Potential impacts of altering discharge pattern from Hauser Dam, Missouri River, on young-of-the-year brown trout and rainbow trout
by Daniel Gregory Carty

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:
Daily flow fluctuations would occur in the Missouri River between Hauser Dam and Holter Reservoir if Hauser Dam were converted to a hydroelectric peaking facility.

To address potential impacts of fluctuating flows on free-swimming young-of-the-year (YOY) brown trout (Salmo trutta) and rainbow trout (S. gairdneri) emergence, growth, abundance, distribtion, movement, and habitat use were investigated. During reduced-flow tests stranding, isolation, displacement, and habitat changes were evaluated. Hydraulic modeling was used to predict changes in the quantity of usable habitat at different discharges. Recruitment from a tributary into the river was also monitored. Field data were collected between April 1982 and November 1983. Young-of-the-year brown trout were first observed in early April while YOY rainbow trout were first found in mid-June. Both species used relatively shallow, low-velocity water near shore where cover was abundant. Reduced-flow tests in August of each year revealed little stranding or isolation, and YOY trout were not permanently displaced from temporarily dewatered habitat. Hydraulic modeling predicted an increase in the quantity of habitat as discharge decreased, but field observations indicated a reduction in habitat quality.

The tributary was found to be a relatively important source of recruitment to the river rainbow trout fishery but rather unimportant to the river brown trout fishery.

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APPROVAL

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Daniel Gregory Carty

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date July 29, 1985

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ABSTRACT

Daily flow fluctuations would occur in the Missouri River between Hauser Dam and Holter Reservoir if Hauser Dam were converted to a hydroelectric peaking facility. To address potential impacts of fluctuating flows on free-swimming young-of-the-year (YOY) brown trout (*Salmo trutta*) and rainbow trout (*S. gairdneri*) emergence, growth, abundance, distribution, movement, and habitat use were investigated. During reduced-flow tests stranding, isolation, displacement, and habitat changes were evaluated. Hydraulic modeling was used to predict changes in the quantity of usable habitat at different discharges. Recruitment from a tributary into the river was also monitored. Field data were collected between April 1982 and November 1983. Young-of-the-year brown trout were first observed in early April while YOY rainbow trout were first found in mid-June. Both species used relatively shallow, low-velocity water near shore where cover was abundant. Reduced-flow tests in August of each year revealed little stranding or isolation, and YOY trout were not permanently displaced from temporarily dewatered habitat. Hydraulic modeling predicted an increase in the quantity of habitat as discharge decreased, but field observations indicated a reduction in habitat quality. The tributary was found to be a relatively important source of recruitment to the river rainbow trout fishery but rather unimportant to the river brown trout fishery.

INTRODUCTION

The flowing portion of the Missouri River between Hauser Dam and Holter Reservoir is a high quality fishing and recreation area. Sportfishing in this reach focuses on brown trout (Salmo trutta), rainbow trout (S. gairdneri), and mountain whitefish (Prosopium williamsoni). Longnose sucker (Catostomus catostomus) and white sucker (C. comersoni) are commonly caught, but not actively harvested. Walleye (Stizostedion vitreum), though rarely taken, are a prized addition to the creel. Brown trout, mountain whitefish, longnose sucker, white sucker, and walleye populations are entirely self-sustaining. The rainbow trout population is augmented by annual stocking of hatchery-reared fish into Canyon Ferry, Hauser, and Holter Reservoirs.

Hauser Dam has been operated by Montana Power Company as a run-of-the-river hydroelectric power plant, i.e. when the reservoir is full, all water which cannot pass through the turbines must be spilled over the dam. Recent engineering studies by Montana Power Company indicated that construction of a new powerhouse, coupled with hydroelectric peaking, would maximize the operational benefit:cost ratio. Hydroelectric peaking would alter

discharge patterns that have been in effect since 1954 (when the U.S. Bureau of Reclamation initiated hydroelectric power generation at Canyon Ferry Dam located approximately 24 km upstream) and daily flow fluctuations in the river downstream of the dam would occur during one or more seasons of the year.

This study was part of a larger investigation designed to predict potential impacts of altering discharge patterns from Hauser Dam on fish populations (White et al. 1984). Due to the importance of the brown trout and rainbow trout fisheries, research emphasis was placed on these species. Specifically, my study concerned potential impacts of fluctuating flows associated with hydroelectric peaking on young-of-the-year brown trout and rainbow trout.

Effects of fluctuating flows due to hydroelectric peaking, experimental drawdowns, and dam inspections on juvenile salmonids have been reported since the 1950's. Lindroth (1956) observed lateral displacement of age-0 anadromous brown trout during daily fluctuations below a hydroelectric plant on a large Swedish river. A number of investigators have reported stranding of fry and fingerlings of chinook salmon (Oncorhynchus tshawytscha), chum salmon (O. keta), coho salmon (O. kisutch), steelhead trout (Salmo gairdneri), and rainbow trout on dewatered substrate (Phillips 1969; Phinney 1974; Witty and Thompson

1974; Bauersfeld 1977,1978; Becker et al. 1981). Others have observed that juvenile fish may become isolated in pools during reduced discharges and exposed to increased water temperatures, decreased dissolved oxygen levels, and increased predation (Bauersfeld 1978; Becker et al. 1981).

I know of no information on potential impacts of fluctuating flows on young-of-the-year brown trout or rainbow trout under flow regimes similar to those tested by Montana Power Company at Hauser Dam. The following objectives were established for investigating potential impacts on young-of-the-year of both species: 1. determine date of earliest emergence; 2. monitor growth, abundance, distribution, and movement; 3. locate and describe habitat used by young-of-the-year trout; 4. evaluate stranding, isolation, and displacement during reduced-flow tests; 5. observe and predict habitat changes at different discharges; and 6. determine the importance of Beaver Creek as a source of recruitment to the river fishery.

Field research for this study was conducted between April 1982 and November 1983.

DESCRIPTION OF STUDY AREAS

Missouri River Below Hauser Dam

Hauser Dam is located on the Missouri River approximately 23 km northeast of Helena, Montana. The dam, in operation since 1911 as a run-of-the-river hydroelectric power generating facility, is a concrete structure with a height of 39.6 m, length of 135.6 m, and a spillway crest elevation of 1,103.7 m above mean sea level. Present intake capacity of the turbines is 121.8 m^3/sec; surplus water exceeding this capacity is spilled (White et al. 1984).

The Missouri River study area extended from Hauser Dam downstream to American Bar Gulch near the head of Holter Reservoir, a river distance of about 6.8 km (Figure 1). From the dam to the mouth of Beaver Creek, the river flows in a confined channel through a high-walled, rugged canyon. It continues through a narrow floodplain bordered by several benches and bars until reaching Upper Holter Reservoir.

A ponderosa pine (Pinus ponderosa)-grassland vegetation type is dominant along the banks of the river; patches of red osier dogwood (Cornus stolonifera) and willow (Salix sp.) are also present (White et al. 1984).