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ABSTRACTS OF PAPERS PRESENTED AT THE MISSISSIPPI RIVER RESEARCH CONSORTIUM
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EFFECTS OF FLOODING ON COLLEMBOLA

John L. Ostdiek
Quincy College
Quincy, Illinois

Three floodplain habitats, one subject to frequent flooding, a second only occasionally flooded, a third rarely flooded were sampled. Collembola from a fourth upland habitat provided a "control," indicating the presumed endemic population and species. The deposition of flood debris enables upstream species to colonize a downstream site.

ARTIFICIAL SUBSTRATES FOR HEXAGENIA MAYFLY NYMPHS

Calvin R. Fremling
Winona State College
Winona, Minnesota

It is difficult to observe the behavior of burrowing mayfly nymphs because nymphal movements cause turbidity in laboratory aquaria which contain mud substrates. Artificial, burrow-containing substrates have been molded from epoxy resin and from polyvinyl acetate plastic. Burrows are arranged around the periphery of plastic blocks in a cut-away fashion so that nymphal activity can be observed within the burrows. Glass sides of the aquaria form the outside walls of the burrows. The substrates have proved very useful in bioassay experiments because they enable the experimentor to determine when a nymph is "ecologically dead" (when it abandons its burrow.) The substrates have also been modified to serve as floating bioassay vessels for river studies. Nymphal behavior in the substrates will be demonstrated with closed circuit television.

THE BENTHIC BIOTA OF AQUATIC MICROCOSMS ESTABLISHED AS BIOASSAYS OF POLLUTION

Edward T. Cauley
Loras College
Dubuque, Iowa

A study of use of benthic microrganisms in the bioassay of pollution in microcosms. Quantitative samples of the benthic biota, separated into life forms; diatoms, flagellates, filamentous and non-motile algae, protists and invertibrates are evaluated as possible indicators of pollution.

MACROINVERTEBRATES OF THE MISSISSIPPI RIVER IN THE MONTICELLO REGION

David McConville
St. Cloud, Minnesota

A nuclear steam-electric generator is being constructed for the Northern States Power Company on the Mississippi River near Monticello, Minnesota. The Monticello study area will be affected by the operation of this power generator which is scheduled to begin power production in 1970. This facility will use a "once through" system of steam condensation which will use up to 65% of the riverflow, during periods of low water, as the primary

coolant. Some of the excess heat will be returned to the river. This represents part of an overall ecological survey to establish the ecological baseline condition before the power plant begins operation. I have attempted to determine the quality and the quantity of the macroinvertebrate population and to determine those factors affecting it. It is hopedthat the invertebrates will provide an index of the biological effects of thermal addition in the river.

Monticello, in central Minnesota, has a mean temperature of 42.4 F and a mean rainfall of 26.49 inches (U. S. Weather Bureau at St. Cloud, Minnesota). In the study area, the river varied from 500 to 700 feet in width and ranged from 6 inches to 20 feet in depth. Seasonal flow levels may vary by a factor of thirty times between low and high water.

Water samples were collected at four stations within the study area. The mean dissolved oxygen was 10.15 mg/l. The mean biochemical oxygen demand was 2.07 mg/l and the ortho-phosphate seasonal mean was 0.12 mg/l. The hydrogen ion concentration varied between 7.2 and 7.4 and the mean alkalinity was 153.8 mg/l. The mean dissolved solids was 184.3 mg/l. Basically, water quality data indicates that the river environment in the Monticello area is relatively stable and free from serious organic pollution.

Representatives of 11 orders, 32 families, and 66 genera of macroinvertebrates were collected. The major groups were Coleoptera, Ephemeroptera, and Hemiptera.

Quantitative bottom sampling was primarily conducted between 1 January 1969 and 1 January 1970. Initial quantitative data, in terms of standing crop, was gained by the use of an artificial substrate sampler designed by C. J. Bull (1968). This sampler was phased out in favor of a more adaptable sampler designed by N. Wilson Britt (1955), consisting of a concrete block with approximately three tenths square meter surface area (31.62 cm X 31.62 cm X 8.00 cm) and roughened by sand blasting to provide sites for invertebrate attachment.

Quantitative samplers were placed in the various river habitats for a period of 30 days after which the samplers were returned to the surface and hand cleaned to remove the captured invertebrates.

The natural river fauna components, which were collected by the artificial substrate samplers, were very dependent upon current, depth, and river bottom characteristics. Trichoptera (caddisflies) and Ephemeroptera (mayflies) were most numerous of the 7 orders, 13 families, and 31 genera of macroinvertebrates, the Trichoptera were the most predominant organisms. Hydropsyche sp. and Cheumatopsyche sp. comprised at least 90% of the caddisfly population. The river bottom fauna appears to reach the highest density on the artificial substrate samplers during the month of September then rapidly decrease thereafter through fall and winter.

ANALYSIS OF SOME FISHES IN THE MONTICELLO REACH OF THE MISSISSIPPI RIVER

Howard P. Scherer
St. Cloud State College
St. Cloud, Minnesota

A nuclear-fueled electrical generating plant is now being constructed for Northern States Power Company on the Mississippi River, near Monticello, Minnesota. Part of the operation of this plant will call for borrowing water from the river to use as a coolant for the condensers. This water will be returned to the river in heated condition, and the heated discharge water is expected to manifest changes in the existing biota of the river.

This is a report on the fish portion of a complete ecosystem study which has been made to establish baselines for future studies designed to delineate the effects the heated discharge water are expected to cause. It has primarily been designed to determine: (1) population makeup, by species, of the fish from a point one mile above the plant site to a point approximately five miles below the site; (2) migration patterns exhibited by the various species of fish inhabiting the study area; (3) an evaluation of indices of physical condition, by age groups within species; and (4) the use made of microhabitat by the various species.

The outstanding characteristic exhibited by the Mississippi River, in the study area, was its marked dynamic nature, not only seasonally, but also evident from a day-to-day basis. While presenting a real challenge, and making the study most interesting, it did make the application of valid quantitative methods very difficult.

Of the twelve species of fish taken in the study area, statistically valid population estimates, through the use of the Schnabel method, could only be made for the two dominant species, northern redhorse and carp. A direct proportion was then applied, using the Schnabel data on northern redhorse as a base, to obtain valid population estimations on the remaining species.

The study of migration patterns of the species of fish in the area tended to show that, for the most part, individual fish which were recaptured seemed to remain in the sector in which they originally had been tagged. An exception was noted in the case of walleye which I regard as a transient species in this section of the river.

Data separating age groups within species, in the study on indices of physical condition, could not, except in rare instances, be statistically supported; however, qualitatively, a steady and predictable increase in both length and weight has been shown.

A study of the use made of mocrohabitat by the fishes indicated that each species had particular requirements of habitat wherein it was best able to function.

COLONIZATION RATES OF INSECT LARVAE ON CEMENT BLOCK SAMPLERS

Kent Dahlquist
St. Cloud State College
St. Cloud, Minnesota

Concrete slabs having dimensions of 31.62 cm per side and 8 cm in thickness are used to sample benthic populations in swift water near Monticello, Minnesota. These squares are normally placed for 30 days to obtain information on population sizes and physical conditions of the biota. Since this procedure does not allow for the determination of events during the 30-day period, 16 squares were placed at the beginning of the study period. Four flocks were recovered each succeeding week to give four sets of samplers with exposure times of 1, 2, 3, and 4 weeks respectively. The four-week sample was repeated once. Quantitative analysis consisted of counting and weighing of insect larvae yielding insects per square meter, weight per organism and percentage composition by numbers and weight in each of the tapa.

Caddisflies ranged from 36% to 83% of the total sample by number and 55.2% to 91.8% by weight. Mayflies comprised 7.2 to 13.3% of the population and accounted for 5.1 to 15.5% of the total biomass. Simulids and other Deptera accounted for .6 to 36.3% of the biomass during the study period.

Caddisflies colonized the samplers to maximum population numbers within three weeks. Mayflies showed generally the same trend. The simulid population reached maximum density after one week. Tendipids increased in number throughout each study period.

Since the colonization by insects, of newly introduced artificial substrates depends on organism life cycle, and seasonal and temporal changes in the environment, benthic taxa must be considered individually with regard to changes in biomass and numbers.

A LIMNOLOGICAL SURVEY OF LITTLE ROCK LAKE
Benton County, Minnesota

Norman W. Esterberg
Biology Instructor, Sauk Rapids High School

Benton County has very few lakes. Its surface is compose mainly of gently rolling ground moraine which was deposited by the Pierz ice lobe which entered this county from the east. The western portion of the county contains outwash deposits with glacial drainages along the Mississippii River Valley. Granite rock crops out in this locality or is found close to the surface. Such terrain is not conducive to the formation of lakes. Little Rock Lake is the largest lake with an area of 1,239.5 acres.

An ice block became buried in the sandy deposits of the Glacial Mississippi River melted and formed Little Rock Lake. The present Mississippi River cut its meander eastward, weakened the southwest wall of the lake and the waters receeded. Lake cottages are built on this exposed lake bottom which supports typical outwash vegetation, the oak grove.

Little Rock Lake has 3 inlets and one outlet which flows in a broad shallow channel to the Mississippi River 1¾ miles away. The lake is used as a storage basin and for various recreational activities.

The water shed of Little Rock Lake extends over an area of 100 square miles to the north and east of the lake and has high volume inflow in the spring. Watershed use is almost entirely agricultural.

A large powerdam is located on the Mississippi River at Sartell, Minnesota, 7 miles to the southwest of the lake. The dam is owned by the St. Regis Paper Company (formerly Watab Paper Company) regulates the lake water level. This dam maintains a 21'6" head of water. St. Regis Paper Company has purchased flowage rights along the Mississippi River and Little Rock Lake.

Previous to 1952, high spring lake levels were common followed by a rapid drawdown due to dam manipulation.

In 1945 the lake level was lowered 2' and exposed 7-10' of lake bottom along most of the shore. When the lake was lowered 4', 30-40' of lake bottom along the shore was exposed.

By 1960, the large fluctuations in lake level which were common as recent as 1952 were remedied by improvements in dam manipulation techniques by the paper company.

Little Rock Lake has been heavily stocked since 1908 and supports an average fish population of perch, walleyes, northern pike, suckers and crappies.

In 1941, no carp were reported to be present, in 1945 young carp were present. The 1970 forage fish populations of carp and bullheads are very abundant.

Aquatic plants in 1945 were present in great variety and abundance throughout the entire lake. Today aquatic plants are very sparse in the large north basin and are sparsely scattered in the smaller south basin.

A study of the physical, chemical and biological conditions of Little Rock Lake is nearing completion. All indicators show the lake to be a highly productive hard water lake undergoing rapid eutrophication. Little Rock Lake's drainage water enters the Mississippi River and is contributing to the eutrophication of the river.