



Some environmental influences on egg production in brown trout (*Salmo trutta*) from Montana streams
by Lawrence L Lockard

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

Montana State University

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Abstract:

The relationships between selected parameters of 17 Montana streams and the attainment of sexual maturity and fecundity of their resident female brown trout were studied. Fish from the streams having conductivity and alkalinity levels greater than 100 micromhos/cm and ppm CaCO₃ respectively, were younger at sexual maturity than fish from waters with lower levels. The attainment of earlier sexual maturity in fish from the former streams could not be completely explained on the basis of greater growth rates. Fish from the stream having the highest levels of conductivity had the slowest growth rate but became sexually mature at the youngest age. A positive relationship was found between chemical fertility (conductivities from 70 to 402 micromhos/cm) of streams and the fecundity of their fish. However, in the stream having the highest levels of conductivity, fish were the least fecund. It was concluded the chemical fertility of their streams is generally related to the age at sexual maturity and fecundity of fish except in fish from Bluewater Creek.

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Date

June 7, 1974

SOME ENVIRONMENTAL INFLUENCES ON EGG PRODUCTION IN
BROWN TROUT (*SALMO TRUTTA*) FROM MONTANA STREAMS

by

LAWRENCE L. LOCKARD

A thesis submitted to the Graduate Faculty in partial
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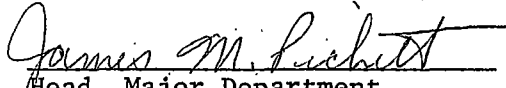
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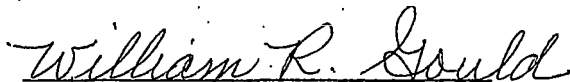
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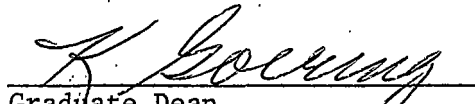
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ABSTRACT

The relationships between selected parameters of 17 Montana streams and the attainment of sexual maturity and fecundity of their resident female brown trout were studied. Fish from the streams having conductivity and alkalinity levels greater than 100 micromhos/cm and ppm CaCO_3 respectively, were younger at sexual maturity than fish from waters with lower levels. The attainment of earlier sexual maturity in fish from the former streams could not be completely explained on the basis of greater growth rates. Fish from the stream having the highest levels of conductivity had the slowest growth rate but became sexually mature at the youngest age. A positive relationship was found between chemical fertility (conductivities from 70 to 402 micromhos/cm) of streams and the fecundity of their fish. However, in the stream having the highest levels of conductivity, fish were the least fecund. It was concluded the chemical fertility of their streams is generally related to the age at sexual maturity and fecundity of fish except in fish from Bluewater Creek.

INTRODUCTION

The size and age at sexual maturity and the fecundity of female fish appear to be related to features of their environment. In Pennsylvania, brown trout (*Salmo trutta*) from infertile waters had a smaller proportion of mature fish per age class and a smaller weight of eggs than comparable fish from fertile waters (McFadden, Cooper and Anderson 1965). Although taken in the same ocean hauls, chinook salmon (*Oncorhynchus tshawytscha*) from the Sacramento River had twice the egg compliments of those from the Klamath River (McGregor 1922 and 1923). Scott (1962) and Bagenal (1969) demonstrated rainbow trout (*Salmo gairdneri*) and brown trout brought a lower number of eggs to maturity under reduced nutritional levels than fish on higher levels of nutrition.

This study is an attempt to determine the relationships between selected environmental parameters and egg production in brown trout from streams in Montana. Welch (1952), Rawson (1951, 1960), Reimers, Maciolek and Pister (1955), Northcote and Larkin (1956), Moyle (1949, 1956), and Carlander (1955) recognized conductivity and alkalinity as indicators of the fertility of water. In this study associations between conductivity and alkalinity with size and age of fish at maturity were determined. Also the interrelations of conductivity, alkalinity, discharge and standing crop and their relations to fecundity of brown

trout in Montana streams were studied. Field collections were made from September 8, to October 23, 1972 and from September 1, to October 19, 1973.

METHODS

A total of 449 female brown trout were collected by electro-fishing. Collecting sites were located on streams belonging to the Clark Fork of the Columbia, Yellowstone and Missouri River drainages (Figure 1). These streams had a wide range of physical, chemical, and biotic conditions (Table 1).

At least one fall, winter, and summer measurement of conductivity and alkalinity was made at each collecting site. The field measurements from each stream were averaged with the yearly conductivity and alkalinity averages obtained from Water Resources Data for Montana (U. S. G. S., 1972) when available for a stream. Discharge values were obtained by averaging available yearly values from the above U. S. G. S. records with values measured or estimated by fisheries biologists of the Montana Fish and Game Department. All U. S. G. S. data were obtained from stations near the collecting sites. Eight of the 11 values for standing crops of trout were obtained from Progress Reports of the Montana Fish and Game Department, Fisheries Division. The standing crop estimates for the two collecting sites on Bluewater Creek were obtained by averaging data from Graham (unpublished data) with those of Peters (1971). Standing crop information for Rock Creek is from Gunderson (1966). Discharge was found to be inversely related to standing crop.

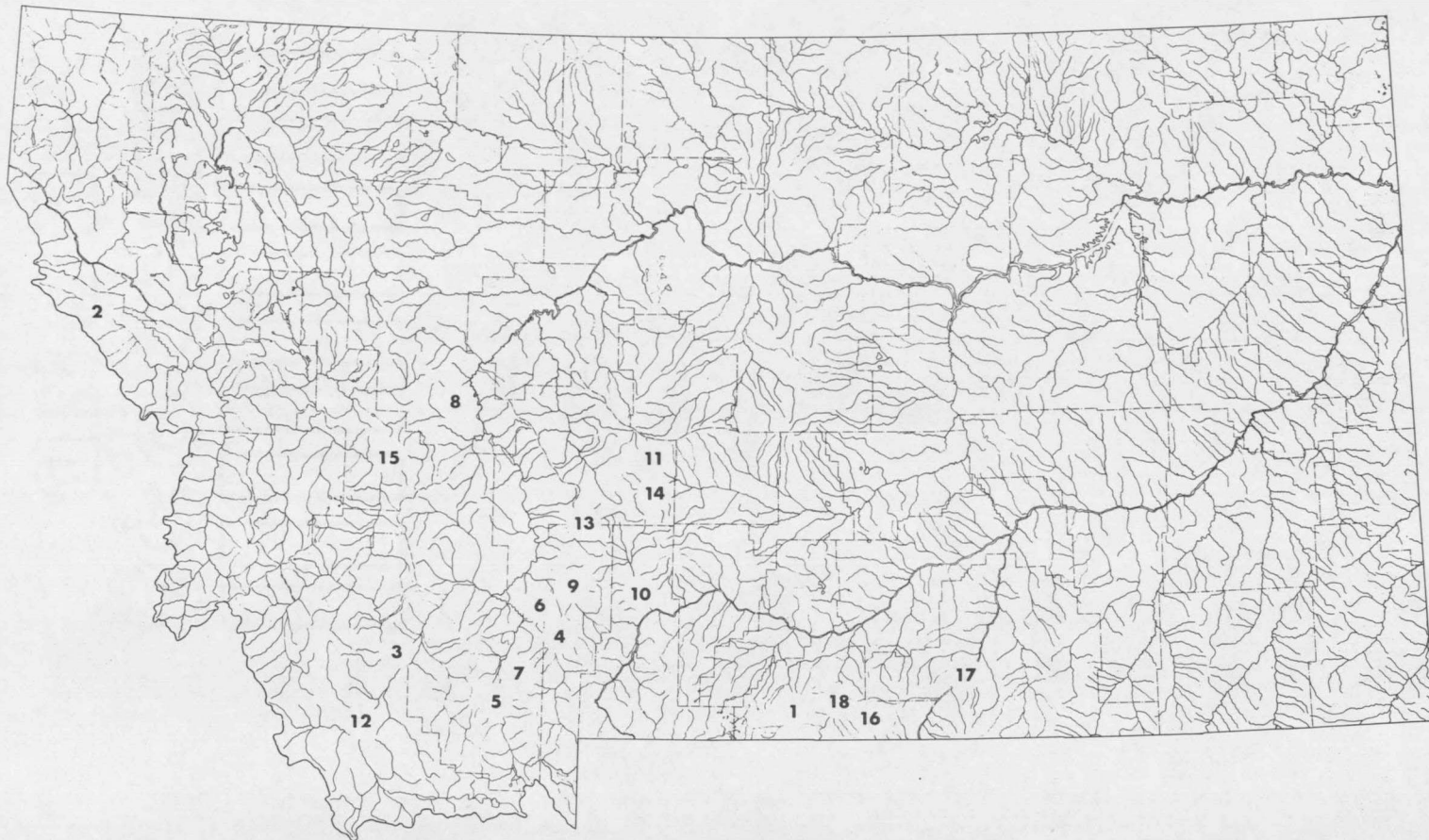


Figure 1. Map showing location of collecting sites.

