ECOLOGY

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Abstracts

The Indiana Natural Heritage Program. JOHN FEINGOLD and JOHN BACONE, Department of Natural Resources, 612 State Office Building, Indianapolis, Indiana 46204, and MARION T. JACKSON, Indiana State University, Terre Haute, Indiana 47809, and The Nature Conservancy, 1800 North Kent Street, Arlington, Virginia 22209._____Indiana became the 11th state to initiate a State Natural Heritage Program when Governor Bowen signed a contract between the Department of Natural Resources and The Nature Conservancy on May 19, 1978. The program will be administered under the direction of John Feingold, Division of Outdoor Recreation, Department of Natural Resources, in close cooperation with the Division of Nature Preserves and The Nature Conservancy.

The Heritage Program is an intensive and ongoing statewide inventory of the significant individual components that comprise Indiana's natural diversity. The natural features, or elements, on which information is collected includes plant and animal species of special interest (eg. endangered, threatened, vulnerable), fragile or critical habitat types, and other uncommon natural phenomenon. Data regarding these target elements are collected for storage in a variety of inter-connected and cross-reference filing systems, including a set of U.S.G.S. 7½ minute topographic maps and manual and computer files. Major uses are expected to be research, natural area preservation, and environmental impact assessment oriented.

The organization, operation and utility of Indiana's Heritage Program are discussed.

Flora and Plant Communities of Spicer Lake Nature Preserve, St. Joseph County, Indiana. VICTOR L. RIEMENSCHNEIDER, Department of Biological Sciences, Indiana University at South Bend, South Bend, Indiana 46615._____Spicer Lake, a pothole lake located on the Valparaiso moraine in the extreme northwest corner of St. Joseph County, Indiana is an excellent example of lake succession. The approximately 1.4 hectares of open water is surrounded by a yellow pond lilly-swamp loose-strife community that is floating on its lakeward side. The shrub zone behind the pond lilies rapidly blends into the shrub layer of the surrounding swamp forest. The shrub zone contains swamp rose, buttonbush, red osier, winterberry and blueberry. Spicebush becomes the dominate shrub as the shrub zone merges with the swamp forest shrub layer. Cinnamon and royal ferns are also important in this zone and goldthread, relatively rare in Indiana, is a common herb. The swamp forest is

dominated by red maple, 67% of the 22.3 m²/ha basal area, with slippery elm an important associate. The herb layer is dominated by a number of species including wild sarsaparilla and canada mayflower. Several other small communities add to the floristic diversity of this 16 hectare natural area.

A Preliminary Annotated Bibliography of Aquatic Studies. Published in the Proceedings of the Indiana Academy of Science, 1891-1935 and H. E. McREYNOLDS, U.S. Forest Service, Bedford, Indiana 47421.____The author reviews biological studies of an aquatic nature published in the Proceedings of the Indiana Academy of Science during the 1891-1935 period. A brief resumé of the contents of these papers is provided. This should aid the reader in deciding whether or not he needed to review the particular paper in its entirety. The author plans to abstract later Proceedings papers (1936-1977) in the future.

Prediction and Evaluation of Aquatic Communities Using Environmental Data. RONALD A. HELLENTHAL, Biology Department, University of Notre Dame, Notre Dame, Indiana 46556.____The prediction of model aquatic communities for specific habitats has long been a critical need in environmental biology. This need is most acute in the evaluation of compliance monitoring programs and in the assessment of the potential impact of introduced toxic substances. A computer based system called EROPT can predict assemblages of organisms using environmental requirements and pollution tolerance data. It can be used to scrutinize biological data from ecological studies to insure that habitat conditions are consistent with the organisms reported, and can show ecological similarities among related taxa, determine the level of taxonomic identification required for the indication of specific ecological conditions, and isolate erroneous environmental information associated with aquatic organisms. The EROPT system consists of computer programs for the capture, storage, and retrieval of environmental information on aquatic organisms. Programs are written in Fortran and the system has been implemented on an IBM 370/168 computer at the University of Notre Dame. Environmental requirements and pollution tolerance data for the system were obtained by digitizing environmental monitoring reports of the U.S. Environmental Protection Agency.

The Indiana Lake Classification Program: The Condition of Indiana Lakes and a Comparison of Trophic State Indices. W. HERBERT SENFT, BYRON G. TORKE and HAROLD BONHOMME.____During the years 1973-1976, over 450 Indiana lakes and reservoirs were sampled for a variety of water quality parameters. These parameters were used to define a broad trophic classification scheme for Indiana lakes. This scheme was evaluated by comparing it to Carlson's trophic state index. It was found that Carlson's index was generally a much poorer indicator of water quality than has been assumed. These results are used to assess the current trophic state and water quality of Indiana lakes.

Impact of Heavy Metals on the Growth of Yellow Perch *(Perca flavescens)* **as Measured by RNA-DNA Ratios.** PAUL K. KEARNS, G. J. ATCHISON, and R. J. VETTER, Bionucleonics Department, School of Pharmacy and Pharmacal Sciences, Purdue University, West Lafayette, Indiana 47907.____Yellow perch *(Perca flavescens)* collected from industrially contaminated Palestine Lake were analyzed for cadmium and zinc content by atomic absorption

spectrophotometry. Ribonucleic acid—phosphorus, deoxyribonucleic acid—phosphorus content of fish and RNA-DNA ratios were determined in an effort to compare growth of fish from the contaminated area of the lake to the growth of fish from the uncontaminated area of the lake.

Of three sampling dates, one revealed significant differences in growth of fish as monitored by length and weight measurements, condition and RNA-DNA ratios between sites. Linear regression analysis of length and weight relationship of fish from the two sites indicated that fish from the uncontaminated area have heavier weights to a given length than fish from the contaminated area of the lake. As body burdens of cadmium increased in yellow perch, condition and RNA-DNA ratio values decreased. Whole body concentrations of zinc had no relationship to condition or RNA-DNA ratios.

Pigeon-Borne People Diseases. WALTER WEBER, Pesticide Consultant, 36 West Roberts Road, Indianapolis, Indiana 46217._____Feral pigeons *(Columbia livia)* are not harmless birds. They have the potential for transmitting over 40 diseases to man and animals. Eight examples follow. Candidiasis primarily affects the mouth, intestines and urogenital tract, especially the vagina. The itching, pain and discharge caused by this fungus is significant enough to warrant the elimination of pigeons which spread the disease. Chlamydiosis affects the respiratory system. Over half of the pigeon population is infected. Cryptococcosis frequently affects the brain covering. It is acquired by inhalation. The yeast is carried in the intestinal tract of pigeons and deposited in their feces. One Indianapolis victim of cryptococcosis spent 81 days in the hospital. Encephalitis is transmitted through bites of infected mosquitoes after they have bitten a host. Pigeons, English sparrows and house finches are the main reservoir. *Salmonella tyhimurium*, often the cause of food poisoning is found in about 2% of pigeon feces. Toxoplasmosis has an affinity for brain tissues. When 80 pigeons were trapped on the Nation's Capitol, 10 revealed evidence of Toxoplasma infection. Yersiniosis is associated with pigeons. The symptoms are indistinguishable from appendicitis. The disease was responsible for 14 unnecessary appendectimies in 1976. Bird mites *(Dermanysus gallinae)* were responsible for a case of pruritis in a N. Carolina hospital. The mites originated in a pigeon nest in the ventilator. Additional pigeon-borne diseases include American trypansomiasis aspergillosis, blastomycosis, coccidiosis, erysipeloid, histoplasmosis, listeriosis, Newcastle, paratyphoid, pasteurellosis, pox, pullorium, trichomoniasis, and tuberculosis.

Ecological Notes on *Robackia demeijerei* (DIPTERA: CHIRONOMIDAE)— An Example of A Well Adapted Sand Dwelling Larval, Midge. RICHARD WHITMAN, Indiana State University, Evansville, Indiana 47112._____*Robackia demeijerei* (Krusemann) has been found throughout Palearctic and Neartic regions and is an excellent example of a highly specialized psammorheobiont adapted for a carnivorous life in unstable stream sands. Gut contents of this midge indicates that its principle food item must be *Aeolosoma* sp. and/or *Rhynchoscolex simplex*. Population dynamics of this midge was investigated in an east Texas sandy stream during 1976. Monthly mean density ranged from 4200 to 9800 org/m³ with an overall mean of 7700 org/m³. Seasonal density did not differ in most areas sampled. Mean monthly standing crops ranged from

12.9 to 49.2 μg/m^3. A good long normal relationship existed between mean weight by instar and head capsule length. *R. demeijerei* preferred sandy areas just upstream from pools and within the center of riffles while pools and margins had lower densities. *R. demeijerei* is found most abundantly at a 5-10 cm sand depth.

A Preliminary Study of the Occurrence of Broken Back Syndrome in Northern Cavefish (*Amblyopsis spelaea* Dekay) at Spring Mill State Park, Mitchell, Indiana. JAMES H. KEITH, Director, Division of Nature Preserves, Indiana Department of Natural Resources, and LOIS MITTINO GRAY, Naturalist, Spring Mill State Park, Indiana Department of Natural Resources._____In July 1976, the staff of Spring Mill State Park noted that several individuals of Northern Cavefish in Upper Twin Cave were apparently injured. Subsequent examination of the fish by a biologist from the U.S. Fish & Wildlife Service Laboratory in Genoa, Wisconsin indicated that the fish probably suffered from "Broken Back Syndrome", a condition in which vertebrae crack and extensive hemorrhaging results. This syndrome occurs under a variety of circumstances including physical trauma, vitamin C deficiency, and exposure to pesticides. Some preliminary work by the Indiana State Board of Health revealed the presence of toxaphene in the stream water of Upper Twin Cave. Results published by other investigators suggest that exposure of fish to toxaphene and related compounds alters the ratio of coldagen: mineral in the skeleton. Bones become brittle and crack easily, resulting in a broken back and associated hemorrhaging.

In the summer of 1977, a similar condition was found. Using funds provided by Indiana's Division of Fish and Wildlife, it was decided to systematically survey the blind fish population and measure the pesticide content (toxaphene and dieldrin) of the stream water on a regular basis. In the summer of 1978, water samples were taken from Upper Twin Cave and analyzed for the presence of pesticides. Samples were taken bi-weekly and during major floods. Five visual censuses of the fish population were implemented to note any changes in the incidence of the syndrome over a two year period. Individual fish were also collected for chemical analysis.

A comparison of recent census data from Upper Twin Cave with data taken from the same cave by Poulson (unpublished) in 1958 and 1964 does not demonstrate an adverse impact on the population at this time. However, the water analyses point to the need for further investigation and monitoring of this system. The potential impact of continued pesticide contamination of the cave water will be discussed along with the need for further study.

The Ecology of the Troglobitic Beelte *Pseudanophthalmus Tenuis Stricticollis*: Recruitment and Fecundity Data. JERRY H. KEITH, Director, Division of Nature Preserves, Indiana Department of Natural Resources._____*Pseudanophthalmus tenuis* inhabits caves in south-central Indiana. In Murray Spring Cave near Paoli, Indiana, the subspecies *Pseudanophthalmus tenuis stricticollis* is the numerically dominant predator in the arthropod community inhabiting the streamside mudbanks. In 1973 and 1974, a study of the mudbank community of Murray Spring Cave was undertaken. Because of its size, and numbers present in the cave, *P.t. stricticollis* was intensively studied.

Mark-recapture studies, censuses and field observation indicate that *P.t. stricticollis* has a seasonal life cycle that is strongly influenced by cave flooding. This differs from other organisms studied in that community, since large (>5mm), mobile organisms tended to have constant numbers over time and small (<2mm) organisms had numbers which varied in response to flooding. *P.t. stricticollis* is large and mobile, and should fit into the former category but fits, instead, into the latter category. Reasons for these differences are discussed.

The Effect of Water Level Fluctuation on Primary Productivity in Lake Monroe. WILLIAM Y. B. CHANG, Department of Biology, Indiana University, Bloomington, Indiana 47401.——Changes in the amount of discharge from the watershed causes significant fluctuation of water level in Lake Monroe. During the dry season when the discharge is decreased significantly and evaporation is intensified, the water level decreases very noticeably, resulting in a significant increase in cations and calcium concentration. This increase in cations and calcium concentration can change the water chemistry and coprecipitate available phosphate ions in the lake. In the case of soft water mesotrophic Lake Monroe, where phosphate is limiting, the effect of coprecipitation becomes strong when it is compounded with the increase of pH attributed to intensive photosynthetic activities. This effect can act to the disadvantage of phytoplankton, and may function as an indirect density-dependent population control.

Branch Abscission and Leaf Fall Relationships in a Mature White Oak. WILLIAM R. CHANEY, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907.——Litter fall from a mature *Quercus alba* L. growing in Martell Forest was sampled weekly from August through January for five years. Litter was separated into abscised twigs, leaves attached to abscised twigs, abscised leaves, and acorns. Two phases of leaf fall were evident. The first was characterized by abscission of twigs with leaves still attached whereas the second phase was characterized by shedding of individual leaves. The peak of twig abscission with attached leaves preceded the peak of individual leaf fall by 10 to 14 days. Approximately 25% of the leaves shed in early autumn were attached to abscised twigs whereas approximately 10% of the total leaf litter was lost from the tree while attached to twigs.

Composition and Homogeneity within an Aspen-White Pine Successional System in Kalkaska County, Michigan. EDWIN R. SQUIERS,* DAVID N. ALLAN, and CARRIE, L. YOUNG, Department of Biology, Taylor University, Upland, Indiana 46989.——The composition and homogeneity of an even aged aspen-white pine successional system was studied at The Taylor University Biological Station, Big Twin Lake, Kalkaska County, Michigan. Density, frequency, and basal area were recorded for each tree species in a series of one hundred 100m^2 circular quadrats chosen at random on ten subsites within the system. Importance values and several dominance/diversity indices were calculated to describe each subsite. Similarity matrices followed by cluster analysis were then used to assess the homogeneity of the total system. Present composition within the system can be explained in terms of species life history, reproductive strategy, and the pattern of past disturbances.

Chemical and Biological Effects of Natural Annual Dieback of *Myriophyllum* *spicatum* **Upon the Littoral Waters of a Large Soft Water Reservoir.** DIXON H. LANDERS, Indiana University, Bloomington, Indiana 47401._____Three polyethylene enclosures (dia: 2 m) were placed in the littoral zone (depth: 1.5 → 2.0 m) of the upper basin of a soft water reservoir during late summer 1977 to determine the effects of natural macrophyte dieback upon the water chemistry and phytoplankton. Enclosures were located in a monospecific stand of the Eurasian watermilfoil (*Myriophyllum spicatum*). Total phosphorus and reactive phosphorus concentrations were significantly higher in the water of the enclosures with rooted and unrooted decaying plant material than in the enclosure without macrophyte tissue. A reactive phosphorus pulse $(5 \rightarrow 9 \, \mu g \, l^{-1})$ was detected as above-sediment decay occurred in the enclosure containing rooted plants. The pulse dissipated as the plants sank to the sediment surface. No reactive phosphorus was detected in the enclosure lacking macrophyte tissue. A high peak of NH_4-N appeared coincident with the reactive phosphorus pulse in the enclosure containing rooted macrophytes. Phytoplankton responses to this natural nutrient addition are discussed.

Log Decomposition in Donaldson's Woods, Spring Mill State Park. P. C. MACMILLAN, Hanover College, Hanover, Indiana 47243._____Stem maps made by Lindsey and Schmelz, et al., of the trees on 20 acres of Donaldson's Woods were used to identify the logs found and to estimate their residence time (RT) on the forest floor. I collected 162 samples of wood from 125 different logs representing 10 genera. Logs were assigned to decay classes 1 to 5 on the basis of physical appearance and assigned to RT classes of 1, 8, 18 & 23 years based on information from the stem maps. The use of these two classification schemes will be discussed. Total log frequency on the forest floor was 6.25 logs/ha; log input rate was calculated at 0.22 logs/yr/ha for ca. 28 years. Only oaks *(Quercus alba, Q. rubra & Q. velutina)* were found in sufficient abundance (64 of 125 logs) to yield good statistical data. The decay rate of oak logs was calculated to be k = -0.094 using the logarithmic decay model Y = a + k · ln t (r^2 = .99). Other physical parameters of the logs will be discussed. This study was supported in part by a grant from the I.A.S.