Yellowstone Science

volume 12 • number 1 • winter 2004

"Ghost of the Rockies"

Dr. Steven E. Sanderson Keynote Address

Yellowstone Mountain Lions and Art

The Life and Death of Cougar M139

TIM DAVENPORT/WILDLIFE CONSERVATION SOCIETY

A Bronx Cheer

RECENTLY, I had lunch with a number of my colleagues at the Yellowstone Center for Resources on one of those rare February days at Mammoth Hot Springs when there's a glimmer of spring in the air. It's usually fleeting, but it was the kind of day that prompts genuine discussion about the weather among those you pass outdoors. It's that winter moment when you notice that the days are growing longer, the sun penetrates the cold air to warm your face, and the sound of flowing water emanates from the downspouts and roof lines of Fort Yellowstone.

It's also the time in Major League Baseball when pitchers and catchers are reporting for spring training in Florida and Arizona for the Grapefruit and Cactus Leagues. On this day, the group's conversation turned towards spring and that field of dreams, only to realize that something divided us far greater than politics or religion ever could—we were a table of Yankee and Red Sox fans. Now, one could say that Yellowstone is to the National Park System what the Yankees are to Major League Baseball. Both are American institutions that elicit passionate emotions and convictions.

Discussion ensued on New York's recent acquisition of Alex Rodriguez, arguably today's best baseball player, following a failed trade that should have sent him to Boston. It was widely agreed that the curse of the Babe lives on. We shared stories about memorable games attended, visits to Yankee Stadium and its fabled monument park, and personal encounters with celebrated players of the past.

As a Yankee fan, it's easy for me to see the greatness that hails from the Bronx; besides being the site of the house that Ruth built, it's the place of my mother's birth (hence my lifelong devotion to the pinstripes), and it's the home of the Wildlife Conservation Society (WCS) and the Bronx Zoo.

It's appropriate that we cheer the Bronx with this *Yellowstone Science* because the work of the WCS can be found throughout this issue. It's a rather surprising serendipity that the origins for each article traced back to the WCS and the New York Zoological Park, or Bronx Zoo.

In this issue, we feature Dr. Steven E. Sanderson, president of the Wildlife Conservation Society, who traveled to Yellowstone in fall 2003 as an invited speaker at the 7th Biennial Scientific Conference on the Greater Yellowstone Ecosystem. His thoughtful and impassioned keynote address on the state of conservation worldwide is reprinted here. (Look for the full conference proceedings later this year.)

WCS scientist Toni Ruth is the leader of the Yellowstone Cougar Project. In her article and accompanying Nature Note, she chronicles the WCS's work in examining the effects of wolf restoration on the park's cougar population. In our concluding article, art scholar Peter Hassrick writes of one Yellowstone mountain lion that was sent to the Bronx Zoo in 1906 by then acting Yellowstone superintendent Major John Pitcher. Hassrick tells the story of "Yellowstone Pete," immortalized in bronze as a tribute to the park by sculptor Alexander Proctor in his work, *Panther with Kill.*

Several individuals were instrumental in the making of this issue. For their support and enthusiasm we wish to thank them: Julie Larsen Maher, creative director at WCS for providing the wonderful photos of their work; Liz Grady, director of the Thomas Mangelsen Images of Nature Stock Agency for making "Mother's Love" available; Krissy Robertson, program director of The Cougar Fund; Bonnie Murray of Third Millennium for her help with photos for Peter Hassrick's article; and Suzanne Bolduc of the Bronx Zoo photo library for the images of Proctor and his subject Yellowstone Pete.

Lastly, a large thank you goes out to our own Tami Blackford for *Yellowstone Science's* new look. We're excited about the results and we hope you will be too, as the magazine and the design continue to evolve this year. In the immortal words of Yankee legend Yogi Berra, "The future ain't what it used to be."

Roger Anderson

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For back issues of *Yellowstone Science*, please see www.nps.gov/yell/publications.

Submissions are welcome from all investigators conducting formal research in the Yellowstone area. To submit proposals for articles, to subscribe, or to send a letter to the editor, please write to the following address: Editor, *Yellowstone Science*, P.O. Box 168, Yellowstone National Park, WY 82190. You may also email: Roger_J_Anderson@nps.gov.

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on the cover:
"Mother's Love"
© Thomas D. Mangelsen
Images of Nature Stock Agency

Dr. Steven E. Sanderson is President of the Wildlife Conservation Society, which is dedicated to preserving biodiversity in landscapes such as the mountains of Africa's Southern Rift. Above is the Mt. Mulanje Massif in Malawi, a WCS study site.

FEATURES

DEPARTMENTS

News & Notes

NPS/JIM PEACO

Cougar Kitten Sighted

A mountain lion kitten (photo above) was seen on February 16 near Seven Mile Bridge on the West Entrance Road. The kitten, whose mother was not observed at the time, spent about an hour on the bank of the Madison River and on a downed tree in the river. It vocalized for a while and was seen by NPS employees, skiers, and passengers of a Xanterra snowcoach. After everyone but the park's photographer had left, the kitten walked back to the road, traveling west for about 60 yards. It then started to follow a packed game trail south of the road. A snowcoach driver later reported seeing an adult cougar with two kittens in the same area across the river.

U.S. District Court Decision on Winter Use

On February 10, 2004, U.S. District Court Judge Clarence Brimmer issued an order temporarily restraining the National Park Service (NPS) from enforcing the 2001 Snowcoach Rule in Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway. Judge Brimmer also required the NPS to promulgate temporary rules for the remainder of the 2003–04 season that were fair and equitable to all parties.

An amendment to Yellowstone's Superintendent's Orders was signed February 11 to allow continued managed snowmobile use in the park. Grand Teton National Park signed a similar order. At the close of the season, the following restrictions were in place for Yellowstone:

- 780 snowmobiles allowed to enter the park per day. Previously, 493 snowmobiles were allowed per day. The 780 snowmobiles were allocated as follows: West Entrance, 400 (previously 278); South Entrance, 220 (previously 90); East Entrance, 100 (previously 65); North Entrance, 60 (numbers remained the same).
- The additional 287 snowmobiles allowed by the Superintendent's Order were required to be Best Available Technology (BAT) snowmobiles.
- All snowmobiles had to be commercially guided.
- Routes that were previously designated snowcoach only remained snowcoach only.
- Park operating hours remained the same, open 7 AM to 9 PM.

NPS

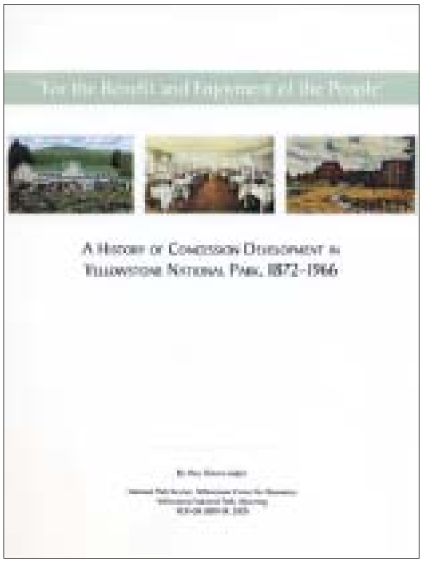
For Grand Teton National Park and the John D. Rockefeller, Jr., Memorial Parkway, the following restrictions were in place at the end of the season:

- 140 snowmobiles allowed each day. The snowmobiles were allocated as follows: Grassy Lake Road (Ashton-Flagg Ranch), 50 snowmobiles per day (previously 25); Continental Divide Snowmobile Trail, 50 snowmobiles per day (previously 25); Jackson Lake (fishing access only), 40 snowmobiles per day (previously 0).
- Snowplanes prohibited on Jackson Lake.
- No requirement for guides or BAT in Grand Teton or the John D. Rockefeller, Jr., Memorial Parkway.
- The Grand Teton Park Road (the inside park road) open to skiing and snowshoeing only.

Information on winter use in Yellowstone, including the Judge's Order, can be found at www.nps.gov/yell. Information on winter use in Grand Teton and the John D. Rockefeller, Jr., Memorial Parkway, including the interim rule, can be found at www.nps.gov/grte.

New Publication Available

A History of Concession Development in Yellowstone National Park, 1872–1966, by Mary Shivers Culpin, is now available from the Yellowstone Center for Resources. The main purpose of this report is to develop a historic context in which to evaluate the significant resources associated with concession development in the park. If you are interested in obtaining a copy, please



contact Virginia Warner at (307) 344-2230, or virginia_warner@nps.gov.

Grand Loop Road Listed on the National Register

On December 23, 2003, the Grand Loop Road Historic District was listed on the National Register of Historic Places. Other historic roads have been listed on the National Register, but few are listed as "nationally significant" (they are either state or locally significant). Even fewer of the historic roads listed are of the size (over 140 miles long) of the Grand Loop Road. The documentation of the historic, character-defining features of 140 miles of road is a feat in and of itself.

Another extraordinary thing about the NR listing of the Grand Loop Road is that it occurred while the historic road is under reconstruction, an effort that has been successful in retaining the road's historic character and integrity. Much interagency (Yellowstone National Park, National Park Service Regional Office, Federal Highway Administration, Historic American Engineering Record, and numerous outside consultants) and interdisciplinary (personnel from the natural and cultural branches of the Yellowstone Center for Resources, maintenance engineers and landscape architects, and planning, law enforcement, and interpretation personnel) effort has been expended to keep this historic road historic.

Work is being concentrated to get another NR nomination (the West Entrance Road) completed and out for draft review. The documentation of the current West Entrance Station (being completed by Jim McDonald) will be included in the nomination as soon as it arrives. National Register nominations are also currently being prepared for the park's Corkscrew Bridge as well as two Precontact archeological sites.

Northern Yellowstone Elk 2003–04 Winter Count

The Northern Yellowstone Cooperative Wildlife Working Group was formed in 1983 to cooperatively preserve and protect the long-term integrity of the northern Yellowstone winter range for wildlife species by increasing our scientific knowledge of the species and their habitats, promoting prudent land management activities, and encouraging an interagency approach to answering questions and solving problems. The group is comprised of resource managers and biologists from Montana Fish, Wildlife and Parks, National Park Service (Yellowstone National Park), U.S. Forest Service (Gallatin National Forest), and U.S. Geological Survey-Northern Rocky Mountain Science Center, Bozeman.

The group conducted its annual winter survey of the northern Yellowstone elk population on December 18, 2003. A total of 8,335 elk were counted during relatively good survey conditions. Approximately 75% of the observed elk were located within Yellowstone National Park, while 25% were located north of the park boundary. Biologists used four fixed-wing aircraft to count elk through the entire


NPS

The use of natural materials and quality workmanship of the Gibbon River Bridge exemplify the historic qualities that make the Grand Loop Road nationally significant.

northern range during the one-day survey. The northern Yellowstone elk herd winters between the northeast entrance of Yellowstone National Park and Dome Mountain/Dailey Lake in Paradise Valley.

This year's count of 8,335 elk was below the 9,215 elk counted during December 2002. The long-term trend in counts of northern Yellowstone elk suggests that their abundance has decreased at an average rate of approximately 6% per year since 1994. Yellowstone National Park wildlife biologist P.J. White said that "predation by wolves and other large carnivores, and human harvests during the Gardiner area late season hunt, have been the primary factors contributing to the decreasing abundance of northern Yellowstone elk since the mid 1990s." Other factors that have contributed to decreased elk abundance include a substantial winter-kill owing to severe snow pack during 1997 and, possibly, drought-related effects on pregnancy and calf survival.

The Gardiner late season elk hunt was designed to reduce elk abundance outside Yellowstone National Park so that elk numbers do not cause long-term changes in plant communities or decrease the quality of the winter range. Tom Lemke, biologist for Montana Fish, Wildlife and Parks, indicated that "as total elk numbers and elk migrations outside of the park have declined in recent years, we have continued to incrementally reduce the number of antlerless elk permits for the Gardiner Late Season Elk Hunt from 2,880 in 1997 to 1,400 in 2004." Montana Fish, Wildlife and Parks will continue to use an adaptive harvest management approach to set biologically based permit levels. Lemke predicted that "based on current trends in the size of the elk population and low elk recruitment rates, elk permit numbers and the late season harvests will likely remain at conservative levels for the next several years." The Gardiner Late Season elk harvest has decreased from 2,365 elk in 1997 to 718 elk in 2003. Lemke added, "Most hunters clearly understand that fewer elk on the ground will translate into reduced hunting opportunities…that's how the system is designed to work." The working group will continue to monitor trends of the northern Yellowstone elk population and evaluate the relative contribution of various components of mortality, including predation, environmental factors, and hunting.

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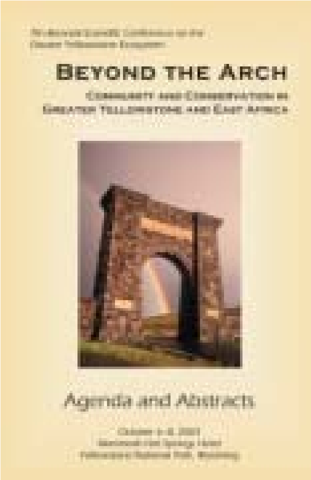
An elk herd in the Lamar Valley on Yellowstone's northern range.



Dr. Steven E. Sanderson Keynote Address

Delivered at the 7th Biennial Scientific Conference on the Greater Yellowstone Ecosystem *Beyond the Arch: Community and Conservation in Greater Yellowstone and East Africa*, October 7, 2003

DENNIS DEMELLO/WILDLIFE CONSERVATION SOCIETY

Dr. Steven E. Sanderson (above, at the Bronx Zoo Bison Range) is President and CEO of the Wildlife Conservation Society (WCS) in New York. Prior to his appointment in 2001, he was Dean of Emory College, Faculty of Arts and Sciences, at Emory University in Atlanta. He received his Ph.D. in Political Science from Stanford University (1978), with a specialty in Latin America. He has been involved with the organization of scientific cooperation on the environment, through the Social Science Research Council, the International Geosphere-Biosphere Programme, and the NRC Oversight Committee on Restoration of the Greater Everglades Ecosystem. A former Fulbright Scholar, Dr. Sanderson has also held fellowships sponsored by the Rockefeller Foundation, the Woodrow Wilson International Center for Scholars, and the Council on Foreign Relations. In addition to several scholarly books about Latin America, his recent publications are "The Future of Conservation," Foreign Affairs *(September 2002); and "The Contemporary Experience of Wild Nature and its Importance for Conservation," (June 2003).*

It is a delight to be included in the ambitious and important program of this conference, in such a beautiful part of the world. I am not an expert in the specific subjects of this conference, but I do represent an organization that is devoted to the protection of great landscapes such as the Serengeti and Yellowstone systems, as well as the sustenance of the wildlife they support. I also grew up on the western slope of the Rockies in Colorado, and I lived my first 13 years in and around the Gunnison/Crested Butte area and in Montana during the late 1940s to 1960. During that time I experienced the transformation of Crested Butte from a sleepy mining and ranching community to one that boasted a tourist economy, and then ecotourism.

I should also add that the bison restoration in the West was sponsored by the New York Zoological Society, our founding organization, and began at the Bronx Zoo. My office is there, and directly across the great court is the historic Lion House where Theodore Roosevelt and William Hornaday, our founding director, created the American Bison Society to repopulate the American West with Bronx Zoo bison. Incidentally, the bison exhibit at the Bronx Zoo was one of the first naturalistic exhibits in any zoo in the world—a 20-acre prairie in a temperate woodland, which hosted the genetic bison stock that populated a lot of this country. So, when you see bison in Yellowstone or the Flathead country, you are looking at the descendants of proud New Yorkers.

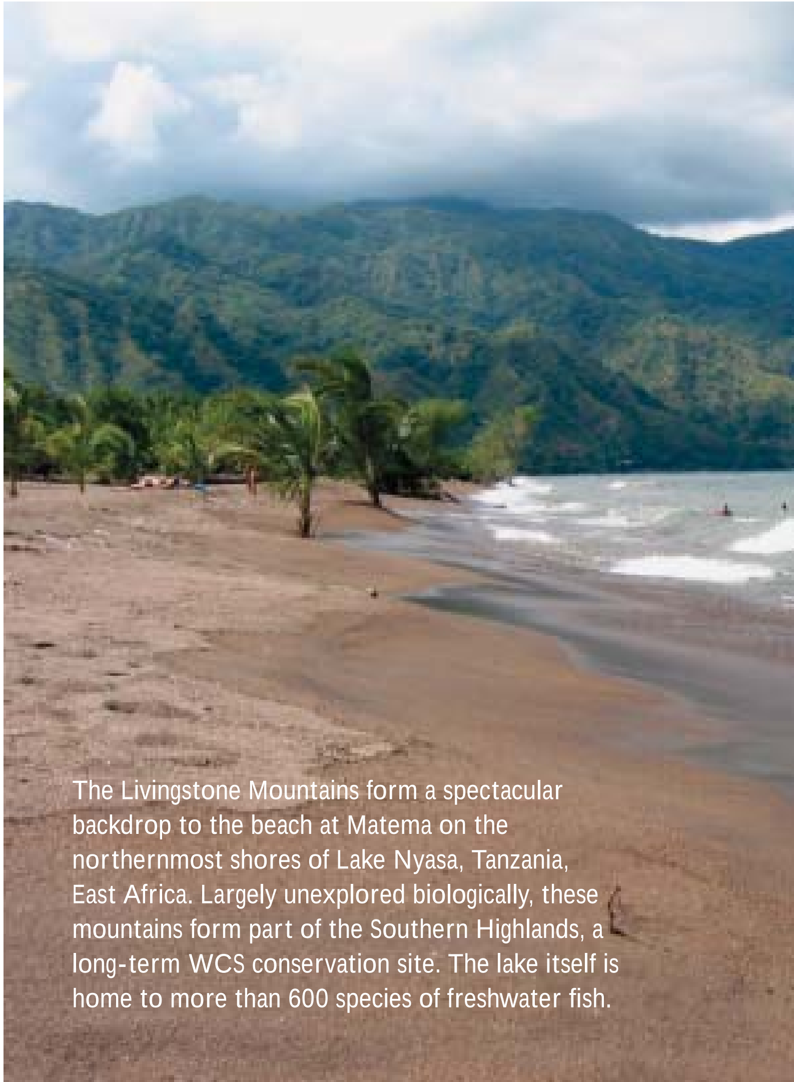
NPS

The conference keynote speakers, pictured here with Yellowstone Center for Resources Director John Varley. From left, Drs. Lee Talbot, George Mason University; Robin Reid, International Livestock Research Institute; Steven E. Sanderson, Wildlife Conservation Society; Charles Preston, Draper Museum of Natural History; Dan Flores, University of Montana; A.R.E. Sinclair, University of British Columbia; (John Varley); and Richard Leakey, of Nairobi, Kenya.

I am filled with admiration for the principal speakers at this meeting, from whom I have learned so much. Dan Flores, Richard Leakey, Tony Sinclair, and Lee Talbot, as well as others on the program represent the very best in natural history, science, and conservation action. Whatever our individual strengths and weaknesses, our work together in coming years is extremely important to the future of life on Earth.

My message to the conference is partly a pessimistic one. From the standpoint of conservation, which is at the intersection of science and public purpose, the temper of the times is not very good. The public commitment to conservation is a muddled one, and it has real implications for our work together as scientists, scholars, and public servants. In Johannesburg last year at the World Summit on Sustainable Development, the world appeared very publicly to walk away from the commitments it had made at the Earth Summit in Rio in 1992, and which had begun at the pathbreaking summit in Stockholm in 1972. By the end of the Johannesburg Summit, conservation had been almost completely obliterated from the public consciousness of the multilateral system in favor of yet another rendition of sustainable development.

This year, the World Parks Congress in Durban, South Africa, was a troubling and difficult exercise, in which conservation was hardly invoked with pride. The chosen theme, "Benefits Beyond Boundaries," should have reiterated a commitment to extend the impact of protected areas to their surrounds. Instead, the discussion turned into a confused, rambling



TIM DAVENPORT/WILDLIFE CONSERVATION SOCIETY

The Livingstone Mountains form a spectacular backdrop to the beach at Matema on the northernmost shores of Lake Nyasa, Tanzania, East Africa. Largely unexplored biologically, these mountains form part of the Southern Highlands, a long-term WCS conservation site. The lake itself is home to more than 600 species of freshwater fish.

discussion that focused on the elimination of the hard edges of protected areas, which we have strived to create over decades of time, and which we should be proud to have achieved: 10 percent of the world's terrestrial surface under some kind of protection. Somehow, credible international conservationists who had worked hard to create those protected areas now positioned themselves more conservatively, to support a much more restricted notion of protected areas that would have "no net negative impact on local peoples"—without so much as a definition of what a "local people" was, much less what "no net negative impact" might mean. Conservationists know well that when there is a publicly contested question of the allocation of natural resources, stakeholders claiming to be local spring up all over the place, with varying degrees of legitimacy. So, for the conservation community to make such arbitrary and unspecified stipulations was disturbing. Additionally, some advocates for indigenous peoples argued—without so much as a word of opposition—that protected areas had been the worst thing ever to have happened to them. The Congress, apparently acquiescing to such categorical statements, conceded that protected areas had to be justified by economic and social criteria, not conservation or ecological integrity. There was very little mention of the achievements of the conservation community or its historic goals. And, in fact, there was a great deal of homage paid to the rural development community, despite the fact that the broad concepts of development offered in the post-World War II era have failed to prove their sustainability or their value to the truly poor.

"From the standpoint of conservation, which is at the intersection of science and public purpose, the temper of the times is not very good."

These issues have been almost uncontested in the rush to promote poverty alleviation in the new millennium. The United Nations (UN) and the multilateral development community goals for the new millennium barely mention conservation. In fact, in the millennium development goals of the UN and the World Bank, sustainable resources with respect to human development have actually taken the place of conservation. The World Bank's new forestry sector policy has shifted from conservation to human poverty alleviation, after a decade of staying out of financing projects in tropical moist forests because the bank itself (along with its many critics) became concerned with the negative impact such projects might have

on the all-too-rapid process of tropical deforestation. The argument for returning to forestry sector loans appears to be that somehow, 10 years later, the world knows enough about achieving sustainable forestry practices throughout the world. The evidence for this claim is missing.

The desire to relieve the world of extreme poverty is a laudable social goal. It is implicitly valuable to human life on Earth, and close to the hearts of those of us who work in developing countries, but also in the American South and West. Poverty is a difficult, degrading human condition that needs attention of the kind that the millennium development goals are paying. And it bears directly on who we are as conservationists. Conservation, like poverty, is a cultural concept, and our culture is concerned with human social progress. As the eminent conservationist Richard Leakey has said in his writing, he is not sure he would be so conservation-minded if he were hungry and cold.

> "…wild nature in our time has been converted into a contested area that is debated, not in terms of nature itself, but purely in terms of economic potential."

However, something or some force in the global community has led the world to believe that conservation of protected areas should be responsible for bearing a great deal of the burden of economic development and local poverty alleviation in the world. How we came to that is a matter of great mystery, especially since the economic growth and development of much of the world has led to a protected areas system that is a tiny fraction of the terrestrial biosphere. The remainder, for better or worse, has been open to development and has been rapidly transformed in the last century, with increasing speed in the post-World War II period. Now, in Equatorial Africa and South and Southeast Asia, where much of the world's rural poverty is concentrated, plans for poverty alleviation depend on increasing agricultural productivity in existing land, using more energy and water, and intensifying livestock husbandry in fragile lands.

The goals of hunger alleviation require that such improvements must accrue to local peoples, as well, but the history of agricultural productivity and the Green revolution during the post-World War II era do not inspire confidence. After all, in 2003, 75 percent of the world's poorest populations are in the countryside after 50 years of agricultural development. Even in the greater Yellowstone area, we can find evidence of local peoples being crowded out or hurt by what appear on the surface to be good ideas for development.

JULIE LARSEN MAHER/WILDLIFE CONSERVATION SOCIETY

WCS is involved in studies that focus on the ecology and behavior of carnivores in livestock-producing areas.

I believe this process around the world is the product of shortsighted economic development ideas, a continuing emphasis on sectoral economics in the face of decades of environmental failure, and a reading of past and future that is more convenient than true. In the American West, much of the so-called local protest against environmental restrictions actually is a stalking horse for large-scale energy, mining, agricultural, and more recently, tourist endeavors that often displace people to less attractive areas where they now staff the service sector for the rich interloper. The issues are posed as local, but they are often national (in the case of energy) or global and corporate, in the case of subsidies or mineral permits.

In any case, wild nature in our time has been converted into a contested area that is debated, not in terms of nature itself, but purely in terms of economic potential. It is my hope that our work together in the future will be controversial in the best sense, pushing flaccid and poorly-argued concepts out of the way in favor of sharper ideas, good science, and plans for conservation. And the first way to do that is to ask how all this happened, and how current forces are arrayed, so that we assess how we act most appropriately. When one looks at the history of any natural system that is human-impacted—and that certainly applies to the focus of this conference—one has to grant a big swath of ground to politically-infused memory. History as we know it is quite often the political use of facts or phenomena in the past to create myths and opportunities for the future.

In the case of natural resource systems, quite often there is a direct political use of natural phenomena, so that a flood on the Mississippi River produces greater effort to engineer flood control. Likewise, in the aftermath of the degradation of the Everglades, the federal government and the State of Florida are investing billions of dollars to recreate the Everglades, restore it, and re-engineer it, and, in fact, re-plumb it. Whether in the Everglades or the Mississippi, history becomes the reinvention of failure as success.

Similarly, in the international community, rural development and human poverty alleviation are reinvented failures now parading as successes. The ostensibly new tools, mechanisms, and models for rural development in the world today go back to the 1940s and 1950s. The only thing that is missing is the intellectual leadership of the post-war economic development theorists, who really led the way to a new way of looking at human progress. Missing also is a serious self-conscious critique of the failures of rural development in our time. River basin development of the kind now in play in the Mekong River Basin is, in fact, similar to projects from the 1960s and 1970s that were emblems of environmental disaster. Integrated rural development projects, increased inputs, credit availability, and agricultural intensification, the integration of agriculture into commercial markets and livestock production—these are all old, old ideas, dogged by as much failure as success. The community-based development ideas bandied about today are not much different than those in practice in Vietnam under the French.

Turning to the landscapes under consideration in this meeting, wilderness and preservation in Yellowstone and Serengeti were invented concepts, invented for specific political purposes. In both places, wilderness and preservation were concepts that did not take into account aboriginal presence. And so they have been, as we have learned over the last hundred years, demonstrably false as explanations of the natural systems of the Rocky Mountain West and East Africa. There has also been a reinvention of the explanation for our current condition, in which the extirpation of wildlife in wild systems has been blamed on the poor. Maurice Hornocker will tell you that cougars were shot out of the American Southwest by 1925, and it was not by the poor.

But the conversation today in the global community insists that poverty leads to degradation and species extinction. Conservation, as the argument goes, stands in the way of economic development and so must be pushed aside in favor of sustainability. Conservation has been reinvented not as a promise for the future, but an obstacle to economic success, and so instead of building on the 10 percent of global lands under some kind of protection, they and their protectors are indicted for keeping people out and keeping people poor. And in landscapes like Yellowstone or Serengeti, or the Mekong or Congo Basins, there is proposed what Dan Flores has referred to as a leap from extractivism to

PATRICIA CALABRESE/WILDLIFE CONSERVATION SOCIETY

Over the next dozen years, the conservation community is charged with transforming the tropical forested countries of the Congo Basin from a logging economy into an ecotourist economy.

ecotourism without the intervening steps. So that in the Congo Basin, one of the most demanding and difficult deliverables that the conservation community is charged with over the next dozen years is to transform what is essentially a logging economy into an ecotourist economy in which there will be no disadvantage to the tropical forested countries of the Congo Basin and, in fact, there will be a clean sustainable future based on European, American, and South African tourism.

"In the United States and in pre-independence Africa, wilderness and preservation were concepts that were developed without regard to people."

The conservation community may welcome the opportunity to make this historic shift, but it requires a standard never demanded of other, less conservation-minded economic agents. To go from logging directly to ecotourism is extremely difficult, just as it was extremely difficult in Crested Butte, Colorado, to go from coal mining to ecotourism without asking about the income gap or the dislocation of local peoples. I can promise you, you cannot find many of the people who lived in Crested Butte when I was born living there today, and I don't mean just that they've all died. Their families are not there. And it was because of the income gap. Likewise, the residents of Aspen today are not those of past generations. To the extent they remain, they are dotted along the valley road to Glenwood Springs. And so on.

There is not a given socio-economic benefit to changing an economy from an extractive base to an ecotourist base. The potential conservation benefit is much clearer. If conservation actually does have to do with human landscapes as well as natural landscapes, someone has to develop viable, realistic human benefits from the economic changes being proposed. And it must be done "on the run," as an ersatz model of economic development with putative ecotourism carving up the landscape.

It is worth noting, too, that conservation has become derivative of human use because the public agencies charged with conservation are also charged with satisfying the public. Nowhere in this world is it harder to satisfy the public than in the United States. The public agencies charged with protecting national forests, public lands—the Forest Service, the Park Service, Bureau of Land Management, all of the public agencies—have to respond to what people want, as expressed through organized civil society and the political process. So, conservation goals become derivative of human use practices. Perhaps no better case exists than the ongoing controversy over winter use rules for snowmobiles in Yellowstone. Twenty years ago it was not an issue; but now, more than 100,000 people use Yellowstone Park in the winter

TIM DAVENPORT/WILDLIFE CONSERVATION SOCIETY

Villagers, staff, and Dr. Tim Davenport on Mt. Rungwe, Tanzania, East Africa. The WCS's Southern Highlands Conservation Program is working to conserve upland habitats and important species of flora and fauna across the mountains of southern Tanzania. These highlands sit between Lakes Nyasa and Tanganyika on the junction of the eastern and western arms of Africa's Great Rift Valley. Montane and riverine forests, plateau grasslands, and crater lakes provide water, natural resources, and cultural identity to thousands of people, as well as refuge to more than one hundred varieties of animals and plants found nowhere else on Earth.

“For the Benefit and Enjoyment of the People”


TOM ROBERTS

every year. The impact of that use is a fundamental issue for Yellowstone and for the National Park Service.

Similarly, in the early 1990s a survey was conducted of visitors to Yellowstone. People asked to rank what they liked about Yellowstone mentioned most often walking outside, going to the visitor center, and shopping. One imagines that in 1872, there must have been something else on people’s minds when Yellowstone was created. While one might approve or disapprove of the hierarchy of consumer demand, national parks cannot be divorced from public satisfaction. That fact is etched on the Roosevelt Arch. The Park Service is not charged with telling the American people what they should insist upon in the parks. But the consumer is a new stakeholder in protected areas, in a way that might not necessarily serve the interests of conservation.

This confusing and distressing place in the history of conservation has come to us thanks to a lack of leadership on all sides. By that I mean that no organization or political consensus has emerged to seize the agenda for conservation in these great landscapes in the way that there must be. In the absence of such convincing hegemonic leadership, society risks a catastrophic compromise in which no one would be satisfied, in which all of the belligerents would butt heads for a period of time, and in which no public policy solutions would be stable.

In conservation today we may be witnessing a convergence of weakness on all sides, development, economic growth, and conservation—from the multilateral to the local political forces in conservation that pull at the complex issues under consideration at this conference and beyond. Wildlife biology is in a tragically weak position, though getting stronger. It is of enormous importance to conservation, but only about a half-century old. The monographic studies and continuous databases on wildlife rarely stretch beyond the life of an individual animal, 8 to 10 years, and some of the longest continuous observations are 20 years. That shallowness in chronological time means that wildlife biology does not have explanations for many of the long-term consequences of different conservation strategies.

Wildlife biology also suffers from the skepticism of public authority. Public authorities view science with a jaundiced eye. Sometimes science plays a positive role in helping define the terms of reference for a public ecosystem restoration. In the Everglades, National Park Service biologists and independent scientists are looking at snail kites and crocodilians, and the hydrologists at salinity and sheet flow, all of which contributes to the creation of models that will drive that restoration. Unfortunately, the role of science is circumscribed in the Everglades, too. When those models cross the political or public policy line, they are pretty readily kicked back across the line or discarded. For example, the restoration of a truly natural Everglades ecosystem by definition of the restoration plan cannot prejudice water availability or flood control for the populations of Floridians outside the Everglades boundaries. The restoration is delimited politically by the very human impacts that degraded the system in the first place. It is not censorship or bad faith, necessarily, but science with a complicated political value assigned to it is often unwelcome. Far better than the Everglades is the case of the Intergovernmental Panel on Climate Change, where despite the scientific consensus and the moderate tone of the panel, the political use of science in public discourse is problematic.

Beyond the uneven experience with domestic public authority, conservation biology does not articulate well with the multilateral development assistance community. Conservation does benefit in some ways from official development assistance, or multilateral development strategies. But it is not an exaggeration to say that conservation has little role in setting their institutional agendas. Conservationists understand little and have even less of a role in multilateral trade, structural adjustment, and international finance. We simply are not at the table.

Some of this arranged irrelevance is the fault of applied science itself, especially its truncated scope. Wildlife biology has been very confused historically about people. Protected areas have been demarcated without regard to local people. Indigenous peoples and frontier folk alike have been demeaned by some protectionist strategies or dislocated by well-meaning conservationists. In the United States and in pre-independence Africa, wilderness and preservation were concepts that were developed without regard to people.

Conservation science has little reputation in the social science community, which itself understands little about natural systems. Social science invests little in knowing anything about wildlife or wild lands. Social scientists tend to spend very short field stints and to fix economic or social equilibrium rather than explore its dynamics. Social scientists in the academy—like their life science counterparts—have no management accountability, which conservation organizations and public agencies do. And they have generally failed to acknowledge or write up successfully the failures of rural development.

Public agencies are burdened by uneven levels of capacity and discretion, and extremely political environments in which to work. The multilateral community does not appear to have any accountability for the projects it supports. While criticism abounds, it is difficult to imagine a circumstance in which the multilateral development banking system will actually be held to account for its loans and project ideas. The same can be said of the World Trade Organization, the International Monetary Fund, and numberless regional development authorities. Combine that lack of accountability with the endless infatuation with hopeful rhetoric and a recipe for adventurous experiments is ready. One might readily include the quest to eliminate half of the world's poverty by the year 2015 in that category.

Non-governmental organizations, for their part, completely lack political legitimacy. However important the work of NGOs, they are always in the position of never having been elected or legitimated by any political process. NGOs are able to work only as long as they are convenient to those in power.

What is to be done? It is an important question, because conservationists have failed to produce a positive agenda that the world can accept and be enthusiastic about. Conservationists can cleave to their core mission by creating models of the kind that are being discussed at this conference, models that integrate human social variability into natural system models. That requires an integrative science that does not yet exist. It does not make sense to talk about the human side of the question separately from the natural side of the question, nor to hold meetings about conservation priorities without a joined social and natural science community.

The community that gathers around these questions has to work at multiple scales, to think about distal drivers, not just local drivers. That also means understanding globalization more seriously. Recently, Montana cattle prices spiked because of BSE [Bovine Spongiform Encephalopathy] in Canada, and the embargo on the imports of cattle from Canada. Since that time, prices have reversed again, thanks to the appearance of BSE in the American West. Forces like that have impact on natural and social systems all the time. And yet conservation does not consider multiple scales for research. Yellowstone is not simply a park, but a linked landscape from the Elk Refuge all the way up into Canada.

“…conservationists must keep their boots muddy.”

In addition to working in an integrative fashion, conservationists must keep their boots muddy. Many organizations in this world do conservation by proclamation. Real conservation must be groundtruthed, and conservation actors must create a contingent model for conservation action as well as scientific observation along the lines of strong, adaptive management principles.

In the end, the community of conservation science, and the science of protected areas and these great landscapes, must cleave to the mission of conservation: the sustenance of wildlife and wildlands in changing human circumstances. As Clifford Geertz would say, that has to be “lit by the lamp of local knowledge.” But it always has to refer back to larger objectives. This community I am addressing must be the best, but with a clear set of outcomes in mind. The positive alternative is a science for conservation in small, out of the way places that is associated with human betterment. It can be done, but it's not easy. Conservation can inspire people to care about wild nature, people who are alienated from wild nature in every facet of their modern life. Conservation can educate young people to science in an applied way that excites them, rather than in the classroom with principles of science. Conservation can create a positive concept of wildlife health, addressing everything from how prey densities may affect populations of lions in the Serengeti to the sources of chronic wasting disease in the American West.

Finally, conservation can represent two-track diplomacy, working in systems where it is very difficult to work politically. By linking science and community development to positive outcomes, conservation can create alternative pathways to formal diplomacy. Does the proclamation of Iran as part of the Axis of Evil make the conservation of the remaining populations of Persian cheetah less important?

Above all, conservation has to represent the integrity of mission, of conservation, knowledge creation, and stewardship, and a vision of a future in which people and nature can co-exist. That's a very bright promise, a very demanding agenda. But it's one that I believe all of us at this meeting share. It crosses from academic to applied organizations, and from private NGOs to public agencies like the National Park Service. I congratulate you on being a part of it, and look forward to your deliberations, which undoubtedly will help us all.

Thank you.

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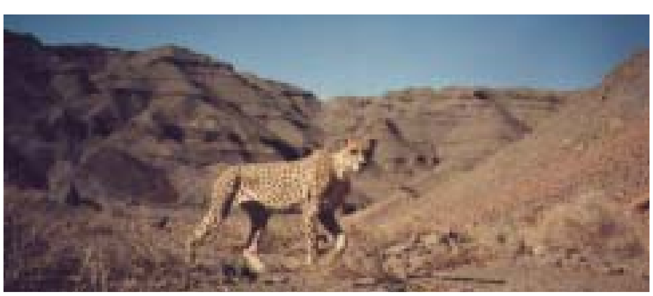

I.R. IRAN D.O.E./WCS

A camera-trap photo of an Asiatic cheetah in the Naybandan Wildlife Refuge, Islamic Republic of Iran.

"Ghost of the Rockies"

The Yellowstone Cougar Project

Toni K. Ruth

A clear winter day spent snowshoeing on Yellowstone National Park's northern range brings a crystalline beauty and a daily news story written in tracks on the white pages spread out across the plateaus and rocky ledges along the river corridor. On this morning, the story is also carried in on crisp air in a raven's caw and the howling of wolves nearby. On many winter days, the ravens and wolves tell a tale of survival through the killing and scavenging of prey. Their story is often audible and visible from the road and surrounding knolls and, frequently, a good pair of ears, eyes, and a spotting scope will transfer the information to diligent human observers. Winter is a good time to hear and see the wolf and raven story; a story of successful reintroduction of our nation's top canid and the resulting effects on prey and other species unfolding before the eyes of spectators.

TONI K. RUTH/WILDLIFE CONSERVATION SOCIETY

Cougars use habitats such as trees and rocks as escape cover from dominant carnivores and as hunting cover.

THE RESTORATION OF WOLVES to Yellowstone has brought a wealth of opportunities for studying ecological relationships among the park's diverse wildlife species. We are learning, for example, that the wolf has been a significant influence on the evolution of raven, elk, and deer behavioral and morphological characteristics (Mech 1970, Stahler et al. 2002). However, there is another carnivore at the top of the predation pyramid that has a significant influence on prey and scavenger populations, and whose behaviors and distribution were influenced by wolves through evolutionary time. This carnivore's story is less well-known, rarely audible, and certainly less visible in Yellowstone, but the story is there, lurking in the rocky ledges and under the cliff rims of the northern range. *Puma concolor*, the American cougar or "ghost of the Rockies," is Yellowstone's most common cat species, and my field crew and I spend our days trying to unravel the mysteries of how cougars and wolves interact with each other, and their prey, in hopes of providing a scientific basis to assist in the management and long-term conservation of these ecologically important species.

Since 1986, the Hornocker Wildlife Institute (HWI), now a program of the Wildlife Conservation Society, has been involved in cougar research in the northern Yellowstone area (fig. 1). During 1986–1994, Dr. Kerry Murphy, then a biologist with HWI, conducted intensive research to evaluate the ecological role of cougars in the northern Yellowstone ecosystem (Murphy 1998). Thus, our studies include the unique ability to compare cougar ecology and predation on prey as a before (pre-wolf establishment) and after (post-wolf reintroduction) experiment.

The goal of our post-wolf reintroduction, or Phase II, study is to quantify cougar ecology and the ecological relations among the guild of large carnivores in Yellowstone: cougars, wolves, and bears. Our specific objectives are to 1) document the characteristics of the cougar population, including population size, survival rates, causes of mortality, and natality rates; and compare results with the pre-wolf data on cougar population characteristics in the northern Greater Yellowstone Ecosystem and similar data collected on cougars in the southern Greater Yellowstone Ecosystem and study sites in Idaho; 2) assess the

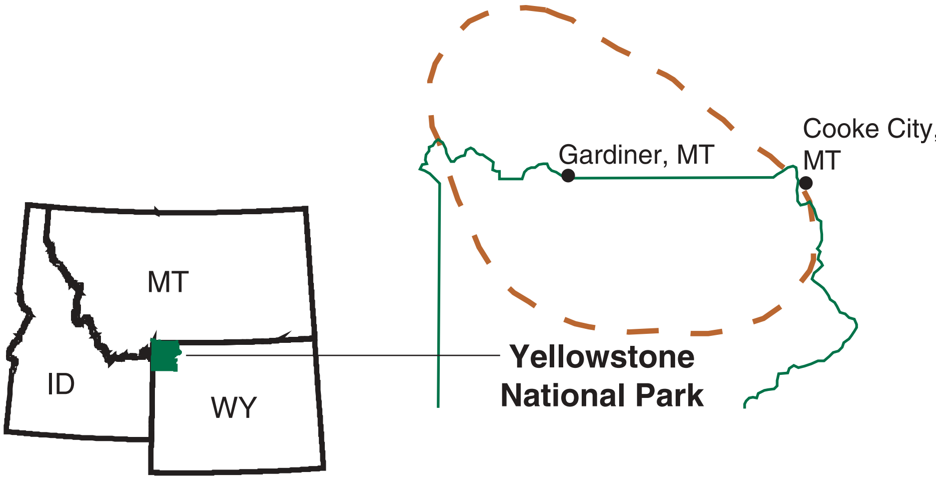

Figure 1. The Yellowstone Cougar Project study area.

and management perspectives. Eventually, continued research and knowledge about these carnivores led to hunting regulations or full protection that resulted in successful re-establishment of both species. Cougar populations across the West have expanded in distribution and abundance as a result of active management programs (including the elimination of bounties) and increased populations of deer and elk, species that represent primary prey for cougars. In Yellowstone, sightings of cougar tracks and cougars began to increase in the early to mid-1980s and Hornocker Wildlife Institute researchers confirmed the presence of enough cats in 1986 to propose a study on the park's northern range. Some believe the cougars that initially re-established in Yellowstone likely made their way here from the wilderness in central Idaho. Cougars probably survived well in the central Idaho wilderness during the bounty period due to its inaccessibility. In 1995, wolves were reintroduced to Yellowstone National Park (YNP) and Idaho as a result of tremendous public support.

effects of cougar predation on elk and mule deer populations as influenced by the presence of wolves; 3) assess competition and resource partitioning between cougars, wolves, and bears by comparing the species' spatial and temporal habitat use patterns and prey utilization characteristics; and 4) communicate and integrate this knowledge into management and conservation planning in the greater Yellowstone region. Our goals and objectives are not possible without strong collaboration with the Yellowstone Wolf Project and the Interagency Grizzly Bear Study Team. We work closely with both these projects to discuss ideas and methodologies to employ that will gain greater understanding of the carnivore community.

Background

Less than a century ago, cougars and wolves were pursued and killed because humans perceived them as threats to prey populations, livestock, and human safety. Heavy killing was exacerbated by a lack of knowledge about these species and, coupled with rapid human development and habitat fragmentation, cougars and wolves were quickly eradicated from the eastern United States (except for a small population that persists in southern Florida). While a similar campaign of eradication successfully removed wolves in the West, the secretive cougar survived due to the difficulty of pursuing an enigmatic, solitary animal, and because large areas of the rocky, rugged habitat they require remained intact. In Yellowstone, both species were hunted and trapped to protect ungulate populations within YNP and livestock in surrounding areas. Similar to the eastern U.S., the Yellowstone predator removal campaign resulted in the extirpation of cougars and wolves from the park around 1930.

Not until the late 1960s did the pioneering work of Maurice Hornocker on cougars and David Mech on wolves provide factual information that led to changes in human perceptions

An understanding of this history is important to looking forward, beyond today and towards the next century. While populations of cougars and wolves in the West appear to be doing well today, on the horizon lies a convergence of two main threats similar to historical threats that caused the eradication of these species: habitat loss and fragmentation, coupled with overkill by humans. Many areas of the western United States are experiencing rapid development, including the greater Yellowstone area, where it is generally occurring along lower elevation valleys (Hansen et al. 2002), resulting in fragmentation, placing humans and wildlife in direct and indirect conflict, and eventually creating islands out of currently connected mountainous habitat. For cougar populations, the main source of mortality continues to be human hunting. Hunting regulations in many western states have been relaxed, creating potential population sinks that rely more heavily on source areas such as national parks, Native American reservations, and wilderness areas where animal populations are protected. As habitat fragmentation increases, the connectivity between source and sink areas can be heavily altered. Although not a direct "threat," the wolf restoration has introduced an unknown effect into the mix of habitat loss and human management of cougar and prey populations through hunting.

With the reintroduction of wolves to the greater Yellowstone area and central Idaho, we are witnessing a restructuring of ecosystems in ways that we know little about.

During the past 25–30 years, scientific studies on cougars have been conducted in the absence of wolves, and studies of wolves have been conducted in the absence of cougars, yet these two species co-existed across much of their historical distribution. How will cougars and wolves sort out the landscape, and will wolves limit cougar populations by competing for space, prey, and through direct interactions? Answers to these questions are critical not only to the conservation of cougars and wolves and the habitats they live in, but also to the conservation of the myriad species that fall under the umbrella of protection within cougar and wolf population ranges.

"During the past 25–30 years, scientific studies on cougars have been conducted in the absence of wolves, and studies of wolves have been conducted in the absence of cougars, yet these two species co-existed across much of their historical distribution."

While researchers have studied the role large carnivores play in structuring prey populations, the role they may play in each other's lives and the lives of smaller carnivores has only recently begun to emerge from studies in Africa and North America. In Serengeti National Park, researchers have documented that three out of four cheetah cubs are killed by lions and hyenas, and that hyenas frequently steal kills from wild dogs (Creel 1998). A study by Creel and Creel (2002) concluded that wild dog density declined as the density of lions or hyenas increased. Similarly, studies in North America show that wolves kill coyotes and frequently exclude them from core areas of pack ranges (Arjo 1998, Crabtree and Sheldon 1999). A reduction in coyotes may prove positive for red fox populations; foxes appear to be filling in behind the missing coyotes (Fuhrmann 2002).

Similar in size, cougars (85 to 170 pounds) and wolves (90 to 130 pounds) utilize large areas (up to 800 square km) and rely on abundant prey such as elk and deer to provide required energy for reproduction, territory defense, and rearing of offspring. In the process of making their living, and because of overlap in body size, prey utilization, and area requirements, cougars and wolves may compete for prey and space through direct interactions such as wolves killing cougars, or indirectly where one species monopolizes an area, thus excluding the other. The social nature of wolves enhances their competitive ability, and in direct interactions with cougars they tend to be dominant. Wolves have directly killed cougars in Glacier National Park (Boyd and Neal 1992, Ruth and Hornocker 1997) and Yellowstone National Park (this article, Ruth 2000) and may influence mortality through indirect effects such as increased competition between cougars (intraspecific competition) and/or increased incidence of malnutrition due to changes in prey availability or energetic costs associated with displacement from kills.

Although they may prey on similar species, cougars and wolves use different hunting strategies to pursue and kill large prey that, in turn, have adapted their own strategies to avoid predation by carnivores. Cougars are "sit and wait," or ambush, predators. They rely on cover to stalk and approach their prey undetected. With bursts of speed, they tend to attack from the side, behind the range of the prey's peripheral vision. Because their radius rotates around the ulna (similar to human forearms), cougars are able to quickly manipulate smaller prey and deliver a bite to the throat or the base of the skull. In contrast, wolves are pursuit predators. They tend to hunt in more open areas where they can move groups of elk around in order to test the elk and look for something wrong; an injured animal or one that is in poor condition. In certain environments, these differences in hunting strategies likely influence use of the landscape and allow cougars and wolves to partition the existing space and habitat. In addition, wolves and cougars may facilitate each other's predation. Finding answers to questions such as these are part of our research effort.

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Radio-collared cougar F121 on Rattlesnake Butte in Yellowstone National Park, January 2002.

Monitoring the Cougar Population

For some animal studies, non-invasive observational methods are employed to obtain quantitative data in an efficient, scientific manner. However, for large-ranging and secretive species like cougars, our study must rely on radio-collaring and radio-tracking tools to monitor cougar movements and habitat use relative to wolves and bears, and to document population changes and rates of predation on prey. To estimate minimum cougar population size each winter, we conduct intensive capture work, and our field crews of three to six people walk and snowshoe approximately 1,200 to 1,600 km of track surveys to document the presence of uncollared cougars against known marked cougars. Cougar tracks are categorized as probable or known marked individuals, unmarked individuals, or unknown classification and, when possible, each track set is placed into a social category of adult male, subadult male, adult female, subadult female, or female with kittens, based on stride lengths, padwidths, and toe-size characteristics. In more rare cases, unmarked cougars have been identified via mating associations with a radio-marked cougar.

> "…our data indicate that production of offspring has slowed in the last two years."

To capture cougars, highly-trained personnel and specially-trained hounds work hand-in-leash to tree them. Hounds are only released from leashes when a fresh cougar track or a kill has been located. By keeping the hounds in check and releasing only on very fresh tracks, we minimize the amount of time the hounds have to chase the cougar into a tree, enabling us to arrive more quickly at the site to re-secure the dogs. Operating in this manner allows us to provide for the safety of both cougar and hounds when working in wolf country. After the cougar is immobilized and safely lowered to the ground, our team constantly monitors temperature, pulse, and respiration while radio-marking each cat and obtaining important blood samples for genetic and disease analyses.

Since we began the post-wolf, or Phase II, cougar study, we have radio-collared and monitored the movements and comings and goings of 65 adult, subadult, and kitten cougars in and adjacent to areas used by 35–88 wolves within three to five wolf packs on the northern Yellowstone study area as a tool to monitor population ecology, predation, and interactions between cougars, wolves, and other scavengers. At the same time, a sample of 3–10 radio-collared wolves was maintained within each wolf pack by Yellowstone Wolf Project staff. Although the wolf population has increased rapidly during the first six years after reintroduction, we have seen few changes in the minimum population estimate of cougars on the northern range since the end of Phase I. The northern cougar population, within the protected area of Yellowstone National Park, remained stable at approximately 15 to 17 resident adult cougars during 1998–2002. Phase I data indicated an increasing cougar population (fig. 2), which may have been associated with recent re-establishment of cougars in YNP during the early 1980s and an increasing elk herd after the 1988 fires. Phase II data show a slight decline, but this is directly related to lack of independent subadults present during the past two winters.

If wolves regularly steal food from cougars, and cougars must invest time and energy to compensate for losses, particularly as wolf densities increase, we may expect to see effects in timing and frequency of reproductive output of maternal females. To date, nine adult female cougars have produced 19 litters of two to four kittens, resulting in 33 offspring born in early spring through early fall. Although cougars can breed year-round, the Yellowstone cougar population reaches its peak breeding season during late winter–early spring and, thus, a birth pulse during spring through summer results in both Phase I and Phase II study data (fig. 3). Timing of births is currently similar for both phases, although Phase II data indicate a slight extension into spring months. Although we need more data to evaluate this pattern, we hypothesize that two factors may be playing a role: 1) the effect of wolves on elk distribution may facilitate cougar access to elk calves during months other than peak elk birthing, and 2) adult elk vulnerability may have increased in late winter and early spring due to poor summer range conditions associated with four years of drought.

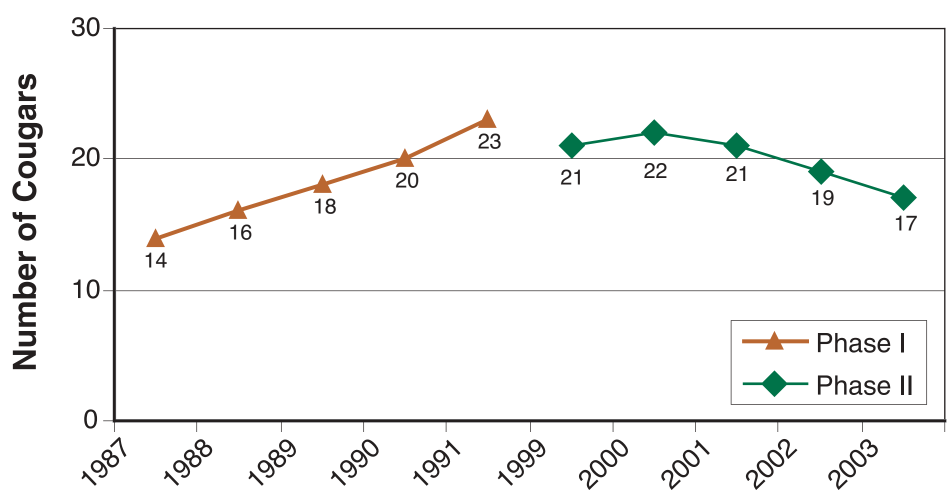

Figure 2. Minimum estimated numbers of adult and subadult cougars during Phase 1 and Phase II. *(Toni K. Ruth, April 2003)*

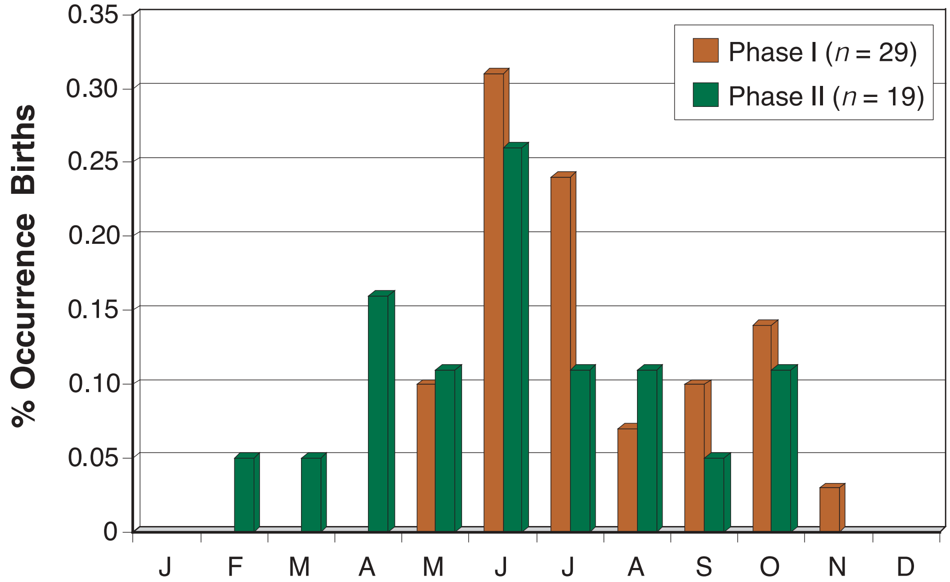

Figure 3. Offspring production. *(Toni K. Ruth, April 2003)*

These individuals ranged in age from 14 months to 3.5 years old, and were located as far away as Ennis, Montana, and Dubois, Wyoming.

In order to better document dispersal movements and areas of home range establishment, we plan to deploy satellite-tracking technologies on dispersers during winter 2004. The need to monitor detailed movements of emigrants from the Yellowstone population is paramount to understanding the habitats used by cougars during dispersal movements, and will greatly enhance the identification of corridors used during dispersal by cougars, wolves, and grizzly bears relative to human development. These data are also important to understanding how the greater

By going to den areas, we are able to obtain information on litter size and sex ratio, collect a DNA sample from each kitten, and radio-collar each kitten in order to monitor their survival through dispersal from or establishment within the Yellowstone cougar population. This methodology is valuable in providing information on reproductive success of male and female cougars, causes of mortality to kittens, dispersal rates, and how the YNP population fits into the bigger landscape picture of cougars and other large carnivores.

About 50% of the kittens born in the YNP population survive to dispersal age, at which time 90% of surviving male kittens and 80% of surviving female kittens leave the protected area of the park in search of a home range of their own. While the litter size of 2.6 kittens per litter in the Phase II study is the same as litter size during the pre-wolf study period, our data indicate that production of offspring has slowed in the last two years. To better understand this pattern, we are examining the interval between births as a way to assess reproductive output over time and what factors may be influencing any decrease in reproductive rate. Similar to Phase I, our data continue to suggest that female and male cougars that have the greatest success of producing offspring are those that live the longest lives. These and other data continue to support our suggestion that conservative approaches in setting sport hunting regulations outside protected areas should be considered.

During aerial search flights covering a 200-mile radius, our field crew continues to monitor the movements of offspring as they disperse from the study area. However, successfully locating dispersers is difficult due to their rapid, long-distance movements and the high cost of flying large areas to search for them. During the past year, six cougars that had been missing for 6–18 months after their dispersal were located because they were killed during the hunting season.


ROB JENSEN/HORNOCKER WILDLIFE INSTITUTE

Toni holding a kitten for sampling and radio collaring at a den capture in Upper Little Buffalo in Yellowstone.

(continued page 20)

Cougars Killed by Wolves

Toni K. Ruth

IN DECEMBER 1999, we documented the first cougar mortalities due to wolves in Yellowstone National Park. In this apparently rare interaction, female cougar F107's four kittens were killed in two separate events. We were able to document all four mortalities within less than 24 hours of their occurrence because F107 and the kittens were radio marked, and because of the collaboration between the cougar and wolf projects, which provided the ability to simultaneously monitor wolves and cougars. Field efforts by both projects provided as complete an interpretation of events proceeding and subsequent to the mortalities as possible.

Each radio collar is equipped with a special feature called a mortality mode. Thus, any collar that remains stationary for longer than six hours will switch to a different pulse rate; in this case a faster pulse than when the collar is not stationary. On December 16, 1999, a check for the F107 family group indicated that two of the kitten signals (F108 and M138) were in mortality mode and in the direction of the location of the cougar family group and Druid wolf pack from the previous day. We continued to monitor the remaining kittens in the family group, and on December 21, 1999, radio signals of the remaining two kittens (M140 and M142) indicated the kittens were dead. We hiked in to the sites and collected three of the kittens and all four of the radio collars within 45–815 yards of a cow elk carcass that had been killed by F107 between December 8 and 13. Sometimes, females with kittens may stay on a large elk kill for 8–10 days.

Although details of the interaction and deaths were obscured by snow deposition, "troughs" through the snow and the location of the bodies suggested that three of the four kittens had run through the deep snow while being pursued by wolves. In particular, M138 had run upslope, out of tree cover, and was killed on top of a small sagebrush knoll. His body was found 139 yards from the elk carcass. His ears and nose had been chewed on and his lower left front leg was missing. After removing the kittens from the field, we had project veterinarian Dr. Kathy Quigley assist with the necropsies. While few external wounds were visible, the amount of internal damage the kittens had sustained was extensive. The ribcages of three kittens had been crushed, inducing trauma to their hearts. Their lungs and livers were hemorrhaged and macerated from bite wounds, and canine punctures were evident into the stomach lining of two kittens. Kitten M138 also had a fracture of the first cervical vertebrae.

Several factors may have played a role in the cougar mortalities. Although adult cougars are proficient at seeking rock outcrop and trees as escape habitat from aggressors, kittens generally lack the experience or knowledge of their home range to seek out appropriate escape habitat. Kittens may seek cover on the ground or by climbing trees that lack ample branches for perching for long periods of time. Adult cougars typically choose to climb Douglas-fir trees with large branches when escaping pursuit by hounds during our capture efforts. Another factor that may have played a role in the deaths of the kittens was their small body mass. Kittens F108 and M138 weighed 16 pounds at death. Kittens typically weigh about 25–35 pounds at four to five months of age. The small size of the kittens may have been negatively influenced by the size of the litter and the fact that this was F107's first litter. The low body weight and snow depth may have affected the ability of the kittens to run effectively during pursuit by wolves. In deeper snow, kittens usually follow their mother through the path she has made in the snow. However, pursuit by an aggressor generally results in separation of the family unit. Finally, the Druid pack spent an unusual amount of time in the Rose Creek area compared to their typical movements about the Lamar Valley (Rick McIntyre, Yellowstone National Park, personal communication). Whether they showed an affinity to this area because of the cougars is unknown; however, the wolves returned to the Rose Creek drainage between the times that they made two elk kills in Lamar Valley. It seems as though their foray into Rose Creek between elk kills may have been to re-investigate F107's kill site. In either case, they encountered F107 with her kittens during their travels to or near her kill.

More recently, on April 4, 2003, at 7:05 AM, Polly Buotte and Jesse Newby of the Wildlife Conservation Society's Yellowstone Cougar Project detected a mortality signal on adult female cougar F106. At 8:30 AM, Buotte and Newby contacted Daniel Stahler of the Yellowstone Wolf Project, who was conducting an aerial telemetry flight for wolves. Buotte informed Stahler of the mortality signal and inquired if Stahler could obtain a location for them. From the air, Stahler and pilot Roger Stradley located F106 on top of Mt. Everts, and


NPS/DOUGLAS SMITH

they obtained a visual of the cat lying motionless on the ground. Stahler and Stradley also located F106's two four-month-old kittens (M164 and M166) nearby; their collars were still transmitting active signals.

At 2:30 PM, Buotte, Newby, Sawaya, and Stahler hiked in to the site to investigate the cause of F106's death. The kittens, which were still alive, were in the vicinity of F106's carcass, but a few hundred meters away. The investigation revealed that F106 had been killed in a fight with a wolf pack. Evidence to suggest this included visible bite wounds on her neck, entrails pulled from her body, wolf hair in her claws and teeth, wolf tracks in the area, and clumps of both wolf and cougar hair. Extensive snow tracking suggests that F106 had been in the area hunting without her kittens, though we found no evidence of a kill. At least eight sets of wolf tracks came into the area at a walk; at one point, ~40 meters out, all the wolves were bounding toward the fight scene. They came in from several directions, at ~45º to F106. A swath of snow ~30 m wide was trampled and contained large clumps of both cougar and wolf hair, blood, and other body fluids. A depression in the snow ~15 m away seemed to be where F106 lay down, severely injured. This area was melted and contained large clumps of cougar hair frozen into the snow. Her body was found ~10 m further away, which seems to indicate the wolves left her barely alive, then she crawled a short distance and died.

On the morning of April 3 at 9 AM, 10 members of the Swan Lake pack were seen crossing the road below Mt. Everts, heading towards the Beaver Ponds (Phil Perkins, YNP personal communication). One of the wolves was lagging far behind its pack mates and was limping badly from an injury to its left front leg. It seems very likely that these wolves were the ones involved in the altercation with F106, and they happened to be spotted as they were leaving the area. The Leopold wolf pack, which also uses this area, was known to be further east during this time (Dan Stahler, YNP, personal communication).

While monitoring for radio signals on the afternoon of April 2, cougar project personnel heard an active VHF signal on F106 from "Bear Rock" along the Jardine Road. With a directional antenna, her signal seemed to be coming from the top of Everts, where she was later found dead. We did not hear F106's signal on April 3; however, we did not listen from Bear Rock that day. We did hear her kittens on April 2 and April 3. Given the sighting of the Swan Lake pack in the area on April 3, it seems likely this interaction occurred during the night of April 2 or the morning of April 3. F106's two male kittens eventually died after being orphaned at 4½ months of age.

Since the initiation of our study, these seven cougar mortalities have been the only ones directly linked to wolves. If direct interactions such as this tend to be rare events, the loss of six kittens may not be significant to the actual population size of cougars in Yellowstone. However, if all the kittens had survived to dispersal (an unlikely scenario), the five male kittens would have been highly likely to have dispersed to other areas and potentially contributed to other populations. If dispersal success is lower for cougars living with wolves, immigration rates to other populations may be affected, and harvest of cougars outside source areas such as Yellowstone may need to be altered. Our long-term study is focusing on trying to answer questions such as these. YS

Wolves Killed by Cougars

On January 12, 2000, male wolf #163M, under two years old, died in a ravine in the Crandall Creek area northeast of the park. When the site was examined by Dr. Kerry Murphy (Yellowstone Wolf Project) on February 5, 2000, cougar scats and tracks of a family group were present, as was a dead bighorn sheep. It is possible that wolf #163M was killed by a cougar after scavenging the cougar-killed bighorn sheep. However, no canine puncture marks were seen in the neck or skull of wolf #163M, and the carcass was heavily scavenged. Also, it could not be established that the bighorn was killed by cougars or by #163M, as there were too few bighorn remains to establish cause of death.

A confirmed cougar kill of a wolf occurred on January 29, 2003, in the Mill Creek area north of the park. Val Asher (Turner Endangered Species Fund) examined the site the following day. Female yearling wolf #297F was found near a fence line in the timber. The wolf was dragged up hill about 50–60 yards and cached under a pine tree, a classic indicator of a cougar kill. Most of her shoulder and back were consumed, then the carcass was covered with about six to eight inches of pine needles, leaving only the hind paws sticking out. Although tracks in the snow were slightly melted, lion tracks were present near the cache site, and it's possible the lion had a cub. There may have been another wolf on scene, but tracks showed it continuing down the road and off into the timber. The necropsy exam showed bite marks on the wolf's head only.

Yellowstone cougar population functions as a genetic link to other cougar populations, and we are working collaboratively with University of Montana biologists to monitor population genetics and disease relative to other cougar populations.

Monitoring Rates of Predation and Kleptoparasitism (stealing food)

Wolves and bears occasionally displace cougars from their kills. Frequent loss of kills to scavenging wolves and bears may result in a decreased interval between kills and, thus, increased rate of predation for cougars to meet their daily energy requirements. To determine if cougar predation rates have changed since wolf reintroduction, and if wolves regularly displace cougars from their kills, we are replicating methodology developed and used during the pre-wolf study on cougars (Murphy 1998). A radio-collared cougar is randomly selected from one of five social classes, or stratifications (adult male, adult female, subadult male, subadult female, maternal female). This "focal" individual is then located one to three times per day, and every location site is searched after the cat has moved >600 meters away. Daily locations continue until three to five ungulate kills are located in sequence, or three kill intervals are successfully completed. A kill interval is calculated as the number of days that pass between kills, from and including the day of the first kill, through the day prior to the next kill.

So, what are we finding? At this point in our study, there does not seem to be very much difference in what types of prey cougars are killing between pre-wolf Phase I and with-wolf Phase II (fig. 4). There are more mule deer to the north and east of YNP than within YNP, and we have not sampled as many cats in this area as the Phase I study did, which may be contributing to the greater proportion of elk in our Phase II sample. Looking more closely at the primary prey, elk and mule deer, there is still not a striking difference. We are seeing proportionally more cow elk and fewer elk calves in our more recent samples (fig. 5). This may be a true difference, it may be a reflection of our sample, or it may be due to changes in the elk herd. However, these are preliminary comparisons, and we are still collecting data to reach sample sizes comparable to Phase I.

In 15 completed predation sequences, field crews have followed focal cougars anywhere from 22 to 68 consecutive days to document the four to five prey kills necessary to calculate rate of predation. The data from these sequences indicate that across all social classes, cougars spend an average of three to four days on a kill, and three to four days moving and hunting before making the next kill. Looking at predation rate in days per ungulate kill, we do not see much difference between Phase I and II. The standard deviation of our sample is 8.1 days, much greater than during Phase I (SD=4.0), but it falls to 3.0 days with the removal of a single cat from our sample.

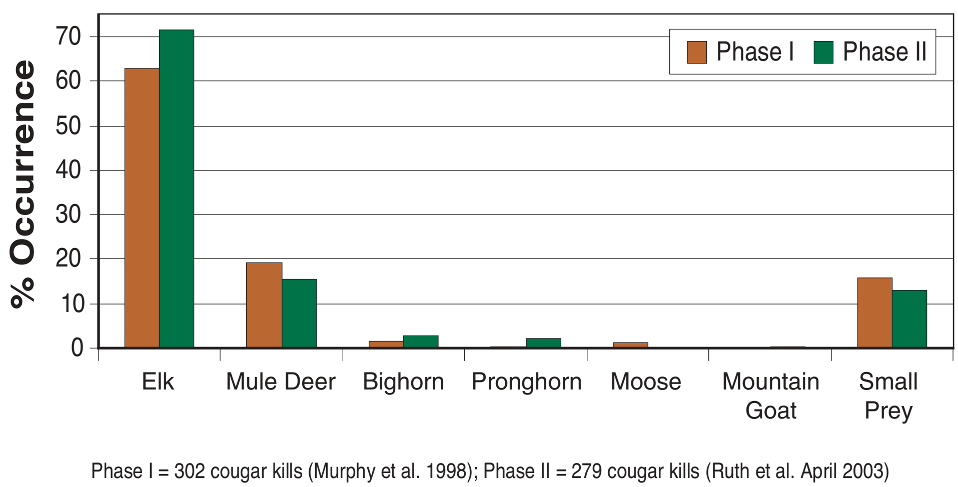

Figure 4. Phase I and Phase II prey.

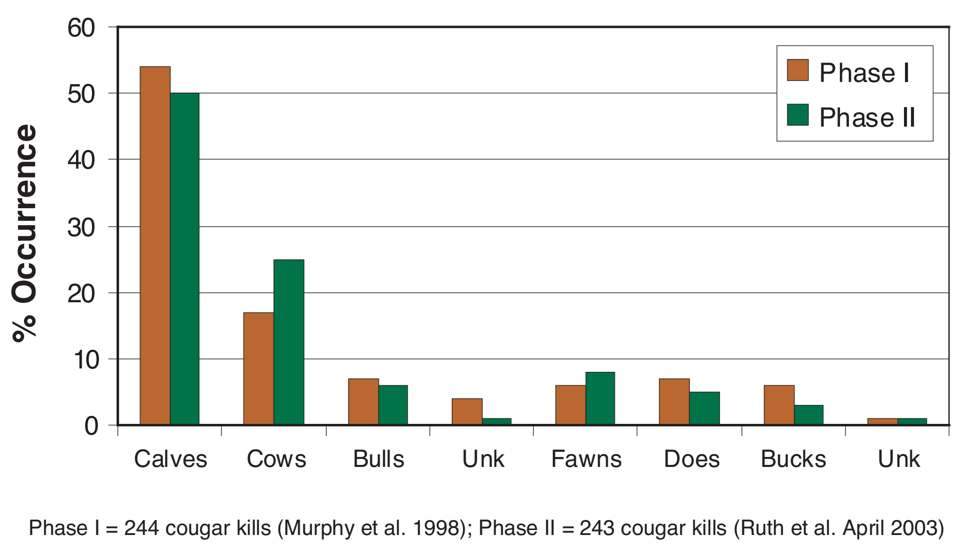

Figure 5. Sex and age composition of elk and mule deer kills.

We followed this adult female, F112, for 41 days. During that time, she killed marmots and grouse, but no ungulates.

How often cougars kill prey is influenced by a number of factors, including prey size, reproductive status of the cougar, and detection by scavengers. While prey of small mass such as deer fawns or elk calves are easier to capture and kill, a cougar can consume them in a shorter amount of time than prey of large mass, such as adult elk. Female cougars with kittens kill more often to feed their growing offspring than do solitary adult females and males (fig. 6). A maternal female with two to three yearling kittens must kill one prey item every 6–7 days, while solitary adult females kill one prey item about every 11 days. Because not all ungulate prey are equal, we also look at predation rate in terms of ungulate biomass killed per day, to account for prey body size. Here again, Phase I and II data are very similar.

Prey mass may also influence how quickly scavengers detect cougar-killed prey. Prey of small mass, like elk calves, have a shorter "handling," or kill time for cougars than large-mass prey such as adult elk. Therefore, while using cover for hunting, cougars are able to quickly kill smaller prey and, if necessary, drag them into an area of thick canopy cover for concealment during consumption. Conversely, our data indicate that cougars are more likely to kill adult elk in open areas with low canopy cover. This is likely due to the longer "handling" time, or time for a cougar to manipulate and kill an adult elk. During the killing process, adult elk tend to run down slope and into open areas with lower canopy cover. Once killed, cougars are unable to drag large-bodied prey to thicker cover for concealment. Thus, large-mass kills are likely more easily detected by avian scavengers than smaller-mass prey that are killed in, or dragged to, heavy cover. In the process, the kills may also be more quickly detected by scavenging carnivores that cue on avian scavenger activity, such as coyotes, wolves, and, potentially, bears.

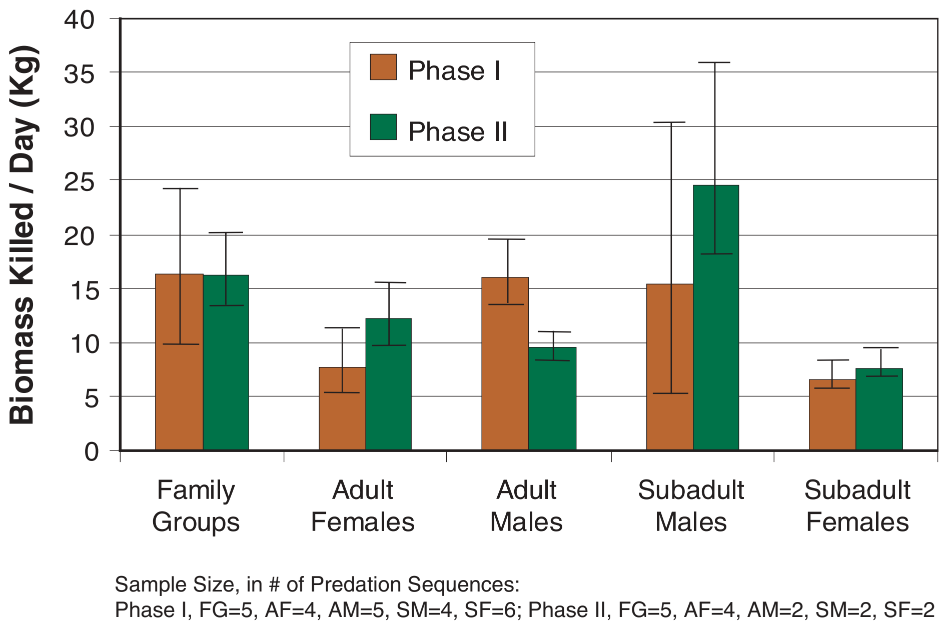

Figure 6. Biomass killed per day by cougar social class.

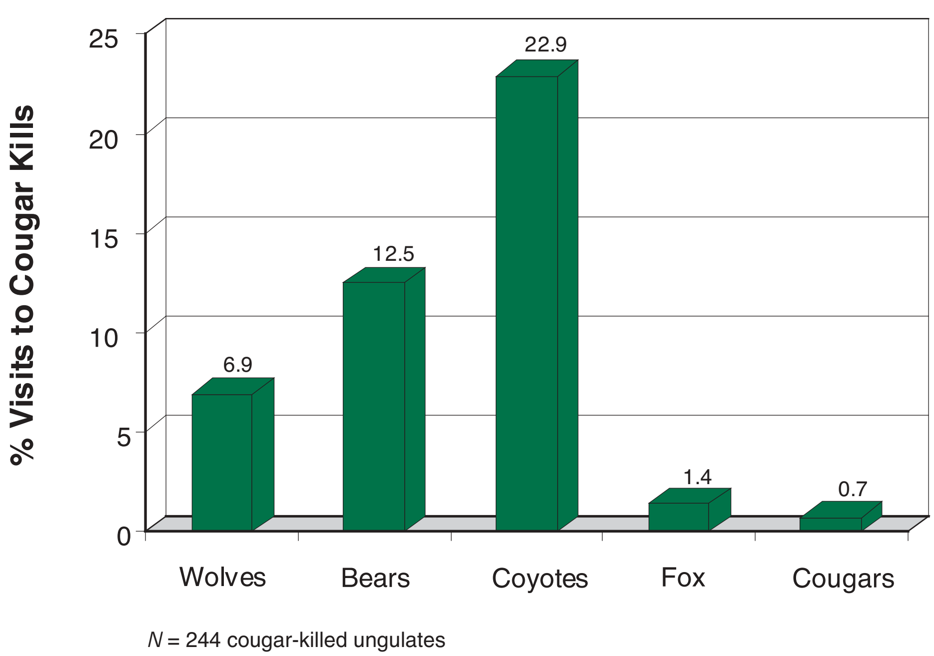

Figure 7. Species interactions.

During our predation rate sampling, at least one scavenger species was present at the site of a cougar-killed ungulate carcass on the presumed date of death 70.2% of the time. Overall, 75% of cougar-killed prey were scavenged by both avian and mammalian scavenger guilds (fig. 7). This presence indicates that scavengers are capable of discovering fresh cougar kills soon after their presence on the landscape, despite cougars' attempts to conceal carcasses through caching or hiding under cover. Seventy-five percent of cougar-killed prey (*N*=244) were scavenged by members of both avian and terrestrial scavenger guilds. Cougars were displaced from their kills by wolves in 8 of 10 documented visits. Five displacements were of maternal females with kittens and resulted in kittens being treed by wolves (three times), or in death.

Cougar–Wolf Interactions

Because wolves are pack animals, they tend to be dominant in interspecific interactions with cougars. Cougars evolved with wolves, and have adapted a variety of strategies to avoid their dominant competitors: wolves and bears. Cougars typically use habitats with vertical cover such as trees and rock, which provide escape cover if a direct encounter with a dominant carnivore occurs (these habitats also provide hunting cover in which cougars can kill prey). If a direct encounter occurs, cougars typically escape by running into a rock outcrop or quickly climbing trees. Another behavioral strategy for cougars is to make or place their kills in areas that minimize detection by avian and mammalian scavengers. Therefore, cougars usually kill their prey in, or drag killed prey to, areas with ample ground cover. Cougars also cache their kills with debris such as conifer duff and grass, minimizing detection of their kills by scavengers.

With these avoidance strategies and the heterogeneity in habitats available to cougars and wolves, these two species may only occasionally interact directly in Yellowstone. However, over the past four years, our study on cougar–wolf interactions has documented the deaths of seven cougars (in two family groups) attributable to wolves in Yellowstone. Overall, 30 cougars have died during the study, including deaths due to hunters (some cougars overlap the park and areas to the north of the park boundary), cougars, wolves, bears, accidents due to prey, and unknown causes (fig. 8).

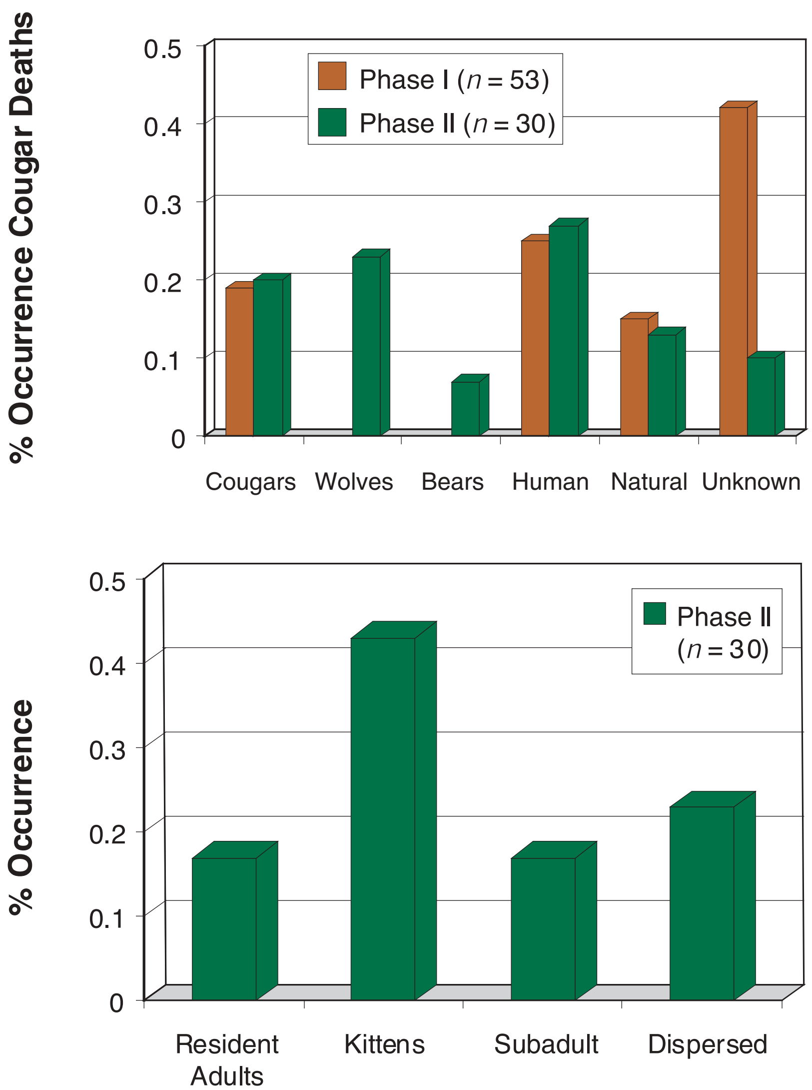

Figure 8. Cougar mortalities.

Spatial-Temporal Interactions and Habitat Use

Although cougars and wolves go after similar prey types and wolves occasionally displace cougars from their kills or directly kill them, cougars may reduce the frequency of these interactions through spatial and temporal avoidance of wolves. Spatial and temporal avoidance of competitors is subtle, and a variety of factors make sampling to document interactions between large carnivores difficult. Since the beginning of our study we have attempted to assess and quantify spatial-temporal interaction between cougars and wolves beyond observations we can document through snow tracking in winter. In an attempt to monitor cougar and wolf movements year-round, we have conducted simultaneous weekly flights in conjunction with the YNP wolf project. In this manner, we attempt to minimize the time between cougar and wolf locations. However, this sample is biased to early morning hours, with an average of one flight every 10 days over a year. In addition to aerial sampling, we have attempted to conduct predation sequence sampling on focal cougars in conjunction with early and late winter wolf predation rate sampling (Smith et al. 2001). Both projects document daily movements of focal animals, which then may be analyzed to determine movement patterns and habitat use. Again, this sample is biased to daytime hours. Last year, the cougar and wolf projects deployed GPS (Global Positioning System) collars to investigate the efficacy of this technology in hopes of sampling movements across all time periods. The two GPS collars we deployed on cougars successfully obtained locations in 60% and 73% of the location attempts. Although a fix was not acquired every time, there were still many instances of simultaneous locations for the two cougars. This data set indicates some pattern of attraction and repulsion, and we were able to identify instances when adult male M137, an older resident adult male, displaced the younger male, M127, from two different kills. These interactions were confirmed by our simultaneous ground location work. We will attempt to develop a subsequent moves analysis with this data set for application to spatial-temporal analysis of cougar and wolf movements.

"Cougars were displaced from their kills by wolves in 8 of 10 documented visits."

Initial analysis of data retrieved from the GPS collars also showed strong promise for identifying kill sites by selecting spatially grouped sequential locations. Kills were found at 20 of 21 possible kill sites identified in the GPS collar data. We are continuing to conduct predation sequence sampling on GPS-collared cougars to determine if kills are missed in our ground sampling, and if kills are incorrectly included in the GPS data sampling. GPS sampling of adult male cougars may be the most time- and cost-efficient method of assessing predation rates on these highly mobile individuals. Our overarching prediction is that cougars are more likely to be located in areas providing hunting cover for prey, security (escape cover) for offspring, and security at day bed sites (i.e., forested areas, rock outcrop, areas with topographic roughness) in the post-wolf reintroduction time period than in the pre-wolf time period.

TONI K. RUTH/WILDLIFE CONSERVATION SOCIETY

Cougars are treed by hounds and researchers, then immobilized for data collection and radio collaring.

Summary

Successful restoration of large carnivores in the northern Rockies and the concomitant increase in carnivore abundance and distribution will challenge humans as development increases throughout the West. Interspecific competition among carnivores can limit spatial distributions, constrain habitat selection, reduce food intake, and increase mortality rates. If competition is an important force limiting certain carnivore populations, why is it now relevant to management of these species? In the northern Rocky Mountains, human population growth rates top 25%, and many wildlife species are threatened by the expansion of rural residential development, energy development, motorized recreation, habitat fragmentation, and negative attitudes toward carnivores. Prior to fragmentation, the intensity of competition may have ebbed and flowed at a particular location; however, with fragmentation, the maintenance of sink populations by immigration may be less likely (Creel et al. 2001).

Our study design includes the unique ability to compare cougar ecology and predation on prey as a before (pre-wolf establishment) and after (post-wolf establishment) quantitative experiment. In addition, our approach has developed collaboration and integrated methodologies with concurrent research projects on large carnivores (cougars, wolves, bears), prey, human influences, and studies of disease prevalence in the cougar population. In the course of conducting research on a guild of large, secretive carnivores in a collaborative atmosphere, data do not accrue quickly. We are currently in the fifth year of the cougar project's proposed seven-year study. Although we have seen few changes in population characteristics, prey selection, and rates of predation on prey between the pre-wolf and during-wolf time periods, we have yet to analyze data relative to changes in spatial and habitat use by cougars. To date, prey abundance has remained high, providing ample food for both cougars and wolves. However, cougars and wolves make use of similar prey species, and it may be reasonable to assume that at low prey densities, intraguild competition will increase. Spatial overlap of cougars and wolves

> "Understanding these relationships in a relatively pristine area such as YNP will have important implications for the management of cougars and wolves in surrounding states."

on the northern range is greatest during winter months when cougars and wolves follow migratory elk to lower elevations, and during this time cougars and wolves may compete more directly for space, prey, and at carcasses.

Understanding these relationships in a relatively pristine area such as YNP will have important implications for the management of cougars and wolves in surrounding states. Over the next two years our goals are to continue our research efforts and collaboration, which will allow us to model the direct and indirect changes that will occur in the system and provide the potential to predict and prepare for changes in the West as wolves and grizzly bears reoccupy once vacant habitats. In addition, we plan to investigate non-invasive monitoring methods for cougars using hair snag pads and backtracking to collect hair and scat samples for DNA analyses. Our project also provides work-related field training and experience for wildlife science and conservation graduates; and provides professional and public presentations, field seminars, and assistance with filming events pertaining to project goals and carnivore conservation.

YS

Acknowledgments

Drs. Maurice Hornocker, Howard Quigley, and Kerry Murphy initiated both Phase I and Phase II studies and have been valuable friends, colleagues, and an inspiration to me during my career. Our project and collaboration in Yellowstone would not be possible without the generosity of many individuals and foundations. Funding was provided by the Richard King Mellon Foundation, Charles Engelhard Foundation, Wildlife Conservation Society, Michael Cline Foundation, Mr. Ripley Comegys, The Laura Moore Cunningham Foundation, The Summerlee Foundation, Tim and Karen Hixon Foundation, The National Geographic Society, Mr. Larry Westbrook, and The Bay Foundation. I would like to acknowledge the substantial contributions and dedicated field effort of project field technicians, specifically: Polly Buotte, Jason Husseman, Tony Knuchel, Mike Maples, Jesse Newby, Michael Sawaya, Erin Shanahan, Dan Stahler, and Craig Whitman. Pilots Stan Monger, Roger Stradley, and Doug Chapman have provided valuable and dependable flying service. Drs. Doug Smith, Chuck Schwartz, Steve Cherry, and Howard Quigley, along with Mark Haroldson, Kerry Gunther, Dan Stahler, and Polly Buotte form the core of our collaborative Large Carnivore Working Group and are acknowledged for their coordination and dedication to further understanding and conservation of the large carnivore guild. Many other folks with Yellowstone National Park; Gallatin National Forest; Montana Fish, Wildlife and Parks; U.S. Fish and Wildlife Service; and Wyoming Game and Fish Commission have contributed to the project in numerous ways. Finally, I wish to thank the many area landowners who have graciously provided access to their property to enable us to follow cougars and collect kills.

ROB JENSEN/HORNOCKER WILDLIFE INSTITUTE

Toni K. Ruth is an Associate Conservation Scientist with the Wildlife Conservation Society and project leader researching the effects of wolf reestablishment on the cougar population in Yellowstone National Park. She received her B.S. in Forest and Resource Conservation from the University of Florida, an M.S. in Wildlife Science from Texas A&M University, and is a Ph.D. candidate in Wildlife Ecology at the University of Idaho. She previously worked with the Hornocker Wildlife Institute for 10 years and has been involved in cougar research in various ecosystems since 1987.

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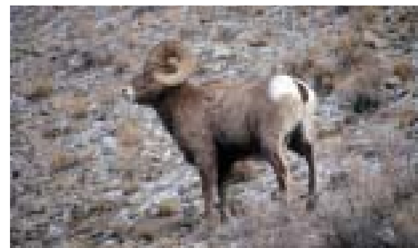
NATURE NOTES

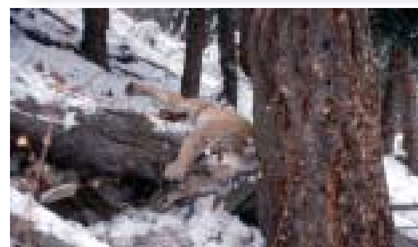
Traversing the Cliffs: The Life and Death of Male Cougar M139

Toni K. Ruth

ALL PHOTOS TONI K. RUTH/WILDLIFE CONSERVATION SOCIETY

The cliffs of Mt. Norris, where cougar M139 died, November 2001.

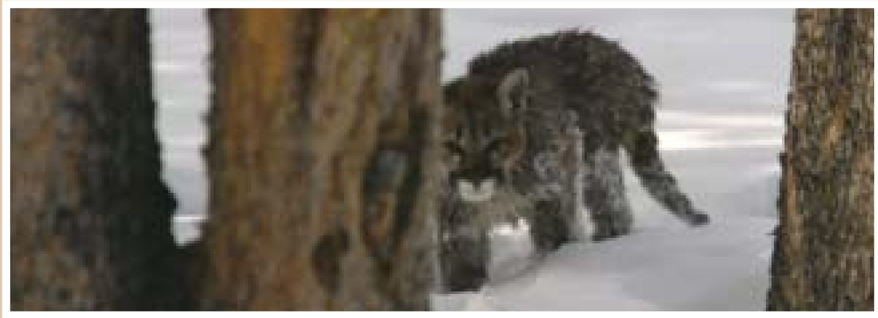




OUR STORY with M139 first began on a late winter day, April 2, 2000. Our monitoring of radio-collared female F107, "Abbie," indicated that she was breeding with an uncollared male in the Slough Creek area. Loud, guttural, yowling vocalizations, indicative of a breeding pair, were emanating from the rocky ledges along Slough Creek and in the same general location as female F107's radio signal. Scanning the area with binoculars from afar, field technician Erin Shanahan was able to observe F107 and see the uncollared male. After receiving capture permission from YNP biologist Kerry Gunther on April 4, we quickly captured the male, who became study animal M139. Each cat we capture is radio-collared and receives a special ID number in the form of a colored ear tag (white for males, orange-brown for females) and the corresponding number is tattooed as a permanent ID in the untagged ear. Ear tags and tattoos have provided valuable information on dispersed cougars, which have been seen or shot in other areas after their collars have dropped off. At capture, we discovered that this new male already had a large ear tag in his left ear. Male M139 had previously been captured and marked by someone else; we suspected a state wildlife agency because of markings on the tag. We noted the tag color, size, and number, collected blood samples from the cat, and monitored his recovery from the anesthesia. Soon, we would be learning the boundaries of M139's home range, how much of his range overlapped with the dominant wolf pack in the area—the Druid Pack—as well as what prey M139 relied on for survival, and his reproductive contribution within the YNP cougar population.

The day following his capture we

(continued page 27)



NPS/JIM PEACO

Wildlife Conservation Society

The Wildlife Conservation Society originated in 1895, when New York State chartered the organization as the New York Zoological Society. Theodore Roosevelt and other notable New Yorkers were involved in its creation. WCS saves wildlife and wild lands through careful science, international conservation, education, and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together, these activities change individual attitudes toward nature and help people imagine wildlife and humans living in sustainable interaction on both a local and global scale. WCS is committed to this work, believing that it is essential to the integrity of life on Earth.

In the wilderness of greater Yellowstone, WCS seeks to continue its long-term cougar research by investigating carnivore/carnivore and carnivore/prey relationships. Prior to wolf reintroduction in Yellowstone, the Hornocker Wildlife Institute, now part of WCS, conducted Phase I of the cougar study to characterize the cougar population and to evaluate the ecological role of cougars. Following the return of the gray wolf in 1995, Phase II, which took advantage of a unique opportunity to examine the effects of wolf reintroduction on cougar population dynamics and predation as well as to quantify species interactions and competition, was initiated. WCS biologists developed collaborative and integrated efforts with concurrent wolf and grizzly bear research projects to determine how large carnivore populations coexist and divide resources. WCS researchers are also exploring several non-invasive techniques for managers and scientists to monitor cougar populations. If you would like more information and to help support this project, contact: WCS Cougar Project, 2023 Stadium Dr., Suite 1A, Bozeman, MT 59715, 406-848-7683 or 406-522-9333, truth@montanadsl.net.

For more information on the
Wildlife Conservation Society:
2300 Southern Boulevard, Bronx, New York 10460
718-220-5100
www.wcs.org

Cougars, often called "ghost cats" due to their elusive nature, secretly and quietly share our wilderness with us. As we expand into and beyond the fringe of wilderness and inevitably overlap with the cougar's territory, our complex relationship with these predators deserves to be better understood. Most cougars are single-mindedly solitary, masters of blending into their surroundings. Few people ever have the opportunity to see one in their lifetime, let alone observe the great cat on its own terms, wild and free. Their mysterious nature is part of what contributes to our lack of understanding about them.

When a female mountain lion and her three cubs were spotted on the National Elk Refuge in Jackson Hole, Wyoming, in February 1999, they made history with what would become the lengthiest period of observation of cougars in the wild. (*See the cover photo of this issue of* Yellowstone Science, *taken by Thomas Mangelsen, co-founder of The Cougar Fund*.) This cougar family, nicknamed *Spirit of the Rockies*, remained on the National Elk Refuge for 42 days, overshadowing even the newsworthy sighting of the first wolves in the valley in 65 years. This rare and moving event was the inspiration for what would become The Cougar Fund.

The Cougar Fund's mission is "to protect the mountain lion in its present and future range, for perpetuity and for all generations to come." The Cougar Fund educates the public on the value of cougars in nature and promotes the gathering and application of sound science. By advocating thriving, sustainable populations of cougars, The Cougar Fund ensures that these beautiful, legendary creatures may exist in ways that enjoy long-lasting public support.

For more information on
The Cougar Fund:
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checked M139's signal and location; he had moved away from the capture site and appeared to be doing fine. Back in Gardiner, I started making phone calls. My first call was to Kevin Frye at Montana Fish, Wildlife and Parks. Within minutes of describing the tag and providing the number, Kevin had information for me. Male 139 had been captured as a 19–24 month-old yearling cougar in Clyde Park, Montana, and he had been translocated to and released in a remote area outside of Cooke City, Montana. By translocating M139 to a more remote area, Montana Fish, Wildlife and Parks used a non-lethal means of dealing with a cougar that had not done anything wrong, but was of some concern due to its nearness to humans. Translocations of young, dispersal-age cougars are successful (Ruth et al. 1998), as these animals are typically searching out new areas in which to establish a home range. Moving the animal to a new area may mimic their long-range dispersal movements, and young cougars that are translocated quickly establish a home range near where they are released. Movement of such animals to a remote area away from human activity provided for the safety of the cougar and people in this case, as M139 successfully established a home range overlapping the park.

Ninety-two days after her breeding association with M139 (about the average gestation period for cougars), female F107 gave birth to a litter of two female kittens in a cliffy, bouldered area near Barronette Ridge. These female kittens successfully dispersed to other areas in the Greater Yellowstone Ecosystem, moving south towards Togwottee Pass and Dubois, Wyoming.

We continued to monitor M139's movements through mid November 2001. Slightly more than a week and a half had elapsed since we had picked up a radio signal from male cougar M139's collar, and now we were receiving a radio transmission from pilot Stan Monger: M139's radio collar was transmitting in mortality mode. My breathing paused as I imagined the rapidly-beating radio signal I would soon hear, and my mind raced with questions and ideas of what fate had befallen male 139, otherwise dubbed "Pilgrim" in our study population of cougars. Slowly, I responded to Stan in the plane overhead while field technician Mike Sawaya jotted down the Global Positioning System (GPS) map coordinates to assist us in locating the signal on the ground. Although Stan located M139 at 11:30 AM, he was unable to contact us until approximately 1 PM to relay the news. Stan additionally indicated that he had observed part of a carcass and blood in the snow below the cliffs of Mount Norris in Yellowstone National Park. Later that afternoon, it became evident to us that had Stan's flight not been delayed by poor weather conditions on that Tuesday morning of November 27, 2001, it is likely that M139's radio collar would not have been transmitting a mortality signal. Additionally, had the flight occurred a day earlier or later, snow would have obliterated the incredible scene that lay before us at the base of those cliffs.

> "My breathing paused as I imagined the rapidly-beating radio signal I would soon hear, and my mind raced with questions and ideas of what fate had befallen male 139, otherwise dubbed 'Pilgrim' in our study population of cougars."

Mike and I had just returned to the truck from a morning spent locating another radio-collared cougar, and now we were deflated by the recent news of the loss of a valued and admired study animal. However, we were also eager to arrive at the site, and we discussed the possibilities of what we might find. Mike plotted out the aerial location on a laminated field map, while we blurted questions at each other: Was M139 still alive and his collar simply malfunctioned? Could his collar have slipped off while he was killing an elk, deer, or bighorn sheep? Or, did he fall off the cliff while trying to kill prey? Although we have detected few sheep in the items of prey killed by cougars in our study here in Yellowstone, we knew that bighorn sheep frequented this cliffy area of Mount Norris and that, in another study, a cougar had died after falling off a cliff while trying to kill a bighorn sheep (Ross and Jalkotzky). Perhaps M139 had been dead for at least a week, and we would not be able to determine what had killed him. The possibilities were numerous, and we were anxious to find the answers to our questions.

With adrenaline-assisted motivation, we hiked to the site, arriving around 3 PM. The signal "bounced" off the nearby cliff, confusing our location of the collar, so we tacked in a slight arc to a point above the signal. We first detected blood and carcass fragments in a slide path on a 38-degree slope directly below a vertical cliff face. We surveyed the treacherous slope with caution. A slight skiff of snow covered the hard, frozen ground, and there were few footholds and little room for error. If one of us slipped, we would slide easily and quickly down slope, potentially impacting one of the trees below. Slowly, we investigated the area and worked with the signal. Within 20 minutes we located M139's carcass and, lying nearby, the carcass of a very large bighorn sheep ram.

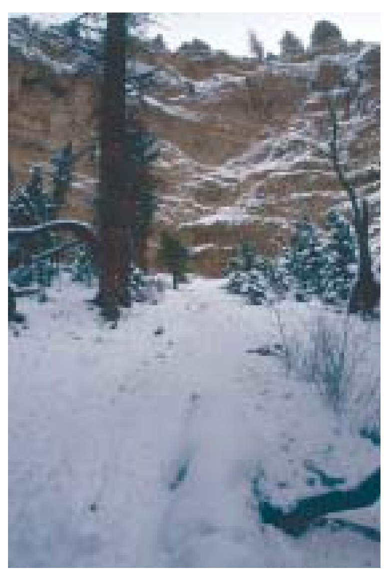
The mortality scene was fresh and provided evidence of what had transpired. We estimated that both animals died between 4 and 6 AM, based on the time the mortality signal was first located, the freshness of the carcass (the bodies of both animals were still warm and very pliable), and the switch into mortality mode of M139's transmitter. Each radio collar is equipped with a special feature called a mortality mode. Thus, any collar that remains stationary for longer than six hours will switch to a different pulse rate; in this case a faster pulse than when the collar is not stationary. From the site evidence, we suspect that M139 attacked the ram somewhere near or on top of the cliff (7,600 ft elevation) and both animals fell approximately 400 feet to the base of the cliffs. Another scenario is that one animal impacted with the ground prior to the other animal. In either event, the sheep, and possibly M139, then slid and impacted a Douglas-fir tree with great force. This impact was evident on the tree, as blood, muscle tissue, sheep hair, and rumen contents covered the tree upwards of 15 feet above the ground, and on the slope adjacent to the tree. The impact appeared to have eviscerated the sheep of all internal organs including those in the upper body cavity (heart and lungs). Both cougar and sheep continued to slide down the slope, but separated approximately halfway down, with both sliding to final resting places approximately 150 feet down slope and about 60 feet apart.

Upon quick examination in fading daylight, we documented the numerous injuries to the two animals, and collected samples for later analysis of body condition and age. In addition to the evisceration, the bighorn sheep had a shattered pelvis, fractured jaw, and an angulated open fracture of the left metatarsus (lower hind leg bone). The cougar had massive internal and subcutaneous hemorrhaging as well as comminuted fractures of both femurs and his right humorous. In my 15 years of studying cougars in Florida, Texas, New Mexico, and Montana, I had never observed a scene such as what lay before me. Mike and I wrapped up our examination with a final note of scavenging by coyotes and magpies at the ram carcass, but no such scavenging was observed at the cougar carcass.

During winter, cougars consistently seek prey larger than themselves to kill. As solitary hunters, attacking large prey can sometimes prove fatal or result in injuries to the cats. Other studies have documented similar dramatic and violent struggles between cougars and their prey. Researchers in Alberta, Canada, reported a cougar that was speared by a sharp branch when the elk that she eventually killed tried to shake her loose. In another report from a study in New Mexico, a female cougar was killed by a desert mule deer when, during the struggle, the deer's browtine pierced the braincase of the cougar. Most studies on cougars report one to a few cougar deaths due to struggles with prey; however, the greatest source of mortality in most cougar populations is due to human hunting.

Although we lost an important study animal with the death of M139, the information we collected during the year and a half we monitored him, including his mortality, will prove valuable to answering the questions posed by our study on the effects of wolf reintroduction on cougar population characteristics (such as causes of mortality and survival rates) and rates of predation on prey (see "Ghost of the Rockies," this issue of YS). This includes documenting how quickly another cat replaces M139. Sometime during the summer of 2002, a new male immigrated into the area vacated by M139's death. We captured male M178, an approximately three-year-old male, in February 2003. Monitoring his radio collar during the summer indicated that he uses similar areas as M139 and overlaps a portion of female F107's home range. We're excited to continue to learn M178's story and his role in the Yellowstone cougar population. YS

> "In my 15 years of studying cougars in Florida, Texas, New Mexico, and Montana, I had never observed a scene such as what lay before me."



The slide path of cougar M139 and the bighorn sheep ram down Mt. Norris.

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Ruth, T.K., K.A. Logan, L.L. Sweanor, M.G. Hornocker, L.J. Temple. 1998. Evaluating cougar translocation in New Mexico. *Journal of Wildlife Management* 62(4):1264–1275.

Yellowstone Mountain Lions and Art

Alexander Phimister Proctor's Sculpture, Panther with Kill

Peter Hassrick

Variant titles: *Panther and Kill; Panther with Deer*
Modeled, 1907; cast initially, 1908
Bronze, 11 1/2 x 5 1/2 x 5 1/2 inches
Markings: "A. Phimister Proctor, SC/copyright 08"
Copyright: None recorded

A. Phimister Proctor Museum, Poulsbo, Wash. Photograph by Howard Giske

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Proctor sculpting at the Bronx Zoo's Elephant House in New York, September 1908.

Alexander Phimister Proctor

THROUGHOUT HIS LONG and productive creative life, Alexander Phimister Proctor was broadly considered to be America's premier sculptor of animals. His first major public commissions—modeling the horses for Augustus Saint-Gaudens' magnificent equestrian monuments to Civil War generals John Logan (Chicago, 1897) and William Tecumseh Sherman (New York, 1903)—brought him professional notoriety at the turn of the twentieth century. He capped his career in 1948, when the University of Texas at Austin dedicated his heroic, multi-figured *Mustangs*, a dramatic emblem to the state's western legacy. In the years between these masterful achievements, in the capacity of what is referred to as an *animalier* artist, he produced dozens of epic-scale works, ranging from the massive, marble *Lions* for President William McKinley's memorial in Buffalo, New York, to the huge, bronze *Buffaloes* that adorn the Q Street Bridge in Washington, D.C.

Proctor was born in Canada in 1860. He and his pioneer family moved to Colorado 11 years later. He grew up in Denver and began studying art there at the age of 12. Although he completed formal schooling through only the eighth grade, he later showed sufficient artistic prowess to earn enrollment in classes at both the National Academy of Design and the Art Students League in New York. From there he traveled to Paris to learn the French method of sculpture, which demanded a precise adherence to naturalism invigorated with the spirit of romanticism. By the time he returned to the United States and established a studio in New York around 1900, he had already won several international awards for his art.


MODEL OF McKINLEY MONUMENT LION.

Figure 1. Newspaper photograph of Proctor modeling *Lions* for the McKinley monument, 1906.

A. Phimister Proctor Museum Archives, Poulsbo, Wash. Reproduction photograph by Howard Giske

"Yellowstone Pete"

Equal to Proctor's devotion to art was his ardent love of nature and the wilds. Having spent much of his youth in the far western reaches of the Colorado Rockies, he relished the hunt and was an able and celebrated sportsman. It was in these joint pursuits, artist and sportsman, that he befriended Theodore Roosevelt and Gifford Pinchot. Roosevelt inducted Proctor into the Boone and Crockett Club in 1893 and collected and commissioned many of the artist's sculptures. Pinchot, who served as chief of the federal Forestry Division (today's U.S. Forest Service) during Roosevelt's presidential terms, was Proctor's closest personal friend. The two often traveled together in the West, sometimes to hunt and at other times simply for the personal enjoyment of each other's company. They were also both quite friendly with Major John Pitcher, acting superintendent of Yellowstone National Park from 1901 to 1907. Pitcher was an old hunting companion of Proctor's, and he was an extremely popular administrator who paid close attention to the needs of park visitors. While he was a zealous guardian of the park's resources, he also insisted that tourists should have the most positive experience possible. His vision of accessibility went beyond the park's boundaries, and Proctor and the world of art became its beneficiaries.[1]

Proctor's friendship with Pitcher and his renowned talents as an *animalier* sculptor had early in 1906 earned him an extraordinary gift from Yellowstone National Park—a mountain lion, one of the park's most celebrated animals. Reports and stories had been circulating for several years about the impact that cougars were having on the park's mountain sheep, deer, and elk populations. Some, like Roosevelt, suggested that despite the serious attrition in elk herd numbers that some claimed was caused by hungry mountain lions, the elk in the park were actually "rather too numerous" and the cougars represented little long-term threat.[2] Others were not so sanguine. Frederic Remington, who had taken a winter tour of the park in 1900, referred to the cougars as "outlaws." In an article published in *Collier's* shortly after his visit, Remington pronounced the cougars a menace and called for them to be dealt with summarily.[3] Pitcher, in his desire for visitors to see as much wildlife as possible, leaned more toward Remington's attitude. He felt a reduction in the lion population was necessary, arguing that they "seriously threaten[ed] the extinction of the deer and other game" in the park.[4] In the spring of 1906, he set out with a party of men and dogs to remedy the situation. One lion, a female who was affectionately, though inaccurately, nicknamed Yellowstone Pete, was treed and about to be dispatched, when Pitcher thought of his friend Proctor. According to an article in the *New York World*, the superintendent

> *remembered that in the Bronx in New York was the most extraordinary art studio in the country—a big building, where a former westerner, now a sculptor, worked from live animal models in the moist clay and afterward fixed the forms into bronze and marble. The major had hunted across the Rocky Mountains with A. Phimister Proctor, the sculptor, when Proctor lived with the cowboys and mountaineers and spent his life studying the denizens of the plains and the hill country. They had gone hungry together among the crags and slept under the same blanket and cut the same venison before the camp fires in the wilds. He determined to capture Pete alive and send him to Proctor.*[5]

Proctor had just completed his huge marble lions for the McKinley monument in Buffalo, each 12 feet long and weighing about 12 tons (fig. 1). Dealing with this scale and working in Vermont marble had challenged the artist; thus, he welcomed the chance to work once again on a small sculptural group. After Yellowstone Pete was donated to New York's Zoological Park (the Bronx Zoo), Proctor began visiting her there. He soon found, however, that Pitcher's trophy was a "wild and unwilling model" under those circumstances.[6] After many efforts to cajole the animal into posing, Proctor persuaded the zookeepers into letting him borrow Yellowstone Pete for the summer. Thus, the cat was moved to the artist's farm at Indian Hill, north of the city near Bedford, New York. Placed in a smaller cage there in the country, she was "a captive to the interests of art."[7] The Proctor children long remembered the feline yowls that pierced the calm of their Westchester evenings.

Proctor spoke of *Panther with Kill* in relaxed terms:

> *Models for the group presented no problem, for we had a caged panther at the farm, and I was permitted to make sketches of a deer that had died at the [New York City] menagerie. I had to prod the panther with a pole to get her*

into the position that I wanted. After a period of poking she seemed to grasp the situation and kept the pose pretty well.[8]

In a letter from Pinchot to Proctor in autumn 1906, Pinchot suggested a hunting trip to Montana and a side excursion to the park. "If we went to Montana," he wrote, "we should be right on the edge of the nat. park.…Both Major Pitcher and Mrs. Pitcher are exceedingly anxious to have you come out there. I saw them recently and they both spoke enthusiastically of your coming. How about it?"[9] One of the reasons that Major Pitcher was so anxious to have Proctor as a park guest was that the artist was just finishing a clay model of the cougar. It had taken several months to complete the model, and once finished, the dramatic little group was sent to the foundry, presumably the Gorham Company. Unfortunately, the Yellowstone visit did not materialize, but the product of Pitcher's generosity was cast in bronze and copyrighted in 1908, and given the title *Panther with Kill*. It tested and revealed everything that Proctor had learned from the French a decade earlier about the beauty of naturalism and the power of the romantic.

In its final form, the bronze paid a romantic tribute to Yellowstone National Park and the West, to the wild instinct for survival, and to the fundamental realities of predation in the balance of nature. It is not known if Proctor agreed with Roosevelt or Pitcher in the elk/cougar numbers debate, but he definitely privileged the cougar as a dominant, pervasive force in nature's scheme.

Proctor's Influences

Proctor paid special tribute in this work to his artistic hero, the early nineteenth century French *animalier* sculptor, Antoine Louis Barye. In pose, theme, and dramatic essence, Proctor's *Panther with Kill* was patterned after Barye's famous, convulsively powerful bronze *Jaguar Devouring a Hare*, which was sculpted in France around 1850. In everything from the highly articulated musculature of the cat's massive shoulders and its taut, twitching tail to the formal base panel, Barye's influence is evident. Just as Barye was reacting in his highly popular "animal combat" sculptures against neoclassicism in favor of romanticism's ideal of truth in nature, so, too, was Proctor making a statement.[10] His McKinley *Lions*, by virtue of their memorial function for a head of state, had possessed a regal, staid air with bows to classicism. In *Panther with Kill*, Proctor stepped vicariously into nature's wilds and aesthetically into romanticism's more dramatic realm.

In 1901, Henri Matisse, the French modernist painter and sculptor, had used Barye's *Jaguar Devouring a Hare* (fig. 2) in a similarly transitional way. Matisse's first serious sculptural piece, also titled *Jaguar Devouring a Hare* (fig. 3), was a freely formed mass of faceted planes crafted as a study after the Barye bronze. Matisse was reacting against Beaux-Arts productions of his time, which to him were uninspiring and crisply representational.[11] While Proctor was not willing to move beyond accepted French and American norms, he was interested in varying his output only within the Beaux-Arts perimeters.

Alexander Phimister Proctor in his studio, c. 1921.

A. Phimister Proctor Museum Archives, Poulsbo, Wash.

Theodore Roosevelt
Variant titles: *Rough Rider*
Modeled, 1920–1922; cast, 1922; dedicated, 1922
Bronze, monumental sculpture
Markings: "Alexander Phimister Proctor Sc./©1922"; "A Gift to the City of Portland From Dr. Henry Waldo Coe."
Copyright: By Alexander Phimister Proctor under No. G65849 on May 19, 1922
City of Portland, Oregon

Photograph by Will Gillham

In 1920, Proctor was extremely fortunate to be given a commission to produce a monumental equestrian portrait of the recently deceased Theodore Roosevelt as a gift from Dr. Henry Waldo Coe to the city of Portland, Oregon. Proctor chose to represent his friend Roosevelt in Rough Rider uniform on a horse in partial repose. Roosevelt's second wife, Edith, and their son, Kermit, found and sent a uniform as well as other items that Proctor used on a soldier boy who was his model.

Figure 2. Antoine-Louis Barye (1795–1875) *Jaguar Devouring a Hare,* modeled 1850
Bronze, 23 inches in height

National Museum of Wildlife Art, Jackson, Wyo.

Figure 3. Henri Matisse (1869–1954)
Jaguar Devouring a Hare
(after Antoine-Louis Barye), 1899–1901
Bronze, 22 x 9 1/8 x 9 1/8 inches

Musée National d'Art Moderne, Centre Georges Pompidou, Paris
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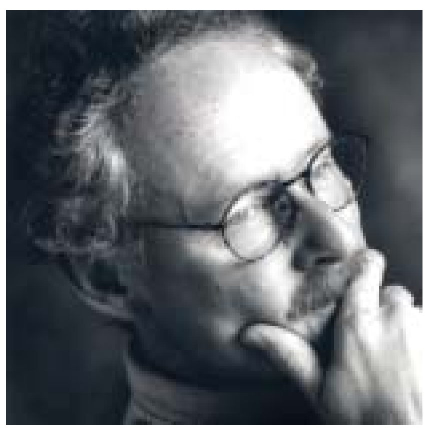
Photograph by Philippe Migeat

Panther with Kill was very popular. Proctor exhibited castings of it widely, beginning with the winter exhibition of New York's National Academy of Design in 1908. Versions of it were later shown in Canada and in two one-man exhibitions at the Art Institute of Chicago and the Corcoran Gallery of Art in Washington, D.C. Proctor and Pinchot talked in later years about trying again to visit Yellowstone, but as far as we know, the artist never reached the park. His summer with Yellowstone Pete would be as close as he would come. YS



Peter Hassrick is a writer and independent American art scholar who serves a national and international constituency of museums as guest curator. He was born in Philadelphia and raised in Denver. He earned a B.A. in History from the University of Colorado and an M.A. in Art History from the University of Denver. He is the Founding Director Emeritus of the Charles M. Russell Center for the Study of Art of the American West at the University of Oklahoma in Norman, Oklahoma. For 20 years, he served as the Director of the Buffalo Bill Historical Center in Cody.

Endnotes

[1] For information on Pitcher, see Aubrey L. Haines, *The Yellowstone Story: A History of Our First National Park,* vol. 2 (Yellowstone National Park: Yellowstone Library and Museum Association, 1977), p. 457.

[2] Quoted in George Bird Grinnell, ed., *American Big Game in Its Haunts* (New York: Forest and Stream Publishing, 1904), p. 36.

[3] Frederic Remington, "Mountain Lions in Yellowstone Park," *Collier's* 24, no. 4 (17 March 1900): 14.

[4] "Snohomish Boy Leader in Art," unidentified clipping attributed to *New York World,* 18 May 1909, Proctor Museum Archives.

[5] Ibid.

[6] Ibid. Vivian A. Paladin somehow confused this story with one that we have been unable to corroborate in which William F. Cody lassoed the cougar in Yellowstone Park and gave it to Roosevelt, who in turn donated it to the Bronx Zoo where Proctor used it to model his *Panther,* first cast in the late 1890s. Vivian A. Paladin, "A. Phimister Proctor: Master Sculptor of Horses," *Montana* 14, no. 1 (January 1964): 15–16.

[7] "Snohomish Boy Leader in Art."

[8] Alexander Phimister Proctor, *Sculptor in Buckskin* (Norman, Okla.: University of Oklahoma Press, 1971), p. 148.

[9] Letter from Pinchot to Proctor, 13 October 1906, Gifford Pinchot Papers, Library of Congress.

[10] Glenn F. Benge, *Antoine-Louis Barye: Sculptor of Romantic Realism* (University Park, Pa.: Pennsylvania State University Press, 1984), pp. 6–7.

[11] See John Elderfield, *Henri Matisse: A Retrospective* (New York: Museum of Modern Art, 1992), pp. 46, 85.

This article is based on the chapter "Panther with Kill" in Hassrick's book, *Wildlife and Western Heroes: Alexander Phimister Proctor, Sculptor,* an illustrated catalogue of more than 60 monumental and studio sculptures, published in September 2003. Essays and catalogue entries by Professor Peter Hassrick; personal recollections by the artist's son and grandson. Published by Third Millennium Information Limited in association with the Amon Carter Museum, Fort Worth, Texas, at $59.95 (hardback). First American serial rights were generously granted to *Yellowstone Science* for the printing of this article. The Proctor exhibition, including *Panther with Kill,* that opened in Fort Worth, Texas, October 2003 will be in the galleries of the Buffalo Bill Historical Center in Cody, Wyoming, all summer 2004, starting May 1.

From the Archives

This photo, ca. 1906–7, of a mountain lion was found in the Bronx Zoo photo archives. Is it "Yellowstone Pete"?

"When I consider that the nobler animals have been exterminated here,—the cougar, panther, lynx, wolverine, wolf, bear, moose, deer, the beaver, the turkey, etc., etc.,—I cannot but feel as if I lived in a tamed, and, as it were, emasculated country.…I take infinite pains to know all the phenomena of the spring, for instance, thinking that I have here the entire poem, and then, to my chagrin, I hear it is but an imperfect copy that I possess and have read, that my ancestors have torn out many of the first leaves and grandest passages, and mutilated it in many places. I should not like to think that some demigod had come before me and picked out some of the best of the stars. I wish to know an entire heaven and entire earth."

—Henry David Thoreau

JULIE LARSEN MAHER/WILDLIFE CONSERVATION SOCIETY

Africa's Western lowland gorillas are threatened by habitat destruction. See Dr. Steven E. Sanderson's keynote address from Yellowstone's 7th Biennial Scientific Conference on the Greater Yellowstone Ecosystem *Beyond the Arch: Community and Conservation in Greater Yellowstone and East Africa*, page 5.

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