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DETERMINING THE LIMITING FACTOR FOR PRODUCTIVITY IN LAKE TENKILLER, OKLAHOMA. Stephanie Buck[1], Tony Clyde[2], and James K. Schooley[1, 2]. [1] Department of Natural Sciences, Northeastern State University, Tahlequah, Oklahoma 74464, [2] Environmental Analysis and Compliance Branch, US Army Corps Of Engineers, Tulsa District, Tulsa, Oklahoma, 74128-4609.

Lake Tenkiller, nestled in the foothills of the Ozark Mountains, was once a classic clear water lake. However, due to upstream non-point source pollutants in conjunction with shoreline development, the productivity of the lake is increasing as indicated in the higher chlorophyll a values. This study consisted of data collected for 2001-2004 utilizing the surface samples of total nitrogen, total phosphorus and their ratios along with chlorophyll a. Prior longitudinal profiles of the riverine transition to the terminal pool was conducted to collect 0.5 meter surface samples. From an annual aspect, the chlorophyll a seems to illustrate a slight but steady increase at all sites. Results show that the limiting factor alternates several times within a season causing a variance in the limiting factors. Research literature has indicated that blue-green algae, *Cylindrospermopsis*, favor conditions similar to those on Lake Tenkiller. This study fails to support the prior hypothesis regarding limiting factors and productivity. Future studies to determine what the limiting factor is and what blue-green algae are capable of living in those conditions need to be conducted. Furthermore, discovery of the percentage of blue-green algae in the chlorophyll a samples is a hopeful future project along with identifying specific blue-green species and measuring any algal toxin concentrations.

THE EFFECTS OF TEMPERATURE, ORIGIN, AND RATION SIZE ON SHELL LENGTH GROWTH OF THE ZEBRA MUSSEL (*DREISSENA POLYMORPHA).* Brett Cooper, Sam Ziara, and James K. Schooley. Department of Natural Sciences, Northeastern State University, Tahlequah, OK 74464.

Zebra mussels between 10 and 13 mm shell length in Oklahoma from Oologah Lake, Kerr Lock & Dam, and, Webber's Falls Lock & Dam were selected to determine the effects of water temperature, ration size, and origin on shell length growth. The temperatures of 16, 23, and, 30°C were used in incubators in the lab and dried algae (AlgaMac protein plus) was used for food. Feeding rations varied from 6.8 to 51 mg dried algae per mussel per day. The first hypothesis tested was: there is no effect on lab growth of young zebra mussels based on Oklahoma origin, water temperature, feeding ration, nor the interaction of these factors. Using an ANOVA General Linear Model the only significant ($p < 0.05$) effect was feeding ration ($p = 0.001$). The higher rations had faster growth rates. The second hypothesis tested was: there is no effect on young zebra mussel field growth based on Oklahoma origin during mid-summer (water temperatures from 28-30°C). This was rejected, there is a significant difference in field growth between all three sites. The Oologah Lake mussels have an aver-

age daily growth of 0.055 mm per day in shell length which was 90% better growth than Kerr mussels (an average of 0.029 mm per day) and substantially better than Webber's Falls mussels (an average of -0.033 mm per day). Conclusions from these two experiments are that: 1) the historical risk assessments done for Oklahoma reservoirs to evaluate possible zebra mussel infestation that relied heavily on the limitations of water temperature greater that 26ºC are suspect; 2) the limited growth that has been observed in late summer for some Oklahoma populations of zebra mussels may be due to food limitations rather than water temperature directly; 3) we hypothesize that based on field growth rates the zebra mussel food resources at Kerr are 200% greater than they are at Webbers Falls and that at Oologah Lake they are 83% greater than Kerr.

RHIZOREMEDIATION: ASSESSMENT OF PAH-DEGRADING BACTERIA IN THE ROOT ZONE OF MULBERRY (*MORUS* SP). Michael D. Kyle, John S. Fletcher, David P. Nagle. Department of Botany and Microbiology, University of Oklahoma, Norman, OK, 73019.

Rhizoremediation is a procedure which relies upon vegetation and the microorganisms in the root zone to ameliorate the effects of chemical contaminants in soils. Certain types of vegetation may foster the development of a microbial population which would biodegrade some organic contaminants, such as polycyclic aromatic hydrocarbons (PAH). The root zones of two mulberry trees *(Morus* sp.) growing in a heavily contaminated chemical sludge-disposal basin were excavated and sampled, as was the soil under *Cynodon* sp. (Bermuda grass) in the same basin (non-tree samples). Counts were taken for total colony forming units (CFUs) and the subset of cells which utilized PAH as sole carbon source (PAHUs). Statistical comparison of tree and non-tree sample counts showed no detectable difference in CFUs (Median, 6.1×10^7/g dry soil; $p = 0.747$) between the two sample groups (N = 64). However, PAHUs in tree samples (Median, 8.7×10^5/g) were significantly higher ($p = 0.001$) than those in the non-tree rhizozone (Median, 7.3×10^3). Quantitative real-time PCR with DNA from the samples using primers for *nah* dioxygenase yielded a number for *nah* gene copies in tree samples (Median, 2.1×10^6 copies/g soil) which was significantly higher than those in the non-tree samples (3.0×10^3 copies/g) ($p = 0.0001$). The results suggest that quantification of the *nah* gene may serve as an indicator for populations of PAH-degraders in soils, and that there may be an enrichment effect for PAHUs in the mulberry rhizozone *via* a mechanism as yet uncharacterized.

SUCCESSIONAL CHANGES IN *SALIX NIGRA* FORESTS AT TISHOMINGO WILDLIFE REFUGE, JOHNSTON COUNTY, OKLAHOMA. D. Moore, E. Corbett, S. Shoopman, S. Lewis, R. Reed, D. Bannister. Department of Biological Sciences, Southeastern Oklahoma State University, Durant, OK 74701-0609.

Tishomingo National Wildlife Refuge (NWR), located in Johnston County in South Central Oklahoma consists of previously cultivated land in various stages of successional development. This presents a unique opportunity to study transitional characteristics as bottomland hardwoods succeed monotypic *Salix nigra* (black willow) forests. To describe vegetation patterns within a 1 square kilometer area adjacent to the Cumberland Pool, we selected 3 distinct forest types to sample for woody and herbaceous vegetation. Seedlings, saplings, and trees were sampled using circular nested quadrats; herbaceous vegetation was

sampled using 25 cm x 25 cm quadrats. The data show a successional progression along an age gradient from newest, to intermediate, to oldest forest types. *Salix nigra* declines from an importance value of 97% in the youngest forest, to complete absence in the oldest. The intermediate forest was dominated by *Carya illinoensis* (pecan) at 30%, with *Ulmus americana* (american elm) and *Salix nigra* having an importance of 14% each. In the oldest forest *Ulmus americana* dominated with an importance value of 47%. The general pattern observed was one of declining dominance of *Salix nigra*, and increasing diversity of overstory trees, with age. This is similar to patterns seen in forested areas with similar histories and environment.

CARING FOR LOST SOULS: A SCIENTIFIC APPROACH TO IDENTIFYING SKELETAL REMAINS. Misty Morrow and Robert Morrow. Biology Department, Oklahoma Panhandle State University, Goodwell, OK, 73939.

In 1988, skeletal remains were found in Baca County, Colorado. The find was reported to the Baca County Sheriff's Department and Dr. Robert Morrow, county coroner. Examination of the area turned up substantial amounts of appendicular and axial bones as well as miscellaneous articles of women's clothing. Although no forms of identification were found, it was determined that she was not from Baca County. Her dental health indicates that she received health care on a regular basis putting her in a middle class background at the least. Several methods were employed to identify the remains. A facial reconstruction was fashioned using the skull. Mitochondrial DNA testing and dental records were used for comparison with other missing persons. Despite the thorough testing, no positive identification has been made. The remains were laid to rest on September 8, 2005.

ZEBRA MUSSEL MONITORING IN THE ARKANSAS RIVER NAVIGATION SYSTEM AND RISK ASSESSEMENT FOR TWO BUREAU OF RECLIMATION RESERVOIRS. Sam Ziara, Brett Cooper, and James K. Schooley, Department of Natural Sciences, Northeastern State University, Tahlequah, OK 74464.

The purpose of this study was to obtain life history and water chemistry data on established zebra mussel (*Dreissena polymorpha*) populations at two sites on the Arkansas River Navigation System, and to assess the potential for zebra mussel infestation in two Bureau of Reclamations (BOR) reservoirs. Since their introduction in Oklahoma waters in the early 90's, adult zebra mussel densities in Webber's Falls Lock and Dam (Webber's) and Robert S. Kerr Lock and Dam (Kerr) have grown substantially. Life history data gathered on adult densities, veliger densities, and post-veliger settling rates, from Webber's and Kerr, indicate that both populations are doing well in western US waters. Likewise, information on water chemistry and temperature from Webber's and Kerr was used in assessing the risk of zebra mussel infestation in McGee Creek Reservoir which is located near Antlers, Oklahoma, and Cheney Reservoir, which is located near Cheney, Kansas. Based on this information, it is unlikely a substantial zebra mussel population will become established at McGee Creek Reservoir due to the low calcium levels which are needed for zebra mussel shell production and growth. However, Cheney Reservoir does not appear to have any water quality limits to successful zebra mussel establishment. Historically, it was originally thought that zebra mussels would not thrive in western waters due to the higher water temperatures that are typically found during the summer; however this may no longer be case. The average

water temperature, when veliger densities reached >10,000 /m^3 was 25.6^o C which is above what was considered ideal (13^o - 20^o C). Follow-up experiments, conducted in the summer of 2005, investigated both the importance and interaction of water temperature and food quantity on zebra mussel growth.