Yellowstone Fisheries & Aquatic Sciences

Annual Report 2005

NPS/JEFF ARNOLD

High Lake, at the headwaters of East Fork Specimen Creek, would provide a refuge for genetically pure westslope cutthroat trout.

Yellowstone National Park is home to the most ecologically and economically important inland cutthroat trout fisheries remaining in North America. However, threats to these native trout have, over the past decade, irreversibly altered and made future sustainability of this thriving and diverse ecosystem uncertain. Science has helped to develop our understanding of the consequences of status-quo management. In fact, without swift and continuing action, negative effects on the native trout populations of Yellowstone—keystone energy sources for numerous mammal and bird species, and a recreational focus for visitors—have the potential to produce impacts that will reverberate throughout the Greater Yellowstone Ecosystem.

For instance, each predatory, non-native lake trout—a species illegally introduced to Yellowstone Lake at least 20 years ago but not discovered until 1994—can annually consume at least 41 cutthroat trout each year. Lake trout have the potential to decimate the Yellowstone Lake cutthroat trout population in our lifetime without heightened and maintained management efforts. Lake trout are not an acceptable substitute for cutthroat trout in the ecosystem because they occupy an ecological niche unavailable to cutthroat-eating predators, threatening the many species, such as grizzly bears, bald eagles, and river otters, which depend on cutthroat trout for survival.

Albeit much more quietly, the brook, brown, and rainbow trout intentionally stocked by managers during the park's early history have also taken their toll on cutthroat trout populations across Yellowstone. The native westslope cutthroat trout of the Madison River, for example, a specialist species requiring pristine habitats, have been eliminated due to their inability to compete with aggressive, non-native trout. In addition, in many park waters the infusion of non-native-trout genetic material into stream-resident cutthroat populations by interbreeding among species has occurred and cannot easily be reversed. The loss to the cutthroat populations is permanent, and any recovery will be achieved only through direct intervention. The recent rainbow trout invasion of the upper Slough Creek meadows, and the resulting loss of that world-renowned fishery's genetic integrity, is an example of how serious this problem is.

The stakes are high, raising the bar for innovative management and fundraising. The increased magnitude of the problems faced by the park's fisheries, and the accelerated rate at which they are occurring, are straining Yellowstone's resources. Despite this, our hope and enthusiasm remain high. Within Yellowstone Lake, cutthroat are showing subtle signs of recovery, while lake trout are showing signs of suppression. Within the streams, momentum could not be greater as we near our first cutthroat restoration operation and the replication of a newly discovered, pure-strain westslope cutthroat trout population.

This annual report describes historic and continuing park aquatics programs with data and information obtained through 2005. In several instances, the report also outlines our vision for the program, with specific project goals and objectives for future years. This was done in an attempt to ensure program transparency; we want to make sure that everyone with an interest has a solid understanding of both our intent and the direction our efforts are taking to preserve and restore native fishes in the waters of this tremendous park.

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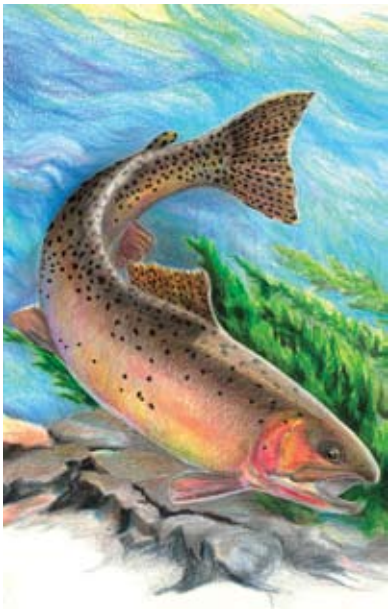

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Yellowstone cutthroat trout

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Yellowstone Center for Resources
Yellowstone National Park, Wyoming
YCR-2006-09

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Front cover photo captions (left to right): NPS fisheries technician Jeremy Erickson and NPS volunteer Matthew Christianson at Soda Butte Creek (photo by Jeffrey Arnold); westslope cutthroat trout from an unnamed Grayling Creek tributary; NPS fisheries staff on board the lake trout gillnetting boat *Freedom* (photo by Philip Doepke). Back cover photo captions (left to right): NPS aquatic ecologist Jeffrey Arnold with a Yellowstone cutthroat trout from the upper Yellowstone River (photo by Brian Ertel); NPS fisheries technicians and volunteers electrofishing Obsidian Creek (photo by Dan Mahony); NPS fisheries technicians Brad Olszewski and Brian Ertel processing a fish sample. Facing page photo caption: Elk Creek at road crossing is a barrier to non-native brook trout (photo by Michael Ruhl).

All photos in this report not otherwise marked are by Todd Koel. (*Note:* Native fishes shown out of water were not injured.)

Contents

Background

Created in 1872, Yellowstone National Park (YNP) was, for several years, the only wildland under active federal management. Early visitors fished and hunted for subsistence, as there were almost no visitor services. At the time, fishes of the park 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 (Schullery 1997).

To supplement fisheries and to counteract "destructive" consumption by wildlife, a fish "planting" program was established in Yellowstone. 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, some 818 million eggs were stripped from Yellowstone trout and shipped to locations throughout the United States (Varley 1979).

Largely due to these activities and the popularity of Yellowstone's fisheries, recreational angling became a long-term, accepted use in national parks throughout the country. In Yellowstone, fisheries management, as the term is understood today, began with the U.S. Army, and was assumed by the National Park Service in 1916. Fish stocking, data gathering, and other monitoring activities begun with the U.S. Fish Commission in 1889 were continued by the U.S. Fish and Wildlife Service until 1996, and have been the responsibility of the National Park Service since then.

NPS PHOTO

NPS personnel packing fish in the Mammoth Hot Springs area in 1938.

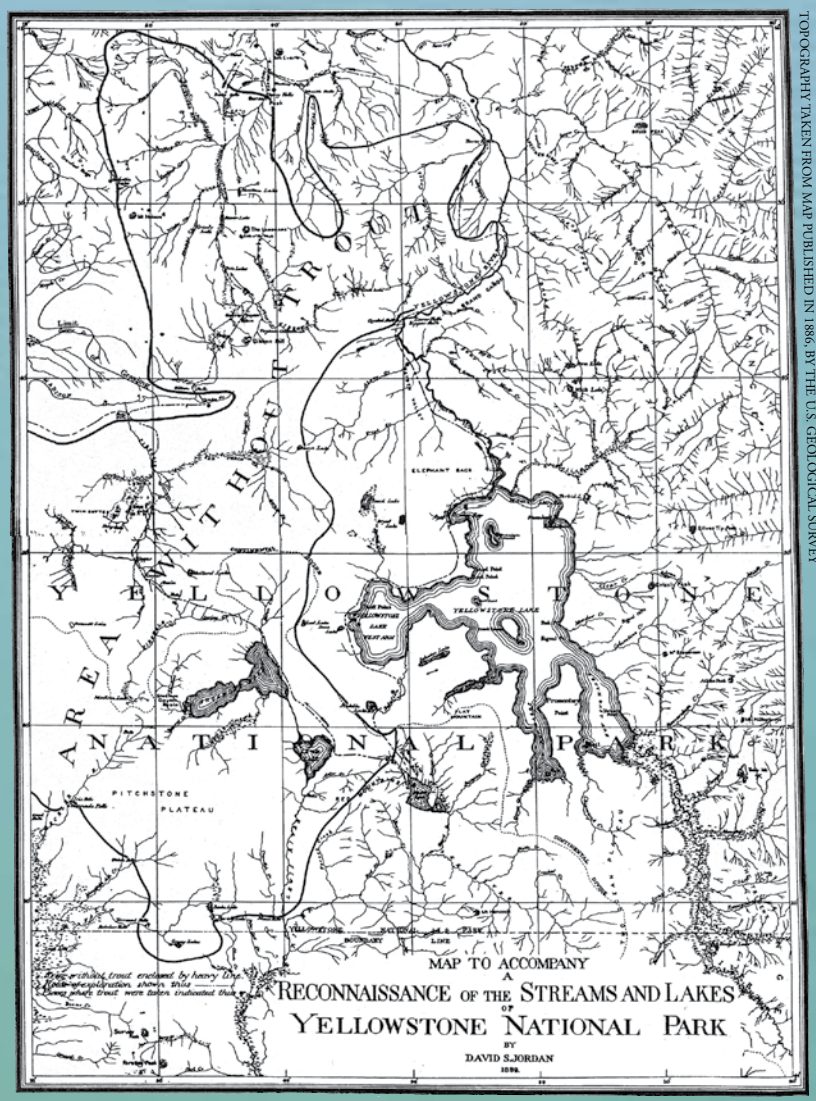
Approximately 48% of Yellowstone's waters were once fishless (Jordan 1891), and the stocking of non-native fishes by park managers has had profound ecological consequences. The more serious of these include displacement of intolerant natives such as westslope cutthroat trout (*O. clarki lewisi*) and 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 sport fishing harvest 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 currently are known to exist in Yellowstone National Park; 13 of these are considered native (they were known to exist in park waters prior to Euro-American settlement), and five 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

NPS PHOTO

The NPS boat Pelican *at Molly Island, July 1957.*

pristine natural systems and also provide for use and enjoyment (NPS 2000). Fisheries management efforts in Yellowstone are currently focused on preservation of native species, while allowing for use of these fisheries by visiting anglers through a complete catch-and-release regulation. Because the primary mission of Yellowstone's Fisheries and Aquatic Sciences Section (Aquatics Section) is the preservation of natural ecosystems and ecosystem processes, the program's activities are not focused on maintenance of established non-native fish stocks. Beginning in 2006, harvest regulations will be liberalized, and anglers encouraged to keep non-native trout caught in waters where they co-exist and are causing harm to native cutthroat trout or Arctic grayling. Aquatics Section activities almost exclusively include the preservation of Yellowstone Lake cutthroat trout, the restoration of fluvial populations of native trout, and focused research and monitoring to support these critical activities.



TOPOGRAPHY TAKEN FROM MAP PUBLISHED IN 1886, 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).*

Fisheries management efforts in Yellowstone are currently focused on preservation of native cutthroat trout.

2005 Summary

Preservation of Yellowstone Lake cutthroat trout continued to be one of the Aquatics Section's top priorities in 2005, as a total of 36,438 non-native lake trout were killed, bringing the overall total killed to more than 139,000 during the period 1994–2005. Because each of those lake trout could have consumed at least 41 cutthroat trout each year, the park's gillnetting effort has saved a tremendous number of cutthroat trout. The angling community has also joined the effort, and has been contributing to the removal of lake trout from Yellowstone Lake each year. The result is a lake trout population that is beginning to show signs of suppression. Catch per unit of effort for lake trout remains low, and the average length of the spawning adult lake trout continues to decline. However, the cutthroat trout population has yet to demonstrate a significant positive response. The number of upstream-migrating cutthroat trout counted at Clear Creek, one of the cutthroats' largest spawning tributaries, was only 917 during 2005. This count was down from 1,438 in 2004; 3,432 in 2003; and 6,613 in 2002, and was the lowest count made at Clear Creek since 1945, the first year when total annual counts were recorded there.

Yellowstone cutthroat trout abundance within Yellowstone Lake, as indicated by the fall netting assessment, has suggested a modest increase in the abundance of smaller juvenile fish within the population. During 2003–2005, this assessment has provided some of the first indications that the cutthroat trout may be responding positively to efforts to remove lake trout. An average of 7.4, 7.9, and 7.4 fish were caught per net in 2003, 2004, and 2005, respectively. Prior to 2003, there had been a reduction in catch by the fall netting program of 0–21% each year (averaging 11% per year) since 1994, the year lake trout were first discovered in Yellowstone Lake. Critical to the cutthroat now will be the ability of these juvenile fish to recruit to the spawning population and appear within the spawning tributaries of Yellowstone Lake; this is really the only means by which the population can be expected to rebound and return to the higher densities seen in the past.

Due to generous support by the Yellowstone Park Foundation and its Fisheries Fund Initiative, developed in 2005, the park's fisheries program is moving quickly forward with restoration of fluvial populations of native trout. Although an introgression of the North Fork Fan Creek westslope cutthroat trout was reported early in the year, in June a potentially pure population was found in a previously unsurveyed, unnamed tributary to Grayling Creek. Aquatics Section staff documented the extent of this population during July and August, and through collaboration with state of Idaho and Montana geneticists, determined that they are pure-strain westslope; the only pure westslope cutthroat trout known in the park, and one of only four pure populations remaining in the entire Gallatin and Madison river drainages of southwest Montana. It is estimated that more than 700 fish exist in this hidden stream, and Aquatics Section staff now intend to carefully replicate this population by moving small numbers of eggs into a much larger, more secure habitat each year. National Environmental Policy Act (NEPA) compliance was initiated in July specifically for this purpose. The focus for restoration is East Fork Specimen Creek, including the biologically productive High Lake, located at the headwaters of this watershed. Work was also completed to prioritize watersheds in the park's northern range based on probability of success for Yellowstone cutthroat trout restoration. Reese Creek, Rose

NPS/PHILIP DOEPKE

Due to the impacts of lake trout, whirling disease, and drought, Yellowstone Lake now harbors only a fraction of the estimated 3–4 million cutthroat trout that thrived here 20–30 years ago.

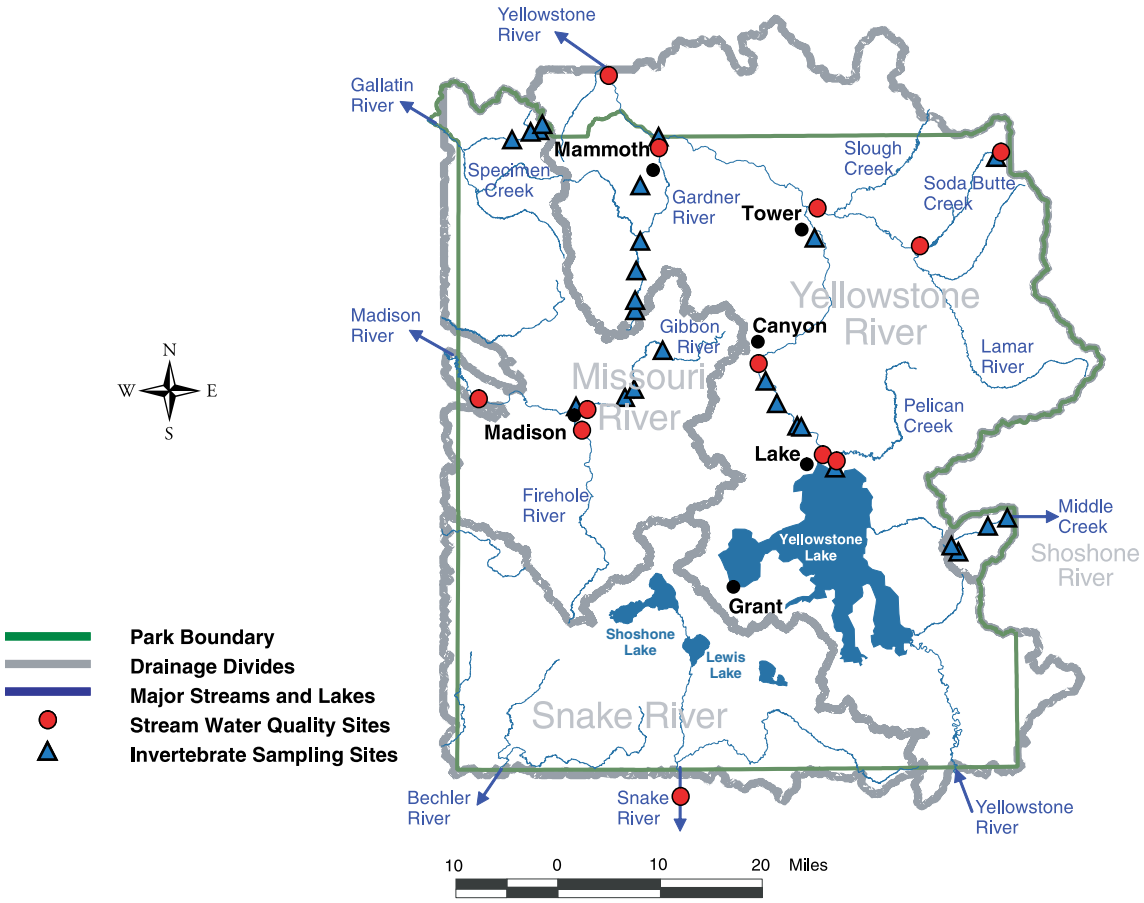


Figure 1. Major surface waters of Yellowstone National Park, with 12 stream sites established for long-term monitoring of water quality and sites sampled for macroinvertebrates in 2005.

Creek, the Elk Creek complex of streams, and Blacktail Deer Creek all provide excellent opportunities for re-establishment of genetically pure Yellowstone cutthroat trout populations. Rose Creek, in particular, given its proximity to the Lamar Buffalo Ranch, would also provide opportunities for public education and awareness activities regarding native trout issues in the park. The next step will be to finalize plans and initiate the NEPA process for restoration in the northern range.

Monitoring of fish communities occurred in many frontcountry and remote backcountry streams during 2005, including research focusing on the status and life history strategies of cutthroat trout in the Yellowstone River and its tributaries upstream of Yellowstone Lake. An inventory of fishes in the remote reaches of the Snake River and its tributaries also continued. These are among the first surveys of fishes in these regions of the park, even though fisheries investigations have been occurring in Yellowstone since the late 1800s. The waters of the upper Yellowstone River support significant numbers of spawning cutthroat trout from Yellowstone Lake. It is unknown to what extent the Snake River supports migrating cutthroat trout. Results will help managers understand the status and dynamics of cutthroat trout in these remote wilderness areas, and the contribution of these systems to the overall cutthroat trout populations of the Greater Yellowstone Ecosystem.

The ecological health of aquatic systems in Yellowstone National Park continues to be monitored intensively. The quality of the park's surface waters is monitored bi-weekly at 12 fixed sites located 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. Macroinvertebrates continue to be sampled using regionally standardized methods to allow

Due to generous support by the Yellowstone Park Foundation and its Fisheries Fund Initiative, the park's fisheries program is moving quickly forward with restoration of fluvial populations of native trout.

JORDAN ALLISON

Remaining genetically pure cutthroat trout will be used to restore populations to streams which currently support hybridized and/or non-native trout.

A total of 506 comments were received, of which 352 (70%) were in favor of the proposed regulation changes.

for easy comparison of data among agencies. Results are being used to assist with the development of National Park Service (NPS) Vital Signs Monitoring protocols for the Greater Yellowstone Inventory and Monitoring Network. A study was also completed that provided information on the effects of road operations at Sylvan Pass on the water quality and macroinvertebrate communities of Mammoth Crystal Spring of the Middle Creek drainage.

Public scoping for proposed changes in fishing regulations occurred in 2005. The framework for the proposal was based on the presence or absence of native sportfish species, and contained just two management areas within the park: a Native Trout Conservation Area and a Wild Trout Enhancement Area. The proposal greatly simplified the regulations' structure compared to what has been used in the past. In addition, the park sought input on the idea of requiring the use of barbless hooks as a way to reduce injury to fishes, especially in popular, heavily fished waters such as the Yellowstone River, Soda Butte Creek, and others. Five public meetings were held in gateway communities. In addition, a period for written public comments remained open for more than five months. A total of 506 comments were received, of which 352 (70%) were in favor of the proposed regulation changes, and 18 (4%) were opposed. Three hundred seventy-six (74%) were in favor of a parkwide policy for barbless hooks and 10 (2%) were against it. Given the strong public support for the proposal, the park plans to implement the regulation changes in 2006.

Anglers caught an estimated 522,258 fish in the park during the 2005 fishing season. Native cutthroat trout remained the most sought-after and caught fish species, comprising 52% of the total catch, followed distantly by rainbow trout (20%), brown trout (13%), brook trout (6%), lake trout (4%), Arctic grayling (3%), and mountain whitefish (*Prosopium williamsoni*; 2%). Overall, native species comprised 57% of the total catch. Yellowstone Lake remained the most popular destination for anglers; an estimated 10,267 anglers fished the lake this year, representing one-quarter of all fishing effort in the park. Anglers fishing Yellowstone Lake reported catching 0.71 cutthroat trout per hour of fishing. This catch rate is lower than that of recent years, and follows a six-year downward trend following a record high catch rate in 1998. The angler-reported catch rate for lake trout in Yellowstone Lake decreased for the second consecutive year, to 0.05 fish per hour. This is a positive sign that lake trout suppression efforts are having some success. The park encourages anglers to fish for lake trout on Yellowstone Lake and killing them is required by law; an estimated 5,529 lake trout were removed by anglers from Yellowstone Lake during the 2005 angling season.

Public involvement with the Aquatics Section continued to greatly increase, primarily through the incorporation of many volunteers. A highlight for the year was the Yellowstone Volunteer Flyfishing Program, in which volunteer anglers from across the United States participated in several specific fisheries projects throughout the park. Information acquired by volunteers is being used to assess the status of fisheries in many waters of Yellowstone.

The Fisheries Program

Yellowstone National Park Core Mission Priorities

Cutthroat trout and Arctic grayling are considered "core" resources that are known to be at risk within Yellowstone National Park. Priorities developed during NPS Core Analysis exercises include efforts to reduce the threats to, and improve the condition of, these and other at-risk resources. Aquatics Section activities are almost entirely aimed at threat reduction and improvement of the overall condition of native aquatic communities in the park, with special focus on cutthroat trout subspecies. Yellowstone National Park lies at the heart of the present-day distribution of Yellowstone cutthroat trout (Figure 2), and the NPS recognizes the need to preserve existing populations and restore them where feasible.

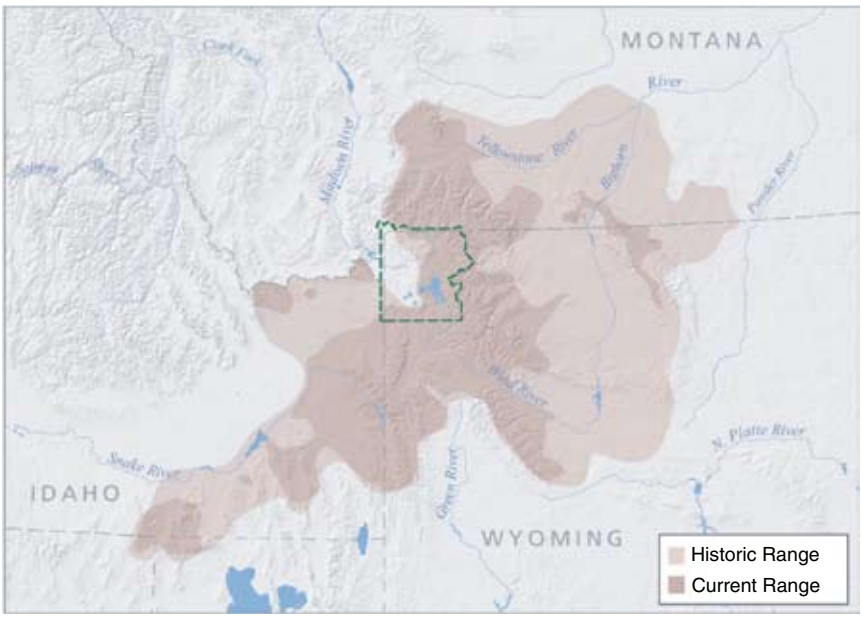


Figure 2. Yellowstone National Park lies at the center of the remaining range of Yellowstone cutthroat trout (adapted from May et al. 2006).

A Model for the YNP Fisheries Program

Over the past decade, the aquatic resources of Yellowstone National Park, and the ecosystems they support, have become seriously threatened by introductions of non-native (from elsewhere in North America) and exotic (from another continent) species. For the foreseeable future, the Aquatics Section will focus the greatest amount of effort possible on conducting activities aimed at supporting its two main priorities: (1) preservation of Yellowstone Lake cutthroat trout, which is the largest remaining concentration of genetically pure inland cutthroat trout in the world; and (2) restoration of fluvial populations of native trout (Figure 3).

The specific activity currently conducted to preserve Yellowstone Lake cutthroat trout is the lake trout suppression program, which is one of the largest non-native fish removal programs occurring in the United States. Activities related to the restoration of fluvial populations of native trout include the environmental compliance process underway for westslope cutthroat trout restoration in the East Fork Specimen Creek watershed. Also, prioritization of streams based on their potential for restoration success has been completed and will allow us to move forward with planning for restoration of Yellowstone

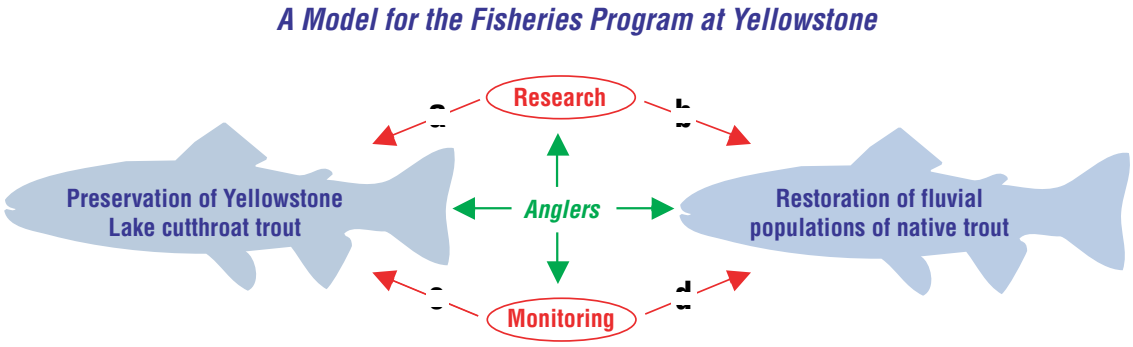


Figure 3. A model for the fisheries program at Yellowstone National Park.

Goals of the Aquatics Section's research program are to support cutthroat trout preservation and restoration activities.

Fisheries technicians Brian Ertel and Michael Ruhl electrofishing an unnamed Grayling Creek tributary.

cutthroat trout in streams of the park's northern range.

The goals of the Aquatics Section's research program are to support and enhance the two primary priorities listed above. Research to support the preservation of Yellowstone Lake cutthroat trout (Figure 3a) includes (1) improving lake trout suppression efficiency through the identification of spawning locations, (2) understanding the ecology of *Myxobolus cerebralis* (the cause of whirling disease) to potentially mitigate for its effects and/or slow its dispersal, and (3) understanding the trophic implications of a cutthroat trout decline in the Yellowstone Lake system. Research to support the restoration of fluvial populations of native trout (Figure 3b) is currently being conducted by partner agencies and universities in the greater Yellowstone region, and will be undertaken within the park when on-the-ground restoration activities begin. Current research to understand the status of fluvial Arctic grayling within the Gibbon River may lead to restoration, or at least preservation efforts for that species.

Monitoring and inventory activities that support the preservation of Yellowstone Lake cutthroat trout (Figure 3c) include the long-term, annual cutthroat trout spawning migration assessment at Clear Creek; the annual visual survey of spawning cutthroat trout at several frontcountry tributaries; and an overall cutthroat trout population assessment within Yellowstone Lake conducted by netting at 11 sites during September each year. Monitoring and inventory activities to support the restoration of fluvial populations of native trout (Figure 3d) include extensive surveys to determine the genetic integrity of cutthroat trout populations; surveys to quantify the geomorphology and habitat conditions of streams supporting existing cutthroat trout conservation populations, and of reaches with the potential to be restored in the future; and surveys of water quality, amphibian, and macroinvertebrate communities and other natural and cultural resources of watersheds, so any potential impacts of future cutthroat trout restorations are well understood.

Anglers are an integral component of the fisheries program model, as they assist with many aspects of native species conservation (Figure 3). For example, anglers contribute to the reduction of lake trout within Yellowstone Lake and they assist with removal of non-native species in streams where they co-exist with native trout. Anglers also provide research assistance; they have tagged Arctic grayling from Grebe and Wolf lakes to help collect information on the dynamics of those fish in that river system. Finally, anglers annually provide an incredible amount of inventory and monitoring information through the Volunteer Flyfishing Program, and through returns of the Volunteer Angler Report Cards provided to all anglers upon their purchase of special use permits required for fishing in park waters.

KIM WEST

Aquatics Section staff, May 2005.