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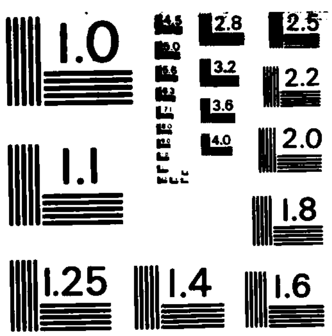


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# Analysis of Existing Information on Adult Fish Movements Through Dams on the Upper Mississippi River

Prepared for

U.S. Army Corps of Engineers
St. Paul District
St. Paul, Minnesota



By

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During the mid-1970's, an assessment of the potential for expansion of the nation's hydroelectric generating capabilities was initiated by the passage of the Water Resources Development Act (PL 94-587). Economic feasibility studies for small-scale hydropower development were performed for sites on the Upper Mississippi River (UMR). The U.S. Fish and Wildlife Service has been asked to provide input into the final feasibility report and draft Environmental Impact Statements for hydropower development at Locks and Dams

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5 and 8.

This report as the following objective: to compile, review, and analyze existing information on movements of adult fish through dams on the UMR from St. Anthony Falls to Lock and Dam 14. Secondary objectives include (1) identification of information gaps about adult fish movements and UMR fisheries in general that would prevent an accurate assessment of the impacts of small-scale hydropower development on UMR fisheries; and (2) identification of impact assessment techniques, approaches, and means of obtaining the necessary data for an assessment of the impacts of small-scale hydropower development on ichthyoplankton and UMR fisheries.

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# 1. INTRODUCTION

## Study Background and Objectives

During the mid-1970's, an assessment of the potential for expansion of the nation's hydroelectric generating capabilities was initiated by passage of the Water Resources Development Act (Public Law 94-587). Section 167 of the act authorized the National Hydropower Study to appraise the potential for new hydropower development at existing dams, as well as the potential of presently undeveloped sites. In 1977, the U.S. Department of Energy established the Small-Scale Hydroelectric Development Program to stimulate and evaluate possible development of small-scale hydroelectric systems with generating capabilities of 30 MW or less. Because of this strong legislative thrust, economic feasibility studies of small-scale hydropower development were performed for sites on the Upper Mississippi River (UMR). Economic feasibilities for hydropower development were identified at Lock and Dam Nos. 5, 7, and 8. However, reconnaissance reports for these sites also indicated that more detailed studies would be needed before development was justified.

Completion of the final feasibility report and draft Environmental Impact Statements (EIS) for hydropower development at Locks and Dams 5 and 8 are scheduled for completion by September 1985. The U.S. Fish and Wildlife Service has been asked to provide input to these reports. This report has the following objective: to compile, review, and analyze existing information on movements of adult fish through dams on the UMR from St. Anthony Falls to Lock and Dam 14. Secondary objectives include (1) identification of information gaps about adult fish movements and UMR fisheries in general that would prevent an accurate assessment of the impacts of small-scale hydropower development on UMR fisheries; and (2) identification of impact assessment techiques, approaches, and means of obtaining the necessary data for an assessment of the impacts of small-scale hydropower development on ichthyoplankton and UMR fisheries.

## Environmental Concerns Related to Ichthyoplankton Drift

Concern over the impacts of small-scale hydropower development on the downstream passage of early-life stages of fishes has been emphasized in discussions on anadromous species of the West Coast (CRFC 1981) and of the Northeast (Ruggles 1980; Loar 1982). There is strong evidence that hydropower facilities can significantly affect survival of salmonids (Raymond 1976; Salo and Stober 1977; Loar 1982) when these fishes move downriver as part of their anadromous cycle. However, direct extrapolation of the effects of hydropower development on the recruitment of these species to the recruitment of nonanadromous, warmwater species of the upper Mississippi River is probably invalid.

The systematic movement of young fishes from spawning habitats to rearing and adult habitats has not been well documented for species of the UMR but it certainly is not as dramatic as that exhibited by anadromous species. However, information on the drift, or passive transport by water currents, of fish eggs and larvae in lotic ecosystems is well documented and has proved important in discussions of the impacts of pump storage and once-through, cooling electric generating facilities on fish recruitment (e.g., Snyder 1975, Nalco Environmental Sciences 1977, Hazleton Environmental Sciences Corp. 1978, Commonwealth Edison and Environmental Research and Technology, Inc. 1980, Environmental Research and Techology,

## REFERENCES

Bahr, D. M. 1977. Homing, swimming behavior, range, activity patterns, and reaction to increasing water levels of walleyes *(Stizostedion vitreum vitreum)* as determined by radio-telemetry in Navigation Pool 7 and 8 of the Upper Mississippi River during spring, 1976. M.S. Thesis. Univ. Wisc., La Crosse, WI.

Cada, G. F., K. D. Kumar, J. A. Solomon, and S. G. Hildebrand. 1982. Analysis of environmental issues related to small-scale hydroelectric development. VI: Dissolved oxygen concentrations below operating dams. ORNL/TM-7887. Oak Ridge National Laboratory, Oak Ridge, TN. 90 pp.

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## 2. EXISTING INFORMATION ON ADULT FISH MOVEMENTS IN THE UMR

Power company, state, university, and federal reports were analyzed to provide information on adult fish movements in the study area (Table 1). When possible, figures of distance traveled (mean and standard deviation) for days at large were constructed. In addition, all available raw data on the date tagged, date recaptured, days at large, distance traveled up or downstream, and number of dams each fish passed through were included in an appendix arranged by species. The following narratives describe each relevant study accessed for this contract:

### POOL 3

1974-1978: Tagging study: Northern pike, channel catfish, white bass, largemouth bass, sauger, walleye.

A fish tagging study was conducted in Pool 3 from 1974 through 1978. Some 5,940 fish were Floy-tagged between April 9, 1974 and December 31, 1978. A total of 676 tags were recovered (11.4%) primarily by anglers.

Of the eight species of fish recaptured; northern pike, channel catfish, white bass, largemouth bass, sauger, and walleye exhibited a mean net downstream movement; smallmouth bass showed a mean net upstream movement; and flathead catfish exhibited no net movement. Channel catfish moved the farthest ($\overline{x}$ = 24.4 miles). Although channel catfish generally moved downstream, one fish was recaptured 128 miles upstream from the tagging site. Sauger displayed the second largest mean net downstream movement of 11.6 miles. Variations in angling pressure among regions of the study area may have biased the mean net movement data. Since fishing pressure between Lock and Dam 3 and Prescott, Wisconsin was very low, fish moving into that area were not as frequently captured as fish that moved

Table 1. Studies of adult fish movements through dams in the upper Mississippi River above Lock and Dam 14, by pool and year

| Pool | Agency | Methodology | Start/stop | Species tagged | Number tagged | Number recaptured | Dams* |
|---|---|---|---|---|---|---|---|
| 3,4 | Northern States Power Company | fish collected by trap nets, electrofishing, gill nets, trawling, and seining; collecting and tagging of fish occurred at various times of the year; anchor tags were used | April 1974/December 1980 | *Esox lucius* | 238 | 52 | unknown |
| | | | | *Cyprinus carpio* | 15 | 0 | unknown |
| | | | | *Ictiobus bubalus* | 4 | 0 | unknown |
| | | | | *Ictalurus punctatus* | 216 | 9 | unknown |
| | | | | *Pylodictis olivaris* | 31 | 3 | unknown |
| | | | | *Morone chrysops* | 3,053 | 357 | unknown |
| | | | | *Micropterus dolomieui* | 110 | 11 | unknown |
| | | | | *Micropterus salmoides* | 22 | 5 | unknown |
| | | | | *Stizostedion canadense* | 1,130 | 133 | unknown |
| | | | | *Stizostedion vitreum* | 1,121 | 124 | unknown |
| Chippewa River | Wisconsin Department of Natural Resources | tagged fish recaptured by electroshocking | July 1976/June 1977 | *Scaphirhynchus platorynchus* | unknown | 19 | 0 |
| 4 | Minnesota Department of Natural Resources | fish collected by electroshocking; Floy tags used | October 1972/September 1975 | *Ictalurus punctatus* | 4,192 | 215 | 27 |
| | | fish collected by electroshocking; Floy tags used | October 1972/November 1974 | *Pylodictis olivaris* | 81 | 12 | 1 |
| | | fish collected by electroshocking; Floy tags used | May 1973/October 1980 | *Stizostedion vitreum* | 6,164 | 955 | 69 |
| | | fish collected by electroshocking; Floy tags used | April 1977/April 1980 | *Stizostedion canadense* | 2,151 | 511 | 19 |
| 4 | Northern States Power Company | radiotelemetry | 1976 | *Morone chrysops* | unknown | unknown | 0 |
| 4 | Wisconsin Department of National Resources | fish collected by electroshocking in the tailwaters of L&D 3; single dart tags (Floy No. 2) inserted between 2nd and 3rd dorsal spines on 745 fish; monel jaw tags used on 153 fish and a combination of the two used on 251 fish | April 28/May 7, 1964 | *Morone chrysops* | 1,149 | 57 | 7 |
| 4 | Minnesota Department of Natural Resources | fish collected by electrofishing during evening periods; tagged with #3 monel strap type jaw tags | May/June 1958 | *Micropterus dolomieui* | 362 | 103 | 0 |
| 4 | Wisconsin Department of Natural Resources | fish collected by seining; tagged with aluminum strap tags; attached to the mandible; fish released at upper Lake Pepin, Lake City, Reeds Landing, Pigeon Island, and Lansing, Iowa | August 1947/February 1950 | *Ictalurus punctatus* | 6,011 | 497 | 120 |
| 5 | Minnesota Department of Natural Resources | fish collected by electroshocking; 500 marked with plastic dart tags and 546 marked with jaw tags | April 1959 | *Stizostedion vitreum* | 960 | 112** | unknown |
| | | | | *Stizostedion canadense* | 86 | 13** | unknown |
| 5 | Wisconsin Department of Natural Resources | fish collected by electroshocking at night in tailwaters region of several pools, Floy tags were inserted at the base of the dorsal fin | April 1980 | *Stizostedion vitreum* | 407 | 33 | 5 |
| 5 | Minnesota Department of Natural Resources | unknown | June/August 1980 | *Esox lucius* | 84 | 8 | 0 |
| | | fish collected by electroshocking; Floy tag inserted at base of anterior dorsal | June/August 1980 | *Lepomis macrochirus* | 446 | 88 | 1 |
| | | fish collected by electroshocking; Floy tag inserted at base of anterior dorsal | | *Pomoxis annularis* | 38 | 10 | 0 |
| | | fish collected by electroshocking; Floy tag inserted at base of anterior dorsal | | *Pomoxis nigromaculatus* | 426 | 81 | 0 |
| 5A | Wisconsin Department of Natural Resources | fish collected by electroshocking at night in tailwaters of lock and dams; plastic Floy tags were inserted at the base of the dorsal fin | April 1980 | *Stizostedion vitreum* | 306 | 30 | 7 |
| 6 | Wisconsin Department of Natural Resources | fish collected by seining, nets, and electrofishing from Trempealeau Bay and the Trempealeau River; type 302 stainless wire with attached plastic disc passed through the back under dorsal spine | April/June 1967 | *Ictalurus punctatus* | 452 | 84 | 13 |
| | | | | *Pylodictis olivaris* | 12 | 0 | unknown |

* Number of fish moved through one or more dams.

** Recaptured in first year.

Table 1. Continued.

| Pool | Agency | Methodology | Start/stop | Species tagged | Number tagged | Number recaptured | Dams* |
|---|---|---|---|---|---|---|---|
| 7,8,9 | Wisconsin Department of Natural Resources | fish collected by electroshocking; tagged with metal strap tags or plastic darts; relied on angler returns for recaptures | April 1958/December 1959 | *Stizostedion vitreum* | 1,784 | 102 | 4 |
| | | | | *Stizostedion canadense* | 409 | 23 | 3 |
| 8 | Wisconsin Department of Natural Resources | fish collected by electroshocking and trap nets below Onalaska spillway and adjacent marshes; monel metal strap tags were attached at rear margin of operculum | April 1964 | *Esox lucius* | 384 | 85 | 1 |
| 6 | University of Wisconsin-La Crosse | radiotelemetry | September 1975/May 1976 | *Stizostedion vitreum* | 13 | N/A | 1 |
| 3 | Wisconsin Department of Natural Resources | fish tagged below Dresbach dam | October 1978/April 1979 | *Stizostedion vitreum* | unknown | 30 | 11 |
| 8 | Wisconsin Department of Natural Resources | fish collected by electroshocking at night in tailwaters of locks and dams; plastic Floy tags were inserted at the base of the dorsal fin | April 1980 | *Stizostedion vitreum* | 431 | 50 | 3 |
| 8 | Wisconsin Department of Natural Resources | fish collected by electroshocking, a radio transmitter implanted surgically anterior to the vent | October 1981/July 1982 | *Stizostedion vitreum* | 14 | N/A | 2 |
| 9,10,11, 13,14,15, 16,17,18, 19 | Iowa Conservation Commission | fish collected by trawling and trammel netting; Floy (FD-67) anchor tags were anchored (1) in the mid-section midway between the dorsal and lateral rows of bony plates, and (2) between the bony plates along the lateral line | May 1972/December 1974 | *Scaphirhynchus platorynchus* | 3,271 | 326; movement data were obtained from 279 recaptured | 25 |
| 9 | Wisconsin Department of Natural Resources | fish collected by electroshocking at night in tailwaters of locks and dams; plastic Floy tags were inserted at the base of the dorsal fin | April 1980 | *Stizostedion vitreum* | 500 | 40 | 10 |
| 10 | Wisconsin Department of Natural Resources | fish tagged with Floy tags | August/November 1983 | *Ictalurus punctatus* | unknown | 32 | 15 |
| | | fish collected by bait-netting; radio transmitter implanted surgically | September/November 1983 | *Ictalurus punctatus* | unknown | N/A | 1 |
| 11 | Iowa Conservation Commission | fish collected by electrofishing within 1 mile below L&D 10 in early April; serially numbered monel strap tags were applied to the left maxilla | April 1957/April 1959 | *Stizostedion vitreum* | 1,149 | 180 | 70 |
| | | | | *Stizostedion canadense* | 1,836 | 290 | 101 |
| 12,13 | Iowa State University | fish collected by gill netting, trammel netting, and snagging; radio transmitters inserted through incision made into anterior portion of body cavity | June 1980/August 1981 | *Polyodon spathula* | 27 | N/A | unknown |
| 13 | Iowa Conservation Commission | fish were tagged | April 1975/September 1978 | *Polyodon spathula* | 2,012 | 18 | 18 |
| 13 | Iowa State University | fish collected by trammel netting; tagged with monel strap tags; twenty-two fish were radio tagged and tracked only during the day | April/October 1982 | *Scaphirhynchus platorynchus* | 2,385 | 148 | 5 |
| | | | | | 22 (radio) | N/A | 0 |
| 14 | Commonwealth Edison | Fish collected by electroshocking, bottom and surface trawls, floating trammel nets and wing nets; hoop nets were also used for freshwater drum collection; spaghetti tags, anchor tags, and fin clips were used to mark the fish | August 1973/October 1974 | *Scaphirhynchus platorynchus* | | 6 | 1 |
| | | | June 1973/November 1974 | *Esox lucius* | | 4 | 0 |
| | | | August/October 1973 | *Cyprinus carpio* | | 5 | 0 |
| | | | | *Ictalurus punctatus* | | 16 | 1 |
| | | | November 1971/October 1973 | *Lepomis macrochirus* | 3,667 total | 18 | 0 |
| | | | October 1971/October 1975 | *Micropterus salmoides* | | 76 | 0 |
| | | | November 1971/October 1975 | *Pomoxis annularis* | | 80 | 0 |
| | | | September 1972/June 1975 | *Pomoxis nigromaculatus* | | 43 | 0 |
| | | | October 1971/October 1975 | *Stizostedion canadense* | | 13 | 0 |
| | | | September 1972/September 1973 | *Stizostedion vitreum* | | 2 | 0 |
| | | | October 1978/June 1981 | *Aplodinotus grunniens* | 14,874 | 293 | 5 |

* Number of fish moved through one or more dams.

into more intensely fished areas. As a result, mean net downstream movements may have been exaggerated. Also, exact dates of mark and recapture were not presented, so no calculations of days-at-large were possible. No indication of the number of fish that may have passed through a dam was given.

REFERENCE: Gustafson. S. P., J. L. Geis, and C. J. Bublitz. 1979. 1978 Progress Report on the Prairie Island fish population study. Prepared for Northern States Power Company.

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POOL 4

1976-1977: Chippewa River: Tagging study: Shovelnose sturgeon.

During May 1977, 18 tagged sturgeon were recaptured by electroshocking after having been at large for 23 to 58 months (Table 1). Data from only 16 of these fish were usable because of recording errors. Eleven had moved upstream; the average was 4.7 miles and the maximum 9.8 miles (Figure 1). Four fish moved downstream; an average of 0.9 miles and a maxiumum of 2.1 miles. No fish passed through dams.

REFERENCE: Wisconsin Department of Natural Resources. 1977. Some life history characteristics of the shovelnose sturgeon in the Chippewa-Red Cedar System. Performance Report July 1, 1976-June 30, 1977. Project No. F-83-R-12, Study No. 215. 6 pp.

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1976: Chippewa River: Radiotelemetry: White bass.

A radiotelemetry study of white bass movements was completed in 1976 (Table 1). No interpool movements were identified. Observed movements appeared to be related to feeding.

* * * * *

1958: Tagging study: Smallmouth bass.

Three hundred sixty-two smallmouth bass were collected during May and June, 1958 by electrofishing. Serially numbered monel strap tags were attached to the jaw. Twenty-eight percent (103 fish) of the tagged fish were recaptured by anglers (Table 1). No interpool movements were identified and all fish were recaptured within a 5 mile radius of the release site.

REFERENCE: Minnesota Department of Natural Resources. 1983. Personal communication. Larry Gates, Lake City, MN.

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1972-1980: Tagging study: Walleye, sauger, channel catfish, flathead catfish.

Four species of fish were marked with Floy-tags during the study period (Table 1). Fish for tagging were captured by electroshocking or seining and recaptured by electroshocking or angling. About 6,000 walleye were tagged between May 1973 and October 1980 and over 900 (15%) were recaptured. Upstream movements were usually greater than downstream (Figure 2a). Movement of 38 miles was documented for one fish. Nearly 70 fish passed through one or more dams. About 2,000 sauger were tagged between April 1977 and April 1980 and over 500 fish (24%) were recaptured. Of these, 19 had passed through at least one dam. Movement appeared to be predominantly downstream (Figure 2b). However, this may be biased since nearly all sauger were tagged in the tailwaters of Lock and Dam 3 during the April spawning period. Over 4,000 channel catfish and 81 flathead catfish were also tagged during the study, 5% and 15% were recaptured, respectively. Twenty-seven channel catfish moved through at least one dam, while only one flathead catfish demonstrated interpool movement. The predominant pattern of movement by channel catfish was downstream (Figure 3a) and the maximum recorded distance was 83 miles. Flathead catfish were captured a maximum of 49 miles upstream of the release site (Figure 3b), but no particular pattern of movement was identified.

REFERENCE: Minnesota Department of Natural Resources. 1983. Personal communication. Larry Gates, Lake City, MN.

* * * * *

1964: Tagging study: White bass.

One thousand one hundred forty-nine white bass were tagged in the spring of 1964 (Table 1). All fish were collected by electroshocking in the tailwaters of Lock and Dam 3. Single dart tags (Floy No. 2), monel jaw tags, or a combination of the two were used to mark fish. With the exception of five fish, all fish were recaptured (by anglers) in the tagging area or downstream. Maximum movement was 131 miles (Figure 4). All fish that moved upstream were found in the St. Croix River above Lock and Dam 3. Two fish moved downstream one pool and one fish was recaptured at Lansing, Iowa (6 dams downstream). The average movement of recaptured fish was 21 miles and the maximum was 131 miles (Figure 4).

REFERENCE: Finke, A. H. 1966. White bass tagging study, Upper Mississippi River, 1964. Wisconsin Conservation Department. Fish Management Report No. 6. 11 pp.

* * * * *

1947-1950: Tagging study: Channel catfish.

Over 6,000 channel catfish were tagged with aluminium strap tags between August 1947 and February 1950 (Table 1). About 700 were released in the upper end of Lake Pepin; 500 near Reads Landing, Minnesota; 500 near Trempealeau, Wisconsin; 2,300 fish from Lansing, Iowa were released at Lake City, Minnesota; and, 2,000 were released near Lansing, Iowa. Eight percent of the released fish were recaptured by anglers. Of these, 24% moved through one or more dams. Two fish from the transferred group were recaptured over 100 miles from their release site, and two others had moved 171 miles downstream. Exact mark and recapture dates were not given.

REFERENCE: Hubley, R. C., Jr. 1963. Movement of tagged channel catfish in the Upper Mississippi River. Trans. Am. Fish. Soc. 92:165-170.

* * * * *

## POOL 5

1980: Tagging study: Northern pike, bluegill, black crappie, white crappie.

During 1980, northern pike, bluegill, and crappie were collected and tagged (Table 1). Collection and tagging methods were not reported for the northern pike; however, 84 fish were marked. Movements were minimal (Figure 5a) based on returns from eight fish. Bluegill and crappie were collected by electroshocking and trap netting and Floy-tags were inserted at the base of the anterior dorsal fin. About 450 bluegill and crappie were tagged; 67 (15%) bluegill and 91 (10%) crappie were recaptured. Information on method of recapture was not reported. Movements of these species were minimal (Figures 5b, 6a, 6b). Seventy-five percent of the fish were recaptured near the release site. Only one bluegill was captured outside of its home pool.

REFERENCE: Minnesota Department of Natural Resources. 1983. Personal communication. Larry Gates. Lake City, MN.

* * * * *

1980: Tagging study: Walleye.

A total of 1,744 walleye were collected in April 1980 using a pulse DC electroshocker from tailwater areas of four dams (Table 1). Fish were tagged with plastic Floy-tags inserted at the base of the dorsal fin. Over 400 walleye were tagged in the tailwaters of Lock and Dam 4; 33 of these tags were recovered. Another 300 walleye were tagged in the tailwaters of Lock and Dam 5; 30 tags were returned. Fifty tags from 431 walleyes tagged in the tailwaters of Lock and Dam 7 were recovered. Five hundred walleye were tagged in the tailwaters of Lock and Dam 8; 40 of these tags were returned. All returned tags were recovered by anglers. Fifteen percent of the recaptured fish moved out of Pool 5 through one or more dams; 23.3% moved out of Pool 5A; 6.0% moved out of Pool 8 and 20.0% moved out of Pool 9. Fish in all four pools showed a general, overall movement downstream (Figures 7,8).

REFERENCE: Mississippi River Work Unit. 1980. Mississippi River Work Unit, Annual Report 1979-1980. Wisc. Dep. Nat. Res. 221 pp.

* * * * *

1959-1960: Tagging study: Walleye, sauger.

Eighty-six sauger and 960 walleye were tagged in April 1959 downstream from Lock and Dam 4. Over 100 walleye and 13 sauger were recaptured by anglers, 60% at the release site, while 11% demonstrated interpool movement. Exact dates of mark and recapture were not given.

REFERENCE: Minnesota Department of Natural Resources. 1960. Walleye and sauger study. Job completion report. Project F-15-R-4, Job No. 1. 9 pp.

* * * * *

POOL 5A

1980: Tagging study: Walleye.

See Pool 5, 1980: Tagging study: Walleye, for description of study.

* * * * *

POOL 6

1967: Tagging study: Channel catfish, flathead catfish.

Over 450 channel catfish and 12 flathead catfish were tagged between April and June 1967 and released in the lower Trempealeau River and Trempealeau Bay (Table 1). Eighty-four channel catfish were recaptured by anglers but no flathead catfish were recovered. Thirteen channel catfish moved through one or more dams; all but one moved downstream. The longest distance traveled was about 92 miles. Ten percent of the recaptures were 13 or more miles from the release site. Exact tagging and recapture dates were not given.

REFERENCE: Rathum, R. G. 1971. A study of the movement and harvest of catfish tagged in the lower Trempealeau River and Trempealeau Bay. Wisconsin Department of Natural Resources, West Central District. Management Report No. 50. 21 pp.

* * * * *

## POOL 7

1958: Tagging study: Walleye, sauger.

A total of 2,193 fish were tagged (1,784 walleye, 409 sauger) in the spring of 1958 (Table 1). Returns began in May with the opening of the fishing season and continued until December 1958. Of the over 100 tags (5.7%) returned; seven (5.6%) had passed through at least one dam. Returns dropped to zero in August, October, and November. This drop corresponded to a reduction in the fishing pressure. Maximum documented movement was 28 miles (Figure 9) but the direction of movement was not given. Mean distances increased with time from 1.5 miles for fish at large for 1 to 15 days tc 22.5 miles for fish that were at large for nearly a year.

REFERENCE: Hubley, R. C., Jr., and G. D. Jergens. 1959. Walleye and sauger tagging investigation on the upper Mississippi River. Wisconsin Conservation Department, Fish Management Division, West Central area. Progress Report, 1958. Investigational Memorandum No. 1. 9 pp.

* * * * *

## POOL 8

1981-1983: Radiotelemetry: Walleye.

Fourteen fish were captured in the fall of 1981 and 18 fish in the fall of 1982 (Table 1). Radio transmitters were inserted through an incision in the body wall anterior to the vent and lateral of the mid-line. Of the 14 fish tracked during 1981-1982, two fish showed interpool movements (Figure 10). Both fish moved upstream through at least four dams. Rapid upstream movement began between April 12 and April 16. Fish #410 navigated through Lock and Dam 4 five times during one

24-hour period. Of the eighteen fish tracked during 1982-1983, six showed interpool movements. Half of these fish (Fish Nos. 726, 134, 903) moved downstream out of Pool 8 into Pool 9 (Figures 11, 12). Two fish moved upstream through three pools, while one fish moved up through one dam.

REFERENCE: Wisconsin Department of Natural Resources. 1983. Personal communication. Jim Holzer.

Holzer, J. A., and K. Von Ruden. 1982. Walleye spawning movements in Pool 8 of the Mississippi River. Pages 1-40 *in* Wisconsin Department of Natural Resources. Mississippi River Work Unit Annual Report 1981-1982.

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1980: Tagging study: Walleye.

See Pool 5, 1980: Tagging study: Walleye, for description of work.

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1978-1979: Tagging study: Walleye.

A total of 1,240 walleye larger than 10 inches were collected with a pulse DC electroshocker during the fall of 1978 and the spring of 1979 (Table 1) and tagged with plastic Floy-tags inserted at the base of the dorsal fin. A total of 193 fish were recaptured by anglers; 50 demonstrated interpool movements (Figure 13).

REFERENCE: Mississippi River Work Unit. 1979. Mississippi River Work Unit Annual Report, 1978-1979. Wisc. Dep. Nat. Res. 139 pp.

Mississippi River Work Unit. 1980. Mississippi River Work Unit Annual Report, 1979-1980. Wisc. Dep. Nat. Res. 221 pp.

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1975-1976: Radiotelemetry and tagging study: Walleye.

Radio transmitters were inserted into 13 female walleye collected from the tailwaters of Lock and Dam 7 between November 1975 and April 1976. In addition, 15 fish were marked with dart tags inserted posterior to the dorsal fin. Most of the tagged fish were recaptured by anglers near the release site but one demonstrated interpool movement. Of the 13 fish with transmitters, data from only two fish were adequate to evaluate spawning movements. Two radio tags proved non-functional at the time of release of the fish. Tracking of six fish was done at some time before or after the period of spawning movement noted by the Wisconsin Department of Natural Resources (see Pool 8 1981-1983 description). Only two fish were tracked during the spawning period and both showed interpool movements. Exact patterns of movement were not reported.

REFERENCE: Bahr, D. M. 1977. Homing, swimming behavior, range, activity patterns, and reaction to increasing water levels of walleye (*Stizostedion vitreum vitreum*) as determined by radio-telemetry in Navigation Pool 7 and 8 of the upper Mississippi River during spring, 1976. M.S. Thesis. University of Wisconsin, La Crosse, WI.

* * * * *

1964: Tagging study: Northern pike.

A total of 384 northern pike were collected with trap nets and electroshockers downstream from the Onalaska Spillway in Pool 8 during April 1964 (Table 1). A monel strap tag was attached to the operculum of each fish. Eighty-five fish were recaptured by anglers; 92% were collected within 5 miles of the tagging site. The maximum distance traveled was an intrapool movement of 21 miles downstream to Stoddard, Wisconsin. One fish was collected above the spillway and presumably had moved upstream through Lock and Dam 7.

REFERENCE: Finke, A. H. 1966. Northern pike tagging study Black River, La Crosse County, Wisconsin 1964-1965. Wisconsin Conservation Department, Fish Management Division. Management Report No. 7. 4 pp. + table and figures.

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1958: Tagging study: Walleye, sauger.

See Pool 7, 1958: Tagging study: Walleye, sauger, for description of work.

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## POOL 9

1980: Tagging study: Walleye.

See Pool 5, 1980: Tagging study: Walleye, for description of work.

* * * * *

1971-1974: Tagging study: Shovelnose sturgeon.

Between 1971 and 1974, 3,271 shovelnose sturgeon collected between Pools 9 and 19 were tagged with Floy anchor tags. Of these, about 200 were actually tagged in Pool 9. Over 300 (10%) were recaptured. In 1972, tag retention was tested by also tagging the first 502 marked fish with monel tags. Tag losses were apparent based on observed erosion of plates adjacent to the insertion point and increased rapidly after the first year. By 1974, one-half of the fish reported had lost their Floy anchor tags. All fish were recaptured with trammel nets or trawls. All fish recaptured during the first 2 years were found in the same pool. However, from July 1973 through June 1974, 25 fish were captured from other pools. In every instance, interpool movements were upstream. The maximum distance traveled was 120 miles by four fish, which moved from Pool 13 to Pool 9.

REFERENCE: Helms, D. 1974. Shovelnose sturgeon in the Mississippi River, Iowa. Iowa Conservation Commission. Technical Series 74-3. 33 pp.

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1958: Tagging study: Walleye, sauger.

See Pool 7, 1958: Tagging study: Walleye, sauger, for description of study.

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POOL 10

1983: Tagging study: Channel catfish.

Fish were Floy-tagged in Pool 10 on August 21, 1983. Of 32 fish tags returned by anglers, only one was returned from outside of Pool 10, approximately 420 miles downstream from the tagging site. A total of 15 dams were crossed in the course of the 94-day, downstream migration of this individual. No information on the intrapool movements was given.

REFERENCE: Wisconsin Department of Natural Resources. 1983. Personal communication. Tom Pellett.

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1983: Radiotelemetry study: Channel catfish.

One channel catfish was implanted with a radio transmitter on October 29, 1983. It traveled 44 miles downstream in the 49 days it was at large and was tracked through one dam (Figure 14).

REFERENCE: Wisconsin Department of Natural Resources. 1983. Personal communication. Pam Thiel, Prairie du Chien, WI.

* * * * *

1971-1974: Tagging study: Shovelnose sturgeon.

See Pool 9, 1971-1974: Tagging study: Shovelnose sturgeon, for description of study. Twelve fish were tagged in this pool.

* * * * *

## POOL 11

1971-1974: Tagging study: Shovelnose sturgeon.

See Pool 9, 1971-1974: Tagging study: Shovelnose sturgeon, for description of study. Two hundred twenty-six fish were tagged in this pool.

* * * * *

1957-1959: Tagging study: Walleye, sauger.

Walleye and sauger were tagged in the tailwater area of Lock and Dam 10 (Table 1) to study fish movements and utilization of the resource by fishermen. Tagging was initiated in 1957 and continued through 1959. During the 3-year study, 1,149 walleye and 1,836 sauger were tagged with monel strap tags. A large portion of the recaptured walleye (54%) and sauger (69%) were taken in Pool 11. However, about 31% of the walleye had moved upstream out of the pool, while 15% moved downstream. About 22% of the sauger had moved upstream out of the pool and 9% moved downstream. Fifty-nine percent of both walleye and sauger returns occurred within 6 months after tagging. Seventy walleye and 101 sauger moved through one or more dams during the tagging study. Average interpool movement was about 50 miles.

REFERENCE: Iowa State Conservation Department. 1958. Progress Report: Walleye and sauger studies in the Mississippi River in Iowa, 1958. Iowa State Conservation Department. Project No. F-53-R, Job No. 2.

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## POOL 12

1980-1981: Radiotelemetry study: Paddlefish.

Paddlefish were collected with gill nets, trammel nets, and snagging gear (Table 1). Radio transmitters were implanted into the anterior body cavity through a small incision. Seventeen fish were tagged in June 1980 and tracked through August 1980. None of these fish moved through any dams. Ten paddlefish were tagged in March 1981 and tracked through August 1981. Specific location/date information was not reported for individual fish. It was reported, however, that there were 15 passages through dams, 10 of which were upstream and 5 downstream. An example of the movement patterns observed is presented in Figure 15.

REFERENCE: Southall, P. D. 1982. Paddlefish movement and habitat use in the upper Mississippi River. M.S. Thesis. Iowa State University, Ames, IA. 100 pp.

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## POOL 13

1982: Tagging and radiotelemetry study: Shovelnose sturgeon.

A total of 2,385 shovelnose sturgeon were tagged during April through October 1982. One hundred forty-eight fish were recaptured by angling or trammel nets in 1982 from within the pool, and five returns in 1983 were from outside the pool. Radio-tagged fish moved an average of 339 meters/day with a maximum of 11.7 km/day. Movements were greatest during the May spawning period (600 m/day) and least in August (73 m/day) and June (209 m/day). No statistically significant differences in direction moved were noted; however downstream distances were always greatest. No interpool movement was documented for the radio-tagged fish.

REFERENCE: Hurley, S. T. 1983. Habitat associations and movements of shovelnose sturgeon in Pool 13 of the upper Mississippi River. M.S. Thesis. University of Iowa, Ames, IA. 82 pp.

* * * * *

1975-1978: Tagging study: Paddlefish.

A total of 1,562 paddlefish were tagged and released in Pool 13; 450 paddlefish were tagged and released in other pools. Eighteen tags were returned by commercial fishermen. All of these fish had moved through one or more dams; four had moved upstream and 14 moved downstream.

REFERENCE: Gengerke, T. W. 1978. Commercial fisheries investigations project completion report. Iowa Conservation Commission, Fisheries section. Project No. 2-255-R, Paddlefish investigations.

* * * * *

1971-1974: Tagging study: Shovelnose sturgeon.

See Pool 9, 1971-1974: Tagging study: Shovelnose sturgeon, for description. A total of 2,101 fish were tagged in this pool.

* * * * *

## POOL 14

1971-1981: Tagging study: Shovelnose sturgeon, northern pike, carp, channel catfish, bluegill, crappies, sauger, walleye, freshwater drum.

Between 1971 and 1981, two studies were conducted in which 24 species of fish were tagged and released. Of these, 12 species were recaptured with nets and by anglers (Table 1). In the most recent study, freshwater drum were collected and tagged between October 1978 and June 1981. No distinct pattern of upstream or downstream movement was observed (Figures 16, 17). About 2% of the recaptured fish had moved through one dam (Table 2, Appendix Table 32). In an early effort (1971-1975), over 3,000 fish were tagged and 227 fish of 11 species were recaptured. Movements of largemouth bass, white crappie, black crappie (Figures 18, 19), northern pike (Figure 20), and carp (Figure 21) were minimal. Sauger moved greater distances upstream than downstream (Figure 19). Shovelnose sturgeon moved an average of 15 miles, but there was no preference for either direction (Figure 20). Channel catfish generally moved downstream (Figure 21).

REFERENCES: Environmental Research and Technology, Inc. 1980. Quad-Cities Aquatic Program. 1979 Annual Report. Volume I. Prepared for Commonwealth Edison Company.

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Nalco Environmental Sciences. 1976. Operational environmental monitoring in the Mississippi near Quad-Cities Station, February 1975-January 1976. Annual Report to Commonwealth Edison Company.

Nalco Environmental Sciences. 1977. Operational environmental monitoring in the Mississippi near Quad-Cities Station, February 1976-January 1977. Annual Report to Commonwealth Edison Company.

* * * * *

1971-1974: Tagging study: Shovelnose sturgeon.

See Pool 9, 1971-1974: Tagging study: Shovelnose sturgeon, for description. A total of 41 fish were tagged in this pool.

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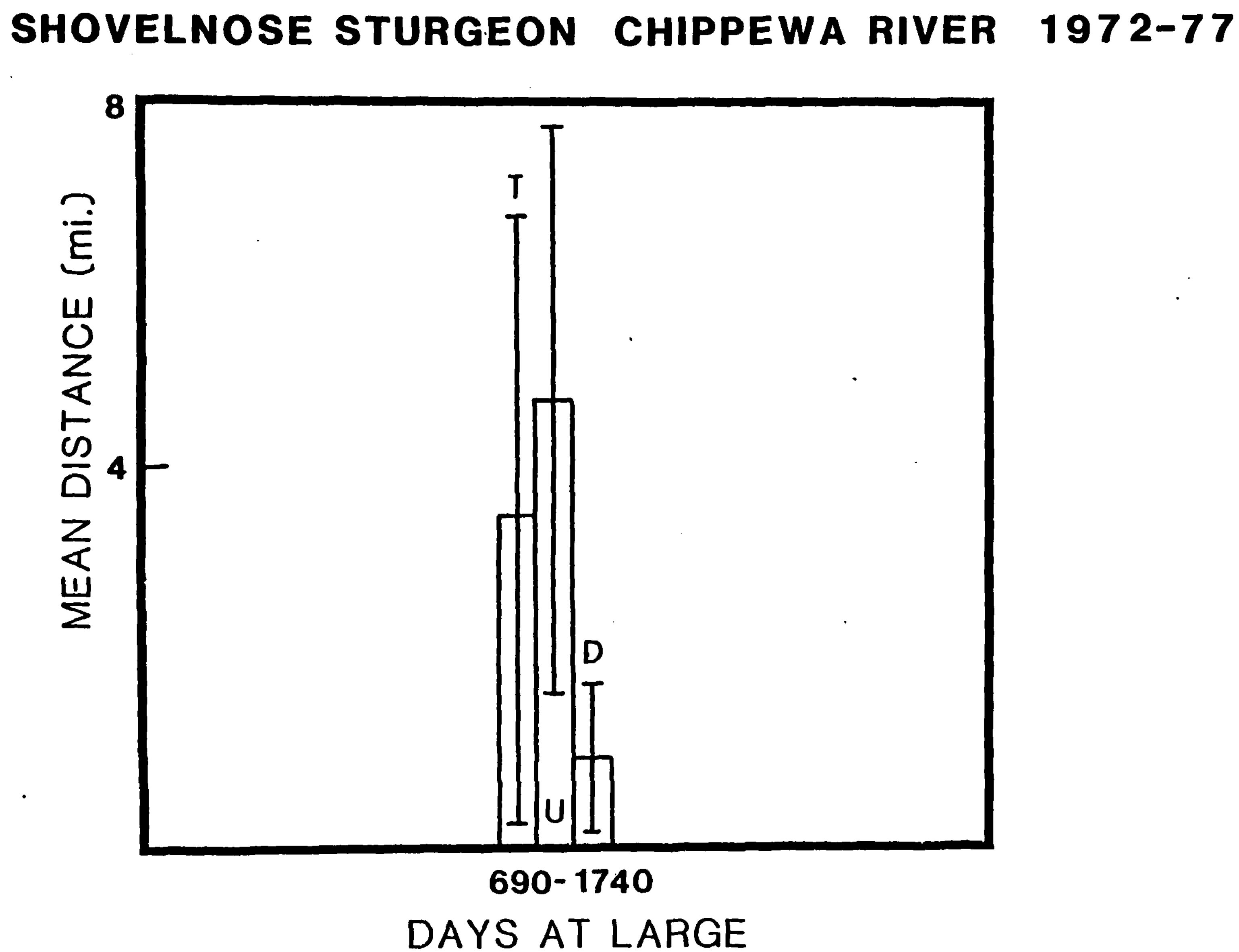



Fig. 1. Distance traveled ($\bar{x} \pm 1$ S.D.) by shovelnose sturgeon based on mark-recapture data, Chippewa River. T = total (includes those fish which did not move); U = upstream; D = downstream.

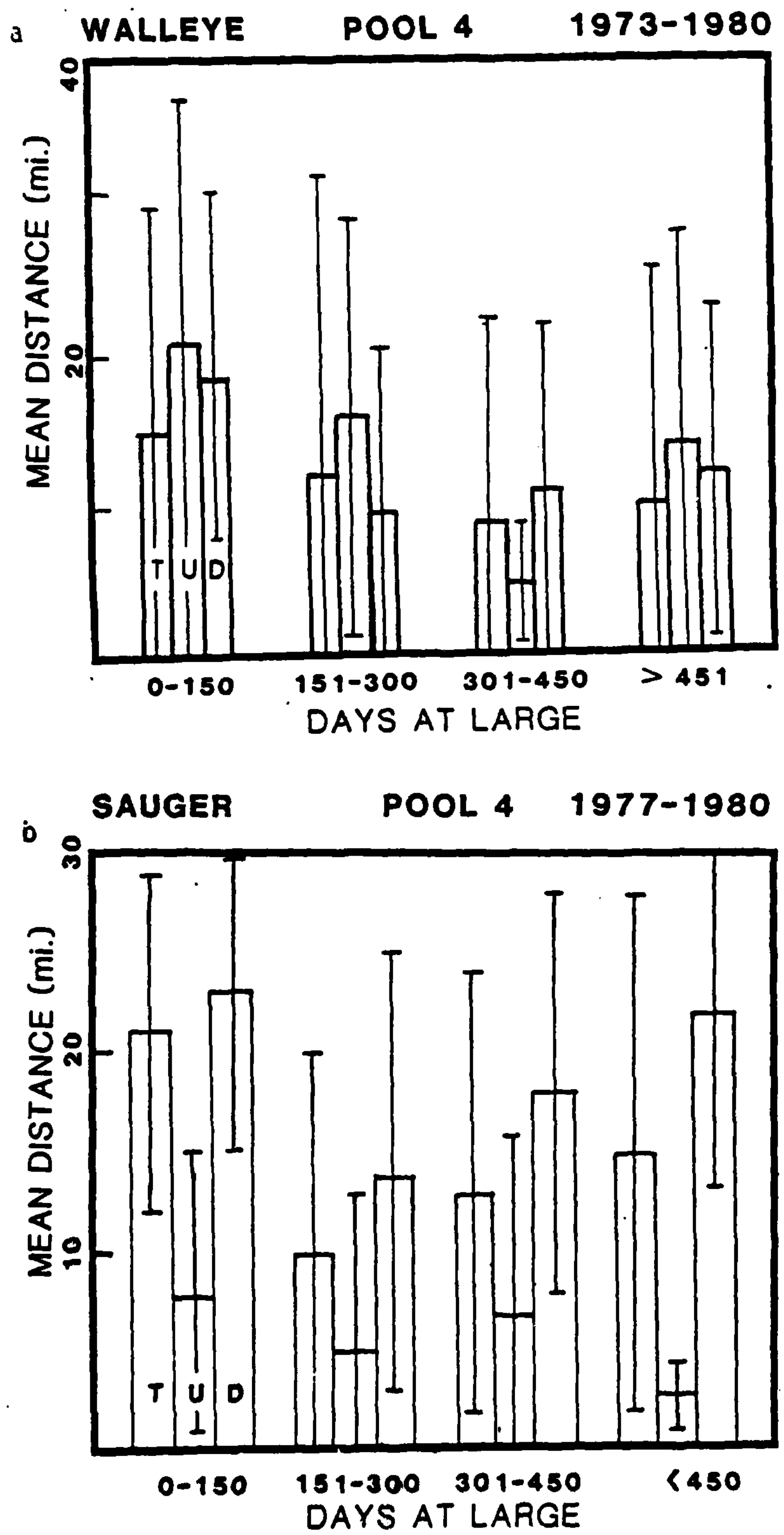
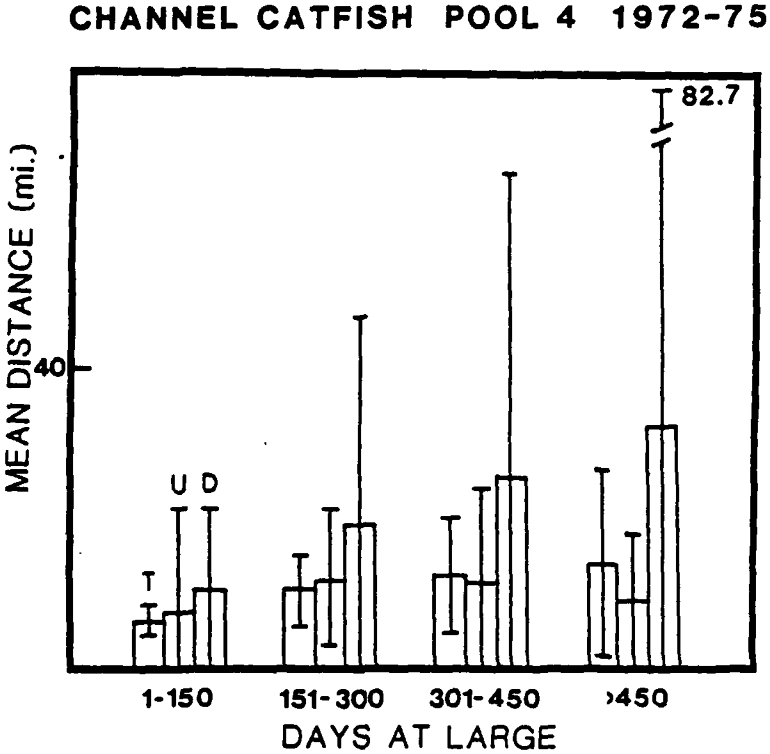



Fig. 2. Distance traveled ($\bar{x} \pm$ 1 S.D.) by walleye (a) and sauger (b) based on mark-recapture data, Pool 4. T = total (including those fish which did not move); U = upstream; D = downstream.

a




b

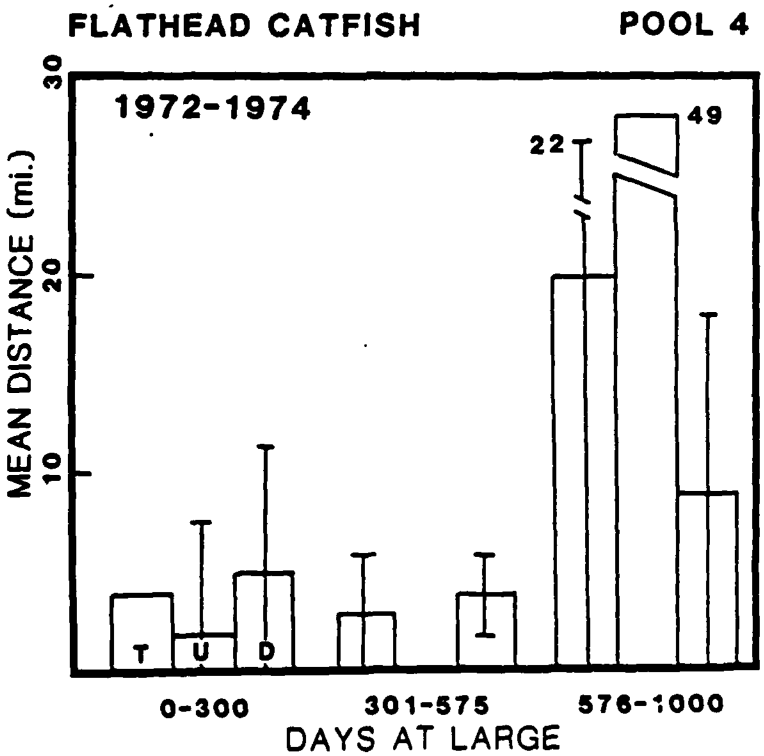



Fig. 3. Distance traveled ($\bar{x}$ ± 1 S.D.) by channel catfish (a) and flathead catfish (b) based on mark-recapture data, Pool 4. T = total (including those fish which did not move); U = upstream; D = downstream.

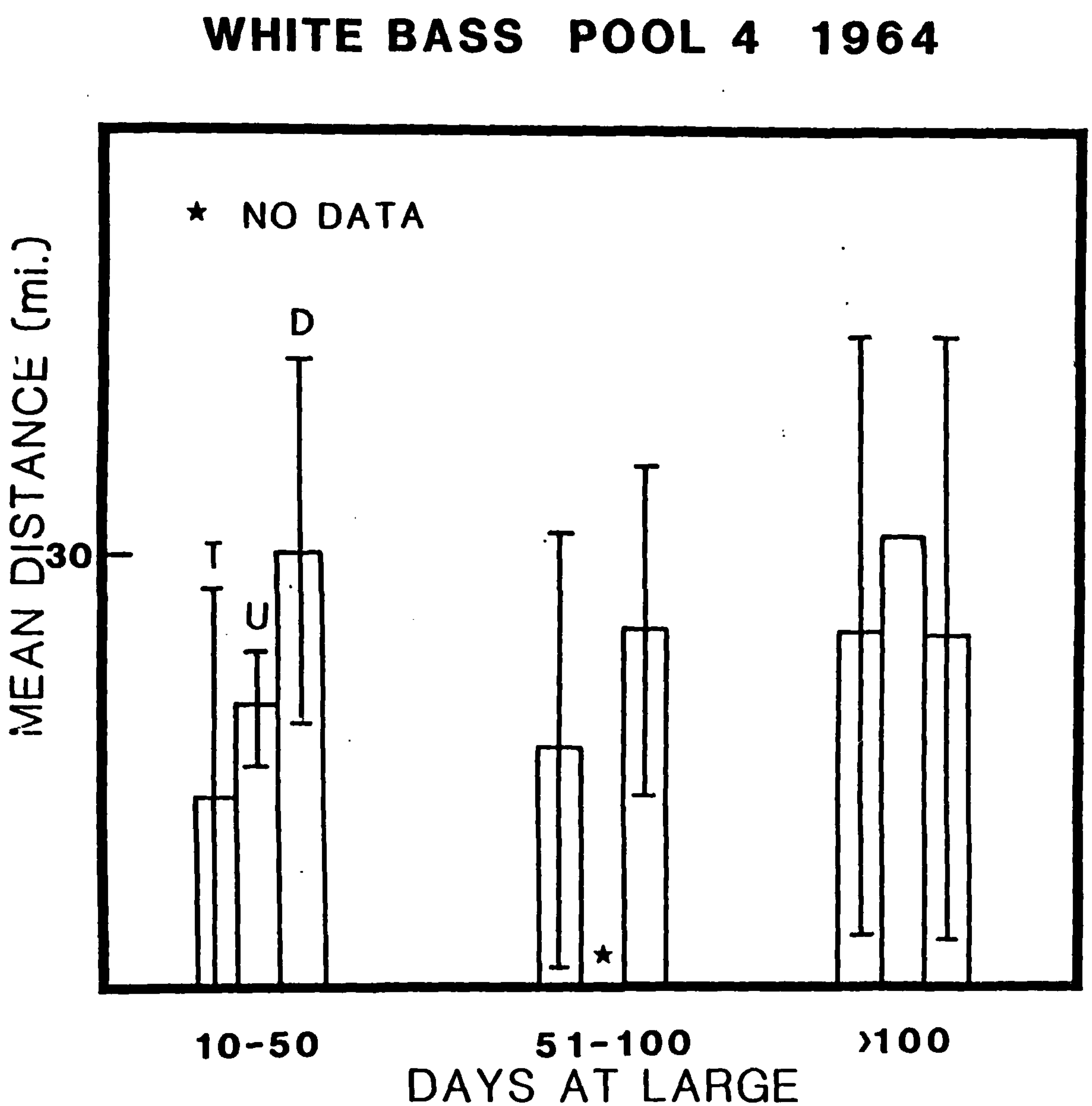



Fig. 4. Distance traveled ($\bar{x} \pm 1$ S.D.) by white bass based on mark-recapture data, Pool 4. T = total (including those fish which did not move); U = upstream; D = downstream.

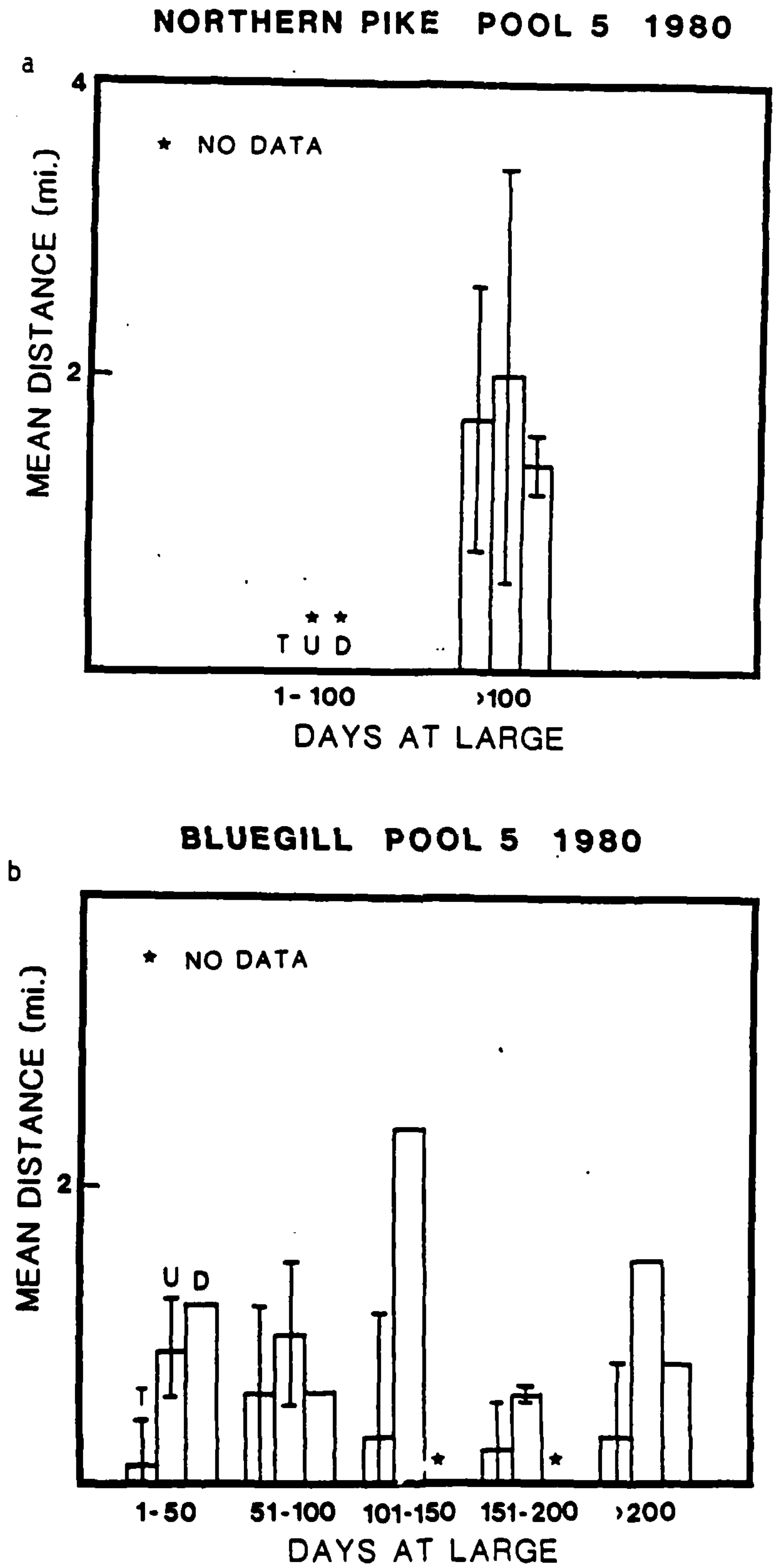
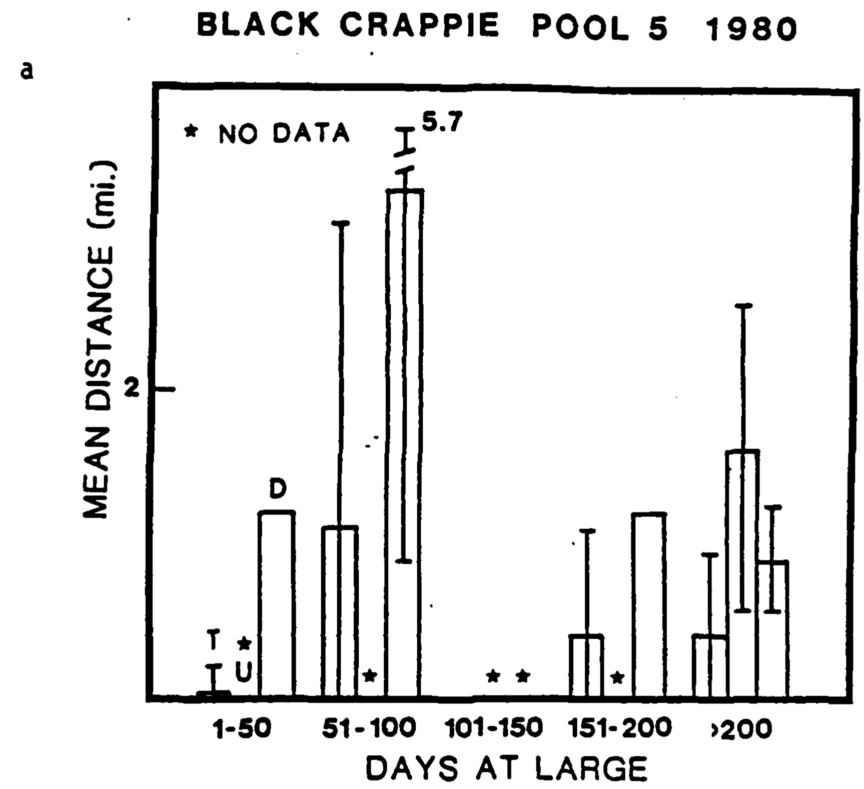



Fig. 5. Distance traveled ($\bar{x} \pm 1$ S.D.) by northern pike (a) and bluegill (b) based on mark-recapture data, Pool 5. T = total (including those fish which did not move); U = upstream; D = downstream.



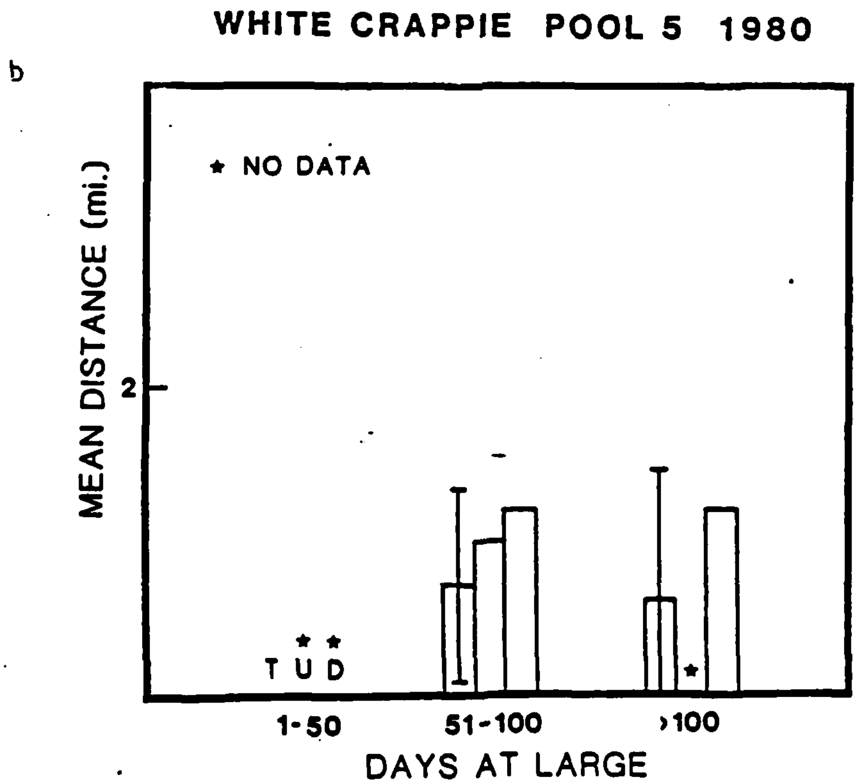




Fig. 6. Distance traveled ($\overline{x} \pm 1$ S.D.) by black crappie (a) and white crappie (b) based on mark-recapture data, Pool 5. T = total (including those fish which did not move); U = upstream; D = downstream.

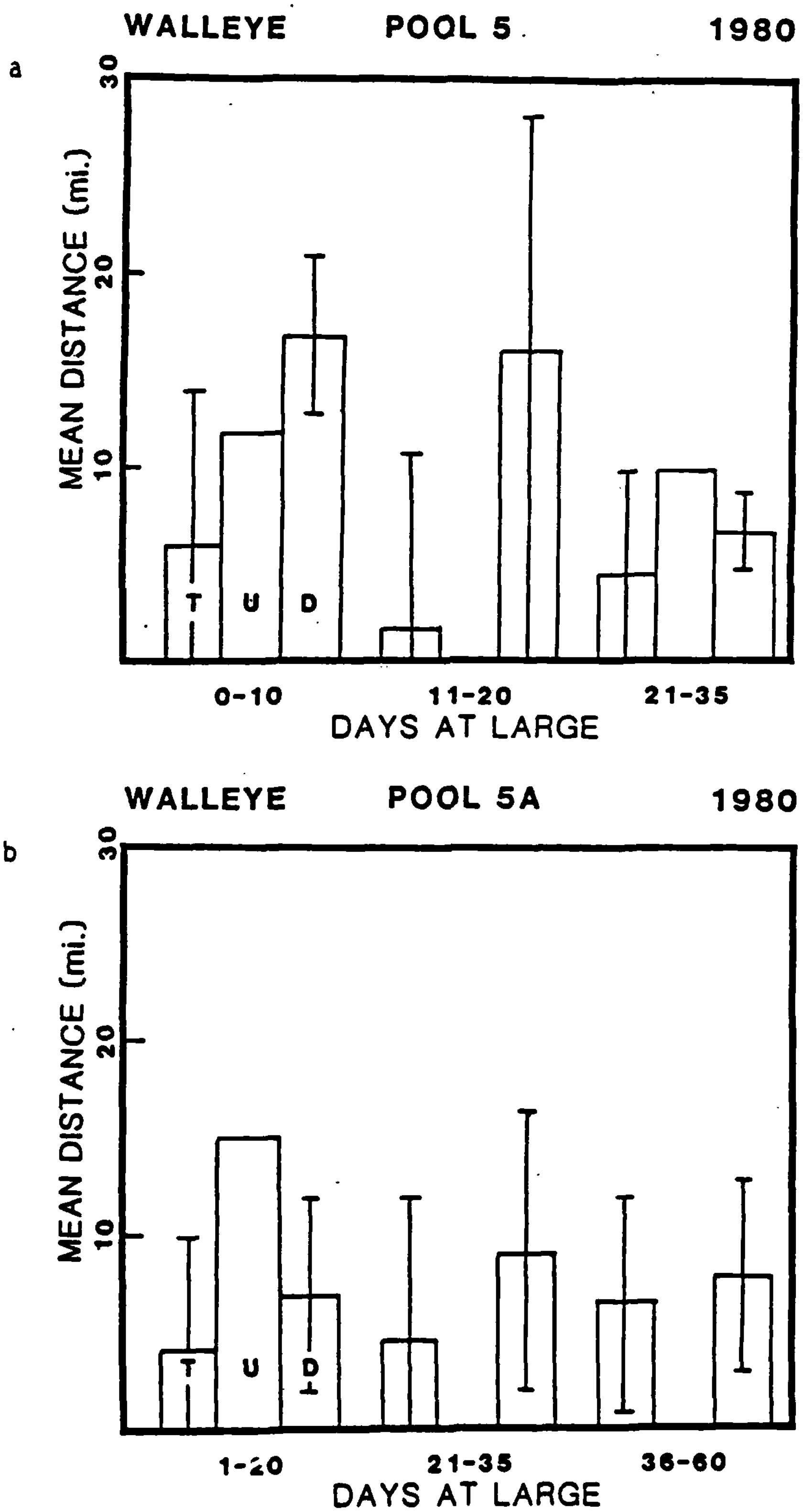



Fig. 7. Distance traveled ($\bar{x} \pm 1$ S.D.) by walleye based on mark-recapture data, Pool 5 (a) and Pool 5A (b). T = total (including those fish which did not move); U = upstream; D = downstream.

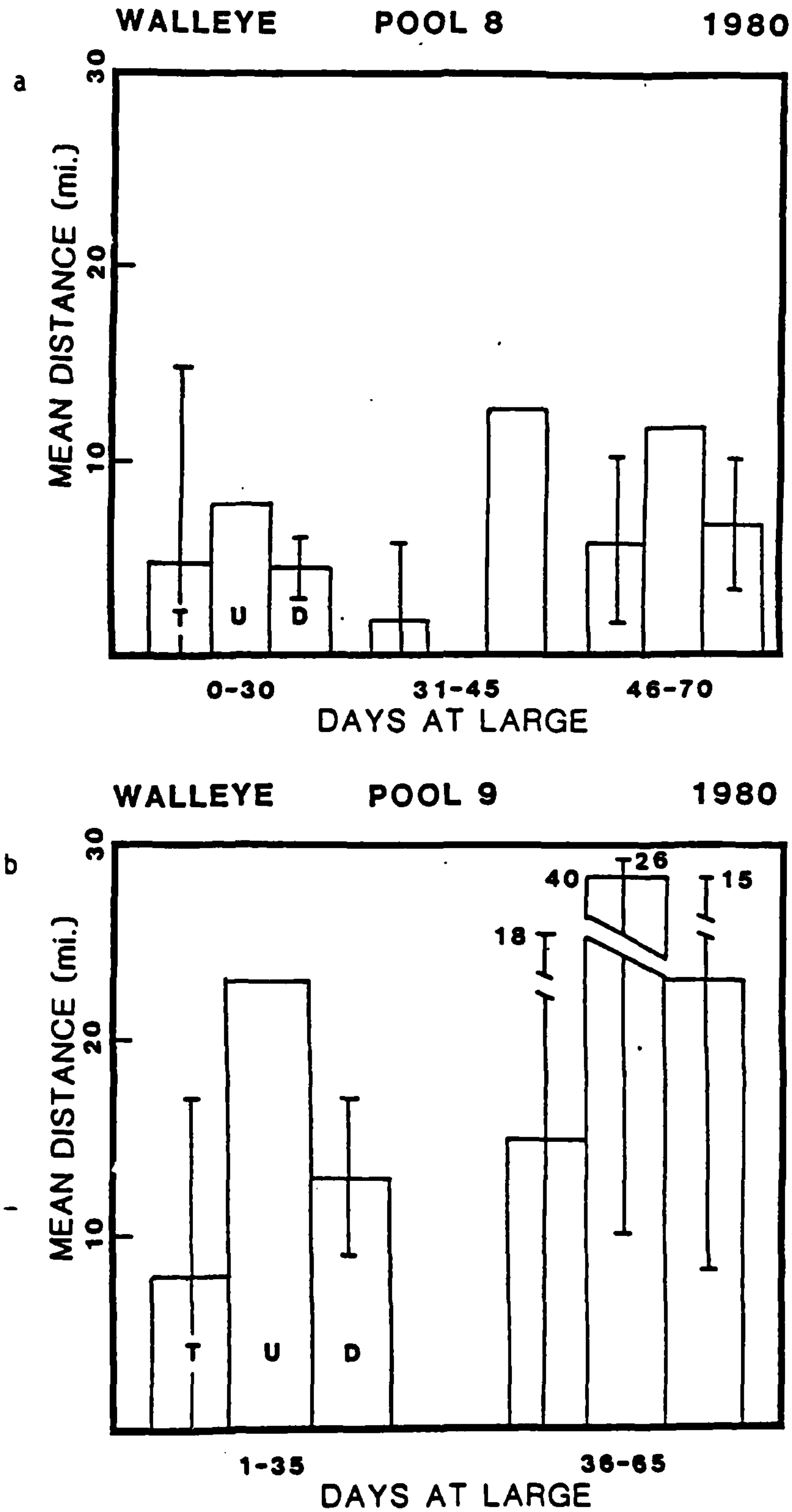



Fig. 8. Distance traveled ($\overline{x} \pm 1$ S.D.) by walleye based on mark-recapture data, Pool 8 (a) and Pool 9 (b). T = total (including those fish which did not move); U = upstream; D = downstream.

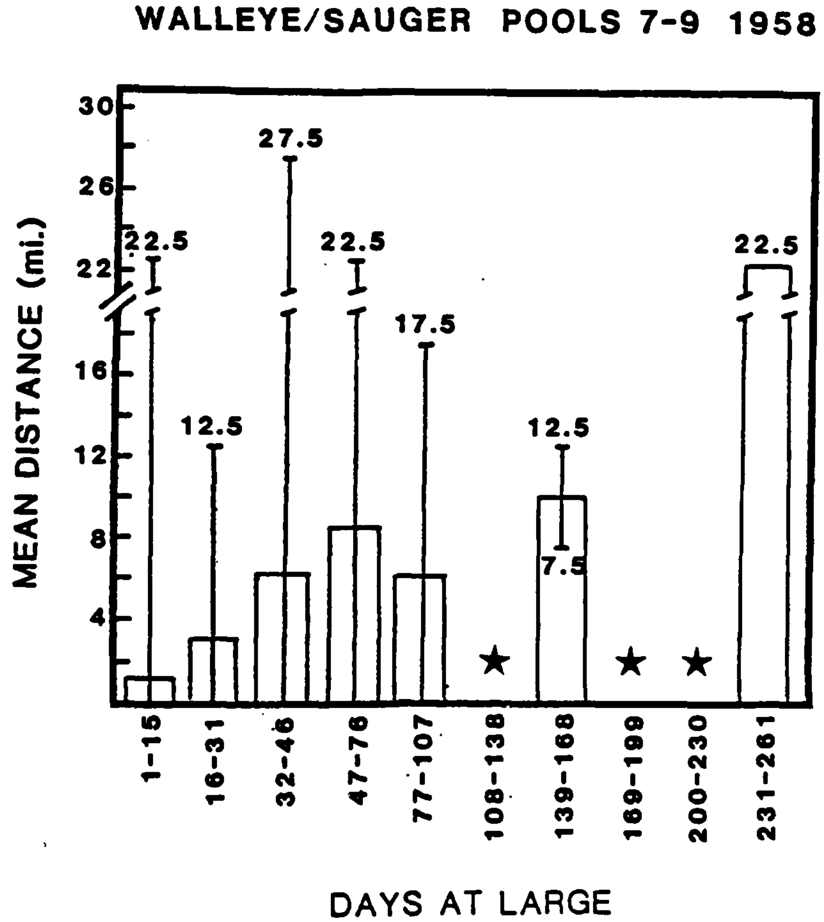



Fig. 9. Mean distance and range traveled by walleye and sauger based on mark-recapture data, Pools 7-9.
* Fish in these categories did not move.

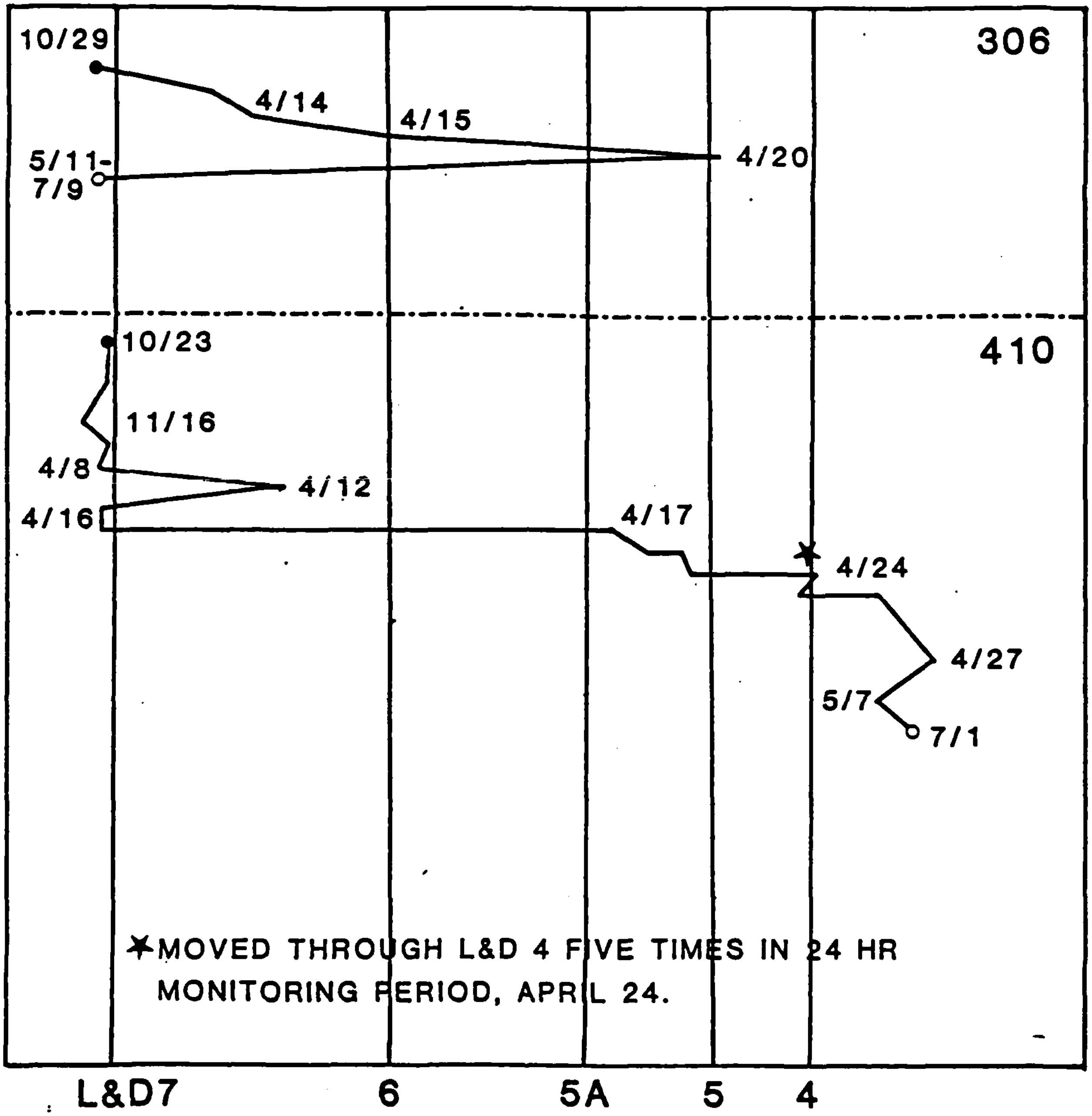



Fig. 10. Interpool movement by two radio-tagged walleye.

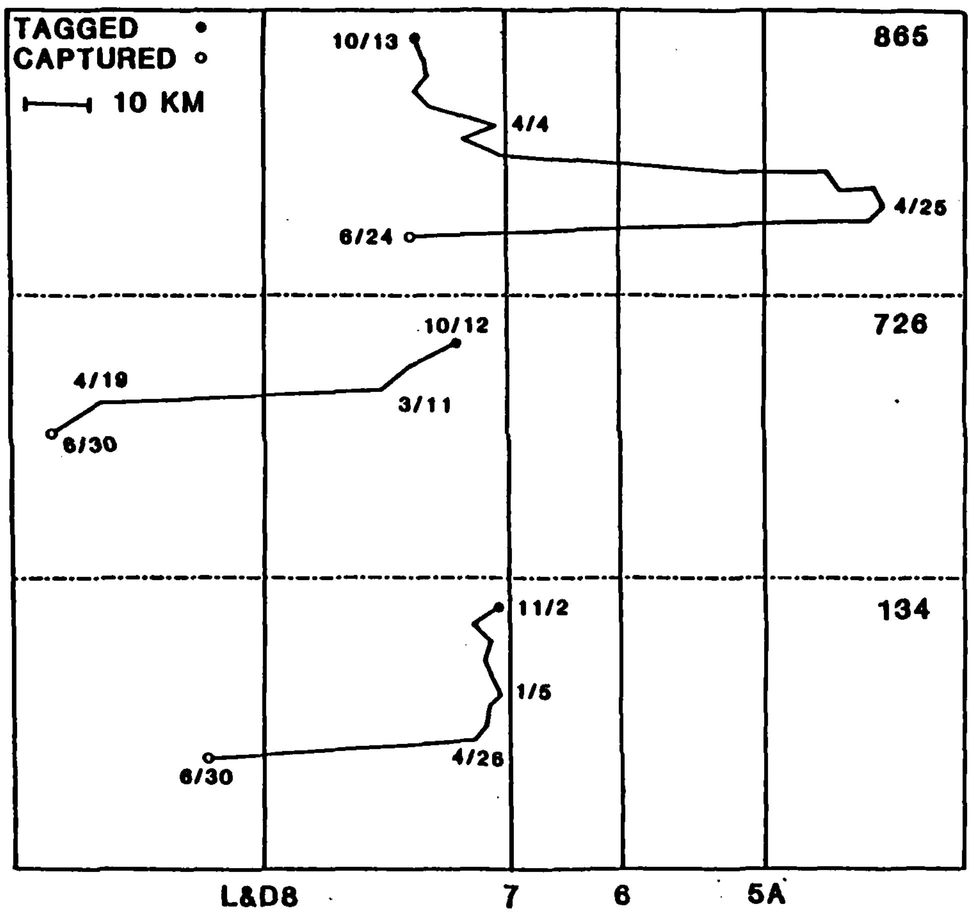



Fig. 11. Interpool movement by three radio-tagged walleye.

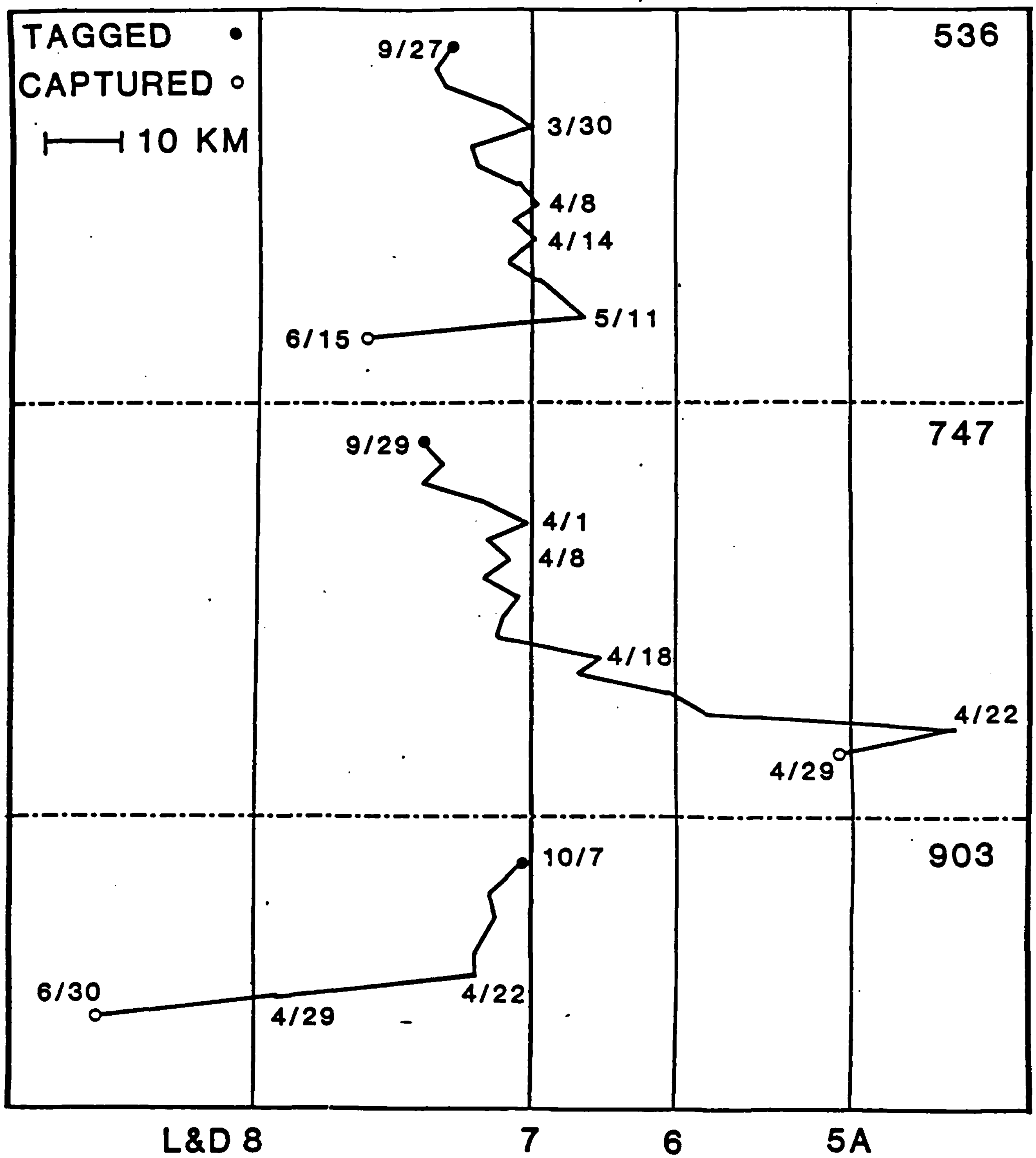



Fig. 12. Interpool movement by three radio-tagged walleye.

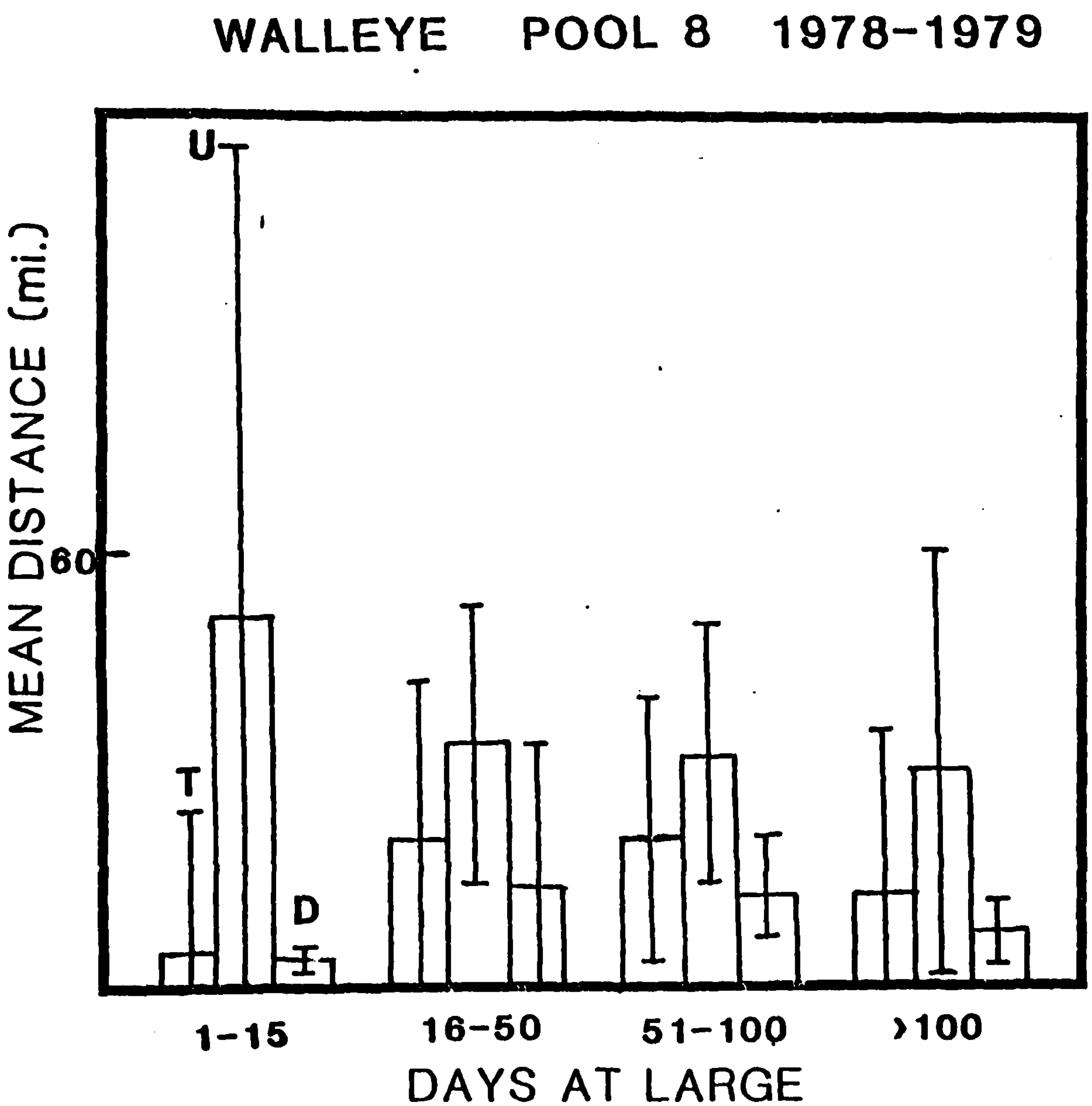



Fig. 13. Distance traveled ($\overline{x} \pm 1$ S.D.) by walleye based on mark-recapture data, Pool 8. T = total (including those fish which did not move); U = upstream; D = downstream.

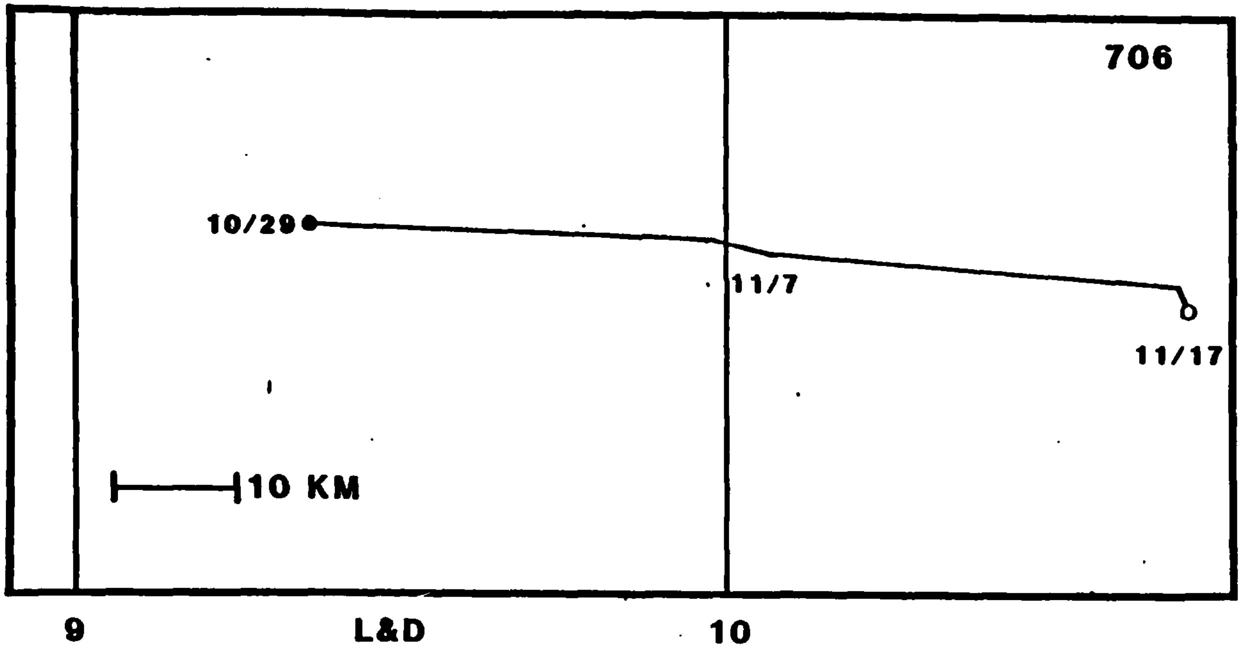



Fig. 14. Interpool movement by a radio-tagged channel catfish.

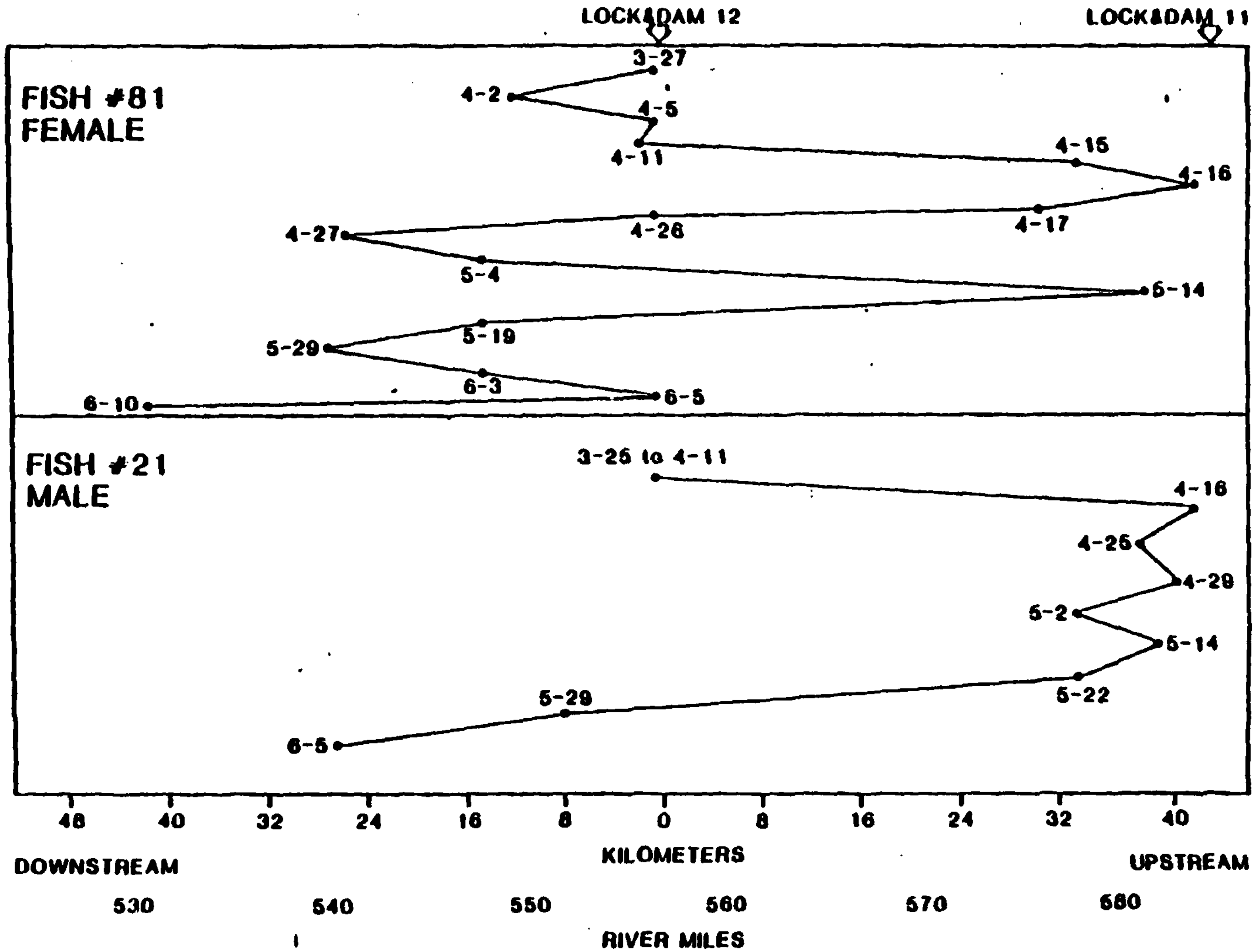



Fig. 15. Interpool movement of two radio-tagged paddlefish.

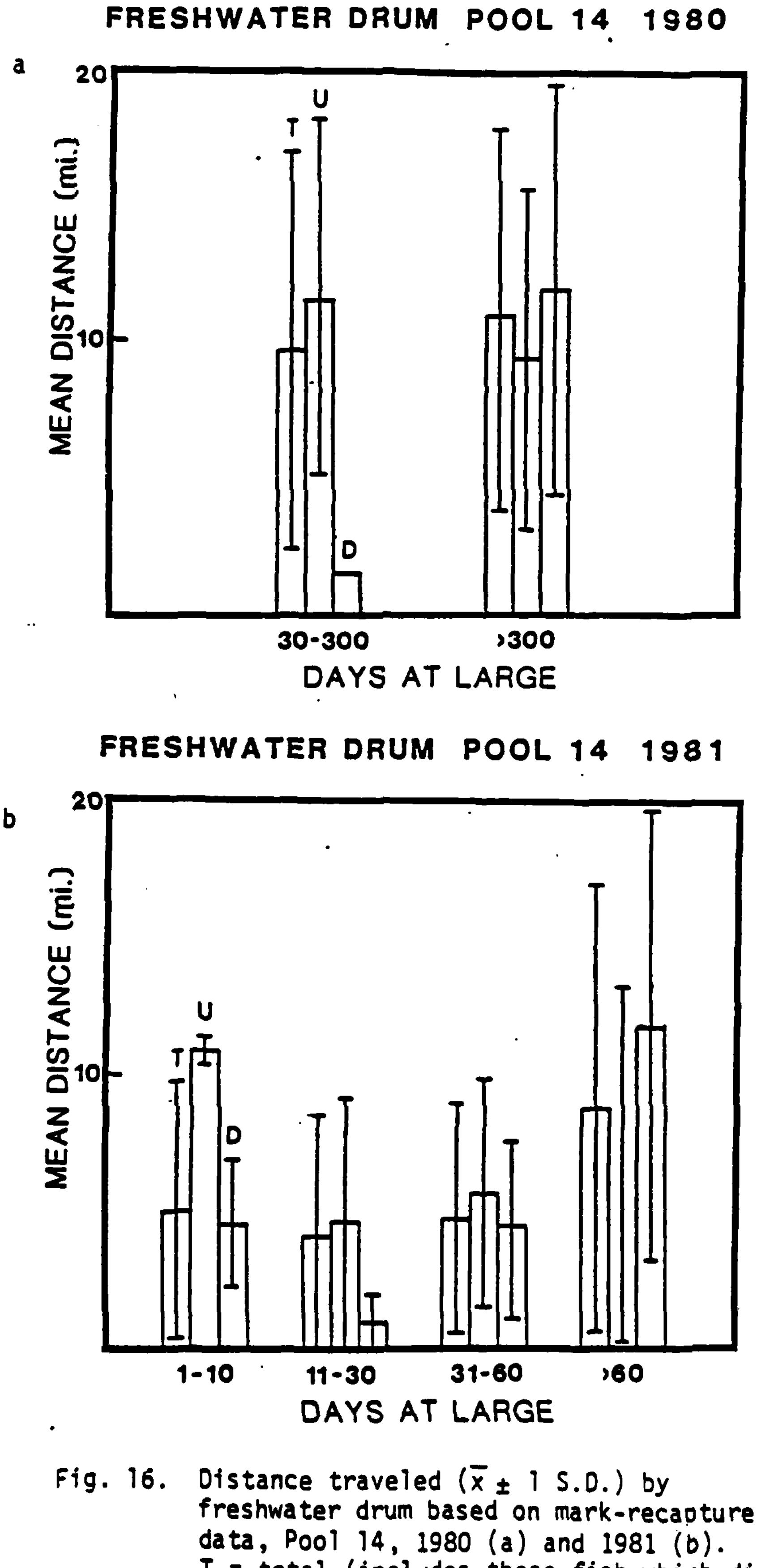
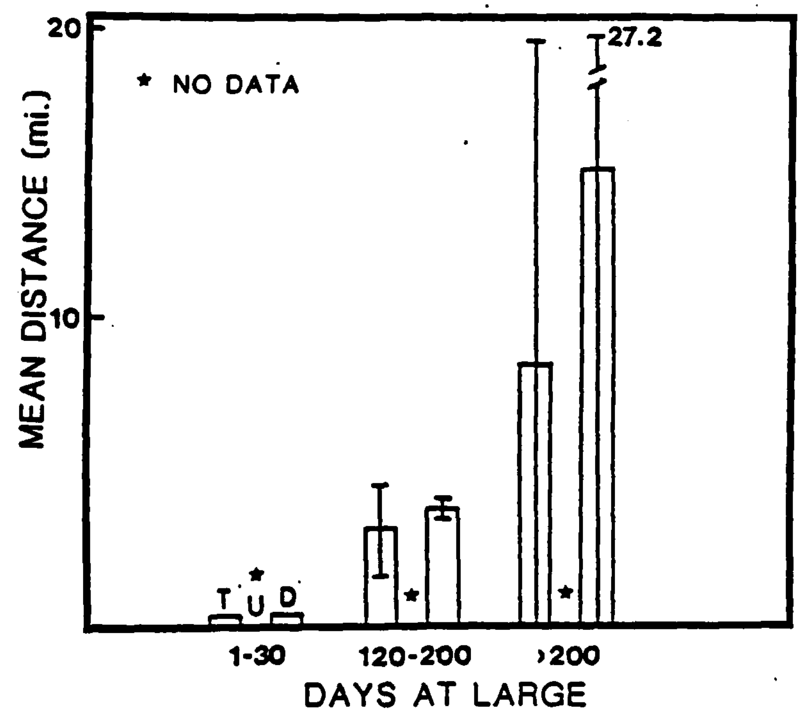



Fig. 16. Distance traveled ($\bar{x} \pm 1$ S.D.) by freshwater drum based on mark-recapture data, Pool 14, 1980 (a) and 1981 (b). T = total (includes those fish which did not move); U = upstream; D = downstream.

## FRESHWATER DRUM POOL 14 1978

a




## FRESHWATER DRUM POOL 14 1979

b

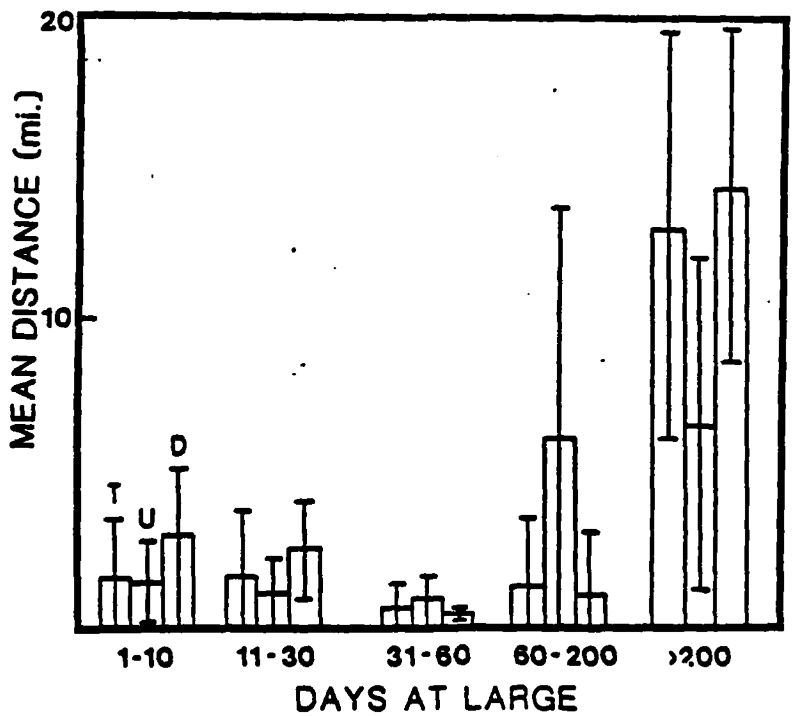
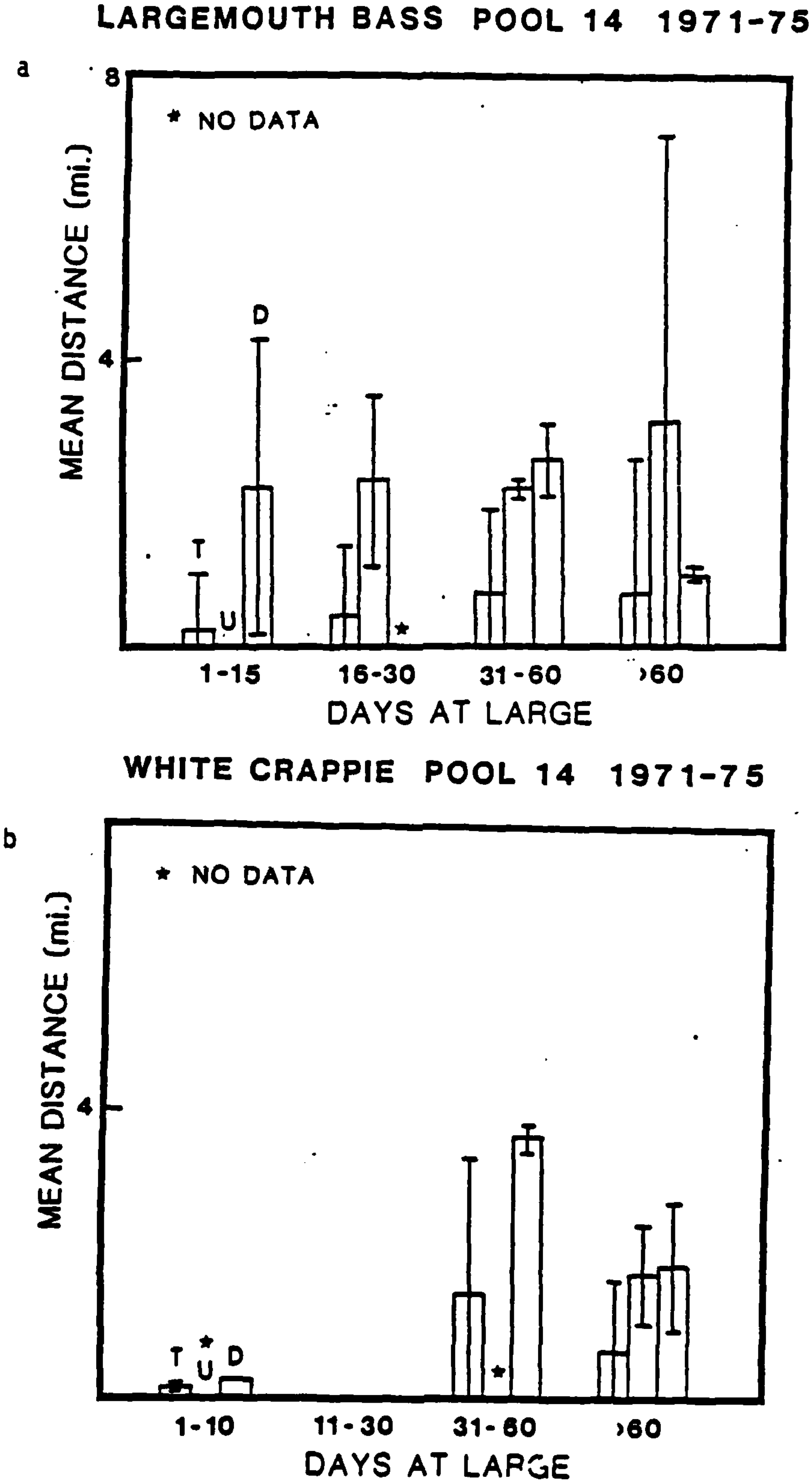



Fig. 17. Distance traveled ($\bar{x}$ ± 1 S.D.) by freshwater drum based on mark-recapture data, Pool 14, 1978 (a) and 1979 (b). T = total (includes those fish which did not move); U = upstream; D = downstream.




F. . 18. Distance traveled ($\bar{x}$ ± 1 S.D.) by largemouth bass (a) and white crappie (b) based on mark-recapture data, Pool 14. T = total (includes those fish which did not move); U = upstream; D = downstream.

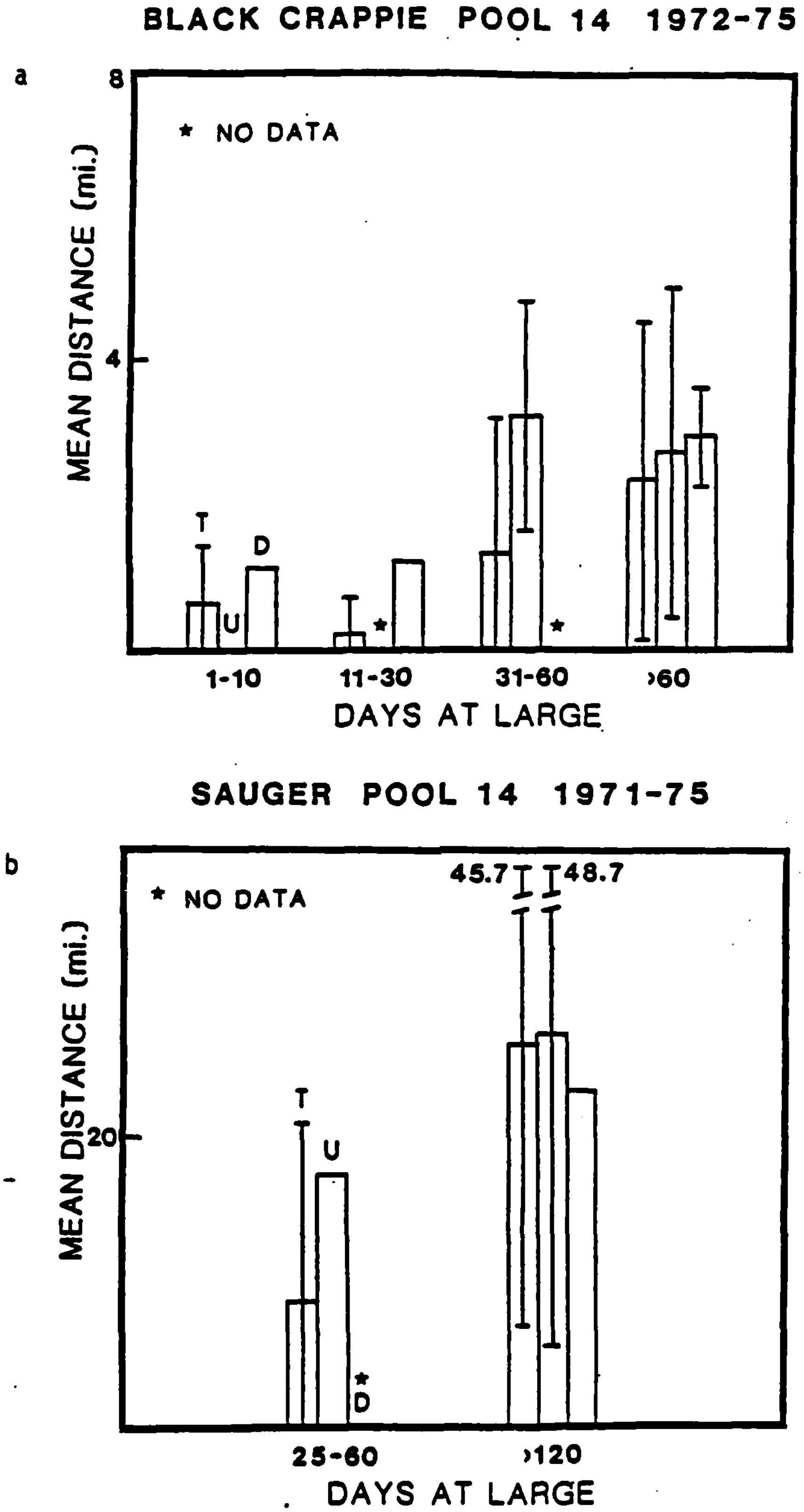



Fig. 19. Distance traveled ($\bar{x} \pm$ 1 S.D.) by black crappie (a) and sauger (b) based on mark-recapture data, Pool 14. T = total (includes those fish which did not move); U = upstream; D = downstream.

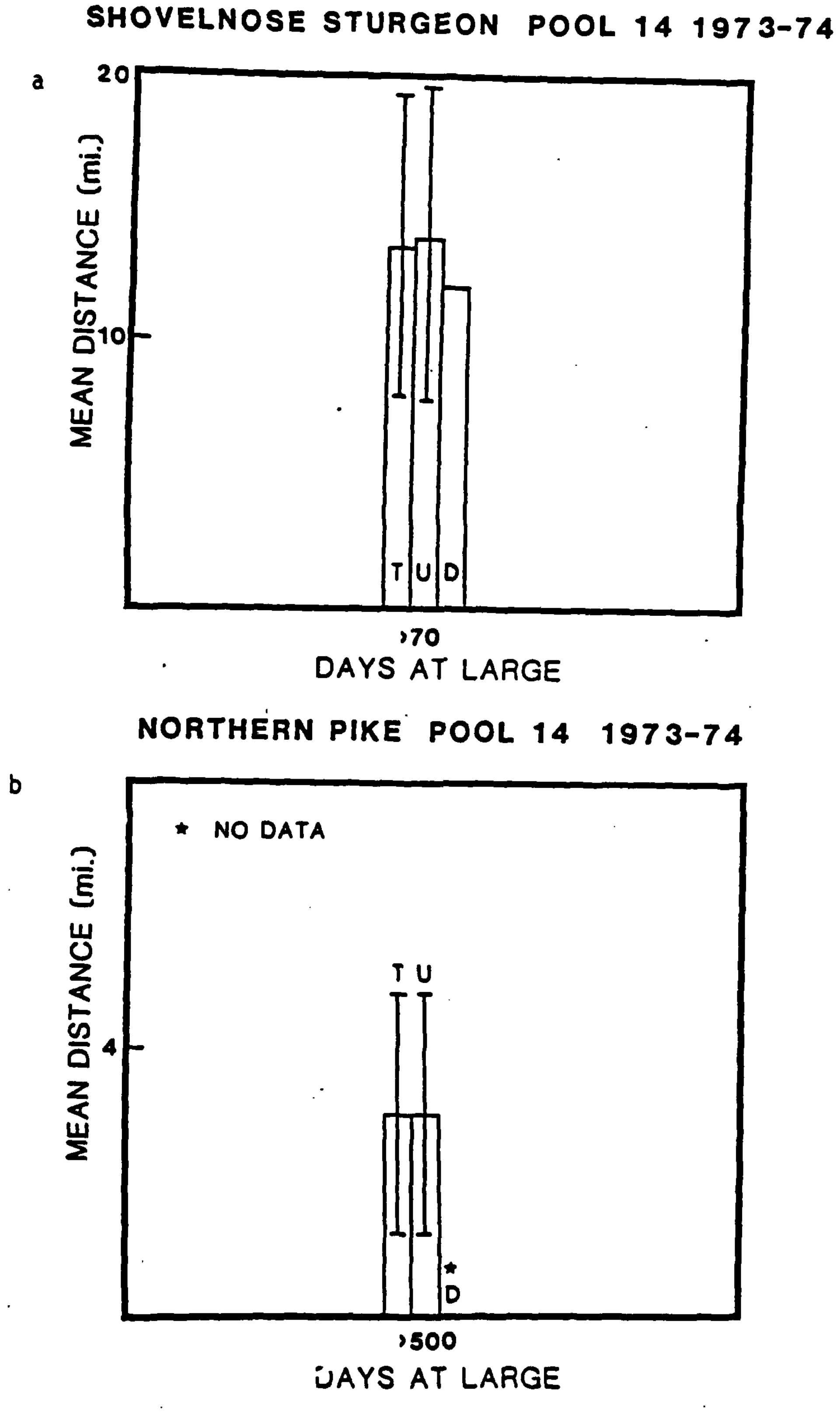



Fig. 20. Distance traveled ($\bar{x}$ ± 1 S.D.) by shovelnose sturgeon (a) and northern pike (b) based on mark-recapture data, Pool 14. T = total (includes those fish which did not move); U = upstream; D = downstream.

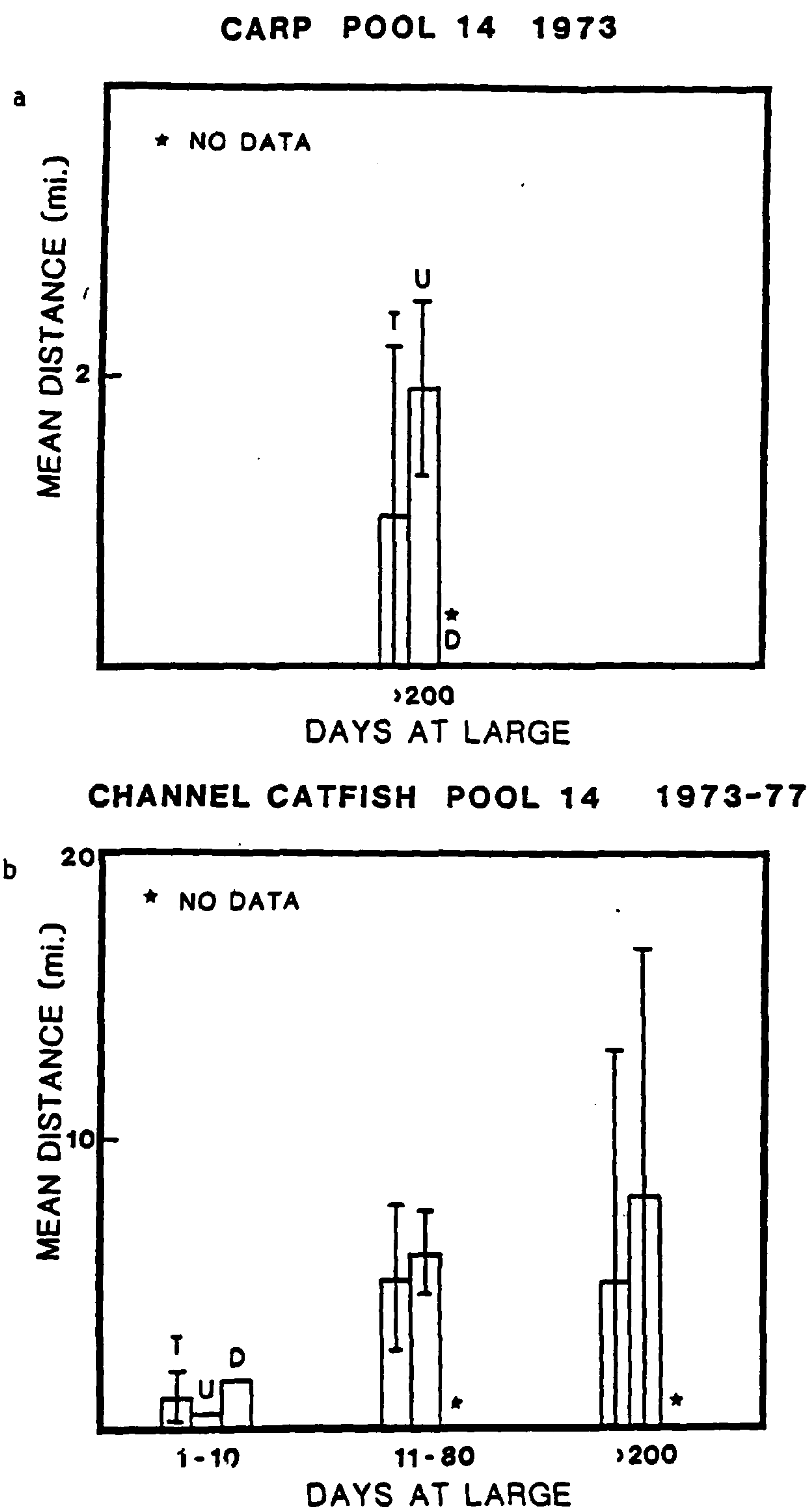



Fig. 21. Distance traveled ($\bar{x}$ ± 1 S.D.) by carp (a) and channel catfish (b) based on mark-recapture data, Pool 14. T = total (includes those fish which did not move); U = upstream; D = downstream.

# 3. FISH SPECIES KNOWN OR SUSPECTED TO UNDERGO MOVEMENTS THROUGH DAMS OF THE UPPER MISSISSIPPI RIVER

Of the 140 species of fish that have been collected in the UMR, only about 80 occur with any regularity in the study area (Van Vooren 1983). Very few of these species have been studied for either intrapool or interpool behavioral movements. Mark-recapture and telemetry studies have concentrated on 14 sport and commercial species. Movements through dams by eight species have been documented. In Table 2, we have included the time of movement if known, the primary direction of movement (e.g. movement upstream and then a return), suspected reasons for movements, approximate percent of fish moving through dams, and appropriate references.

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Wisconsin Department of Natural Resources. 1983a. Personal communication. Tom Pellett.

Wisconsin Department of Natural Resources. 1983b. Personal communication. Jim Holzer.

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Table 2. Fish species known to undergo movements through dams of the upper Mississippi River.

| Species | Season | Direction of movement | Suspected reason | Percent moving through dams | References |
|---|---|---|---|---|---|
| Shovelnose sturgeon | May-June | upstream and return | spawning | 0 | Wisconsin Department of Natural Resources 1977 |
| | | | | 8 | Helms 1974 |
| | | | | 0 | Hurley 1983 |
| | | | | 20 | Industrial Bio-Test Laboratories, Inc. 1975 |
| Paddlefish | unknown | downstream | feeding | 100 | Gengerke 1978 |
| Channel catfish | unknown | downstream | feeding | 18 | Hubley 1963 |
| | | | | 14 | Minnesota Department of Natural Resources, pers. comm. 1983 |
| | | | | 15 | Rathum 1971 |
| Flathead catfish | unknown | downstream | feeding | 3 | Wisconsin Department of Natural Resources, pers. comm. 1983a |
| | | | | 8 | Minnesota Department of Natural Resources, pers. comm. 1983 |
| | | | | 0 | Rathum 1971 |
| White bass | unknown | downstream* | ?, feeding | 12 | Finke 1966 |
| | | | | 0 | Hudson 1976 |
| Sauger | late April-early May | upstream and return | spawning behavior | 35 | Iowa State Conservation Department 1958 |
| | | | | 4 | Minnesota Department of Natural Resources, pers. comm. 1983 |
| Walleye | late April | upstream and return | spawning behavior | 39 | Iowa State Conservation Department 1958 |
| | | | | 8 | Bahr 1977 |
| | | | | 7 | Minnesota Department of Natural Resources, pers. comm. 1983 |
| | | | | 26 | Mississippi River Work Unit 1979 |
| | | | | 16 | Mississippi River Work Unit 1980 |
| | | | | 33 | Wisconsin Department of Natural Resources, pers. comm. 1983b |
| | | | | 14 | Holzer and Von Ruden 1982 |
| Freshwater drum | unknown | ** | spawning | 2 | Environmental Research and Technology, Inc. 1982 |

* Based on Finke 1966. However, white bass may move upstream to spawn in April to June in the UMR since in lentic systems they prefer running water of tributary streams (Becker 1983). Specific data for the UMR are unavailable.

** No identifiable preference for one direction.

## 4. GUILD ASSIGNMENTS

Reproductive guilds, feeding guilds, and economic guilds were defined to aid in the selection of representative, important fish species (Table 3). Each of the eight species with documented interpool movement has been assigned to various guilds (Table 4).

Table 3. Definitions of guilds applied to species known or suspected to occur in UMR main channel ichthyoplankton drift.

| General guild | Specific guild |
|---|---|
| Reproductive Guild | Non-guarder-open stratum |
| Species of fish, which utilize similar reproductive strategies, based on the physical parameters of their spawning and nursery habitats and on early life history behavior patterns. | Pelagophils: Nonadhesive eggs are released and scattered in the open water column. Near neutral or positively buoyant eggs. Larvae swim constantly and are positively phototropic. |
| | Litho-pelagophils: Eggs are deposited on rocks or gravel, but larvae become buoyant and water currents carry them downstream. |
| | Lithophils: Eggs are deposited on rocks etc. Larvae are highly photophobic. |
| | Phyto-lithophils: Eggs are deposited on submerged vegetation or logs, gravel, rocks. Many of the species have larvae with cement glands. Larvae usually closely associated with vegetation. |
| | Guarder-nest spawner |
| | Lithophils: Eggs are deposited in a single-layer or multi-layer on cleaned areas of rocks or in pits in gravel. |
| | Speleophil: Eggs are deposited and guarded in natural holes and crevices or in specially constructed burrows. |
| Feeding Guilds | Open-water |
| Species of fish whose adult stage incorporates the same general types of food and feeding position in the water column. | Omnivore: Adults feed up in the water column on a diversity of foods. |
| | Planktivore: Adults feed up in the water column by actively selecting plankton or sieving plankton from the water. |
| | Piscivore: Adults feed up in the water column. Fish make up the primary food of these fishes by volume. |
| | Surface-water |
| | Omnivore: Adults consume a variety of food organisms directly from the surface or from near-surface waters. |
| | Bottom-water |
| | Omnivore: Adults consume a variety of food organisms from directly on the bottom or disturb the bottom to obtain food actually located in bottom substrates. |
| | Piscivore: Adults feed in bottom waters. Fish make up a predominant portion of the diet by volume. |
| Economic Guilds | Recreational |
| Species of fish that provide monetary input into the local economy through commercial fisheries, recreational/sport fisheries, or indirectly as important forage fish for species in the above fisneries. | Tailwater: Species that are actively sought after by recreational fishermen in the tailwater habitats of UMR pools. |
| | Boat: Species that are actively sought after by recreational fishermen in a variety of habitats in UMR pools that require access by boat. |
| | Shore: Species that are actively sought after by recreational fishermen from shore areas of UMR pools. |
| | Commercial |
| | Food: Species that are collected by commercial fishermen and sold as food. |
| | Minor: Those species that are not caught in significant numbers by commercial fishing. |

Table 4. Predominant guild assignments for fish known to undergo significant movements through dams of the UMR.

| Species | Guilds* | Selected references* |
|---|---|---|
| *Scaphirhynchus platorynchus* | Nonguarder litho-pelagophil; bottom omnivore; commercial (minor) | Balon (1975); Held (1969); Becker (1983) |
| *Polyodon spathula* | Nonguarder litho-pelagophil; open water planktivore; commercial (minor) | Purkett (1961); Becker (1983); Becker (1983) |
| *Ictalurus punctatus* | Guarder, nest-spawner speleophil; bottom omnivore; commercial; recreational (shore, boat) | Balon (1975); Finke (1964); Rasmussen (1979) |
| *Pylodictis olivaris* | Guarder, nest-spawner lithophil; bottom piscivore; commercial; recreational (shore, boat) | Balon (1975); Minckley and Deacon (1959); Becker (1983) |
| *Morone chrysops* | Nonguarder phyto-lithophil; surface omnivore; recreational (boat, tailwater, shore) | Balon (1975); McNaught and Hasler (1961); Rasmussen (1979) |
| *Stizostedion canadense* | Nonguarder lithophil; open water piscivore; recreational (tailwater) | Balon (1975); Joy (1975); Becker (1983); Wright (1970) |
| *S. vitreum* | Nonguarder lithophil; open water piscivore; recreational (tailwater) | Balon (1975); Scott and Crossman (1973); Becker (1983) |
| *Aplodinotus grunniens* | Nonguarder pelagophil; open water omnivore; commercial | Balon (1975); Couey (1935); Becker (1983) |

* Reproductive guild; feeding guild; economic guild

## 5. RECOMMENDATION ON REPRESENTATIVE, IMPORTANT FISH SPECIES (RIFS) FOR FUTURE STUDY

Eight species are known to move through dams (Table 2). Each represents a different combination of guilds and we have included all of them in further discussion. However, given the limited time available for an evaluation of potential impacts from hydroelectric development on the river, a definite prioritization of the species can be given.

Data on walleye are most abundant and provide the best base for further study. Sauger appear to behave in a similar manner, but few telemetry data are available. Construction of the navigation dams has been blamed for reductions in shovelnose sturgeon populations. Populations of this species appear to have stablizied, however, they might be significantly altered by further development. The reproductive strategy of freshwater drum suggests that active upstream movements of adults are vital to the maintenance of populations in upper pools of the UMR.

Of the species that have interpool movements related to feeding behavior, we suggest study of the channel catfish because a good base of information exists for this species. We recommend that fish species be examined in the following order of priority: Priority #1 - walleye and channel catfish, Priority #2 - freshwater drum and shovelnose sturgeon, Priority #3 - sauger and paddlefish, and Priority #4 - flathead catfish and white bass.

## 6. LIFE HISTORY AND REPRODUCTIVE STRATEGY OF RIFS

The degree to which small-scale hydropower development on the UMR might affect the recruitment of fish species by limiting behavioral movements through dams depends heavily on their life history characteristics. This section presents relevant information on the distribution, abundance, and life history of the representative important fish species under consideration. The data utilized have been primarily summarized from Scott and Crossman (1973), Becker (1983), Van Vooren (1983), Balon (1975), and Pflieger (1975).

### Shovelnose Sturgeon

Shovelnose sturgeon (*Scaphirhynchus platorynchus*) occur from the Hudson Bay drainage southward to New Mexico, Arkansas, and Kentucky (Eddy and Underhill 1974). They inhabit the open channels of rivers near the bottom, usually in areas of swift current and sand gravel substrates. In the UMR, this species occurs in the tailwaters of dams and downstream from wingdams and other structures which accelerate water flow (Becker 1983).

The shovelnose sturgeon is collected only occasionally in the UMR but there are local concentrations in Pool 4 and downstream to Lock and Dam 26. They are found in Wisconsin only in the Mississippi River and in its major tributaries up to the first obstruction on those rivers (Helms 1973). The shovelnose is the most abundant sturgeon species in the Mississippi River (Van Vooren 1983).

Adults mature and spawn at V to VII years of age. Males mature at about 551 mm, females at about 645 mm (Helms 1973). It is generally accepted that this species migrates upstream during the spawning season, runs on the Mississippi River are variable: best when discharge is low and poor when discharge is high (Becker 1983).

This species apparently spawns in open channels of large rivers in strong current (Pflieger 1975) at water temperatures of 19.5 to 21.1°C. Spawning may also occur in the tailwaters of navigation dams of the UMR (Farabee 1979). Fecundity ranges from 13,908-57,217 for females 61-85 cm TL (Helms 1973). Demersal, glutinous eggs, which adhere to objects after spawning, are deposited over rock or gravel substrates (Pflieger 1975).

## Paddlefish

The paddlefish (*Polydon spathula*) occurs in large rivers and reservoirs of central North America with rare reports from the Great Lakes (Becker 1983). This species is rare in Minnesota (Miller 1972) and is under study as a possible threatened species in Wisconsin (Les 1979). Although this fish was formerly abundant in much of the UMR, overharvest, pollution, and destruction of spawning habitat have contributed to a decline to where it is now rare and only occasionally collected (Becker 1983, Pflieger 1975, and Van Vooren 1983).

Paddlefish inhabit quiet or slow-flowing, open waters where they filter-feed on plankton. Spawning occurs in the spring over gravel bars at temperatures above 10°C (Purkett 1961). Fecundity ranges from 226,000-519,000 eggs per female (Farabee 1979), however, spawning may not take place every year (Eddy and Underhill 1974). Eggs are demersal and adhesive after fertilization. Incubation is reported to be from 12-24 days (Purkett 1963). Larvae in the yolk-sac stage show an irregular vertical swimming behavior (Purkett 1961). Sexual maturity is reached at about age VII (~ 102 cm) in males and age IX or X (~ 107 cm) in females.

## Channel Catfish

The channel catfish (*Ictalurus punctatus*) is distributed throughout most of the eastern United States (Becker 1983). In the UMR, it is common in all pools (Van Vooren 1983). Channel catfish frequent large rivers in areas that range from no current to swift current (Scott and Crossman 1973). Cool, clear, deep waters or muddy waters are common habitats (Scott and Crossman 1973). These fish are usually located on or near the bottom and are most active at dusk and dawn.

Channel catfish are nest spawning speleophils (Balon 1975). Fecundity is variable, ranging from 1,000 to 7,000 (Carlander 1953, Jearald and Brown 1971). Their eggs are demersal and very adhesive. Spawning usually occurs between May and July at an optimum temperature of 26.7°C (Becker 1983). Incubation is from 5-10 days at 15-27°C (Scott and Crossman 1973) and larvae have their full fin compliment before the yolk is absorbed (Jones et al. 1978). Larvae are guarded by the male and travel in tight schools until they disperse as juveniles. Young are rarely collected in plankton nets, but are abundant in trawl samples from the main channel, particularly those taken at midnight (Holland and Sylvester 1983).

## Flathead Catfish

Flathead catfish (*Pylodictius olivaris*) are distributed from the Mississippi Valley south to Mexico through the Gulf states, north to Pennsylvania and New York, west to Nebraska. The northern limit for the species is southern Minnesota and Wisconsin. Flathead catfish are common in Pools 1 to 7 and Pool 20 to the mouth of the Ohio River. They are collected occasionally in Pools 9-19 (Van Vooren 1983).

Flatheads inhabit a variety of streams but they avoid systems with high gradients or intermittent flows (Pflieger 1975). Adults occur in pools near logs, piles of drift, and other cover. The young may be found among the rocks in riffles (Pflieger 1975).

This species builds nests in protected areas, in holes (Pflieger 1975), or shallow depressions (Scott and Crossman 1973). Nests are typically located in hidden and secluded areas in lakes and rivers. Fecundity ranges from 6,900-11,300 (Minckley and Deacon 1959). Eggs are demersal and adhesive and form a mass when deposited (Scott and Crossman 1973). Incubation is 6-7 days at 23-27°C (Giudice 1965). Upon hatching, the young stay in a compact school near the nest, later they become solitary and active at night (Pflieger 1975). The male guards the nest and young until they are juveniles (Katz 1954).

## White Bass

White bass (*Morone chrysops*) occur from the St. Lawrence River west to South Dakota and south through the Ohio and Mississippi River drainages (Scott and Crossman 1973). In the UMR, this species is common in all pools and reaches (Van Vooren 1983). They often travel in schools and are surface feeders (Scott and Crossman 1973).

White bass spawn near the surface in shoal areas; spawning may extend over periods from 3 days to as long as several weeks (Becker 1983). Spawning occurs when water temperatures range from 12.8 to 26.1°C (Scott and Crossman 1973) with a peak at 16.9-22.6°C (Horrall 1962). Any rapid increase in water temperature during the spring triggers an increase in reproductive activity and shortens the spawning period (Becker 1983). Fecundity is variable but has a mean of 565,000 eggs per female (Riggs

1955). Eggs hatch at 20.2°C in 45 hours from a Wisconsin lake (Horrall 1962). Eggs are adhesive and demersal. This species is a phyto-lithophil (Balon 1975) which implies that the larvae are closely associated with vegetation. Yolk-sac stages are uncommon in the drift. However, older larvae are very abundant in the drift in side channel areas associated with flooded hardwoods (Holland et al. 1983) and are common in the drift from many of the pools discussed earlier.

## Walleye

Walleye (*Stizostedion vitreum*) are common in many drainage systems of central and northern North America and in the UMR above Lock and Dam 20 (Van Vooren 1983). They inhabit open waters of lakes and reservoirs, pools of streams over gravel, bedrock, and firm bottoms, and are particularly common in tailwaters of dams on the UMR where turbidity of the water is lowest (Pflieger 1975 and Holland and Huston 1983).

Spawning is commonly preceded by movements out of large rivers and reservoirs into tributaries and side channels; males arrive at the spawning grounds ahead of females. The presence of a firm silt-free substrate and a strong circulation of water are the principle characteristics of spawning sites (Pflieger 1975). During high water periods in the UMR, adult walleye may move into stands of flooded timber (Pitlo, pers. comm. and Holzer, pers. comm.) and tailwaters where spawning occurs. This species is a kpredominantly lithophil reproductive strategist (Balon 1975). Fecundity ranges from 140,000-180,000 (Smith 1979) and the incubation is approximately 7 days at 13.9°C (Niemuth et al. 1959). Its eggs are initially adhesive, but they later become nonadhesive and are demersal to semi-buoyant.. Larvae are highly photophobic and scatter quickly amongst bottom materials (Balon 1975).

### Sauger

The sauger (*Stizostedion canadense*) is common in many of the major river systems in central North America and it is common in all 27 pools of the UMR (Van Vooren 1983). The species is more tolerant of silted bottoms and turbid waters than the walleye. Sauger prefer shallow, turbid lakes or large, turbid, slow-flowing rivers (Scott and Crossman 1973) and are particularly common in tailwaters on the UMR.

Spawning habitat appears to vary with location. In lakes, spawning takes place in shallow waters over sand or gravel (Scott and Crossman 1973). In the UMR, spawning occurs in main channel border areas (Pitlo, personal communication) and in tailwaters. This species is a lithophil reproductive strategist (Balon 1975). Fecundity is less than that of the walleye 15,000-40,000 per female (Smith 1941) and the incubation period is 21 days at 8.3°C (Nelson 1968). Eggs are initially adhesive, but later they become nonadhesive and are demersal to semi-buoyant. Larvae are highly photophobic and scatter quickly amongst bottom materials (Balon 1975). Ichthyoplankton sampling with conventional gear seldom catches larvae.

### Freshwater Drum

Freshwater drum (*Aplodinotus grunniens*) occur throughout major river drainages of central North America. They inhabit large rivers, lakes, and impoundments (Becker 1983). The species prefers open, turbid waters of warm, sluggish lakes and streams. Freshwater drum are common to abundant in all pools and reaches of the UMR (Van Vooren 1983).

Spawning occurs pelagically in open waters, usually from May to the end of June, at water temperatures of 19 to 22°C (Becker 1983). This pelagophil reproductive strategist (Balon 1975) has highly pelagic eggs and buoyant yolk-sac stage larvae. Fecundity is variable, ranging from 43,000 to 508,000 eggs (Daiber 1953) and incubation is from 24-48 hours (Becker 1983). Eggs and larvae concentrate above locks and dams of the UMR and densities at such locations can be several times those found elsewhere (Holland and Sylvester 1983).

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## 7. BEHAVIOR OF RIFS IN RELATION TO ADULT FISH MOVEMENT

### Shovelnose Sturgeon

Shovelnose sturgeon are generally sedentary (Helms 1974, Moos 1978, Hurley 1983), however, movements traveled during the spring spawning periods (late-May or early-June, 19-21°C) (Christenson 1975, Hurley 1983) are greatest. Both upstream and downstream interpool movements have been documented during periods of high flow when dam gates were open (Helms 1974, Hurley 1983). This indicates that dams may potentially be an effective barrier to sturgeon movements when the dam gates are closed. Most mark-recapture data indicate upstream movement patterns (Table 2, Appendix Tables 1, 2). Movements among a series of home areas were postulated by Moos (1978), but were not observed in displacement experiments on tagged sturgeon. Hurley (1983) documented eight fish exhibiting homing behavior. Current velocity is probably important in distribution and movement. Hurley (1983) found shovelnose sturgeon preferred current velocities of 20 to 40 cm/sec near the bottom and 40 to 70 cm/sec at the surface. This species is more tolerant of higher current velocities than other species. However, strong current appears to be a factor limiting the abundance of shovelnose sturgeon in the main channel. Helms (1974) suggested that movements of this species may be explained by its preference for lotic conditions.

### Paddlefish

Paddlefish are very mobile, capable of moving as much as 2,000 km (Rosen et al. 1982). Most movement occurs in the spring when spawning adults may make extensive upstream migrations (Southall 1982). Preferred spawning habitat is thought to be gravel shoal areas with swift current

(Purkett 1961). Movements to these areas are apparently triggered by photoperiod, water temperatures of greater than 10°C, and rising water levels. Low water levels in the spring may interfere with spawning or spawning migration (Needham 1965, Elzer 1977). Southall (1982) states that closed dam gates and low flows may block or delay upstsream spawning migrations. Coker (1929) also indicated that dams were an effective barrier to upstream paddlefish movements. Passage through the lock was found to be minimal. However, it was reported that downstream passage occurred without injury. Downstream interpool movement has been observed in other studies (Purkett 1963, Gingerke 1978, Southall 1982). Movements during non-spawning periods are generally thought to be random in direction and reduced in distance as related to feeding behavior. Gengerke (1978) found most movements were downstream, but his findings were based on only 18 tag returns (Table 2, Appendix Table 3). However, Rosen et al. (1982) observed long migrations downstream in the Missouri River. In this study, upstream movement was barred by the Gavins Point Dam.

## Channel Catfish

Observation on channel catfish movement patterns in the UMR are based on mark-recapture studies. This species has been found to move long distances at various times not related to spawning. Both upstream and downstream movements have been documented with several fish passing through dams (Hubley 1961, 1963). No evidence of dams blocking channel catfish interpool movement was reported.

Most likely, downstream movements of this species in the summer are related to random foraging behavior (Table 2, Appendix Tables 7, 8). One radio-tagged channel catfish was documented passing through Lock and Dam 9 in November 1983 (Pam Thiel, personal communication). Movements have been observed both into and out of tributaries of the Mississippi River (Ranthum 1971, Brynildson 1964, Hubley 1963). Timing of interpool movements has not been consistantly correlated with any environmental parameters.

## Flathead Catfish

A limited number of studies indicate that most movements are small (Table 2, Appendix Tables 7, 8), probably related to foraging behavior. However, movements of up to 80 km have been documented as well as movement through dams (Funk 1957, Larry Gates, personal communication). From the available data, there is no indication that environmental parameters are of value in predicting interpool movements. Hart (1974) observed homing behavior of flathead catfish in a reservoir in Oklahoma.

## White Bass

Upstream movements of white bass may be related to spawning since they prefer running water of tributaries for spawning (Becker 1983). However tagging data indicate a pattern of downstream movement (Table 2, Appendix Table 11). Finke (1966) found that white bass in the UMR are mobile and capable of extended journeys up to 211 km. Telemetry studies in Lake Mendota, Wisconsin suggest active movements during feeding as well as during homing behavior (Hasler et al. 1969). Since no telemetry studies have analyzed movements of this species over a year period, no comments on actual reasons for movement, the importance of movement, or on environmental cues can be made.

## Walleye

Walleye clearly move between pools during spawning behavior but mark-recapture data reveal no distinct preference for direction of movement (Appendix Tables 24-31). Holzer and Von Ruden (1982), used radio telemetry to document dramatic patterns of upstream movement for this species that occur during a very distinct period (Figures 10-12). Movement appears to be cued by a specific combination of flow and temperature. Spawning migration occurs soon after ice out at 3.3-6.7°C. Bennett (1965) reports that walleye are active during the spring when water temperatures are low. Marked walleye in Leech Lake, Minnesota were recaptured in the spring at a distance further away from the release site than those released and recaptured during other seasons (Schupp 1972). This is concurrent with Eddy and Surber (1947) who found that higher water temperatures in the summer reduce walleye activity. Further analyses may identify other environmental stimuli and provide an accurate model to predict probable periods of movement through dams.

## Sauger

Mark-recapture data indicate downstream movements (Appendix Tables 20-23) for sauger and, as for walleye, is probably related to spawning. Sauger made runs up nearby rivers to spawn from Lake Erie (Fish 1932). As the water warmed, they moved downstream to the lake. Collette et al. (1977) reported this species to be the most migratory of the percids. Saugers congregate in the tailwaters of Fort Randall Dam on the Missouri River (Nelson 1969). After the completion of spawning, sauger returned to Lewis and Clark Lake. However, few data are available to determine the environmental cues that mitiate sauger movements.

## Freshwater Drum

Based on mark-recapture data, no identifiable preference for upstream or downstream movement can be identified (Table 2, Appendix Table 32). Nord (1967) found only movement into shallow waters in spring and back into deep water of the main channel in late fall. However this species has pelagic eggs and significant downstream transport of young; consequently, it is probable that upstream movements occur prior to spawning. Without a telemetry study, no further evaluation can be made.

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## 8. SWIMMING SPEEDS OF REPRESENTATIVE, IMPORTANT FISH SPECIES (RIFS)

Assessments of swimming speeds are critical to discussions of potential impacts of hydropower development because of changes that may occur in current regimes. Many studies have been done on the swimming speeds of anadromous fish because of the effect of impoundments on their migration. Little information, however, is available on non-migrating species.

Several methods can be used to measure swimming speeds for fish. Laboratory methods using flow through chambers in which oxygen, temperature, and velocity can be controlled give accurate estimates (Brett and Glass 1973, Davis et al. 1963). These values may overestimate true speeds due to the controlled variables (i.e. temperature and velocity) which may fluctuate greatly in the environment. Field techniques (i.e. tagging studies or radio-telemetry) are also used to estimate swimming speeds (Hurley 1983, Southall 1982). Summerfelt et al. (1972) found that speeds based on data from tagging studies may produce underestimated speeds 6.3 times smaller than actual swimming speeds. Therefore, a combination of methods is best used when estimating swimming abilities of fish.

Equations relating swimming speed to body length have also been developed (Brett 1964, Blaxter 1969) as a way to estimate speed of travel. Burst speed estimates range from 2 body lengths/sec up to 10 body lengths/sec (Lagler et al. 1962). Sustained travel speeds have been measured as 1-3 body lengths/sec (Brett 1964). These formulas, however, assume that the increase in swimming speed is proportional to body length.

Hunter (1971) reported that swimming speeds are proportional to a fractional power of length (L) equal to $<0.6 \pm 0.1$. Fish use the whole length of their body to generate the energy required to swim. However, body morphology, as well as length, are important in determining swimming speeds. Calculated sustained and burst speeds (Brett 1964, Bainbridge 1961;) used only length and not body morphology (Table 5). Therefore, an overestimate of swimming abilities resulted as compared to Hunter's figures.

Known values of the RIF species swimming speeds are listed in Table 6. Most of these values were derived from tagging studies which measured distance traveled over time. Although these values are minimum speeds of movement, they give a more accurate estimation of the fishes movement than speeds calculated from equations.

Oxygen, food availability, temperature, and velocity also affect a fish's swimming ability (Hocutt 1973, Farlinger and Beamish 1977). Increases or decreases in temperature may reduce the ability of fish to swim because they are cold-blooded and they react to the temperature of their environment. Each species has an optimal temperature range, as well as $O_2$ range, and values above or below this affect their swimming ability. Field study values, therefore, represent only an approximation of swimming ability since no control of environmental variables is available. Since these variables may be changed by hydropower developments, detailed studies of swimming abilities of freshwater-non-migrating fishes are needed.

## Shovelnose Sturgeon

Experimental data on burst speeds, actual sustained speeds, and environmental influences on shovelnose sturgeon are unavailable. However, information on the swimming ability of this species from tagging studies is available. These values are included to estimate the swimming ability of sturgeon. Radio-tagged sturgeon averaged 339 m/day with movements up to 11.7 km/day in Pool 13 of the UMR. They were most active in May (their spawning period) and moved an average of 600 m/day. There was no significant pattern in the direction moved (Hurley 1983).

Recaptured, strap-tagged sturgeon moved 1,717 m/day (Hurley 1983). In a study by Helms (1974), tagged sturgeon moved a maximum of 193 km in 255 days (728 m/day). A tagging study on the Chippewa-Red Cedar River system showed that the 14 recaptured sturgeon moved an average of 10 m/day with one fish moving a maximum of 1,577 m/day (Christenson 1977).

## Paddlefish

No information is available on actual or experimentally-calculated swimming or burst speeds of paddlefish. However, based on tagging studies, the greatest movement of a paddlefish in Pool 13 of the UMR was 1.9 cm/sec (187.5 km in 114 days) (Gengerke 1978). This figure is low when compared to sustained and burst speeds calculated for this species (Table 5). Southall (1982) measured 148 cm/sec as the fastest speed recorded in his study. The greatest movement for this species occurred in the spring and the overall median minimum distance moved during this period was 0.8 cm/sec.

## Channel Catfish

Hocutt (1973) reported that juvenile channel catfish swim at 41.66 cm/sec (Table 6) based on a value calculated in an experimental test chamber. Adult channel catfish speeds have been reported as 0.66 cm/sec (Funk 1953). This value is far less than calculated values (Table 5) but the method used for determining swimming speed was not reported (Funk 1953).

## Flathead Catfish

A detailed study on the burst and sustained speeds of flathead catfish was done by Summerfelt et al. (1972). Experimental methods were used to calculate a burst speed of 105 cm/sec and fish were observed swimming 22.8 to 27.6 cm/sec for 20 to 30 minutes. Fish were forced to swim against a strong gradient or receive an electric shock. The experimental values obtained are also much less than those calculated for this species (Table 5).

## White Bass

No information is available on the burst or sustained speeds of white bass, except for one tagging study. Finke (1966) reported that white bass moved 15 miles in 10 days or 2.78 cm/sec (Table 6). This rate is far below values calculated for white bass (Table 5).

## Walleye

No studies have been done on burst speeds, however, several studies have been done on the swimming abilities of walleye. Using radiotelemetry, Kelso (1978) indicated maximum swimming speeds of 3.7 body lengths/sec. However, 86% of the fish in his study moved less than 1 body length/sec. Bahr (1977) used radiotelemetry data to calculate swimming speeds of walleye. The average random swimming rate was 3.42 cm/sec and the average directional swimming rate was 14.3 cm/sec (Table 6). Sustained swimming ability of larval walleye (over 9.5 mm) has been calculated in an experimental setting as approximately 3 to 4 body lengths/sec for 1 hour (Houde 1969). In addition, calculated sustained speed and burst speed were derived using formulas from Brett (1964) and Bainbridge (1961) (Table 5). Such values are much higher than those calculated from tagging studies; perhaps because the values from tagging studies are obtained by taking the distance traveled divided by the time at large. Such values represent only minimum swimming speeds because movements at large are unknown.

### Sauger

Few studies have been done on the burst or sustained swimming ability of sauger. Cleary (1958) estimated swimming speeds based on a tagging study. Maximum travel speed based on his work is listed as 3.56 cm/sec (Table 6). This value is almost equal to the average value for directional movement of walleye (Bahr 1977). It is also close to the value Kelso (1978) reports as the maximum swimming movement (Table 6). This may be due to the similarity in body shape of the two species. Calculated sustained and burst speeds of this species are much higher than those derived from field and test observations (Table 5).

## Freshwater Drum

Information on the swimming abilities of freshwater drum is lacking but maximum sustainable and burst speeds can be calculated using formulas from Brett (1964) and Bainbridge (1961). Maximum sustained speeds range from 26 to 77.6 cm/sec, while burst speeds ranged from 141 to 370 cm/sec (Table 5). Cruising speed was calculated (Table 6) by dividing distance traveled by days at large for 14 freshwater drum tagged by Industrial Bio-Test Laboratory (1982). The resultant cruising speed, 0.84 cm/sec, is considerably less than the calculated maximum sustained speed.

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Table 5. Calculated sustained speed and burst speed for RIF species of the UMR. Sustained speed is measured as 2 x TL and burst speed as $ax^b$ where a = 14.8/s, x = body length (cm), and b = 0.88. Total lengths (TL) are for end of 1st year, at age of maturity, and at average age of adult fish, respectively.

| Species | Age | TL (mm) | Sustained speed (cm/s)* | Burst speed (cm/s)** |
|---|---|---|---|---|
| Shovelnose sturgeon | 1 | 213 | 42.6 | 218 |
| | 4 | 399 | 79.8 | 698 |
| | 8 | 483 | 96.6 | 826 |
| Paddlefish | 1 | 292 | 58.4 | 288 |
| | 4 | 612 | 122.4 | 552 |
| | 7 | 988 | 197.6 | 842 |
| Channel catfish | 1 | 150 | 30 | 160 |
| | 4 | 300 | 60 | 295 |
| | 6 | 500 | 100 | 462 |
| Flathead catfish | 1 | 168 | 34 | 177 |
| | 4 | 450 | 90 | 421 |
| | 7 | 703 | 140 | 622 |
| White bass | 1 | 119 | 23.8 | 130 |
| | 3 | 277 | 54 | 275 |
| | 5 | 335 | 67 | 325 |
| Walleye | 1 | 100 | 20 | 112 |
| | 3 | 300 | 60 | 295 |
| | 5 | 518 | 103 | 477 |
| Sauger | 1 | 114 | 22.8 | 125 |
| | 3 | 264 | 52.8 | 263 |
| | 6 | 361 | 72.2 | 347 |
| Freshwater drum | 1 | 130 | 26 | 141 |
| | 3 | 256 | 51.4 | 257 |
| | 7 | 388 | 77.6 | 370 |

* Brett, J. R. 1964. The respiratory metabolism and swimming performance of young sockeye salmon. J. Fish. Res. Board Canada 21:1183-1226.

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Table 6. Swimming speeds for RIF species reported in the literature.

| Species | Swimming speed* | References |
|---|---|---|
| Shovelnose sturgeon | .69 cm/sec - May (spawning)<br>.26 cm/sec - May to August combined | Hurley 1983* |
| Paddlefish | 147.75 cm sec - maximum downstream travel speed<br>.70 cm/sec - summer 1981 | Southall 1982* |
| Channel catfish | .66 cm/sec - maximum travel speed<br>41.66 cm/sec - juvenile | Funk 1953*<br>Hocutt 1973* |
| Flathead catfish | 7.2 cm/sec maximum travel speed<br>105.0 cm/sec - burst speed | Summerfelt et al. 1972* |
| White bass | 2.78 cm/sec - upstream travel speed<br>1.45 cm/sec - travel speed | Finke 1966* |
| Walleye | 3.42 cm/sec - average random movement<br>14.3 cm/sec - average directional movement | Bahr 1977* |
| | 3.7 body lengths/sec - maximum<br>1.9 body lengths/sec - majority | Kelso 1978* |
| Sauger | 3-4 body lengths/sec - larval > 9 mm<br>3.56 cm/sec - maximum travel speed | Houde 1969*<br>Cleary 1958* |
| Freshwater drum | .84 cm/sec - average travel speed | Industrial Bio Test Laboratories 1982*<br>Quad-Cities Annual Report |

* Values reported or calculated were based on studies; these values are minimum speeds because movement from time of tagging to time of recapture is not known.

## 9. STATUS OF RIFS POPULATIONS

To properly evaluate our ability to discern impacts of hydropower development over time on the selected test species, it is necessary first to determine if the present populations are stable or if other unrelated stresses are affecting or could affect the populations. A variety of sources, including unpublished sport and commercial catch statistics for the various pools were obtained and synthesized for comparison to historical data. This is not intended to be an exhaustive evaluation of long-term changes in fish populations of the UMR, but rather it is a brief discussion of trends. Harber et al. (1981) noted that "the lack of good commercial fishing records and the selectivity of the gear itself made determining the relative abundance of channel . . . catfish very difficult." This is true for many species and a more comprehensive analysis of population trends of the RIFS will be required prior to final impact analysis.

### Shovelnose Sturgeon

Shovelnose sturgeon have been adversely affected by the construction of locks and dams on the river system and as a result occur in relatively low numbers (GREAT I 1980). Commercial catch records indicate that historically the shovelnose sturgeon was much more prevelant in the catch (1894: 432,000 lbs.; 1899: 383,000 lbs.; 1922: 119,000 lbs.; 1956: 120,160 lbs.; 1962: 18,385 lbs.). However, during the 25-year period (1953-1977), sturgeon harvest has not shown a significant trend (Farabee 1979, Kline and Golden 1979).

Iowa biologists have computed annual harvest in their states waters as approximately 16% of the total population for pools with substantial fishing interest for sturgeon. Total annual mortality was estimated at nearly 60%; fishing mortality contributed to 5-25% (Farabee 1979). Commercial harvest of shovelnose sturgeon does not appear to be affecting this species.

## Paddlefish

No significant trend in the commercial harvest of paddlefish from 1953-1977 was found by Kline and Golden (1979). Recent harvest figures are much lower than in the late 1950's but they are greater than those of the early 1960's. This fish is listed as "a species that may or may not be holding its own at the present time" in Wisconsin (Hine et al. 1973). Farabee (1979) predicted that, in the near future, paddlefish could become a more important sport fish in the upper Mississippi River since both Iowa and Illinois have recently established a fishery.

## Channel Catfish

Although Kline and Golden (1979) reported an apparent trend toward over exploitation of the channel catfish fishery during the 25-year period (1953-1977), no statistical trend existed. However, a significant trend toward an increase in the population of Pool 4 and decreases in the populations of Pools 3, 6, and 9 do exist.

Wisconsin Department of Natural Resources' data for the period 1973-1982 show a general increase in catch/effort in Pool 4 and decreases in Pools 7, 8, 9, and 10 (Table 7). Total catches in Pools 7, 8, 9, and 10 appear to decreasing, but are stable or increasing in other pools (Table 8).

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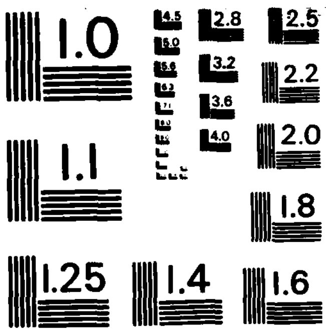


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## Flathead Catfish

No information is available on the status of flathead catfish populations in the upper Mississippi River. These fish are a minor component of the commercial and sport fishery.

## White Bass

Creel census estimates for the study area indicate that the catch/man-hour fluctuates from year to year for this species (Tables 9-12). However, overharvest does not appear to be a problem (Farabee 1979). Insufficient catch statistics exist to properly evaluate trends in the population.

## Walleye

Walleye are listed as common in all pools of the UMR (Rasmussen 1979). A creel survey of Pools 4, 5, 7, 11, 13, 18, and 26 ranked walleye 6-8 in the top ten sport fish captured by total number. It ranges from ?.4% of the catch in 1962-1963, to 5.4% in 1967-1968 and 6.9% in 1972-1973 (Rasmussen 1979). No distinct trend is evident from a creel survey on Pool 7 (Table 9). Catch/man hour increases slightly from 1962-1973, however, total numbers of fish varies greatly (Table 10). A creel survey on Pools 8-9 in 1971-1973 do not indicate significant trends (Tables 11, 12). Although catch/man hour is relatively low for all years. Catch for this species was always less than that for sauger.

## Sauger

Catch of sauger/man-hour increased steadily from 1967 through 1973 in Pool 7 (Tables 9, 10). Catch/man-hour was relatively stable in Pools 8 and 9 between 1971 and 1973 (Tables 11, 12). Farabee (1979) found that sauger were becoming an increasingly important sport species based on creel surveys for the period 1962 through 1973 (Nord 1964, Wright 1970, Fleener 1975). The populations remained fairly stable between 1976 and 1979 (Table 13).

### Freshwater Drum

Total harvest of freshwater drum and catch/effort data (Tables 9-12) remained fairly constant in the sport catch between 1962 and 1973 (Nord 1964, Wright 1970, Fleener 1975). Kline and Golden (1979) found trends in the commercial catch for the period 1953-1977:

Increase - Pools 5A, 8, 9, 10

Decrease - Pools 4, 5

Over the last 10 years, the total catch appears to have increased in Pools 4 and 5 and remained fairly constant in Pools 6, 7, 8, 9, and 10 (Table 8). Catch/effort has decreased consistently only in Pools 5A, 6, and 7 (Table 7).

### Known Stressors

Adult fish populations in the UMR are already subjected to a variety of stresses. The major stressors include commercial and sport fishing, heavy metal and pesticide contamination, loss of spawning and nursery habitats due to sedimentation and vegetation growth, and unknown impacts of commercial navigation. An accurate picture of the effects of any of these stressors on long-term population trends is unavailable but certain data are available to indicate which stresses may act most heavily on each RIFS. Hydropower may simply add linearly to the present stress load of

RIFS populations. However, many of the above stressors are highly interrelated and, however, it is more likely that all stressors act synergistically.

Commercial navigation is one of the main suspected stressors of fish populations in the UMR. Specifically, fish may be effected by the resultant changes in flow patterns, channel morphology, water quality, sediment transport, and ice cover (ERT 1979). The actual construction of the navigation system has had the most significant impact on the original riverine characteristics. The dams have produced an environment dominated by lentic, pool dynamics. Channelization has resulted in significant alteration in the original chemical/physical characteristics of the system. Simons et al. (1981) and Lubinski et al. (1981) summarize the extent and nature of the ranges in physical and chemical dynamics of the system.

An extensive amount of literature addresses suspected or known impacts of navigation on the aquatic community of the UMR (e.g., GREAT I 1979, Harber et al. 1981, Kennedy et al. 1981, Lubinski et al. 1981, Rasmussen and Harber 1981, Schnick et al. 1982). Significant information has been compiled to indicate that operation and maintenance activities such as clearing and snagging, dredging, dredespoil deposition, bank stabilization, and leveeing may stress the environment and directly or indirectly the fisheries. Adverse effects of boat traffic are also of concern. Bank erosion and increased sediment transport into backwaters has been documented (Simons et al. 1981). The potential for altered recruitment into the fisheries of the UMR from navigation related water drawdown has been documented (Holland and Sylvester 1983a). Increased mortality in freshwater drum eggs and changes in ichthyoplankton distribution have been shown to occur in the main channel with passage of commercial vessels (Holland and Sylvester 1983b). It appears that nearly all components of the biological community are affected by the physical and chemical changes caused by barge traffic (UMRBC 1981). Although the magnitude of all of these impacts have not been determined, significant evidence exists to support concerns that increases in navigation-related activities on the river will adversely effect the quality of the ecosystem.

Evaluation of some of the potential impacts of navigation on fishes of the UMR was undertaken during the Master Plan process. Kennedy et al. (1981) evaluated potential effects on fish early life stages. Most of the RIFS selected to evaluate hydropower development also were selected as indicator species for evaluation of navigation impacts. Freshwater drum, gizzard shad, and emerald shiners were thought most susceptible to direct effects of navigation. Channel catfish young may be effected minimally. However, concerns over major data gaps were voiced. Wave wash/drawdown impacts and direct effects of hull and propeller impacts were indicated for sauger. Little specific data on navigation impacts on white bass were found. Habitat loss due to increased sedimentation might significantly alter success of species which spawn in backwaters (e.g., carp, black crappie). Kennedy et al. (1981) found that 15 major data gaps exist that limit further analyses of navigation impacts. Rassmussen and Harber (1981) found that navigation may significantly affect quality spawning habitat for channel catfish.

Organic and inorganic contaminants from domestic waste, urban runoff, industrial effluents, and agricultural runoff into the UMR have created a signficant problem in recent years (Sprafka 1981, Wiener et al. 1984). Although the distribution and biological effects of some pollutants have been studied in some depth, little is known about many more.

Metals of major concern include cadmium, mercury, lead, cyanide, zinc, copper, nickel, and arsenic. Most of these metals are toxic nonessential elements; some like zinc and copper are essential elements yet toxic at high concentrations (Forstner and Wittmann 1979). Heavy metals are not biodegradable and once in an aquatic system are usually adsorbed onto fine sediments and organic matter (Forstner and Wittman 1979). Even if associated with sediments, many metals possess the potential for change in chemical reactions or biological interactions sometimes to a more toxic or available compound (Sprafka 1981). Some documented effects of certain metals on fish include death, reproductive failure, reduced growth, weight loss, impaired swimming, and other behavioral changes (Jackson et al. 1981, Sprafka 1981).

Many organic pollutants are of concern because of their environmentally persistant nature. Organochlorines, pentachlorophenol (PAP), phenols, polycyclic aromatic hydrocarbons (PAH's) and polychlorinated biphenyls (PCB's) are some organic pollutants (Jackson et al. 1981). In addition to resistance to degradation, these compounds tend to bioaccumulate within the aquatic food chain (Brown 1978). They adsorb to fine sediments as metals do and can be adsorbed directly, or ingested by organisms. Organochlorines are reported to disrupt transmission of nerve impulses, however, the exact method of toxicity of most organic pollutants are unknown (Jackson et al. 1981).

Harmful levels of contaminants determined in the laboratory are often based on acute toxicity tests under very specific conditions and cannot be directly compared to levels *in situ*. Availability and effects of metals and pollutants depends on environmental factors such as pH, alkalinity, hardness, oxidation-reduction potential of the sediments, nature of the sediments and organic matter, and hydrology factors (Khalid et al. 1977, Jackson et al. 1981). Little information is available on sublethal effects of contaminants or on the cumulative, synergistic, or antagonistic effects of combinations of the compounds as they are found in aquatic systems (Jackson et al. 1981).

Of the RIFS in this report, the bottom feeders or those that feed on organisms which spend time on the bottom have the greatest probability of stress from metal contaminants because of the adsorption of these elements to sediments. Organic pollutants that bioaccumulate may affect populations of top predators more than lower level consumers.

Commercial and sport harvests of fishes are known stressors on populations. However, harvests are strictly regulated to maintain a sustained yield. There is little evidence that significant overharvest of species is occurring in the UMR. However, certain populations may be harvested at their maximum sustainable yield (e.g. walleye) or overharvested currently in certain pools. The addition of another stressor to these populations may have significant impacts on harvest.

Loss of aquatic habitat in the UMR is another stressor that will affect the RIFS. Loss of backwater habitats because of upland erosion or navigation activities affects available spawning-nursery habitats and feeding areas. None of the RIFS rely heavily on backwaters for spawning or nursery habitat. However, feeding may occur in backwaters.

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Table 7. Available commercial catch statistics (lb/unit effort) of RIFS for 1973 through 1982, Wisconsin Department of Natural Resources

| Species | Pool | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel catfish | 3 | 0.01 | - | - | - | - | <0.01 | <0.01 | - | <0.01 | <0.01 |
| | 3A | - | <0.01 | <0.01 | ND | <0.01 | <0.01 | ND | <0.01 | <0.01 | 0.01 |
| | 4 | 0.05 | 0.08 | 0.13 | 8.24 | 0.06 | 0.17 | 0.52 | 18.99 | 0.23 | 0.16 |
| | 4A | 0.01 | <0.01 | 0.03 | 0.02 | 0.01 | 0.01 | 0.03 | 0.03 | 0.06 | 0.06 |
| | 5 | 0.14 | 0.05 | 0.02 | 0.05 | 0.03 | 0.04 | 0.07 | 0.04 | 0.02 | 0.84 |
| | 5A | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.01 | <0.01 | 0.01 | 0.01 | 0.02 |
| | 6 | 0.04 | 0.01 | 0.03 | 0.01 | 0.05 | 0.03 | 0.02 | 0.02 | 0.04 | 0.02 |
| | 7 | 0.09 | 0.14 | 0.22 | 0.04 | 0.03 | 0.04 | 0.04 | 0.07 | 0.04 | 0.04 |
| | 8 | 0.12 | 0.12 | 0.14 | 0.12 | 0.04 | 0.06 | 0.04 | 0.04 | 0.04 | 0.02 |
| | 9 | 0.08 | 0.10 | 0.14 | 0.05 | 0.05 | 0.05 | 0.03 | 0.04 | 0.03 | 0.03 |
| | 10 | 0.06 | 0.11 | 0.13 | 0.05 | 0.04 | 0.06 | 0.04 | 0.03 | 0.03 | 0.01 |
| Freshwater drum | 3 | 0.02 | - | - | - | - | <0.01 | ND | ND | <0.01 | ND |
| | 3A | - | 0.04 | ND | 0.03 | <0.01 | 0.01 | ND | - | <0.01 | 0.04 |
| | 4 | 0.02 | 0.02 | 0.01 | 0.53 | <0.01 | 0.01 | ND | ND | 0.02 | 0.38 |
| | 4A | 0.0 | 0.01 | 0.19 | 0.03 | 0.01 | 0.08 | 0.01 | 0.01 | 0.18 | 0.04 |
| | 5 | 0.12 | 0.15 | 0.01 | 0.08 | 0.01 | 0.02 | 0.05 | 0.06 | <0.01 | 12.04 |
| | 5A | 0.25 | 0.07 | 0.04 | 0.01 | 0.03 | <0.01 | <0.01 | <0.01 | 0.02 | 0.03 |
| | 6 | 0.06 | 0.01 | 0.09 | 0.02 | 0.01 | 0.01 | <0.01 | 0.01 | 0.01 | <0.01 |
| | 7 | 0.11 | 0.09 | 0.17 | 0.02 | 0.02 | 0.03 | 0.02 | 0.04 | 0.03 | 0.04 |
| | 8 | 0.19 | 0.06 | 0.07 | 0.11 | 0.18 | 0.16 | 0.07 | 0.13 | 0.24 | 0.07 |
| | 9 | 0.20 | 0.34 | 0.24 | 0.17 | 0.09 | 0.10 | 0.35 | 0.08 | 0.17 | 0.18 |
| | 10 | 0.02 | 0.03 | 0.02 | 0.04 | 0.03 | 0.03 | 0.03 | 0.02 | 0.04 | 0.01 |

Table 8. Available commercial catch statistics (lbs/year) of RIFS for 1973 through 1982, Wisconsin Department of Natural Resources

| Species | Pool | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel catfish | 3 | 545 | -- | -- | -- | -- | 47 | 34 | 166 | 246 | 332 |
| | 3A | -- | 23 | 36 | ND | 96 | 149 | ND | -- | 259 | 1,001 |
| | 4 | 5,645 | 13,053 | 9,223 | 9,668 | 10,100 | 5,771 | 2,717 | 5,508 | 10,334 | 7,494 |
| | 4A | 17,752 | 15,250 | 18,673 | 12,112 | 9,828 | 9,323 | 8,505 | 13,220 | 17,621 | 13,173 |
| | 5 | 11,008 | 4,363 | 9,143 | 19,114 | 16,250 | 8,630 | 7,419 | 6,301 | 13,334 | 4,342 |
| | 5A | 2,695 | 4,547 | 2,814 | 2,912 | 2,629 | 4,382 | 842 | 3,871 | 2,573 | 2,998 |
| | 6 | 5,101 | 823 | 940 | 1,283 | 6,102 | 17,363 | 8,029 | 7,583 | 10,466 | 14,138 |
| | 7 | 37,601 | 60,749 | 83,015 | 56,212 | 32,421 | 31,013 | 39,227 | 48,455 | 44,436 | 22,261 |
| | 8 | 115,699 | 130,112 | 149,455 | 182,479 | 92,181 | 90,442 | 64,038 | 83,429 | 66,845 | 53,723 |
| | 9 | 94,903 | 98,102 | 84,377 | 48,593 | 48,133 | 49,304 | 21,086 | 23,776 | 20,077 | 16,538 |
| | 10 | 48,323 | 56,280 | 60,368 | 30,043 | 33,283 | 44,739 | 34,499 | 27,856 | 29,799 | 21,074 |
| Price ($/lb) | | 0.40 | 0.355 | 0.365 | 0.44 | 0.44 | 0.45 | 0.525 | 0.55 | 0.605 | 0.565 |
| Freshwater drum | 3 | 939 | -- | -- | -- | -- | 13 | ND | ND | 435 | ND |
| | 3A | -- | 875 | ND | 845 | 10 | 350 | ND | -- | 13 | 4,828 |
| | 4 | 1,672 | 2,760 | 1,004 | 622 | 657 | 200 | ND | ND | 806 | 18,276 |
| | 4A | 60,115 | 55,018 | 113,305 | 22,461 | 4,951 | 50,273 | 3,199 | 5,902 | 54,356 | 9,385 |
| | 5 | 9,817 | 11,715 | 5,343 | 27,725 | 2,888 | 3,557 | 4,827 | 10,242 | 2,776 | 62,329 |
| | 5A | 20,203 | 9,616 | 4,519 | 1,156 | 5,020 | 1,532 | 1,643 | 2,192 | 7,510 | 4,856 |
| | 6 | 8,272 | 1,289 | 3,250 | 2,081 | 1,136 | 5,993 | 2,264 | 3,047 | 2,111 | 2,622 |
| | 7 | 46,356 | 37,875 | 66,183 | 29,658 | 22,175 | 22,455 | 28,058 | 24,468 | 37,786 | 21,948 |
| | 8 | 181,328 | 68,145 | 79,130 | 163,232 | 395,276 | 255,997 | 105,019 | 298,802 | 408,014 | 167,462 |
| | 9 | 248,643 | 321,738 | 151,480 | 155,840 | 86,351 | 96,816 | 214,972 | 51,451 | 123,816 | 114,848 |
| | 10 | 12,786 | 14,516 | 9,537 | 20,262 | 23,151 | 22,056 | 27,492 | 17,798 | 42,012 | 10,845 |
| Price ($/lb) | | 0.08 | 0.085 | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |

Table 9. Available creel census estimates of catch/man hr. of RIFS for Pool 7, spring 1967-1970 and fall 1971-1973, Wisconsin Department of Natural Resources. Numbers in parentheses equal total number of fish.

| Species | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|---|---|---|---|---|---|---|---|
| Channel catfish | 0.0015 (4) | 0.0003 (1) | -- -- | -- -- | 0.0008 (1) | -- -- | -- -- |
| White bass | 0.0225 (59) | 0.0036 (13) | 0.1837 (203) | 0.0095 (15) | 0.0856 (110) | 0.0223 (34) | 0.0018 (2) |
| Walleye | 0.1020 (268) | 0.0660 (238) | 0.2498 (276) | 0.1147 (182) | 0.0988 (127) | 0.2064 (315) | 0.1530 (169) |
| Sauger | 0.0563 (148) | 0.0905 (326) | 0.1873 (207) | 0.3687 (58) | 0.7856 (1,010) | 0.7012 (1,070) | 0.6980 (771) |
| Freshwater Drum | 0.0023 (6) | 0.0006 (2) | 0.0009 (1) | -- -- | 0.0117 (15) | 0.0033 (5) | 0.0063 (7) |

Table 10. Available 12-month creel census estimates of catch/man hr. of RIFS for Pool 7, Wisconsin Department of Natural Resources. numbers in parentheses equal total number of fish.

| Species | 1962-1963 | | 1967-1968 | | 1972-1973 | |
|---|---|---|---|---|---|---|
| Channel catfish | 0.0062 | (70) | 0.0135 | (257) | 0.0135 | (101) |
| White bass | 0.0162 | (182) | 0.0344 | (654) | 0.0562 | (419) |
| Walleye | 0.0243 | (273) | 0.0482 | (917) | 0.0569 | (424) |
| Sauger | 0.0395 | (444) | 0.0627 | (1,193) | 0.0998 | (744) |
| Freshwater drum | 0.0209 | (235) | 0.0174 | (332) | 0.0350 | (261) |

Table 11. Available creel census estimates of catch/man hr. of RIFS for Pool 8, fall 1971-1973, Wisconsin Department of Natural Resources. Numbers in parentheses equal total number of fish.

| Species | 1971 | | 1972 | | 1973 | |
|---|---|---|---|---|---|---|
| Channel catfish | 0.0020 | (3) | 0.0017 | (3) | 0.0050 | (9) |
| White bass | 0.1214 | (181) | 0.0115 | (20) | 0.0176 | (32) |
| Walleye | 0.1174 | (175) | 0.2049 | (357) | 0.2204 | (400) |
| Sauger | 0.6325 | (943) | 0.6919 | (1,205) | 0.5813 | (1,055) |
| Freshwater drum | 0.0054 | (8) | 0.0092 | (16) | 0.0066 | (12) |

Table 12. Available creel census estimates of catch/man hr. of RIFS for Pool 9, fall 1971-1973, Wisconsin Department of Natural Resources. Number in parentheses equal total number of fish.

| Species | 1971 | | 1972 | | 1973 | |
|---|---|---|---|---|---|---|
| Channel catfish | 0.0037 | (12) | 0.0004 | (1) | 0.0014 | (3) |
| White bass | 0.1123 | (365) | 0.0170 | (45) | 0.0078 | (17) |
| Walleye | 0.1261 | (410) | 0.1219 | (322) | 0.1796 | (393) |
| Sauger | 0.5993 | (1,948) | 0.8866 | (2,341) | 0.5382 | (1,177) |
| Freshwater drum | 0.0079 | (25) | 0.0080 | (21) | 0.0073 | (16) |

Table 13. Creel survey of sauger in Pools 7, 8, and 9 from 1976 through 1979, Wisconsin Department of Natural Resources

| Pool | Spring 1976 | Fall 1976 | Spring 1978 | Fall 1978 | Spring 1979 |
|---|---|---|---|---|---|
| 7 | 0.136 | 0.563 | 0.202 | 0.295 | 0.538 |
| 8 | 0.136 | 0.684 | 0.333 | 0.236 | 0.333 |
| 9 | 0/167 | 0.391 | 0.347 | 0.460 | 0.247 |

## 10. EVALUATION OF THE IMPORTANCE OF MOVEMENTS THROUGH DAMS

Few data document the importance of interpool movements of fish to the stability of populations. However, the ability to move between pools may be most critical to those species with documented spawning movements. Sauger and walleye, and perhaps white bass and freshwater drum, move upstream to spawn. The timing of walleye movements upstream has been clearly demonstrated (Figures 10-12). From 7 to 39% of fishes monitored (Table 2) have been found to pass through one or more dams. Many fishes tagged in Pool 8 have traveled as far as Pools 5A and 4 to spawn. Information on movement of sauger is not as extensive, but mark-recapture studies have documented movement in at least 4 to 35% of the population. It is unclear whether this is individual learned behavior or an instinctive pattern of specific subpopulations. In either case, consequences of delayed or restricted interpool movement are unknown, but any delays would affect the realized reproductive potential of the fish.

Documentation of freshwater movement patterns has been limited to mark-recapture studies in Pool 14. Only 2% of the fishes moved outside their "home" pool (Table 2). However, Pool 14 is a fairly large pool (29 river-miles). Distances between mark and recapture sites as great as 19 miles and commonly 10 miles have been documented (Figure 16). Interpool movements of freshwater drum may actually be more prevalent than suggested by the available data. This species has a reproductive strategy (Table 4) that indicates that active upstream movement of adults may be necessary to maintain populations.

White bass are known to travel up tributaries in many aquatic systems to spawn. Although studies on the upper Mississippi River have not documented significant interpool movement (Table 2), movements of this species are quite extensive. Total mean travel of individuals ranges from 13 to 25 miles (Figure 4) based on mark-recapture studies. Movements up stream of 31 miles and downstream of 131 miles from marking sites have been recorded. Movements up the main tributary of the pool, the Chippewa River, were most extensive and common. Data from pools without a suitable tributary for spawning, are necessary to determine if more extensive interpool movements occur.

Data from other systems indicate that paddlefish and sturgeon migrate during spawning. Little information has been compiled to document movements of these species in the upper Mississippi river (Table 2). Again, movement up and down the Chippewa River is important (shovelnose sturgeon: Figure 1). Paddlefish movement is better documented (Figure 15). Up to 100% of tagged fish moved through dams (Table 2). It has been suggested that populations of both of these species have been affected by the presence of navigation dams. Some individuals, however, appear able to pass through the dams. The installation of additional or modified physical barriers may precipitate a further reduction in numbers.

Restrictions on random downstream movements related to feeding probably will have minimal impacts on a population if it is assumed that food is not limiting in any one pool. However, species may become increasingly susceptible to passage through a hydropower unit during feeding. A clearer understanding of the random downstream movements and their roles is needed.

The mark-recapture technique has been used extensively in the UMR to examine fish movements. While this technique is useful in determining days at large, it is misleading in total distance traveled from day marked to recaptured. The mark-recapture technique provides no data on movements between date of marking to recapture. Most notably are behavioral movements for spawning and foraging. For example, the rapid, short-term upstream movements seen during walleye spawning can easily be missed and total distances underestimated by this technique. Caution should be taken when evaluations of the importance of interpool movement to population stability are based solely on mark-recapture data.

# 11. EVALUATION OF ASSESSMENT APPROACHES AND RECOMMENDATIONS

Two major impact target areas can be identified (Table 14). A hydropower unit and its operation may act as a physical barrier to upstream movements of fish along "normal" pathways. In addition, any diversion of flow through turbines may result in entrainment or impingement of fish. Significant effects may be expressed as restricted or disrupted upstream migrations, disrupted spawning activity, disrupted foraging activity, alteration of habitat, artificial concentrations of fishes and anglers, immediate mortality, sublethal injuries, or disorientation of fishes passing through the turbine. Ultimately, a reduction of population levels could occur.

A variety of gaps exist in our understanding of fish movements, and thus, limit the critical evalution of possible impacts of hydropower development (Table 15). As is evident from the review provided in an earlier section of this report, the majority of the information we have on fish movements has been derived from mark-recapture studies. Such studies provide no information of the timing of passage or actual frequency of passage and, as a result, yield few data on the reasons for or importance of interpool movement. The literature provides some information to identify cues for movement of some RIF species, but quantitative information for the upper Mississippi River is minimal. It is not possible then, to evaluate how hydropower development might affect the parameters that act as cues. Even in walleye, where significant amounts of data based on telemetry studies are available, we do not know the existing sites of passage through a dam. Without these vital data, the physical characteristics and impacts from hydropower development on specific characteristics of the passage "window" cannot be evaluated.

Table 14. Impact target, source, mode of action, and effects of hydropower development on fish movements.

| Impact target | Source | Mode of action | Primary effects | Secondary effects |
|---|---|---|---|---|
| Fish migrating upstream through dam | --hydro plant construction<br>--hydro plant operation<br>--dam gate operation | --physical barrier to upstream movement through dam (solid or current velocity, barrier) | --restriction, disruption of upstream migration<br>--restricted, disrupted spawning activity<br>--restricted, disrupted foraging activity<br>--restriction of available habitat<br>--concentration of fish in tailwaters<br>--concentration of anglers in tailwaters | --reduced population levels |
| Fish migrating downstream through dam | --hydro plant construction<br>--hydro plant operation<br>-dam gate operation | --physical barrier to downstream movement along "normal" pathways through structure<br>--diversion of flow through turbines<br>--entrainment of fish into intake stream<br>--physical stress of turbine passage (direct impingement shear forces, abrupt pressure changes, acceleration) | --restriction, disruption of downstream movement<br>--restricted, disrupted foraging or return from spawning activity<br>--immediate mortality<br>--sublethal damage<br>--disorientation | --delayed mortality<br>--increased predation<br>--decreased growth<br>--reduced population levels |

Table 15. Gaps in information related to adult fish movements through dams of the UMR.

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1. Seasonality of movements for each RIFS.
2. Reason for movements for each RIFS
3. Cues for these movements for each RIFS
4. Percent of each RIFS presently passing through dams.
5. Specific site of upstream passage.
6. Specific site of downstream passage.
7. Physical characteristics of "windows" through dam.
8. Probable alteration of "window" characteristics by hydropower unit.
9. Characteristics of swimming abilities of RIFS.
10. Determine if upstream or downstream spawning areas are "learned" or are "instinctive" characteristics of subpopulations.
11. Determine if delay or elimination of interpool movement during spawning causes reduced reproductive potential.
12. Direct and indirect mortality caused by passage through unit.
13. Quantitative data on RIFS population levels.

Swimming abilities also have not been adequately documented. Impacts of altered current velocities and patterns on the ability of a fish to swim upstream cannot be quantified. Finally, it is unknown if the selection of spawning areas is learned or instinctive. If it is instinctive, restrictions of interpool movements will affect the realized reproductive potential of an unknown percentage of the populations in each pool.

Three major techniques can be used to analyze fish movements: radiotelemetry, hydroacoustics, and mark-recapture studies. Mark-recapture studies are least expensive and make it possible to tag large numbers of fish. However, no information on the timing of passage or site of passage through a dam can be obtained. Earlier in this report, the inadequacies of this technique for evaluation of hydropower impacts were discussed.

Hydroacoustical techniques can provide significant information on the total numbers of fish moving through dams and on the timing, site, and perhaps direction of movement. However, the identification of species is difficult and information on the percent of the population that is moving cannot obtained. The method has not been applied to the UMR because of its heavy load of debris. The method is expensive and would require special installations in the existing dam facilities.

Radiotelemetry studies by the Wisconsin Department of Natural Resources demonstrate the value of this technique for evaluating fish movements and specifically, for estimating probable impacts of hydropower development. This technique can provide species-specific information on the time, site, percent of movement, and direction. The method is intermediate in cost, but provides the most valuable information.

We recommend that an intensive effort be applied to detailed evaluations of walleye and channel catfish movements using radiotelemetry methods. Movements in the area of the dam should be closely monitored. We suggest that recording current meters be placed in each gate of a selected dam. The specific site of passage should be recorded and correlated to current data. Fish movements in several pools should be carefully monitored to better understand if spawning sites are learned or instinctive. Laboratory studies should be conducted concurrently with these field studies to evaluate the swimming abilities of all Representative, Important Fish Species. The resulting data, in conjunction with information on projected changes in current caused by the hydropower unit, will provide a better evaluation of the impacts of any of increased barriers to migration. If funds permit, telemetry studies should be expanded to cover freshwater drum and white bass. Both have early life stages that may also be effected by hydropower development and the combined impact of reduced interpool movement and reduced ichthyoplankton survival might be significant.

## 12. GLOSSARY

Adhesive - referring to eggs, those which stick to each other or a substrate after water hardening (Auer 1982).

Anadromous - ascending rivers from the sea to spawn, as do shad and some salmonid fishes (Scott and Crossman 1973).

Burst speed - involves maximum thrust for short duration (Lagler et al. 1977).

Cruising speed - are those involved in ordinary travel of fish. Data were usually obtained from mark-recapture studies and, therefore, are lower than actual speeds because information is lacking on detours and stop-overs (Lagler et al. 1977).

Days-at-large - number of days from when a fish was tagged to when it was recaptured.

Demersal - referring to an egg which rests upon the substrate as a result of deposition or settling (Auer 1982).

Economic guilds - species of fish that provide monetary input into the local economy through commercial fisheries, recreational/sport fisheries, or indirectly as important forage fish for species in the above fisheries.

Entrainment - the act of drawing an organism into a water intake structure as part of the volume it occupies.

Feeding guilds - species of fish whose adult stage incorporates the same general types of food and feeding position in the water column

Glutinous - used when referring to eggs that have sticky membranes.

Impingement - occurs when the entrapped organism is held in contact with the intake screen.

Interpool - used when referring to fish movement between pools.

Intrapool - used when referring to fish movement within the pool.

Lithophils - Eggs are deposited in a single-layer or multi-layer on cleaned areas of rocks or in pits in gravel - guarder-nest spawner (Balon 1975).

Maximum sustainable speed - the speed that a fish can maintain for lengthy intervals. This speed has been measured experimentally by determining the length of time fish can swim in one place when currents of known velocity pass by them (Lagler et al. 1977).

Migration - periodic movement from one place to another and the subsequent return.

Pelagic - floating free in water column; not necessarily near the surface (Jones et al. 1978)

Pelagophil - Nonadhesive eggs are released and scattered in the open water column. Near neutral or positively buoyant eggs. Larvae swim constantly and are positively phototrophic - (Balon 1975: non-guarder-open stratum)

Photophobic - exhibiting an avoidance to light.

Phyto-lithophil - eggs are deposited on submerged vegetation or logs, gravel, rocks. Many of the species have larvae with cement glands. Larvae usually closely associated with vegetation non-guarder-open (Balon 1975: stratum).

Radiotelemetry - method of following fish movements which employes an implanted transmitter in a fish and a mobile receiver.

Yolk-sac larva - a larval fish characterized by the presence of a yolk-sac (Jones et al. 1978).

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# A P P E N D I X

Table 1. Returns from mark-recapture study on shovelnose sturgeon in Chippewa River during 1972-1977, by Wisconsin Department of Natural Resources.

| Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) |
|---|---|---|
| 1,740 | | 2.1 |
| 1,710 | 6.7 | |
| 1,440 | 1.5 | |
| 1,380 | 8.9 | |
| 1,350 | 5.3 | |
| 1,380 | | 0.9 |
| 1,350 | 2.2 | |
| 1,380 | | 0.3 |
| 1,350 | 6.9 | |
| 1,350 | | 0.4 |
| 1,050 | 9.8 | |
| 1,020 | 5.8 | |
| 1,020 | 0.1 | |
| 720 | 3.4 | |
| 690 | 1.0 | |
| 720 | 0 | 0 |

Table 2. Returns from mark-recapture study on shovelnose sturgeon in Pool 14 during 1973-1974, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/22/74 | 05/21/75 | 212 | | 12 | 1 |
| 04/16/74 | 10/09/75 | 541 | 17.5 | | 0 |
| 07/23/74 | 08/29/74 | 37 | 2.6 | | 0 |
| 06/05/74 | 10/05/74 | 122 | 15.8 | | 0 |
| 07/10/74 | 10/16/74 | 98 | 17.4 | | 0 |
| 08/09/73 | 10/25/74 | 77 | 15.8 | | 0 |

Table 3. Returns from mark-recapture study on paddlefish in Pool 13 during 1976-1978, by the Iowa Conservation Commission.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 1976 | | 310 | 0 | 54.0 | 1 |
| " | | 133 | 3.5 | 0 | 1 |
| " | | 389 | | 55.5 | 1 |
| 1977 | | 431 | | 36.5 | 1 |
| " | | 395 | | 3.5 | 1 |
| " | | 142 | | 50.0 | 1 |
| " | | 166 | | 43.9 | 1 |
| " | | 502 | | 43.9 | 1 |
| " | | 114 | | 116.5 | 4 |
| " | | 394 | | 100.7 | 3 |
| " | | 640 | | 100.7 | 3 |
| 1978 | | 724 | | 34.0 | 1 |
| " | | 101 | | 62.5 | 1 |
| " | | 1,078 | | 71.0 | 3 |
| " | | 265 | 26.5 | | 1 |
| " | | 78 | | 34.0 | 1 |
| " | | 270 | 59.5 | | 2 |
| " | | 392 | 116.5 | | 4 |

Table 4. Returns from mark-recapture study on northern pike in Pool 5 during 1980, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/12/80 | 12/23/81 | 559 | | 1.5 | 0 |
| " | 07/29/80 | 47 | 0 | 0 | 0 |
| 07/23/80 | 07/30/80 | 7 | 0 | 0 | 0 |
| 07/29/80 | 07/30/80 | 1 | 0 | 0 | 0 |
| 08/12/80 | 05/07/82 | 664 | | 1.2 | 0 |
| " | 08/15/80 | 3 | 0 | 0 | 0 |
| 08/13/80 | 06/22/81 | 313 | 1.0 | | 0 |
| 08/15/80 | 07/02/81 | 321 | 3.0 | | 0 |

Table 5. Returns from mark-recapture study on northern pike in Pool 14 during 1973-1974, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/19/73 | 03/19/76 | 1,004 | 2.9 | | 0 |
| 08/07/73 | 08/20/73 | 13 | 0 | 0 | 0 |
| 10/10/73 | 04/17/75 | 555 | 4.9 | | 0 |
| 11/06/74 | 03/22/76 | 502 | 1.3 | | 0 |

Table 6. Returns from mark-recapture study on common carp in Pool 14 during 1973 by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/09/73 | 10/20/75 | 437 | 0 | 0 | 0 |
| 10/09/73 | 07/11/74 | 276 | 0 | 0 | 0 |
| 09/24/73 | 05/03/74 | 222 | 1.2 | | 0 |
| 10/09/73 | 09/15/74 | 341 | 2.2 | | 0 |
| 08/09/73 | 09/18/74 | 405 | 2.2 | | 0 |

Table 7. Returns from mark-recapture study on channel catfish in several UMR pools during 1947-1950, by Wisconsin Department of Natural Resources.

| Groups of fish | Local | Upstream | Upstream and into tributary | Down-stream | Down-stream and into tributary | Unknown | Total |
|---|---|---|---|---|---|---|---|
| Residents* | | | | | | | |
| Number | 79 | 62 | 15 | 151 | 16 | 7 | 330 |
| Percentage | 23.9 | 18.8 | 4.5 | 45.8 | 4.9 | 2.1 | 100.0 |
| Transplants** | | | | | | | |
| Number | 17 | 101 | 7 | 32 | 10 | 0 | 167 |
| Percentage | 10.2 | 60.5 | 4.2 | 19.1 | 6.0 | 0.0 | 100.0 |
| Total | | | | | | | |
| Number | 96 | 163 | 22 | 183 | 26 | 7 | 497 |
| Percentage | 19.3 | 32.8 | 4.4 | 36.8 | 5.3 | 1.4 | 100.0 |

* Fish caught and released in same area.

** Fish caught at Lansing, Iowa and released in Pepin, Wisconsin.

Table 8. Returns from mark-recapture study on channel catfish in Pool 4 during 1972-1975 by the Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/19/72 | 08/15/73 | 300 | 7 | | 0 |
| " | 05/24/73 | 217 | | 2 | 0 |
| " | 06/20/73 | 244 | 29 | | 0 |
| " | 01/20/73 | 93 | 3 | | 0 |
| " | 08/15/73 | 300 | 7 | | 0 |
| " | 10/21/73 | 367 | 0 | | 0 |
| 10/20/72 | 08/18/73 | 302 | 0 | 16 | 1 |
| " | ? | ? | ? | ? | ? |
| " | 06/20/74 | 608 | 16 | | 0 |
| 10/25/72 | 06/23/74 | 606 | 0 | 8 | 0 |
| " | 07/10/74 | 623 | 15 | | 0 |
| " | 09/08/73 | 322 | 2 | | 0 |
| " | 04/29/73 | 190 | | 8 | 0 |
| " | 08/15/73 | 294 | 7 | | 0 |
| " | 06/28/73 | 246 | 4 | | 0 |
| " | 01/25/73 | 92 | 0 | 0 | 0 |
| " | 06/01/73 | 219 | | 10 | 0 |
| " | 08/15/74 | 645 | 12 | | 0 |
| " | 01/23/73 | 90 | 3 | | 0 |
| " | ? | ? | | 1.5 | 0 |
| 10/26/72 | 07/21/73 | 268 | | 0 | 0 |
| " | 06/29/73 | 246 | | 37 | 3 |
| " | 06/06/73 | 223 | | 1.5 | 0 |
| " | 10/26/72 | 0 | 0 | 0 | 0 |
| " | 05/14/73 | 200 | | 5 | 0 |
| " | 07/09/73 | 256 | | 2 | 0 |
| " | 08/27/73 | 305 | | 1.5 | 0 |
| 10/27/72 | 07/19/73 | 266 | | 2 | 0 |
| " | 07/19/73 | 266 | | 5 | 0 |
| " | 10/05/73 | 343 | 0 | 0 | 0 |
| " | 06/06/73 | 223 | | 1.5 | 0 |
| " | 06/20/74 | 601 | 30 | | 0 |
| " | 06/28/74 | 609 | 17 | | 0 |
| " | 06/05/74 | 586 | | 50.7 | 4 |
| 05/23/73 | 08/20/73 | 89 | | 12 | 4 |
| " | 06/15/74 | 388 | | 38.7 | 4 |
| 05/24/73 | 06/15/74 | 387 | 0 | 38.7 | 4 |
| " | 08/09/74 | 442 | 21.5 | | 0 |
| " | 09/20/73 | 484 | 22 | | 0 |
| " | 06/09/73 | 381 | 0 | 48 | 4 |
| 05/25/73 | 06/28/74 | 399 | | 265 | 10 |
| " | ? | ? | | 4.5 | 0 |

Table 8. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 05/29/73 | 07/09/73 | 42 | 19.5 | | 0 |
| 06/28/73 | 06/19/75 | 721 | | 4 | 1 |
| 06/28/73 | ? | ? | ? | ? | ? |
| " | 09/03/74 | 402 | 21.5 | | 0 |
| " | ? | ? | 2 | | 0 |
| 07/03/73 | 09/15/74 | 470 | | 7.5 | 0 |
| " | 08/01/73 | 29 | | 3 | 0 |
| " | 06/15/74 | 347 | | 4.5 | 0 |
| " | 09/17/74 | 441 | | 20 | 1 |
| " | 05/15/74 | 316 | | 6 | 0 |
| " | 08/14/73 | 42 | | 5.5 | 0 |
| " | 06/10/74 | 342 | | 162.5 | 8 |
| 07/05/73 | 05/17/74 | 318 | | 33 | 1 |
| " | 08/15/73 | 41 | 4 | | 0 |
| " | 08/29/74 | 422 | | 7 | 0 |
| " | 08/23/73 | 49 | | 15.5 | 0 |
| " | 09/15/74 | 440 | | 34.5 | 0 |
| 07/13/73 | 08/09/74 | 388 | 21.5 | | 0 |
| 07/16/73 | 08/19/73 | 34 | 9 | | 0 |
| " | 08/17/73 | 32 | | 18.5 | 0 |
| " | 08/20/75 | 765 | | 15 | 0 |
| 07/31/73 | 05/15/74 | 288 | | 12 | 0 |
| " | 10/05/74 | 431 | | 10 | 0 |
| " | 09/05/73 | 36 | | 17 | 0 |
| " | 06/05/74 | 309 | | 61 | 0 |
| " | 08/29/74 | 394 | | 12 | 0 |
| 08/02/73 | 05/15/75 | 651 | | 4 | 0 |
| " | 01/22/74 | 173 | | 1 | 0 |
| " | 08/15/74 | 378 | | 2 | 0 |
| " | 02/15/75 | 562 | | 1 | 0 |
| " | 08/04/73 | 363 | | 6 | 0 |
| 08/07/73 | 06/15/74 | 312 | | 66.5 | 5 |
| " | 09/27/73 | 51 | | 4 | 0 |
| 08/08/73 | 01/27/74 | 172 | | 17 | 0 |
| 08/09/73 | 06/05/74 | 300 | | 12 | 0 |
| " | 08/29/74 | 385 | | 12 | 0 |
| 08/13/73 | 05/20/75 | 644 | | 39 | 3 |
| " | 08/27/74 | 379 | 5.5 | | 0 |
| " | 08/27/74 | 379 | 5.5 | | 0 |
| " | 10/20/74 | 432 | | 1 | 0 |
| " | 08/29/74 | 381 | | 1 | 0 |
| " | 06/14/74 | 305 | 1 | | 0 |

Table 8. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/13/73 | 06/15/74 | 306 | | 3.5 | 0 |
| 08/14/73 | 05/15/74 | 275 | | 16 | 0 |
| " | 01/09/75 | 513 | | 9 | 0 |
| " | 10/28/73 | 75 | | 12 | 0 |
| " | 06/05/74 | 295 | | 318 | 13 |
| " | 02/13/74 | 183 | | 5 | 0 |
| " | 08/29/74 | 380 | | 5 | 0 |
| 08/15/73 | 05/15/74 | 273 | | 25 | 0 |
| 08/16/73 | 08/29/74 | 378 | | 15 | 0 |
| " | 10/22/74 | 432 | | 21.5 | 0 |
| " | 06/12/74 | 300 | | 22 | 0 |
| " | 05/28/77 | 1,365 | | 18.5 | 0 |
| 08/17/73 | 07/06/75 | 688 | 0.5 | | 0 |
| " | 05/15/74 | 271 | 6 | | 0 |
| 08/21/73 | 10/12/73 | 52 | | 1 | 0 |
| " | 05/30/77 | 1,377 | | 6 | 0 |
| 08/29/73 | 05/23/76 | 997 | | 59 | 3 |
| 10/16/73 | 06/06/75 | 598 | | 7 | 0 |
| " | 07/04/74 | 261 | | 7 | 0 |
| 10/18/73 | 07/20/75 | 640 | 2 | | 0 |
| " | 07/16/74 | 271 | 3 | | 0 |
| " | 07/19/74 | 274 | 3 | | 0 |
| " | 02/15/75 | 485 | 3 | | 0 |
| " | 02/15/74 | 120 | 4.5 | | 0 |
| 11/06/73 | 06/28/74 | 234 | 23 | | 0 |
| " | 05/15/74 | 190 | 21 | | 0 |
| " | ? | ? | ? | ? | ? |
| " | 01/28/74 | 83 | 3 | | 0 |
| 11/08/73 | 07/20/75 | 619 | | 60 | 4 |
| " | 05/15/74 | 188 | | 2 | 0 |
| " | 01/24/74 | 77 | 3 | | 0 |
| 11/13/73 | 05/15/75 | 548 | | 1.5 | 0 |
| 02/19/74 | 06/10/74 | 111 | | 53.5 | 3 |
| 06/28/74 | 06/15/75 | 352 | | 5.2 | 1 |
| 07/03/74 | 06/15/75 | 347 | | 5.5 | 0 |
| 07/09/74 | 06/19/75 | 345 | | 14 | 0 |
| 07/10/74 | 01/01/75 | 175 | | 9 | 0 |
| " | 05/05/77 | 1,029 | | 30 | 0 |
| " | 07/22/74 | 12 | 16 | | 0 |
| " | 06/09/75 | 334 | | 17 | 0 |
| " | 10/09/74 | 91 | | 0.5 | 0 |
| " | ? | ? | | 12 | 0 |

Table 8. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 07/18/74 | 08/08/74 | 21 | 1 | | 0 |
| 07/19/74 | 07/05/75 | 351 | | 134 | 7 |
| " | 06/16/75 | 332 | | 16 | 0 |
| " | 07/14/75 | 361 | | 15.5 | 0 |
| " | 06/16/75 | 333 | | 16 | 0 |
| " | 06/06/75 | 323 | | 15.5 | 0 |
| 07/22/74 | 08/21/74 | 29 | | 1 | 0 |
| 07/25/74 | 05/22/75 | 301 | | 9 | 0 |
| 07/26/74 | 05/15/75 | 293 | | 21 | 0 |
| " | 07/16/74 | 355 | 1 | | 0 |
| 08/01/74 | 01/05/75 | 157 | | 9 | 0 |
| " | 05/15/75 | 287 | | 15.5 | 0 |
| " | 05/16/75 | 288 | | 11.5 | 0 |
| " | 07/23/75 | 355 | | 20 | 1 |
| 08/06/74 | 06/19/75 | 317 | 4.5 | | 0 |
| " | 08/22/74 | 16 | | 13 | 0 |
| " | 08/19/74 | 13 | 4.5 | | 0 |
| " | 05/28/75 | 295 | 15 | | 0 |
| " | 09/10/75 | 400 | | 14 | 0 |
| " | 05/21/75 | 288 | | 18.5 | 0 |
| " | 03/07/76 | 660 | | 18.5 | 0 |
| " | 05/02/75 | 269 | | 1 | 0 |
| 08/07/74 | 01/07/75 | 153 | | 7 | 0 |
| " | 01/23/75 | 178 | | 7 | 0 |
| " | 06/03/75 | 309 | | 15.5 | 0 |
| " | 07/09/75 | 345 | | 15.5 | 0 |
| " | 09/15/75 | 413 | | 22 | 0 |
| " | 06/14/76 | 676 | | 26 | 0 |
| " | 09/29/74 | 53 | | 15.5 | 0 |
| " | 09/03/74 | 27 | | 4.5 | 0 |
| " | 06/22/75 | 319 | | 15.5 | 0 |
| 08/08/74 | 08/10/74 | 2 | 1 | | 0 |
| " | 01/15/75 | 160 | | 1 | 0 |
| " | 07/05/75 | 331 | | 19 | 1 |
| " | 08/18/74 | 10 | | 0.5 | 0 |
| " | 08/16/74 | 8 | 1 | | 0 |
| " | 05/28/75 | 293 | | 8 | 0 |
| " | 05/15/75 | 280 | | 4.5 | 0 |
| " | 07/26/75 | 352 | | 6.5 | 0 |
| 08/09/74 | 06/16/75 | 311 | | 6 | 0 |
| " | 09/01/80 | 2,213 | | 19 | 0 |
| 08/12/74 | 08/07/74 | 360 | | 1.5 | 0 |

Table 8. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/12/74 | 10/15/76 | 428 | | 15 | 0 |
| " | 05/21/75 | 281 | | 42 | 2 |
| " | 05/22/75 | 282 | | 123 | 6 |
| " | 08/22/74 | 19 | 15.5 | | 0 |
| " | 07/15/75 | 337 | | 1 | 0 |
| " | 08/27/75 | 380 | | 82 | 5 |
| " | 06/15/76 | 672 | | | 0 |
| 08/13/74 | 08/27/75 | 379 | | 82 | 5 |
| " | 06/28/75 | 321 | | 54 | 7 |
| " | 06/02/77 | 1,025 | | 57 | 7 |
| " | 01/02/75 | 142 | | 14 | 0 |
| " | 05/28/75 | 291 | | 15 | 0 |
| " | 06/15/75 | 306 | | 17 | 0 |
| " | 05/02/75 | 265 | | 1 | 0 |
| 08/19/74 | 09/15/74 | 27 | | 4.5 | 0 |
| " | 09/15/75 | 392 | | 12 | 0 |
| " | 06/12/75 | 297 | | 18.5 | 0 |
| " | 05/24/76 | 643 | | 30 | 0 |
| 09/09/74 | 05/27/75 | 260 | | 13.5 | 0 |
| " | 06/01/75 | 265 | | 12 | 0 |
| " | 12/26/74 | 108 | | 11 | 0 |
| 09/10/74 | 10/15/74 | 35 | | 19 | 0 |
| 09/16/74 | 06/15/75 | 272 | | 6 | 0 |
| " | 05/15/75 | 241 | | 3.5 | 0 |
| " | 06/09/75 | 266 | | 9 | 0 |
| " | 06/16/75 | 273 | | 4 | 0 |
| " | 05/09/75 | 235 | | 16 | 0 |
| 10/31/74 | ? | ? | 12 | | 0 |
| " | 06/01/75 | 213 | 0 | 0 | 0 |
| 11/04/74 | 05/22/76 | 564 | 20 | | 0 |
| " | 07/15/75 | 253 | 4 | | 0 |
| " | 02/15/75 | 103 | 3 | | 0 |
| " | 02/15/75 | 103 | 3 | | 0 |
| 11/05/74 | 06/16/75 | 223 | | 2 | 0 |
| " | 06/14/76 | 586 | | 12 | 0 |
| 11/06/74 | 06/04/76 | 575 | | 7 | 0 |
| " | 08/15/76 | 646 | 0 | 0 | 0 |
| 08/27/75 | 08/15/76 | 353 | 1 | | 0 |
| " | 08/15/76 | 353 | 1 | | 0 |
| 08/29/75 | 01/19/76 | 143 | | 3 | 0 |
| " | 05/07/77 | 618 | | 18 | 0 |
| " | 06/06/76 | 281 | | 66 | 0 |

Table 8. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/29/75 | 02/18/77 | 538 | 8 | | 0 |
| " | 05/10/77 | 619 | | 13 | 0 |
| " | 10/15/76 | 412 | | 17 | 0 |
| " | 05/29/76 | 273 | 1 | | 0 |
| " | 01/22/76 | 146 | | 1 | 0 |
| " | 08/15/76 | 351 | | 4 | 0 |
| " | 06/10/76 | 285 | | 11 | 0 |
| 09/08/75 | 05/02/77 | 601 | | 27 | 0 |
| " | 05/15/78 | 979 | | 23 | 0 |
| 09/22/75 | 06/06/76 | 257 | | 7.5 | 0 |
| 09/24/75 | 05/11/77 | 594 | | 29.5 | 0 |
| 09/29/75 | 02/20/76 | 144 | | 7 | 0 |
| " | 06/03/76 | 247 | | 14 | 0 |
| " | 08/15/76 | 320 | | 12 | 0 |
| " | 05/07/76 | 219 | | 97.5 | 5 |

Table 9. Returns from mark-recapture study on channel catfish in Pool 14 during 1973-1974, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 07/24/74 | 05/10/75 | 290 | 0 | 0 | 0 |
| 08/09/73 | 05/19/74 | 284 | 21.0 | | 1 |
| 08/20/73 | 07/12/74 | 326 | 0 | 0 | 0 |
| 08/20/73 | 07/25/74 | 344 | 3.5 | | 0 |
| 09/12/73 | 04/14/74 | 215 | 3.5 | | 0 |
| 06/22/72 | 07/11/74 | 748 | 1.3 | | 0 |
| 05/02/74 | 07/20/74 | 79 | 6.0 | | 0 |
| 07/24/74 | 08/17/74 | 24 | 5.8 | | 0 |
| 07/12/74 | 08/28/74 | 47 | 0 | 0 | 0 |
| 07/24/74 | 09/08/74 | 46 | 6.6 | | 0 |
| 09/11/74 | 09/12/74 | 1 | | 1.6 | 0 |
| 09/11/74 | 09/14/74 | 3 | 0.3 | | 0 |
| 09/11/74 | 10/02/74 | 21 | 3.0 | | 0 |
| 08/27/74 | 10/03/74 | 38 | 5.8 | | 0 |
| 08/09/73 | 10/08/73 | 61 | 7.5 | | 0 |
| 08/22/73 | 10/08/73 | 48 | 7.0 | | 0 |

Table 10. Returns from mark-recapture study on flathead catfish in Pool 4 during 1972-1974, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/25/72 | 07/09/73 | 251 | 0 | 1.5 | 0 |
| 10/18/72 | 06/18/73 | 242 | 0 | 12.2 | 1 |
| 10/26/72 | 07/20/73 | 261 | 2 | 0 | 0 |
| " | 06/15/74 | 596 | 0 | 1.5 | 0 |
| " | 08/02/74 | 644 | 48.6 | 0 | 0 |
| " | 06/12/73 | 228 | 0 | 1.5 | 0 |
| 10/27/72 | 06/01/73 | 216 | 0 | 0 | 0 |
| " | 01/28/74 | 457 | 0 | 3 | 0 |
| " | 09/25/73 | 332 | 0 | 5 | 0 |
| 08/20/74 | 05/15/77 | 998 | 0 | 23 | 0 |
| 10/23/73 | 09/15/74 | 327 | 0 | 0 | 0 |
| 11/06/74 | 06/26/76 | 597 | 0 | 2 | 0 |

Table 11. Returns from mark-recapture study on white bass in Pool 4 during 1964, by Wisconsin Conservation Department.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/29/64 | 05/21/74 | 22 | 21 | | 1 |
| 05/06/64 | 06/13/64 | 38 | 24 | | 1 |
| " | 06/06/64 | 31 | 17 | | 1 |
| 05/07/64 | 05/17/64 | 10 | 15 | | 1 |
| 04/30/64 | 05/22/65 | 387 | 31 | | 1 |
| ~ 05/03/64* | ~ 05/64** | ~ 12 | 0 | 0-0.25*** | 0 |
| ~ 05/03/64* | ~ 05/64** | ~ 12 | 0 | 0-0.25*** | 0 |
| ~ 05/03/64* | ~ 05/64** | ~ 12 | 0 | 0-0.25*** | 0 |
| ~ 05/03/64* | ~ 05/64** | ~ 12 | 0 | 0-0.25*** | 0 |
| ~ 05/03/64* | ~ 05/64** | ~ 12 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 05/64** | ~ 12 | | 11-33**** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | | 11-33**** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | | 11-33**** | 0 |
| ~ " * | ~ 06/64** | ~ 43 | | 11-33**** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 07/64** | ~ 73 | 0 | 0-0.25*** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |

Table 11. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| ~ 05/03/64* | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 08/64** | ~ 104 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 09/64** | ~ 135 | | 11-33**** | 0 |
| ~ " * | ~ 10/64** | ~ 165 | | 11-33**** | 0 |
| ~ " * | ~ 10/64** | ~ 165 | | 11-33**** | 0 |
| ~ " * | ~ 10/64** | ~ 165 | | 11-33**** | 0 |
| ~ " * | ~ 10/64** | ~ 165 | | 11-33**** | 0 |
| 05/01/64 | 06/17/64 | 47 | | 37 | 0 |
| 04/30/64 | 06/12/64 | 43 | | 44 | 0 |
| 05/07/64 | 06/20/64 | 44 | | 44 | 0 |
| 04/29/64 | 07/06/64 | 68 | | 48 | 1 |
| 05/07/64 | 09/15/64 | 131 | | 131 | 5 |

* Exact date tagges not given. All fish tagged between April 29, 1964 and May 7, 1964.

** Exact data recaptured not given. Month of recapture given, therefore the 15th of given month used for calculation of days at large.

*** Exact miles traveled not given. Approximated as 0.

**** Exact miles traveled not given. Approximated as 20.

Table 12. Returns from mark-recapture study on largemouth bass in Pool 14 during 1972-1975, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/08/74 | 12/30/74 | 83 | 2.2 | | 0 |
| 10/10/73 | 01/06/75 | 453 | 0 | 0 | 0 |
| 07/11/73 | 03/01/75 | 600 | 0 | 0 | 0 |
| 10/28/75 | 10/30/75 | 2 | 0 | 0 | 0 |
| 06/07/72 | 06/08/72 | 1 | 0 | 0 | 0 |
| 07/13/72 | 07/27/72 | 14 | 0 | 0 | 0 |
| 06/06/72 | 07/18/72 | 42 | 0 | 0 | 0 |
| 07/27/72 | 08/08/72 | 12 | 0 | 0 | 0 |
| " | 08/23/72 | 27 | 0 | 0 | 0 |
| 07/26/72 | 08/23/72 | 28 | 0 | 0 | 0 |
| 09/06/72 | 09/19/72 | 13 | 0 | 0 | 0 |
| 10/20/71 | 06/19/72 | 243 | 0 | 0 | 0 |
| 05/22/73 | 07/10/73 | 49 | | 3.0 | 0 |
| 06/19/73 | 07/11/73 | 22 | 0 | 0 | 0 |
| 09/20/72 | 07/12/73 | 266 | 0 | 0 | 0 |
| 07/10/73 | 07/27/73 | 17 | 0 | 0 | 0 |
| 07/12/73 | 07/26/73 | 14 | 0 | 0 | 0 |
| 10/17/72 | 07/12/74 | 634 | | 1.0 | 0 |
| 07/25/73 | 06/07/74 | 342 | 0 | 0 | 0 |
| 08/07/73 | 07/12/74 | 339 | | 1.0 | 0 |
| 08/09/73 | 05/16/74 | 281 | 1.0 | | 0 |
| 08/20/73 | 07/22/74 | 336 | 0 | 0 | 0 |
| 09/11/73 | 04/01/74 | 203 | 0 | 0 | 0 |
| 09/11/73 | 07/11/74 | 303 | 0 | 0 | 0 |
| 09/25/73 | 08/06/74 | 315 | 9.0 | | 0 |
| 06/07/74 | 07/25/74 | 48 | 0 | 0 | 0 |
| 07/12/74 | 07/22/74 | 1 | | 0.7 | 0 |
| " | 07/25/74 | 13 | 0 | 0 | 0 |
| " | 07/24/74 | 12 | 0 | 0 | 0 |
| " | 07/24/74 | 12 | 0 | 0 | 0 |
| 06/07/74 | 07/24/74 | 47 | 0 | 0 | 0 |
| 07/12/74 | 07/27/74 | 15 | | 3.7 | 0 |
| 06/07/72 | 08/11/74 | 795 | 0.2 | | 0 |
| 07/22/74 | 08/11/74 | 20 | 3.0 | | 0 |
| 07/25/73 | 08/28/74 | 34 | 0 | 0 | 0 |
| 10/10/73 | 08/28/74 | 223 | | 0.9 | 0 |
| 07/24/74 | 08/31/74 | 38 | 2.3 | | 0 |
| 08/28/74 | 09/17/74 | 20 | 2.9 | | 0 |
| 09/10/74 | 10/05/74 | 25 | 0.9 | | 0 |
| 09/11/74 | 10/16/74 | 35 | 2.2 | | 0 |
| 08/27/74 | 10/24/74 | 59 | 0 | 0 | 0 |
| 07/11/73 | 11/21/74 | 498 | 0 | 0 | 0 |

Table 12. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/08/74 | 12/30/74 | 83 | 0 | 0 | 0 |
| 07/25/72 | 08/09/73 | 380 | 0 | 0 | 0 |
| 09/20/72 | 07/12/73 | 296 | 0 | 0 | 0 |
| 05/22/73 | 07/10/73 | 49 | | 2.3 | 0 |
| 06/19/73 | 07/11/73 | 22 | 0 | 0 | 0 |
| 07/10/73 | 08/07/73 | 28 | 0 | 0 | 0 |
| " | 09/26/73 | 78 | 0 | 0 | 0 |
| " | 07/27/73 | 17 | 0 | 0 | 0 |
| " | 09/10/73 | 62 | 0 | 0 | 0 |
| " | 08/07/73 | 28 | 0 | 0 | 0 |
| " | 08/09/73 | 30 | 0 | 0 | 0 |
| " | 10/09/73 | 91 | 0 | 0 | 0 |
| 07/11/73 | 10/22/73 | 103 | 0 | 0 | 0 |
| 07/12/73 | 08/08/73 | 27 | 0 | 0 | 0 |
| " | 07/26/73 | 14 | 0 | 0 | 0 |
| 07/25/73 | 08/22/73 | 28 | 0 | 0 | 0 |
| 07/26/73 | 08/08/73 | 13 | 0 | 0 | 0 |
| 08/07/73 | 08/22/73 | 15 | 0 | 0 | 0 |
| " | 08/20/73 | 13 | 0 | 0 | 0 |
| " | 08/20/73 | 13 | 0 | 0 | 0 |
| " | 08/20/73 | 13 | 0 | 0 | 0 |
| " | 09/24/73 | 48 | 0 | 0 | 0 |
| " | 09/26/73 | 50 | 0 | 0 | 0 |
| 08/08/73 | 08/20/73 | 12 | 0 | 0 | 0 |
| " | 09/11/73 | 34 | 0 | 0 | 0 |
| 08/09/73 | 08/22/73 | 13 | 0 | 0 | 0 |
| " | 08/22/73 | 13 | 0 | 0 | 0 |
| " | 08/22/73 | 13 | 0 | 0 | 0 |
| " | 08/20/73 | 11 | 0 | 0 | 0 |
| 08/20/73 | 09/10/73 | 21 | 0 | 0 | 0 |
| " | 10/09/73 | 60 | 0 | 0 | 0 |
| 08/22/73 | 09/26/73 | 35 | 0 | 0 | 0 |
| 09/12/73 | 09/26/73 | 14 | 0 | 0 | 0 |
| 09/26/73 | 10/11/73 | 15 | 0 | 0 | 0 |

Table 13. Returns from mark-recapture study on bluegill in Pool 5 during 1980, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/11/80 | 09/14/80 | 95 | ? | ? | ? |
| 06/12/80 | 09/06/80 | 86 | | 0.6 | 0 |
| 06/16/80 | 06/17/80 | 1 | 0 | 0 | 0 |
| " | 01/22/81 | 220 | 0 | 0 | 0 |
| " | 08/17/80 | 62 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 10/06/80 | 114 | 0 | 0 | 0 |
| " | 07/06/81 | 385 | | 0.8 | 0 |
| " | 12/20/80 | 187 | 0 | 0 | 0 |
| " | 08/30/80 | 75 | 0.4 | | 0 |
| " | 06/17/80 | 1 | 0 | 0 | 0 |
| " | 09/06/80 | 82 | 0.8 | | 0 |
| " | 09/09/80 | 85 | 0.8 | | 0 |
| " | 06/17/80 | 1 | 0 | 0 | 0 |
| " | 06/17/80 | 1 | 0 | 0 | 0 |
| " | 06/17/80 | 1 | 0 | 0 | 0 |
| 06/17/80 | 09/18/80 | 93 | 1.3 | | 0 |
| " | 06/20/80 | 3 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 07/05/80 | 18 | | 1.2 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 01/14/81 | 211 | 0 | 0 | 0 |
| " | 07/31/80 | 44 | 0 | 0 | 0 |
| " | 08/14/80 | 58 | 0 | 0 | 0 |
| " | 02/08/81 | 236 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 10/08/80 | 113 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 12/27/80 | 193 | 0 | 0 | 0 |
| " | 10/25/80 | 130 | 0 | 0 | 0 |
| " | 10/25/80 | 130 | 0 | 0 | 0 |
| " | 02/15/81 | 243 | 0 | 0 | 0 |
| " | 06/20/80 | 3 | 0 | 0 | 0 |
| 06/18/80 | 07/02/80 | 20 | 0 | 0 | 0 |
| " | 12/27/80 | 193 | 0.6 | | 0 |
| " | 06/20/80 | 2 | 0 | 0 | 0 |
| " | 12/27/80 | 193 | 0.6 | | 0 |

Table 13. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/18/80 | 01/09/81 | 206 | 0 | 0 | 0 |
| 06/20/80 | 12/17/80 | 181 | 0.7 | | 0 |
| " | 01/07/81 | 204 | 1.5 | | 0 |
| " | 09/06/80 | 78 | 1.7 | | 0 |
| 07/29/80 | 09/06/80 | 39 | 0 | 0 | 0 |
| " | 01/22/81 | 174 | 0 | 0 | 0 |
| 07/30/80 | 08/12/80 | 13 | 0 | 0 | 0 |
| " | 09/06/80 | 38 | 0 | 0 | 0 |
| " | 08/22/80 | 23 | 0 | 0 | 0 |
| 07/31/80 | 08/15/80 | 15 | 0 | 0 | 0 |
| " | 07/31/80 | 0 | 0 | 0 | 0 |
| " | 08/02/80 | 2 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 09/06/80 | 37 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/13/80 | 13 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| 08/12/80 | 09/23/81 | 407 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/18/80 | 6 | 0 | 0 | 0 |
| " | 08/15/80 | 3 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 12/15/80 | 125 | 2.4 | | 0 |
| " | 02/08/81 | 180 | 0 | 0 | 0 |
| " | 09/06/80 | 25 | 0 | 0 | 0 |
| " | 08/14/80 | 2 | 0 | 0 | 0 |
| " | 09/30/80 | 49 | 1.1 | | 0 |
| 08/13/80 | ? | ? | 0 | 0 | 0 |
| " | 09/06/80 | 24 | 0 | 0 | 0 |
| " | 08/17/80 | 4 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 10/08/80 | 56 | 0 | 0 | 0 |
| 08/14/80 | 01/11/81 | 150 | 0 | 0 | 0 |
| " | ? | 0 | 0 | 0 | 0 |
| " | 01/09/81 | 145 | 0 | 0 | 0 |
| " | 08/15/80 | 1 | 0 | 0 | 0 |
| " | ? | 0 | 0 | 0 | 0 |
| " | 01/09/81 | 147 | 0 | 0 | 0 |
| 08/15/80 | 05/17/81 | 272 | 0 | 0 | 0 |

Table 13. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/15/80 | 02/18/81 | 186 | 0 | 0 | 0 |
| " | 06/07/81 | 295 | 35.6* | | 1 |
| " | ? | ? | 0 | 0 | 0 |

* Data point is suspected.

Table 14. Returns from mark-recapture study on bluegill in Pool 14 during 1971-1973, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 11/19/71 | 06/19/72 | 213 | 0 | 0 | 0 |
| 06/20/72 | 07/10/72 | 20 | 0 | 0 | 0 |
| 06/07/72 | 07/12/72 | 35 | 0 | 0 | 0 |
| 06/06/72 | 07/05/72 | 27 | 0 | 0 | 0 |
| 06/20/72 | 07/05/72 | 15 | 0 | 0 | 0 |
| 11/30/73 | 04/25/74 | 147 | 0 | 0 | 0 |
| 07/12/74 | 09/10/74 | 29 | 0 | 0 | 0 |
| 07/27/72 | 08/08/73 | 377 | 0 | 0 | 0 |
| 10/18/72 | 08/08/73 | 295 | 0 | 0 | 0 |
| 07/25/73 | 08/07/73 | 13 | 0 | 0 | 0 |
| 08/07/73 | 08/22/73 | 15 | 0 | 0 | 0 |
| " | 08/22/73 | 15 | 0 | 0 | 0 |
| 08/08/73 | 10/22/73 | 75 | 0 | 0 | 0 |
| 08/09/73 | 08/22/73 | 13 | 0 | 0 | 0 |
| 08/02/73 | 09/11/73 | 40 | 0 | 0 | 0 |
| 09/10/73 | 09/26/73 | 16 | | 1.0 | 0 |
| 10/09/73 | 10/22/73 | 13 | 0 | 0 | 0 |
| 10/10/73 | 11/30/73 | 51 | 0 | 0 | 0 |

Table 15. Returns from mark-recapture study on white crappie in Pool 5 during 1980, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/11/80 | 07/29/80 | 48 | 0 | 0 | 0 |
| 06/12/80 | 08/12/80 | 61 | 0 | 0 | 0 |
| " | 07/30/80 | 48 | 0 | 0 | 0 |
| 07/29/80 | 08/13/80 | 15 | 0 | 0 | 0 |
| " | 05/31/81 | 306 | | 1.2 | 0 |
| " | 10/29/80 | 92 | 1.0 | | 0 |
| 07/30/80 | 08/15/80 | 16 | 0 | 0 | 0 |
| 08/12/80 | 08/13/80 | 1 | 0 | 0 | 0 |
| 08/14/80 | 06/06/81 | 293 | 0 | 0 | 0 |
| 08/15/80 | 11/18/80 | 95 | | 1.2 | 0 |

Table 16. Returns from mark-recapture study on white crappie in Pool 14 during 1971-1975, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/21/75 | 03/19/76 | 150 | 1.9 | | 0 |
| " | 03/22/76 | 153 | 1.9 | | 0 |
| 08/09/73 | 03/05/75 | 574 | 1.2 | | 0 |
| 06/19/73 | 04/17/75 | 668 | 2.3 | | 0 |
| 07/22/74 | 04/17/75 | 270 | 0.3 | | 0 |
| 06/13/75 | 08/08/75 | 56 | | 3.7 | 0 |
| 08/21/75 | 09/26/75 | 36 | 0 | 0 | 0 |
| 11/03/71 | 05/03/72 | 182 | 0 | 0 | 0 |
| 06/16/72 | 06/21/72 | 5 | 0 | 0 | 0 |
| 06/21/72 | 07/12/72 | 21 | 0 | 0 | 0 |
| 07/12/72 | 07/26/72 | 14 | 0 | 0 | 0 |
| 06/07/72 | 07/26/72 | 49 | 0 | 0 | 0 |
| 06/16/72 | 07/26/72 | 40 | 0 | 0 | 0 |
| 06/21/72 | 07/26/72 | 35 | | 3.4 | 0 |
| 09/05/72 | 04/01/74 | 574 | 0 | 0 | 0 |
| 04/18/72 | 04/01/74 | 714 | 0 | 0 | 0 |
| 05/16/72 | 04/17/74 | 702 | 0 | 0 | 0 |
| 04/24/73 | 04/25/74 | 366 | 0 | 0 | 0 |
| 10/04/72 | 04/25/74 | 569 | 0 | 0 | 0 |
| 10/22/73 | 04/25/74 | 186 | | 2.6 | 0 |
| 08/20/73 | 04/74 | ~ 240 | 2.5 | | 0 |
| 11/05/73 | 06/06/74 | 214 | 0 | 0 | 0 |
| 06/20/72 | 07/11/74 | 751 | 0 | 0 | 0 |
| 11/07/72 | 07/12/74 | 612 | | 1.0 | 0 |
| 09/12/73 | 07/24/74 | 314 | 0 | 0 | 0 |
| 08/28/74 | 09/05/74 | 8 | | 0.2 | 0 |
| 04/24/73 | 09/10/74 | 504 | 0 | 0 | 0 |
| 10/11/73 | 09/11/74 | 335 | 0 | 0 | 0 |
| 08/27/74 | 09/11/74 | 15 | 0 | 0 | 0 |
| 06/07/74 | 10/27/74 | 142 | 2.1 | | 0 |
| 11/06/74 | 11/21/74 | 15 | 0 | 0 | 0 |
| 04/18/72 | 04/01/74 | 713 | 0 | 0 | 0 |
| 05/16/72 | 04/17/74 | 701 | 0 | 0 | 0 |
| 06/20/72 | 07/11/74 | 751 | 0 | 0 | 0 |
| 09/05/72 | 04/01/74 | 574 | 0 | 0 | 0 |
| 10/07/72 | 04/25/74 | 568 | 0 | 0 | 0 |
| 10/17/72 | 09/73 | ~ 335 | 0.8 | | 0 |
| 11/07/72 | 07/12/74 | 613 | | 1.0 | 0 |
| 04/24/73 | 04/25/74 | 364 | 0 | 0 | 0 |
| 08/20/73 | 04/74 | 239 | 2.5 | 0 | 0 |
| 09/12/73 | 07/24/74 | 323 | 0 | 0 | 0 |
| 10/22/73 | 04/25/74 | 184 | | 2.6 | 0 |

Table 16. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 11/05/73 | 06/06/74 | 214 | 0 | 0 | 0 |
| 09/07/72 | 12/13/73 | 462 | 1.5 | | 0 |
| 05/15/72 | 08/20/73 | 432 | 0 | 0 | 0 |
| 10/04/72 | 07/12/73 | 282 | 0 | 0 | 0 |
| 07/12/73 | 07/26/73 | 14 | 0 | 0 | 0 |
| 08/09/73 | 11/06/73 | 89 | 0 | 0 | 0 |
| 08/20/73 | 09/10/73 | 21 | 0 | 0 | 0 |
| 08/22/73 | 09/10/73 | 19 | 0 | 0 | 0 |
| 09/10/73 | 09/24/73 | 14 | 0 | 0 | 0 |
| 09/12/73 | 10/11/73 | 29 | 0 | 0 | 0 |
| 11/03/71 | 11/17/71 | 14 | 0 | 0 | 0 |
| 09/16/72 | 09/20/72 | 4 | 0 | 0 | 0 |
| " | 10/02/72 | 16 | 0 | 0 | 0 |
| 06/21/72 | 10/04/72 | 105 | 0 | 0 | 0 |
| 07/26/72 | 10/04/72 | 70 | 0 | 0 | 0 |
| 06/21/72 | 10/17/72 | 118 | 0 | 0 | 0 |
| 10/04/72 | 10/18/72 | 14 | 0 | 0 | 0 |
| 10/17/72 | 11/07/72 | 21 | 0 | 0 | 0 |

Table 17. Returns from mark-recapture study on black crappie in Pool 5 during 1980, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/11/80 | 12/28/80 | 200 | | 1.2 | 0 |
| 06/12/80 | 08/15/80 | 64 | 0 | 0 | 0 |
| " | 09/17/80 | 97 | | 5.0 | 0 |
| " | 07/30/80 | 48 | 0 | 0 | 0 |
| " | 07/30/80 | 48 | 0 | 0 | 0 |
| " | 07/30/80 | 48 | 0 | 0 | 0 |
| " | 05/28/81 | 350 | | 1.2 | 0 |
| " | 08/13/80 | 62 | 0 | 0 | 0 |
| " | 09/04/82 | 814 | | 0.6 | 0 |
| 06/17/80 | 02/16/81 | 244 | 2.3 | | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/15/80 | 59 | 0 | 0 | 0 |
| " | 02/23/81 | 241 | 0.8 | | 0 |
| 07/23/80 | 11/23/80 | 123 | 0 | 0 | 0 |
| 07/28/80 | 08/12/80 | 15 | 0 | 0 | 0 |
| " | 08/12/80 | 15 | 0 | 0 | 0 |
| " | 06/06/81 | 313 | 0 | 0 | 0 |
| " | 08/15/80 | 18 | 0 | 0 | 0 |
| " | 07/30/80 | 2 | 0 | 0 | 0 |
| " | 05/27/81 | 302 | 0 | 0 | 0 |
| 07/29/80 | 07/31/80 | 2 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/12/80 | 14 | 0 | 0 | 0 |
| " | 04/12/81 | 257 | ? | ? | ? |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 05/24/81 | 299 | | 1.2 | 0 |
| 07/31/80 | 08/15/80 | 15 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/14/80 | 14 | 0 | 0 | 0 |
| 08/12/80 | ? | ? | 0 | 0 | 0 |
| " | 08/13/80 | 1 | 0 | 0 | 0 |
| " | 04/31/81 | 254 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/14/80 | 2 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 01/11/81 | 152 | 0 | 0 | 0 |
| " | 01/12/81 | 146 | 0 | 0 | 0 |
| 08/13/80 | 08/15/80 | 2 | 0 | 0 | 0 |
| " | 05/24/81 | 284 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |

Table 17. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/13/80 | ? | ? | 0 | 0 | 0 |
| " | 08/14/80 | 1 | 0 | 0 | 0 |
| " | 08/14/80 | 1 | 0 | 0 | 0 |
| " | 10/08/80 | 56 | 0 | 0 | 0 |
| 08/14/80 | 05/31/81 | 290 | 0 | 0 | 0 |
| " | 06/06/81 | 296 | 0 | 0 | 0 |
| " | 09/04/82 | 751 | | 0.6 | 0 |
| " | 11/18/80 | 96 | | 1.6 | 0 |
| 08/15/80 | 05/31/81 | 286 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 01/11/81 | 117 | 0 | 0 | 0 |
| 07/29/80 | 08/12/80 | 14 | 0 | 0 | 0 |
| " | 08/13/80 | 15 | 0 | 0 | 0 |
| " | 08/12/80 | 14 | 0 | 0 | 0 |
| " | 08/15/80 | 17 | 0 | 0 | 0 |
| " | 08/14/80 | 16 | 0 | 0 | 0 |
| " | 08/02/80 | 4 | 0 | 0 | 0 |
| " | 11/18/80 | 20 | | 1. 2 | 0 |
| " | 08/15/80 | 17 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/08/82 | 740 | 0 | 0 | 0 |
| " | 01/12/81 | 167 | 0 | 0 | 0 |
| " | 09/11/82 | 774 | 0 | 0 | 0 |
| 07/30/80 | 08/15/80 | 16 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 08/12/80 | 13 | 0 | 0 | 0 |
| " | 08/12/80 | 13 | 0 | 0 | 0 |
| " | 07/31/80 | 1 | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 07/31/80 | 1 | 0 | 0 | 0 |
| " | 10/15/81 | 442 | 0 | 0 | 0 |
| " | 08/15/80 | 16 | 0 | 0 | 0 |
| " | 04/31/81 | 274 | 0 | 0 | 0 |
| " | 10/15/81 | 442 | 0 | 0 | 0 |
| " | 08/13/80 | 14 | 0 | 0 | 0 |
| 07/31/80 | ? | ? | 0 | 0 | 0 |
| " | 08/15/80 | 15 | 0 | 0 | 0 |

Table 18. Returns from mark-recapture study on black crappie in Pool 14 during 1972-1975, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/09/73 | 04/08/76 | 902 | | 3.1 | 0 |
| 10/23/74 | 03/16/76 | 510 | | 3.5 | 0 |
| 11/06/74 | 03/19/76 | 499 | 1.9 | | 0 |
| 08/21/74 | 01/24/76 | 521 | 0.2 | | 0 |
| 11/05/74 | 01/24/75 | 80 | 2.2 | | 0 |
| 10/09/74 | 02/01/75 | 115 | 2.2 | | 0 |
| 11/16/71 | 02/23/75 | 1,195 | 0.5 | | 0 |
| 11/06/74 | 02/23/75 | 109 | 2.2 | | 0 |
| 08/27/74 | 03/09/75 | 195 | 2.9 | | 0 |
| 10/09/74 | 04/17/75 | 191 | 3.3 | | 0 |
| 06/14/75 | 08/11/75 | 58 | 0 | 0 | 0 |
| 08/20/73 | 03/21/74 | 214 | 0 | 0 | 0 |
| 06/19/73 | 04/19/74 | 304 | 10.0 | | 0 |
| 10/22/73 | 04/21/74 | 182 | 2.0 | | 0 |
| 05/22/73 | 04/22/74 | 335 | 0.8 | | 0 |
| 06/07/74 | 07/12/74 | 45 | 0 | 0 | 0 |
| 06/07/74 | 07/25/74 | 58 | 4.3 | | 0 |
| 07/12/74 | 08/27/74 | 46 | 0 | 0 | 0 |
| 10/08/74 | 10/17/74 | 9 | | 1.1 | 0 |
| 09/06/72 | 10/23/74 | 775 | 0 | 0 | 0 |
| 10/24/74 | 12/28/74 | 65 | 2.2 | | 0 |
| 09/11/73 | 07/24/74 | 317 | | 2.1 | 0 |
| 06/07/74 | 07/12/74 | 35 | 0 | 0 | 0 |
| " | 07/25/74 | 48 | 4.4 | | 0 |
| 09/06/72 | 10/08/73 | 397 | 3.3 | | 0 |
| 09/19/72 | 03/01/73 | 164 | 0 | 0 | 0 |
| 09/20/72 | 04/10/73 | 203 | 0 | 0 | 0 |
| 10/04/72 | 08/06/73 | 306 | 5.7 | | 0 |
| 06/19/73 | 07/26/73 | 37 | 0 | 0 | 0 |
| 06/20/73 | 10/20/73 | 122 | 2.3 | | 0 |
| 08/08/73 | 08/20/73 | 12 | 0 | 0 | 0 |
| 08/20/73 | 09/10/73 | 21 | 0 | 0 | 0 |
| " | 11/05/73 | 46 | 3.0 | | 0 |
| 08/22/73 | 09/26/73 | 35 | 0 | 0 | 0 |
| 09/24/73 | 11/02/73 | 39 | 1.0 | | 0 |
| 06/06/72 | 06/21/72 | 15 | 0 | 0 | 0 |
| 07/12/72 | 07/25/72 | 13 | 0 | 0 | 0 |
| 09/05/72 | 09/18/72 | 13 | 0 | 0 | 0 |
| 09/07/72 | 09/18/72 | 11 | | 1.2 | 0 |
| 09/18/72 | 10/02/72 | 14 | 0 | 0 | 0 |
| 10/02/72 | 10/04/72 | 2 | 0 | 0 | 0 |
| 07/13/72 | 12/18/72 | 158 | 1.5 | | 0 |

Table 19. Percent returns from mark-recapture study on sauger in Pool 4 during 1978-1980, by Minnesota Department of Natural Resources.

| Recapture location | Spring 1978 | Summer 1978 | Spring 1979 | Summer 1979 | Spring 1980 |
|---|---|---|---|---|---|
| Pool 3 and St. Croix River | 7% | 0% | 13% | 0% | 2% |
| Pool 4 | 92% | 100% | 86% | 100% | 97% |
| Pool 5 and Chippewa River | 1% | 0% | - | 0 | 1% |

Table 20. Returns from mark-recapture study on sauger in Pool 4 during 1977-1980, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/23/77 | 10/04/77 | 12 | 7 | | 0 |
| 04/10/78 | 05/16/78 | 37 | | 21 | 0 |
| 04/11/78 | 03/22/81 | 995 | | 9 | 0 |
| " | 09/11/78 | 163 | | 21 | 0 |
| " | 08/15/79 | 477 | | 27 | 0 |
| " | 08/12/79 | 474 | | 27 | 0 |
| " | 04/15/78 | 5 | 0 | 0 | 0 |
| " | 05/28/78 | 48 | | 11 | 0 |
| " | 05/29/78 | 49 | | 12 | 0 |
| " | 05/15/78 | 35 | | 37 | 0 |
| " | 05/26/81 | 1,115 | | 31 | 0 |
| " | 05/26/78 | 46 | 15 | | 1 |
| " | 06/11/79 | 416 | | 5 | 0 |
| " | 07/78 | 81 | | 20 | 0 |
| 04/12/78 | 05/24/80 | 775 | ? | ? | ? |
| " | 06/02/79 | 417 | | 29 | 0 |
| " | 05/23/78 | 42 | | 24.5 | 0 |
| " | 04/19/79 | 373 | 15 | | 1 |
| " | 05/25/78 | 44 | 15 | | 1 |
| 04/16/78 | 05/29/78 | 44 | | 29 | 0 |
| " | 06/01/78 | 47 | | 23 | 0 |
| " | 07/02/78 | 78 | | 26.5 | 0 |
| " | 05/29/80 | 774 | | 26 | 0 |
| " | 05/20/78 | 35 | 16 | | 1 |
| " | 06/09/79 | 389 | | 17 | 0 |
| " | 10/08/78 | 176 | | 28 | 0 |
| " | 06/13/78 | 59 | | 27 | 0 |
| " | 08/20/78 | 127 | | 16 | 0 |
| " | 06/18/78 | 64 | ? | ? | ? |
| " | 05/15/78 | 30 | | 7:5 | 0 |
| " | 08/19/79 | 491 | | 24 | 0 |
| " | 06/02/78 | 48 | | 21 | 0 |
| " | 03/11/81 | 1,060 | | 4 | 0 |
| " | 05/14/80 | 759 | | 22 | 0 |
| " | 05/27/78 | 42 | | 30 | 0 |
| " | 06/03/78 | 49 | | 17 | 0 |
| " | 05/29/78 | 44 | | 17 | 0 |
| " | 05/29/80 | 774 | | 31 | 0 |
| 04/17/78 | 06/03/78 | 49 | | 25 | 0 |
| " | 06/02/78 | 48 | | 22 | 0 |
| 04/19/78 | 06/79 | 378 | | 31 | 0 |
| " | 08/26/79 | 495 | | 29 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/19/78 | 07/01/78 | 74 | | 41 | 0 |
| " | 06/05/79 | 382 | | 5 | 0 |
| " | 05/25/78 | 43 | | 23 | 0 |
| " | 09/25/78 | 160 | | 19 | 0 |
| " | 09/09/78 | 150 | | 24 | 0 |
| " | 06/11/79 | 388 | | 25 | 0 |
| " | 07/29/79 | 461 | | 28 | 0 |
| " | 08/04/78 | 109 | | 28 | 0 |
| " | 06/05/78 | 48 | | 23 | 0 |
| " | 05/23/78 | 35 | | 11 | 0 |
| " | 05/06/78 | 18 | 15 | | 1 |
| " | 06/03/78 | 46 | | 22.5 | 0 |
| " | 05/17/78 | 29 | | 36 | 0 |
| " | 07/01/79 | 439 | | 23 | 0 |
| " | 05/24/78 | 36 | | 30 | 0 |
| " | 02/18/79 | 306 | 0 | 0 | 0 |
| " | 05/28/78 | 40 | | 21 | 0 |
| " | 05/31/78 | 43 | 15 | | 1 |
| " | 08/03/78 | 107 | | 26.5 | 0 |
| 04/24/78 | 05/24/78 | 31 | 15 | | 1 |
| " | 07/26/80 | 824 | | 20.5 | 0 |
| " | 08/31/78 | 130 | | 21 | 0 |
| " | 06/01/78 | 39 | | 4 | 0 |
| " | 05/28/78 | 35 | 16 | | 1 |
| " | 05/29/78 | 36 | ? | ? | ? |
| " | 08/04/78 | 104 | ? | ? | ? |
| " | 09/03/78 | 134 | ? | ? | ? |
| " | 08/24/79 | 124 | ? | ? | ? |
| " | 06/17/78 | 56 | ? | ? | ? |
| " | 08/10/78 | 110 | ? | ? | ? |
| " | 05/25/80 | 763 | | 23 | 0 |
| " | 06/03/78 | 42 | | 11 | 0 |
| " | 07/15/78 | 84 | | 23.5 | 0 |
| " | 05/25/80 | 763 | ? | ? | ? |
| " | 03/21/78 | ? | 0 | 0 | 0 |
| " | 02/10/79 | 294 | | 17 | 0 |
| " | 06/04/78 | 43 | | 23.5 | 0 |
| " | 06/04/78 | 43 | | 24 | 0 |
| " | 09/10/78 | 141 | | 21 | 0 |
| " | 07/24/78 | 93 | | 22 | 0 |
| 05/25/78 | 05/30/78 | 6 | | 7.5 | 0 |
| 04/30/78 | 08/78 | 94 | | 21 | 0 |
| " | 11/03/78 | 188 | | 5 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/30/78 | 10/10/78 | 164 | 0 | 0 | 0 |
| 06/08/78 | 06/78 | ? | 0.5 | | 0 |
| 06/14/78 | 05/26/80 | 712 | 4 | | 0 |
| 06/20/78 | 08/16/78 | 67 | | 3 | 0 |
| 07/18/78 | 08/09/78 | 23 | | 6 | 0 |
| 07/20/78 | 08/10/78 | 22 | | 6 | 0 |
| 07/27/78 | 01/21/79 | 179 | 6 | | 0 |
| 08/16/78 | 09/03/79 | 384 | | 4 | 0 |
| " | 07/24/80 | 708 | 0 | 0 | 0 |
| 08/17/78 | 07/11/80 | 694 | 0 | 0 | 0 |
| " | 05/28/80 | 651 | 2 | | 0 |
| " | 09/22/78 | 37 | 1 | | 0 |
| " | 08/18/78 | 1 | 4.5 | | 0 |
| " | 05/22/80 | 644 | 0 | 0 | 0 |
| " | 05/18/79 | 275 | | 1.5 | 0 |
| 08/21/78 | 08/31/78 | 11 | 0 | 0 | 0 |
| " | 09/09/78 | 20 | | 7 | 0 |
| " | 08/24/79 | 369 | 2 | | 0 |
| " | 05/20/81 | 638 | | 7 | 0 |
| " | 08/15/79 | 360 | | 2 | 0 |
| 08/22/78 | 09/11/81 | 1,116 | | 9 | 0 |
| " | 05/03/80 | 620 | | 13.5 | 0 |
| 08/23/78 | 05/29/80 | 646 | 0 | 0 | 0 |
| " | 09/03/78 | 13 | 0 | 0 | 0 |
| " | 08/25/78 | 3 | 0 | 0 | 0 |
| " | 10/25/78 | 65 | 23 | | 0 |
| " | 04/28/79 | 249 | ? | ? | ? |
| " | 06/30/80 | 677 | 0 | 0 | 0 |
| " | 05/23/79 | 274 | 0 | 0 | 0 |
| 08/28/78 | 07/21/80 | 693 | ? | ? | ? |
| " | 06/05/79 | 282 | | 6 | 0 |
| " | 05/27/80 | 638 | | 2 | 0 |
| " | 05/23/80 | 634 | 0 | 0 | 0 |
| " | 06/21/79 | 298 | 0 | 0 | 0 |
| 08/29/78 | 09/15/78 | 18 | | 1 | 0 |
| " | 04/26/79 | 238 | 21 | | 0 |
| " | 04/07/79 | 219 | 21 | | 0 |
| " | 06/15/79 | 291 | | 1 | 0 |
| " | 05/26/80 | 636 | 5 | | 0 |
| 04/09/79 | 02/22/81 | 685 | 0 | 0 | 0 |
| " | 05/21/79 | 43 | | 32 | 0 |
| 04/17/79 | 06/06/80 | 416 | | 9.5 | 0 |
| " | 05/30/79 | 44 | | 24 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/17/79 | 05/30/79 | 44 | | 24 | 0 |
| " | 01/29/81 | 653 | | 19.5 | 0 |
| " | 08/15/79 | 122 | | 28 | 0 |
| " | 10/20/80 | 553 | | 16 | 0 |
| " | 06/01/79 | 46 | | 19.5 | 0 |
| " | 05/15/79 | 29 | 14 | | 1 |
| " | 06/09/79 | 54 | | 30 | 0 |
| " | 05/21/79 | 35 | 14 | | 1 |
| " | 08/02/80 | 473 | | 22.5 | 0 |
| " | 06/16/79 | 61 | | 27.5 | 0 |
| " | 10/02/79 | 169 | | 19.5 | 0 |
| " | 04/13/82 | 362 | 0 | 0 | 0 |
| " | 03/21/81 | 735 | 0 | 0 | 0 |
| " | 03/08/81 | 722 | 0 | 0 | 0 |
| " | 06/08/79 | 53 | | 32 | 0 |
| " | 05/16/80 | 395 | | 17 | 0 |
| " | 04/07/80 | 386 | 0 | 0 | 0 |
| " | 07/18/81 | 823 | | 29 | 0 |
| " | 05/25/79 | 39 | | 24 | 0 |
| " | 06/02/79 | 47 | | 26 | 0 |
| " | 11/05/80 | 568 | 0 | 0 | 0 |
| " | 05/10/80 | 389 | 14 | | 1 |
| " | 05/22/79 | 36 | 14 | | 1 |
| " | 04/22/82 | 1,101 | 0 | 0 | 0 |
| 04/18/79 | 06/06/81 | 779 | | 10 | 0 |
| " | 10/25/81 | 920 | 0 | 0 | 0 |
| " | 11/04/81 | 930 | | 1 | 0 |
| " | 10/15/79 | 180 | | 29 | 0 |
| " | 06/05/80 | 382 | | 8 | 0 |
| " | 09/11/79 | 146 | | 25 | 0 |
| " | 10/04/79 | 169 | | 25 | 0 |
| " | 07/05/79 | 78 | | 23 | 0 |
| " | 06/30/79 | 73 | | 25 | 0 |
| " | 10/20/80 | 550 | | 16 | 0 |
| " | 09/03/79 | 138 | | 29 | 0 |
| " | 06/29/79 | 72 | | 24 | 0 |
| " | 05/20/79 | 32 | | 26 | 0 |
| " | 04/30/80 | 377 | | 1 | 0 |
| " | 05/31/80 | 408 | | 29 | 0 |
| " | 01/12/82 | 1,000 | | 22 | 0 |
| " | 05/31/79 | 44 | | 24 | 0 |
| " | 10/13/82 | 575 | | 32 | 0 |
| " | 04/21/79 | 4 | | 1 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/18/79 | 08/79 | 106 | | 16 | 0 |
| " | 05/26/79 | 39 | | 20 | 0 |
| " | 08/15/79 | 120 | | 28 | 0 |
| " | 08/25/79 | 129 | | 29 | 0 |
| " | 07/11/79 | 85 | | 17 | 0 |
| " | 05/26/79 | 39 | | 20 | 0 |
| " | 06/06/80 | 415 | | 22.5 | 0 |
| " | 02/14/81 | 668 | ? | ? | ? |
| " | 05/21/79 | 34 | 14 | | 1 |
| " | 05/20/79 | 33 | 14 | | 1 |
| 04/19/79 | 05/12/79 | 25 | | 9.5 | 0 |
| " | 06/05/79 | 48 | | 25 | 0 |
| " | 05/24/81 | 766 | | 10 | 0 |
| " | 10/31/82 | 1,291 | | 32 | 0 |
| " | 05/31/80 | 408 | | 30 | 0 |
| " | 09/06/80 | 506 | | 20 | 0 |
| " | 05/80 | 378 | 14 | | 1 |
| " | 79 | ? | | 1 | 0 |
| 04/22/79 | 11/05/79 | 198 | 0 | 0 | 0 |
| " | 06/05/79 | 45 | 14 | | 1 |
| " | 04/23/79 | 2 | | 1 | 0 |
| " | 05/25/80 | 399 | | 24 | 0 |
| 04/23/79 | 05/10/80 | 383 | | 24 | 0 |
| " | 07/09/81 | 808 | | 17 | 0 |
| 06/07/79 | 04/24/80 | 322 | 24 | | 0 |
| 06/13/79 | 07/04/80 | 387 | 0 | 0 | 0 |
| 06/15/79 | 06/26/79 | 12 | | 3 | 0 |
| " | 06/03/80 | 354 | 0 | 0 | 0 |
| 07/09/79 | 07/24/80 | 383 | 2 | | 0 |
| " | ? | ? | ? | ? | ? |
| 07/17/79 | 08/07/79 | 22 | | 10.5 | 0 |
| 07/26/79 | 08/06/80 | 377 | 2 | | 0 |
| 08/01/79 | 06/22/80 | 326 | 0 | 0 | 0 |
| 08/07/79 | 05/19/80 | 286 | | 1 | 0 |
| 08/10/79 | 09/19/79 | 41 | | 4 | 0 |
| " | 05/28/80 | 292 | | 2 | 0 |
| 08/28/79 | 05/21/80 | 157 | | 7 | 0 |
| 08/29/79 | 08/03/80 | 340 | 0 | 0 | 0 |
| " | 07/23/80 | 329 | ? | ? | ? |
| " | 05/21/80 | 266 | | 5 | 0 |
| 08/30/79 | 07/01/80 | 306 | | 2.5 | 0 |
| " | 10/15/80 | 412 | 20 | | 0 |
| " | 04/05/80 | 219 | 20 | | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 08/20/79 | 08/03/80 | 338 | 0 | 0 | 0 |
| " | 07/08/80 | 313 | 0 | 0 | 0 |
| 09/04/79 | 06/80 | 271 | | 0.5 | 0 |
| " | 06/03/80 | 273 | | 0.5 | 0 |
| " | 06/01/80 | 271 | | 2 | 0 |
| 09/05/79 | 05/24/80 | 262 | | 3 | 0 |
| " | 09/20/80 | 381 | 20 | | 0 |
| " | 05/21/80 | 382 | | 6 | 0 |
| " | 08/09/80 | 339 | ? | ? | ? |
| 09/27/79 | 05/26/80 | 242 | 1 | | 0 |
| 10/02/79 | 05/24/80 | 235 | | 0.5 | 0 |
| 10/10/79 | 05/21/80 | 224 | 0 | 0 | 0 |
| " | 05/22/80 | 225 | 2 | | 0 |
| 04/15/80 | 04/17/80 | 2 | 1 | | 0 |
| " | 05/25/80 | 41 | | 20 | 0 |
| " | 05/18/80 | 34 | | 21.5 | 0 |
| " | 06/10/80 | 57 | | 25 | 0 |
| " | 05/31/80 | 47 | | 22 | 0 |
| " | 05/01/80 | 17 | | 31 | 0 |
| " | 05/26/80 | 42 | | 25 | 0 |
| " | 09/16/80 | 155 | | 27 | 0 |
| " | 04/29/80 | 15 | 0 | 0 | 0 |
| " | 10/14/80 | 153 | 15 | | 0 |
| " | 05/31/80 | 47 | | 23 | 0 |
| " | 05/28/80 | 44 | | 28 | 0 |
| " | 05/30/80 | 46 | | 24 | 0 |
| 04/16/80 | 05/30/80 | 45 | | 25 | 0 |
| " | ? | ? | 0 | 0 | 0 |
| " | 06/03/80 | 49 | | 25 | 0 |
| " | 06/06/80 | 52 | | 31 | 0 |
| " | 07/01/82 | 777 | ? | ? | ? |
| " | 04/18/80 | 3 | 1 | | 0 |
| " | 05/15/80 | 30 | ? | ? | ? |
| " | 06/04/80 | 50 | | 28 | 0 |
| " | 03/03/81 | 322 | 1 | | 0 |
| " | 10/05/80 | 172 | | 8.5 | 0 |
| " | 02/02/80 | ? | | 26 | 0 |
| " | 05/12/80 | 27 | | 24 | 0 |
| " | 04/20/80 | 5 | 0 | 0 | 0 |
| " | 05/13/80 | 28 | | 21.5 | 0 |
| " | 05/14/80 | 29 | | 16 | 0 |
| " | 05/29/80 | 44 | | 23 | 0 |
| " | 10/18/80 | 186 | | 7.5 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/16/80 | 06/01/80 | 47 | | 23 | 0 |
| " | 11/02/80 | 201 | 1 | | 0 |
| " | 05/25/80 | 40 | | 20 | 0 |
| " | 05/08/80 | 23 | | 31 | 0 |
| " | 05/31/80 | 46 | | 25 | 0 |
| " | 05/28/80 | 43 | | 25 | 0 |
| " | 10/21/80 | 189 | 1 | | 0 |
| 04/17/80 | 06/24/80 | 69 | | 22 | 0 |
| " | 03/12/81 | 330 | 1 | | 0 |
| " | 05/24/80 | 38 | | 15 | 0 |
| " | 04/28/80 | 12 | 1 | | 0 |
| " | 06/03/80 | 48 | | 15 | 0 |
| " | 05/16/80 | 30 | | 20 | 0 |
| " | 05/26/80 | 40 | | 20 | 0 |
| " | 04/15/81 | 364 | ? | ? | ? |
| " | 06/14/80 | 59 | | 25 | 0 |
| " | 05/14/80 | 28 | | 23 | 0 |
| " | 07/12/80 | 87 | | 21.5 | 0 |
| 04/18/80 | 10/06/80 | 172 | | 31 | 0 |
| " | 05/04/82 | 747 | 2 | | 1 |
| " | 05/15/80 | 28 | | 23 | 0 |
| " | 05/30/80 | 43 | | 25 | 0 |
| " | 05/19/80 | 32 | | 24 | 1 |
| " | 06/10/80 | 54 | | 23 | 0 |
| " | 05/25/80 | 38 | | 28 | 0 |
| " | 10/15/80 | 181 | | 15 | 0 |
| " | 10/06/83 | 1,267 | | 31 | 0 |
| " | 05/27/80 | 40 | | 31 | 0 |
| " | 05/19/80 | 32 | | 44 | 0 |
| " | 05/03/80 | 16 | | 24 | 0 |
| " | 07/11/80 | 85 | | 21 | 0 |
| " | 04/30/80 | 13 | | 4 | 0 |
| " | 10/13/81 | 544 | 0 | 0 | 0 |
| " | 06/06/80 | 50 | | 21.5 | 0 |
| " | 05/18/81 | 396 | | 8 | 0 |
| " | 07/21/80 | 95 | | 16 | 0 |
| " | 06/10/80 | 54 | ? | ? | ? |
| " | 06/05/80 | 49 | | 23.5 | 0 |
| " | 05/29/80 | 42 | | 28 | 0 |
| " | 05/25/80 | 38 | | 21 | 0 |
| " | 10/23/81 | 554 | 0 | 0 | 0 |
| " | 10/24/80 | 190 | 1 | | 0 |
| " | 05/05/80 | 18 | | 23 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/18/80 | 05/28/80 | 41 | | 22 | 0 |
| " | 07/06/81 | 445 | | 31 | 0 |
| " | 05/17/80 | 30 | | 21.5 | 0 |
| " | 07/23/80 | 97 | | 20.5 | 0 |
| " | 06/06/80 | 38 | | 29 | 0 |
| " | 05/18/80 | 31 | | 21.5 | 0 |
| " | 03/10/81 | 327 | 1 | | 0 |
| " | 06/06/81 | 415 | | 9 | 0 |
| " | 06/10/80 | 54 | ? | ? | ? |
| " | 02/15/81 | 304 | 1 | | 0 |
| " | 05/25/80 | 38 | | 22 | 0 |
| " | 05/21/80 | 34 | | 28 | 0 |
| 04/20/80 | 10/16/80 | 150 | 1 | | 0 |
| " | 04/21/80 | 2 | | 16 | 0 |
| 04/22/80 | 06/03/81 | 408 | | 16 | 0 |
| " | 06/22/81 | 62 | | 19 | 0 |
| " | 05/27/80 | 36 | | 28 | 0 |
| " | 07/16/80 | 86 | | 31 | 0 |
| " | 08/28/80 | 99 | | 23 | 0 |
| " | 07/20/81 | 455 | ? | ? | ? |
| " | 07/07/80 | 77 | | 31 | 0 |
| " | 05/17/80 | 26 | | 18.5 | 0 |
| " | 03/27/82 | 705 | 1 | | 0 |
| " | 05/21/80 | 30 | | 28 | 0 |
| " | 06/17/80 | 57 | | 36 | 0 |
| " | 06/07/80 | 47 | | 31 | 0 |
| " | 12/15/80 | 238 | 1 | | 0 |
| " | 05/30/80 | 39 | | 26.5 | 0 |
| " | 08/25/80 | 126 | | 18.5 | 0 |
| " | 05/30/81 | 404 | | 17 | 0 |
| " | 05/20/80 | 29 | | 31 | 0 |
| 04/23/80 | 05/20/80 | 28 | | 21.5 | 0 |
| " | 02/17/81 | 301 | | 21 | 0 |
| " | 09/24/80 | 155 | | 19 | 0 |
| " | 05/28/80 | 36 | | 28 | 0 |
| " | 04/29/80 | 7 | 1 | | 0 |
| " | 05/25/80 | 33 | | 16 | 0 |
| " | 07/15/80 | 84 | ? | ? | ? |
| " | 07/08/80 | 77 | | 19 | 0 |
| " | 06/04/80 | 43 | | 21.5 | 0 |
| " | 06/06/81 | 410 | | 43 | 0 |
| " | 07/05/80 | 74 | | 28 | 0 |
| " | 05/10/80 | 18 | | 23 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/23/80 | 06/02/80 | 41 | | 31 | 0 |
| " | 05/28/80 | 36 | | 21 | 0 |
| " | 09/01/80 | 132 | | 18.5 | 0 |
| " | 05/27/81 | 400 | | 23 | 0 |
| " | 01/13/81 | 266 | | 18.5 | 0 |
| " | 09/08/80 | 139 | | 18.5 | 0 |
| 04/24/80 | 05/25/80 | 32 | | 23 | 0 |
| " | 06/15/80 | 53 | | 16 | 0 |
| " | 05/31/81 | 403 | | 16 | 0 |
| " | 05/03/80 | 10 | 1 | | 0 |
| " | 06/03/80 | 41 | | 19 | 0 |
| " | 10/06/81 | 531 | 1 | | 0 |
| " | 05/31/80 | 38 | | 23 | 0 |
| " | 06/03/81 | 406 | | 8.5 | 0 |
| " | 07/01/82 | 799 | | 28 | 0 |
| " | 05/16/81 | 388 | | 21.5 | 0 |
| " | 05/14/80 | 21 | | 26.5 | 0 |
| " | 07/01/82 | 799 | | 28 | 0 |
| " | 05/27/80 | 34 | | 25 | 0 |
| " | 08/13/80 | 112 | | 25 | 0 |
| 04/16/80 | 04/26/80 | 11 | 1 | | 0 |
| " | 06/08/80 | 54 | | 22 | 0 |
| " | 05/05/81 | 385 | | 19 | 0 |
| " | 05/22/80 | 37 | | 31 | 0 |
| " | 04/26/80 | 11 | 1 | | 0 |
| " | 11/80 | 200 | 1 | | 0 |
| " | 04/24/83 | 1,104 | | 31 | 0 |
| " | 05/08/81 | 388 | 26 | | 1 |
| " | 06/06/80 | 52 | | 31 | 0 |
| 04/21/80 | 05/22/80 | 32 | | 31 | 0 |
| 04/22/80 | 05/20/80 | 393 | | 23 | 0 |
| " | 03/26/81 | 339 | 1 | | 0 |
| " | 05/11/80 | 20 | | 21 | 0 |
| " | 11/80 | 194 | | 31 | 0 |
| " | 05/24/80 | 33 | | 21 | 0 |
| 04/23/80 | 10/15/80 | 176 | | 31 | 0 |
| " | 05/23/80 | 31 | | 31 | 0 |
| " | 06/03/81 | 407 | | 16 | 0 |
| " | 07/04/80 | 73 | | 23 | 0 |
| " | ? | ? | ? | ? | ? |
| " | 05/25/80 | 33 | | 31 | 0 |
| " | 06/01/81 | 405 | | 16 | 0 |
| " | 05/14/80 | 22 | | 23 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/23/80 | 09/07/80 | 138 | | 2 | 0 |
| " | 06/06/80 | 45 | | 31 | 0 |
| " | 02/14/81 | 298 | | 21 | 0 |
| " | 05/30/80 | 38 | | 19 | 0 |
| 04/21/80 | 06/28/80 | 69 | | 21.5 | 0 |
| " | 07/01/80 | 72 | | 24 | 0 |
| " | 05/23/80 | 33 | | 23 | 0 |
| " | 05/24/80 | 34 | | 23 | 0 |
| " | 09/15/80 | 148 | | 18.5 | 0 |
| " | 05/23/80 | 33 | | 18.5 | 0 |
| " | 05/19/80 | 29 | | 21.5 | 0 |
| " | 06/06/81 | 412 | | 31 | 0 |
| 04/17/80 | 07/11/80 | 86 | | 22 | 0 |
| " | 05/23/80 | 37 | | 18.5 | 0 |
| " | 05/04/80 | 18 | | 16 | 0 |
| " | 06/14/80 | 59 | | 28 | 0 |
| " | 04/20/80 | 4 | 1 | | 0 |
| " | 03/07/81 | 325 | 1 | | 0 |
| 04/22/80 | 05/24/80 | 3 | | 21.5 | 0 |
| " | 06/25/80 | 65 | | 31 | 0 |
| " | 10/06/80 | 168 | 1 | | 0 |
| " | 05/31/80 | 40 | | 22 | 0 |
| 04/17/80 | 05/29/80 | 43 | | 25 | 0 |
| " | 03/14/81 | 332 | | 23 | 0 |
| " | 07/20/80 | 95 | | 18.5 | 0 |
| " | 06/28/80 | 73 | | 25 | 0 |
| " | 05/26/80 | 40 | | 27 | 0 |
| " | 06/10/80 | 55 | | 24 | 0 |
| 04/16/80 | 06/13/80 | 59 | 1 | | 0 |
| 04/17/80 | 03/07/81 | 325 | 1 | | 0 |
| " | 05/24/80 | 38 | | 16 | 0 |
| " | 08/81 | 472 | | 28 | 0 |
| " | 11/08/80 | 206 | | 23 | 0 |
| " | 04/01/81 | 350 | 1 | | 0 |
| " | 05/18/80 | 48 | | 31 | 0 |
| 04/22/80 | 07/18/80 | 88 | ? | ? | ? |
| " | 05/18/80 | 48 | | 31 | 0 |
| " | 07/04/80 | 74 | | 31 | 0 |
| " | 05/13/80 | 22 | | 23 | 0 |
| " | 07/28/82 | 828 | | 29 | 0 |
| " | 10/05/80 | 198 | | 7.5 | 0 |
| " | 06/02/80 | 42 | | 28 | 0 |
| " | 04/15/81 | 359 | 1 | | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/22/80 | 05/23 '80 | 32 | | 23 | 0 |
| " | 05/11 '80 | 20 | | 31 | 0 |
| " | 08/03 '80 | 104 | | 19 | 0 |
| " | 05/03 '80 | 12 | 1 | | 0 |
| " | 05/28 '80 | 37 | | 21 | 0 |
| 04/23/80 | 07/20 '80 | 89 | | 29 | 0 |
| " | 07/01 '80 | 70 | | 28 | 0 |
| " | 06/03 80 | 42 | | 21.5 | 0 |
| " | 05/28 80 | 36 | | 21 | 0 |
| " | 08/19 83 | 1,214 | | 26.5 | 0 |
| " | 05/28 82 | 766 | | 22 | 0 |
| " | 09/12 80 | 143 | 1 | | 0 |
| " | 06/24 80 | 63 | | 23 | 0 |
| 04/24/80 | 05/21 80 | 28 | | 29 | 0 |
| " | 06/19 81 | 422 | | 24 | 0 |
| " | 05/31 80 | 38 | | 25 | 0 |
| " | 06/05 80 | 43 | | 23.5 | 0 |
| " | 07/02 80 | 40 | | 24 | 0 |
| " | 04/29 81 | 371 | | 31 | 0 |
| " | 05/29 80 | 36 | | 24 | 0 |
| " | 05/21 81 | 393 | | 19 | 0 |
| " | 06/16 80 | 54 | | 31 | 0 |
| " | 06/24 80 | 31 | | 25 | 0 |
| " | 05/27 80 | 34 | | 21 | 0 |
| " | 05/20 81 | 392 | | 9 | 0 |
| " | 05/31 80 | 38 | | 19 | 0 |
| " | 06/04 81 | 408 | | 31 | 0 |
| " | 06/07 80 | 45 | | 22 | 0 |
| " | 05/24 80 | 31 | | 19 | 0 |
| " | 05/28 80 | 35 | | 24 | 0 |
| " | 05/26 80 | 33 | | 22 | 0 |
| " | 07/01 80 | 139 | | 28 | 0 |
| " | 05/22 80 | 29 | | 31 | 0 |
| " | 10/07 80 | 167 | 0 | 0 | 0 |
| " | 05/24 81 | 396 | | 9 | 0 |
| " | 07/09 80 | 77 | | 28 | 0 |
| 04/25/80 | 05/24 80 | 30 | | 31 | 0 |
| " | 05/11 80 | 17 | 0 | 0 | 0 |
| " | 04/24 83 | 1,095 | 1 | | 0 |
| " | 05/30 80 | 36 | | 16 | 0 |
| " | 05/24 80 | 30 | ? | ? | ? |
| " | 05/31 80 | 37 | | 31 | 0 |
| " | 10/08 80 | 167 | | 31 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/25/80 | 09/15/81 | 144 | | 16 | 0 |
| " | 08/81 | 464 | | 28 | 0 |
| " | 07/22/82 | 819 | | 28 | 0 |
| " | 06/01/81 | 403 | | 16 | 0 |
| " | 07/25/80 | 92 | | 24 | 0 |
| " | 05/21/80 | 27 | | 23 | 0 |
| " | 06/08/80 | 43 | | 22 | 0 |
| " | 05/15/80 | 21 | | 23 | 0 |
| " | 05/25/80 | 31 | | 18 | 0 |
| " | 07/10/80 | 77 | 1 | | 0 |
| " | 06/08/80 | 45 | | 28 | 0 |
| " | 05/25/80 | 31 | | 31 | 0 |
| " | 05/11/80 | 17 | 0 | 0 | 0 |
| " | 05/29/80 | 35 | | 25 | 0 |
| " | 05/25/80 | 31 | | 19 | 0 |
| " | 05/22/80 | 28 | | 28 | 0 |
| " | 05/03/80 | 9 | | 14 | 0 |
| " | 05/22/80 | 28 | | 31 | 0 |
| " | 07/15/80 | 82 | | 23 | 0 |
| " | 05/24/81 | 395 | ? | ? | ? |
| " | 09/15/81 | 509 | ? | ? | ? |
| " | 06/19/81 | 421 | | 24 | 0 |
| " | 06/01/80 | 38 | | 24 | 0 |
| " | 09/20/81 | 514 | | 21.5 | 0 |
| " | 05/25/80 | 31 | | 8.5 | 0 |
| " | 05/24/80 | 30 | | 19 | 0 |
| " | 07/15/81 | 480 | | 47.5 | 0 |
| " | 06/16/80 | 53 | | 24 | 0 |
| " | 07/02/80 | 69 | | 39.2 | 0 |
| " | 08/02/80 | 100 | | 31 | 0 |
| " | 02/19/81 | 301 | 1 | | 0 |
| " | 05/27/80 | 33 | | 31 | 0 |
| " | 05/15/80 | 21 | | 24 | 0 |
| " | 06/04/80 | 41 | | 31 | 0 |
| " | 07/12/80 | 79 | | 16 | 0 |
| " | 05/21/80 | 27 | | 28 | 0 |
| " | 05/25/80 | 31 | | 27 | 0 |
| " | 07/08/81 | 440 | | 26.5 | 0 |
| " | 05/25/80 | 31 | | 32 | 0 |
| " | 05/18/80 | 24 | | 16 | 0 |
| " | 04/05/81 | 346 | | 22 | 0 |
| " | 05/26/80 | 32 | | 22 | 0 |
| " | 06/01/82 | 768 | | 21.5 | 0 |

Table 20. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/25/80 | 05/27/80 | 33 | | 24 | 0 |
| " | 05/19/80 | 25 | | 39 | 0 |
| 04/28/80 | 07/13/80 | 77 | | 21.5 | 0 |
| " | 06/11/83 | 1,140 | | 28 | 0 |
| " | 07/04/80 | 68 | | 19 | 0 |
| " | 05/25/80 | 28 | | 28 | 0 |
| " | 07/09/80 | 73 | | 31 | 0 |
| " | ? | ? | 1 | | .0 |
| " | 06/11/80 | 45 | | 24 | 0 |
| " | 06/13/80 | 47 | | 31 | 0 |
| " | 05/29/80 | 32 | | 26 | 0 |
| " | 05/01/80 | 4 | 0 | 0 | 0 |
| " | 09/04/81 | 495 | | 26.5 | 0 |
| " | 07/24/80 | 88 | | 17 | 0 |
| " | 05/31/80 | 34 | | 22 | 0 |
| " | 06/03/80 | 37 | | 28 | 0 |
| 04/29/80 | 05/22/80 | 24 | | 24 | 0 |
| " | 03/22/81 | 328 | 0 | 0 | 0 |
| " | 05/23/80 | 25 | | 24 | 0 |
| " | 06/13/80 | 46 | | 31 | 0 |
| " | 07/17/80 | 80 | | 23 | 0 |
| " | 10/01/80 | 156 | 1 | | 0 |
| " | 07/27/80 | 90 | ? | ? | ? |
| " | 06/19/80 | 52 | | 26.5 | 0 |
| " | 05/22/80 | 24 | | 19 | 0 |
| " | 11/10/80 | 196 | 1 | | 0 |
| " | 05/27/80 | 29 | | 21 | 0 |
| " | 05/21/80 | 23 | | 25 | 0 |
| " | 05/27/81 | 394 | | 24 | 0 |
| " | 11/22/80 | 208 | 1 | | 0 |

Table 21. Returns from mark-recapture study on sauger in Pool 5 during 1959, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| 04/59 | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |

Table 22. Returns from mark-recapture study on sauger in Pool 14 during 1971-1975, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/29/75 | 04/20/76 | 174 | 49.8 | | 1 |
| 06/06/72 | 06/20/72 | 14 | 0 | 0 | 0 |
| 06/20/72 | 06/22/72 | 2 | 0 | 0 | 0 |
| " | 06/21/72 | 1 | 0 | 0 | 0 |
| 08/22/72 | 09/06/72 | 15 | 0 | 0 | 0 |
| 09/06/72 | 10/03/72 | 27 | 0 | 0 | 0 |
| 10/03/72 | 10/17/72 | 14 | 0 | 0 | 0 |
| 10/20/71 | 11/02/72 | 378 | 4.0 | | 0 |
| " | 02/26/72 | 129 | 15.0 | | 0 |
| 10/02/72 | 02/24/73 | 145 | 15.5 | | 0 |
| 09/19/72 | 04/03/73 | 196 | 50.5 | | 1 |
| 10/09/73 | 04/20/74 | 194 | | 23.0 | 2 |
| 08/27/74 | 10/25/74 | 59 | 17.4 | | 0 |

Table 23. Percent returns from mark-recapture study on walleye in Pool 4 during 1976-1980, by Minnesota Department of Natural Resources.

| Recapture location | Fall 1976 | Spring 1977 | Fall 1977 | Spring 1978 | Summer 1978 | Fall 1979 | Fall 1980 |
|---|---|---|---|---|---|---|---|
| Pool 3 and St. Croix River | 3% | 5% | 8% | 11% | 3% | 8% | 1% |
| Pool 4 | 95% | 90% | 91% | 84% | 94% | 84% | 96% |
| Pool 5 and Chippewa River | 2% | 5% | 1% | 3% | 3% | 8% | 1% |

Table 24. Returns from mark-recapture study on walleye in Pool 4 during 1973-1980, by Minnesota, Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 05/23/73 | 07/14/73 | 52 | | 2 | 0 |
| " | 08/19/73 | 88 | | 3 | 0 |
| " | 06/01/73 | 8 | | 3 | 0 |
| 05/29/73 | 06/18/73 | 20 | | 0.5 | 0 |
| 05/30/73 | 07/12/73 | 43 | 4 | | 0 |
| 06/05/73 | 06/23/73 | 18 | 0.5 | | 0 |
| 06/07/73 | 07/18/73 | 41 | 1 | | 0 |
| " | 06/21/73 | 14 | 1 | | 0 |
| " | 06/15/73 | 8 | | 0.5 | 0 |
| " | 06/29/73 | 22 | | 1 | 0 |
| 06/11/73 | 06/17/73 | 6 | 2 | | 0 |
| 07/23/73 | 06/17/74 | 329 | 11.5 | | 0 |
| 11/06/73 | 07/15/74 | 251 | | 2 | 0 |
| " | 05/18/74 | 193 | 0 | 0 | 0 |
| " | 06/01/75 | 572 | 11 | | 0 |
| " | 06/04/74 | 210 | 2 | | 0 |
| 10/18/73 | 05/18/74 | 212 | | 1.5 | 0 |
| " | 03/20/74 | 153 | ? | | 0 |
| 11/09/73 | 05/16/74 | 188 | 1 | | 0 |
| " | 07/12/74 | 245 | | 7 | 0 |
| 06/24/74 | 06/25/74 | 1 | 0 | 0 | 0 |
| 07/10/74 | 05/12/74 | 1,036 | | 40.8 | 2 |
| 08/08/74 | 05/06/75 | 271 | 44 | | 0 |
| 09/20/74 | 05/13/75 | 235 | | 6 | 0 |
| " | 06/14/75 | 267 | 16.5 | | 0 |
| " | 05/22/75 | 244 | | 6 | 0 |
| " | 06/20/75 | 273 | | 1 | 0 |
| " | 06/20/75 | 273 | 5 | | 0 |
| " | 05/13/76 | 600 | 0 | 0 | 0 |
| " | 01/06/76 | 695 | | 3 | 0 |
| 09/27/74 | 05/27/75 | 243 | 6 | | 0 |
| " | 06/16/75 | 263 | 9 | | 0 |
| " | 08/06/75 | 314 | | 6 | 0 |
| " | 07/11/75 | 288 | 2 | | 0 |
| " | 10/26/75 | 394 | | 1 | 0 |
| " | 07/03/75 | 280 | 6 | | 0 |
| " | 05/25/76 | 242 | | 3 | 0 |
| " | 07/06/75 | 283 | 6 | | 0 |
| " | 06/07/75 | 254 | 8 | | 0 |
| " | 06/01/75 | 248 | | 5.5 | 0 |
| " | 06/08/75 | 255 | | 8 | 0 |
| " | 06/20/75 | 267 | 18.5 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/27/74 | 09/01/75 | 339 | 3 | | 0 |
| " | 06/27/75 | 274 | | 5.5 | 0 |
| " | 06/01/75 | 248 | 18 | | 0 |
| " | 08/06/75 | 314 | | 3 | 0 |
| " | 06/29/75 | 276 | 6.5 | | 0 |
| " | 05/03/75 | 219 | 44 | | 0 |
| 04/24/75 | 05/29/76 | 400 | 95.5 | | 0 |
| " | 05/12/75 | 21 | 89.5 | | 0 |
| " | 05/29/76 | 35 | 111.5 | | 0 |
| 06/13/75 | 08/21/75 | 69 | | 3 | 0 |
| 08/28/75 | 05/30/76 | 275 | 6 | | 0 |
| 09/08/75 | 06/13/76 | 278 | 0 | 0 | 0 |
| 09/09/75 | 03/06/76 | 178 | 30 | | 0 |
| 09/24/75 | 05/15/78 | 963 | 41 | | 0 |
| " | 04/28/76 | 216 | 0 | 0 | 0 |
| " | 07/03/76 | 282 | 9 | | 0 |
| " | 11/01/75 | 38 | 0 | 0 | 0 |
| " | 05/18/76 | 236 | 0 | 0 | 0 |
| " | 06/05/76 | 249 | 5.5 | | 0 |
| " | 06/19/76 | 263 | 0.5 | | 0 |
| " | 05/21/76 | 234 | 5 | | 0 |
| " | 05/22/76 | 235 | 5 | | 0 |
| " | 06/25/76 | 269 | 11 | | 0 |
| " | 05/29/76 | 242 | 1 | | 0 |
| " | 06/01/76 | 245 | | 0.5 | 0 |
| 09/29/75 | 06/20/76 | 259 | 0 | 0 | 0 |
| " | 11/15/75 | 47 | | 1 | 0 |
| " | 05/01/76 | 214 | 16.5 | | 0 |
| " | 05/26/76 | 239 | 6 | | 0 |
| " | 05/15/76 | 228 | | 1 | 0 |
| " | 04/30/76 | 213 | | 12 | 0 |
| " | 04/27/76 | 210 | 12 | | 0 |
| " | 05/30/77 | 578 | 0 | 0 | 0 |
| " | 04/28/76 | 211 | 18 | | 0 |
| " | 04/30/76 | 213 | | 14 | 0 |
| " | 04/16/77 | 564 | 16 | | 0 |
| " | 05/05/76 | 218 | 14 | | 0 |
| " | 05/26/76 | 239 | 1 | | 0 |
| " | 10/18/75 | 19 | 1 | | 0 |
| " | 04/11/77 | 559 | 20 | | 0 |
| 01/28/76 | 11/15/80 | 1,751 | ? | ? | ? |
| " | 04/19/76 | 81 | 32.2 | | 0 |
| " | 04/29/76 | 91 | | 7 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 01/28/76 | 06/15/76 | 138 | 21.5 | | 0 |
| " | 06/08/76 | 131 | 37 | | 0 |
| " | 12/18/76 | 324 | | 5.5 | 0 |
| 02/03/76 | 05/10/76 | 96 | | 5.5 | 0 |
| " | 05/28/76 | 114 | | 1 | 0 |
| " | 05/02/76 | 88 | | 5.5 | 0 |
| 04/05/76 | 04/26/76 | 21 | | 1 | 0 |
| " | 06/16/76 | 72 | | 0.4 | 0 |
| 04/06/76 | 06/06/76 | 61 | | 0.5 | 0 |
| " | 05/05/75 | 29 | | 0.9 | 0 |
| 04/07/76 | 07/03/76 | 87 | | 32.6 | 0 |
| " | 04/11/76 | 4 | 10 | | 0 |
| " | 06/15/76 | 69 | | 10 | 0 |
| " | 05/31/76 | 54 | | 5 | 0 |
| " | 05/04/76 | 27 | 0 | 0 | 0 |
| 04/08/76 | 05/29/76 | 51 | | 0.5 | 0 |
| 04/15/76 | 06/03/76 | 49 | | 48.5 | 1 |
| " | 05/15/76 | 30 | | 48.5 | 1 |
| " | 05/28/78 | 408 | ? | ? | ? |
| " | 06/02/76 | 48 | | 46 | 1 |
| " | 06/29/76 | 75 | | 8.5 | 0 |
| " | 05/29/76 | 44 | 6 | | 0 |
| " | 05/30/76 | 45 | | 6.5 | 0 |
| " | 04/08/77 | 372 | 3 | | 0 |
| 04/16/76 | 05/29/76 | 43 | | 22 | 0 |
| " | 06/01/76 | 46 | | 3 | 0 |
| " | 08/09/76 | 115 | | 26 | 0 |
| " | 05/24/77 | 403 | | 16 | 0 |
| 04/19/76 | 06/01/76 | 43 | 2.1 | | 0 |
| 05/05/76 | 05/18/76 | 13 | 0 | 0 | 0 |
| " | 05/09/76 | 4 | 0 | 0 | 0 |
| " | 05/15/76 | 10 | 0 | 0 | 0 |
| 05/24/76 | 05/30/76 | 6 | 1 | | 0 |
| " | 07/22/76 | 56 | 5 | | 0 |
| 09/22/76 | 05/03/77 | 223 | 20 | | 0 |
| " | 02/10/77 | 141 | 30 | | 0 |
| " | 07/19/77 | 300 | 29 | | 0 |
| " | 04/26/77 | 216 | 0 | 0 | 0 |
| " | 06/02/77 | 253 | 9.5 | | 0 |
| " | 03/03/77 | 162 | | 53.5 | 0 |
| " | 01/18/77 | 118 | 1 | | 0 |
| " | 05/06/77 | 226 | | 4 | 0 |
| " | 03/11/77 | 170 | 28 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/22/76 | 07/15/77 | 296 | | 1 | 0 |
| " | 04/16/77 | 206 | 22 | | 0 |
| " | 03/05/77 | 164 | 28 | | 0 |
| " | 05/01/77 | 221 | | 5 | 0 |
| 09/23/76 | 06/04/77 | 254 | 4 | | 0 |
| " | 05/29/77 | 248 | 5 | | 0 |
| " | 06/12/77 | 262 | 6 | | 0 |
| " | 03/18/77 | 176 | 26 | | 0 |
| " | 03/11/77 | 169 | 26 | | 0 |
| " | 10/31/76 | 38 | | 1 | 0 |
| " | 05/24/77 | 243 | | 5 | 0 |
| " | 10/04/76 | 11 | | 5.5 | 0 |
| " | 07/08/77 | 288 | | 1 | 0 |
| " | 05/24/77 | 243 | 10 | | 0 |
| " | 04/30/77 | 219 | 94 | | 2 |
| " | 05/19/77 | 238 | 2 | | 0 |
| " | 06/22/77 | 272 | 0 | 0 | 0 |
| 09/24/76 | 05/09/77 | 227 | | 5 | 0 |
| " | 07/03/77 | 282 | 0 | 0 | 0 |
| " | 06/03/77 | 252 | ? | ? | ? |
| " | ? | - | 12 | | 0 |
| " | 04/18/77 | 206 | 12 | | 0 |
| " | 12/24/76 | 91 | | 7 | 0 |
| | 10/29/76 | 35 | | 4 | 0 |
| | 03/23/80 | 180 | 12 | | 0 |
| " | 02/22/77 | 151 | 15 | | 0 |
| " | 05/11/77 | 229 | 9 | | 0 |
| " | 06/14/77 | 263 | 0 | 0 | 0 |
| " | 10/30/76 | 36 | 11.5 | | 0 |
| " | 06/18/77 | 267 | | 3 | 0 |
| " | 06/15/77 | 264 | | 5 | 0 |
| " | 02/19/77 | 148 | 15 | | 0 |
| " | 05/23/77 | 241 | | 3 | 0 |
| " | 02/24/77 | 153 | 15 | | 0 |
| " | 04/17/77 | 205 | 15 | | 0 |
| " | 03/26/77 | 183 | 15 | | 0 |
| " | 10/30/76 | 36 | 15 | | 0 |
| " | 04/12/77 | 200 | 15 | | 0 |
| 09/27/76 | 05/24/77 | 239 | 0 | 0 | 0 |
| " | 05/26/78 | 606 | 32 | | 1 |
| " | 04/16/77 | 201 | 18 | | 0 |
| " | 05/20/77 | 235 | 0 | 0 | 0 |
| " | 04/07/77 | 192 | 27 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/27/76 | 10/27/76 | 30 | 0 | 0 | 0 |
| " | 06/07/77 | 253 | | 3 | 0 |
| " | 09/05/77 | 343 | | 2 | 0 |
| " | 05/30/78 | 610 | 12 | | 0 |
| " | 06/02/77 | 248 | 0 | 0 | 0 |
| " | 03/12/77 | 166 | 18 | | 0 |
| " | 04/09/77 | 194 | 18 | | 0 |
| " | 03/24/77 | 178 | | 11 | 0 |
| " | 10/16/76 | 19 | | 4 | 0 |
| " | 08/13/78 | 320 | 8 | | 0 |
| " | 06/02/77 | 248 | 2 | | 0 |
| " | 06/17/78 | 263 | | 4 | 0 |
| " | 07/16/78 | 234 | | 4.5 | 0 |
| " | 02/16/77 | 142 | 20 | | 0 |
| " | 04/29/77 | 214 | | 2.5 | 0 |
| " | 05/14/77 | 229 | 2 | | 0 |
| " | 08/06/78 | 678 | 2 | | 0 |
| " | 04/10/77 | 195 | 20 | | 0 |
| " | 06/19/78 | 265 | 10.5 | | 0 |
| " | 06/23/79 | 269 | 2 | | 0 |
| " | 05/02/78 | 217 | ? | ? | ? |
| " | 06/22/77 | 268 | 0 | 0 | 0 |
| " | 11/06/76 | 40 | 20 | | 0 |
| " | 12/11/76 | 75 | 2 | | 0 |
| 09/28/76 | 05/13/78 | 290 | 0 | 0 | 0 |
| " | 05/26/79 | 303 | 0 | 0 | 0 |
| " | 05/01/78 | 580 | 9 | | 0 |
| " | ? | ? | | 2 | 0 |
| " | 07/02/77 | 277 | 5 | | 0 |
| " | 05/11/77 | 225 | | 3 | 0 |
| " | 06/24/78 | 634 | | 16 | 0 |
| " | 10/22/76 | 24 | 0 | 0 | 0 |
| " | 05/25/79 | 969 | 7 | | 0 |
| " | 09/16/77 | 261 | | 14 | 0 |
| " | 10/01/78 | 733 | | 3 | 0 |
| 09/29/76 | 06/03/77 | 247 | | 18.2 | 1 |
| " | 07/23/78 | 297 | | 7 | 0 |
| " | 06/04/78 | 613 | | 7 | 0 |
| " | 05/14/77 | 227 | 2 | | 0 |
| " | 04/30/77 | 213 | ? | ? | ? |
| " | 06/28/77 | 272 | | 7 | 0 |
| " | 10/26/76 | 27 | | 17 | 0 |
| " | 05/25/77 | 238 | 24 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/29/76 | 04/23/77 | 206 | 22 | | 0 |
| " | 02/11/77 | 135 | 1 | | 0 |
| " | 06/18/77 | 262 | 12 | | 0 |
| " | 08/13/77 | 318 | 11 | | 0 |
| " | 05/01/77 | 214 | 22 | | 0 |
| " | 02/25/78 | 149 | 27 | | 0 |
| " | 04/16/77 | 199 | 28 | | 0 |
| " | 06/19/77 | 263 | | 4 | 0 |
| " | 03/31/77 | 183 | | 17 | 1 |
| " | 10/01/77 | 367 | | 2 | 0 |
| " | 04/22/77 | 208 | | 4 | 0 |
| " | 06/28/80 | 275 | | 6 | 0 |
| " | 06/02/78 | 249 | | 3 | 0 |
| " | 10/01/77 | 370 | 3 | | 0 |
| " | 08/05/78 | 678 | 24 | | 0 |
| " | 05/29/77 | 245 | 16 | | 0 |
| 09/30/76 | 10/29/76 | 29 | 17 | | 0 |
| " | 04/22/79 | 934 | 33 | | 1 |
| " | 06/03/81 | 1,706 | 18 | | 0 |
| " | 05/15/80 | 1,322 | | 14 | 0 |
| " | 06/11/77 | 254 | 3 | | 0 |
| " | 05/14/77 | 226 | 17 | | 0 |
| " | 05/30/77 | 232 | | 36 | 1 |
| " | 06/12/77 | 245 | | 75 | 3 |
| " | 06/01/77 | 234 | 2 | | 0 |
| " | 06/12/77 | 245 | | 5 | 0 |
| " | 04/28/77 | 200 | | 15 | 0 |
| " | 04/07/77 | 179 | 16 | | 0 |
| " | 11/11/78 | 772 | 9 | | 0 |
| " | 07/15/78 | 653 | 6 | | 0 |
| " | 03/09/77 | 160 | 18 | | 0 |
| " | 10/26/76 | 26 | | 2 | 0 |
| " | 03/13/77 | 164 | | 6 | 0 |
| " | 04/15/77 | 197 | | 15 | 0 |
| " | 07/07/79 | 1,010 | | 12 | 0 |
| " | 05/29/77 | 241 | 3 | | 0 |
| " | 03/31/77 | 102 | 14 | | 0 |
| " | 05/16/77 | 228 | 14 | | 0 |
| " | 05/07/77 | 219 | | 1 | 0 |
| " | 05/10/77 | 222 | 2 | | 0 |
| " | 04/14/77 | 196 | 12 | | 0 |
| " | 06/16/77 | 259 | | 13 | 0 |
| " | 11/07/76 | 38 | 19 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/30/76 | 11/12/78 | 773 | 11 | | 0 |
| " | 02/11/77 | 134 | 19 | | 0 |
| " | 05/14/77 | 226 | 4 | | 0 |
| " | 06/09/77 | 252 | 6 | | 0 |
| " | 06/01/79 | 974 | | 11 | 0 |
| " | 04/02/77 | 184 | 21 | | 0 |
| " | 04/16/77 | 198 | 21 | | 0 |
| " | 06/01/77 | 244 | 4 | | 0 |
| " | 05/16/77 | 228 | 16 | | 0 |
| " | 10/07/76 | 7 | | 2 | 0 |
| 10/01/76 | 05/29/77 | 240 | | 32 | 0 |
| " | 12/14/76 | 74 | 0 | 0 | 0 |
| " | 10/08/76 | 7 | 0 | 0 | 0 |
| " | 11/15/78 | 775 | | 7 | 0 |
| " | 11/19/78 | 779 | | 3 | 0 |
| " | 04/03/77 | 184 | 9 | | 0 |
| " | 05/08/77 | 219 | | 23 | 0 |
| " | 06/20/77 | 262 | 0 | 0 | 0 |
| " | 03/12/78 | 162 | 9 | | 0 |
| " | 07/07/77 | 279 | | 23 | 0 |
| " | 02/18/79 | 870 | 9 | | 0 |
| " | 02/20/77 | 142 | 7 | | 0 |
| " | 05/27/77 | 238 | | 23 | 0 |
| " | 06/11/77 | 253 | | 23 | 0 |
| " | 05/02/77 | 213 | 0 | 0 | 0 |
| " | 04/23/77 | 204 | 10 | | 0 |
| " | 01/04/77 | 95 | 10 | | 0 |
| 04/01/77 | 04/04/78 | 368 | 0 | 0 | 0 |
| " | 06/16/77 | 76 | 0 | 0 | 0 |
| " | 05/03/80 | 1,127 | | 12.5 | 0 |
| " | 06/17/78 | 442 | | 17 | 0 |
| " | 04/15/77 | 14 | 0 | 0 | 0 |
| " | 10/14/77 | 196 | | 43 | 0 |
| " | 06/19/77 | 79 | | 5 | 0 |
| " | 05/01/78 | 395 | 12 | | 1 |
| " | 04/14/77 | 13 | | 5 | 0 |
| 04/16/77 | 05/25/77 | 38 | | 9.5 | 0 |
| " | 05/24/77 | 37 | | 18 | 0 |
| 04/19/77 | 06/11/77 | 53 | | 20 | 0 |
| 04/17/77 | 05/14/77 | 27 | | 22 | 0 |
| 04/19/77 | 06/18/77 | 60 | | 0.5 | 0 |
| " | 07/17/77 | 89 | 0 | 0 | 0 |
| 04/20/77 | 09/15/77 | 148 | | 3 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/20/77 | 06/13/78 | 419 | 0 | 0 | 0 |
| 04/25/77 | 05/14/77 | 19 | | 2 | 0 |
| 04/27/78 | 05/13/78 | 381 | | 11 | 0 |
| " | 07/29/78 | 458 | | 19 | 0 |
| 04/28/77 | 05/31/78 | 398 | 0 | 0 | 0 |
| 09/08/77 | 07/01/78 | 296 | | 10 | 0 |
| " | 08/24/78 | 350 | 56 | | 1 |
| " | 10/18/78 | 405 | | 1 | 0 |
| " | 07/02/78 | 297 | 0.5 | | 0 |
| " | 07/12/78 | 307 | 2 | | 0 |
| " | 05/28/79 | 627 | 22 | | 0 |
| 09/08/77 | 11/01/80 | 1,042 | | 1 | 0 |
| " | 10/19/77 | 41 | | 5 | 0 |
| " | 10/01/77 | 23 | | 1 | 0 |
| " | 06/18/78 | 283 | 0 | 0 | 0 |
| " | 07/04/78 | 299 | 0 | 0 | 0 |
| " | 07/13/78 | 308 | 1.5 | | 0 |
| " | 05/26/79 | 654 | 0 | 0 | 0 |
| " | 05/02/78 | 265 | | 8 | 0 |
| " | 04/09/79 | 606 | | 15.2 | 0 |
| " | 07/20/79 | 709 | 0 | 0 | 0 |
| " | 12/19/78 | 465 | 0 | 0 | 0 |
| " | 04/29/80 | 963 | 5 | | 0 |
| " | 08/05/78 | 331 | | 1 | 0 |
| 09/13/77 | 06/21/78 | 281 | 1 | | 0 |
| " | 06/16/79 | 641 | 2 | | 0 |
| " | 09/28/78 | 380 | | 4 | 0 |
| " | 05/21/78 | 250 | | 11 | 0 |
| " | 10/04/77 | 21 | 0 | 0 | 0 |
| " | 10/06/77 | 23 | 2 | | 0 |
| " | 12/09/78 | 452 | 6 | | 0 |
| " | 06/14/78 | 274 | 54 | | 0 |
| " | 06/02/79 | 627 | | 2 | 0 |
| " | 08/19/78 | 340 | | 1 | 0 |
| " | 05/23/78 | 252 | | 1 | 0 |
| " | 06/12/78 | 272 | | 6 | 0 |
| " | 05/02/78 | 231 | | 2 | 0 |
| " | 04/29/79 | 593 | | 3.5 | 0 |
| " | 09/15/77 | 2 | 0 | 0 | 0 |
| " | 09/02/79 | 719 | 3 | | 0 |
| " | 06/08/79 | 633 | | 2 | 0 |
| " | 04/21/78 | 220 | | 8 | 0 |
| 09/23/77 | 02/02/78 | 132 | 0 | 0 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/23/77 | 11/01/80 | 1,134 | | 3 | 0 |
| " | 10/22/77 | 29 | 2 | | 0 |
| " | 10/13/77 | 20 | 16 | | 0 |
| " | 05/25/78 | 244 | 0 | 0 | 0 |
| " | 05/11/78 | 230 | 4 | | 0 |
| " | 06/10/78 | 264 | 5.5 | | 0 |
| " | 07/13/78 | 287 | 22 | | 0 |
| " | 03/06/79 | 529 | 27 | | 0 |
| " | 08/11/78 | 322 | | 2 | 0 |
| " | 10/31/78 | 403 | 4 | | 0 |
| " | 06/19/78 | 269 | | 6 | 0 |
| " | 05/15/78 | 234 | | 9 | 0 |
| " | 07/16/78 | 296 | | 5 | 0 |
| " | 05/12/78 | 231 | | 1 | 0 |
| " | 06/10/78 | 260 | 50 | | 2 |
| 09/28/77 | 08/06/78 | 312 | 2 | | 0 |
| " | 05/17/78 | 231 | 0 | 0 | 0 |
| " | 08/06/78 | 312 | 4 | | 0 |
| " | 06/11/78 | 256 | 12 | | 0 |
| " | 04/20/78 | 204 | 36 | | 1 |
| " | 06/16/78 | 261 | 10.5 | | 0 |
| " | 05/31/78 | 245 | 11.5 | | 0 |
| " | 06/28/78 | 273 | | 2 | 0 |
| " | 06/13/79 | 623 | 2 | | 0 |
| " | 06/14/79 | 624 | | 12 | 0 |
| " | 08/01/78 | 307 | 4 | | 0 |
| " | 07/28/78 | 303 | 2 | | 0 |
| " | 07/20/78 | 295 | 0 | 0 | 0 |
| " | 08/15/79 | 686 | 0 | 0 | 0 |
| " | 03/19/78 | 172 | 19 | | 0 |
| " | 09/08/78 | 345 | | 2 | 0 |
| " | 07/15/79 | 655 | 0 | 0 | 0 |
| " | 02/12/79 | 502 | 17 | | 0 |
| " | 09/07/78 | 354 | | 12 | 0 |
| " | 08/19/78 | 325 | 0 | 0 | 0 |
| " | 05/10/78 | 224 | | 6 | 0 |
| " | 06/01/78 | 246 | | 6 | 0 |
| " | 07/17/78 | 292 | 0 | 0 | 0 |
| " | 05/10/78 | 224 | | 6 | 0 |
| " | 09/27/79 | 729 | | 4 | 0 |
| " | 07/10/78 | 285 | 0 | 0 | 0 |
| " | 07/13/78 | 288 | | 14 | 0 |
| " | 11/04/77 | 37 | 17 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/28/77 | 07/13/78 | 288 | 6.5 | 0 | 0 |
| " | 06/04/78 | 249 | 1 | | 0 |
| " | 05/12/78 | 226 | | 12 | 0 |
| " | 05/26/78 | 240 | | 4 | 0 |
| " | 05/25/78 | 239 | | 4 | 0 |
| 10/12/77 | 06/01/79 | 597 | | 6 | 0 |
| 10/14/77 | 05/23/79 | 587 | 52 | | 1 |
| " | 05/05/78 | 204 | 14 | | 0 |
| " | 05/20/78 | 219 | 8 | | 0 |
| " | 03/01/78 | 138 | 19 | | 0 |
| " | 07/01/78 | 261 | | 2 | 0 |
| " | 05/03/78 | 202 | 50.5 | | 1 |
| " | 05/19/78 | 215 | 19 | | 0 |
| " | 02/26/78 | 135 | 19 | | 0 |
| " | 07/28/79 | 653 | 6 | | 0 |
| " | 09/06/78 | 327 | | 2 | 0 |
| 10/17/77 | 11/18/17 | 32 | 2 | | 0 |
| 10/18/77 | 07/13/78 | 269 | | 20 | 0 |
| " | 05/23/78 | 217 | 27 | | 1 |
| " | 05/10/79 | 569 | 0 | 0 | 0 |
| " | 06/24/78 | 249 | | 20 | 0 |
| " | 11/18/78 | 396 | | 20 | 0 |
| " | 04/15/78 | 179 | 26 | | 1 |
| " | 07/04/79 | 625 | 2.5 | | 0 |
| " | 06/19/78 | 245 | 2.5 | | 0 |
| " | 08/06/78 | 293 | | 14 | 0 |
| " | 06/03/78 | 232 | | 10 | 0 |
| " | 04/08/78 | 176 | 14 | | 0 |
| " | 04/29/78 | 193 | 63 | | 1 |
| " | 04/23/78 | 187 | | 17 | 0 |
| " | 06/03/78 | 229 | | 18 | 0 |
| " | 04/20/78 | 184 | 14 | | 0 |
| 10/19/77 | 08/01/79 | 651 | | 2 | 0 |
| " | 05/02/78 | 195 | | 2 | 0 |
| " | 06/26/78 | 250 | | 7 | 0 |
| " | 06/04/79 | 228 | | 4 | 0 |
| " | 05/31/78 | 224 | 10 | | 0 |
| " | 05/20/78 | 213 | | 6 | 0 |
| 10/20/77 | 10/27/77 | 7 | 10 | | 0 |
| " | 06/04/78 | 227 | 24 | | 0 |
| " | 06/10/79 | 598 | 12 | | 0 |
| " | 02/14/79 | 117 | 17 | | 0 |
| " | 05/26/78 | 218 | | 2 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/20/77 | 05/06/78 | 198 | 9 | | 0 |
| " | 04/22/80 | 184 | 29 | | 1 |
| " | 05/21/78 | 213 | | 7 | 0 |
| " | 04/20/78 | 182 | 14 | | 0 |
| 10/21/77 | 07/07/78 | 259 | | 6 | 0 |
| " | 08/05/79 | 653 | | 22 | 0 |
| " | 04/26/78 | 185 | 33 | | 1 |
| " | 05/27/78 | 216 | | 2 | 0 |
| " | 06/17/78 | 239 | 0 | 0 | 0 |
| " | 09/23/78 | 306 | | 11 | 0 |
| " | 05/25/78 | 214 | | 4 | 0 |
| " | 05/14/78 | 205 | 34 | | 1 |
| " | 02/01/78 | 103 | | 8 | 0 |
| " | 06/16/78 | 238 | | 4 | 0 |
| " | 02/28/80 | 860 | 22 | | 0 |
| " | 07/19/78 | 271 | 4 | | 0 |
| " | 03/18/78 | 148 | 21 | | 0 |
| " | 06/01/78 | 223 | 0 | 0 | 0 |
| " | 08/23/78 | 306 | | 4 | 0 |
| " | 06/10/79 | 232 | 52 | | 1 |
| " | 06/01/81 | 1,318 | | 22 | 0 |
| " | 05/20/78 | 211 | 10 | | 0 |
| " | 07/23/78 | 275 | | 16 | 0 |
| " | 06/12/78 | 234 | | 10 | 0 |
| 10/25/77 | 06/06/78 | 224 | 40 | | 1 |
| " | 07/02/78 | 250 | 8 | | 0 |
| " | 05/12/78 | 199 | | 4 | 0 |
| " | 05/13/78 | 200 | | 5 | 0 |
| " | 11/07/77 | 13 | | 5 | 0 |
| " | 05/24/78 | 211 | | 1 | 0 |
| " | 06/03/78 | 221 | | 10 | 0 |
| " | 05/11/78 | 198 | 0 | 0 | 0 |
| " | 06/18/79 | 571 | 1 | | 0 |
| " | 07/16/79 | 599 | | 10.5 | 0 |
| " | 06/02/79 | 555 | | 5.5 | 0 |
| " | 06/10/78 | 228 | | 5 | 0 |
| " | 05/10/78 | 197 | | 10 | 0 |
| " | 08/25/78 | 304 | 58 | | 1 |
| " | 04/17/79 | 538 | 42 | | 1 |
| " | 05/31/80 | 948 | 1 | | 0 |
| " | 06/03/78 | 221 | 1 | | 0 |
| " | 06/19/78 | 237 | | 8 | 0 |
| " | 05/06/78 | 193 | | 1 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured |
|---|---|
| 10/25/77 | 05/18/78 |
| " | 02/14/79 |
| " | 07/23/78 |
| " | 06/12/79 |
| " | 10/07/79 |
| " | 05/23/78 |
| " | 05/27/79 |
| " | 09/10/80 |
| " | 05/22/79 |
| " | 05/26/78 |
| " | 07/11/79 |
| " | 04/26/79 |
| " | 05/15/78 |
| " | 07/08/79 |
| " | 06/22/78 |
| " | 05/01/78 |
| " | 06/02/78 |
| " | 06/05/78 |
| " | 02/01/78 |
| " | 05/22/78 |
| " | 07/16/78 |
| 10/26/77 | 07/02/78 |
| " | 11/14/77 |
| " | 05/27/78 |
| " | 04/29/79 |
| " | 05/23/78 |
| " | 05/27/78 |
| " | 09/15/78 |
| 04/03/78 | 09/15/78 |
| " | 02/03/79 |
| " | 07/27/78 |
| " | 04/29/78 |
| " | 06/18/78 |
| " | 06/03/78 |
| " | 05/04/78 |
| " | 05/23/79 |
| " | 04/29/78 |
| " | 05/26/79 |
| " | 05/28/79 |
| " | 07/10/78 |
| " | 05/27/78 |
| " | 10/28/78 |
| 04/04/78 | 05/15/78 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/04/78 | 07/01/78 | 88 | | 35 | 0 |
| " | 05/22/78 | 48 | | 4 | 0 |
| " | 04/01/79 | 362 | 0 | 0 | 0 |
| 04/07/78 | 05/14/78 | 37 | | 17 | 0 |
| " | 08/19/78 | 134 | | 5 | 0 |
| " | 05/05/79 | 393 | 15 | | 1 |
| " | 05/08/79 | 396 | 15 | | 0 |
| " | 07/11/78 | 95 | 31 | | 1 |
| " | 08/31/78 | 146 | | 21 | 0 |
| " | 07/25/78 | 109 | | 29 | 0 |
| " | 08/26/78 | 141 | | 27 | 0 |
| " | 06/04/78 | 58 | 1 | | 1 |
| " | 09/23/79 | 533 | | 29 | 0 |
| " | 08/26/78 | 140 | 0 | 0 | 0 |
| " | 08/12/78 | 126 | 21 | | 1 |
| " | 05/08/78 | 122 | | 29 | 0 |
| " | 05/14/78 | 128 | | 8 | 0 |
| " | 10/20/79 | 651 | | 36 | 0 |
| " | 09/26/78 | 263 | 28 | | 1 |
| " | 07/16/78 | 191 | | 39 | 0 |
| " | 01/28/79 | 661 | 31 | | 1 |
| " | 05/20/78 | 134 | | 31 | 0 |
| " | 03/19/80 | 711 | 0 | 0 | 0 |
| 04/10/78 | 05/16/78 | 36 | 15 | | 1 |
| " | 05/25/80 | 775 | | 22 | 0 |
| " | 07/25/79 | 471 | | 36 | 0 |
| " | 06/03/79 | 419 | | 11 | 0 |
| " | 08/01/78 | 113 | | 23.5 | 0 |
| " | 04/30/78 | 20 | | 18 | 1 |
| " | 06/15/78 | 66 | | 32 | 0 |
| 04/11/78 | 05/13/78 | 32 | | 2 | 0 |
| " | 07/04/79 | 449 | | 9 | 0 |
| " | 06/15/78 | 65 | 20 | | 1 |
| " | 05/13/78 | 32 | 42 | | 1 |
| " | 10/16/79 | 188 | | 5 | 0 |
| " | 05/27/78 | 46 | | 9 | 0 |
| " | 07/31/78 | 111 | | 39 | 0 |
| " | 06/03/78 | 53 | | 33 | 0 |
| " | 05/26/78 | 45 | | 25 | 0 |
| " | 06/19/78 | 69 | | 31 | 0 |
| " | 04/21/83 | 1,835 | 15 | | 1 |
| " | 04/15/80 | 734 | | 44 | 0 |
| " | 07/15/78 | 95 | 15 | | 1 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/11/78 | 05/28/78 | 47 | | 22 | 0 |
| " | 06/09/78 | 59 | 5 | | 1 |
| " | 05/28/78 | 47 | 16 | | 1 |
| " | 10/28/78 | 212 | | 15 | 0 |
| " | 03/29/80 | 717 | 1 | | 0 |
| " | 05/21/78 | 40 | | 23 | 0 |
| " | 06/04/78 | 54 | | 23 | 0 |
| " | 06/19/81 | 69 | | 30 | 0 |
| " | 05/17/78 | 36 | 15 | | 1 |
| " | 05/31/78 | 50 | | 31 | 0 |
| " | 06/10/78 | 60 | | 8 | 0 |
| 04/12/78 | 04/16/78 | 4 | 0 | 0 | 0 |
| " | 07/16/78 | 95 | | 15 | 0 |
| " | 08/22/78 | 132 | 35 | | 1 |
| " | 05/30/78 | 48 | 0 | 0 | 0 |
| 04/13/78 | 05/30/78 | 47 | | 40 | 0 |
| " | 05/22/78 | 39 | | 37 | 0 |
| " | 06/08/78 | 56 | | 31 | 0 |
| 04/14/78 | 06/02/79 | 413 | | 33 | 0 |
| " | 05/31/78 | 47 | | 31 | 0 |
| " | 05/25/79 | 406 | | 8 | 0 |
| " | 05/10/78 | 26 | | 8 | 0 |
| " | 10/15/79 | 549 | | 36 | 0 |
| " | 08/19/79 | 492 | | 23 | 0 |
| " | 07/05/78 | 82 | | 22 | 0 |
| " | 08/29/79 | 502 | | 29 | 0 |
| " | 09/24/78 | 163 | | 29 | 0 |
| " | 06/17/78 | 64 | 15 | | 1 |
| 04/15/78 | 05/12/78 | 27 | | 24 | 0 |
| " | 05/20/79 | 400 | 7 | | 0 |
| " | 06/04/78 | 50 | | 9 | 0 |
| " | 06/16/78 | 62 | | 22 | 0 |
| 04/16/78 | 05/21/78 | 35 | | 6 | 0 |
| " | 05/28/79 | 407 | | 9 | 0 |
| " | 05/23/78 | 37 | | 31 | 0 |
| " | 05/16/78 | 30 | | 41 | 0 |
| " | 07/25/79 | 465 | | 36 | 0 |
| 04/17/78 | 07/16/78 | 90 | | 42 | 1 |
| " | 07/19/80 | 823 | | 6 | 0 |
| " | 10/20/80 | 915 | 0 | 0 | 0 |
| " | 05/28/80 | 771 | | 16 | 0 |
| " | 05/28/79 | 406 | | 5 | 0 |
| " | 02/24/79 | 313 | | 2 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/17/78 | 05/27/79 | 405 | 2 | | 0 |
| " | 09/01/78 | 137 | 3 | | 0 |
| " | 08/13/78 | 118 | | 6 | 0 |
| " | 05/29/78 | 42 | | 21 | 0 |
| " | 09/16/78 | 152 | | 14 | 0 |
| " | 05/31/78 | 44 | | 29 | 0 |
| " | 06/03/79 | 412 | | 15 | 0 |
| 04/19/78 | 06/16/78 | 58 | | 21 | 0 |
| " | 07/05/79 | 442 | | 20 | 0 |
| " | 07/08/78 | 80 | | 17 | 0 |
| " | 06/17/78 | 59 | | 17 | 0 |
| " | 05/28/78 | 39 | | 24 | 0 |
| " | 05/01/78 | 11 | | 5 | 0 |
| " | 07/24/78 | 96 | | 36 | 0 |
| " | 05/20/78 | 31 | | 36 | 0 |
| " | 06/03/78 | 45 | | 39 | 0 |
| " | 05/28/78 | 39 | | 11 | 0 |
| " | 08/03/78 | 106 | | 36 | 0 |
| " | 02/13/79 | 300 | 0 | 0 | 0 |
| " | 03/24/79 | 339 | 0 | 0 | 0 |
| " | 05/31/79 | 407 | | 31 | 0 |
| " | 08/17/78 | 119 | 0 | 0 | 0 |
| " | 06/08/78 | 49 | | 32 | 0 |
| " | 06/18/78 | 59 | | 17 | 0 |
| " | 05/25/78 | 36 | | 22 | 0 |
| " | 07/05/79 | 442 | | 32 | 0 |
| " | 05/20/78 | 31 | | 37 | 0 |
| " | 05/26/78 | 37 | | 53 | 1 |
| " | 06/20/78 | 62 | | 9 | 0 |
| " | 07/01/78 | 73 | | 11 | 0 |
| " | 07/19/78 | 91 | 0 | 0 | 0 |
| 04/20/78 | 05/23/78 | 33 | | 23 | 0 |
| " | 09/29/78 | 162 | 0 | 0 | 0 |
| " | 04/30/78 | 10 | | 23 | 0 |
| " | 10/13/78 | 176 | | 32 | 0 |
| " | 05/31/78 | 41 | | 31 | 0 |
| " | 05/16/78 | 26 | | 5 | 0 |
| " | 07/16/78 | 87 | | 17 | 0 |
| " | 06/17/78 | 58 | | 17 | 0 |
| " | 05/28/78 | 38 | 0 | 0 | 0 |
| " | 08/09/78 | 111 | | 28 | 0 |
| " | 05/20/78 | 30 | | 28 | 0 |
| " | 06/22/78 | 63 | | 27 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/20/78 | 07/31/78 | 102 | | 29 | 0 |
| 04/21/78 | 07/16/78 | 86 | | 15 | 0 |
| " | 10/15/79 | 177 | | 3 | 0 |
| " | 12/29/68 | 251 | | 23 | 0 |
| " | 06/30/79 | 252 | | 11 | 0 |
| " | 08/31/78 | 132 | | 27 | 0 |
| " | 07/17/78 | 87 | | 23 | 0 |
| " | 06/16/78 | 56 | 1 | | 1 |
| " | 05/20/78 | 29 | | 37 | 0 |
| " | 06/13/80 | 53 | | 16 | 0 |
| " | 07/06/78 | 76 | | 29 | 0 |
| " | 07/17/78 | 87 | | 21 | 0 |
| " | 06/09/78 | 49 | | 8 | 0 |
| " | 07/02/80 | 802 | | 30 | 0 |
| " | 04/21/79 | 365 | | 4 | 0 |
| " | 07/16/78 | 86 | | 7 | 0 |
| " | 06/04/79 | 44 | | 21 | 0 |
| 04/24/78 | 05/20/78 | 26 | 18 | | 0 |
| " | 05/28/78 | 34 | 18 | | 0 |
| " | 05/28/78 | 34 | | 54 | 1 |
| " | 07/02/79 | 434 | | 29 | 0 |
| " | 04/22/79 | 363 | 15 | | 1 |
| " | 05/31/78 | 37 | | 31 | 0 |
| " | 06/02/78 | 39 | | 32 | 0 |
| " | 06/13/78 | 52 | | 19 | 0 |
| " | 06/22/78 | 61 | | 17 | 0 |
| " | 05/31/78 | 37 | | 6 | 0 |
| " | 05/21/78 | 27 | | 37 | 0 |
| " | 03/19/80 | 694 | 1 | | 1 |
| " | 06/02/78 | 39 | | 32 | 0 |
| " | 06/13/78 | 50 | | 19 | 0 |
| " | 06/22/78 | 57 | | 17 | 0 |
| " | 05/31/78 | 35 | | 8 | 0 |
| " | 05/21/78 | 25 | | 37 | 0 |
| " | 03/19/80 | 694 | | 1 | 0 |
| " | 03/19/79 | 329 | | 53 | 1 |
| " | 06/13/78 | 50 | | 14 | 0 |
| " | 06/03/79 | 405 | | 16 | 0 |
| " | 05/18/78 | 24 | | 15 | 0 |
| " | 06/11/78 | 48 | | 13 | 0 |
| " | 05/13/78 | 19 | | 2 | 0 |
| " | 06/09/78 | 46 | | 9 | 0 |
| " | 05/16/78 | 22 | | 27 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/24/78 | 05/09/78 | 15 | 0 | 0 | 0 |
| " | 07/04/78 | 71 | | 27 | 0 |
| " | 07/17/78 | 84 | | 31 | 0 |
| " | 11/07/78 | 197 | 0 | 0 | 0 |
| " | 05/25/78 | 31 | | 31 | 0 |
| " | 06/10/78 | 47 | 11 | | 0 |
| " | 06/17/78 | 54 | | 6 | 0 |
| " | 05/12/78 | 18 | | 23 | 0 |
| " | 06/07/79 | 378 | | 1 | 0 |
| " | 06/01/78 | 38 | | 3 | 0 |
| " | 06/05/78 | 42 | | 8 | 0 |
| " | 06/03/78 | 40 | | 43 | 0 |
| " | 10/28/78 | 187 | | 8 | 0 |
| " | 06/18/78 | 55 | | 28 | 0 |
| " | 05/27/78 | 33 | | 30 | 0 |
| " | 05/26/78 | 32 | | 30 | 0 |
| " | 04/09/79 | 350 | | 42 | 0 |
| 04/25/78 | 09/29/78 | 157 | | 18 | 0 |
| " | 05/21/78 | 26 | | 28 | 0 |
| " | 06/06/78 | 42 | 0 | 0 | 0 |
| " | 06/01/79 | 402 | | 31 | 0 |
| " | 06/14/78 | 54 | | 27 | 0 |
| " | 05/20/78 | 25 | | 5 | 0 |
| " | 05/11/78 | 16 | | 8 | 0 |
| " | 06/03/78 | 39 | | 14 | 0 |
| " | 05/14/78 | 19 | | 5 | 0 |
| " | 06/10/78 | 46 | | 17 | 0 |
| 06/05/78 | 05/20/80 | 714 | | 6 | 0 |
| 06/08/78 | 05/31/80 | 722 | | 15 | 0 |
| 06/14/78 | 07/16/78 | 32 | 6 | | 0 |
| " | 05/24/80 | 709 | | 8 | 0 |
| 06/20/78 | 09/02/78 | 74 | | 3 | 0 |
| 07/07/78 | 07/24/78 | 17 | 0 | 0 | 0 |
| " | 07/23/78 | 16 | 8 | | 0 |
| " | 07/06/79 | 364 | 6 | | 0 |
| 07/20/78 | 09/17/78 | 59 | | 4 | 0 |
| " | 06/04/79 | 319 | 1 | | 0 |
| " | 08/06/78 | 17 | 5 | | 0 |
| 07/18/78 | 06/11/83 | 1,824 | | 5 | 0 |
| 07/19/78 | 07/25/78 | 6 | 2 | | 0 |
| " | 08/23/78 | 35 | | 8 | 0 |
| 07/20/78 | 05/31/82 | 1,410 | 7 | | 0 |
| " | 09/29/78 | 71 | | 4 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 07/24/78 | 05/25/79 | 305 | 10 | | 0 |
| " | 06/02/79 | 313 | | 18 | 0 |
| " | 06/03/79 | 314 | 2 | | 0 |
| 07/26/78 | 05/27/79 | 305 | | 5 | 0 |
| " | 07/04/81 | 1,438 | 2 | | 0 |
| 07/27/78 | 05/19/79 | 296 | 1 | | 0 |
| " | 06/05/79 | 313 | 0 | 0 | 0 |
| 08/16/78 | 06/15/79 | 303 | 0 | 0 | 0 |
| " | 10/20/80 | 795 | 8 | | 0 |
| 08/17/78 | 05/20/79 | 276 | 0 | 0 | 0 |
| " | 06/17/79 | 304 | 6 | | 0 |
| " | 07/11/82 | 1,423 | 0 | 0 | 0 |
| " | 08/01/79 | 349 | 1 | | 0 |
| " | 07/19/79 | 336 | | 1 | 0 |
| 08/21/78 | 06/21/80 | 669 | 0 | 0 | 0 |
| " | 05/05/79 | 257 | 36 | | 1 |
| " | 07/21/79 | 334 | | 3 | 0 |
| " | 07/04/79 | 317 | 0 | 0 | 0 |
| " | 06/05/79 | 288 | 5 | | 0 |
| 08/23/78 | 08/26/78 | 3 | 2 | | 0 |
| " | 07/15/82 | 1,421 | 0 | 0 | 0 |
| " | 02/19/79 | 180 | 23 | | 0 |
| " | 05/30/79 | 280 | | 14 | 0 |
| 08/29/78 | 06/07/79 | 282 | | 2 | 0 |
| 09/24/79 | 05/27/80 | 245 | 13 | | 0 |
| " | 06/21/80 | 270 | 4 | | 0 |
| 09/27/79 | 07/22/80 | 298 | | 22 | 0 |
| " | 06/12/83 | 1,353 | 12 | | 0 |
| " | 06/10/81 | 621 | | 10 | 0 |
| " | 07/19/80 | 295 | 3 | | 0 |
| " | 07/05/80 | 281 | 1 | | 0 |
| " | 08/10/82 | 1,047 | | 5 | 0 |
| " | 06/20/80 | 266 | 0 | 0 | 0 |
| " | 07/10/80 | 286 | 1 | | 0 |
| " | 05/08/80 | 223 | 47 | | 1 |
| " | 05/20/80 | 235 | 56 | | 1 |
| " | 04/27/80 | 212 | 17 | | 0 |
| " | 06/30/80 | 276 | | 11 | 0 |
| " | 07/07/80 | 283 | | 5 | 0 |
| 09/28/79 | 07/15/80 | 290 | 5 | | 0 |
| 10/01/79 | 09/11/83 | 1,440 | 3 | | 0 |
| " | 03/12/81 | 527 | 12 | | 0 |
| 10/02/79 | 05/10/81 | 585 | 0 | 0 | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/04/79 | 07/26/80 | 295 | 10 | | 0 |
| 10/08/79 | 05/31/80 | 266 | 42 | | 1 |
| " | 06/08/80 | 244 | 60 | | 1 |
| " | 05/01/80 | 205 | | 12 | 0 |
| " | 05/15/80 | 219 | | 54 | 0 |
| " | 05/23/80 | 227 | 0.5 | | 0 |
| " | 01/24/80 | 108 | 1 | | 0 |
| " | 06/12/83 | 1,341 | 7 | | 0 |
| " | 08/21/81 | 681 | | 16 | 0 |
| " | 03/06/81 | 514 | 13.5 | | 0 |
| " | 06/14/80 | 249 | | 3 | 0 |
| " | 06/09/80 | 244 | | 3 | 0 |
| 10/16/79 | 05/25/80 | 221 | 5 | | 0 |
| 10/18/79 | 05/31/80 | 225 | | 10 | 0 |
| " | 05/28/80 | 222 | | 3 | 0 |
| " | 07/26/83 | 294 | 2 | | 0 |
| " | 01/14/80 | 88 | 12 | | 0 |
| " | 07/06/80 | 261 | | 55 | 0 |
| " | 07/23/81 | 643 | 10 | | 0 |
| " | 07/07/80 | 260 | | 10 | 0 |
| " | 06/14/80 | 237 | | 1 | 0 |
| " | 10/25/79 | 7 | | 2 | 0 |
| " | 06/30/83 | 1,338 | 5 | | 0 |
| " | 05/20/80 | 214 | | 10 | 0 |
| " | 05/12/80 | 206 | 0 | 0 | 0 |
| " | 06/01/80 | 226 | 0 | 0 | 0 |
| 10/19/79 | 06/25/80 | 249 | | 3 | 0 |
| " | 10/06/80 | 252 | 16 | | 0 |
| " | 06/24/80 | 248 | 9 | | 0 |
| " | 07/10/80 | 264 | 4 | | 0 |
| " | 06/21/80 | 245 | 11 | | 0 |
| " | 05/09/80 | 202 | 0 | 0 | 0 |
| " | 06/21/80 | 245 | 1 | | 0 |
| " | 09/10/81 | 691 | | 3 | 0 |
| " | 07/10/80 | 264 | 2 | | 0 |
| " | 08/30/80 | 315 | | 2 | 0 |
| " | 06/17/80 | 241 | | 1 | 0 |
| 10/25/79 | 07/15/80 | 263 | | 6 | 0 |
| 09/05/80 | 07/04/82 | 667 | 2 | | 0 |
| " | 07/08/81 | 306 | 1 | | 0 |
| 09/08/80 | 05/16/81 | 219 | | 4 | 0 |
| " | 06/28/81 | 262 | 2 | | 0 |
| " | 07/16/81 | 280 | | 1 | 0 |

Table 24. Continued.

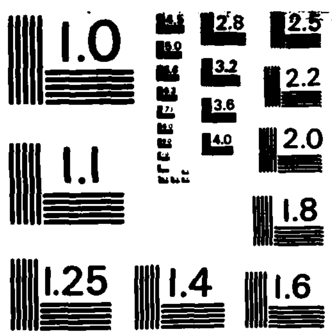
| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/08/80 | 02/15/81 | 160 | 31 | | 0 |
| 09/09/80 | 07/02/81 | 296 | | 6 | 0 |
| " | 06/11/83 | 1,005 | 1 | | 0 |
| 09/12/80 | 07/26/81 | 317 | 1 | | 0 |
| " | 06/24/82 | 650 | | 7 | 0 |
| " | 09/21/81 | 374 | | 4 | 0 |
| " | 05/29/82 | 624 | | 4 | 0 |
| 09/17/80 | 03/01/81 | 165 | 23 | | 0 |
| " | 05/31/82 | 626 | 1 | | 0 |
| " | 07/19/81 | 305 | 6 | | 0 |
| " | 09/17/83 | 1,095 | 0 | 0 | 0 |
| " | 12/12/80 | 86 | | 3 | 0 |
| " | 08/15/81 | 332 | | 3 | 0 |
| " | 05/29/82 | 619 | 0 | 0 | 0 |
| " | 08/11/82 | 693 | 56 | | 1 |
| " | 07/17/81 | 303 | | 3 | 0 |
| " | 05/27/82 | 617 | | 1 | 0 |
| " | 07/26/82 | 677 | | 6 | 0 |
| " | 07/28/81 | 314 | | 6 | 0 |
| " | 01/13/81 | 118 | | 3 | 0 |
| " | 07/16/81 | 302 | | 6 | 0 |
| " | 04/28/81 | 223 | 21 | | 0 |
| " | 09/05/81 | 353 | | 1 | 0 |
| " | 02/15/81 | 151 | 30 | | 0 |
| " | 07/08/82 | 663 | | 1 | 0 |
| " | 04/23/81 | 218 | 30 | | 0 |
| " | 05/28/81 | 253 | | 4 | 0 |
| " | 08/15/81 | 332 | 3 | | 0 |
| " | 11/04/80 | 48 | 5 | | 0 |
| " | 08/20/83 | 1,067 | 0 | 0 | 0 |
| " | 07/18/81 | 304 | 0 | 0 | 0 |
| " | 05/16/82 | 606 | 1 | | 0 |
| " | 09/15/81 | 363 | | 8 | 0 |
| " | 05/02/82 | 592 | | 1 | 0 |
| " | 12/17/80 | 91 | 5 | | 0 |
| " | 12/17/80 | 91 | 5 | | 0 |
| " | 06/07/81 | 263 | | 3 | 0 |
| " | 04/02/83 | 1,292 | 19 | | 0 |
| " | 12/02/82 | 806 | 4 | | 0 |
| " | 06/11/81 | 267 | | 4 | 0 |
| 09/18/80 | 07/20/81 | 285 | | 3 | 0 |
| " | 08/05/81 | 321 | 11 | | 0 |
| " | 03/21/83 | 184 | 16 | | 0 |

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/15/80 | 09/05/81 | 355 | 1 | | 0 |
| " | 08/12/81 | 331 | 0 | 0 | 0 |
| " | 09/24/81 | 374 | 1 | | 0 |
| " | 04/20/82 | 582 | 0 | 0 | 0 |
| " | 08/19/81 | 338 | 6 | | 0 |
| " | 06/10/83 | 998 | 0 | 0 | 0 |
| " | 07/01/82 | 654 | | 1 | 0 |
| 09/23/80 | 05/13/81 | 232 | | 3 | 0 |
| " | 03/13/82 | 536 | 20 | | 0 |
| " | 05/24/81 | 243 | 10 | | 0 |
| " | 05/16/82 | 600 | 1 | | 0 |
| " | 07/13/81 | 293 | | 4 | 0 |
| " | 09/26/81 | 368 | | 5 | 0 |
| " | 05/17/81 | 238 | | 6 | 0 |
| " | 05/08/81 | 229 | 4 | | 0 |
| " | 09/13/81 | 355 | 0 | 0 | 0 |
| " | 04/29/83 | 948 | ? | ? | ? |
| " | 01/10/80 | 17 | 4 | | 0 |
| " | 05/29/82 | 613 | 0 | 0 | 0 |
| " | 05/30/83 | 979 | 3 | | 0 |
| " | 09/20/81 | 362 | | 1 | 0 |
| " | 07/04/81 | 294 | 11 | | 0 |
| " | 07/07/81 | 287 | 1 | | 0 |
| " | 07/15/82 | 660 | 5 | | 0 |
| " | 06/15/82 | 630 | 3 | | 0 |
| " | 07/13/81 | 293 | 0 | 0 | 0 |
| " | 06/15/81 | 265 | | 5 | 0 |
| " | 06/17/82 | 632 | 43 | | 1 |
| " | 05/29/81 | 248 | | 5 | 0 |
| " | 05/28/81 | 247 | | 3 | 0 |
| " | 02/23/81 | 153 | 5 | | 0 |
| " | 07/18/81 | 294 | 0 | 0 | 0 |
| " | 06/30/81 | 276 | 0 | 0 | 0 |
| " | 09/11/81 | 353 | | 1 | 0 |
| " | 07/21/81 | 297 | 0 | 0 | 0 |
| " | 06/30/83 | 1,006 | 0 | 0 | 0 |
| " | 08/11/81 | 322 | | 1 | 0 |
| " | ? | ? | 10 | | 0 |
| " | 06/04/81 | 254 | | 6 | 0 |
| " | 10/15/81 | 387 | | 1 | 0 |
| " | 05/14/83 | 963 | 43 | | 1 |
| " | 04/30/81 | 219 | 5 | | 0 |
| " | 05/14/82 | 598 | 2 | | 0 |

AD-A139 608 ANALYSIS OF EXISTING INFORMATION ON ADULT FISH MOVEMENTS THROUGH DAMS ON THE UPPER MISSISSIPPI RIVER (U) NATIONAL FISHERY RESEARCH LAB LA CROSSE WI 3/3

UNCLASSIFIED L HOLLAND ET AL. FEB 84 F/G 6/3 NL




MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

Table 24. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/23/80 | 06/13/81 | 263 | | 4 | 0 |
| " | 06/11/83 | 991 | 0 | 0 | 0 |
| " | 07/11/81 | 291 | 5 | | 0 |
| " | 08/11/81 | 322 | 11 | | 0 |
| " | 05/30/81 | 249 | 19 | | 0 |
| " | 10/25/80 | 397 | 2 | | 0 |
| 09/24/80 | 05/21/83 | 969 | | 4 | 0 |
| " | 09/14/81 | 355 | 5 | | 0 |
| " | 10/06/80 | 13 | | 1 | 0 |
| 10/03/80 | 07/20/81 | 291 | | 2 | 0 |
| " | 06/01/83 | 972 | 41 | | 1 |
| " | 06/30/81 | 271 | | 11 | 0 |
| 10/07/80 | 10/18/80 | 11 | 2 | | 0 |
| " | 06/13/81 | 249 | 0 | 0 | 0 |
| " | 04/24/82 | 564 | 41 | | 1 |
| " | 05/27/82 | 597 | | 1 | 0 |
| " | 08/17/81 | 314 | | 3 | 0 |
| " | 09/14/81 | 342 | 3 | | 0 |
| " | 05/14/81 | 250 | 19 | | 0 |
| " | 02/24/83 | 870 | 26 | | 0 |
| " | 10/14/80 | 7 | | 1 | 0 |

Table 25. Returns from mark-recapture study on walleye in Pool 5A during 1980, by Wisconsin Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/15/80 | 05/19/80 | 34 | 0 | 0 | 0 |
| 04/16/80 | 05/02/80 | 16 | 0 | 0 | 0 |
| " | 05/19/80 | 33 | | 10 | 1 |
| " | 05/16/80 | 30 | 0 | 0 | 0 |
| " | 05/01/80 | 14 | 15 | | 2 |
| " | 05/04/80 | 18 | 0 | 0 | 0 |
| " | 05/11/80 | 25 | | 13 | 1 |
| " | 05/26/80 | 40 | | 13 | 1 |
| " | 06/13/80 | 58 | | 5 | 0 |
| 04/17/80 | 05/25/80 | 40 | | 5 | 0 |
| " | 05/11/80 | 24 | 0 | 0 | 0 |
| " | 05/31/80 | 44 | 0 | 0 | 0 |
| " | 05/24/80 | 37 | | 3 | 0 |
| " | 05/31/80 | 44 | | 13 | 1 |
| " | 05/11/80 | 24 | | 24 | 2 |
| " | 05/11/80 | 24 | 0 | 0 | 0 |
| 04/22/80 | 05/10/80 | 18 | | 13 | 1 |
| " | 05/10/80 | 18 | 0 | 0 | 0 |
| " | 05/17/80 | 25 | | 2 | 0 |
| " | 05/24/80 | 32 | 0 | 0 | 0 |
| 04/23/80 | 04/28/80 | 5 | 0 | 0 | 0 |
| " | 04/26/80 | 3 | 0 | 0 | 0 |
| " | 05/12/80 | 19 | | 5 | 0 |
| " | 05/09/80 | 16 | | 3 | 0 |
| " | 05/09/80 | 16 | 0 | 0 | 0 |
| " | 05/25/80 | 32 | | 7 | 0 |
| " | 05/25/80 | 32 | | 4 | 0 |
| " | 05/26/80 | 33 | | 3 | 0 |
| " | 05/15/80 | 22 | 0 | 0 | 0 |
| " | 05/17/80 | 24 | 0 | 0 | 0 |

Table 26. Returns from mark-recapture study on walleye in Pool 5 during 1980, by Wisconsin Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/24/80 | 04/25/80 | 1 | 0 | 0 | 0 |
| " | 05/01/80 | 7 | 0 | 0 | 0 |
| " | 05/12/80 | 18 | 0 | 0 | 0 |
| " | 05/06/80 | 12 | 0 | 0 | 0 |
| " | 05/80/80 | 14 | 0 | 0 | 0 |
| " | 05/11/80 | 17 | 0 | 0 | 0 |
| " | 05/13/80 | 19 | 0 | 0 | 0 |
| " | 05/16/80 | 22 | 0 | 0 | 0 |
| 04/28/80 | 05/04/80 | 6 | 0 | 0 | 0 |
| " | 05/14/80 | 16 | 0 | 0 | 0 |
| " | 05/14/80 | 16 | 0 | 0 | 0 |
| " | 04/28/80 | 0 | 0 | 0 | 0 |
| " | 05/15/80 | 17 | 0 | 0 | 0 |
| " | 05/25/80 | 27 | 10 | | 1 |
| " | 05/15/80 | 17 | | 25 | 3 |
| " | 05/16/80 | 18 | | 8 | 0 |
| 04/29/80 | 05/29/80 | 30 | | 8 | 0 |
| " | 06/08/80 | 9 | 12 | | 1 |
| " | 05/26/80 | 27 | | 5 | 0 |
| " | 06/01/80 | 33 | 0 | 0 | 0 |
| " | 05/14/80 | 15 | 0 | 0 | 0 |
| " | 05/17/80 | 18 | 0 | 0 | 0 |
| " | 05/18/80 | 19 | 0 | 0 | 0 |
| " | 05/15/80 | 16 | 0 | 0 | 0 |
| " | 05/28/80 | 29 | 0 | 0 | 0 |
| 04/30/80 | 06/03/80 | 3 | | 15 | 1 |
| " | 05/10/80 | 10 | 0 | 0 | 0 |
| " | 05/14/80 | 14 | 0 | 0 | 0 |
| " | 05/16/80 | 16 | 0 | 0 | 0 |
| " | 05/11/80 | 11 | 0 | 0 | 0 |
| " | 06/05/80 | 5 | | 20 | 1 |
| " | 05/26/80 | 26 | | 7 | 0 |

Table 27. Returns from mark-recapture study on walleye in Pool 5 during 1959-1960, by Minnesota Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/59 | 07/59 | ~ 90 | 39 | | 1 |
| " | 05/59 | ~ 30 | 21 | | 1 |
| " | 05/59 | ~ 30 | 8 | | 1 |
| " | 06/59 | ~ 60 | 8 | | 1 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |

Table 27. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/59 | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 06/59 | ~ 60 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 07/59 | ~ 90 | 0 | 0 | 0 |
| " | 08/59 | ~ 120 | 0 | 0 | 0 |
| " | 08/59 | ~ 120 | 0 | 0 | 0 |
| " | 08/59 | ~ 120 | 0 | 0 | 0 |
| " | 09/59 | ~ 159 | 0 | 0 | 0 |
| " | 09/59 | ~ 159 | 0 | 0 | 0 |
| " | 09/59 | ~ 159 | 0 | 0 | 0 |
| " | 09/59 | ~ 159 | 0 | 0 | 0 |
| " | 09/59 | ~ 159 | 0 | 0 | 0 |
| " | 10/59 | ~ 180 | 0 | 0 | 0 |
| " | 10/59 | ~ 180 | 0 | 0 | 0 |
| " | 10/59 | ~ 180 | 0 | 0 | 0 |
| " | 02/60 | ~ 300 | 0 | 0 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |

Table 27. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/59 | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 06/59 | ~ 60 | | 8 | 0 |
| " | 07/59 | ~ 90 | | 8 | 0 |
| " | 08/59 | ~ 120 | | 8 | 0 |
| " | 08/59 | ~ 120 | | 8 | 0 |
| " | 08/59 | ~ 120 | | 8 | 0 |
| " | 08/59 | ~ 120 | | 8 | 0 |
| " | 08/59 | ~ 120 | | 8 | 0 |
| " | 09/59 | ~ 150 | | 8 | 0 |
| " | 09/59 | ~ 150 | | 8 | 0 |
| " | 09/59 | ~ 150 | | 8 | 0 |
| " | 10/59 | ~ 180 | | 8 | 0 |
| " | 10/59 | ~ 180 | | 8 | 0 |
| " | 05/59 | ~ 30 | | 14 | 1 |
| " | 05/59 | ~ 30 | | 14 | 1 |
| " | 06/59 | ~ 60 | | 14 | 1 |
| " | 07/59 | ~ 90 | | 14 | 1 |
| " | 02/60 | ~ 300 | | 14 | 1 |
| " | 05/59 | ~ 30 | | 24 | 1 |
| " | 06/59 | ~ 60 | | 24 | 1 |
| " | 06/59 | ~ 60 | | 24 | 1 |
| " | 08/59 | ~ 90 | | 24 | 1 |
| " | 05/59 | ~ 30 | | 38 | 2 |

Table 28. Returns from mark-recapture study on walleye in Pool 8 during the fall of 1978 and the spring of 1979, by Wisconsin Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 10/18/78 | 07/31/79 | 284 | 2.5 | | 0 |
| " | 05/10/79 | 204 | | 2 | 0 |
| " | 10/29/78 | 11 | | 2 | 0 |
| 10/19/78 | 04/10/79 | 173 | 0 | 0 | 0 |
| " | 07/30/79 | 282 | 0 | 0 | 0 |
| " | 10/21/79 | 367 | 5 | | 0 |
| 10/23/78 | 04/28/79 | 187 | | 1 | 1 |
| 10/25/78 | 04/05/79 | 162 | | 1 | 0 |
| " | 06/02/79 | 222 | 34 | | 3 |
| 10/30/78 | 02/14/79 | 107 | 4 | | 0 |
| " | 04/05/79 | 157 | | 19 | 1 |
| " | 06/06/79 | 221 | | 12 | 0 |
| " | 06/15/79 | 230 | 0 | 0 | 0 |
| " | 07/24/79 | 267 | 36 | | 3 |
| " | 04/16/79 | 168 | 0 | 0 | 0 |
| 11/01/78 | 05/26/79 | 206 | 12 | | 0 |
| " | 04/10/80 | 160 | 22 | | 0 |
| " | 04/17/80 | 167 | 0 | 0 | 0 |
| 11/02/78 | 05/26/79 | 205 | 30 | | 2 |
| " | 11/22/78 | 20 | 4 | | 0 |
| " | 11/11/78 | 9 | 0 | 0 | 0 |
| 11/06/78 | 12/27/78 | 51 | 13 | | 0 |
| " | 06/03/79 | 209 | 3 | | 0 |
| 11/07/78 | 06/03/79 | 208 | 36 | | 2 |
| " | 04/20/79 | 164 | 4 | | 0 |
| 11/08/78 | 04/13/79 | 156 | 9 | | 0 |
| 11/09/78 | 11/11/78 | 2 | 0 | 0 | 0 |
| " | 11/27/78 | 18 | 0 | 0 | 0 |
| " | 06/01/79 | 204 | 72 | | 5 |
| 11/13/78 | 06/04/79 | 203 | 31 | | 3 |
| " | 12/27/78 | 44 | 0 | 0 | 0 |
| " | 04/05/79 | 143 | 0 | 0 | 0 |
| " | 04/17/79 | 155 | | 5 | 0 |
| " | 05/23/79 | 191 | 36 | | 3 |
| " | 12/23/78 | 40 | 4 | | 0 |
| " | 04/21/79 | 159 | 4 | | 0 |
| " | 05/12/79 | 180 | | 1 | 0 |
| " | 11/27/78 | 14 | 0 | 0 | 0 |
| " | 12/28/78 | 45 | 0 | 0 | 0 |
| " | 05/15/79 | 183 | | 6 | 0 |
| " | 06/19/79 | 218 | 64 | | 5 |

Table 28. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 11/13/78 | 05/25/80 | 558 | | 5 | 0 |
| " | 03/23/79 | 130 | 0 | 0 | 0 |
| " | 06/23/79 | 222 | 0 | 0 | 0 |
| 11/14/78 | 06/27/79 | 225 | 0 | 0 | 0 |
| " | 06/14/79 | 213 | 0 | 0 | 0 |
| " | 04/06/79 | 143 | 1 | | 0 |
| " | 03/31/79 | 137 | 0 | 0 | 0 |
| " | 05/25/79 | 192 | | 11 | 0 |
| " | 05/13/79 | 180 | | 11 | 0 |
| " | 12/05/78 | 21 | 0 | 0 | 0 |
| 11/15/78 | 03/30/79 | 135 | 0 | 0 | 0 |
| " | 11/22/78 | 7 | 0 | 0 | 0 |
| " | 03/18/79 | 123 | 0 | 0 | 0 |
| " | 11/25/78 | 10 | 0 | 0 | 0 |
| " | 11/26/78 | 11 | 0 | 0 | 0 |
| " | 12/29/78 | 44 | 0 | 0 | 0 |
| " | 04/24/79 | 160 | 12 | | 1 |
| " | 04/21/79 | 157 | 36 | | 3 |
| " | 05/08/79 | 174 | 0 | 0 | 0 |
| " | 05/04/79 | 170 | 36 | | 3 |
| " | 05/04/79 | 170 | 0 | 0 | 0 |
| " | 05/30/79 | 196 | 34 | | 3 |
| " | 04/21/80 | 157 | 0 | 0 | 0 |
| 11/16/78 | 05/09/79 | 174 | | 5 | 0 |
| 04/01/79 | 04/09/79 | 8 | 0 | 0 | 0 |
| " | 04/16/79 | 15 | 0 | 0 | 0 |
| 04/04/79 | 04/28/79 | 24 | 1 | | 0 |
| 04/08/79 | 04/17/79 | 9 | 0 | 0 | 0 |
| " | 06/02/79 | 45 | 34 | | 3 |
| " | 06/05/79 | 48 | 62 | | 5 |
| 04/09/79 | 04/23/79 | 14 | 12 | | 1 |
| " | 04/22/79 | 13 | 0 | 0 | 0 |
| " | 04/05/79 | ? | 0 | 0 | 0 |
| " | 06/12/79 | 64 | | 5 | 0 |
| " | 06/27/79 | 79 | 36 | | 3 |
| " | 06/08/79 | 60 | | 10 | 0 |
| " | 07/15/79 | 87 | 51 | | 4 |
| " | 08/21/79 | 124 | 110 | | 5 |
| 04/10/79 | 06/29/79 | 80 | 15 | | 2 |
| " | 06/17/79 | 68 | 51 | | 4 |
| " | 05/19/79 | 39 | 36 | | 3 |
| 04/14/79 | 04/16/79 | 2 | 0 | 0 | 0 |
| " | 04/22/79 | 8 | 0 | 0 | 0 |

Table 28. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/14/79 | 05/27/79 | 43 | 36 | | 3 |
| " | 10/01/79 | 170 | | 7 | 0 |
| 04/16/79 | 07/07/79 | 82 | 1 | | 1 |
| " | 06/11/79 | 56 | 0 | 0 | 0 |
| " | 10/17/79 | 184 | 95 | | 5 |
| " | 06/04/79 | 49 | 26 | | 2 |
| " | 06/23/79 | 68 | 0 | 0 | 0 |
| " | 11/19/79 | 217 | 12 | | 1 |
| " | 03/25/80 | 343 | | 3 | 1 |
| " | 05/22/80 | 401 | 0 | 0 | 0 |
| " | 05/09/80 | 388 | | 6 | 0 |
| " | 04/22/79 | 6 | 0 | 0 | 0 |
| " | 05/15/79 | 29 | 31 | | 3 |
| " | 04/28/79 | 12 | 0 | 0 | 0 |
| " | 06/08/79 | 53 | | 21 | 0 |
| 04/17/79 | 05/18/79 | 31 | 36 | | 3 |
| " | 06/25/79 | 69 | | 9 | 0 |
| " | 04/22/79 | 5 | 0 | 0 | 0 |
| " | 05/11/79 | 24 | 0 | 0 | 0 |
| " | 05/02/79 | 15 | 95 | | 5 |
| " | 03/24/80 | 341 | 0 | 0 | 0 |
| " | 05/30/80 | 408 | | 5 | 0 |
| " | 04/02/80 | 350 | 0 | 0 | 0 |
| " | 04/22/80 | 370 | 51 | | 4 |
| " | 04/14/80 | 362 | 0 | 0 | 0 |
| " | 08/79 | ~ 120 | | 8 | 0 |
| " | 05/19/79 | 32 | | 36 | 1 |
| " | 06/26/79 | 70 | 36 | | 3 |
| " | 06/20/79 | 64 | 51 | | 4 |
| 04/18/79 | 09/24/79 | 159 | 12 | | 1 |
| " | 01/09/80 | 266 | 0 | 0 | 0 |
| " | 02/06/80 | 294 | 0 | 0 | 0 |
| " | 01/23/80 | 280 | 13 | | 0 |
| " | 03/25/80 | 341 | 13 | | 0 |
| " | 05/02/79 | 14 | | 5 | 0 |
| " | 05/19/79 | 31 | 41 | | 4 |
| " | 05/24/79 | 36 | 36 | | 3 |
| " | 06/04/79 | 47 | 36 | | 3 |
| " | 05/01/79 | 13 | 0 | 0 | 0 |
| " | 06/11/79 | 54 | 26 | | 2 |
| " | 05/28/79 | 40 | 63 | | 5 |
| 04/19/79 | 05/28/79 | 39 | 63 | 5 | |
| " | 04/21/79 | 2 | 0 | 0 | 0 |
| " | 04/21/79 | 2 | 0 | 0 | 0 |

Table 28. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/19/79 | 05/01/79 | 12 | 0 | 0 | 0 |
| " | 05/19/79 | 30 | 31 | | 3 |
| " | 10/02/79 | 166 | | 8 | 0 |
| " | 10/19/79 | 183 | | 10 | 0 |
| 04/20/79 | 10/03/79 | 166 | 95 | | 5 |
| " | 04/28/79 | 8 | 0 | 0 | 0 |
| " | 05/30/79 | 40 | 36 | | 3 |
| " | 06/12/79 | 53 | 32 | | 3 |
| 04/23/79 | 05/24/79 | 31 | | 5 | 0 |
| " | 08/28/79 | 127 | 19 | | 2 |
| " | 05/16/80 | 23 | 0 | 0 | 0 |
| 04/24/79 | 05/07/79 | 13 | 0 | 0 | 0 |
| " | 05/05/79 | 11 | 0 | 0 | 0 |
| " | 07/07/79 | 74 | | 18 | 1 |
| " | 05/07/79 | 13 | 0 | 0 | 0 |
| " | 05/05/79 | 11 | 0 | 0 | 0 |
| 04/25/79 | 05/28/79 | 33 | | 5 | 0 |
| " | 06/26/79 | 62 | | 10 | 1 |
| " | 10/05/79 | 163 | | 9 | 0 |
| " | 05/15/80 | 385 | 0 | 0 | 0 |
| " | 03/25/80 | 334 | 12 | | 1 |
| " | 03/27/80 | 336 | 0 | 0 | 0 |
| " | 05/06/80 | 376 | 0 | 0 | 0 |
| " | 05/31/80 | 401 | 0 | 0 | 0 |
| 05/02/79 | 06/05/79 | 34 | 1 | | 0 |

Table 29. Returns from mark-recapture study on walleye in Pool 8 during 1980, by Wisconsin Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 03/31/80 | 04/16/80 | 16 | 0 | 0 | 0 |
| 04/07/80 | 04/10/80 | 3 | 0 | 0 | 0 |
| " | 04/11/80 | 4 | 0 | 0 | 0 |
| " | 04/20/80 | 13 | 0 | 0 | 0 |
| " | 05/02/80 | 25 | 0 | 0 | 0 |
| " | 05/16/80 | 39 | 0 | 0 | 0 |
| " | 05/17/80 | 40 | 0 | 0 | 0 |
| " | 05/15/80 | 38 | 0 | 0 | 0 |
| " | 05/29/80 | 52 | | 6 | 0 |
| " | 05/19/80 | 42 | 0 | 0 | 0 |
| " | 05/26/80 | 49 | | 7 | 0 |
| " | 05/24/80 | 47 | | 13 | 0 |
| " | 04/09/80 | 2 | 0 | 0 | 0 |
| " | 04/21/80 | 14 | | 5 | 0 |
| " | 04/10/80 | 3 | 0 | 0 | 0 |
| " | 04/17/80 | 10 | 0 | 0 | 0 |
| " | 05/19/80 | 42 | 0 | 0 | 0 |
| " | 05/20/80 | 43 | 0 | 0 | 0 |
| " | 05/30/80 | 54 | | 9 | 0 |
| " | 06/13/80 | 68 | | 23 | 1 |
| " | 05/29/80 | 52 | | 5 | 0 |
| " | 04/18/80 | 11 | 0 | 0 | 0 |
| " | 06/03/80 | 58 | | 5 | 0 |
| " | 04/10/80 | 3 | 0 | 0 | 0 |
| " | 04/16/80 | 9 | 0 | 0 | 0 |
| " | 04/18/80 | 11 | 0 | 0 | 0 |
| " | 04/19/80 | 12 | 0 | 0 | 0 |
| " | 04/07/80 | 0 | 0 | 0 | 0 |
| " | 05/07/80 | 30 | 8 | | 1 |
| " | 05/11/80 | 34 | 0 | 0 | 0 |
| " | 05/12/80 | 35 | 0 | 0 | 0 |
| " | 04/18/80 | 11 | 0 | 0 | 0 |
| 04/09/80 | 04/18/80 | 9 | 0 | 0 | 0 |
| " | 04/21/80 | 12 | 0 | 0 | 0 |
| " | 05/22/80 | 43 | 0 | 0 | 0 |
| " | 05/30/80 | 51 | 0 | 0 | 0 |
| " | 05/25/80 | 46 | 12 | | 1 |
| " | 04/19/80 | 10 | 0 | 0 | 0 |
| " | 05/25/80 | 46 | 0 | 0 | 0 |
| " | 05/03/80 | 24 | 0 | 0 | 0 |
| " | 04/17/80 | 8 | 0 | 0 | 0 |
| " | 04/17/80 | 8 | 0 | 0 | 0 |

Table 29. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/09/80 | 05/06/80 | 27 | 0 | 0 | 0 |
| 04/10/80 | 05/09/80 | 30 | | 4 | 0 |
| " | 05/15/80 | 36 | 0 | 0 | 0 |
| " | 05/16/80 | 37 | 0 | 0 | 0 |
| " | 05/02/80 | 22 | | 5 | 0 |
| " | 05/23/80 | 43 | | 13 | 0 |
| 04/14/80 | 05/06/80 | 22 | 0 | 0 | 0 |

Table 30. Returns from mark-recapture study on walleye in Pool 9 during 1980, by Wisconsin Department of Natural Resources.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/01/80 | 04/03/80 | 2 | 0 | 0 | 0 |
| " | 04/04/80 | 3 | 0 | 0 | 0 |
| " | 05/25/80 | 54 | | 10 | 0 |
| " | 05/25/80 | 54 | 0 | 0 | 0 |
| " | 05/30/80 | 59 | 21 | | 1 |
| " | 05/24/80 | 53 | | 45 | 2 |
| " | 05/25/80 | 54 | 0 | 0 | 0 |
| " | 05/01/80 | 31 | 0 | 0 | 0 |
| " | 05/04/80 | 34 | | 15 | 0 |
| " | 05/09/80 | 39 | 0 | 0 | 0 |
| " | 05/23/80 | 52 | | 9 | 0 |
| " | 05/28/80 | 57 | 0 | 0 | 0 |
| 04/02/80 | 04/10/80 | 8 | 0 | 0 | 0 |
| " | 04/22/80 | 20 | 0 | 0 | 0 |
| " | 05/07/80 | 35 | | 12 | 0 |
| " | 05/17/80 | 45 | 0 | 0 | 0 |
| " | 05/14/80 | 42 | 0 | 0 | 0 |
| " | 05/24/80 | 52 | | 45 | 1 |
| " | 05/29/80 | 57 | | 15 | 0 |
| " | 04/26/80 | 24 | 0 | 0 | 0 |
| 04/03/80 | 05/03/80 | 30 | 0 | 0 | 0 |
| 04/06/80 | 04/10/80 | 4 | 0 | 0 | 0 |
| " | 04/10/80 | 4 | 0 | 0 | 0 |
| " | 05/03/80 | 27 | 23 | | 1 |
| " | 05/05/80 | 29 | | 18 | 0 |
| " | 05/27/80 | 51 | | 16 | 0 |
| " | 05/24/80 | 48 | 0 | 0 | 0 |
| " | 05/15/80 | 39 | 0 | 0 | 0 |
| " | 06/08/80 | 63 | | 16 | 0 |
| " | 05/07/80 | 31 | | 12 | 0 |
| " | 05/11/80 | 35 | 23 | | 1 |
| " | 04/27/80 | 21 | | 9 | 0 |
| " | 04/25/80 | 19 | 23 | | 1 |
| " | 05/01/80 | 25 | 0 | 0 | 1 |
| " | 05/27/80 | 51 | | 12 | 1 |
| " | 05/26/80 | 50 | | 16 | 0 |
| " | 05/25/80 | 49 | 0 | 0 | 0 |
| " | 05/25/80 | 49 | | 45 | 2 |
| " | 05/20/80 | 44 | 59 | | 2 |
| " | 05/20/80 | 44 | 0 | 0 | 0 |

Table 31. Returns from mark-recapture study on walleye in Pool 14 during 1972-1973, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 09/06/72 | 01/06/73 | 122 | 15.5 | | 0 |
| 09/26/73 | 10/17/73 | 21 | 2.3 | | 0 |

Table 32. Returns from mark-recapture study on freshwater drum in Pool 14 during 1978-1981, by Commonwealth Edison.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 03/30/81 | 04/09/81 | 10 | 0 | 0 | 0 |
| 03/03/81 | 04/13/81 | 41 | 0 | 4.1 | 0 |
| 04/20/81 | 05/04/81 | 14 | 11.7 | | 0 |
| 04/10/81 | 05/07/81 | 27 | 0.8 | | 0 |
| 04/30/81 | 05/13/81 | 13 | 0 | 0 | 0 |
| 04/10/81 | 05/16/81 | 36 | | 7.0 | 0 |
| 05/12/81 | 05/16/81 | 4 | | 3.1 | 0 |
| 04/14/81 | 05/20/81 | 36 | 0.1 | | 0 |
| " | 05/22/81 | 38 | | 3.2 | 0 |
| 03/31/81 | 05/30/81 | 60 | 11.2 | | 0 |
| 04/16/81 | 06/01/81 | 46 | | 3.7 | 0 |
| 04/06/81 | 06/01/81 | 56 | 13.0 | | 0 |
| 03/30/81 | 06/02/81 | 64 | 13.1 | | 0 |
| 05/01/81 | 06/03/81 | 33 | | 2.6 | 0 |
| 05/12/81 | 06/03/81 | 22 | 1.3 | | 0 |
| 04/16/81 | 06/05/81 | 50 | 0.6 | | 0 |
| 05/22/81 | 06/05/81 | 14 | 8.2 | | 0 |
| 03/30/81 | 06/06/81 | 68 | 9.2 | | 0 |
| 04/10/81 | 06/07/81 | 58 | 10.5 | | 0 |
| 04/13/81 | 06/07/81 | 55 | 11.2 | | 0 |
| 04/24/81 | 06/08/81 | 45 | 11.2 | | 0 |
| 05/12/81 | 06/09/81 | 38 | 10.4 | | 0 |
| 05/08/81 | 06/11/81 | 34 | | 10.2 | 0 |
| 05/07/81 | 06/11/81 | 35 | 11.2 | | 0 |
| 06/05/81 | 06/13/81 | 8 | 10.5 | | 0 |
| 03/30/81 | 06/14/81 | 76 | 13.7 | | 0 |
| 06/08/81 | 06/14/81 | 6 | 11.2 | | 0 |
| 06/12/81 | 06/15/81 | 3 | 0 | 0 | 0 |
| 05/01/81 | 06/16/81 | 46 | | 0.2 | 0 |
| 06/05/81 | 06/16/81 | 11 | 11.2 | | 0 |
| 06/02/81 | 06/17/81 | 15 | 4.0 | | 0 |
| 06/05/81 | 06/17/81 | 12 | 8.0 | | 0 |
| 05/26/81 | 06/18/81 | 23 | 0.4 | | 0 |
| 03/30/81 | 06/19/81 | 81 | 3.2 | | 0 |
| 05/04/81 | 06/19/81 | 46 | 4.0 | | 0 |
| 05/07/81 | 06/19/81 | 43 | 0.6 | | 0 |
| 06/16/81 | 06/20/81 | 4 | | 7.2 | 0 |
| 04/14/81 | 06/20/81 | 67 | 1.4 | | 0 |
| 06/19/81 | 06/23/81 | 4 | | 3.3 | 0 |
| 06/01/81 | 06/23/81 | 22 | 0 | 0 | 0 |
| 06/09/81 | 06/23/81 | 14 | | 1.6 | 0 |
| 04/28/81 | 06/23/81 | 56 | | 1.6 | 0 |

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 04/13/81 | 06/24/81 | 72 | 0 | 0 | 0 |
| 05/22/81 | 06/24/81 | 33 | | 3.2 | 0 |
| 04/02/81 | 06/24/81 | 83 | | 0.2 | 0 |
| 05/22/81 | 06/25/81 | 34 | 5.4 | | 0 |
| 05/05/81 | 06/25/81 | 51 | 1.4 | | 0 |
| 06/11/81 | 06/25/81 | 14 | 5.2 | | 0 |
| 05/14/81 | 06/25/81 | 42 | 0.8 | | 0 |
| 04/21/81 | 06/26/81 | 66 | 1.5 | | 0 |
| 05/01/81 | 06/27/81 | 57 | 2.0 | | 0 |
| 04/20/81 | 06/29/81 | 70 | 1.3 | | 0 |
| 04/24/81 | 07/01/81 | 68 | 4.2 | | 0 |
| 06/12/81 | 07/06/81 | 36 | 4.2 | | 0 |
| 04/06/81 | 07/07/81 | 92 | 0 | 0 | 0 |
| 06/19/81 | 07/07/81 | 18 | | 0.2 | 0 |
| 06/05/81 | 07/08/81 | 33 | 11.2 | | 0 |
| 03/31/81 | 07/10/81 | 101 | 7.2 | | 0 |
| 04/23/81 | 07/14/81 | 82 | 11.4 | | 0 |
| 04/20/81 | 07/15/81 | 86 | 11.1 | | 0 |
| 05/22/81 | 07/15/81 | 54 | 8.6 | | 0 |
| 05/01/81 | 07/16/81 | 76 | 1.5 | | 0 |
| 05/04/81 | 07/20/81 | 77 | 7.0 | | 0 |
| 05/26/81 | 07/21/81 | 56 | 0.7 | | 0 |
| 05/11/81 | 07/23/81 | 73 | 3.0 | | 0 |
| 06/12/81 | 07/24/81 | 42 | 4.0 | | 0 |
| 04/20/81 | 07/25/81 | 96 | 29.4 | | 1 |
| 03/31/81 | 07/27/81 | 118 | | 9.1 | 0 |
| 05/29/81 | 07/28/81 | 60 | | 3.0 | 0 |
| 05/28/81 | 07/30/81 | 63 | 3.6 | | 0 |
| 05/29/81 | 08/01/81 | 64 | | 16.6 | 0 |
| 04/06/81 | 08/01/81 | 117 | | 0.3 | 0 |
| 05/22/81 | 08/03/81 | 73 | 1.3 | | 0 |
| 04/14/81 | 08/03/81 | 121 | 11.4 | | 0 |
| 06/04/81 | 08/04/81 | 61 | | 11.8 | 0 |
| 04/20/81 | 08/10/81 | 122 | | 3.7 | 0 |
| 05/26/81 | 08/11/81 | 77 | | 0.4 | 0 |
| 04/27/81 | 08/14/81 | 119 | | 0.3 | 0 |
| 05/08/81 | 08/17/81 | 71 | | 100.2* | 4* |
| 04/09/81 | 08/18/81 | 131 | 4.0 | | 0 |
| 06/09/81 | 08/20/81 | 72 | | 7.5 | 0 |
| 04/14/81 | 08/20/81 | 134 | | 0.3 | 0 |
| 04/28/81 | 08/20/81 | 120 | 0 | 0 | 0 |
| 05/21/81 | 08/21/81 | 92 | | 9.8 | 0 |
| 05/05/81 | 08/22/81 | 109 | 5.2 | | 1 |

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/04/81 | 08/26/81 | 83 | | 2.5 | 0 |
| 05/04/81 | 08/27/81 | 115 | 0.3 | | 0 |
| 04/09/81 | 08/28/81 | 141 | | 6.7 | 0 |
| 05/26/81 | 09/14/81 | 111 | 0.5 | | 0 |
| 05/18/81 | 09/15/81 | 120 | 11.4 | | 0 |
| 04/20/81 | 09/23/81 | 156 | 13.9 | | 0 |
| 05/15/81 | 09/28/81 | 136 | 0.6 | | 0 |
| 05/11/81 | 10/81 | ~ 140 | | 16.8 | 0 |
| 05/19/81 | 10/81 | ~ 140 | | 22.0 | 0 |
| 06/09/81 | 10/81 | ~ 110 | | 16.8 | 0 |
| 03/30/81 | 10/81 | ~ 180 | | 16.8 | 0 |
| 06/05/81 | 10/81 | ~ 110 | | 24.8 | 0 |
| 05/26/81 | 10/81 | ~ 140 | | 16.8 | 0 |
| 05/12/81 | 10/81 | ~ 140 | | 16.8 | 0 |
| " | 10/81 | ~ 140 | | 16.8 | 0 |
| " | 10/81 | ~ 140 | | 24.0 | 0 |
| 04/24/81 | 10/81 | ~ 170 | | 20.0 | 0 |
| 06/19/81 | 10/81 | ~ 110 | | 20.0 | 0 |
| 04/13/81 | 10/81 | ~ 170 | | 16.8 | 0 |
| 04/20/81 | 10/81 | ~ 170 | | 14.3 | 0 |
| 06/09/81 | 10/81 | ~ 110 | | 24.0 | 0 |
| 05/01/81 | 11/07/81 | 190 | | 0.4 | 0 |
| 04/28/81 | 11/03/81 | 189 | | 0.3 | 0 |
| 06/19/80 | 08/05/80 | 47 | 7.1 | | 0 |
| 06/24/80 | 11/07/80 | 136 | 7.2 | | 0 |
| 05/30/80 | 11/16/80 | 170 | 20.9 | | 0 |
| 05/22/80 | 03/06/81 | 288 | | 1.3 | 0 |
| 06/20/80 | 03/28/81 | 281 | 11.3 | | 0 |
| 05/12/80 | 04/03/81 | 326 | 0.1 | | 0 |
| " | 04/07/81 | 330 | | 0.4 | 0 |
| 05/08/80 | 04/10/81 | 333 | | 0.4 | 0 |
| 05/15/80 | 04/16/81 | 336 | | 0.3 | 0 |
| 06/12/80 | 04/23/81 | 315 | 0.1 | | 0 |
| 06/24/80 | 05/01/81 | 311 | 15.5 | | 0 |
| 04/24/80 | 05/04/81 | 355 | 0.5 | | 0 |
| 04/10/80 | 05/06/81 | 339 | 8.7 | | 0 |
| 05/08/80 | 05/07/81 | 364 | 0.5 | | 0 |
| 06/19/80 | 05/08/81 | 323 | | 0.2 | 0 |
| 06/12/80 | 05/09/81 | 331 | 9.2 | | 0 |
| 05/29/80 | 05/11/81 | 347 | 11.2 | | 0 |
| 05/02/80 | 05/12/81 | 375 | 19.8 | | 0 |
| 06/12/80 | 05/12/81 | 334 | | 2.8 | 0 |
| 06/24/80 | 05/12/81 | 322 | | 0.3 | 0 |

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 03/31/80 | 05/14/81 | 409 | 7.6 | | 0 |
| 05/01/80 | 05/20/81 | 384 | 0 | 0 | 0 |
| 06/12/80 | 05/24/81 | 346 | 9.2 | | 0 |
| 05/15/80 | 05/24/81 | 374 | 9.2 | | 0 |
| 04/21/80 | 05/29/81 | 403 | 3.4 | | 0 |
| 04/28/80 | 06/02/81 | 400 | 11.4 | | 0 |
| 04/21/80 | 06/02/81 | 407 | 8.2 | | 0 |
| 06/06/80 | 06/08/80 | 367 | 3.7 | | 0 |
| 05/01/80 | 06/09/81 | 404 | 11.2 | | 0 |
| 05/30/81 | 06/13/81 | 379 | 13.9 | | 0 |
| 05/22/80 | 06/16/81 | 390 | 11.2 | | 0 |
| 05/23/80 | 06/17/81 | 390 | 25.3 | | 0 |
| 05/08/80 | 06/17/81 | 405 | 13.7 | | 0 |
| 06/16/80 | 06/18/81 | 367 | | 0.2 | 0 |
| 05/01/80 | 06/20/81 | 415 | 0.6 | | 0 |
| 05/20/80 | 06/25/81 | 401 | 13.5 | | 0 |
| 05/19/80 | 07/28/81 | 435 | 13.8 | | 0 |
| 05/01/80 | 07/29/81 | 454 | 6.7 | | 0 |
| 05/22/80 | 07/30/81 | 435 | | 3.8 | 0 |
| 05/08/80 | 08/81 | ~ 450 | | 16.8 | 0 |
| 05/02/80 | 08/81 | ~ 456 | | 10.5 | 0 |
| 04/11/80 | 08/81 | ~ 477 | | 14.3 | 0 |
| 04/21/80 | 08/81 | ~ 460 | | 16.8 | 0 |
| 05/08/80 | 08/81 | ~ 450 | | 16.8 | 0 |
| 06/16/80 | 08/81 | ~ 414 | | 16.8 | 0 |
| 04/18/80 | 08/81 | ~ 460 | | 14.3 | 0 |
| 05/15/80 | 08/81 | ~ 442 | | 20.0 | 0 |
| 04/10/80 | 08/81 | ~ 477 | | 16.8 | 0 |
| 04/17/80 | 08/81 | ~ 460 | | 16.8 | 0 |
| 04/21/80 | 08/81 | ~ 460 | | 20.0 | 0 |
| 06/24/80 | 08/24/81 | 426 | | 2.8 | 0 |
| " | 08/25/81 | 427 | | 2.6 | 0 |
| 05/08/80 | 08/25/81 | 474 | 14.6 | | 0 |
| 08/16/80 | 08/27/81 | 376 | | 3.8 | 0 |
| 06/12/80 | 09/81 | ~ 449 | | 16.8 | 0 |
| 04/11/80 | 09/81 | ~ 512 | | 16.8 | 0 |
| 05/08/80 | 09/81 | ~ 484 | | 20.8 | 0 |
| 04/24/80 | 09/81 | ~ 498 | | 16.8 | 0 |
| 06/16/80 | 09/81 | ~ 445 | | 16.8 | 0 |
| " | 09/81 | ~ 445 | | 16.8 | 0 |
| 05/08/80 | 09/81 | ~ 484 | | 16.8 | 0 |
| " | 09/81 | ~ 484 | | 16.8 | 0 |
| 06/12/80 | 10/81 | ~ 477 | | 16.8 | 0 |

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 06/09/80 | 10/81 | ~ 480 | | 16.8 | 0 |
| 04/28/80 | 10/81 | ~ 522 | | 16.8 | 0 |
| 06/19/80 | 10/81 | ~ 470 | | 20.0 | 0 |
| 06/09/80 | 10/81 | ~ 480 | | 14.3 | 0 |
| 06/05/80 | 10/81 | ~ 476 | | 16.8 | 0 |
| 05/12/80 | 11/10/81 | 547 | | 0.3 | 0 |
| 04/23/79 | 05/09/79 | 16 | | 4.3 | 0 |
| 05/09/70 | 05/10/79 | 1 | 0 | 0 | 0 |
| 04/23/79 | 05/21/79 | 28 | 0.6 | | 0 |
| 04/16/79 | 05/29/79 | 43 | 3.1 | | 0 |
| 05/23/79 | 05/29/79 | 6 | 0.6 | | 0 |
| 05/14/79 | 05/29/79 | 15 | 1.6 | | 0 |
| 04/30/79 | 05/29/79 | 29 | 0.6 | | 0 |
| 05/02/79 | 05/29/79 | 27 | 0.6 | | 0 |
| 05/23/79 | 05/30/79 | 7 | | 4.3 | 0 |
| 05/14/79 | 06/01/79 | 18 | | 2.5 | 0 |
| 05/29/79 | 06/01/79 | 3 | | 0.6 | 0 |
| 05/09/79 | 06/03/79 | 25 | | 3.0 | 0 |
| 05/16/79 | 06/04/79 | 19 | 0.7 | | 0 |
| 04/25/79 | 06/04/79 | 40 | 0.5 | | 0 |
| 05/25/79 | 06/05/79 | 11 | | 4.3 | 0 |
| 05/16/79 | 06/07/79 | 22 | 0.4 | | 0 |
| 04/30/79 | 06/08/79 | 39 | 0.3 | | 0 |
| 06/04/79 | 06/09/79 | 5 | 2.9 | | 0 |
| 05/09/79 | 06/09/79 | 31 | | 0.3 | 0 |
| 05/21/79 | 06/12/79 | 22 | | 0.3 | 0 |
| 05/29/79 | 06/12/79 | 14 | | 4.4 | 0 |
| 04/23/79 | 06/12/79 | 50 | 0.4 | | 0 |
| 06/04/79 | 06/14/79 | 10 | 0.7 | | 0 |
| 05/25/79 | 06/14/79 | 20 | 0.7 | | 0 |
| " | 06/14/79 | 20 | 0.5 | | 0 |
| 05/29/79 | 06/16/79 | 18 | | 3.3 | 0 |
| 06/04/79 | 06/16/79 | 12 | 0 | 0 | 0 |
| " | 06/18/79 | 14 | 0.7 | | 0 |
| 05/31/79 | 06/18/79 | 18 | 3.3 | | 0 |
| 04/30/79 | 06/18/79 | 49 | 0.6 | | 0 |
| 05/07/79 | 06/18/79 | 42 | 0.3 | | 0 |
| 05/21/79 | 06/18/79 | 28 | | 0.1 | 0 |
| 05/02/79 | 06/18/79 | 47 | | 0.1 | 0 |
| 06/07/79 | 06/18/79 | 11 | | 3.5 | 0 |
| 04/28/79 | 06/21/79 | 54 | 0.7 | | 0 |
| 05/14/79 | 06/21/79 | 38 | 0.3 | | 0 |
| 05/07/79 | 06/23/79 | 47 | | 0.1 | 0 |

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 11/07/79 | 08/81 | ~ 640 | | 16.8 | 0 |
| 11/06/79 | 08/81 | ~ 640 | | 16.8 | 0 |
| 11/20/79 | 08/81 | ~ 640 | | 16.8 | 0 |
| 10/24/79 | 08/81 | ~ 670 | | 16.8 | 0 |
| 10/24/79 | 08/81 | ~ 670 | | 16.8 | 0 |
| 10/24/79 | 08/81 | ~ 670 | | 16.8 | 0 |
| 11/06/79 | 08/81 | ~ 640 | | 16.8 | 0 |
| 11/06/79 | 08/81 | ~ 640 | | 16.8 | 0 |
| 11/06/79 | 09/81 | ~ 670 | | 16.8 | 0 |
| 11/20/79 | 09/81 | ~ 670 | | 16.8 | 0 |
| 11/07/79 | 09/81 | ~ 670 | | 16.8 | 0 |
| 11/20/79 | 10/15/81 | 694 | 8.6 | | 0 |
| 10/25/78 | 11/16/78 | 22 | 0 | 0 | 0 |
| 10/25/78 | 11/16/78 | 22 | | 0.2 | 0 |
| 10/31/78 | 03/05/79 | 123 | | 3.3 | 0 |
| 10/25/78 | 03/22/79 | 146 | | 4.0 | 0 |
| 10/25/78 | 04/06/79 | 161 | | 4.0 | 0 |
| 10/25/78 | 05/09/79 | 194 | 0.5 | | 0 |
| 10/25/78 | 05/13/79 | 198 | | 3.7 | 0 |
| 10/25/78 | 06/05/79 | 221 | 0 | 0 | 0 |
| 10/25/78 | 06/23/79 | 239 | | 13.2 | 0 |
| 10/25/78 | 07/06/79 | 252 | 0 | 0 | 0 |
| 10/25/78 | 08/03/79 | 280 | | 27.5 | 1 |
| 10/25/78 | 08/04/79 | 281 | | 3.5 | 0 |

* Suspect data point, not included in calculations.

Table 32. Continued.

| Date tagged | Date recaptured | Days at large | Distance traveled upstream (miles) | Distance traveled downstream (miles) | Number of dams passed through |
|---|---|---|---|---|---|
| 05/16/79 | 06/25/80 | 405 | 0.7 | | 0 |
| 05/23/79 | 06/25/79 | 33 | 0.7 | | 0 |
| 04/30/79 | 06/25/79 | 56 | 0.7 | | 0 |
| 05/09/79 | 06/25/79 | 47 | 0.7 | | 0 |
| 05/21/79 | 06/25/79 | 35 | 0.4 | | 0 |
| 05/14/79 | 06/25/79 | 42 | 0.4 | | 0 |
| 06/04/79 | 06/25/79 | 21 | 0.4 | | 0 |
| 05/12/79 | 06/25/79 | 44 | | 0.3 | 0 |
| 05/14/79 | 06/28/79 | 45 | 0.3 | 0 | 0 |
| 05/16/79 | 06/28/79 | 43 | 0.3 | | 0 |
| 06/07/79 | 06/28/79 | 21 | | 0.3 | 0 |
| 05/12/79 | 07/02/79 | 51 | | 0.4 | 0 |
| 06/04/79 | 07/06/79 | 32 | | 0.3 | 0 |
| 05/14/79 | 07/09/79 | 56 | 0.8 | | 0 |
| 06/07/79 | 07/16/79 | 49 | 0.7 | | 0 |
| 05/14/79 | 07/16/79 | 63 | | 0.2 | 0 |
| 05/29/79 | 07/14/79 | 50 | 2.7 | | 0 |
| 05/19/79 | 07/23/79 | 69 | | 1.3 | 0 |
| 05/23/79 | 07/25/79 | 67 | | 0.3 | 0 |
| 05/29/79 | 07/31/79 | 63 | | 0.2 | 0 |
| 06/04/79 | 08/07/79 | 64 | | 3.3 | 0 |
| 05/14/79 | 08/28/79 | 106 | 11.5 | | 0 |
| 05/31/79 | 09/27/79 | 119 | 0 | 0 | 0 |
| 05/16/70 | 11/07/79 | 160 | | 0.3 | 0 |
| 05/12/79 | 11/07/79 | 164 | | 0.3 | 0 |
| 04/23/79 | 11/28/79 | 219 | | 0.9 | 0 |
| 05/09/79 | 11/28/70 | 203 | | 0.3 | 0 |
| 05/21/79 | 11/28/79 | 191 | | 0.3 | 0 |
| 04/25/79 | 12/02/79 | 292 | | 3.5 | 0 |
| 04/30/79 | 12/02/79 | 287 | | 0.3 | 0 |
| 04/30/79 | 12/02/79 | 287 | | 0.3 | 0 |
| 05/02/79 | 12/02/79 | 285 | | 0.3 | 0 |
| 05/21/79 | 12/02/79 | 266 | | 0.3 | 0 |
| " | 12/02/79 | 266 | | 0.3 | 0 |
| 05/23/79 | 12/02/79 | 264 | | 0.3 | 0 |
| 05/29/79 | 12/02/79 | 258 | | 0.3 | 0 |
| 05/02/79 | 12/04/79 | 285 | | 0.3 | 0 |
| 05/09/79 | 12/04/79 | 280 | | 0.3 | 0 |
| 05/31/79 | 12/04/79 | 260 | | 0.3 | 0 |
| 11/20/79 | 04/05/81 | 502 | 10.2 | | 0 |
| 10/17/80 | 06/19/81 | 246 | | 0.2 | 0 |
| 11/07/79 | 06/30/81 | 601 | | 0.1 | 0 |
| 10/24/79 | 06/30/81 | 615 | 0.4 | | 0 |

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