboratory Manual*, 4th Ed., p. 125, 1980). This procedure has been modified in the present application, so that commercially-prepared unknowns can be used. The spectrophotometer is interfaced with a microcomputer for reading and manipulation of the absorbance-concentration data. The experiment not only provides an example of microcomputer application and serves to eliminate human error in data acquisition, but allows performance of repetitive tasks which are nearly impossible by hand.

The student needs no computer capability, since the entire procedure is screen-prompted. The following are features of the experimental procedure:

1) The computer accepts absorbance data for each standard solution 100 times, averages the readings then presents the average to the student. This alleviates the indecision some students have when reading a needle that sometimes flickers.
2) Solution concentrations are entered following each averaging, with the values entered based on student preparation of solutions of ferrous ammonium sulfate.
3) When all known solutions are completed, the computer gives a screen which lists the concentrations of the solutions provided, the absorbance value on the best-fit line for those concentrations, and the slope and intercept of the best-fit line.
4) Best-fit and raw data points are then screen-graphed. This shows the scatter of the student's data and allows immediate judgment of the necessity for repetition of the work.
5) The student then reads any number of unknowns and the computer calculates their iron concentration from the least-square slope and intercept values.

With the computer-based procedure, no significant improvement in accuracy was noted, as compared to classes that took data by hand (Hoyt, Unpublished Data, 1982). There have been significant improvements in speed (or spectrophotometer use-time), calculation accuracy (particularly in eliminating tedious least-square manipulations), and ease of making judgments about reliability of data. Student reaction has been enthusiastic, but some effort must be expended by instructional personnel to prevent rote manipulation of "black boxes" and permit understanding of the logic involved.

The spectrophotometer used is the B & L Spectronic 70, although the ubiquitous Spectronic 20 is interchangeable. Any of a number of similar digital or non-digital instruments could be adapted with the proper interfacing arrangement. The interface used is one of several built during an annual workshop on microcomputer interfacing (Wisman, Chemistry Department, University of Arkansas, Fayetteville, AR 72701. Circuit used with permission.) The program requires 6K on the 4032-N PET microcomputer. The program runs on both new (4.0) and older (2.0) RAM in PET BASIC. The 301 lines (58 comments) in the program are capable of being greatly reduced, but are presented so as to permit modification and ease of understanding. Transfer to other brands of microcomputer would require modification of the graphics portion of the program, as well as some changes in the interface adapter. The program is written for the small-screen PET, but minimal changes would accommodate the new 12" (80 column) screen. The modified Day/Underwood experiment, a schematic of the interface, a program listing, and a sample execution are available from the author.

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AQUATIC MACROINVERTEBRATES OF THE HIATT PRAIRIE REGION, FRANKLIN COUNTY, ARKANSAS

At one time significant disjunct expanses of natural grassland or prairie occurred in all quarters of Arkansas. These were predominantly tall grass prairies with scattered areas of wetlands or marsh. Most have been destroyed by agricultural practices (Ark. Dept. Planning, 1974). Only two prairie tracts remain in Arkansas that are associated with permanent water. One of these is Hiatt Prairie. Little work has been done on the aquatic macroinvertebrates of prairie-associated streams in Arkansas. It was the primary intent of this study to establish a species list of aquatic macroinvertebrates for the Hiatt Prairie region.

Hiatt Prairie is located 2 km N of Charleston in the SW¼ S25, R29W, T8N, Franklin County, Arkansas. Hiatt Creek, formerly called Prairie Creek, is a first order stream that meanders to the west across the Prairie, approximately 1 km. Recently beaver have invaded the area and caused a drastic change in stream flow. Six large beaver dams cross the stream channel at approximately 140 m intervals, and smaller dams are occasionally interspersed between them. As a result, the typically narrow, shallow stream has become deeper and more sluggish at the beaver pools established behind each dam.

The main channel width varies from 0.9 to 2.4 m and the depth varies from 20 to 91 cm, dependent on the beaver dams. The substrate of the channel is typified by silt several cm deep in areas of little current, whereas broken slate and rock predominate where the current is more rapid. Compacted clay is typically found at each bend in the stream. Substrate in the beaver pools is characterized by a thick silt, augmented by detrital material from the surrounding watershed.

An oval-shaped stock pond is located approximately 0.1 km NE of the St Hwy 217 bridge over Hiatt Creek. The pond was constructed in the early 1900's and has maintained a supply of water since that time (Hiatt, pers. comm.). During periods of excessive rainfall, the pond overflows its east bank creating excellent habitat for aquatic macroinvertebrates in the surrounding grasses and low shrubs. Several kinds of aquatic vascular plants abound in this low flooded area where the effect of siltation is minimal. The substrate within the normal boundaries of the pond consists of a very deep layer of silt, with the complete absence of vegetation.

Thirty-four collections were made during 15 trips from 24 May 1980 to 21 February 1982. Seventeen collections were made from the stream channel, 10 from the beaver pools and seven from the stock pond. Collections were made monthly from spring through fall and bi-monthly during the winter. Temperature, pH and turbidity were measured on each sampling date. Dissolved oxygen, carbon dioxide and alkalinity were measured only on the final trip. Chemical determinations were made by standard limnological methods. Aquatic macroinvertebrates were collected with an aquatic dip net. The stream channel was sampled at approximately 20 pace intervals. Each microhabitat was sampled proportionately in the beaver pools. The circumference and overflow area of the stock pond were sampled randomly, although dense silt accumulations were avoided. On each trip an ultraviolet light was used for one hour after dusk to collect emerging adults. Dip net and ultraviolet light specimens were preserved in 70% ethanol. Adult Odonata were collected by aerial net, placed in paper triangles, and immersed in acetone for 18-24 hours. All specimens are housed in the Arkansas State University Museum of Zoology (ASUMZ) Aquatic Macroinvertebrate Collection.

Physicochemical parameters of both the stream and stock pond were within the known limits of tolerance for freshwater organisms and caused no visible detrimental effects. The aquatic macroinvertebrate fauna of the Hiatt Prairie region was quite diverse, with 138 taxa representing 18 orders, 55 families and 115 genera (Table). Of these, 126 taxa were collected in Hiatt Creek; 104 and 95 taxa in the beaver pools and channel, respectively. Seventy-one taxa were collected from the stock pond. The three major zones had 42 taxa in common, while 31 taxa were shared by the channel and beaver pools only, 15 taxa by the beaver pools and stock pond only, and five taxa by the channel and stock pond only. Seventeen taxa were found in the channel only, 16 in the beaver pools only, and nine in the stock pond only. Coleoptera was the most diverse order with representatives from eight families and 51 species. The most frequently collected orders were Isopoda, Coleoptera, Decapoda, Hemiptera, Amphipoda, and Ephemeroptera, respectively. Most of the taxa are adapted to a variety of habitats and environmental conditions (Pennak, 1978).

The beaver activity has increased the diversity of aquatic macroinvertebrates in Hiatt Creek by increasing the diversity of microhabitats, introducing instability, or a combination of the two. The beaver pools provide a greater range of water depth, current speed (absent to moderate), and substrate types (particulate organic matter to decomposing leaf litter). The beaver pools also have gradually sloping bottoms which are conducive to the establishment of a greater variety and density of aquatic vegetation and associated fauna. During the study period the beaver pools were in the process of being established, and thus were areas of transition. Such transitions are marked by temporary instability. Increased species diversity can result, as some new species will be developing, others will be at population peaks, and yet others will be declining (Reed, 1978).

The aquatic macroinvertebrate fauna of the channel was qualitatively similar to that of the beaver pools, with 95 and 104 taxa, respectively. Of these, 73 taxa were collected from both zones. Fewer taxa were collected from the channel than the beaver pools despite more intensive collection in this zone (17 samples vs 10 from the beaver pools). In many areas of the channel the substrate was compacted clay, and the stream banks were of vertical, eroded clay, providing little suitable habitat. Most of the taxa found in the channel only (e.g. *Hagenius, Pycnopsyche, Stenelmis crenata*) are characteristically stream inhabitants (Needham and Westfall, 1955; Brown, 1976; Wiggins, 1977).

Aquatic macroinvertebrate diversity was least in the stock pond. This primarily resulted from the homogeneity of its silt substrate (Harrell, 1969). The fewest samples were taken from this zone, and this also reduced the number of taxa collected. Most taxa were obtained in the overflow