# FISHES OF THE KNIFE LAKE WATERSHED

# IN KANABEC AND MILLE LACS COUNTIES OF MINNESOTA

by

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## Introduction

The Knife River begins at Ernst Fool on the Mille Lacs Wildlife Management Area and flows 19 miles through Mille Lacs and Kanabec Counties to Knife Lake about five miles above its confluence with the Snake River near Mora, Minnesota.

During the week of 9 October 1989, the Minnesota Department of Natural Resources chemically treated the entire Knife Lake watershed with rotenone to eradicate the common carp (Cyprinus carpio) which had become established in 1972 when heavy rains and resulting flood destroyed the original dam.

Beginning on 19 April 1989 and continuing through 11 October 1989, twenty-nine surveys were conducted to document species occurrence of nongame forage fishes. The purpose of these surveys, in conjunction with others conducted by the James Ford Bell Museum of Natural History and Minnesota Department of Natural Resources, was to provide a reference base that could be used to verify the elimination of native fishes, and ultimately, justify a reintroduction program which would attempt to restore the watershed's historical ichthyofauna.

## Methods and Materials

Twenty-nine surveys were conducted at 11 sites within the watershed above the Knife Lake Dam (Figure 1). Collecting methods included seines, riffle nets, minnow traps, and a final field inspection following the rotenone treatment (Table 1). Seines and riffle nets were the primary gear types used. Sampling took place during the day except for two nocturnal surveys conducted at two sites on 4 October 1989.

Table 1. Knife Lake watershed 1989 fish survey sites, locations, dates, and collection methods.

| No. Site | Location | Dates | Method |
|---|---|---|---|
| 1. Knife Lake | -T41N-R23W-S32/Public Access | 10/11/89 | Rotenone |
| 2. Knife River | T40N-R24W-S10/County Road 8 | 5/2/89 | Riffle Net/Seine |
| | | 5/12/89 | Riffle Net/Seine |
| | | 6/15/89 | Riffle Net/Seine |
| | | 7/23/89 | Riffle Net/Seine |
| | | 10/4/89 | Riffle Net/Seine |
| | | 10/5/89 | Minnow Trap |
| | | 10/11/89 | Rotenone |
| 3. Knife River | T40N--R24W-S4/County Road 88 | 5/12/89 | Riffle Net/Seine |
| | | 7/23/89 | Riffle Net/Seine |
| | | 10/4/89 | Riffle Net/Seine |
| | | 10/11/89 | Rotenone |
| 4. Bean Brook | T41N-R24W-S35/Gravel Road | 10/11/89 | Rotenone |
| 5. Knife River | T41N-R24W-S28/Old Bridge | 5/12/89 | Riffle Net/Seine |
| | | 7/23/89 | Riffle Net/Seine |
| | | 10/5/89 | Minnow Trap |
| | | 10/11/89 | Rotenone |
| 6. Knife River | T41N-R24W-S29/County Road 3 | 5/12/89 | Seine |
| | | 10/5/89 | Minnow Trap |
| | | 10/11/89 | Rotenone |
| 7. Tributary | T41N-R24W-S9/County Road 15 | 10/11/B9 | Rotenone |
| 8. Knife River | T41N-R24W-S7/State Hwy. 47 | 5/12/89 | Seine |
| | | 10/5/89 | Minnow Trap |
| | | 10/11/89 | Rotenone |
| 9. Knife River | T41N-R25W-S2/County Road 156 | 4/19/89 | Riffle Net/Seine |
| | | 5/12/89 | Riffle Net/Seine |
| | | 10/11/89 | Rotenone |
| 10. Knife River | T41N-R25W-S4/County Road 126 | 10/11/89 | Rotenone |
| 11. Ernst Pool | T41N-R25W-S4/Mille Lacs WMA | 10/11/89 | Rotenone |

Fish sampled at each site were identified and tallied by species. Specimens of most species were deposited in the fish collection at the Bell Museum in Minneapolis. All survey data were compiled on an IBM compatible computer using Dbase 3 Plus.

## Results and Discussion

1989 was the third year of an ongoing drought and species abundance, distribution, and diversity within the watershed may have been different from years with normal stream flows. These results may reflect an assemblage of fishes more tolerant of adverse conditions.

A total of 1998 fish representing 38 species in 10 families were sampled during the 1989 Knife Lake watershed surveys. The minnow family dominated the catch at 58.4%, and the sunfish family was next at 16.5%. The most abundant species were the hornyhead chub, common shiner, and rock bass which comprised 10.4%, 15.0%, and 12.3%, of the catch, respectively (Table 2) . These species were also the most frequently sampled throughout the survey period at 19, 23, and 19 times, respectively (Table 2). The most uncommon species were the chestnut lamprey, brown bullhead, and channel catfish which were sampled once and were each represented by a single specimen.

Table 2. Knife Lake watershed 1989 species list, composition, and frequency. An asterisk (*) indicates species not found in Bell Museum or MDNR surveys (Table 4).

| **FAMILY** Scientific name | Common name | Composition (#) | Composition (%) | Frequency (x) |
|---|---|---|---|---|
| **PETROMYZONTIDAE** | | | | |
| *1. Ichthyomyzon castaneus | Chestnut lamprey | 1 | 0.1 | 1 |
| **UMBRIDAE** | | | | |
| 2. Umbra limi | Central mudminnow | 47 | 2.4 | 6 |
| **ESOCIDAE** | | | | |
| 3. Esox lucius | Northern pike | 4 | 0.2 | 2 |
| **CYPRINIDAE** | | | | |
| 4. Cyprinus carpio | Common carp | 46 | 2.3 | 4 |
| 5. Hybognathus hankinsoni | Brassy minnow | 123 | 6.2 | 15 |
| 6. Nocomis biguttatus | Hornyhead chub | 207 | 10.4 | 19 |

Table 2. Continued.

| FAMILY<br>Scientific name | Common name | Composition (#) | (%) | Frequency (x) |
|---|---|---|---|---|
| 7. Notemigonus-crysoleucas | Golden shiner | 71 | 3.6 | 6 |
| 8. Notroois cornutus | Common shiner | 299 | 15.0 | 23 |
| *9. Phoxinus eos | Northern redbelly dace | 184 | 9.2 | 12 |
| 10. Pimephales notatus | Bluntnose minnow | 11 | 0.6 | 5 |
| 11. Pimephales promelas | Fathead minnow | 63 | 3.2 | 10 |
| 12. Rhinichthvs atratulus | Blackness dace | 32 | 1.6 | 9 |
| 13. Rhinichthvs cataractae | Longnose dace | 50 | 2.5 | 10 |
| 14. Semotilus atromaculatus | Creek chub | 64 | 3.2 | 11 |
| 15. Semotilus margarita | Pearl dace | 16 | 0.8 | 2 |
| **CATOSTOMIDAE** | | | | |
| 16. Catostomus commersoni | White sucker | 101 | 5.1 | 11 |
| 17. Hypentelium nigricans | Northern hogsucker | 2 | 0.1 | 2 |
| 18. Moxostoma erythrurum | Golden redhorse | 2 | 0.1 | 1 |
| 19. Moxostoma macrolepidotum | Shorthead redhorse | 5 | 0.3 | 3 |
| **ICTALURIDAE** | | | | |
| 20. Ictalurus melas | Black bullhead | 59 | 3.0 | 7 |
| 21. Ictalurus natalis | Yellow bullhead | 13 | 0.7 | 2 |
| 22. Ictalurus nebulosus | Brown bullhead | 1 | 0.1 | 1 |
| 23. Ictalurus punctatus | Channel catfish | 1 | 0.1 | 1 |
| 24. Noturus flavus | Stonecat | 30 | 1.5 | 4 |
| 25. Noturus gyrinus | Tadpole madtom | 22 | 1.1 | 3 |
| **GASTEROSTEIDAE** | | | | |
| 26. Culaea inconstans | Brook stickleback | 70 | 3.5 | 5 |
| **CENTRARCHIDAE** | | | | |
| 27. Ambloplites rupestris | Rock bass | 246 | 12.3 | 19 |
| 28. Lepomis gibbosus | Pumpkinseed | 3 | 0.2 | 2 |
| 29. Lepomis macrochirus | Bluegill | 36 | 1.8 | 3 |
| 30. Microoterus dolomieui | Smallmouth bass | 30 | 1.5 | 9 |
| 31. Micropterus salmoides | Largemouth bass | 3 | 0.2 | 2 |
| 32. Pomoxis annularis | White crappie | 3 | 0.2 | 1 |
| 33. Pomoxis nigromaculatus | Black crappie | 9 | 0.5 | 1 |
| **PERCIDAE** | | | | |
| 34. Etheostoma nigrum | Johnny darter | 74 | 3.7 | 16 |
| 35. Perca flavescens | Yellow perch | 3 | 0.2 | 2 |
| 36. Percina caprodes | Logperch | 36 | 1.8 | 5 |
| 37. Stizostedion vitreum vitreum | Walleye | 5 | 0.3 | 1 |
| **SCIAENIDAE** | | | | |
| 38. Aplodinotus grunniens | Freshwater drum | 26 | 1.3 | 1 |
| Total | | 1998 | | |

The most widely distributed fishes were the brassy minnow, common shiner, northern redbelly dace, creek chub, white sucker, and Johnny darter which were collected at 8, 11, 8, 8, 9, and 8 sites, respectively (Table 3). Conversely, 21 fishes were found at three or fewer sites. The site possessing the greatest species diversity was survey site 2 (Knife River at County Road 8) where 24 species were recorded (Table 3).

Table 3. Knife Lake watershed 1989 species distribution and diversity. Survey site numbers correspond with location information presented in Figure 1 and Table 1.

| Species | Survey Sites | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
| Chestnut lamprey | | + | | | | | | | | | | 1 |
| Central mudminnow | | | + | | | + | + | | | + | + | 5 |
| Northern pike | + | | | | | | | | + | | | 2 |
| Common carp | + | + | | | | | | + | + | | | 4 |
| Brassy minnow | | + | + | + | + | + | + | | + | + | | 8 |
| Hornyhead chub | | + | + | | + | + | + | + | + | | | 7 |
| Golden shiner | + | | | | + | | + | + | + | | + | 6 |
| Common shiner | + | + | + | + | + | + | + | + | + | + | + | 11 |
| Northern redbelly dace | | + | + | + | | + | + | | + | + | + | 8 |
| Bluntnose minnow | + | + | + | | | | | | | | | 3 |
| Fathead minnow | | + | | | + | | | | + | | + | 4 |
| Blacknose dace | | + | + | + | | | + | | + | | | 5 |
| Longnose dace | | + | + | + | | | | | + | | | 4 |
| Creek chub | | + | + | + | + | + | + | | + | | + | 8 |
| Pearl dace | | | | | | | | | + | + | | 2 |
| White sucker | + | + | + | + | + | + | + | + | + | | | 9 |
| Northern hogsucker | | | + | | + | | | | | | | 2 |
| Golden redhorse | | | | | | + | | | | | | 1 |
| Shorthead redhorse | | + | + | | | + | | | | | | 3 |
| Black bullhead | | | | + | | | + | + | + | + | + | 6 |
| Yellow bullhead | + | + | | | | | | | | | | 2 |
| Brown bullhead | | | | + | | | | | | | | 1 |
| Channel catfish | + | | | | | | | | | | | 1 |
| Stonecat | | + | + | | + | | | | | | | 3 |
| Tadpole madtom | + | | | | | | | + | + | | | 3 |
| Brook stickleback | | + | | | + | | | | | + | + | 4 |
| Rock bass | | + | + | | + | + | + | + | + | | | 7 |
| Pumpkinseed | | + | | | | | + | | | | | 2 |
| Bluegill | + | + | | | | | | | | | | 2 |
| Smallmouth bass | | + | + | | + | + | + | | + | | | 6 |
| Largemouth bass | + | + | | | | | | | | | | 2 |
| White crappie | + | | | | | | | | | | | 1 |
| Black crappie | + | | | | | | | | | | | 1 |

Table 3. Continued.

| Species | Survey Sites 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Johnny darter | + | + | + | + | + | + | + | | + | | | 8 |
| Yellow perch | + | + | | | | | | | | | | 2 |
| Logperch | | + | + | | | | | | | | | 2 |
| Walleye | + | | | | | | | | | | | 1 |
| Freshwater drum | + | | | | | | | | | | | 1 |
| **TOTAL** | **17** | **24** | **18** | **9** | **13** | **12** | **14** | **8** | **18** | **7** | **8** | |

The survey following the rotenone application provided the most productive results for the least amount of effort. The total catch was more than doubled and 15 species were added that had not been previously sampled. Besides fish, the mudpuppy (Necturus maculosus) was observed at every site containing boulder and rubble substrates.

A species list representing survey results from the Bell Museum and the MDNR is shown in Table 4. The Hell Museum conducted surveys on 10 October 1989 during the rotenone application. The MDNR conducted several surveys in Knife Lake and stream surveys above the lake in 1964 and 1988. The combined results collected 43 species representing ii families. The differences between these results and the 1989 surveys (Table 2) have been indicated and bring the cumulative species total to 45.

Table 4. Bell Museum and MDNR Survey Results of the Knife Lake Watershed 1964-89. An asterisk (*) indicates species not found in Table 2 surveys.

| Scientific name | **FAMILY** | Common name |
|---|---|---|
| | **AMIIDAE** | |
| *1. Amia calva | | Bowfin |
| | **UMBRIDAE** | |
| 2. Umbra limi | | Central mudminnow |

Table 4. Continued

| Scientific name | Common name |
|---|---|
| **FAMILY** | |
| **ESOCIDAE** | |
| 3. Esox lucius | Northern pike |
| **CYPRINIDAE** | |
| *4. Campostoma anomalum | Central stoneroller |
| 5. Cyprinus carpio | Common carp |
| 6. Hybognathus hankinsoni | Brassy minnow |
| 7. Nocomis biauttatus | Hornyhead chub |
| 8. Notemigonus crysoleucas | Golden shiner |
| *9. Notroois atherinoides | Emerald shiner |
| 10. Notroois cornutus | Common shiner |
| *11. Notropis hudsonius | Spottail shiner |
| 12. Phoxinus neogaeus | Finescale dace |
| 13. Pimephales notatus | Bluntnose minnow |
| 14. Pimephales promelas | Fathead minnow |
| 15. Rhinichthys atratulus | Blacknose dace |
| 16. Rhinichthys cataractae | Longnose dace |
| 17. Semotilus atromaculatus | Creek chub |
| 18. Semotilus margarita | Pearl dace |
| **CATOSTOMIDAE** | |
| 19. Catostomus commersoni | White sucker |
| 20. Hypentelium nigricans | Northern hogsucker |
| *21. Moxostoma anisurum | Silver redhorse |
| 22. Moxostoma erythrurum | Golden redhorse |
| 23. Moxostoma macrolepidotum | Shorthead redhorse |
| **ICTALURIDAE** | |
| 24. Ictalurus melas | Black bullhead |
| 25. Ictalurus natalis | Yellow bullhead |
| 26. Ictalurus nebulosus | Brown bullhead |
| 27. Ictalurus punctatus | Channel catfish |
| 28. Noturus flavus | Stonecat |
| 29. Noturus gyrinus | Tadpole madtom |
| **CYPRINODONTIDAE** | |
| 30. Fundulus diaphanus | Banded killifish |
| **GASTEROSTEIDAE** | |
| 31. Culaea inconstans | Brook stickleback |
| **CENTRARCHIDAE** | |
| 32. Ambloplites rupestris | Rock bass |
| 33. Lepomis gibbosus | Pumpkinseed |
| 34. Lepomis macrochirus | Bluegill |
| 35. Micropterus dolomieui | Smallmouth bass |
| 36. Micropterus salmoides | Largemouth bass |
| 37. Pomoxis annularis | White crappie |
| 38. Pomoxis nigromaculatus | Black crappie |

Table 4. Continued

| Scientific name | Common name |
|---|---|
| **FAMILY** | |
| **PERCIDAE** | |
| 39. Etheostoma nigrum | Johnny darter |
| 40. Perca flavescens | Yellow perch |
| 41. Percina caprodes | Logperch |
| 42. Stizostedion vitreum vitreum | Walleye |
| **SCIAENIDAE** | |
| 43. Aplodinotus grunniens | Freshwater drum |

There may be a few species that were never collected from the Knife Lake watershed above the dam and some may have been extirpated prior to the first surveys. A potential species list has been compiled from surveys conducted by author, Bell Museum, and MDNR from the Snake River and its tributaries in Kanabec County (Table 5).

Table 5. Species of potential historical occurrence in the Knife Lake watershed. An asterisk (*) indicates species found in the Knife River below the Knife Lake dam.

| Scientific name | Common name |
|---|---|
| **FAMILY** | |
| **ACIPENSERIDAE** | |
| *1. Acipenser fulvescens | Lake sturgeon |
| **CYPRINIDAE** | |
| 2. Notropis dorsalis | Bigmouth shiner |
| *3. Notropis spilopterus | Spotfin shiner |
| 4. Notropis stramineus | Sand shiner |
| **CATOSTOMIDAE** | |
| *5. Moxostoma valenciennesi | Greater redhorse |
| **PERCOPSIS** | |
| 6. Percopsis omiscomavcus | Trout-perch |
| **GADIDAE** | |
| *7. Lota lota | Burbot |

Table 5. Continued

| | Scientific name | Common name |
|---|---|---|
| | **FAMILY** | |
| | **PERCIDAE** | |
| 8. | Etheostoma exile | Iowa darter |
| 9. | Percina evides | Gilt darter |
| 10. | Percina phoxocephala | Slenderhead darter |

## Recommendations

Additional surveys should be conducted to evaluate the effectiveness of the reclamation program and to determine how many have species been eliminated from the watershed. Although these recommendations are primarily concerned with the nongame forage fishes, restoration efforts should consider all missing native species. In addition to fish, the mudpuppy should receive similar attention.

Species should be stocked from other streams in the area such as the Snake and Ann Rivers which should have populations possessing a similar genetic make up to those that existed in the Knife Lake watershed. One possibility is the Little Ann River which was also surveyed concurrently in 1989. The Little Ann contains most of the forage fishes found in the Knife and the distance between several potential collecting and stocking sites is less than 10 miles.

Best results should be achieved if most of the restoration efforts are completed before the game fish populations are established. Transplant stock should be comprised of adults and introduced before the breeding season occurs. To help minimize predation losses at the stocking site, fish should be released at night in areas where adequate cover exists.

Monitoring will be necessary to determine which species have become established and which require further reintroductions.

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