



Grizzly bear habitat use on cutthroat trout spawning streams in tributaries of Yellowstone Lake
by Daniel Paul Reinhart

A thesis submitted 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:

Grizzly bears (*Ursus arctos*) and black bears (*U. americanus*) prey on spawning cutthroat trout (*Oncorhynchus clarki*) in tributary streams of Yellowstone Lake in Yellowstone National Park. Tributaries were surveyed from 1985 to 1987 to determine the presence and level of trout spawning activity and bear use. Indices were developed to estimate spawner density and levels of bear activity and fishing on streams. Of 126 known tributaries of Yellowstone Lake, 48% had a spawning run. Of these spawning streams, 95% had evidence of associated bear activity, and 61% had associated evidence of bear fishing. Bear use of cutthroat trout spawning streams was largely a positive function of spawner density/ m^3 . Bear use was secondarily related to timing of spawning runs, proximity to other spawning streams, and abundance and quality of streamside vegetation. Less bear use of spawning streams than expected from regression analysis occurred near park developments. Scat analysis showed 16.5% scat volume of cutthroat trout remains and translated into 91.8% estimated total ingested volume of trout when fecal correction factors were applied. Vegetation communities along Yellowstone Lake spawning streams were rated overall higher quality habitat for bears than Yellowstone Park at large or the upland communities surrounding Yellowstone Lake. I concluded that spawning cutthroat trout were an important seasonal food for a large number of Yellowstone bears.

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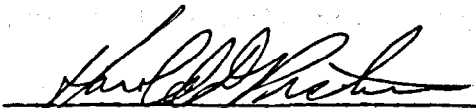
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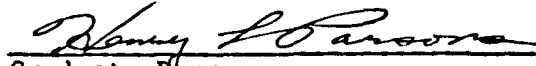
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ABSTRACT

Grizzly bears (*Ursus arctos*) and black bears (*U. americanus*) prey on spawning cutthroat trout (*Oncorhynchus clarki*) in tributary streams of Yellowstone Lake in Yellowstone National Park. Tributaries were surveyed from 1985 to 1987 to determine the presence and level of trout spawning activity and bear use. Indices were developed to estimate spawner density and levels of bear activity and fishing on streams. Of 126 known tributaries of Yellowstone Lake, 48% had a spawning run. Of these spawning streams, 95% had evidence of associated bear activity, and 61% had associated evidence of bear fishing. Bear use of cutthroat trout spawning streams was largely a positive function of spawner density/m³. Bear use was secondarily related to timing of spawning runs, proximity to other spawning streams, and abundance and quality of streamside vegetation. Less bear use of spawning streams than expected from regression analysis occurred near park developments. Scat analysis showed 16.5% scat volume of cutthroat trout remains and translated into 91.8% estimated total ingested volume of trout when fecal correction factors were applied. Vegetation communities along Yellowstone Lake spawning streams were rated overall higher quality habitat for bears than Yellowstone Park at large or the upland communities surrounding Yellowstone Lake. I concluded that spawning cutthroat trout were an important seasonal food for a large number of Yellowstone bears.

INTRODUCTION

Effective management of grizzly bears (*Ursus arctos horribilis*) in the Yellowstone Ecosystem relies on understanding their food habits and habitat use. The designation of the grizzly bear as "threatened" under the Endangered Species Act in 1975 requires special protection and management on Federal lands for this species (Interagency Grizzly Bear Guidelines, 1986). Effective control of grizzly bear mortality and maintenance of high quality habitat is critical to their survival.

The grizzly bear in the Yellowstone Ecosystem has been studied extensively. Murie (1944) reported initial findings on grizzly bear food habits. From 1959-70, researchers studied food habits, social behavior, general ecology, and management of Yellowstone grizzly bears (Craighead and Craighead 1971, 1972; F. Craighead 1976; J. Craighead 1980; Craighead et al. 1982; and others). From 1973 to the present, the Interagency Grizzly Bear Study Team (IGBST) studied food habits, habitat use, movements, population status, general ecology and management of grizzly bears in the Yellowstone Ecosystem (Mealey 1975, Blanchard 1978, Graham 1978, Kendall 1983, Schleyer 1983, Knight et al. 1984, Knight and Eberhardt 1985, Harting 1985, Mattson et al. 1987, and others).

Spawning and migrating salmonids are a major food of brown bears (*U. arctos*) and black bears (*U. americanus*) worldwide. Anadromous Pacific salmon (*Oncorhynchus* spp.) comprise a major part of seasonal

bear diets in coastal systems of Alaska (Clark 1959, Frame 1974, Luque and Stokes 1976, Berns et al. 1980, Glenn and Miller 1980), British Columbia (Meehan 1961, Hamilton and Archibald 1985), and the Soviet Union (Bergman 1936, Bromlei 1965, Kistchinski 1972). Bears historically used salmonids in headwaters of the Columbia and Clearwater Rivers in northwest United States (Wright 1909, Russell 1967) and elsewhere. Hydroelectric development and fisheries practices have disrupted spawner numbers and bear movements in these river systems (Butterfield and Almack 1985, Davis et al. 1986), in California (Piekielek and Burton 1975), the Soviet Union (Lazarev 1978), and Japan (Aoi 1985).

In Yellowstone National Park, grizzly and black bears fish for adfluvial cutthroat trout (Oncorhynchus clarki, formerly known as Salmo clarki) in tributaries of Yellowstone Lake (Hoskins 1974, 1975; Mealey 1975, 1980). This has been evident from an abundance of fish carcasses, trail matting of vegetation, bear scats, tracks, and observations of bears along banks of spawning streams around Yellowstone Lake. Bear use of fish is consistent with the fact that bears are morphologically and physiologically adapted to digest protein, and fish are highly digestible (Herrero 1978, Bunnell and Hamilton 1983, Hewitt and Robbins 1990).

In 1974 and 1975, the Interagency Grizzly Bear Study Team (IGBST) conducted a survey of Yellowstone Lake spawning streams and associated bear use (Hoskins 1974, 1975). Mealey (1975, 1980) also investigated bear use of spawning trout as part of his food habits study in

Yellowstone Park. Since 1975, changes in management of the cutthroat trout fishery have resulted in an increase in the population age and size structure of trout in Yellowstone Lake (Gresswell and Varley 1988).

This study was conducted from 1985 through 1987 to further investigate bear use of spawning streams in Yellowstone Park. The first 2 years of this study were a cooperative project by the IGBST and the U. S. Fish and Wildlife Service (USFWS) Fisheries Assistance Program in Yellowstone Park. Jones et al. (1986, 1987) presented information obtained by the USFWS on fish population structure and physical stream attributes related to cutthroat trout spawning runs. This manuscript provides data on seasonal grizzly bear habitat use of spawning streams and provides a framework for management of areas around Yellowstone Lake. Specific objectives of this study were:

1. To appraise the relative value of cutthroat trout as a food source for Yellowstone grizzly bears.
2. To quantify spawning stream attributes that contribute to usability by bears.
3. To appraise the overall food habits and habitat use of bears on spawning streams.
4. To identify changes in bear use of streams since the 1970's.
5. To provide data for park managers to develop guidelines to reduce bear-human conflicts near spawning streams.

STUDY AREA

Yellowstone Lake and Tributaries

The study area included all tributary streams of Yellowstone Lake in east-central Yellowstone National Park (Fig. 1).

Yellowstone Lake is a high elevation (2358 m), oligotrophic lake. It is relatively deep with an average depth of 42 m and a maximum depth of 98 m. Yellowstone Lake has a surface area of 35,391 ha, basin capacity of $14 \times 10^9 \text{ m}^3$ (Benson 1961), and an estimated shoreline of 176 km. The size of tributaries feeding Yellowstone Lake varied considerably. The small, intermittent streams had flows of less than $0.01 \text{ m}^3/\text{sec}$. The largest tributary, the Yellowstone River Inlet, had an estimated drainage basin capacity of 43,269 ha (Jones et al. 1986). There are 124 known tributaries that feed Yellowstone Lake (Hoskins 1974, Varley et al. 1976, Jones et al. 1986). Unnamed streams were numbered by Hoskins (1974) and by Yellowstone Park officials using a system of numbering Yellowstone waters (SONYEW) in 1975 (Varley et al. 1976). This system was recently changed to provide stream classification by hierarchical order and geographical location, and provide the ability to add new streams without changing the entire numbering system (Jones et al. 1986). All tributary streams are listed by name, Hoskins number, old, and revised SONYEW number in Appendix Table 14. Revised SONYEW numbers are referenced in the text and presented in Appendix Fig. 1.

