CALCULATIONS

The volume of water sampled in each case is calculated as follows:
1. The initial flowmeter reading is subtracted from the final reading to obtain the total number of counts.
2. The total number of counts is divided by the number of seconds elapsed during the retrieval of the net to obtain the number of counts per second.
3. By means of the graph supplied with each flowmeter, the number of counts per second is converted to centimeters per second to obtain the velocity at which the net was retrieved.
4. The velocity is multiplied by the total number of seconds elapsed during retrieval of the net to obtain the total distance sampled.
5. The volume of water sampled can be calculated by using the formula for the volume of a cylinder, \[ V = \pi r^2 h \], where \( r \) is the radius of the orifice of the net and \( h \) is the distance sampled.

DISCUSSION

The equipment and modifications described here have proved useful in TVA's work on zooplankton. The equipment is relatively inexpensive, is easy to operate and maintain, and when used in accordance with the described procedures provides a representative sample with limited variation caused by nonuniform vertical distribution or by avoidance of the sampling device by the zooplankton. The variation caused by nonuniform vertical distribution is minimized because the oblique, bottom-to-surface tow provides a quantitatively and qualitatively integrated sample of the water column. Variation attributable to avoidance is minimized by the relatively large diameter of the net.

Samples collected in surveys utilizing Modifications I, II, or III have shown that acceptable replication can be obtained with all three modifications. Numbers of organisms per cubic meter for the three principal zooplankton groups (Rotifera, Cladocera, and Copepoda) and for the total combination of these important groups [zooplankton assemblage] were analyzed statistically for sample mean (\( X \)), standard deviation (SD), and the coefficient of variation (CV, percentage ratio of the standard deviation to the mean). (Table 1). Average CV values were 3.9, 14.3, and 11.9% for Modification I; 21.1, 28.9, and 16.1% for Modification II; and 8.3, 12.6, and 8.5% for Modification III for Rotifera, Cladocera, and Copepoda respectively. CV values for the total zooplankton assemblage were 7.3%, 14.9%, and 9.8% for Modifications I, II, and III respectively. Only 2 of the 27 samples (both collected with Modification II) had CV values above 25%, the maximum level considered acceptable for our sampling regimes.

ACKNOWLEDGMENT

We wish to thank Dr. Dewey L. Bunting, University of Tennessee, for his encouragement and guidance as we have developed sampling methods for our studies and for his critical review of our work.

REFERENCES

Liliaceae with 16 genera while the largest genus was Viola with 11 species. An annotated list of all specimens whose range in Tennessee is limited, i.e., Disporum racemosum, Panax trifolium and Hydrastis canadensis.

INTRODUCTION
Frozen Head State Park, formerly Morgan State Forest, is in the southeastern section of Morgan County and very limitedly in Anderson County. State highway 116 passes through the southeastern portion of the park and federal highway 62 is approximately three miles south of the park (Fig. 1). Historically, the earliest white settlers entered this area in the late 1700's and early 1800's. Of Scotch-Irish stock, they gradually replaced the Chicksaw and Cherokee which once roamed this area. Later, in the mid-1800's, Swin and Cherokee joined the earlier settlers, drawn by reports of bountiful game and rich farming land (Crouch and Adams, 1972). The park area, roughly 8,000 acres, was purchased in the early 1900's for use as a State Forest; although managed for hardwood timber products, few trees were ever cut. In December of 1970, this acreage was transferred to the Division of State Parks to facilitate the development of Frozen Head State Park. Shortly after this transfer of land the closing of Brushy Mountain Prison, with its 4,000 acres of forested land and 1,800 acres of farm land associated with the State Forest, came under the control of the Tennessean Department of Conservation (Crouch and Adams, 1972). The specimens collected were from the 12,000 acres of forested land and are not intended to reflect the species diversity of the Honor Farm, which lies west of the forested area.

Although the study area is generally considered to lie within the Appalachian Plateau Province, which includes a tableland-type terrain with an average of 2,000 feet elevation, it is specifically a portion of the sub-province known as the Cumberland Mountains. This is a ruggedly dissected mountainous section where park terrain varies from 1,340 feet on North Prong Flat Fork to 3,334 feet at the observation tower on Frozen Head Mountain (Fig. 2). The striking surface features of this area are primarily attributed to the erosional-resistant Pennsylvanian sandstones and conglomerates which underlie the entire uplands (Floyd, 1965). Interbedded with these rocks are shales and two known coal seams, the Pembree seam at approximately 2,600 feet and the Walnut Mountain seam at about 300 feet. The climate of the park can be generally described as humid but moderate with frost-free days extending from mid-April to mid-October. Tennessee Valley Authority rainfall station 167 at Pettus indicates a 34

year mean annual precipitation of approximately 60 inches, including about 20 inches of snow. The park has never had a temperature station but the United States Weather Bureau station at Crossville with a corresponding elevation (1,810 feet) and location shows a ten-year average from 1961 to 1971 of 54.5 degrees Fahrenheit (Crouch and Adams, Inc. 1972).
The study area lies within the Cumberland Plateau Section of the Mixed Mesophytic Forest Region (Braun, 1950). This is conterminous here with the Cumberland-Moench physiographic-floristic regions of Shanks (1958). Within the park these taxa share dominance in the ravines: Fagus grandifolia, Liriodendron tulipifera, Quercus rubra, Q. alba, Acer rubrum, Aesculus octandra, Prunus serotina and Taxus canadensis. Along the drier ridges these taxa share dominance: Liquidambar styraciflua, Quercus rubra, P. prinus and Vitis virginiana.

MATERIALS AND METHODS
Specimens were collected during the spring months from March through May in 1974 and 1975 and deposited at Van- derbilt University Herbarium, Nashville. Nomenclature follows mainly that of Fernald (1959) and Gleason and Cronquist (1963).
The following terms, in descending order of importance, are used to denote distribution: abundant, common, frequent, infrequent, and rare. They relate to the area surveyed and are not intended to reflect distribution patterns of wide-ranging species. The listing of taxa is first by class then alphabetically by family and scientific name.

RESULTS
Monocotyledonae

Amaryllidaceae

Hypoxis hirsuta (L.) C.Yever Dry, sandy soils of open woods: infrequent but locally abundant.

Araceae

Acorus calamus L. Schott Moss woods, marshes; common; Voss (1960) widespread. (Britt.) Stevens widely scattered.

Convallariaceae

Tricyrtis hirta (Bl.) Luck. Woodland roadside to moist, deep woods; widely scattered to all elevations.

Cyperaceae

Carex aurea Mill. Rich woods; common throughout, abundant in Flat Fork drainage area. C. nigraeformis Schw. Dry often steep sloped woods; primarily of Straight Fork drainage area. C. nigraeformis var. Moore, rich woods; infrequent.

Dioscoreaceae

Dioscorea quercifolia (Walt.) Gmel. Deciduous woods; throughout.

Gramineae

Poa cupulata Nutt. Rocky, wooded slopes; infrequent.

Iridaceae

Iris virginica L., M. Common throughout. Sarracenia magellanica Mill. Open woods, old roads; scattered throughout.

Juncaceae

 Luzula campestris (L.) DC. Open woods; infrequent.

Liliaceae


Orchidaceae

Cypripedium catesbaei (L.) Moist, mesophytic woods; rare, total of seven plants reported from three widely scattered locations. Oncidium spectabile L. Moist mesophytic woods; widely scattered.

Dicotyledonae

Araliaceae

Panax trifolium (L.) Moist mesophytic woods; rare, only one population of approximately 24 plants in Panther Branch area at 2,000 feet.

Aristolochiaceae

Aranantiche daweri Hill Rich woods especially along streams; flowering vines confined to Flat Fork area. Asarum canadense Michx. Woodlands; throughout. A. catharactae (L.) Moist ravines especially along rocky banks; throughout.

Aucupariaceae

Aeschynanthus quadrifidus E. Woodlands, especially along old roads; throughout. Berberis thunbergi Caud. 2,000 foot elevation Woodlands, throughout. Podophyllum peltatum (L.) Woodlands; throughout.

Boraginaceae

Cephalanthera virginiana (L.) Woodlands; Flat Fork drainage area.

Campanulaceae

Striblaria perfoliata (L.) A. DC. Roadside, waste places.

Caprifoliaceae

Tilostemma auriculatum Stickell Dry woods; rare, only one location along roadside at 3,000 feet.

Caryophyllaceae

Dianthus armeria (L.) Roadside, waste places; rare, Flat Fork valley.

Silene virginica (Walt.) Open woods, shaded roadside; throughout.

Stellaria pubera (Michx.) Woodlands; abundant.

Celastraceae

Euonymus americanus (L.) Rich woods, ravines and stream banks; throughout.

Floristic Survey of Spring Flowering Herbs

FIG. 2: Map showing major surface features and drainage system within the park.

FIG. 1: General Location Map, Frozen Head State Park

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**Floristic Survey of Spring Flowering Herbs**

11 species is the most common genus encountered. Especially common are *V. blanda, V. canadensis, V. hastata* and *V. rostrata* which frequently cover the greater part of a meadow. Only *V. canadensis* and *V. rostrata* are rarely seen and then in deep, forested areas.

Three other species demand attention, each rare in Tennessee. *Carex caryophyllea*, although considered rare in Tennessee, grows in all major drainage areas of the state. It is especially common in the Flat Fork drainage basin, although its green leaves are conspicuous in the winter months. Unfortunately, the number of these species, *Hydrastis canadensis*, may now be much diminished as a result of the reduction in the production of other species, such as *Panax quinquefolium*.

The remaining species, *Panax trifolium*, is exclusively found in a single station of 24 plants within the Panther Creek drainage area. This delicate beautiful plant grows in deep, mesophytic woods and may be the most abundant population of flowering plants in the park, including large numbers of *Viola canadensis* and *Tiarella cordifolia*.

Indeed, the entire upper reaches of the North Prong Flat Fork, including both Panther Branch and Emory Gap Branch, harbor extensive and diverse populations of spring flowering herbs. Fortunately, the efforts of the Conservation Department call for the entire area to be preserved as a protected watershed.

**Disc**

**Discussion**

The foregoing case study was the careful observation and description of the spring flora of a portion of a physiographic area which, in Tennessee, has been largely ignored. It is also the author's hope that this recently little-disturbed land would be recognized as an important ecological setting which is rapidly disappearing from the Cumberland Mountains, probably due to excessive demand for the timber brought to this region by strip mining. The edges of the northern part of the valley marks the starting point for one of the most intensive coal mining operations in Tennessee, that of the New River drainage area. It is thus with some trepidation that one realizes the significance of the two previously mentioned species found within the park. The development of these species would upset countless acres of forest and bury hundreds of other areas. Additionally, it would be a serious detri-

**Acknowledgments**

The author would like to thank Dr. Robert Rinaldi, Curator of Herbaria at Vanderbilt University, whose assistance in identifications and general encouragement were instrumental in completing this project.

**Literature Cited**


