

**TVA KINGSTON ASH RECOVERY PROJECT
ROANE COUNTY EDUCATION INITIATIVE**

“BENTHIC INVERTEBRATE SAMPLING”

Abstract: Scientists are conducting benthic invertebrate community surveys to assess impacts of the ash spill on number and variety of invertebrates in the area. In addition, three types of invertebrates were selected as study animals to evaluate potential effects of exposure to coal ash (i.e., metals). These include two widespread and abundant species, the silty horn snail and burrowing mayfly, and several species of mussels.

Students will be provided a brief overview of the different types of benthic invertebrates and their feeding habitats and life cycles. Sampling techniques will be demonstrated to the students with some “hands on” and observational activities.

What are Benthic Invertebrates

Benthic invertebrates are animal such as worms, mussels, snails, crayfish, and immature forms of aquatic insects that lack backbones and live on the bottom of the river. Because they generally have limited capability of movement and live where ash may have deposited in the river, benthic invertebrates can be exposed to contaminants found in the coal ash. These contaminants may accumulate in the tissue of these animals over time. This could impact the health of the individual organism as well as other animals that might feed on them.

Students will be able to view various benthic invertebrates and will be provided a brief overview of their different feeding habitats and life cycles.



Benthic Invertebrate Community Collections

A small dredge is used to collect sediments from the bottom of the river to determine the numbers and kinds of invertebrates present. The dredge is attached to a motorized winch mounted on a boom in the center of the boat. This setup provides a convenient way to collect the substrate and organisms in deep waters and bring them to the surface for processing. The content in the dredge is transferred to a tray

containing a mesh bottom and the fine material (e.g., silt) is removed by carefully washing the sample using a surface water pump and spray hose. The organisms and any remaining substrate are placed in sample containers so that the organisms can be picked from the substrate, identified, and counted later in the lab.

Students will be able to observe samples of different types of substrates. They will be asked to “process samples” by picking a few different invertebrates from each sample.



Ponar Dredge and Boom



Wash tray with dredged sample



Sample after washing

Mussel Collections

TWRA uses diving gear to study mussels in the large rivers near Kingston. TWRA conducted underwater surveys of the mussel populations in the area. They also collected mussels from other Valley waterways and transported them live to Kingston. Once at Kingston, divers placed mussels in cages either on the bottom of the river or suspended about mid-depth in the water column. The mussels remained in the river for almost a year during the dredging operations, and then they were removed and analyzed for metals. Additional mussels were placed in the river after dredging operations were completed and will remain there for approximately one year for comparison.

Dive equipment, various mussel shells, and a “mussel cage” will be on display along with a poster of sampling photos. Students will be able to examine the differences in some of the native mussels and observe how they are positioned in a “mussel cage”.



Suited-up to dive for mussels

Mayfly Collections

The nymphs (immature forms) of burrowing mayflies live 1 to 2 years in burrows dug in silt-clay substrates that are soft enough to burrow into but rigid enough that the burrows don't collapse. Each year, primarily June through August, a generation of nymphs transform and emerge ("hatch") in large numbers as non-feeding adults. The adults only live about 48 hours to reproduce, but several different groups may emerge at one location each year, with each group providing a feast to many nearby aquatic (fish, turtles) and terrestrial (spiders, birds, bats) predators.

A dredge is used to collect the nymphs in the same way that benthic invertebrate community samples are collected. Because we don't know exactly when or where the adults will emerge, we ask other scientists, fishermen, and local residents to notify us when they observe mayflies "hatching". Adult mayflies are collected by hand or sweep nets from vegetation along the shoreline. In the lab, the adults are separated into groups based on their sex and adult development stage, called imago and subimago.

Live mayfly nymphs and samples of adult mayflies will be on display. Students will be able to observe the difference between nymphs and adults and asked to distinguish between the two adult development stages.



Mayfly Nymphs



Mayfly Adults – imago and Subimago



Adult Mayflies Emerging ("Hatching")

Snail Collections

The silty horn snail is a relatively large snail that typically lives in shallow waters where it feeds on algae and detritus. They can be collected by hand from shallow rocky or stable wooden structures near the shoreline. The snails are kept alive for 72 hours in a laboratory to clear their digestive systems (i.e., depuration), then the tissue is removed from the shells and sent to an analytical lab to determine the amounts of ash-related elements in their tissue.

At least 16 species of snails have been encountered from TVA reservoirs. Different species of snails will be on display along with a poster of sampling photos.



Display Items:

Large map with sampling locations

Large display of invertebrate photos and sampling

Shells of native mussel and some exotic invasive species (Asiatic clam and Zebra mussels)

Shells of snails

Samples of Adult Mayflies

Live mayfly nymphs, snails, and Asian clams

Fingernail clams for size comparison to native mussels

Ponar and Peterson Dredge

Wash Screen

Aerial Sweep Nets

“Mussel cages”

Dive gear such as wet (or dry) suits, air hose, weight belt, and face mask,