

YELLOWSTONE CENTER FOR RESOURCES



ANNUAL REPORT
2002
FISCAL YEAR

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FISCAL YEAR (OCTOBER 1, 2001, TO SEPTEMBER 30, 2002)



Yellowstone Center for Resources
National Park Service
Yellowstone National Park, Wyoming

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Photographs not otherwise marked are courtesy of the National Park Service.

Front cover: clockwise from top right, a possible McKean component precontact site; J.E. Stuart's "Old Faithful" oil painting; elk and a Druid pack wolf by Monty Sloan; Eastern Shoshone dancer by Sandra Nykerk; and center, peregrine falcon fledgling by Wayne Wolfersberger.

Title page: wolf #113, alpha male of the Agate Creek pack, attacking a cow elk. Photo by anonymous donor.

Back cover: Yellowstone cutthroat trout.

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Introduction

For 2002, the Yellowstone Center for Resources (YCR) annual report has changed from a calendar year to a fiscal year (October 1, 2001, to September 30, 2002) report. Some information in the 2001 report may therefore be recorded here as well. Please forgive the overlap as we make this transition. National Park Service funding appropriated by Congress is provided by fiscal year, and many of our projects are funded by competitive grants, all of which require fiscal year tracking of expenditures, personnel, and accomplishments, as well as annual reports. Fiscal year accomplishment reports are also required by the superintendent, and the regional and central offices. We hope this change will allow YCR staff to more easily, accurately, and efficiently report on projects for which money has been allocated by fiscal year (FY).

Highlights of FY02 include the celebration of the tenth year of the YCR's quarterly journal, *Yellowstone Science*, which publishes articles on many aspects of Yellowstone's natural and cultural resources. Its circulation has grown to nearly 2,500 individuals and institutions across the United States and around the world. The Research Permit Office authorized 278 research permits to investigators who came from almost every state in the Union as well as six foreign countries. The first-ever servicewide EIS was drafted in FY02 for release in 2003. It evaluates how best to manage benefits-sharing arrangements with the small number of park-permitted researchers who are characterized as bioprospectors.

A volunteer fly-fishing program was established to use catch-and-release angling as a capture technique to gather biological information on fish populations throughout the park. The paleontology program continued to grow, with several important surveys completed in 2002. In an unusual show, Steamboat Geyser erupted twice. Grizzly bear recovery parameters were met again in 2002, and have now been achieved every year since 1998. Wolves also met the minimum population size as outlined in the recovery plan for the third successive year, but delisting cannot proceed until approved state management plans are in place.

The North Entrance Road and the Mammoth Hot Springs Historic District were listed on the National Register in FY02 after several years of effort. A long-awaited ethnographical report, *American Indians and Yellowstone National Park: A Documentary Overview*, by Peter Nabokov and Lawrence Loendorf was published in FY02. The remainder of the Susan and Jack Davis Collection, consisting of approximately 10,000 postcards, was acquired by the park, and the Davis Collection will move into the new Heritage and Research Center in 2004 for all to enjoy.

We hope this report continues to assist us in attaining the goals of the YCR, which are to provide outreach, contribute to literature, promote interpretation, and most of all, strive to learn more about the resources we are mandated to manage and protect. For more information about specific topics of interest, readers may contact us at (307) 344-2203 or visit the park's web site at www.nps.gov/yell. For some projects, additional information may be available in technical publications or special reports (see *Appendix II*).



John D. Varley
Director, Yellowstone Center for Resources



An elk herd moves in response to pressure from the Leopold pack.

Part I. Resource Highlights

WOLF—CARNIVORE INTERACTION STUDIES

The reintroduction of wolves into Yellowstone National Park (YNP) has provided an opportunity to examine interactions among a full suite of carnivores and their prey. Preliminary evidence from concurrent field studies focusing on the park's large carnivores (wolves, cougars, grizzly bears, and black bears) already suggest that these interactions have significant effects on carnivore community structure, population dynamics, and prey population impacts. Collaboration between YCR wildlife teams (Bear Management, Ungulate Project, Bison Ecology and Management) and interagency (Interagency Grizzly Bear Study Team; Montana Fish, Wildlife and Parks) researchers has already been productive in pursuing science-based questions on multi-carnivore relationships. The use of new technologies such as GPS telemetry collars will advance our ability to understand the carnivore community and its interactions, as well as their impact on prey populations.

In fall 2002, a manuscript was submitted to a peer-reviewed scientific journal describing the activities of humans and carnivores on YNP's northern boundary prior to, and during, the fall elk hunting season. The study monitored the movements of grizzly bears, wolves, and cougars in a 2,391-km² study area centered on YNP's northern range and the Absaroka-Beartooth Wilderness. Grizzly bears were more likely to be located inside the YNP boundary during the pre-hunt period and north of the boundary once hunting began. Cougars tended to be found outside the park during the pre-hunt period and moved inside the park when hunting began. Wolves did not significantly change their movement patterns during the pre-hunt and hunting periods. Qualitative information on elk indicated that prey moved into the park after hunting began, suggesting cougars followed living prey, bears focused on dead prey (gut piles and crippled elk), and wolves may have taken advantage of both.

In addition, project staff are documenting wolf–grizzly interactions in order to examine the population- and community-level consequences that result from their behavioral interactions. The most common interactions between wolves and grizzly bears involved wolves and bears in the same area (34%), followed by bears defending kills from wolves (19%; probably wolf kills usurped by bears) and bears usurping wolf kills (19%). Interactions most often occurred at kill sites (66%). Most encounters were won by bears (40%), or the winner could not be determined (40%), even though wolves outnumbered bears during 76% of the interactions. Adult bears without cubs were involved in 88% of the encounters.

THERMOPHILE INVENTORY

The Yellowstone National Park Thermophile Survey is systematically documenting the diversity of microbes that live in the park's hot springs and other thermal features.

During April 2002, samples collected during Fiscal Year (FY) 2000 were analyzed, and DNA sequences for 70 organisms isolated, representing the thermophiles from 15 springs. In May, the survey modified its FY2000 protocols for site selection to remove sampling bias, and generated a list of 300 target sites for the summer. Between June and September, survey staff collected 216 samples, ranging in pH from 1.7 to 9.3, from 5 of the 12 major thermal areas. The park has added \$10,000 to complement U.S.G.S. Biologic Resource Management Division funding, allowing for the analysis of up to 100 samples in FY03.

VOLUNTEER FLY-FISHING PROGRAM

In 2002, a new program was established to incorporate fly-fishing volunteers and use catch-and-release angling as a capture technique to gather biological information on fish populations located throughout the park. The Volunteer Fly-fishing Program was coordinated by Dr. Timothy Bywater, an avid fly-fisherman and long-time supporter and promoter of Yellowstone's fisheries. Questions addressed included:

- determination of the range of hybridized Yellowstone cutthroat trout in the Lamar River and its major tributaries;
- documentation of the Pebble Creek fishery;
- status and genetic uniqueness of brook trout in special regulation lakes;
- status and genetic uniqueness of westslope cutthroat trout in Grayling Creek; and
- documenting the status and movement patterns

of grayling originating in Grebe and Wolf Lakes of the Gibbon River system.

The program was incredibly successful, as 40 volunteer anglers from across the U.S. participated as an active component of the Aquatics Section. Solid bonds have been developed between the angling community and the Yellowstone fisheries biologists. Volunteers were able to experience first-hand many fisheries issues, and biological data has been collected that will assist in understanding the park's fisheries status. The program suffers from a complete lack of funding, and support is actively being sought to continue this valuable work.



The park's volunteer fly-fishing program is increasing the amount of biological and population information available to aquatics staff.

YELLOWSTONE CONTINGENT MEETS AFFILIATED SIOUX TRIBES IN SOUTH DAKOTA

From October 14 to 19, 2002, Yellowstone staff conducted their first government-to-government meetings away from the park at locations where affiliated tribes live and could easily attend. The first meeting, at Pierre, South Dakota, was centrally located enough to enable 30 representatives from affiliated Sioux tribes to attend. Tribes participating included the Cheyenne River, Flandreau Santee, Lower Brule, Oglala, Sisseton–Wahpeton, Spirit Lake, and Yankton Sioux Tribes.

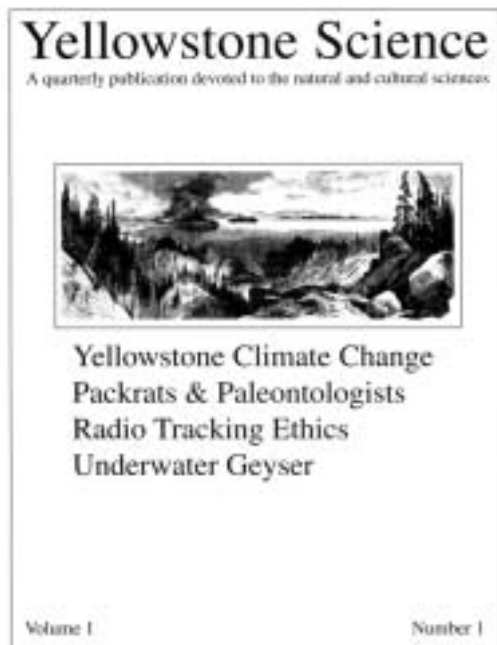
In the days following the meeting, the Yellowstone contingent, consisting of the assistant superintendent, YCR director, cultural resources branch chief, bison biologist, and cultural anthropologist, traveled to the reservations of the Cheyenne River, Lower Brule, and Oglala Sioux Tribes to meet with tribal members at their request. At the meeting with members of the Oglala Sioux Tribe, the Grey Eagle Society gave Assistant Superintendent Frank Walker and Yellowstone National Park a star quilt with a white buffalo in the center of it. YCR Director John Varley was given a red, white, and blue star quilt.

The purpose of the travel, as well as visits to tribal homelands, was to allow park managers to become better acquainted with individual tribes and

their various issues, and to explore opportunities to work with tribes in areas of mutual interest. At each local meeting, NPS managers discussed the park's management philosophy, provided information, answered questions, and received suggestions from tribal members in regard to what might be done to foster mutual interests. Transcripts of all meetings can be obtained by contacting cultural anthropologist Rosemary Sucec at rosemary_sucec@nps.gov.

TEN YEARS OF *YELLOWSTONE* SCIENCE

In 2002, the quarterly journal *Yellowstone Science* celebrated its tenth year with a variety of articles highlighting many aspects of Yellowstone's natural and cultural resources. With generous financial support from the Yellowstone Association and its loyal readers, its circulation reaches nearly 2,500 individuals and institutions across the United States and around the world. Issues this year featured interviews with Jack and Susan Davis (including color photographs of their Yellowstone memorabilia collection), Dr. Cathy Whitlock on her work coring Crivice Lake, and Kenyan conservationist Richard Leakey. Among the feature articles showcased in FY2002 were stories on Native Americans and geysers, Yellowstone's red fox, the 2001 Christmas bird count, a reprint of the conclusions and recommenda-



The quarterly journal *Yellowstone Science* celebrated its tenth year in 2002.

tions section of the National Research Council's report on the northern range, and an historical treatment of Theodore Roosevelt and his views on predator control in Yellowstone.

TRILOBITE POINT PALEONTOLOGIC INVENTORY

Organization, staging, and execution of a week-long paleontological survey of the Middle Cambrian exposures at Mount Holmes' Trilobite Point were accomplished, with fieldwork completed the last week of August 2002. The study area was chosen because of the rarity of the Middle Cambrian exposures in YNP, the previously undocumented namesake fossil resources (trilobites), and because of previous notoriety received by the location from visits by preeminent scientists such as W. H. Holmes and C. D. Walcott. The prospect of conducting a paleontological survey near the summit of Mount Holmes, deep in grizzly country, was discussed with the Yellowstone Park Foundation (YPF) staff and board members in June 2002. With YPF support, research on the fossil locale was organized and conducted.

A multi-disciplinary team, including a variety of trilobite and Middle Cambrian experts, participated in the project. Trilobite-bearing sediments were located within the first hour of fieldwork and within sight of camp. The remaining three days were spent locating and documenting numerous other fossil-bearing locations with abundant trilobites, brachiopods, and hyoliths. Photographs, GPS locations, field notes (including expert descriptions of the fossils *in situ*), field laboratory identification of the collected specimens, and descriptions of the fossil-bearing sediments were recorded. Field collections included numerous brachiopods, hyoliths, three genera of trilobites [*Agnostids*, *Ptycoperia*, and *Crepacephalis*], and trace fossils (worm casts). The inventory teams were efficient and successful, and everyone got to the top of the mountain and back again safely.

Post-fieldwork activities are ongoing, and include the sorting of fossils by type and degree of preservation. The identification of collected specimens and analysis of their significance is currently underway. Well-known trilobite experts Arvid Aase, team member, and Dr. Pete Palmer, retired from the Smithsonian, will provide identification and analysis of those fossil species. Dr. Ronald Shimik, marine biologist and Montana State University professor,

has agreed to look at the brachiopods and hyoliths. A graphic artist has completed measured drawings of two genera of trilobites. Other collected specimens have been photographed with the aid of a microscope and digital camera. After identification, the fossils will be cataloged into the museum collection and available, at a later time, for research and educational purposes. Site forms have been completed on the fossil localities identified in the inventory area. Maps, photographs, and location information on each locality will be added to YNP's fossil inventory files and fossil database maps.

After analysis is complete, the inventory report will be compiled, providing detailed descriptions of the project and the results. It is hoped that the project will be presented at the Geological Society of America's conference next spring. The report should be completed by June 30, 2003.

ENVIRONMENTAL PLANNING FOR A REMOTE VACCINATION PROGRAM FOR BISON

The premise for a decision on whether or not to implement a remote delivery vaccination program for brucellosis in park bison will be based on the criteria set forth in the *Record of Decision (ROD) for Bison Management for the State of Montana and Yellowstone National Park*. Evaluation of the environmental consequences of a safe and effective remote delivery system were deferred in the 2000 ROD. A contract was initiated in August 2002 to assist YNP in developing a public scoping process for this next decision in bison management. The contract was awarded to Greystone Environmental Consulting. An initial meeting to outline the work to accomplish was conducted in October 2002.

One of the objectives of the Interagency Bison Management Plan is to protect livestock from the risk of transmission of brucellosis from bison. By further reducing the sero-prevalence rate in bison, the risk of transmission could be reduced from a low probability to an even lower probability. Thus, the remote vaccination of eligible bison with an effective and safe vaccine would contribute to a decrease of sero-prevalence in the population. In addition, a parkwide vaccination program could be a first step toward eventual elimination of the bacteria in Yellowstone's bison population.



Laughing gull.

NEW BIRD FOUND IN PARK

One new bird species was added to the Field Checklist of Birds of Yellowstone National Park in 2002. On August 9, 2002, park ornithologist Terry McEneaney observed a laughing gull (*Larus atricilla*) in first summer-second winter plumage on Yellowstone Lake. This marks the first laughing gull record for Yellowstone National Park. Laughing gulls are typically found east of the Mississippi River, but primarily occur along the East Coast and the Gulf of Mexico, with a population segment that ventures into the Gulf of California. Photographs were taken of this bird to accompany the detailed written documentation.

MAMMOTH HOT SPRINGS HISTORIC DISTRICT LISTED ON NATIONAL REGISTER

After several years of effort, the Mammoth Hot Springs Historic District was listed on the National Register on March 20, 2002. The nomination was originally prepared by Front Range Research Associates, Inc., and revised by former park historic architect Lon Johnson. The district includes 189 buildings, including today's Albright Visitor Center (Building #1, the former Bachelor Officers' Quarters); the original Army Post Headquarters (Building #8, currently used for park housing); the Mammoth Hotel, Recreation Hall, and the H.W. Child (Executive) House, all of which were designed

by Robert Reamer, who also designed the Old Faithful Inn; and the former Haynes Picture Shop/House, Headquarters, and Warehouse/Stockroom buildings, built by Jack Ellis Haynes, the early concessioner—provider of pictures, post cards, film, and guidebooks in the park. Three additional sites are included in the district, including the Mammoth Campground—one of the earliest designed auto campgrounds in a national park—the former U.S. Army parade ground, and the flagpole, which is a remnant of a once-taller pole that flew the stars and stripes over Fort Yellowstone. The historic district overlays the proposed Fort Yellowstone National Historic Landmark, which was recommended for listing in late 2002, but not acted upon by year's end.

WILDLIFE RESEARCH

In 2002, the YCR's Wildlife Resources Team initiated several research projects, including the following:

- a comprehensive analysis of trumpeter swan population dynamics based on a 62-year data set;
- evaluation of the effects of fire on vegetative foods used by grizzly bears, and estimation of the portion of fish in grizzly diets using estimates of mercury content in bear hair;
- studies of bison spatial ecology to identify effects of winter use by park visitors and identify bison travel corridors;
- collaboration with Dr. Charlotte Quist, Wildlife Health Associates, Inc., to evaluate penetration and wound characteristics resulting from the impact of a biodegradable polymer bullet to be used for brucellosis vaccination of free-ranging bison;
- collaboration with Dr. Dave Grainger, Colorado State University microbiologist, to improve effectiveness of delivery of *Brucella* vaccine deployed in bio-bullets used for vaccinating bison. This project is studying creative ways to package live vaccine through a photopolymerization process; and
- continued lynx surveys and research on wolf-prey interactions, wolf population dynamics and demographics, and multi-trophic level effects of wolves.



Planning efforts for the park's new Heritage and Research Center were completed this year. The center is scheduled to begin operations in 2004.

Part II. Cultural Resource Programs

This year, the Branch of Cultural Resources, the Branch of Planning and Compliance, and the Maintenance Division together completed planning and design for a new collections storage facility. By the end of the fiscal year, a contract had been issued for construction of the Yellowstone Heritage and Research Center, which will house the majority of the park's museum, archives, and library collections. Two of the park's historic districts—Mammoth Hot Springs and the North Entrance Road—were formally listed on the National Register of Historic Places, and interested readers received a long-awaited publication, *American Indians and Yellowstone National Park: A Documentary Overview*. Archeologists completed salvage excavation of the park's oldest known precontact site at Osprey Beach on the shores of Yellowstone Lake, and also excavated a multi-layer archeological site that yielded important new information and artifacts from the Black Canyon of the Yellowstone River. New acquisitions for the park's museum, library, and archival collections included the only known scrapbook from any of Howard Eaton's 1912–1914 trips through the park, a 1940s-era park bus driver's uniform, an 1885 James Everett Stuart painting of Old Faithful, and Colonel Frank Triplett's 1883 book, *Conquering the Wilderness*.

Cultural resource staff regularly provide advice and input to park staff on the value of historic and prehistoric resources and how proposed activities might affect them. Much of this consultation occurs in order to comply with laws such as the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA). The branch chief continued to serve as a member of the park's Resource Council and the Research Permit Review Committee, where she reviewed and commented on project proposals from all disciplines in the park. The historic architect, archeologist, cultural resources technician, historian, and branch chief all represented historic preservation concerns on a variety of new or ongoing projects discussed in 2002: completion of plans and an environmental assessment for the new Yellowstone Heritage and Research Center; plans to construct a new Old Faithful Visitor Education Center; rehabilitation of the Old

Faithful Inn “Old House;” rehabilitation of an historic cavalry stables, building #38, and associated placement of a temporary structure in the Mammoth Hot Springs Historic District to accommodate the offices of employees displaced from that structure; seismic retrofit of the main park administration building #36; the draft Wildland-Urban Interface Fuels Management Plan and Environmental Assessment; preliminary proposals for a new Canyon Ranger Station and a new or relocated and adapted West Entrance Station; and a variety of smaller projects such as proposed backcountry trail re-routes.

The branch included 17 employees throughout the year, who worked on programs to address archeology, ethnography, history, historic structures, and museum collections. The authorized base budget allocation was \$429,200, while additional support came from the Yellowstone Association (\$75,437), including near-total support of the library operation and new acquisitions; the Federal Lands Highway Program (\$124,800); the Recreation Fee Demonstration Program (\$10,122); the Yellowstone Park Foundation (\$85,000 for archeological excavation); and NPS Special Emphasis Program Allocation System (SEPAS) funds (\$198,700).

The branch chief continued to assist park managers in developing a Business Plan. In 2002, she and writer-editor Mary Ann Franke re-worked drafts produced during Superintendent Mike Finley’s tenure for the acting and new park superintendents.

New additions to Yellowstone’s staff this year included Rosemary Sucec, who held previous temporary positions at the Intermountain Regional Office and Yellowstone prior to becoming the park’s first full-time cultural anthropologist, and Herb Dawson, who came with much experience at both the Montana and Wyoming State Historic Preservation Offices to become the park’s new historic architect. The park was especially grateful to Harpers Ferry National Historic Park for their cooperation in detailing Nancy Hatcher as acting museum curator.

ARCHEOLOGY

Park archeologist Dr. Ann Johnson and her staff, along with cooperators from the Museum of the Rockies and the Office of the Wyoming State Archaeologist (OWSA), completed intensive inventory of 3,325 acres, and documented 155 new sites. A major salvage excavation project at Osprey Beach,

supported by private donations, resulted in new and exciting information about one of the oldest known archeological sites in the park. Dr. Johnson and park managers are especially grateful for the many volunteers who participated in summer fieldwork and assisted during winter by cataloging artifacts from earlier projects and organizing collections for storage. Volunteers made great progress cataloging the Fountain Soldier Station investigations, and only 12 boxes remained to be cataloged and entered into the Re-Discovery cataloging program at year’s end.

Dr. Johnson also worked with park rangers on archeological resource protection, and the number of arrests for unauthorized collection of artifacts jumped in 2002. Alert law enforcement rangers stopped four individuals or groups with archeological specimens. These cases were brought to court and four offenders were fined between \$600 and \$1,400 each for their crimes; one offender was banned from the park for several years. Several other cases remained under investigation at the end of the year.

National Historic Landmark Properties

The park archeologist submitted a biennial report on the status of Obsidian Cliff National Historic Landmark, concluding that it was in generally good condition. She reported that efforts by park rangers to contact visitors and close the steep cliff face along the park’s Grand Loop Road to climbing had resulted in a decrease in erosion and loss of vegetation, which helps screen and protect obsidian chunks from collectors. At the request of NPS Intermountain Regional Office staff, she also reported on the condition of the Hagan Site in eastern Montana, with which she had familiarity from previous archeological work done across the region. She recommended that both landmarks be on the NHL “watch” list, as opposed to being actively threatened or endangered.

Field Inventories

Archeologists inventoried along both sides of the Madison River from the park boundary to Seven Mile Bridge, near the West Entrance Station and the Bechler Ranger Station, along the Yellowstone Lake shore, and along backcountry trails in the southwest corner of the park.

Shoreline inventory on Yellowstone Lake identified a number of Cody Complex artifacts (primarily Scottsbluff and Cody knives) and a Haskett point. Haskett points date at about 10,000 before present (B.P.) (500 years older than the Cody Complex), and represent an Intermountain cultural group.

The cooperators inventoried a loop of backcountry trails from the park boundary to Union Falls in the southwest corner of the park. This was an area without any previous archeological inventory. Investigators identified four prehistoric campsites and collected obsidian specimens for source analysis. Sources to the south of the park dominated the results.

Historic roads and bridges.

Tower to Canyon.—The Office of the Wyoming State Archaeologist conducted data recovery at the historic former Tower Fall Soldier Station (48YE163) in 2001, in accordance with the ongoing road reconstruction program in the park. While preparing their initial report, archeologists realized that the features excavated did not match what was expected from the magnetic map they had previously produced. They re-investigated that site in 2002 and excavated a historic trash pit in an area that will be affected by road reconstruction. Using historic photographs, researchers located the foundation remains of a structure not previously recorded, providing a much better understanding of the site. At year's end, they were still preparing their data recovery report.

Norris to Golden Gate.—OWSA crews conducted an inventory of proposed stockpile and staging areas in the Bunsen Peak quarry and the Swan Lake Flat pit. They located historic and prehistoric archeological sites in the vicinity of both areas; documentation in the Swan Lake gravel pit site included the remains of a slaughterhouse and part of the park's earliest water diversion and aqueduct system (48YE754). The crew located the western boundary of ineligible historic and prehistoric site 48YE130 to assess its association with historic remains. In separate field surveys, a research crew from the Museum of the Rockies (MOR) identified the boundary of the buried prehistoric component of the historic Swan Lake Flat Wiley Camp, 48YE483, and completed site documentation for this complicated, multi-component site. They also documented a road construction-era dynamite bunker and stone hauling sled (stone boat) in the area.

East Entrance Road.—OWSA archeologists also surveyed and recorded several Euro-American sites on or near the previously abandoned (ineligible) segment of the East Entrance road in anticipation of possible disturbance for future

wetland reclamation projects associated with road reconstruction. Researchers documented four sites, two of which were 1930s-era road camps, another that was an early roadside lunch station, and the last a can/bottle dump associated with 1950s-era concession activities.

Canyon Rim drives.—Euro-American historic archeological sites located near the road in the Brink of the Upper Falls area include remnants of the early Canyon Ranger Station and several concessions facilities. OWSA documented these sites in 2002, and park historian Lee Whittlesey provided archival research on the development of the area and provided field assistance to help the archeologists locate the sites. The 2002 investigations clarified overlapping and previously misidentified site boundaries.

Lamar River Bridge.—OWSA investigated a block area around the Lamar River Bridge for historic and prehistoric archeological remains. Their report and site documentation forms will be available for review and comment in 2003.

Other secondary roads.—The Museum of the Rockies archeological crew inventoried the road corridor at Virginia Cascades Drive, Firehole Canyon Drive, and Firehole Lake Drive in anticipation of road repair and overlay. They found a possible McKean component precontact site along the Virginia Cascades Drive. Site documentation forms will be available in 2003 in anticipation of National Register testing to assess site composition and integrity.



A possible McKean component precontact site was discovered along the Virginia Cascades Drive.

Determinations of Eligibility

In 2002, Yellowstone National Park evaluated numerous archeological sites for eligibility on the National Register of Historic Places in association with the Federal Lands Highway Program. They included:

- 27 prehistoric sites, of which:
6 were determined ineligible, and
21 remain unevaluated pending subsurface or National Register testing.
- 1 historic site, which was ineligible (a non-contributing portion of an eligible site).
- 3 multiple-component sites,
1 for which prehistoric components were unevaluated, and
2 with ineligible historic components.

Salvage Excavations

Salvage excavations were carried out at two sites undergoing uncontrolled erosion. These efforts were possible because Dr. Johnson successfully competed for special funding from the NPS Cultural Resources Preservation Program (CRPP) to salvage Black Canyon sites, and also from the Yellowstone Park Foundation, who found donors to support the archeological excavation at Osprey Beach.

Osprey Beach. In August, Mack Shortt and his crew from the Museum of the Rockies undertook data recovery at an Early Precontact Period Cody Complex camp, the Osprey Beach locality, on Yellowstone Lake. This locality is part of the larger site 48YE409/410. John Albanese, a consulting geoarcheologist from Casper, Wyoming, visited the site during excavation, as did Dr. Ken Pierce of the United States Geological Survey. These experts agree that early people camped on the beach at this location some 9,000+ years ago.

Artifacts found include Scottsbluff points, Cody knives, retouched flakes, 2 end scrapers, tertiary obsidian flakes, and 12 sandstone abraders. Some of the abraders have broad grooves for use with shafts, and others are narrow for sharpening awls or grinding stone tool edges. Some have both broad and narrow grooves (see drawing, next page). Elsewhere in North America, no more than three shaft abraders had previously been found in a Cody Complex site. From the high number of flakes and abraders found at Osprey Beach, it appears that the users of the site were replenishing their tool kits.

The Teton County Historic Preservation Board donated funds for blood residue analysis on tools excavated by the researchers. Samples were tested using immunological analysis, a process often used to identify blood at modern crime scenes. The blood residues found matched the blood protein of bear, bighorn sheep, deer, rabbit, and some form of canid that could have been wolf, coyote, or fox. Interestingly, the results showed no evidence of bison, which until recently was thought to be a staple of the Cody Complex people's diet. This has caused archeologists to speculate that the early settlers at Osprey Beach in this intermountain area had a broader, less specialized economic orientation than pure bison hunting. It may also be the case that the bison population in the park in the several millennia immediately post-glaciation was low or absent, leaving hunters little choice but to hunt animals other than bison.

The Horner site, the Cody Complex type site, is near Cody, Wyoming. There were only two pieces of obsidian found in three seasons of excavation there. Archeologists from Shortt's team borrowed these specimens in fall 2002, and submitted them for obsidian sourcing. The base of a Scottsbluff point



Volunteers at the Osprey Beach site.

was fingerprinted to Obsidian Cliff, while a flake apparently comes from a currently unknown source. Since the Horner site and Osprey Beach were occupied about the same time, investigators wondered if one or two different groups of people used these sites. The vast majority of Horner site stone artifacts were made with stone from the Bighorn Mountains to the east of Cody, with very little coming from the

west. At Osprey Beach, the stone tool sources are from Yellowstone, Grand Teton, and eastern Idaho. These results suggest there were two groups of people, and that there was little contact between them.

Black Canyon of the Yellowstone River. NPS Cultural Resource Preservation Program funds were allocated beginning in late FY01 to salvage archeological sites subject to natural flooding and erosion of the Yellowstone River. Because the initial amount of funding available was small and notice came late into the field season, salvage work did not begin until the summer of 2002. The Museum of the Rockies crew also led these excavations.



Sandstone abrader.

Site 24YE353.—As the crew began work on this site, they knew there was a component dating to about A.D. 600 (Avonlea), and they hoped that there would be a deeper cultural horizon, perhaps associated with the McKean Complex (1,000–3,500 B.C.). They also hoped to find roasting pits because they often contain excellent information about foods and food processing. An 18-square-meter block excavation revealed a living floor at 40 cm below the surface, with mixed components of Avonlea, Pelican Lake (A.D. 200–1,000 B.C.), and McKean. Sites

tested further upriver had been used by more than one group. The benefit of a block excavation is that it exposes a broad surface and the relationships between artifacts and features, which results in easier and better interpretation of activities that created the site.

Due to time limitations, archeologists used a 1 × 4-meter trench to sample deeper sediments. Below 30 cm of sterile soil, researchers recovered a Haskett point (not to be confused with the one from Yellowstone Lake) from a 10-cm horizon with burned/unburned bone and flakes. They identified three additional cultural horizons with fire-cracked rock, burned/unburned bone, and flakes below the Haskett level, each clearly separated by sterile deposits. If radiocarbon dates support the identification of the Haskett point, then the three deeper campsites constitute the oldest archeological materials in the park.

As cataloging and some analysis were completed, archeologists recognized that this site is important for two reasons. Site 24YE353 contains the earliest components representing undisturbed camp remains—possibly the oldest thus far identified in the park. The upper 40 cm of the site also contain archeological fish bone and net weights. Both are rare finds in the park. Due to the mixed upper deposits, these cannot be assigned to one culture, but are assumed to be associated with the Avonlea or Pelican Lake components based on research done elsewhere (Glacier National Park, for example) that demonstrates association of these cultures with pre-contact fishing. Net weights are usually flat river stones with two or four notches that were presumably used to hold fishing nets in place, just as today's fisheries biologists use weights to keep their nets in the right locations. Researchers believe the large net sinker (shown, next page) was sized to keep a net in place in the strong current of the Yellowstone River.

Archeologists plan to return to site 24YE353 during summer 2003 for a better sample of the earliest components found in this location.

Site 24YE356.—In late summer, retired NPS resource manager Jim Sweaney reported eroding precontact hearths along the Yellowstone River. In September, archeologists excavated a 1 × 3-meter trench parallel with and back 0.3 meters from the eroding bank that included the back halves of the reported hearths. Bulk feature contents were submitted for macrofloral analysis, and this will identify the charcoal as to species. Researchers obtained two

radiocarbon dates. Feature 1 had a date of $1,310 \pm 60$ years B.P. (Beta-171262), and Feature 2 had a date of $1,620 \pm 60$ years B.P. For radiocarbon dating, “present” is A.D. 1950.

As the tops of the features were encountered within six cm (five inches) of the modern surface, scientists were surprised at the antiquity of the hearths. They believe the dates to be accurate, as they fall within the period containing 70% of all radiocarbon dates from the park. This suggests that there has been either little deposition in this area, or that erosion is removing the topsoil and exposing these cultural deposits. The latter is most likely, given the scatter of flakes in the general vicinity. Archeologists recommend that the site receive repetitive monitoring to identify and salvage other portions as they begin to be exposed by erosion.

TAH MADSEN



Fishnet weight.

Archeological fish bone at site 24YE26.—

Evidence for prehistoric fishing in the park is rare, and generally limited to a few bones and net weights found along the Yellowstone River at site 24YE353 (see above). Now, there is a new find of fish bone at another site. A few years ago, researchers tested another precontact campsite (24YE26) in the Black Canyon of the Yellowstone. As it turned out, this site contains four camps, one on top of another, and the one of interest here was made by people of the Pelican Lake culture, dating from 1,000 B.C. to A.D. 200. Researchers collected two samples of bone,

identified as probably fish, while soil was being screened. The larger of these bones is about $2.5 \text{ cm} \times 1 \text{ cm} \times 3 \text{ mm}$, and might be scrap except that the bone is largely whole with two exterior surfaces. This year, Yellowstone fish biologist Dan Mahony identified the bone as a cutthroat operculum, or gill cover.

Obsidian Sourcing

Dr. Ken Pierce of the U.S. Geological Survey estimates that there are more than 40 rhyolite flows in Yellowstone that contain obsidian. Of course, not all of these meet the requirements of size and quality needed for tool manufacture. Our goal is to identify the park's different obsidians, their geological sources, and the ones that were used by precontact people. Researchers have continued to submit obsidian and ash flow tuff samples for chemical fingerprinting with interesting results.

One of the possible uses for obsidian sourcing data from archeological specimens is to track the movements of prehistoric people. The model suggests that people collected stone of tool quality when they were in the vicinity of stone sources. These obsidian sources are both primary, such as Obsidian Cliff, where the raw material is collected from the site where it was originally created, and secondary, where tool stone has been moved from its original position. Water and glacial action are prime forces for creating secondary deposits.

Obsidian samples from site 48YE252 in the South Arm of Yellowstone Lake and from the 2002 trails inventory near Mountain Ash Creek (east of the Bechler River) came from known locales at Crescent H, Teton Pass, Conant Pass, Lava Creek Tuff, Packsaddle Creek, Park Point, and Obsidian Cliff. The first four sources are south of the park, near Jackson Hole, Wyoming. Packsaddle Creek is in eastern Idaho almost due west of Teton Pass. Park Point is on the Yellowstone Lake shore. These results support artifact-sourcing results from previous years, and show strong connections with archeological sites in the southern portion of the park and the Grand Teton area.

One interpretation of these results is that prehistoric people were moving seasonally from eastern Idaho into Jackson Hole, and then up to the south end of Yellowstone Lake. They would have returned to eastern Idaho for the winter. Another obvious conclusion is that the southern portion of Yellowstone has a very different pattern of use by people than the

northern portion of the park, where obsidians from Jackson Hole and eastern Idaho are rarely identified.

It is not unusual to have a secondary obsidian source (cobbles moved from their original location by gravity, water, or perhaps glaciers) contain two chemically different obsidians or ash flow tuffs. For example, Crescent H and Teton Pass obsidians are mixed in the Teton Pass area gravels. Through XRF fingerprinting of geological and archeological samples, researchers know that the Park Point area, on the eastern side of Yellowstone Lake, also contains two ash flow tuffs in secondary deposits. Prehistoric peoples utilized both to manufacture tools. Geologist Bob Christiansen's most recent map of Yellowstone's surficial geology shows the Park Point area as having Lava Creek Tuff deposits, but provides few clues as to the origin and age of the tuff known as "Park Point." Physically, Park Point Tuff is identical to Lava Creek Tuff, but it has dramatic chemical differences, especially with regard to barium and titanium, suggesting that it represents a distinct origin. Park Point Tuff is of currently unknown age and origin, and because of its typical inclusion cracks and flaws, never became more than a minor raw material source for the prehistoric manufacture of tools. The park's sampling efforts have identified a little mystery, and Dr. Johnson believes more extensive sampling is warranted to determine the range of chemical variation and distribution of the Park Point Tuff, which will help clarify the eruptive geological history of the park.

ARPA Investigations

Park archeologist Dr. Ann Johnson worked with the park's criminal investigators on several Archeological Resources Protection Act (ARPA) cases in 2002. On August 3, a pilot flying for a park research project reported seeing a suspicious vehicle off-road near Yellowstone's north boundary. When park rangers located the vehicle's two occupants, they discovered approximately 150 pounds of rocks, wood, plants, and several archeological artifacts in plain view through the back window. Although the driver initially insisted that the materials came from western Montana, when pressed he admitted to collecting many of the items in the park. On August 25, a park ranger observed a woman collecting archeological artifacts along the park's west boundary. Both cases were still awaiting resolution at the end of the year.

On September 1, 2002, a park ranger contacted a Gardiner, Montana, resident in possession of 100 mineral items and archeological artifacts. He was

charged with a misdemeanor ARPA violation and a CFR mineral resource violation. He later pled guilty before U.S. Magistrate Stephen Cole, who fined the man \$200, ordered him to pay \$900 in restitution, and placed him on one-year probation. On September 15, a ranger contacted a woman in possession of 227 mineral items and archeological artifacts. She faced similar charges, and Judge Cole sentenced her to one-year probation and ordered her to pay a \$700 fine and \$700 in restitution.

ETHNOGRAPHY

In summer 2002, Rosemary Sucec was converted from a temporary appointment to a permanent position as the park's cultural anthropologist, representing the park's commitment to this growing program. Six volunteers spent several hundred hours helping the park anthropologist with small research projects (including work with the photo archives); with filing, copying, arranging and hosting consultation meetings; and with data entry into the ethnographic resource inventory (ERI) and the database, which contains contact information for the park's 26 affiliated tribes and 54 bison-interested tribes. The latter is a dynamic database that requires continuous updating and data entry. Appreciation is extended to Irvin Blackie, Amanda Bramblett, Kristin Carlson, George Nell, Sandy Nykerk, and Doreen Packila for the reliable aid they provided this year.

Park officials broke ground this year in conducting government-to-government relationships with affiliated tribes by inaugurating a tradition of holding one of the park's two general consultation meetings at locations where affiliated tribes live and can easily attend. We also continued collaboration with several affiliated tribes in gathering oral histories about their ancestral presence in Yellowstone. Park staff continued a partnership with three tribes—the Confederated Tribes of the Colville Indian Reservation, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe—to cooperatively develop visitor education media for the Nez Perce (Nee-Mee-Poo) National Historic Trail in Yellowstone. The park and the three tribes will enter into a formal copyright agreement for one of the media, a 30-minute CD. This is a first for the National Park Service. A different project with the Confederated Salish and Kootenai Tribes is coming to a close. Under a cooperative agreement, they were funded to produce and finish a video entitled "Before Yellowstone," which provided a succinct

summary of their ancestral presence in what is now the park.

Another landmark event occurred this year when an elder of the Crow Tribe, also a descendant of the Mountain Crow, who seasonally camped in Yellowstone for more than 300 years, relayed relatively detailed knowledge that he retained from his annual visits here with his great grandfather, Comes Up Red. Grant Bulltail spent several days in the park, visiting about a dozen sites related to Crow history. Also, information on more than 70 resources was entered into the NPS ERI database for safekeeping and for resource management purposes. Finally, the report providing baseline information about American Indian histories with Yellowstone was published.

Intergovernmental Meetings

Spring consultation meeting at Yellowstone. Fifteen representatives from the Comanche Tribe, Confederated Salish and Kootenai Tribes, Crow Tribe, Eastern Shoshone Tribe, Kaibab Paiute Indian Tribe of Utah, Northern Cheyenne Tribe, and the Shoshone-Bannock Tribes attended the May 29–30 meeting. Representatives from the Intertribal Bison Cooperative (ITBC) also were present; ITBC represents more than 50 tribes across the nation, all owners of buffalo herds. Assistant Superintendent Frank Walker and other park staff (including YCR Director John Varley, Cultural Resource Branch Chief Sue Consolo Murphy, and Cultural Anthropologist Rosemary Sucec) were active participants in discussing the following issues:

- bison management and internship opportunities with this program at Yellowstone;
- an overview of and updates on the *National Elk Refuge and Grand Teton National Park Bison and Elk Management Plan/EIS*;
- brucellosis research and eradication by representatives from the U.S.D.A. Animal and Plant Health Inspection Service (APHIS);
- proposed development projects and road reconstruction in the park;
- management of Obsidian Cliff and wickiups;
- excavation of a Yellowstone lakeshore site;
- the new fee exemption policy for American Indian traditional and religious purposes;

- Heritage Center construction; and
- an open forum to hear from tribal representatives about issues of importance to them.

During the open session, tribal representatives expressed a desire to work with the park on a policy to allow collecting for traditional purposes. Assistant Superintendent Frank Walker responded that park staff would work with tribes to develop a process best for all concerned, one that is respectful of the NPS mission and simultaneously considers the obligations of the federal government toward Indian tribes.

On the second day, several attendees accompanied park staff on field trips. Rick Wallen of the bison management program led a group to see the park's bison herds. The other trip, to Obsidian Cliff National Historic Landmark, was led by YCR



Intergovernmental meetings were held both in Yellowstone and in South Dakota in 2002.

Director John Varley. Varley engaged those attending in a dialogue about ways to protect and interpret the site, given the importance of the place to Indians, and the fact that many people yearn to remove obsidian as souvenirs of the park.

To enable park staff, community members, and affiliated tribes to become better acquainted, YNP and the Bear Creek Council co-sponsored a potluck dinner in the Eagles Hall at Gardiner, Montana, on the evening of May 29. Some 80 people attended. After dinner, tribal members shared stories about their tribes' affiliation with what is now Yellowstone.

Yellowstone contingent meets affiliated Sioux Tribes in South Dakota. From October 14 to 19,

2002, Yellowstone staff conducted their first government-to-government meetings away from the park at locations where affiliated tribes live and could easily attend. The first meeting, at Pierre, South Dakota, was centrally located enough to enable 30 representatives from affiliated Sioux tribes to attend. Tribes that sent representatives included the Cheyenne River, Flandreau Santee, Lower Brule, Oglala, Sisseton-Wahpeton, Spirit Lake, and the Yankton Sioux Tribes.

In the days following the meeting, the Yellowstone contingent, consisting of the assistant superintendent, YCR director, cultural resources branch chief, bison biologist, and the cultural anthropologist, traveled to the reservations of the Cheyenne River Sioux Tribe, the Lower Brule Sioux Tribe, and the Oglala Sioux Tribe to meet with tribal members at their request. At the meeting with members of the Oglala Sioux Tribe, the Grey Eagle Society gave Frank Walker and Yellowstone National Park a star quilt with a white buffalo in the center of it. John Varley was given a red, white, and blue star quilt.

The purpose of the travel, as well as visits to tribal homelands, was to allow park managers to get better acquainted with individual tribes and their various issues, and to see if opportunities exist to work with tribes in areas of mutual interest. At each local meeting, NPS managers discussed the park's management philosophy, provided information, answered questions, and received suggestions from tribal members in regard to what might be done to further foster mutual interests.

Issues discussed include the following:

- bison management, including discussions with each of the Sioux tribes about their bison herd practices, including the number of bison in the herd, source, size of pasture, and how buffalo are used;
- brucellosis transmission and eradication;
- getting seronegative, live bison to tribes through quarantine and how the process would work;
- the offer of tribes to help ensure the genetic integrity of the Yellowstone bison population by providing refuges for them;
- incorporating the cultural significance of buf-

falo, as well as information about tribes, into park educational materials;

- student internships at Yellowstone;
- the potential exchange of natural and cultural resource staff;
- opportunities to provide interdisciplinary training and technical assistance to each other;
- involve tribal youth in education programs at the park; and
- the potential for tribes to collect certain materials in the park.

Transcripts of all meetings can be obtained by contacting the park's cultural anthropologist Rosemary Sucec at rosemary_sucec@nps.gov.



YCR Director John Varley, Charlie Quiver of the Oglala Sioux Tribe, YNP Assistant Superintendent Frank Walker, Wildlife Biologist Rick Wallen, Cultural Resources Branch Chief Sue Consolo Murphy, and Elaine Quiver of the Grey Eagle Society of the Oglala Sioux Tribe in front of the Oglala Sioux Tribe headquarters.

Park staff viewed the consultation meeting and visits to reservations as very successful. Comments characterized park personnel as "sincere," "caring," "interested in input from tribal people," and "willing to listen and learn." The topic of greatest interest was management of the Yellowstone bison herd. The meetings and visits provided an opportunity to have in-depth discussions about the complexities of inter-agency management—something letters or literature cannot fully address. Participants discussed rationales for decisions, agencies' management philosophies and practices, and Yellowstone's ecology, fundamental to an understanding of park actions. Tribes are extremely interested in receiving live bison, and options for how that can happen were explored.

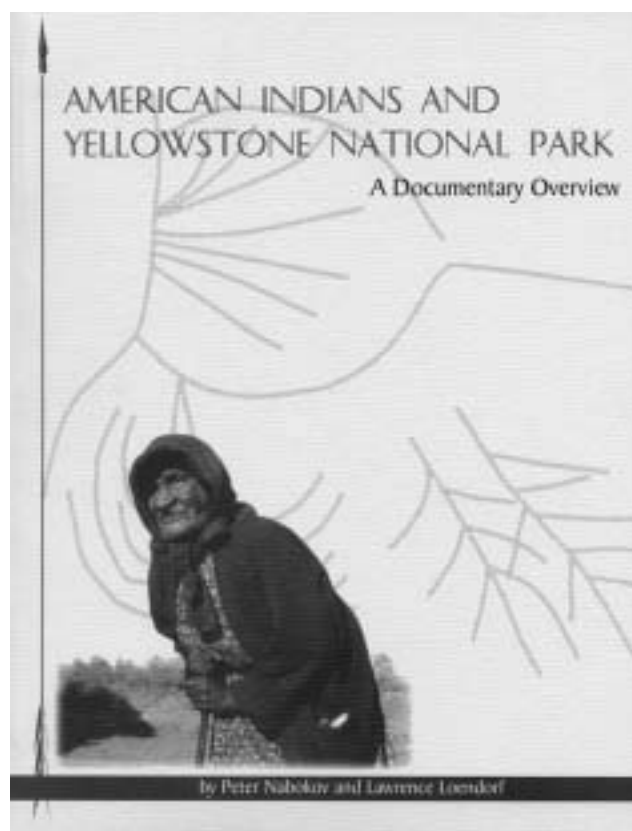
Another strong motif was the critical role that Yellowstone can play in keeping Lakota traditions alive. Oliver Red Cloud of the Oglala Sioux lamented, “our youth don’t understand what the buffalo is anymore. The buffalo is the life of the people.” All of the tribes emphasized the need to use the park as a classroom to teach their youth about the environment that remains essentially the same as when their ancestors lived, as well as to teach youth about the animals, especially the buffalo, that are keystone to traditional Lakota lifeways, histories, and ethics.

The investment of staff time and the park’s financial resources engendered goodwill among the Sioux tribes. Managers hope to conduct future consultations at locations close to and convenient for tribal affiliates.

Ethnographic Research and Management

Ethnographic assessment. In 2002, the park published *American Indians and Yellowstone National Park: A Documentary Overview*, by authors Peter Nabokov and Lawrence Loendorf, and distributed it to park staff, affiliated tribes, and interested others. The park library has copies on file for lending, and the authors plan to publish a book version through the University of Oklahoma Press in 2004. The report identifies more than 70 ethnographic resources—multiple species of plants; obsidian and thermal mud; an array of animals; archeological sites; topographic features such as Yellowstone Lake and Obsidian Cliff; geysers and other thermal features; trails; mountains; and rivers, including the Yellowstone, the Firehole, and the Snake. The substantial information contained in the report has been and will continue to be used as an indispensable reference by park managers and staff as the park engages in planning efforts such as the multi-year road reconstruction. It also helps interested parties deliberate the complexities of natural and cultural resource management and preservation and provide visitors information about native peoples and their relationships with the Yellowstone ecosystem.

Ethnographic survey of Mammoth-to-Norris road. Under a cooperative agreement with the University of Wyoming, the park consulted with 25 of the park’s 26 affiliated tribes regarding the proposed improvement of the Mammoth-to-Norris Junction road. The Shoshone-Bannock Tribes were not contacted because they surveyed this road segment in the summer of 2001. Federal laws and agency policies require that the NPS not adversely affect any tribal resources when ground-disturbing activities occur. The tribes were sent a letter inform-



A book version of *American Indians and Yellowstone National Park: A Documentary Overview* will be published by the University of Oklahoma press.

ing them of the planned improvements and asking if they were aware of any impacts to ethnographic resources. In addition to phone consultations, visitations to the road were made by representatives of the Kiowa Tribe (Bill Evans Horse, George and Marjorie Tahbone Sr., George Daingkau, and Wilson Daingkau), the Confederated Tribes of the Umatilla Indian Reservation (Roberta Conner), and the Northern Cheyenne (Gilbert Brady). A management summary was submitted to the park at the end of the year. It identified previously-known and new ethnographic resources, and made recommendations for monitoring the road construction given the density of archeological sites along the corridor and the potential that the road overlays the surface of the Bannock Trail.

Interpretive media for the Nez Perce (Nee-Mee-Poo) National Historic Trail. More than 30 tribal and federal representatives convened on March 25–26, 2002, in Spalding, Idaho, at the Nez Perce National Historical Park (NEPE) to discuss interpretive media to be developed for the trail in Yellowstone. Plans includes a 30-minute CD, three 5-minute sound extracts, a visitor education

brochure, and two new wayside exhibits. Representatives from the Confederated Tribes of the Colville Indian Reservation, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe in Idaho met with representatives from Yellowstone and NEPE and addressed a process for completing the media, subject matter to be included, and copyright issues. Media development is being partially funded through a Challenge Cost Share grant. On the second day, the entire group discussed events for the commemoration of the 125th anniversary of the Nez Perce conflict (see below).

Work with descendants of tourists embroiled in the 1877 Nez Perce conflict. Four generations of the Andrew Weikert family visited the Otter Creek site where their relative, Andrew Weikert of the “Otter Creek” or “Helena Party,” was shot and his horse killed in 1877 by Nez Perce who were traveling across the park to Canada. Ten family members commemorated the event and shared reminiscences and knowledge with the park anthropologist. The family will be giving the park a photo album and a copy of Andrew’s diary.

Salish oral history. The park received a \$7,750 grant through the Challenge Cost Share Program for documentation of the oral histories of the Confederated Salish and Kootenai Tribes in the Yellowstone ecosystem. The Salish-Pend d’Oreille Culture Committee submitted a draft copy of a ten-minute film that captures the essence of the Salish presence in this area. They will also provide copies of translated and transcribed oral histories obtained in the park during the summer of 2001 and used as the foundation for the film. The Division of Interpretation and the park anthropologist were still reviewing the film at year’s end, but information from the film already has been integrated into planned exhibits for the new Canyon Visitor Center. The information is being entered into the ERI database for planning and management purposes.

Crow oral history of Yellowstone. From June 27 to 30, Grant Bulltail, a descendant of the southern band of the Mountain Crow and an elder and historian among the Crow Tribe, traveled to about a dozen

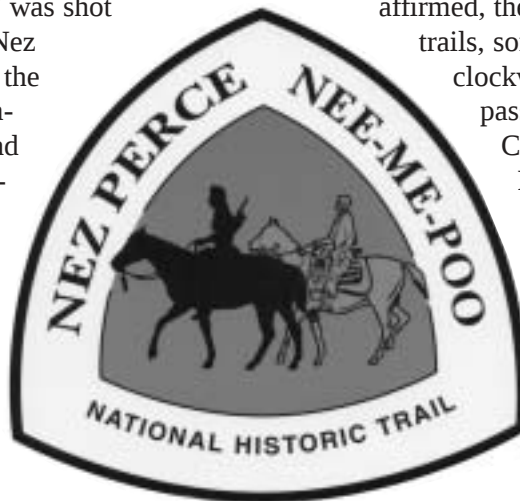
sites within the park to relay accounts of his ancestors’ seasonal migrations. His stories were video-recorded, and transcripts are being made from the audio portion of the videotapes. The Crow are believed to have come into the area as early as the 1500s, during a time known as the Little Ice Age. The 1851 Treaty of Fort Laramie recognized the eastern portion of the park, from Yellowstone Lake along the Continental Divide, as Crow aboriginal territory. Mr. Bulltail told park personnel that the Yellowstone Plateau was used as a mountain summer home for the Crow, also known as the Sheepstealers (a name that applies to Mountain Shoshone, too). He said that what is now the park would be entered from the east, at Cody, as if entering a tipi. Petition

for entrance was made to the patron spirits. Once affirmed, the journey began along rivers and trails, some of which are now roads, in a clockwise direction. Family groups passed by Yellowstone Lake, over Craig Pass, and along the Firehole River. Bulltail also relayed a compelling epic saga of how a bright and skillful Crow hero courageously engaged the powerful and dangerous forces of nature here, once referred to as “monsters,” to make the land safe for Crows to live. These places include the Mammoth Terraces, the Grand Canyon, Dragon’s Mouth and Mud Volcano, as well as the pine trees at Craig Pass.

Ethnographic Resources

Inventory (ERI) database. With the help of Student Conservation Association (SCA) intern Kristin Carlson, more than 70 ethnographic resources were entered into the ERI, an electronic database system that houses information about NPS ethnographic resources. The ERI at Yellowstone contains information about such resources within park boundaries as informed by consultations and written sources. The resources entered this summer are those from the recently completed ethnographic overview and assessment by Nabokov and Loendorf. In November, the park anthropologist was appointed to a national Data Standards and Implementation Committee for the ERI.

Assistance to the other park divisions. The anthropologist reviewed and contributed text to sev-



Tribal and federal representatives met in March to discuss interpretive media for the section of the Nez Perce National Historic Trail that passes through Yellowstone.

eral environmental assessments for ground-disturbing projects, including the data recovery plan for several archeological excavations including Osprey Beach, a cultural landscape study of Artist's Point, the Norris wastewater treatment plant, and the Heritage Center. She also reviewed and revised documents for visitor and staff education, including *The Yellowstone Guide*, *Yellowstone Resources & Issues 2002*, curriculum for *Expedition Yellowstone!*, electronic field trips, books and other educational material sold in visitor centers, and video projects and exhibits created under the auspices of the Division of Interpretation.

Assistance to tribes and other partners. The park anthropologist receives numerous calls throughout the year from affiliated and bison-interested tribes, asking questions and requesting assistance regarding topics including bison management; wolf restoration; NPS policies on fee exemption, collection, and sacred sites; and the park's process and philosophy concerning consultation. In some cases, research is required before an issue can be appropriately addressed. She provided park press releases, job announcements, and other information such as proposals to implement the Native American Graves Protection and Repatriation Act (NAG-PRA) electronically or, where email is not available, in hard copy to affiliated tribes. She also responded to calls from other parks about Yellowstone's consultation and other advice.

Visit to Osprey Beach. The Crow Tribe requested to visit the archeological excavation along the Yellowstone Lake shore at Osprey Beach. At the first visit, George Reed, Director of Cultural Affairs for the tribe, monitored the excavation activities and asked questions about artifacts that had been found. He briefly discussed Crow history with the archeologists. Mr. Reed visited a second time, at the close of the excavation. He blessed the site, and park archeologist Ann Johnson showed him Cody Complex artifacts that had been removed.

Educational Opportunities for Park Staff and the Visiting Public

Eastern Shoshone singers and dancers at Old Faithful. On Mother's Day weekend, May 11–12, 2002, the Eagle Spirit Dancers from Fort Washakie,

Wyoming, performed two programs of traditional Shoshone song and dance in front of the Old Faithful Inn. The park and the Yellowstone National Art Trust co-sponsored the event, and the anthropologist assisted with logistics and on-site management of the event. A tribal narrator, James Trosper, interpreted the dances, explaining the history of each dance and the meaning of the performers' traditional regalia. The dances and songs have been a part of the Shoshone culture for hundreds of years. The performances included an overview of Shoshone history in the Greater Yellowstone country. In an especially meaningful component of the program, the master of ceremonies named each of the dancers, describing their heritage, present occupations, and future aspirations.



SANDRA NIKERK

Eastern Shoshone singers and dancers performed at Old Faithful on Mother's Day weekend.

125th anniversary commemoration of the 1877 Nez Perce conflict. The park sponsored a series of four guest lectures during August. It was during the last week of August and the first week of September 1877 when more than 800 Nez Perce with about 2,000 horses transected the park as they were fleeing the U.S. Army. Historian and author Stan Hogatt spoke, on August 6–7, about the route the Nez Perce followed from Pelican Valley in the park through the Clarks Fork Canyon to the east of Yellowstone. On August 29, Allen Pinkham of the Nez Perce Tribe spoke about early 19th-century travels by equestrian Nez Perce into and through Yellowstone country prior to 1877. On August 30, Roberta Conner of the Confederated Tribes of the Umatilla Indian Reservation lectured about the aftermath of 1877.

She discussed what happens to individuals, families, and entire cultures when major cultural trauma is inflicted upon them. She helped the audience understand the relationship of historical events with contemporary issues by relaying a personal account of her family history. All of these lectures were videotaped with copies available in the park library.

Films incorporate Crow history and traditions.

Two films shot in Yellowstone during the summer included members of the Crow Tribe. The MTV program "Music In High Places" featured the band Unwritten Law and included the Black Whistle Singers, a Crow singing and drumming group, performing on the shores of Yellowstone Lake. A second film, for the PBS series "The Grand View," featured an interview with Grant Bulltail, who spoke briefly about Crow history in the park.

HISTORY

Park archivist Lee Whittlesey continued to also function as park historian, and completed several college course hours to further his continuing education in this professional field. After being vacant for nearly nine months, the position of historic architect was filled in August with the addition of Herb Dawson to Yellowstone's cultural resource staff. Herb has more than 20 years of experience working with historic structures, including previous assignments at the Montana and Wyoming State Historic Preservation Offices and with the Advisory Council on Historic Places.

Historic Buildings

Old Faithful Inn. This National Historic Landmark structure will be 100 years old in 2003, and planning continued in FY02 for a multi-million-dollar restoration of its original section, the "Old House." The work, scheduled to begin in FY04, is a three-phase project to upgrade the structure's ability to withstand seismic events; meet current standards for electrical, mechanical, and plumbing systems; and meet fire and building codes. Funds will pay for restoration of the original sunken floor around the fireplace in the lobby and for installation of new public restroom facilities. The rooms in the Old House will have new décor that is closer to the original design of the interior. The design development neared completion in 2002, and contractors began preparation of construction documents. The historic architect worked with park concessioner Xanterra, the park's Business Management Division, and

James R. McDonald of A&E Architects, and his consultants, to review plans for work on this most significant building.

Haynes photo-finishing laboratory. This historic structure at Old Faithful was used by F.J. Haynes, whose family ran various photography-related businesses in Yellowstone from 1884 through March 1968. In 2001, the Wyoming State Historic Preservation Office concurred with the park's determination that the 1887 photo-finishing lab, which had been moved from its original location in the 1930s, retained significant integrity to be eligible for listing on the National Register of Historic Places. The Division of Interpretation has proposed relocating and rehabilitating the rustic log structure for use as an artist-in-residence studio. The historic architect, along with a volunteer, began measuring the structure in response to a request to develop a plan and cost-estimate for rehabilitation.

Assessment of National Historic Landmark buildings. One of the new historic architect's first assignments was to prepare a biennial report of structures that are National Historic Landmark properties. These properties in the park are rated on their condition and the potential for loss of historic fabric or loss of the property itself. Properties for which needed maintenance has been deferred are considered to be endangered or threatened. Herb Dawson inspected four landmark structures within the park and, at the request of NPS Intermountain Regional Office staff, also reported on landmark properties in nearby historic Virginia City, Montana, with which he had had considerable experience because of his former job as historic architect for the Montana State Historic Preservation Office. All of the museums were recommended for "watch" status, as opposed to being threatened or endangered.

Norris Geyser Trailside Museum. The Norris Museum received special funding for extensive exterior maintenance during FY01 and '02 to prevent failure of epoxy treatments done in the early 1980s by Harrison Goodall of Conservation Services, Inc. However, there is still stonework around the patio retaining walls that has been dislodged, and cracks have appeared in the chimney of the building. The associated historic restroom building, built at the same time as the Norris Museum and currently used as a Yellowstone Association (YA) bookstore, did not receive much treatment and is in serious need of exterior restoration.

Fishing Bridge Museum. The Fishing Bridge Museum has also had some preventive maintenance,

but is in need of more at this time. Harrison Goodall and his team worked on the purlins, log crowns, and rafter tails of this structure in the 1980s. The epoxy treatments have stood up well over the years, although preventive maintenance has sometimes been deferred.

Madison Museum. The Madison Museum appeared to be in very good condition, and an inspection of this structure revealed no threatening conditions.

Northeast Entrance Station. The Northeast Entrance Station has rotted rafter tails that extend up into the roof structure. The flagstone around the perimeter of the foundations has lost a lot of mortar in the joints, and water is penetrating into the interior of the foundations of the structure. Combined with this problem, there are re-drainage problems in the valleys of the roof. Dawson recommended this significant structure remain on the “threatened” list, and planned to submit a request in FY03 for special project funding to address these problems.

List of Classified Structures. The NPS uses a servicewide database, the List of Classified Structures (LCS), to track information on its historic buildings and structures. In 2002, cultural resource staff hosted Intermountain Regional Office staffers Sayre Hutchison and Chuck Hanson, who came to Yellowstone to inspect buildings and update LCS records, particularly in the Lake Fish Hatchery and Roosevelt Lodge Historic Districts. At the end of the fiscal year, records for nearly 500 of the 951 structures on the LCS had been updated, although final certification (requiring approval at the park, regional, and Washington-office levels) was not complete. The branch chief also made a considerable effort to incorporate accurate information from the LCS and the National Register of Historic Places to help maintenance staff complete an “Asset Priority Index” for part of the new Facilities Management Software System (FMSS). This effort ensured that valuable historic structures received appropriate consideration along with other prioritization factors, such as whether the buildings were actively used for administrative, residential, or other purposes, and whether they helped protect other park resources (e.g., the buildings that house museum objects).

National Register of Historic Places

In keeping with the National Historic Preservation Act and NPS management guidelines, Yellowstone’s cultural resource staff continue to identify, evaluate, and nominate significant historic properties to the National Register of Historic

Places. Individual structures, landscapes, archeological sites, roads, natural or cultural landmarks, and historic districts listed on or determined eligible for the National Register are maintained and managed in ways that consider the preservation of the qualities that made them worthy of such recognition.

Although Yellowstone has many sites and districts that have been determined eligible for the National Register, the actual number of properties for which the lengthy nomination process has been completed is much smaller, although several significant listings occurred in 2002.

Mammoth Hot Springs Historic District. After several years of effort, the Mammoth Hot Springs Historic District was listed on the National Register on March 20, 2002. The nomination was originally prepared by Front Range Research Associates, Inc., and revised by former park historic architect Lon Johnson. The district includes 189 buildings, including today’s Albright Visitor Center (Building #1, the former Bachelor Officers’ Quarters); the original Army Post Headquarters (Building #8, currently used for park housing); the Mammoth Hotel, Recreation Hall, and the H.W. Child (Executive) House, all of which were designed by Robert Reamer, who also designed the Old Faithful Inn; and the former Haynes Picture Shop/House, Headquarters, and Warehouse/Stockroom buildings, built by Jack Ellis Haynes, the early concessioner-provider of pictures, post cards, film, and guidebooks in the park. Three additional sites are included in the district, including the Mammoth Campground—one of the earliest designed auto campgrounds in a national park—the former U.S. Army parade ground, and the flagpole, which is a remnant of a once-taller pole that flew the stars and stripes over Fort Yellowstone. The historic district overlays the proposed Fort Yellowstone National Historic Landmark, which was recommended for listing in late 2002, but not acted upon by year’s end.

North Entrance Road Historic District. On May 22, 2002, the first of Yellowstone’s roads was listed on the National Register. The 5.23-mile North Entrance Road Historic District extends from the park’s north boundary at Gardiner, Montana, to Mammoth Hot Springs. It is significant as an integral part of the planned road system in Yellowstone, and with the Army Corps of Engineers’ role in the development of the park. It provides a significant example of the “blending with nature” design philosophy first espoused by the Army Corps and later expounded upon by NPS landscape architects.

The listing includes the North Entrance (or Roosevelt) Arch, which, in addition to being an important feature of the North Entrance Road, is also significant as a symbol of Yellowstone—the earliest attempt to recognize a park entrance and that visitors crossing its threshold were in transition to a special place. Construction of the arch was supervised by Army Corps officer Hiram Chittenden, who felt that the original (and, at the time the most visited) park entrance deserved an impressive gate. The cornerstone for the arch was laid in a ceremony attended by President Theodore Roosevelt on April 23, 1903.

Determinations of Eligibility. The historic architect reviewed several existing structures built in association with the NPS's Mission 66-era period of nationwide reconstruction. While these structures are, in many cases, not yet old enough (50 years or more) to typically be considered as historic, NPS guidelines call for formally considering their potential cultural value prior to altering or removing them.

Old Faithful Visitor Center. Park officials have decided that the existing, 7,000-square-foot Old Faithful Visitor Center (OFVC) is too small for today's and future needs. It has no exhibit or classroom space, lacks sufficient room to serve visitors seeking information or purchasing educational materials from the cooperative Yellowstone Association, and also lacks adequate office and practice space for interpreters to prepare programs. The park and the Yellowstone Park Foundation are working together to raise private funds to augment NPS line-item construction monies to build a new visitor education center.

Investigation and research into the history of the existing Old Faithful Visitor Center has resulted in the park's determination that the building would be eligible for listing on the National Register of Historic Places; the Wyoming State Historic Preservation Office concurred. The visitor center, constructed in 1972, was one of the last visitor centers designed under the Mission 66/Parkscape construction program, and its opening was planned to

coincide with centennial celebrations for Yellowstone National Park. First Lady Pat Nixon dedicated the Old Faithful Visitor Center in June 1972. The facility was designed to have three "electronic" prediction boards, and was one of the first attempts by the National Park Service to provide electronically-presented data to visitors.



COURTESY DORIS WHITHORN

The Roosevelt Arch shortly after its completion.

Unfortunately, the prediction boards never worked as advertised, and were finally removed in the 1980s. Unfulfilled plans included five semi-open amphitheaters, designed to be adjacent to the two existing small theater buildings, which were never constructed.

The Western Office of Project Design in San Francisco designed the complex. One preliminary design had an immense flat roof over all the amphitheaters, combined with a small, year-round interpretive center. While innovative, someone remembered that the Old Faithful area has tremendous snow loads, and that an enormous flat roof would likely have collapsed. At the time the visitor center was constructed, Old Faithful received few wintertime visitors. The designers in the mid-to late-1960s did not anticipate the popularity of snowmobiling as a means of accessing the park in winter. Consequently, there was minimal accommodation for wintertime visitors. The new Old Faithful Visitor Education Center will better address the needs of current and anticipated future year-round visitors. The existing visitor center will be removed and appropriately documented for the role it has played in Yellowstone's history.

West Entrance Station. Other Mission 66 structures in the park that have been determined to be eligible include the Canyon Visitor Center and the West Entrance Station. The historic architect, along with Mike Yochim from the park's planning office, researched the West Entrance Station, built in 1968. William C. Muchow and Associates from Denver, Colorado, were architects on the project. W.C. Muchow was one of the leading Modernist architects in the Rocky Mountain region, and was responsible for more than 800 projects in his 40-year career. This research was done as part of plans to redesign or develop a new West Entrance Station, office, and visitor contact station in West Yellowstone.

The following Yellowstone resources are officially listed on the National Register of Historic Places:

- **National Historic Landmarks**
 - Old Faithful Inn
 - Madison Junction Trailside Museum
 - Norris Geyser Basin Trailside Museum/Comfort Station
 - Obsidian Cliff
 - Fishing Bridge Trailside Museum
 - Northeast Entrance Station
- **Historic Districts**
 - Old Faithful
 - Roosevelt Lodge
 - Lake Fish Hatchery
 - Mammoth Hot Springs
 - North Entrance Road
- **Sites**
 - Obsidian Cliff (Nature Shrine) Kiosk
 - Lamar Buffalo Ranch
 - U.S. Post Office, Yellowstone Main
 - Lake Hotel
 - Queen's Laundry Bath House

Compliance with NHPA

The National Historic Preservation Act (NHPA) requires that the park consider the effects of its proposed actions (including new construction, removal or rehabilitation of existing structures, and other ground-breaking activities) on historic properties. The historic architect, park archeologist, cultural resource technician, and other cultural resource staff spent on average at least 25% of their time throughout the year reviewing or assisting with planning for projects including: a new Old Faithful Visitor Education Center; a new Canyon Ranger Station; a new or revamped West Entrance Station; rehabilitation of the Administration Building, #36, and the former fire cache-telecommunications building, #38; restoration of the Old Faithful Inn "Old House;" pro-

posed backcountry trail re-routes; and placement of alternative energy devices such as fuel cells in several park locations. Staff addressed cultural resource concerns and facilitated consultation with the Montana, Idaho, and Wyoming State Historic Preservation Officers, as appropriate. The Wyoming State Historic Preservation Officer and his deputy visited Yellowstone on August 12–13, 2002, to discuss upcoming or ongoing park projects related to buildings, archeological sites, and roads.

Historic roads and bridges. The Western Federal Lands Highway Division (WFLHD) design engineers, working in conjunction with the Yellowstone Park road team, has delivered context-sensitive transportation designs for Yellowstone's historic road system. These innovative designs guide the reconstruction of the roads without the loss of character-defining features, graceful curves, and natural materials that allow Yellowstone's roads to blend with the environment. For their commitment to well-designed roads that blend with the natural environment and cultural heritage, the WFLHD's Yellowstone National Park team received national recognition in the Strive for Excellence Customer Service Award in 2002.

Madison-to-Norris road. Construction of portions of the Madison-to-Norris section of the Grand Loop Road began early in 2001. New parking areas are planned to provide pleasant and safe access to the Artists' Paintpots, Terrace Springs, and Beryl Spring thermal areas. In 2002, contractors began work to dismantle the tallest of the historic Gibbon River Bridges (48YE807), widen the bridge deck, and fortify its abutments. The masonry work on the abutments was reassembled using some stone matching the original found in the road cuts, and other matching stone from the Norris quarry. Workers re-attached the bridge railing, and will complete repairs to the piers, caused by erosion, in the 2003 construction season. Crews also dismantled the smaller of the historic bridges over the Gibbon River (48YE808) and removed the piers, salvaging stones to re-face the retaining wall that extends from the northwest abutment wing wall next to the river.

In the Beryl Spring area, contractors widened the road and extended the existing log guardrail on the east (river) side of the road. In the process of removing the old viewing platform previously attached to the bridge, they discovered that several of the wooden bridge support piers had deteriorated and sheared due to the acid soils in the thermal area. Although the Beryl Spring bridge is not yet 50 years old, it



Acidic soils have caused the support piers of the Beryl Spring bridge to deteriorate.

soon will be, and thus will be repaired using historic preservation standards.

In the Tanker Curve-to-Gibbon Falls area, plans call for a major re-route of the road, which the park and the SHPO determined to be an adverse effect on cultural resources. The park agreed to provide a new wayside exhibit to interpret the history of road construction in the area, and in 2002 secured private funding to design a kiosk-style interpretive area. Construction engineers also explored ways to facilitate removal of loose material and boulders directly across from the Gibbon Falls viewing area retaining walls without damaging the existing historic walls.

Sylvan Pass to East Entrance. In 2002, the park prepared preliminary engineering designs for the fourth phase of the East Entrance Road widening

and reconstruction project, and sent them to the WYSHPO for review and comment. Plans call for retaining the current, 40-mph design speed and the road's graceful curves, steep rock cuts, and hanging waterfalls. Stone masonry guardwalls will be reconstructed and placed in more appropriate locations for safety and scenic values. Improved parking areas at two major watercourses will be constructed, and a new parking area built with a view of the historic Corkscrew Bridge. Workers will extend culverts and reconstruct their historic headwalls. The design through the East Entrance station area will remain within the present footprint of disturbance, although the existing check station is not historic.

North and South Canyon Rim

Drives. Planning for repair of these secondary roads was still underway in 2002. In coordination with Federal Highway Administration (FHWA) work on these segments, a private contractor is preparing a cultural landscape inventory (CLI) as part of proposed restoration of the Artist Point area. Cultural resource staff reviewed and commented on the draft CLI, which recommends that the historic viewing area be eligible for listing on the National Register of Historic Places. This spot on the canyon's south rim is often (mistakenly) interpreted as the location from which famed 19th-century artist Thomas Moran

painted the Lower Falls of the Yellowstone River. Although Moran actually viewed the falls from the north canyon rim, the south rim wayside area nevertheless has historic significance and an attractive, formally-planned design of rock work and walkways that the park hopes to retain while improving the site for public safety and improved accessibility.

Golden Gate to Norris. In May 2002, the YNP road team and FHWA staff began initial resource inventory of the Golden Gate-to-Norris road. As tentatively planned, reconstruction will begin immediately south of the Golden Gate viaduct and terminate south of the modern bridge across the Gibbon River north of Norris Junction. It will likely be completed in two phases, with the split somewhere around the Obsidian Cliff National Historic Landmark. The

park archeologist and ethnographer had previously developed plans to identify and evaluate historic properties and ethnographic resources along this corridor. National Register testing is being conducted for those archeological sites that were previously bisected by or abut the current alignment. The cultural resource specialist documented all historic bridges and road features, and prepared the information for submittal to WYSHPO. A joint effort between the Cultural Resource Branch and park landscape architects has resulted in a nearly-complete CLI for the Apollinaris Spring area. Archivist-historian Lee Whittlesey provided a written summary of the site's history to add to information provided by the former historic architect, Lon Johnson [see *Yellowstone Science* 11(1)]. Plans for widening the road in that area will ensure that there is no impact to historically-constructed roadside features. Whittlesey also prepared a history of road construction in the Norris Junction area for use by the park archeologist.

West Entrance Road. FHWA funds were used to revise a draft National Register nomination for the West Entrance Road, and archeologists inventoried this road corridor in anticipation of further reconstruction in 2005. As reported above, the historic architect began evaluating and documenting the Mission 66-era entrance check station as part of a proposed relocation or remodel of this structure along the road.

Historic American engineering record. Cultural resource specialist Elaine Hale reviewed the final draft of the addendum to the "Yellowstone Roads and Bridges" (HAER Wy-24) in 2002. The expanded historic context includes the Corkscrew Bridge, Canyon Bridge, Chittenden Memorial Bridge, and additional documentation for the Golden Gate viaduct. It also provides historic context for the Gardiner-to-Mammoth "High Road," the Firehole Canyon Drive, the Firehole Lake Drive, the access to the Grand Canyon of the Yellowstone, the road to the summit of Mount Washburn (also documented as the proposed Chittenden Road Historic District), and the Virginia Cascades Drive. She also completed documentation of historic road features for the Mammoth-to-Norris road segment late in 2002.



Apollinaris Spring following a major renovation in 1925.

Researchers with the Office of the Wyoming State Archeologist documented the historic and unique road features on the Virginia Cascades Drive.

Emergency consultation. In September 2002, erosion threatened the abutment supports of the historic, Army-era bridge over Obsidian Creek that provides access to Indian Creek Campground. Engineers feared sudden failure of the bridge. The park staff and FHWA conducted emergency consultation with the WYSHPO in order to initiate bank stabilization repairs; the historic bridge and the campground were closed until repairs could be completed. The repairs were completed with no damage to the bridge.

Historic Research and Publications

Archivist-historian Lee Whittlesey researched and wrote numerous manuscripts in 2002. He worked with the Yellowstone Association to finish the text for the 2003 YA history calendar, a popular sales item that contributes to the return of monies to support park educational efforts. In May, he was selected to attend a three-day NPS history conference in Estes Park, Colorado, that featured such notable historians as Dr. Patricia Nelson Limerick, Dr. Elliott West, and Dr. Richard Sellars. On his own time, Lee completed several graduate-level history classes at Montana State University.

In July, he hiked with former YA board member Monte Later and Dr. Jett Hitt to an alleged Indian vision quest site in the Crystal Creek area. In August, he hiked with Deer Lodge photographer and

historian Lee Silliman to an alleged Indian vision-questing site on the summit of Mount Everts. At Rosemary Sucec's request, he attended the Nez Perce tribal commemoration at Camas Prairie, Idaho, in August, and accompanied her and members of the Nez Perce Tribe to historic sites at Otter Creek and Nez Perce Ford.

The park's Public Affairs Office referred a number of media organizations to the archivist, who was interviewed by the *Minneapolis Star Tribune*; the *Idaho State Journal*; and the History Channel regarding Yellowstone's resources and its history.

Books and articles prepared. This year, Whittlesey revised his manuscript on the history of early interpretation in YNP and sent it to the University of Oklahoma Press, which has expressed interest in publishing a revised version. With Paul Schullery, he prepared a manuscript on Yellowstone's Creation Myth for the University of Nebraska Press, which will publish it in 2003. An abridged version and several other articles on park history will appear as separate articles in *Montana the Magazine of Western History* in 2003. With the late Aubrey L. Haines, Whittlesey completed a pamphlet published by the Wyoming Historical Society entitled "A Mile-by-Mile History Excursion Around Yellowstone's Grand Loop Road." He also completed, at the request of the superintendent of Big Hole National Battlefield, an article entitled "The Nez Perce in Yellowstone in 1877: A Comparison of Various Writers' Attempts to Deduce Their Route." He wrote a brief history of the Chinese Garden area on the Gardner River, and both "Yellowstone's First Female Rangers," and "Hendersons Explore Yellowstone Roots," were published in *The Buffalo Chip* this year. An article entitled "Native Americans: the Earliest Interpreters: What is Known About Their Legends and Stories of Yellowstone National Park and the Complexities of Interpreting Them" was published in the George Wright Forum; and "Letters to the Editor, More on Thomas Hine" was published in *Montana the Magazine of Western History*.

At the request of the park's superintendent, Whittlesey also completed "Brief Notes on Theodore Roosevelt's 1903 Trip to Yellowstone" and a draft speech entitled "Gateway to Yellowstone: Livingston, the Northern Pacific, and the Park Branch Railroad," for her to deliver in Livingston at the christening of the Montana Rockies Rail Cars.

Reviews. The archivist-historian completed the following reviews of other writers' manuscripts:

Mike Yochim's article "Beauty and the Beet," relating to park dams in the 1920s; Bob Goss' "Making Concessions in Yellowstone;" Alice Wondrak's "Wrestling with Horace Albright," an article about park visitors and bears for *Montana the Magazine of Western History*; Leandra Holland's piece on the islands of Yellowstone Lake; Mike Keller's article on the history of Giant Geyser for GOSA Transactions; and Richard Saunders' book *The Storied Domain: Yellowstone in Fiction and Literature* for the University of Utah Press. He also reviewed the *Yellowstone Resources & Issues 2002* handbook for the Division of Interpretation.

Oral histories. In July, Whittlesey spent two days with the James Dean Henderson family, descendants of G.L. Henderson and Walter Henderson, who were so important in Yellowstone's history between 1882 and 1913. The family gave the park much genealogical information relating to the many Hendersons who lived in Yellowstone, and Whittlesey toured them around the Mammoth area to places that were important to G.L. Henderson, and which were named by him. An article about the family was published in the park's *Buffalo Chip* newsletter.

In late March, Whittlesey traveled to Ravalli, Montana, to interview Gerald Good, former director of transportation for T.W. Services, and to bring back a great number of photographs and artifacts given to the park collections by Mr. Good. In August, he participated in the Heart Mountain Reunion of World War II Japanese-American Boy Scouts and recorded an oral history reminiscence with them. Whittlesey accompanied them to their 1942 work-site at Nez Perce camp (south of Nez Perce cabin), and to the footbridge on Nez Perce Creek that they built.

Charissa Reid continued to collect oral histories from departing or retired park employees, and to set up interviews related to the history of bear management in the park. After the death of former grizzly bear research Frank Craighead Jr., she worked hard to schedule an interview with his surviving twin brother, John. Dr. Craighead agreed to provide an oral history for the park, but by year's end his health and schedule conflicts had prevented him from successfully meeting with Mrs. Reid. She continued to make contacts through the International Bear Biology Association with other persons interested in contributing historical perspectives.

At the request of the NPS's Washington Office, Charissa completed an oral history interview with former Yellowstone Superintendent and Alaska

Regional Director Robert (Bob) Barbee, now retired. Before the formal interview, Barbee was guest of honor at a luncheon in Mammoth attended by many park employees and partners. He informally spoke of his many NPS experiences, and answered questions from the attendees, particularly about the historic wildfires of 1988, about wolf restoration, and about grizzly bear management.

Charissa received assistance from several contractors, including Carolyn Wallen, Rene Farias, and



Former Yellowstone Superintendent Bob Barbee, at top left, completed an oral history interview with park staff in 2002.

Jennifer Morey, who worked to transcribe much of the backlog of oral history tapes in the park's research library. Their contributions and the financial support of the Yellowstone Association made the continuation of a small but steady oral history program possible.

Assistance to Other Park Divisions and Partners

The archivist-historian advised outside researchers and NPS staff members on park history on numerous occasions. Some examples included a Gardiner High School history class researching Chinese Garden; Steve Mishkin on the history of law and law enforcement in Yellowstone; Mary Ellen Strom on the Northern Pacific Railroad; Dale Nuss on his law enforcement career here; Cheryl Jaworowski on historic Mammoth-to-Gardiner road slides; Mabaye Dia, from Mauritania, on Yellowstone's place in American national park history; writer John Taliaferro on the Nez Perce trek through the park; and John Herman and Brian McAlonie of Delaware North Corporation on the history of Hamilton Stores.

MUSEUM, LIBRARY, AND ARCHIVES

In 2002, Yellowstone's permanent museum staff consisted of museum curator Susan Kraft and museum aide Beth Raz, who was working half-time and attending MSU at Bozeman. Susan was on extended sick leave due to health issues for most of the year. Nancy Hatcher, from Harpers Ferry National

Historical Park in West Virginia, served as the acting curator on a three-month detail from November 2001 through February 2002, and did an outstanding job of working with the staff.

The remaining museum staff were funded primarily through special project monies. Jon Dahlheim, a temporary museum technician, worked with the photo archives until his resignation in July. Sean Cahill, term museum technician, worked on conservation of historic motorized vehicles. Steve Tustanowski-Marsh was hired in March as a term museum technician to accession and catalog museum objects. By autumn, the Cultural Resources Branch Chief relied on Steve to serve as the lead museum tech and assist in the daily management of the museum operation during the absences of the museum curator. During summer 2002, Alice Hart, on leave from her position as a collections manager for the University of Kansas at Lawrence, served as a seasonal museum/library technician. Several contracts were awarded to Susan Glenn to perform cataloging and re-housing of artifacts within the collection, and she also began a museum inventory as a precursor to the move of the collection in 2004. The museum staff did an outstanding job of maintaining the museum operation despite staffing and supervisory shortages.

Lee Whittlesey continued to serve as both archivist and historian, assisted by term archival technician Harold Housley, who passed the Certified Archivist Exam in August 2002 in Milwaukee, Wisconsin. Research library staff this year included librarians Alissa Cherry and Barbara Zafft and library technician Tara Cross. Contractors Sean Miculka and Mark Catellier provided assistance with projects. The library recorded 2,320 patrons in 2002, 426 of which were NPS staffers and the other 1,894 who were independent researchers or concessioner employees.

Preservation, Conservation, and Access

A variety of projects contributed to the preservation and accessibility of the collection for research, education, and other purposes. The Yellowstone Park Foundation, the Yellowstone Association, and the NPS Special Emphasis Program Allocation System (SEPAS) funds supported these projects and the staff needed to accomplish them.

Archival inventory. In autumn 2002, the park's webmaster worked with the Washington Office of the NPS to provide a searchable version of the park's Master Archival Inventory on Yellowstone's web site.

Book maintenance. Yellowstone Association project funds were used to send Alissa Cherry to a book repair workshop and acquire more knowledge and skill in book conservation. Funds also supported more than 50 hours of librarians' time repairing or re-housing at least 100 books in the park's collection.

Cataloging objects. Beth Raz, Steve Tustanowski-Marsh, and Susan Glenn traveled to Kemmerer, Wyoming, for training with the latest version of the collections management database, Automated National Catalog System (ANCS+ version 6.3). The new version is greatly enhanced, provides a much more user-friendly atmosphere, and has better functionality. The staff continued to work on a large backlog of items that need to be formally accessioned and cataloged into the park's museum collection. Some of the backlog has resulted from a staffing shortage, but there is a never-ending stream of new Yellowstone-related objects donated by people around the world who have an interest in helping the park preserve its history.

The FY2002 Collections Management Report (CMR) for the park indicates that a total of 5,269,649 items had been accessioned into the museum and archival collections as of September 30, 2002. This includes an estimated 4,766,672 archival items (estimated based on the linear feet of record in the files) and 296,900 museum objects. The total increased 4,092 since the 2002 CMR was submitted, and the report also indicates that only 379,441 of the items have been cataloged into ANCS+. The latter includes 91,941 archeological objects, 245 of ethnological origin, 65,705 historic objects, 14,552 biological specimens, 106 paleontological objects, 815 additional geologic specimens, and 206,077 archival records. Again this year, the park received \$60,000 in SEPAS funds to catalog a portion of the backlog in archival items and museum objects.

Herbarium. The park herbarium, which is managed as a separate museum collection by botanist Jennifer Whipple of the Branch of Natural Resources, includes approximately 7,900 specimens of vascular and non-vascular plants that are identified, mounted, and cataloged into the NPS Automated National Cataloging System (ANCS+). During the 2002 field season, 98 specimens were collected that will eventually be mounted and cataloged. These specimens were needed to strengthen the collection by documenting the native flora in under-collected portions of Yellowstone and the arrival and spread of exotic species. Park personnel and outside researchers continued to extensively use the herbarium, especially during the summer months.

Disaster plan. In mid-summer, museum staff provided contractor Jim Davis with a week-long orientation to the park and its dispersed museum locations, to prepare him for writing a museum disaster plan. Steve Tustanowski-Marsh also met with Mr. Davis last autumn in Washington, D.C., where they toured several museums, reviewed security concerns and systems, and discussed other aspects of the park's draft plan.

Exhibit conservation. The museum staff did conservation work on objects while re-opening the Fishing Bridge Museum and the Museum of the National Park Ranger. In September, Steve Tustanowski-Marsh was selected as one of five attendees to the first Advances in Conservation and Museum Collections Management class at Harpers Ferry Center in Charles Town, West Virginia. Conservation is defined as the process of treating damage to objects while preserving as much of the original material of the object as possible. The first week of the training focused on developing and maintaining exhibits, and attendees traveled to Washington D.C. to visit several of the Smithsonian Institution's museums and the private International Spy Museum. One of the highlights of the Smithsonian visit was seeing the behind-the-scenes conservation efforts on Old Glory. The class spent the second week working in each of the major conservation labs (paper, textiles, wood, metal, archeology, and ethnography) at Harpers Ferry Center. Participants were afforded the opportunity to get involved in "hands on" conservation projects while learning appropriate methods of 1) conservation evaluation for objects, 2) techniques for interceding, and 3) mitigating actions. As a post-class project, Steve was assigned to create a plan to address con-

servation issues in the areas of museum exhibitions and storage facilities.

Historic vehicle collection. Sean Cahill continued to make significant advances in preservation of and access to—at least virtually—the historic vehicle collection. He performed stabilization work on motorized maintenance vehicles and continued to apply integrated pest management techniques to the vehicle collection storage building #2009, in the Yellowstone Park Transportation Company historic district located on park land in Gardiner. Using Cultural Cyclic Maintenance funds, Sean performed



Vehicle storage building #2009 and some of its contents.

preventive conservation treatments on two of the largest motorized vehicles in the collection, a 2.5-ton “Boom Truck” and a massive 5-ton tank truck. He did additional work on two of the smallest motorized vehicles, a 7-passenger touring car and an 11-passenger open touring bus commonly referred to as “Old Number One.”

While maintaining the vehicles in an impressive manner and working on associated projects, Sean worked on increasing accessibility to the collection by developing an online tour of the park’s historic vehicle collection for Yellowstone’s web page. It features text with descriptions and histories, as well as current and historic images of many vehicles from the collection. Park staff hope this “virtual exhibit” will allow more people to enjoy the historic vehicle collection and increase their awareness of this important historical resource. The online tour may be viewed at www.nps.gov/yell/technical/museum/historicvehicles/index.htm.

James Everett Stuart paintings. As reported in the 2001 YCR Annual Report, a significant work of

art by James Everett Stuart, “Great Falls and Cañon of the Yellowstone,” was sent to Florida for professional conservation treatment. Unfortunately, when the park received the piece back, the museum staff discovered that extensive damage to the canvas had occurred while the painting was in transit from the conservator. One theory is that the piece experienced intense climatic condition changes while being transported from southern Florida, where the temperatures and humidity were much higher than the Yellowstone area. The combination of rapidly fluctuating environments and perhaps a lack of sensitivity in handling the piece created an approximately 11" tear on the canvas.

After park staff documented the damage and contacted the conservator, they decided to send the painting back to the conservator for further treatment and repair. The piece, once repaired, was safely stored away in the collection vault, and may at some point be included in a temporary exhibit in the Heritage and Research Center.

Yellowstone Association funds for painting preservation also paid for the purchase of a specially designed art storage cabinet that was delivered to the park in 2002. It will be displayed in the new Heritage and Research Center.

Loan to Livingston. The archivist arranged for the loan of seven rare books to Diana Seider and the Livingston Depot Museum for their Northern Pacific Railroad summer exhibit. The items were returned to the park in December 2002.

Map preservation. A grant from the Yellowstone Association was used to re-house historic maps and drawings in the park’s library and archival collections. Maps were cataloged in both MARC and Microsoft Word format, making them more accessible to patrons. During the course of the project, nearly two-thirds of the rare and fragile maps were encapsulated in clear archival plastic (Mylar) to reduce damage from handling and prevent further deterioration.

Nitrate negatives. Beth Raz nearly completed work on the cellulose nitrate negative project she began in 1999. Most of the highly flammable nitrates in the park’s collection have been reformatted, but the park continues to receive new acquisitions of this type. This format presents both a risk to property and to humans using the collection, and can deteriorate quickly, causing a loss of a valuable photographic record. Handling and storage of these objects can be expensive and dangerous, and so the

park continues to work on developing a plan to relocate them to a more appropriate storage repository.

Shaw and Powell Studebaker Mountain Stage.

The Shaw and Powell Camping Company vehicle, also known as a “mountain spring wagon,” built circa 1898, had been on exhibit in the lobby of the Old Faithful Inn for a number of years. At the request of the park’s Business Management Division, the museum technicians moved the wagon to the Old Faithful Lodge in June, with some assistance from Xanterra staff. This required disassembling the wagon at the Inn, transporting it to the new location, and reassembling it at the Lodge, which is also the site of a former Shaw and Powell camp. The museum technicians updated and improved the enclosure of the exhibit after the object was reassembled, resulting in enhanced protection of this original piece of the park’s transportation history.

Photo archives. Interest in historic photos relating to Yellowstone’s resources continues to grow; museum staff handled more than 1,000 research inquiries related to the photo archives this year. There is a request of some sort to provide assistance and access to the photo/image collection virtually every day. Requests came from organizations such as National Geographic Films Division, the Discovery Channel, ESPN, PBS, numerous independent authors and publications, other NPS sites, Yellowstone staff members, park partners, and park visitors.

In 2002, museum staff were fortunate to procure a new scanner, which directly benefited individual researchers by providing high-quality scanned images that could be electronically sent to them via email. It also greatly reduced the time needed to respond to requests. Previously, it could take up to six weeks for staff to have photo reproductions made, then mail them to the requesting researcher. Now, a researcher can receive digital images in a matter of minutes, once staff have retrieved the image from the collection and scanned it. The scanner also provides a benefit for the preservation of these significant records of history. Once the images are scanned, they are transferred to a computer database for future access, which reduces the number of times a photo, postcard, or negative must be handled. Museum staff plan for these images to be available on the Internet for easy access by users on a worldwide basis. At present, only 2.5% of the image collection is digitized.

Temporary relocations. In recent years, space limitations in the basement of the Albright Visitor

Center—where the research library and the majority of the park’s museum and archival collections are stored—have caused staff to use at least four additional overflow storage areas. In 2001–2002, one of these, located in historic cavalry stables building #38, was evacuated due to construction work.

Archival and museum staff relocated museum storage cabinets, archival boxes, map cases, fire records, fireproof filing cabinets, a film cabinet, and shelving to other temporary storage in the former Hamilton’s Nature Store and the Scout House at the YCC-Mammoth Garage administrative area.

Rare books. In a search of the rare book room, librarian Alissa Cherry “discovered” some surprisingly valuable titles of which the current staff were unaware. These include:

- General W.E. Strong’s personal copy of his 1875 *Yellowstone and the Great Geysers*;
- One of only ten known copies of the Chester A. Arthur party’s journal of their 1883 journey through Yellowstone National Park and northwestern Wyoming;
- A first edition of Zebulon Pike’s 1810 *An Account of Expeditions to the Sources of the Mississippi River*;
- An 1817 first edition copy of Lewis and Clarke’s [sic] three-volume *Travels to the Source of the Missouri River*;
- Brevet Captain J.C. Fremont’s 1845 *Report of the Exploring Expedition to the Rocky Mountains*;
- A first edition of Alexander Ross’ 1855 *Fur Hunters of the Far West*;
- A first edition of George Armstrong Custer’s 1874 *My Life on the Plains*; and
- An autographed copy of John Muir’s 1902 *Our National Parks*, signed to Hiram Chittenden.

Using \$50,000 provided by the Recreation Fee Demonstration Program, library and archives staff completed the first phase of a project to preserve rare books, journals, diaries, and manuscripts. In 2000, funds were used to contract professional book conservator Renee DeVille, who examined approximately 5,000 items in the rare book collection and prepared treatment proposals for each item. She also provided hands-on training in basic actions to help library staff prevent damage to these papers and minimize further deterioration. Staff purchased specially designed clamshell boxes to house rare and valuable items, and performed basic conservation treatment for numerous items in accordance with her

training, although the items needing most work remain to be treated, probably by a professional conservator.

Notable Acquisitions

Curators apply equal importance, care, and value to each and every object held in a collection; no one piece is more important than the next. Museum professionals are entrusted to maintain the same standards for a projectile point flake as for a Thomas Moran painting. However, more emphasis may be placed on one object over another based on sensitivity of the object and preservation concerns. The listing that follows is in no way an effort to diminish the importance of any acquisition or donation received from any source during FY2002, but represents a sampling of the generosity of people who have enhanced the overall significance of the park's museum collection.

Archives. New archival acquisitions for the year include copies of additional records from the Kansas City regional office of the National Archives and Records Administration (NARA), acquired with Recreation Fee Demonstration money. NARA holds numerous documents important to Yellowstone's history in Record Group 79, Records of the National Park Service, National Parks and Monuments Central Classified Files (1936–52) and Region II (Midwest Region), General Files 1952–60. They were apparently sent to Kansas City by the NPS during the 1950s and 1960s, when the former Rocky Mountain Regional Office was in Omaha, Nebraska. The records relate to roads, park housing units, and their construction from 1950 to 1960; wildlife management, including bison management at Yellowstone's Buffalo Ranch from 1936 to 1963; Civilian Corps Conservation camps from 1933 to 1941; early attempts to plow park roads and other aspects of winter use from 1950 to 1963; law enforcement; general maintenance of roads and trails; and park administration. The first shipment of records had occurred in 2000, but the funded portion of this project was completed in 2002, when the remaining copies were purchased for \$23,000. Harold Housley boxed, numbered, and cataloged the newly received NARA records.

Other additions included hydrothermal and geyser observations from the park's Spatial Analysis Center, files from the Superintendent's Office, Yellowstone Association records, and travel statistics from Yellowstone's Visitor Services Office.

Davis Postcard Collection. The acquisition of the Susan and Jack Davis Collection was appropri-

ately chronicled in the 2001 YCR Annual Report. Aptly described by curator Susan Kraft, the Davis Collection is considered "the foremost collection of its kind in the nation." The portion acquired in 2001, however, was not the entirety of the Davises' life-long efforts. As originally planned by the park, the Davises, and the Yellowstone Park Foundation, the remaining portion of the collection—approximately 10,000 postcards—was acquired in 2002. In December, branch chief Sue Consolo Murphy and museum technician Steve Tustanowski-Marsh traveled to the headquarters of the Yellowstone Park Foundation at Bozeman, Montana, to receive the last installment of the collection. This postcard collection, conservatively valued at \$150,000, is considered to be the most significant collection of postcards relating to one site ever compiled. Several of the images portrayed in the collection are single copies of as few as four individual cards known to exist. Even though the Yellowstone Park Foundation raised the money to purchase the collection as valued, it could probably have been sold on the open market for a considerably higher value. Susan and Jack Davis wanted, however, to preserve their collection at Yellowstone so that it will be available for study and appreciation by generations of public users to come. The Davises also donated a number of duplicate postcards and suggested the park use them as "trade items" to help the museum acquire other significant historic objects.

J.E. Stuart Painting. The park was able to make another significant addition to its collection of artwork when Susan Kraft successfully bid \$3,565 in an online auction for "Old Faithful" through the San Rafael Gallery in California. Stuart is increasingly viewed as an important artist, and the museum already includes two of his paintings (see *Preservation, Conservation, and Access, above*). The acquisition of this oil painting increased the significance of our collection regarding this particular Western landscape artist. After receiving the painting in September, museum technicians hung it for temporary display in the lobby of the Superintendent's Office at park headquarters in Mammoth Hot Springs. The piece is in very good condition, but will at some point need conservation treatment to clean and stabilize it, perhaps with some minor inpainting.

Horace and Old Tex. In 2002, the museum staff began work on the transfer of an object significant to the history of bison in the park and to one of the NPS's most notable employees, former Yellowstone

superintendent and NPS director Horace M. Albright. “Horace” is the name given to the hide of a record-sized bison, “Old Tex” (originally from Montana) that once roamed the Lamar Valley of the park. The skull of Old Tex is preserved in the park’s museum collection. The stories relating to these objects range from “ranger lore” to factual documentation.

“Horace” has been stored at Grand Portage National Monument in Grand Marais, Minnesota, where it has been a significant educational tool for that park’s interpretive program. An employee of Grand Portage contacted Yellowstone to ask if the park would want the hide back, since it had little direct relationship with the Midwestern site. Prior to being transferred to Grand Portage, the hide had been at Morristown National Historic Park in New Jersey; then-Director Albright had donated it to the park superintendent, who was a friend of his. Yellowstone museum staff are still researching the story of how the skull and hide of Old Tex became separated.

Gerry Good items. This acquisition is significant to the transportation history of Yellowstone. Mr. Good was the transportation director for the Yellowstone Transportation Company in the 1950s and 1960s. Included in this collection was a stagecoach-era linen duster in excellent condition. The item would have been used from the 1880s through the 1920s. Other significant objects in this collection include more than 100 photographic images of the early days of motorized transportation in the park, and objects from the 1970s including periodicals, buttons, and pins.

Historic photo albums. Lee Whittlesey successfully bid on eBay for an album, containing some 180 images, that is the only known photo documentation of Howard Eaton’s 1912–1914 trips through the park. This collection of images provides a rare glimpse into the history of the Howard Eaton Trail and its namesake. Other photo albums acquired this year include the 1909–1910 Weatherwax photo album that illustrates rare views such as the rear of the former Fountain Hotel; Janet Walker’s 1905 stagecoach album; and photos and other materials relating to the life of Henry Klammer, the owner and builder of what is now known as the Old Faithful Lower Hamilton Store.



J.E. Stuart’s “Old Faithful.”

Diaries. The archivist-historian acquired diaries of park trips in 1901 and 1910 by visitor D.D. Streeter; the diaries of visitor Pamela Swingey; a diary with photographs of a 1919 trip entitled “Through Yellowstone Park with Mrs. and Mr. Kelly, Mr. Hoage, and Gene Girard”; and Edward Zahn’s “Journal of Trip through Yellowstone in June 1899.”

Rare books. Primarily using funds provided by the Yellowstone Association, library staff purchased 11 books identified as rare or hard-to-find, and added them to the rare book collection. Some of these books had been on the library’s wish list for a very long time, and many of these titles were acquired at incredible prices:

- *The Pacific Coast Scenic Tour*, by Henry T. Finck (1890);
- *A Midsummer Ramble: being a descriptive sketch of the Yellowstone National Park*, by H.Z. Osborne (1888);
- *Frank’s Rancho or My Holiday in the Rockies*, by Edward Marston (1886);
- *An Illustrated History of the Yellowstone Valley, Montana*, by Albert L. Babcock (1907);
- a very rare and hard to find work, *The Picturesque West: our Western Empire beyond the Mississippi*, by H.L. Williams (1891);
- *My Mountains*, by Roselle Theodore Cross (1921);
- *Eastward through the Storied Northwest*, by O.D. Wheeler (1906);
- *Conquering the Wilderness*, by Col. Frank Triplett (1885), which contains a section on John Colter;
- *Vacation Journeys East and West*, by David M. Steele (1918); and

- *The Influence of Photography on American Landscape Painting, 1839–1880*, by Elizabeth Lindquist-Cox (1977); a rare and important, although not old, work.

Other Acquisitions.

- Biographical materials on G. L. Henderson and his family, donated by the James Dean Henderson family of Whidbey Island, Washington. Henderson was the first national park interpreter and owner of the former Cottage Hotel at Mammoth Hot Springs;
- Albert L. Babcock's 1907 *An Illustrated History of the Yellowstone Valley: Embracing the Counties of Park, Sweet Grass, Carbon, Yellowstone, Rosebud, Custer and Dawson, State of Montana*;
- a complete 1940s-era park bus driver uniform;
- a photograph of the construction of the Gardiner depot taken in 1903;
- seven ranger letters from the 1920s; and
- a rare Acmeograph postcard view of Wylie's Geyser Camp, Old Faithful.

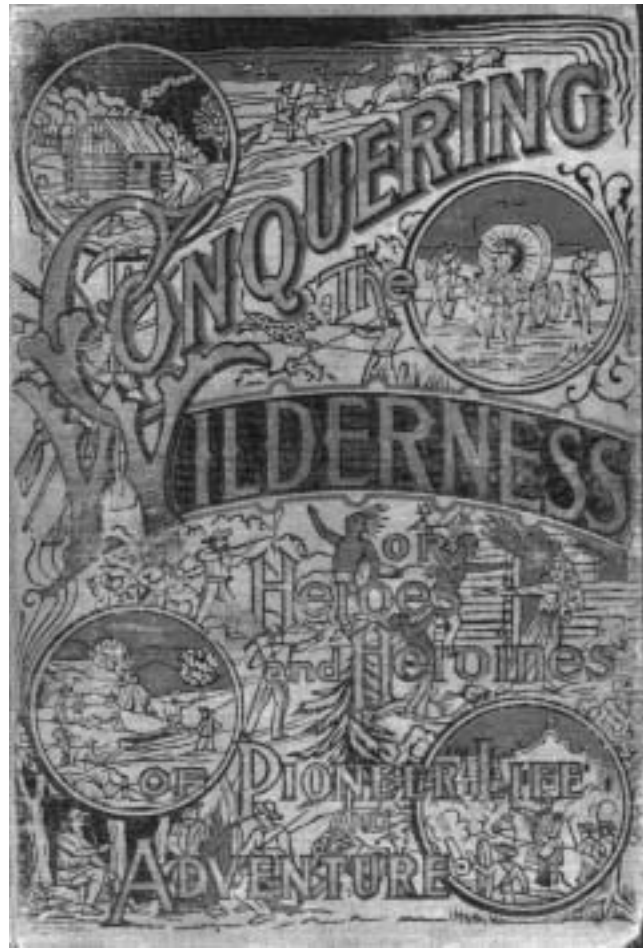
Research, Technical Assistance, and Outreach

The demand for access to the museum collection steadily increased during the year. Technicians met more than 1,000 research and reference requests, often requiring significant staff time. The photo archives were again the most frequently accessed portion of the collection. However, all facets of the collection played a significant role in enhancing the overall understanding of a vast array of interested users.

Exhibit plans. Museum staff assisted the park's exhibit specialist with an upgrade of exhibit signage at the Albright Visitor Center. While this project was being accomplished, the museum staff also did a condition survey of objects on exhibit. The results indicated need for a higher degree of attention to the conservation of objects on exhibit.

Yellowstone Museum Partnership. In April, Lee Whittlesey represented the park at a meeting of the Yellowstone Area Museum Partnership meeting held at Livingston's Fly Fishing Museum. On Saturday, June 8, he also attended the National Park paper show at Billings, Montana. The branch chief contacted several members of the museum partnership for technical advice in the absence of the park curator, and for assistance in recruiting to fill museum staff vacancies.

Assistance to other park staff and partners. During the 2002 tribal consultation meeting at



Colonel Frank Triplett's *Conquering the Wilderness*, acquired in 2002 by the Yellowstone archives.

Mammoth, Steve Tustanowski-Marsh assisted the park anthropologist with logistical support, providing access to the collection as desired by the participants, and participating in a hike to Obsidian Cliff. He also represented Yellowstone at the first annual Nez Perce Symposium held at the Monastery of St. Gertrude in Cottonwood, Idaho, the Nez Perce National Historic Trail Association board meeting; the 125th Chief Joseph and Warriors Powwow; the Pipe Ceremony commemorating the 125th anniversary of the battle at White Bird during the Nez Perce War of 1877; and an orientation to a collection of objects related to the Nez Perce people held at Nez Perce National Historical Park in Spalding, Idaho.

Steve also worked with archeology volunteers performing a boundary survey of the Obsidian Cliff National Historic Landmark. This project consisted of developing a map of the boundary developed by doing ground surveys in the proposed area.

Tours. Sean Cahill conducted numerous tours of the vehicle collection for visitors, park staff, and contractors. The Yellowstone Institute's Roosevelt

Rendezvous classes on the “History of Transportation in Yellowstone” toured the collection on three occasions, with each tour followed by a short ride in one of the eight White Motor Company buses, or “Skagway Ladies,” recently purchased by the park and assigned to the Xanterra concessioner. (These vehicles are not part of the historic vehicle collection, although two other White Motor Company buses are.)

Museum staff also gave tours of the main museum collection vault to the park’s new superintendent, the Business Plan team, and other interested individuals and groups. Lee Whittlesey gave tours of the library and archives collections, to staff of the Billings Museum; new park superintendent Suzanne Lewis, accompanied by YCR Director John Varley and Deputy Director Wayne Brewster; the Gilder-Lehrman Institute; descendants of “first park ranger” Harry Yount; Ohio archivist Jean Edgerly; members of the Nez Perce tribe of Lewiston, Idaho; Evelyn Rose, Yellowstone Park Foundation donor; and Joel Barker of the National Archives and Records Administration Denver office, who made his annual inspection tour of the park archives.

Yellowstone Heritage and Research Center

The cultural resource branch assisted in completing planning for the new Yellowstone Heritage and Research Center, which resulted in the park issuing a \$6.1 million-dollar contract to construct the building, beginning in FY03. Staff from virtually every division within the park participated in this process. In January 2002, the park held a public open house in Gardiner, Montana, for persons interested in commenting on the draft environmental assessment, which had been previously released. Some 30–40 persons attended the meeting and provided comments to Acting Park Superintendent Frank Walker, YCR Director John Varley, Cultural Resources Branch Chief Sue Consolo Murphy, Acting Curator Nancy Hatcher, Planner Leigh Anne Dunworth, and Engineer John Stewart. Other interested parties, including the Montana State Historic Preservation Office, were consulted during the public comment

period about site selection, building design, and other concerns. The park received public comments supporting the need for the facility and expressing interest in seeing more objects exhibited in the new building.

The planning effort culminated in the award of a contract to Dick Anderson Construction of Helena, Montana. Groundbreaking and actual construction began in October 2002 at the Gardiner, Montana, site. Monies were provided by the NPS line-item construction program, and engineer John Stewart, project manager for the design and construction, received an award from the YCR for his outstanding work in keeping the project on track and working cooperatively to meet the concerns of curatorial professionals. The new facility will meet NPS and NARA standards and other health and safety codes, and will house all but the largest museum objects (most notably, the historic vehicle collection), as well as the entire park research library and archival collections.

Outreach. In June, at the request of the Wyoming Heritage Program, Lee Whittlesey attended a meeting in Cody, Wyoming, to discuss building the Wyoming history program in local schools. On June 21–22, he welcomed the Wyoming Historical Society to the park for their annual meeting, giving a Fort Yellowstone walk, a dinner speech on the park’s top ten historic events, and an all-day bus tour. The archivist-historian made speeches to groups visiting the park and to some in other locations. Talks included “Great Conservation Events in Yellowstone,” “Deaths in Yellowstone,” the “Top Ten Events in Yellowstone History,” and “Greater Yellowstone Bison Distribution and Abundance.” The historian and the branch chief made presentations for seasonal orientation of park and concession employees.

The archivist-historian also taught several classes on the history of Yellowstone photographers and stereo photos, and on the history of wildlife, for the Yellowstone Institute, Southwest Montana College, and Elderhostel groups.



Steamboat Geyser erupted twice in 2002.

Part III. Natural Resource Programs

AIR, LAND, AND WATER

Air Quality

Resource management specialist Mary Hektner continued to represent the park in the Greater Yellowstone Area Clean Air Partnership. The partnership is made up of Yellowstone and Grand Teton National Parks; Gallatin, Custer, Beaverhead, Shoshone, Bridger-Teton, and Targhee National Forests; Red Rock Lakes National Wildlife Refuge; the Idaho National Engineering and Environmental Laboratory; and the Montana, Idaho, and Wyoming Departments of Environmental Quality. The partnership serves as an advisory group to the Greater Yellowstone Coordinating Committee and is a forum for information exchange to facilitate air program coordination and the implementation of consistent air quality management strategies.

The NPS Air Resources Division released a report summarizing the results of ten years of air quality monitoring activities in Yellowstone and 31 other national parks. Between 1990 and 1999, there was a statistically significant improvement in Yellowstone's visibility conditions on the 20% (73) cleanest days, a non-significant improvement of visibility on the 20% (73) haziest days; a significant improvement in sulfate concentrations, and improvement in nitrogen concentrations (sulfate and nitrogen are prime components of air pollution).

Of concern was the finding that there was a significant increase in ground level ozone—the principal ingredient of urban smog. The levels are well below ambient air standards that protect public health, but it could harm some of the most sensitive vegetation in the park. So far, no signs of ozone damage have been detected in the park, but there are also no long-term studies being conducted to see if plant life is changing

because of ozone. It is probably too early to tell what kinds of changes might be seen in the Yellowstone ecosystem. The source of the increased ozone is also not known, but growth in the area, transportation, oil and gas development, and other factors affect the local airshed.

A proposal for a coal-fired power plant at Roundup, Montana, 122 miles northeast of Yellowstone, raised concern when air quality modeling by the NPS and Fish and Wildlife Air Quality Divisions found that the project could contribute significantly to Class I increment consumption and visibility impairment at Yellowstone (as well as the USFWS UL Bend National Wilderness). Both agencies are providing technical assistance to the park in reviewing the company's application and a draft EIS prepared by the state of Montana. They are also trying to work with the state to explore ways to work with RPP and MT DEQ to find a solution to these issues. The state is expected to make a decision on the permit by January 2003.

Disturbed Lands and Mining Impacts

Restoration of the remaining 3.0 miles of the abandoned Turbid Lake Road between Turbid Lake and the East Entrance Road began in 2002 using NPS Natural Resource Preservation Program Disturbed Lands Reclamation funding. One mile of road was reclaimed in 2002 and 1.25 miles of new trail were built to replace one-half mile of the existing Turbid Lake trail that was going through wetlands.

Park staff continued to participate in planning and technical meetings, and to monitor reclamation projects associated with three mining areas located outside the park: the New World Mining District Response and Restoration Project, the TVX Mineral Hill Gold Mine, and the McLaren Mill tailings.

Environmental cleanup of historic mining impacts in the New World Mining District adjacent to the park's Northeast Entrance is proceeding smoothly. The U.S. Forest Service continues to identify sources of pollution and conduct site investigations to refine cleanup activities. Resource management specialist Mary Hektner continued to serve as the Department of Interior Project Coordinator for the New World project.

Reclamation of the Mineral Hill mine north of the park is nearly complete, and revegetation efforts are underway.

Park and NPS Water Resources and Geologic Resources staff continued to work with the Montana Department of Environmental Quality to explore

options for treatment and removal of the McLaren Mine tailings, which are located upstream and just outside the park's northeast boundary.

Wetlands

One of the year's highlights was obtaining the approval to add a GS-09 four-year term botanist (Heidi Anderson) to our team to assist with our ever-increasing workload of vegetation projects, especially wetland compliance. Wetland mapping and delineation continued along the Grand Loop Road between Norris and Golden Gate as part of the park-wide road reconstruction program. Areas for potential wetland restoration were also delineated along the abandoned Turbid Lake Road. Monitoring plots and groundwater wells were installed along the Phase 1 restored segment of Turbid Lake Road to document wetland restoration success as required by the 404 permit for the Tower-to-Canyon road reconstruction project. Monitoring plots and wells were also installed on the portion of Turbid Lake Road Phase 2 restoration that was completed this year. Significant amounts of time were spent with the Federal Highway Administration's design team planning for the Tower-to-Canyon, East Entrance Segment C, Norris-to-Golden Gate, and Canyon Rim Drive road reconstruction projects.

More than ten project clearances were reviewed to ensure that impacts to wetland resources would be avoided or minimized.

AQUATICS SECTION

Lake Trout Removal

Following the discovery of lake trout in Yellowstone Lake in 1994, the U.S. Fish and Wildlife Service Yellowstone Fisheries Assistance Office (until 1996) and the Yellowstone Center for Resources (since then) have conducted increasingly intensive investigations to counteract the nonnative threat. In June 2001, the addition of a new boat, the NPS *Freedom*, designed specifically for gillnet operations on Yellowstone Lake, greatly improved working conditions for employees and efficiency of the gill net operations. This helped increase gillnetting effort approximately nine-fold from the 1999 level.

Gillnetting results for 2002. Since 1994, more than 56,200 lake trout have been removed from Yellowstone Lake via gillnetting. Over 12,000 lake trout were removed from Yellowstone Lake in 2002 using approximately 14,570 net units (one net unit is 100 m of net set over one night). On a typical day

during the open water season on Yellowstone Lake, nearly ten miles of gillnet are in place fishing for lake trout. Catch rate (catch per unit of effort) has declined for the third year in a row and was the lowest seen since 1995. Mean total length of lake trout caught near Solution Creek and in Breeze Channel during spawning showed a decrease from previous years; it rose slightly at Carrington Island, the main lake trout spawning site. Overall number of spawners caught was down from 2001.

Bioenergetics modeling (estimates of how many cutthroat trout a lake trout potentially consumes) suggests that an average mature lake trout will consume 41 cutthroat trout per year. Thus, the lake trout control project has saved a large number of cutthroat trout from predation by lake trout.

Hydroacoustic surveys to document population change. Surveys using state-of-the-art hydroacoustic equipment for estimating fish densities were conducted throughout Yellowstone Lake three times during the 2002 field season. Combining this data with detailed bathymetry data produced by the USGS will allow us to identify lake areas where we need to either increase or decrease our lake trout gillnetting effort to improve efficiency.

Long-term prospects. Although recent numbers from the lake trout removal program are encouraging, we have by no means declared victory over the lake trout crisis in Yellowstone Lake. Lake trout densities in the West Thumb remain high and a serious threat to the Yellowstone cutthroat trout. Given the available habitat in Yellowstone Lake, the effect of an expanding lake trout population will be very real if control efforts are reduced or eliminated. Model simulations indicate that a 60% or greater decline in the cutthroat population could be expected within 100 years if the lake trout population were permitted to grow uncontrolled.

Whirling Disease Research

The causative agent of salmonid whirling disease [*Myxobolus cerebralis*], was first detected in Yellowstone Lake in 1998. This discovery immediately caused great concern because the disease has devastated wild trout populations in other waters of the Intermountain West. Adult Yellowstone cutthroat trout that are incidentally killed by lake trout removal efforts are tested for the disease, and we have determined that the incidence of whirling disease appears to be higher in the northern region of the lake (19%) compared to the south arms (9%) or West Thumb (12%). Additionally, NPS fisheries biologists have exposed age-zero Yellowstone cut-

throat trout to lake tributary waters each year since 1999 in an attempt to determine the distribution of *M. cerebralis* in the basin, and the characteristics of the environment that are conducive to the disease. Lower Pelican Creek in the vicinity of the road viaduct is highly infected. All Yellowstone cutthroat trout exposures conducted there to date have resulted in positive tests for the presence of whirling disease. These exposure tests were repeated in 2002, and laboratory examination of fishes is now being conducted to determine the extent of infection.

In 2001 and 2002, we also completed the first survey of *Tubifex tubifex* worms and substrate conditions in the same streams used for exposures of trout. We located *T. tubifex* hosting actinospores in Yellowstone River, Bridge Creek, Arnica Creek, Little Thumb Creek, Creek 1167, Sewer Creek, and Beaverdam Creek. Recent results of genetic examination of these worms has determined that the infection in Yellowstone River and Pelican Creek (from worms sampled in 2002) is indeed *M. cerebralis*. There is a high risk of infection in additional tributaries to Yellowstone Lake that are suitable for the persistence of the disease.

Movement patterns within Yellowstone Lake. Whirling disease research has suggested young Yellowstone cutthroat trout are becoming infected primarily in the Yellowstone River and Pelican Creek. We were interested in determining the movement patterns of spawning adults from these streams and Clear Creek, the site of our long-term spawning migration trap, in Yellowstone Lake. A total of 24 Yellowstone cutthroat trout adults were fitted with



The microscopic worm *Tubifex tubifex* is the alternate host for the whirling disease life cycle and a focus of study for understanding this disease in Yellowstone.

ultrasonic tags and tracked July through September 2002. Ten fish locations were identified, representing 6 of the 24 tagged fish. Of these, three fish were tagged at Yellowstone River near Fishing Bridge, two were tagged at Pelican Creek near the road viaduct, and one was tagged at the Clear Creek fish trap. Eight of the ten tag locations and relocations occurred in the northern region of the lake near Storm Point, Pelican Creek, the Yellowstone Lake outlet, and Stevenson Island. The greatest movement that we determined was by a Clear Creek fish relo-



NPS fisheries technician Mike Ruhl listens for the signal from an ultrasonic tagged cutthroat trout in Yellowstone Lake, July 2002.

cated in the West Thumb near Arnica Creek, and by a Yellowstone River fish relocated south of Elk Point along the lake's eastern shore. This research provides additional evidence that Yellowstone cutthroat trout can disperse widely throughout Yellowstone Lake following spawning in specific tributary streams.

Long-term monitoring programs. Annual assessment of the Yellowstone cutthroat trout population of Yellowstone Lake has been conducted by counts of upstream-migrating spawners at Clear Creek, Bridge Creek, and Arnica Creek; by dip-netting adult spawners at LeHardys Rapids; and by a netting program on the lake conducted during September each year.

Using multi-mesh-size gillnets set in shallow water at 11 sites throughout Yellowstone Lake, the Aquatics Section has been able to collect valuable cutthroat trout population information. Catches by our annual fall netting program averaged 5.1 cutthroat trout per net, the lowest catch recorded since the initiation of the program in 1969. The reduction in catch has been 0–21% each year (average of 11% per year) since 1994, the year lake trout [*Salvelinus namaycush*] were first discovered in Yellowstone Lake.

Examination of length-frequency data from the fall netting survey shows a severe decline in the number of adult cutthroat trout in Yellowstone Lake. In fact, entire age classes are virtually missing from the lake population. In 2002, few fish were caught between the lengths of 300 to 430 mm. Historically, these have been the sizes of the majority of cutthroat trout in spawning tributaries such as Clear Creek and at LeHardys Rapids. Despite this, there is an apparent increase in juvenile cutthroat trout in 2001 and 2002 as an encouraging sign, and an indication that the lake trout removal program may be having a significant effect, contributing to the preservation of Yellowstone cutthroat trout in this system. The south arms of Yellowstone Lake may act as refuges for cutthroat trout due to the low numbers of lake trout found there. Our long-term netting site near Peale Island in the South Arm produced 132 cutthroat trout (and no lake trout) over one night. This was a much higher catch than all other sites and represented 39% of all cutthroat trout sampled by the September 2002 netting program.

The Yellowstone cutthroat trout population decline has also been seen in total numbers of upstream-migrating cutthroat trout at Clear Creek, a major spawning tributary on the lake's eastern side. A total of 6,613 upstream-migrating cutthroat trout were counted at Clear Creek, down from 9,581 in 2001 and the lowest count since 1994. Fish counting stations were also operated on Arnica and Bridge Creeks. In Arnica Creek, 455 cutthroat trout were counted migrating upstream during the 2002 field season. In Bridge Creek, 373 cutthroat trout were

counted migrating upstream from late April to mid June, 2002. This represents a 67% decrease from the 2001 total of 1,140, and an 84% decrease since monitoring began in 1999.

Restoration of Westslope Cutthroat Trout

Life history strategies at Fan Creek. For the past several decades, park fishery personnel have been gathering population abundance, size structure, and genetics data about the westslope cutthroat trout [*Onchorhynchus clarki lewisi*] residing in Fan Creek. Data from multiple samplings indicates that the only genetically pure population of westslope cutthroat trout in the park resides in Fan Creek. In fall 2000, we began a cooperative graduate study to examine the fish's seasonal distribution and movements.

Stream Fishery Surveys and Fish Health

Population surveys. For the third consecutive year, we sampled four separate sections of the Gibbon River. The principal objective of this study was to monitor impacts to portions of the stream near areas of major road reconstruction. The Madison-to-Norris road reconstruction is probably one of the most ambitious projects that the park has undertaken in recent years. Thus, the potential for increased sediment input into the stream and habitat degradation is very high. More importantly, this project represents one of the first attempts to restore a stream segment that has been seriously affected by historical road building. Much of the work will occur in an area that was originally barren of fish, but the sections downstream from Gibbon Falls (Tuff Cliffs and Canyon Creek sample areas) historically contained westslope cutthroat trout and the riverine form of Arctic grayling. Our secondary objective is to examine effects of the construction project on the few grayling that may reside in the lower sections of the stream.

No grayling were captured during 2002 in the Gibbon River and only two were caught the previous year. Brown trout were the most common fish collected at each of the four sample areas, and the only species captured in the Tanker Curve section. Rainbow trout were only captured downstream from Gibbon Falls.

In response to concerns related to perceived excessive angler use and potential riparian damage, the fisheries staff initiated a multi-year population assessment of Yellowstone cutthroat trout in Slough Creek. Despite high levels of angler use in this catch and release fishery, we estimate that there are several hundred adult cutthroat trout (longer than 330 mm)

per kilometer in Slough Creek.

Surveys for fish health. As part of the U.S. Fish and Wildlife Service National Fish Health Survey, park biologists periodically collect fish that are lethally sampled and examined for a variety of parasitic infections and bacterial and viral diseases. In 2002, rainbow trout and brook trout from Tower Creek were collected and submitted for analyses, as well as several dozen mountain whitefish [*Prosopium williamsoni*] from the Snake River, and 25 rainbow trout and brown trout from a tributary of Fan Creek.

Genetics surveys. Preservation of native trout genes is an important management priority in Yellowstone. As non-lethal analysis techniques are now available, extensive sampling of small or other at-risk populations is possible. In addition to the large amount of sampling of suspected westslope cutthroats in the Gallatin River watershed, fin tissue samples for genetic determination have been collected from Antelope Creek, Slough Creek, Soda Butte Creek, and Gneiss Creek, a tributary of the Madison River. At all of these sites, the possibility of hybridization with non-native rainbow trout may have occurred. Several hundred samples have not yet been analyzed. Large backlogs of samples at the analytical laboratories and funding constraints continue to delay determination of the genetic status of these important fish populations.

Aquatic Ecosystem Health Program

Invasive aquatic exotic species threaten the park. In addition to the parasite that causes whirling disease, YNP aquatic systems have been invaded by the New Zealand mudsnail [*Potamopyrgus antipodarium*]. First found in the park in 1994, mudsnails now occupy waters of the Firehole, Gibbon, Madison, and Gardner Rivers, Polecat Creek, and likely others. Recent research indicates that these animals have been out-competing and displacing native invertebrates. The effects of these invaders on fish is unknown, but recent research indicates that mudsnails can pass completely through the gut of a fish unharmed offering no nutritional value.

Establishment of long-term water quality monitoring. In 2002, we initiated a new program aimed at tracking the ecological health of aquatic systems in Yellowstone National Park. The quality of the park's surface waters is now routinely monitored biweekly at 12 fixed sites located near the confluences of major streams and rivers. The physical and chemical characteristics of Yellowstone Lake are monitored seasonally to assist the targeting of non-

native lake trout. Macroinvertebrates are now sampled using regionally standardized methods to allow for easy comparison of data among agencies.

Angling in the Park

Trends from the volunteer angler report cards. In 2002, the Visitor Services Office of the Resource Management and Visitor Protection Division issued 55,092 fishing permits. When issued, a voluntary angler report card is provided with the permit and anglers have the opportunity to provide critical information to the Aquatics Section by returning these cards to the park.

Recent data from the report cards suggest that the average angler in Yellowstone typically fishes two to three days for about three hours each day. More than 80% of single-day anglers will land one or more fish, with cutthroat trout being the most frequently captured fish, followed by rainbow trout, brook trout (*Salvelinus fontinalis*), and brown trout. Most anglers (more than 80%) have reported being satisfied with their overall fishing experience while in Yellowstone, and more than 70% of anglers have reported being satisfied with numbers and sizes of fish landed. The most popular fishery in the park is Yellowstone Lake, which consistently attracts more than 50% of anglers. The average angler on Yellowstone Lake lands about one cutthroat trout for every hour of fishing. In recent years, the average size of cutthroat trout caught in Yellowstone Lake has increased to an average of more than 400 mm. This trend is similar to that noted by our Aquatics Section September netting program, in that large cutthroat trout have comprised a significant proportion of the catch.

Public Involvement with the Aquatics Section

Volunteer fly-fishing program. In 2002, a new program was established to incorporate flyfishing volunteers and use catch-and-release angling as a capture technique to gather biological information on fish populations located throughout the park. The Volunteer Fly-fishing Program was coordinated by Dr. Timothy Bywater, an avid fly-fisherman and long-time supporter and promoter of Yellowstone's fisheries. Questions addressed included:

- determination of the range of hybridized Yellowstone cutthroat trout in the Lamar River and its major tributaries;
- documentation of the Pebble Creek fishery;
- status and genetic uniqueness of brook trout in



NPS Aquatic Ecologist Jeff Arnold lowers a monitoring probe into the Yellowstone River as part of the long-term water quality monitoring program, August 2002.

special regulation lakes;

- status and genetic uniqueness of westslope cutthroat trout in Grayling Creek; and
- documenting the status and movement patterns of grayling originating in Grebe and Wolf Lakes of the Gibbon River system.

The program was incredibly successful, as 40 volunteer anglers from across the U.S. participated as an active component of our Aquatics Section. Solid bonds have been developed between the angling community and the Yellowstone fisheries biologists. Volunteers were able to experience firsthand many fisheries issues, and biological data has been collected that will assist in our understanding of the park's fisheries status. The program suffers from a complete lack of funding, and support is actively being sought to continue this valuable work.

Long-term volunteer assistance. In 2002, we received assistance from 81 volunteers with a total contribution of 6,382 hours dedicated to fisheries programs.

Educational programs. Aquatics Section staff continued to provide a variety of short-term educational programs for visiting schools and other interested groups. Of special note in 2002 was the incorporation of four high-school scholars from St. Steven's & St. Agnes School, Washington, D.C., and their leader, Mansir Petree. This group spent over a week living in the park's interior and working closely with NPS fisheries biologists, primarily on tributary spawning migration trap operations.

GEOLOGY AND GEOTHERMAL RESOURCES

In 2002, YNP employed Dr. Henry Heasler through an Intergovernmental Personnel Act with the University of Wyoming. Henry worked with David Susong, research hydrologist with the United States Geological Survey (USGS), to begin expanding Yellowstone's geology program. Also assisting was Cheryl Jaworowski, Professor at Laramie County Community College, who was employed during the summer to assist with geomorphic studies and education efforts.

Notable geologic events during the year consisted of two eruptions of Steamboat Geyser. Eruptions occurred on April 26, 2002, and September 13, 2002.

Databases

Electronic geyser eruption catalog and database. Ralph Taylor, volunteer at Old Faithful, continued an ongoing project of compiling all the electronic geyser eruption data. Eruption interval data has been collected for nearly a decade using small data loggers with thermistors placed in the runoff channels. Analysis of this data provides the basis for monitoring changes in geyser activity and for eruption prediction models. All data through 2002 are compiled into a database. A catalog of the database listing features, types of data, frequency of data, period of record, and collector, is being prepared.

Yellowstone Geologic Database. A database is being constructed to contain the geologic and geothermal data collected each year in Yellowstone. The database currently includes electronic photographs, electronic reports, temperature data, global positioning system data, and geographic information systems data. The Geologic Database will become more robust and better populated through time, making it an excellent archive of work accomplished.

Partnerships

Yellowstone Volcanic Observatory. A scientific meeting of the Yellowstone Volcanic Observatory was held in Salt Lake City in April 2002. Over 30 scientists attended this meeting to present and discuss the state of knowledge concerning the Yellowstone magmatic/volcanic/geothermal system. A meeting was planned for October 2002 to begin the discussion of volcanic and geologic hazards.

A new seismic station was permitted and established for the Mirror Plateau during summer 2002.

This station greatly enhances the analysis of seismic energy traveling through the Yellowstone volcano.

Administration of Montana Compact. The cooperative agreement with the State of Montana for the administration of water rights in the controlled groundwater area continued in 2002. Henry Heasler attended a meeting of the Technical Oversight Committee in Bozeman, where a request for funding continued monitoring was presented by the Montana Bureau of Mines and Geology. This funding request is being considered by Yellowstone National Park as part of its commitment to the Montana Compact.

During 2003, four groundwater use applications for the controlled groundwater area were reviewed by the National Park Service Water Resources Division and Henry Heasler.

Reese Creek flume study. Colorado State University (CSU) researchers completed the second phase of the Reese Creek flume study. The objective of the study is to attempt to calibrate the Reese Creek flumes to measure supercritical flow. The second phase of the study, performing small-scale experimental tests on parshell flumes in the lab, showed that it was possible to develop a calibration curve. As a result, CSU researchers visited Reese Creek to precisely measure channel geometry and streambed parameters.

Assistance to the University of Montana Fire Research Laboratory. In 2001, the YCR Infometrics 760 infrared instrument was lent to the UMT Fire Research Lab for use in remote sensing of fire behavior. The Fire Lab tested the instrument in laboratory applications.

Chloride flux monitoring program. The chloride flux program expanded during 2002, with the addition of three river gauging stations at the Boiling, Firehole, and Gibbon Rivers. The data collected by these three gauging sites is viewable through the Internet either at the Yellowstone Volcano Observatory web site or the USGS, Water Resources Division, Montana District web site. A USGS laboratory in Menlo Park, California, will analyze the samples for chloride and sulfate. Data analysis is being completed by David Susong, USGS, in consultation with Irving Friedman.

Yellowstone Lake bathymetry. Lisa Morgan and Pat Shanks finished the Yellowstone Lake detailed bathymetry study with funding from the YCR and the USGS.

Support of Park Operations

Park Maintenance, Interpretation, and Resource Management and Visitor Protection divisions require

ongoing support and assistance. Geologic resources staff assisted with ongoing projects, provided training, and responded to crises.

Road construction. The Norris road construction is impacting a number of sensitive thermal areas. Geologic resources staff monitored construction activities in and near the thermal basins including the Beryl Spring bridge. A thermal inventory of the road corridor north of Norris has begun.

Theft of mineral specimens. Henry Heasler and Cheryl Jaworowski assisted law enforcement rangers with the sorting and identification of mineral specimens believed to have been taken from the park.

Closure of Firehole Lake Drive. Firehole Lake Drive was closed in mid-summer due to severe buckling of the pavement near White Dome Geyser. Electronic temperature monitors were deployed to assess the situation. A section of pavement that had been trapping steam and heat was removed, allowing the road to reopen.

Fuel spill at Old Faithful. In August, Henry Heasler, Ralph Taylor, and Tim Thompson monitored a fuel spill cleanup at Old Faithful's lower YPSS gas station for potential impacts to the hydrothermal system. The clean-up procedure involved digging in an area with sinter and known geothermal activity. The site was monitored during any digging or drilling to watch for signs of hot ground or thermal waters.

Sedimentation of Mammoth sinkhole. Henry Heasler consulted with landscape architects regarding Clematis Creek and the sedimentation that has filled a sinkhole in the Mammoth parade ground. Clematis Creek terminates in the sinkhole, and large storm events have washed large volumes of sediment into the hole, nearly filling it. If another storm event washes more sediment into the sinkhole, it may completely fill and become plugged, and the Creek will develop a new channel, possibly through a developed area.

Thermal activity affecting boardwalks and trails. At Norris, ground temperatures were mapped on a segment of the Bask Basin trail, near the Son of Green Dragon thermal feature. Temperatures were measured as high as 42°C in the trail. At West Thumb, a section of boardwalk was closed when a thermal feature began expanding under the existing boardwalk. At Mammoth, discussions were held concerning the movement of boardwalk at Canary Springs and Palette Springs.

Norris Wastewater Treatment Plant Environmental Assessment. The Norris Wastewater

Treatment Plant Environmental Assessment was completed. Two geothermal concerns were addressed. The principal geothermal resource concern is blasting in close proximity to Norris Geyser Basin. The second concern is the excavation of relatively deep (4 m) trenches for sewer lines. Blasting will be minimized, and the supervisory geologist will be notified of both blasting and trenching schedules.

Reese Creek. Henry Heasler consulted with Resource Management staff and provided input on the operation and maintenance of the Reese Creek water measurement flumes. The measurement of the flow in Reese Creek and diversion ditches continues to be a problem.

Canyon Visitor Center. The new Canyon Visitor Center will focus on the geology of Yellowstone. Design and review of exhibit material has been ongoing and intensive. Exhibit material has also been sent to other geology and geophysics subject matter experts, and their viewpoints incorporated into the exhibit's text.



Graphic showing the area of the Firehole Lake Drive damaged by nearby thermal activity.

Old Faithful Visitor Education Center. The proposed Old Faithful Visitor Education Center may be located near the current Old Faithful Visitor Center. In an effort to determine the possibility of shallow hydrothermal water flow in the area of the proposed visitor center, 22 temperature sensors were deployed to gather data over the winter. These data will be plotted in map form and analyzed to determine the presence of shallow subsurface thermal water flow.

Scanned and cataloged surficial geologic maps of Yellowstone National Park. The 15-minute-quadrangle USGS maps showing the surficial geology of Yellowstone have been scanned by the National Park Service, Geologic Resources Division. These maps have been rectified to display correctly on the Yellowstone Geographic Information System. The availability of the surficial maps in this format will increase the efficiency and ease of answering geologic questions.

Geothermal Inventory

(See Part IV, *Spatial Analysis Center, Projects, Thermal area inventory.*)

Hydrothermal activity. Ralph Taylor deployed electronic temperature monitors on geysers on Geyser Hill, Pyramid Geyser, Lone Pine Geyser at West Thumb, and other areas. Results were downloaded weekly and analyzed for eruption intervals. Ralph Taylor also located all electronic temperature monitors with global positioning system equipment and took electronic photos of each site.

Ralph Taylor also continued his efforts at cleaning the thermal features.

Paleontology

In 2002, three field research projects were conducted that provided documentation of YNP fossil resources. Although staff funding continues to be difficult to acquire, the Branch of Cultural Resources provided ¼ FTE for management of the park's paleontology program, in conjunction with the Branch of Natural Resources' geology program. Special project funding was provided from three sources: NPS Regional Natural Resource funds, Federal Highway Administration road reconstruction funds for the East Entrance Road, and the Jane Smith Turner Foundation, an affiliate of the Yellowstone Park Foundation. All three projects involved partnerships with outside agencies and individuals, bringing paleontological and geological expertise into YNP to locate, document, and assess the significance of the park's fossil resources.

Cretaceous stratigraphy and paleontological study of Mount Everts. The purpose of the study was to conduct a scientific survey of the fossil bearing Cretaceous rock formations and alluvial deposits on Mount Everts. The field study was needed to provide baseline geographic data on fossil localities; stratigraphic data related to the geology of the localities; paleontological data related to the identification of fossil species; and geologic data related to the depositional environment of the fossil-bearing units.

The two-year project provided documentation, stratigraphic assessment, and baseline data necessary for management decisions concerning resource protection and infrastructure development.

An interdisciplinary team of experts participating in fieldwork for this project were Dr. William Cobban, USGS Paleontologist Emeritus and expert in Cretaceous index fossils; Dr. Douglas Nichols, USGS Palynologist; Dr. Thaddeus Dyman, USGS Geologist; Dr. Karen Porter, Senior Research Geologist with the Montana Bureau of Mines and Geology; Dr. Scott Wing, Paleobotanist with the Smithsonian Institution; Ken Takahashi, USGS Computer/Technology Specialist; Dr. Gail Wiggett, trace fossil and sediment analysis; and Vince Santucci, NPS paleontologist. Yellowstone National Park personnel involved with this project were Elaine Hale, project director, and Julia Fitzke, contract paleontologist. The project also received assistance from Dr. Henry Heasler, YNP supervisory geologist, and Cheryl Jaworowski, research geologist.

Prior to, and ongoing throughout the two-year project, a literature search was conducted to identify all of the known research previously conducted on the Cretaceous sediments of Mt. Everts. Fossils previously collected were located in our museum collections, analyzed, and photographed. Research published on the Mt. Everts area located in other repositories was accessed and copied for review by the team's subject matter experts.

In 2002, field work included pedestrian inventory of the Cretaceous exposures to clarify stratigraphy, collect index fossils, fossil pollen samples, dateable bentonites, and other information about the depositional environment. Areas of particular interest were the Frontier Sandstone—Mowry Shale contact and the marine/non-marine depositional environment of the Thermopolis/Muddy sandstone, which is the oldest exposure. The Cody Shale, Landslide Creek Formation, Eagle Sandstone, and Everts upper units were also investigated. Fossil locales were documented, and index or indicator fossils collected for analysis, interpretation, and curation. All collections were made under the research permit process, and all collected fossil specimens were accessioned into the museum collections. Fossil locales were documented, site forms completed, and photographs taken of the specimen and its *in situ* environment. Fossil leaves, clams, ammonites, pollen, trace fossils, and bentonite will be analyzed to further pinpoint the stratigraphic units. Digital images of all aspects of

the field inventory were taken in the field and will be incorporated into the final report. Fieldwork was completed the end of August 2002.

Due to the time needed for laboratory work, specimen preparation and analysis, the final report will not be available for distribution in May 2003 as expected. The report will be produced digitally and published in CD-ROM format, although paper copies will also be available. The text will be written in lay-reader terms, with hot links to the technical aspects and scientific terminology. Color images and graphics will be incorporated with the text and easily



With the help of Ellis Yochelson's lupe, Julia Fitzke inspects a fossil recovered during the Trilobite Point Paleontologic Survey.

viewed using Adobe Acrobat 5.0. Images will include panoramic views of the depositional character of Mt. Everts, drafted figures of stratigraphic units, line drawings and images of fossils, photographs of fossils, and a fossil inventory. The specific location of fossil-bearing units will be removed from the report, and a resource protection message provided in the introduction.

The total project cost for research, field investigations, laboratory and expert analysis, and report pro-

duction totaled \$29,100 over the 2001 and 2002 fiscal years. All available funds have been obligated in accordance with the project proposal submittal.

Funding for this project was made available through the Intermountain Regional Natural Resource Fund under they FY2001 SEPAS funding call.

The Mount Everts Stratigraphic and Paleontological Study has provided articles for *Yellowstone Science* and *The Buffalo Chip*, and has been invited to submit an article to *Park Science*.

Trilobite Point paleontologic inventory.

Organization, staging, and execution of a week-long paleontological survey of the Middle Cambrian exposures at Mount Holmes' Trilobite Point were accomplished, with fieldwork completed the last week of August 2002. The study area was chosen because of the rarity of the Middle Cambrian exposures in YNP, the previously undocumented namesake fossil resources (trilobites), and because of previous notoriety received by the location from visits by preeminent scientists such as W.H. Holmes and C.D. Walcott. The prospect of conducting a paleontological survey near the summit of Mount Holmes, deep in grizzly country, was discussed with the Yellowstone Park Foundation staff and board members in June 2002. With YPF support for the project, research on the fossil locale was organized and conducted.

A variety of trilobite and Middle Cambrian experts were contacted to participate in the project. The multi-disciplinary team participating in the fieldwork consisted of trilobite expert Arvid Aase, Fossil Butte National Monument; fossil snail expert and author Ellis Yochelson, National Museum of Natural Science; and trilobite expert Brian Sparks, Director of the Yellowstone Gateway Museum. YNP staff Ann Rodman, Julia Fitzke, Ben Dorsey, and Russian geologist Anton Gerasimensko, international volunteer with Fossil Butte NM, joined the project to provide expertise in the field. YNP photographer Jim Peaco, and Sue Consolo Murphy, Branch Chief of Cultural Resources, provided additional expertise to the fossil inventory and recordation project. Law Enforcement Ranger Brian Helms provided logistical support, and Corral Operations staff packed field equipment into the remote backcountry location. Elaine Hale directed and participated in the project.

Trilobite-bearing sediments were located within the first hour of fieldwork, and within sight of camp. The remaining three days were spent locating and documenting numerous other fossil-bearing locations

with abundant trilobites, brachiopods, and hyoliths. Photographs, GPS locations, field notes (including expert descriptions of the fossils *in situ*), field laboratory identification of the collected specimens, and descriptions of the fossil-bearing sediments were recorded. Field collections included numerous brachiopods, hyoliths, three genera of trilobites [*Agnostids*, *Ptycoperia*, and *Crepacephalis*], and trace fossils (worm casts). The inventory teams were efficient and successful, and everyone got to the top of the mountain and back again safely.

Post-fieldwork activities are ongoing, and include the sorting of fossils by type and degree of preservation. The identification of collected specimens and analysis of their significance is currently underway. Well-known trilobite experts Arvid Aase, team member, and Dr. Pete Palmer, retired from the Smithsonian, will provide identification and analysis of those fossil species. Dr. Ronald Shimik, marine biologist and Montana State University professor, has agreed to look at the brachiopods and hyoliths. A graphic artist has completed measured drawings of two genera of trilobites. Other collected specimens have been photographed with the aid of a microscope and digital camera. After identification, the fossils will be cataloged into the museum collection and available, at a later time, for research and educational purposes. Site forms have been completed on the fossil localities identified in the inventory area. Maps, photographs, and location information on each locality will be added to YNP's fossil inventory files and fossil database maps.

After analysis is complete, the inventory report will be compiled, providing detailed descriptions of the project and the results. It is hoped that the project will be presented at the Geological Society of America's conference next spring. The report should be completed by June 30, 2003.

Several articles have been written about the inventory project. The NPS-wide publication, *Natural Resources Year in Review*, is featuring a half-page sidebar on the project. Julia Fitzke authored an article published in *The Buffalo Chip*. Diane Smith, science writer and author of *Letters From Yellowstone*, participated in the field project and has completed an article to be submitted to the Department of Interior publication, *People, Land, and Water*.

The total project cost for research, field equipment, field investigations, analysis, and museum cataloging of collected specimens, and the production of a report will total \$12,000.

Paleontological survey of the Sylvan Pass-to-East Entrance road corridor. A scope of work was developed and a contract negotiated through the Cooperative Ecosystem Studies Unit for paleontological survey, assessment, and recommendations concerning the impact of reconstruction of the Sylvan Pass to East Entrance road. Through this contract, YNP seeks assistance to assess the significance of the geologic characteristics of this road segment, as well as recommendations for the reconstruction of the road that will mitigate the impact to the geologic resources, particularly fossils, located within the road corridor. Dr. Marc S. Hendrix, Professor of Geology at the University of Montana has agreed to complete the task, broken into various stages, begun in 2002 and scheduled to be completed by 2005.

In 1994, during the construction of the Lake Butte-to-Sylvan Pass segment of the East Entrance Road, excavation and removal of parts of the Langford Formation, a middle Eocene unit of volcanic-derived sediments, produced large fossil leaf specimens and fossilized wood. The fossil leaves were recovered from a low energy mud/debris flow typical in volcanic settings. Similar mud/debris flows are present along the road corridor on the Sylvan Pass-to-East Entrance segment of road. This inadvertent discovery alerted YNP to the need for identifying potential fossil bearing areas prior to construction, and developing a plan to recover, evaluate, and interpret any significant geologic resources within the road corridor.

The project is divided into several components. Prior to construction, planned to begin in spring 2003, a survey of the road corridor was conducted to identify potential fossil-bearing areas. Dr. Marc Hendrix completed the pedestrian inventory of the road corridor and adjacent rock formations in August 2002. The inventory report, due in February 2003, will include paleontological information gathered through the inventory process, identifying any areas along the roadside that exhibit the potential for fossils. Included in the report will be a strategy for YNP staff to monitor the road construction to facilitate fossil recovery, along with a fossil preservation strategy. The contract also provides for the identification and evaluation of any fossils recovered through the road construction activities.

The second component involves an assessment of the road construction on the Langford geologic formation, and recommendations for the interpretation of the fossils and geologic resources found within

the reconstructed road corridor. This component will be ongoing throughout the road construction, with the final report due in September 2005.

The cost of the project is \$20,000, funding for which was provided through the Federal Highway Administration's road construction program. To date, \$5,000 has been spent, with \$15,000 remaining for the completion of the project.

Other highlights of 2002. In July, Elaine Hale and Julia Fitzke conducted a YNP field tour to a joint group of German and Swedish graduate paleontology students and professors sponsored by the Institute of Palaeontology at the University of Bonn. Rock formations from two particular periods, the Late Cambrian (520–500 million years ago) and Mississippian (360–320 million years ago), were of particular interest to the group. Several locations in the northeast portion of the park were visited, with a Pebble Creek location providing an excellent example of the types of fossils found in the Mississippian exposures.

Also of interest to the group were the fossil forests exposed on Specimen Ridge, but the Wrong Fire had advanced toward the area, and the Specimen Ridge trail was closed. As an alternative, the petrified tree interpretive area was used to conduct the bilingual lesson in fossil forming processes, such as petrification.

VEGETATION

Plant Inventories

New collections and clarifications resulted in six new native vascular plant species being confirmed to occur within the park. Previous reports of Brown's peony [*Paeonia brownii* Dougl. ex Hook.] were based on a specimen in the Yellowstone herbarium that was actually collected outside of the park. A small population was located in early June near Cave Falls in Bechler, just within the park boundary. Another species that had been previously reported to occur in Yellowstone was Aunt Lucy [*Ellisia nyctelea* L.], though to the park's knowledge there were no herbarium collections that documented its presence. Aunt Lucy was found in three different locations this summer near Gardiner and Stephens Creek. Golden currant [*Ribes aureum* Pursh var. *aureum*] is a conspicuous component of the vegetation in Paradise Valley, and so could reasonably be expected to occur in the park. During a survey of the Xanterra warehouse area in Gardiner, golden currant was encountered on the edge of one of the ware-

houses, and also in a gully above the Gardner River. A small patch of purple avens [*Geum rivale* L.] was found along Glen Creek. This population is probably native, but since it is immediately adjacent to the Bunsen Peak Road, there is the possibility that this species is actually present in the park due to an inadvertent introduction. Thicketleaf draba [*Draba crassa* Rydb.] and beavertip draba [*Draba globosa* Payson] were located by Ken Aho during fieldwork funded by the National Park Service to develop baseline information on high elevation vegetation in the



Park botanist Jennifer Whipple points out Brown's peony (*Paeonia brownii* Dougl. ex Hook.), one of six new native vascular plant species confirmed in the park in 2002.

Absaroka Mountains. Several other species have been reported to be in the park by other researchers, but these reports will need to be confirmed after examination of specimens.

Regretfully, additional exotic vascular plant species continued to be discovered within the park. The Madison sewage facility demonstrated the toughness of some seeds, since a healthy population

of tomatoes [*Lycopersicon esculentum* Mill.] was found to be growing in one of the sludge drying beds. Obviously, tomatoes, which cannot set seed during Yellowstone's short summers, will not be expected to be invasive into undisturbed vegetation in the park. In contrast, spring speedwell [*Veronica verna* L.] has already spread into undisturbed ground in both the Upper and Midway Geyser Basins. This inconspicuous species, which closely resembles another common exotic species present in the thermal areas, had apparently been overlooked previously. Examination of unidentified backlog specimens of *Veronica* revealed another collection from 1995, so this species probably has been present in the park for at least a decade. Detected on the edge of the Mammoth Xanterra concession corrals were a few plants of small-flowered alyssum [*Alyssum parviflorum* Fisch. ex Bieb. var. *micranthum* (Meyer) Dorn] intermingled with the extensive infestation of pale alyssum. Hopefully, this species was detected while it is still possible to eradicate it. Two different exotic grasses that were likely to be present somewhere within the park were also detected for the first time this year. A small patch of colonial bentgrass [*Agrostis capillaris* L.] was encountered near Frying Pan Spring. Roughstalk bluegrass [*Poa trivialis* L.] is well established in an undisturbed wetland in the vicinity of Twin Lakes, and regrettably, is probably invasive at other locations in the park. With the addition of the five species found during the field season of 2002, the total of exotic taxa detected within the park is now 201.

Summer fieldwork concentrated on rare plant surveys associated with various construction projects throughout the park. The primary focus was on the road from Norris Junction-to-Golden Gate for the parkwide road reconstruction program, along with the North and South Rim Drives and a proposed new route into the Grebe Lake Pit. Various other construction sites were also investigated for rare plants including: proposed site for the Bechler photovoltaic cell; proposed sites for new West Yellowstone Entrance Station; Xanterra warehouse area and several lots in Gardiner; new septic system for Apollinaris Spring; jack leg fence reconstruction at the Xanterra Mammoth Horse Corrals; Madison Junction Wastewater Treatment Station; new bridge at Zipper Creek at Old Faithful; proposed sites for Canyon Ranger Station; new comfort stations at Slough Creek and Hellroaring trailheads; lighting along paths in the Lake area; proposed sites previously unsurveyed for the Mammoth housing EA;

culvert at Stephens Creek; new waterline at Old Faithful; Grayling Dorm addition at Grant Village; Norris water and wastewater lines and facilities; and proposed new campfire circle at Norris Campground. Additional surveys were also initiated for other ground disturbing activities including: proposed new river gauging sites near Madison Junction, Firehole Canyon Drive, and Boiling River; proposed seismograph site on the Mirror Plateau; archeological dig sites on Yellowstone Lake and along the Yellowstone River; boardwalk reconstruction due to increases in thermal activity at Norris and West Thumb Geyser Basins; and proposed back-country campsite replacement in the South Arm of Yellowstone Lake. The summer field season resulted in documenting 136 additional sites for "species of special concern," or rare plants, in Yellowstone National Park.

Alpine Vegetation Study

A study to characterize alpine vegetation on volcanic substrates in the northeast corner of the park continued in 2002. This work, which is being done as a Montana State University master's thesis, is the first extensive plant ecological work to be done in the park's alpine zone of the Absaroka Mountains. It will also establish a baseline from which the park can monitor potential impacts from exotic mountain goats, which are increasingly moving into and utilizing the area.

Vegetation Management and Research

Hazard tree removal. The management biologist organized and conducted a two-day hazard tree identification training class for resource operations personnel, and recruited subject matter experts from the USDA Region 1 Forest Health Group as part of the training cadre. He regularly consulted with area resource management personnel on various identification and removal projects, and participated in hazard tree identification along the road corridor from Tower Junction to the Northeast Entrance.

Fire management. The management biologist participated in the management of fires during the active 2002 season in which 12,800 acres burned. He provided fire behavior analyses to the interagency overhead fire management team for the 9,140-acre Broad Fire, and to the park fire management program for the 3,600-acre Phlox Fire. He flew daily aerial reconnaissance flights and mapped fire growth while providing fire behavior predictions. He further compiled daily fire situation reports to be broadcast nationally, and compiled fire weather and fire behav-

ior forecasts for inclusion in the daily shift plans.

He participated as a member of an interagency GYA fire management working group to develop a consistent fire/fuels mapping database for application across all units. He similarly participated as a member of the park's interdivisional fire management team in the early stages of rewriting the YNP fire management plan and environmental assessment. He provided fire-related information to the private contractor for inclusion in the wildland-urban interface plan and environmental assessment.

The management biologist served as an instructor for the courses S130-190 (Introduction to Fire Behavior) and S290 (Intermediate Fire Behavior) held in YNP, and RX340 (Fire Effects on Ecosystem Dynamics) held in Missoula, Montana.

He also provided field tours/lectures to 22 different university, professional, and public interest groups, including NBC-TV, the Discovery Channel, History Channel, and Japanese television, on issues ranging from fire ecology to northern range vegetation.

Exotic vegetation management. The management biologist continued to participate as a member of an interdivisional team in the compilation of an exotic plant management plan and environmental assessment. A draft of the weed plan has been circulated among team members for review while sections of the environmental assessment are being

written. He also represented the YCR as a member of a multi-park team in developing staffing needs and identifying work priorities in the formation of an exotic plant management team for weed control among northern Rocky Mountain parks. He continued to collect field information regarding germination of exotic annuals in a disturbed area of the park near Gardiner, Montana, and participated in the planning and execution of weed control efforts with area resource management coordinators. Additional consultation efforts occurred with Montana State University contractors on a pilot program to inventory the northern range for select exotic plant species.

Northern range issues. The management biologist continued to work with researchers from Oregon State University and the University of Wisconsin at Stevens Point to describe woody (aspen) vegetation condition in relation to wolf/elk dynamics. Consultation and coordination with biologists from the USGS BRD and Brigham Young University resulted in the analysis of aspen tissues to identify inter- and intra-annual trends in secondary metabolite production in aspen. The management biologist further consulted with researchers from Montana State University to investigate abiotic influences on aspen performance, and with researchers from Colorado State University on hydrological influences of willow physiology and demographics. He also led a field tour of government and university scientists participating in the Pronghorn Antelope Conservation Assessment Workshop to assess summer and winter range conditions in the park.

PHOTO DERIVED FROM ARCHIVES OF THE DISBANDED COEUR D'ALENE (IDAHO) FOREST INSECT LABORATORY, COURTESY OF M.M. FURNISS



YNP ARCHIVES

Episodes in YNP's forest insect management history, as described by the park's management biologist in "Evolution of National Park Service Policy Regarding Forest Insect Management." *Left*, aerial application of DDT near the Lava Creek drainage to control for spruce budworm, probably in July 1955. *Right*, ground application of lead arsenate to control for the lodgepole needle-tier and lodgepole sawfly along the West Entrance Road near West Yellowstone, summer 1924. This was the first effort directed at forest insect control in YNP.

Integrated Pest Management

As the park's IPM Coordinator, the management biologist responded to 33 different pest complaints involving 20 different taxa and provided information and/or actions to mitigate or eliminate the problem. Pest complaints were associated with insects (14), small mammals (13), birds (3), spiders (2), and fungi (1). He compiled Pesticide Use Logs for FY2001 and Pesticide Use Requests for FY2002 and submitted such documentation to the Washington Office. He worked with the historic architect to secure funding and devised control strategies, exclusion techniques, and a monitoring protocol for implementation by resource personnel to mitigate continuing rodent problems in the Norris Ranger Museum.

The management biologist attended the Western Forest Insect Work Conference in Whitefish, Montana, and presented a paper titled, "Evolution of National Park Service Policy Regarding Forest Insect Management." He also participated in the aerial survey and mapping of forest insect and disease conditions throughout the park in cooperation with the USDA Region 1 Forest Health Group. These data are currently being digitized and summarized as part of the regional report. He also represented the YCR at one meeting of the GYA Whitebark Pine Committee to discuss survey needs regarding white pine blister rust, and attended one meeting of the Whitebark Pine Ecosystem Foundation to discuss whitebark pine status, trends, and research needs.

WILDLIFE RESOURCES

The Wildlife Resources Team (WRT) is an assemblage of wildlife biologists, biological technicians, administrative assistants, and volunteers within the Yellowstone Center for Resources. The team works to achieve the mission of the National Park Service, Yellowstone National Park, and the Yellowstone Center for Resources. During 2002, the WRT conducted an array of wildlife monitoring, management, and research activities by itself and in concert with professionals associated with other wildlife management agencies and universities. The WRT program emphasizes bird, bison, elk, pronghorn, bear, lynx, and wolf conservation, as described below. Of special note, the WRT:

- continued service to the park's Planning and Compliance Office to assess effects of park projects on threatened and endangered species and other wildlife;
- worked with the park's environmental educa-

tion staff to offer numerous wildlife-related presentations to audiences inside and outside the park;

- initiated a comprehensive analysis of trumpeter swan population dynamics based on a 62-year data set;
- initiated studies to evaluate fire effects on vegetative foods used by grizzly bears and to estimate the portion of fish in grizzly diets using estimates of mercury content of bear hair;
- began studies of bison spatial ecology to identify effects of winter use by park visitors and identify bison travel corridors;
- began collaboration with Dr. Charlotte Quist, Wildlife Health Associates, Inc., to evaluate penetration and wound characteristics resulting from impact of a biodegradable polymer bullet to be used for brucellosis vaccination of free-ranging bison;
- began collaboration with Dr. Dave Grainger, Colorado State University microbiologist, to improve effectiveness of delivery of *Brucella* vaccine deployed in bio-bullets used for vaccinating bison. This project is studying creative ways to package live vaccine through a photopolymerization process; and
- continued lynx surveys and research on wolf-prey interactions, wolf population dynamics and demographics, and multi-trophic level effects of wolves.

The WRT increased its depth of personnel during FY2002, filling four vacant permanent positions (two bison; one bear; and one wolf management) and two term (one lynx; one wolf) biological science technicians. These positions will allow the WRT to ensure consistency and quality in data collection for existing programs.

The FY2002 WRT base budget was approximately \$1,010,000. Other funding sources included Fee Demonstration (\$75,000), Federal Highway Administration (\$18,600), and donations raised in cooperatively with the Yellowstone Park Foundation (\$109,700).

Bears

Population monitoring.

Bear sightings.—There were 1,585 bear sighting reports recorded in YNP during calendar year 2002. These reports included 887 observations of grizzly bears, 641 of black bears, and 54 of unidentified species of bear. In addition, there were 80 observations of grizzly bear sign, 7 of black bear sign, and

11 of sign from unidentified species of bear. The first observation of spring grizzly bear activity was recorded on March 21 in Pelican Valley. The last seasonally recorded grizzly bear activity of the year was a bear observed on a bison carcass near the Pelican Creek Bridge on December 1. The first observed black bear activity of the year was recorded on April 7 between Slough Creek and Lamar Valley. The last recorded black bear activity was a visual observation on October 19 in the Shoshone Lake area.

Grizzly females with cubs.—At least 20 female grizzly bears with home ranges either wholly or partially within YNP produced cubs in 2002. These 20 females produced at least 40 cubs. There were 5 one-cub litters, 10 two-cub litters, and 5 three-cub litters counted within the park. Average litter size in YNP was 2.0 cubs per litter. Some of these females had home ranges entirely within the boundaries of YNP, while others had home ranges that overlapped the park boundary.

Observation flights.—In 2002, as part of the Interagency Grizzly Bear Study Team grizzly bear population monitoring program, the YNP Bear Management Office conducted two series of aerial observation flights in the Lamar, Pelican/Clear Creek, Two Ocean Plateau, Washburn, and Firehole/Hayden Bear Management Units (BMUs) within the park. During the first series of flights (19 observation hours) in the five BMUs, 37 grizzly bears were observed in 19 groups. The mean group size was 1.9 grizzly bears per group. None of the observed grizzly bears was radio-marked. In addition, six black bears were observed in five groups. Mean group size was 1.2 black bears per group. None of the observed black bears was radio marked. Observation rates were 1.95 grizzly bears and 0.32 black bears per flight hour.

During the second series of observation flights (21.4 observation hours), 66 grizzly bears were observed in 35 groups. Mean group size was 1.9 bears/group. One observed grizzly bear was radio marked (adult female #370). There were six black bears observed in five groups during the second series of flights. Mean group size was 1.2 black bears per group. Observation rates were 3.08 grizzly bears and 0.28 black bears per flight hour.

Grizzly bear recovery status.—Grizzly bear recovery parameters are recorded and calculated based on a calendar year. At the end of 2002, all population recovery parameters for grizzly bears in the Greater Yellowstone Ecosystem were being

achieved. The grizzly bear has been listed as a threatened species under the Endangered Species Act (ESA) since 1975. The Grizzly Bear Recovery Plan sets forth three population goals that must be achieved before the grizzly bear will be considered for a status change within the Yellowstone ecosystem: 1) to have a six-year average of 15 adult females with COY per year both inside the recovery zone and within a ten-mile area immediately surrounding the recovery zone; 2) to have 16 of the 18 BMUs in the recovery zone occupied by females with young from a running six-year sum of observations, with no two adjacent BMUs unoccupied; and 3) to have known human-caused mortality not exceed 4% of the minimum population estimate based on the most recent three-year sum of females with cubs minus known adult female deaths. In addition, no more than 30 percent of the known human-caused mortality can be females. To meet the recovery requirements, these mortality limits cannot be exceeded during any two consecutive years, habitat-based recovery goals must be established, and there must be a demonstration that “adequate regulatory mechanisms” are in place to ensure conservation of the species if it is removed from the special protections granted by the ESA.

The three population goals were met in the Yellowstone ecosystem for the first time in 1994, but the mortality limits were exceeded in each of the next three years. The population goals have now been achieved every year since 1998. Habitat-based recovery criteria as well as a conservation strategy are being developed to specify how the grizzly bear will be managed within the current recovery zone and state plans for management outside of the recovery zone. If both the habitat and population recovery parameters continue to be met, then the population can be considered for a status review and removal from threatened status when the conservation strategy, state management plans, and the habitat-based recovery criteria are agreed upon.

Grizzly bear food sources. The availability of important high quality bear foods in YNP was quantitatively and/or qualitatively assessed by experienced biologists using diagnostic field sign. In 2002, most bear foods were below average abundance during all seasons. The winter of 2001–2002 was mild. As a result, the number of winter-killed elk and bison carcasses counted on transect sites was lower than observed following severe winters. During the spring (den emergence–May 15), we observed bears scavenging the relatively few ungulate carcasses

available and digging up and consuming pocket gophers and their food caches in localized areas where they were abundant. During the estrous season (May 16–July 15), grizzly bears preyed on elk calves and spawning cutthroat trout, and also grazed clover in localized areas where it was abundant. The number of spawning cutthroat trout counted in surveyed streams was lower than the long-term averages recorded from 1995 to 2000. During early hyperphagia (July 16–August 31), YNP experienced drought conditions that likely limited the availability of above ground vegetal foods. Drought conditions continued during the late hyperphagia (September



Grizzly on cached bison carcass.

1–den entrance) season. In addition, the production of whitebark pine seeds, as measured at transect sites, was below average. During late hyperphagia, we observed bears making extensive use of sweet-cicely roots and scavenging ungulate carcasses. It appeared that bears were both preying on elk and scavenging the remains of wolf-killed elk.

Winter-killed ungulate carcasses.—In 2002, we surveyed 26 routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses. A total of 15 bison carcasses and 24 elk carcasses were documented along the 262 km of survey routes completed.

Seven routes totaling 74.7 km were surveyed in the thermally-influenced ungulate winter range in the Firehole area, with one transect not surveyed due to a closure to protect a wolf den site from disturbance. Twelve bison and six elk carcasses were observed. Grizzly bear sign was observed along five of the seven routes. Black bear sign was observed on

one of the seven routes surveyed. An average of 0.24 ungulate carcasses per kilometer surveyed were observed in the Firehole region.

Four routes totaling 21.7 km were surveyed in the thermally influenced ungulate winter range in the Norris Geyser Basin. No ungulate carcasses were observed and no grizzly or black bear sign was identified along any of the four routes.

Three routes totaling 16.8 km were surveyed in the thermally influenced ungulate winter range at Heart Lake. No carcasses were observed. Grizzly bear sign was observed on two of the three survey routes; black bear sign was not observed on any routes.

In 2002, we added a new survey route in an area of thermally influenced ungulate winter range in the Hayden Valley area. We surveyed 7.0 km around Mud Volcano and Obsidian Pool. No carcasses were found. However, we did find sign of grizzly bears using the area.

Twelve routes totaling 141.8 km were surveyed in low elevation ungulate winter range on the northern range. Two northern range carcass transects were not completed due to closures in effect to protect wolf den sites. Twenty elk carcasses, one bison carcass, and one unidentifiable carcass were observed for an average of 0.2 ungulate carcass per km of survey route. Grizzly bear sign was observed on five of the 12 routes, and black bear sign was observed on four of the 12 routes. Sign from bears that could not be identified to species was observed on 3 of the 12 survey routes.

The overall rate of one ungulate carcass observed per 6.8 km of survey route in the areas of thermally influenced ungulate winter range (Firehole thermal area, Norris Geyser Basin, and Heart Lake area) recorded in 2002, was approximately equal to the long-term average of one large mammal carcass observed per 6.7 km of survey route recorded from 1992 to 2001, but significantly lower than the numbers observed following severe winters.

The overall rate of one ungulate carcass observed per 6.4 km of survey route on the northern ungulate winter range recorded in 2002 was approximately equal to the long-term (five-year average) of one large mammal carcass observed per 6.2 km of survey route recorded from 1997 to 2001.

Cutthroat trout spawning.—Park staff conduct surveys along eight streams within or near the Lake developed area and four streams within or near the Grant Village developed area. The surveys are conducted to monitor the timing and relative magnitude

of cutthroat trout spawning runs and associated bear activity along spawning streams. YNP uses the information to manage visitor use and set opening dates for recreational facilities in the Lake and Grant Village developed areas, which are adjacent to clusters of spawning streams. Management of recreational activities in these areas is done to reduce the potential for bear–human conflict. In past years, bear predation on spawning cutthroat trout in Yellowstone Lake tributaries within or near park developed areas has led to conflicts between humans and bears.

In 2002, a total of 144 spawning cutthroat trout were counted during the peak week in the 12 monitored frontcountry tributaries to Yellowstone Lake. Grizzly bear activity was observed on five (42%) of these streams. No black bear activity was identified. The number of spawning cutthroat counted in each stream during the peak week in 2002 was lower than the long-term averages for 1995 to 2000.

Cutthroat trout spawning activity began in the Trout Lake Inlet during the week of June 17. The last spawners in the inlet were observed the first week of July. During the peak week of the spawn, 255 cutthroat trout were counted, lower than the average recorded the three previous years. Evidence of black bear was observed in the area. No grizzly bear activity was observed.

Whitebark pine seeds.—Whitebark pine seeds are an important fall food for bears due to their high fat content and their potential abundance as a pre-hibernation food source. During years with low availability of natural bear foods, especially fall foods, bears often seek alternate foods in association with human activities and both the number of bear–human conflicts and human-caused bear mortalities increase during the fall season. As part of an ecosystem-wide whitebark pine survey, cone counts are conducted at 19 whitebark pine transects located within the Yellowstone ecosystem. YNP staff conduct cone counts on the ten transects located within YNP. Cone counts at these ten transects averaged 0.5 ($\pm$ 1.5 SD) cones per tree in 2002. This was less than the long-term (1987–2000) average of 14.3 ($\pm$ 31.3 SD) cones per tree, per year for all transects located within YNP.

Confrontations and conflicts with humans, and bear management actions. Bear–human conflicts, confrontations, management actions, and human-caused bear mortality are recorded and reported

based on a calendar year. Data on conflicts, confrontations, management actions, and human-caused mortality can be found in the Bear Management Office Annual Report for calendar year 2002.

Outreach. Park management recognizes visitor education as a key component in implementing the park’s bear management program. The long-term survival of bears in the Yellowstone ecosystem depends on park visitors and surrounding communities having an understanding of bears and bear management practices. As part of this goal the Bear Management Office presented 35 bear-related educational talks and slide shows to various groups in 2002.

Birds

Threatened and endangered species.

Bald eagle.—In 1995, the U.S. Fish and Wildlife Service reclassified the bald eagle from “endangered” to “threatened” due to significant population gains made over the last three decades. Certain specific populations, however, are not completely recovered due to heavy metal contamination problems in the Great Lakes region, and habitat encroachment and development problems associated with riparian zones in the desert southwest.

In Yellowstone, a total of 24 eaglets fledged from 31 active nests during 2002. This marks the highest number of fledged eaglets ever recorded in the history of Yellowstone National Park. The Yellowstone bald eagle population continues to incrementally increase, territorial shifts and new nests are appearing in unexpected places. This year was no exception, with a pair of bald eagles building a nest 55 meters off the Madison-to-West Yellowstone road. This created quite an attraction for visitors, and kept



Bald eagle closure area at Eagle Bend.

wildlife managers and rangers on their toes with crowd control throughout the spring and summer. Nest substrate instability, as a result of the 1988 Yellowstone wildfires, caused minimal problems this year for nesting pairs. However, over the next couple of decades we expect large numbers of trees to topple to the ground, which will undoubtedly result in nest failure, loss of nest sites, or sudden changes in location of a nesting territory. Although bald eagles have occasionally been documented taking over previously occupied osprey nests, the incidence of takeover appears to be gradually increasing.

A pair of bald eagles occupied a nest only 150 feet off the road at 6 Mile (Eagle Bend) on the Madison River. The eagles created quite an attraction from mid February through early July. In an effort to protect the eagles from human disturbance, park staff (bird management, resource management, patrol rangers, and interpretation) coordinated a temporary closure in the immediate vicinity of the nest. A zone style system was established where visitors could stop and observe or photograph the eagles from a distance, then travel by the nest without stopping. The no-stopping zone allowed the eagles to come and go freely with prey and nest material without being disturbed by people. Although there were some people who violated the closure, the compliance was exemplary. The eagles hatched two chicks of which one managed to fledge from the nest. A similar closure is expected to be in place as long as the eagles continue to nest there.

Whooping crane.—The whooping crane is currently classified as an endangered species. The worldwide population consists of both wild and captive populations. This endemic North American species continues to rank as the rarest and most endangered crane in the world. Population figures as of 2002 placed the wild population at 283 cranes and the captive population at 132 cranes, for a total world population numbering 415 whooping cranes.

In the Greater Yellowstone and Rocky Mountains, only one whooping crane remained alive in 2001. The “ultralight” whooping crane from the Gray’s Lake experiment was last seen on September 6, 2001, near China Hat, a geologic formation located 15 miles north of Soda Springs, Idaho, where it had

been spending the last couple summers. This bird was not found in the fall in Colorado’s San Luis Valley during fall migration, nor in New Mexico’s Rio Grande Valley (two winter concentration areas for cranes). The Whooping Crane Recovery Team has classified this missing “ultralight” bird as a mortality of a four year old. In 2001, the lone surviving whooping crane (born in 1983, making it an 18 year old) from the Gray’s Lake experiment continued to reside in the summer in the Centennial Valley of Montana. In the fall of 2001, this bird migrated south to its wintering grounds in New Mexico. Extensive searches for this crane during the 2002 spring proved fruitless, and has resulted in declaring this bird another mortality.

Species of Special Concern.

Peregrine falcon.—The peregrine falcon has been delisted or “removed” from the list of endangered species and is now managed as a species of special concern. Under provisions afforded by the Endangered Species Act, even though this species is

no longer officially listed as endangered, it still needs to be monitored closely for five years to ensure its recovery. Yellowstone continues to be a stronghold for peregrines in the northern Rockies. Three new eyries were found in 2002, bringing the total number to 20, compared to 17 eyries in 2001. As a result of finding the new peregrine eyries, 35 young fledged in 2002, making this the highest number of fledged peregrine ever recorded in Yellowstone National Park.

Trumpeter swan.—The YNP resident trumpeter swan population continues to show signs of a population at risk. Traditionally, the Centennial Valley of Montana has been a hot spot for cygnet production in the

greater Yellowstone area. Swan recruitment from outside of Yellowstone National Park is a critical factor in maintaining the resident swan population. A reduction in the number of breeding swans, coupled with low numbers of fledged cygnets throughout the Greater Yellowstone Area, continue to generate serious concern.

The number of adult swans in Yellowstone National Park has declined steadily since 1961. Only 22 non-migratory individuals were observed in 2002. This is the tenth lowest number of adults ever



Peregrine fledgling.

WAYNE WOLFERSBERGER

recorded since we have been collecting trend data, and represents numbers reminiscent of the early 1930s. Adult swan recruits from the Paradise Valley may be helping to maintain the Yellowstone swan population for the time being. Adult swan recruitment has been observed on the southern portion of the park. However, no adult recruitment has been observed on the western portion of the park, as evidenced by a lone adult female that has been waiting for a mate in the 7 Mile Bridge area since February 2001.

In recent years, trumpeter swan nest attempts have ranged from 2 to 10 per year. There were only three swan nesting pairs in 2002, compared with two in 2001, seven in 2000, six in 1999 and nine nesting pairs in 1998. In 2002, four cygnets fledged from one brood in Yellowstone National Park. During two other severe drought years (1988 and 2000), Yellowstone National Park fledged seven cygnets each year. In 2001, a severe drought year produced no cygnets. Except for these anomalies, cygnet production has been dismal over the last 14 years, ranging from zero to five cygnets per year.

Yellowstone National Park also participates in trumpeter swan conservation issues in the Paradise Valley (north of the park) of Montana. In 2002, the Paradise Valley flock had three nest attempts and fledged four young from two broods. One pair hatched four young, one of which was immediately killed by an intruding subadult pair. Two other youngsters died from inattentive parents, causing the young to lag behind and resulting in death by fatigue and exhaustion. The adult female from this pair was eventually killed trying to attack vehicles on U.S. Highway 89 in Emigrant, Montana. The remaining male and lone cygnet traveled cross-country, eventually ending up 20 miles downstream at a safe haven near the Yellowstone River. In another incident, a female died on a nest containing six eggs, just days from hatching. In 2002, the Paradise Valley swan population totaled 15 swans, compared to 15 also in 2001 and 2000, and 21 swans in 1999. The primary reason adult swans declined in numbers was due to collision mortality with wires, lead poisoning, and recruits exploring the confines of Yellowstone National Park and the Paradise Valley. Banded swans from Paradise Valley have been seen in Yellowstone National Park.

Molly Islands colonial nesting birds.—The Molly Islands Colonial Nesting Bird Census was conducted in mid May, early June, early August, and mid September 2002. The Molly Islands consist of

two small islands appropriately named Rocky Island and Sandy Island, due to the nature of the substrate. The census techniques applied this year are consistent with those conducted over the last several years, however, this year both aerial and boat surveys were employed.

Even though there was what appeared to be a late spring this year, American white pelicans arrived on the islands slightly later than normal. On Rocky Island, a total of 85 pelicans initiated nests on the eastern, or highest part of the island. Nests were restricted to this one aggregation. Double-crested cormorants constructed 44 nests in the same area as the pelicans. The islands were free of flooding this year, and snow meltwater runoff was gradual. What was perplexing was the total abandonment of Rocky Island by nesting pelicans and cormorants. Avian predators in the form of bald eagles have been observed causing disturbances on the island many times, but never have caused total abandonment. Egg fragments and ripped-up nests were visible from the air, indicating sudden abandonment of the site and leading us to believe it was caused by some unknown mammalian predator. Later on, California gulls and Caspian terns did nest. Of the 110 California gulls that attempted to nest, only 60 were successful in hatching young, whereas of the five nest attempts by Caspian terns, only three were successful in hatching and rearing young. A total of 65 California gulls and three Caspian terns fledged from Rocky Island this year.

Predation was not a factor on Sandy Island this year. Consequently, a total of 270 American white pelican nests were initiated, but only 110 nests were successful in rearing 180 young. Double-crested cormorant nest attempts were surprisingly good, with 115 nests initiated and 92 nests successful in fledging 280 young. Pelicans nested in five aggregations: three large and two small. No Caspian terns or California gulls nested on this island this year.

In summary, 2002 was a year of surprisingly good colonial nesting bird production, despite disturbance to one island. Lake flooding did not occur due to the drought, which presented favorable conditions. Total production on the Molly Islands resulted in fledging 180 American white pelicans, 280 double-crested cormorant, 65 California gulls, and three Caspian terns.

Osprey.—The Yellowstone National Park osprey population continues to show signs of natural annual variation. In 2002, however, only 24 young fledged from 83 nests. This represents the lowest production

experienced in the last 16 years of collecting detailed osprey population data. Strong winds throughout the summer caused many of the nests and/or nest trees to fall to the ground, resulting in high failure rates. This pattern has been occurring more frequently in the last four years. Tree nest site instability and weather continue to play a major role in influencing osprey productivity in the park. The incidence of bald eagles taking over osprey nest sites was noted again this year, and was documented at one site.

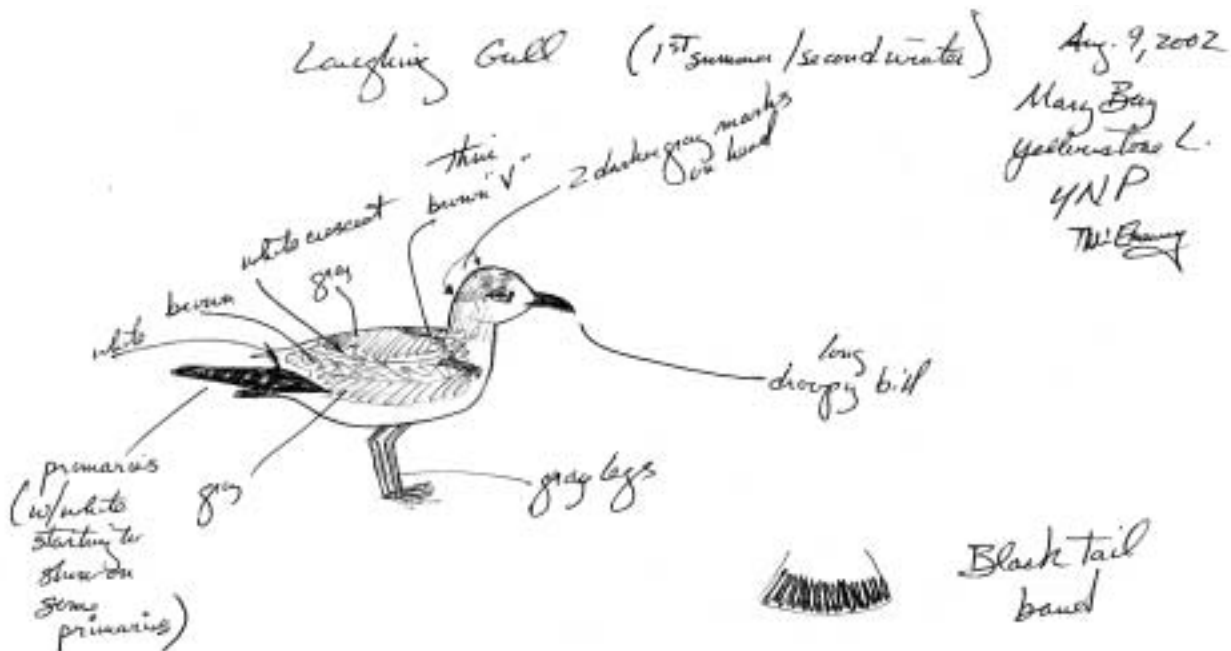
Harlequin duck.—The harlequin duck population in Yellowstone continues to maintain itself and is only mildly variable from year to year, with generally 16–22 nesting pairs residing in the park. Monitoring adults is the most effective method of keeping track of population vigor and trends. Monitoring annual productivity is not cost effective, as data collection is extremely time-consuming and difficult due to the remoteness of many of the areas in which harlequins are found. Productivity is extremely variable from year to year and is highly influenced by weather, such as flooding.

Common loon.—The common loon population in Yellowstone continues to fluctuate from year to year. There were nine nest attempts in 2002, yet only five young managed to reach fledgling age, compared to nine nest attempts and seven fledglings in 2001, nine nest attempts and eight fledglings in 2000, and 14 nest attempts and two fledglings in 1999. A total of 38 adults were found in the park in 2002, compared

to 35 adults in 2001, 34 adults in 2000, and 42 adults in 1999. These adult numbers have reliably ranged between 34 and 51 individuals over the last fourteen years. Yearly fluctuations in adult numbers and in the production of young are the result of variable weather conditions. The moderate loon production and the low adult numbers are likely a reflection of prevailing drought conditions.

Birds added to park checklist. One new bird species was added to the Field Checklist of Birds of Yellowstone National Park in 2002. On August 9, 2002, the park ornithologist observed a laughing gull (*Larus atricilla*) in first summer-second winter plumage on Yellowstone Lake. This marks the first laughing gull record for Yellowstone National Park. Laughing gulls are typically found east of the Mississippi River, but primarily occur along the East Coast and the Gulf of Mexico, with a population segment that ventures into the Gulf of California. Photographs were taken of this bird to accompany the detailed written documentation.

As of 2002, 316 species of birds have been documented in the park since it was established in 1872. The Field Checklist of Birds of Yellowstone National Park was last revised in April 2000. A newly revised bird checklist was made available to the public in March 2001. This checklist is available on the park web site at www.nps.gov/yell/nature/lists/pdfs/bird2000.pdf. Updates to this checklist are scheduled for March 2003 or 2004.



Field drawing of laughing gull by park ornithologist, August 9, 2002.

Other interesting and/or unusual Yellowstone bird finds for the year include: a single double-crested cormorant that spent the winter 2001–2002 on the Madison River; a remarkable irruption of common redpolls throughout the winter 2001–2002; a great egret that spent some time on Pelican Creek in May 2002; a large influx of surf scoters on Yellowstone Lake in October; a juvenile mew gull and a dark juvenile broad-winged hawk on the shores of Yellowstone Lake in November; a large movement of snow geese and Ross's geese over the North Entrance station on November 24, 2002; and first evidence of nesting for hooded merganser and winter wren.

Trumpeter swan data analysis and monograph. For the last year, the staff ornithologist has been actively entering and analyzing trumpeter swan data for an upcoming scientific monograph on the Yellowstone trumpeter swan. This peer-reviewed publication is scheduled to be completed within two years and will pave a new course of action for trumpeter swan management in the Yellowstone National Park.

Wolf predation of Canada geese. On July 7, 2001, during an aerial survey, the staff ornithologist witnessed a pack of wolves swimming after molting Canada geese in the South Arm of Yellowstone Lake. Since that first event, two other observations confirm that wolves are taking Canada geese on occasion. Again on February 8, 2002, a lone wolf was observed chasing and killing a Canada goose in Gibbon Meadow. The goose was up on dry ground grazing on grasses when the wolf chased it into deep snow, which led to its demise. On July 8, 2002, a pack of eight wolves (four black, four cream) were seen killing molting Canada geese at Turbid Lake. There were several piles of feathers on the ground 200–300 feet from shore, each representing individual kill sites, while one of the wolves was running with a Canada goose in its mouth. A grizzly walked through the kill site and was hardly noticed by the wolves.

Outreach. Public contacts are increasing each year. The park concessioners annually request bird lectures from professional biologists to train summer and winter guides. The bird management staff also lectured at the Yellowstone Teachers' Workshop and the annual Naturalists' Training Workshop held at Mammoth Hot Springs. In addition, there are hundreds of letters of inquiry and emails about bird information. Speaking engagements were again popular in 2002.

Bison

Interagency Bison Management Plan. Wild, free-ranging bison continue to thrive in the Yellowstone area, summering throughout the park and in some adjacent, high-elevation ranges, and migrating to winter range in geothermal areas and lower elevation grasslands both in and outside the park. Controversy has grown for the last three decades over the management of bison leaving the park in winter.

Historically, bison moving from the park onto public or private land in Montana have been shipped to slaughter or shot because some of them are infected with the disease brucellosis. To address this issue, an Interagency Bison Management Plan (IBMP) was completed in December 2000. The IBMP employs an adaptive management strategy that allows the agencies to gain experience and knowledge before proceeding to successive management steps, particularly with regard to managing bison on winter range outside Yellowstone National Park. The IBMP employs a combination of disease and population management actions:

1. Spatial and temporal separation of bison and cattle in special management zones outside the park.
2. A late winter/early spring population management target of between 2,300 and 3,000 bison.
3. Vaccination of bison both inside and outside the park.
4. Monitoring and testing of bison for disease.
5. Contingency plans for handling a large migration of bison out of the park.
6. Vaccination of cattle in the area surrounding the park.
7. APHIS-mediated protection from threats to the state of Montana's brucellosis class-free status.

Development of field operating procedures.

The National Park Service received a Department of Interior, Office of the Solicitor opinion that clarified the authority of NPS staff to participate in certain bison management activities outside the park, resolving issues of employee liability. The opinion noted that NPS employees do have resource management authority to participate in bison management activities outside the park, both in emergency and non-emergency situations, under the auspices of the IBMP, for purposes of conserving park resources. This authority would allow NPS employees to respond to requests by the State of Montana for assistance in bison management activities outside the

park in both preplanned, non-emergency situations and in response to emergencies.

The field operating procedures is a document that clarifies the individual agency tasks and responsibilities involved in managing the Yellowstone bison population. The development of the procedures document continued through another round of review and editing by all agencies during FY2002.

Implementation of the Interagency Bison Management Plan. While the details of field operating procedures were being discussed, field operations continued. Operations associated with implementing the IBMP can be categorized mostly into 11 activity types (Table 1). Some actions occur infrequently, and may not be directly associated with IBMP goals, and are thus identified as miscellaneous activities.

The definitions for the management activities identified in Table 1 are as follows:

Aerial Flights. Aerial flights for location monitoring during winter. The YCR conducts flights for estimating the abundance of the population and monitoring the abundance and distribution of bison in management monitoring zones.

Capture. Capture of bison in the Stephens Creek, Horse Butte, or the Duck Creek facilities.

Disappearance Study. Fetal Disappearance Study is a related external research project receiving NPS assistance.

Dispatch Assistance. Dispatch assistance occurs when the NPS assists the Montana Department of Livestock with lethal removal of an animal

outside of the park, possibly because of security reasons.

Field Dispatch. Field Dispatch occurs when the NPS lethally removes a bison within the park for health, safety, or humane reasons.

Field Testing. Field Testing is the NPS collection of biological samples from an animal that was field dispatched.

Hazing. The process of herding/moving animals to a new location. Ranger staff supervises all hazing actions at the north boundary, and assists the MTDOL at the west boundary.

Law Enforcement. Law Enforcement activities can range from monitoring protestors to assisting a hazing operation by stopping traffic.

Monitoring. Monitoring consists primarily of Ranger staff or Bison Management Crew looking for bison from wheeled vehicles or snowmobiles, and noting their number and location. Ground monitoring is focused on the area from Hellroaring Creek overlook west and north, Swan Lake Flats, and along the Madison River from Madison Junction west.

Remote Vaccination Project. This project consists of time spent, primarily by the Bison Management Crew, developing the methodologies for the future field vaccination of bison. Activities include documentation of bison behavior when approached by humans, gaining an understanding of available remote delivery equipment, and working on methods for improving efficiency of remote vaccination delivery.

TABLE 1. COMPILATION OF NPS BISON MANAGEMENT ACTIVITIES, 2002.

NUMBER OF PERSONNEL DAYS			TIME (HRS)/ EVENT		NUMBER OF PEOPLE/ EVENT	
YCR Staff	Ranger Activities Staff	Management Activity (number of events)	Average	Range	Average	Range
13	1	aerial flights (8)	7.51	2–16.36	1.75	1–2
0	47	capture (18)	15.25	1–32.5	2.67	1–8
1	0	disappearance study (1)	7.5	7.5	1	1
0	4	dispatch assistance (2)	16.5	7–26	2.3	1–3
3	9	field dispatch (6)	6.67	2–11	2	1–3
N/A	N/A	field testing (0)	N/A	N/A	N/A	N/A
0	91	hazing (34)	15.64	1–50	2.8	1–7
0	11	law enforcement (9)	2.33	0.5–6	1.22	1–2
111	88	monitoring (113)	7.08	1–42.5	1.76	1–5
171	0	remote vaccination project (60)	23.65	6–52	2.85	2–5

The Bison Ecology and Management Office (BEMO) collated information provided by other staffs and agencies and distributed 29 bison management status reports. Status reports were initially produced weekly, but changed to bi-weekly in January, and monthly during July, August, and September. These reports summarize weather conditions and hazing operations (Figures 1 and 2), and keep track of the cumulative total number of animals captured and the results of brucellosis testing. The reports also track natural and other non-IBMP mortality of bison observed by park staff, visitors, and personnel from partner agencies.

The FY2002 bison management season ended in June 2002, with the hazing of the last animals back into the park. Hazing operations throughout the winter were successful in keeping bison from spending extended periods of time outside the park. Of 262 animals captured in the West Yellowstone area during the winter, 119 were disease-tested at the capture facility (Table 2). Sixty-six bison tested positive for brucellosis and were transported to slaughter. Another 133 were captured during spring and trans-

ported to slaughter as a population control measure. Additionally, three mortalities resulted from implementation of the IBMP. One adult male was killed outside the park in November, and two more adult bulls were killed in June. All three animals were killed in the West Yellowstone management area because operations were unable to haze the animals away from private property and back into the park.

Monitoring of sero-negative, pregnant female bison. This project was conducted in collaboration with Montana Fish, Wildlife and Parks and USDA Animal and Plant Health Inspection Service (APHIS) as a disease management component of the IBMP. Eighteen female bison, ages 2 through 10+, diagnosed by palpation as pregnant and testing serologically negative at capture facilities, were fitted with neck collar radio transmitters and vaginal implant transmitters. A blood test for pregnancy-specific protein B (PSPB) was conducted after the animals were released. Fifteen bison gave birth to live calves that were monitored throughout the summer. Three bison were never observed with calves. The PSPB test for one of these later animals was nega-

tive. This animal never ejected the implant transmitter, which was subsequently removed when she was recaptured at Swan Lake Flat in early October.

Another of these three animals was blood-culture positive for exposure to brucellosis, based on follow-up lab testing. All 15 cow/calf pairs moved back to summer in Hayden Valley. Of those 15, two moved through Norris Junction and Canyon en route to summer range. The remainder used the typical travel corridor over Mary Mountain to reach Hayden Valley. Birthing synchrony of this sample of pregnant females was relatively equally spread out from April 26 to May 31

Figure 1. Number of Bison Hazed

(does not represent individual bison; some animals may have been hazed multiple times)

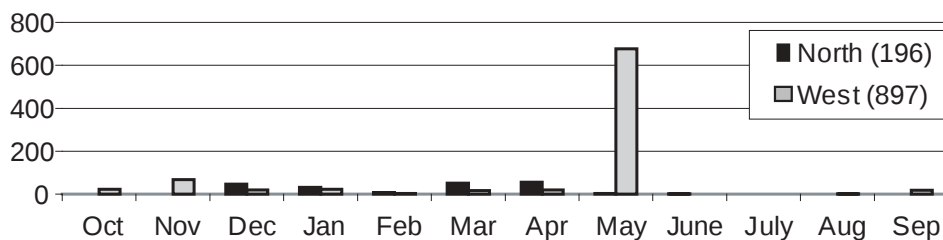
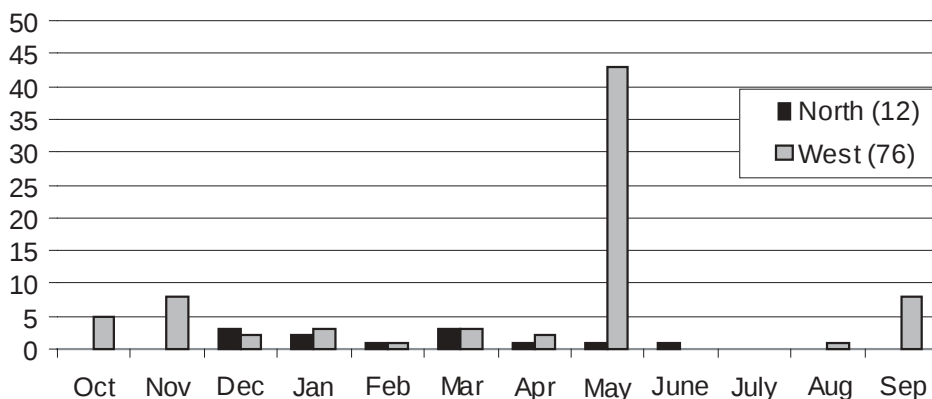


Figure 2. Total Number of Hazing Operations Conducted

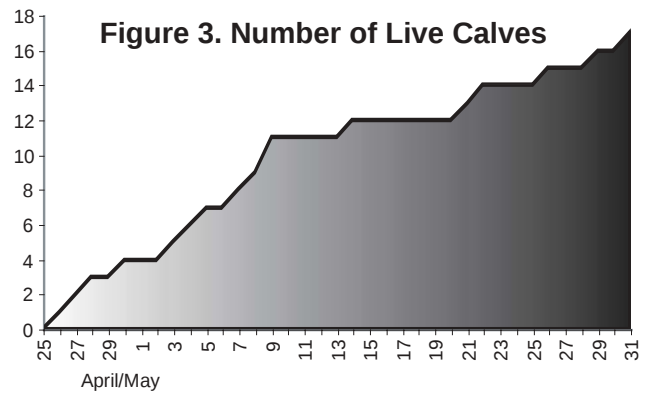


(Figure 3). All of the calves were observed with their respective mothers as late as October 2002.

Ballistic technologies workshop. On January 23–24, 2002, the NPS Biological Resources Management Division assembled a small group of experts in Fort Collins, Colorado, to discuss the development of new technology for ballistic delivery of vaccines and other biologics to wildlife. These experts came from state and federal wildlife agencies, academia, and the private sector, and represented expertise in ballistics, polymer chemistry, and wildlife management. The goals of the workshop were to (1) develop product specifications for a new biobullet and a ballistic system for its delivery, and (2) establish various alternatives on which to base further research. The most pressing need for this technology in the NPS is the remote delivery of a brucellosis vaccine to bison in YNP. However, it has other applications in wildlife management, including remote delivery of contraceptives, medications, and other vaccines to free-ranging wildlife.

The workshop included technical presentations and moderated group discussions. The workgroup concluded by defining five action items to stimulate further action and development:

- Determine the feasibility of an NPS-sponsored “Remote Ballistic Vaccination Consortium” consisting of academic, private sector, and agency participants. The group will:



- determine the viability of the vaccine and the polymer;
- address short-term goals for YNP;
- continue to develop and improve models for long-term use; and
- establish a multi-park goal.

The NPS will continue to seek and solicit information from people who were not at the conference, and seek out funding and other resources for future testing.

A meeting date was also set for January 2003, in Fort Collins, Colorado, so that the participants can reconvene and present updates on their work and set new directives and action items to determine if the remote ballistic delivery system can be ready to go in 2004–2005 as predicted.

**TABLE 2. SUMMARY OF MANAGEMENT OPERATIONS FOR THE WINTER PERIOD
OCTOBER 2001–JUNE 2002.**

Number of bison captured:	262	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Number of bison tested for brucellosis:	119	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Number of bison testing sero-positive for brucellosis:	66	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Number of bison testing sero-negative for brucellosis and released:	53	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Number of bison captured, sent to slaughter for population control measures:	133	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Total number of mortalities resulting from capture, test, and slaughter operations:	199	at West Yellowstone mgt. zone
	0	at northern mgt. zone
Mortalities resulting from management action shootings:	3	at West Yellowstone
	0	at the northern part of the park
Known natural mortalities:	43	
Other mortalities:	9	

Ballistic consultation in Yellowstone National Park. On August 19–22, 2002, YNP staff invited personnel from Ballistic Technologies, Inc. (BTI), of Oklahoma City, Oklahoma, to visit the park and demonstrate the remote delivery system they have developed for use in the cattle industry. The system consists of a compressed air rifle that shoots a biobullet at animals approximately ten yards distant. BTI modified their existing system to deliver the payload further down range to approximately 40 yards for potential use in YNP. Modifications included a higher-pressure regulator; a delivery unit capable of operating with the higher pressure; a longer biobullet; and a longer biobullet containing tungsten particles, to add weight for shots at longer distances (over 20 yards). On August 20, BTI and BEMO personnel fired the various air rifles and biobullets to learn how they shoot, how accurate they are, and to troubleshoot any potential problems that might be encountered in the field. The delivery systems demonstrated were a 1200-psi regulator and rifle, a 1500-psi regulator and rifle, a standard short biobullet, the 0.08-longer standard biobullet, and the 0.08-longer, tungsten-alloy biobullet.

Data from the demonstrations suggest that for short distance shots (10–15 yards), the 1200-psi regulator and the short standard biobullet combination exhibited acceptable accuracy. The accuracy was improved when the 1200-psi delivery system was used to shoot the 0.08-longer, standard biobullet. For longer distances, the 1500-psi delivery system performed adequately with the 0.08-longer, standard biobullet and the 0.08-longer, tungsten biobullet at distances out to 40 yards.

Future collaboration with BTI will include YNP staff conducting an accuracy study of the various delivery system and biobullet combinations to determine which will work best in the park. BTI has graciously offered the use of their high-powered delivery system, and production of an adequate supply of

biobullets to see the study through to completion.

Wounding characteristics study. A cooperative agreement with Montana State University was established to evaluate the wound site characteristics of biobullets on bison. Wildlife Health Associates was chosen as a collaborator to draft a protocol for testing any vaccine delivery systems that the park may want to consider for use in a remote delivery program. A complete literature review of remote ballistic vaccination programs and previously-used methods has been completed. The park hopes to use the protocol to test the BTI rifle and biobullet delivery system within one year.

Environmental planning for a remote vaccination program. The premise for a decision on whether or not to implement a remote delivery vaccination program will be based on the criteria set forth in the Record of Decision for Bison Management for the State of Montana and Yellowstone National Park. Evaluation of the environmental consequences of a safe and effective remote delivery system were deferred in the 2000 ROD. A contract was initiated in August 2002 to assist YNP in developing a public scoping process for this next decision in bison management. A request for proposals was issued, and the contract was awarded to Greystone Environmental Consulting. An initial meeting to outline the work to accomplish was conducted in October 2002.

One of the objectives of the IBMP is to protect livestock from the risk of transmission of brucellosis from bison. By further reducing the sero-prevalence rate in bison, the risk of transmission could be reduced from a low probability to an even lower probability. Thus, the remote vaccination of eligible bison with an effective and safe vaccine would contribute to a decrease of sero-prevalence in the population. In addition, a parkwide vaccination program could be a first step toward eventual elimination of the bacteria in the bison population.

Aerial population count flights. Approximately once a month, NPS staff conducted aerial surveys of the entire bison population across bison range inside YNP. Five flights were cancelled because of adverse weather conditions or scheduling conflicts with the pilots or biologists. The number of bison in the population grew to more than 4,000 animals after the 2002 calving season (Table 3).

Population abundance estimate (summer 2002). Calf production this year was estimated at 680 newborns (Table 4). This estimate is based on the late-July count of 679 calves, combined with



Bison bison.

TABLE 3. SUMMARY OF TOTAL BISON OBSERVED FROM SEVEN AERIAL MONITORING FLIGHTS.

Month Flight Occurred	Bison Observed on the Flight
November 2001	3,307
February 2002	3,330
April 2002	2,991
May 2002	3,545
June 2002	3,648
July 2002	3,715
August 2002	4,045

observations of a few red calves in late September, indicative of some individuals born very late. Using a population estimation model, we have calculated the abundance of adults only during summertime, and added the number of calves to each of the abundance estimators.

Demographic study of Yellowstone bison. In collaboration with the USGS's Northern Rocky Mountain Science Center, the park initiated a project to estimate the demographic consequences of our bison management program. Current management models are based on demographic parameters estimated from sampling bison that are killed in management capture operations. The underlying assumption is that these animals are representative of the population as a whole. This project will address the question of whether the animals captured in our management operations at the park boundary are representative of the population park wide.

In June 2002, the USGS organized a workshop of professional ecologists and biologists from across the continent who have conducted bison projects.

The results of the two-day discussion are the basis for the study design of this work. A project study proposal is being developed and scheduled to begin in winter 2002–2003. The demographic parameters under investigation are group classification, age structure, disease status, and mortality patterns.

Ground classification counts. Management decisions regarding Yellowstone bison require an understanding of the population ecology of the herd. This understanding necessitates quality population estimates and data on herd sex and age composition. A single estimate of the population size at a specific time and location may have limited value, while estimates obtained for the same locations over longer periods can provide critical information for a monitoring program. This information can be used to detect trends in the bison population and aid in identifying the demographic variable (mortality, reproduction, immigration, emigration) that is resulting in these trends. It is advantageous for resource managers to predict future changes or trends in the population before they occur. In order to do this, it is necessary to monitor the sex ratio and age structure of the population through space and time. Much of this type of information has been obtained opportunistically from captured bison leaving the park boundary. The sampling (blood and tissue) conducted at the capture facilities is important for assessing the prevalence of disease and creating a genetic profile of the herd, but the demographic information collected may not be representative of the Yellowstone bison population.

Yellowstone's bison are separated into three units according to wintering location. These are the Pelican, Mary Mountain, and Lamar areas. In any given year, bison from all three groups may not be

TABLE 4. FLIGHT DATA FROM BISON ECOLOGY AND MANAGEMENT OFFICE FLIGHTS CONDUCTED DURING SUMMER 2002.

	MAY		JUNE		JULY		AUGUST
	adult	calf	adult	calf	adult	calf	adults and calves combined
Northern Range	852	116	479	71	517	95	601
Pelican Valley	44	0	45	0	207	34	481
Mary Mountain	2,169	364	2,513	540	2,312	550	2,963
Total	3,065	480	3,037	611	3,036	679	
Total Bison	3,545		3,648		3,715		4,045

Lower limit: 3,036 adults + 680 calves = 3,716
Point estimate: 3,219 adults + 680 calves = 3,899
Upper limit: 3,441 adults + 680 calves = 4,121

sampled at the capture facilities, and thus, the demographic information collected there may not be representative of the Yellowstone bison population.

A classification program combining aerial and ground surveys was developed in order to provide a more accurate representation of the age and sex structure of the Yellowstone bison herd. This information can be compared with data obtained from the capture facilities. Also, the classification data is collected on all three bison groups at different periods of the year, allowing comparative estimates of population size, sex ratios, and age structure to be made among the three units at different times. Indices of sex- and age-specific mortality and recruitment can also be obtained from the data collected. This classification information can assist in predicting the effects of management activities on Yellowstone bison, and identify the cause of population changes. The overall purpose of this study is to conduct surveys to determine abundance, sex and age composition, and spatial locations of Yellowstone bison in order to develop a long-term monitoring program.

Sampling area and methods.—The park was divided into five main study areas, including the northern range, Mammoth-to-Norris region, the Madison/Firehole area, Hayden Valley, and the Lake/Pelican area. Bison were surveyed by two to three person crews. Crew members approached groups on foot to a distance at which age and sex of the animals could be determined and observers' safety was not jeopardized. Classifications were made using 10 × 42 binoculars or a 60× spotting scope. Crews attempted to classify as many individuals as they could each day. When possible, multiple observers classified the same group of bison, and totals of each observer's classification were averaged

for each bison group classified (i.e., if Observer A recorded 50 cows in a group, and Observer B recorded 46 cows in the same group, then the total cows in the group would be 48). Procedures are currently being developed to address the error associated with each observer's classification.

Ground crews classified bison during early summer (June 25–July 12). The time allotted to each sampling zone varied with bison density and size of groups being classified. Bison were classified as bulls, cows, calves, yearling bulls, yearling cows, unknown yearlings, and unknown bison. The sex of calves was not determined. Prior to classification, all crew members discussed, developed, and weighted criteria for categorizing each bison class. Due to topography and orientation of individual bison within groups, it was not possible to accurately classify all animals in each group. Efforts were made to minimize the number of individuals put into the unknown category by safely moving along the perimeter of bison groups. Environmental variables (precipitation and cloud cover) that may have affected an observer's classification efforts were recorded for each classification period. For each group classified, UTM coordinates corresponding to the center of the group were calculated using GPS units, maps, and compasses. Table 5 provides a breakdown of the locations that make up the five study areas.

Preliminary results.—The number of bison classified for early summer was 3,245 animals (Table 6). Adult female bison comprised 43% of the population, and 46% of those had calves in attendance.

Tribal consultations. Bison management was an issue of interest at government-to-government consultations conducted in Yellowstone in May, and in South Dakota in October. Many Indian tribes are

TABLE 5. YELLOWSTONE BISON CLASSIFICATION SAMPLING LOCATIONS.

Northern Range	Mammoth to Norris	Madison/Firehole	Hayden Valley	Lake/Pelican
Eagle Creek/Bear Creek	Bunsen Peak	Gibbon Meadows	Alum Creek	Bridge Bay
Blacktail	Swan Lake Flat	Elk Park	Violet Creek	Lake Hotel
Oxbow/Geode Plateau	Gardners Hole	Sylvan Springs	Sulphur Mountain	Fishing Bridge
Hellroaring Slope	Obsidian Creek	Gibbon Geyser Basin	Trout Creek	Mary Bay
Pleasant Valley	Solfatara Creek	Madison River	Elk Antler Creek	Steamboat Springs
Little America Flat	Norris Geyser Basin	Duck Creek/Cougar Creek	Mud Volcano	Pelican Valley
Slough Creek		Sentinel Meadows		
Crystal Bench		Fairy Creek		
Lamar Valley		Fountain Flat		
Round Prairie		Nez Perce Creek		

**TABLE 6. EARLY SUMMER (JUNE–JULY) 2002
YELLOWSTONE NATIONAL PARK BISON CLASSIFICATION.**

	TOTAL INDIVIDUALS			PERCENT COMPOSITION		
	Pelican Valley	Northern Range	Central/Mary Mtn.	Pelican Valley	Northern Range	Central/Mary Mtn.
Bulls	36	283	327	100	29	15
Cows	0	383	1,016	0	39	45
Calves	0	163	477	0	17	21
Yearling bulls	0	61	183	0	6	8
Yearling cows	0	43	204	0	4	9
Unknown yearlings	0	14	10	0	1	0
Unknown	0	21	24	0	2	1
Total	36	968	2,241			

Total calf/cow = 640/1,399 = 0.46

interested in becoming more involved in the decision processes of the IBMP. Of primary interest is how tribes could procure bison destined for the slaughter facilities and instead have them released onto tribal lands. Discussions in South Dakota led to the Intertribal Bison Cooperative representative's proposing that their organization construct and manage a quarantine facility in order to facilitate the development of a process for Indian tribes to have access to live bison from Yellowstone that become identified as surplus animals.

Education and outreach. The Bison Ecology and Management Office provided a total of 18 talks to college and high school groups, NPS and concession staff, and professional societies. The majority of the talks covered the topics of the history of bison management in YNP and details of the Interagency Bison Management Plan, and how the plan fits into the mission of the NPS and YNP.

Administrative duties. The Bison Ecology and Management Office provided replies to nine congressional inquiries about bison management and the IBMP. In addition to congressional inquiries, the office collaborated with the YCR publications office to develop a site bulletin that describes the salient points and issues that the IBMP is attempting to resolve. Over 600 copies of the final Environmental Impact Statement and Record of Decision were mailed to constituencies throughout North America.

Elk and Other Ungulates

Yellowstone National Park participated as a member of the Northern Yellowstone Cooperative Wildlife Working Group (i.e., member agencies are

Montana Fish, Wildlife and Parks; National Park Service; U.S. Forest Service; and U.S. Geological Service Northern Rocky Mountain Science Center) to share costs and duties for monitoring ungulates on the northern range (inside and outside the park). The overall purpose of this group is to preserve and protect the long-term integrity of the northern Yellowstone winter range by increasing scientific knowledge of its species and habitats, promoting prudent land management activities, and encouraging an interagency approach to answering questions and solving problems. Yellowstone National Park also continued its partnerships with academic institutions (e.g., Michigan Technological University, Montana State University, University of Alberta, University of Minnesota) to monitor the demographics of elk and wolves, and the potential "cascading" effects of their interactions on woody vegetation in the northern portion of the park.

Elk. The estimated minimum number of elk residing on the northern range during 2002 was 11,969, based on the number of animals counted from fixed-wing aircraft during December 21–23, 2001. The 2001–02 count was less than the 13,400 elk counted during the winter of 2000–01, but higher than counts during the winters of 1997–98 and 1998–99. Because annual counts are not adjusted for biases in detecting elk within and among surveys, it is not possible to determine if the December 2001 count represents an actual decrease in elk abundance. However, that count is within 14% of the average for 20 annual counts during 1976–2002.

A late winter elk classification flight was flown via helicopter on the northern range during February

27–28, 2002. A total of 4,001 elk were classified, and 14 calves and 43 total bulls per 100 cows were observed. The estimated ratio of 43 total bulls per 100 cows is similar to the average ratio (i.e., 46 bulls per 100 cows) during 1995 through 2001. However, the estimated ratio of 14 calves per 100 cows was less than the range of 22 to 34 calves per 100 cows observed during 1995 through 2001. This low calf:cow ratio suggests that recruitment into the northern range elk population was relatively low for this cohort. The cause of this year's apparent low recruitment is unknown and cannot be inferred from the survey data. Potential contributing factors likely include drought-related effects on maternal condition and calf survival, predation, hunting, and winter kill.

The estimated number of non-migratory elk residing in the west-central portion of the park during



A variety of factors have led to wide annual variability in elk recruitment since 1992.

2002 was approximately 460. This estimate was derived from a series of ten daily mark-recapture experiments conducted by biologists from Montana State University along the road system during both April/May and September/October 2002. This estimate is only slightly lower than the average count of 506 elk (range = 440–612 elk, $N = 9$) for this population during 1965 to 1988. A ratio of approximately 3 calves per 100 cows was observed by biologists from Montana State University during the April/May 2002 surveys. Wide annual variability in recruitment (less than 1–38 calves per 100 cows) has been observed in this population since 1992 owing to variations in snow pack and predation pressure.

In 1999, Yellowstone National Park initiated a broad monitoring and collaborative research program to evaluate the proposition that wolves will ultimate-

ly regulate the northern Yellowstone elk population at a level sharply lower than that established prior to wolf restoration, resulting in a “trophic cascade” of top-down effects on herbivores and vegetation. There are four integrated components to the project: 1) wolf functional and numerical responses; 2) elk habitat selection and population demographics; 3) elk and wolf behavioral adjustments; and 4) vegetation responses to changes in elk densities.

Radiotelemetry is used to monitor the survival, reproduction, movements, and resource selection of elk during these studies. Since 1999, biologists have obtained more than 2,300 locations from approximately 98 adult female elk that utilized the northern range during winter. There have been 20 deaths of radiocollared elk, including 10 elk legally harvested by hunters outside the park, 6 elk killed by predators

(i.e., 5 wolves, 1 mountain lion), and 4 elk that died due to unknown causes. Currently, 54 adult female elk on the northern range are equipped with functional radiocollars (45 VHF, 9 GPS).

In 1991, Yellowstone National Park partnered with Montana State University to investigate the demographics of elk in the west-central portion of the park. This investigation has continued for 11 consecutive winters, and was expanded in scope to include predator-prey interactions when wolves established a territory in this area of the park during 1998. Ungulate demographic data collected during this effort includes multiple annual population estimates, indices of annual pregnancy rates and recruitment, and esti-

mates of survival and cause-specific mortality. To date, population distribution and individual movement databases include approximately 11,000 locations of elk, 540 locations of radiocollared wolves, 1,280 kilometers of travel vectors for wolves obtained from snow tracking, and the identification of 272 wolf kills. In conjunction with this effort, researchers from California State University at Monterey Bay initiated an ambitious study of snow pack characteristics, distribution, and dynamics two years ago. This effort has produced databases including 1,200 snow cores, 30 snow pack temperature and hardness profiles, and one season's worth of continuous snow pack thermal gradient measurements from nine sites in varying terrain. These researchers also completed an unprecedented inventory of the geothermal features of Yellowstone during 2002 using

advanced remote sensing technology and classification techniques.

Mule deer. Biologists from Montana Fish, Wildlife and Parks conducted a classification survey of mule deer on the northern range via helicopter on December 20, 2001. A total of 486 deer were classified and there were approximately 52 fawns per 100 does and 24 bucks per 100 does. Since 1990, ratios of bucks to does in the Gardner basin have ranged between 7 to 24 bucks per 100 does, with a mean of 13 bucks per 100 does. Survey results suggest that buck numbers have increased during recent years.

Biologists from Montana Fish, Wildlife and Parks observed 1,934 mule deer during a helicopter count on the Gardner basin winter range (i.e., Yankee Jim Canyon to Mammoth) during May 3–4, 2002. This was the second highest count of mule deer since the relatively severe winter of 1996–1997. A total of 928 of these mule deer were classified by sex/age. Based on this sample, there was a ratio of 33 fawns per 100 adults. During 1988 to 2002, spring recruitment averaged 39 fawns per 100 adults (range = 14–57 fawns per 100 adults).

Pronghorn surveys. The estimated minimum number of pronghorn residing on the northern range during 2002 was 242, based on the number of animals counted during simultaneous fixed-wing aircraft and ground surveys on April 2, 2002. This estimate is similar to annual counts obtained during 1995 to 2001 (range = 204–235 pronghorn), suggesting that the abundance of the Yellowstone pronghorn population has remained approximately constant during this time period.

On September 30, 2002, an aerial observer classified 70 pronghorn in 18 groups during a fixed-wing flight of the northern range. We observed 19 fawns per 100 does, compared to 15–27 fawns per 100 does during 1998 to 2000. In addition, we observed 13 bucks per 100 does during 2002, compared to 22–25 bucks per 100 does during 1998–2000.

During 1999–2001, a cooperative study of Yellowstone pronghorn fecundity, fawn mortality, and resource selection was conducted by biologists from Montana State University, the University of Idaho, and the Yellowstone Center for Resources. Radiotelemetry data were collected from 34 adult does during this period. During 2002, the Yellowstone Center for Resources continued monitoring remaining radiocollared pronghorn ($N \sim 15$) on a weekly basis to build upon baseline information regarding vital rates, distribution, and movements of Yellowstone pronghorn collected during 1999 to

2001. Preliminary results of these studies suggest that annual adult female survival was relatively low (0.85), and recruitment of pronghorn fawns was poor (0.04 to 0.61 fawn per female) during 1999–2002.

During January 28–31, 2002, Yellowstone National Park convened an expert panel on pronghorn consisting of members from academia and federal and state agencies. The expert panel concluded that there was an appreciable risk of a catastrophic event (e.g., severe winter) reducing the pronghorn population. A primary recommendation of the panel was for the park to implement a rigorous monitoring program to estimate abundance and vital rates (e.g., adult fecundity and survival, recruitment, age structure). The expert panel also recommended that park biologists identify and monitor migration routes, fawning areas, the proportion of the population in each summer sub-group, and differential fawn mortality among groups. A report summarizing the results of the workshop was issued by the Yellowstone Center for Resources during October 2002.

Based on the recommendations of the expert panel, the YCR drafted a long-term monitoring program for Yellowstone pronghorn. The proposal includes identifying key vital rates that are indicative of pronghorn population dynamics, and implementing a rigorous monitoring program of these vital rates over the long term (i.e., over 10 years) that includes data collection, analytical modeling, and reporting protocols.

Bighorn sheep. Biologists from Montana Fish, Wildlife and Parks observed 172 bighorn sheep (i.e., 92 ewes, 27 lambs, 52 rams, 1 unclassified) during a helicopter count on the Gardner basin winter range (i.e., Yankee Jim Canyon to Mammoth) during May 3–4, 2002. Since 1995, the total count has ranged between 134 and 229 sheep (mean = 161 sheep). Estimates of recruitment and adult sex ratios during 2002 were 29 lambs per 100 ewes and 57 rams per 100 ewes. Lamb recruitment was similar to the previous three years and higher than the seven to eight lambs per 100 ewes observed during 1997 and 1998.

While total sheep numbers within and outside Yellowstone National Park appear to have declined since the mid-1990s, recruitment was relatively high (36 lambs per 100 ewes) during 2002 for the portion of the population within the park.

Winter ground counts of bighorn sheep in the area from Mount Everts to Point of Rocks in the Gallatin National Forest (i.e., north of Yellowstone National Park) were conducted by groups of

observers on foot or in vehicles on January 3, 2002. A total of 31 sheep (14 ewes, 5 lambs, 12 rams) was observed, compared to 40 sheep last winter. Since 1979, total ground counts have ranged between 31 and 265 sheep. Though these counts are likely unreliable for assessing trends in abundance, they permit closer observations of the physical condition and age of sheep.

During April and May 2002, we partnered with Montana Fish, Wildlife and Parks to opportunistically collect and examine fecal pellets from bighorn sheep in the Corwin Springs (three ewes, one lamb), LaDuke Hot Springs (three ewes, five lambs), and McMinn Bench/Rattlesnake Butte (three ewes, three males) areas to assess lungworm infestation. Lambs in the LaDuke Hot Springs band had high lungworm loads (i.e., >300 larvae of *Protostrongylus* lungworm per gram of feces). Samples from adult sheep in all areas were not remarkable.

Mountain goats. Biologists from Montana Fish, Wildlife and Parks conducted fixed-wing surveys for non-native mountain goats inside and adjacent to the northeastern boundary (Absaroka Range) of Yellowstone National Park on September 24, 2001. A total of 90 goats (67 adults, 23 kids) were observed during the survey, compared to between 27 and 76 goats during 1997–1999. No surveys were conducted during 2000. A ratio of 34 kids per 100 adults was observed during September 2001, compared to a range of between 17 and 36 kids per 100 adults during 1997–1999. Two cases of twinning were observed during September 2001, which is indicative of a healthy, rapidly-growing population. Also, kid production was documented for the first time south of Soda Butte Creek in Yellowstone National Park.

Biologists from Montana Fish, Wildlife and Parks conducted fixed-wing surveys for mountain goats inside and adjacent to the northwestern boundary (Gallatin Range) of Yellowstone National Park on September 25, 2001. A total of 34 goats (30 adults, 4

kids) was observed during the survey, compared to between 36 and 65 goats during 1997–1999. No surveys were conducted during 2000. A ratio of 13 kids per 100 adults were observed during September 2001, compared to a range of between 29 and 48 kids per 100 adults during 1997–1999. The 2001 count and classification data for this area should not be considered accurate or comparable to previous years, however, owing to poor sightability.

On September 23, 2002, we conducted a survey of suitable mountain goat habitat within the northern portion of Yellowstone National Park.

Though weather conditions precluded a complete survey of suitable habitat, we

observed 54 mountain goats (41 adults, 13 kids) and a ratio of 32 kids per 100 adults.

Adult goats were observed on Sepulcher Mountain,

Bannock Peak, Antler Peak, Trilobite,

Meridian Peak, Lost

Creek, Cutoff Mountain, and

Barronette Peak. Kids were observed on Sepulcher Mountain, Trilobite, Lost Creek, Cutoff Mountain, and Barronette Peak.

The 2001 and 2002 survey results suggest that mountain goat abundance is increasing within Yellowstone National Park. During September 2001, 96 goats were observed inside or within 0.25 mile of Yellowstone National Park, compared to between 24 and 82 goats during 1997–1999. Mountain goats have clearly established a breeding population in the park. Some occupy habitat along the border, while others are several miles inside the park. Based on the 2001 survey and goat sightings from the interior, there are probably 100–125 goats in the northeast corner and north-central portion of Yellowstone National Park.

Lynx

During 2000, the U.S. Fish and Wildlife Service (FWS) listed the Canada lynx [*Lynx canadensis*] as a threatened species. Despite evidence that lynx historically and currently reside in Yellowstone National



Bighorn sheep.

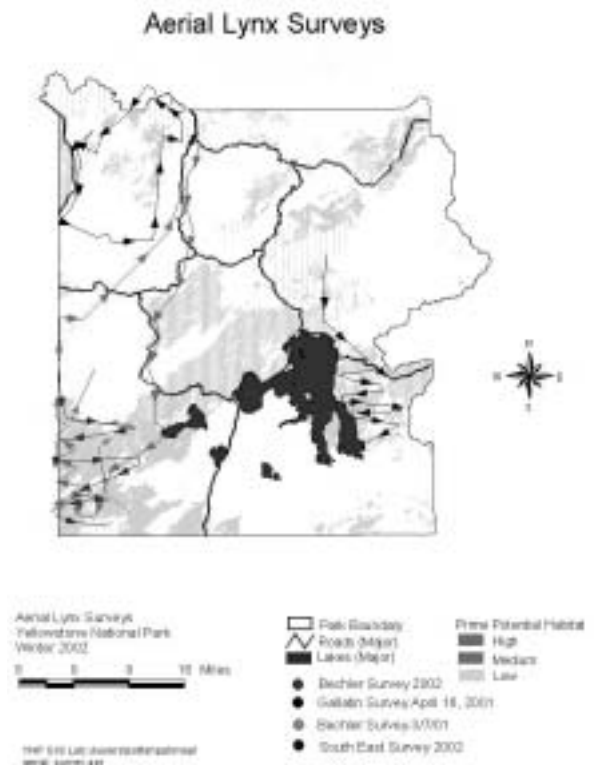
Park, little effort has been made to document lynx numbers and distribution. From 2001 to 2004, YCR staff are implementing a three-year survey to document lynx in the park using snowtracking during the winter and hair-snares during summer. Snowtracking surveys are distributed widely throughout the park but occur mostly in prime lynx habitats (e.g., mature subalpine fir [*Abies lasiocarpa*] cover types).

Biologists detected one possible and one probable lynx track in the interior of the park during winter 2001. During summer 2001, we deployed a 62-transect, hair-snare grid spanning 200 mi² on the east side of YNP, following the USFS National Lynx Detection Survey Protocol. Hair samples were sent to the Carnivore Conservation Genetics Laboratory at the University of Montana, Missoula, for DNA-based species and sex identification. One female lynx was detected. During FY2002, 95 snow tracking surveys, ranging from 1 to 21 miles length, totaling 359 miles, were completed. Three snowmobile-based surveys along the East Entrance, Canyon-to-Lake, and Old Faithful-to-West Thumb road segments, totaling 66 transect miles, were also completed. Seven camera stations were deployed for 170 camera nights on the east side of YNP.

Biologists detected one probable lynx track during the snowtracking survey and photographed coyotes at camera stations on four occasions. Wolverines [*Gulo gulo*], cougars [*Puma concolor*], grizzly bears [*Ursus arctos*], bobcats [*Lynx rufus*], wolves [*Canis lupus*], pine marten [*Martes americana*], and numerous coyotes [*Canis latrans*] were also detected. During summer 2002, 35 hair-snare transects were deployed using similar methods and the same location as 2001, collecting 112 hair samples. Results of laboratory analysis are pending and will be reported in the FY2003 report.

Wildlife Management and Monitoring

Road-killed wildlife. A total of 79 large mammals were hit and killed by vehicles on YNP roads during calendar year 2002. Bison ($N = 28$, 35%) and elk ($N = 18$, 22%) were the species most often killed in collisions with vehicles. Other species of large mammals hit and killed by vehicles on park roads included 14 mule deer (18%), 6 coyotes (8%), 5 moose (6%), 2 grizzly bears (3%), 1 (1%) beaver, 1 (1%) bighorn sheep, 1 (1%) black bear, 1 (1%) gray wolf, 1 (1%) mountain lion, and 1 (1%) raccoon. Although not systematically reported, 10 small mammals that were hit and killed by vehicles were recorded, including 3 porcupines, 3 pine marten, 2 red fox, 1 badger, and 1 striped skunk.



Locations of aerial surveys for lynx in YNP, winters of 2000–2001 and 2001–2002.

The average large mammal road-kill rate of all park roads combined was 0.3 road-kills per mile of road. The West Yellowstone-to-Madison Junction road (1.0 road-kills/mile) and U.S. Highway 191 (0.9 road-kills/mile) had the highest large mammal road-kill rates of all park roads.

The 79 road-kills reported in 2002, was the lowest number recorded since the park began keeping records in 1989, and was significantly lower than the long-term average of 106 (± 20 SD) road-kills per year recorded from 1989 to 2000. The highest number of large mammals killed by vehicles was 148 in 1994.

Wolves

Population monitoring and management.

Population status.—At the end of September 2002, at least 148 wolves in 14 packs were present in Yellowstone National Park. Of these 14 packs, 12 were considered breeding pairs according to the U.S. Fish and Wildlife Service's definition. Combined with breeding pairs in Idaho and northwest Montana, 2002 will be the third successive year that the minimum population size (30 breeding pairs) for wolves in the northern Rockies, according to the recovery plan, will have been achieved. In addition to meeting biological criteria for wolf delisting, approved state

management plans are required, and currently not all of the states have completed approved plans. Therefore, delisting cannot proceed and federal management of wolves will continue until acceptable plans are completed by the states.

Of the 14 YNP packs, all but two bred. The Tower pack, comprised of two wolves, was attacked by another pack of six wolves in March (Agate Creek pack), right after the breeding season, and the female likely lost her pups from wounds suffered during the attack. The Slough Creek pack, a group that formed from the splitting of the once record-large Druid Peak pack, also did not breed for unknown reasons.

Four new packs formed in YNP in 2002, three of them as a result of the splintering of the Druid Peak pack: Agate Creek, Geode Creek, and Slough Creek packs all formed with at least one Druid Peak disperser and reside on the northern range of YNP. Interestingly, all three of these packs are anchored by females (#103F, #105F, and #106F) born at the same den in Lamar Valley in 1997. The alpha male of the Agate Creek pack is a five-year-old male from the Chief Joseph pack. The last newly formed pack is the Bechler pack, discovered in August 2002, after numerous reports of tracks and sightings in the area. This is the first resident group of wolves in the Bechler area since wolf reintroduction began in 1995. Prior to this there was little wolf activity and only occasional reports of tracks. The group is comprised of a very large dispersing male from the Rose Creek pack and three uncollared wolves, two of which are pups, so the pack will count as a breeding pair (a minimum of two pups are required to be considered a breeding pair). They have ranged as far north as Little Firehole Meadows and have so far not been located outside YNP.

The formation of the three new packs from the splintering of the large Druid Peak pack was mostly observed by field staff and was unique, and not previously recorded in the wolf literature. As the Druid Peak pack crumbled during winter 2001–2002, groups of wolves formed with little affinity to area, and individual wolves moved between the different groups. For example, #218F, originally from the Druid Peak pack, was recorded traveling with the Agate Creek, Geode Creek, and Slough Creek packs. Four

Nez Perce wolves (#213F, #214M, #215M, and 252M) from the Madison–Firehole area joined in the ménage of wolves often centered around Tower Junction. The area where many of the interactions took place was mostly newly-acquired Druid Peak territory (usurped from Rose Creek). On one occasion near Hellroaring Creek in March 2002, one of the “new” split-off Druid packs (Geode Creek) interacted with the old, much-reduced Druid Peak pack. Wolf #106F, an old Druid wolf, greeted her former packmates with her tail up and wagging, but an aggressive interaction ensued between the two groups. After this encounter the Druid Peak pack was split and did not reunite until mid-April. The young pups and yearling Druid wolves remained near Hellroaring Creek, killing elk on their own, while the Druid alphas with two yearlings left the area and never returned. The Hellroaring area now belongs mostly to the new Geode Creek pack (#106’s new pack).

Pack size ranged from 2 to 20 and averaged 10.6. As expected, the record-large Druid Peak pack did not stay together, so the formation of new packs did not appreciably increase the number of wolves present from 2001 (2001 = 132, 2002 = 148; 12% increase).

Reproduction.—At least 67 pups were born to 12 YNP wolf packs in 2002. At least 14 litters were born; the Druid Peak and Agate Creek packs each had two litters of pups. The Agate Creek pack, one of those packs formed from the crumbling of the Druid Peak pack, denned at separate locations and appeared as if they would split into two packs. They did not, however, and joined up mid-summer, and have been functioning as one pack since that time.



Wolves surround a bull elk.

Interestingly, despite the fact that both of these packs had two litters, only four pups survived out of eight for the Agate Creek pack, and three of six in the Druid Peak pack. Geode Creek had at least eight, possibly nine, pups mid-summer, but only three of those were with the pack this fall. Overall, the maximum number of pups observed by wolf dens this summer was 65 or 66. In September, 56 (85%) of these pups could be accounted for, but it is likely more pups are missing because observability of some packs is low.

Mortalities.—At least six adult wolves died in YNP during the 2002 fiscal year. This figure does not include pups that died within the first four months of life. Four were natural mortalities, one was a vehicle strike on highway 191, and one was unknown. Two and possibly three of the natural mortalities were due to interpack conflict. Longtime alpha female #7F of the Leopold pack (founder wolf, first shipment of wolves from Canada January 12, 1995) was killed by other wolves in May, probably by the Geode Creek pack, which was denning nearby (see *Yellowstone Science* 10(3)). Wolf #34, longtime alpha male of the Chief Joseph pack (1996 reintroduced wolf), was likely injured by an elk and finished off by the Cougar Creek pack. Wolf #254M, who dispersed from the Druid Peak pack, was found dead at the base of a cliff near the headwaters of Timothy Creek. Cause of death was categorized as natural, but could have been accidental (base of a cliff), or could have involved other wolves. The carcass was partly decayed, so positive determination was not possible. The other natural mortality was elk-caused. Most other wolf mortalities in the GYA were outside YNP and were predominantly human caused. One Chief Joseph wolf dispersed to near Helena, Montana, and was shot by Wildlife Services after depredating sheep.

Population movements.—The YNP wolf population increased by 11% in 2002. Almost all of the increase was in non-northern range packs. In 2001, 77 wolves occupied the northern range, and in 2002, 78 did, and the non-northern range wolf population increased from 55 to 70. Therefore, despite the increased number of packs on the northern range in 2002 (five in 2001, eight in 2002) the number of wolves there increased only by one. Throughout the rest of YNP there was only one new pack from 2001 (Bechler pack, four wolves), so the increased number of wolves was due to increases in the number of wolves in existing packs (Nez Perce 18 to 20, Cougar Creek 6 to 10, Mollie's 10 to 12, etc).

Wolf use of YNP was typical of previous years except for the new Bechler pack. Few prey exist in Bechler in winter, making it difficult for wolves to live there throughout the year. The alpha male of that pack, for example, was located in the northern part of Yellowstone in April chasing deer, the time of year when pups are being born. Either the Bechler pack moved there later, or the alpha male made extremely wide-ranging trips in search of prey for a denning female.

Wolf-prey relationships. Wolf-prey relationships were documented by observing wolf predation directly and by recording the characteristics of wolf prey at kill sites. Wolf packs were monitored during two winter-study sessions, 30-day periods in March and November–December during which wolves were intensively radio-tracked. The Leopold, Rose Creek II, and Druid Peak packs were monitored by two person teams from the ground and from aircraft; the Swan Lake, Chief Joseph, Mollie's, Nez Perce, Sheep Mountain, Tower, Cougar, and Yellowstone Delta packs were monitored from aircraft only. YNP staff recorded and entered into a database behavioral interactions between wolves and prey, predation rates, the total time wolves fed on their kills, percent consumption of kills by wolves and scavengers, characteristics of wolf prey (e.g., nutritional condition), and characteristics of kill sites. In addition, similar data were collected opportunistically throughout the year during weekly monitoring flights and ground observations. The abundance and sex-age composition of elk within wolf pack territories were also estimated from the ground and from fixed-wing aircraft.

Composition of wolf kills.—Project staff detected 137 definite, 187 probable, and 4 possible kills made by wolves between October 1, 2001, through September 30, 2002, including 275 elk (84% of total), 20 bison, (6%), 6 deer (2%), 3 coyotes (1%), 1 pronghorn (<0.5%), 1 badger (<0.5%), 1 Canada goose (<0.5%), and 20 unknown prey (6%). The composition of elk kills was 36% calves (0–12 months), 34% cows, 19% bulls, 6.5% elk of unknown sex, and 3.5% elk of unknown sex and age. Bison kills included ten calves (unknown sex), three yearlings (two female, one male), and seven adults (three female, two male, two unknown sex). Of the bison kills, one was killed during January, five in February, six in March, seven in April, and one during the summer months. The Nez Perce pack was known to make 13 of the bison kills and Mollie's pack was known to have killed two. During winter,

wolves residing on the northern range killed an average of 1.8 elk/wolf/30-day study period.

Winter studies.—During the 2001 November–December winter study (30 days), wolves were observed for 175 hours from the ground. The number of days wolf packs were located from the air ranged from 3 (Yellowstone Delta) to 12 (Swan Lake). Forty-one definite or probable wolf kills were detected, including 35 elk, 2 coyotes, and 4 unknown prey. Among elk, 15 (43%) of the kills were calves, 11 (31%) were cows, 6 (17%) were bulls, and 3 (9%) kills were adult elk of unknown sex. During the 2002 March winter study (30 days), wolves were observed for 243 hours from the ground. The number of days wolf packs were located from the air ranged from one (Yellowstone Delta) to 15 (Leopold, Rose Creek II, Tower, and Sheep Mountain). Seventy-two definite or probable wolf kills were detected, including 65 elk, 3 bison, and 4 prey of unknown species. Among elk, 19 (29%) were calves, 22 (34%) were cows, 18 (28%) were bulls, 4 (6%) were of unknown sex, and 2 (3%) were of unknown sex and age.

Wolf–carnivore interactions. The reintroduction of wolves into YNP has provided an opportunity to examine interactions among a full suite of carnivores and their prey. Preliminary evidence from concurrent field studies focusing on the park’s large carnivores (wolves, cougars, grizzly bears, and black bears) already suggest that these interactions have significant effects on carnivore community structure, population dynamics, and prey population impacts. Collaboration with interdepartmental (bear management, ungulate management, bison ecology and management) and interagency (Interagency Grizzly Bear Study Team; Montana Fish, Wildlife and Parks) researchers has already been productive in pursuing science-based questions on multi-carnivore relationships. The use of new technologies such as GPS telemetry collars will advance our ability to understand the carnivore community and its interactions, as well as their impact on prey populations.

In fall 2002, a manuscript was submitted to a peer-reviewed scientific journal describing the activities of humans and carnivores on YNP’s northern boundary prior to, and during, the fall elk hunting season. The study monitored the movements of grizzly bears, wolves, and cougars in a 2,391 km² study area centered on YNP’s northern range and the Absaroka-Beartooth Wilderness. Grizzly bears were more likely to be located inside the YNP boundary during the pre-hunt period and north of the boundary

once hunting began. Cougars tended to be found outside the park during the pre-hunt period and moved inside the park when hunting began. Wolves did not significantly change their movement patterns during the pre-hunt and hunting periods. Qualitative information on elk indicated that prey moved into the park after hunting began, suggesting cougars followed living prey, bears focused on dead prey (gut piles and crippled elk) and wolves may have taken advantage of both.

In addition, project staff are documenting wolf–grizzly interactions in order to examine the population and community-level consequences that result from their behavioral interactions. The most common interactions between wolves and grizzly bears involved wolves and bears in the same area (34%), followed by bears defending kills from wolves (19%; probably wolf kills usurped by bears) and bears usurping wolf kills (19%). Interactions most often occurred at kill sites (66%). Most encounters at most sites were won by bears (40%), or the winner could not be determined (40%), even though wolves outnumbered bears during 76% of the interactions. Adult bears without cubs were involved in 88% of the encounters.

The use of wolf-killed ungulate remains by bears is particularly high in Pelican Valley, where most elk emigrate in winter, but some bison remain. Bison or elk killed by Mollie’s pack in that part of YNP are routinely lost to grizzlies. In fact, every time project staff aerially located Mollie’s pack on a kill during the spring, summer, and fall of 2002, at least one grizzly was in the area, or more commonly, at the kill. During a September backcountry horse trip into upper Pelican Creek, Doug Smith, Dan Stahler, and Wayne Brewster documented six recently killed bull elk carcasses, all of which were probably Mollie’s pack kills, and every one had evidence of bear visitation. In poor whitebark pine cone production years, such as documented in 2002, carrion availability to bears via wolf kills may have significant population-level effects. Such routine wolf–grizzly interactions have important implications both behaviorally and ecologically for both species, particularly with respect to wolf–prey interactions and carrion availability to bears, and continued research will allow a better understanding of their relationship.

Although wolves lost most disputed kills to bears, wolves were quite successful at defending dens, as highlighted by the following two observations. On a flight in late July 2002, the Yellowstone Delta pack was observed holding a large adult grizzly at bay at

the pack's Thorofare den. One of the wolves came up behind the bear and bit it on its hind end, and eventually the two wolves escorted the bear out of the den area, with two additional wolves following. A couple of weeks later, the same pack was aerially located at their Thorofare rendezvous site with a large grizzly bear sitting in the middle of six adult wolves and four pups. The wolves were agitated with the bear's presence and maintained pressure on the bear to keep it away from the pups. Although the outcome of this second observation is unknown because the



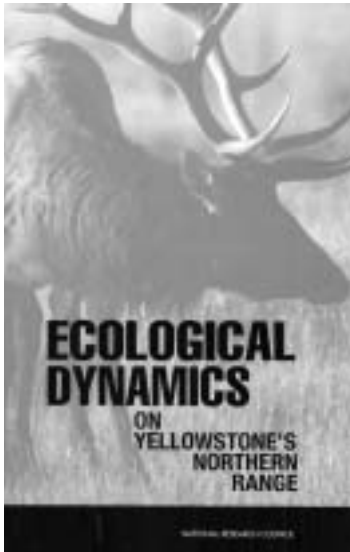
Grizzlies compete with wolves from Mollie's pack over a carcass.

animals went out of sight into the thick willows, the wolves appeared to successfully protect their pups.

TABLE 7. NOVEMBER 2002 SUMMARY OF WOLF POPULATION IN YELLOWSTONE NATIONAL PARK.

Pack	Adults/ Yearling	Pups	Total Est. Pack Size	Breeding Pair?	No. of Litters (yes/no)	General Location
Agate Creek	6	4	10	Yes	2	Agate to Antelope Creeks
Bechler group	2	2	4	Yes	1	Bechler
Chief Joseph	2	8	10	Yes	1	W/NW YNP
Cougar Creek	5	5	10	Yes	1	Western YNP
Druid Peak	8	3	11	Yes	2	Lamar Valley to Hellroaring Creek
Geode Creek	6	3	9	Yes	1	Geode Creek
Leopold	8	8	16	Yes	1	Blacktail Plateau to Mt. Everts
Mollie's	10	2	12	Yes	1	Pelican Valley
Nez Perce	15 ¹	3 ¹	20 ¹	Yes	1	Central YNP
Rose Creek II	7	3	10	Yes	1	Hellroaring Creek to Crevice Creek
Slough Creek group	4	0	4	No	0	Slough Creek
Swan Lake	5	11	16	Yes	1	Gardner's Hole/Swan Lake Flat
Tower	2	0	2	No	0	Tower
Yellowstone Delta	10	4	14	Yes	1	Thorofare
Total: 14 packs	90	56–58¹	148	12	14	

¹Adult and yearling count is estimated; pup count is at least 3; total pack size is accurate.



The National Research Council's report on Yellowstone's northern range was published in 2002 and featured in *Yellowstone Science*. Yellowstone resource management specialist Roy Renkin discusses the northern range with the National Academy of Sciences committee during a 1999 visit.

Part IV. Professional Support Programs

This section describes the work accomplished or coordinated by the YCR staff who provide services for other YCR branches and other park divisions.

- The Spatial Analysis Center, responsible for the park's geographic information system, global positioning systems, and other resource databases;
- Resource Information, which produces publications and provides special programs on natural and cultural resource topics;
- Research Support; which oversees permitting for visiting and park researchers;
- Benefits-Sharing EIS; which provides for public dialogue on issues surrounding benefits-sharing as well as a means to evaluate potential environmental effects related to a set of alternative approaches to managing benefits-sharing when research involving biological specimens collected from NPS units yields commercially valuable results; and
- Funding and Personnel Support for the YCR Division.

SPATIAL ANALYSIS CENTER

The Spatial Analysis Center (SAC) is the home for the park's geographic information system (GIS), global positioning systems (GPS), image analysis, soil information support, and a park resource database system. SAC's goals are to maintain an up-to-date GIS lab, provide GPS equipment and expertise, increase the GIS and GPS skill level of park staff, acquire new data and make it useful, provide information and technical support to park staff, and make information available to outside agencies and the public.

GIS Administration and GPS Support

In FY02, SAC staff gave direction to the GIS and information management needs of Yellowstone. SAC staff continued to mold the GIS lab into a functional entity that meets the park's analysis needs. SAC staff

maintained and developed the tools and resources needed for SAC technicians and other GIS users in the park and provided the data and hardware necessary to conduct information analysis.

Network. The information (more than 200 gigabytes) maintained on SAC servers is used by every division of the park and every YCR branch. More space will be needed next year. We have regular system backups and annual system archives. This year, SAC purchased two computers with DVD data storage capability to cement this process in place and make it more efficient. SAC staff maintain a strong relationship with Computer Support Services, and as a result, have input into upcoming network changes. Changes in network infrastructure will give more users faster access to SAC information.

Software. This year SAC staff began a transition, along with the industry, to ArcGIS, a new software suite used to produce sophisticated GIS analysis with the latest tools. To support this transition, the SAC Intranet site was redesigned for specific help about the new software. ArcGIS operates using a license server, which means more users in the YCR will have access to the same number of software licenses. This staged implementation plan will continue into 2003. SAC staff also started using ArcIMS, a software program that serves dynamic GIS projects over the Intranet. Many casual users will access spatial data with this interface rather than through the traditional, desktop GIS software.

Hardware. SAC staff continue to provide access to the hardware resources needed for spatial data collection and analysis. This includes but is not limited to 14 GIS workstations, 20 GPS units, printers, digital cameras, scanners, laptop computers, and video projectors. Much of this equipment is used for more than work in the Spatial Analysis Center; laptops, projector, and GPS units are freely loaned to other users in the park. This year, two older workstations were replaced with two high-end computers. Two new Trimble GPS units, the XT and the XM, were purchased. These units are just out and on the cutting edge of where the technology is going. They are smaller than the current models and include GIS capabilities right in the hand-held unit. This means that you will be able to view GIS maps and imagery as you navigate to your sampling location. In the middle of last summer, every GPS unit was checked out.

Data. New layers were added to the permanent directory this year, bringing the total to 83 documented spatial data layers. These layers, located on

the G: drive, constitute our reference library (read only) of spatial information. They allow GIS users to access accurate, documented data for use in reports and analysis. Many of these permanent layers (e.g., wetlands, trails, and thermal areas) need annual updates.

Outreach. Every year SAC staff provide GIS and GPS training to park staff and outside researchers. We have redesigned our Internet site to be a “help desk” for GIS and GPS technology in the park. Through our Internet site, the public can download many of the park’s GIS datasets. Staff regularly attend meetings with other federal, state, and local government agencies, and non-government organizations to promote the sharing of cross-boundary data.

Projects

The following are some of the projects that SAC staff supported or initiated during 2002.

Fire history atlas (YELL & GYA). SAC staff finished two fire history databases for Yellowstone: Fire Perimeters, larger (> 100 acres) fires 1881 to present; and Fire Starts, all fires 1931 to present. There are 2,170 fire starts and 121 fire perimeters in the database so far. In addition, funding from the Greater Yellowstone Coordinating Committee was used to begin compiling 15 years of fire history, including fire perimeters (417) and fire starts (10,534), for the entire GYA.

Fire burn severity maps. SAC staff are working with the fire cache to create accurate fire perimeters and burn severity maps using imagery from LANDSAT satellites. This year, burn severity mapping for the 2001 fires was completed.

Mining claims, and oil and gas leases. SAC staff created a GIS database of mining claim and oil and gas lease data from the areas surrounding Yellowstone and Grand Teton National Parks, and Bighorn Canyon National Recreation Area. Much of this information was previously available only on paper maps. This information will help us identify potential stressors to park resources.

Rare plants and wetlands. SAC staff compiled historic rare plant and wetland data into databases and linked them to GIS layers. Working with old data is extremely tedious, time consuming, and often frustrating. It underscores the need for consistent guidelines for data collection, attribute names, and general data management. SAC staff also helped to collect, organize, and document the 2002 rare plant and wetland data.

Thermal area inventory. This year, eight thermal areas were visited, and 1,233 new features were

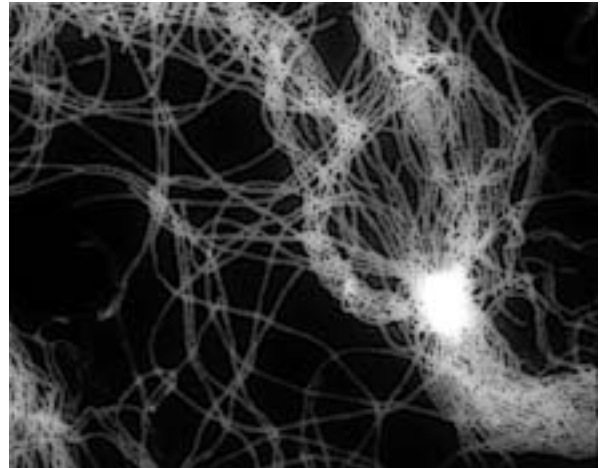
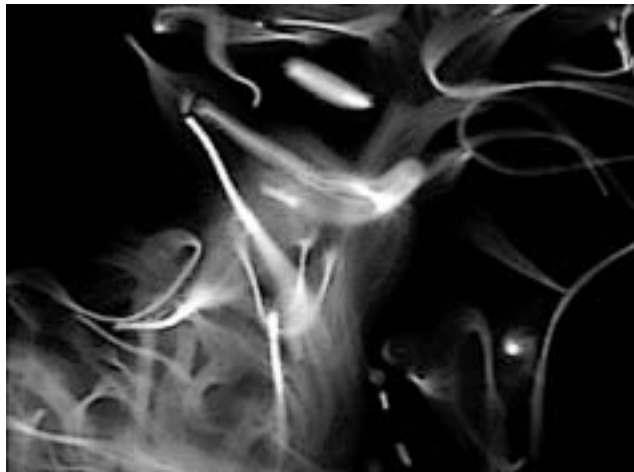
added to the database. Locations and photographs for 6,667 features are now in the database. The majority of these also have data for pH, temperature, and electro-conductivity. This is a Fee Demonstration project.

Thermophile inventory. The Yellowstone National Park Thermophile Survey is systematically documenting the diversity of microbes that live in the park's hot springs and other thermal features. During April 2002, samples collected during FY2000 were analyzed, and the DNA sequences for 70 organisms were isolated, representing the thermophiles from 15 springs. In May, the FY2000 protocols for site selection were modified to remove sampling bias, and generated a list of 300 target sites for the summer. Between June and September, we collected 216 samples, ranging in pH from 1.7 to 9.3, from 5 of the 12 major thermal areas. The park

Breeding bird survey. In FY02, protocols were developed for downloading breeding bird survey data from the Internet into a database linked to GIS. On average, this database has information on the abundance and distribution of more than 430 different species per year.

Compliance/planning database development. A spatial database is being built that will hold the resource data needed to make good planning decisions. This year, most of the data layers required for this application were completed. Staff also started designing the Intranet-based interface that will allow people to access the information with a web browser.

Fisheries. SAC staff continued converting research data collected by the Fisheries and Aquatic Management Program into a digital database. This includes information about backcountry fish and macroinvertebrate surveys, gill netting for lake trout,



Two thermophiles discovered during the thermophile inventory conducted by the Spatial Analysis Center in 2002.

has added \$10,000 to complement U.S. Geological Survey Biologic Resource Management Division funding, allowing for the analysis of up to 100 samples in FY03.

Utility maps. A pilot project to determine what resources would be needed to create accurate, digital maps of the utilities at the major developed areas was begun. Old Faithful was the prototype area, and accurate maps were quickly created. The key is finding someone who knows exactly where the utilities are. Protocols have been developed to implement next year for all the major developed areas. The maps produced this year have been popular with maintenance staff, rangers, and structural fire staff.

and stream temperature measurements.

Historic landscape alterations. SAC staff added new information to the spatial coverage of Landscape Alterations, places where people have dug up or built things. In 2002, SAC staff focused on historic alterations (buildings, roads, trails, dumps, fences, etc.) in the Hayden Valley and Canyon areas of the park.

Trail maintenance. Existing trail and campsite information was updated to include all reroutes and campsite relocations as of this year. SAC staff added or edited 23 trail segments (over 17 miles) along with the locations of 9 campsites.

RESOURCE INFORMATION AND PUBLICATIONS

Several staff changes occurred among the Resource Information and Publications team in 2002. Visual information specialist Renée Evanoff announced her retirement after more than a decade of service to YCR publications. Writer-editor Kevin Schneider left on a detail to the park's planning office in late May, and during the summer accepted a permanent transfer to planning. In turn, Alice Wondrak, upon completing her Ph.D. from the University of Colorado, filled the vacancy left by Kevin's departure when she accepted an appointment as a full-time writer-editor.

Publications

In 2002, the quarterly journal *Yellowstone Science* celebrated its tenth year with a variety of articles highlighting many aspects of Yellowstone's natural and cultural resources. With generous financial support from the Yellowstone Association and its loyal readers, its circulation reaches nearly 2,500 individuals and institutions across the United States and around the world. Issues this year featured interviews with Jack and Susan Davis (including color photographs of their Yellowstone memorabilia collection), Dr. Cathy Whitlock on her work coring Crivice Lake, and Kenyan conservationist Richard Leakey. Among the feature articles showcased in FY2002 were stories on Native Americans and geysers, Yellowstone's red fox, the 2001 Christmas bird count, a reprint of the conclusions and recommendations section of the National Research Council's report on the northern range, and an historical treatment of Theodore Roosevelt and his views on predator control in Yellowstone.

American Indians and Yellowstone National Park: A Documentary Overview by Peter Nabokov and Lawrence Loendorf was published in 2002. This long awaited, 367-page ethnographical report was distributed to park staff, affiliated tribes, other constituents, and interested public. Other publications produced this year included the *2000 YCR Annual Report*, the *2001 Wolf Project Annual Report*, the *2001 Yellowstone Bird Report*, and *2000 Investigators' Annual Report*. Resource information staff also researched, authored, and designed a new bison site bulletin, "When Bison Leave the Park" (Yell # 298), in consultation with the Bison Ecology and Management Office, the Division of Interpretation, and the Public Affairs Office.

In FY02, five issues of *The Buffalo Chip* were produced, including a special summer issue devoted to bison research and management. Other issues of the park's resource management newsletter featured stories on a wide variety of natural and cultural resource topics of interest to park staff. In addition to timely news briefs, among 2002 highlights were articles on archeology, the Greater Yellowstone Network's Vital Signs Monitoring Program, the sixth biennial science conference on Yellowstone Lake, the listing of Queen's Laundry on the National Register of Historic Places, the lynx project, the purchase of eight historic White buses, the proposed Heritage and Research Center, Yellowstone's first woman rangers, and winter use.

Resource information staff co-authored and coordinated the submission of six articles from the park for the 2002 *Natural Resource Year in Review*.

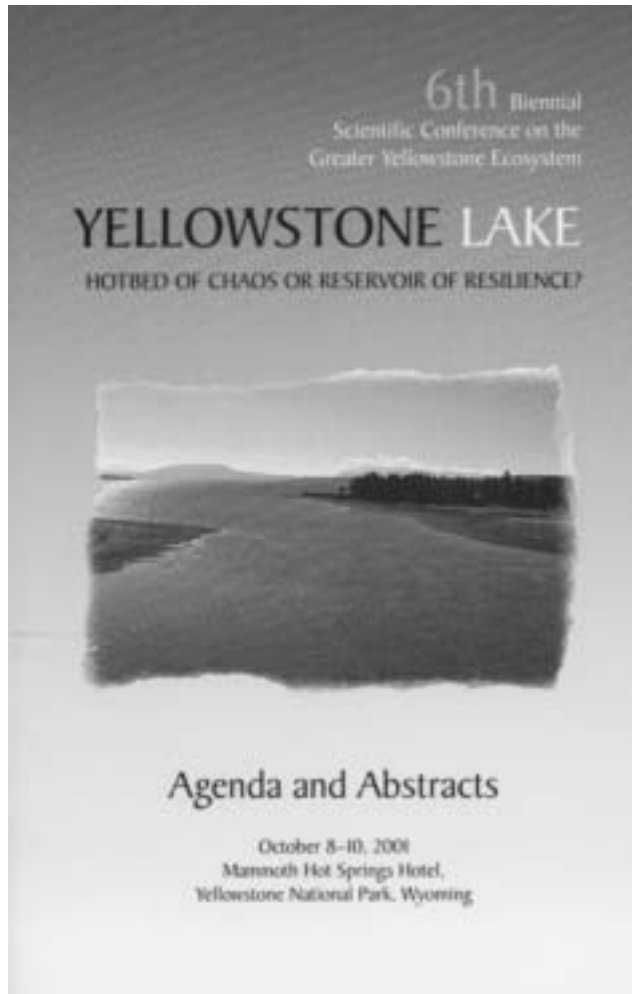
Articles highlighted the success of wolf restoration, the work of park staff with Russian scientists seeking brucellosis solutions, the interagency bison management plan, the monitoring of volcanic and earthquake unrest with the establishment of the Yellowstone Volcano Observatory, the lessons from the 1988 fires reported in the park publication, *Yellowstone in the Afterglow*, and the progress being made managing nonnative lake trout in Yellowstone Lake.

Staff prepared the YCR contribution to the Superintendent's annual report, reviewed the park newspaper, official park map and folder, books, and other documents as requested. They provided technical support to YCR and other park staff by scanning images, producing graphics, assisting with software issues, and helping with audiovisual needs, including PowerPoint presentations. The Resource Information Office was also called upon on several occasions to produce flyers, posters, and other promotional materials for brown bag lunches and other park events. Roger Anderson served as YCR representative working with Interpretation and the Visitor Services Office in developing a publications database as part of a parkwide Publications Plan.

Sixth Biennial Scientific Conference

Resource information staff planned, organized, and coordinated the Sixth Biennial Scientific Conference on the Greater Yellowstone, held Oct. 8-10, 2001. The conference theme was "Yellowstone Lake: Hotbed of Chaos or Reservoir of Resilience?" The three-day gathering with nearly 150 in attendance was noteworthy for its interdisciplinary nature; the conference addressed the management issues, natural features, and the human history asso-

ciated with Yellowstone Lake. The program committee accepted papers from 39 speakers and invited 5 guest presenters. Session topics included archeology, human history, climate and environmental change, species distributions and trends in the Yellowstone Lake Basin, fisheries and ecosystem-level functions, and hydrothermal and geologic processes in the Yellowstone Lake basin.



Agenda and abstracts from the Sixth Biennial Scientific Conference on the Greater Yellowstone Ecosystem.

The conference's guest speakers were: Dr. Cathy Whitlock from the University of Oregon, who presented the opening keynote address; YCR director John Varley, who presented the Aubrey Haines Lecture; Dr. Robert Smith of the University of Utah, who presented the A. Starker Leopold Lecture; and Dr. Nigel Trewin from the University of Aberdeen, Scotland, who spoke at the Superintendent's International Luncheon.

Kevin Schneider was instrumental in organizing the conference, working closely with the park's con-

cessioner, AmFac, who hosted the event, and communicating regularly with conference presenters and participants. Writer-editor Sarah Stevenson produced the conference agenda and abstract booklet, and returned on-assignment to Yellowstone to oversee final preparations and to handle conference registration. Visual information specialist Renée Evanoff created artwork and produced registration and other promotional materials in support of the event. Other park divisions also assisted with paid staff and volunteer support; Hank Coleman of telecommunications provided the sound system at all venues, and Jim Peaco from the Division of Interpretation videotaped the presentations.

The conference was hosted by AmFac Parks and Resorts at the Mammoth Hot Springs Hotel, and was generously supported by the Yellowstone Association. Registration fees covered all conference expenses and yielded a profit of \$5,429, which will go toward the production and printing of proceedings. The George Wright Society is producing the proceedings, with publication expected in late 2002.

Presentations, Seminars, and General Information

The resource information staff responded to hundreds of requests for information on a variety of park topics including, but not limited to, wolves, bison, bears, ecosystem management, resource issues, threatened and endangered species, geology, bioprospecting and benefits-sharing, and fisheries. Requests were made in person, through e-mail, phone calls, and in writing. Resource information staffers Roger Anderson, Kevin Schneider, and Alice Wondrak made 18 presentations to groups ranging from high school and university students to teachers, park staff, the visiting public, and professional organizations. Kevin presented several talks on benefits-sharing to a variety of internal and external audiences. Roger spoke to several university groups on park issues and presented evening programs for the public during July and August at the Bridge Bay amphitheater. Additionally, the resource information staff coordinated dozens of talks by YCR staff with subject matter expertise. In total, YCR staff presented 96 public programs in 2002, excluding training and presentations made to staff.

Throughout 2002, staff provided consultation and support to Kathy Sheehan of Montana State University's Thermal Biology Institute and David Patterson of the University of Sydney, Australia, in the development and organization of a book proposal

and outline for a forthcoming full-color book on Yellowstone microbes. Resource Information supported the project with \$5,000, and is assisting the authors in identifying an appropriate publisher. Publication is expected in 2004.

To alleviate space issues, a storage facility was leased in Gardiner, Montana, to address the ongoing need for publication storage. The unit, approximately the size of a one-car garage, stores the bulk of YCR publications and is being shared by the vegetation section, which is using the facility to store cabinets from the herbarium. Moving publication storage off-site has allowed the Resource Information Office to establish a scanning station for the YCR and to more efficiently display and distribute publications to interested parties through a reorganization of the workspace.

Until his detail and ultimate transfer to the planning office, writer-editor Kevin Schneider continued to provide half-time assistance to the YCR director in preparing a servicewide environmental impact study on benefits-sharing agreements in the national park system.

RESEARCH PERMITTING AND SUPPORT

In fiscal year 2002, Yellowstone's Research Permit Office authorized 278 research permits to 245 different principal investigators. These investigators came from almost every state in the union, as well as six foreign countries, and were supported by a cast of over 450 field technicians. Of the 278 permits issued, 27 were undergraduate and graduate level educational research permits. Educational research permits are issued to professors teaching field studies courses specializing in field methods and data collection instruction.

Although Yellowstone is well known for its wildlife and geothermal systems, a wealth of research related to other topics occurs here. A breakdown by topic is as follows:

Air, Soil, and Geology	39
Microbiology	51
Lakes, Streams, and Groundwater	12
Vegetation	32
Wildland Fire	6
Bears	8
Birds	2

Bison	7
Elk and Other Ungulates	9
Fish and Aquatic Life	23
Wolves	5
Other Wildlife Species	21
Archeology	6
Paleontology	9
Ethnographic Resources	1
Geographic Information Systems	9
Education and Interpretation	32
Resource Management Planning	6

The National Park Service and Yellowstone National Park are in the third year of using a new Internet-based program to administer independent research in the national parks. This remarkable new program, called the Research Permit and Reporting System, allows researchers to request permission to



In 2002, 51 research permits were issued to people studying microbiology in Yellowstone; such research is often conducted in the park's thermal areas.

conduct research and get research permits from any national park, nationwide, over the web. It also acts as a national database, archiving research information and results. Finally, it provides the public centrally located access to the results of research projects conducted on NPS lands nationwide.

NPS SERVICEWIDE BENEFITS- SHARING ENVIRONMENTAL IMPACT STATEMENT

As 2002 drew to a close, the Benefits-Sharing NEPA Team anticipated the release of the draft EIS for servicewide review, scheduled to occur spring

2003. This first-ever servicewide EIS will evaluate how best to manage benefits-sharing arrangements with the small number of park-permitted researchers who are commonly characterized as bioprospectors. Bioprospecting is the search for valuable substances in nature, usually bioactive molecules and genetic components, and is an offshoot of permitted research and specimen collection in the national parks. Currently, NPS facilitates research in parks, yet if an approved research project results in a valuable discovery, no direct benefits are returned to the parks. Existing laws allow for agreements that return benefits to parks if research leads to commercial success. The National Parks Omnibus Management Act of 1998 (Public Law 105-391) specifically authorizes the NPS to enter into "negotiations with the research community and private industry for equitable, efficient benefits-sharing arrangements."

In 1998, a legal challenge to a benefits-sharing agreement, a CRADA (cooperative research and development agreement) negotiated between Yellowstone National Park and Diversa Corporation resulted in the judge dismissing the case with prejudice. CRADA's were ruled to be consistent with the National Park Service Organic Act and Yellowstone National Park's enabling legislation. As a result of a prior order from the same court, the NPS was directed to conduct an analysis under NEPA (the National Environmental Policy Act of 1969), which the EIS effort addresses. The EIS process provides for public dialogue on issues surrounding benefits-sharing as well as a means to evaluate potential environmental effects related to a set of alternative approaches to managing benefits-sharing when research involving biological specimens collected from NPS units yields commercially valuable results.

The EIS applies to all units of the National Park System and evaluates and compares potential means to implement benefits-sharing within the NPS and the resultant effects, including a "no action" alternative that would preclude parks from engaging in benefits-sharing. None of the actions proposed by the National Park Service would weaken long-standing research and collection approval policies intended to protect park resources, nor would additional collections be authorized under benefits-sharing agreements. Prohibitions on the sale and unauthorized transfer of specimens collected for NPS units would not be altered by any of the actions proposed.

Staffing and EIS Teams

The Benefits-Sharing NEPA Team consists of YCR staff Sue Mills (Project Manager), John Varley,

Ann Deutch, and Kevin Schneider; and Preston Scott, Thom Minner, and Mansir Petrie of the World Foundation for Environment and Development (WFED), on contract to draft the bulk of the EIS and to provide legal and technical expertise in the fields of bioprospecting and benefits-sharing.

In support of the EIS effort, the NEPA team met on two occasions with the NPS Washington-level Bioprospecting Advisory Committee and the EIS's Interdisciplinary Team (IDT) to provide an orientation on key issues and to gain face-to-face input and feedback on the development of the draft EIS. The IDT includes members from representative parks and central offices from all regions of the NPS and is co-chaired by John Varley and Mike Soukup, NPS Associate Director for Nature Resources in the Washington Office.

FUNDING, PERSONNEL, AND ADMINISTRATIVE SUPPORT

Base Operating Budget

A base operating budget of \$3,434,800 for the YCR was approved by Acting Superintendent Frank Walker in April 2002. This represented an increase of \$772,900 over FY01 funding levels. The additional funds were used to help defray the cost of benefits increases and to permanently establish the bison management program according to the requirements of the Record of Decision implemented in FY02.

Additional Funding

Recreation Fee Demonstration funds. New funding of \$6,000 was made available in order to bring one resource management project nearing completion to a close. No other new funds were granted for resource management projects in FY02 under this program. The overall amount allocated to YCR since the inception of the program remained at approximately \$1,300,000 for 18 individual projects.

Fishing fee program. The YCR received authorization to use \$261,900 from fishing permit fee revenue to partially cover the estimated \$800,000 total cost of the aquatic resources program in FY02.

Federal Lands Highway Program. Federal Highways funded \$293,200 for natural resource inventories, archeological surveys, and resource compliance along the road corridors in the park scheduled for major repair or reconstruction in the near future.

Special Emphasis Program Allocation System. The Branch of Natural Resources received \$293,000

to continue the lake trout control program on Lake Yellowstone, the baseline inventory of aquatic thermophiles, and a paleontological inventory of Mt. Everts from this funding source in FY02. New funds were received to begin baseline inventories for Canada lynx and wolverines.

The Branch of Cultural Resources successfully competed for a total of \$198,700 in special emphasis program funding. These funds were used for cyclic maintenance of the historic vehicle collection and the Norris Ranger Museum, improving storage conditions in the collections facility, an ethnographic resource inventory, a cataloging project, and Phase I of the Black Canyon archeological site salvage project.

Other NPS and federal funds. The YCR administered funds and provided support for a number of other federally sponsored projects in FY02, most significantly the Benefits-Sharing EIS and the Greater Yellowstone Network Inventory and Monitoring project. Funds were also managed for the USGS-BRD grizzly bear studies (\$11,700) in the park.

Private funds. A total of \$126,400 was donated to the park by private organizations or individuals in support of a lynx population survey, grizzly bear habitat studies, wolf recovery program operations, vegetation mapping projects, and whirling disease surveys.

Personnel

There were 269 personnel actions processed in FY02. Of special note were the following:

Wildlife management programs continued to solidify with the selection of Rick Wallen as the managing biologist for the bison program (vice-John Mack), Dr. P.J. White as the managing biologist for the ungulate program, and the conversion of four previously temporary biological technician positions to permanent appointments.

Dr. Henry Heasler of the University of Wyoming was recruited as the park supervisory geologist on an 18-month detail through a cooperative agreement with the university.

The cultural resources staff welcomed the addition of Rosemary Sucec as the park cultural anthropologist and tribal liaison on a permanent basis.

Historic architect Lon Johnson transferred to Glacier National Park in October, and his position was refilled by Herb Dawson, formerly an employee of the Montana State Historic Preservation Office.

Park curator Susan Kraft was on extended medical leave during most of FY02 while she underwent several surgeries and chemotherapy treatment for cancer. Nancy Hatcher, a curator at Harper's Ferry National Historic Site, accepted a detail to Yellowstone to backfill during part of Susan's absence.

Two permanent administrative support positions were added to address the continually increasing YCR workload. Colleen Watson was selected to assist with center-wide budget and personnel duties and Maurine Hinckley-Cole was appointed to provide clerical and administrative support to the Branch of Cultural Resources.

Sue Mills, team captain of the servicewide Benefits-Sharing EIS effort, transferred from the Alaska Support Office to become a permanent member of the Yellowstone Center for Resources staff as an environmental protection specialist.

Upon completion of her doctoral degree, SCEP employee Alice Wondrak accepted a full-time, permanent technical writer-editor position with the Resource Information and Publications Team, filling a vacancy left by Kevin Schneider's departure to the Planning Office.

The Intermountain Regional Office selected Cathie Jean as the coordinator for the Greater Yellowstone Network (GRYN) Inventory & Monitoring program. Cathie established the GRYN headquarters in Bozeman, Montana, and the staff members who had been duty-stationed in YCR relocated to the new offices.

Contracting

Forty-five contracting actions were processed in FY02, totaling obligations of \$855,200 primarily for interagency and university assistance agreements. Significant contracting actions involved research in support of the GRYN Inventory and Monitoring project, studies related to bison management, administration of the Montana Water Compact, archeological surveys and evaluations, a variety of wildlife and aquatic resources studies, and a vegetation mapping project.

Procurement Actions

There were 985 procurement actions processed in FY02, totaling approximately \$1,004,700.

Clerical Support

There were 1,627 pieces of correspondence and 592 travel authorizations processed in FY02.

Table 1. Yellowstone Center for Resources distribution of FY02 funds.

Program	Park Base	Nat Res Project Funds	Cult Res Project Funds	Fish Fee	FLHP	Fee Demo	Other NPS	Other Federal	Private	Total	% of Total Funding
Support: (Mgmt, Admin, Sci, Pubs, GIS)	903,600	—	—	—	30,100	6,000	—	—	—	939,700	20.3%
Natural Resources	2,102,000	293,000	—	261,900	138,300	—	—	11,700	124,500	2,931,400	63.4%
Cultural Resources	429,200	—	198,700	—	124,800	—	—	—	1,900	754,600	16.3%
Total:	3,434,800	293,000	198,700	261,900	293,200	6,000	—	11,700	126,400	4,625,700	100%

Table 2. Funding history of the Yellowstone Center for Resources.

NATIONAL PARK SERVICE FUNDS										
FY	Park Base	Nat Res Project Funds	Cult Res Project Funds	Fish Fee	FLHP	Fee Demo	Other NPS	Other Federal	Private	Total
93	1,004,600	16,000	—	—	—	—	785,000	188,000	20,000	2,013,600
94	1,250,000	260,000	33,200	65,000	43,300	—	320,600	79,600	10,000	2,061,700
95	1,500,000	420,000	45,000	65,000	303,600	—	59,800	20,000	5,300	2,418,700
96	1,544,100	404,000	201,100	274,500	626,700	—	157,800	65,000	31,500	3,304,700
97	1,674,100	204,000	228,400	213,400	433,700	340,000	42,700	398,300	48,000	3,582,600
98	2,245,600	130,500	242,100	284,800	330,800	31,000	24,000	65,300	37,700	3,391,800
99	2,531,900	—	221,900	285,000	396,500	298,000	152,900	105,200	56,700	4,048,100
00	2,568,600	237,500	101,000	280,000	214,900	631,000	1,418,000	41,300	52,700	5,545,000
01	2,661,900	297,000	216,700	285,100	409,000	—	—	15,000	85,500	3,970,200
02	3,434,800	293,000	198,700	261,900	293,200	6,000	—	11,700	126,400	4,625,700

Appendix I.

Personnel Roster for Fiscal Year 2002

		<u>FTE</u>	<u>Borrowed FTE</u>
PROFESSIONAL SUPPORT BRANCH			
<i>Management and Administration</i>			
1	Wayne Brewster	Deputy Director	1.00
2	Elizabeth Cleveland	Administrative Support Assistant	0.58
3	Ann Deutch	Administrative Support Assistant	0.59
4	Barbara Foster	Administrative Clerk	0.01
5	Lisa Fox	Resource Management Specialist	0.49
6	Christie Hendrix	Environmental Protection Specialist	1.00
7	Sara Housley	Center Clerk	0.11
8	Melissa McAdam	Supervisory Budget Analyst	1.00
9	Sue Mills	Environmental Protection Specialist	0.48
10	Joy Perius	Budget Analyst	1.00
11	Beth Taylor	Secretary	0.76
12	John Varley	Director	1.00
13	Colleen Watson	<u>Administrative Support Assistant</u>	<u>0.52</u>
	subtotal M&A	8.04	0.50
<i>Resource Information and Publications Team</i>			
14	Roger Anderson	Resource Management Specialist	0.99
15	Tami Blackford	Technical Writer Editor	0.46
16	Clarence Coleman	Telecommunications Specialist	0.02
17	Renée Evanoff	Visual Information Specialist	0.46
18	Mary Ann Franke	Technical Writer Editor	0.30
19	Kevin Schneider	Technical Writer Editor	0.66
20	Paul Schullery	Resource Naturalist	0.44
21	Sarah Stevenson	Technical Writer Editor	0.38
22	Alice Wondrak	<u>Technical Writer Editor</u>	<u>0.47</u>
	subtotal RIPT	4.16	0.02
<i>Advanced Resources Technology/Spatial Analysis Center</i>			
23	Erin Campbell	Cartographic Technician	0.23
24	Ben Dorsey	Cartographic Technician	0.29
25	Adam Kiel	Cartographic Technician	0.23
26	Jeanette McBride	Cartographic Technician	0.11
27	David Merwin	Cartographic Technician	0.10
28	Steve Miller	Cartographic Technician	0.80
29	James Napoli	Cartographic Technician	0.35
30	Ann Rodman	Supervisory GIS Specialist	1.00
31	Shannon Savage	GIS Specialist	0.98
32	Lianne Terrill	<u>Cartographic Technician</u>	<u>0.22</u>
	subtotal SAC	4.31	
	Total Professional Support Branch	16.51	0.52

			<u>FTE</u>	<u>Borrowed FTE</u>
NATURAL RESOURCES BRANCH				
<i>Natural Resources Administration</i>				
1	Rebecca Anthony	Administrative Support Assistant	0.72	
2	Tom Olliff	<u>Chief, Branch of Natural Resources</u>	<u>1.00</u>	
	subtotal NRA		1.72	
<i>Wildlife Resources Team</i>				
3	Erin Bentley	Biological Science Technician	0.50	
4	Mark Biel	Wildlife Biologist	1.00	
5	Shelley Buranek	Biological Science Technician	0.25	
6	Susan Chin	Biological Science Technician	0.48	
7	Trevor Clark	Biological Science Technician		0.06
8	Michael Curtis	Biological Science Technician	0.05	
9	Laura Dooley	Forestry Technician (Dispatcher)		0.01
10	Terry McEneaney	Wildlife Biologist	1.00	
11	Rachael Gray	Biological Science Technician	0.43	
12	Deb Guernsey	Program Assistant	0.98	
13	Kerry Gunther	Wildlife Biologist	1.00	
14	Justin Hadwen	Biological Science Technician	0.29	
15	Wendy Hafer	Supervisory Forestry Tech. (Helitack)		0.01
16	Darren Ireland	Biological Science Technician	0.99	
17	Douglas Kraus	Biological Science Technician	0.17	
18	Julie Mao	Biological Science Technician	0.44	
19	Rick McIntyre	Biological Science Technician	0.53	
20	Kerry Murphy	Wildlife Biologist	0.97	
21	Melissa Peer	Biological Science Technician	0.44	
22	Glenn Plumb	Supervisory Wildlife Biologist	1.00	
23	Tiffany Potter	Biological Science Technician	1.00	
24	Eric Reinertson	Biological Science Technician	0.02	
25	Lori Roberts	Biological Science Technician	0.24	
26	Rebecca Roland	Park Ranger (Interpretation)		0.07
27	Monty Simenson	Horse Handler		0.16
28	Doug Smith	Wildlife Biologist	1.00	
29	Dan Stahler	Biological Science Technician	0.22	
30	Linda Thurston	Biological Science Technician		0.31
31	John Treanor	Biological Science Technician	1.00	
32	Richard Wallen	Wildlife Biologist	0.71	
33	Brian Wheat	Biological Science Technician	0.99	
34	P.J. White	Wildlife Biologist	0.64	
35	Travis Wyman	<u>Biological Science Technician</u>	<u>1.00</u>	
	subtotal WRT		17.34	0.62
<i>Fisheries and Aquatic Resources</i>				
36	Sandra Arnett	Biological Science Technician	0.01	
37	Jeff Arnold	Ecologist	0.66	
38	John Bauer	Biological Science Technician	0.08	
39	Beth Bear	Biological Science Technician	1.00	
40	Pat Bigelow	Fishery Biologist	1.00	
41	Matthew Delheimer	Biological Science Technician	0.39	

		<u>FTE</u>	<u>Borrowed FTE</u>
42	Thomas Duster	Biological Science Technician	0.07
43	Brian Ertel	Biological Science Technician	1.00
44	Rene Farias	Administrative Support Assistant	0.38
45	Steve Gale	Biological Science Technician	0.98
46	Ryan Harnish	Biological Science Technician	0.39
47	Jonathan Kasitz	Biological Science Technician	0.25
48	Todd Koel	Supervisory Fisheries Biologist	1.00
49	Dan Mahony	Fishery Biologist	1.00
50	Anna Maki	Biological Science Technician	0.24
51	Theresa Morgan	Biological Science Technician	0.34
52	Barbara Rowdon	Biological Science Technician	1.00
53	Michael Ruhl	Biological Science Technician	0.37
54	Cynthia Sanders	Biological Science Technician	0.02
55	Melinda Sefton	Painter	0.08
56	Amanda Seibel	Biological Science Technician	0.31
57	Don Wethington	Maintenance Worker	0.63
58	Davina White	<u>Biological Science Technician</u>	<u>0.55</u>
	subtotal F&AR	11.67	0.08
<i>Vegetation Management</i>			
59	Heidi Anderson	Botanist	0.33
60	Susan Glenn	Biological Science Technician	0.20
61	Mary Hektner	Resource Management Specialist	1.00
62	Scott McBurney	Biological Science Technician	0.30
63	Vicki Pecha	Biological Science Technician	0.04
64	Roy Renkin	Vegetation Management Specialist	1.00
65	Freya Ross	Biological Science Technician	0.05
66	Jennifer Whipple	<u>Botanist</u>	<u>0.79</u>
	subtotal VM	3.71	
<i>Geology and Physical Sciences</i>			
67	Carrie Guiles	Physical Science Technician	0.32
68	Cheryl Jaworowski	Geologist	0.19
69	Kendra Maas	Physical Science Technician	0.45
70	Steve Miller	Physical Science Technician	0.20
71	Tim Thompson	<u>Physical Science Technician</u>	<u>0.09</u>
	subtotal GPS	1.25	
<i>Greater Yellowstone Network I&M Program</i>			
72	Jerald Cameron	Biologist	0.79
73	Patrick Flaherty	Cartographic Technician	0.76
74	Chad Jacobson	Cartographic Technician	1.00
75	Catherine Jean	<u>Biologist</u>	<u>0.20</u>
	subtotal I&M	2.55	0.20
	Total Natural Resources Branch	38.24	0.90

			<u>FTE</u>	<u>Borrowed FTE</u>
CULTURAL RESOURCES BRANCH				
1	Rebecca Anthony	Administrative Support Assistant	0.28	
2	Sean Cahill	Museum Technician	0.94	
3	Sue Consolo Murphy	Chief, Branch of Cultural Resources	1.00	
4	Jon Dahlheim	Museum Technician	0.71	
5	Herbert Dawson	Historic Architect	0.14	
6	Gina Garrett	Biological Science Technician		0.29
7	Elaine Hale	Cultural Resources Technician	0.83	
8	Alice Hart	Museum Technician	0.32	
9	Nancy Hatcher	Acting Curator	0.27	
10	Maurine Hinckley-Cole	Administrative Support Assistant	0.42	
11	Harold Housley	Archives Specialist	1.00	
12	Ann Johnson	Archeologist	1.00	
13	Lon Johnson	Cultural Resources Program Manager	0.06	
14	Linda Juneau	Cultural Resources Technician	0.23	
15	Susan Kraft	Museum Curator	0.95	
16	Beth Raz	Museum Aide	0.92	
17	Charissa Reid	Cultural Anthropologist	0.17	
18	Rosemary Sucec	Cultural Anthropologist	0.82	
19	Ryan Tripp	Biological Science Technician		0.41
20	Steven Tustanowski-Marsh	Museum Technician	0.52	
21	Lee Whittlesey	<u>Archivist</u>	<u>1.00</u>	
Total Cultural Resources Branch			11.58	0.70
TOTAL YCR FY02			66.33	2.12

Appendix II.

Publications, Reports, and Papers

The following professional publications, administrative reports, and information papers published in 2002 were authored or co-authored by Yellowstone Center for Resources staff.

Professional Publications

- Bangs, E., J. Fontaine, M. Jimenez, T. Meier, C. Niemeyer, D. Smith, K. Murphy, D. Guernsey, L. Handegard, M. Collinge, R. Krischke, J. Shivik, C. Mack, I. Babcock, V. Asher, and D. Domenici. 2001. Gray wolf restoration in the northwestern United States. *Endangered Species Update* 18(4):147–152.
- Garrott, R.A., L.L. Eberhardt, J.K. Otton, P.J. White, and M.A. Chaffee. 2002. A geochemical trophic cascade in Yellowstone's geothermal environments. *Ecosystems* 5:659–666.
- Gipson, P.S., E.E. Bangs, T.N. Bailey, D.K. Boyd, H.D. Cluff, D.W. Smith, and M.D. Jimenez. 2002. Color patterns among wolves in western North America. *Wildlife Society Bulletin* 30(3): 821–830.
- Gunther, K.A., and M.J. Biel. 2002. Evidence of grizzly bear predation on a black bear in Hayden Valley. *Yellowstone Science* 10(4), pp. 22–24.
- Gunther, K.A., M.J. Biel, N. Anderson, and L. Waits. 2002. Probable grizzly bear predation on an American black bear in Yellowstone National Park. *Ursus* 13:372–374.
- Haroldson, M.A., M.A. Ternent, K.A. Gunther, and C.C. Schwartz. 2002. Grizzly bear denning chronology and movements in the Greater Yellowstone Ecosystem. *Ursus* 13:29–37.
- MacNulty, D.R. 2002. The predatory sequence and the influence of injury risk on hunting behavior in the wolf. M.S. thesis, University of Minnesota.
- McEneaney, T. 2002. 2001 Christmas bird count. *Yellowstone Science* 10(1):16–18.
- Nabokov, P., and L. Loendorf. 2002. American Indians and Yellowstone National Park: A documentary overview. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-CR-2002-01.
- Peterson, R.O., A.K. Jacobs, T.D. Drummer, L.D. Mech, and D.W. Smith. 2002. Leadership behavior in relation to dominance and reproductive status in gray wolves, *Canis lupus*. *Canadian Journal of Zoology* 80:1405–1412.
- Schwartz, C.C., M.A. Haroldson, K.A. Gunther, and D. Moody. 2002. Distribution of grizzly bears in the Greater Yellowstone Ecosystem, 1990–2000. *Ursus* 13:203–212.
- Smith, D.W. 2002. Wolf pack leadership: Doug Smith explores the issue in Yellowstone and Isle Royale. *Howlings: The Central Rockies Wolf Project* 11(2):10–12.
- Smith, D.W. 2002. Wolf #7: The passing of a matriach. *Yellowstone Science* 10(3):18–19.
- Smith, D.W., and R. McIntyre. 2002. Wolf pack size: How did the Druid Peak pack get to be so big? *International Wolf* 12(1):4–7.
- Smith, D.W., D.R. Stahler, R. McIntyre, D. Graf, E. West, G. Plumb, B. Phillips, B. Chan, M. Ross, J. Knuth Folts, D. Chalfant, and B. Suderman. 2002. Managing wolves and humans in Lamar Valley: A final report on the Druid road project 2002. YNP report. 9 pp.
- Stahler, D.R., B. Heinrich, and D.W. Smith. 2002. Common ravens, *Corvus corax*, preferentially associate with grey wolves, *Canis lupus*, as a foraging strategy in winter. *Animal Behaviour* 64:283–290.
- Stahler, D.R., D.W. Smith, and R. Landis. 2002. The acceptance of a new breeding male into a wild wolf pack. *Canadian Journal of Zoology* 80:360–365.
- Thurston, L.M. 2002. Homesite attendance as a measure of alloparental and parental care by gray wolves (*Canis lupus*) in northern Yellowstone National Park. M.S. thesis, Texas A&M University.

- Varley, N., and K.A. Gunther. 2002. Grizzly bear predation on a bison calf in Yellowstone National Park. *Ursus* 13:377–381.
- Whittlesey, L.H. 2002. Native Americans: the earliest interpreters: What is known about their legends and stories of Yellowstone National Park and the complexities of interpreting them. *George Wright Forum* 19 (2002):40–51.
- Whittlesey, L.H., and Aubrey L. Haines. 2002. A mile-by-mile history excursion around Yellowstone's Grand Loop Road, prepared for the Wyoming Historical Society June 27, 2002. Cheyenne, Wyoming: Wyoming State Historical Society.
- Wondrak, A.K. Yellowstone wildlife watching: A survey of visitor attitudes and desires. *Yellowstone Science* 10(3):2–7.
- Wyman, T.C. 2002. Grizzly bear predation on a bull bison in Yellowstone National Park. *Ursus* 13:375–377.

Administrative Reports

- Anderson, R.J., D. Harmon, eds. 2002. Yellowstone Lake: Hotbed of chaos or reservoir of resilience? Proceedings of the 6th Biennial Scientific Conference on the Greater Yellowstone Ecosystem. October 8–10, 2001, Mammoth Hot Springs Hotel, Yellowstone National Park. Yellowstone National Park, Wyo., and Hancock, Mich.: Yellowstone Center for Resources and The George Wright Society.
- Biel, M.J., S. Chin, D. Ireland, and K.A. Gunther. 2001. Biological evaluation of mammal activity along the Canyon to Fishing Bridge road corridor in Yellowstone National Park. Unpubl. report on file at Bear Management Office, Yellowstone National Park, Wyo. 64pp.
- McEneaney, T. 2002. Yellowstone bird report, 2001.

National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-NR-2002-03.

- Smith, D.W., and D.S. Guernsey, 2002. Yellowstone Wolf Project: Annual report, 2001. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-NR-2002-04.
- Yellowstone Center for Resources. 2002. Yellowstone Center for Resources annual report, 2000. National Park Service, Mammoth Hot Springs, Wyoming, YCR-AR-2000.
- Yellowstone Center for Resources. 2002. Yellowstone Center for Resources annual report, 2001. National Park Service, Mammoth Hot Springs, Wyoming, YCR-AR-2001.
- Yellowstone Center for Resources. 2002. Investigators' annual reports, 2000. National Park Service, Mammoth Hot Springs, Wyoming, YCR-IAR-2002.

Information Papers

- Gunther, K.A. 2002. Yellowstone National Park bear-related injuries/fatalities. Info. Paper No. BMO-1. Yellowstone National Park, Wyo. 2pp.
- Gunther, K.A. 2002. Where are all the bears? Info. Paper No. BMO-4. Yellowstone National Park, Wyo. 2pp.
- Gunther, K.A. 2002. Bear management area program, Yellowstone National Park. Info. Paper No. BMO-5. Yellowstone National Park, Wyo. 4pp.
- Gunther, K.A. 2002. Recovery parameters for grizzly bears in the Yellowstone ecosystem. Info. Paper No. BMO-6. Yellowstone National Park, Wyo. 4pp.
- Gunther, K.A. 2002. Bears and menstruating women. Info. Paper No. BMO-7. Yellowstone National Park, Wyo. 2pp.

Appendix III.

Partnerships

YCR staff represent Yellowstone National Park in the following external partnerships:

Cultural Resources

Yellowstone Area Museum Partnership

Mission: To support the preservation and interpretation of the historical, cultural, and natural history of the Greater Yellowstone Area by coordinating efforts, minimizing redundancy, and taking opportunities to work together by sharing ideas, expertise, and resources. Members include the Buffalo Bill Historical Center (Cody), the Western Heritage Center and the Yellowstone Art Museum (Billings), the Wind River Historical Center (Dubois), the Yellowstone Historic Center (West Yellowstone), the Livingston Depot Center, International Fly Fishing Center, and the Yellowstone Gateway Museum (Livingston), the Museum of the Rockies (Bozeman), the National Museum of Wildlife Art (Jackson), the Homesteader's Museum and Park County Museum Board (Powell, Wyoming), and Yellowstone National Park.

Commitment: Two one-day meetings each year.

Representative: Lee Whittlesey (in the absence of museum curator).

2002 Highlights: Partner members provided some assistance to Yellowstone in helping recruit for and acting curator and new employees. Member institutions sponsored a number of museum exhibits and reported a good year in terms of increased visitation.

Natural Resources

Bear Taxon Advisory Group

Mission: To support the conservation of all wild bear species from around the world through captive management, exhibition of captive bears, and financial support for research and management of wild bears.

Commitment: Annual meetings, four days per meeting.

Representative: Kerry Gunther

2002 Highlights: Did a presentation at the annual meeting informing zoo keepers of captive bears about bear behavior in the wild. Assisted with the placement of nuisance wild bears into captive facilities.

Greater Yellowstone Area Clean Air Partnership

Mission: The partnership is made up of Yellowstone and Grand Teton National Parks; Gallatin, Custer, Beaverhead, Shoshone, Bridger-Teton, and Targhee National Forests; Red Rock Lakes National Wildlife Refuge; the Idaho National Environmental and Energy Laboratory; and the Montana, Idaho, and Wyoming Departments of Environmental Quality. The partnership serves as an advisory group to the Greater Yellowstone Coordinating Committee and is a forum for information exchange to facilitate air program coordination and the implementation of consistent air quality management strategies.

Commitment: Annual meeting.

Representative: Mary Hektner

2002 Highlights: Information was shared on visibility data, air quality rule making, Yellowstone's "greening" efforts, and snow deposition chemistry studies.

Greater Yellowstone Area Whitebark Pine Subcommittee

Mission: This group is a cadre of biologists within the greater Yellowstone area in addition to members from academia and state and other federal agencies with a research and management interest in whitebark pine. The mission is to work together to help ensure the long-term viability and function of whitebark pine ecosystems in the GYA.

Commitment: Roy attended two meetings.

Representative: Roy Renkin

2002 Highlights: Roy was appointed to a work-

ing group to address the needs, feasibility, and successes of whitebark pine restoration.

Greater Yellowstone Bald Eagle Working Group

Mission: Established in 1982, this group monitors eagle productivity and other information.

Participants include GYA state and federal government agencies and non-governmental organizations.

Commitment: Previously annual meetings, but a meeting has not been held in the last four years. Information is communicated via email.

Representative: Terry McEneaney

2002 Highlights: The bald eagle is ecologically recovered in the greater Yellowstone area. The group is unified in its belief that the bald eagle can be delisted in this area, and the U.S. Fish and Wildlife Service is expected to take such action in the near future. In 2002, 24 eaglets fledged from 31 active nests, the highest number of fledged eaglets ever recorded in Yellowstone's history.

Greater Yellowstone Interagency Brucellosis Committee (GYIBC)

Mission: The GYIBC was formed through a Memorandum of Agreement between the Secretaries of the Department of Agriculture and Interior and the governors of Montana, Wyoming, and Idaho. The GYIBC has an executive committee and two subcommittees, the technical subcommittee, and the information and education subcommittee. Through its executive committee, the agreed upon scope of work for the GYIBC is to develop options and recommendations for member agencies in charting a management program for brucellosis-affected wildlife populations and their habitat in the GYA; provide coordination of agency responsibilities without usurping agency mandates; encourage cooperation in resolving resource problems and conflicting interests related to brucellosis in wildlife; and provide guidance and oversight to subcommittees. The technical subcommittee, which serves at the direction of the executive committee, will develop a comprehensive, objective, and scientific base of information and recommend strategies based on common understanding of brucellosis and its impacts on the resources of the GYA; and serve as the scientific advisor to the GYIBC. The information and education subcommittee will develop

factual information regarding the purpose of the GYIBC for public distribution and will develop a brucellosis information and education strategic plan for the GYIBC.

Commitment: NPS-IMR Regional Director is represented on the executive committee by the Associate Regional Director for Natural Resources and Science. Yellowstone provides a representative for the technical subcommittee, currently, Wayne Brewster. He has served the first of a two-year term as the technical subcommittee's chairman. Technical and executive committee meetings are held three times annually.

Representative: Wayne Brewster

2002 Highlights: Participation in committee meetings as well as completion of technical subcommittee assignments.

Greater Yellowstone Peregrine Falcon Working Group

Mission: The park works closely with two peregrine falcon working groups, Montana and Wyoming, and has been an active participant since peregrines have been found in greater Yellowstone. Yellowstone also works closely with the Peregrine Fund.

Commitment: Wyoming has an informal working group, with coordination done over the telephone. Montana has a more formalized working group with an annual meeting, which the staff ornithologist attended in January 2002.

Representative: Terry McEneaney

2002 Highlights: The peregrine falcon was officially delisted from the Endangered Species List on August 26, 1999. In 2002, a record 20 eyries were recorded in YNP, and a record 35 young fledged.

Greater Yellowstone Trumpeter Swan Working Group

Mission: The Greater Yellowstone Trumpeter Swan Working Group was organized in 1997, and Yellowstone's ornithologist was the first chairman. The group collects annual population and production data. Management activities are communicated between agencies at meetings.

Commitment: Yellowstone participated in the fall 2002 meeting held in Jackson, Wyoming.

Representative: Terry McEneaney

2002 Highlights: The group continued to coordinate trumpeter swan data for the GYA.

Grizzly Bear Conservation Strategy Working Group

Mission: To develop a multi-agency cooperative management strategy for the Yellowstone ecosystem grizzly bear population to be implemented by state and federal agencies upon delisting of the species. The objective of the Conservation Strategy is to describe and summarize the coordinated efforts to manage the grizzly bear population and habitat, and the public education/involvement efforts that will be applied to ensure continued conservation of the grizzly bear in the greater Yellowstone area; and document the regulatory mechanisms that exist to maintain the Yellowstone population as recovered through legal authorities, policy, guidelines, management programs, monitoring programs, and the commitment of participating agencies.

Commitment: Approximately 5 to 10 meetings per year, meetings are typically 1 to 4 days in length, for a total commitment of 15–25 person days per year.

Representative: Kerry Gunther

2002 Highlights: Completed draft Conservation Strategy. The draft will be presented to the Yellowstone Ecosystem Subcommittee and the Interagency Grizzly Bear Committee for approval in fiscal year 2003.

Harlequin Duck Working Group

Mission: This group is an international (U.S. and Canada) and interagency (state, federal, and provincial) group designed to share harlequin duck information and data.

Commitment: Although unable to attend a formal meeting in recent years, the ornithologist plans to attend future meetings.

Representative: Terry McEneaney

2002 Highlights: This group did not meet in 2002.

Interagency Grizzly Bear Cumulative Effects Modeling Team

Mission: This group is a cadre of biologists representing each of the units of the greater Yellowstone area whose mission is to implement and provide line officers with an assessment of grizzly bear habitat conditions and the effects of human activities on grizzly bear habitat for the GYA recovery zone. The purpose and role is to “develop and maintain the Cumulative Effects Model (CEM)/Access database and model, and provide coordination and consistency regarding

all aspects of the Yellowstone Ecosystem CEM.” *Commitment:* Roy Renkin has been the park representative for the past 18 years, and co-chairperson (with Kim Barber of the Shoshone National Forest) for the past eight years. The group met formally once. Roy also worked on an analysis to update model coefficients.

Representative: Roy Renkin

2002 Highlights: The 2001 effort resulted in a science monograph to be published by the USGS-BRD entitled: Mattson, D., K. Barber, R. Maw, and R. Renkin. *In press*. Coefficients of productivity for Yellowstone’s grizzly bear habitat. USGS-BRD Science Monograph.

Interagency Grizzly Bear Study Team

Mission: To 1) conduct short and long-term research addressing information needs for bear management; 2) monitor the bear population, including status and trend, numbers, reproduction, and mortality; 3) monitor grizzly bear habitats, foods, and impacts of humans; 4) provide technical support to agencies and other groups responsible for the immediate and long-term management of grizzly bears in the GYE.

Commitment: Two to four meetings annually. Meetings typically range from one to two days.

Representative: Kerry Gunther

2002 Highlights: Study team members had nine peer reviewed papers accepted for publication in the scientific journal *Ursus*. Papers accepted for publication covered a variety of topics including distribution of grizzly bears in the Yellowstone ecosystem in the 1990s, denning chronology, denning habitat, bear-human conflicts, mortality, population estimates, predation on bison, and use of moths and mushrooms.

Intermountain Region Natural Resources Communication and Advisory Team

Mission: Intermountain Region Director Karen Wade initiated this team to create more proactive and effective systems to achieve natural resource goals, improve communications, and ensure accountability.

Commitment: Bi-annual meetings and work assignments on the budget and awards workgroups.

Representative: Tom Olliff

2002 Highlights: Developed an agenda and location for an Intermountain Region Resources Workshop to be held in April 2004. Drafted a re-

engineered process for the Intermountain Region to respond to the Servicewide Comprehensive Funding Call for natural resources.

McLaren Mine Tailings Reclamation

Mission: The potential reclamation of the McLaren Mine tailings, and other water quality issues in the Cooke City area.

Commitment: Public meetings on both the Cooke City Total Maximum Daily Load (TMDL) Planning Area and the McLaren tailings.

Representative: Mary Hektner

2002 Highlights: Comments on the state of Montana's Water Quality Restoration Plan for the TMDL, and on the preliminary draft of the Expanded Engineering Evaluation/Cost Assessment for the McLaren tailings were prepared and reviewed.

Montana Bird Records Committee

Mission: This interagency group reviews new and rare bird records, and keeps the park up-to-date on the latest advances in ornithology.

Commitment: Meets once or twice a year, depending on the volume of information.

Representative: Terry McEneaney was chairman of this committee for several years, but resigned in 2002. He remains a member.

2002 Highlights: The group reviewed 2002 bird records.

Montana Fluvial Arctic Grayling Workgroup

Mission: This group develops short- and long-term goals and works toward the restoration of populations in the upper Missouri basin.

Commitment: A one-day meeting each year plus any required field activities.

Representative: Todd Koel

2002 Highlights: Over 100 grayling at Grebe and Wolf Lakes were tagged as part of a grayling migration survey in the Gibbon River.

Montana/NPS Reserved Water Rights Compact Technical Oversight Committee

Mission: This agreement, signed in 1994 by the NPS and the state of Montana, guarantees that Yellowstone's historical water rights will not be violated and that geothermal aquifers with potential connections to Yellowstone's geyser systems will not be compromised. The agreement quantified Yellowstone's water rights and set up a process to protect these rights from outside devel-

opment. The compact requires outside developers to demonstrate that no potential exists for adverse effects to the hydrothermal system and that any scientific doubt concerning the effects will be resolved in favor of hydrothermal protection for the park. A technical oversight committee of scientists with hydrothermal system expertise reviews the evidence and oversees the Yellowstone Controlled Groundwater Area.

Commitment: The park representative reviews new water well applications, reports consumptive uses, and monitors data and plans for the Yellowstone Controlled Groundwater Area as needed.

Representative: Hank Heasler

2002 Highlights: The committee developed a monitoring plan for the controlled groundwater area and a funding proposal to implement the monitoring plan.

National Partnership for the Management of Wild and Native Coldwater Fisheries

Mission: This group provides leadership and recommendations for the Whirling Disease Initiative and the Montana Water Center.

Commitment: One three-day meeting each year.

Representative: Todd Koel

2002 Highlights: The partnership explored other possible initiatives. Yellowstone provided research priorities on whirling disease.

Neotropical Migrant Working Groups

Mission: Yellowstone typically participates in three neotropical migrant working groups. The two state working groups are the Partners in Flight of Montana and Wyoming. The third group, called the Western Working Group Partners in Flight, is international. They are currently focused on prioritizing species and developing conservation plans.

Commitment: Meetings occur twice a year, usually in different areas of the West. The staff ornithologist attended the International Partners In Flight meeting in Monterrey, California, in the spring of 2002.

Representative: Terry McEneaney

2002 Highlights: In September 2002, Yellowstone hosted the Partners In Flight Management Steering Committee meeting held in Gardiner, Montana. Approximately 50 biologists from all over the country attended.

New World Mining District Response and Restoration Project

Mission: In 1998, an interagency Memorandum of Understanding (MOU) was established between the U.S. Department of Agriculture, The U.S. Environmental Protection Agency, and the U.S. Department of Interior. The MOU provides the framework and responsibilities for intra-governmental coordination among Federal Agencies regarding the development, selection, implementation, and oversight of certain response and natural resource restoration activities, including coordination, by the Federal Agencies with the states of Montana and Wyoming and public participation, in the New World Mining District. The U.S. Forest Service is the lead agency.

Commitment: The park participated in seven public and agency meetings related to the on-going restoration work, and reviewed, commented upon, and concurred with the Forest Service's quarterly progress reports to Congress. DOI comments on the McLaren Pit Response Action Engineering and Environmental Cost Analysis, the draft 2002 and 2002/2003 Work Plans, and the 2002 Action Memorandum were prepared and compiled.

Representative: Mary Hektner is the Department of Interior's Project Coordinator.

2002 Highlights: DOI's comments resulted in several design changes that are expected to better minimize potential future pollution.

Rocky Mountain Cluster Natural Resource Managers Group

Mission: The natural resource chiefs of the Rocky Mountain Cluster meet annually to discuss important cluster resource issues and funding initiatives, and to receive updates on servicerwide issues.

Commitment: A two-day annual meeting.

Representative: Tom Olliff is chair through 2003.

2002 Highlights: Held second annual information workshop February 4–6 in Denver.

University of Montana Snowshoe Hare [*Lepus americanus*] Abundance in Yellowstone National Park

Mission: Document abundance of snowshoe hares in selected YNP forest habitat types.

Commitment: 20 workdays.

Representative: Kerry Murphy

2002 Highlights: To estimate the absolute and relative abundance of snowshoe hares, the University of Montana team deployed 13 live-trap

grids in four cover types, including early-succession, mid-succession, and late-succession lodgepole pine [*Pinus contorta*] stands and spruce-fir [*Picea engelmanni*] forests. Trapping yielded snowshoe hares on only four of 13 sites, a finding supported by low fecal-pellet counts in these areas as well. These preliminary data suggest low densities of snowshoe hares. We plan to continue the project for > 2 years to determine whether low snowshoe hare numbers are characteristic of these forest types or trapping simply occurred during a low point in the snowshoe hare cycle.

Wyoming Important Bird Area Technical Review Committee (WIBATRC)

Mission: The WIBATRC is sponsored by Wyoming Audubon, and is responsible for reviewing, designating and implementing important land tracts in Wyoming for bird conservation.

Commitment: Two conference calls annually.

Representative: Terry McEneaney

2002 Highlights: Reviewed many new proposed IBAs, and accepted eight new ones.

Wyoming Rare Plant Technical Committee

Mission: Focused on coordinating activities between different government agencies with rare plant responsibilities and promoting awareness of rare plants statewide.

Commitment: Eight days.

Representative: Jennifer Whipple

2002 Highlights: Technical committee with the Wyoming Native Plant Society sponsored the three-day Wyoming Plant Conservation Conference in March 2002 in Laramie, Wyoming. The theme was "Biological Diversity of Sagebrush Landscapes."

Yellowstone River Task Force

Mission: Commissioned by the governor of Montana in 1998 and continued through 2003, this task force seeks to bring together landowners, sportsmen, and community leaders to develop a shared understanding of the issues and competing values and uses that impact the upper Yellowstone River, and encourage a comprehensive approach to action taken along the river to ensure that its integrity remains intact.

Commitment: Monthly meetings and annual field trips. Yellowstone sits on the task force as an *Ex Officio* member.

Representative: Tom Olliff

2002 Highlights: Drafted a list of 46 recommen-

ditions. The group expires at the end of August 2003; the final event will be a conference at Chico Hot Springs in October 2003.

Yellowstone Volcano Observatory

Mission: This cooperative venture between the USGS, Yellowstone National Park, and the University of Utah, created under the USGS Volcano Hazards Program, seeks to monitor earthquake and volcano unrest to improve human safety. The group is in the early stages of developing a Volcano Hazards Response Plan for Yellowstone.

Commitment: Weekly telephone conferences prior to establishment, and monthly telephone conferences after establishment along with a steering committee meeting in the park to continue organization and outline activities.

Representative: Hank Heasler

2002 Highlights: Dr. Hank Heasler became Yellowstone's YVO Chief Scientist. Dr. Jake Lowenstern took over from Dr. Bob Christiensen as the Scientist in Charge of the Volcano Observatory. Began to develop a Volcano Hazards Assessment.

YCR and Parkwide Support Global Biodiversity Institute

Mission: Provides knowledge for better use of biodiversity and biotechnology through consultation and training in the use and conservation of biodiversity in developing countries.

Commitment: Periodic week-long training sessions in a developing nation that serves as the host country for neighboring countries' delegates.

Representative: John D. Varley, GBDI faculty member.

2002 Highlights: Two training sessions were presented in Africa during 2001. The first, for 13 Francophone countries, was held in Cotonou, Benin. The second, for 18 East Africa countries, was staged in Dar Es Salaam, Tanzania.

Yellowstone's experiences with biodiversity preservation and emerging bioprospecting challenges were presented to the students near the end of their four week course as a real-life case history. This is particularly helpful to the students, as much of the course is foundational or theoretical material, and there are few actual case histories beyond the rich experience of Costa Rica and the emerging experience of Yellowstone. The NPS gains through these activities by being able to explore the full range of complications that can

occur when managing biodiversity and biotechnology. While the group has remained as an organized entity, no training sessions were scheduled because of global tensions and uncertainty.

NPS Servicewide Benefits-Sharing EIS Task-Force and Advisory Group

Mission: The National Park Service is considering policy options on how best to manage a small group of permitted researchers in parks commonly characterized as bioprospectors.

Bioprospecting is the search for valuable substances in Nature, usually bioactive molecules and genetic components, and is an offshoot of permitted research and specimen collection in the national parks. By federal court decree, an EA/EIS process under the authority of the National Environmental Policy Act was chosen to facilitate this process, involve the citizens of our country in the potential decisions, and explore all reasonable alternative management scenarios.

Commitment: Yellowstone Park has a greater proportion of bioprospecting occurring in its boundaries than any other park in the system, and thus has a significant commitment to choose the management option that works best for the park and its resources. In 2002, it is estimated that the park expended 3 FTE toward this end, mostly as a collateral duty.

Representatives: John D. Varley, Sue Mills, Kevin Schneider, Ann Deutch, Sarah Stevenson, Sarah Housley.

2002 Highlights: Yellowstone provided this effort's co-chair, job captain, and two analysts to the EIS Task-Force and participated in servicewide interdisciplinary Advisory Board activities. The effort was funded through Yellowstone base operations and servicewide planning funds. Work in 2002 included a transition from an EA process to a full EIS, which is now scheduled to be released for public comment in late 2003.

Thermo Biology Institute and Center for Life in Extreme Environments

Mission: Established by Montana State University-Bozeman in 1997 to conduct and promote research and education focused on the biology and interrelated physical and chemical processes of geothermal environments in the Greater Yellowstone Ecosystem.

Commitment: An annual meeting, periodic seminars, and administration and logistics associated

with their permitted researchers in the park.

Representative: John Varley has a chair on TBI's Scientific Advisory Board; Christie Hendrix services all other commitments.

2002 Highlights: TBI's close proximity to the park provides a unique opportunity for in-depth analysis of life at high temperatures. Nine TBI faculty are leading park projects that range from the discovery and cultivation of new high temper-

ature organisms and viruses, to examination of unique plant-microbe interactions, to understanding the interplay between the geochemical environment and the diversity of thermophilic life. The results of TBI research has resulted in over three dozen publications and invited presentations at national and international meetings, working with NPS interpreters on material for park visitors, and outreach to regional schools.

YELLOWSTONE CENTER FOR RESOURCES

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