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.

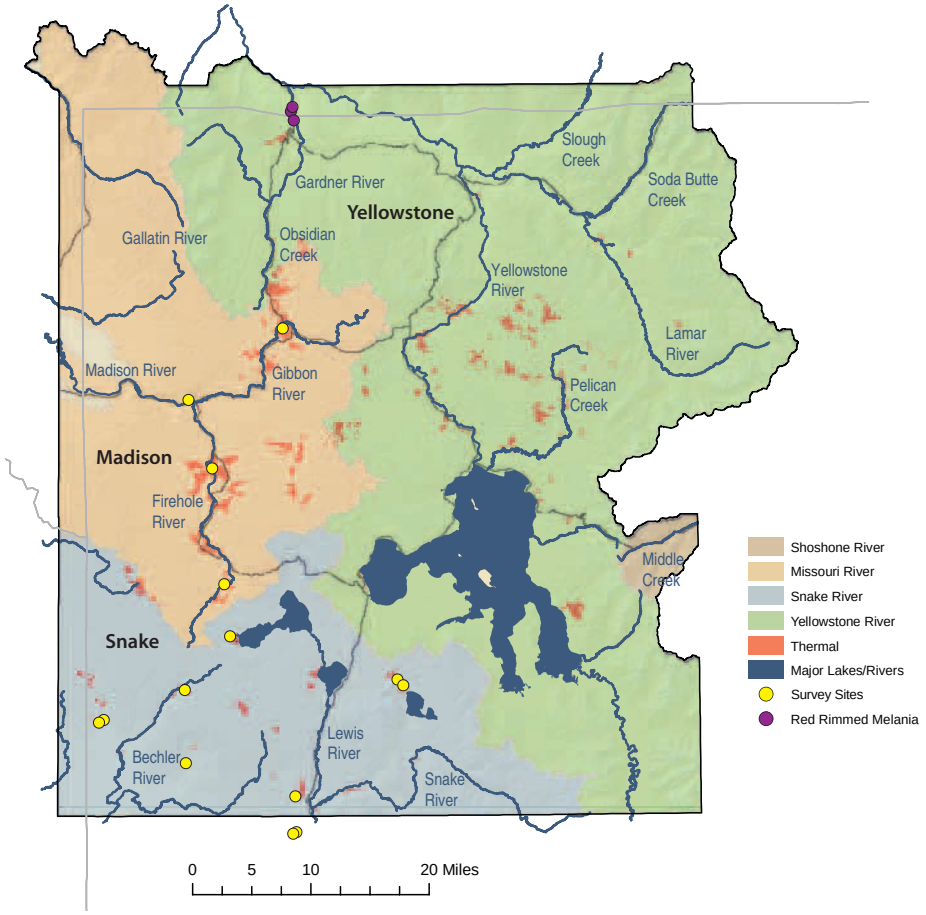

Figure 10. Sites surveyed for red-rimmed melania and other aquatic species during 2010.

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

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.

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.

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%.

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

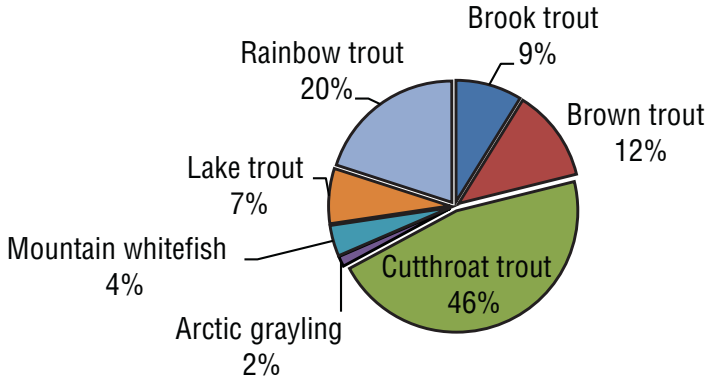

Figure 11. Native cutthroat trout remained the most sought after and caught fish species by anglers in 2010, comprising 46% of all fish caught in Yellowstone National Park.

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.

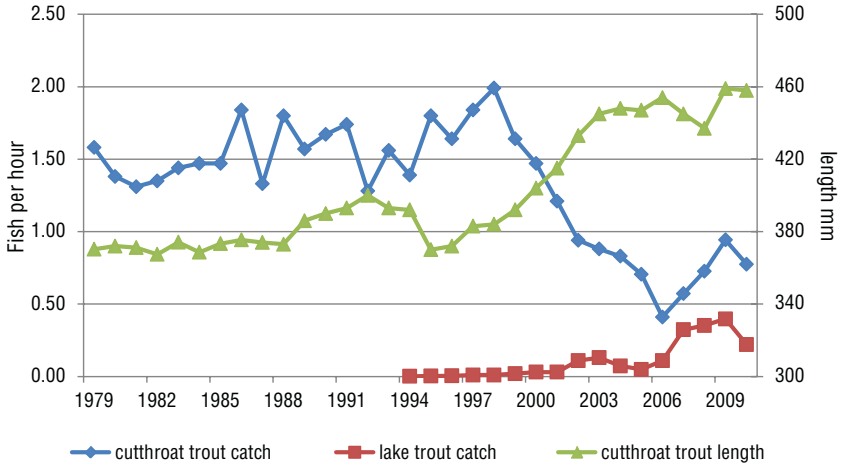

Figure 12. The 2010 angler-reported catch in Yellowstone Lake demonstrated a decrease in catch rates for both Yellowstone cutthroat trout and lake trout.

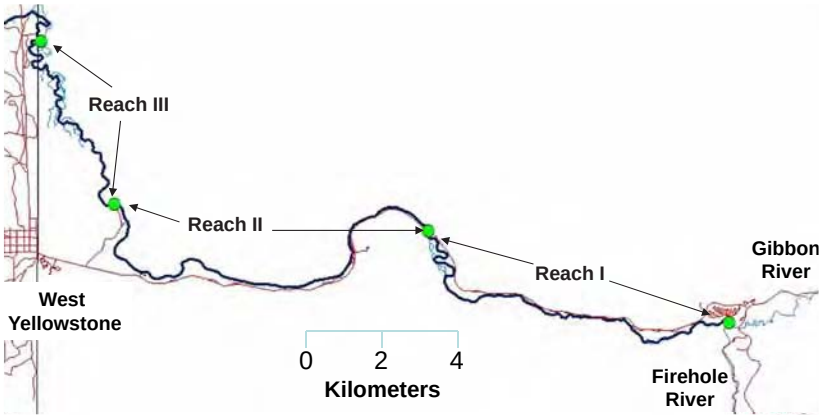

Figure 13. Reaches of the Madison River in Yellowstone National Park surveyed for fishes by raft-mounted electrofishing at night during October 2009.

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).

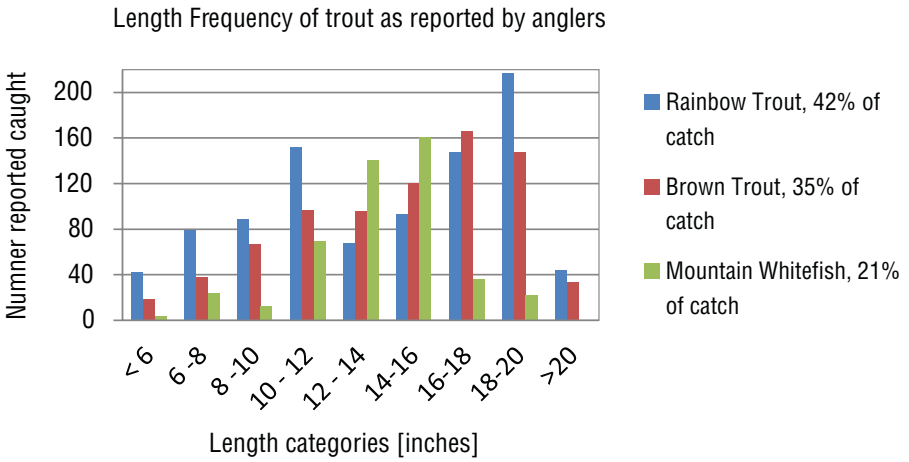

Figure 14. Length frequency of trout caught by anglers from the Madison River in 2009.

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.

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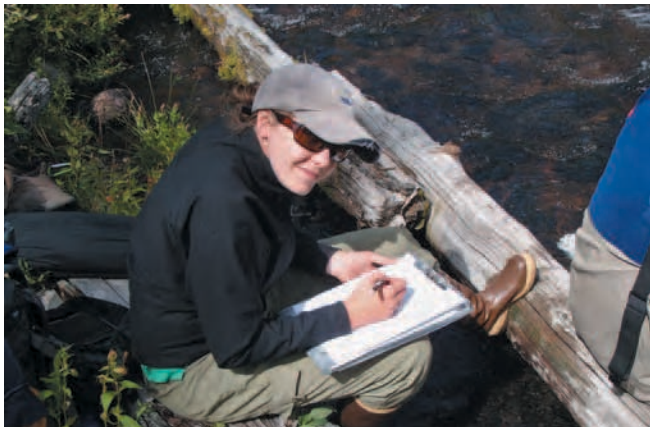

NPS/J. ARNOLD

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.


NPS

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