ECOLOGY

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ABSTRACTS

Genetic Variation in *Yucca glauca*. Lori Ann Aspray, Department of Biological Sciences, Purdue University, West Lafayette, Indiana, 47907.——The genetic variation of the monocot perennial, *Yecca glauca*, of the Central Grasslands of the United States was studied to determine which life history feature (breeding system, longevity, demography) influences the variation. The genetic variation for this outcrosser was assessed through starch gel electrophoresis. Three enzyme systems, alcohol dehydrogenase, phosphoglucose isomerase, and phosphoglucomutase were well resolved, and they were polymorphic. Many electromorphs formed various patterns in each system. Heterozygosity could not be identified for the populations due to the inability to determine loci; however, heterogeneity was noted within each of the eight sampled populations and individual capsule. The standard variance, F_{ST}, was calculated from electrophoretic data, and its value allows the conclusion that there is heterogeneity between populations. The F_{ST} value for *Y. glauca* is located between the values of biparental herbs and woody biparentals. It is possible that *Y. glauca*'s genetic variation is influenced by the breeding system.

The Egg Laying Process in the Micronesian Orb-weaving Spider, *Cyrtophora moluccensis* (Araneae: Araneidae). James W. Berry, Department of Zoology, Butler University, Indianapolis, Indiana 46208.——The female spider lives in a horizontal dome-shaped web up to one meter in diameter. The egg laying process starts about 10-12 PM and takes about four hours to complete. She first builds in the center of her web a horizontal, silken, shallow, concave disc about 10-15 mm in diameter. Building this disc takes about two hours. The white silk strands forming this disc are applied in a side-to-side motion at a rate of about one strand per second. When this inverted silken "dish" is completed, she fills it with a mass of about 1500 fertilized eggs in about 3 - 5 minutes. From beneath the egg mass, she begins applying silk over the eggs in a side-to-side motion, attaching the silk to the edges of the previously formed disc. When the eggs are completely covered with the white silk, she covers the entire egg case with greenish-colored silk. The egg case, attached horizontally to the center of the domed web, is cut free on all sides except one. This leaves the egg case hanging at 90° from the position in which it was formed. In as few as 10 days, a second egg case may be attached below the first one. A single female may produce as many as six egg cases. Intruding females have been observed adding egg cases to the one produced by the first female. Spiderlings leave the egg case in about 25 days. The female may remain with the egg case or cases long after the spiderlings leave the first egg case.

An Analysis of Disperal in *Peromyscus leucopus*. Mark Henry and David T. Krohne, Department of Biology, Wabash College, Crawfordsville, Indiana 47933——The patterns of dispersal in the white footed deer mouse, *Peromyscus leucopus* were studied at Allee Woods Memorial Forest from May, 1980 to September, 1983. Two methods were used.

First, an extensive system of live-trapping grids identified dispersers by virtue of long distance moves within and between grids without any manipulation. In the second phase of the study dispersers were identified when they moved onto a removal grid from which all mice were removed at three week intervals. The two methods were in agreement on the characteristics of dispersers; adult males predominated. Dispersal was most common in the late summer and early fall but showed no proportional increase with density. The two methods differed in the frequency of dispersal. The removal study detected twice the number of dispersers as the unmanipulated system, perhaps because it artificially drew non-dispersers onto the removal grid.

Effects of Submersed Plants on Sediment Redox and Solute Levels. MARY L. JAYNES and STEPHEN R. CARPENTER, Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556.——The chemistry of sediments colonized by vascular plants and mosses were compared with bare sediments in a soft-water acidic lake. Vascular vegetation consisted of *Isoetes braunii* and *Myriophyllum tenellum*, with total biomass averaging 24.88 g dry weight/m^2. *Drepanocladus exannulatus* dominated the moss vegetation, with total biomass averaging 59.39 g dry weight/m^2. All sampling sites were located at 3.6-4.0 m depth. Redox potentials (E_h) were significantly higher at vascular plant sites than at bare or moss-covered sites. Filterable phosphorus levels were lower in vascular-colonized sediments than in bare or moss-colonized sediments. No significant differences in filterable iron between sites were found. Results indicate that *Drepanocladus exannulatus* does not significantly alter sediment E_h and phosphorus levels from what is found in bare sediments, whereas the vascular macrophytes *Isoetes braunii* and *Myriophyllum tenellum* may effect these changes. Future field manipulations of these macrophytes and their sediments will seek to determine rates and mechanisms of sediment chemistry variations.

Changes in Population Characteristics of Yellow Perch in Indiana Waters of Lake Michigan, 1976-1981, Including Proportional Stock Density. THOMAS S. MCCOMISH, Department of Biology, Ball State University, Muncie, Indiana 47306.——Yellow perch (*Perca flavescens*) were sampled by trawling and gillnetting in Indiana waters of Lake Michigan from June through August, 1976-81, to monitor population characteristics. Rapid decreases in growth rate were observed comparing 1976 to 1981; males age I decreased 35mm, age II 61mm, age III 55mm, and age IV 44mm while females age I decreased 35mm, age II 55mm, age III 65mm, and age IV 51mm.

Gillnet catch curves were similar for all six years due to size selection. Trawl catch curves, however, revealed rapid growth occurred when recruitment to age I was low and the population was dominated by fish >100mm. In 1978 a strong 1977 year class dominated the population (fish < 100mm) and growth decreased in both 1978 and 1979. Continued rapid decreases in growth in 1980-81 were again due to strong 1979 and 1980 year classes and dominance of smaller fish (< 100mm) in the population.

Proportional stock density (PSD), the percent of quality size $\geq$ 200mm of the stock size $\geq$ 130mm, was applied to both gillnet and trawl catches. Gillnet PSD was very high at 80-90% in 1976-77 and declined to about 50-55% from 1978-81. Trawl PSD was greatest at about 25-35% in 1976-77 but decreased to 13% in 1978 and was only 3% by 1981.

Selectivity for larger fish limited usefullness of gillnet catch data but trawl catch data allowed adequate insight to changes in population structure and associated growth. A rapid decrease in growth rate and a shift in population structure toward dominance by smaller fish (< 100mm) occurred between 1976-81. The growth decreased was associated with high recruitment and strength of 1977, 1979, and 1980 year classes. Quality size fish, as measured by PSD, decreased dramatically after 1977 to lowest levels in 1981.

Trawl PSD appeared to be a better measure of actual population length-frequency shifts than gillnet PSD.

Computer-based Floristic Maps of the United States. JACK D. MCMILLEN and THEODORE J. CROVELLO, Department of Biology, University of Notre Dame, Notre Dame Indiana 46556.——We created floristic maps of the United States based on presence and absence of 177 tree species in 3049 counties of the counterminous United States. Counties were grouped into floristic regions using the SAS procedure FASTCLUS which produces nonoverlapping, nonhierarchical clusters from large datasets. The resultant maps are not totally objective since a number of subjective decisions affect the outcome. Subjective decisions include the species to use, number of regions and data transformation. We varied number of regions from 5 to 20 and used a number of transformations. Using simple presence/absence data, depauperate areas cluster rapidly. This results in one large region (of 20) encompassing the Great Plains and surrounding areas. At the opposite extreme is a transformation that produces distances similar to a Jaccard co efficient. This results in larger clusters of species rich areas and thus, the entire eastern deciduous forest becomes one of twenty regions. Use of different data transformations and numbers of clusters produce different maps. All of them concur, to some degree, with published floristic and vegetation maps and to physiographic areas. The decision as to which of the maps is best is still subjective, and should be based on the purpose of the study.

Do Amphibians Feed or Exploit Ponds? CRAIG E. NELSON, Department of Biology, Indiana University, Bloomington, Indiana 47405 and IBRAHIM H. JAAFAR, School of Biological Sciences, Universiti Sains Malaysia, Minden Penang, Malaysia.——The "successional energy exploitation" and "larval efficiency" models predict that acquatic-breeding amphibians with non-aquatic adults will exploit ponds by removing more energy as metamorphosed young than they transport as eggs. Two alternative frameworks, the "successional nutrient transport" and "limiting nutrient" models, focus on nutrient transport rather than energy transport and predict that amphibians will remove more nutrients than they transport in. The relative energy contents of eggs and newly metamorphosed young were determined for four *Ambystoma* and three *Rana* species. Comparisons with rates of survival to metamorphosis from other studies show that, contrary to the first two hypotheses, the energy transported into ponds as eggs often exceeds the energy removed as metamorphosed young. In-so-far as energy flow provides an estimate of nutrient flow, this suggests that the nutrient-based hypotheses will also often fail. A similar conclusion is suggested by the limited data available on nutrient-transport by pond-breeding amphibians. Thus the predictions from these four hypotheses are not universally true and appear not to be usually true: amphibians appear to feed ponds more often than they exploit them. Alternative models more compatible with our results are discussed.

A Model for the Interactions of a Tripartite Association. ROBERT J. REINSVOLD, Research Instructor, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907.——The tripartite association of a leguminous plant, a dinitrogen-fixing bacterium, and a mycorrhizal fungus is the norm for members of the Fabaceae. The purpose of this paper is to present a model which incorporates all the interactions of this complete system, i.e. the interactions between any two members and the effects of the environment.

Both *Rhizobium* (the dinitrogen-fixing bacterium) and the mycorrhizal fungus rely on the plant for carbohydrates and other organic compounds which serve as a source of carbon and energy. In the nodule, the bacterial enzyme nitrogenase chemically

reduces atmospheric dinitrogen (N_2) to ammonia (NH_3). The NH_3 is assimilated into nodular amino acids which are transported to the plant proper.

The mycorrhizal fungus enhances the growing conditions of the plant by 1) increasing the absorption of relatively immobile ions in the soil, e.g. P, Cu, Zn, and S and 2) providing a greater tolerance to adverse biotic and abiotic growing conditions.

The interaction between the two microbes appears to be more indirect, with the plant acting as an intermediary. The high phosphorus needs of the ATP metabolism in the nodules are satisfied by the greater uptake via the mycorrhizal hyphae which are in contact with the plant root. Nitrogen is fixed allowing the plant to grow and produce more foliage and leaf area. This in turn increases the total photosynthesis, supplying the photosynthate required to sustain both endosymbionts. Factors affecting photosynthesis however, also affect the activities of both the fungus and the bacterium, e.g. low light intensity has been shown to reduce plant growth, mycorrhizal development, and nodule activity. This tripartite association is a prime example of a finely tuned symbiotic system.

A Microcomputer Based System for Making Time Course Measurements of Dissolved Oxygen. DAVID F. SPENCER and HARRY W. JARRETT, III, Department of Biology, Indiana University-Purdue University at Indianapolis, Indianapolis, Indiana 46223.—— Time course measurements of dissolved oxygen can be used to estimate rates of oxygen production or uptake by aquatic organisms. Advances in ion electrode technology have made such measurements feasible using a system composed of an oxygen electrode and a pH meter. A major disadvantage of this procedure is that it requires repeated measurements made over short time intervals. This obstacle has been overcome by interfacing the oxygen measuring system (Orion Model 901 Ionalyzer and Orion Model 92-05 Oxygen electrode) with a Commodore 64 microcomputer. The required circuitry is easy to construct and the components are inexpensive. A program written in BASIC monitors the electrode output at specified time intervals; prints the data; and calculates the slope, Y-intercept, and correlation coefficient. Data from oxygen consumption measurements using crayfish illustrate the usefulness of this method.

Limnological Assessment and Feasibility Study of Lakes of the Four Seasons. ARTHUR J. WHITE and W. H. SENFT, II, Department of Biology, Ball State University, Muncie, Indiana 47306.——The lakes of Lakes of the Four Seasons, a residential development in northwestern Indiana, have been identified as highly eutrophic lakes with severe water quality problems that impair their aesthetic and recreational value. With funding from the Property Owners Association, a diagnostic feasiblity study for the restoration of these lakes was conducted from December, 1981 through November, 1982. Mass water loading for this period to the system of interconnected lakes was estimated at 3.596×10^6 m^3 y^{-1}, with a resulting residence time 0.715 y. Areal phosphorus and nitrogen loadings were estimated at 0.4885 g m^{-2} y^{-1} and 12.234 g m^{-2} y^{-1} respectively. Stream flow input contributed 40% of the P and 54% of the N loading while direct runoff and subsurface seepage yielded 29% of the P and 17% of the N loading. Internal sources (sediments) accounted for 30% of P loading. The mean annual total P concentration for the system was 45.0 μg l^{-1} indicating a high degree of eutrophy. Mamagement strategies for the lakes focus upon cosmetic control of macrophyte and algal populations through chemical and/or mechanical treatments.