Observations on the life history and taxonomy of the sauger (Stizostedion canadense Smith) in Garrison reservoir, North Dakota
by Louis H Carufel

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management Mohtana State College
Montana State University

Abstract:
A study on the life history and taxonomy of the sauger (Stizostedion canadense) in Garrison Reservoir, its tributaries, and the tailrace was initiated during June, 1959 and continued to July, 1960. A total of 1,558 sauger was used in the study. These ranged in total length from 4.0 to 26.5 inches. Scales were read with aid of micro-projector, and a direct proportion of scale length to body length was used in calculating the length of fish at each year of life. Average calculated total lengths for sauger from Garrison Reservoir at annuli I-VI were 4.9, 8.8, 12.3, 15.5, 18.4, and 23.1 inches respectively while those from the tail-race at annuli I - VIII were 4.8, 9.3, 11.3, 13.8, 16.2, 18.7, 20.8, and 25.6 inches respectively. The number of eggs estimated for 50 sauger ranged from 10,488 to 117,058. Of the 1,466 sauger used in sex determinations 71 percent were females and 29 percent were males. The smallest mature male was 10.6 inches in total length and the female was 12.9 inches. Only 21 percent of the males and 19 percent of the females mature when 3 years old. All males and 63 percent of the females were mature at 4 years. The height of the spawning season was from May 8 to May 28, 1960. A total of 564 sauger, 90 walleye, and 5 hybrids was studied for taxonomic differences.

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Approved:

Head, Major Department

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Introduction

The sauger (Stizostedion canadense) is indigenous to the Missouri River in North Dakota. The earliest record was that of Girard (1858) who reported this species from a collection taken by Dr. Frederick Hayden near Fort Union. Since then sauger have been collected several times. Personius and Eddy (1955) reported it for the Little Missouri River and the North Dakota Game and Fish Department has taken this species on a number of occasions in their test-netting surveys of Garrison Reservoir.

Sauger was once reported to be of little importance as a game fish in the Missouri River Basin (Evermann and Cox, 1894), but at the present time it is one of the important game fish in North Dakota. Large numbers of sauger are caught by anglers each year, from May to October, in both the Garrison Reservoir and the tailwaters of the dam.

Aside from the limited fisheries surveys conducted on the Missouri River drainage the sauger has not been investigated in North Dakota. A study on the life history of the sauger in Garrison Reservoir, its tributaries, and the tailrace was initiated during June, 1959 and continued to July, 1960. Observations were also made on the taxonomy of this species in comparison with the walleye (Stizostedion vitreum).

Acknowledgments

The writer extends thanks to those individuals and agencies that assisted in this investigation. Dale L. Henegar, Chief of Fisheries, North Dakota Game and Fish Department suggested the problem and gave advice during the study. Dr. C. J. D. Brown directed the study and helped

in the preparation of the manuscript. Dr. E. B. Harvey aided in the histological work. Dr. Reeve M. Bailey, University of Michigan, identified some of the specimens. Robert Needham, Selmar Enger, Dwight Meyers, Ralph Wright, Edmund Hibbard, and James Sprague assisted in the field. My wife, Catherine, aided in the tabulation of data. The U. S. Army, Corps of Engineers, supplied photos, maps, and temperature records. The North Dakota Health Department made the chemical water analysis. The North Dakota Game and Fish Department provided equipment and financial support under Federal Aid Projects F-3-R 7, 8.

Description of Area

The 210 foot high dam impounding Garrison Reservoir was completed in 1954 by the U. S. Army, Corps of Engineers. The spillway (elevation 1825 feet m.s.l.) is at the east end of the dam and the tailrace (elevation 1640 feet m.s.l.) is at the west end. The latter covers approximately 40 surface acres and has a maximum depth of 35 feet (Fig. 1).

Garrison Reservoir is a multiple-purpose impoundment on the mainstem of the Missouri River in McLean and Mercer Counties. It has a length of approximately 200 miles and varies in width from 0.75 mile to 14 miles with an average of 3 miles (Fig. 2). At the maximum operating pool (elevation 1850 feet m.s.l.) the shoreline is approximately 1600 miles long, the surface area about 390,000 acres and the storage capacity 23,000,000 acre feet. In an average year the reservoir level is lowered about 16 feet during the winter to accommodate spring flood waters. The minimum level is attained usually in February and the maximum in late June or

Figure 1. Garrison Dam, spillway, tailrace, and Missouri River below dam showing test netting stations.

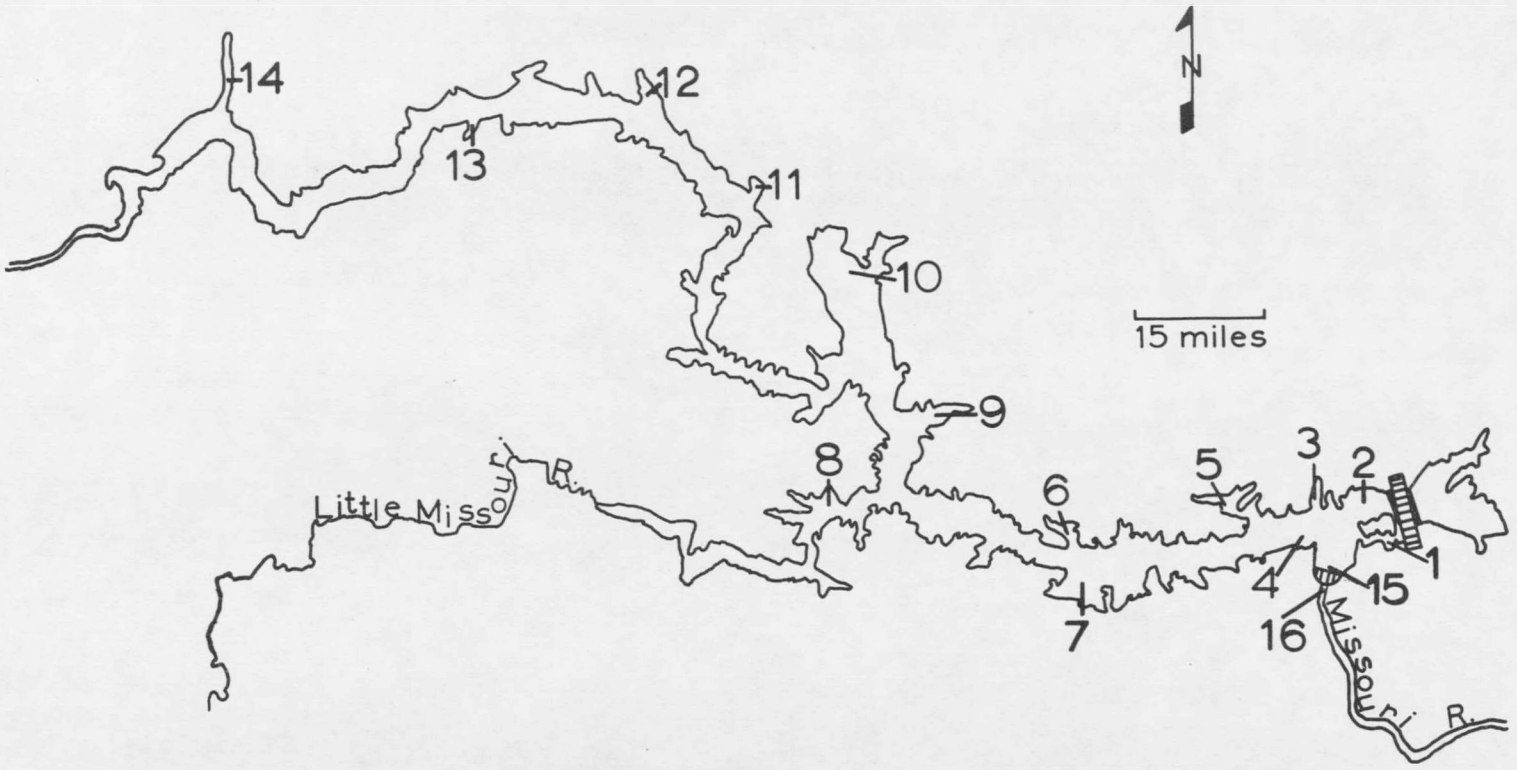

Figure 2. Garrison Reservoir, its tributaries, and tailrace, North Dakota - showing stations.

early July.

The principal source of reservoir water is from the Missouri River, but there are five main tributaries which enter the impoundment, Little Missouri River, Shell Creek, White Earth River, Tobacco Garden Creek, and Little Muddy River.

The maximum recorded water surface temperature for the reservoir during the study period was 77° F. while that of the tailrace was 65° F. Ice usually occurs during late November or early December and disappears in late April or early May and may reach a thickness of 3 to 4 feet. The tailrace did not completely freeze over.

Certain chemical and physical analyses were made at 16 stations in the reservoir during the summer of 1959 and these were repeated for 8 stations in the spring of 1960. Determinations were made of total dissolved solids, total alkalinity, total hardness, conductivity, pH, turbidity, and temperature (Table 1).

A total of 45 species of fish was found in association with sauger in Garrison Reservoir and its tributaries (Table 2). Most of these are native to the drainage; but brown trout, rainbow trout, carp, and largemouth bass are known to have been introduced and several other species may have been. The goldeye was the most abundant species in the reservoir and the white sucker in the tributary streams as judged from net catches.

Methods

Sauger used in this investigation were collected with the following equipment: experimental gill nets (1.25 to 3 inch mesh); fyke nets (rec-

Table 1. Ranges of chemical and physical data for Garrison Reservoir and tailrace, 1959 and 1960 (Dates in parentheses).

Analysis	Reservoir		Tailrace	
	1959	1960	1959	1960
Total dissolved solids p.p.m.	295.0 (9/11) - 422.0 (9/9)	326.5 (6/22) - 492.3 (5/23)	395.0 (8/4)	477.6 (6/25) - 484.8 (5/9)
Total alkalinity p.p.m.	122.0 (8/12) - 166.0 (9/9)	130.0 (6/22) - 185.0 (5/23)	106.0 (8/4)	175.0 (5/9) - 180.0 (5/23)
Total hardness p.p.m.	144.0 (8/12) - 232.0 (9/9)	140.0 (6/22) - 210.0 (5/23)	212.0 (8/4)	205.0 (5/23) - 210.0 (5/9)
Conductivity	1730 (9/9) - 2475 (9/11)	1625 (5/23) - 2450 (6/22)	1845 (8/4)	1650 (5/9) - 1675 (6/25)
pH	7.0 (9/11) - 7.7 (7/23)	7.5 (6/22) - 8.6 (4/30)	5.7 (8/4)	7.3 (5/23) - 8.7 (5/9)
Turbidity p.p.m.	0.5 (7/9) - 3.5 (7/14)	0.2 (6/13) - 18.5 (6/22)	0.7 (8/4)	1.2 (6/25) - 6.0 (5/9)
Temperature $^{o}F.$	33 (1/1) - 77 (7/30)	33 (1/1) - 74 (7/12)	65 (8/4)	33 (1/1) - 41 (6/25)

tangular opening with 100 foot lead fastened to the center of the frame); pocket nets (two typical fyke nets with a single lead fastened to the opening of each net); seines (common sense and 100 foot bag). Some specimens were also secured by the use of toxicants and from sport fishermen.

Measurements were made on 1,558 sauger ranging in total lengths from 4.0 to 26.5 inches. In order to compare measurements made in the present study with those of other workers, standard, fork, and total lengths were taken to the nearest 0.1 inch. The relationships between these lengths were nearly rectilinear and single conversion factors could be used for