Biology and predator use of cisco (Coregonus artedi) in Fort Peck Reservoir, Montana
by Mark Scott Mullins

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

Abstract:
Selected biological parameter of the cisco (Coregonus artedi) and its use by predators in Fort Peck Reservoir were examined during 1989 and 1990. The average length of cisco was approximately 144, 210, and 273 mm at ages 1, 2, and 3, respectively. The average size of spawners was approximately 240 mm and mean condition factors for size groups ranged from 0.75 to 0.91. Comparisons indicated that average size, growth, and condition factors have declined from previous years. Fecundity ranged from 1,119 to 13,956 for spawners with most gonadal development occurring during the fall months for both males and females. Qualitative analysis of stomach contents showed that the cisco utilized primarily Daphnia spp. and copepods and appeared to select the larger zooplankton types. Densities of reservoir zooplankton have not changed from pre-cisco (1984) introduction densities, but the zooplankton community composition has shifted towards smaller species. Examination of fish predator stomach contents showed that cisco were the most frequent prey species.

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ABSTRACT

Selected biological parameter of the cisco (*Coregonus artedi*) and its use by predators in Fort Peck Reservoir were examined during 1989 and 1990. The average length of cisco was approximately 144, 210, and 273 mm at ages 1, 2, and 3, respectively. The average size of spawners was approximately 240 mm and mean condition factors for size groups ranged from 0.75 to 0.91. Comparisons indicated that average size, growth, and condition factors have declined from previous years. Fecundity ranged from 1,119 to 13,956 for spawners with most gonadal development occurring during the fall months for both males and females. Qualitative analysis of stomach contents showed that the cisco utilized primarily *Daphnia* spp. and copepods and appeared to select the larger zooplankton types. Densities of reservoir zooplankton have not changed from pre-cisco (1984) introduction densities, but the zooplankton community composition has shifted towards smaller species. Examination of fish predator stomach contents showed that cisco were the most frequent prey species.

INTRODUCTION

Cisco (*Coregonus artedi*) is a salmonid endemic to North America (Lee et al. 1980), with a historical range in the northern Midwest and eastern United States, the Great Lakes region, and over most of Canada (Scott and Crossman 1977; Hubbs and Lagler 1964). *Coregonus artedi* has the widest distribution of all cisco species (Scott and Crossman 1977) and within its range has evolved into 22 subspecies (Hubbs and Lagler 1964).

Cisco is both a commercial and a forage species. In the past it was an important commercial fish in the Great Lakes with huge quantities being sold annually; now harvests are clearly smaller (Becker 1983; Eddy and Underhill 1974). Its importance as a prey item for many predaceous fish is well known (Becker 1983). The cisco's importance as a sport fish is limited. Cisco may provide some recreational fishing in the spring as well as through the ice in the winter (Scott and Crossman 1973), but Becker (1983) reported that cisco have little value as a sport fish in Wisconsin.

Cisco were introduced into Fort Peck Reservoir in the spring of 1984 by the Montana Department of Fish, Wildlife, and Parks (MDFWP) (Wiedenheft 1984). Subsequent stockings

were made in 1985 and 1986 (W.D. Wiedenheft, MDFWP, unpublished data). Source of cisco and the number of fish planted are listed in the Appendix, Table 16.

Cisco were introduced to enhance the prey base for walleye (*Stitzostedion vitreum*), sauger (*Stitzostedion canadense*), lake trout (*Salvelinus namaycush*), and northern pike (*Esox lucius*) (Wiedenheft 1983). They were to supplement a 1982 introduction of spottail shiners (*Notropis hudsonius*) in providing forage (W.D.Wiedenheft, MDFWP, personal communication). At this time it is the only population of cisco in the state of Montana.

Recently fisherman and sportsman groups have asked the MDFWP to stock cisco into additional reservoirs in central Montana to improve the prey base for sport fish. Before additional stockings the MDFWP determined that an assessment of the status and utilization of the existing cisco population was needed. This study was undertaken to aid in making decisions relative to further introductions in the state. Its major objectives were to determine:

1. the well being of the cisco as indicated by:
    a. age and growth
    b. fecundity, gonadosomatic index (GSI), and egg development
    c. condition factors
2. food habits of cisco

3. depth and/or temperature preference of cisco

4. utilization of cisco by predator sport fish

In addition, information was gathered on gill raker morphology to determine its relationship to the size of zooplankton eaten, and the condition factors of the fish. Field work was initiated in August 1989 and terminated in December 1990.

STUDY SITE DESCRIPTION

Fort Peck Reservoir is located in northeast Montana, approximately 29 km southeast of the city of Glasgow (Figure 1). The reservoir lies within the Charles M. Russell National Wildlife Refuge. Fort Peck was created by damming the Missouri River in 1939, and was filled by 1947 (Phenicie 1950). The reservoir is long and narrow in shape and has two distinct sections. The largest section, the Missouri Arm, extends 215.6 km up the Missouri River. The other major section, the Big Dry Arm, extends 64.4 km south of the dam. The Missouri and the Musselshell Rivers are the main sources of water feeding the reservoir. The U.S. Corps of Engineers operate Fort Peck Reservoir to provide water storage for navigation and flood control on the lower Missouri River, with hydroelectric power being a secondary benefit (Phenicie 1950).

The normal operating elevation of the reservoir is 684.6 m above mean sea level (MSL) with an average annual fluctuation since 1966 of 2.7 m (Liebelt 1981). At normal level the reservoir has a storage capacity of 506,928 m^3, and a surface area of 97,128 ha (Liebelt 1981). Its maximum depth is 67 m, with an average depth of 24 m. Its average width is 4.8 km and has a shoreline of 2,445.7 km