Yellowstone Science

A quarterly publication devoted to the natural and cultural sciences

Lake Trout Invasion
Eocene Fossil Find
Tracking Lions II
Winter History

Volume 2 Number 4

U.S. Geological Survey *Plate XXXIX*

Spike Geyser Heart Lake Basin

News, Bad and Good

We have expanded our "News and Notes" section in this issue of *Yellowstone Science*, largely because of important stories that required more than the usual few paragraphs. Our lead news story is a frightening one, about the establishment of non–native lake trout in Yellowstone Lake, one of the last great strongholds of the Yellowstone cutthroat trout. We can expect to be reporting on this story as it develops for a long time; the unanimous opinion among the fisheries biologists with whom we've spoken is that Yellowstone will be dealing with the consequences of this regrettable invasion far into the future.

The death of Ranger Ryan Weltman is a great loss that affected many park staff this summer, all the more because he is the second ranger to die in the line of duty this year. Human tragedies like these make all the consternation and confusion over this or that resource issue pale to insigificance, reminding us of what is really important here.

Our story about the fossil discovery along the East Entrance Road is as exciting as the lake trout story is dismaying. The collection of plant fossils opened a small but significant window on Yellowstone's remote past, reminding us again of how diverse Yellowstone's resources, and educational opportunities, really are.

One item of news not included in this issue's "News and Notes" is in fact very good news. The Yellowstone Association, at its board meeting in early October, has funded a third year of *Yellowstone Science*. With this issue we complete our second year of publication, and we thank not only the Yellowstone Association but also the many people who have written for or otherwise contributed to this little enterprise. It is apparent that not only does Yellowstone have an endless number of stories to tell us, but that we have a more or less insatiable appetite to hear them.

PS

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Volume 2 Number 4 Summer 1994

Bob Wiesner

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On the cover: Like a 3-D mirror image, the contours of this fossil leaf are revealed in one of the specimens found during road construction on the East Entrance Road. See the story on page 17. Photo by Jim Peaco.

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Yellowstone Science is published quarterly, and submissions are welcome from all investigators conducting formal research in the Yellowstone area. Editorial correspondence should be sent to the Editor, *Yellowstone Science*, Yellowstone Center for Resources, P.O. Box 168, Yellowstone National Park, WY 82190.

Support for *Yellowstone Science* is provided by the Yellowstone Association for Natural Science, History & Education, a non-profit educational organization dedicated to serving the park and its visitors. For more information about the Yellowstone Association, including membership, write to P.O. Box 117, Yellowstone National Park, WY 82190.

Yellowstone Science Interview: Kerry Murphy

The Yellowstone Lion

All photos courtesy Bob Wiesner

Part Two: The long day of a lion hunter

In our previous issue, we discussed with Kerry Murphy the history and results of his 5-year study of Yellowstone mountain lions. In this issue, we follow Kerry through the process of capturing, handling, and releasing a lion. Kerry has offered to write up more of the results of his team's work for future issues of Yellowstone Science, *and we look forward to that information. Ed.*

YS Let us follow you on a typical day as you captured a lion. Let's say it's a lion that you haven't captured before, but you've seen tracks, so you know it's in the area. Lead us through the whole procedure.

KM Remember first of all that lions are pretty vulnerable to hounds once a good fresh track is located. Even an otherwise poor hound that can follow a set of lion prints made in 2 or 3 inches of soft snow can tree a lion with fair success. And with good dogs, it's 95 to 99 percent certain. So we start with that certainty, once we find a good fresh set of lion prints.

YS Where did you start, when you tracked lions in the park?

KM We used the usual trailheads that gave us access to the best lion country on the northern range: Blacktail ponds, Hellroaring, Slough Creek, Soda Butte, and Trout Lake. We recorded where we had seen old sign of uncollared lions, and we revisited those areas in search of fresh tracks. We just kept returning until we finally cut a track that we could follow, one that was only 2 or 3 days old. We just hoped that it was the track of the uncollared lion whose sign we saw before. We used our radio receiver to verify that the lion was not collared.

YS So it might take days or weeks to find a fresh track, even from a lion you knew was in the area?

KM That's right. But remember that we worked almost entirely on foot, and that a lion could range over an area of more than 50 square miles during the winter. There were individual lions whose sign we saw for as long as 18 months before we could catch them with the dogs. The males were especially difficult. They were easy to detect, but hard to catch up with because they travelled so far and used so many different watersheds.

So our usual methodology was to leave the trailhead and cover an area

Bob Wiesner, Kerry Murphy and some fourth-generation study subjects.

The loads and the rugged terrain varied little between winter and summer lion tracking. Left: Kerry and Todd Frederickson on a summer recapture. Right: Jay Tischendorf, John Murnane, and Kerry during a snowstorm tracking session.

either by making a loop or by walking across country to another vehicle we had shuttled to a second trailhead, or to a backcountry cabin. We traveled alone or in teams of two.

For instance, one person might walk down Oxbow Creek, another down Blacktail Creek itself, and somebody else might walk up the Yellowstone River from Gardiner. We would stay overnight at the lower Blacktail cabin [*on the Yellowstone River. Ed.*], then work on the other side of the river the next day. We kept in touch by radio. If we located a fresh track of an uncollared lion, we could release our dog, and the other team members would have to catch up.

Sometimes teams of two people would travel together with the hounds. We did that a lot during the early years of the study when a lot of unmarked cats existed in the population. Once we had marked most of the adult lions, it made more sense to split up and search alone for uncollared individuals, then team up once they were located.

YS Describe your equipment.

KM We kept it all organized in back packs. I usually was the person who darted the lion, so I carried the drugging equipment. The person who climbed the tree to secure the lion usually carried the climbing spurs, the rope, the climbing belt, and the rest of the climbing gear. We usually shared the radio-tracking equipment.

I carried 28 to 33 pounds of equipment, and my partner carried about 35. Of course that included all our extra clothing, lunch, and emergency kits—matches, an extra hat, extra gloves, etc. Sometimes our packs weighed as much as 45 pounds, when we carried snowshoes and some extra items.

YS What kind of dogs did you use?

KM We used coon hounds or lion hounds of all breeds. The breed didn't matter as long as the dog performed well on lions, wouldn't chase elk or deer, and was reasonably easy to handle.

YS What do good lion hounds cost?

KM We paid as much as $2,500. Typically, we would pay about $2,000.

YS People often think that lion hunting involves large packs of hounds which howl and run through the woods scaring the daylights out of everything. This sounds pretty alarming in a national park. But it wasn't really that way on this study; you only used one or two dogs.

KM That's a good point. Usually we would work with two dogs. Sometimes we would have three along, but we didn't want to have to handle any more dogs than necessary. When we had to carry all that equipment through rough country, we found ways to simplify the operation, and extra hounds were the first items to get left at home, especially dogs that were hard to handle.

YS Did you keep them on the leash until you found a track?

KM Usually, except when we let the hounds cast freely on bare ground during winters with poor snow and when we knew we were close to a lion.

YS How many hours old was a "fresh" track?

KM Tracks made the night before or more recently were considered fresh. We released the hounds if we felt they could tree the cat before dark. We did immobilize lions in the dark if we had to, when we were comfortable with it.

YS Once you found the track and unleashed the dogs, could you keep up with them?

KM No, but we could listen for their barking or follow their tracks in the snow. We also used telemetry equipment on the dogs, so we could locate them that way if we needed to.

YS How fast were the hounds on a good track?

KM The dogs covered the country at least three times as fast as we did. We always said that their biggest advantage was that they possessed 4-wheel drive. But really it's their speed and stamina for running that puts distance between them and you. That's why they were able to tree the lion to begin with. Per unit weight, they have much greater lung capacity than do the cats. And of course it's much greater than ours, too.

YS Were you ever there when the dogs first caught up with the lion?

KM Occasionally we saw the final

Hounds are sometimes radiocollared so that they are easier to follow.

Kerry investigating a network of winter tracks on Slough Creek.

events of the chase, like the dogs actually coming up behind the lion. This occurred, say, when we were on the other side of a canyon from the cat. Houndsmen say the lion is "jumped" when it actually moves in response to the dogs. We learned a lot about how the cats reacted. Surprisingly, they often did little running—just trotted a few yards and climbed a tree. But sometimes it was an all-out foot race.

YS What kinds of things affected the length of the chase?

KM Chases on bare ground were almost always longer than on snow. Usually, the lions treed in a mature conifer with numerous limbs to stand on. The job of the hounds was to hold the lion in the tree until we got there.

YS In following the hounds, could one person follow the tracks and the other person follow the sound?

KM We followed the action using tracks, sounds, and telemetry. Sometimes we even got to the tree before the hounds did. It depended on how fresh the track was and whether following the tracks of the lion seemed necessary.

There were important decisions involved in determining how to reach the lion. If we all left the lion's track and went directly to where we could hear the hounds were, we might not see something important, such as a kill the lion had made. On the other hand, we might need to get to the dogs quickly to help them find a lost lion track on bare ground.

YS What was the time range of the chases, say from the time that you let the dogs loose to the time you caught up with them with the treed cat?

KM We had some that went a minute, and some that went on for 8 or 9 hours. When the chases were long, that wasn't time exclusively in actual pursuit of a jumped lion. It was mostly time the dogs spent following the track until they caught up with the lion.

YS Did the lions use evasive maneuvers at times?

KM Occasionally they circled back and crossed their own tracks behind the hounds. We noticed that females with kittens would often cross in front of the dogs to divert attention to themselves and away from the kittens. That was an advantage of working more than one hound, or at least, more than one good hound; they solved problems more quickly and kept the pressure on the cat.

YS Did the lions understand that it was the tracks that gave them away? For example, did they jump across windfall to break up their scent trail?

KM I think that after several pursuits, the lions somehow understood that it was the line of scent produced by their track that the hounds were using to overtake them. Sometimes they climbed a tree, jumped to another tree, then climbed down, and ran off, apparently in an effort to confuse the hounds. Houndsmen call this "tree-tapping".

YS The dogs would think the lion was still up in the first tree he climbed?

KM Right. They would get to the tree and start barking. They often could not see the lion anyway, but their treeing instinct caused them to stay in the immediate area. Again, that's where it was advantageous to have more than one hound. Inevitably, one dog would circle around and pick up the track again and away they would go.

YS Is tracking in the park different than in other places?

KM Yes, in several ways. Lion hunting in much of the northern Rockies is typically done using motorized vehicles on roads covered by snow. We were disadvantaged because we almost always had to walk to reach lion habitat, so we could cover less country in a day. But we also had advantages, because we could choose our own travel routes through the best lion habitat. This meant that we looked for lions where they spent most of their time. Consequently, many of the tracks of uncollared lions we located were very fresh. In some cases, the tracks told us that the lion had seen us or heard us coming, long before we discovered its presence. The disadvantage of working from roads is that you don't get to dictate where the road goes. Consequently, you spend a lot time outside the best lion habitat.

YS What was the procedure once you arrived at a location where the hounds had treed an uncollared lion?

KM We had a protocol for how to approach a treed lion and what to do when we got there. The basic procedure was to leash the dogs, dart the lion with drugs that would immobilize it and make it safe to approach, and then have someone secure it in the tree with a rope and lower it to the ground.

YS Why did it matter how you approached a tree containing a lion?

KM It mattered to the lion because lions are usually afraid of people. If we approached down a slope from above the lion, it might feel threatened when it saw us at eye level, jump out unnecessarily, and run off. It was best to approach the tree from below.

YS What next?

KM We quietly looked over the situation. We would want to know the size and sex of the lion. Was a shot with a dart safe to the lion? Was the tree safe to climb? If the lion fell from the tree, would it fall on rocks or soft snow? We tried to think through the entire operation and anticipate all the possible complications.

YS What might cause you to call it off?

KM If the lion was low in the tree, it

Bob Weisner with Jammer, obviously a very enthusiastic hound.

might jump out as soon as the dart hit it. Under the influence of the drug, it then could fall off a cliff if the terrain in the area was rocky. In other cases, the trees were too dangerous to climb or we thought a drugged lion might fall out of a tree before we could secure it.

YS We should also keep in mind that you're usually doing this in the winter, and you've been running after the dogs for a while. You have to think of your own welfare here, too.

KM Right. We immediately put on warmer clothes after we got to the lion, and we sometimes carried sweaters for the dogs. We lost body heat quickly. Sometimes it was difficult to function after even 30 minutes when temperatures were well below zero. That complicated matters, especially for the person climbing the tree.

YS What were the other immediate risks?

KM There was always the possibility that a lion would climb down the tree and face the dogs, particularly if it was a kitten. Kittens presented special problems because of this behavior and because they were less coordinated than the adults. Kittens might not climb trees when pursued, and might even face the dogs on the ground. Or, they might not climb high enough to be out of reach of the dogs. All this was because they were less comfortable with the heights than the adults. And because of their smaller size, they could be easily injured by the dogs in a fight. The subadults and adults, which might weigh 70 pounds or more, could easily keep our one or two dogs at bay. We used only a single small hound when we pursued young kittens.

YS Once you had a lion in a tree and you saw that everything looked right, how did you proceed?

KM We usually discussed a game plan—how to respond to various scenarios that might occur after the dart hit the lion. Everybody knew what to do.

Topography in the area was important: if the darted lion jumped from its tree and came under the influence of the drug on the ground, were there cliffs and precipices from which it might fall? And how fast could we traverse the country to reach the lion and prevent that from happening? Who would track the lion if it jumped out of the tree? Who would come along later with the hounds on leashes? There were lots of things to consider, lots of opportunities for mistakes that potentially affected our success and the safety of the lion. I think the captures went smoother because we tried to think it through ahead of time.

Once we settled those questions, we leashed the hounds away from the tree containing the lion, so the cat could relax a bit. I think quiet conditions reduced the apprehension of the lion, which helped us get the desired effects from the immobilizing drugs. This helped keep the captures as simple as possible, and reduced the need for additional dosages.

Scott Relyea aiming a drugged but recovering lion in a safer direction.

YS What was the best place to hit the lion?

KM We would usually try to place the dart in the ham of a rear leg. Usually, the shots were relatively easy, but occasionally we had to make shots, of say, 60 feet.

YS So assuming you hit the lion properly with the dart and, the lion stayed in the tree, what happened next?

KM Once the lion received the drug, we noted the time and began watching for its first effects. We were looking for some evidence that the drug was working—mostly a wobbly or drooping head or a slumping body. We didn't want a climber to start up the tree until we knew that the lion received at least some drug. At that point, we were attempting to balance the safety of the climber, who could get hurt by the cat, and the safety of the lion, which might fall from the tree within minutes if not secured promptly by the climber. These were difficult decisions and they made for tense moments. A lot was at stake. The climber would take a step or two up the tree and we would watch from below to see how the lion responded.

After the climber got up close to the groggy lion, he secured himself with the safety belt by looping it around the trunk of the tree and then snapping it back into a loop on the belt around his waist. This allowed him to work with both hands free. He then secured the lion with a critical piece of equipment called the dally. This was a 3-foot rope with a taut-line hitch at each end, and a loop tied in the middle. It had the shape of an inverted "Y." The hitches worked like slip-knots. They fit around the hocks of the lion, a knot for each foot. The loop in the middle attached to the 60-foot capture rope. This was the brainchild of Jay Tischendorf, who worked on the study the first 2 years. It wasn't anything fancy, but it was a great idea because it greatly reduced the time required to secure the lion during the critical moments it might fall from the tree.

The climber would have one end of the dally already connected to the capture rope via a carabiner. Once the slipknots were tight, the lion was secure.

Young kittens can be safely and humanely restrained in a bag.

The capture rope was long enough to extend to the ground, where it was being held tight by one of us. At that point we might have had a tiger by the tail, but at least it was secure from falling. If possible, the climber put a hood over the lion's head.

YS Was the hood to keep the lion calm?

KM Partly. The drugs we used didn't necessarily cause the lion to close its eyes, so it needed protection from abrasion as it was being lowered and when on the ground. Mark Johnson, a veterinarian who worked for us on the project, made the hoods out of elastic cloth. It was essentially a tube with snaps at one end. It slipped over the head and could be snapped snug, but allowed the nose to stick out so the cat could breath easily.

But as you said, it was also important because it cut down on visual stimuli to the cat. It also protected the eyes from direct sunlight.

YS How did you lower the lion out of the tree? Did the person on the ground just feed more rope?

KM We worked it that way sometimes. Or the tree climber, if he was in a good position, could lower the lion himself. Usually, the climber started the process. He would get the lion uncoupled from the tree by releasing the grip the lion's claws had on the tree. But once the lion swung free out over a branch or a limb, the folks on the bottom could work the rope. If the lion became tangled in limbs as it was lowered, the climber would go down and work it free.

Ultimately, there were two critical elements of smooth captures. The first was the correct placement of the dart on the first attempt. Poor first shots immensely complicated the procedure, because the lion might move higher in the tree or jump out upon impact of the dart. These things necessitated the use of additional darts and more stress for the lion, particularly if hounds were used to tree the cat a second time.

The second element was the ability and confidence possessed by the person climbing the tree. As it turned out, we were blessed with some really good tree climbers on this project: Jay Tishchendorf, Scott Relyea, Brian Holmes, Greg Felzien, and John Murnane. These people were crucial to our capture operations. Their performance during the 3 to 10 minutes they had to climb the tree and secure the lion determined the health and survival of the cat, themselves, and indirectly, that of the project. They deserve a lot of credit.

Above: Maneuvering an anesthetized lion through the branches. Right: Carrying a kitten to the ground.

YS What happened when the lion reached the ground?

KM That depended first of all on the lion and its condition. We had lions reach the ground in various stages of anesthesia. Sometimes they were partly alert and clawing at the ground. In that case, we gave them an additional dose of drug. If the lion was completely unconscious, we disconnected it from the rope, and took it to a flat site we had preselected. We tied the dogs farther back at this point, because they weren't needed any more.

We immediately checked the lion's temperature, pulse, and respiration. We made sure it was breathing normally. We looked for signs of shock by checking for responses of the pupils to light and for good circulation in the gums. We had one person who primarily monitored the lion, telling us how it was responding, and how much time remained before it would recover from the anesthesia. We usually had half an hour to 40 minutes to work before the cat began to struggle.

YS Once the lion was secure, what were your goals?

KM Fitting the radio collar was probably the next most important job, and it presented some interesting challenges. With a young lion, it had to be loose enough to allow for growth of its neck, but not so loose it would fall off or get hung up in sticks and branches at ground level. Sometimes we added a cotton link to the collar, which deteriorated and would eventually allow the collar to fall off.

YS How long did the radio in the collar keep transmitting?

KM The transmitters in the collars typically lasted 2 1/2 years. The smaller expandable collars that we put on kittens would last about 9 months. As the kitten grew, we recaptured it and re-

Lion M-38 was first captured at 4 weeks of age and was subsequently monitored as a kitten, subadult, and adult for 3 1/2 years until he was killed by a hunter.

Kerry and Brian Holmes with F-5, the oldest lion in the study. She successfully raised one litter of kittens and is believed to be one of the population founders.

placed that collar with another larger expandable collar—one large enough for yearling males and fully-grown adult females.

Once the collar was on and working, we installed tags in the ears. This was useful for identification purposes if the lion reappeared later without its collar. We also tattooed an identification number in the ears, which was a permanent mark.

We took a lot of measurements and got a blood sample, which we will use to establish paternal relationships among the kittens and adult lions using DNA analysis. Those data will be extremely valuable to our work on lion social ecology.

YS How do you weigh a big lion in the wilderness?

KM We suspended the scale from a tree branch or a walking stick and secured the lion with the dally or cradled it in a tarp. The smaller kittens could be lifted and weighed by one person.

YS How much did the adults weigh?

KM Our biggest male was 173 pounds. He had a full stomach. A young adult male, say 2 to 3 years old, would weigh 140 to 155 pounds; a yearling male about 130 pounds. The biggest female we weighed was 132 pounds. She was pregnant and full of elk meat. A typical adult female weighed about 100 pounds. A yearling female, in her first winter of independence, weighed 65 to 80 pounds.

YS Once you completed your work, how did you leave the lion? Did you stay around and monitor it until it was completely out of the drug?

KM If we finished the measurements and the lion was lying quietly, we moved away about 50 yards and waited for the lion to become mobile. If the terrain was rocky, we carried the lion to a safe place. If the lion became mobile before we finished the work, we let it move off by itself. Again, if the terrain looked dangerous, we stirred the lion away from danger by positioning ourselves between the cliff and the lion and clapping our hands if necessary to get the lion to change directions.

We were especially concerned near rivers. If a lion tried to swim when half immobilized, it might drown. We also had to worry about ravens or coyotes taking advantage of the lion's awkwardness and immobility during the early portion of the recovery period. That's why we watched the lion recover from a distance. When the cat was able to defend itself and gained sufficient coordination, we headed for home.

YS Did you ever lose any lions in these operations?

KM We were very fortunate. We made more than 170 captures and never lost a lion. Kitten captures involved just physical restraint rather than immobilizing drugs. We did have three injuries, but based on our exams of the cats during subsequent captures, the injuries were not serious in the long term.

M-38 being weighed. DNA blood analysis is being done to determine paternal relationships for this lion, who was a second-generation study animal.

During a capture operation, the animal's teeth were examined, and gum circulation was monitored to ensure the animal was not going into shock.

YS You frequently express your concern for the animal, and it's obvious from your capture record that you were very careful not to harm them. But you also mention learning new things as the project went on. How did your capture and handling procedures evolve over time?

KM Most of the improvements came by objectively critiquing our operation in the field and by trying to anticipate problems before they occurred. We put our heads together on how to avoid the glitches. Then once we saw that the change was useful, it wasn't very long before the old pattern had disappeared entirely among the capture teams. I think the open-mindedness to improve our methods and good communication were at the heart of our success.

We also invited a veterinarian and two veterinary students to assist some captures and give us feedback. As I mentioned, we also grew a lot due to Mark Johnson, a wildlife veterinarian who brought his veterinary expertise to the project. It was really nice having a vet to consult with at any time.

YS You give the impression that no matter how much experience you had, you never for a moment felt you could relax and treat lion captures as routine.

KM Remember the type of conditions under which we did the work. Usually we did all this in cold weather, in darkness or dusk, and often in rough terrain. Even under the best conditions of terrain, temperature, and light, just the nature of the capture operation was often potentially dangerous because the animal was high above ground and climber and cat were subject to falling. There is an important difference between immobilizing mountain lions in trees and other carnivores in snares or traps. As John Murnane pointed out [*John worked on this study, as well as working on several grizzly and black bear studies elsewhere. Ed.*], the lion picks the place of the immobilization by what he chooses to do after he hears the hounds. He also picks the time, often late in the day or in the dark, as a consequence of the country in which he lives and the logistics that are involved in lion research.

In bear or wolf work, the trapper intentionally picks an advantageous trap site and normally checks the set in the morning. This means that the trapper usually has more control over the situation, particularly since the animal is constrained by the snare or trap when the trapper arrives. Trappers can select trap sites that allow both a safe approach and exit if the bear gets out of the snare or a mother bear returns to defend a cub in a trap. Lion captures are a lot more unpredictable because the lion is not initially restrained and the variable of rough terrain further complicates matters. Usually it wasn't getting hurt by the lion that concerned us, it was the country.

YS You talked about finishing up with a cat after dark. Most people probably don't realize the enormous difference between hiking on a backcountry trail and engaging in the sort of cross-country work you did with no convenient trails to use. That made travel in darkness or bad weather more difficult. When you finished with a lion later than usual, did you ever just stay where you were until morning? Were you always confident that you could find your way through the dark back to the cabin or truck?

KM We had a game plan on how to get out once it was apparent that darkness and the cold were going to be upon us. This meant that we looked at the country and the map before dark and made sure we could get out before we committed ourselves by turning the hounds loose. Of course, we carried all the appropriate gear, including flashlights. If it was really dark, with no moonlight or starlight, we navigated by map and compass only. That was unnerving at times, particularly if we travelled more than a mile in the dark through lodgepole pine stands with closed canopies.

Once Mark Johnson and I hiked out of the Cedar Creek drainage and had to rappel down a slope in the dark, carrying packs and coaxing the hounds. That was a nasty situation.

One nice aspect of Yellowstone is that the forest understory is usually pretty sparse. And there were a lot of game trails to use. We usually didn't have to break our own trails through the snow, because the elk had done that for us. We travelled on ridges because they were often blown free of snow and it was easier to see at night. We got pretty

Kerry Gunther with Jammer in some typically rugged lion country near Knowles Falls on the Yellowstone River.

comfortable with working and navigating in the dark. But there were times when we weren't sure we were going to get to a cabin or the truck without a problem. The latest we got out was 2 a.m. Even the old cans of salted bacon you find in the ranger cabins look pretty good by then.

YS Can you summarize your philosophical thoughts about the Yellowstone work?

KM Looking back, the work was pretty intense. I could not imagine working much harder on a project for as long. Except for the loss of Greg Felzien, I think the quality of the data we collected easily justified, in the long run, what we put ourselves and the lions through. I know that from some previous experiences of my own, and in looking at other projects, the end does not necessarily always justify the means. A field effort has little prospect of success unless it starts with a good and realistic study design, and a commitment to both quality fieldwork and a completed write-up. A successful work is a completed work—start to finish. The best technique, all the late nights in the field, and great hounds won't amount to much if the data just sit in our files. We have lots of good information to work with and I think this project will be a lasting contribution, assuming the write-up is as successful as the fieldwork.

YS And after that? What do you want

Top left: M-8 "King of the Northern Range," the oldest male in the study. Top right: M-38 as a subadult. Middle left and right: F-5, who burned her foot pads in the fires of 1988. Bottom left: a treed cub; and bottom right, two kittens who died after their mother was killed by M-8. One cub died of starvation and the other from a crushed skull, possibly the result of an attack by M-8 or another lion.

to try next, when all the results of the lion study are written up and published?

KM Well, I understand that good fast hounds can tree a wolverine...

A Houndsman's Lexicon

Like many specialties, lion–hunting has a language of its own. For the sake of smooth reading, we have not used many of these terms in the interview, but they are an important part of the houndsperson's vocabulary, and are colorful and often evocative. We didn't want to deprive readers of this aspect of the story, and so here is a sampling of lion–hunting terminology.

bawl–mouth This describes a hound that gives the classic howl when trailing a lion.

bugger–barking When a hound has been released on a lion track, but barks unnecessarily when off the trail of the lion, it is said to be bugger–barking.

cold–nosed A hound with a special ability to scent and follow an old track.

cutting the track When a track is crossed and identified by the hunters or the dogs, they have "cut" the track and then follow it.

dawgs People often refer to their hounds as "dawgs."

freshening the track As the hounds follow the track of the lion, they are continually following fresher, or more recent tracks as they get closer to the lion. This is known as freshening the track.

jumping the lion When the lion first becomes aware of the dogs and reacts by moving, it is said to have been jumped. "Jumped race" describes the lion after it has been jumped.

jumping tree When the lion has been treed and decides to leave the tree and run again.

locator bark This is an especially melodic bawl given by some hounds when they first see the lion in a tree. The locator bark tells the hunters that the pursuit has ended.

moving the track When the dogs are pursuing an animal along its track, they are moving the track.

popup A lion that immediately climbs a tree when it hears the hounds.

running the track wide This occurs when the lion track is so fresh that the hounds can run alongside it instead of exactly on it. At these times, the hounds may actually be following the lion's scent in the air rather than on the tracks.

sorting a loose When the dogs come to a confusing place in the trail, where the movement of the lion is unclear, they attempt to determine the lion's direction, often by circling in the area until they pick up the trail. This is sorting a loose.

super–tom A very large male lion.

trash–free A trash–free dog is one that concentrates on the preferred quarry; thus, a trash– free lion hound will not be distracted by the tracks or presence of elk, deer, coyotes, or other animals.

tree–tapping When the lion climbs one tree, jumps to another, and climbs down, in order to throw the dogs off the track.

Bark Eating by Yellowstone Elk

Additional notes on a little-known food habit

by Jeff Henry

Bark stripped by elk, near lower edge of Specimen Ridge. All photos courtesy of Jeff Henry.

In Volume 1, Number 4 of Yellowstone Science, P.J. White and his coauthors reported on elk use of burned lodgepole pine bark. I have a related piece of information that P.J. and other readers may find interesting.

In the spring of 1986, while doing a winterkill survey for the Interagency Grizzly Bear Study Team (IGBST), I found conclusive evidence of elk stripping and consuming bark from live lodgepole pines. The stripped trees, about 30 in number, were pole size lodgepoles approximately 5–9 inches diameter at breast height, and were located along White Creek near the Firehole Lake Drive. The trees were clustered in a fairly small area, an acre or so I recall, and most of the peeling had a southwest or west–southwest compass orientation. In size, the peeled strips averaged one quarter to one half the circumference of the trees, and had been pulled off in strips up to 2.5 to 3 meters (3 to 3.5 yards) long. Apparently, peeling had occurred in March or early April.

Elk appeared to strip the bark by gnawing a piece loose near the bottom of the tree and then pulling the loosened end outward and upward to peel off the long strips. Dan Reinhart and Dave Mattson, at that time also with the IGBST, joined me in investigating the site after the snow had gone from the immediate area, and we found little in the way of bark shreds or traces of cambium on the ground; most of the material apparently had been consumed. Dan and Dave agreed with me that tooth marks on the trunks of the stripped trees and tracks on the ground left little doubt that elk had done the stripping.

The area where I found the peeled lodgepoles is a known elk wintering

Cambium layer of an Engelmann spruce fed upon by a grizzly bear in Pelican Valley, Yellowstone National Park.

Below: A lodgepole pine stripped of bark by elk near the Firehole Lake Drive and White Creek, Yellowstone National Park.

ground, but we don't know for sure that the stripping was done by bulls. The site experiences a slight thermal influence: it collects snow in the winter, but never to the depth of most of the surrounding forest, and it melts free relatively early in the spring.

Weather during the winter of 1985–86 was distinctive, being extremely cold

Dave Mattson of the U.S. Interagency Grizzly Bear Study Team tasting cambium from a lodgepole pine that had been stripped of bark by elk near the Firehole Lake Drive.

and snowy in November, after which mild and mostly dry conditions prevailed until mid–February, when a week–long storm dumped huge amounts of wet snow. Unseasonably mild and rainy weather followed the big storm, which in turn was followed by cold temperatures that froze the snowpack rock hard. The snowpack during March and April of 1986 was so hard that even bison walked on top of 5 to 6 feet of snow without breaking through. These conditions lasted for several weeks and persisted throughout each day; there was no afternoon softening of the snowpack during that time. Overall, winterkill in the Firehole that year was moderate, with a total of about 83 carcasses found during a three month search.

The trees I've described are still obvious by the scars they bear from the 1986 peeling. They are located about one quarter mile from the entrance to the Firehole Lake Drive, on the left side of the road, and are visible from the road.

Dan Reinhart inspecting a lodgepole pine stripped of bark.

I've checked the grove frequently since 1986, but have seen no further evidence of cambium stripping there in subsequent years. Nor can I recall having seen such stripping by elk anywhere else at any other time. The grove of lodgepoles by the Firehole Lake drive did not burn in 1988.

Bears sometimes strip cambium from conifers in a manner similar to the stripping we saw in 1986. According to Dave Mattson, analysis has shown that conifer cambium in spring can have a sugar content comparable to that of berries. Dave, Dan, and I all sampled some cambium from the White Creek site, and found it pleasantly sweet and not at all pitchy or resinous.

Jeff Henry first worked in Yellowstone in 1977, and has held various positions with the National Park Service and the Interagency Grizzly Bear Study Team since then. He is currently a full-time freelance photographer living in Emigrant, Montana.

Yellowstone's First Winter Wildlife Survey

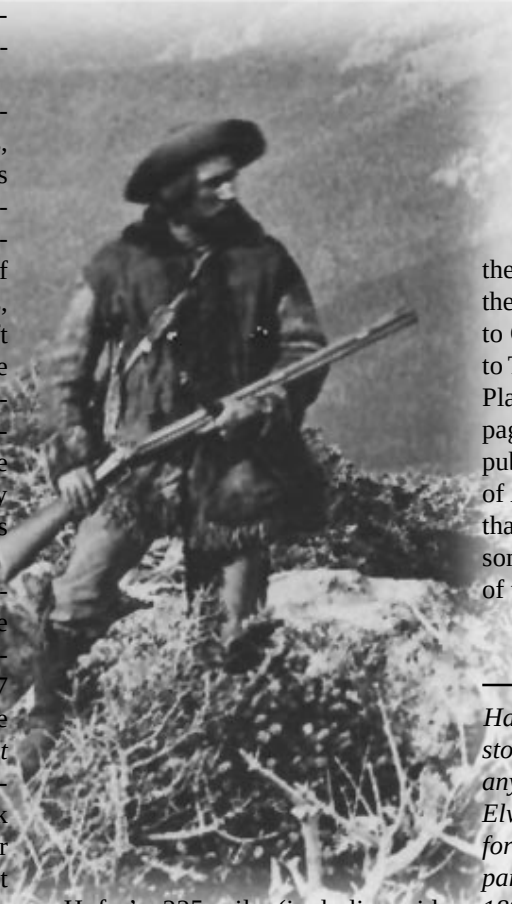
by Paul Schullery

The late nineteenth century witnessed the dawn of modern wildlife science and management in North America, and Yellowstone National Park, created in 1872, was the site of much early experimentation. Wildlife protection was not a primary impetus for the creation of the park, but within a few years the slaughter of park animals had engaged the interest of the public, and soon conservationists campaigned to ensure the survival of park animals.

Little formal wildlife study was accomplished in the park's early decades, though various early federal surveys discussed park wildlife. Superintendent Philetus Norris (1877-1882) included long, informal discussions of wildlife in some of his annual reports, and his gamekeeper, Harry Yount, left the first counts of bison, but very little attention was paid to determining distribution and abundance of the most common mammals. Even an exhaustive review of anecdotal information in many early accounts of the park only allows for a general portrait of conditions.

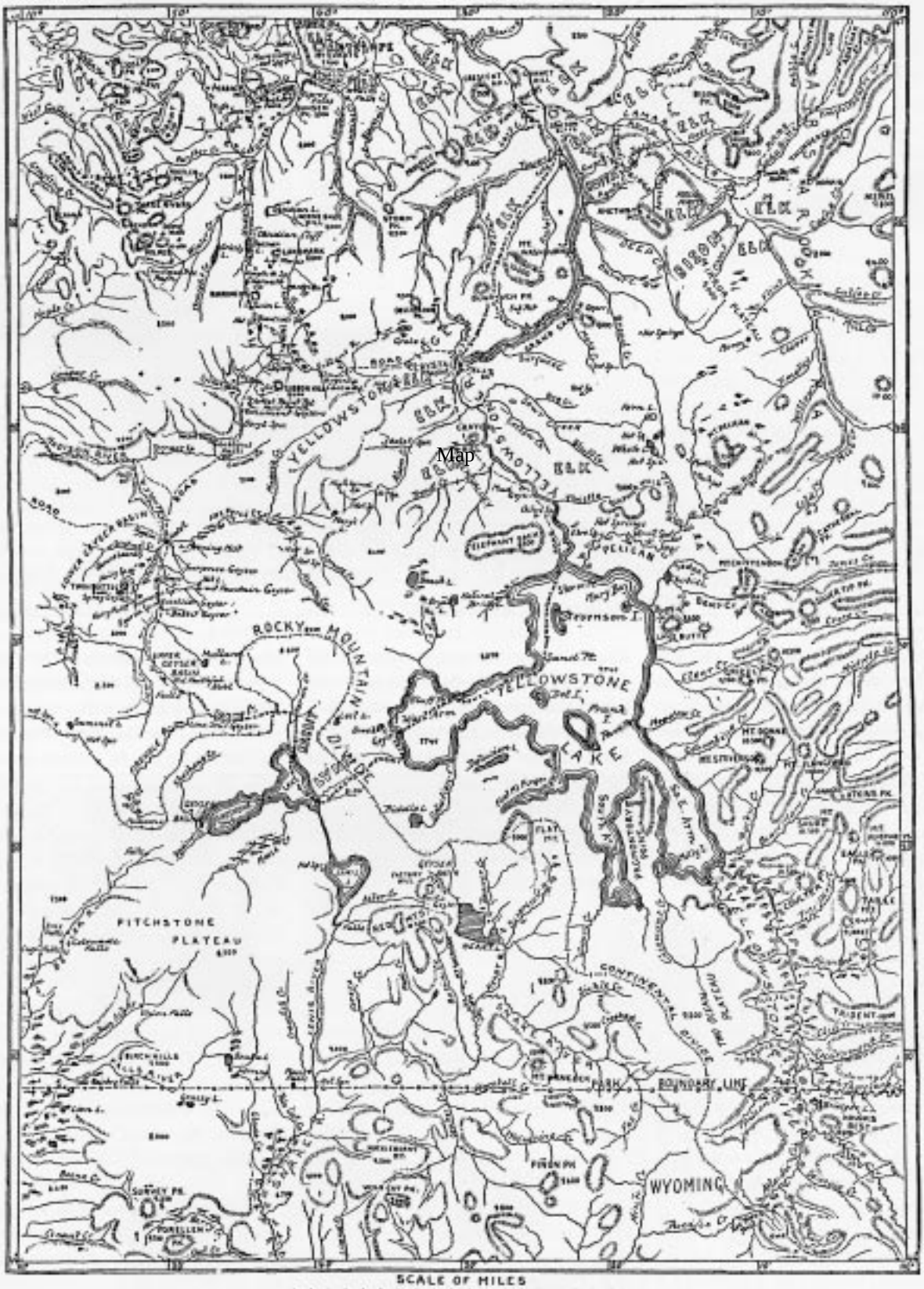
One remarkable exception to the generally vague and incomplete state of the wildlife record prior to 1890 was Thomas Elwood Hofer's account of his 1887 midwinter ski expedition around the park, which was sponsored by *Forest and Stream* magazine. Hofer, a longtime western traveler, sometime park concessioner, and animal trapper for the National Zoo, was one of the most respected observers of the time, whose skills were admired by leading conservationists and naturalists. He made the trip with one companion, a young local man named Jack Tansey.

In his five-part series of articles, published on April 7, 14, 21, 28, and May 5, 1887 in *Forest and Stream*, Hofer told an amazing story of winter adventure, and chronicled all wildlife sightings made along the way, even including fish and birds. It remains a fascinating and tantalizing document, a rare glimpse at another Yellowstone, when summer visitation was a few thousand and winter visitation was unheard of.



Hofer's 225-mile (including side trips) route took him from Gardiner, Montana, through the Norris, Lower, Midway, and Upper Geyser Basins, along the east side of Shoshone Lake, then over to West Thumb and across the thumb and northern part of the lake to the present Fishing Bridge area. From there he followed the Yellowstone River to Canyon, then across Dunraven Pass to Tower, and back across the Blacktail Plateau to Mammoth Hot Springs. On page 13, we reprint the map of his route, published in the April 28, 1887, edition of *Forest and Stream*. Note especially that the map shows the locations of some of the more significant sightings of various species of mammals.

Harry Yount, left, was the first Yellowstone Park employee to attempt to count any park wildlife species. But it was Elwood Hofer, shown above, who first formally surveyed winter wildlife in the park. The Hofer picture is part of an 1894 drawing by Frederic Remington, showing a ski party wading Alum Creek in Hayden Valley. The drawing was apparently based on an F.J. Haynes photograph. We can assume Hofer's gear and behavior were much the same during his pioneering 1887 trip.



MAP OF THE YELLOWSTONE NATIONAL PARK.

From the latest Government Surveys. The line -+-+- shows route followed by the FOREST AND STREAM's Mid-Winter Expedition.

This photograph of the Canyon Hotel was taken in January of 1887 by F.J. Haynes, whose winter photographic expedition through the park preceded Hofer's wildlife survey by a few weeks. Reprinted by permission of the Haynes Foundation Collection, Montana Historical Society.

Some of what he saw is quite familiar to modern winter visitors, and some is different. What follows is a brief summary of some of the highlights.

Elk were by far the most common large mammal, appearing in many of the same locations they occupy on today's winter range, as well as in a few other places. As he headed south from Mammoth Hot Springs, he saw several bands on the windblown ridges around Swan Lake Flat, totalling about 120. He had little to say about elk in the geyser basins and along the lake, but again reported them in Hayden Valley, including a band of 14 cows and calves along Trout Creek, a single bull just north of Trout Creek, and evidence of a larger group of about 60 near Alum Creek. Reports of elk wintering in Hayden Valley were not uncommon prior to 1900, though they rarely appear in numbers there today.

Arriving at Canyon on February 27, Hofer learned that on February 18, the local winterkeepers had tried to "rescue" a small band of eight elk that they believed had been stranded by deep snow in the area. Hofer reported that these elk were eating aspen, spruce, and fir branches, and would starve if not driven into better country (presumably Hayden Valley). One cow, unwilling to leave the rim of the Grand Canyon of the Yellowstone, slipped on the ice and fell to the base of the Lower Falls.

On March 4, when Hofer and Tansey set out for Tower, they soon began crossing the trails of elk, and as they climbed near Dunraven Pass he reported small bands of elk on the windswept ridges. On all the bare ridges on the north side of Mount Washburn he saw "elk scattered in bands, three, four and ten in a place," and as they descended toward Tower he encountered several other bands, including ones of 54, 15, 12, 7, and 20. They saw many others as they continued on. From the top of the hill above Tower Fall, he saw "elk in every direction," and "soon gave up trying to count them." Interestingly, at Lost Creek, near present Tower Junction, he "saw the first willows of our trip. The others were under snow." On the trip from Yancey's hotel, near present Tower Junction, to Mammoth Hot Springs, he reported being continually in sight of elk most of the way.

Hofer concluded the following about elk wintering in the park:

"On the ridges around Washburne [*sic.*] there are at least 150 elk; about the falls, 50; on Specimen Ridge and the section of the park to the north, at least 2,000; on Black Tail, Lava, Elk and lost creeks, and country north of Tower Creek, some 1,600; in the country between Mammoth Hot Springs and the Madison Mountains, some 500. I know nothing of the number on the west side of these mountains. On Alum Creek and the country across the river there are elk, but how many I do not know. Perhaps 200 would be a large estimate, though some people put it as high as 800. In the south end of the Park I do not think the elk winter".

Hofer estimated 4,500 elk wintering in the park, and said that some other knowledgeable observers estimated 7,000 to 8,000. His travel route did not take him to all the areas he mentioned, and so he was apparently making his estimate based on his as well as others' observations.

The day he started, February 17, he

reported a small band of bighorn sheep (four ewes and two lambs) along the Gardner River, as well as numerous trout (17 small ones at one point) and various birds. On his return to the Mammoth Area, coming down Lava Creek on March 6, he saw bighorn 10 sheep on Mount Everts.

Hofer estimated there were still 200 to 300 bison in the park (he saw 30 between Tower and Mount Washburn), and was obviously disappointed not to find more; their fate was a primary concern of conservationists at the time.

Hofer reported that only a few bighorn sheep and pronghorn wintered in the park, "but no blacktail or white-tail worth mentioning". He said "a great many" deer summered in the park, and had "seen hundreds of sheep and blacktail on their way out in the fall, and returning in the spring."

He occasionally reported coyotes or coyote tracks, but did not report any evidence of wolves, perhaps because they had been subjected to extensive poisoning by then.

Some of his smaller mammal sightings are especially intriguing. At several points (Norris Geyser Basin, Lower Geyser Basin, Midway Geyser Basin, between Shoshone and Yellowstone lakes, Alum Creek, and Canyon) he reported the tracks of lynx, and saw one lynx near the Little Firehole River. He also reported wolverine tracks at Norris and Fountain Flats, and a thriving colony of beaver along the Firehole River upstream from Old Faithful.

Hofer was a veteran woodsman and a keen observer, and his account is both important, but his conclusions must be used with extreme care.

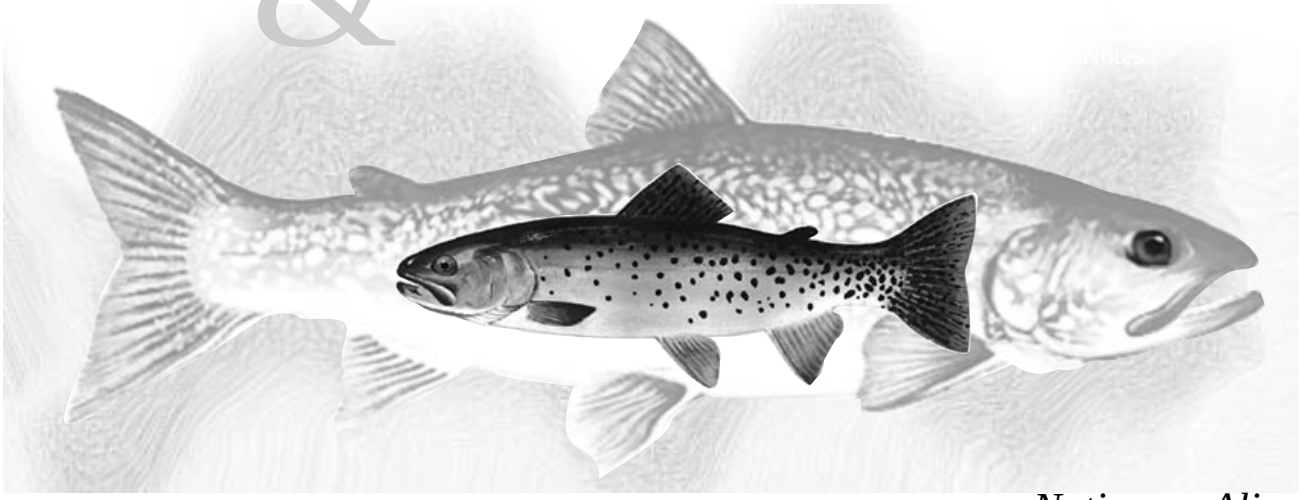
For example, it is difficult, if not impossible, to evaluate the completeness of his elk population estimates; he did not even see large parts of what is now considered winter range in the park, and relied on other observers to fill in the gaps in his information.

Perhaps more significant, he made his trip just a few years after the park's wildlife had been subjected to year after year of intensive market hunting, when thousands of elk and other large mammals were killed for their hides, and many carcasses were poisoned to kill predators and scavengers. These activities could have affected the numbers and distribution of wildlife.

Climate may provide the most complex variable of all. By most accounts, Yellowstone had just emerged from the Little Ice Age, and its winters were colder than they are now. That was apparently true in the winter of 1886-1887, the most infamous of all late-nineteenth-century western winters. Hundreds of thousands of cattle in Montana and Wyoming died, and many ranching operations were crippled. Hofer's reports of snow depths at many locations could be seen as suggesting a considerably less hospitable winter range than elk, deer, and other animals find in Yellowstone today.

But, for all the possible limitations of his methods, Hofer made a good start at the sort of survey that has become a mainstay of modern wildlife management, reporting as best he could what was going on in a park that only a few winterkeepers and poachers usually traveled. He refused to consider himself a great adventurer in winter travel, stating that the skiing was routine (which it decidedly was not), and that winter travel was "most enjoyable." For all of his disregard of his achievement, perhaps he would not mind if we at least celebrated him as a pioneering naturalist.

F.J. Haynes took this photograph of the Mud Volcano patrol cabin during another winter trip, in 1894. Courtesy of the Haynes Foundation Collection.



Native vs. Alien

Lake Trout Invade Yellowstone Lake

Lake trout (*Salvelinus namaycush*), have been discovered in Yellowstone Lake, where they pose a grave threat to the future of the lake's native Yellowstone cutthroat trout (*Onchorhynchus clarki bouveri*) and to many other animals. On July 30, a park visitor caught a one-pound lake trout south of Stevenson Island, and on August 5 another visitor caught a similar-size lake trout near the lake shore between Breeze Point and Wolf Point. Subsequent investigations established the authenticity of the catches, and brought forth other reliable reports of lake trout caught in Yellowstone Lake, some prior to 1994. On September 20, U.S. Fish & Wildlife Service personnel, as part of an effort to learn more about possible lake trout distribution in Yellowstone Lake, caught a 12-inch lake trout in 125 feet of water near Pumice Point.

It is the conclusion of NPS and U.S. Fish and Wildlife Service staff in the park that these fish were almost certainly illegally stocked, which Yellowstone Superintendent Robert Barbee has described as an "appalling act of environmental vandalism." Lake trout, which are native to the Great Lakes region, were stocked in other park waters in the 1890s, but have never before been scientifically documented in Yellowstone Lake.

To help determine the extent of lake trout presence, and to control their numbers, the NPS announced on July 11 that Yellowstone Lake fishing regulations were amended to improve the chances the new species would be taken by anglers. Under the new regulations, there are no limits on the number or size of lake trout (*Salvelinus namaycush*) that anglers may take from Yellowstone Lake. Regulations for Yellowstone Lake cutthroat trout have not changed. Regulations for lake trout in other park waters have not changed. Anglers capturing lake trout from Yellowstone Lake are required to kill them.

Because little is yet known about the numbers, distribution, or origin of these lake trout, the Superintendent requested that anglers catching lake trout present them at the ranger station at Fishing Bridge, Bridge Bay, or Grant Village. Anglers may be asked to turn in lake trout for study, but may keep the fish if they prefer.

The National Park Service is offering a $10,000 reward for information leading to the arrest and conviction of those responsible for introducing lake trout into Yellowstone Lake. Barbee said that $10,000 is only a small fraction of what it will eventually cost to attempt to control lake trout in Yellowstone Lake, and that if the exotic fish becomes widespread the ecological and economic costs will be extraordinary. "The presence of this fish in Yellowstone Lake may not seem significant to some people," said Barbee. "But we appear to be on the verge of an ecological disaster. The potential consequences of this thoughtless act are enormous."

Barbee explained that when lake trout are introduced on top of existing cutthroat trout populations, the cutthroats may be nearly or completely wiped out. Large lake trout prey heavily on the smaller cutthroat. "This has grave implications," said Barbee. "It could mean the destruction of the last major stronghold of inland cutthroat trout. Yellowstone Lake has been an almost museum-pure home of these fish for thousands of years, and it would be a tragic loss to Yellowstone's wilderness quality, to anglers, and to science." The introduction of lake trout to Heart Lake, in south-central Yellowstone Park, is generally recognized as having led to the near-extirpation of the Heart Lake cutthroat trout, which was only saved from complete elimination by strict regulation of angler harvest. Other cutthroat trout lakes in the west have suffered similar fates, and Yellowstone Lake is regarded as an excellent home for lake trout--just the sort of body of water where they could be expected to thrive.

Much of the reason for alarm results from the effects of the trout on other elements of the lake ecosystem. The implications of lake trout in Yellowstone Lake reach far beyond the park's mission to preserve native trout populations. "If lake trout make serious inroads on the cutthroat trout population, many animals will suffer, including eagles, osprey, otters, and bears," Barbee said. "Cutthroats dwell in shallow water, and are readily available to many

fish-eating birds. Lake trout spend almost all of their time in deep water, out of reach of most predators. And unlike cutthroat trout, which spawn in over 100 small streams around the lake, lake trout will spawn in deep water in the lake itself. Many grizzly bears feed heavily on stream-spawning cutthroat trout, and could simply lose that important food source."

Cutthroat trout are also the basis of a multimillion dollar sportfishing activity in Yellowstone National Park, with anglers coming from all over the world to capture these wild native fish. "Some thoughtless individual has jeopardized a sportfishing resource that contributes to the livelihood of many people in this region," Barbee said. Lake trout, because of their deep-water habits, will be available to relatively few anglers, and will not provide an equivalent sport fishery if they reduce or destroy the cutthroat trout population.

Plans are underway to attempt to control the exotic fish, including identification and monitoring of possible lake trout spawning areas, where the fish gather in the fall. Barbee also emphasized the importance of public involvement. "We're going to be counting on our fishermen friends," he said. "They're out there every day, and they can help. Their catches will not only reduce the number of lake trout, but will also tell us a great deal about what's happening to the lake ecosystem."

Yellowstone Lake is the site of one of North America's longest-running and most productive aquatic ecology research efforts. The cutthroat trout of this lake have been studied intensively and productively since the late 1800s, providing ecologists and fisheries managers with numerous important lessons in how large, relatively wild lake ecosystems function. The future of that scientific resource is now in jeopardy as well, but thanks to a formidable body of past research, monitoring possible changes in the lake will be much easier.

Eocene Fossils Discovered During East Entrance Road Construction

Yellowstone paleontology enjoyed a rare episode of headline-gathering early this summer. On June 3, Federal Highway Administration employee Ron Jones noticed several fossil leaf imprints in the wake of a bulldozer cut along the East Entrance Road. A quick inspection by National Biological Survey Geologist Wayne Hamilton, Yellowstone Park Research Geologist Rick Hutchinson, and other park staff established that the find, which included both fossil leaves and petrified wood, was of potentially great importance.

Eventually five sites were identified in road cuts. Yellowstone Park Landscape Architect Eleanor Williams was placed in charge of a special Incident Command Team (such teams are formed for many kinds of special events and emergencies) to determine the management needs of the sites, and to judge how they might affect ongoing road construction work.

Three leading paleontologists were invited to evaluate the sites, which they did between June 8 and June 10. They were William Fritz, a volcano stratigrapher from Georgia State University, who has studied the "fossil forests" of Specimen Ridge and other sites in the Absarokas for many years; Scott Wing, a paleobotanist with the Smithsonian Institution in Washington, D.C.; and Kirk Johnson, Director of Paleontology at the Denver Museum of Natural History. All three have submitted reports on their assessment of the site.

The location and distribution of the fossils was as much the subject of study as were the fossils themselves. The rock outcrops containing the fossils are part of the Langford Formation, the result of volcanic activity in the middle Eocene Period, about 46 million years ago. Johnson observed that one of the special values of the outcrops is that, though other similar-aged fossils occur elsewhere in the region, the new ones are "the only good exposures of the Langford Formation on paved roads and thus accessible for study by geology field courses."

Fritz, who has been a leading investigator of Yellowstone's famous Specimen Ridge fossils, summarized the Langford formation as follows. "The Langford Formation is one of the younger formations in the Absaroka Volcanic Supergroup, an extensive andesitic pile of tuffaceous sandstone, volcanic conglomerate pyroclastic flow deposits, lava flows, and shallow intrusive bodies." Perhaps the most important thing about this list of materials and processes is that it reveals the extreme diversity of the geologic products of

Photos Jim Peaco/NPS

Above, and below: Details of two fossil leaves; note the pronounced relief visible in the leaf structure. These and almost all other leaves found were identified as sycamores.

volcanic activity. The eruption itself sets in motion many processes, involving not only the direct products of the eruption (including lava and other material ejected from the volcano), but also other materials (preexisting surface rock and soil, mudflows from intense tropical rains or even melted snow, and a variety of organic matter) that are violently mixed and relocated at the same time.

In recent years, Fritz has disagreed with earlier interpretations of the Specimen Ridge fossil forests. Previously, the prevailing view was that a series of volcanic ashfalls simply buried the various levels of forest, one at a time, until the many "layers" were created. In the 1980s, Fritz suggested a much less tidy process, in which movements of lava, rock, sand, and mud buried and preserved the area's fossil forests. Hamilton, commenting on this new find along the East Entrance Road, described it as "the clear exposure of the part of the story told by Fritz. In roadcuts one can see masses of andesite, a volcanic flow rock. Nearby is a white band that appears to be tuff from an explosive eruption. There are petrified logs. There are the sandstones, in which leaf preservation is absolutely excellent, and there are the coarse, bouldery debris flows. At one outcrop the sandstone has been overridden by a debris flow after such a short time, as indicated by contorted and broken bedding in the sand, that one gets the impression that all hell was breaking loose up on the mountain."

The importance of the contorted and broken bedding is revealed by the fossils themselves, as described by Hutchinson. "They are often found curled or contorted, indicating that they were buried violently in a viscous, cement-like mudflow that swept rapidly down the sides of the volcanoes. This was illustrated at Mt. St. Helens and Pinatubo in the Philippines. Had the deposition been gradual and less violent, the fossils would be lying in flat, horizontal layers."

Because of the complex and uneven nature of this process, it is virtually impossible to predict where concentrations of fossils will appear. Volcanoes do not necessarily create new geological strata in neat order on top of existing ones. As Wing said in a briefing following an initial visit to the sites, "This is not a layer cake situation. This is not stripes in the ground." A single flow of mud or other debris, laden with plant parts, might come to rest in a slight depression and be covered over, creating a relatively small "lens" of fossil-rich material such as was uncovered by the bulldozer along the East Entrance Road. It is impossible to know when a similar, or much larger, lens might be encountered.

One of the distinguishing features of the fossils is their large size.

Johnson reported that the fossils "are significant because they can provide information about the nature of the vegetation and climate of the region in the Eocene. All the fossil leaves belonged to the genus *Macginitiea*, a member of the Platanaciae or sycamore family. Some of the specimens were unusually large and may represent a species of *Macginitiea* unknown to science."

Wing elaborated on the fossils, noting that "*Macginitiea* is probably the most common type of leaf fossil in the Absaroka Volcanic Supergroup. Many specimens have been collected previously from the Sepulcher and Lamar River Formations, from the unnamed lacustrine ashes below the Aycross Formation in the southern Absarokas, and from the Aycross and Wind River Formations in the Wind River Basin.... The specimens are among the largest, if not the largest I have seen, measuring about 40 cm (15 3/4 in) across. Large size is *not* an indication that these specimens belong to a new species."

Almost all of the fossils that could be identified were of this one species (the one additional specimen found after construction resumed may have been a type of willow). Wing suggested that *Macginitiea* was probably a plant that colonized disturbed sites, which would explain why no more species were found. "The lack of clear bedding in the sandstone and the twisting of the leaves into vertical orientations is consistent with deposition in a hyper-concentrated flow, i.e. a dense mixture of water, sand and silt. Fragmentary leaves preserved two to three layers thick on horizontal surfaces near the bottom of the sand may indicate that a thin leaf mat had developed on the surface just prior to the deposition of the sand. These sedimentary features, and the dominance of a single leaf type at the site, suggest that the site #1 area was a highly disturbed setting. Frequent mudflows down the volcanic cone would have destroyed existing vegetation and made new surfaces available for colonizing plants."

Though some of the fossils are of exceptional quality, and of definite value in revealing climatic conditions, there are too few of them to provide a full portrait of their plant community. About 60 leaf fossils, and a few pieces of petrified wood, were collected at the sites, but, as Johnson pointed out, "paleobotanists typically need to collect 350-500 specimens per site to make an adequate assessment of species richness."

Their accessibility, along a major park road, heightens their significance, because so many students and professionals will have access to the area. An unfortunate effect of any new road construction is that some older road cuts are altered; the older, weathered exposures provide geologists and students the best

Rick Hutchinson, park research geologist, examining a road cut.

opportunities to study such sites, and that opportunity is lost when the new cut is made (one of the three key road cuts in the fossil area was altered).

The fossils' general high quality of preservation and large size further increase their educational value. Fritz described them as "a spectacular example of a tropical colonizing vegetation." Wing said that "the plants tell a pretty amazing story of climatic and evolutionary change. I think that story is important in its own right, and that it would enhance people's appreciation of what the park has." The fossils reveal a Yellowstone dramatically unlike the modern one, a far warmer and wetter environment than today's.

For the moment, a small temporary exhibit of fossils has been placed on the second floor of the Albright Visitor Center, at Mammoth Hot Springs.

Scientific excitement aside, discoveries of this sort are often at the very least an inconvenience for construction crews, for whom the resultant delays can be very costly in the short high-elevation work season. The need to resolve the issues associated with continuing the construction work added an urgency to investigations. Work at the site was in fact halted until June 13, when construction began again, with Rick Hutchinson monitoring the work to watch for fossil materials. As of late September, only one additional leaf specimen had appeared, but numerous small wood fragments of undetermined species had been collected.

Ranger Ryan Weltman Dies in Boating Accident

Shoshone Lake Backcountry Ranger Ryan Francis Weltman, 22, died in a boating accident on July 3 or 4. He failed to check in during a routine radio check on Sunday, July 3, and again on the morning of July 4. At about 8:30 a.m. on July 4, rangers began a search on foot, by boat, and by helicopter. Shortly after the search began, a visitor reported seeing a capsized boat with a white bottom on Shoshone Lake near the Narrows. At 9:59, rangers located Ryan's body and his kayak a few hundred yards from the east shore of the lake.

Winds up to 40 miles per hour had been reported late Sunday afternoon, and though the accident is still under investigation, it is assumed that wind was a factor. Ryan was wearing a life vest.

On Thursday, July 7, about 150 friends and co–workers joined Ryan's family for a memorial service at the Lake Ranger Station. He was eulogized as a bright and shining star and a dedicated

Ecology and Conservation in a Changing Landscape

Third Biennial Scientific Conference on the Greater Yellowstone Ecosystem

September 24-27, 1995
Mammoth Hot Springs Hotel
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First call for papers will be issued in the fall, 1994.
Watch for further announcements, and for additional reports in future issues of *Yellowstone Science.*

Would you like to help support wolf reintroduction ....and hang a beautiful poster on your wall?

You can, by purchasing *"I shall return..."* This poster was made possible by the Yellowstone Association for Natural Science, History & Education. The ghostly image of the wolf in the poster was originally created for the cover of the Environmental Impact Statement, *The Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho,* and now lives on in this striking poster. The poster commemorates Secretary of the Interior Bruce Babbit's signing of the Record of Decision in May of 1994, to initiate the process of reintroduction.

Wolf reintroduction is as costly as it is significant, and the public support that has driven the process so far will be crucial to its ultimate success.

The 24" x 36" poster is printed in duotone on creamy poster stock. To order, send your check for $15.00 to The Yellowstone Association, Dept. WP, P.O. Box 117, Yellowstone National Park, WY 82190

ranger, and an exceptional person who will be sorely missed.

Ryan is survived by his father, Martin Weltman of Andover, Minnesota, his mother, Signa Enos of Brooklyn Park, Minnesota, and a sister, Ursula Weltman, a seasonal naturalist staioned at Norris.

A memorial fund has been established in his name. Donations will be used for resource management projects at Shoshone Lake. Checks should be made payable to the "Ryan Weltman Memorial Fund–NPS" and sent to the Chief Ranger, P.O. Box 168, Yellowstone National Park, Wyoming 82190.

The Superintendent urges all staff, researchers, and visitors to be aware of the dangers of park travel and work. Sudden changes in conditions, and other wilderness hazards, must be kept in mind at all times.

Hantavirus Policy Update

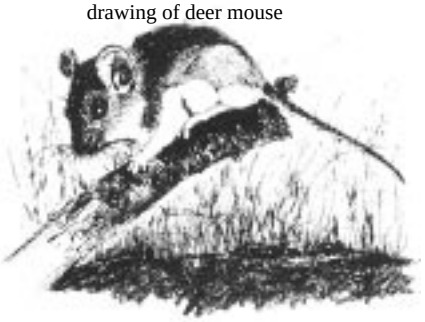
In the short time since hantavirus first made headlines, its distribution and potential effects have become the focus of a growing number of studies. Originally reported in the Southwest, cases have now been recorded in a number of states, including Montana.

Deer mice (*Peromyscus maniculatus*) appear to be the primary reservoir host, but other small mammals have tested positive for the virus. Many questions remain unanswered, however. How do population changes in deer mice influence the abundance of the virus? How do vegetation, climate, and other environmental factors affect it? How do human activities influence it?

These questions are of concern to Yellowstone residents and researchers, and so a hantavirus study has been launched in Yellowstone under Dr. Mark Johnson, NPS wildlife veterinarian. The study design for this work was developed in coordination with the Center for Disease Control's Hantavirus Task Force, which is surveying many N P S areas for hantavirus. The results of the Yellowstone study will be forthcoming in a future issue of *Yellowstone Science*, as well as in other reports.

In the meantime, the NPS in Yellowstone has produced a hantavirus policy,

drawing of deer mouse



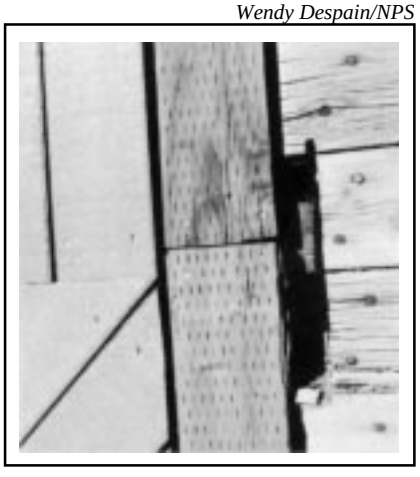
Renee Evanoff

which includes detailed guidelines for dealing with potentially hazardous situations. The policy is available from Galen Warren, Infectious Control Officer, P. O. Box 168, Yellowstone National Park, Wyoming 82190 (307) 344–2030.

Recycled Plastic Boardwalks

In the Old Faithful area, visitors are finding something new under foot. About 30 feet of boardwalk was replaced with lumber made from recycled plastic, and there's more to come. In all, 1,000 linear feet of boardwalk in the Old Faithful area will be replaced with the recycled plastic lumber. The section already in place, on a loop of walkway by Grand Geyser, was installed in May as a sort of "show-and-tell" for the visit of Secretary of the Interior Bruce Babbitt. The Maintenance Division plans to install the rest sometime in the fall when there's less traffic.

Wendy Despain/NPS



Durawood, new wood boardwalk and old wood boardwalk.

Jim Peaco/NPS

Above: Secretary of Interior Bruce Babbitt trying out the fastening system on the recycled boardwalk.
Below: an expanse of Durawood boardwalk in the Old Faithful area.

Wendy Despain/NPS

Eaglebrook Products Inc. manufactures the lumber, called Durawood. It's made of recycled plastic from thick, plastic bottles like milk containers. After processing, the lumber is 90% recycled post–consumer plastic. The lumber used in Yellowstone boardwalks is the color of weathered wood, although many different colors are available.

In testing, the color changes very little over time. Durawood doesn't absorb water, so it won't rot, warp, splinter, or crack from exposure and requires very little maintenance. It can be cut and drilled with the same tools as wood, and fastened with ordinary screws or nails. However, it isn't as rigid as wood, and can't be used in the structural supports of boardwalks. Under the uniformly–colored walkway is the same wooden structure that holds up the rest of the boardwalks in the park.

Nancy Ward, Supervisory Environmental Engineer, says there has been no trouble with the new boardwalk, although she points out that it hasn't been through a Yellowstone winter yet. She says using Durawood boardwalk in a geyser basin is very experimental. The company is confident of their products' performance, but it's never been used this way and although they have testing labs, "they don't test things like buffalo walking on it." She says it costs more than wood, but it may be cost effective to use in the future if it lasts longer than wood boardwalks.

Lever Brothers Company donated the Durawood to the National Park Foundation to promote creative uses for recycled materials. Nine other national parks will also receive recycled materials, including The Mall, Washington, D.C.; Martin Luther King, Jr. National Historical Site, Atlanta, Georgia; and Mount Rainier National Park, Ashford, Washington. Yellowstone is the first to install the donated recycled materials.