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ABSTRACTS OF THE SEVENTY-SEVENTH ANNUAL SESSION

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Abstracts are printed as they were received for publication.

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POSTER SESSION III: ECOLOGY

BIOLOGY

STEVEN L. STEPHENSON and MARTIN SCHNITTLER, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Studies of Neotropical Myxomycetes.

During the period of 1997 to 2001, as a result of funding provided by National Science Foundation grant DEB-9705464, a biotic survey of myxomycetes (plasmodial slime molds) was carried out in a number of study areas in Central and South America to document more completely the species associated with tropical forest ecosystems in this region of the world. More limited data were obtained for dictyostelids and protostelids, two other groups of mycetozoans that share some of the same microhabitats as myxomycetes. The body of data represented by the more than 5,000 collections accumulated during the project have provided evidence for a number of ecological patterns not previously reported for myxomycetes. The most important of these are that (1) both overall abundance and species richness of myxomycetes are lower in tropical forests than in temperate forests, (2) species richness of myxomycetes decreases with increasing elevation in subtropical/tropical regions of the world, (3) species richness and [especially] relative abundance increase with decreasing moisture conditions, and (4) in tropical forests, distinct assemblages of myxomycetes are associated with microhabitats that have no counterparts in temperate forests. The most extensive of the latter is the aerial litter (dead but still attached plant parts) microhabitat, where myxomycetes appear to be especially abundant and diverse. The survey, which is still ongoing, was designed to include a number of undergraduates as active participants, and more than a dozen students from Fairmont State College have been involved in either the field or laboratory components of the project.

ADAM W. ROLLINS and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554 and **DONNA L. MOORE,** Biology/Chemistry Division, Corning Community College, Corning, NY 14830. First records of protostelids from West Virginia.

The protostelids are a group of mycetozoans (slime molds) unknown to science until 1960 but apparently widely distributed in many different kinds of terrestrial habitats. All of the approximately 40 species described to date produce microscopic fruiting bodies characterized by a delicate acellular stalk that supports one or a few spores. The fruiting bodies of protostelids are the smallest produced by any of the mycetozoans, and those of some species are less than 10 ìm tall. Because of their very small size, protostelids can be detected only by the microscopic examination of substrates under laboratory conditions. In the present study, samples of aerial litter (dead but still attached plant parts) and forest floor litter were collected from a mixed hardwood forest located near Fairmont and then placed in a series of primary isolation plates of the type used for protostelids. These plates yielded the first records (at least of which we are aware) of protostelids from the state of West Virginia. Among the species recovered were *Echinosteliopsis oligospora*, *Protostelium mycophaga*, *Protostelium pyriformis*, *Soliformovum irregularis*, and *Tychosporium acutostipes*. Protostelids seemingly coexist in some of the same microhabitats as dictyostelids and myxomycetes, the two other groups of mycetozoans commonly encountered in nature. However, much less is known about their distribution and ecology. The present study represents an effort to obtain baseline data on the assemblages of protostelids associated with forest communities in north central West Virginia.

SUSAN MOYLE STUDLAR, Dept. of Biology, West Virginia University, Morgantown, WV 26506-6057. Moss harvest in West Virginia: target species and incidental take.

Five bags of commercial moss (about 50 pounds of moist bryophytes) were analyzed to determine what species are harvested in West Virginia, and in what proportions. The bags of moss (probably from Nicholas, Webster, and Pocahantas Counties) had been sold by moss harvesters to a dealer in Rainelle in late October, 2001. In the five bags examined, *T. delicatulum* is by far the most abundant species (total cover 33 m^2), followed by *Loeskeobryum brevirostre* (5.6), *Hypnum imponens* (5.0), and *Hypnum curvifolium* (3.0). In eastern North America, *Hypnum imponens* and *Thuidium delicatulum* are evidently the first and second most preferred moss species in the commercial trade (for use in terraria, as packing material, for floral arrangements, and in the decorative arts). Both species

are plagiotropic and form extensive carpets on logs and boulders. Analysis of the five bags from Rainelle thus suggests that either *H. imponens* is declining due to harvest or it is much less abundant than *T. delicatulum* in the mesic forests where moss harvesters work. Including the four most abundant species (cited above), there are 51 species (46 mosses and 5 liverworts) in the five bags, with an average of 21 species per bag. Only four species were found in all five bags, and 32 species were variously present in one bag only. This indicates high incidental take of non-target bryophytes. Dissection of mats demonstrated that *Thuidium delicatulum* is a keystone species. It serves as a substratum for most of the minor (low cover) species, and also overgrows orthotropic taxa (such as *Dicranum* species) on soil, wood, and bark. Such taxa become embedded in the mats and are removed (often with substratum attached) when the mats are stripped from the forest. The bag with the most species (35) displays numerous small, thin mats still attached to wood and bark; the moss is rated as bad (unusable) by the dealer. The bag with the fewest species (12) has fewer, relatively large, thick, clean mats; the moss is rated as good for commercial trade. Pending further study (analysis of more moss bags, along with field studies of bryophyte communities in harvested and non-harvested forests), it appears that the removal of younger, thinner, more biodiverse mats may have a greater ecological impact than the removal of older, thicker, less species-rich mats.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554.
Myxomycetes of the New Zealand subantarctic islands.

McKenzie and Foggo, who reviewed all previous records of fungi collected on the New Zealand subantarctic islands, listed only two myxomycetes (*Tricha favoginea* from the Auckland Islands and *Lamproderma echinulatum* from the Snares Islands). During a survey of fungal biodiversity carried out on Campbell Island for a two-week period (March 6–18) in 2000, the types of substrates upon which these organisms typically occur were investigated for the presence of myxomycete fruiting bodies that had developed under field conditions. In addition, samples of various kinds of dead plant material were collected. Later, these samples were placed in moist chamber cultures of the type used for the laboratory isolation of myxomycetes. Although the primary focus of the survey was on the fungi of Campbell Island, an opportunity to spend several days (March 20–23) on the Auckland Islands yielded a number of field collections of myxomycetes. At least 31 species in 17 genera were represented among the specimens obtained as a result of the entire survey. This total included 11 species recorded from moist chamber cultures and 24 species represented by field collections. These records included the southernmost known occurrence of such species as *Arcyria leiocarpa*, *A. major*, *Badhamia nitens*, *Lamproderma columbinum*, and *Trichia erecta*. (Supported in part by grant DEB-9971695 from the National Science Foundation.)

JOHN C. LANDOLT, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443, **JAMES C. CAVENDER,** Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701 and **STEVEN L. STEPHENSON,** Dept. of Biology, Fairmont State College, Fairmont, WV 26554.
Dictyostelid cellular slime molds of the Great Smoky Mountains National Park.

As part of the All Taxa Biodiversity Inventory (ATBI) project currently being carried out in the Great Smoky Mountains National Park, an ongoing survey of dictyostelid cellular slime molds has yielded a combination of previously reported species together with additional Park records as well as a number of species possibly new to science. As results from previous studies conducted elsewhere in the world have indicated, there appear to be assemblages consisting of particular species of dictyostelids characteristically associated with certain habitats in the Park. In many cases, the distribution pattern of a given species can be related to the differences that exist from place to place for such environmental parameters as elevation, soil pH and moisture regime. In this presentation, we report on the current status of the ATBI dictyostelid survey and discuss some of the more interesting and/or unusual species discovered thus far. This study is supported in part by a grant from Discover Life in America.

CHEMISTRY/BIOTECHNOLOGY

JAMIE L. BREWER, Dept. of Microbiology, Immunology, and Cell Biology, West Virginia University, Morgantown, WV 26506 and **SOLVEIG G. ERICSON**, Depts. of Medicine and Microbiology, Immunology, and Cell Biology, West Virginia University,

Morgantown, WV 26506. Developing a methodology to detect human T cell receptor variable family gene expression patterns.

T cells constitute a component of the immune system that is able to distinguish self vs. non-self. This is accomplished through the interaction of their T cell receptor (TCR) with the major histocompatibility:antigen complex expressed on the surface of cells within the organism. The T cell receptor is a heterodimer composed of an alpha (α) and beta (β) chain, each consisting of variable and constant regions. It is the variable region of these chains that directly contacts the antigen:major histocompatibilty complex (MHC) molecule, eliciting the T cell response. Based on the Arden classification system, there are 32 different functional variable α families (with 69 subfamily members total) and 25 different functional variable β families (with 91 subfamily members total) in humans. Previously there has been no method established to evaluate the expression of all members of the TCR families. To develop a PCR based strategy to efficiently evaluate T cell receptor variable α (TCR Vα) and β (TCR Vβ) gene family expression in humans, sequence analysis was performed using GenBank to determine candidate primer sequences. Sequences were chosen to specifically amplify a given TCR variable family without the cross-reactive amplification of other TCR variable families. The result was a panel of 62 primers with products ranging in size from approximately 275 to 500 bp. Southern blot analysis was used to confirm the specificity of the primers. Through the use of RT-PCR analysis of RNA collected from a human sample, such as peripheral blood, the expression pattern of the T cell receptor variable families can be determined, aiding in the study of various immunological conditions in which alterations in the T cell receptor repertoire occur.

JEREMY CHAMBERS, Dept. of Chemistry, West Liberty State College, West Liberty, WV 26074. Synthesis of Antimony tris (N,Ndialkyldithiocarbamates).

Six antimony complexes with diakyldithiocarbamates have been prepared using six different dialkylamines, carbon disulfide, and antimony (III) chloride. The complexes were examined by elemental analysis, FTIR spectra, and H-NMR spectra. The results illustrate that the antimony is complexed to three dithiocarbamic ligands through three sulfur atoms.

JIBEN ROY, Department of Biosciences, Salem International University, Salem, WV 26426 [roy@salemiu.edu]. Formation of pharmaceutical impurities during manufacturing processes and afterwards- an overview.

The control of pharmaceutical impurities is currently a critical issue to both pharmaceutical industries and to regulatory authorities. This paper will discuss the impurities found in active pharmaceutical ingredients, particularly ampicillin trihydrate, impurities formed during formulation of medicines such as diclofenac sodium injections and photo-degradants from an eye drop solution. Studies show the presence of traces of ampicillin polymers, hydrolyzed products and by-products in the active ingredient. A detailed analysis using gradient controlled HPLC revealed most of the impurities. In case of diclofenac sodium injections, a known impurity is formed during the formulation if it is terminally sterilized by autoclave. This impurity has been detected as 1-(2,6-diclorophenyl)indolin-2-one, which is also an intermediate from which diclofenac sodium is generally synthesized. It is the condition of the autoclave method (123 ± 2^0C) that enforces the intramolecular cyclic reaction of diclofenac sodium forming the indolinone derivative and sodium hydroxide. Regarding photo-degradation of eye drop solution, a fluoroquinolone antibiotic such as ciprofloxacin has been studied. Sunlight induces the photo-cleavage reaction producing ethylenediamine analog of ciprofloxacin. A strategic solution to avoid or minimize all these impurities to allowable limits has been found by using optimum parameters in case of ampicillin or alternative method of sterilization such as aseptic filtration for diclofenac sodium injections and opaque container for ciprofloxacin eye drop solution.

AISLINN TIERNEY and **ROGER VIADERO, JR**, Dept of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Implications of active dissolved metal concentrations and speciation on the use of treated mine water for the culture of *Oncorhyncus mykiss*.

The objective of this study was to assess the bioavailability and potential toxicity of metals in the effluent of an active mine water treatment facility to *Oncorhyncus mykiss* (rainbow trout) and explain observations in terms of ionic activity and metal speciation.

Fifty trout were raised to approximately one pound (0.45 kg) in treated mine water effluent to assess their viability and the potential for bioaccumulation of trace heavy metals. The trout were deployed in a nylon cage in October 2000 and were monitored for signs of stress and mortality through May 2001. The fish were then removed and analyzed for trace heavy metal concentrations (Cd, Se, As, Pb, Cr, Cu, Zn, Sb, Ni, Ag, Be, Tl, and Hg). A grab sample for analysis of trace heavy metal concentrations in the treated effluent was taken in November 2000 as a baseline measurement. Monthly grab samples, taken for the duration of the study, were analyzed for dissolved concentrations of typical acid mine drainage (AMD) metals (iron, manganese, aluminum, magnesium, and calcium). Additionally, sulfate concentrations, alkalinity, acidity, and hardness were measured.

Concentrations of heavy metals in grab samples were below detection limits, however further testing was required to ascertain the possibility of biomagnification. Research collaborators from WVU's Aquaculture Extension Agency detected no signs of stress, nor were there any fish mortalities after living in the treated effluent for nearly seven months. Eight trout were randomly selected for bioaccumulation analysis and no detectable concentrations of trace heavy metals were found in the fish flesh. Based on preliminary results of monthly water quality monitoring and analyses performed at the mine water treatment facility, it was found that common AMD metals concentrations listed in the West Virginia Criterion for Trout Waters were exceeded.

Though dissolved AMD metals concentrations in the water exceeded recommended limits; the fish showed no signs of stress or mortality. It was believed that the high ionic strength of the treated waters (average specific conductance value of 6.78 mS/cm), played a major factor in reducing the active concentrations of metal ions. Based on the Güntelberg approximation to the DeBye-Hückel equation, the average active concentration of divalent ions in the treated effluent at this facility was 32.4% less than the actual concentration predicted in low ionic strength waters. Similarly, for trivalent ions, the average active concentration was only 8% of the actual measured concentrations. In addition, complex formation resulted in the presence of diverse species of metal-ligand complexes and was also a significant factor in the reduced bioavailibility of dissolved metals. The formation of complexes generally reduces the free metal ion concentration, affecting the bioavailability of the metal. Thus, while the total concentration of a metal may exceed the prescribed limits, only a fraction of the metal may be present as a species that is bioavailable.

ECOLOGY

RONALD H. FORTNEY, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **WILLIAM N. GRAFTON**, Division of Forestry, West Virginia University, Morgantown, WV 26506; and **ROBERT B. COXE**, Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222. Plant communities of West Virginia roadsides.

The vegetation of roadside habitats is, overall, poorly studied. There have been no investigations that have characterized the floristics and the assemblages of plant communities on highway corridors over a wide geographic area. Most studies have dealt with the management of roadside vegetation through the use of plant species for sediment and erosion control, use of herbicides, and mowing operations.

In 2000, the West Virginia Division of Highways funded a comprehensive study in which quantitative data on the structure and composition of roadside vegetation were obtained from 300 randomly selected study sites located along interstate and other four-lane highways throughout the state. Each study site consisted of 20 m wide plot that extended from the edge of the highway to the limit of construction. Data were collected on percent slope and aspect and relative abundance of all species within the plot, using the following scale: rare, occasional, common, and abundant.

Except for areas with unstable slopes, roadsides were mostly vegetated. The non-native plant components included species planted for sediment/ erosion control and species naturally emigrating to roadside environments from off-site locations. In general, the species making up roadside communities are characteristic of other types of disturbed habitats and/or are species introduced for roadside soil stabilization. Herbaceous species planted for sediment and erosion control were predominant. Prominent examples included *Lolium arundinaceum*, *Festuca*

rubra, *Eragrostis curvulata*, *Lespedeza cuneata*, and *Coronilla varia*. Other important nonnative herbaceous species included *Cirsium arvense*, *Daucus carota*, *Leucanthemum vulgare*, and *Dipsacus fullonum*. On older roadsides several native herbaceous species were common, including *Solidago canadensis* and *Solidago juncea*. On many older roadsides, several nonnative shrubs were common, including *Lonicera marrowii*, *L. japonica*, *Rosa multiflora*, and *Elaeagnus umbellate*. Native shrubs and vines were occasional components of roadside communities. The most common were *Parthenocissus quinquefolia*, *Rhus capallinum*, and *Rhus glabra*. Tree species were uncommon, but the invasive *Ailanthus altissima* was common along many highways.

Our data indicate that the vegetation of West Virginia roadsides usually consists of assemblages of naturally native and non-native invasive species. Moreover, species diversity generally increases with highway age.

DENA LEADMAN, Institute of Environmental Studies, Shepherd College, Shepherdstown, WV 25443 and **PETER VILA** Institute of Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Physical, Chemical, and Biological Assessment of Three Run, Berkeley County, West Virginia.

Various physical chemical, and biological parameters were collected and analyzed from Three Run, Berkeley County West Virginia. Water samples were collected on three dates in spring and early summer at low, medium and high discharge. In addition, a low-lying area inundated during high precipitation events was also sampled. Values for temperature, pH, dissolved oxygen, salinity, turbidity, specific conductivity, and total dissolved solids were within the expected range and similar to values found in nearby streams. Nutrient levels (nitrogen and phosphorus) were high and the results depended upon the ionic form present. Aluminum and iron levels exceeded the National Secondary Drinking Water Standards set by the EPA; zinc levels did not exceed the standards. Lead levels exceeded the National Primary Drinking Water Standards set by the EPA. Sulfate and chloride levels were below the EPA National Secondary Drinking Water Standards. Fecal coliform and *E. coli* levels were extremely elevated with up to 6000 colonies per 100 ml. These values indicate an agricultural or residential input of bacteria to the stream.

JAMES S. RENTCH and RAY R. HICKS, JR. Division of Forestry, West Virginia University, Morgantown, WV 26506 [jrentch2@wvu.edu]. Comparison of presettlement and modern forest composition for five counties in the Central Hardwood Forest Region.

This study tallied species abundance from witness trees of early land surveys in five counties in eastern Ohio, southwestern Pennsylvania, and north central West Virginia to reconstruct presettlement forest composition. Results were then compared to current U.S.D.A. Forest Service forest inventory (FIA) data to determine long-term changes in species composition. Presettlement forests in this region were predominately oak-dominated forests. *Quercus alba* was dominant, at minimum, twice as abundant as *Q. velutina*, the second ranked species. *Acer saccharum* and *Fagus grandifolia* were among the ten most abundant species in each county; however their importance was consistently less than one-third the value for *Q. alba*. *Quercus rubra*, *Q. prinus*, *Castanea dentata*, and *Acer rubrum* were relatively minor components of presettlement forests, rarely ranked among the ten most abundant tree species. The one county for which diameter-distribution data are available shows that oaks were well distributed among all but the smallest size classes, suggesting that oak replacement was a stable feature of these forests. Cluster analysis and rank-ANOVA of presettlement and FIA data show a statistically significant separation by historical period. Modern inventories show a significant decline in *Q. alba* and a large increase for *A. rubrum*. The species composition of presettlement forests suggests a highly variable disturbance regime in which a variety of species with different life history strategies, disturbance tolerances, and growth requirements shared overstory position. Changes in species dominance over the time period reviewed suggest that 20th century reduction in fire frequency resulted in reduced oak abundance and accelerated recruitment of fire intolerant species.

ECOLOGY AND PALEONTOLOGY

ZACHARY LOUGHMAN, Biology Dept. West Liberty State College, West Liberty, WV 26074 zloughman@hotmail.com. Herpetofauna of the Lewis Wetzel Public Hunting Area in Wetzel County, West Virginia.

Herpetofaunal populations were surveyed in the Lewis Wetzel Public Hunting Area in Wetzel County, West Virginia over a period of three field seasons (1999 – 2001). The fact that this area represents virgin timber was the primary ideal behind these field surveys. The results of these surveys were five county records, two amphibians and three reptiles. Historical populations present in the game land were also surveyed, including one of the northernmost populations of Timber Rattlesnake (*Crotalus horridus horridus*) present in the state. The results of field observations over the corse of three field seasons indicated thriving herpetofaunal populations for this game land, and a picture of classic herpetological populations that were once present in the state prior to the past mass logging efforts.

ARIANA N. BREISCH, Dept of Biological Sciences, Marshall University, Huntington, WV 25755, **ALVIN R. BREISCH**, New York State Dept of Environmental Conservation, Albany, NY 12110 and **THOMAS K. PAULEY,** Dept of Biological Sciences, Marshall University, Huntington, WV 25755. Thermal regime of *Clemmys* in West Virginia.

The Spotted Turtle (*Clemmys guttata*) and Wood Turtle (*C. insculpta*) are the only members of the genus *Clemmys* that occur in West Virginia. In the spring of 2001, a one-year radio-telemetry study began of these two species in the eastern panhandle of West Virginia near the known southern limits of the wood turtle range. This site is the only location in the state where these two species occur together. In addition to monitoring seasonal movements, the thermal regime of the turtles' over wintering refuges was studied. StowAway TidbiT® data loggers were attached to the carapace of six Wood Turtles to record external temperature. Due to the small size of Spotted Turtles, data loggers were attached after they had entered hibernacula and activity slowed. Additional data loggers were also placed four feet above ground, in hibernacula, and in the stream channel to determine if turtles were selecting a thermal regime that was different from the general environment. Temperature was recorded at 1 hour intervals during the summer and longer intervals during hibernation. Data logger information was compared to local weather station records and temperatures recorded in the field. Data collected in this study was used to show the extremes in temperature the turtles tolerated and compare turtle behaviors to temperature and weather. Comparisons between this study and the thermal regimes of more northern populations of Wood and Spotted Turtles may help us understand if over wintering temperature is a limiting factor in the distribution of these species.

E. RAY GARTON, Curator West Virginia Geological Survey, PO Box 200, Barrackville, WV 26559 and **MICHAEL D. DUNN**, 1001 Mica Road, Mineral, VA 23117 and **ROBERT L. PYLE**, 1964 Negley Avenue, Morgantown, WV 26505. New localities for the trilobite *Kaskia chesterensis* from the upper Mississippian of West Virginia.

A collection of pygidia and one complete, well preserved, enrolled *Kaskia chesterensis* was made from two previously unreported localities in West Virginia. The first locality is an abandoned limestone quarry at the mouth of Maiden Run, Monongalia County. The second locality is within the J.F. Allen limestone quarry on the waters of the Tygart River, Randolph County. The Maiden Run locality in is the upper portion of the Greenbrier Formation, Lloyalhanna member. The J.F. Allen locality is on several large quarried limestone blocks no longer *in situ* but appear to also have been part of the Lloyalhanna member. Only one genera of trilobite, *Kaskia*, with several species is known from the upper Mississippian strata of the Appalachians, both assigned to the genus *Kaskia*. (Brezinski, 1988, 1999, 2002 personal communication).

MIZUKI TAKAHASHI, Dept of Biological Sciences, Marshall University, Huntington, WV 25701 and **THOMAS K. PAULEY**, Dept of Biological Sciences, Marshall University, Huntington, WV 25701. Reproductive and morphological differences between two populations of *Plethodon cinereus* at different altitudes.

The eastern red-backed salamander, *Plethodon cinereus*, has a broad distribution throughout the

northeastern United States, ranging from southern Quebec and Nova Scotia to southern North Carolina. *P.cinereus* has been studied well because of its high availability. However, little emphasis has been placed on morphological differences due to elevation. In West Virginia, *P. cinereus* is found statewide up to an elevation of 4,800 feet, but is not found in the counties bordering the Ohio River. They have not only a wide latitudinal range but also a wide vertical range. Two populations were selected from different elevations (>4000 and 1500 – 1000 ft.) and the snout-vent length (SVL) and cranial width (CW) of approximately 80 individuals (40 males and 40 females) from each population were measured. There is significant difference ($p<0.05$) in SVL between the two populations. This result may be explained by longer winter at higher elevations. In order to understand this difference, stomach content data and tail fat percentages were analyzed.

CLIFFORD E. STARLIPER, National Fish Health Research Laboratory, USGS, Kearneysville, WV 25430. Captive rearing of native freshwater mussels: addressing the concerns of pathogens and diseases.

This presentation will highlight research topics for a new area of research: pathogens and diseases of freshwater mussels and the potential for mussels to serve as pathogen vectors.

Approximately 300 species and subspecies of freshwater mussels (Unionidae) are native to North America, and the majority are listed as endangered, threatened, or of special concern. Factors that have contributed to the decline of this fauna include siltation from runoff and waterway construction. Also, the inadvertent introduction of zebra mussels (*Dreissena polymorpha*) now represents a major threat to native populations in major river systems throughout the Mississippi River basin and Great Lakes drainages, reducing their overall numbers and in some instances eliminating entire species. Conservation of native mussels was intensified in the mid 1990's; a major effort is to collect federally listed mussels and relocate them to safe refugia with the goal to propagate them for subsequent re-introduction. Safe refuges include fish rearing hatcheries and as a result there is great concern by resource managers with regard to introduction of pathogens and diseases (to fish and to mussels). Unfortunately, the scientific literature is void of described pathogens of mussels and the potential for mussels' to act as pathogen vectors.

Therefore, the study objective was to initiate research to address the aforementioned concerns. Initial studies developed methodology for isolation of bacteria from mussels and to study the dynamics of their bacterial flora relative to a water change. Mussels average 1×10^6 cfu bacteria/g of soft tissue and their flora responds within 24 h of a water change. Mussels from the Ohio River were shown to harbor fish pathogens and more important, transmit them to fish. But, transmission is voided if mussels are allowed to depurate (for less than 15 days) in pathogen-free water. Current studies are focusing on developing a bacterial database for the purpose of identifying causative agents of (natural) mussel epizootics, expanding the use of a transmission model that was developed to evaluate vectoring potential and development of non-lethal sampling.

COLLIN K. BALCOMBE, JAMES T. ANDERSON, RONALD H. FORTNEY, WALT M. KORDEK, West Virginia University, Division of Forestry, Wildlife and Fisheries Resources Program, Morgantown, WV 26506. An evaluation of mitigation wetland success in West Virginia.

Mitigation wetland success was assessed through an evaluation of vegetation and wildlife communities in 11 mitigated wetlands in West Virginia. These wetlands were compared to four respective reference locations within the state. Plant species richness and diversity were higher in mitigated wetlands than in reference wetlands ($p < 0.05$). Habitat Suitability Indices (HSI) were calculated for four wildlife species, three of which were similar between mitigated and reference wetlands ($p > 0.05$). Beaver scored an HSI value that was higher in reference (mean = 1.0, SE = 0.0) than in mitigated (mean = 0.74, SE = 0.06) wetlands ($p < 0.05$). Avian abundance, richness, and diversity were similar between wetland types ($p > 0.05$). Out of the five most abundant bird species observed, only song sparrow (*Melospiza melodia*) abundance was higher in reference (mean = 2.5, SE = 0.46) than in mitigated (mean = 1.41, SE = 0.25) wetlands ($p = 0.005$). Similarly, tree swallow (*Tachycineta bicolor*) abundance was higher in mitigated (mean = 2.47, SE = 0.78) than in reference (mean = 0.0, SE = 0.0) wetlands ($p = 0.04$). Mean Wisconsin Index (WI) values for anurans were higher

in mitigated (mean = 1.84, SE = 0.16) than in reference (mean = 1.50, SE = 0.32) wetlands (p = 0.01). Differences in vegetation and wildlife indices between wetland types can be attributed primarily to wetland age and structure. These data suggest that some mitigated wetlands evaluated in this study are successfully supporting vegetation and wildlife communities.

E. RAY GARTON, Curator West Virginia Geological Survey, PO Box 200, Barrackville, WV 26559 and **TOM HAY**, PO Box 4215, Morgantown, WV 26505 and **ROBERT L. PYLE**, 1964 Negley Avenue, Morgantown, WV 26505. The first record of *Petalodus* (Condrichthyes) shark from the Ames Formation, Conemaugh, Pennsylvanian of West Virginia.

A well preserved, 70% complete, *Petalodus* tooth was collected from the Pennsylvanian, Conemaugh, Ames Formation of Marion County, West Virginia. *Petalodus* became extinct in the Permian and was a ray-shaped, pavement toothed, bottom feeder. This is the first record of this genus from the Ames of the state and the third record for the state. The Ames of northern West Virginia has yielded a rich fauna of invertebrates over the past several decades. The fauna includes a variety of gastropods, brachiopods, and bivalves. Occasional fish teeth and scales have also been reported along with a few isolated *Xenacanthus* shark teeth. Such a rich invertebrate fauna would have provided a good food source for vertebrate bottom feeders which until this discovery were lacking in evidence.

ROBERT C. WHITMORE, Program in Wildlife and Fisheries, West Virginia University, PO Box 6125 Morgantown, WV 26506-6125, and **MICHAEL McKAY WHITMORE**, 1313 Dogwood Ave, Morgantown, WV 26505. Songs of the Mangrove Warbler (*Dendroica petechia castaneiceps*) from Baja California Sur, Mexico: Thoughts on Divergence in Isolated Populations.

During the springs of 1997-98 vocalizations of the Mangrove Warbler were collected in all of the known mangrove stands within the general area of Concepcion Bay between 26°-27° in south central Baja California. Songs from 13 males, believed to be the entire adult territorial male population, were analyzed spectrographically and compared with all (n=17) Yellow Warbler (*Dendroica petechia ssp*) vocalizations from the western United States archived at the Library of Natural Sounds at Cornell University and the Borror Laboratory of Bioaccoustics at Ohio State University. In sum, "mangrove" type songs are significantly ($p <$ 0.0001) lower in all measures of frequency, shorter in total length, have shorter individual song elements and wider gaps between song elements; all adaptations for sound transmission in dense habitat. Moreover, all individual "mangrove" type songs were either entirely or had significant portions of their song elements at or below 4 kHz, a level shown to reduce attenuation and increase amplification approximately 1-2 m above ground level in dense habitats. Un-weighted pair group arithmetic average cluster analysis (r^2 = 0.79) of an "Ochiai" similarity matrix compiled from a song element catalog (69 different note forms) placed nearly all "mangrove" type birds in the same clusters, while those of other locations were widely dispersed between clusters, indicating the "mangrove" type birds had the same or similar tutors or that the habitat fine tuned their songs towards a common structure. However, song structure within individual mangrove stands was more similar than between mangrove stands suggesting that tutors may be more important than habitat.

ENGINEERING

AUSTIN BARNARD, JENNIFER HAZELTON, MATTHEW LECHLITER, ANDREW STARN, and JOHN KUHLMAN, Dept. of Mechanical and Aerospace Engineering, **DONALD D. GRAY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown WV, 26506, and **CHRISTOPHER WILKINS**, Mechanical and Aerospace Department, Rensselaer Polytechnic Institute, Troy, NY 12180. Kelvin body force effects on a paramagnetic fluid in a wedge.

A series of microgravity experiments have been conducted aboard the NASA KC-135 "Weightless Wonder" research aircraft in Houston, Texas, on August 14-15, 2001, as part of the NASA Reduced Gravity Student Flight Opportunities Program. The experiments examined effects of the magnetic Kelvin body force on a paramagnetic fluid (a 3.3 molar solution of $MnCl_2$ in water) in a reduced gravity environment.

The experimental phenomenon took place in the wedge-shaped region between a pair of flat

rectangular pieces of window glass, with the pieces joined along one vertical edge and separated along the opposite edge to produce a wedge angle of 0.5 degrees. Two identical wedges were partially submerged in a reservoir filled with the manganese chloride solution, which was then drawn up into the wedge-shaped regions by surface tension. In normal gravity, the surface tension force is balanced by the weight of the liquid and the meniscus has the approximate form of a hyperbola with the highest rise near the apex of the wedge. A 0.7 Tesla Neodymium-Iron-Boron magnet was mounted near the liquid interface in one of the wedges, while the other "control" apparatus did not have a magnet. In the "zero-g" environment produced by the parabolic flight path of the KC-135 aircraft, the Kelvin force stabilized the meniscus of the paramagnetic solution, while the liquid in the "control" wedge was drawn higher up into the wedge by the unbalanced surface tension force. The meniscus positions were recorded on videotape for each parabola flown, and the coordinates of the interface shapes were read from each image and averaged. A significant difference between the interface shapes of the "magnet" and "no magnet" cases was observed as far as 17 cm away from the magnet. The height of rise in the presence of the magnetic field was typically between 3 to 5 cm less than in the no-magnet case. This indicates a significant ability of the Kelvin force to maintain the position of the paramagnetic liquid between the plates in a zero-g environment. Also, it was noted that the fluid that was influenced by the magnet appeared to move sideways, toward the magnet, as expected.

CHARLES BATTLESON, SHANNON GLASPELL, AUSTIN BARNARD, JENNIFER HAZELTON, PAUL KREITZER, MATTHEW LECHLITER, MICHELLE LECHLITER and JOHN KUHLMAN, Dept. of Mechanical and Aerospace Engineering, and **DONALD D. GRAY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Kelvin body force effects on sloshing of a paramagnetic fluid in microgravity.

A series of microgravity experiments have been conducted aboard the NASA KC-135 "Weightless Wonder" research aircraft in Houston, Texas, as part of the NASA Reduced Gravity Student Flight Opportunities Program. The experiments examined effects of the magnetic Kelvin body force on sloshing of a paramagnetic fluid (a solution of manganese chloride [$MnCl_2$] in water) in a reduced gravity environment.

The experimental configuration consisted of two rectangular tanks, each partially filled with the $MnCl_2$ solution. One of the tanks had a 1.3 Tesla neodymium-iron-boron magnet mounted at the tank bottom, while the other (control) tank did not have a magnet. In the "zero-g" environment aboard the KC-135 aircraft, the paramagnetic $MnCl_2$ solution in the tank fitted with the magnet was attracted towards the magnet. However, the liquid in the control tank (no-magnet case) was not subject to the Kelvin body force.

The motion of the liquid free surface was recorded on videotape for each parabola flown, and the data for the interface shapes were read from each image and averaged. A significant difference between the interface shapes of the magnet and no-magnet cases was observed. This indicates a significant ability of the Kelvin force to maintain the position of the paramagnetic liquid in the bottom of the tank. These results have potential application for spacecraft propellant positioning in a microgravity environment.

ISAAC HOWARD, VIMILA SHEKAR, and DR. HOTA GANGARAO, College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV 26506. Composite Bridges of West Virginia.

The focus of this presentation deals with Fiber Reinforced Polymer Composite Bridges of West Virginia that are currently in service. Brief summaries will be given with respect to geometric details, design parameters, and the use of fiber reinforced plastics (FRP's) in the structures. These bridges will be divided into four broad categories based on the way FRP is used. The details can be seen in the following paragraph.

Four ways in which fiber reinforced plastics are currently being used include replacement of bridge deck systems, reinforcing bars in concrete, rehabilitation and strengthening via wrapping, and construction of bridge deck and superstructure systems. All four of these techniques are relatively new to the structural engineering community, and hence new information is gained with each project. Noteworthy items such as improvements in wrapping techniques and current performances of FRP bridges in West Virginia that

are being monitored will be presented, in addition to their basic details.

The presentation will also contain a brief introduction describing what composites are as well as their advantages and disadvantages. Some advantages include excellent corrosion resistance, high strength to weight ratio, and easy field assembly, while disadvantages such as excessive shear lag, high initial cost, and lack of long-term performance data exist. Furthermore, concluding remarks will be given on current research such as lightweight FRP decks and their role in the future of composites in the bridge construction industry.

SUMEETH SIVANAGERE and JOHN KUHLMAN, Dept. of Mechanical and Aerospace Engineering, and **DONALD D. GRAY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown WV 26506. Performance of a thermosiphon.

A single phase loop thermosiphon was designed and built such that velocity profiles and heat transfer rates could be studied by obtaining temperature data, along with a detailed set of non-intrusive Laser Doppler Velocimetry measurements. The quantities measured were the instantaneous velocity profiles of the water flow, as well as temperatures around the flow loop. The velocities were then reduced into sets of mean and RMS velocities, for different angles of tilt of the experimental setup. Nominal heating and cooling rates were held constant.

The thermosiphon consisted of an aluminum flow loop that was rectangular in cross section with a test section made of Plexiglas. The loop was filled with distilled water for the present set of experiments. Flow was generated by thermoelectric coolers fixed on both sides of the top leg and thermoelectric heaters fixed on both sides of the bottom leg of the thermosiphon. The flow direction was reversed by changing the angle of tilt of the experimental setup. Velocity traverses were taken across the 3.18 cm and 1.9 cm dimensions of the test section at both the center and at the right end of the wall as tilt angle was varied from 3.6° clockwise to 4.2° counterclockwise.

The observed mean velocities were of the same order of magnitude (2 cm/s) as the predicted velocities from a one-dimensional flow model for all tilt angles investigated. Average heating rate was 70 Watts, while measured average cooling rate was 27 Watts. RMS velocities were typically 10-20% of the mean velocities. It was found that the mean velocity profiles across the 3.18 cm dimension of the flow area were consistently higher near the back wall and lower near the front wall of the test section.

JAMES H. CUNNINGHAM and ROGER C. VIADERO, JR., Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Increased production potential at two West Virginia aquaculture operations, based on effluent pollutant load and current permit limitations.

In order to reduce pollutant loading nationwide, the U.S. Environmental Protection Agency (EPA), working in conjunction with the U.S. Department of Agriculture (USDA), is developing effluent management guidelines and standards for private and public aquaculture operations. As part of a larger study to develop baseline effluent water quality data specific to West Virginia, the objective of this research was to examine the potential for increases in production, based on effluent pollutant production and current permit limitations.

For a constant water flow rate, effluent pollutant load can be directly correlated to the amount of fish produced; thus larger facilities have greater effluent "strength". In this study, both large (producing ~90,000 kg of fish per year) and small (producing < 9,000 kg of fish per year) facilities were examined. Both facilities reared *Oncorhynchus mykiss*, utilized a flow-through arrangement, and had a spring water source. The large facility had a granular media recirculation filter, and effluent sedimentation pond for treatment, while the small facility had a sedimentation pond of questionable performance. The influent and effluent of the two anonymous facilities were monitored approximately every six weeks for flow, temperature, conductivity, dissolved oxygen (DO), turbidity, biochemical oxygen demand (BOD_5), total suspended solids (TSS), settleable solids (SS), nitrogen species (NH_4, NH_3, NO_3, NO_2), and total phosphorus (TP). All analyses were performed according to standard EPA protocols and a multi-tiered quality assurance/quality control plan was followed. Using flow rate and pollutant concentrations, mass loadings are then calculated for each constituent. Mass loadings are the basis for pollutant regulation in watersheds with established total maximum daily load (TMDL). Current pollutant permit limitations were taken from National Pollutant Discharge Elimination System (NPDES) permits for aquaculture operations.

Current effluent limitations are as follows: 196 kg/d BOD_5, 196 kg/d TSS, 68.3 kg/d NH_3, 0.2 ml/L SS, 6 mg/L DO, and pH from 6 to 9, respectively. Seasonal fluctuations in pollutant load were observed at the large facility with maximums concentrations of 101 kg/d BOD_5, 148 kg/d TSS, and 68.3 kg/d NH_3. Concentrations of SS, DO, and pH values were within permit limits. The small facility also had seasonal fluctuations in pollutant load, however maxima of 13.7 kg/day BOD_5, 24.5 kg/d TSS, and 0.594 kg/d NH_3 were observed. Concentrations of SS, DO, and pH values were within permit limits.

All parameters monitored at the large facility were within permit limitations; thus, the facility has the capacity for higher production. However, during seasonal peaks in pollutant load, DO could be a limiting factor in increasing productivity. Consequently, a process engineering assessment would be needed to overcome such a technical hurdle. Parameters monitored at the small facility were also below current limitations. Thus, the small facility has potential for increased productivity, if other factors such as water flow rate are constant. Bioenergetic models could be employed to maximize productivity while maintaining water quality standards (WQS), but further study is warranted before this tool is applied for broad use.

SAM LAMONT, Dept. of Civil and Environmental Engineering, West Virginia University, WV 26505 and **ROBERT ELI**, Dept. of Civil and Environmental Engineering, West Virginia University, WV 26505 and **RONALD FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, WV 26505. A Hydrologic Analysis of a Fresh Water Wetland in Southern Canaan Valley State Park, West Virginia.

The Canaan Valley, located in the northern mountains of West Virginia, is the largest area of inland freshwater wetlands in the Appalachian mountain region. Small, isolated wetlands within the 5,000 ha valley often support many rare plant species. One such area is Abe's Run wetland, in the southern end of Canaan Valley State Park.

A comprehensive hydrologic study is being conducted within the approximately 100 ha Abe's Run sub-basin to aid in the protection and management of the area's rare plants. This concurrent study includes the analysis of: the gradient of the local water table using two inch, screened groundwater wells installed throughout the wetland, stream discharge using a V-notched weir and automated water level loggers, soil moisture and temperature, simulated evapotranspiration, and meteorological conditions such as air temperature, relative humidity, precipitation, and solar radiation. The weather data will be referenced to the readings of a nearby weather station operated by the Canaan Valley Institute. Also, a digital terrain model will be created from a 5 foot contour topographic map using geographic information systems to support a spatially distributed watershed catchment model. The model will also allow for the spatial relationship between the area's rare plants and other factors such as soil types and local geology. Finally, the hydrologic model TOPMODEL will be applied to the catchment to further describe the surface/subsurface water flow.

This study will provide information necessary for the environmental protection and management of the wetland. The hydrologic analysis will allow for the prediction of the wetland's reaction to future events such as floods or droughts as well as the effect of human influences such as the road that bisects the outlet. The results of this study will also be applied to future studies in the northern end of Canaan Valley.

BRAD MESSENGER, DONALD D. GRAY, and RONALD H. FORTNEY, Dept of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Development of an analytical model for the evaluation of vertical hydraulic barriers as a mitigation wetland design technique.

Wetland mitigation has become an accepted practice to compensate for unavoidable impacts to natural wetlands. Suitable sites for mitigation construction are relatively rare in the central Appalachian Mountain region. A geologic setting that is conducive to natural wetland creation is a nickpoint, which is developed when dipping erosion-resistant strata outcrop in streambeds. Wetlands are formed upstream of nickpoints as the overlying more erodible strata weather to a temporary base level that causes the lower-gradient stream to deposit silts and clays that create a poorly drained alluvial valley upstream of the nickpoint.

In order to increase the number of potential wetland mitigation sites, a new construction technique inspired by the nickpoint mechanism was proposed. This is the installation of a vertical hydraulic barrier, either parallel or perpendicular to a stream channel to act as a

subsurface dam by impeding groundwater flow. The barrier may be constructed of low permeability materials such as clay, or impermeable materials such as concrete or metal sheet pile, or a combination of these materials. Design criteria to insure long-term performance, durability, and low construction cost will be presented. The concept was analyzed using an analytical model to evaluate its effectiveness at impeding the flow of groundwater, and consequently raising the upstream groundwater table. A computer program was written to calculate the profile of the phreatic surface.

DEWEY D. SANDERSON, Department of Geology, Marshall University, Huntington, WV 25755 and **ROBERT F. MASLOWSKI**, Huntington District, U.S. Army Corps of Engineers, Huntington, WV 25701. Integration of archeological preservation and engineering design using GIS.

Congress appropriated funds for the upgrade of the Marmet Lock and Dam on the Kanawha River. A new lock required purchase of additional land adjoining the present lock that included the Burning Springs Branch Site, 46KA142, a multicomponent archeological site that includes late Archaic and Woodland components, a Fort Ancient Village (circa A.D. 1430 - 1500) and the 19th century Reynolds estate. For determination and preservation of site components, the site was georeferenced with a Trimble ProXRS GPS to establish UTM coordinates for CAD drawings. Engineering drawings were transformed from State Plane Coordinates to UTM coordinates. CIR imagery from the DEP web site, site maps and engineering drawings were merged in ArcView. The site has an area of 1.98 hectares (4.88 acres) of which the village covers 0.54 hectares (1.33 acres). Less than one-half, 0.24 hectares (0.59 acres) could be left undisturbed. Due to the slope of the lock chamber and decant structure cuts, 0.30 hectares (0.74 acres) and 0.36 hectares (0.89 acres) of the Woodland and Late Archaic components, respectively, will be left in place for future archeological research. The integration of archeological excavation and preservation with engineering design through GIS can be an important tool for historic preservation.

SCOTT A. COPEN, DONALD D. GRAY, and RONALD H. FORTNEY, Dept of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Comparison of groundwater fluctuations in a constructed wetland to those of a natural wetland.

Wetlands have been constructed for mitigation in West Virginia for well over a decade. While data does exist on the functionality of their vegetation and wildlife, little if any information is available on the hydrologic regimes of these constructed wetlands, even though it is well known that hydrology is the single most important factor in the development of a wetland. Some aspects of the hydrologic regime can be inferred from the observation of flora and fauna, but direct observations are needed to fully understand the hydrologic regime, to determine if problems exist, and to suggest how they might be corrected.

As part of an ongoing study, monitoring wells, piezometers, and automated water level recorders were installed in one constructed and one natural wetland in January and February of 2001. Water level data were collected twice each month until the end of the fall 2001 drawdown period. From that time on, observations have been continued on a monthly basis. In addition, automated recorders have been collecting data at the two sites at three-hour intervals for the duration of the study. Comparisons between the two sites help to determine if the constructed wetland has achieved the intended hydrologic regime.

VIPIN BHARDWAJ, National Drinking Water Clearinghouse, and **DONALD D. GRAY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Antiscaling magnetic treatment devices.

Scale formation from water is caused by precipitation of weakly soluble salts, usually calcium carbonate, which forms an encrustation on susceptible surfaces. Most commonly this occurs as a result of temperature or pH changes that influence the solubility of the salt. Scaling causes a reduction in pipe carrying capacity and heat transfer coefficient; and increases in maintenance, emergency shutdowns, operational safety hazards, corrosion, and operating costs. Anti-scale magnetic treatment (AMT) has a long and controversial history and has been reported as being effective in numerous instances, as well as ineffective in some. Reported effects vary widely; and the apparent lack of their reproducibility has tended to undermine the credibility of the process. The rarity of systematic studies of the phenomenon, independent of

AMT device manufacturers, the lack of recorded design criteria, and the lack of standards for testing these devices have limited the acceptance of the method by process designers and plant engineers. After an exhaustive study of the published literature, the possible mechanisms by which AMT may work have been described, the factors which seem to be crucial for a successful application have been identified, and a test program to validate these hypotheses has been designed. A proposal to carry out the test program will be submitted to some funding agencies that are independent of device manufacturers.

SOCIAL SCIENCE/PSYCHOLOGY/ EDUCATION

ANDREAS BAUR, School of Science and Mathematics, Fairmont State College, Fairmont, WV 26554, abaur@mail.fscwv.edu. Infrared spectroscopy in the general chemistry laboratory.

The presentation will demonstrate how infrared spectroscopy can be introduced effectively in the freshman general chemistry laboratory. The laboratory experiment uses animations to show the stretching vibrations of simple organic molecules. Students investigate the animations and determine the typical stretching frequencies for carbon-hydrogen bonds, hydroxyl, carbonyl and nitrile groups. These theoretical data are compared with experimentally determined spectra. Finally, the students determine the major functional group for an unknown sample. Students respond well to this experiment and enjoy using the IR spectrometer.

MICHAEL J. DEMCHIK, Retired, Box 1420, Shepherdstown, WV25443 **and VIRGINIA C. DEMCHIK**, Jefferson High School, Shenandoah Junction, WV 25442. Practical school level research projects.

The six projects described in this presentation include the Antarctica, Acid Rain, Acid Snow, Three Streams, Ozone, and Toys Project.

Each project has a set of objectives, complete descriptors for methodology, data samples, photographs, tables, interpretations, and evaluations. Each project operates for an extended amount of time and in some cases overlap. The evaluation data collected and analyzed suggests that these projects can significantly influence student participation where volunteers are required. It has proven to improve thinking and writing skills, as well as, project performance. Each project can fit into any classroom and at the same time meet county and state objectives for science classroom. The projects might also besuited for the college level too.

MARK FLOOD, Dept of Biology, Fairmont State College, Fairmont, WV 26554. Development and implementation of an objective primary trait analysis (PTA) system for assessment of laboratory reports.

A primary trait analysis (PTA) method of objective grading of laboratory reports was developed and implemented. The PTA scale developed by Dr. Virginia Anerson from Towson University (near Baltimore, MD) was utilized as a starting point (*Effective Grading*, Walvoord and Anderson, Jossey-Bass Publishers, 1988). After evaluation by several biology faculty members, some of Dr. Anderson's PTA categories were modified, while others were determined to be inappropriate for use in our program. The critical items were identified for each category. Points were then assigned to each category, and items within each category, based upon how important the faculty members believe each category and item is to a good laboratory report. The categories agreed upon at the start of the semester were: 1) title page, 2) introduction, 3) materials and methods, 4) results, 5) discussion, 6) conclusions, 7) citations, and 8) organization. The introduction, results, discussion, and organization sections were assigned more points than the other categories. The PTA method for assessment of lab reports is being utilized in Biological Principles I and II, Animal Physiology, and Molecular Biotechnology courses for the first time during the spring 2002 semester. In Molecular Biotechnology (Biology 390), the third lab report of the semester was graded (using the PTA scale) by one of their peers and by the instructor. Of the 15 members of the class, the majority of student graders gave a lower score on the lab report than what was assigned by the instructor. After completing this task, a discussion about the fairness of the rankings within each category ensued, and some adjustments were made to the PTA scale for the grading of future lab reports. An additional category dealing with grammar/spelling was added to the other categories listed above for this course. It is expected that the PTA method will also be adapted to meet the needs of the other courses in the future. Overall,

students and faculty prefer this more objective grading system compared to the normal "fuzzy" subjective grading, partially because students and faculty both clearly know the expectations for the lab reports up front. Furthermore, this method of grading is especially suggested for courses where teaching assistants perform laboratory report grading, since the PTA method will remove some of the grading subjectivity that can occur.

ALAN D. SMITH, Dept of Management and Marketing, Robert Morris University, 600th 5th Ave., Pittsburgh, PA 15219-3099. E-lending: Foundations of financial and consumer marketing in an information intensive society.

E-lending can significantly reduce the amount of time it takes to process loans by allowing the potential borrower to do much of the work. The cost savings for presumably many thousands of applications per year will be substantial. However, that the start-up costs for e-lending can be significant. Lenders must be confident of volume projections. E-lending provides another opportunity to gain wallet share. Thus, offering e-lending services to your already savvy Internet customers allows banks to increase the amount of business with that customer. Lenders can use the increased flow of information and real-time interaction to offer a variety of products and services that are relevant to a particular customer. E-lending also allows lenders to reach borrowers outside of their traditional market areas. In malls, the customer can do research on products, rates, terms, etc., and then choose a lender. In auctions, the process is that of the reverse auction, where lenders bid for the customer's business based on the information that the customer provides. QuickenLoans, OnMoney.com, and GetSmart.com are examples of the banking mall, while LendingTree.com, Priceline.com, and LoanWeb.com are reverse auctions. The hyper-growth in e-lending, will tend to force lenders to keep up with lending technology or risk being left behind by the competition. In our information-based society, the question of ownership of key information is an important issue, and one that is to continue causing controversy.

DEWEY D. SANDERSON, Department of Geology, Marshall University, Huntington, WV 25755 and **DAN K. EVANS**, Herbarium, Department of Biological Sciences, Marshall University, Huntington 25755. Mitigation by creation of an educational wetland along the Kanawha River, Putnam County, West Virginia.

Section 404 of the Clean Water Act requires mitigation for the loss of wetlands. Traditionally this has been accomplished by the creation of new and similar wetlands in the area of the destroyed wetlands. An alternative to this approach is to take an existing wetland and turn it into an 'outdoor classroom.' A low relief, poorly developed drainage on the floodplain of the Kanawha River, approximately 5 km downstream from the John Amos Power Plant in Putnam County, has been changed to a natural wetland by a beaver dam. The former bottomland hardwood forest has been killed by the inundation due to a beaver dam and replaced by more flood-tolerant species. Using a total station theodolite and GPS, three prominent vegetation zones have been delineated; these are dominated by button bush (Cephalanthus occidentalis), smartweed (Polygonus hydropiperoides, P. cespitosum) and grasses (Leesia oryzoides, Phalaris arundinacea) from deep to shallow water, respectively. Small communities of bulrush (Scripus cyprinus), common rush (Juncus tenuis), swamp dogwood (Cornus amomum), and black willow (Salix nigra) are found scattered among the smartweed and grass zones.

To transform the surveyed 9.4 acres (3.8 hectare) site into an educational wetland, mulch (or gravel) paths, boardwalks, kiosks, a stage, wells, signage and a parking lot will be constructed. Various interactive activities will be developed to promote knowledge and understanding of wetlands.

KRISTIN L. PLUMSKY, KYLIN B. HARVEY, and JOHN H. HULL, Dept of Psychology, Bethany College, Bethany, WV 26032. Body image and body satisfaction among African American and European American women.

Individually, African American and European American women participants were given a set of nine line drawings of female figures ranging either from 1 - very thin to 9 - very obese or 1 - very thin to 9 - very muscular. Using the nine-drawing scale, women were asked to rate their body type, the body type they would prefer to have, the body type they thought men preferred, and the body type they thought other women preferred. In addition, all participants completed the 14-item Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ).

Among participants receiving the obesity scale drawings, African American and European American women did not differ significantly on any of the four body type ratings, while women in both groups preferred to be significantly thinner than they were. On the SATAQ, European Americans agreed significantly more strongly that music videos showing thin women made them wish they were thin, that photographs of thin women made them wish they were thin, and that they wished they looked like swimsuit models, while African Americans agreed significantly more strongly that in today's society it's not important to always look attractive.

Among participants receiving the muscularity scale drawings, African Americans rated how they would prefer to look, and how they thought other women preferred to look, as significantly more muscular than did European American women, while women in both groups preferred to be significantly less muscular than they were. On the SATAQ, European Americans agreed significantly more strongly that music videos made them wish they were thin, that they compared their bodies to people in magazines and on TV, that attractiveness is important in our culture, that people should work hard on their figures/physiques, that they wished they looked like swimsuit models, and that they compared themselves to models in fashion magazines, while African Americans agreed significantly more strongly that fat people are not regarded as unattractive in our society.

Our study shows that, while both African American and European American women wish to be smaller than they are now, African American women express less concern overall about external pressures to change their bodies.

ALAN D. SMITH, Dept of Management and Marketing, Robert Morris University, 600th 5th Ave., Pittsburgh, PA 15219-3099. Extranets: Creating performance through linkage technology.

The use of extranets as a performance linking technology can streamline communications and processes that are essential to maintain and strengthen supplier and customer relations. Based on research, the Virtual Private Network (VPN) approach of establishing extranets is the most current and exciting linking technology driving business communications and transactions. Not surprisingly, extranets represent one of the most rapidly growing technology investments today. For example, the projected growth of customer extranet deployments will more than double over the next three years reaching 65% of today's corporations and enterprises, while supplier extranet deployments will more than triple over the next three years to reach 50%. This paper explores the impacts, utilizations, barriers, and the organizational commitment necessary to make extranets a performance liking technology.

VIRGINIA C. DEMCHIK, Jefferson H.S., Shenandoah Junction,WV 25442. Studying the CRC for reference purposes.

The CRC Handbook of Chemistry and Physics is a valuable tool for the beginning chemistry student. The book is taught in as a follow up to an ion interaction lab. The cations include barium, calcium, copper (II), cobalt (II), iron (III), manganese, silver, strontium, and zinc. The anions include acetate, bromide, carbonate, chloride, hydroxide, iodide, oxalate, phosphate (ortho), silicate (meta), and sulfate. The compounds are interpreted, compared and information recorded. An open notes test scored at ninety percent or better determines if the student can use the CRC effectively and interpret selected physical properties.

E.C. KELLER JR., Department of Biology, West Virginia University Morgantown, WV 26506 and **ED KELLER, III**, Morgantown High School, Morgantown, WV 26501. Grade differential of High School students with and without disabilities in collaborative classrooms.

Students taught in "collaborative classes" generally have both discipline teachers (science or mathematics teachers) and special education teachers present in class at the same time. Both students with and those without disabilities are also present. This presented a somewhat controlled educational environment with both types of students present, obtaining the same topical and content presentations. Anonymous sampling of final course grades were obtained for ninth, tenth, and eleventh-grade students in both Science and Mathematics courses. One hundred twenty-nine students were impaired. Of note is that none of the 129 were intellectually impaired. One hundred seventy students were non-disabled. An analysis of variance indicated that there was a significant difference ($p<.0001$) between those students with disabilities versus those without disabilities. The magnitude of

these differences was approximately one letter grade. These were highly consistent findings among several schools in two counties, five different courses, and ten different sets of instructors over a four-year period. We feel that the above finding of about one-letter grade difference is a student penalty due to limitations of our adaptive technologies, strategies, and teaching methods for students with disabilities. Clearly, this level of penalty creates a major barrier for the advancement of students with disabilities, which is due - in part - to systemic not student, deficiencies.

WILDLIFE/ZOOLOGY

JAMES T. ANDERSON, West Virginia University, Division of Forestry, Wildlife and Fisheries Resources Program, Morgantown, WV 26506-6125. Effects of drawdown rates on waterfowl and carrying capacity on Atlantic Coast impoundments.

Wetlands of the Atlantic coast provide important habitat for wintering and migrating waterfowl and other waterbirds. However, management strategies may influence waterbird use and potential carrying capacity of wetland impoundments. The effects of drawdown rates on waterbird use and potential use was studied on 16 national wildlife refuges from Virginia to Maine. The specific objectives of this study were to compare waterbird use and carrying capacity of wetland impoundments subject to slow drawdowns timed specifically for spring migrating shorebirds (treatment) and more traditional drawdown techniques (control). A total of 83 species of waterbirds was observed on the study impoundments: 66 on control and 72 on treatment impoundments. Total duck densities averaged 19.3/ha (SE = 3.5) on treatment wetlands and were about 2.5 times higher than densities on control impoundments ($P < 0.05$). Total waterfowl use-days exceeded 7,117/ha on control impoundments and 12,044/ha on treatment impoundments from September 2000 to February 2001. Feeding waterfowl density averaged 1,573/ha on control and 3,754/ha on treatment impoundments. Potential carrying capacity based on seeds and invertebrates (expressed as potential Duck Use-Days/ha) averaged 2,971/ha (SE = 639) on treatment impoundments but only 1,712/ha (SE = 457) on control impoundments ($P < 0.05$), which were relatively close to feeding waterfowl density estimates. Slow drawdowns targeting spring migrating shorebirds, not only increase shorebird use but are an effective method of increasing actual duck use and potential carrying capacity on the Atlantic Coast.

KIMBERLY BAYNE and THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. The natural history and morphology of the eastern cricket frog, *Acris c. crepitans*, in West Virginia.

Two subspecies of cricket frogs, *Acris c. blanchardi* and *Acris c. crepitans*, have historically occurred in West Virginia. The range of *Acris c. blanchardi*, Blanchard's cricket frog, enters West Virginia along the Ohio River. *Acris c. crepitans*, eastern cricket frog, only occurs in the eastern panhandle. This study examined the natural history and morphological features of the eastern cricket frog. Natural history data included time of first mating calls, time of amplexus, time of egg deposition, number of eggs deposited per female, and incubation period. Morphological data consisted of the total length of tadpoles and snout-to-vent length of froglets and adult frogs.

NANCY J. DICKSON and THOMAS K. PAULEY, Department of Biological Sciences, Marshall University, Huntington, WV 25755. Egg size and larval development of Blanchard's cricket frog, *Acris crepitans blanchardi*, in southern Ohio.

The first objective of this study was to compare the size of eggs laid in May to the size of eggs laid in June. The second objective was to track the larval development from hatching until metamorphosis into a froglet by placing a single egg in a screen box and measuring the developing tadpole. The vitellus and envelope of eggs were measured with vernier calipers. Eggs discovered on 18 May (n=3) were significantly (t test, P=0.015) smaller in diameter of the vitellus and diameter of the envelope when compared to eggs discovered on 30 June (n=6). Tadpoles from eggs found on 18 May (n=3) reached metamorphosis significantly sooner (t test, P=0.029) than tadpoles from eggs found on 30 June (n=6) by an average of 12.9 days. However, the maximum size reached by tadpoles before metamorphosis and the SUL of the resulting froglet were not significantly different (t test, P=0.065 and P=0.361). Despite larger size of eggs found in late June, tadpoles and froglets from these eggs were not larger than the tadpoles and froglets from the smaller eggs found in mid May.

KATRYNA ANNE FLEER, Dept. of Biological Sciences, Marshall University, Huntington WV 25755, **MOSES MAKONJIO OKELLO**, Center For Wildlife Management Studies, Nairobi, Kenya, and **MARY ETTA HIGHT**, Dept. of Biological Sciences, Marshall University, Huntington WV 25755. Proposed Kuku Community Conservation Area, Kenya: Evaluation of ecological and socio-economic potentials.

Kuku Group Ranch (KGR), in the Kajiado District of southern Kenya, is located within an important wildlife dispersal area and migration corridor between Tsavo and Amboseli National Parks. The members of the group ranch are of the largely pastoralist Maasai tribe. Historically, pastoralism was thought to be compatible with wildlife, but increasing human populations and the shifting from pastoralism to agriculture are now threatening the survival of wildlife. The main objective of this study was to assess the establishing of the proposed Kuku Community Conservation Area (KCCA), based on ecological and social considerations, as well as ecotourism potential. Large mammal counts were performed in four different study sites and interviews with both KGR members and tourists were conducted using standard questionnaires.

The proposed KCCA was found to have the second highest wildlife density (29.06 ± 7.87) and the third highest diversity (Simpson's Index: D_s=0.86; Inverse Simpson's Index: d_s=7.25) of the four sites. Wildlife density in the proposed KCCA was found to have a positive relationship with livestock, but a negative relationship with human settlement. The majority of KGR members supported conservation (92.98%) and the establishment of a community wildlife sanctuary (77.78%). Group ranch subdivision and agricultural expansion were also supported by the majority (85.96% and 96.43%, respectively), both of which could be detrimental to the conservation of wildlife. Most tourists (82.5%) were interested in visiting a community wildlife sanctuary, and most (68.8%) wanted to see wildlife over other attractions. Most (64.3%) were willing to pay the same entry fee as that of a national park, which could bring in a net yearly revenue of Ksh 12,373,920. The community conservation area should be established as a managed nature reserve, to allow group ranch members limited access to resources. The sanctuary should initially be leased by outside investors until the group ranch members are trained to manage it themselves. The establishment of the proposed KCCA is a worthwhile venture in that it is rich in wildlife, supported by KGR members, and demonstrates a high ecotourism potential.

ANDREW K. ZADNIK, West Virginia University, Division of Forestry, Morgantown, WV 26506-6125, **JAMES T. ANDERSON**, West Virginia University, Division of Forestry, Morgantown, WV 26506-6125, **PETRA BOHALL WOOD**, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV 26506-6125, **KERRY BLEDSOE**, West Virginia Division of Natural Resources, Fairmont, WV 26554. Are Ohio River island back channels worth protecting for wildlife?

The islands and associated back channels of the Ohio River are recognized as providing critical wildlife habitat. Quantitative information on this value is needed to assist wildlife managers and policy makers in conserving these areas. We examined waterbird abundance and Habitat Suitability Index (HSI) models and compared them between back and main channels and between island and mainland sides of the river. Preliminary data suggest wood duck (*Aix sponsa*) and great blue heron (*Ardea herodias*) densities (birds/ha) were higher on the back channel island sides than the back channel mainland or main channel island and mainland sides ($p < 0.05$). Values for the brood rearing component of the wood duck HSI model were higher on the back (mean = 0.09; SE = 0.02) than on the main (mean = 0.03; SE = 0.01) channel ($p < 0.05$). Belted kingfisher (*Ceryle alcyon*) densities appeared to be higher on the main than the back channels. Values for the belted kingfisher HSI model were higher on the main (mean = 0.42; SE = 0.01) than the back (mean = 0.36; SE = 0.02) channels ($p < 0.05$). Values for the great blue heron HSI model were generally higher when associated with the island than the mainland sides. These results suggest that back channels provide important habitat for species requiring abundant cover. We recommend protecting back channels and associated shorelines from development and limiting human activities that could cause damage in these areas.

ROBERT FIORENTINO and THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Status of the *Ambystoma texanum* (Mathes), Small-mouthed Salamander, in West Virginia.

Over the past sixty years very little information on the natural history of *Ambystoma texanum* (Small-mouthed Salamander) has been collected in West Virginia. Three historical breeding populations of *A. texanum* have been documented in the state, but salamanders from two of these sites have not been documented for the past 30 years. Searches of historical sites and favorable habitat in Mason, Jackson, and Wood counties yielded no evidence for the presence of *A. texanum*, except for the known breeding site in Wood County. Information on breeding migration and egg development was collected at the Wood County breeding site. Data collection ended when the breeding pool dried on May 13, 2001. The first clutch of eggs hatched on April 17, 2001, when the remaining clutches of eggs were in late stages of development. No new populations were found in the state.

GREG M. FORCEY and JAMES T. ANDERSON, Division of Forestry, West Virginia University, Morgantown, WV 26506. E-mail: gforcey@wvu.edu.
A comparison of two different double-observer approaches for conducting bird point counts.

Unlike traditional single-observer point count methodology, the use of two observers allows a detection probability to be calculated for each bird species. Detection rates derived from two observers allows one to calculate more robust estimates of bird abundance compared to numbers derived from single-observer point count data. One double-observer (DO) technique involves two observers recording data together on a single data sheet. The primary observer dictates the number of each species that is detected while the secondary observer records this information; the secondary observer also notes birds that the primary observer did not detect. The independent double-observer (IO) protocol involves two observers recording data independently on separate data sheets without verbal communication between observers. This study compares the detection rates generated by both double-observer methods to ascertain which approach generates higher probabilities. Point counts were conducted on 137 point locations in northern West Virginia during the spring of 2000 and 2001 utilizing both double-observer methodologies. Detection probabilities were generated using programs DOBSERV and CAPTURE for the DO and IO data respectively. ANOVA was used to compare detection probabilities between years and between double-observer treatments. Differences in detection probabilities between years were not present ($p = 0.10$), however detection probabilities generated from the DO data were significantly higher than those computed from the IO data ($p < 0.01$). These results suggest that conducting point counts using the DO technique will yield more precise estimates of avian abundance because detection rates are significantly higher than those generated by the IO approach.

POSTER SESSION I: BIOLOGY I

C. MILLER, S. MITCHEM, D. DILELLA, and E. VOLKER, Department of Chemistry, Shepherd College, Shepherdstown, WV 25443.
A quick and accurate microwave extraction-based method for the determination of ergosterol.

Ergosterol is a sterol that is considered to be the best marker for fungal matter. Many procedures for the determination of ergosterol in plant and soil samples have appeared in the literature. We have previously reported on an analysis procedure that was based on the addition of an internal standard. The use of the internal standard greatly improved the reproducibility of the analysis. We have recently replaced the reflux extraction of the previous procedure with a microwave extraction and have been able to reduce the analysis time significantly. In addition, the microwave extraction appears to obtain more ergosterol than the convention method. This analysis requires much less solvent than most of those previously published.

BONNIE FREEMAN and TONY E. MORRIS, Ph.D., Department of Biology, Fairmont State College, Fairmont, WV 26554.
Examination of mutagenic potential of common environmental substances or exposures as measured by bacterial reverse mutation (Ames test).

The objective of this study was to examine common, every-day exposure to environmental factors. The Ames test is commonly used to evaluate the mutagenic potential (and therefore the carcinogenic potential) of environmental substances. The Ames test is often the initial method of examining mutagenic potential. Ames test kits were purchase commercially (Presque Isle Cultures, Presque Isle, PA). The negative control was distilled water. The positive control was 4-nitro-o-

phenylenediamine (4-NOPD) at a concentration of 100 ìg/ml. Glucose-minimal salts agar was inoculated with *Salmonella typhimurium* (TA98, Ames strain). This strain of *S. typhimurium* has a mutant gene in the biosynthesis pathway of histidine, but in the presence of a mutagen will revert and begin histidine biosynthesis. Since glucose-minimal salts agar has no histidine, the presence of colonies indicates that a back mutation has occurred. Substances to be tested (as well as controls) were autoclaved and applied to a sterile paper disc in the center of the petri dish. Revertant colonies grew around the paper disc and were counted and compared to controls.

Increased numbers of revertant colonies were observed for many substances examined. When an extract of charred beef was examined, 22 colonies were observed. Approximately 200 colonies were observed on the positive control plate (4-NOPD, a potent carcinogen), while the negative control (distilled water) yielded only around 10. The extract of charred beef produced over twice as many revertant colonies than distilled water.

The results indicate that common substances may contribute to mutagenesis and carcinogenesis. Avoiding some common substances may contribute to better health.

STEVEN L. STEPHENSON and RANDY G. DARRAH, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Myxomycetes associated with subalpine coniferous forests in the Great Smoky Mountains National Park.

Subalpine coniferous forests dominated by red spruce (*Picea rubens*) occupy higher peaks and ridges in the Great Smoky Mountains National Park. During the 1999, 2000, and 2001 field seasons, the assemblages of myxomycetes associated with these communities have been studied as part of the All Taxa Biodiversity Inventory (ATBI) currently being carried out in the Park. At least 49 species in 25 genera have been identified from the more than 225 field collections obtained thus far. Among these are several species that appear to be restricted largely to subalpine coniferous forests and are rarely if ever collected in the forests found at lower elevations in the Park. Prominent examples include *Barbeyella minutissima*, *Colloderma oculatum*, *Elaeomyxa cerifera*, *Lamproderma columbinum* and *Lepidoderma tigrinum*. All five species tend to be associated with a substrate complex represented by the decaying wood of decorticated spruce logs with a cover of leafy liverworts (particularly *Nowellia curvifolia*) present. A number of other myxomycetes, including *Cribraria rufa*, *Diderma roanense* and *Trichia erecta*, seem to have distributions centered in subalpine coniferous forests of the southern Appalachians. (Supported in part by a grant from Discover Life in America.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Myxomycetes associated with decaying fronds of nikau palm in New Zealand.

Nikau palm (*Rhopalostylis sapida*) is one of the more characteristic small trees of lowland forests throughout much of the northern half of New Zealand. The leaves (commonly called fronds) of this plant are rather large, and the base of the petiole is expanded to form a sheath where it is attached to the stem. After abscission occurs and the fronds fall to the forest floor, the edges of the sheath become convoluted, creating a more-or-less enclosed space that appears to function as a "natural moist chamber" for myxomycetes (plasmodial slime molds). Such microhabitats examined during the course of fieldwork carried out in New Zealand during the period of 1992-2001 often yielded collections of myxomycetes when all other substrates at the same locality were non-productive. At least 35 species in 13 genera were represented among the >260 collections from decaying fronds of nikau palm considered in the present study. The vast majority (99%) of these are members of the Physarales or Trichiales. *Didymium squamulosum* was the single most abundant species (>30% of all collections), but *Trichia favoginea*, *Physarum pusillum*, and *Perichaena depressa* also were relatively common (with each represented by >5% of all collections). Among the other myxomycetes recorded from nikau palm were a number of species not previously known to occur in New Zealand or known from only one or two collections. Prominent examples include *Badhamia gracilis*, *Craterium aureum*, *Physarum hongkongense*, and *P. pezizoideum*. (Supported in part by two grants from the National Geographic Society.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **CERIDWEN A. PEARCE**, Australian Tropical Mycology Research Centre, PO Box 312, Kuranda 4872, Queensland, Australia; and **DAWN R. BLACK**, Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701. Myxomycetes associated with the aerial litter microhabitat in tropical forests of northern Queensland, Australia.

One surprising result from studies carried out in Neotropical moist forests over the past four years is that myxomycete biodiversity seems to be greatest in microhabitats located above the ground, whereas in temperate and boreal forests it is greatest in microhabitats associated with the forest floor. Myxomycetes appear to be organisms adapted to highly fluctuating conditions of environmental moisture, but continuous high moisture levels apparently do not favor their growth and development. In addition to their apparent displacement from forest floor (relatively moist) to aerial (relatively drier) microhabitats, the majority of the myxomycetes encountered in Neotropical moist forests are characterized by a phaneroplasmodium, which is robust, can achieve considerable size in some species, and appears to tolerate the two extremes of the moisture gradient better than the other types of plasmodia found in myxomycetes. The objective of the present study, which is still ongoing, is to investigate the quantitative ecology and distributional relationships of myxomycetes associated with aerial litter microhabitats in tropical forests of northern Queensland, Australia. More than 90% of moist chamber cultures prepared with samples of aerial litter collected at (1) the Australian Canopy Crane Facility (16° 17' S, 145° 29' E) near Cape Tribulation and (2) Butcher's Creek (17° 24' S, 145° 44' E), a study site located approximately 30 km SE of Atherton, yielded some evidence (either plasmodia or fruiting bodies) of myxomycetes. *Didymium squamulosum* was the single most abundant species, with *Physarum compressum* and *P. pusillum* also important. All three of these are among the more characteristic myxomycetes associated with aerial litter in Neotropical forests, which at least suggests that the aerial litter microhabitat may support compositionally similar assemblages of species in tropical forests throughout the world.

ADAM W. ROLLINS, MARTIN SCHNITTLER, and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Snowbank myxomycetes from West Virginia.

A distinctive ecological group of myxomycetes (plasmodial slime molds) is associated with the melting snowbanks that occur during late spring and early summer in alpine regions of the Temperate Zone. The species that occupy this rather special and very limited microhabitat are usually referred to as "snowbank" or "nivicole" myxomycetes, since they produce fruiting bodies only during the relatively brief period of time when the special microenvironmental conditions associated with melting snowbanks and apparently required for their growth and development exist. Snowbank myxomycetes are particularly well known from the mountains of western North America. However, with the exception of a single collection of *Prototrichia metallica* from the Great Smoky Mountains, we are not aware of any previous records of the group in the central and southern Appalachians. In late May of 1999, two additional species (*Lamproderma sauteri* and *Lepidoderma carestianum*) were collected from dead fern litter near a small snowbank at the Snowshoe Ski Resort (elevation 1475 m) in Pocahontas County, West Virginia. The snowbank represented the last remnant of a snowfield that had been created artificially during the winter ski season at the resort. Both species are among the most common snowbank myxomycetes encountered in the mountains of western America. It seems likely that these and possibly other snowbank species could occur in similar situations elsewhere in the central and southern Appalachians, especially since visits to the Snowshoe Ski Resort in May of 2000 and 2001 yielded several more specimens of the same two species collected in 1999.

DENISE E. BINION, USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, WV 26505. Preliminary report on the myxomycetes of the New York City Catskill watershed.

Myxomycetes (plasmodial slime molds) are eukaryotic, phagotrophic bacteriovores usually present and often abundant in terrestrial ecosystems. Most of what is known about the assemblages of myxomycetes associated with particular types of terrestrial ecosystems has been derived from studies carried out

in a relatively limited number of localities in temperate regions of the world. The Catskill area of the New York City watershed (NYCWS), although characterized by an extremely diverse range of habitats, has received very little study with respect to the distribution and occurrence of myxomycetes. The primary emphasis of the present study, which is still ongoing, is on determining patterns of species composition, species diversity and taxonomic diversity of these organisms. Twenty-six species of myxomycetes representing 13 genera have been recorded from moist chamber cultures prepared with samples of tree bark, bryophytes, leaf litter and other plant debris, and herbivore dung collected from eight different study sites. These include an old-growth hemlock forest, a high-elevation dry ridgetop community, a mixed hardwood forest, a clear-cut area, a sphagnum bog, and an area of abandoned successional farmland.

JODI FORTNEY and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554 and **GARY A. LAURSEN**, Dept. of Biology and Wildlife, University of Alaska, Fairbanks, AK 99775. Myxomycetes associated with the litter microhabitat in Arctic tundra of northern Alaska.

The moist chamber culture technique was used to investigate the assemblages of myxomycetes (plasmodial slime molds) associated with aerial (dead but still attached plant parts) and ground litter in Arctic tundra of northern Alaska. The two study sites from which samples of litter were collected are located near Toolik Lake (68° 37 N, 149° 36' W) north of the Brooks Range. These samples were used to prepare a series of 60 moist chamber cultures. Values of pH recorded for the cultures ranged from 4.4 to 6.2, with a mean value of 5.4 for all cultures. Seventy five percent of the cultures yielded some evidence (either plasmodia or fruiting bodies) of myxomycetes, but only five species were recorded. One of these (*Physarum bivalve*) was relatively common and represented 60% of all collections. *Arcyria cinerea* was the only other species represented by as many as four collections. Samples of aerial litter (83% positive cultures) were somewhat more productive than samples of ground litter (67% positive cultures), and all of the myxomycetes recovered from both sets of samples were members of the orders Physarales and Trichiales. In general, myxomycetes do not appear to represent a conspicuous element of the biota of Arctic tundra plant communities, but a few species are not uncommon in certain microhabitats. (Supported in part by several grants from the National Park Service to the University of Alaska Fairbanks.)

POSTER SESSION II: BIOLOGY II

C. J. BROADWATER and MARK FLOOD, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Classification of several myxomycetes based on large subunit ribosomal DNA similarity.

The myxomycetes (plasmodial slime molds) are one of the last major groups of living organisms lacking a phylogeny based on molecular data. The reasons for this includes that myxomycetes are poorly understood, myxomycetes are difficult to culture in the laboratory, and it has been difficult to extract DNA from the tough myxomycete spore. Previous undergraduate research at our institution (Overking et. al., 2000 Tri-Beta Regional Conference held at Gannon University in Erie, PA) indicated that sonication was an appropriate method for disrupting the spore coat of myxomycetes, while allowing the DNA inside to remain intact. Based on these findings, myxomycete spores were disrupted by sonication for 1 minute on ice. DNA from the disrupted spores was then isolated using the Wizard® genomic DNA isolation kit (Promega), and quantified by checking the A_{260}. Amplification of DNA from the large subunit (LSU) ribosomal DNA (rDNA) region was accomplished using a specific pair of primers. The PCR program for amplification of LSU rDNA was 95°C for 5 minutes followed by 35 cycles of 95°C for 1 minute, 58°C for 1 minute, and 72°C for 1 minute, with incubation at 72°C for an additional 3 minutes after the last cycle. PCR samples were then electrophoresed on a 1% agarose gel, and PCR products were extracted from the gel using the Freeze 'n Squeeze® protocol (Biorad). The myxomycete PCR products were ligated into the pCR® 2.1 vector using the TA Cloning® kit (Invitrogen). One Shot® INVáF cells (Invitrogen) were then transformed with the resulting recombinant DNA. An overnight culture of recombinant cells was subjected to a standard miniprep procedure (Qiagen) to isolate the recombinant DNA. The myxomycete DNA insert was then sequenced at the Marshall University DNA Core Facility in

Huntington, West Virginia. Preliminary evaluation of sequences from several myxomycetes indicates that there is homology in some areas, and other areas are dissimilar. Therefore, this LSU rDNA region appears to be an appropriate region for molecular phylogenetic analysis. It is anticipated that the information generated from this research project will provide enough data from which further studies on myxomycete classification can be launched. This research was supported by grants from the WV NASA Space Grant Consortium, Fairmont State College's Faculty Development program, and NSF Grant DEB 9705464.

SHIRISHA YELAMANCHILI and SUZANNE M.D. ROGERS, Dept. of Molecular Biology, Salem International University, Salem, WV 26426-0500. Standardization of procedures for *Agrobacterium tumefaciens*-mediated transformation of *Typha augustifolia* (Cattail).

Typha species (Cattails) are monocots common in freshwater wetland habitats. Their ability to bioaccumulate and biometabolize numerous chemical pollutants has resulted in their use in bioremediation of polluted waters and sediments. These plants lack, however, the ability to tolerate and accumulate most toxic heavy metals. The transformation of single-gene traits into wetland monocot plants for generation of plants that can remove and process heavy metals is a long-term goal of our study. Standardization of procedures for transformation of *Typha augustifolia*, using *Agrobacterium* strains with binary vectors that included selection (hygromycin) and marker genes (â-Glucuronidase-GUS) was performed. Seedling derived calli were co-cultivated with *Agrobacterium tumefaciens* strains and assayed for GUS activity. Tobacco was used as the positive control to compare transformation efficiency with *Typha*. Only low frequencies of GUS positive cells were observed in the *Typha* cultures, compared to tobacco explants. Preliminary experiments indicated that adding acetosyringone to cocultivation treatments enhanced the frequency of GUS-expressing cells, whereas adding proline had no effect. Culturing in the presence of auxin over time increased GUS frequency. In conclusion, GUS activity can be used to monitor transient transformation of *T. angustifolia* by *Agrobacterium* and optimization of protocols can increase the frequency of GUS-positive cells.

DONNA VEACH, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201, and **JEFFREY A. SIMMONS** Dept. of Biology, West Virginia Wesleyan College, Buckhannon WV 26201. The effects of acid rain on pigment concentration within *Brassica rappa*.

Acid precipitation in West Virginia is a growing problem. The eastern states, including West Virginia, have the lowest pH of the country, ranging from 3.9 - 4.5. The soil has a natural buffering and neutralizing capability that mitigates somewhat the effects of pollutants. However, when the pollution is chronic, problems arise. Among these problems are low soil pH and an imbalance of soil nutrients. These physical changes in the soil have an impact on vegetation.

This experiment examined the effect of acid precipitation on plants directly through the foliage and indirectly through the soil. *Brassica rappa* plants were germinated and grown in the greenhouse for two weeks before treatment was begun. Plants were subjected to one of the following treatments: watering with low pH solution, watering with low pH solution with added aluminum (to simulate soil acidification), and watering with deionized water but acidic mist sprayed directly on the plant shoots.

Using an extraction procedure and a spectrophotometer, we were able to identify the concentration of this pigment in tissue samples of the varying treatments. Paper chromatography was used to compare spot patterns and identify differences in patterns between the treatments. By determining how and to what degree acid pollution influences chlorophyll concentration we can begin to understand how healthy and hardy the vegetation of an area can remain when exposed to the stress of acid precipitation.

CHRISTI N. ROSS, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443 cross01@shepherd.edu and **PATRICK J. DROHAN**, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443 pdrohan@shepherd.edu. Water depth and nitrogen and phosphorus concentrations in a fine-loamy, carbonatic, mesic fluventic calciudoll A horizon encroached upon by *Typha latifolia*.

Typha latifolia competition in wetland systems of marl-derived soils threatens vegetative communities native to these unique soils as well as the necessary

open water habitats for avian populations. Deep water and high nitrogen and phosphorus levels are often implicated in *Typha latifolia* invasions. The wetland system in this study could be subject to high nutrient levels from adjacent pastures and altered hydrology from road construction that bisects the wetland area. We examine the relationship between elevated water and nutrient levels and whether these influence cattail dominance on a marl-derived soil atypical for West Virginia. Since P is usually unavailable to plants in high pH, marl-derived soils, our study provides information on an unusual instance of cattail invasion.

EHREN GROSS, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201, and **JEFFREY A. SIMMONS**, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201
The effects of phosphorus concentrations on duckweed (*Lemna minor*) growth.

Phosphorus is predominately detected in polluted run off water that is carrying laundry soap or fertilizers. This experiment's objective was to show that various concentrations of phosphorus affect growth of duckweed. Duckweed is a type of aquatic plant that is found in many wetland areas. This experiment used six replicates of each of six concentrations of phosphate (0.0, 0.005, 0.01, 0.02, 0.03, and 0.05 mg L^{-1}). Twenty duckweed plants in each replicate beaker were incubated for seven days in an environmental chamber in 50 ml of nutrient solution. The effect of phosphate concentration on duckweed growth rate was measured.

JIM VANDERHORST, Wildlife Diversity Program, Division of Natural Resources, Elkins, WV 26241. Plant communities of the New River Gorge National River.

Plant communities of the New River Gorge National River (northern and southern thirds) were classified and mapped to assist natural resource planning for the park and provide data for the state's community classification and conservation databases. Classification was based on quantitative sampling of 132 plots chosen to represent the range of ecological diversity within the study area. Plot location coordinates were determined using a differential global positioning system (DGPS). Data collected from each 20 m diameter circular plot included environmental variables, soil descriptions, stand physiognomy and structure, and cover estimates for nearly all vascular plant species occurring in each strata. Plot data were analyzed and classified using detrended correspondence analysis (DCA) and two way indicator species analysis (TWINSPAN). The classified communities were described based on summary statistics and were "cross-walked" to associations in the National Vegetation Classification maintained by NatureServe.

Mapping of the north section was based on transects positioned to cross the major environmental gradients in the study area. The transect data, which included environmental variables and cover estimates for dominant species, were analyzed and classified using canonical correspondence analysis (CCA) and TWINSPAN. Mapping units were delineated by extrapolating the classified transect data to unsampled areas based on topographic position, elevation, and aspect. Digital rastor graphics (DRGs) of USGS 7.5 minute topographic maps served as a base on which the vegetation theme was built using a geographical information system (GIS). Mapping of the north section was completed by Dean Walton. Polygons were later attributed with corresponding community names from the classification of plots.

Mapping of the southern section utilized both DRGs and digital ortho quarter quadrangles (DOQQs) as base layers. The DOQQs are USGS approved products based on 1/40,000 NAPP color infra red photography flown in April 1996 ("leaf off"). Mapping units were delineated on screen based on extrapolation of aerial photo signatures of the classified plots, interpretation of topographic variables, and field observations.

Twenty-seven plant communities were classified and mapped including 13 forest and woodland types, one shrubland type, 10 herbaceous types, and three sparsely vegetated types. Four deciduous forest types cover about 84% of the study area. Riparian community types, the most unique, diverse, and heavily impacted in the study area, cover about 6% of area. About 7% is developed. The remainder is occupied by miscellaneous small patch communities including wetlands, pine forests and woodlands, and cliffs. Eight hundred twenty-four taxa of vascular plants were identified in the plots.

JAMES T. ANDERSON, JOHN W. EDWARDS, KYLE J. HARTMAN, J. TODD PETTY, and ROBERT C. WHITMORE. Division of Forestry, West Virginia University, Morgantown, WV 26506.

Wildlife and fisheries undergraduate education: a curriculum to meet future needs in natural resource management.

Students in natural resources fields are under increased pressure to be well versed in a myriad of biological, ecological, and sociological disciplines. Potential employers expect wildlife and fisheries students to be competent in traditional areas including species identification, natural history, ecology, habitat management, and population management. In addition, employers increasingly expect that students are well versed in human dimensions, wildlife and fisheries policy, Geographic Information Systems (GIS), resource economics, statistics, computer modeling, and numerous other areas. These expectations and resulting additional courses are concomitant with classes required of all university students. Moreover, student demographics are changing. Students in wildlife and fisheries that once came from a predominantly rural background, are now increasingly from an urban setting. Traditional skills and concepts that students once learned growing up on the farm, that are essential to some wildlife or fisheries management positions, may be foreign to many current students. To increase the skill level of our students, increase retention rates, and address employers concerns, we have developed a set of new curriculum options in the Wildlife and Fisheries Resources Program at West Virginia University. We have combined our traditional separate curriculums in either Wildlife or Fisheries into a joint Wildlife and Fisheries Science or a Wildlife and Fisheries Management option. The list of acceptable Liberal Studies courses has been narrowed to create a greater focus on skills needed by students in their future employment. A summer internship requirement and a new introductory *Science and Management of Natural Resources* course was added to improve field skills and better integrate students into our program, respectively. Further, we are collaborating with potential employers to develop a list of knowledge, skills, and abilities that can be used to improve and evaluate the content of our current course offerings. To assist the students and faculty in making their decisions and keeping records a series of checklists and suggested course sequences have been developed.

JUDITH VOJIK, West Virginia Wesleyan College, Buckhannon, WV 26201 and **JEFFREY A. SIMMONS**, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. Changes in pH, alkalinity, and nitrate pollution in water flowing through Triangle Wetland, Buckhannon, WV.

Wetlands are rapidly becoming important in facing environmental issues dealing with the world's increasing problem of water pollution. Studies on wetlands are finding that these natural areas are efficient sinks in which organic and inorganic nutrients as well as toxic materials, such as heavy metals, will settle out from the water flowing through them. Some studies on alkalinity have shown significant reductions in alkalinity because wetlands have removed it from the passing water. Other studies have been conducted that show wetlands reduce the amount of nutrients from nutrient-rich wastewater and runoff. Some of these experiments show that wetland ecosystems actually are reducing nutrients in water such as nitrogen.
In the study performed, four samples were collected from the channel water entering Triangle Wetland, four from the center of the wetland, and four from the outflow stream on one day to determine the changes in pH, alkalinity, and nitrate through the wetland. The objectives of this study was to show that this wetland will act similarly to previous studies by significantly reducing nitrate concentrations (milligrams/liter) and also significantly change the pH and alkalinity of the water.

POSTER SESSION III: ECOLOGY

MISAKI HORIBA, BRUCE EDINGER, STEPHANIE ROBERTS, and TIM CRADDOCK, Dept. of Bioscience, Salem International University, Salem, WV 26426 and West Virginia Department of Environmental Protection, Office of Water Resources, 1201 Greenbrier Street, Charleston, WV 25311. Effects of benthic macroinvertebrate community sample replicates, sample size, specificity of identification, and type of stream condition index on conclusions of stream health.

Benthic macroinvertebrate communities (BMCs) have been used as indicators of pollution by stream ecologists for over twenty years. Many protocols and metrics have been designed for specific stream

assessment purposes. Volunteer watershed associations sample BMCs as a quick assessment of stream health, but conclusions based on inadequate sample sizes and insufficient level of identification may be suspect. We evaluated variability between replicates, effects of sample sizes of 100 or 200 individuals, ordinal versus family level of identification, and use of various stream condition indices on conclusions concerning stream quality. Four sites about 2-3 km apart along Ten Mile Creek, Harrison Co., WV were sampled (three different riffles per site) in December 2001 using a 500 micron Nitex net, invertebrates preserved in ethanol, and transported to the lab for sorting and identification.

There was significant variability (sometimes greater than 50%) among metric values (e.g., EPT family diversity, % abundance shredders) derived from 100-individual samples from different riffles at the same site. This indicates even volunteer sampling needs replication for robust conclusions.

There was little variation among most BMC metrics calculated from two different 100-organism subsamples. However, % midges, EPT family abundance and EPT family diversity did vary (likely reflecting non-random selection of midges from the original sample). Several BMC metrics based on taxon diversity were higher for 200-individual versus 100-individual subsamples. For example, family richness averaged 32% higher, EPT family richness averaged 29% higher, EPT richness averaged 30% higher, a candidate Stream Condition Index (SCI) averaged 8% higher, WVSOS scores averaged 14% higher, and combined WVSOS scores averaged 13% higher. The reasons certain metrics are sample-size dependant, and how biased conclusions based on unequal sample sizes can be avoided, are discussed.

KATA RISHEL, Institute of Environmental Studies, Shepherd College, Shepherdstown, WV 25443 and **PETER VILA** Institute of Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Biological and physio-chemical Sampling of Tuscarora Creek, Berkeley County, West Virginia.

This study established a baseline study to investigate the water quality and stream health of the Tuscarora Creek, located in Martinsburg, West Virginia. On two separate dates, May 27, 2000 and September 27, 2000, Surber samples were taken at six sites along the nine-mile stretch of the creek. Sites were located in areas running above, through, and below the Martinsburg city limits. On each sampling date, 18 macroinvertebrate Surber samples were taken; physio-chemical parameters included pH, dissolved oxygen, salinity, conductivity, specific conductivity, turbidity, and discharge. The physical and chemical parameters were typical of surrounding streams. Macroinvertebrate community structure was dominated by Diptera (including chironomidae and simuliidae), Tricoptera, and Isopoda. Generally, diversity of macroinvertebrates was greater at sites above the city; less diversity and greater numbers of Diptera were found at sites in and downstream of the city.

STEPHANIE ROBERTS and BRUCE EDINGER. Dept. of Bioscience, Salem International University, Salem, WV, 26426. Relationships between stream habitat variables and benthic macroinvertebrate stream condition index measurements for a section of Ten Mile Creek, Harrison Co., West Virginia.

Benthic macroinvertebrate communities (BMCs) and stream habitat parameters are integral parts of stream and watershed health surveys. Since local changes in stream habitat parameters could be one reason for changes in stream health as measured by BMCs, a study was designed to evaluate effects on BMCs of 1) stream sections with larger and smaller flow, 2) stream sections with different streambed and bank characteristics, and 3) stream sections with different immediate land use practices. We studied four sites along an 8 km stretch of Ten Mile Creek in December of 2001. Stream flow rates, temperature and pH were measured. Benthic macroinvertebrate samples (three replicates per site, 100 individuals per replicate) were made with a 500 micron mesh rectangular kick net, stored in ethanol, and sorted and identified in the lab. Habitat and stream variables were scored using the guidelines in the WVSOS advanced methods manual.

Temperature and pH were normal and varied little site to site. The two downstream sites had flow rates were about double those of the two upstream sites, and a higher average WVSOS stream health score, 22, while upstream sites scored 17. Channel flow status scores, for both riffle run and the glide pool area, also correlated positively with WVSOS scores. Higher flow rate and/or narrower channels may have better year-round water quality for benthic macroinvertebrates, either through less exposure of channel beds to drying

during low flow or better removal of sediment. Levels of periphton were variable, but did not correlate with BMC indices. We evaluated land use practices that could be affecting the aquatic community. We did not find any factors we evaluated to be effecting stream health. Two sites had potential non-point source polluters, but these did not correlate with BMC indices.

ROBERT LONG, JOHN W. EDWARDS, Division of Forestry, West Virginia University, 322 Percival Hall, Morgantown, WV 26506-6125, and **WILLIAM GIULIANO**, Louis Calder Center, Biological Field Station, Fordham University, P.O. Box K, 53 Whippoorwill Rd., Armonk, NY 10504. Variation in ruffed grouse ceca length in relation to food habits.

Ceca length and crop contents were examined from 282 ruffed grouse collected in March and April 2000-2001 in KY, MD, NC, MI, MN, PA, VA, WI, and WV to determine regional and annual variation in ceca length in relation to food habits. Ceca lengths differed among sites in both years ($F_{8,124\text{-}138} > 4.57$, $p < 0.0001$) and between years on four of nine sites ($F_{1,8\text{-}60} > 7.12$, $p < 0.05$). Ceca length was not related to skeletal size as indexed by percent carcass ash ($F_{1,245} = 0.02$, $p = 0.90$). We used multiple linear regression to determine which forage classes present in crop contents were the most important determinants of ceca length. Overall, four diet variables explained a significant amount of the variation in ceca length ($R^2 = 0.71$, $p = 0.002$). Mean aggregate percentages of acorns and beechnuts, catkins, and aspen flower buds in crops were negatively related and mean aggregate percentage of buds and twigs was positively related to ceca length. Grouse feeding on highly digestible hard mast and flower buds had shorter ceca than grouse foraging on high-fiber foods such as buds, twigs, and leaves. Our results support the theory that intraspecific cecal morphology variation in gallinaceous birds is largely attributable to dietary differences rather than body size.

T. SYDNEY BURKE, Dept. of Biology, Marshall University, Huntington, WV 25755 (burke4@marshall.edu) and **MARY ETTA HIGHT**, Dept. of Biology, Marshall University, Huntington, WV 25755 (hight@marshall.edu). Diets of bats in West Virginia.

Very little work has been conducted concerning feeding ecology of bats, and only a single study has been done in West Virginia. West Virginia is a prime location for the study of bats, with twelve species reported in the state. In order to increase knowledge of the food habits of bats inhabiting West Virginia, fecal samples of seven species were examined. The species included are: Virginia big-eared bat (*Corynorhinus townsendii virginianus*), Rafinesquii's big-eared bat (*Corynorhinus rafinesuqii*), big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and eastern pipistrelle (*Pipistrellus subflavus*). Collections of samples were made in the eastern mountainous area, the Ohio Valley area, and the New River Gorge area of the state. Biologists of the WV Department of Natural Resources (DNR) Nongame Program and their associates involved in bat survey work during the 2001 and 2002 summer field seasons collected the samples used. Fecal pellets were teased apart in petri dishes and insect remains were identified to the lowest taxonomic level possible. After identification, volume and frequency percentages were calculated to estimate major food sources for the bats. With knowledge of diet and feeding ecology it is possible to make inferences about habitat requirements.

ARIANA N. BREISCH, Dept of Biological Sciences, Marshall University, Huntington, WV 25755, **ALVIN R. BREISCH**, New York State Dept of Environmental Conservation, Albany, NY 12110 and **THOMAS K. PAULEY**, Dept of Biological Sciences, Marshall University, Huntington, WV 25755. Thermal regime of *Clemmys* in West Virginia.

The Spotted Turtle (*Clemmys guttata*) and Wood Turtle (*C. insculpta*) are the only members of the genus *Clemmys* that occur in West Virginia. In the spring of 2001, a one-year radio-telemetry study began of these two species in the eastern panhandle of West Virginia near the known southern limits of the wood turtle range. This site is the only location in the state where these two species occur together. In addition to monitoring seasonal movements, the thermal regime of the turtles' over wintering refuges was studied. StowAway TidbiT® data loggers were attached to the carapace of six Wood Turtles to record external temperature. Due to the small size of Spotted Turtles, data loggers were attached after they had entered

hibernacula and activity slowed. Additional data loggers were also placed four feet above ground, in hibernacula, and in the stream channel to determine if turtles were selecting a thermal regime that was different from the general environment. Temperature was recorded at 1 hour intervals during the summer and longer intervals during hibernation. Data logger information was compared to local weather station records and temperatures recorded in the field. Data collected in this study was used to show the extremes in temperature the turtles tolerated and compare turtle behaviors to temperature and weather. Comparisons between this study and the thermal regimes of more northern populations of Wood and Spotted Turtles may help us understand if over wintering temperature is a limiting factor in the distribution of these species.

KIMBERLY A. BJORGO, JOHN W. HOWELL, and KYLE J. HARTMAN. West Virginia University, Department of Fisheries and Wildlife, 322 Percival Hall, Morgantown WV 26506. Movement patterns of selected Kanawha River fishes as determined by radiotelemetry.

Human impacts on large rivers often lead to alteration of habitat quality and subsequently the dynamics of riverine fish species. Our goals were 1) to describe movement patterns and 2) identify areas that may represent critical large river fish habitat. In May 2000, we implanted radio tags in 60 fish in the Kanawha River, West Virginia. We obtained telemetry data on several species, including freshwater drum *Aplodinotus grunniens* (n = 7, 15 observations) common carp *Cyprinus carpio* (n = 16, 123 observations), smallmouth buffalo *Ictiobus bubalus* (n = 17, 128 observations), hybrid striped bass *Morone saxatilis* X *M. americana* (n = 9, 46 observations), and flathead catfish *Pylodictus olivarus* (n = 5, 26 observations). We used the nearest neighbor index (R statistic) to determine if there was any spatial pattern to the telemetry data. We found that the fish were distributed in a clumped pattern (R = 0.88), so we next turned to habitat data to look for reasons the fish would be aggregating. We used the log likelihood chi square statistic (alpha = 0.05) to examine the observed frequency of four habitat variables: overhanging vegetation (presence/absence), large woody debris (presence/absence), shoreline habitat type (perturbed or natural), and location (mid-channel or shoreline). During the summer and fall, there was no association between species and orientation towards overhanging vegetation, large woody debris, and location ($p < 0.05$). However, during the same seasons, there was an association between species and shoreline habitat type ($p > 0.05$). During the winter, there was no association between species and orientation towards overhanging vegetation and habitat type ($p < 0.05$), but there was an apparent association between large woody debris and location ($p > 0.05$). In conclusion, we found that movement patterns and habitat associations of instrumented fish are highly variable and so exhibit some seasonal patterns. Habitat use by instrumented fish may be influenced by other factors such as benthic substrate and configuration or possibly water quality. Further spatial assessment of habitat availability is needed, and we will address this in continued research.

THOMAS K. PAULEY, ARIANA N. BREISCH, and SETH J. MYERS, Dept of Biological Sciences, Marshall University, Huntington, WV 25755.

The West Virginia Academy of Science gave Neil D. Richmond $100 in 1935 to travel the state with the West Virginia Biology Field Course and collect amphibians and reptiles. These specimens and supplemental collections in 1937 and 1938 formed the nucleus for a state collection of amphibians and reptiles. Since Richmond was not associated with a museum or university, he lacked curatorial services and a building to hold the collections. To provide curatorial services, the collections were moved to Marshall College in 1939 under the care of N. Bayard Green. N. B. Green maintained the collections from 1939 to 1971. During this time the collections grew from approximately 1,000 to over 5,000. Michael Seidel served as the curator from 1971 to 1987 and Thomas K. Pauley assumed the curatorship in 1987 and continues to provide curatorial services for the collection today. Presently, there are over 14,000 specimens. The West Virginia Division of Natural Resources, United States Park Service, and United States Department of Agriculture – Forest Service have provided financial assistance for the maintenance of the collections.

POSTER SESSION IV: PHYSICS/CHEMISTRY

JASON BEST, Astronomy and Physics Group, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. A preliminary analysis of structure within the Cosmic Background Explorer four-year data.

I use the relationship between the area of a fractal and its perimeter, as described in Mandelbrot's 1977 work, to analyze the structure of the universe's cosmic microwave background radiation. This radiation, discovered by Penzias and Wilson in the early 1960s, is an expected relic of the universe's origin from a hot, dense state.

Utilizing the four-year data obtained from NASA's space-borne Cosmic Background Explorer (COBE) satellite, I find the fractal dimension of the radiation to be D=1.73. This value is consistent with other independent analyses of galactic clustering on scales much smaller than those measured by COBE. Such agreement on multiple scales implies that the structure seen currently in the universe is prevalent over tens of billions of years, at least in some form.

COOPER CHILDERS and JASON BEST, Astronomy and Physics Group, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. An investigation of fundamental issues in quantum cosmology.

The unification of physical laws to describe the functioning of the universe as a whole has been an important focus of physics dating back at least to Maxwell's unification of the forces of electricity and magnetism through a set of simple equations in the late 19th century.

In the early 20th century, Einstein's special and general theories of relativity fundamentally changed the way the macroscopic universe is viewed. At the same time, Bohr, Heisenberg, Schroedinger, de Broglie (and others) were changing our understanding of the microscopic world with their efforts in quantum mechanics. However, the probabilistic nature of quantum mechanics is inconsistent with "classical" relativistic theory, and as a result of this inconsistency, the unification of the two theories has become the predominant focus of modern quantum cosmology.

Our research has indicated that physicists are now concentrating their efforts in two major areas of quantum cosmology. One major effort is the construction of "Grand Unified Theories" (such as the String Theories and Ashtekar's "Quantum Loops") to explain both the large-scale and small-scale structure of the universe while incorporating the Heisenberg Uncertainty Principle. A second area is the investigation of the precise forces contained within our universe. We show how recent developments in the understanding of dark matter, dark energy, and neutrino mass are fundamentally reshaping our understanding of the Universe as a whole.

JENNIFER FABIAN and JASON BEST, Astronomy and Physics Group, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. The connection between galaxy morphology and environment in the CfA2 catalog.

Benoit Mandelbrot's contention that "Mountains are not cones, clouds are not spheres, bark is not smooth, nor does lightning travel in a straight line" highlights the fact that standard Euclidean geometry is, at times, an incomplete description of the universe. In such cases, fractal geometry can and has served as an alternative, and often superior, tool for analyzing aspects of nature.

One of the situations where fractals have been found useful is in the description of galaxy distributions. Using a method known as the pointwise dimension (which is based in fractal geometry), we have been able to study how different types of galaxies cluster and evolve with respect to their environments.

We have examined the 18,000 galaxies of the Harvard-Smithsonian Center for Astrophysics Survey (CfA2), focusing on three morphological types of galaxies: ellipticals, lenticulars, and spirals. Using the pointwise dimension, we have found that lenticulars cluster in the manner of ellipticals. Environments with ellipticals and lenticulars appear to be very different from those containing spirals. However, when considering the entire environment without regard to morphological types, the environments are not significantly different. This suggests that while environment may be a factor in galactic evolution, it is not necessarily a primary factor.

ZACHARY S. DRAGAN, Biology Dept., West Virginia Wesleyan College, Buckhannon, WV 26201, and **JEFFREY A. SIMMONS**, West Virginia

Wesleyan College, Buckhannon, WV 26201. Water quality comparison of West Virginia forested and urban streams.

There are many factors that affect water quality. The addition of phosphate, usually a limiting nutrient, to an aquatic system can result in blooms of unwanted algae and other aquatic weeds. Phosphate enters an aquatic system by being leached from sedimentary rocks and in runoff from urban and agricultural areas. Another factor affecting water quality is turbidity, the presence and quantity of suspended particles in water. High turbidity blocks sunlight, limiting photosynthesis, and clogs the respiratory passages of aquatic animals. The focus of this study was to determine if stream flow through an urban area has an effect on the water quality compared to an undeveloped forested area. A comparison was made between phosphate and turbidity levels in periods of high flow (during or closely following a rain event) and normal flow. Based on existing literature, a significant difference was expected in water quality between stream sites, with the forested site having better water quality. A total of four replicate samples were taken from each stream site at each flow period. Turbidity analysis was made using a HACH, Inc. 2100P Turbidity Meter. Phosphate analysis was made using the ascorbic acid procedure for phosphate, using a Bausch & Lomb Spec 20 Spectrophotometer.

HELEN CALDWELL, West Virginia Wesleyan College, Buckhannon, WV 26201, and **JEFFREY A. SIMMONS**, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. An analysis of a wetland's ability to treat acid mine drainage.

Among the plethora of problems facing West Virginia today is the widespread pollution of the state's streams and rivers resulting from coal mining. Acid Mine Drainage (AMD), created from water running over unearthed minerals (i.e., FeS_2), has and will continue to be an environmental concern in West Virginia long after the last mountain is mined. There are many mechanisms that can be implemented to neutralize the acidic water before it enters into streams and rivers; one of these techniques being the construction of wetlands. Wetlands are known to be natural filters by facilitating the settling of compounds due to the slow moving water, or by removal of compounds via plant uptake. This study examined the effectiveness of the constructed wetland at Mud Lick Road in Buckhannon at reducing the water's pH and removing sulfate and iron from the water system. Three samples were collected from the main tributary into the wetland and three samples from the main outlet. The pH was measured with an electrode, sulfate using a turbidimetric method, and iron using atomic spectroscopy.

ERIN R. LAWRENCE, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201, and **JEFFREY A. SIMMONS**, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. Does phosphate alleviate heavy metal toxicity in phytoplankton?

Preliminary evidence suggested that phosphate (P) may play a role in alleviating the toxicity of heavy metals in phytoplankton in acid mine drainage treatment ponds. This laboratory experiment was designed to test the hypothesis that high concentrations of phosphate will cause greater gross and net primary productivity (GPP/NPP) in pond water contaminated with heavy metals.

Phytoplankton were grown in artificial solutions designed to mimic the chemistry of acid mine drainage treatment ponds. Phytoplankton were subjected to one of six different experimental solutions: control (nutrients, low P), +P (nutrients, high P), M1 (nutrients, low metals), M1+P (nutrients, low metals, high P), M2 (nutrients, high metals), M2+P (nutrients, high metals, high P). After one week of exposure GPP and NPP were measured using the light-dark bottle technique.

MINDY GIBSON, RACHEL WILT, and DONALD E. TRISEL, Department of Biology, Fairmont State College, Fairmont WV 26554. Water quality assessment of the Tygart River and Three Forks Creek in Grafton, WV.

This study is designed to determine the possible point or non-point pollution sources contributing to the poor water quality of the Tygart River. Personal conversations with local officials and scientists regarding the possible sources of pollution indicate acid mine drainage as the most likely suspect.

We are currently monitoring the water quality of sections of the Tygart River below the Grafton dam and sections of the Three Forks Creek the Tygart by utilizing a YSI multiparameter probe in the field and

computerized probes in the lab. Biweekly measurements have been (and continue to be) collected and analyzed for levels of: nitrate, calcium, chloride, pH, turbidity, temperature, salinity, dissolved oxygen, conductivity, chlorophyll, TDS, and ORP. Initial data collection shows that Three Forks Creek has low pH values, which supports the theory of acid mine drainage. Other tests indicate that ion concentrations were notably different among different sites. For example, the calcium levels at the Dam site were approximately thirty-five times higher than the Three Forks River sites.

KENDALL BO FOWLER, Dept of Chemistry, Shepherd College, WV 25443, **DANIEL CARSON EADES and EDWARD MCKINLEY SNYDER**, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Analysis of leachate and water quality at the Berkeley County Landfill, a longitudinal study.

For the past three years an ongoing study of the Berkeley County landfill, closed in 1991, has been undertaken by students of the Shepherd College Institute for Environmental Studies working in conjunction with GAI Consultants and the West Virginia Department of Environmental Protection Solid Waste Division. The intent of the study is to establish a baseline for environmental parameters at the site prior to the capping and final closure of the landfill in 2003. Overall environmental impact of the landfill on the surrounding watershed is being established and quantified in the current study. Levels of zinc (Zn), cadmium (Cd), and iron (Fe) are being monitored at six sites on the Opequon Creek and an unnamed tributary immediately south and adjacent to the landfill. In addition, zinc, cadmium, and iron levels are being monitored in leachate samples from onsite test wells to establish controls subsequent to landfill capping. Sampling sites are recorded using a handheld GPS unit as well as Trimble GPS unit, and entered into a computer database for use in a GIS system. In the lab, samples are prepared through two methods, standard filtering, and filtering after preparation with concentrated nitric acid (HNO_3). Metal concentrations from each sample are then determined through the use of an Atomic Absorption Spectrometer (AA). It is hoped that in the future, this work, in conjunction with the work of others, will allow officials to make appropriate decisions that are beneficial to local communities, taxpayers, and the natural environment, in regards to the treatment of closed landfills statewide.

MICHAEL M. LORANTY, Dept. of Biology West Virginia Wesleyan College, Buckhannon, WV 26201 and **JEFFREY A. SIMMONS**, Dept. of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. A comparative study of water chemistry in an unpolluted stream and a stream affected by acid mine drainage.

The focus of this experiment was to compare the difference in water chemistry between two streams. Both streams are located approximately ten miles south of Buckhannon, West Virginia. One stream, Tenmile Creek, receives large amounts of acid mine drainage from nearby abandoned mines. Fox Run is a stream near Tenmile that is relatively unpolluted and free of acid mine drainage. The data will be used to gain further insight into the effects of mining and acid mine drainage on streams. Parts of Fox Run watershed are scheduled for mining in two years. By comparing its present water chemistry to that of Tenmile Creek, I hope to gain insight into what may happen to Fox Run and the implications this may have for the ecosystems in and around it.

Four 500 ml samples were collected from each stream for analysis. Each sample was then analyzed in the laboratory for sulfate concentration using a turbidimetric method, acidity by titration to pH 8.3 using NaOH, and conductivity with a salinity and conductivity electrode. These parameters are often considered to be indicators of acid mine drainage in streams. The data were analyzed using a t-test.

DIANNE K. ANESTIS, TIMOTHY W. CRISLIP, AMANDA S. CASTO, HANG SUN and GARY O. RANKIN, Dept of Pharmacology, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV 25704-9388. Structure-nephrotoxicity relationships among the chloroanilines in isolated renal cortical cells from Fischer 344 rats.

Chloroanilines are widely used as chemical intermediates in the manufacture of pesticides and other compounds. Chloroanilines can appear in the environment following accidental spillage into waterways, as wastewater contaminants and through the degradation of pesticides. Mammals exposed to

chloroanilines *in vivo* can develop nephrotoxicity characterized as oliguric acute renal failure. The purpose of this study was to examine the nephrotoxic potential of several mono-, di- and trichloroanilines in vitro using freshly isolated renal cortical cells (IRCC) from untreated male Fischer 344 rats as the kidney model. IRCC were obtained following collagenase perfusion of the kidneys in anesthetized rats. Cells (~ 3 – 4 million cells/ml) were incubated at 37° C under a 95% oxygen/5% carbon dioxide atmosphere with up to 4.0 mM of a chloroaniline for 60 or 120 min. The compounds tested were 2-; 3-; and 4-chloroaniline; 2,3-; 2,4-; 2,5-; 2,6-; 3,4-; and 3,5-dichloroaniline; 2,3,4-; 2,4,5-; 2,4,6-; and 3,4,5-trichloroaniline. Cytotoxicity was determined at the end of the incubation period by measuring the release of the cytosolic enzyme lactate dehydrogenase (LDH) into the medium. None of the monochloroanilines were toxic at 60 or 120 min at the concentrations tested. Among the dichloroanilines, 3,4 and 3,5-dichloroaniline were the most toxic. These isomers increased LDH release at bath concentrations of 1.0 mM or higher at 60 min and at bath concentrations of 0.5 mM (3,5-dichloroaniline) at 120 min. Trichloroanilnes were generally intermediate in toxic potential between 3,4- or 3,5-dichloroaniline and the remaining mono- and dichloroanilines. These results indicate that the number of chloro groups and their position on the aromatic ring are important determinants for nephrotoxic potential among the chloroaniline compounds.