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23 August 2000

Mr. Fran Hardy
 Illinois Department of Natural Resources
 2005 Round Barn Road
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Dear Mr. Hardy,

Attached please find a copy of the final report associated with the contract entitled "Evaluation of Turtle Communities in the Illinois River: A Polluted Ecosystem. If you have any questions please feel free to contact me at 217-581-2817.

Sincerely,

Robert Fischer
 Dr. Robert Fischer

PS. Should I tell Bob S. that I sent you the report and do I need to send copies anywhere?

*cc: Chris Phillips
 Kevin Cummings
 197.00*

Introduction

The Illinois River is an example of ecosystems that has undergone dramatic changes over the last century due to various environmental and man made stocastisities. Historical accounts describe the Illinois River Valley as being a rich habitat for fish and wildlife. According to Sparks and Starrlett (1975), before 1820 the river valley was an important source of fur for the trade industry as well as a major inland commercial fishery. In addition, before 1820 the Illinois River Valley remained largely uninhabited, except for small groups of Native American and a few white settlers living in the river valley. Even as late as the 1890's the water in the Illinois River was still fairly clear and aquatic vegetation abundant (Bellrose 1979). However by the turn of the century over 3.3 million people were living in the Illinois River Basin and a third of the meadows and wooded bottomlands had been closed for some sort of cultivation (Bellrose 1979). From 1900 until today, the Illinois River has endured one disaster after another. Human alteration of the Illinois River and it is adjacent flood plains, lakes, marshes, and ponds have accelerated throughout this last century (Bellrose 1979). "If the Illinois River and it's backwater lakes were a fragile ecosystem, they would have passed into oblivion long ago" (Bellrose 1979).

Chanalization of tributaries and the drainage of wetlands began in the 1800's and increased the rate of flow of topsoil and pollutants into the river (Annonomous 1994). In the early 1900's the major pollution of the Illinois River was organics, with the major cause of increased organic load occurring when the city of Chicago, in the beginning of the 1900's, reversed the flow of the Chicago River (Sparks and Starrlet 1975). On January 1st 1900, sanitary waste from Chicago was diverted from Lake Michigan

Chicago drinking water source, to the Illinois-Michigan Canal. The water was then dumped into the Des Plaines River, eventually winding up in the Illinois River (Sparks and Starrlet 1975). Nelson (1900) reported that "When the current of the Chicago river was first turned through the canals and the rivers, it caused the fish to bloat to a large size, and rising to the surface, they floated down stream in large numbers. It was estimated that several tons of dead fish passed through one of the canal locks just after the foul water commenced running through the canal." This extra flow due to the diversion, raised water level, killed less tolerant species of trees, which were in the flood plain (Annomous 1994) and brought excessive nutrients, which degraded the water quality in the Illinois River.

Additional perturbation of the Illinois River occurred from 1903 to 1926 when one half of the floodplain was leveed and the wetlands drained for agriculture. These changes reduced the systems ability to hold and store water and destroyed the most productive land for wildlife and waterfowl (Anonomous 1994). Later a system of dams was constructed in order to keep a 9-foot minimum navigation channel in the river. However, this kept lands that where seasonally wet or dry, now permanently inundated (Anonomous 1994) causing year round sedimentation and backwater lakes to fill in with a soft muck. Since 1950, increased industrial style farming methods have caused an increase of soil erosion running into the Illinois River, further complicating the siltation problem. This runoff also contains chemicals and fertilizers, which help to deteriorate the overall water quality in the Illinois River (Anonomous 1994). Although, the water quality of the Illinois River has improved somewhat over the last 30 years, problems such

as siltation, pesticide/fertilizer runoff, heavy barge and recreational traffic and development continue to be problems for the river.

The Illinois Natural History Survey at Havana, Illinois has closely monitored the effects of abiotic changes on biotic communities such as fish. However, turtles have received little attention. Previous research has provided baseline data on the species richness (Total number of turtles) and diversity (Importance of each species based on its abundance) of the turtles at six sites associated with the Illinois River (Moll 1977). The purpose of this study was to 1) determine the species richness and diversity of the turtle community of the Illinois River and 2) determine how turtle species richness and diversity have changed in response to physical and chemical changes in the river over the past 20 years.

Results

A total of 1,144 turtles, comprised of eight species, were captured during the summers of 1998-1999. The three major species captured were *T.scripta* (649 turtles), *C.picta* (158 turtles) and *A.spinifera* (150 turtles). The total number of turtle captured from the 6 sites ranged from a high of 472 at Spring Lake to a low of 62 at Woodford Co. At Havana 22 *A.spinifera*, 3 *A.mutica*, 158 *C.picta*, 79 *C.serpentina*, 4 *G.geographica*, 15 *pseudogeographica*, 86 *S.oderatus*, and 649 *T.scripta* were captured. The total capture at Chautauqua was comprised of 35 *A.spinifera*, 15 *C.picta*, 22 *C.serpentina*, 5 *S.oderatus*, and 120 *T.scripta*. The totals for Spring Lake were 5 *A.spinifera*, 119 *C.picta*, 49 *C.serpentina*, 8 *G.pseudogeographica*, 3 *S.odoratus*, and 240 *T.scripta*. At Woodford County Conservation Area 38 *A.spinifera*, 4 *C.picta*, and 20 *T.scripta* were captured. At Kingston Mines a total of 34 *A.spinifera*, 4 *G.geographica*, 7 *G.pseudogeographica*, and 18 *T.scripta* were captured. The total capture for Honey Point was 16 *A.spinifera*, 7 *C.picta*, 1 *C.serpentina*, 8 *G.pseudogeographica*, 3 *S.oderatus*, and 240 *T.scripta*.

A paired chi-square contingency table was constructed to determine if the turtle populations at the six sites during 1999-1998 were significantly different from each other. For comparisons between all sites, excluding Kingston mines, the five most abundant turtle species (*A.spinifera*, *T.Scripta*, *C.picta*, *S.odoratus*, and *C.serpentina*) were used in the analysis. *A. Mutica* and turtles in the genus *Graptemies* were not included in this analysis because they were only trapped at a few sites and in low numbers. Comparisons between Kingston Mines and the other 5 sites included 7 species (*A.spinifera*, *T.scripta*, *C.picta*, *S.odoratus*, *C. Serpentina*, *G. pseudogeographica*, and *G. Geographica*) because the two *Graptemies* species captured at Kingston Mines comprised 14% of the turtles

captured, and 50% of the turtle species captured. The chi-square contingency table showed that the proportional composition of the turtle communities at each of the six sites sampled in 1998-1999 were significantly different. Since all sites were significantly different from each other, the sites could not be grouped. A comparison of Shannon-Weiner indices showed that Havana was significantly different (at the .05 level) from all other sites. Spring Lake was significantly different from all sites except Chautauqua. Kingston Mines was the similar to all other sites, except Havana.

In 1998-1999 a total of 1,144 turtles were captured during 11,006 trap hours as compared to a total 1,272 turtles captured during 17,933 trap hours during 1975-1976 for the same six trap sites. In 1998-1999, nine turtle species were captured as compared to only eight species captured in 1975-1976. A paired chi-square contingency tables was constructed to determine if the turtle communities at the six sites trapped in 1998-1999 and 1975-76 were proportionally different (in the composition of turtle species). Turtle community composition at all sites in 1998-1999 were significantly different ($p < 0.00001$ level) except Havana which was significantly different at the $p < 0.06$ level from the same communities in 1975-1976. The totals for the communities at all 6 sites combined in 1998-1999 were significantly different ($P < 0.00001$ level) from the combined totals for the same communities in 1975-1976.

Comparisons of Shannon-Wiener diversity indices between 1998-1999 and 1975-1976 showed that three sites (Havana, Chautauqua, and Kingston Mines) showed no significant change in diversity between 1998-1999 and 1975-1976. Three sites (Woodford Co., Honey Point and Spring Lake) all showed a highly significant change in diversity between 1975-1976 and 1998-1999. At both the Woodford Co. and Honey Point sites a

decline in diversity has occurred. In 1975-1976 six species of turtle were captured, while only 3 were captured in 1998-1999. Honey Point also had a reduction in turtle species captured, from 7 in 1975-1976 to 6 in 1998-1999 (*T. scripta* comprised only 46% of the turtles captured in 1975-1976 as compared to 90% in 1998-1999). The diversity of all six sites combined was also significantly different between 1998-1999 and 1975-1976. Of the 8 species captured three species show an increase the number of turtles captured and in the % of the total turtle community they represent: *A. spinifera* (102 turtles (8%) in 1975-1976 and 150 turtles (14%) in 1998-1999), *T. scripta* (449 turtles (35%) in 1975-1976 and 649 turtles (57%) in 1998-1999), and *C. serpentina* (27 turtles (2%) in 1975-1976 and 79 turtles (7%) in 1998-1999). Four other species have shown a decrease in the number and the % of the total turtle community they represent: *C. picta* 419 turtles (33%) in 1975-1976 and 158 turtles (14%) in 1998-1999, *G. geographica* 59 turtles (5%) in 1975-1976 and 4 turtles (0.03%) in 1998-1999), *G. pseudogeographica* 97 turtles (8%) in 1975-1976 and 15 turtles (1.3%) in 1998-1999), and *S. oderatus* 119 (9%) in 1975-1976 and 86 turtles (7.5%) in 1998-1999. *A. mutica* which was not caught in 1975-1976, was thought to extirpated (D.Moll 1976) was captured at one site in 1998-1999 (three turtles were captured at Havana in 1999).