

## **Quantification of Injury to Aquatic Resources resulting from the Pryor Oil Spill and Fire, Obed Wild and Scenic River (Task No. 1)**

On 19 July 2002, oil spilled from the Howard/White Unit No.1 oil well (Pryor Oil Company, Cookeville, Tennessee) in Morgan County, Tennessee. This oil spill contributed approximately 200-500 barrels of oil per hour into Clear Creek and nearby White Creek. A resultant fire followed the oil flow to the banks of both creeks, burning much of the riparian vegetation. Soils were soaked with oil and surface soils were burned. At least 3.2 km of Clear Creek and 0.8 km of White Creek were impacted by this spill and the resultant fire. Oil continued to seep into creeks, with a noticeable sheen remaining visible as late as October 2003.

As a result of this environmental disturbance, federal and state natural resource trustees elected to conduct a Natural Resource Damage Assessment (NRDA) to determine potential impacts. The study described in this report concerns assessment of benthic macroinvertebrate communities associated with Clear Creek as part of the NRDA. Specific tasks were to analyze benthic index scores associated with samples collected after the oil spill, to determine if significant changes in species composition and relative abundance occurred, particularly within more sensitive taxa, and to evaluate life histories of affected taxa to estimate time of return to baseline conditions following oil exposure.

Preassessment of macroinvertebrate samples collected from 1996 to 1999 and during 2002 at Jett Access, downstream of the oil spill, resulted in little variation in benthic index scores. All scores were within the non-impaired range for streams within Tennessee Bioregion 68a. However, during October 2002, samples from Barnett Bridge revealed differing results. Barnett Bridge is located just downstream of the spill site. The benthic index score from a sample collected upstream of the spill indicated non-impairment, but the score from a sample at Barnett Bridge indicated moderate impairment. Therefore, additional samples were collected from Clear Creek locations during 2003 and again during 2005. Data from these samples were analyzed and compared with those from 2002 to address the tasks set forth in this study.

The United States Fish and Wildlife Service's Ecological Services Office in Cookeville, Tennessee sent data collected by the Tennessee Department of Environment and Conservation (TDEC) to the investigator. Data received included samples from 2002, 2003, and 2005 from Hegler Ford, Barnett Bridge, and Jett Access; however, not all sites were sampled during each of the three years. No data from 2004 were received; therefore, there was a one-year gap in the database.

All data were entered into Excel spreadsheets and all metric values (i.e., Taxa Richness, Ephemeroptera-Plecoptera-Trichoptera (EPT) Richness, % EPT, % Oligochaeta/Chironomidae (%OC), North Carolina Biotic Index Scores (NCBI), % Dominant Taxon, and % Clinger organisms) were re-calculated and checked for accuracy. Metric values were compared to detect spatial and temporal variation. In addition, overall benthic index scores were recalculated using metric scores from Tennessee Bioregion 68a. Index scores were then compared for detection of spatial and temporal variation.

A taxa-location-sampling date matrix was then constructed to identify those taxa that varied spatially or temporally. Life histories of taxa that varied spatially and/or temporally were then reviewed and used to help explain any variation. Unfortunately, due to unequal numbers of samples at each location, lack of sufficient replication, and the one year gap (2004) in the database, statistical procedures, other than the multi-metric analysis to determine index scores, could not be used to analyze benthic community variation.

Results from this study indicate that while the benthic community at Barnett Bridge was influenced by the 2002 oil spill (Benthic Index Score = 20), the benthic community at this site appeared to have recovered by 2003. Many benthic organisms are often eliminated when oil substances coat the substrate. Free oil and emulsions can coat gills and interfere with respiration. Many sensitive aquatic macroinvertebrates, especially Ephemeroptera, Plecoptera, and Trichoptera, respire using tracheal gills. If these gills were affected by the oil, this could have resulted in loss of many of these organisms and explain the low EPT richness and % EPT values recorded for this sample (EPT = 4; % EPT = 5.56). Therefore, only the more tolerant organisms would have survived this environmental disturbance. Oligochaetes and Chironomidae larvae are often considered tolerant to environmental disturbance and the % abundance of these taxa was elevated in the 2002 Barnett Bridge sample (% OC = 52.2).

Improvement of the benthic communities in Clear Creek during 2003 was confirmed by data collected in a study of the benthic macroinvertebrate communities of the Emory River Watershed during 2004 and 2005. Fourteen locations, including Hegler Ford, Barnett Bridge, White Creek, and Jett Access, were sampled during 2004. The mean benthic index score for the Clear Creek sub-watershed was 38.57, which was the highest score for the four sub-watersheds sampled. Benthic index scores for Hegler Ford, Barnett Bridge, White Creek, and Jett Access were 36, 40, 36, and 36, respectively. Thus, all sites were considered non-impaired. This proved that the oil spill was no longer affecting the benthic macroinvertebrate communities at Barnett Bridge and White Creek during 2004, providing support for the theory that the communities had improved in 2003 and further improved in 2004. However, during low flow conditions in 2005, benthic communities at the Barnett Bridge sites (downstream of spill and confluence with White Creek) appeared to be affected by the continued seepage of oil evident at these sites. Therefore, during normal and high flow events benthic communities at the Barnett Bridge sites appear non-impacted, but may be influenced by increased contact with oil during low flows.

The Cumberland Plateau Physiographic Province is rich in natural resources. The relatively flat terrain surrounding headwater streams in the upper reaches of Clear Creek provides opportunities for changes in land use. Currently, land coverage is primarily undeveloped forest, and this provides a degree of protection for the aquatic resources found there. However, with increasing population growth in this area, the current status of these natural resources could be jeopardized. Oil exploration within this sub-watershed will probably continue, and environmental disturbances such as the one investigated in this report will probably re-occur. Therefore, it is essential to understand the dynamic interactions that occur as a result of such a disturbance within an aquatic ecosystem like Clear Creek. Regular, long-term benthic macroinvertebrate monitoring of

valuable aquatic resources in this region should be instituted to provide continual assessment of the environmental health of these ecosystems.