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Yellowstone cutthroat trout

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Front cover photo captions (left to right): NPS fisheries technician Stacey Sigler and Student Conservation Association (SCA) intern Allison Millar lifting a lake trout gillnet from Yellowstone Lake (photo by Audrey Squires); westslope cutthroat trout from Geode Creek (photo by Todd Koel); Specimen Creek trail after the Owl Fire (photo by Todd Koel). Back cover photo captions (left to right): fisheries workskiff on Yellowstone Lake (photo by Stacey Sigler); Yellowstone cutthroat trout from Clear Creek (photo by Pat Bigelow); MSU fisheries technician Derek Rupert prepares an incubator for westslope cutthroat trout eggs at High Lake (photo by Todd Koel).

Facing page photo: MSU fisheries restoration biologist Mike Ruhl setting up an incubator for westslope cutthroat trout eggs at High Lake (photo by Todd Koel).

Note: Native fishes shown out of water were not injured.

Contents

NEIL TODD KOEL

Background

When Yellowstone National Park was established in 1872, it was the only wildland under active federal management. Early visitors fished and hunted for subsistence, as there were almost no visitor services. Fishes were viewed as resources to be used by sport anglers and provide park visitors with fresh meals. Fish-eating wildlife, such as bears, ospreys, otters, and pelicans, were regarded as a nuisance, and many were destroyed as a result (Varley and Schullery 1998).

To supplement fishing and counteract "destructive" consumption by wildlife, a fish "planting" program was established. Early park superintendents noted the vast fishless waters of the park and asked the U.S. Fish Commission to "see that all waters are stocked so that the pleasure seeker can enjoy fine fishing within a few rods of any hotel or camp" (Boutelle 1889). The first fishes from outside the park were planted in 1889–1890, and included brook trout (*Salvelinus fontinalis*) in the upper Firehole River, rainbow trout (*Oncorhynchus mykiss*) in the upper Gibbon River, and brown trout (*Salmo trutta*) and lake trout (*Salvelinus namaycush*) in Lewis and Shoshone lakes (Varley 1981). The harvest-oriented fish management program accounted for the planting of more than 310 million native and non-native fish in Yellowstone between 1881 and 1955. In addition, from 1889 to 1956, 818 million eggs were stripped from the cutthroat trout of Yellowstone Lake and shipped to locations throughout the United States (Varley 1979).

Largely because of these activities and the popularity of Yellowstone's fisheries, recreational angling became an accepted use of national

NPS PHOTO

Fisheries crew from Spearfish federal fish hatchery preparing nets to capture spawning cutthroat trout at Clear Creek, ca. 1910.

NPS PHOTO

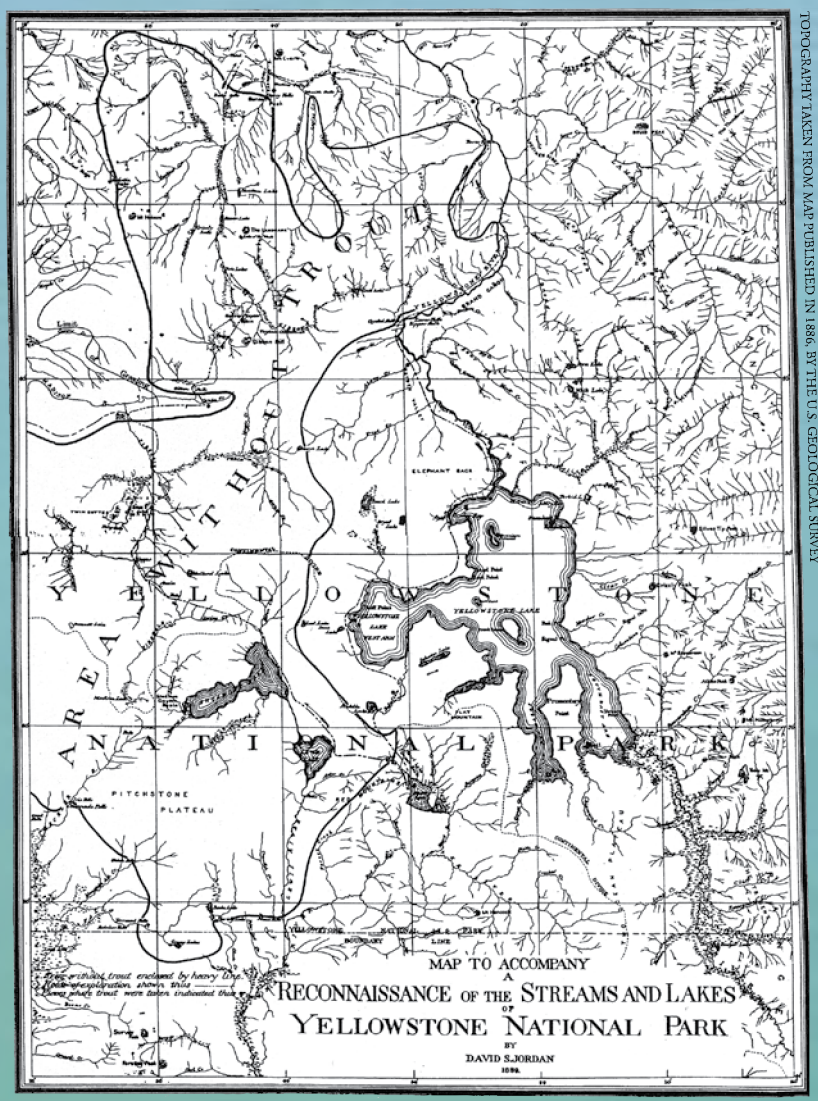
Ranger McCarty (right) and angler John Harvey with a catch from Slough Creek, July 1936.

parks throughout the country. In Yellowstone, fisheries management, as the term is understood today, began with the U.S. Army, and was taken over by the National Park Service in 1916. Fish stocking, data gathering, and other monitoring activities initiated by the U.S. Fish Commission in 1889 were continued by the U.S. Fish and Wildlife Service until 1996, when they became the responsibility of the National Park Service.

Approximately 48% of Yellowstone's waters were once fishless (Jordan 1891), and the stocking of non-native fishes by park managers has had profound ecological consequences. The more serious of these include displacement of intolerant natives such as westslope cutthroat trout (*O. clarkii lewisi*) and Arctic grayling (*Thymallus arcticus*), hybridization of Yellowstone (*O. c. bouvieri*) and westslope cutthroat trout with each other and with non-native rainbow trout, and, most recently, predation of Yellowstone cutthroat trout by non-native lake trout. Over the years, management policies of the National Park Service have drastically changed to reflect new ecological insights (Leopold et al. 1963). Subsistence use and harvest orientation once guided fisheries management. Now, maintenance of natural biotic associations or, where possible, restoration to pre-Euro-American conditions have emerged as primary goals. Eighteen fish species or subspecies are known to exist in Yellowstone National Park; 13 are considered native (they were known to exist in park waters prior to Euro-American settlement), and 5 are introduced (non-native or exotic; see Appendix i) (Varley and Schullery 1998).

A perceived conflict exists in the National

Park Service mandate to protect and preserve pristine natural systems and provide for public use and enjoyment (NPS 2006). Fisheries management efforts in Yellowstone are currently focused on preservation of native species while allowing for use of these fisheries by anglers through a catch-and-release requirement. Because the primary mission of Yellowstone's Fisheries and Aquatic Sciences Program (Fisheries Program) is the preservation of natural ecosystems and ecosystem processes, it does not emphasize maintenance of non-native fish stocks. In fact, harvest regulations have been liberalized to encourage anglers to keep non-native trout caught in waters where they are harming native cutthroat trout or Arctic grayling. Fisheries Program activities are focused almost exclusively on the preservation of Yellowstone Lake cutthroat trout, the restoration of fluvial (stream-resident) populations of native trout, and the research and monitoring needed to support these critical activities.



TOPOGRAPHY TAKEN FROM MAP PUBLISHED IN 1896 BY THE U.S. GEOLOGICAL SURVEY

Fisheries authority David Starr Jordan produced this map of Yellowstone waters in 1889, showing the large portion of the western side of the park as an AREA WITHOUT TROUT, *in anticipation of the extensive stocking program that followed. (From Barton W. Evermann, Report on the Establishment of Fish Cultural Stations in the Rocky Mountain Region and Gulf States, U.S. Government Printing Office, 1892).*

...harvest regulations have been liberalized to encourage anglers to keep non-native trout caught in waters where they are harming native cutthroat trout or Arctic grayling.

2007 Summary

Environmental conditions for fishes and other aquatic resources in 2007 were driven by low winter snowpack and snow water equivalent, early snow melt and stream runoff, low summer precipitation, and warmer than average summer temperatures. Yellowstone Lake's ice succumbed to waves on May 14, a date that was among the earliest on record, allowing lake trout gillnetting crews early access. Within three days of deploying our boats, >9 miles of gillnet had been placed to kill lake trout. This early netting proved highly productive, as >10,000 lake trout were removed when these nets were first lifted by our crews the following week. Overall, 74,038 lake trout were removed from Yellowstone Lake via gillnetting in 2007 in an effort nine times greater than that conducted in 2000, prior to acquisition of the gillnetting boat *Freedom*. However, along with increases in total number harvested, the catch-per-unit-effort of lake trout has been steadily increasing each year and is a serious cause for concern.

Indices of abundance suggest that the Yellowstone Lake cutthroat trout spawning population has yet to demonstrate a significant positive response to our lake trout suppression efforts. The number of upstream-migrating cutthroat trout counted at Clear Creek, one of the cutthroats' largest spawning tributaries, was only 538 during 2007—very similar to the count of 489 obtained in 2006. Historically, Clear Creek supported >30,000 spawning cutthroat trout, but those numbers have not been seen since the mid-1990s.

Cutthroat trout abundance has also been monitored annually by a fall netting assessment at sites across Yellowstone Lake. This year, the average number of cutthroat trout caught per gillnet was 9.1, much higher than in previous years; it hasn't been that high since 1998, when 9.9 were caught per gillnet. While this is exciting to see, it is important to consider that most of the cutthroat trout we captured in 2007 were small, juvenile fish. We remain hopeful that these young cutthroat will survive and recruit to the spawning population so we can observe them within the lake's spawning tributaries, including Clear Creek.

The East Fork Specimen Creek westslope cutthroat trout restoration project focused on High Lake in 2007. Fish from both of the genetically pure populations known within the park were used in an effort to restock High Lake following rotenone treatment in 2006. Embryos from Last Chance Creek and the Sun Ranch upper Missouri River broodstock were introduced using remote site incubators placed in High Lake inlet streams. Juveniles and adults were collected from the Oxbow/Geode Creek complex and moved to High Lake via helicopter. Monitoring indicated initial success of all 2007 High Lake stocking efforts. The introduction of westslope cutthroat trout to High Lake is expected to continue in 2008 and 2009.

The Owl Fire, a naturally caused 2,810-acre wildfire, burned through a large portion of the East Fork Specimen Creek restoration area. One of the most intensely burned areas was the site where construction of a barrier to upstream fish movement had begun. Considerable work, including a 76-m water diversion structure built in 2006, and approximately 40 mule loads of equipment and supplies were completely destroyed by the fire. However, the fire's most significant impact was that we were unable to work at the site due to dangers posed by the fire itself and later by the hazard trees left in the wake of the burn.

The ecological health of the park's aquatic systems continues to be monitored. The quality

NPS/BILL VOIGT

Yellowstone cutthroat trout from Tower Creek below Tower Falls.

of the surface waters is monitored monthly at 12 fixed sites near the confluences of major streams and rivers (Figure 1). The physical and chemical characteristics of Yellowstone Lake are monitored seasonally to assist the targeting of non-native lake trout. New emphasis is being placed on the assessment of potential impacts of piscicides on non-target species during native fish restorations. We continued to monitor amphibians and aquatic invertebrates at High Lake after the rotenone treatment. Overall, the invertebrate populations within the High Lake outlet stream demonstrated recovery one year following rotenone treatment, while those in the inlet stream did not. Additional surveys in 2008 will allow for a much more complete understanding of rotenone's potential impacts.

The Fly Fishing Volunteer Program, funded by the Yellowstone Park Foundation, continues to be an integral mechanism for communicating information and raising public awareness of issues facing Yellowstone's native fishes. This year 90 anglers from across the United States contributed over 1,776 hours to fisheries projects throughout the park. Data were gathered on the native cutthroat trout of Slough Creek, the effectiveness of existing waterfalls and cascades in restricting movements of trout, and the presence/abundance of trout in several small accessible lakes.

NPS/TODD NOEL

Fisheries crew collecting genetically-pure westslope cutthroat trout from Geode Creek to be stocked to High Lake.

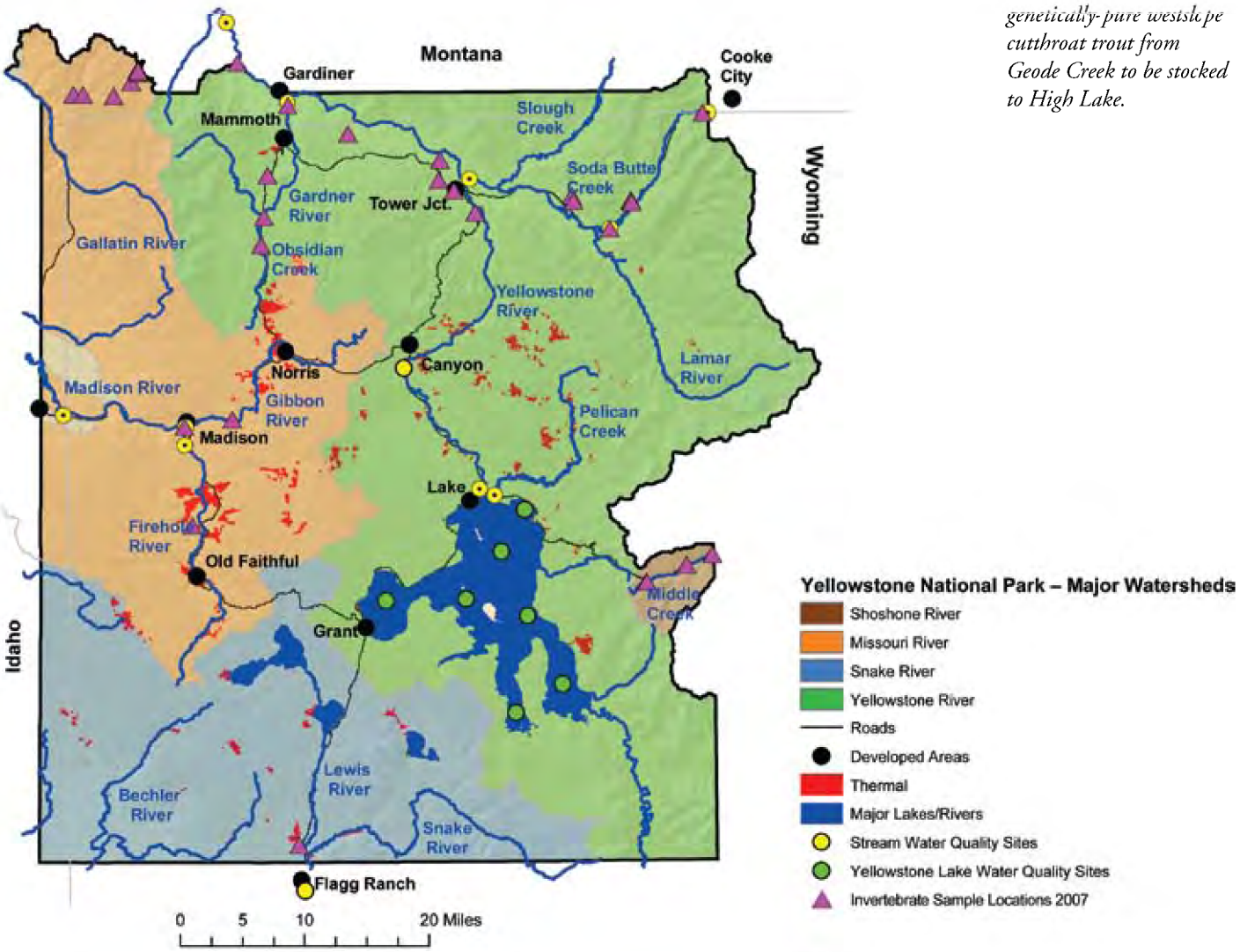


Figure 1. Major watersheds and surface waters of Yellowstone National Park, with sites established for long-term water quality monitoring on streams (12 sites–yellow circles) and Yellowstone Lake (7 sites–green circles). Areas sampled for aquatic invertebrates in 2007 (29 sites–purple triangles) are also shown.

The 2007 Water Year

NPS/BILL VOIGT

Lamar River during August 2007.

For the park's coldwater fishes, the heat and drought reduced available habitat (reduced volume) and elevated stream temperatures, causing high stress and mortality.

Environmental conditions for fishes and other aquatic resources in 2007 were driven by low winter snowpack and snow water equivalent (SWE), early snow melt and stream runoff, summer drought conditions, and higher than average summer temperatures. In fact, March was more than 5°F warmer than average all across the contiguous United States, making it the warmest March since 1910 (NOAA 2007). Mountain snowpack in the Yellowstone region and much of the West was far below normal as May began. In the upper Yellowstone River basin, SWE on May 1 was only 65% of the 30-year average (1971–2000; Phil Farnes, personal communication, 2008). Discharge of the Yellowstone River near Corwin Springs peaked on May 13 at 11,000 cfs, the third lowest peak since the Yellowstone fires of 1988 (1987–2007; Figure 2). The heat continued through May, accelerating the rate of snow melt through much of the West. The 2007 ice-off date for Yellowstone Lake, May 14, was among the earliest recorded since 1951 (Figure 3). Ice-off has been taking place earlier in recent decades; seven of the earliest recorded ice-off dates on Yellowstone Lake have occurred in the last 30 years.

During summer 2007, the Yellowstone region experienced the warmest July since statewide recording of temperatures began in 1895, with mean temperature records broken in Idaho, Montana, and Wyoming (NOAA 2007). Unusually dry conditions and severe to extreme drought persisted across most of the West during summer, resulting in a fire season with the second most burned acres in the U.S.

NPS/TODD KOEL

Nez Perce Ford of the Yellowstone River during September 2007.

NPS/BRIAN ERTEL

High stream temperatures resulted in fish die-offs on the Firehole River (pictured above) and Pelican Creek.

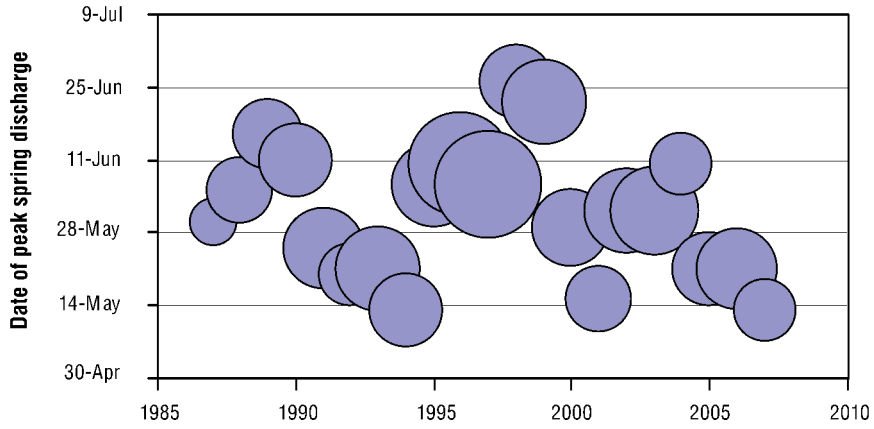


Figure 2. Dates when discharge of the Yellowstone River peaked at the U.S. Geological Survey gaging station (06191500) near Corwin Springs, Montana, January 1987–December 2007. Circle size relates to magnitude of peak discharge, which ranged from 29,900 cubic feet per second (cfs) on June 6, 1997, to 6790 cfs on May 30, 1987. The year 2007 had the lowest peak discharge since 1987, and it was tied with 1994 for having the earliest date of spring peak discharge (May 14) during this period of record.

in the historical record. In Yellowstone, a total of 27 fires occurred in 2007, the most significant of which were the Columbine Fire (east side of Yellowstone Lake; 18,595 acres) and the Owl Fire (Specimen Creek watershed; 2,810 acres; Joe Krish, Yellowstone Wildland Fire, personal communication, 2007). For the park's coldwater fishes, the heat and drought reduced the available habitat (reduced volume), and elevated stream temperatures caused high stress. These conditions affected popular fisheries throughout the park, including those on the northern range (Figure 4). Overall, the 2007 water year in Yellowstone resulted in challenging conditions for fish, visiting anglers, and park managers alike.

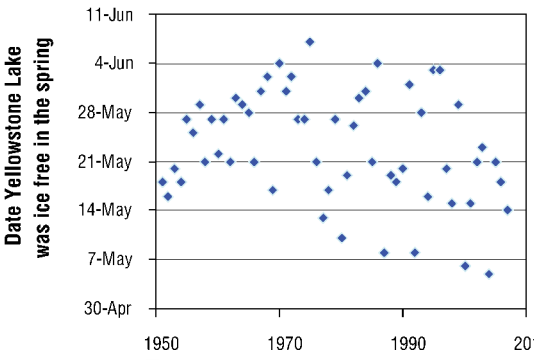


Figure 3. Dates in the spring when Yellowstone Lake first became free of ice, 1951–2007. The seven earliest dates (all before May 14) have occurred in the last 30 years. Data complied by Phil Farnes.

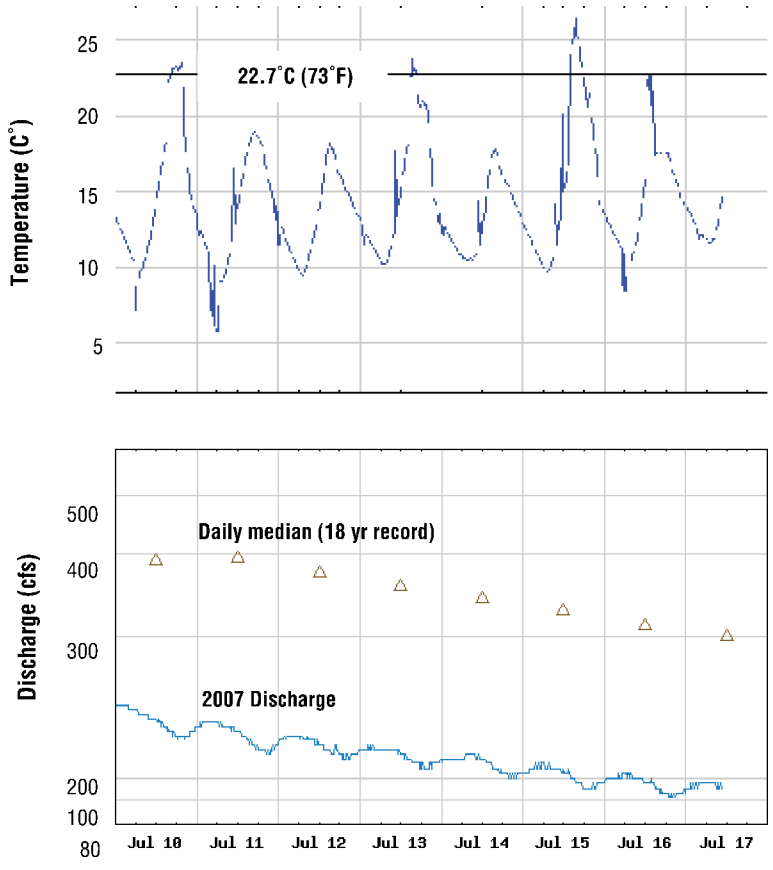


Figure 4. Hourly stream temperature and discharge, and the long-term (18 years) median discharge of Soda Butte Creek at the U.S. Geological Survey gaging station (06187950) during a period when restrictions were placed on fishing in the park, July 2007. Horizontal line (22.7°C [73°F]) represents temperature criteria used (in part) to guide fishing closures.

The Fisheries Program

NPS/TODD KOEL

Fisheries crew hiking to an electrofishing site at the headwaters of Mountain Creek in the Teton Wilderness.

NPS/DEREK RUPERT

Yellowstone cutthroat trout-westslope cutthroat trout hybrid from Grayling Creek.

Primary Emphasis Areas

The aquatic resources of Yellowstone National Park and the ecosystems they support are threatened by the presence of species that are non-native (from elsewhere in North America) and exotic (from another continent). For the foreseeable future, the Fisheries Program will focus the greatest effort on two priorities: (1) preservation of cutthroat trout in Yellowstone Lake, which is the largest remaining concentration of genetically pure inland cutthroat trout in the world; and (2) restoration of fluvial populations of native trout, many of which have been lost because of non-native species introductions.

The lake trout suppression effort to preserve Yellowstone Lake cutthroat trout is one of the largest non-native fish removal programs occurring in the United States. Activities related to fluvial populations of native trout include westslope cutthroat trout restoration in the East Fork Specimen Creek watershed and planning/compliance efforts leading toward Yellowstone cutthroat trout restoration on streams across the northern range.

EEEJE SMIT

NPS aquatic ecologist Jeff Arnold and MSU water quality technician Ty Harrison sampling Soda Butte Creek for metals in September 2007.

AUDREY SQUIRES

NPS fisheries technician Stacey Sigler with a lake trout from Yellowstone Lake.