Journal of the Arkansas Academy of Science

Volume 38 Article 29

1984

Influence of DeGray Reservoir on Zooplankton Populations in the Caddo and Ouachita Rivers

Ralph B. Roseberg
Dworshak National Fish Hatchery

Mark Karnes
Ross Foundation

ponents from their native, resistant state even though particle size is reduced significantly. Finally, the caustic pretreatment, which is similar to the old caustic pulping process once used in the paper industry, resulted in dramatic increases in product yield as a result of significantly disrupting the highly resistant nature of the native substrate. As previously mentioned, this may be attributed to the fact that grassy plants contain ester linkages between the lignin and the hemicellulose. This allows the resistant nature of the substrate to be sufficiently altered in a manner which provides β-1,4-bonds which are not only accessible but also susceptible to enzymatic hydrolysis.

Agricultural wastes have great potential as process substrates for the production of ethyl alcohol and other chemicals currently produced from petroleum feedstocks. In order to effectively hydrolyze these lignocellulosic wastes, they must be pretreated in order to increase both accessibility and susceptibility to cellulases. Mechanical pretreatment in the form of ball milling is ineffective in the cases of bagasse and rice straw; however, caustic pretreatment did result in significant increases in product yields. Theoretical conversions attained were 67.6% for bagasse and 74.0% for rice straw which represent 70.7 and 66.7 gallons of ethanol produced/dry ton of the respective substrates.

LITERATURE CITED

BLOTKAMP, P. J., M. TAKAGI, M. S. PEMBERTON, and G. H. EMERT. 1978. Enzymatic Hydrolysis of Cellulose and Simultaneous Fermentation to Alcohol. AIChE Symp. Ser. No. 181, 74:85-90.

EMERT, G. H., E. K. GUM, JR., J. A. LANG, T. H. LIU, and R. D. BROWN, JR. 1974. Cellulases. Adv. Chem. Ser. 136:79-100.

GRACHECK, S. J., K. E. GIDDINGS, L. C. WOODFORD, and G. H. EMERT. 1981. Continuous Enzyme Production as Used in the Conversion of Lignocellulosics to Ethanol. ASAE Natl. Energy Symp., Ag Energy. 2:305-310.

RIVERS, D. B. 1983. Effects of Intrinsic Physical and Chemical Factors on the Enzymatic Hydrolysis of Lignocellulosics. Dissertation, University of Arkansas.

TAKAGI, M., S. ABE, SUZUKI, G. H. EMERT, and N. YATA. 1977. A Method for Production of Alcohol Directly from Cellulose Using Cellulase and Yeast. 551-571. Proc. Biocon. Symp. IIT Delhi.

VAN SOEST, P. J., and R. H. WINE. 1968. Determination of Lignin Cellulose in Acid-Detergent Fiber with Permanganate. J. Ass. Offic. Anal. Chem. 51(4):780-785.

DOUGLAS B. RIVERS, GISELLA M. ZANIN, and GEORGE H. EMERT, Biomass Research Center, University of Arkansas, Fayetteville, AR 72701.

THE INFLUENCE OF DeGRAY RESERVOIR ON ZOOPLANKTON POPULATIONS IN THE CADDO AND OUACHITA RIVERS

Potamoplankton populations are usually rather limited (Hynes 1970). However, reservoirs with significant water retention time have extensive zooplankton communities and large populations can greatly influence the tailwater plankton community via releases. In 1978, at the request of the Arkansas Game and Fish Commission, MORS began sampling zooplankton populations in the DeGray Reservoir tailwater on the Caddo River (R3), in the Ouachita River above the confluence with the Caddo (R2), and in the Ouachita below the confluence (R5) (Figure).

Zooplankton samples were duplicate five minute horizontal tows with a Clarke-Bumpas sampler equipped with a No. 10 mesh (160 micron) net. Samples were taken at 4 to 6 week intervals at all three stations; all stations being sampled within a week. Sampling occurred from April through October. Sampling was not event dictated so some samples were collected during high water, some during moderate flow, and some during low flow. Cladocerans and rotifers were identified to species when possible, while copepods were identified to suborder.

Twelve cladoceran species, eleven rotifier species (Table 1), and two orders of copepods were found at the upper Ouachita station (R2). Twenty cladoceran species, twenty-one rotifer species, and two copepod suborders were found at the Caddo River station (R3). Thirteen cladoceran species, thirteen rotifer species, and two suborders of copepoda were found at the lower Ouachita (R5). Mean densities for each year were greater by two orders of magnitude at the Caddo station than at the Ouachita River stations (Table 2). Abundant cladocerans at the Caddo station (R3) were *Bosmina longirostris, Ceriodophnia lacustris, Chydorus sphaerius, Daphnia ambigua, D. galeata, D. catawba, Diaphansoma leuchtenbergianum,* and *Holopedium amazonicum*. Abundant rotifers were *Asplanchna priodonta* and *Conochilus unicornus*. Common rotifers were *Kellicottia bostoniensis, Keratella cochlearis,* and *Synchaeta stylata*. All of the preceding forms were frequently encountered in DeGray Reservoir. Littoral cladocerans such as *Latona parviremis, Macrothrix rosea, Eurycercus lamellatus, Camptocercus oklahomensis,* and *Alona sp.* were also found at the Caddo station. The only forms found at the Ouachita stations but not the Caddo station were *Scapholebris kingi, Leydigia acanthocercoides,* and *Kellicottia longispina,* which had not been found in the DeGray Reservoir. Forms found at the Caddo station but not at the Ouachita stations included *Bosminopsis deitersi, Latona parviremis, Camptocercus oklahomenses, Ceriodaphnia reticulata, Eurycercus lamellatus, Lecane luna, Platyis quadricornis,* and *Proalinopsis sp.* Some Ouachita River samples (especially during high water periods) had no zooplanktors, while many high water samples had extremely low numbers.

Cyclopoids dominated the copepod segment of the community in 96 percent of the samples at the upper Ouachita station (R2), 53 percent of the samples at the Caddo station (R3), and 85 percent of the samples at the lower Ouachita station (R5). Calanoid densities at the Ouachita River stations were always very low but were occasionally very important in the Caddo River sample.

The Caddo River station was more diverse than the Ouachita stations. This station community is composed of reservoir produced zooplankton and also those forms associated with a riverine or littoral situation. Numerically the reservoir-produced organisms dominate the population at this point but the other forms are not excluded. Hynes (1970) summarized the findings of several workers that found reservoirs and lakes greatly influence the plankton populations of their immediate tailwaters and contribute the vast majority of the constituents of the population. Edmondson (1959) states "The limnetic region of the inland lakes has a cladoceran population large in number of individuals but not rich in species." Thus this tailwater area is dominated by a relatively small group of species but not limited to just these forms. Shallow, weedy areas produce a greater variety of species (Edmondson, 1959) than any other habitat. Therefore the weedy river margins, shallow shoals areas, and the flow retarding influence of the reregulating pool account for the presence of a substantial number of littoral and/or riverine forms at the Caddo River station, even though the densities are dominated by reservoir produced limnetic zooplanktors.

The balance of the cyclopoid-calanoid ratio at station R3 is a reflection of the reservoir influence on that community. The consistent cyclopoid dominance at the Ouachita River stations leads one to speculate that they are more adapted to a limnetic and/or riverine environment than the calanoid. Hynes (1970) indicated cyclops to be a common potamoplanktor.

There is no abundant source of reservoir-produced plankton for the Ouachita River stations. Therefore, a reduced number of limnetic type zooplanktors (Table 1) are only occasional constituents of the communities there and never have high densities (1.0 organism/ Table 2). The riverine habitat is more limited at the Ouachita River stations since during much of the sampling season high flow variability did not allow the diverse vegetation to be established here that was found at the Caddo River station. Also, the Ouachita River has higher turbidity and a greater silt load that is found in the Caddo. Hynes (1970) indicated that many cladocera are elimінted from the plankton because they ingest silt or sand and then sink. Therefore, the Ouachita River stations contained fewer littoral and/or riverine species and the forms that were collected were found at lower densities than in the DeGray tailwater. The lower Ouachita River station (R5) had a slightly more diverse community (Table 1) than the upper station (R2) but the communities are similar in make up and densities.

The influx of large numbers of organisms from DeGray Reservoir into the Caddo River, which then empties into the Ouachita River, has little influence on the indigenous plankton populations in these rivers, since these limnetic organisms disappear completely by the time the Caddo empties into the Ouachita River and they do not supplant the already present littoral forms in the Caddo.

Table 1. Number of species found at the three river sampling stations.

	R2	R3	R5
Cladoceran species	12	20	13
Rotifer species	11	21	13

Table 2. Annual mean total organisms/ at the three river stations by year.

Year	R2	R3	R5	Samples
1978	.7758	3.1361	.3537	9
1979	.1166	5.5364	.2341	7
1980	.0359	4.0629	.0272	7
1981	.0031	6.6442	.0371	6
1982	.0145	3.1650	.0633	5
Average of all years	.1892	4.5089	.1431	

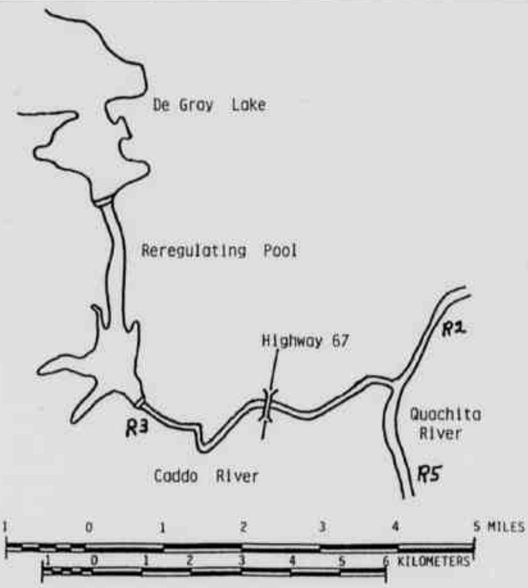

Figure. Caddo River tailwater stations.

LITERATURE CITED

BROOKS, J. L. 1959. Cladocerans, *In* (W. L. Edmondson, ed., Freshwater Biology, 2nd ed.), John Wiley and Sons, New York. p. 587-656.

EDMONDSON, W. T. 1959. Rotifers, *In* (W. L. Edmondson, ed., Freshwater Biology, 2nd ed.), John Wiley and Sons, New York. p. 420-494.

HYNES, H. B. N. 1970. *The ecology of running waters*. Chapter on Plankton. p. 94-111.

RALPH B. ROSEBERG, Dworshak National Fish Hatchery, P.O. Box 18, Ahsahka, ID 83520, and MARK KARNES, Ross Foundation, 1039 Henderson, Arkadelphia, AR 71923.