



Status and biology of the spawning population of Red Rock Lakes Arctic grayling
by James Tory Mogen

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:

The population of lacustrine Arctic grayling (*Thymallus arcticus*), historically large in Red Rock Lakes, Montana, has declined substantially in recent years. The goal of this study was to determine the current status of the Red Rock Lakes grayling and provide the biological basis for directing management and future restoration efforts of this native population. The spawning population of Arctic grayling in Red Rock Lakes system was monitored during the springs and summers of 1994 and 1995. A cross-channel weir was installed in both years in Red Rock Creek, the primary spawning tributary for these fish, in an attempt to capture all migrants. In both years, grayling began their spawning migrations prior to ice-off of the Upper Lake, while flows were increasing and daily mean temperatures were near 6.0 C. The peak of upstream movement occurred 4-11 May in 1994 and 14-23 May in 1995.

Stream residency for adult grayling captured on both upstream and downstream migration averaged 17.7 d (sd 11.3) for females and 34.8 d (sd 10.2) for males and were significantly different ($p < .001$). Total numbers of spawners captured in Red Rock Creek were 241 in 1994 and 85 in 1995. Only 20 (8.3%) of the grayling captured in 1994 were recaptured in 1995. Average lengths, weights, and condition factors were greater in 1994. Females outnumbered males in the spawning runs by a ratio of 1.8 to 1.0 in 1994 and 2.1 to 1.0 in 1995. Red Rock grayling mature at ages II and III. A shift in age structure was observed between the 2 years. Spawning runs were composed of ages II-VII in 1994 and ages II-VI in 1995. Ages II-III made up 27 and 63 percent of the runs while ages V+ made up 51 and 15 percent of the runs in 1994 and 1995, respectively. In 1994, a weir was also installed in Odell Creek, another historically important spawning tributary. Only 12 grayling were captured from this stream. During the study, no grayling were observed in any of the other 10 historic spawning tributaries for this population. Fry emigration was monitored in Red Rock Creek in 1994. Age-0 grayling first appeared in the stream approximately 32 d after initial spawning activity and resided in the stream 10-15 d before emigration. Mean lengths ranged from 12.3 mm at swim-up to 28.5 mm on the last day of stream residence.

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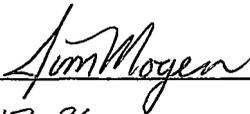
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ABSTRACT

The population of lacustrine Arctic grayling (Thymallus arcticus), historically large in Red Rock Lakes, Montana, has declined substantially in recent years. The goal of this study was to determine the current status of the Red Rock Lakes grayling and provide the biological basis for directing management and future restoration efforts of this native population. The spawning population of Arctic grayling in Red Rock Lakes system was monitored during the springs and summers of 1994 and 1995. A cross-channel weir was installed in both years in Red Rock Creek, the primary spawning tributary for these fish, in an attempt to capture all migrants. In both years, grayling began their spawning migrations prior to ice-off of the Upper Lake, while flows were increasing and daily mean temperatures were near 6.0 C. The peak of upstream movement occurred 4-11 May in 1994 and 14-23 May in 1995. Stream residency for adult grayling captured on both upstream and downstream migration averaged 17.7 d (sd 11.3) for females and 34.8 d (sd 10.2) for males and were significantly different ($p < .001$). Total numbers of spawners captured in Red Rock Creek were 241 in 1994 and 85 in 1995. Only 20 (8.3%) of the grayling captured in 1994 were recaptured in 1995. Average lengths, weights, and condition factors were greater in 1994. Females outnumbered males in the spawning runs by a ratio of 1.8 to 1.0 in 1994 and 2.1 to 1.0 in 1995. Red Rock grayling mature at ages II and III. A shift in age structure was observed between the 2 years. Spawning runs were composed of ages II-VII in 1994 and ages II-VI in 1995. Ages II-III made up 27 and 63 percent of the runs while ages V+ made up 51 and 15 percent of the runs in 1994 and 1995, respectively. In 1994, a weir was also installed in Odell Creek, another historically important spawning tributary. Only 12 grayling were captured from this stream. During the study, no grayling were observed in any of the other 10 historic spawning tributaries for this population. Fry emigration was monitored in Red Rock Creek in 1994. Age-0 grayling first appeared in the stream approximately 32 d after initial spawning activity and resided in the stream 10-15 d before emigration. Mean lengths ranged from 12.3 mm at swim-up to 28.5 mm on the last day of stream residence.

INTRODUCTION

Within North America, Arctic grayling (Thymallus arcticus) are distributed throughout Alaska and in Canada to the Hudson Bay. Additionally, two genetically distinct populations of grayling occurred in the contiguous United States, apparently as glacial relicts (Vincent 1962; Lynch and Vyse 1979; Everett and Allendorf 1985). These geographically isolated populations existed in Michigan and Montana. Since the turn of the century, Arctic grayling have become extinct in Michigan and have progressively declined in Montana (McAllister and Harington 1969; Kaya 1992).

Two distinctly different life-history forms are indigenous to Montana. The fluvial form (residing entirely within lotic systems) and the lacustrine form (spawning in streams, but residing in lentic systems) are genetically different from each other, as well as from Alaskan and Canadian populations (Lynch and Vyse 1979; Everett and Allendorf 1985). Fluvial grayling, once abundant and distributed intermittently throughout the headwaters of the Missouri River upstream from Great Falls, now occur only in the upper Big Hole River (Shepard and Oswald 1989; Kaya 1992). These fish represent the last remaining population of fluvial Arctic grayling in the contiguous United States and have recently been petitioned for listing as endangered. Efforts to reestablish other fluvial populations have thus far been unsuccessful.

The only native lacustrine population of Arctic grayling in the contiguous United States exists in Red Rock Lakes of extreme southwestern Montana (Kaya 1992). While the distribution of lacustrine grayling has been greatly expanded through introduction into lakes of

many western states, little is known about the origin of these fish except that they came indirectly from Madison River or Red Rock Lakes stocks. The Red Rock Lakes grayling, while greatly reduced in numbers, have maintained themselves without artificial propagation.

Red Rock Lakes and much of the surrounding area lie within the boundaries of Red Rock Lakes National Wildlife Refuge making more complete management of this unique population possible. However, numbers have progressively declined over the past 100 years (USFWS 1978; Unthank 1989). A number of factors appear to have contributed to this decline including excessive habitat degradation both on and off the refuge, siltation of critical habitats, water diversions, and competition with and predation by native and introduced fishes (Unthank 1989). Concern for the continued existence of this population has recently increased. Recent observations indicate that numbers have declined to low levels suggestive of imminent extinction (Neithammer, USFWS, pers. comm.).

According to early settlers, grayling were once abundant in the Centennial Valley. Homesteaders first moved into the valley around 1876, using the area primarily as summer cattle range (Unthank 1989). In the late 1800's the waters of the area supplied anglers with superb fishing, with trout and grayling present in great numbers (Brower 1896). As early as the 1890's, grayling from Red Rock Lakes were being used as a source for introduction into other waters (Unthank 1989). In the early 1940's, spawning grayling were so plentiful that Jim Hanson, a rancher in the Red Rock Creek drainage, reported that he could "scoop them out of his irrigation ditch with a pitch fork," and that "fishermen

used to limit in an hour from his ditch." Refuge Manager Hull reported that sections of Red Rock Creek in late May 1942 "looked more like a fish hatchery than a natural stream with so many grayling" (USFWS 1978). Local ranchers reported that Elk and Picnic creeks were also once "thick with grayling, with as many as 50-75 grayling per hole" (USFWS 1978). In the early 1950's Nelson (1954) observed spawning grayling throughout Red Rock Creek and in the lower reaches of its tributaries and in Elk, Battle, Tom, and Odell creeks. A fish weir spanning Red Rock Creek during the spawning runs of 1962-1966 captured an average of 704 upstream migrating grayling per year during its 5-year existence (USFWS 1978). Overall, grayling spawning runs were documented in at least 12 of the small tributaries of the upper Centennial Valley (Figure 1)(Brown 1938, Nelson 1954, USFWS 1978, and Unthank 1989).

In early June of 1976, grayling populations of Upper and Lower Red Rock lakes and several tributaries were investigated by the Montana Department of Fish and Game (MDFG). "Large" numbers of spawners were observed in Red Rock and Odell creeks, while only four females were captured in Tom Creek. No grayling were found in any of the other tributaries including, Elk, Grayling, Shambow, East Shambow, Moose, and East Nye creeks (MDFG 1977). Two gill nets set overnight in each of the Red Rock Lakes in August of 1976 yielded 23 grayling from the upper lake and only one from the lower lake. Two grayling captured in the upper lake had been tagged the previous June in Odell Creek, indicating that grayling could negotiate the "river marsh" between the lakes and that the primary year-around residency for grayling was in the upper lake (MDFG 1977).

