Yellowstone Fisheries & Aquatic Sciences

Annual Report 2009–2010

Yellowstone Fisheries & Aquatic Sciences

Annual Report 2009-2010


© MIMI MATSUDA
Yellowstone cutthroat trout

Todd M. Koel, Jeffrey L. Arnold, Patricia E. Bigelow,
Philip D. Doepke, Brian D. Ertel, and Michael E. Ruhl

National Park Service
Yellowstone Center for Resources
Yellowstone National Park, Wyoming
YCR-2011-11

Suggested citation:
Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M. E. Ruhl. 2012. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2009–2010. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2011-11.

Title page art courtesy Mimi Matsuda.
Front cover captions (left to right): Hickey Brothers Fisheries, LLC setting trap nets on Yellowstone Lake; University of North Texas graduate student Joe Skorupski, and fisheries technician Derek Rupert, sampling invertebrates on Specimen Creek (photo by J. Arnold); Fisheries technician Phil Doepke with lake trout removed from Yellowstone Lake.
Back cover captions (left to right): NPS Hammerhead on Yellowstone Lake (credit T. Koel); Public scoping meeting for Native Fish Conservation Plan (photo by NPS); Fisheries technician Kate Olsen and supervisory fisheries biologist Todd Koel stocking westslope cutthroat trout eggs.
Background: Moonlight on Yellowstone Lake (NPS photo by J. Schmidt, 1977).
Opposite page: Grayling Creek (photo by Allison Klein).

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

Contents


NPS/A. KLEIN

Grayling Creek.

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. Fish 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 that many of the park's waters were fishless and asked the US 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 planting more than 310 million native and nonnative 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 parks throughout the country. In Yellowstone, fisheries management, as the term is understood today, began with the US Army, and was taken over by the National Park Service (NPS) in 1916. Fish stocking, data gathering, and other monitoring activities initiated by the US Fish Commission in 1889 were continued by the US Fish and Wildlife Service until 1996, when they became the responsibility of the NPS.

The stocking of nonnative 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 nonnative rainbow trout; and predation of Yellowstone cutthroat trout by nonnative lake trout. Over the years,


YELL-34645

Planting fish in the Bechler River 1936.

NPS management policies have 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 were introduced (nonnative or exotic; see Appendix i) (Varley and Schullery 1998). In addition, approximately 48% of Yellowstone's waters were once fishless (Jordan 1891).

A perceived conflict exists in the NPS 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 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 nonnative fish stocks. In fact, harvest regulations have been liberalized to encourage anglers to keep nonnative 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.

2009–2010 Summary

NPS/T. KOEL

Arnica fire near Bridge Bay, Yellowstone Lake in 2009.

NPS/T. KOEL

Hickey Brothers Fisheries, LLC setting a large deep water entrapment net to remove lake trout from Yellowstone Lake in 2010.

Following guidance from an August 2008 scientific panel review of the cutthroat trout conservation program on Yellowstone Lake, the fisheries team moved quickly into a contracting process to incorporate private sector lake trout netters. Under a pilot study, contracts were awarded to Hickey Brothers Fisheries, LLC to assist on Yellowstone Lake by gillnetting (2009–2010) and live entrapment netting (2010). The pilot efforts proved very successful. Contract netters contributed to the increased numbers of lake trout removed in recent years, and impacts to other resources in the lake area were low. In particular, the work demonstrated that large adult lake trout could be removed from shallow water habitats where they co-exist with cutthroat trout. Live entrapment gear, such as trap nets, allow for most cutthroat trout to be released without harm. Additionally, fishing gill nets for a short duration (typically one night) in waters expected to have a high Yellowstone cutthroat trout bycatch, enabled release of many of these fish alive. These pilot efforts laid the groundwork for long-term incorporation of private sector netters into the suppression program.

The need to undertake aggressive conservation actions to restore Yellowstone Lake, and other streams, rivers, and lakes resulted in the development of a programmatic Native Fish Conservation Plan/ Environmental Assessment (EA) for Yellowstone National Park. Public scoping in April 2010 included four open-house meetings in Montana (Bozeman and West Yellowstone) and Wyoming (Cody and Jackson). The impacts of four alternatives were analyzed and included in a document made available for public comment during a 45-day period beginning on December 16, 2010. The EA provides guidance and an adaptive management framework for making decisions regarding fisheries and aquatic resources conservation over the coming decades. Actions are included to reduce the lake trout population in Yellowstone Lake through full incorporation of contracted netters; recover the abundance of Yellowstone cutthroat trout in the lake and maintain their access to lake tributaries for spawning; reconstruct the Clear Creek weir and fish trap; and restore Arctic grayling, Yellowstone cutthroat trout, and westslope cutthroat trout in several drainages throughout the park.

Since their initial discovery in 1994, over 600,000 lake trout have been removed by our suppression efforts, including 100,756 and 146,671 lake trout in 2009 and 2010, respectively, by far the highest annual numbers on record. However, the catch of lake trout in each net set (catch-per-unit-effort) has steadily increased each year. This trend is serious cause for concern and suggests that the lake trout population continues to expand.

Indices of abundance suggest that the cutthroat trout spawning population of Yellowstone Lake has yet to demonstrate a significant positive response to our lake trout suppression efforts. The weir and fish trap at Clear Creek failed during spring flood flows in 2008, precluding further annual assessments of upstream-migrating cutthroat trout. However, conceptual designs have been developed for reconstruction of the structure in the near future. Cutthroat trout abundance has also

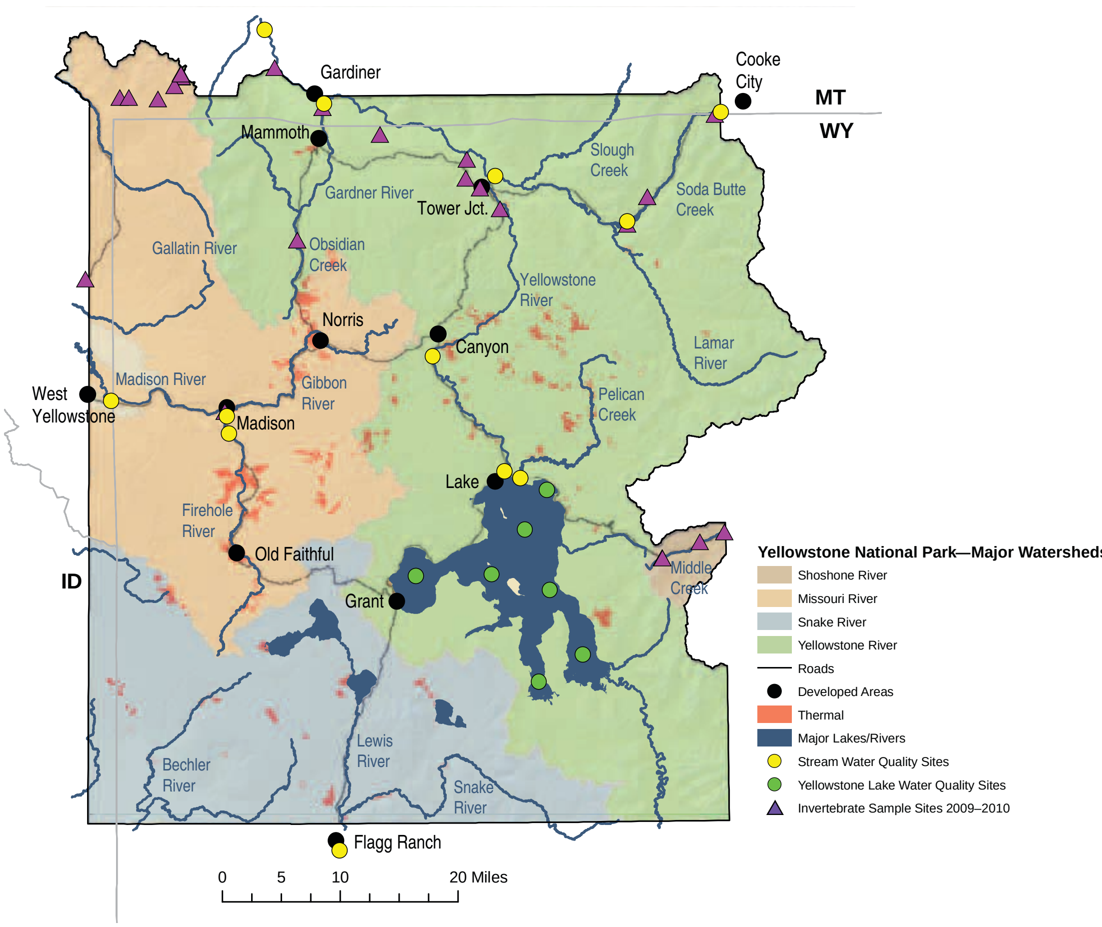


Figure 1. Major watersheds and surface waters of Yellowstone National Park, with sites established for long-term water quality monitoring on streams (12 sites:yellow circles) and Yellowstone Lake (7 sites:green circles). Areas sampled for aquatic invertebrates in 2009–2010 (22 sites:purple triangles) are also shown.

been monitored annually by a fall netting assessment at 11 sites across Yellowstone Lake. In 2009, the average catch per net was 9.5 cutthroat trout, however, in 2010 it was only 5.3, the lowest observed since 1977.

Westslope cutthroat trout recovery efforts focused on East Fork Specimen Creek during 2009 and 2010. Following a successful round of piscicide treatments in 2008, the same treatments were applied again in 2009. Following the two years of treatments and monitoring, the East Fork Specimen Creek was considered free of nonnative fish and restocking efforts proceeded in 2010. Over 4,500 eggs from Geode Creek were placed in remote site incubators throughout the drainage, resulting in the introduction of thousands of fry.

The ecological health of the park's aquatic systems continues to be monitored. The quality of the surface waters is monitored monthly at twelve fixed sites near the confluences of major streams and rivers (fig. 1). The physical and chemical characteristics of Yellowstone Lake are monitored seasonally. Emphasis continues to be placed on the assessment of potential impacts of rotenone on non-target species (amphibians and aquatic invertebrates) during native fish restoration projects.

The Fly Fishing Volunteer Program continues to be an integral mechanism for communicating information and raising public awareness of issues facing Yellowstone's native fishes. Throughout the 2009 and 2010 field seasons, 162 volunteers participated in the program for a total of 3,957 hours. They assisted with the Specimen Creek westslope cutthroat trout restoration and collection of genetic samples from trout in order to document potential introgressions, especially in the Lamar River, Slough Creek, Soda Butte Creek, and Trout Lake. Also, by marking trout, the volunteers are assessing the effectiveness of existing waterfalls and cascades for restricting upstream movement of trout in several streams. This information has been instrumental in guiding native trout restoration in Yellowstone.

The Fisheries Program

Native Fish Conservation Plan

In order to implement aggressive actions that will ensure recovery of native fish and restore natural ecosystem function, a Native Fish Conservation Plan/ Environmental Assessment (EA) was completed and made available for review and comment on December 16, 2010, concluding a year-long internal planning and public participation process. The EA proposes to conserve native fish from threats of nonnative species, disease, and climate-induced environmental change, and it provides guidance and an adaptive framework for managing fisheries and aquatic resources over the next two decades.

The EA recommends addressing the issues by implementing large scale removal of lake trout on Yellowstone Lake via NPS netting crews and the incorporation of private sector, contract netters. It describes in detail the development of benchmarks for lake trout suppression and an adaptive management strategy for actions on Yellowstone Lake and in streams and lakes elsewhere across the park and calls for the development and implementation of robust monitoring and continued scientific review through collaboration with partners.


NPS/B. KLEIN

The interdisciplinary team for development of the Native Fish Conservation Plan/Environmental Assessment included compliance specialists and representatives from all park divisions.


NPS/B. KLEIN

Seasonal staff, such as National Park Service Biological Science Technician Kate Olsen (right), comprise a majority of the workforce for completing native fish conservation actions each year.


NPS/C. BARKER

A native fish restoration field team hiking to a remote reach of upper Grayling Creek, 2009.

Preservation of Yellowstone Lake Cutthroat Trout

JAY FLEMING

Spawning Cutthroat at Clear Creek

The Yellowstone Lake cutthroat trout population is the largest remaining, genetically unaltered population of Yellowstone cutthroat trout (YCT) in the world (Behnke 2002). However, impacts from nonnative lake trout, whirling disease, and extended drought (late 1990s–mid 2000s) have driven this population into decline. The number of upstream migrating cutthroat trout in Clear Creek (fig. 2) declined from 54,928 in 1988 to just 538 in 2007 (fig. 3) and mean total length of upstream migrants increased from 393 mm to 523 mm during the same period. The apparent lack of recruitment and the aging spawning population indicate that this population is at serious risk of extirpation. Unfortunately, high run-off in 2008 damaged the Clear Creek fish weir and trap, rendering it inoperable in 2009 and 2010. The fisheries team is implementing plans to restore the monitoring of YCT spawning at Clear Creek.

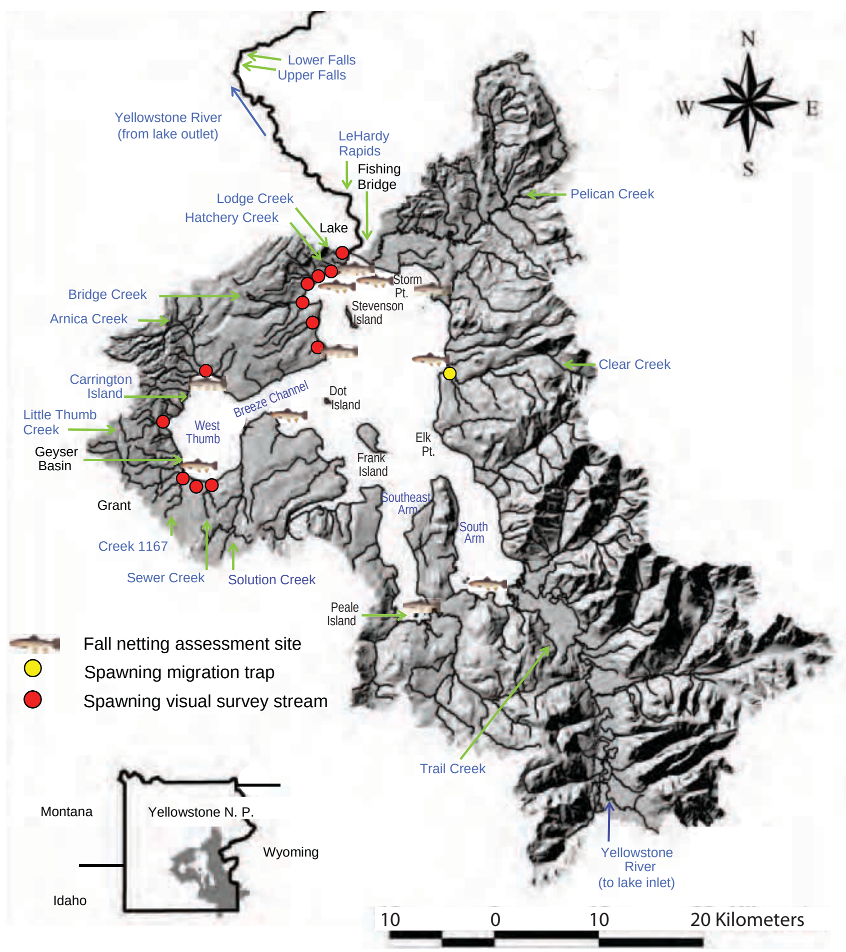


Figure 2. Yellowstone Lake and several major tributary drainages within Yellowstone National Park.

Chelsey Pasbrig displays lake trout caught in NPS nets.

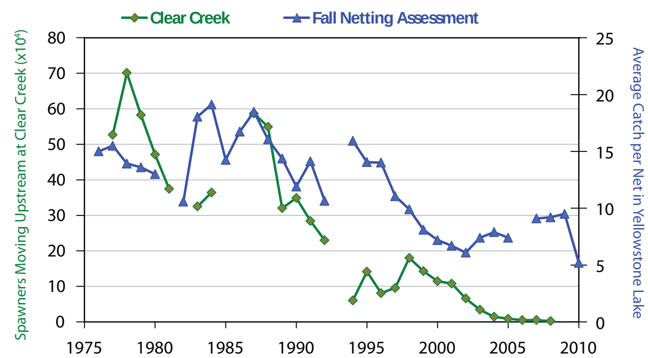


Figure 3. Total number of upstream-migrating cutthroat trout counted at the Clear Creek spawning migration trap and mean number of cutthroat trout collected per net during the fall netting assessment on Yellowstone Lake (1976–2010).

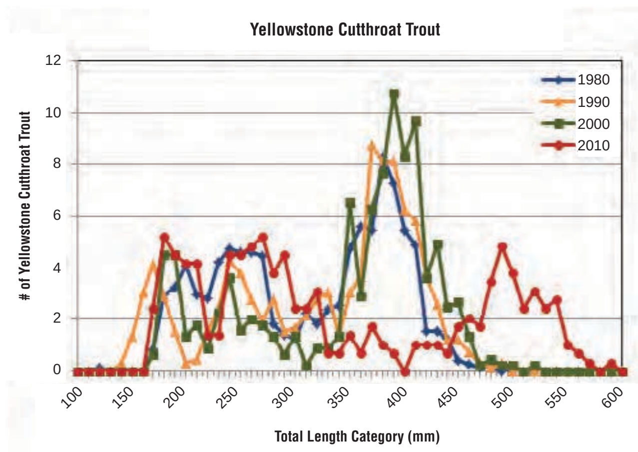


Figure 4. Percent frequency of Yellowstone cutthroat trout in 10-mm size class increments sampled during the annual fall netting assessment of Yellowstone Lake.

Distribution Netting of Cutthroat and Lake Trout

To effectively implement an adaptive management strategy for Yellowstone Lake, we needed to enhance efforts to monitor the status of the lake trout and cutthroat trout populations. In August 2009 and 2010 we used methods developed in the late-1990s by Ruzyki (2004) for this purpose. In 2009, nets were set at two depths and in 12 locations. In 2010, we set nets at three depth strata at 24 randomly chosen sites. Through collaboration with the US Geological Survey, Montana Cooperative Fishery Research Unit, we intend to develop a statistically robust design for this long-term monitoring program. The information obtained by this monitoring will be key in determining if benchmarks for lake trout mortality and cutthroat trout recovery are being met, and whether adjustments to conservation actions should be made.

Fall Netting Assessment of Cutthroat Trout

In 2009 and 2010, staff continued to monitor the YCT population in Yellowstone Lake with an annual gill net assessment. In 2009, 524 cutthroat trout (9.5 trout/net; fig. 3) were sampled in eleven sampling locations. This was the highest catch since 1998 and continued a trend of increasing cutthroat trout catches since 2001. The number of cutthroat trout sampled dropped drastically in 2010 to just 289 cutthroat trout (5.3 trout/net), the lowest catch since 1977 (fig. 3). Mean fish lengths in 2009 and 2010 were 310 mm and 334 mm respectively. While mean fish length has not changed drastically over the past decade, there has been a shift in the length frequency of sampled cutthroat trout (fig. 4).

Over the past several years there has been a decline in the proportion of the population in the 330–450 mm size range. Historically, fish in this size class were the most abundant fish sampled and made up the majority of the spawning population. Lake trout predation on smaller size-classes of fish is likely preventing YCT from surviving to adulthood and continues to affect spawning and juvenile survival. Increased efforts to suppress the lake trout population are intended to allow more cutthroat trout to survive to spawning age.

Lake Trout Suppression Program Overview

Nonnative lake trout, discovered in Yellowstone Lake in 1994, pose a serious threat to its native YCT population. Since their discovery, the NPS has been working to

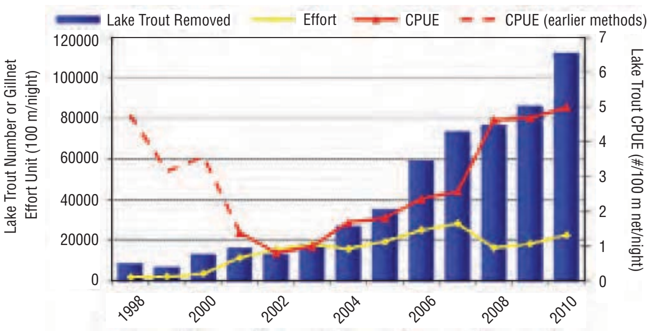


Figure 5. Total number of lake trout removed, gill net units of effort (1 unit = 100 m of net/night), and lake trout catch per unit of effort, 1994–2010.

Dennis Hickey and Steve Warwick of Hickey Brothers Fisheries LLC, check a trap net set in the West Thumb of Yellowstone Lake.

understand lake trout distribution and population dynamics, and to develop effective strategies to suppress the population. The result has been a substantial and growing body of scientific literature, program input from premier scientific experts, and a suppression program that includes operation of two NPS gillnetting boats and the addition of private-sector contract netters in 2009.

Suppression efforts removed 100,482 lake trout in 2009 and an additional 146,306 lake trout in 2010 (fig. 5). More than 19,000 in 2009 and approximately 25,500 in 2010 of these fish were caught while targeting adults primarily during the late August to early October spawning season. During 2009 and 2010, approximately 53% of NPS total effort and 57% of NPS total lake trout catch occurred in the West Thumb portion of Yellowstone Lake (fig. 6), where lake trout are the most concentrated. Both the number of lake trout removed and the catch-per-unit-effort (CPUE; 100 meters of net per night) by the NPS have steadily increased each year since 2002 (fig. 5), which is a cause for serious concern.

NPS Lake Trout Suppression

The majority of our suppression effort has targeted juvenile lake trout in deep water of Yellowstone Lake using small mesh nets (25, 32, and 38 mm bar measure). Park staff lift and reset gill nets at least weekly from late May or June through October. During the peak of the 2010 field season more than 17.6 km (11 miles) of gill net were in the lake each day. The number of lake trout removed by small mesh gill nets was 69,690 in 2009 and 101,623 in 2010, accounting for 81% and 91% of the total annual NPS catches, respectively.

Adult lake trout were also targeted in 2009 and 2010 using large-mesh gill nets (38 to 76 mm bar measure). These nets were set mostly during the late summer and fall in areas known to be frequented by spawning lake trout. Large-mesh gillnetting by NPS crews yielded 16,361 lake trout in 2009 and 10,438 in

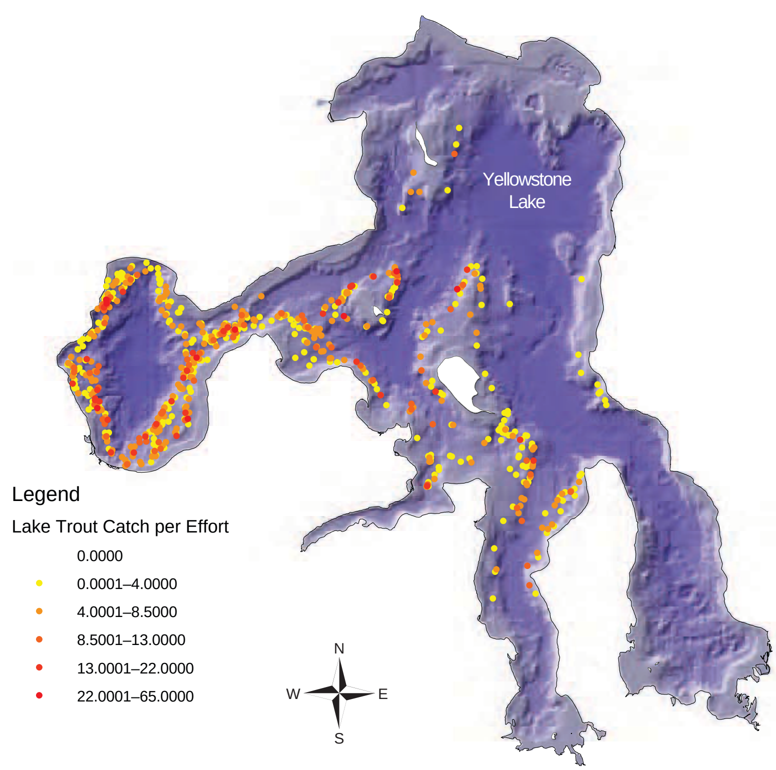


Figure 6. Locations of gill nets and catch-per-unit-effort (1 unit = 100 m of net set per night) of lake trout on Yellowstone Lake, 2010.

2010. The lake trout captured via large-mesh netting are large, mostly sexually mature fish. Eliminating these fish, which not only can prey on YCT, but also have high reproductive potential because of their size, is important to suppressing the population within the lake.

Contracted Lake Trout Suppression

In 2009 and 2010 the NPS conducted a pilot study to evaluate the potential of increasing lake trout suppression efforts by contracting private fishermen to use commercial fishing techniques. Hickey Brothers Fisheries, LLC from Bailey's Harbor, Wisconsin, was contracted to set gill nets in Yellowstone Lake. They captured 14,429 lake trout during 5 weeks in 2009 and 31,665 lake trout during 10 weeks in 2010, significantly increasing overall suppression effort. During the same 10 weeks in 2010, Hickey Brothers also set four large, live entrapment nets (trap nets). These nets were set on the lake bottom and used 183–274 m lead lines to guide fish into a trap box (see diagram, fig. 7). Fish captured in the trap nets remain alive until removed, allowing cutthroat trout to be released unharmed. Overall, trap nets captured 2,580 lake trout in 2010 (fig. 8), bringing total contractor suppression to 34,245 lake trout removed for the year. While trap nets accounted for only 8% of the overall contracted catch, the fish captured in trap nets were larger and a higher proportion were females than those caught in gill nets. If trap net catches can be improved, especially if they can continue to effectively target these larger, female lake trout, this gear type will be a valuable addition to the suppression efforts. With the inclusion of the contracted netters, over 17% of the total catch (146,306) in 2010 were caught in gear targeting adults.

Incidental Catch of Cutthroat Trout

The total number of Yellowstone cutthroat trout caught in NPS and contractor lake trout suppression gill nets during 2009 and 2010 was 9,885, of which 42% were released alive back to the lake. Cutthroat trout bycatch is minimized by carefully monitoring and adjusting netting strategies, such as setting nets at depths with fewer cutthroat trout and limiting the use of mesh sizes with higher cutthroat trout bycatch. For example, based on previous experience, the 25-mm mesh nets tend to have increased cutthroat trout bycatch in the fall so we have reduced use of this mesh size at that time of year. Another netting strategy to avoid cutthroat trout bycatch is to cease setting in an area once lake trout catches decrease, particularly near lake trout spawning areas. The use of trap nets also resulted in YCT bycatch; however, almost all (96%) of the YCT caught in trap nets were released alive.

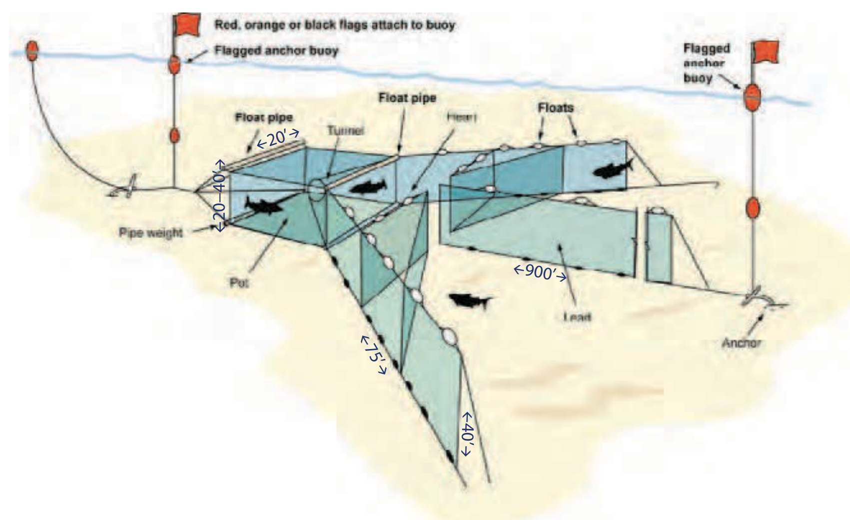


Figure 7. Diagram of live entrapment net used by contract netters on Yellowstone Lake in 2010.

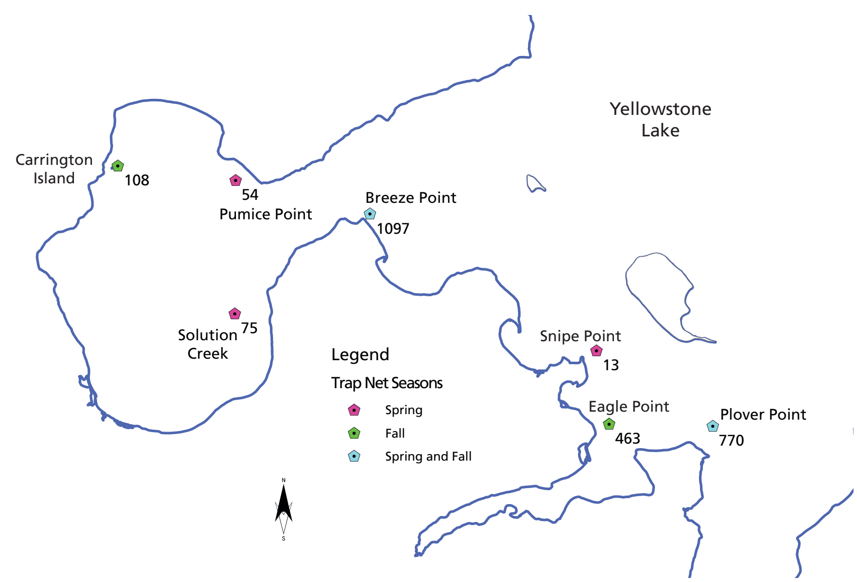


Figure 8. Locations where live entrapment nets were set, the season each was fished, and total number of lake trout caught in each trap in 2010.

Stream Resident Cutthroat Trout and Grayling Conservation

East Fork Specimen Creek Restoration

In 2006 park fisheries staff set out to restore westslope cutthroat trout to the East Fork Specimen Creek (EFSC), completing both an Environmental Assessment and initial project phases in that year (Koel and York 2006). Nonnative fish were removed from High Lake in 2006, restocking High Lake with westslope cutthroat trout began in 2007, a fish barrier was constructed on lower EFSC in 2008, and removal of nonnative fish from EFSC was initiated, also in 2008. As in previous years, in 2009 westslope cutthroat trout were introduced into High Lake both as fertilized eggs via remote site incubators and as live fish. Only eggs and fish from Geode Creek were used in 2009; no collections were made on Last Chance Creek and the Sun Ranch westslope cutthroat trout brood experienced low production due to unstable spring weather. In total, 838 fertilized eggs and 930 live fish were stocked into High Lake in 2009, bringing the three-year totals to 5,345 eggs and 2,964 fish. In 2010

NPS/B. ERTEL

NPS/D. RUPERT

NPS/T. KOEL

Counter-clockwise from top photo: A fisheries survey crew led by Derek Rupert collects westslope cutthroat trout from Geode Creek to be stocked into High Lake; Biologist Mike Ruhl (left) and Student Conservation Association intern Kate Olsen placing westslope cutthroat trout eggs into an incubator in an inlet of High Lake; Fish Restoration Biologist Mike Ruhl spawns a female westslope cutthroat trout on Geode Creek. Eggs collected from this fish were used to restock High Lake.

NPS/T. KOEL

Piscicide treatment is applied to East Fork Specimen Creek in 2009.

no eggs or fish were stocked in High Lake, however, fry were observed in the inlets of High Lake, confirming that natural reproduction of westslope cutthroat trout is occurring in the lake and making further stocking unlikely to be necessary.

Significant work also occurred on EFSC during 2009 and 2010. Following the first successful round of piscicide treatments in 2008, the same treatments were applied again in 2009, with CFT Legumine (rotenone) used in flowing waters, rotenone powder in springs and seeps, and potassium permanganate used to neutralize the rotenone at the down-stream end of the project area. Following two years of treatments and monitoring the creek was considered free of nonnative fish and restocking efforts proceeded in 2010. Over 4,500 eggs from Geode Creek were placed in remote site incubators throughout the EFSC drainage, resulting in the introduction of thousands of fry. Additional introductions of eggs from Geode Creek, the Sun Ranch, and other sources are expected in 2011 and 2012.

NPS/J. ARNOLD

NPS/D. RUPERT

Top: Technicians Joe Skorupski (left) and Derek Rupert collecting aquatic invertebrates on East Fork Specimen Creek to assess the impact of the piscicide treatment. Bottom: A High Lake westslope cutthroat trout .

East Fork Specimen Creek Fish Barrier

The spring run-offs of 2009 and 2010 tested the integrity of the EFSC fish barrier, constructed in 2008. Overall, the barrier performed well and appears to have remained secure. However, some erosion occurred along the south bank of the structure and it was determined that the area needed repairs and improvements to withstand continued use. For this reason, a significant amount of concrete was hauled to the site via pack stock and used to create a rock and mortar abutment around the existing structure, and a log-corduroy splash pad was added below the barrier south of the existing concrete splash pad. These repairs and improvements to the barrier were completed during the late-summer low-water periods of 2009 and 2010. We expect that the fish barrier will require minor repairs and improvements in order to continue to function as desired in the coming years.

The 2010 EA outlines a potential project to restore westslope cutthroat trout to the remainder of the Specimen Creek watershed, including the North Fork and Main Stem Specimen Creek. Included in the potential project are plans to construct a permanent fish barrier near the Specimen Creek Trailhead.

Potential for Restoring a Native Fish Community to Grayling Creek

Since 2007, park fisheries staff teamed with biologists at the Montana Department of Fish, Wildlife and Parks to assess Grayling Creek for a potential fluvial Arctic grayling and westslope cutthroat trout restoration project (Koel et al. 2008). The 2007 survey indicated that, although the creek is occupied by brown trout and hybridized cutthroat trout, it may be suitable for fluvial Arctic grayling upstream of the upper falls. The interagency cooperation expanded in 2009 with the US Department of Agriculture Forest Service joining another multi-day trip into the remote drainage. The focus in 2009 and 2010 was on collecting information on fish species, distribution, and genetic data from the stream's headwater and tributary reaches. Genetic samples were collected from tributaries throughout Grayling Creek. Visual inspection of fish from both the south fork and its fish-inhabited tributary indicate far less hybridization than in the main stem or east fork reaches. Brown trout were captured in both the main stem and the east fork, indicating the stream's accessibility to nonnative species. The genetic analysis of the samples collected will indicate the degree of genetic purity in the sampled reaches. The park's fisheries staff, along with their agency partners, will continue detailed surveys of the drainage in the coming years. This information will be useful for identifying potential genetically unaltered westslope cutthroat trout. and delineating the extent of fish distribution for future restoration efforts. Included in the 2010 EA is a description of potential future conservation actions on Grayling Creek.


NPS/K. OLSEN


NPS/C. BARKER


NPS/J. ARNOLD


NPS/C. BARKER

Clockwise from top left: Native Fish Restoration crew conducting an electrofishing survey of upper Grayling Creek; There are no established trails in the Grayling Creek drainage, making the logistics of working in this large remote area challenging; Fish Restoration Biologist Mike Ruhl (left) leads a survey crew in Grayling Creek, 2009; Biological Science Technicians Derek Rupert (left) and Joe Skorupski surveying for amphibians in a Grayling Creek wetland, 2009.

The East Fork Specimen Creek fish barrier.

A volumetric feeder (foreground) applying potassium permanganate to East Fork Specimen Creek to neutralize the piscicide below the fish barrier (background) during the 2009 treatment.

Brook Trout Removal from Soda Butte Creek

In 2009 and 2010 the NPS was again part of a multi-agency (USDA Forest Service; Montana Fish, Wildlife and Parks) effort in Soda Butte Creek and its tributary streams to remove brook trout and gather data on Yellowstone cutthroat trout abundance and distribution. In 2009, the main stem of Soda Butte Creek was sampled from the Sheep Creek confluence downstream to Ice Box Canyon using a jon boat outfitted with electrofishing equipment (fig. 9). In 2010, sampling was concentrated in the areas with the highest catches from previous seasons (table 1). Tributary streams were sampled by making a single pass with a backpack electrofishing unit, working up stream to probable fish barriers or areas where no fish were captured for 500 m.

Brook trout catches were higher in 2009 (152) and 2010 (134) than in 2008 (48) (table 1). There was also an increase in the number of young-of-the-year brook trout captured, from 3 in 2008 to 24 in 2009 and 31 in 2010. This indicates brook trout are successfully spawning in the system. Similar to previous years, concentrations of brook trout were found between Silver Gate, outside the park, and Warm Creek, within the park. The section between Warm Creek and the first bridge downstream showed the largest increase in brook trout from 3 in 2008 to 51 in

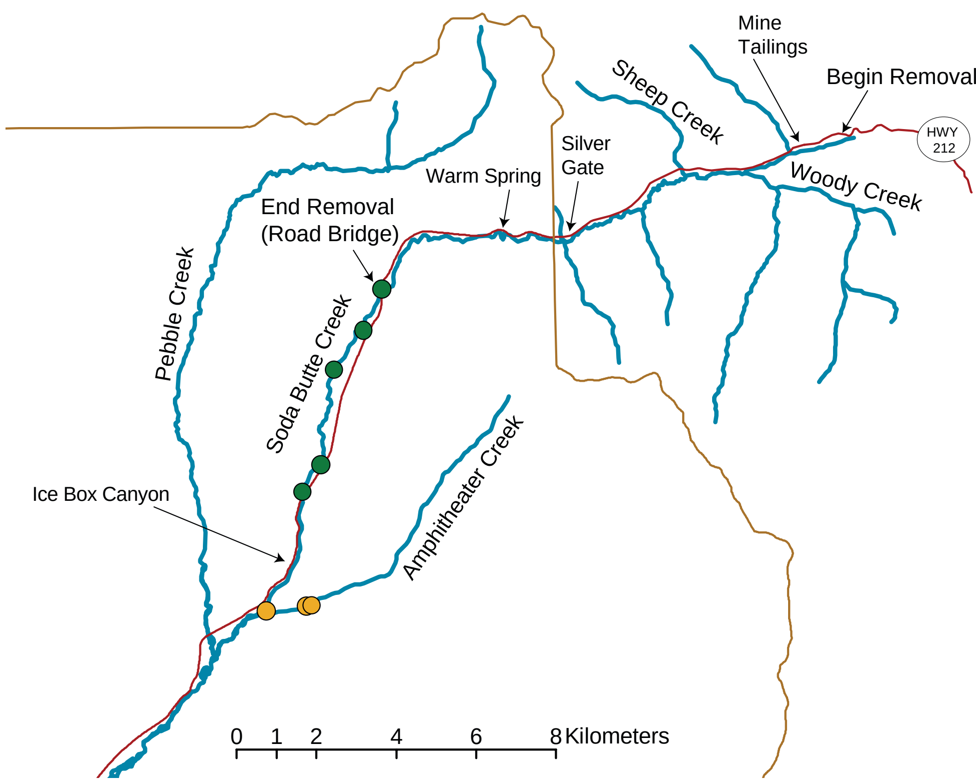


Figure 9. Soda Butte Creek watershed in northeastern Yellowstone National Park and the Gallatin National Forest, including reaches electrofished to remove nonnative brook trout in 2009–2010.

Table 1. Total (and young-of-year only) brook trout mechanically removed from Soda Butte Creek within the Gallatin National Forest, State of Montana, and Yellowstone National Park, 2004–2010*

Removal Reach	2004	2005	2006	2007	2008	2009	2010
HWY 212 to McClaren Mine Tailings	19(1)	3(0)	0(0)	0(0)	0(0)	NS	NS
McClaren Mine Tailings to Woody Creek	15(0)	17(0)	3(0)	3(0)	2(0)	NS	NS
Woody Creek to Sheep Creek	8(2)	43(0)	16(0)	0(0)	1(0)	NS	NS
Sheep Creek to Silver Gate	251(79)	932(51)	142(6)	45(8)	5(0)	6(0)	NS
Silver Gate to Yellowstone Park Boundary	9(3)	80(9)	54(2)	48(19)	13(0)	30(2)	16(0)
Yellowstone Park Boundary to Warm Spring	7(0)	11(0)	0(0)	50(27)	23(2)	56(10)	43(2)
Warm Spring to Road Bridge	0(0)	1(0)	0(0)	0(0)	3(1)	51(12)	68(29)
Road Bridge to Ice Box Canyon	NS	NS	NS	NS	0(0)	1(0)	7(0)
Tributaries	0(0)	17(0)	15(0)	4(0)	1(0)	8(0)	NS
Total	309(85)	1,104(60)	230(8)	150(54)	48(3)	152(24)	134(31)

* NS = Not Sampled.

2009 and 68 in 2010. Sampling for the first time in two sections, the road bridge to Ice Box Canyon produced 1 brook trout in 2009 and 7 in 2010. Electrofishing of tributary streams outside the park produced 8 brook trout in 2009 (5 in Amphitheater Creek outside the park and 3 from a small spring flowing through the town of Silver Gate) and none in 2010. No brook trout were collected in tributary streams within the park.

A comparison of sections sampled in both 2009 and 2010 showed a decline in YCT numbers with 2,188 and 565 fish sampled, respectively. This may have resulted from an early season flash flood that altered much of the habitat in the system. One rainbow trout was removed in 2009 and three cutthroat/rainbow trout hybrids in 2010. Rainbow trout, which have been captured in low numbers in the past, pose a serious threat to the cutthroat trout population through competition and hybridization. During 2009, tissue samples for genetic analysis were collected from a random sample of 30 fish just upstream of Ice Box Canyon and from an additional 20 fish that appeared to be cutthroat trout/rainbow trout hybrids.

The increase in brook trout was the first recorded since 2005. Although our catch numbers remain low, the greater numbers of both juvenile and adult brook trout downstream of Warm Creek indicate that the population is expanding downstream and possibly spawning in new downstream locations. Our current plan is to continue with mechanical removal of brook trout in the system.

NPS

Nonnative brook trout are removed from upper Soda Butte Creek each year to curtail population growth and expansion.

NPS

A small "push boat" is used to carry the generator and electrofishing unit for brook trout removal on Soda Butte Creek.

Long-term Water Quality Monitoring

Monitoring water quality continues to be a high priority for Yellowstone, with standardized data available for 17 sites dating to May 2002. The monitoring is conducted in cooperation with the Vital Signs Monitoring Program of the Greater Yellowstone Inventory & Monitoring Network, which includes Yellowstone National Park, Grand Teton National Park, John D. Rockefeller Jr. Memorial Parkway, and Bighorn Canyon National Recreation Area. In Yellowstone, 12 sites are on major rivers and 7 are on Yellowstone Lake, including two sites added to the program in 2003 (fig. 1). Because stream discharge strongly influences limnological processes, most of the stream sites are located near US Geological Survey discharge gauging stations so the flow-weighted measurements can be calculated for chemical parameters.

Data was collected monthly during 2009 and 2010 at each monitoring site on core water quality parameters, including water temperature, dissolved oxygen, pH, specific conductance, and turbidity. Water was also collected from each site, filtered, dried, and weighed for total suspended solids (TSS), volatile suspended solid (VSS), and fixed suspended solid (FSS) analysis. In addition, nine of the stream sites were sampled for various chemical parameters, including anions (sulfate, chloride, bicarbonate, and carbonate), cations (calcium, magnesium, sodium, and potassium), and nutrients (total phosphorus, orthophosphate, nitrate, nitrite, and ammonia). Dissolved and total metals (arsenic, copper, iron, and selenium) in water and sediments are measured twice annually during high and low flow periods on upper Soda Butte Creek at the park boundary near Silver Gate, Montana.


NPS/T. KOEL

Graduate Research Assistant Joe Skorupski places nets to examine macroinvertebrate drift during rotenone treatment of East Fork Specimen Creek, 2010.

During 2009–2010, most water quality sites sampled in Yellowstone met or surpassed national/state water quality standards for all parameters on all collection days. Some sites, such as the Gibbon River and Yellowstone River near Canyon, had lower than expected pH values, which is most likely attributable to inputs from nearby geothermal features.

The upper Soda Butte Creek regulatory site exceeded Environmental Protection Agency (EPA)/state standards for total iron and aquatic life criteria during 27 visits (15 in 2009, 12 in 2010) and exceeded drinking water standards during 5 visits (2 in 2009, 3 in 2010).

Table 2. The waters of Yellowstone

Area of Yellowstone National Park[1]	3,468.4 mi^2 (8,983 km^2)
Water surface area[2,3]	approximately 5% of park area
Number of named lakes[1]	150
Surface area of named lakes[1]	24.7 mi^2 (63.9 km^2)
Number of lakes with fish[2]	~45
Yellowstone lake surface area[1]	131.8–135.9 mi^2 (341–352 km^2)
Number of named streams[3]	278
Total stream length[3]	3,496,329 meters (2,172.52 miles)
Number of streams with fish[2]	~200

[1]Yellowstone Spatial Analysis Center data 2010. [2]Varley and Schullery 1998.
[3]GRYN Water Quality Report 2009

Regulatory Monitoring of Impaired Waters

Three stream segments on the park boundary are listed as 303(d) impaired by the state of Montana and are monitored as regulatory streams: (1) upper Soda Butte Creek near Cooke City; (2) Yellowstone River upstream of Corwin Springs to the Montana state line; and (3) Reese Creek on the park's north boundary.

In-stream metals contamination in Soda Butte Creek is a result of historical mining in the vicinity of Cooke City, approximately 8 km from the park boundary. Mine tailings

National Park Service Aquatic Ecologist Jeff Arnold and Technician Jamie Kilgo sampling macroinvertebrates on Soda Butte Crreek in 2009.

persist within the Soda Butte Creek floodplain and contribute to the listing of a portion of this stream as impaired and only partially supporting of aquatic life and coldwater fisheries. At the upper Soda Butte Creek site, water and sediment samples were analyzed for metals (i.e., arsenic, copper, iron, and selenium) from May to October in 2009 and 2010.

The Yellowstone River upstream of Corwin Springs was listed on Montana's 303(d) list in 2006 for sedimentation and arsenic levels that exceed drinking water standards. In addition to routine water quality monitoring, data on total dissolved arsenic, copper, iron, and selenium were collected from this site from July to October 2009.

The lower portion of Reese Creek is on Montana's 303(d) list because irrigation practices from adjacent land owners often leave too little water in the stream to sustain a healthy resident fish population during the critical months of July and August. Discharge measurements on Reese Creek were collected during 17 site visits from May 28 to September 17, 2009, by the park's resource management staff to calculate instream flows.

Yellowstone Lake Limnology

Understanding the limnology of Yellowstone Lake, the park's most prominent body of water, is an important part of comprehending the ecology of lake trout and carrying out the lake trout suppression program. Water temperature, dissolved oxygen, specific conductance, and turbidity measurements were sampled monthly from May/June through October for both years at seven sites in the Yellowstone Lake basin (fig. 1). Weather permitting, temperature profile data were also collected from the West Thumb and South Arm. Water samples were collected at each location for analysis of total suspended solids (TSS), volatile suspended solids (VSS) and fixed suspended solids (FSS).

Macroinvertebrates Surveys

Aquatic invertebrates are an important element in aquatic food webs and include a wide assortment of feeding groups: primary consumers (filter feeders, gatherers, scrapers, and shredders) and predators that feed on other invertebrates, and small vertebrates (larval amphibians, and young fish). In turn, the various life stages of those invertebrates provide an important food source for fish, birds, and mammals. Because aquatic invertebrates are sensitive to environmental changes, they are used to supplement long-term water quality data, evaluate the impact of road construction activities on aquatic resources, and assess the impacts that our fish restoration activities have on non-target organisms.

In 2009 and 2010, 25 and 18 invertebrate sites were surveyed respectively within Yellowstone National Park. For both years, five sites were sampled as part of our long-term water quality monitoring program and six sites were associated with road construction projects. The remaining sites were located within current or proposed native fish restoration watersheds. During August 2009, CFT legumine formulation (rotenone) was used to remove nonnative fish from the East Fork Specimen Creek drainage. Pre- and post-treatment aquatic invertebrate surveys were conducted to assess the piscicide's impact on the stream invertebrate community. All invertebrate samples were sent to an independent contractor for analysis.

Red-rimmed Melania Found in the Boiling River

The red-rimmed melania (*Melanoides tuberculata*) is a snail that is native to the subtropical waters of Asia, Africa and Australia. It was introduced into North America in the 1930s through the aquarium trade and populated local watersheds when discarded by aquarium owners. In December 2009, it was found at the confluence of the Boiling River and Gardiner River near Mammoth Hot Springs. In 2010, other hot spring areas used by park visitors were surveyed to inventory and locate the distribution of the red-rimmed melania snails and aquatic native species (fig. 10). This survey also incorporated the collection of basic water quality information and native gastropod population inventories to evaluate the potential impacts of red-rimmed melania on native fauna. Other surveys may be designed to monitor the spread of these snails in the future.

Red-rimmed melania were not observed at any of the 19 surveyed hot spring sites, but they were found in very large masses on September 8, 2010, during an aquatic invasive species survey about 100 meters downstream from where they were initially discovered. These snails were located on a 60-meter stretch along the west bank of the Gardner River in submerged aquatic vegetation and algae. A much smaller quantity was found 1.6 km (1 mile) downstream of the Boiling River and Gardner River confluence.

The source of the red-rimmed melania in the Boiling River is unknown. It was most likely introduced unintentionally by a "soaker" or angler who transported the species from a contaminated hot spring, such as Kelly Warm Springs, a very popular soaking area in Grand Teton National Park. These particular snails can survive out of water for several days.

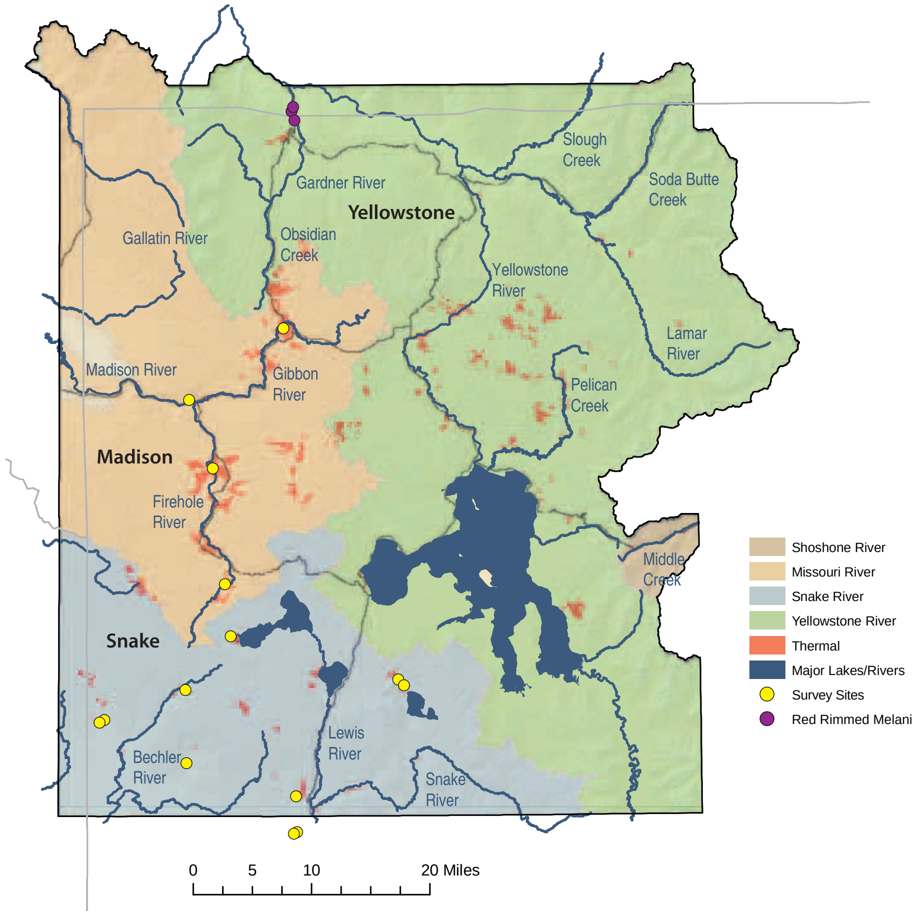


Figure 10. Sites surveyed for red-rimmed melania and other aquatic species during 2010.

Amphibian Surveys

Yellowstone is home to four amphibian species: the Columbia spotted frog (*Rana luteiventris*), the boreal chorus frog (*Pseudacris maculata*), the boreal toad (*Bufo boreas*), and the blotched tiger salamander (*Ambystoma tigrinum*) (Koch and Peterson 1995). During 2009 and 2010 we investigated wetlands identified by the National Wetlands Inventory (US Fish and Wildlife Service 1998) for the presence of amphibians in areas targeted for native fish restoration. In 2009, 79 wetlands were surveyed within Elk, Grayling, and Specimen creek drainages with 17, 49, and 13 sites sampled respectively. A total of 24.75 hours of effort were expended searching for the presence of adult and larvae amphibians. In 2010, 22 wetlands were surveyed within Blacktail Deer Creek, Trout Lake, and Goose Lake drainages with 11, 8, and 3 sites sampled respectively. A total of 19.37 hours of effort were expended searching for the presence of adult and larval amphibians. Goose Lake drainage is a small watershed located approximately 7 km north of Old Faithful Geyser Basin and consists of 3 lakes, the largest which is Goose Lake. Six hours of survey effort were expended looking for amphibians within these three lakes. Adults of all four of the park's amphibian species were present, however, only one larval Columbia spotted frog was found in the small headwater lake of this drainage.

NPS/J. ARNOLD

Blotched tiger salamander from the Grayling Creek drainage, July 2009.

Angling in the Park

Trends from Volunteer Angler Report Cards


NPS

National Park Service coordinator Tim Bywater (right) and a Fly Fishing Volunteer Program angler pose with a large rainbow trout from the Madison River System in 2010.

Angling remains a popular pastime for those visiting, living near, or working in Yellowstone National Park. During 2009 and 2010, there were 50,113 and 50,372 special use fishing permits issued to the 3.3 and 3.6 million park visitors, respectively. Everyone receiving a fishing permit (required for fishing in park waters) should also have received a volunteer angler report (VAR) card. These cards have been distributed since 1973 and provide anglers an opportunity to share their fishing success and opinions with park managers.

In 2009, park-wide angler use (total number of days anglers spent fishing) was 259,382 days, a 3% decrease from 2008. An estimated 48,458 anglers landed 700,643 and creeled 31,933 fish, releasing more than 95% of fish caught. Anglers fished for an average of 2.8 hours a day during a typical outing and fished 1.7 days during the season. Anglers who fished only one day comprised 62% of the total anglers and 84% of them caught fish. Anglers reported being satisfied with the overall fishing experience (81%), with the number of fish caught (68%) and with the size of fish (71%); this is an increase in satisfaction in all three categories over previous years.

In 2010, park-wide angler use (total number of days anglers spent fishing) was 255,735 days, a 2% decrease from 2009. An estimated 48,730 anglers landed 588,997 and creeled 37,882 fish, releasing 94% of fish caught. Anglers fished for an average of 2.7 hours a day during a typical outing and fished almost 1.7 days during the season. Anglers who fished only one day comprised 64% of the total anglers and accounted for 79% of the fish caught. Anglers reported being satisfied with the overall fishing experience (80%), with the number of fish caught (65%) and with the size of fish (70%); this is a slight decrease in satisfaction in all three categories from the previous year.

Native cutthroat trout remained the most sought after and caught fish species by anglers in 2009 and 2010, comprising 48% and 46% of all fish caught, respectively (fig. 11). Rainbow trout was the second most abundantly caught fish species, comprising 20–22% of angler catch, followed by brown trout, 11–12%; lake trout, 7–8%; brook trout, 6-9%; mountain whitefish, 4%; and grayling, 1–2%.

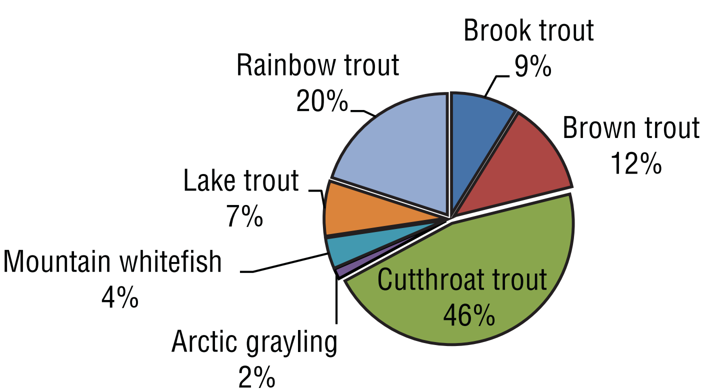


Figure 11. Native cutthroat trout remained the most sought after and caught fish species by anglers in 2010, comprising 46% of all fish caught in Yellowstone National Park.

Yellowstone Lake remains the most popular destination for anglers fishing in the park. Over 20% (>9,000 anglers) reported fishing the lake each year. The average length of angler-caught cutthroat has increased to nearly 460 mm (approx. 18 inches), the greatest average size reported since the inception of the VAR Program in 1973 (fig. 12). Catch rates for cutthroat trout remain approximately one fish per every hour of fishing on Yellowstone Lake. However, these catch rates are greatly reduced from what they were a decade ago.

Madison River Fishery Survey

In 2009, we completed the second year of a fisheries assessment of the Madison River from the confluence of the Firehole and Gibbon rivers to the park's west boundary. The objectives were to determine the abundance of brown trout, rainbow trout, and mountain whitefish and the percentage of the spawning rainbow trout and brown trout that migrate upstream into the park from Hebgen Reservoir. We divided this 36-km portion of the river into three sections of approximately equal length: section I was from the confluence to 7-Mile bridge, section II from 7-Mile Bridge to Barnes Hole, and section III from Barnes Hole to Bakers Hole Campground (fig. 13).

One mark and one recapture run were made in each section using a 15-foot raft outfitted with electrofishing equipment. All captured mountain whitefish, brown trout, and rainbow trout were measured (total length in millimeters) and clipped using a specific mark for each sample section (adipose, left pelvic, or right pelvic). A sub-sample of 100 fish of each species in each section was weighed to the nearest 10 grams. Montana Fish, Wildlife and Parks operated a weir near Bakers Hole Campground where they marked fish with a tag or clip.

From October 12 to 21, 2009, we captured a total of 1,920 brown trout, 772 rainbow trout, and 2,403 mountain whitefish in the three sample sections. The most abundant species in section I was brown trout and in sections II and III was mountain whitefish (table 3). We captured approximately 71 fish/km, (27 brown trout, 11 rainbow trout, and 33 mountain whitefish), leading to population estimates of 837 brown trout/km, 208 rainbow trout/km, and 983 mountain whitefish/km. Rainbow trout had the greatest mean total length, 398 mm (table 4). Fish of each species were found in both pre- and post-spawning condition in all


NPS

Fisheries crew examining fish collected on the Madison River by night electrofishing, October 2009.

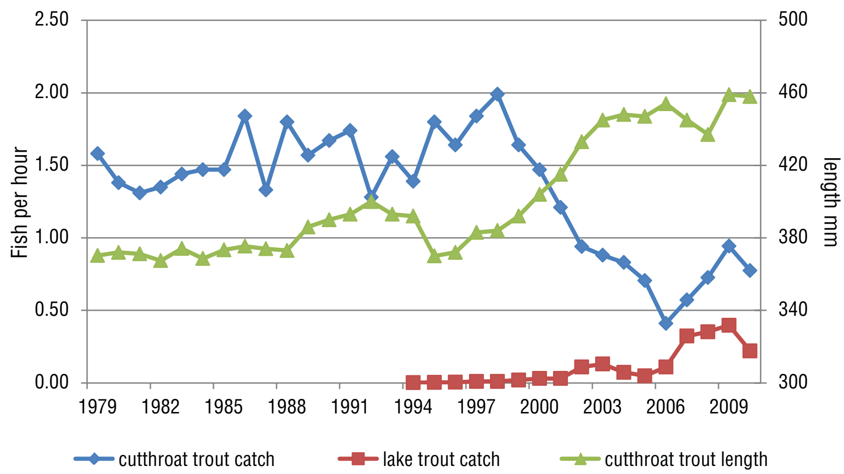


Figure 12. The 2010 angler-reported catch in Yellowstone Lake demonstrated a decrease in catch rates for both Yellowstone cutthroat trout and lake trout.

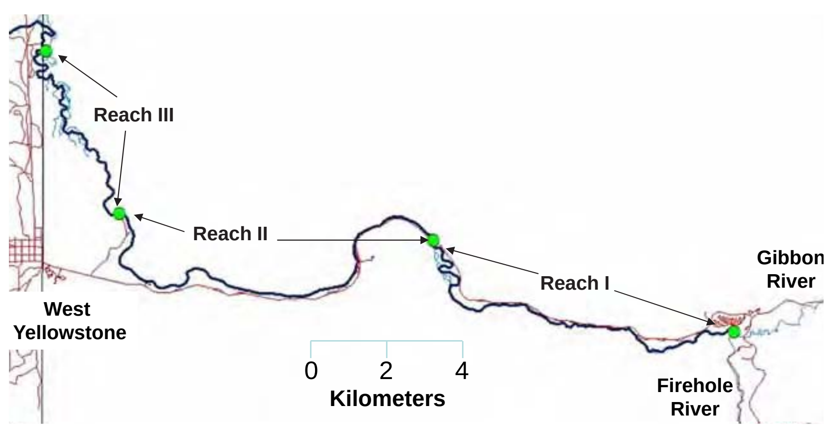


Figure 13. Reaches of the Madison River in Yellowstone National Park surveyed for fishes by raft-mounted electrofishing at night during October 2009.

sections of the river, although section III contained the majority of spawning whitefish.

Results of our initial survey indicate healthy populations of the three species. Less than 1% of fish captured in the park had been tagged at the Montana Fish, Wildlife and Parks weir near the park boundary. Fish tagged at the weir were captured by electrofishing as far upstream as the confluence of the Gibbon and Firehole rivers. Anglers have reported catching tagged fish even further upstream in both stream systems. VAR Program reports suggest that anglers are consistently catching large (>508 mm; >20 inches) rainbow and brown trout from the Madison River (fig. 14).

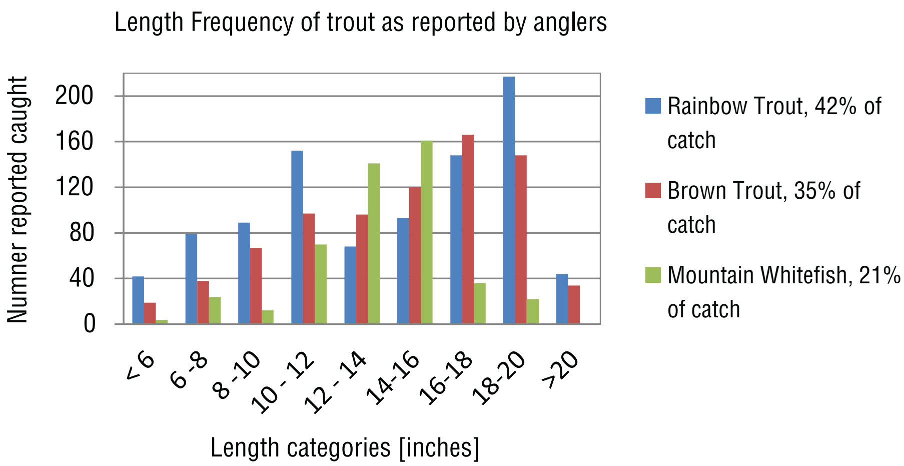


Figure 14. Length frequency of trout caught by anglers from the Madison River in 2009.

Table 3. Abundance estimates for mountain whitefish, brown trout, and rainbow trout in three study sections of the Madison River, Yellowstone National Park

Species	Estimate Type	Section I	Section II	Section III	All Sections
Mountain whitefish	Point Estimate (N)	2,312	14,476	18,602	29,033
	95% Confidence Interval	1,436–3,669	5,885–28,952	13,293–25,945	22,127–38,041
Brown trout	Point Estimate (N)	12,925	6,237	10,961	30,726
	95% Confidence Interval	8,508–19,474	2,942–11,998	5,170–21,086	21,730–43,281
Rainbow trout	Point Estimate (N)	4,500	2,694	3,635	11,250
	95% Confidence Interval	2,549–7,710	607–3,088	1,477–7,271	6,773–18,343

Table 4. Mean total length (mm) of mountain whitefish, brown trout, and rainbow trout sampled in the Madison River, Yellowstone National Park, Wyoming, and Montana

Species	Section	N	Mean TL (mm)	Range (mm)
Mountain whitefish	I	368	321	126–465
	II	489	292	115–454
	III	1,537	341	107–494
	Total	2,394	328	107–494
Brown trout	I	1020	356	103–636
	II	384	384	84–650
	III	510	427	97–588
	Total	1,914	380	84–650
Rainbow trout	I	440	400	95–557
	II	106	388	122–510
	III	236	397	115–555
	Total	782	398	95–557

Public Involvement

Eighth and Ninth Year of Fly Fishing Volunteers

During 2009 and 2010 the Fly Fishing Volunteers program again assisted with fisheries conservation projects and scientific data collection across the park. Volunteers assisted the Specimen Creek westslope cutthroat trout restoration by capturing trout at several locations in the lower portion of the drainage and by spending several nights at High Lake, the headwater lake of East Fork Specimen Creek, sampling westslope cutthroat trout. The volunteers also focused on sample collection for cutthroat trout genetics, including distribution of pure and hybridized fish in the Lamar River, Slough Creek, Soda Butte Creek, and Trout Lake. Anglers also investigated a bedrock waterfall on Grayling Creek and a long cascade on lower Elk Creek to determine if either feature could block upstream movement of fish. Both of these streams provide excellent opportunities for cutthroat trout restoration and are included as potential projects in the Native Fish Conservation EA.

Throughout the 2009 and 2010 field seasons, 162 volunteers participated in the program for a total of 3,957 hours. As in past years, the volunteers indicated that the experience they had was very positive, and were very happy that they could participate in such a program and contribute to Yellowstone fisheries.

NPS

Graduate Research Assistant Joe Skorupski (left) and NPS Fisheries Technician Derek Rupert sampling for aquatic macroinvertebrates on East Fork Specimen Creek.

NPS/J. ARNOLD

SCA volunteer Angie Brison measures a fish.

Long-term Volunteer Assistance

The Fisheries Program recruits volunteers through the Student Conservation Association (SCA) and other sources (see Appendix iii) to work a full-time schedule for 12 or more weeks while living in park housing at Lake or Mammoth. Typically, one group of SCA volunteers participates from mid-May through early August, and a second group from early August through late October. Our goal is to have the volunteers gain experience with as many fisheries program activities as possible. Given that tens of thousands of hours of assistance have been provided by volunteers over the years, there is no question that all aspects of our program have greatly benefited from both long- and short-term volunteer support.

Educational Programs

Fisheries Program staff continued to provide a variety of short-term educational programs for visiting schools and other interested groups, with an emphasis on native fish conservation. Park staff also provided American Red Cross first aid and CPR certification for fisheries employees and volunteers.

Collaborative Research

The Fisheries Program, through the Yellowstone Center for Resources, provides both direct and indirect support for collaborative research with scientists at other institutions, primarily universities. These studies address some of the most pressing issues faced by NPS biologists and other regional managers of aquatic systems.

Projects by Graduate Students

Graduate student: Julie Alexander (Doctor of Philosophy).
Committee co-chairs: Drs. Billie Kerans and Todd Koel, Department of Ecology, Montana State University.
Title: Detecting *Myxobolus cerebralis* infection in *Tubifex tubifex* of Pelican Creek.
Status: Completed November 2010.

Graduate student: Patricia Bigelow (Doctor of Philosophy).
Committee chair: Dr. Wayne Hubert, US Geological Survey, Wyoming Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology, University of Wyoming.
Title: Predicting lake trout spawning areas within Yellowstone Lake, Wyoming.
Status: Completed May 2009.

Graduate student: Hilary Billman (Master of Science).
Committee chair: Dr. Charles Peterson, Department of Biological Sciences, Idaho State University.
Title: Investigating effects of the piscicide rotenone on amphibians in southwestern Montana through laboratory experiments and field trials.
Status: Field studies completed, data analyses and writing ongoing.

Graduate student: Brian Ertel (Master of Science).
Committee chair: Dr. Thomas McMahon, Department of Ecology, Montana State University.
Title: Distribution, movements, and life history of Yellowstone cutthroat trout in the upper Yellowstone River basin.
Status: Field studies completed, lab work, analyses, and writing ongoing.

Graduate student: Lynn Kaeding (Doctor of Philosophy).
Committee chair: Dr. Daniel Goodman, Department of Ecology, Montana State University.
Title: Comprehensive analysis of historic and contemporary data for the cutthroat trout population of Yellowstone Lake.
Status: Completed April 2010.

Graduate student: Joseph Skorupski (Master of Science).
Committee chair: Dr. James Kennedy, Department of Biological Sciences, University of North Texas.
Title: Effects of CFT legumine rotenone on macroinvertebrates in four drainages of Montana and New Mexico.
Status: Field studies, data analyses and writing ongoing.

Graduate student: John Syslo (Master of Science).
Committee chair: Dr. Christopher Guy, US Geological Survey Cooperative Fisheries Research Unit, Department of Ecology, Montana State University.
Title: Demography of lake trout in relation to population suppression in Yellowstone Lake, Yellowstone National Park.
Status: Completed May 2010.

Interagency Workgroups

Yellowstone National Park actively participates in the Yellowstone Cutthroat Trout Interstate Workgroup, the Montana Cutthroat Trout Steering Committee, and the Fluvial Arctic Grayling Workgroup. Shared goals and objectives among partner agencies and non-governmental organizations are defined in a memorandum of agreement for the rangewide conservation and management of Yellowstone cutthroat trout, a memorandum of understanding and conservation agreement for westslope cutthroat trout and Yellowstone cutthroat trout in Montana (http://fwp.mt.gov/wildthings/concern/yellowstone.html), and an memorandum of understanding concerning the recovery of fluvial Arctic grayling (http://fwp.mt.gov/wildthings/concern/grayling.html).

Cutthroat Trout Broodstock Development

The park has verified two genetically unaltered westslope cutthroat trout populations. Gametes from the population located in Last Chance Creek are incorporated (as available) into the upper Missouri River westslope cutthroat trout broodstock at the Sun Ranch in Madison Valley, Montana. In 2010, these gametes were used to supplement westslope cutthroat trout recovery efforts in Little Teepee Creek and McClure Creek in the Gallatin National Forest.

NPS/J. ARNOLD

Graduate Research Assistant Joe Skorupksi.

Acknowledgments

Much appreciated administrative support for the Fisheries Program in 2009 and 2010 was provided by Barbara Cline, Kevin Franken, Montana Lindstrom, Melissa McAdam, and Alanda Darr. Bianca Klein and Linda Mazzu from the Branch of Environmental Compliance provided tremendous support and guidance for the NEPA process leading to a Native Fish Conservation Plan/ Environmental Assessment.

Diane Eagleson, Todd Kipfer, and John Varley of the Big Sky Institute, Montana State University, have graciously provided essential staff support for stream resident cutthroat trout restoration and coordination of the Fly Fishing Volunteer Program. We also appreciate the support and guidance for our cutthroat trout restoration activities from Lee Nelson, Don Skaar, and Ken Staigmiller, Montana Fish, Wildlife and Parks; and Dale White, Gallatin National Forest. Special thanks to Jim Magee and Austin McCullough of Montana Fish, Wildlife and Parks for helping us determine the suitability of upper Grayling Creek for fluvial Arctic grayling.

Cathie Jean, Tom Olliff, Kristin Legg, and the Greater Yellowstone Network have been instrumental in the development and funding of the park's water quality monitoring program.

Tim Bywater, William Voigt, and Joanne Voigt once again did an outstanding job coordinating the Fly Fishing Volunteer Program and safely guided volunteers from across the country to waters within the park.

Many other people from within Yellowstone National Park contributed to the success of Fisheries Program activities; unfortunately, we cannot mention them all here. However, we would like to especially thank Ben Cunningham, Dave Elwood, Tim McGrady, Travis McNamara, Alison Schyler, and Wally Wines from Corral Operations; Wendy Hafer from the Fire Cache; Phil Anderson, Greg Bickings, Earl McKinney, Bruce Sefton, Art Truman, Mark Vallie, Lynn Webb, and Dave Whaley from the Lake Garage; Dan Reinhart from Resource Management; Rick Fey, Brad Ross, and Kim West from the South District Rangers; and Bonnie Gafney, Michael Keator, and Jessica Knoshaug from the West District Rangers. Randy and Sharon Nador served as West District VIPs and greatly assisted with operations at Specimen Creek.

Special thanks to our dedicated fisheries technicians and volunteers for their contributions to our program.

NPS/T. KOEL

NPS Trails Program Packer Tim McGrady preparing for a trip up East Fork Specimen Creek, 2009.

The accomplishments of 2009–2010 would not have occurred without your hard work and tireless efforts!

The Student Conservation Association (SCA) and Montana Conservation Corps MCC) have allowed for the incorporation of many people into the day-to-day activities of the Fisheries Program. Our projects would not be completed without the dedicated support of SCA and MCC.

The Fisheries Program is supported through Yellowstone Center for Resources base funding and a portion of the fees collected from anglers who purchase fishing permits. In 2009–2010, additional funding was received from these sources:

- Yellowstone Park Foundation, through the Fisheries Fund Initiative and Fly Fishing Volunteer Program
- National Fish and Wildlife Foundation
- Greater Yellowstone Network, Vital Signs Monitoring Program of the National Park Service
- Recreational Fee Demonstration Program of the Federal Lands Recreation Enhancement Act
- Greater Yellowstone Coordinating Committee
- Park Roads and Parkways Program of the Federal Highway Administration
- Trout Unlimited
- US Geological Survey, Biological Resources Division, Biological Research for the Parks

We would like to extend special thanks to the Yellowstone Park Foundation board and staff, and to the many private individuals who have graciously provided support for our critical fisheries projects in the park.

This report is made possible only by the dedicated work of the Science Communication Office, Yellowstone Center for Resources. Special thanks to Virginia Warner, Mary Ann Franke, Paul Super, Janine Waller, and Emily Yost, for making this report a reality.

Literature Cited

Behnke, R. J. 2002. *Trout and salmon of North America*. New York: The Free Press.

Boutelle, F. A. 1889. Supplemental report of the Superintendent of the Yellowstone National Park. Washington, D.C.: US Government Printing Office.

Jordan, D. S. 1891. A reconnaissance of streams and lakes in Yellowstone National Park, Wyoming in the interest of the US Fish Commission. *Bulletin of the US Fish Commission 9* (1889):41–63.

Koch, E. D., and C. R. Peterson. 1995. *Amphibian and reptiles of Yellowstone and Grand Teton national parks.* Salt Lake City, Utah: University of Utah Press.

Koel, T., J. Arnold, P. Bigelow, and M. Ruhl. 2010. Native fish conservation plan/environmental assessment. National Park Service, Yellowstone National Park. 380 pp.

Koel, T. M., and J. York. 2006. Restoration of westslope cutthroat trout in the East Fork Specimen Creek Watershed. Environmental Assessment. National Park Service, US Department of the Interior, Yellowstone National Park. May 5, 2006. 82 pp. and appendices.

York, J. and T. Koel. 2006. Finding of No Significant Impact (FONSI). Restoration of westslope cutthroat trout in the East Fork Specimen Creek Watershed. Environmental Assessment. Yellowstone National Park, Idaho/Montana/Wyoming. June 30, 2006. http://parkplanning.nps.gov

Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M.E. Ruhl. 2008. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2007. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2008-02.

Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M.E. Ruhl. 2010. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2008. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2010-03.

Leopold, A. S., S. A. Cain, C. M. Cottam, I. N. Gabrielson, and T. L. Kimball. 1963. Wildlife management in the national parks. Transactions of the North American Wildlife and Natural Resources Conference. Volume 28.

National Park Service (NPS). 2006. NPS management policies 2006. National Park Service, US Department of the Interior. 274 pp. <http://www.nps.gov/policy/MP2006.pdf>.

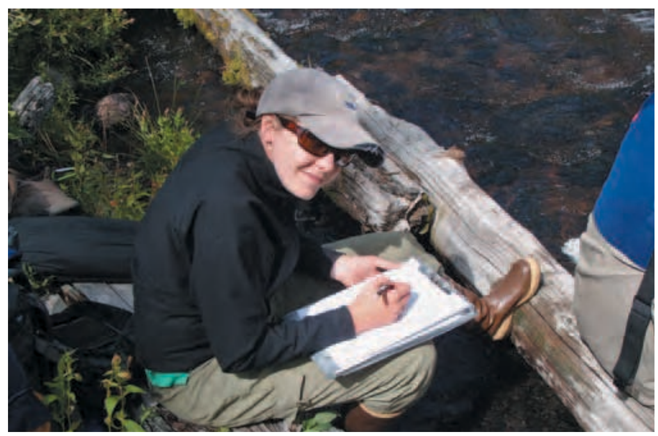
Ruzycki, J. R. 2004. Impact of lake trout introductions on cutthroat trout of selected western lakes of the continental United States. Ph.D. dissertation. Utah State University. 151 pp.

US Fish and Wildlife Service. 1998. National Wetlands Inventory data. http://wetlandsfws.er.usgs.gov/NWI.

Varley, J. D. 1979. Record of egg shipments from Yellowstone fishes, 1914–1955. Information paper no. 36. Yellowstone National Park. 45 pp.

Varley, J. D. 1981. A history of fish stocking activities in Yellowstone National Park between 1881 and 1980. Information paper No. 35. Yellowstone National Park. 94 pp.

Varley, J. D., and P. Schullery. 1998. *Yellowstone fishes: Ecology, history, and angling in the park.* Mechanicsburg, Pa.: Stackpole Books, 154 pp.



NPS/J. ARNOLD

National Park Service Biological Science Technician Jamie Kilgo records data for long-term water quality monitoring, 2009.

NPS/T. KOEL

National Park Service resource management staff, including Margie Fey (left), Sharon Gerot, and Pat Perrotti, conduct an inspection for aquatic nusiance species prior to placing the contract netting boat in Yellowstone Lake, 2009.

Appendices

Appendix i. Fish Species List

Native (N) and introduced (nonnative or exotic; I) fish species and subspecies known to exist in Yellowstone National Park waters including the upper Missouri River (Missouri, Madison, and Gallatin rivers), Snake River (Snake), and Yellowstone River (Yellowstone) drainages

Family	Common Name	Scientific Name	Status	Missouri	Snake	Yellowstone
Salmonidae	Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Native	I	N	N
	westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Native	N	—	—
	finespotted Snake River cutthroat trout	*Oncorhynchus clarki behnkei**	Native	—	N	—
	rainbow trout	*Oncorhynchus mykiss*	Nonnative	I	I	I
	mountain whitefish	*Prosopium williamsoni*	Native	N	N	N
	brown trout	*Salmo trutta*	Exotic	I	I	I
	eastern brook trout	*Salvelinus fontinalis*	Nonnative	I	I	I
	lake trout	*Salvelinus namaycush*	Nonnative	—	I	I
	Arctic grayling	*Thymallus arcticus montanus*	Native	N	—	I
Catostomidae	Utah sucker	*Catostomus ardens*	Native	—	N	—
	longnose sucker	*Catostomus catostomus*	Native	—	—	N
	mountain sucker	*Catostomus platyrhynchus*	Native	N	N	N
Cyprinidae	lake chub	*Couesius plumbeus*	Nonnative	—	—	I
	Utah chub	*Gila atraria*	Native	I	N	—
	longnose dace	*Rhinichthys cataractae*	Native	N	N	N
	speckled dace	*Rhinichthys osculus*	Native	—	N	—
	redside shiner	*Richardsonius balteatus*	Native	—	N	I
Cottidae	mottled sculpin	*Cottus bairdi*	Native	N	N	N

* Scientific name suggested by Behnke (2002), *Trout and Salmon of North America* (New York: The Free Press), and not currently recognized by the American Fisheries Society.

NPS/J. BUNN

Hickey Brothers Fisheries LLC supplement the NPS lake trout suppression efforts on Yellowstone Lake.

NPS/T. KOEL

Hickey Brothers Fisheries personnel Todd Stuth and Steve Warwick set the lead line for one of the trap nets set near Breeze Point in Yellowstone Lake.

Fisheries program staff at Lake for seasonal orientation in May 2010. Left to right: Todd Koel, Jacob Boone, Hanna Gunderman, Sean Lewandowski, Rance Schreibvogel, Kole Stewart, Patrick Jarrett, Angie Brison, (back) Brian Ertel, (front) Pat Bigelow, Kevin Keretz, Phil Doepke, Mike Ruhl, Jeff Arnold, Kate Olsen, Mike Consolo, Chelsey Pasbrig, Jason Bunn, and Earl Drescher.

Appendix ii. Seasonal Staff

Name	Year
Adams, Rebecca	2009
Brodbeck, Amy	2009
Bunn, Jason	2009, 2010
Bywater, Tim	2009, 2010
Consolo, Mike	2010
Drescher, Earl	2010
Dumond, Paul	2009
Firmage, David	2009
Gunderman, Hanna	2009, 2010
Jarrett, Patrick	2010
Kilgo, Jamie	2009
Lewandoski, Sean	2010
Lohmeyer, Adam	2009, 2010
Olsen, Kate	2009, 2010
Pasbrig, Chelsey	2010
Rupert, Derek	2009
Skorupski, Joe	2009
Stewart, Kole	2010
Voigt, William	2009, 2010

Appendix iii. Long-term Volunteers

Year	Name
2009	Barltett, Todd
	Broshears, Chester
	Consolo, Mike
	Crouse, Alexander
	Dodge, Caitlin
	Goldfarb, Benjamin
	Hasselgren, Erinn
	Isbell, Sarah
	Lewandowski, Sean
	Olsen, Samantha
	Williams, Emily
2010	Bastian, Emily
	Boone, Jacob
	Brison, Angie
	Caskey, Alex
	Droney, Ryan
	Finney, Courtney
	Golden, Rachael
	Hansen, Bradley
	Horwath, Sarah
	Keretz, Kevin
	King, Rachel
	LaCivita, Garrett
	Schreibvogel, Rance