

ECOLOGY

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ABSTRACTS

Occurrence of the Protozoan parasite, *Henneguya exilis* Kudo, on channel catfish in Indiana. RAYMOND A. SCHLUETER, Division of Science and Mathematics, University of Tampa, Tampa, Florida 33606.—The Genus *Henneguya* belongs to a large and well-known group (Order Myxosporidia) of Protozoa which are typically parasitic on fish. *Henneguya exilis* is characterized by the spore being ovoidal, two polar capsules at anterior end, each shell-valve prolonged posteriorly into a long process, sporoplasm with an iodophilous vacuole. *H. exilis* is found in gills and integument of *Ictalurus punctatus*, the channel catfish, forming conspicuous cysts up to 3 mm in diameter.

H. exilis has been reported in Illinois and in Iowa.

From June 1973 to August 1974, channel catfish were collected on a monthly basis from the White River near Petersburg, Pike Co., Indiana. Twelve out of 123 catfish had cysts containing the spores of *H. exilis*. These whitish pustules were found in the integument along the sides and caudal peduncle areas of the body. Only one fish (15 cm in Standard Length) was moderately infected. Most catfish had just a few cysts. The infection was only observed during the summer months (June through September).

It is not surprising to find *H. exilis* in the White River because Kudo (1934) states that *H. exilis* probably infects channel catfish living in major rivers of the Mississippi River drainage.

Black Locust as a winter food for Bobwhite Quail. ROBERT PRIDDY, Huntington College, Huntington, Indiana.—Black locust seeds ranked fourth in volumetric content and fifth by frequency of occurrence in crop content analysis of 398 bobwhite quail collected on the Salamonie Reservoir, northeastern Indiana, during the months of November through March, 1971-1975. Black locust was a major bobwhite food during January through March, and the availability of black locust seeds in periods of snow cover made this food source an important item in bobwhite winter diets.

Black locust seeds were fed to 20 pen-reared bobwhites during an eight-week period, March-May, 1976. A commercial flight conditioner was fed to 14 control birds during the same period. Males fed black locust seeds had the same change in weight as males fed commercial flight conditioner. Females fed black locust seeds and those fed commercial flight conditioner gained more weight than the males of both groups, however, females fed commercial flight conditioner gained significantly

more than females fed black locust seeds. Birds that were fed black locust seeds consumed 37 percent more water than control birds and they defecated loose feces.

Changes Over a Half-Century in the Davis-Purdue Natural Forest. J. K. EICHENBERGER and G. R. PARKER, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907. —The Davis-Purdue Natural Forest, located in Randolph County, is one of the finest wet-site, oak-hickory stands in Indiana. The 20.6 hectare (51 acre) woods is among the largest old-growth remnants on the intensively farmed Tipton Till Plain. Since its acquisition in 1917 by Purdue University, the forest has been essentially undisturbed. The National Park Service has designated the forest a registered National Landmark.

An unpublished Purdue study was made of the tract in 1926. Each tree greater than 10 cm (4 inches) dbh was numbered, tagged, described in detail, and located on a large-scale map. Indiana forests offer few, if any, instances for which such complete prior data can be obtained. The present (1976) study re-examines the center 8.5 hectares (21 acres) with similar scrutiny. Changes in species composition, basal area, density, size-class relationships, and spatial pattern are being investigated.

A Comparison of Presettlement and Extant Forest Vegetation of Indiana. WILLIAM B. CRANKSHAW, Ball State University, Muncie, Indiana 47306. —A three-dimensional ordination of forests located on forty major southern Indiana soil types was constructed using absolute basal area. Derived from the original land survey data a second ordination using current basal area values was constructed for 18 stands, each of which occurred basically on one soil type. The comparison was made between the two ordinations for indications of temporal trends.

Preliminary Report on the Flora, Fauna and Habitats of the Swamp Rose Nature Preserve, St. Joseph County, Indiana. VICTOR L. RIEMENSCHNEIDER, Department of Biological Sciences, Indiana University at South Bend, South Bend, Indiana 46615. —The Swamp Rose Nature Preserve, about 40 ha in size, is located in the northeast corner of the new Potato Creek State Recreation Area. During 1975-76, 256 species and varieties of vascular plants have been identified in the three major habitat types, forest, upland old field and wetland, within the preserve. In addition, 62 species of birds have been observed within the preserve along with a few other species of amphibians, reptiles and mammals. The purpose of this study is to provide park personnel with base line data to determine management and use of the preserve. Complete species lists are on file with the Division of Nature Preserves and property manager of Potato Creek State Recreation Area. Plant specimens are presently located in the Department of Biological Sciences, Indiana University at South Bend.

Preliminary Observations on Reproductive Ecology of *Ambystoma tigrinum* (Amphibia: Urodela) in Northern Indiana. DAVID M. SEVER and

CLARENCE F. DINEEN, Department of Biology, Saint Mary's College, Notre Dame, Indiana 46556.—A long-term study began in 1976 on reproductive ecology of *Ambystoma tigrinum* breeding in a temporary pond in northern Indiana. *A. tigrinum* is the only salamander in the pond which at maximum size is .25 ha and 60 cm deep. Between 28 February-22 March, 172 adult specimens (125 ♂♂, 47 ♀♀) were captured by seining. Also, 14 specimens (7 ♂♂, 7 ♀♀) were caught from 29 February-14 March in 12 pit traps with drift fences set so that about 17% of the pond circumference was sampled. Schnabel and Schumacher population estimates based on mark-recapture of seined individuals predict 769-917 adults. Traps were turned 23 March so emigrating salamanders could be sampled, and 12 specimens were caught 29 March. Seining the pond 2 April produced no results. First egg masses were found 2 March and first hatching larvae 2 April. Larvae were unselective predators of any animals small enough to swallow. *Bufo* tadpoles were most frequent food items in May. Between 6 July-29 July, 158 newly metamorphosed *A. tigrinum* were caught in traps, 58% in the NEN-ESE directions. The pond dried completely 20 July, and many larvae were found desiccated, but heavy rains on 21 July refilled the pond and resulted in 35 trapped specimens after which no more larvae were found in the pond.

Viability and Growth Effects of Soil Applied Heavy Metals on Several Herbs Native to Northwestern Indiana. LARRY J. MILES and GEORGE R. PARKER, Department of Forestry, Purdue University, West Lafayette, Indiana 47907.—Preliminary results of greenhouse experiments indicate that soil applied heavy metal concentrations comparable to those encountered in the urban-industrial region of northwestern Indiana can affect the viability and growth of several native herbs. Viability appears to be more severely affected than growth. Plants grown on heavy metal impacted soil collected from an intensive study site in East Chicago do not show these effects. On the impacted soil, growth, at least for some species, was stunted, whereas viability was unaffected. These results indicate that some soil factor is limiting plant growth on the impacted site soil. This factor does not appear to be cadmium and may not be any of the heavy metals.

The Effects of Heavy Metal Contamination on Litter Decomposition in Northwestern Indiana. JOHN C. INMAN and GEORGE R. PARKER, Department of Forestry, Purdue University, West Lafayette, Indiana 47907.—The decomposition rate of three plant species, black oak (*Quercus velutina* Lam.), starry false Solomon's-seal (*Smilicina stellata* L.) and quaking aspen (*Populus tremuloides* Michx.) was monitored using nylon litter bags at a heavy metal polluted site and an unpolluted site. All three species of plant litter lost weight more slowly at the polluted site than at the unpolluted site.

Initial concentrations of all four heavy metals were greater at the polluted site than at the unpolluted site for all species of litter. As decomposition progressed, metal concentrations increased more rapidly

in litter from the polluted site than the unpolluted site except for ZN and Cd in quaking aspen litter.

Microcosm laboratory studies were made on microfungus populations of contaminated and uncontaminated site litter using a leaf washing technique and the dilution plate method. There was no consistent difference in fungus populations on litter of Solomon's-seal and black oak from the two sites. The addition of CdCl₂ to uncontaminated litter had little effect on microfungus populations except for one species (*Aureobasidium* sp.). Counts also indicated a succession of fungi on the leaves, with Willow Slough treated and control litters being similar in succession but different from that of EC litter.

Impact of Phosphorus Removal on the St. Joseph River. LAWRENCE L. GARBER, Department of Chemistry, Indiana University at South Bend, South Bend, Indiana 46615, and MICHAEL J. JETER, Analytical Laboratory, Bureau of Sewers and Waste Water, South Bend, Indiana 46616. —The installation of tertiary phosphorus treatment, which utilizes iron(III) chloride as a precipitant, at the South Bend Waste Treatment Plant has reduced the discharge of phosphorus into the St. Joseph River from approximately 2.1 g/sec to 0.7 g/sec. The total phosphorus removal at the plant is approximately 85 percent. Before phosphorus removal the effluent from the South Bend Waste Treatment Plant increased ortho-phosphate phosphorus concentration by about 88 percent. After phosphorus removal orthophosphate phosphorus concentrations increased by about 11 percent. The effluent had minimal impact on polyphosphate phosphorus and organic phosphorus concentrations for both before and after phosphorus removal.

Before phosphorus removal the range/mean for upstream ortho-phosphate phosphorus and polyphosphate phosphorus levels were 17-135 ppb/49 ppb and 8-53 ppb/22 ppb, respectively. The corresponding downstream parameters are for ortho-phosphate phosphorus 37-139 ppb/92 ppb, for polyphosphate phosphorus 9-65 ppb/25 ppb. After phosphorus removal the range/mean for upstream ortho-phosphate phosphorus, polyphosphate phosphorus and organic phosphorus were 44-162 ppb/68 ppb, 10-60 ppb/29 ppb, 21-118 ppb/50 ppb, respectively. The corresponding downstream values are for ortho-phosphate phosphorus 50-169 ppb/76 ppb, for polyphosphate phosphorus 10-84 ppb/28 ppb, for organic phosphorus 25-102 ppb/53 ppb.

Further Observations on the Seasonal Distribution of Brown Hydras. DONALD E. MILLER, Department of Biology, Ball State University, Muncie, Indiana 47306. —Observations, similar to those made from late June, 1972, to late March, 1974, and reported to the Ecology Section in 1974, were made from April 1, 1974 to March 31, 1976. All observations were made in Hamlin Lake, Mason County, Michigan.

Hydras were observed on natural and artificial supports. Most observations were made at shallow water situations. However, from April 25 to August 16, 1975, a float was anchored where the water was 10.5 m. in depth. Observations were made on artificial supports attached to this float about 0.5 m. below the water surface.

Observations at all stations, particularly on artificial supports, reaffirmed those made before and reported in 1974. Seasonal distribution was about the same. Accumulations of other organisms and detritus on supports did not seem to be important in excluding hydras from the supports or in determining the abundance of hydras on the supports.

The reason for the reduced population of hydras during July and August remains uncertain. Studies of hydras in other lakes, particularly during the period June through August, are recommended.

Those interested in more detail with regard to this problem are referred to the following: Trans. Amer. Micro. Soc., Vol. LV, No. 2, p. 123-193, April, 1936.

Aspects of the Symbiotic Behavior of *Periclimenes rathbunae* Schmitt and *Thor amboinensis* (De Man) with Their Host Tropical Sea Anemone, *Stoichactis helianthus* (Ellis), from Jamaica. DANIEL M. LEVINE and ORLAND J. BLANCHARD, JR., Department of Biology, Earlham College, Richmond, Indiana 47374.—*Periclimenes rathbunae* Schmitt and *Thor amboinensis* (De Man) are commonly found in association with the sea anemone, *Stoichactis helianthus* (Ellis) in depths of 1 to 6 feet. Neither shrimp species is ever found free-living. Specimens of *P. rathbunae* are usually found in pairs, with ovigerous females occupying the center of the oral disc near the mouth cavity, while males are restricted to the periphery. Specimens of *T. amboinensis* are usually found in groups of 3 or more in the immediate vicinity of an anemone, very often an anemone occupied by *P. rathbunae*. Behavioral studies indicate that *P. rathbunae* must acclimate to the stinging tentacles of its anemone host after a 24 hour period of isolation. In addition to this behavior, *P. rathbunae* exhibits many behaviors that parallel those of pomacentrid fishes in relation to their anemone hosts. These include territoriality, the storing of food on the host, agonistic behavior, grooming and cleaning the host and preference for specific hosts, as well as others. The anemone benefits from the presence of *P. rathbunae* by receiving scraps of food and by being constantly cleaned of dead cells and debris. The shrimp in return receives protection from predators and has an ever present food source in the form of material consumed during the cleaning service it renders to the anemone. *P. rathbunae* and *S. helianthus* are therefore classified as mutual symbionts. *T. amboinensis* performs no services for the anemone and only seeks its protection when in danger. It is adapted for standing high above the stinging tentacles, and has an upright posture that also tends to minimize contact with the tentacles. *T. amboinensis* is classified as a commensal symbiont of *S. helianthus*.

Studies of the Cave Crayfish, *Orconectes Inermis Inermis* Cope (Decapoda, Cambaridae). Part I: Home Range. H. H. HOBBS III, Department of Biology, Wittenburg University, Springfield, Ohio 45501.—Two-hundred and eleven individuals of the obligate cave crayfish *Orconectes inermis inermis* (Cope) were externally and internally tagged in Pless Cave, Lawrence County, Indiana. During the two-year study period, 96 tagged individuals were recaptured at least once, a 46% recapture

rate. The population size was estimated to be 1586 ± 79 over the 540 m study area. The size of the population remained relatively stable during the time of study.

Use of total range of movements indicates that the home range of male *O. i. inermis* is as large as 20 m and up to 23 m for females, although the maximum distances moved for both sexes greatly exceeds these values. Ranges of individuals overlap, suggesting direct competition among crayfish for food, space, mates, etc. Smaller individuals (male and female) are displaced greater distances downstream and larger crayfish show a significant upstream movement, however by pooling all the movement data, both sexes exhibit a net downstream movement. This downstream movement of individuals is greatly influenced by numerous and extensive spates which occur during the winter and spring months.