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USE OF MCBRIDE LAKE STRAIN YELLOWSTONE CUTTHROAT TROUT FOR LAKE AND RESERVOIR MANAGEMENT IN MONTANA

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July, 1987

For Dr. Behnke

ABSTRACT

Poor performance in Montana alpine lakes by hatchery reared Yellowstone cutthroat trout was blamed on lack of adaptability and loss of genetic variability in the hatchery broodstock. A new broodstock was developed from wild gametes taken at McBride Lake in Yellowstone National Park. Random methods of mating fish and selecting fish for future broodstock were designed to maintain genetic diversity as close as possible to that of the wild population. Genetic variability of broodstock was tested annually and wild gametes were reintroduced into the broodstock every third generation.

Naturally reproducing populations of McBride strain Yellowstone cutthroat trout have been established in lakes with suitable inlet or outlet spawning habitat, usually after a single introduction. Performance in alpine lakes is characterized by rapid growth, high catchability and longevity up to nine years. McBride strain cutthroat are opportunistic feeders, adaptable to a variety of situations. Tests of the strain's ability to coexist with other species have not been completed.

The keys to successful implementation of a strain management program are selection of a strain that is well adapted to its intended use and preserving adaptability through maintenance of genetic variability.

INTRODUCTION

Poor performance by hatchery fish in specific situations in the wild has led many fisheries managers to search for species or strains of fish naturally adapted to those situations. In some cases, poor performance in the wild may be due to loss of genetic variability in the hatchery fish. Significant reduction in genetic variability of westslope cutthroat trout (Salmo clarki lewisi) broodstock in Montana was noted within 14 years of removal from the wild (Allendorf and Phelps 1980). When a domesticated broodstock is maintained for a long period of time, artificial selection for traits that make the fish easier to rear in the hatchery (but less suited to surviving in the wild) is likely to occur. A combination of these factors led Montana fisheries managers to establish a new broodstock of Yellowstone cutthroat trout (Salmo clarki bouvieri), primarily for use in alpine lakes of south central Montana.

The Beartooth Plateau region, located northeast of Yellowstone National Park, provides substantial alpine lake fishing opportunities. Several hundred lakes, at elevations as high as 3,300 m, support fishable trout populations in or near the Absaroka-Beartooth Wilderness Area. The Montana Department of Fish, Wildlife, and Parks (MDFWP) began a comprehensive inventory of Beartooth Plateau lakes in the 1960's for the purpose of developing management plans. Most of the lakes were originally barren of fish. Various species have been introduced, including

rainbow trout (Salmo gairdneri), brown trout (Salmo trutta), brook trout (Salvelinus fontinalis), lake trout (Salvelinus namaycush), and arctic grayling (Thymallus arcticus). The majority of the lakes however, are managed for Yellowstone cutthroat trout, the only trout native to the area.

The MDFWP broodstock maintained for stocking these lakes originated from Yellowstone Lake. When egg taking operations at Yellowstone Lake ceased in 1956, the source of wild gametes for MDFWP's broodstock was lost (Gresswell and Varley 1986). When the Beartooth Plateau lake inventory was initiated, it quickly became apparent that hatchery reared Yellowstone cutthroat trout were not performing up to expectation in many alpine lakes. Loss of genetic variability was suspected to be the major problem. However, an innate lack of ability to adapt to various conditions may also have been a factor. Behnke (1979) suggested that evolution of the Yellowstone Lake cutthroat in a stable environment, free of competition from other species may have resulted in a lack of adaptability. As a result, MDFWP managers began a search for a different strain of fish adapted to alpine lake conditions and compatible with native fish stocks.

BROODSTOCK DEVELOPMENT AND PERFORMANCE

The search for a new broodstock ended at McBride Lake, a small (9.3 hectares), high elevation (1,999 M) lake in the northeast

corner of Yellowstone National Park, not far from the Beartooth Plateau. McBride Lake is a highly productive lake supporting a naturally reproducing population of Yellowstone cutthroat trout. The lake's population has been confirmed as genetically pure through electrophoresis, in spite of a 1936 plant of rainbow trout (Varley 1981)

In 1969, gametes from 15 spawning pairs of McBride Lake cutthroat trout were brought into the MDFWP hatchery system. Outbreaks of furunculosis disease delayed production of fish for stocking until 1975. Since then, the McBride Lake strain has been the major strain used for alpine lake management in Montana east of the Continental divide.

Several steps have been taken to insure the maintenance of genetic variability of the McBride strain broodstock. Brood fish are tested annually for genetic variability and compared to the wild population. Random methods are used in mating fish and in selection of fish for future broodstock. Previous experience has shown that broodstock can be maintained for at least three generations in the hatchery with no detectable loss of variability. Consequently, wild gametes from McBride Lake are reintroduced into the broodstock every third generation (Dotson 1985). No detectable loss of genetic variability has occurred.

McBride strain cutthroat have performed extremely well in alpine lakes. Naturally reproducing populations have been established

in lakes containing suitable inlets or outlets. Among these is Marker Lake, at 3,313 m, the highest elevation fishery in Montana. Often, a single introduction is sufficient to generate a naturally reproducing population. Rapid growth occurs in productive lakes and maximum sizes of 60 cm and 3 kg have been documented. In less productive lakes, McBride strain cutthroat normally reach lengths of 25 to 30 cm in three or four years. Catchability is high, a common characteristic of cutthroat trout. Longevity appears to be normally in the range of six to seven years, but may reach nine years.

McBride strain cutthroat appear to be very adaptable in their food habits. Zooplankton and amphipods comprise the major portion of the diet in most alpine lakes. Terrestrial insects may be seasonally important. In some lowland lakes, they may be quite piscivorous.

Recent introductions of McBride strain cutthroat in lowland lakes and reservoirs appear promising as an alternative management strategy. Several Montana reservoirs require annual plants of large numbers of hatchery rainbow trout to maintain a fishery. In spite of the availability of good quality spawning habitat, the rainbow stocks used rarely establish naturally reproducing populations. Trojnar and Behnke (1974) demonstrated increased game fish biomass and angler opportunity can be produced when different species or strains can partition the available habitat.

However, more time will be required before the McBride strain's ability to coexist with other species can be assessed.

DISCUSSION

The success of McBride strain Yellowstone cutthroat trout in MDFWP's alpine lake management program is predictable given their adaptation to an alpine lake ecosystem. Adaptability of the strain to a variety of situations probably results from a relatively short evolutionary history (invasion of the upper Yellowstone drainage occurred within the last 8,000 years) in an environment favoring an ecological "generalist" rather than a "specialist" (Behnke 1979). Continued success of the program will depend on the MDFWP's ability to maintain the genetic variability (and subsequent adaptability) of the strain in the hatchery system.

McBride strain cutthroat have proven highly adaptable to a variety of single-species lacustrine ecosystems. However, they evolved in a simple ecosystem without competition from other species. Tests of their ability to successfully coexist with other species are still in progress.

The implications of MDFWP's McBride strain program are clear for fisheries managers contemplating a move towards strain management. A program is likely to be successful if the strain

selected is well adapted to its intended use. The MDFWP program is designed to take advantage of the McBride strain's adaptability in a variety of lake environments. A key element in the program is insuring retention of the genetic variability of a wild population and consequently, the adaptability that made the strain well suited to its environment. In its simplest terms, a successful strain management program is one that takes advantage of the natural selection that has occurred in a wild population and attempts to avoid artificial selection for traits that favor hatchery performance.

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