Introduction

The Ichetucknee River, located in Columbia County, is a tributary of the Santa Fe River, which flows into the Suwannee River (see maps in Appendix). While the surface water flow of the river originates in several Floridan Aquifer fed springs within the Ichetucknee Springs State Park, the groundwater recharge area for the system is believed to extend north to the vicinity of Lake City. The Division of Recreation and Parks requested the Bureau of Laboratories to analyze samples of water, sediment, and biological communities collected from the river and/or recharge area. The purpose of the study was to characterize present conditions in the river and to identify potential present or future pollution sources in the recharge area. Water quality and sediment data have previously been reported by the DEP Chemistry Section (FDEP 1996). This report discusses the results from biological sampling.

Methods

The focus of this investigation was to collect biological information from two stations in the Ichetucknee River. Station I was located in the Ichetucknee River just below the confluence with Blue Hole Run. Station II was located in the Ichetucknee River approximately 200 m upstream from the US 27 bridge. Benthic macroinvertebrate communities were collected via Hester-Dendy artificial substrate samplers, which were incubated for a 28 day period. The resulting samples were brought back to the laboratory for sorting and identification under the dissecting and compound microscopes.

Major characteristics of community structure of study sites.

	Station I	Station II
Macroinvertebrate Hester-Dendy		
Number of Taxa	31	31
Florida Index	18	25
Shannon-Weaver Diversity	2.63	3.23
EPT Index	9	9
% Diptera	10.5	8.7
% Ephemeroptera	6.5	24.8
% Trichoptera	25.0	36.0
% Amphipoda	50.4	8.2
% Gastropoda	7.2	18.2
% Dominant Taxon	47.5	34.4
% Predators	2.3	4.3
% Above Surface Deposit Feeders	36.5	15.5
% Suspension Feeders	26.0	38.7
% Scrapers	7.3	30.1
% Shredders	24.6	1.7
% Scavengers	1.7	5.0

Explanation of Measurements of Community Health

Selected measurements of macroinvertebrate community health were employed to assess a site. These are briefly discussed here.

Taxa richness: Stress tends to reduce the number of different types of organisms present in a system, although moderate nutrient enrichment may sometimes be correlated with increased algal taxa richness.

Shannon-Weaver diversity: This index is specified in the Florida Administrative Code as a measure of biological integrity. Low diversity scores are undesirable. They represent conditions where only a few organisms are abundant, to the exclusion of other taxa.

Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. For example, the Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy.

Ephemeroptera/Plecoptera/Trichoptera Index: This index is the sum of the number of EPT taxa present. Higher EPT values are associated with healthier systems.

Community structure: Substantial shifts in proportions of major groups of organisms, compared to reference conditions, may indicate degradation.

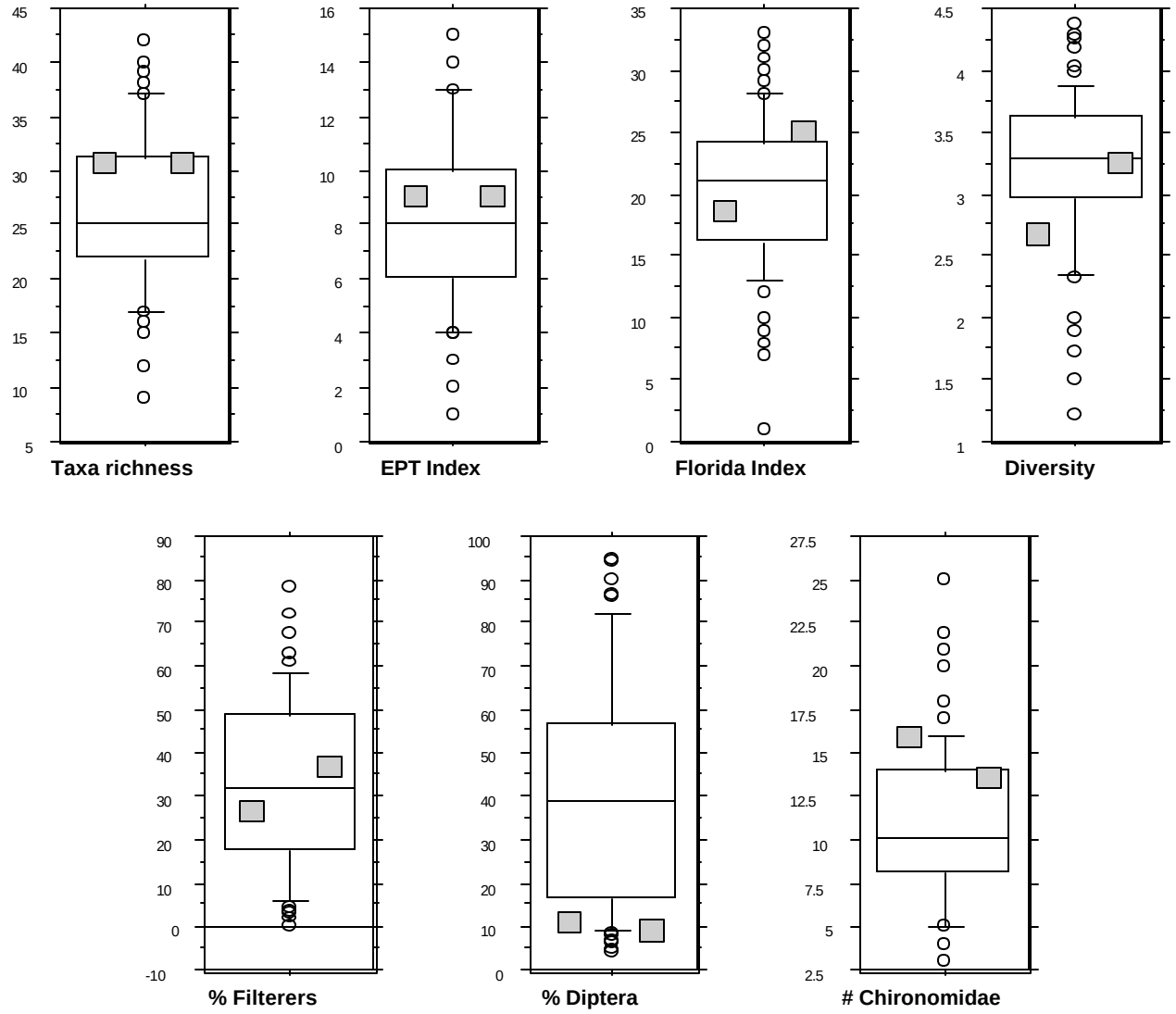


Figure 1. Typical ranges of selected macroinvertebrate parameters from eleven Floridan Aquifer dominated streams, collected with Hester-Dendy samplers (number of observations = 65). Results from the present Itchetuchnee River Hester-Dendy sampling have been superimposed upon the box plots: = Station I = Station II.

Trophic composition/feeding guilds: Disturbance can shift the feeding strategies of invertebrates. In Florida for example, pollution may be responsible for reducing the numbers of filter-feeders (FDEP 1994) and shredders (EA Engineering 1994).

The following were involved in this investigation: Sam Cole (DEP Recreation and Parks - sampling, and report review) and Lyn Burton, Jennifer Eichelberger, Russel Frydenborg, Joy Jackson, Elizabeth Miller, Urania Quintana, Bart Richard, Lisa Tamburello, Vicki Whiting, and Greg Wynn (Tallahassee Biology Laboratory).

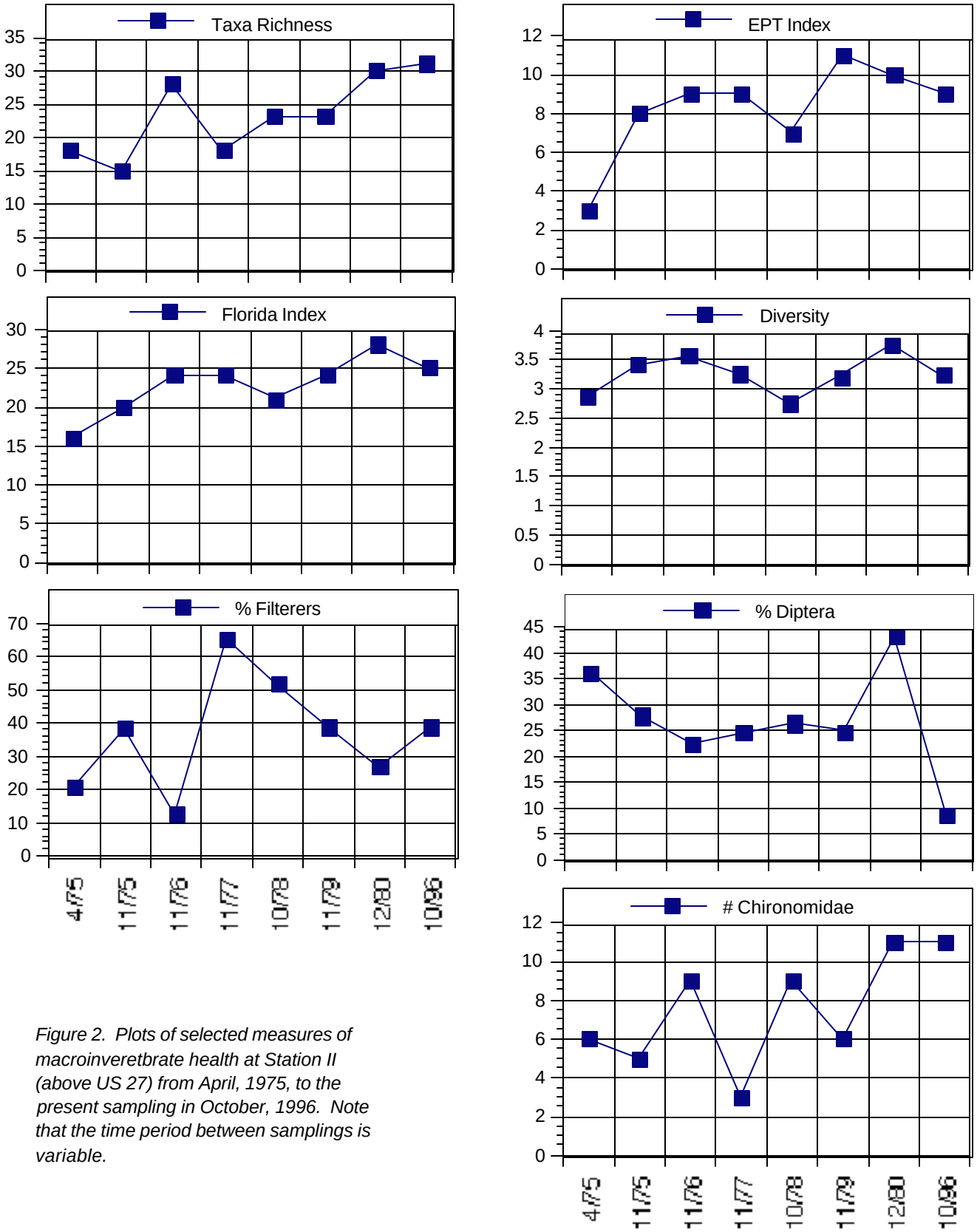


Figure 2. Plots of selected measures of macroinveretbrate health at Station II (above US 27) from April, 1975, to the present sampling in October, 1996. Note that the time period between samplings is variable.

Results and Discussion

Seven different measures of macroinvertebrate community health were calculated. These included taxa richness, the Florida Index, Shannon-Weaver diversity, the EPT Index, the number of chironomid taxa, the % filter-feeders, and the % Diptera. These measures have been shown to successfully discriminate between natural background, or reference sites, and those sites affected by toxicity, low dissolved oxygen, and habitat degradation (Barbour *et al*. 1996). As mentioned previously, Shannon-Weaver diversity is specified in the Florida Administrative Code (Rule 62-302.530(11) as a measure of biological integrity. With the exception of the % Diptera, higher values indicate healthier conditions.

The Ichetucknee River is dominated by Floridan Aquifer groundwater. We compared the measures of biological health obtained from the present Ichetucknee sampling to similar Floridan Aquifer-fed systems in Florida. Hester-Dendy data were available for eleven other undisturbed Florida spring fed streams, including Juniper Spring Run, the Wekiva River, Silver Run, the Santa Fe River, the Wakulla River, McBride Slough, Spring Creek, Blue Run, the Waccasassa River, the Chipola River, and Econfina Creek. A total of 65 observations since 1976 were retrieved and the distribution of the data summarized in box and whisker plots (Figure 1).

The values for the present Ichetucknee sampling were superimposed upon these plots, with stations I and II indicated. The top of the box represents the upper 75th percentile of the data distribution, the bottom represents the lower 25th percentile, and the line across the box is the median. The whiskers represent the upper 90th and lower 10th percentiles. The lower 25th percentile (for measures in which higher values mean healthier conditions) is often used as a lowest acceptable threshold level. In other words, values that fall below the lower 25th percentile generally imply stressed conditions.

In general, the current macroinvertebrate data from the Ichetucknee River compares favorably with other spring fed streams. Taxa richness (31 at both Ichetucknee stations) was near the upper 75th percentile of the other systems. The EPT Index (9 at both Ichetucknee stations) was well above the median value. The Florida Index (18 at station I, 25 at station II) values in the Ichetucknee were above the lower 25th percentile and above the 75th percentile, respectively. It was not unexpected that some macroinvertebrate measures would be lower at station I, which is near the headwaters of the stream and consequently, would receive less biological recruitment from upstream sources.

Diversity at station I (2.63) was below the lower 25th percentile distribution of the other spring systems, while diversity at station II (3.23) was roughly equivalent to the median value of the other streams. The lower than expected diversity at station I can be explained by the high numbers (1,204 organisms/m^2) of the amphipod, *Hyalella azteca,* that colonized the samplers at that location. *Hyalella azteca* is a cosmopolitan organism, common in submerged aquatic vegetation. The samplers at this station were directly adjacent to *Sagittaria kurziana* and *Zinzania aquatica* beds. Because all other indicators of invertebrate health were good, this lower than normal diversity value is no cause for alarm.

The % filter feeders (26% at station I, 38.7% at station II) was near the median value of the other spring fed streams, while the % Diptera (10.5 % at station I, 8.7 % at station II) was near the lower 10th percentile distribution. Unlike the other parameters discussed so far, an increased % Diptera is usually associated with pollution, meaning that lower % Diptera values imply less organically enriched conditions. Therefore, the low dipteran abundance in the Ichetucknee suggests favorable conditions. The low relative abundance of dipterans at station I was due to the corresponding high abundance of amphipods (50.4%), trichopterans (25%) and ephemeropterans (6.5%) there. The low relative abundance of dipterans at station II was due to the high abundance of trichopterans (36%), ephemeropterans (24.8%), and gastropods (18.2%) at that location. Despite the fairly low abundance of dipterans, the number of chironomid taxa (16 at station I, 13 at station II) was at or above the upper 75th percentile distribution, indicating that sufficient numbers of chironomid taxa were represented in the samples.

In summary, macroinvertebrate communities in the Ichetucknee River, when compared with other undisturbed Floridan Aquifer fed streams, indicate that healthy conditions currently prevail.

Macroinvertebrates were sampled via Hester-Dendy artificial substrate samplers at station II (upstream of US 27) on 6 occasions previously (Figure 2). With one exception, the past samplings took place in the late fall/early winter period. While there is a certain amount of variability in the macroinvertebrate measures, a general trend toward moderately improving con-

ditions was visually apparent in the plots of taxa richness, the EPT Index, the Florida Index, and the number of chironomid taxa (Figure 2). The values for the Shannon-Weaver diversity and the % filter feeders appeared cyclic, with the latest measures falling in the middle of the historic range. The % Diptera was unusually low in the latest station II samples, explained by the present high abundance of trichopterans, ephemeropterans, and gastropods. If the improving trend in many of the parameters is indeed genuine, a plausible explanation may be related to management strategies employed by the Division of Recreation and Parks. Since the land between the headwaters and US 27 were acquired by the State in 1970, the park management has gradually controlled the number of people using the river on a daily basis. The resulting decrease in physical disruption (*e.g.*, as would be caused by tubers disturbing aquatic habitat) may have had a beneficial effect on the invertebrate communities.

Conclusions

Macroinvertebrate communities at the two stations sampled in the Ichetucknee River, when compared with those found in other undisturbed Floridan Aquifer fed streams, indicate that healthy conditions currently prevail. These data suggest that human activities in the recharge area of the springs have not negatively affected water quality. Additionally, based on historical data from the station upstream of US 27, a moderately improving trend was visually apparent in the plots of taxa richness, the EPT Index, the Florida Index, and the number of chironomid taxa. The decrease in physical disruption of aquatic habitat, resulting from daily limits on the number of recreational users of the stream, may have had a beneficial effect on the invertebrate communities.

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