Montana Grayling
and Its Habitat

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Introduction

This publication has been developed as an attempt to summarize the existing information on the Montana grayling (Thymallus arcticus montanus) in North America, with emphasis on the western United States. It is particularly directed toward examining the historical distribution, present status, and habitat relationships of the species. As our literature review and correspondence with persons knowledgeable about the grayling progresses, it became apparent that the grayling is not yet threatened or endangered over much of its former habitat, but that all possible efforts should be taken to understand its ecology, and to protect its habitat.

The North America graylings were originally separated into three species: Arctic grayling (Thymallus signifer), Michigan grayling (T. tricolor) and Montana grayling (T. montanus). They have now been grouped as a single species (T. articus), of which the Montana grayling is a subspecies (T. a. montanus). The arctic grayling of Canada and Alaska is not presently threatened and the Michigan grayling is now extinct. The river form of the Montana grayling is thought to be the "true" form of Montana grayling, while many of the present-day populations are thought to have been derived from lake dwelling -stream spawning populations.

Historical Perspective

The Montana grayling was evidently originally found in the Missouri River and its tributaries above Great Falls in western Montana (see Figure 1). Vincent (1962) reported that the former distribution included the Big Hole

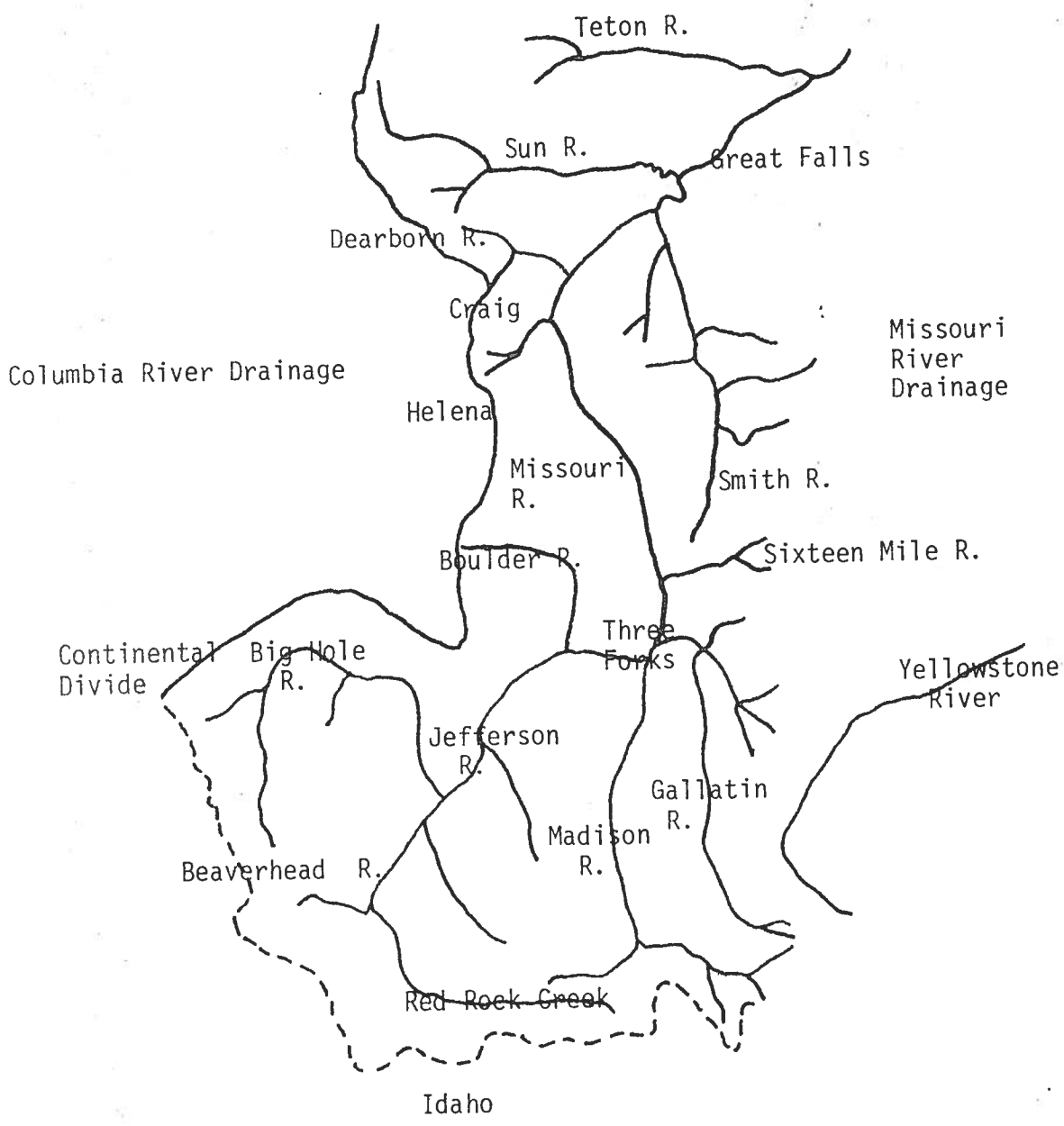

Figure 1. Distribution of Indigenous Montana Grayling.

River, Red Rock Lakes, Red Rock Creek, Beaverhead River, Madison River, Gallatin River, Dearborn River, Upper Missouri River near Three Forks, Sun River and Smith River. Henshall (1898) reported that grayling were found only in the Jefferson, Gallatin and Madison Rivers and their tributaries. He reported that the Red Rock Lakes were transplanted with grayling in 1898.

Lewis and Clark first described the fish at the headwaters of the Jefferson River. In 1805 they caught grayling in the upper part of the Beaverhead River near the present location of Clark Canyon Reservoir.

Grayling were reported in Yellowstone National Park by Jordan (1891). He stated that the fish were very abundant in the Madison River below the junction of the Firehole and Gibbon Rivers. They were also collected from Horse Thief Spring. The grayling ascended the Madison River in the summer as far as the Firehole Falls and Gibbon Falls. Jordan also reported the fish to be present in the Gallatin River. Everman (1893) reported the grayling to be in the Red Rock Creek and Red Rock Lakes, Beaverhead River, Firehole River, Gibbon River, Madison River and Horse Thief Springs.

The Deseret News published in Salt Lake City in 1901 reported that 110,000 eggs were brought from Montana in 1899 to the Cold Spring Trout Hatchery near Salt Lake City. Many of the fry escaped from the hatchery into ponds and channels of Big Cottonwood Creek, the Jordan River, and into Utah Lake. Grayling were transplanted into stream tributaries of Utah Lake, East Canyon Creek (Summit County), Silver Lake, and Blanche and Martha Lakes in the South Fork of Big Cottonwood Creek. Phelps reported in a letter to Calhaun (1969) that grayling were at that time present in 15 lakes in the Uinta Mountains and in the Uinta River. These lakes vary in surface area from 2-205 acres, and are at elevations ranging from 9,000 to 11,000 feet.

Johnson (1937) reported that grayling were found in Yellowstone National Park and had been transplanted into South Dakota and Wyoming waters.

In 1938 Brown stated that Meadow Creek in Madison County, Montana was one of few ancestral waters still occupied by grayling in Montana. He reported that they were present in Rogers Lake in Flathead County, were found in Grebe Lake in Yellowstone National Park, and had been stocked in Lake Agnes in Beaverhead County. Peterson (1972) stated that grayling were stocked in Lake Agnes in the 1930's.

Grayling were reported to be gone from the Missouri River and its tributary the Gallatin River by Nelson in 1954. They were also said to be rare in the Madison River drainage and gone from the main stream of the Jefferson River. He reported two small remnant populations: the Big Hole River drainage maintained through artificial propagation and Red Rock Lakes maintained without artificial propagation. By 1959, Kruse stated that the Red Rock Lakes area harbored the only remaining indigenous population in Montana.

Present Distribution and Status

The present locations of Montana grayling and their status vary from one published report to another. Vincent (1962) stated that the grayling was present at that time in 21 lakes and 29 streams in Montana, 2 lakes in Washington, 1 lake in Glacier National Park (stocked in Elizabeth Lake in 1889), 4 or 5 lakes in Wyoming, 20 lakes in Utah, 3 lakes in Colorado, and 1 lake in Yellowstone National Park (Grebe Lake stocked in 1924). Peterman (1972) reported that there were 39 self-sustaining populations in lakes and 14 in streams in western Montana.

In a U.S. Fish and Wildlife Service report made in 1973, there were said to be relict and transplanted populations in 20 lakes and 25 streams in Montana,

20 lakes in Utah, 3 lakes in Wyoming, 2 lakes in Washington, 1 lake in Colorado and in Glacier and Yellowstone National Parks.

Cook (pers. com. 1975) stated that the Big Hole River, some of its tributaries, Red Rock Lakes and some streams adjacent to the Centennial Valley are currently major contributers to Montana's grayling population. Erikson (n.d.) reported the recent identification of a native, undisturbed grayling population in the Pioneer Mountains, part of the Big Hole River drainage. The Red Rock Lakes presently have a small population of grayling, with an apparent absence of young age classes (Roscoe pers. com. 1975). Grayling are currently located in the Clark Fork of the Yellowstone River drainage in the Beartooth Mountains of Montana (Marcuson 1974).

Holton (1971) stated that Montana grayling are found in the Smith River and its tributaries; the Sun River; and the Gallatin, Jefferson and Madison Rivers and their tributaries. He further stated that grayling have been introduced into lakes in Wyoming, Arizona, Utah, Washington, Idaho, California and Colorado.

Grayling have been planted in Pot Lake, Williams Lake, Bald Mountain Lake, and Upper Post Office Lake in Idaho (Jenni pers. com. 1975) and in Upper Granite Lake in Washington (Wasem pers. com. 1975).

Habitat Relationships

The habitat of the Montana grayling has been studied and documented for several years. Thus, there is considerable information in the literature on the habitat relationsihps of the fish.

The grayling seems to have rather specific requirements for a habitat. Their rather spotty and irregular distribution historically has resulted in their presence in one tributary of a river, but not in a nearby tributary of the same stream. Their specificity of habitat also results in their location

in only certain sections of a stream. Thus, the grayling seems to have a rather narrow ecological amplitude.

In North America the grayling is often associated with alpine, arctic, or subarctic conditions, leading to an incorrect assumption that swift mountain streams and very cold water temperatures are a necessary habitat feature (Vincent 1962). For example, grayling habitat in Saskatchewan has been described as large, clear, cold, rock-strewn rivers and lakes with nearby tumultuous rapids and falls (Saskatchewan Dept. Nat. Res. 1971). The grayling are certainly found in these waters, but these are not necessarily optimum habitat as will be discussed later.

Spawning Beds

Montana grayling spawn in the spring, with the time of spawning partly regulated by water temperature. The spawning commences when the water temperature reaches the 40-50°F range (Holton 1971). Spawning beds are stream bottoms of pebbles, gravel, sand or rubble (Eriksen n.d., Holton 1971) with some rooted vegetation developing by midsummer. A stream bottom of detritus and peat are not suitable for spawning (Nelson 1954). Brown (1938a) has noted that grayling will travel great distances to spawn, provided that suitable spawning beds are available.

The grayling was originally found only in streams in Montana, but has been introduced into several lakes throughout the West. When present in lakes, they prefer cool lakes with spring-fed tributaries up which they can move for spawning (Holton 1971). Grayling stocked in Utah have been reported to spawn successfully in lakes without inlets or outlets, and reservoirs with severe water level fluctuations apparently do not adversely affect grayling reproduction (Phelps 1969). However, it remains to be seen whether grayling

n lakes without accessible streams can remain over a period of time. In those akes where beaver dams have impeded the movement of grayling into streams o spawn, the populations have declined (Nelson 1954, U.S. Fish and Wildl. erv. 1973).

A study of grayling in Lake Agnes (Montana) by Peterman (1972) led to he conclusion that "the marginal nature of the spawning stream with its shifting sand bottom and frequent bank cave-ins, and the variable amount of stream available to spawning fish between years are believed to be the most important factors contributing to the population fluctuations." Undoubtedly, there is a need to protect the stream bank from erosion and cave-ins, and to maintain a well-vegetated watershed to assure that spawning beds are protected.

Stream and Lake Characteristics

Grayling prefer spring-fed streams with clear water, stable flow, and a stable temperature (Vincent 1962, Holton 1971). The preferred stream flow should be 1-2 feet per second, with a stream gradient not exceeding 20 feet per mile (Vincent 1962). Waters occupied by grayling usually do not freeze over (Banks 1960). Montana grayling streams have a peak flow from mid-May to mid-July, with flooding and low-water levels being minimized by the stream being spring-fed and fed by snow melt throughout the summer. Grayling do not prefer turbulent waters. Grayling are seldom found in stream water deeper than 5 feet (Vincent 1962) and prefer unsilted water (Emig 1969).

Grayling seem to prefer shallow water having abundant vegetation (Brown 1938b, Holton 1971). In order to live in these waters, they need to be spring-fed and to be well-shaded to maintain the cooler temperatures.

Brown (1938b) studied the grayling in Rogers Lake and Grebe Lake where grayling had been stocked. He described Rogers Lake as having a maximum depth

of 25 feet, a maximum temperature of 80°F, and supporting enormous amounts of vegetation. Grebe Lake is located at about 8,000 feet elevation, is shallow and supports abundant vegetation.

Water Temperature

The maximum water temperature that can be tolerated by grayling is not known. However, they prefer a temperature of 50-65°F (Holton 1971, Vincent 1952). They avoid water temperatures below 50°F (Vincent 1952) and migrate in winter to streams that don't freeze over (Ward 1951). Emig (1969) stated that grayling tolerate temperatures to 74°F, but experience stress in water above 60°F. High water temperatures may not be as critical as the availability of spring-fed streams or springs into which they can move to escape these high temperatures. "Natural geologic warming. . .has been accelerated by human activities such as removal of stream-side vegetation, reservoirs, return of irrigation water,. . . or (reduction) in stream flow" (Vincent 1962).

Tolerance of Low Oxygen Levels

Grayling have a low oxygen tolerance (Eriksen n.d., Holton 1971). They seem to tolerate the low oxygen content of high mountain lakes in California that are largely barren of other fish (Anonymous 1971). Thus, the grayling may be a potential species for stocking many of the high altitude lakes in the West where other fish species have been relatively unsuccessful.

Competition with other Trout Species

Grayling do not compete well with exotic trout species. Their decline over much of their historic range in Montana may be related to the introduction of exotic trout (Holton 1971). Marcuson (1974) stated that brook trout

generally dominate and often eliminate grayling. Nelson (1954) also stated that brook trout and rainbow trout introductions have led to declines in grayling populations.

Food Habits

The grayling is an opportunistic feeder (Vincent 1952, Ward 1951) with food selection depending mostly on availability (Brown 1938b). Emig (1969) stated that grayling eat primarily larvae, pupae and adults of aquatic and terrestrial insects and crustaceans, while Leonard (1939) reported that the majority of the diet is immature and adult stages of predaceous aquatic insects. According to Holton (1971) they sometimes eat fish.

A study by Brown (1938b) showed that grayling eat many aquatic and terrestrial insects, including mayflies, damselfly nymphs, aquatic Coleoptera, aquatic Crustacea, water fleas, and some algae. He found that the diet commonly contains 20% damselflies and 40% midges.

Reasons for Population Declines

Grayling populations now occupy a very small portion of their former range in Montana. The reasons for declines have mostly related to disturbances in their habitat that have made it unsuitable for their reproduction and survival. Eriksen (n.d.) stated that the factors leading to grayling population delines include improper timber, grazing and irrigation management which allowed muddying and warming of the water, increased flows, silting of spawning beds and "habitat dewatering." The introduction of exotic trout, as mentioned previously, has led to a decline of grayling in many waters.

Over-fishing of grayling has been mentioned by Holton (1971) as a possible cause of declines.

The U.S. Fish and Wildlife Service (1973) listed the reason for grayling declines as a decline in habitat quality due to timber removal, mining, overgrazing, warmer stream temperatures, gravel spawning areas filling with silt and sand, beaver dams blocking spawning streams, irrigation channels, and competition with exotic trout species.

The reduction in shrub and tree cover for shading streams has also had an adverse effect. The construction of dams which inundate grayling streams has also been detrimental. Holton (1971) mentioned that several spawning streams have been blocked by irrigation structures. Horse Thief Springs, which formerly had a large population of grayling, is now flooded by Hebgen Lake.

Habitat Model

Our literature review has revealed some rather specific characteristics of the habitat of the Montana grayling. The existing information on the grayling's habitat has been assimilated into a conceptual model shown in Figure 2. This model is only a preliminary one and should be tested and expanded or modified as more definitive information becomes available.

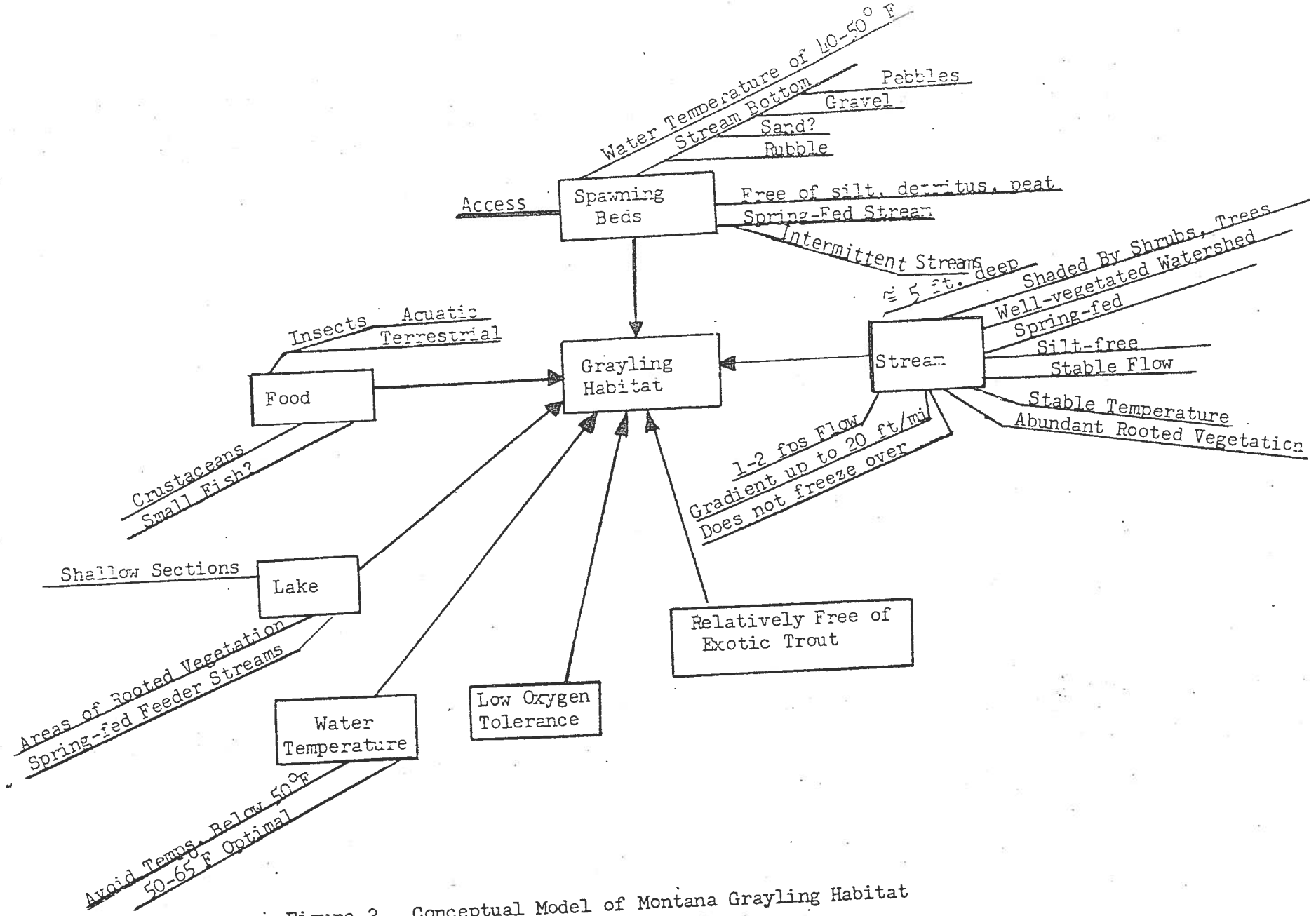

Figure 2. Conceptual Model of Montana Grayling Habitat

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Sources of Information by Subject

Former Distribution: 1,4,5,12,14,17,18,21,22,37,39,40,41,42.

Present Distribution and Status: 1,4,6,8,9,10,11,13,14,15,18,19,22,27,29, 33,34,36,37,38,41,42,45,46.

Spawning: 3,7,10,11,14,15,18,22,23,29,32,33,40,42.

Stream and Lake Characteristics: 9,10,11,13,14,15,18,22,29,31,32,34,37,38, 41,42,44,46.

Transplanting: 1,5,16,18,20,22,29,32,33,38,39,42.

Water Temperature: 3,4,5,10,11,12,13.14,18,22,28,40,42,46.

Tolerance of Low Oxygen Levels: 1,11,13,14,18,22,42.

Competition with other Trout Species: 9,13,15,22,29,33,40,42.

Food Habits: 4,6,10,18,22,23,26,28,31,42,44,46.

Reasons for Population Declines: 5,11,14,22,29,32,38,41,42.

General: 2,6,7,10,11,12,13,14,18,21,22,24,25,30,34,35,42,43,46.