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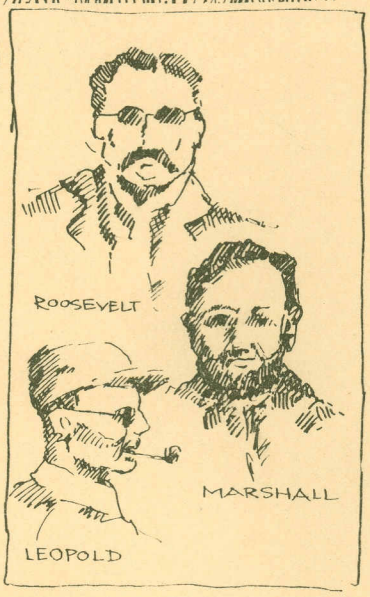

FISH & WILDLIFE OF THE BOB MARSHALL WILDERNESS COMPLEX and SURROUNDING AREA

Limits of Acceptable Change in Wilderness

1988

Montana Department of Fish, Wildlife & Parks

in cooperation with
REGION ONE
U.S. FOREST SERVICE

BOB MARSHALL WILDERNESS COMPLEX

FISH AND WILDLIFE PLAN

Drafted by the Montana
Department of Fish, Wildlife and Parks

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This initial planning document is submitted as part of the "Limits of Acceptable Change" Wilderness management program of the United State Forest Service. The primary authors of this report are: Jim Posewitz, the historical background and philosophy section; Gayle Joslin, the wildlife section; and John Fraley, the fishery section. Numerous other contributors are recognized in the appropriate sections.

REPORT ORGANIZATION

This report is organized in three distinct parts. The first part discusses some historical and philosophical perspectives on wilderness in general and the formation of the Bob Marshal complex in particular. The second part addresses the wildlife resource of the area. This section approaches the issue on a species by species basis. The section features big game animals because of public interest in these animals and because there is a sufficient amount of information to support an analysis. The wildlife analysis, of necessity, went beyond designated wilderness boundaries when adjacent areas were essential to the species being discussed. The third part addresses the fishery resource of the area. The fishery section approaches the issue on a drainage basis. This approach conforms reasonably well with the wilderness boundaries.

This report is considered a first complete draft. The authors recognize that the Limits of Acceptable Change Committee will be reviewing its contents and will be offering additional perspectives and information.

THE BOB MARSHALL WILDERNESS COMPLEX
HISTORICAL AND PHILOSOPHICAL PERSPECTIVE

FOREWORD

Wilderness conservation and wildlife protection have shared the time and attention of America's conservationists throughout our history. This discourse will recognize representative parts of the history of the land under consideration along with development of the philosophy that led to it's current condition.

This background is valuable in assessing the wilderness and wildlife legacy entrusted to us. Likewise it is important that we contribute what we are able to secure and enhance this heritage. In 1836 Ralph Waldo Emerson began his essay "Nature" with the sentences, "Our age is retrospective. It builds the sepulchres of the fathers." He concludes the same paragraph by counciling "The sun shines today also. ..... There are new lands, new men, new thoughts. Let us demand our own works and laws and worship." (Cook 1950). Thus we have an admonishion to respect our origin and a license to express our contemporary vision. This fish and wildlife plan pursues that noble purpose.

AN EVOLVING WILDLAND PHILOSOPHY

To develop a background for a wilderness and wildlife management philosophy the writings of three individuals were reviewed. These people, Theodore Roosevelt (1858-1919), Bob Marshall (1901-1939), and Aldo Leopold (1887-1948) were prominent in laying the groundwork for the American wilderness system. None of them lived to see passage of the Wilderness Act. Each of them brought a different perspective to the issue reflecting their own sensitivities and passions. Collectively their philosophies richly endow our wilderness heritage and enhance our understanding of why the institution of wilderness now attends our culture. That understanding will help us plan the future of the Bob Marshall Wilderness complex.

Theodore Roosevelt was a hunter and an advocate for preserving wilderness, wildlife, and the hunt. In an article he authored in 1905 he wrote, "A peculiar charm in the chase of the wapiti, comes from the wild beauty of the country in which it dwells." Further in the article he continues, "All really wild scenery is attractive. The true hunter, the true lover of the wilderness, loves all parts of the wilderness, just as the true lover of nature loves all seasons." (Schullery 1986). One of Roosevelt's many conservation legacies was the Forest Reserve System from which many of our wilderness areas were or are being derived. To him the wilderness was the still uncharted lands. When he was born buffalo hides from Montana's Rocky Mountain Front were being sent down the Missouri River by the tens of thousands each year. When he died the American conservation movement was firmly committed to public land preservation and wildlife restoration. Theodore Roosevelt was one of the first Americans with political clout who also saw value in preserving of our nation's wildness. His vision came home through the eyes of a sport hunter. To Roosevelt, big game hunting, particularly elk hunting, and wild country were synonymous. In 1893 he wrote; "Hunting in the wilderness is of all pastimes the most attractive, and it is doubly so when not carried on merely as a pastime. Shooting over a private game preserve is of course in no way to be compared to it. The wilderness hunter must not only show skill in the use of the rifle and address in finding and

approaching game, but he must also show the qualities of hardihood, self-reliance, and resolution needed for effectively grappling with his wild surroundings." (Op. Cit.).

If one can look beyond Theodore Roosevelt's somewhat exaggerated preception of what was considered manhood at the turn of the century other important concepts are articulated. One of these concepts is that conservation of wildlife and wild country are the same issue. The other is that these resources are for all people. In a 1905 writing he reveals his thoughts as follows:

> "Every believer in manliness and therefore in manly sport, and every lover of nature, every man who appreciates the majesty and beauty of the wilderness and of wild life, should strike hands with the farsighted men who wish to preserve our material resources, in the effort to keep our forests and our game beasts, game-birds, and game-fish - indeed, all the living creatures of prairie and woodland and seashore - from wanton destruction.
>
> Above all, we should realize that the effort toward this end is essentially a democratic movement. It is entirely in our power as a nation to preserve large tracts of wilderness, which are valueless for agricultural purposes and unfit for settlement, as playgrounds for rich and poor alike, and to preserve the game so that it shall continue to exist for the benefit of all lovers of nature, and to give reasonable opportunities for the exercise of the skill of the hunter, whether he is or is not a man of means." (Op. Cit.).

Although we were still more than a half a century away from passage of the Wilderness Act, American conservationists were laying the foundation. This foundation, clearly shows a relationship between preserving wild lands and sustaining wildlife for the hunter. It also shows the significance of the hunter in developing not only the philosophy of wilderness preservation but in Roosevelt's case the conversion of those ideas into action. Roosevelt's conservation legacy as president is legend. When he ascended to the presidency there were 40 million acres of National Forest lands, when he left there were 194 million acres. In essence, much of the rough material from which the wilderness system would be fashioned was being set aside in public ownership. It would take time and thoughtful debate to eventually formalize the institution of a congressionally classified Wilderness System.

The generation between Roosevelt's land reserving and a wilderness system produced at least two thoughtful advocates that concentrated on the issue, Bob Marshall and Aldo Leopold. Both men saw lands they were responsible for being divided by roads and subjected to mechanized use. In response they conceived the notion that some lands must remain unaffected and protected from this use.

Bob Marshall's life and career attended the evolution of the wilderness concept and saw wilderness become a reality under United State's Forest Service regulation. Marshall's attention seemed most focused on the esthetic aspects and physical challenge of wilderness. Wildlife and it's pursuit were rarely the center of his attention. To Marshall, wilderness was a big, wild, challenging place and he responded by constantly testing himself against wild country. At the same time his esthetic sensativities were never diminished no matter how arduous his adventure. In this physical relationship to wilderness, Marshall shared some of Theodore Roosevelt's sense of exhilaration. Unlike Roosevelt,

Marshall had no passion for the hunt, his attention focused other values. Writing in 1928 in defense of wilderness as a minority right he stated:

> "A small share of the American people have an overpowering longing to retire periodically from the encompassing clutch of a mechanistic civilization. To them the enjoyment of solitude, complete independence, and the beauty of undefiled panoramas is absolutely essential to happiness. In the wilderness they enjoy the most worthwhile or perhaps the only worthwhile part of life." (Glover 1987).

Marshall often argued for wilderness because of it's physical dimension and the esthetics that often attended that physical testing. In 1930 he wrote, "Life without such exertions would be for many persons a dreary game, scarcely bearable in it's horrible banality." In the same article he added, "But when one looks at and listens to the wilderness he is encompassed by his experience of beauty, live's in the midst of his aesthetic universe." (Op. Cit.). Bob Marshall's contribution to wild land preservation are also legend. His focus and energy sought to emphasize and revel in the physical and esthetic experience. In many respects he added balance to evolving wilderness thought by keeping the purely aesthetic experience well represented among the cadre of activists actually developing the wilderness system within the U.S. Forest Service.

Among that cadre was an articulate wilderness advocate whose arguments for conservation of country, wildlife and a sensitive human relationship with both became gospel that persists to this day, Aldo Leopold. More than any other thinker Leopold honed the wilderness and wildlife relationship to an edge keen enough to carve through complexities perhaps unheard of in his time. His credentials as a scientist, manager, teacher and citizen activist are impeccable. He was a founder of the Wilderness Society, a forester, author of the classic textbook "Game Management" and philosopher whose essays on conservation, esthetics, and management remain classics of our culture. His writings present ideas and concepts that can be relied upon for contemporary guidance. His many articles and essays also record the fact that wild land conservation and wildlife conservation were carried by a common ancestry.

Writing in American Forests and Forest Life, the magazine of the American Forestry Association in October of 1925 Leopold stated, "Wild places are the rock-bottom foundations of a good many different kinds of outdoor play, including pack and canoe trips in which hunting, fishing, or just exploring may furnish the flavoring matter" (Leopold 1925). In this statement we see the close association between the seeds of the wilderness movement and hunting and fishing. The association is drawn by one of the founding fathers of the wilderness movement who also is creditably identified as the father of wildlife management. This idea then was germinating 39 years before there would be a Wilderness Act. Articulation of this concept and association recurs frequently in Leopold's writings.

The record of grassroots public advocacy for wilderness in the early 1900's is difficult to find. One such reference, however, appears in an essay addressing "Origin and Ideals of Wilderness Areas". The article appeared in the official publication of The Wilderness Society in July of 1940. The article attempted to trace the wilderness movement prior to 1926. In that article the author states, "The earliest action I can find in my files is a letter dated September 21, 1922, notifying the District Forester that two local Game Protective Associations had

endorsed the establishment of a wilderness area on the head of the Gila River, in the Gila National Forest." (Leopold 1940). Game protective associations were the rod and gun clubs or sportsmen's associations of that era. The important point is that wilderness advocacy was a part of the wildlife conservation advocacy of sportsmen as well as philosophical leaders the stature of Leopold.

A distinction that must eventually be addressed is whether contemporary wilderness management programs are to focus on production of harvestable game or on some other aspects of recreation such as certain perceptions of hunting quality. In addressing a difference of opinion held between the Ecological Society and the Wilderness Society in 1942 Aldo Leopold said; "Serious ecological studies of a professional nature are...important, and they...have a place in wilderness areas. The fallacy lies in the assumption that all ecology must be professional, and that wilderness sports and wilderness perception are two things rather than one. Good professional research in wilderness ecology is destined to become more and more a matter of perception; good wilderness sports are destined to converge on the same point. A sportsman is one who has the propensity for perception in his bones. Trigger-itch, wanderlust, and buck-fever are simply the general raw materials out of which perception is built" (Leopold 1942). This particular passage addresses a number of points and interestingly carries an endorsement for the current process being employed to develop wilderness management plans. Specifically, that endorsement is that ecological contemplations and wildlife management planning is as much the domain of the perceptive sportsman as it is the professional manager. The same fundamental point appears in more contemporary writing when authors Schoenfeld and Hendee point out, "The flavor of wilderness-wildlife management..... depends on the strength of the wilderness ethic among wilderness-wildlife managers and their constituencies" (Schoenfeld and Hendee 1978).

<u>It therefore follows that one of the first steps this planning process must take is to identify a common perception regarding how we will relate to wilderness fish and wildlife as managers, as sportsmen and as other users of this resource.</u>

Leopold as always can be relied upon for some degree of guidance. In his essay "Conservation Esthetic" he stated, "To promote perception is the only truly creative part of recreational engineering" (Leopold 1966). One of our other mentors, Theodore Roosevelt, displayed the desire for a more direct involvement when he wrote, "Hunting in the wilderness is of all pastimes the most attractive, and it is doubly so when not carried on merely as a pastime." In a later article Roosevelt argued, "It is...in our power...to preserve large tracts of wilderness...to preserve the game so that it shall continue to exist for the benefit of all lovers of nature, and to give reasonable opportunities for the exercise of the skill of the hunter, whether he is or is not a man of means" (Schullery 1986). The thoughts of these two conservation pioneers suggest that hunting, and conservation to support a particular kind of hunting are a reason for wilderness. They also suggest we must give attention to building sensitive perceptions into how recreationists relate to that activity. Traditionally resource managers avoid this type of "social engineering." Perhaps this process involving both professional managers and Leopold's sportsmen, with a "propensity for perception in his bones", can cross that threshold.

Resource planning efforts that begin with considering the origins of the ideas that produced the wilderness concept need also to consider the origins of the specific areas involved. In doing this we declare a respect for both, the

national and the local energy, that was expended in conserving wildlife and protecting wildlands.

THE CLASSIFICATION OF THE LAND

On the 17th of May 1933 Bob Marshall wrote to the Regional Forester Meyer Wolff, in Missoula: "I do wish that you would hurry up and get that entire country from the Locksaw River to the southern border of Region One set aside as wilderness before some damn fool chamber of commerce or some nonsensical organizer of unemployed demands a useless highway to provide work and a market for hotdogs and gasoline" (Glover 1987). Bob Marshall failed to inspire forester Wolff. The U.S. Forest Service at that time already had regulations that allowed setting aside "primitive" areas. These rules, the "L" regulations and later a new classification the "U" regulations were used to begin assembling the Bob Marshall complex. The upper Sun River, the Pentagon area, and the upper South Fork of the Flathead River, were protected by this classification. Bob Marshall died in 1939 and a year later these three primitive areas were combined into a wilderness and named the Bob Marshall Wilderness in his honor. (Graetz 1985).

The land to the north and south of these protected areas remained quietly under U.S. Forest Service custodial care until 1968. In that year a plan for development of the Lincoln-Scapegoat was issued. The plan, entitled "The Blackfoot - Sun River Divide Area, Management for People." called for a Continental Divide crossing, logging roads, logging 25 percent of the area, campgrounds and winter recreation vehicle use of the area. The result was a controversy that spanned a four year period and resulted in the creation of the Scapegoat Wilderness. (Op. Cit.).

There were many important lessons and points of relevance that need to be remembered in the Lincoln-Scapegoat debate. Review of the testimony offered in congressional hearings on this area shows that preservation of fish and wildlife values was a recurring theme among the advocates for protection. Also evident in this debate was the coalition of sportsmen and outfitters that worked for including this area in the Wilderness preservation system. (Op. Cit.). U.S. Forest Service historian Dennis M. Roth identifies the Lincoln-Scapegoat legislation as, "...the first strictly citizen wilderness proposal made after the passage of the Wilderness Act." Historian Roth's analysis was further qualified with the recognition that this issue stirred considerable debate within the U.S. Forest Service and that "Without the dissenting voices of Bob Morgan (Helena Forest Supervisor) and the Lincoln District Rangers...roads would have been built...before the Scapegoat Wilderness Act of 1972" (Roth 1984).

If any two people could be singled out as citizen leaders in the advocacy for the Lincoln-Scapegoat they are Cecil Garland and Tom Edwards. Garland a Lincoln merchant spoke often and eloquently for a country he loved. His feelings are portrayed by a portion of his testimony before a congressional hearing on September 23, 1968.

"Senator Burdick, Senator Metcalf, and ladies and gentlemen: Fifteen years ago, when I first brought my family to the community of Lincoln, I was told of a great wild country to the north known as the Back Country. They told me with awe in their voices of places called Ringeye, Scotty Creek, Lost Pony, Red Mountain, the East Fork, the North Fork, Parker Lake, Meadow Lake, the Twin Lakes and an almost

unworldly country called Scapegoat and Half Moon Park.

"I longed to see that country, to know its wild beauty, to catch its fish, to hunt its game, and to climb its mountains.

"Unusually wonderful, it was then, when the time came to pack our camp and move away from roads that led back to that world we call civilization.

"We camped that first night on a small bench above Ringeye Falls. Taking down our tent from an old frame that the pack rats were using for a home, we made a secure camp, cooked our supper, fed our stock, and then turned our complete thoughts to our whereabouts.

"We took from our duffle an old reed elk bugle and as the chill air fell with the sun we shattered the calm of that September evening with a blast from our elk call. Then almost as by magic, above us on Red Mountain a bull elk bugled his challenge that this was his home. All through the frosty fall air the calls echoed back and forth and I knew that I had found wilderness.

"I would not sleep that night for I was trying to convince myself that this was really so; that there was wild country like this left and that somehow I had found it. But all was not at peace in my heart for I knew that someday, for some unknown reason, man would try to destroy this country, as man had altered and destroyed before.

"That night I made a vow, that whatever the cost for whatever the reason, I would do all that I could to keep this country as wild as I had found it."

Tom Edwards, at the same hearing, put it this way:

"I am Tom Edwards, of Ovando, Montana. I have owned and operated the Whitetail Ranch continuously since 1937. My sole income comes from outfitting into the Lincoln-Scapegoat back country and the Bob Marshall Wilderness areas. For over a quarter of a century I have virtually lived in these areas, especially the Lincoln-Scapegoat back country, from Decoration Day to Thanksgiving. I have been privileged to take guests from all over the United States and some from foreign lands into every crook and cranny of this marvelous wilderness. I love the high country and alpine meadows with a passion - it restores my soul and into this land of spiritual strength I have been privileged to guide over the years literally thousands of people, the old, many past 70, the young, the poor, the rich, the great, and small people like myself. I have harvested a resource of the forest of most importance. No one word will suffice but to explain this resource let us call it the 'hush' of the land."

The list of witnesses at that hearing was long. Significantly it included outfitters, hunters, and a variety of wildland advocates supporting one another in the cause of wilderness classification for the Lincoln-Scapegoat area.

The next addition to the Bob Marshall complex was the Great Bear Wilderness. The local rod and gun club of Kalispell initially petitioned the U.S. Forest Service in the mid 1950's asking that the area be added to the Bob Marshall Wilderness. The request was turned down (Graetz 1985). What is particularly interesting is the parallel between this act and the one taken by a sportsmen's club in 1922 to save the headwaters of the Gila River as reported by Leopold (Leopold 1935). The

thread of sportsmen supporting wild land for wildlife purposes runs consistently through this process.

On March 12, 1977 a group that dubbed itself "The Citizen's for the Great Bear Wilderness" met at Trixie's Saloon at Ovando. The purpose of the group is self evident. Like the Lincoln-Scapegoat advocates the group was richly endowed with hunters, outfitters and people dedicated to wild land protection. Wilderness classification was achieved in 1978 (Op. Cit.).

The effort to continue classifying additional lands as wilderness all along the perimeter of the currently classified areas continues. The Montana Congressional delegation has introduced legislation that would add substantially to the land in this complex now endowed with formal wilderness protection.

In addition to the lands identified by our human institutions as country needing protection there is at least one other perspective that must be drawn. The wildlife of this complex has a selection process of it's own. It is a process attended by ecological necessities and territorial imperatives. These biological realities are just as important and significant as our human selections and designations. Just as the history of our philosophical and political efforts is important so is the history of wildlife presence important.

THE HISTORY OF WILDLIFE

The primordial wildlife abundance of Montana was best documented by the Lewis and Clark expedition 1804-1806. During their journey to the Pacific the expedition passed to the east of what would become the Bob Marshall complex. On the return journey Capt. Lewis ascended the Big Blackfoot River and crossed the Continental Divide at the head of Alice Creek. The pass, Lewis and Clark Pass, commemorates this crossing. The expedition's commentary made approaching and following this crossing reflects several important considerations. These are the scarcity of game they experienced in the region's mountainous areas and the abundance of game they found on the northern plains and along the Missouri.

On July 7, 1806 Captain Clark crossed from the Columbia drainage into the Missouri. The next day his journal reported, "we...proceeded due north, through an open plain, till we reached Shishequaw Creek (now Elk Creek)...here we halted and dined and now felt, by the luxury of our food, that we were approaching the plains of the Missouri, so rich in game." Three days later along the Sun River they recorded, "They had seen elk; but in this neighborhood the buffaloe are in such numbers, that on a moderate computation, there could not have been fewer than ten thousand within a circuit of two miles. At this season, they are bellowing in every direction, so as to form an almost continued roar, which at first alarmed our horses, who being from the west of the mountains, are unused to the noise..." The summary of the chapter of the journal immediately preceding the one containing the above entry consisted of a general description of travel in the western mountains. This summary included the following passages: "...the party set out, and arrived at Hungry Creek - the serious and desponding difficulties that obstructed their progress - ...- their distress for want of provisions--...--the danger of the route described--their scarcity of provision (Hana 1961) (emphasis added).

The point being suggested by the above is that in pristine Montana it was the fertile plains that held the abundance of game rather than the mountainous

enclaves that later became synonymous with the opportunity to find big game.

By the 1850's commercial traffic in buffalo parts had reached the Rocky Mountain Front. In 1857 36,000 robes were shipped down the Missouri from Fort Benton. In 1876, the year Custer died on the Little Big Horn, 80,000 robes went down the Missouri. By 1884 the hide trade declined to zero and the country was left to the bone pickers and an economy of domestic livestock (Picton and Picton 1975).

What was going on in the mountains to the west left little record for posterity. Augusta and Choteau were growing in the 1880's and lumber for that growth was coming from a sawmill in Sun River Canyon. By 1885 area residents considered the game herds to be remnants. The Great Falls Tribune reported on March 26, 1887 that local "Nimrods and fishermen discussed the formation of a sportsman club..." (Op. Cit.). At least one hunter still found the Rockies attractive. In an article entitled "The Wapiti or Round-Horned Elk published in 1905 Theodore Roosevelt reported; "In the early nineties it was still abundant as ever in large regions in western Wyoming and Montana and northwestern Colorado. In western Montana they are scattered over a wider region and are protected by the denser timber, but are nowhere plentiful" (Schullery 1986).

Events also began to take place that announced the beginning of a new era for wildlife. In 1897 the mountainous area became a Forest Reserve. In 1905 the U.S. Forest Service was created and took over its management. Results, however, were slow to materialize. Elers Koch an early ranger reported in 1905 that in a month's trip through the Blackfoot, Swan, South Fork of the Flathead, Sun and Teton river country that they saw no big game (Graetz 1985). Ranger Clyde P. Fickes noted, "In May 1908 I counted and estimated that 500-600 elk wintered on the West Fork (Sun River) licks and vicinity. That was about all the elk in the area at that time" (Op. Cit.).

The record of fish and wildlife trends in the mountainous country that today comprises the Bob Marshall complex is at best poor. The impressions we gain from the bits and pieces we have suggests that if the country ever was rich in game it was badly depleted at the turn of the century. The early 1900's saw not only a reversal of that trend but perhaps the development of a new order in which wildlife recovery and survival was dominated and influenced by human institutions and actions. Predator control was one of those actions and bounties on wolves ranged up to $75 (Picton and Picton 1975). In time, bounties, government hunters and poisons combined to extripate wolves.

In 1913 the Montana legislature created the Sun River Game preserve between the north and south forks of the Sun River and the continental divide. This preserve, a growing list of hunting regulations, wild fires and improved public land management practices all contributed to a response on the part of wildlife. Elk were responsive and their population growth received considerable public attention. By 1916 there were a reported 1,479 elk in the Sun River herd and by 1917 the reported number grew to 1,708 (Op. Cit.). A summary of the early elk population response in the Sun River country contained the following information:

> "The first quarter of the 20th century saw the elk herd grow from a relatively small herd to a population threatening its own habitat as well as cattle grazing in the upper Sun River. The increased population and improved transportation brought an open conflict between individuals

pursuing their separate ideals of wilderness America and the cattle industry. Because the newly created Office of the State Game Warden was still weak and politically unstable, the U.S. Forest Service took the brunt of the problems. The closing years of the period saw an increasing involvement of professionally trained foresters in the management of the area. These professionals consistently recommended the abolition or modification of the Game Preserve" (Op. Cit.)

The problems of wilderness wildlife now took on a new focus. Settlement had now domesticated the critical foothill winter ranges while wildlife protection had accommodated a rapid recovery of big game. Overgrazing of critical winter ranges was a real problem. Sun River Canyon where elk and bighorn sheep shared the available forage was among the affected areas. The winter of 1927-28 was particularly bad and in that winter a die-off of bighorn sheep was reported. That same winter 2,261 elk were counted wintering on private lands outside the mountains. (Op. Cit.). The problems of accommodating the growth of migratory game populations that seasonally rely on the wilderness were to persist for decades.

In 1934 two men met on Cabin Creek tributary to the Sun River's North Fork to discuss the problems of elk and land use. The men talked of both the need for wilderness and winter ranges to secure the elk and other game populations of this wild country. The men were Bob Cooney working at that time for the U.S. Forest Service and Olaus Murie of the U.S. Fish and Wildlife Service. (Graetz 1985). In 1940 Cooney became the first big game manager for the Montana Department of Fish and Game. In that position he was instrumental in the eventual acquisition of the Sun River Game Range. Of particular significance, Murie became one of the founding fathers of the Wilderness Society and when the Montana Wilderness Association was formed in 1958 Bob Cooney sat on its first governing council.

The problems of wildlife were not easily solved. Winter losses of bighorn sheep were reported in 1932 and again in 1936. Winter losses of elk were reported for the Sun River in 1935 and were reported as severe in the south fork of the Flathead from 1933 to 1937. These annual losses were estimated at from 1,575 to 2,275 in the South Fork (Picton and Picton 1975). In 1937 Bob Marshall was called to Montana to consider flying hunters into the South Fork primative area to encourage a reduction of elk numbers. Stimulus for this action was the fact that, "after one especially hard winter, five hundred elk carcasses had been found in a ten-mile strip along the South Fork" (Glover 1987). On the Rocky Mountain Front the Fish and Game Department hired "elk herders" to drive elk off private property and hold them in the mountains.

In 1943 concerned sportsmen and ranchers formed the Sun River Conservation Council to assist in finding a solution. With substantial assistance from this council the Sun River Game Range was acquired, a property holding that eventually grew to nearly 20,000 acres of state owned and leased land. Today the state has since acquired the Blackfoot-Clearwater, Ear Mountain, and Blackleaf management areas which support wilderness wildlife. Private conservation organizations are now also contributing with the Nature Conservancy having acquired the Pine Butte swamp property and the Boone and Crockett Club the Triple Divide Ranch. The Boone and Crockett acquisition was made to celebrate their first century of conservation activity and the ranch is now named in honor of their founding father, Theodore Roosevelt.

Evaluation of the effectiveness of the Sun River Game Range is of importance. In the first winter 36 percent of the elk inventoried were counted on the new range. Three years later 79 percent of the elk were found there. The elk herd census that year provided one of the highest counts on record (Picton and Picton 1975). What became evident was that wildlife, how they used the country, and their levels of abundance, all were responsive to manipulations man exercised on their behalf. Of equal significance is the emerging realization that the wilderness wildlife are dependent on ecosystem components beyond the designated boundaries. Of final importance emerges the fact that the investment necessary for wildlife recovery largely came from sportsmen.

Enormous strides have been made to create a wildland philosophy, convert that philosophy into the creation of a wilderness system and fashion a wildlife recovery of substance. Allocation of the use of that resource is probably the most difficult aspect of resource management. Consensus on restoring wildlife and providing once unavailable components of their ecosystem took almost a half century to accomplish. The process continues, now into what will soon be a century of conservation effort. Achieving equity in its use, and including the fish and wildlife populations in the search for that equity, will be more challenging.

THE ALLOCATION OF RESOURCES

Recent trends in hunting seasons, hunter numbers, and elk harvest are addressed in the wildlife section of this report. The question of resource allocation is addressed here to present background information based on the writings of Leopold and Roosevelt. What is being established is that the issue of allocating wild land resources was a subject addressed early in the evolution of the conservation movement.

The allocation of wildlife or the opportunity to pursue wildlife has enjoyed a peaceful tradition. For the most part, anyone who wanted to hunt or fish simply did so. The need to limit use, for conservation purposes was initially handled by restricting use uniformly. Either sex elk seasons were shortened and all users conformed. When permits for cow elk became necessary a drawing seemed to satisfy the basic public desire for equal treatment. For the outfitters restrictions on use followed a different pattern. For them use problems were addressed by limiting the number of outfitters allowed to operate on some of the public lands, and in time the number of client use days they could utilize.

For the rank and file hunter and fisherman restriction became a growing part of recreation. Gear restrictions, access restrictions, season limitations, catch and release fishing and other changes became facts of life. In a major move the state legislature established a limit of 17,000 on nonresident hunters buying the combination license that included the elk license. This was done in 1976. That limitation produced no particular concern until the demand for those licenses escalated. When that demand reached competative proportions, in the mid 1980's, a specific number was allocated to hunters utilizing the service of outfitters.

The nonresident "set aside" was first done administratively and in 1987 the Montana legislature adopted and somewhat expanded on the concept. This action probably combined with a growing body of other restrictions attracted considerable public attention and stimulated some controversy. If this wildlife planning process eventually leads to addressing the allocation of available

hunting opportunity, background on the question of equitable opportunity is important.

Repeating what Theodore Roosevelt counseled is again of value.

> "...Above all, we should realize that the effort toward this end is essentially a democratic movement. It is entirely in our power as a nation to preserve large tracts of wilderness, ...as playgrounds for rich and poor alike, and to preserve the game so that it shall continue to exist for the benefit of all lovers of nature, and to give reasonable opportunities for the exercise of the skill of the hunter, whether he is or is not a man of means" (Schullery 1986).

Roosevelt went on to say,

> "It is foolish to regard proper game-laws as undemocratic, unrepublican. On the contrary, they are essentially in the interests of the people as a whole, because it is only through their enactment and enforcement that the people as a whole can preserve the game and can prevent its becoming purely the property of the rich, who are able to create and maintain extensive private preserves" (Op. Cit.).

On still another occasion Roosevelt offered, "The movement for the conservation of wildlife, and the larger movement for the conservation of all our natural resources, are essentially democratic in spirit, purpose and method" (Op. Cit.).

Both Bob Marshall and Aldo Leopold saw wilderness allocation as protection of a minority right. Both seemed sensitive to even the suggestion that wilderness could ever be an undemocratic allocation. At one time Marshall argued that it was a wilderness lover who wrote that people are "...endowed by their creator with the inalienable rights...to life, liberty and the pursuit of happiness..." Marshall added, "the full enjoyment of these rights is possible only in the wilderness..." (Glover 1987). That statement certainly was true for Marshall.

Leopold responded to the idea that wilderness may not be democratic because it is in a way limiting the range of uses. He wrote,

> "There are those who decry wilderness sports as 'undemocratic' because the recreational carrying capacity of a wilderness is small, as compared with a golf links or a tourist camp. The basic error in such argument is that it applies the philosophy of mass-production to what is intended to counteract mass-production. The value of recreation is not a matter of ciphers. Recreation is valuable in proportion to the intensity of its experiences, and to the degree to which it differs from and contrasts with workaday life. By these criteria, mechanized outings are at best a milk and water affair." (Leopold 1966).

In many respects today's question of allocation of wilderness opportunity is a new problem. The origin of this problem lies in the intersection of rising demand, limited area, and fish and wildlife resources of growing economic proportion. In some respects this problem is the step child of our success. Resolving the question of equitable opportunity is clearly one of our most challenging horizons.

CONCLUSION

With this background the fish and wildlife plan now presents two additional dimensions. The first is "Wildlife of the Bob Marshal Wilderness Complex and Surrounding area". The second is "Fishery of the Bob Marshall Wilderness Complex". The final aspect of this process, developing management objectives and options for the land and its wildlife, will remain the task of the limits of acceptable change task force.

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WILDLIFE OF THE BOB MARSHALL WILDERNESS COMPLEX AND SURROUNDING AREA

SUMMARY

The Bob Marshall Wilderness Complex (BMWC) ecosystem is important to several species of wildlife and provides exceptional outdoor recreational opportunities. Although many areas of the state have been developed over the years, the BMWC ecosystem has maintained a back-country tradition where hunting has remained relatively unchanged and the recreational values offered are considered not only exceptional in Montana but rare in the entire country. Important big game populations occur in the ecosystem, but elk hunting has historically provided the majority of recreational opportunity. In order to maintain traditional wildlife values, attention must focus on activities and management within statutory Wilderness, and upon other areas essential to the welfare of wildnerness wildlife populations.

Elk were selected as the focal wildlife species in the Limits of Acceptable change (LAC) analysis because there is considerable information on elk and because they attract the majority of wilderness users for the 3 month hunting season. Brief summaries of other big game and special interest species that occur in the BMWC are also presented, including mule deer, white-tailed deer, moose, bighorn sheep, mountain goat, mountain lion, black bear, grizzly bear, and wolves. These species occur in the BMWC seasonally and depend upon non-wilderness lands for a portion of their needs. Future management of these lands will have far reaching consequences for most wildlife species inhabiting the BMWC ecosystem.

Nine to 11 thousand elk inhabit the nearly 4 million acre BMWC elk ecosystem. The population has historically averaged at least 8,000 and is considered to be relatively stable. Over the years, the number of elk harvested varies somewhat depending upon conditions during the hunting season and other factors.

Over the last 30 years, the BMWC elk ecosystem has experienced fewer changes in the elk population, hunting regulations, or composition of the harvest, than any other area of Montana. The BMWC provides some of the least restrictive elk hunting seasons available in the United States, largely because motorized access is negligible or lacking over much of the ecosystem. The BMWC provides about 17% of the area of the state open to elk hunting. It accommodates about 18% of the state's hunters, produces 14% of the state's total elk harvest, 12% of the state's bull harvest, and 14% of the state's branch-antlered bull harvest. These figures demonstrate the importance of the BMWC elk population. The State of Montana has purchased four Wildlife Management Areas (WMA) along the eastern and southern edge of the Wilderness. The interest and concern for wildlife has spread to private conservation organizations, which have purchased land to accommodate the needs of wildlife. These state and private acquisitions account for 5% of elk winter range within the ecosystem.

Seven entities own or manage lands in the BMWC elk ecosystem. The United States Forest Service (USFS) manages 74% of the area, the private sector owns 17%, and 10% is controlled by State of Montana, corporate, Bureau of Land Management (BLM), Blackfeet Indian Reservation, or Glacier National Park (GNP).

The entire area is elk summer range, and about 95% of the elk use statutory Wilderness at some time during the year. Elk winter range tends to occur around the perimeter of the Wilderness. Over 80% of the elk population winters on non-wilderness lands. Forty-one elk winter ranges were identified. About 4,000 elk winter east of the Continental Divide on the Sun River, Teton, and Two Medicine areas; another 3,000 elk winter on the Flathead areas west of the Divide and between 2,000 and 3,000 elk winter on the Blackfoot and Dearborn areas at the southern end of the ecosystem.

On-going and proposed land management could result in development of 2/3 of the elk winter range within the ecosystem. This would affect 26 different winter ranges. Forty-two percent of elk winter range occurs on private and corporate lands, while 53% occurs on USFS lands. Over 1/2 of the latter (about 134,000 acres) is outside of Wilderness. Although there is only limited opportunity to influence land management on private and corporate lands, management of the public lands can be influenced through this LAC process and implementation of other state and federal laws.

PREFACE

This report on wildlife of the Bob Marshall Wilderness Complex (BMWC) was developed in response to public review of the draft BMWC wilderness action plan, limits of acceptable change in wilderness (LAC). It was compiled by biologists from Regions 1, 2, and 4 of the Montana Department of Fish, Wildlife and Parks.

The focus of this report is on elk, with brief reviews of other big game and special interest species. Information on elk was reported upon by Gayle Joslin, mule deer by Gary Olson, white-tailed deer and mountain lion by Shawn Riley, moose by Kurt Alt, bighorn sheep by John McCarthy, mountain goat by Bob Henderson and Gayle Joslin, black bear by Jim Cross, grizzly bear by Arnold Dood, and wolves by Arnold Dood and Gayle Joslin.

This report was assembled by Gayle Joslin. Final maps, graphs, and cover design were prepared by Ed Madej of Great Divide Graphics. Assistance in data collection from forest plans by Bob Martinka is appreciated.

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INTRODUCTION

In 1982 the USFS initiated the process of developing an action plan for managing recreation in the Bob Marshall, Great Bear, and Scapegoat Wildernesses, otherwise known as the Bob Marshall Wilderness Complex (BMWC). National Forest Management Act regulations (36 CFR 219.18 (a)), require the USFS to prepare such plans for managing visitor use in wilderness.

The draft Bob Marshall, Great Bear, Scapegoat Wilderness Action Plan for Managing Recreation (the limits of acceptable change) (LAC) (1985) states:

> This plan has been developed through continuous in depth involvement of a Task Force that includes a diverse group of citizens who represent a range of viewpoints regarding management of the BMWC. The Task Force citizen involvement is being followed by a formal public review process that enables members of the public who have not participated in the Task Force to have an opportunity to make their views known.
>
> This plan when finalized will represent a social contract between the public and Forest Service managers regarding how visitor use of the BMWC is to be managed and what kind of wilderness experience the public expects ...
>
> This plan provides a uniform system for protecting or restoring the resource and social conditions needed to comply with the Wilderness Act of 1964 and to assure a high-quality experience for each user. It is to be used by personnel of the four National Forests involved and by interested citizens in caring for the Bob Marshall Complex.

The final LAC document will become a part of the forest plans of the four National Forests which manage the BMWC. These forests are the Lewis and Clark, Helena, Lolo, and Flathead.

A consistent criticism of the draft LAC report was that it neglected to discuss wildlife and the recreational experiences it provides. In July 1986 the Task Force and U.S.F.S. enlisted the Department of Fish, Wildife and Parks (MDFWP) to draft a report about wildlife values of the BMWC, the recreational opportunity wildlife provides, and the habitat elements essential to maintain this resource. This section on wildlife focuses on strategies to maintain elk numbers and perhaps improve herd composition in the BMWC.

Elk were selected as a key wildlife species because there is an available information base and because they attract the majority of wilderness users for at least 3 months of the year, primarily the fall hunting season. The land area addressed in this report is defined as the BMWC elk ecosystem, or that area in and around the wilderness complex which is used by elk.

The process of developing a wildlife plan for this area BMWC is involved. Elements covered here include current elk distribution and population levels, land ownership, past elk management practices and trends in harvest, land management throughout the ecosystem and on winter ranges, and brief reviews of

other big game species within the elk ecosystem. Information relative to waterfowl, upland game, nongame, and furbearers is recognized as an important part of Wilderness management. At the present time information and personnel limitations preclude their inclusion in this report.

A broader perspective of wildlife habitat and security needs throughout the BMWC ecosystem is essential to maintaining wildlife recreational opportunities within the Wilderness. Management of statutory Wilderness alone will not sustain wildlife populations; many wildlife values of the Wilderness are contingent upon lands surrounding the Wilderness complex. Management of these lands, particularly the public lands, will determine the future status of BMWC wildlife. Numerous opportunities do exist to assure wildlife values through sensative land management practices on adjacent non-wilderness lands.

STUDY AREA

The study area (Fig. 1) is defined on the basis of elk distribution. Elk within this area range from Glacier National Park (GNP) on the north to the Blackfoot-Clearwater valley on the south, and from the Swan Valley on the west to the foothills of the Rocky Mountain Front on the east. The heart and bulk of this vast elk range is the Bob Marshall, the Great Bear, and the Scapegoat Wilderness areas. For purposes of this discussion it is called the BMWC elk ecosystem.

The 3,923,448 acre BMWC elk ecosystem includes portions of the Flathead, Lolo, Helena, and Lewis and Clark National Forests as well as State of Montana, BLM, GNP, corporate, private, and Blackfeet Indian Reservation lands. The USFS controls and administers 74% of the ecosystem, private holdings constitute 17%, while holdings of the other 5 landowners/custodians amount to less than 10% of the ecosystem.

The physiography of the Bob Marshall ecosystem is described by Alt (1985). The grinding action of several great ice ages, combined with intermittent periods of melting and erosion, sculpted and gouged the mountains which constitute the ecosystem. The tallest peaks range from 8700 to 9400 feet. Relief from valley floor to mountain top exceeds 5000 feet on all sides of the complex.

No brief discussion can explain the weather of the BMWC, and yet climate is a major influence on wildlife use patterns throughout the ecosystem. Over 60% of the ecosystem's moisture falls in the form of snow, although patterns of snow fall are quite variable. Westerly weather systems bring heavy snow to the Swan Range, while dry Arctic fronts are often drawn southward by low pressure cells occurring to the south of Montana. These often extremely cold systems, are usually relatively dry. However, deep snows do accumulate along the Rocky Mountain Front, usually during the coldest months, by a process known as upsloping (Graetz 1985). Warm dry winds howling down the east slopes of the Continental Divide were called snow eaters (chinooks) by the Indians. These winds free the open rolling slopes of the Rocky Mountain Front, and are the driving climatic force of the eastern edge of the ecosystem. In contrast to the Front, the snow laden valleys of the Swan, Flathead, and Blackfoot Rivers are typical of western Montana valleys which often experience moist maritime storm tracks. Temperature extremes range from over 100 to -60 F. Summer weather may vary from cool drenching rains to hot dusty winds. Reflecting the variability of the climate and lay-of-the-land, is the vegetation of the BMWC. Here too, the ecosystem is a house diverse and divided with cedar, hemlock, larch, white pine, devil's club, and ocean spray, among other species, occurring west of the Divide. Limber pine, horizontal juniper, and buffalo berry tend to occupy to the more arid regions east of the Divide. Detailed descriptions of vegetation throughout the ecosystem are given in Picton (1960), Knight (1970), Arno (1979), and Pfister et al (1979) and Harvey (1980).

Although the history of elk within the BMWC ecosystem is incomplete, that of the Sun River elk herd is well documented in Knight (1970) and Picton and Picton(1975). Reports relative to elk in the Flathead by Gaffney (1941), Rognrud (1950 and 1955), Pengelly (1960), and Simmons (1974), Biggins (1975), provide perspective to the story of elk in the BMWC.

Wildlife management in the BMWC ecosystem attempts to balance animal needs with climate, physiography, land management, and recreational demands. The MDFWP

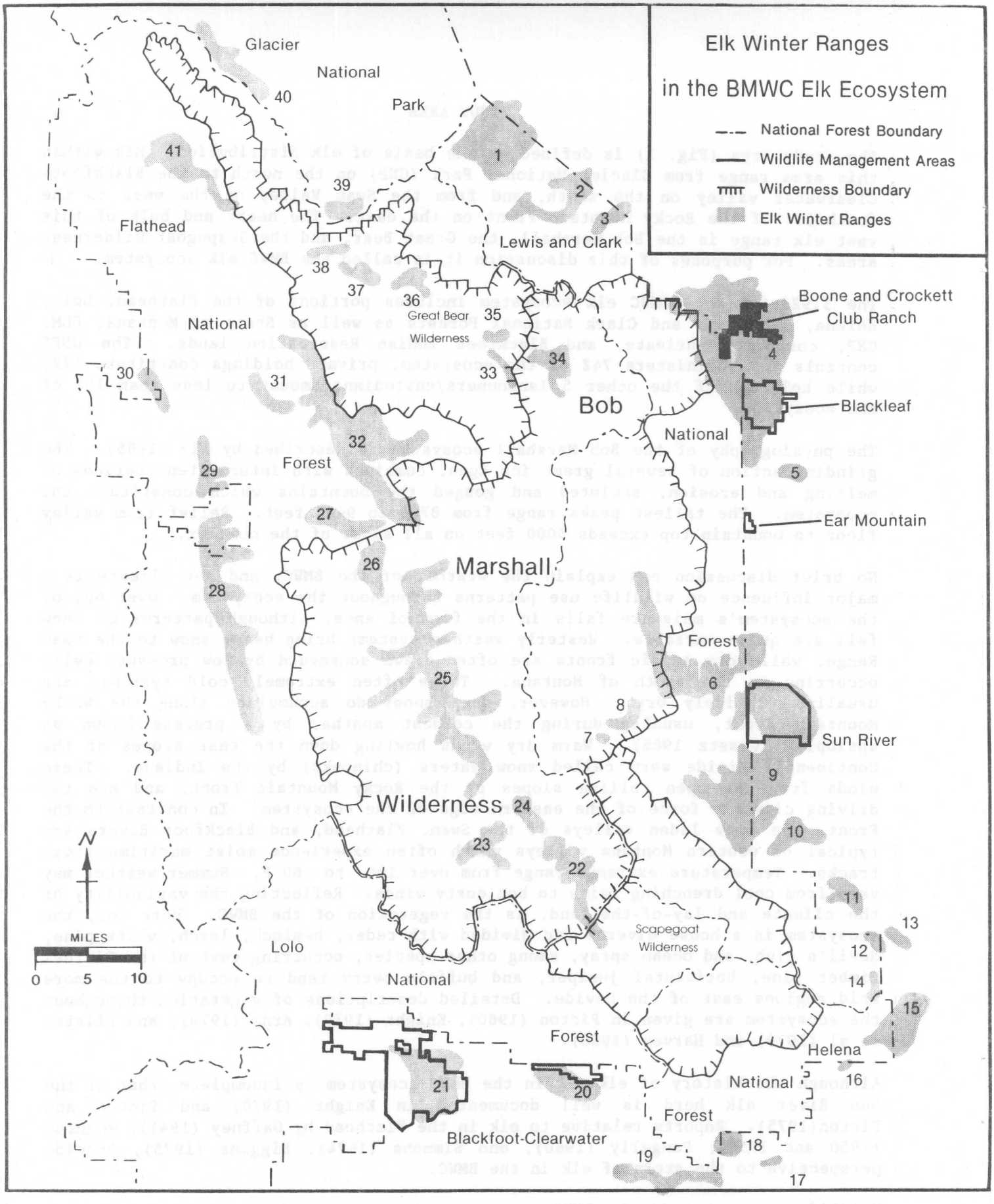

Figure 1. Bob Marshall Wilderness Complex and surrounding area.

manages the ecosystem's wildlife through three administrative regions: the Flathead and Swan drainages occur in Region 1, the Blackfoot and Clearwater drainages occur in Region 2, and the Two Medicine, Badger, Birch, Teton, Sun, and Dearborn drainages occur in Region 4. Since nearly 3/4 of the elk's ecosystem is administered by four national forests. Consequently forest plans will bear directly upon the future of elk and other wildlife within the ecosystem.

The 1971 position of the MDFWP regarding land use in Montana, is as relevant now as it was when it was drafted. The need to act decisively to maintain the integrity of wild lands, is today, even more pressing:

> Wildlife have been an important part of the heritage of Montanans. Hunting and year-around enjoyment of wildlife is an integral part of our standard of living. Intensifying land use and accelerating demands for recreation challenge the future quality and quantity of wildlife in Montana which are tied inseparably with land and people. Being a product of the land, the destiny of wildlife resources depends upon what is further done with, on, for, or to the land. What is or is not done to the land depends upon the attitudes, needs, knowledge, and hopefully the conscience of the people owning or using the land.
>
> Wynn Freeman,
> (Mussehl and Howell 1971)

METHODS

Techniques used to assess elk use of the BMWC involved researching MDFWP archives, analyzing unreported MDFWP Regional data, measuring land ownership and USFS land management prescription acreages, and interviewing MDFWP biologists. Data on elk seasonal distribution, abundance, harvest composition and rates, hunters in the field, and hunting seasons were gathered from 1964-1985 Pittman-Robertson reports and hunter questionnaire surveys. A historical perspective of the elk herd prior to 1964 was compiled through a review of information from 1915 through the 1970's. Changes in regulations and hunting district map boundaries since 1964 were summarized at 5 year intervals.

The term Region refers to portions of the 3 MDFWP administrative regions within the BMWC. Hunter and elk harvest information is reported within the context of these 3 Regions. That portion of the BMWC west of the Continental Divide within the Flathead drainages is part of Region 1. The segment of the BMWC that occurs in the Blackfoot River drainage is part of Region 2. The portion of the BMWC east of the Continental Divide is part of Region 4.

Portions of 4 National Forests occur in the BMWC. They roughly parallel the MDFWP Regions as follows: the Flathead National Forest (FNF) is in MDFWP Region 1. The Lolo National Forest (LNF) segment occurs in MDFWP Region 2, as well as a portion of the Helena National Forest (HNF). East of the Continental Divide, the Lewis and Clark National Forest (L&CNF) equates with MDFWP Region 4.

Land ownership acreages within the ecosystem were calculated from USFS maps (1/2 inch per mile) using the planimeter-digitizing option of the MDFWP Research Lab

Discovery computer. Private, corporate, state, GNP, tribal and BLM lands are reported under the name of the adjacent National Forest. In tables 2 through 5 these lands are described as part of an area named after the appropriate NF.

Information from the four forests within the ecosystem were gathered from 1986 Forest Plans. Combinations of management area prescriptions were used to quantify land use activity. Prescriptions were grouped to produce 5 broad land-use categories, including Wilderness, proposed Wilderness or RARE II areas, unroaded, low-moderate access, and developed-timber (Appx 1). Proposed Wilderness areas are areas proposed by the USFS for Wilderness designation. Unroaded areas are presently non-roaded, unallocated areas. Low-moderate access areas are areas which will receive slight to moderate amounts of motorized use. Developed-timber refers to management areas calling for moderate to heavy amounts of motorized access and maximized timber harvest or intensive recreational development (Appx 1). Total acreages for each of these prescriptions were calculated as described for land ownership.

RESULTS

SEASONAL ELK DISTRIBUTION AND RECENT POPULATION LEVELS

Nine to 11 thousand elk inhabit the 3,923,448 acre BMWC ecosystem (Fig. 1). Virtually the entire area, is elk summer range although elk activity tends to occur in clusters rather than in an even distribution. Peripheral logged, roaded, or otherwise disturbed and insecure habitats are used to a lesser extent. During summer, elk are not constrained within any particular habitat. Some elk remain on winter range year long; the majority tend to follow the spring green-up to increasingly higher elevations until the more palatable forage desiccates. Elk then shift their attention toward cool thickets and windy ridges. Although elk are not prevented from using non-wilderness areas about 95% of them use the Wilderness sometime during the summer.

With the changing seasons, elk funnel through every major and most minor mountain passes as they travel from summer to winter range and back. The fall migration tends to involve long steady movements, while spring migration often occurs in a series of shorter steps (Simmons 1974). Documented elk movements based on marked animals reveal the importance of an ecosystem concept when dealing with such large, mobile animals. Elk, marked while wintering in the Spotted Bear-Dry Park areas of the South Fork Flathead traveled as far as the Middle Fork Flathead, and across the Continental Divide to Badger-Two Medicine, Glacier National Park, and the North Fork Sun River to summer (Biggins 1975).

Yearly weather vagaries often dictate where calves are born. Most births occur near the edges of the winter range or along the spring migration routes. Few specific calving areas have been delineated since they tend to be a function of weather, which is unpredictable during the calving season. Calving areas known to be consistently used include: Alice Creek-North Fork Dearborn, Falls Creek Ridge, Willow Creek, Wood Creek Fairview Plateau, Patrick's Basin, Pretty Prairie, Red Butte Creek, Hannan Gulch, Arsenic Creek, Circle-Biggs Creeks, Muddy-Blackleaf Creeks, Scoffin Creek, Volcano Reef, Mettler Coulee, and Two Medicine Ridge.

Elk winter range within the Wilderness is quite limited. Lower elevation foothills surrounding the BMWC are more suitable winter range than the higher deep snow country. Only about 20% of elk winter range occurs within the Wilderness. Over 80% of the elk population uses non-wilderness lands for the majority of the winter.

Figure 1 depicts the 41 delineated elk winter ranges in the BMWC ecosystem. Land ownership and U.S.F.S. management on each winter range are presented in Appendix 2. Nineteen occur entirely within the Flathead drainage system. One the Danahur-Dry Fork overlaps the South Fork Flathead and Blackfoot rivers. The Blackfoot River portion of the ecosystem contains two winter ranges, and shares a fourth, the Marcum Mountain-Long Creek, with the Dearborn drainage. Four winter ranges occur entirely within the Dearborn portion of the ecosystem. The Sun River, Teton, and Two Medicine portion of the ecosystem winter about 4,000 elk. About 3,000 elk winter on the Flathead areas, and between 2,000 and 3,000 use the Blackfoot and Dearborn drainages.

HISTORIC ELK POPULATION AND COMPOSITION

Early census figures for the BMWC ecosystem elk population are fragmentary. Specific data are not available for the Dearborn, Teton, Badger, and Two-Medicine areas prior to 1985 . This analysis covers the period 1915 to 1960 although spotty information after 1960 is included. Regular censuses have been made of the Middle and South Forks of the Flathead since 1958, portions of the Sun River herd since 1955, and in portions of the Blackfoot herd since 1965. Classification data in several cases were not reported in MDFWP P-R reports, (1955-1986). Sporadic population estimates exist for the Sun River since 1915, for the Seeley-Swan area from 1944 to 1950, and for the Flathead in 1941 and 1942. (MDFWP P-R reports 1955 - 1986, Cooney 1940, Jansen 1962, Rognrud 1950 and 1955).

Early elk population estimates elk in the Sun River country, based on ten year averages, ranged from 1,594 (1915-1924) to 2,917 (1945-1954). The next period, a 7 year period (1955-1961) averaged 3,051. During the next 6 year period (1962-1966) estimates averaged 1,800 per year. During the 1970s (7 years of surveys) the herd averaged 1,772. The 5 year average for 1981-1985 was 2,273. The population trend appeared to increase from early in the century, reaching a high in the 1950s, and has fluctuated between 1,700 and 2,300 elk, over the last 15 years.

The Middle and South Forks of the Flathead elk herd appeared to peak in the 1940s when an average herd size of 2,066 was determined from 1941 and 1942 surveys. The herd averaged 742 (range 354-1,537) between 1958 and 1969, 783 (range 401-1,033) between 1970-1979, and 1,320 (range 781 - 1,775) between 1980-1986. Surveys of the Swan-Blackfoot population segment averaged 2,158 elk from 1944 to 1950 (range 1,715-2,640); and for a portion of the Blackfoot between 1965-1969, 1970-79, and 1980-86, the herd averages are 301 (3 surveys), 364 (5 surveys), and 783 (6 surveys), respectively.

A 1940's elk population, based on averages of the above surveys is aproximately 7,150. This is a minimum figure for the total elk population of the BMWC ecosystem at that time because it does not include herd segments from the Dearborn, Teton, Badger, and Two-Medicine areas. In addition, the efficiency of early surveys was limited compared to current aerial census methods. If 1986 herd estimates, for the areas which were not surveyed in the 1940s, are added to

the above population figure, the elk herd would have been about 8,200. This estimate is somewhat less than the 1986 population of 9,000 to 11,000 elk. In general, the elk population of the BMWC appears to have remained stable or increased somewhat over the past 40 years. The pattern over these years begins with low populations in the early years (1915-1924) increasing through the late 1940s. This was followed by a decline to the mid 1960s and an increase since then.

Composition of the Flathead herd segment have remained relatively stable over 1958-1986 time span. Calves per 100 cows have averaged from 22 to 26, and bulls per 100 cows from 22 to 23, during 3 time periods (1958-1968, 1970-1979, and 1980-1986). Composition data for the Sun River herd (1974 to 1985), give higher ratios averaging 40 calves and 33 bulls per 100 cows. However, 1942 and 1949 surveys reveal only 16 and 19 bulls per 100 cows, respectively. Calves per 100 cows in 1942 and 1949 were 48 and 14, respectively. Early composition data for other herd segments are not available.

RECENT TRENDS IN HUNTING SEASONS, HUNTER NUMBER, AND ELK HARVEST

Average elk harvests recorded from the Sun River herd from 1910 to 1960 increased steadily from 90 to 607. Flathead harvest information is not as consistent as that of the Sun River. Average harvests recorded at the Coram check station for the periods 1930-39, 1940-48, and 1960-62 were 454, 389, and 389, respectively. Composition of the Sun River harvest for the 1940-49 period was 37% bulls, 42% cows, and 17% calves. For the 1960-63 period it was 37% bulls, 45% cows, and 19% calves for the 1950-59 period, and 41% bulls, 37% cows, and 21% calves. Bull harvest in the Flathead, compared to the Sun River, was 8% higher during the 1940-49 period, but similar in the 1960's.

This analysis of the early BMWC elk population serves to illustrate 2 points. First, that the population has historically averaged at least 8,000 elk, and second, the composition of the population, and the elk harvested has remained relatively stable. These data, indicate that from the early 1900's to the present, the BMWC elk composition and population has remained relatively stable.

Over the last 30 years, the nearly 4 million acre BMWC elk ecosystem has experienced fewer changes in the elk population, in the hunting regulations, and in composition of the elk harvest than any other area of Montana. Were it not for the fact that the BMWC has remained secure for wildlife (little logging and roading), its long, liberal hunting seasons would not be possible. The BMWC maintains a large elk population that exhibits a diverse age structure that is reflected in the high hunter harvest of older bulls.

Hunting Seasons

Hunting regulations for the BMWC elk ecosystem are summarized in Table 1 and listed in Appx 3 for each hunting district (HD) at 5 year intervals from 1964 to 1984; 1986 is also included. The number of HDs increased from 9 in 1964 to 18 in 1984 as large districts were divided. Table 1 shows a continuum in the degree of hunting season restrictions. In 1964 the entire ecosystem had at least some either sex hunting, and over half of the districts had season-long either-sex seasons. In 1979, 95% of the HDs still had some either-sex hunting. Permit only hunting came into effect for 1 HD in 1974, and occurred in 2 HDs by 1984. Antlerless permit and permit only restrictions were in effect in about 25% of the

Table 1. Percentage of hunting districts in the BMWC ecosystem having various season types, 1964-1986.

	1964	1969	1974	1979	1984	1986
Either-sex Season Long	56	17	11	17	11	17
Some Either Sex	44	83	83	78	61	44
Antlered-bull Season Long					17	17
Permit Only			6	5	11	11
Branched-Antlered Bull						11

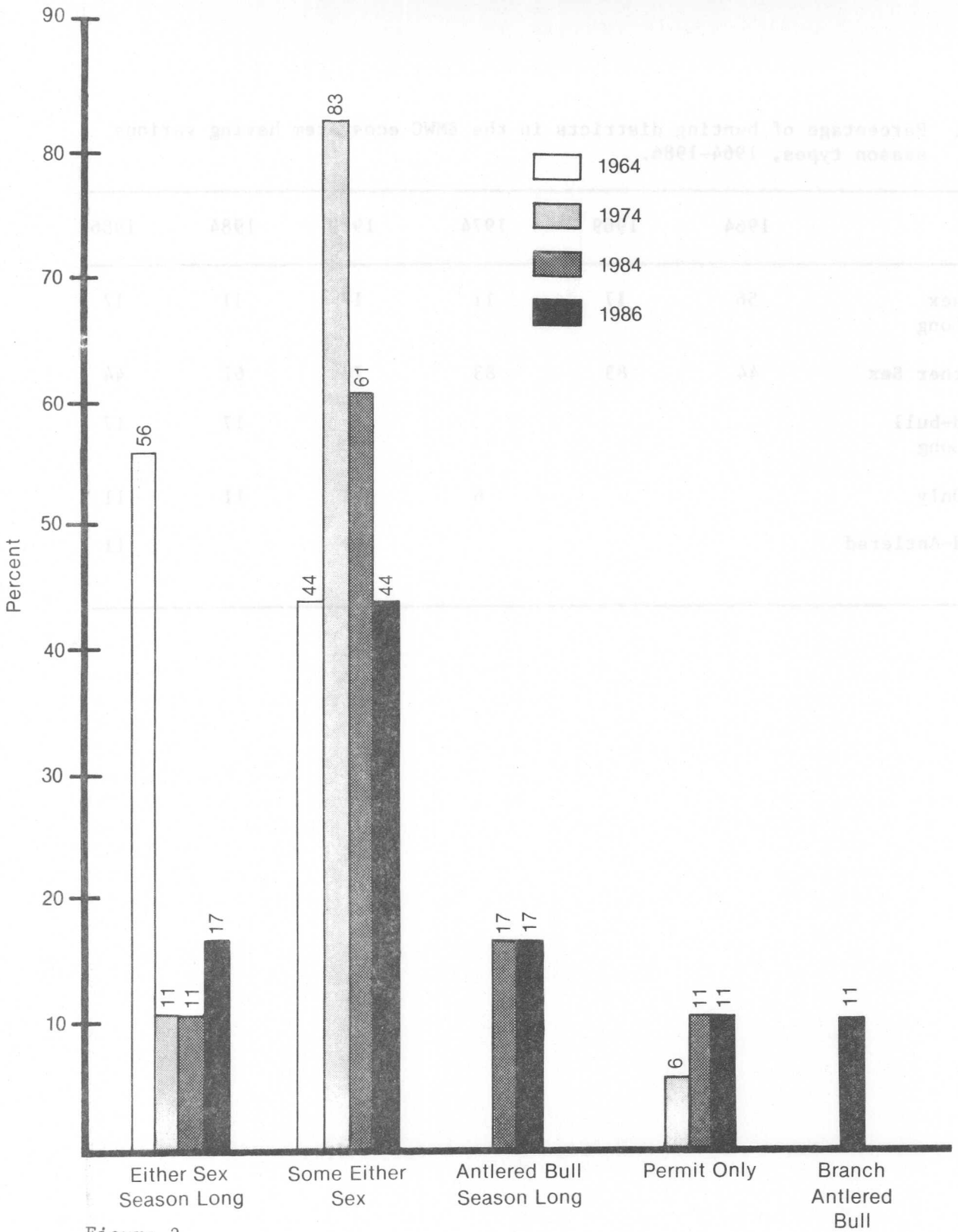

Figure 2.

Comparison of Five Elk Hunting Regulation Types in the BMWC Elk Ecosystem Between 1964, 1974, 1984 and 1986

HDs for the ecosystem in 1984. Branch-antlered bull seasons came into effect in 1985 in 2 HDs. By 1986, 39% of the HDs had at least an antlered bull restriction, but some type of either-sex season still occurred in 61% of the districts. Figure 3 delineates current hunting district boundaries within the BMWC elk ecosystem.

The BMWC elk ecosystem maintains some of the least restrictive hunting seasons available to sportsmen anywhere. In fact, few areas in the United States provide the hunting public with relatively unrestricted 5 to 10 week long seasons. This is but one of the options available to hunters in the spectrum of hunting experiences offered in Montana. This type of hunting opportunity can only be responsibly provided in large areas where motorized access is negligible or lacking. The BMWC continues to provide such an opportunity.

Hunter Numbers

Over the past 25 years, the estimated number of elk hunters in Montana has increased 44% (MDFWP, 1985). Elk hunters in the BMWC have also increased, but to a lesser degree (Appx 4). Comparing the 1960's with the 1980's, the increasing trend of from 9% to 14% in hunter numbers was similar for each of the individual regions of the ecosystem.

Elk Harvest

Although the harvests during individual hunting seasons vary due to weather and other factors the trend in the cow and calf harvest from the 1960s to the 1980s has been relatively stable. There has been a significant increase in the number of bulls harvested. Branch-antlered bull harvest (Appendix 13) has been relatively stable, but a dramatic increase in the spike harvest has occurred (MDFWP, 1985). In comparison, the overall elk harvest of the BMWC has decreased (Appx 4 and 9). This has involved a decrease in the cow and calf harvest, a decrease in the branch-antlered bull harvest, and a slight increase in the spike harvest. A slight decrease in total elk harvested is also shown individually in the 3 Regions of the ecosystem (Appx 5-7). The percentage of branch-antlered bulls in the bull harvest in the BMWC has decreased somewhat over the last 20 years, but in the state as a whole, the percentage of branch-antlered bulls in the bull harvest has declined markedly (MDFWP, 1985). The BMWC accounts for 12% of the statewide bull harvest, and 14% of the branch-antlered bull harvest.

A major elk management objective of the MDFWP is to provide elk hunters a diversity of elk hunting opportunities (from mechanized day hunts to extended back-country hunts). Generally, areas which are accessible by vehicle produce a young age structured elk population and little opportunity to observe or harvest a mature bull. In comparison, unroaded areas such as the BMWC produce elk populations having a diverse age structure where people do have the opportunity to observe or shoot an older bull. The BMWC provides an exceptional hunting opportunity in Montana. Its undeveloped condition provides one hunting experience in the spectrum of hunting opportunities available in Montana. This type of hunting experience, regardless of the quantity or individual size of elk harvested, cannot be duplicated in a roaded setting simply through season manipulation. It is the remote nature of the land that defines the "backcountry" hunting experience. Based on hunting statistics, the BMWC provides a unique segment of Montana's elk hunting spectrum.

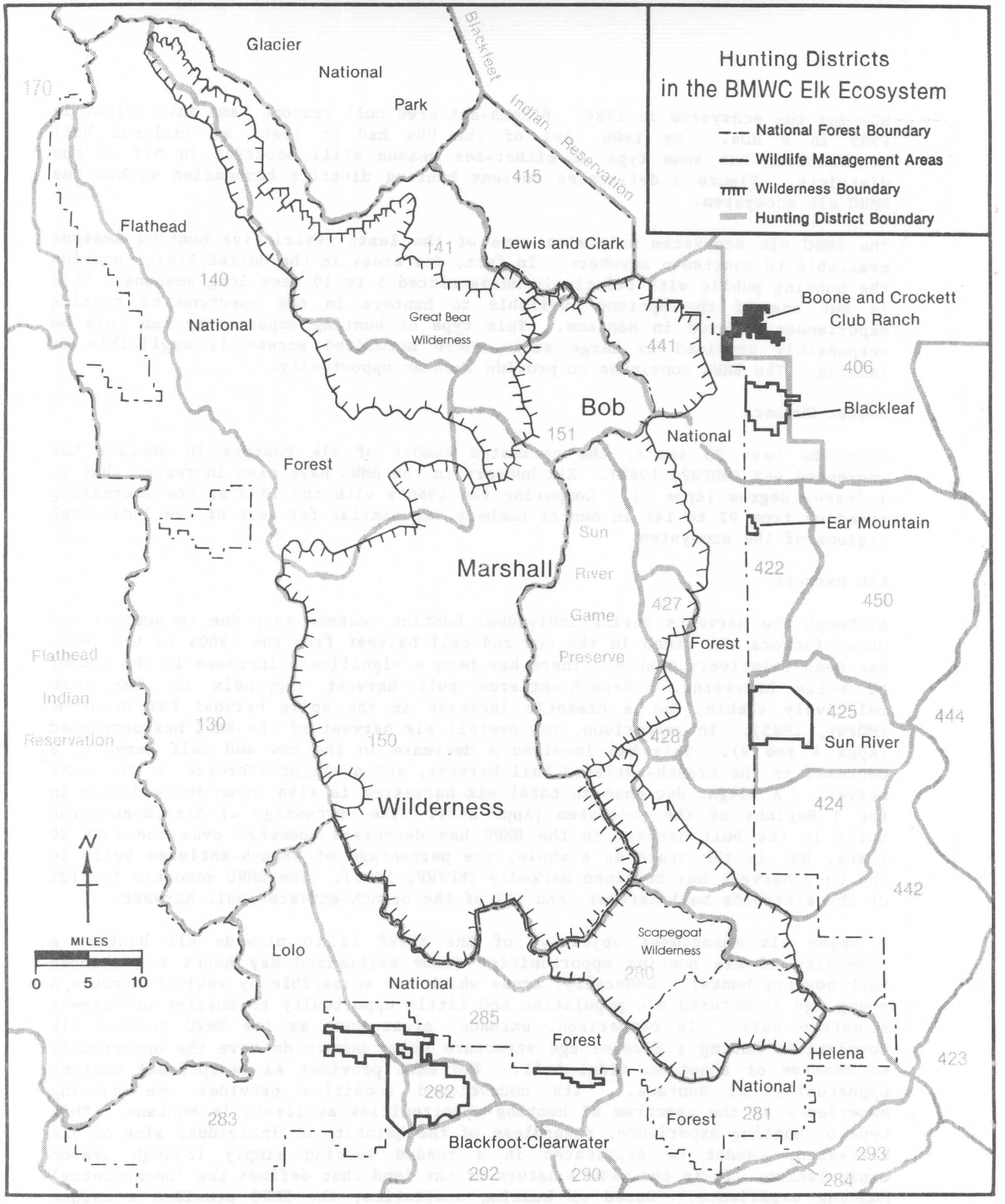

Figure 3. Hunting districts in the BMWC elk ecosystem.

LAND OWNERSHIP AND MANAGEMENT

Land management philosophy for the Bob Marshall country will determine the destiny of the ecosystem's wildlife. The nearly 4 million acres within the elk ecosystem are owned or managed by 7 entities (Table 2). Each of these entities follows its own direction in land management. Management philosophy within each entity is not always consistent. For example, State of Montana lands, depending on whether they are school trust or wildlife management properties, are managed according to different objectives. School trust lands are generally managed in order to return maximum revenue to the school trust fund. On the other hand Wildlife Management Areas are managed to maintain wildlife values and perpetuate healthy wildlife populations for wildlife-oriented recreation. Similarly, varied land management approaches occur on USFS, private, BLM, and tribal lands. Only National Park Service and corporate lands tend to be managed according to a single direction.

Recognizing that limitations exist in making assumptions about land management by the 7 controlling entities within the ecosystem, some points can be made regarding planned management of lands surrounding the Wilderness. A commodity extraction-oriented land management style is clear for most corporate and some State, USFS, BLM, tribal,and private lands. These activities include, timber harvest, developed recreation, and oil and gas and mineral exploration and development. This type of management is currently being applied to about 64% of the ecosystem. The remaining, 36% of the ecosystem is being managed to maintain or improve wildlife values, or is in proposed or actual Wilderness status.

The USFS manages 74% of the ecosystem. The next largest landowner is the private sector with 17%, followed by State of Montana with 4% (1% is MDFWP Management Areas), corporate with 3%, and BLM, Blackfeet Indian Reservation, and GNP each constituting 1% or less of the ecosystem. Since the USFS manages three-fourths of the area, planned National Forest land management is important.

Slightly more than half of the USFS lands (53%) are designated Wilderness, 5% are proposed by the USFS for Wilderness, and 3% are in an unroaded status (Table 3). The remaining 39% (1,112,256 acres) are or will be roaded, according to Forest Plan specifications (Appx 1). This breakdown applies to the 74% of the ecosystem managed by the USFS. The other 26% is largely roaded and developed in some fashion. The opportunity to influence land management on private and corporate lands (20% of the ecosystem) is limited. On the other hand, the opportunity to influence land management on public lands does exist, and in fact public participation in federal land management is built into the system. This LAC project is part of that process. Therefore, an emphasis toward analyzing management of the 1,112,256 acres of National Forest lands which have management prescriptions that affect elk habitat security is appropriate. Generally speaking, wildlife winter range is the nexus between survival and a return to summer range (mostly within Wilderness). Elk winter range in the BMWC ecosystem is owned or controlled by all 7 previously described landowners (Table 4). Fifty-three percent of elk winter range is controlled by the USFS. Of the 47% controlled by other landowners, 77% is currently managed (by corporate, private, and Department of State Lands (DSL) to maximize an economic return. This approach often conflicts with improvement of or maintenance of elk habitat. The remaining 24% has been managed to maintain or enhance wildlife habitat by GNP, BLM (primarily under its Natural Areas classification), and MDFWP. Elk winter

Table 2. Bob Marshall Wilderness Complex elk ecosystem land ownership.

OWNER	FLATHEAD AREA ACRES / %	LOLO AREA ACRES / %	HELENA AREA ACRES / %	L & C AREA ACRES / %	TOTAL ACRES / %
Forest Service	1,590,744 / 94	326,416 / 46	179,951 / 74	786,967 / 62	2,884,088 / 74
State	30,016 / 2	21,376 / 3	7,232 / 3	92,544 / 7	151,168 / 4
BLM	- / -	2,176 / Tr	1,408 / 1	21,440 / 2	36,608 / 1
GNP	11,584 / 1	- / -	- / -	- / -	11,584 / Tr
Corporate	33,088 / 2	56,256 / 8	14,144 / 6	- / -	103,488 / 3
Private	28,096 / 1	302,592 / 43	40,320 / 16	299,712 / 24	670,720 / 17
Blackfeet	- / -	- / -	- / -	65,792 / 5	65,792 / 1
TOTAL	1,693,528 / 100%	708,816 / 100%	243,055 / 100%	1,266,455 / 100%	3,923,448 / 100%

Table 3. Planned management of Forest Service lands in the BMWC elk ecosystem.

MANAGEMENT	FLATHEAD AREA ACRES / %	LOLO AREA ACRES / %	HELENA AREA ACRES / %	L & C AREA ACRES / %	TOTAL ACRES / %
Wilderness	996,056 / 63	74,192 / 23	80,697 / 45	384,407 / 49	1,535,352 / 53
Proposed Wilderness	(98,080)[1]	69,696 / 21	- / -	90,816 / 12	160,512 / 5
Unroaded	1,472 / Tr	- / -	11,712 / 7	62,784 / 8	75,968 / 3
Low-mod. Access	306,176 / 19	53,440 / 16	56,512 / 31	237,248 / 30	653,376 / 23
Developed/ Timber	287,040 / 18	129,088 / 40	31,040 / 17	11,712 / 1	458,880 / 16
TOTAL	1,590,744 / 100%	326,416 / 100%	179,961 / 100%	786,967 / 100%	2,884,088 / 100%

[1] Acreage allocated for other management purposes if not designeated wilderness.

801/18.1/4

Table 4. BMWC elk winter range land ownership

OWNER	FLATHEAD AREA ACRES / %	LOLO AREA ACRES / %	HELENA AREA ACRES / %	L & C AREA ACRES / %	TOTAL ACRES / %
Forest Service	147,150 / 80	2,240 / 6	3,878 / 20	85,248 / 41	238,516 / 53
State	8,064 / 4	10,886 / 28	2,112 / 11	32,256 / 16	53,312 / 12
BLM	- / -	2,406 / 6	1,114 / 6	6,912 / 3	10,432 / 2
GNP	11,584 / 6	- / -	- / -	- / -	11,584 / 3
Corporate	14,592 / 8	17,050 / 43	1,510 / 8	- / -	33,152 / 7
Private	3,072 / 2	6,746 / 17	10,470 / 55	78,400 / 38	98,688 / 22
Blackfeet	- / -	- / -	- / -	2,944 / 2	2,944 / 1
TOTAL	184,462 / 100%	39,322 / 100%	19,084 / 100%	205,760 / 100%	448,628 / 100%

Table 5. Planned management of Forest Service lands on elk winter range in the BMWC ecosystem.

MANAGEMENT	FLATHEAD AREA ACRES / %	LOLO AREA ACRES / %	HELENA AREA ACRES / %	L & C AREA ACRES / %	TOTAL ACRES / %
Wilderness	73,806 / 50	1,702 / 76	- / -	14,208 / 17	89,716 / 38
Proposed Wilderness	640 / Tr	- / -	- / -	6,784 / 8	7,424 / 3
Unroaded	448 / Tr	- / -	- / -	6,746 / 8	7,194 / 3
Low-mod. Access	19,520 / 13	- / -	3,456 / 89	55,654 / 65	78,630 / 33
Developed/ Timber	52,736 / 36	538 / 24	422 / 11	1,856 / 2	55,552 / 23
TOTAL	147,150 / 100%	2,240 / 100%	3,878 / 100%	85,248 / 100%	238,516 / 100%

801/18.1/5

range on the Blackfeet Indian Reservation (less than 1% of elk winter range), may or may not be managed to benefit elk.

From the above it can be seen that about two-thirds of elk winter range in the BMWC ecosystem could potentially be developed contrary to the best interest of elk winter habitat. Elk winter range on USFS lands (Table 5) includes about 38% (89,716 acres) in Wilderness, another 3% is unroaded, 3% occurs in USFS proposed wilderness. The remaining 56% (about 134,182 acres) will be managed for resources other than wildlife or wildlands where some access, will be provided. About 40% of the latter figure will be intensively managed for timber or developed recreation.

Land ownership and planned USFS land management programs on the 41 elk winter ranges in the BMWC ecosystem are presented in Appx 2. Wilderness is not used by elk for winter range in proportion to its occurrence within the ecosystem; 39% of the ecosystem is Wilderness, yet only 20% of elk winter range occurs in Wilderness. Low snowpack foothills around the Wilderness constitute the majority of elk winter range. Much of this non-wilderness land is or will be managed to produce timber and other commodity resources, often at the expense of suitable winter range. Roadless, undeveloped lands still exist and would provide the most dependable winter security for elk. Of the 41 individual winter ranges scattered throughout the ecosystem, 14 occur in Wilderness, 2 in GNP, and 1 is almost entirely within a WMA. Twenty-four occur on combinations of state, private, corporate, BLM, USFS, and Blackfeet lands. These 24 areas constitute about 2/3 of the total winter range acreage. Some of this acreage is seasonally used for livestock grazing and is roaded with travel restrictions in place. About half of this area is scheduled for timber harvest or oil and gas activity. Some areas have already been heavily logged and sustain high road densities. Appendix 2 details those winter ranges in most jeopardy.

If the areas proposed for Wilderness by the USFS were added to the Wilderness base, 7,424 acres of additional elk winter range, would be Congressionally protected from development. In addition, seasonal elk habitat would receive Wilderness protection. Other Wilderness proposals would incorporate even more acres (Tables 6 and 7). Wilderness, and other land management alternatives could effectively protect the integrity of existing elk winter range, and thus the elk population of the ecosystem. These might incldue easement agreements with private and corporate landowners, or acquisition of these lands for WMAs USFS management perscriptions could also assure that these lands would not be developed or roaded. It is clear that opportunities do exist to protect wildlife values within the BMWC by altering existing or planned land management practices on adjacent non-wilderness lands. These opportunities have the potential to sustain or improve the existing condition for elk. Likewise there is also a potential for diminishing the elk resource if other objectives are pursued on these lands.

OTHER WILDLIFE

Mule deer, white-tailed deer, moose, bighorn sheep, mountain goat, mountain lion, black bear, grizzly bear and wolves are other large mammals native to the BMWC. Brief summaries relating life history information, and current management objectives of each are provided. Future public interest and LAC task force direction may dictate in-depth analysis, as has been done for elk, of one or more

Table 6. Existing and proposed Wilderness on elk winter range in the BMWC ecosystem.

Wilderness	Flathead NF	Lolo NF	Helena NF	Lewis and Clark NF
Existing	73,806	1,702	1/	14,208
Forest Service Proposed	640	--	--	6,784
Governor's Recommendation	640	--	--	7,232
Alternative W-2/	960	--	--	41,792

1/ Helena NF wilderness in the Scapegoat is added to the Lewis and Clark NF total.
2/ Alternative wilderness proposal prepared by the Montana Wilderness Association.

Table 7. Existing and proposed Wilderness in BMWC elk ecosystem.

Wilderness	Flathead NF	Lolo NF	Helena NF	Lewis and Clark NF
Existing	996,056	74,192	80,697	384,407
Forest Service Proposed	98,080	69,696	--	90,816
Governor's Recommendation	79,360	67,000	1/	158,080
Alternative W-2/	172,500	68,600	1/	317,900

1/ Proposals for the Helena NF are included in the Lewis and Clark NF totals.
2/ Alternative wilderness proposal prepared by the Montana Wilderness Association.

of these species as they influence and are affected by recreational use of the BMWC.

Mule Deer

The entire BMWC is summer range for mule deer (Odocoileus hemionus), with wintering areas in the South Fork and Middle Fork of the Flathead within the wilderness and along the periphery of the wilderness on USFS, BLM, State, and private lands. Several mule deer winter ranges are scattered along the Rocky Mountain Front as well as along major river systems which drain the BMWC west of the Continental Divide.

In general, mule deer winter ranges are at lower elevations than summer ranges. Forage is more available on the windswept foothills of the Rocky Mountain Front and the warmer valleys west of the Divide. Deer normally leave winter ranges by late May and remain at higher elevations until snow and cold temperatures force them down to traditional winter areas, generally in late November or December. In some cases, mule deer that winter along the Front migrate 40-50 airline miles to and from seasonal ranges; these movements take place in a few day's time.

Mule deer populations in the BMWC appear to be less affected by climatic extremes than populations in eastern Montana. Fawn production, tends to be more static than in eastern Montana because habitat and environmental factors are more stable.

Generally, buck:doe ratios are higher than in eastern Montana, due to the relatively inaccessible nature of the wilderness terrain and limited numbers of hunters. Exceptions occur when early winter weather forces mule deer to lower elevations where greater numbers of hunters occur.

Montana sportsmen probably regard the BMWC areas as a "trophy buck" reservoir due to rugged topography and seasonal migration habits of the various herds. Large 4-point mule deer bucks can make up a relatively high proportion of populations that tend to remain in the BMWC until late fall. These herds are seldom available to large numbers of hunters. However, when above-average harvest does occur, sportsmen express concern for the general welfare of the population.

Fire in the wilderness system will undoubtably benefit most big game species. Lodgepole pine and Douglas fir invasion of traditional parklands and associated edges has caused a decline in available forage for big game. Mule deer probably forage in shrub fields and open parks with mixed composition of forbs, shrubs and grasses more than in dense conifer stands. Fire helps to maintain the balance between forests and grasslands.

Livestock grazing can have spatial and temporal effects on mule deer. Depending upon the class of stock grazing an area, certain forage types are selected under relatively light grazing pressure. This might then leave certain types for wildlife. Cattle, for instance, will select grasses and leave forbs under intensive grazing schemes. More conservative grazing will allow for a mixed plant composition which is probably more desirable for most big game species.

Duration and timing of livestock grazing should be site specific. For example on high density mule deer summer range cattle (etc.) should not be allowed to graze season-long. Mule deer use of the same ranges should be taken into account in

order to avoid excessive spatial competition. The intensive grazing management needed to obtain an optimum balance is probably not appropriate within a designated wilderness.

Mule deer are a very important component of how the BMWC is appreciated by the Public. Backcountry users expect to see deer as well as other wildlife. This opportunity should be a part of wilderness management plans. Such plans should meet the needs of photographers, hikers, hunters, or whoever wants to enjoy our wildlands.

The MDFWP has an obligation to the hunting public to provide recreation, within the biological boundaries of each population. Hunting seasons should provide a diversity of opportunity including the quality or "trophy" sentiment of hunters. This may mean a conservative approach to wilderness hunting with an effort towards a uniform harvest of all age classes and sexes. This approach accommodates both the big buck hunter and the meat hunter. In order to accomplish this the Public needs to realize that opportunity to harvest a deer may decline as hunting pressure increases.

Cooperation with the U.S.F.S. is essential to insure that land management practices are compatible with the wildlife resource. Management of fire, recreation, and grazing will play a key role in mule deer management in the Bob Marshall Wilderness Complex for generations to come.

White-tailed Deer

White-tailed deer (Odocoileus virginianus) are not widely distributed and do not occurred in large numbers anywhere in the BMWC. Little is known of their movements, population dynamics, or relationship to adjacent non-wilderness areas. Whitetails typically comprise 30% of the deer harvest within the BMWC.

Fires during the early part of this century caused an early successional environment which was beneficial to elk and mule deer. However, this habitat structure did not necessarily benefit whitetails. Whitetails in northwestern Montana appear to be adapted to older aged, mixed species forest and to well developed riparian areas. Early accounts and surveys by the MDFWP, do not mention whitetails as abundant species in the BMWC.

Whitetails currently seem to be increasing in the South Fork of the Flathead and along the North Fork of the Sun River. Several relatively mild snowfall years, combined with advancing vegetational succession, and expanding whitetail populations adjacent to wilderness herds, appear to be responsible for expanding interior populations. A radio-collared whitetail doe observed at Big Prairie indicates dispersal into the area from the west. Over 60 whitetails were observed in Danaher Meadows during one evening in May, 1986.

Whitetails winter in the interior of the BMWC occur only in parts of the South and Middle Forks of the Flathead where closed canopy timber provides adequate snow intercept and late seral stage vegetation. Those that summer along the Teton and Sun rivers winter along the Rocky Mountain Front foothills.

Whitetails may serve as an ecological indicator in the BMWC. Because of they depend on closed canopy forest during winter, their population trends may act as a general indicator of vegetation successional trend.

Whitetails are readily observed along the Danaher, Basin, and Youngs creek bottoms by back country travelers year-round. Harvest surveys by the MDFWP indicate that whitetails constitute 20 to 35% of the annual deer harvest from the area. This figure could rise with continued population growth and more liberalized hunting seasons.

Moose

The BMWC provides a limited amount of moose (Alces alces) habitat, primarily in the northern portion of the area. Overall 17 either-sex permits were issued in three HDs during the 1986 hunting season.

Moose numbers and distribution appear to have increased over the last 8 to 10 years in the lower South Fork Flathead. The majority of moose in this area are found from the Wilderness boundary north to Hungry Horse Dam. A portion of this increase might be attributed to younger successional stages of cut-over areas north and west of the Wilderness.

A small but productive moose population is found in the Middle Fork Flathead. This population is primarily associated with the large meadow complex around Schaffer Meadows, and extends downstream.

All moose permits were eliminated in the upper South Fork drainage in 1985. However, moose have been observed all along the South Fork to the Danaher area. The upper Middle Fork has a small moose population, which is possibly a spill-over from the Schaffer Meadows area.

In the Summit - North Fork Birch Creek area, moose populations appear to have increased over the last 10 years. Moose hunting has been allowed in this area (HD 415) since 1984.

Scattered moose observations have been reported in the Swan and Clearwater drainages to the west and Monture Creek and North Fork Blackfoot drainages to the south.

Moose appear to be associated with younger successional stages associated with post-logging and burning periods. Matchett, (1985), reported that, "15 to 30 year-old logged areas intermixed with mature closed canopied timbered stands" were important for wintering moose in northwestern Montana. It is felt that fire suppression could be a major limiting factor on the moose population in the BMWC. Although not documented, moose hunting by Native Americans, both on and off the reservation, could also be depressing moose populations.

Bighorn Sheep

Bighorn sheep (Ovis canadensis), which are native to the Bob Marshall area, currently range from Major Steele Backbone north of Swift Dam south to Crown Mountain, which lies on the northern border of the Scapegoat Wilderness. Summer ranges within the BMWC are found at high elevations along the Chinese Wall, the Prairie Reef-White Ridge area, the divide from Arsenic Mountain to Rocky Mountain, the divide from Hodley Creek to Crown Mountain, and around Mount Patrick Gass and Crooked Mountain. Outside the Wilderness, summer ranges extend

to the eastern edge of the Rocky Mountain Front, along Castle Reef and Sawtooth Ridge, and in the drainages of Willow Creek and Renshaw Creek.

Two areas that receive use by bighorns throughout the year are: south of Swift Dam to Walling Reef; and, from Mount Werner to Choteau Mountain, just North of the Teton River. Animals in these areas use lands under private, state, and federal jurisdiction.

Bighorn sheep occupy nine winter ranges within this ecosystem located almost entirely outside Wilderness. Nearly 60% of the winter range occurrs on non-wilderness USFS lands. Approximately 40% of sheep winter range lies outside the Forest. These winter ranges are by far the most important to the continued perpetuation of these bighorn populations. The nine winter ranges are: Major Steele Backbone, Old Man of the Hills, Clary Coulee, Ear Mountain, Deep Creek, Castle Reef, Gibson Lake, McCarty Hill and Ford Creek. Prior to a die-off on the Rocky Mountain Front in the winter of 1983-1984, which claimed about 20% of the population, over 1100 head of sheep occupied these winter ranges from November through early May.

Bighorns historically occupied most suitable habitat within the ecosystem. By 1944 numbers had dwindled to approximately 275 animals located north of the Sun River Canyon between the North Fork of the Sun and the Forest boundary on the east. Competition with domestic stock, competition with a growing elk herd, and the affects of "pot hunters", were largely responsible for the population decline. The population began to prosper following the removal of domestic stock between 1913 and 1937. In addition, competition with elk was reduced following the purchase of the Sun River Wildlife Management Area in 1947. Extensive grasslands established following fires in the late 1800s and early 1900s also favored the bighorns.

Fire suppression, currently threatens large portions of occupied sheep habitat with reforestation. A closing forest canopy will ultimately result in a loss of forage on both summer and winter range and a gradual decline in the number and quality of sheep that can be sustained on the habitat. Bighorns utilize Wilderness areas and other U.S.F.S. lands during the year. Therefore a comprehensive program that recognizes the roll of natural and prescribed fire, will need to be implemented in order to maintain current sheep numbers. Reintroduction of bighorns could also take place within historic habitat within the BMWC. This would require transplants into areas following natural or prescribed fire to set back plant succession and re-establish grasslands in otherwise suitable habitat.

Domestic grazing policies that would increase grazing pressure on bighorn winter ranges, or result in increased competition between elk and bighorns would also decrease the bighorn population. Again, a policy of habitat alteration to maintain or increase the available forage in these areas is needed.

Other developments such as oil and gas exploration, logging, and increased demands for recreational opportunities in the BMWC will have impact on the bighorn population. Disturbances inherent to these activities can be extremely detrimental to a population if they are concentrated on critical places or at critical times. Periods when animals are under stress, such as while on winter range, or during lambing, are of particular importance. In addition, disturbances that cause movements from critical ranges, that alter migration

routes, or result in the use of less secure habitat can result in the loss of animals. Any such activity will have to be carefully considered and strictly regulated in order to maintain current populations.

Mountain Goat

Craggy ridges connecting the rugged peaks comprise the core of mountain goat (Oreamnos americanus) habitat. While goats are generally thought to be relegated to ice and rock, they travel through and use most of the habitat types in the BMWC. Although they rarely venture far from precipitous escape terrain, U.S. Highway 2, running between GNP and the BMWC, is readily crossed by mountain goats, particularly in the Isaak Walton bridge area where a natural mineral lick lures goats from the Park and the Wilderness. Goats in the BMWCare distributed along all the ridges running south from the Two Medicine and Middle Fork Flathead rivers, to the headwaters of the Sun, Blackfoot, and South Fork Flathead rivers. About 70% of suitable mountain goat habitat occurs within Wilderness. Non-wilderness areas where goats occur include the north Swan, Badger-Two Medicine, segments of the Rocky Mountain Front, and many slopes extending outward from the Wilderness boundary.

In this Continental Divide country snow is often dry, and wind-swept ridges offer reprieve from heavy snowpack at lower more sheltered areas, mountain goats do not have far to wander to locate forage. For this reason, goats in this part of Montana generally do not travel more than a few miles, if at all, between summer and winter ranges. Research along the Rocky Mountain Front has shown that winter range is generally a reduced version of summer range. Kidding and breeding activity is usually confined to the most secure cliffy portion of that yearlong range.

Historical information indicates that mountain goats were once more widely distributed. General locations from which goats have either been disappeared or declined include: the north Swan; the Red Mountain area in the Blackfoot; the Ford and Fairview plateaus, Deep Creek, and Badger Creek along the Rocky Mountain Front. Mountain goat population trends within the BMWC have not been researched, but comparative data from the late 1940s indicates that a general decline has occurred within the BMWC.

Areas where goat numbers have declined most noticably occur outside or on the accessible edges of the Wilderness. Factors contributing to herd declines largely involve road access which contributes to both legal and illegal harvest. Habitat and/or behavioral alteration associated with timber harvest, oil and gas exploration, and recreational development are also involved. Road construction into mountain goat habitat in the Bunker Creek, Red Mountain, Deep Creek, North Fork Teton, Badger Creek, and Middle Fork Flathead contributed to herd declines in these locations.

Since 1955 all mountain goat hunting within the ecosystem has been on a permit basis, and except where development has occurred within their habitat, goat numbers seem to have remained relatively stable. Eleven mountain goat hunting districts occur in and around the BMWC. Sixty-six either-sex permits were issued in 1986. Since 1985 an informational brochure has been mailed to all permit holders encouraging them to harvest a male goat.

Fire may or may not be a beneficial habitat modification tool for mountain goats. Alpine and subalpine habitats generally are not particularly susceptible to extensive fire. Therefore, fire is allowed to play a natural role in these environments it will probably be beneficial or neutral for mountain goat habitat.

Livestock grazing is not likely to be in direct conflict with mountain goats, although domestic sheep formerly grazed portions of mountain goat habitat along the Continental Divide. Competition could occur if livestock displace either bighorn sheep or mule deer which in turn could shift their distribution and compete for either forage or space within mountain goat habitat. In general livestock grazing is not a problem for mountain goats, although it is recommended that domestic sheep allotments which adjoin mountain goat range not be filled.

Wilderness clearly provides the most stable mountain goat habitat for a species which has one of the highest natural mortality rates among North American big game animals. Few opportunities exist to improve or develop mountain goat habitat, given the rugged terrain they require. It simply must be protected and maintained where it exists.

Mountain Lion

The mountain lion or cougar (Felis concolor) is a highly adaptable animal, living under a broad spectrum of environmental conditions. No other large land mammal has a more extensive range in the western hemisphere: from northern British Columbia to the Straits of Magellan. However, distribution of lions in the United States has been effectively reduced to the western mountain states.

In Montana, the lion was and hunted under a bounty system until 1962. Cougars were legislatively classed as predators in 1966 and gained status as a big game species in 1971. They have either held their own or expanded their distribution statewide since that time. Mountain lions are an important economic concern because of actual or potential effects on livestock, and because of their positive effects on the hunting recreation industry. The mountain lion's role in the BMWC ecosystem is as a predator and for human recreational interests.

Little information about lion populations and distribution in the BMWC exists. Seasonally, they probably occupy the entire Wilderness but are limited to big game winter ranges in that season.

The cougar's diet consists mostly of deer, elk, porcupines, hares, and other small animals. However, when available, mule deer seem to be a preferred species. Due to the link with big game as a food source, management of deer and elk and the lion's own social imparatives ultimately dictate mountain lion population potential.

Demand for lion hunting opportunity, expressed in license sales, has increased three-fold from 1971 to 1986. Most of the lion harvest formerly occurred west of the Continental Divide. Recently the harvest has increased east of the Divide and along the Rocky Mountain Front. The documented legal harvest from within the BMWC has not exceeded more than 4 cats per year and has typically been 1 or 2. Logistical problems with hounds, recent heavy harvest of lions, and increasing recreational use of Wilderness suggest that expanded lion hunting within the Wilderness is not likely to be encouraged. Although not especially productive lion habitat, the Wilderness may function as a reservoir for lions taken in more

accessable adjacent areas. Furthermore, some mountain lions harvested along the Rocky Mountain Front, Swan Valley, and Lincoln areas are partially dependent upon the Wilderness and associated big game.

Studies have indicated that mountain lion predation does not function as a big game population regulation mechanism. Social behavior maintains lion populations more or less in check with their prey's population level. The number of deer and elk taken by lions may be offset by the benefits of lions motivating the game to redistribute themselves on their winter ranges. Mountain lions in the BMWC should be managed to allow for a sustained harvest while keeping population levels high enough to play a natural ecological role in the system. Efforts should be made to allow for a wider distribution of wintering big game inside the Wilderness which would allow for an expanded mountain lion population. In addition, mountain lions should be managed conservatively along the perimeter of the Wilderness until more is known about Wilderness-non-wilderness predator-prey interaction.

Black Bear

The BMWC sustains a healthy black bear (Ursus americanus) population. In the period 1976 through 1985, hunters took an annual average of 55 black bear from the upper South and Middle Forks of the Flathead River. Approximately 88% of the hunting effort occurs in the fall season, and a very high proportion of that is by non-resident hunters. Total recreation days associated with black bear hunting in the upper South and Middle Forks averaged 2,533 days annually during the past 5 years and appeared to decline during that period.

Habitat in the BMWC appears adequate for black bears. Vegetative succession following extensive forest fires of the early 1900s may have lowered habitat quality in recent years through diminished production of seasonally important bear foods. Moderately high grizzly bear populations may be competing with the black bear for limited amounts of seasonally important foods. Grazing by domestic stock and elk could adversely impacting seasonal bear habitat.

Black bear hunting in the BMWC is not suppressing population levels. Habitat quantity and quality changes occurr slowly. The present hunting strategy includes a spring hunting season from April 15 through May 31 and a fall harvest season from early September through late November. At the request of outfitters, the spring season was extended until June 15 for a couple years in the early 1980s, but little use was made of that opportunity. The extended portion of the spring black bear season was eliminated.

Grizzly Bear

The Eurasian brown bear and the North American grizzly are considered the same species (Ursus arctos). Current theory holds that this species developed its large size, aggressive temperament, flexible feeding habits, and adaptive nature in response to habitats created by intermittent glaciation. It is believed that ancestors of the grizzly bear migrated from Siberia across a land bridge at the Bering Strait at least 50,000 years ago. As the continental ice sheet receded about 10,000 years ago, the species began to work its way south over post glacial North America.

European explorers found grizzlies throughout most of the American West, including northern Mexico. It is not known exactly how many grizzlies lived in the U.S. before 1700. Historical sightings and modern-day densities, suggest around 100,000 bears lived in parts of 17 states.

Almost without exception, bear numbers declined where man and bear came together for any length of time. The deline of the grizzly took less than 60 years, from the end of the trapping era in 1840 to the turn of the century. The decline was due to a number of things, including a reduction of prey because of market hunting associated with gold exploration and mining, construction of railroads, homesteading, predator control, and loss of habitat related to ranching, farming, and human settlement. Much of the killing was based on the notion that the grizzly bear posed a constant threat to people and livestock, and was incompatible with human activity.

The grizzly bear occurs throughout the BMWC and adjacent areas in higher numbers than anywhere else in the lower 48 states. Grizzly bears are relatively long-lived, and require large land areas for their survival. They are slow reproducers with females not producing cubs until they are five years or older, and they generally produce a litter at three-year intervals. Litter size is usually around two cubs. The reproductive performance of the species in the BMWC is very high. Some of the females have produced litters at two-year intervals instead of three, and litter size has averaged over two cubs/litter.

Grizzly bears occupying the BMWC use a wide variety of habitat types. Because grizzlies are opportunistic omnivores (they eat a wide variety of plant and animal matter), and are highly mobile they have the ability to make use of seasonally abundant food sources. General patterns of use in the BMWC begin with bears generally moving from high elevation den sites to lower elevations and riparian areas in the spring. They move progressively higher as summer advances. In some areas, they move back to lower elevations in early fall prior to returning to high elevation den sites. It should be moted that this is only a very generalized statement of habitat use and, in fact, some grizzlies in the complex move to lower elevation sites in spring and remain there throughout the summer and fall.

The MDFWP grizzly management goals are to maintain between 280-540 grizzlies in those areas of the BMWC outside of GNP. Current population estimates for these areas is a minimum of 356 (549 if the bears in GNP are added), and the population is stable to increasing in most areas (MDFWP Programmatic EIS 1986). To maintain these goals into the future, cooperation of many people and agencies is required. Overall, the MDFWP management program is conservative ensuring the continued existence of the bear.

In managing the grizzly bear in this area, the objective is to maintain good numbers of bears while at the same time minimizing potential and actual conflicts with people.

Generally, within the core areas of the BMWC, the changes in land use since the 1930s have favored grizzly bears (i.e. elimination of grazing, establishment of wilderness areas, etc.) At the present time conflicts have occurred on the periphery of the complex. The importance of these areas to the overall health of the entire complex's grizzly population cannot be overstated. If the grizzly bear is to be successfully maintained in the BMWC, progressive programs in core

areas of the complex will have to be combined with a genuine concern for the bear on adjacent public and private lands.

Wolf

The wolf (Canis lupus) is a northern hemisphere circumpolar species. Populations in the southern portions of its original range have been largely extirpated. In North America, the species once ranged from central Mexico to Ellesmere Island occupying all habitats except the most arid desert types. As settlement of North Americas proceeded, the wolf was gradually eliminated from much of its original range due to both real and perceived conflicts with man's interests.

In Montana, bounty systems and predator control programs have been sponsored by livestock interests, county governments, and the territorial state, and federal governments. In early 1914, Congress provided funds to the U.S. Biological Survey for predator and rodent control in the West. The wolf control portion of that program was organized and in place by fall. Montana wolves were eliminated as a viable species by 1926. Some reports of pack activity occurred as late as 1932-33. The last wild wolf subject to government control under this program in Montana was taken on a strychnine drop bait in Powell County in 1944.

Since 1944, reports of wolf occurrence have occurred sporadically, with occasional specimens being taken. An exception to this pattern was a temporary population increase in the North Fork Flathead River and in the BMWC during the 1950s. Since 1984, wolves have again increased in the North Fork area. Pack activity is now present, with additional wolf activity on the east side of Glacier National Park. Total numbers are currently estimated at 4-18 wolves. Because Montana contains substantial wild areas and substantial populations of potential prey wolf expansion is likely.

Canada and Alaska have healthy wolf population hower the wolf is currently listed as endangered in the 48 conterminous states except for Minnesota where it is listed as threatened. As a result of this listing, a recovery plan has been prepared. That plan is currently being revised. Proposed revisions have not yet been approved by the U.S. Fish and Wildlife Service (USFWS).

In the absence of wolf predation, the elk population in the BMWC appears to have fluctuated moderately over the past half century. For years this population has sustained a relatively constant level of sport hunting. The existing population could be stressed due to potential threats to 66% of the winter range. If the present population is to be maintained, winter range must be protected. If the elk population of the ecosystem is to sustain both the harvest from sportsmen and act as a prey base for wolves, not only will existing winter range need protection and enhancement, but new areas within the ecosystem will have to be managed or acquired for elk winter range.

A minimum of 1,000 elk equivalents are estimated to be necessary to sustain a recovered wolf population comprised of 10 breeding pairs, each with an associated pack size of 5-16 wolves (USFWS 1984). Certainly mule deer, and to some extent white-tailed deer, moose and bighorn sheep, will also be prey of wolves. Estimates of wolf consumption of each prey species is not possible. If elk comprise 20% to 80% of the wolf prey base, then a minimum of 200 to 800 elk per year must be allocated for wolves. To maintain a stable elk population this number of elk must be produced annually in addition to the current annual

increment removed through natural mortality and hunter harvest. If a stable, recovered population of wolves is ever to be realized in the BMWC, elk and deer populations must be increased in proportion to the prey base demand of at least 10 packs of wolves. It is questionable whether or not the current winter ranges can sustain such an increase.

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APPENDIX

Appendix 1. Descriptions of forest management area prescriptions according to the following categories: Wilderness, Proposed Wilderness, Unroaded, Low-Moderate Access, and Developed-Timber.

No.	Name	Forest[1]	Roads	Description
WILDERNESS PRESCRIPTIONS				
P	Classified Wilderness	L&CNF	Roadless	Bob Marshall and Scapegoat Wildernesses; grazing is allowed, withdrawn from mineral activity.
P-1	Wilderness	HNF	Roadless	Scapegoat Wilderness; 34% managed by Lincoln Ranger District; grazing is all owned, withdrawn from mineral activity
12	Wilderness	LNF	Roadless	Bob Marshall and Scapegoat Wildernesses; grazing is allowed; withdrawn from mineral activity.
18	Wild & Scenic River	FNF	Roadless in Wild segment; in Recreational and Scenic Segment, roads designed to enhance river values.	Flathead River; pack stock grazing only; no timber harvest; mineral leasing withdrawal; in Wild Segment no motorboats, in Recreational and Scenic segment no boats exceeding 10 horsepower will be allowed.
21	Wilderness	FNF	Roadless	Great Bear and Bob Marshall Wilderness areas; grazing is allowed; withdrawn from mineral activity.
PROPOSED WILDERNESS PRESCRIPTIONS				
Q	East Slope Recommended Wilderness	L&CNF	All areas and trails open to trail vehicles and snow machines, except where restricted.	Manage to protect wilderness values
N	RARE II	L&CNF	Minimize access; limit motorized use to existing roads. No construction for surface resources; for subsurface resources roads will be closed to public.	Deep Creek Reservoir North; further planning area pending oil and gas decisions; grazing is allowed.
12	Proposed Wilderness	LNF	Roadless	Same prescription number as Wilderness; timber harvest not permitted; grazing is allowed.
-	Proposed Wilderness	FNF	No motorized access except for administrative purposes to microwave repeater.	Shaded area on management area map. Area 19 Jewel Basin Hiking Area; no surface occupancy for minerals; helicopter access allowed.

Appendix 1. (continued)

No.	Name	Forest[1]	Roads	Description
UNROADED PRESCRIPTIONS				
N-1	Research Natural Areas	HNF	No Construction.	Timber harvest and livestock grazing, will not be allowed; areas for research, observation and study.
8	Timberland/Roadless	FNF	Roads constructed for temporary support of aerial harvest or mineral access.	Timber harvest scheduled; pleasing natural appearance.
R-1	Primitive and Semi-Primitive Recreation	HNF	Roads will not be constructed except to access mineral activity on private land; roads exist but motorized access not allowed.	Unsuitable for timber management; grazing is allowed and range improvements may be implemented (salt; water developments)
LOW-MODERATE ACCESS PRESCRIPTIONS				
E	Big Game Winter Range/ Livestock	L&CNF	Local roads may remain open; low access (0.5-1.5 mi/mi^2) will be maintained. New roads will be allowed only for minerals. Some seasonal closures.	Harvest unprogrammed timber; maintain grazing.
F	Semi-primitive Recreation	L&CNF	Existing roads maintained.	Unprogrammed timber. Existing range use; maintain as is. Undeveloped land with limited motorized access. Semi-primitive recreation.
G		L&CNF	Motorized access limited to designated roads and trails; no new roads unless for minerals; these will be reclaimed.	Harvest unprogrammed timber using existing roads only; existing range use; existing condition.
O	Commercial Forest	L&CNF	Limit motorized access to existing roads and trails. New roads will be closed to the public.	Low intensity timber production at 0.5 million board feet per year/moderate grazing.
I	Wildlife Habitat	L&CNF	0.5-1.5 mi road/mi^2. Roads built only for mineral activity.	Harvest unprogrammed timber; maintain existing range permits.

Appendix 1. (continued)

No.	Name	Forest[1]	Roads	Description
M-1		HNF	Roads allowed for minerals, special uses, and access to other management areas. Maintain existing roads.	Salvage and firewood timber harvest. Unsuitable for timber management. Maintain present condition with minimal investment.
L-1	Grazing	HNF	Motorized recreation allowed.	Timber harvest may be used to improve forage production; unsuitable for timber production. Vacant allotments will be restocked if in demand.
L-2	Grazing/Wildlife	HNF	Motorized access limited to designated routes.	Livestock grazing maintained; timber harvest may be used to improve forage production; unsuitable for timber management.
W-1	Wildlife	HNF	Road management.	Variety of wildlife habitat; timber harvest only to enhance wildlife values.
1	Nonforest/Noncommercial	LNF	Roads exist; some travel restrictions; construction for access to adjacent areas may occur or for mineral activity.	Scattered parcels; unsuitable for timber harvest but salvage and firewood harvest may occur; grazing permitted; maintain wildlife habitat.
10		LNF	Unroaded; roads permitted for mineral activity if need is proven, public use may be restricted.	Small unroaded parcels; severe physical constraints; unsuitable for timber; maintain natural condition; livestock grazing permitted.
11	Dispersed Recreation	LNF	No motorized access except for mineral activity; some roads exist.	Dispersed recreation; unsuitable for timber harvest; grazing allowed.
13	Riparian/Water Quality	LNF	Roads exist; new road construction will be limited.	Timber harvest scheduled; occasional packstock grazing; enhance fish and aquatic habitat, wildlife, water quality or recreational.
14	Riparian/Grazing	LNF	Numerous roads exist; new construction will be constrained.	Timber harvest scheduled on portion of area; grazing is allowed in some areas.
19	Wildlife	LNF	Roads will not be constructed for surface management activities but may pass through to access other management areas.	Unsuitable for timber harvest; grazing is allowed if compatible with wildlife.

Appendix 1. (continued)

No.	Name	Forest[1]	Roads	Description
20	Grizzly/Timber	LNF	Few roads will be left open to public use; new roads will be closed.	Timber harvest scheduled; livestock grazing allowed.
20a	Grizzly/Nontimber	LNF	Seasonal road closures; road construction to access other areas or for mineral activity.	Optimize grizzly habitat conditions; timber harvest only for habitat improvement and safety hazards; unsuitable for timber harvest.
27	Commercial Forest	LNF	Roads may pass through to access other areas or for mineral development.	Difficult to harvest, therefore timber considered unsuitable; livestock grazing may occur but will be incidental; no management activities increase wildlife use.
1		FNF	Construction allowed to meet adjacent management area objectives.	Maintain present conditions; minimal investment.
2, 2A 2B	Primitive & Semi-primitive Rec.	FNF	Some motorized, some unroaded.	Six subprescriptions to provide variety of primitive and semi-primitive recreation; existing facilities will be maintained; timber salvage and firewood but timber harvest will not be scheduled; existing grazing maintained; no surface mineral occupancy.
3		FNF	Roads exist; mineral roads will be closed to public.	
11, 11A	Grizzly Habitat	FNF	Control public access; new roads will be local, low standard.	Six subprescriptions to maintain or improve grizzly habitat, maintain existing facilities, including certain campgrounds; grazing is not allowed; timber harvest varies from scheduled to unscheduled.
12	Riparian	FNF	Roads exist; new roads constructed with limitations.	Enhance riparian vegetation and wildlife diversity; unscheduled timber harvest may occur if compatible with riparian goals; grazing is allowed.
13, 13A, 13D	Timberland/Wildlife	FNF	Roads constructed if compatible with wildlife; seasonal closures.	Suitable (13) and unsuitable (13A, 13D) timber; scheduled and unscheduled harvest will occur; grazing allowed.

Appendix 1. (continued)

No.	Name	Forest[1]	Roads	Description
DEVELOPED-TIMBER PRESCRIPTIONS				
H	Developed Recreation/ Livestock	L&CNF	Achieve high public access. (+3.0 mi. of open road/mi^2)	Campgrounds, ski areas, recreation residences, some livestock grazing, harvest unprogrammed timber. Create new recreation sites or expand existing sites.
2	Administrative Sites	LNF	Roads will be constructed.	Ranger stations, work centers, lookouts; grazing is allowed; administrative timber removal.
9	Recreation Areas	LNF	Extensive road system in place	Concentrated public use; near population centers, streams or lakes; recreation is encouraged; unsuitable for timber harvest.
16	Timber	LNF	Extensive road system is in place and will be further developed.	Timber harvest scheduled; grazing may be allowed.
17	Timber	LNF	Extensive road system in place; average density of 1.5 mi/mi^2.	Timber harvest scheduled; grazing may be allowed.
24	Visual/timber	LNF	Extensive road system; densities vary from 4.6 mi to 2.8 mi/mi^2.	Timber harvest scheduled.
25	Visual/Partial Retention	LNF	Extensive roads system.	Timber harvest scheduled.
5	Roaded Timberlands	FNF	Roads will be constructed	Maintain natural landscape; scheduled timber harvest.
7	Roaded Timberlands	FNF	Roads will be constructed.	Two subprescriptions; timber harvest scheduled; maintain a pleasing natural landscape.
9, 9B	Timberlands/Deer Winter Habitat	FNF	Seasonal closures; road construction or reconstruction if compatible with white-tailed deer.	Timber harvest scheduled and grazing allowed on management area 9; timber harvest not scheduled and grazing not allowed on 9B.
11C	Timberlands/Grizzly Habitat	FNF	New roads will be local, low standard; seasonal closures.	Timber harvest scheduled; grazing allowed.
13	Timberland/Wildlife	FNF	Seasonal closures; road construction and reconstruction if compatible with deer and elk.	Five subprescriptions; 13 and 13C suitable for timber harvest and will be scheduled; grazing allowed in 4 areas and not allowed in 1.

Appendix 1. (continued)

No.	Name	Forest[1]	Roads	Description
15	Timberlands	FNF	Some motorized restrictions; roads will be constructed.	Six subprescription; emphasize timber; livestock grazing allowed.
16	Timberlands	FNF	Roads for timber may be constructed, otherwise support roads for aerial harvest will be temporary.	Four subprescriptions; emphasize timber except on 678 acres of proposed wilderness; no permitted livestock grazing.
17	Riparian/Timber	FNF	Roads will be constructed.	Timber harvest scheduled; grazing allowed.
T-1	Timber	HNF	Constructed as needed.	Timber production; grazing maintained.
T-2	Timber/Wildlife	HNF	Road management constructed as needed.	Timber production, grazing maintained.
T-3	Timber/Wildlife	HNF	Constructed as needed.	Timber production compatible with wildlife; grazing maintained.
T-4	Timber/Visual	HNF	Road management, constructed as needed.	Timber production; grazing maintained.

[1]Forest abbreviation: L&CNF = Lewis and Clark National Forest; HNF = Helena National Forest; LNF = Lolo National Forest; FNF = Flathead National Forest.

801/18.1/19

Summary of Appendix 1: Combinations of U.S. Forest Service management area prescriptions used in the 1986 Forest Plans to quantify land use activity on four forests within the BMWC eco-system.

	Flathead NF	Lolo NF	Helena NF	Lewis and Clark NF
Wilderness (W)	18[1/] 21	12	P-1	P
Proposed Wilderness (P) or RARE II areas	19	12		Q N
Unroaded (U)	8		R-1 N-1	
Low-Moderate Access (L)	1 2 12 2A 13A 2B 13D 3 10 11 11A	1 27 10 11 13 14 19 20 20a	M-1 L-1 L-2 W-1	E F G O I
Developed - Timber (T)	5 17 7 9 11C 13 15 15E 16	2 9 16 17 24 25	T-1 T-2 T-3 T-4	H

1/ All management prescriptions are from 1986 Forest Plans.

801/18.1/11

Appendix 2. Land ownership and USFS land management on elk winter ranges within the BMWC ecosystem.

LEWIS & CLARK		TOTAL	LAND OWNERSHIP						FS MANAGEMENT				
			FS	PRVT	CORP	STATE	BLM	BLKFT	WLDRNS	P.WLDR	U	M	TD
ID.	NAME												
1	Badger Two-Medicine	21,952	17,984	1,664	-	-	-	2,304	-	-		17,984	-
2	Badger	8,448	8,256	-	-	-	-	192	-	-	2,890	5,366	-
3	Lookout R	3,328	2,880	-	-	-	-	448	-	-	1,296	1,584	-
4	Blackleaf-Scoffin	73,536	13,952	44,352	-	10,688	4,544	-	2,432	-	-	11,520	-
5	Teton-Twin Lakes	2,368	-	1,856	-	512	-	-	-	-	-	-	-
6	NF Sun	22,592	19,904	1,856	-	64	768	-	8,256	6,784	2,560	1,152	1,152
7	Deadman	192	192	-	-	-	-	-	192	-	-	-	-
8	Pretty Prairie	3,328	3,328	-	-	-	-	-	3,328	-	-	-	-
9	Sun RGR-Ford Cr	54,144	16,832	16,832	-	19,136	1,344	-	-	-	-	16,128	704
10	Haystack	4,608	-	3,520	-	1,088	-	-	-	-	-	-	-
11	Harrison Ridge	5,824	-	5,120	-	448	256	-	-	-	-	-	-
12	Cuniff Basin	1,344	576	448	-	320	-	-	-	-	-	576	-
13	Wrangle Cr.	2,240	-	2,240	-	-	-	-	-	-	-	-	-
14	Falls Cr. Ridge	1,856	1,344	512	-	-	-	-	-	-	-	1,344	-
TOTAL		205,760	85,248	78,400	-	32,256	6,912	2,944	14,208	6,784	6,746	55,654	1,856

Appendix 2. (continued)

HELENA		TOTAL	LAND OWNERSHIP						FS MANAGEMENT				
			FS	PRVT	CORP	STATE	BLM	BLKFT	WLDRNS	P.WLDR	U	M	TD
ID.	NAME												
15	Sunrise-Sunset	13,632	3,200	9,280	-	640	512	-	-	-	-	3,200	-
16	Alice Cr	256	256	-	-	-	-	-	-	-	-	256	-
17	Cool Cr	960	-	192	256	512	-	-	-	-	-	-	-
18	Theodore	2,624	320	576	768	960	-	-	-	-	-	-	320
19	Marcum-Long	1,612	102	422	486	-	602	-	-	-	-	-	102
TOTAL		19,084	3,878	10,470	1,510	2,112	1,114	-	-	-	-	3,456	422
LOLO													
19	Marcum-Long	6,452	410	1,690	1,946	-	2,406	-	-	-	-	-	410
20	Ovando Mtn.	9,152	128	1,152	4,288	3,584	-	-	-	-	-	-	128
21	Blackfoot-Clearwater	22,016	-	3,904	10,816	7,296	-	-	-	-	-	-	-
22	Danahur-Dry FK	1,702	1,702	-	-	-	-	-	1,702	-	-	-	-
TOTAL		39,322	2,240	6,746	17,050	10,880	2,406	-	1,702	-	-	-	538

Appendix 2. (continued)

FLATHEAD		TOTAL	LAND OWNERSHIP						FS MANAGEMENT				
			FS	PRVT	CORP	STATE	BLM (GNP)	BLKFT	WLDRNS	P.WLDR	U	M	TD
ID.	NAME												
22	Danahur Mtn - Dry Fork	6,810	6,810	-	-	-	-	-	6,810	-	-	-	-
23	Hahn Cr	5,184	5,184	-	-	-	-	-	5,184	-	-	-	-
24	Danahur Basin	2,944	2,944	-	-	-	-	-	2,944	-	-	-	-
25	Black Bear Gordon Cr	34,880	34,880	-	-	-	-	-	34,880	-	-	-	-
26	Picture Rdg	4,160	4,160	-	-	-	-	-	4,160	-	-	-	-
27	Bunker Cr	5,632	5,632	-	-	-	-	-	-	-	-	4,672	960
28	Soup Cr - Condon	33,408	10,816	1,600	13,696	7,296	-	-	-	640	-	832	9,344
29	Swan-Lost Cr	3,456	3,072	-	-	384	-	-	-	-	-	640	2,432
30	Swan Lk-Sixmile	3,200	704	1,216	896	384	-	-	-	-	-	-	704
31	Sullivan Cr	2,624	2,624	-	-	-	-	-	-	-	-	640	1,984
32	Dry Park Big Bill Meadow Cr	42,240	42,240	-	-	-	-	-	2,560	-	-	11,840	27,840
33	Cable Mtn	1,280	1,280	-	-	-	-	-	1,280	-	-	-	-
34	Winter	6,144	6,144	-	-	-	-	-	6,144	-	-	-	-
35	Schaffer Md	1,088	1,088	-	-	-	-	-	1,088	-	-	-	-

Appendix 2. (continued)

FLATHEAD		TOTAL	LAND OWNERSHIP						FS MANAGEMENT				
			FS	PRVT	CORP	STATE	(GNP)	BLKFT	WLDRNS	P.WLDR	U	M	TD
ID.	NAME												
36	Patrol Rdg	2,688	2,688	-	-	-	-	-	2,688	-	-	-	-
37	Bradley Mtn	4,032	4,032	-	-	-	-	-	4,032	-	-	-	-
38	Spruce Cr	1,216	1,216	-	-	-	-	-	1,216	-	-	-	-
39	GNP Bear Cr	4,288	-	-	-	-	(4,288)	-	-	-	-	-	-
40	GNP Nyak	8,000	448	256	-	-	(7,296)	-	-	-	448	-	-
41	Firefighter	10,688	10,688	-	-	-	-	-	320	-	-	896	9,472
TOTAL		183,962	146,650	3,072	14,592	8,064	(11,584)	-	73,806	640	448	19,520	52,736

Appendix 3. Elk hunting regulations for hunting districts within the BMWC ecosystem, 1964 - 1986.

	1964	1969	1974	1979	1984	1986
130	HD13 Arch5[1] ES5 10[2]	HD13 ES3 AB 5	ES3 AB 5	ES1 AB 5	ES1 AB 5	ES1 AB 5
140	HD14 ES5 5	HD14 ES3 5 AB	ES3 AB 5	ES1 AB 5 AP1	ESP1 AB 5 ES1	ES1 AP1 5 AB
141	See 140 (14)	See 140 (14)	See 140	ES1 AB 5	ES1 AB 5	ES1 AB 5
150	HD15 ES6 6	HD15 ES8 10 AB	ES8 AB 10	ES4 AB 10	ES2 AB 10	ES2 AB 10
151	See 150 (15)	See 150 (15)	See 150	See 150	ES2 AB 10	ES2 AB 10
280	ES10 10	ES8 AB 11	ES8 AB 10	ES½ AB 10	AB AP5 10	BAB AP5 10
281	ES5 5	ES3 AB 6	ES2 AB 5	AB ES3 5	AB AP5 5	BAB AP5 5
282	See 285 (28)	ES2 2	ESP1½ 1½	ESP1 1	ESP2	ESP2
284	See 281	See 281	See 281	ES½ AB 5	ArchAB 5	ArchAB 5
285	HD28 ES5 5	HD28 ES3 AB 6	HD283 ES1½ AB 5	HD283 ES½ AB 5	HD283 AP5 5	AP5 AB 5
415	HD41-01-02 ES1 AB 5	ES2 AB 6	ES2 AB 5	ES1 AB 5	ES2 AB 5	ES1 AB 5
422	ES2 AB 5	ES5 5	ES5 5	ES5 5	ES5 5	ES5 5
424	See 422	HD422 ES6 6	ESQ AB 5	ESQ AB 5	ESQ AB 5	ESQ BAB 5

Appendix 3. Continued

425	HD42-01-02 -03 ESQ AB 5	ESQ AB 1	ES1 1	ESQ AB 5	ES2 2	AP2 Antl 2
427	See 442 (42)	See 442 (42)	See 442 (42)	ESQ 5	ESQ AB 5	ESQ 5
428	See 425 (42)	See 442 (42)	See 424 (42)	ESQ 5	ESQ AB 5	ESQ 5
441	See 415 (41)	HD41 ES1 AB 6	ES1 AB 5	ES1 AB 4	ES2 AB 5	AP5 AB 5
442	See 425 (42)	HD42 ESQ AB 6	ESQ AB 5	ESQ AB 5	ESQ AB 5	ESQ BAB 5

HD = hunting district (recent HD number may be different from earlier number, due to division of early HD)
Arch = archery only
Q = quota
ES = either sex
ESP = either sex permit
AP = antlerless permit
ANT = antlerless elk
AB = antlered bull
BAB = branched antlered bull

[1]Arch5 = number next to hunting season code indicates season length for that code in weeks
[2]10 = total season length in weeks

Appendix 4. Elk harvest and composition, and numbers of hunters in the total BMWC elk ecosystem.

TOTAL BMWC

YEAR	TOTAL	BAB	SPIKE	COW	CALF	UNK	HUNTERS
1966	2358	824	416	896	211	11	9705
1967	2362	791	390	852	329	0	12,759
1968	2302	739	272	938	321	32	13,869
1969	1918	581	254	797	278	8	11,342
1970	2545	972	372	637	258	6	11,848
1971	2022	810	348	592	231	41	15,718
1972	2012	696	298	703	260	55	18,484
1973	2618	824	403	933	314	144	20,123
1974	1630	598	232	394	185	221	20,349
1975	2205	697	365	769	236	138	20,612
1976	1270	542	145	434	84	65	17,157
1977	1741	732	312	455	169	73	17,497
1978	1413	553	259	404	149	48	17,613
1979	1027	430	149	332	87	29	15,060
1980	1512	545	362	462	116	27	15,308
1981	1358	477	339	445	92	5	12,841
1982	1459	634	351	392	67	15	11,479
1983	1178	477	337	295	68	1	11,281
1984	2208	727	568	714	195	4	11,959
1985	1788	634	389	594	170	1	11,933

Appendix 5. Elk harvest and composition, and numbers of hunters in Region 1 of the BMWC elk ecosystem. (Hunter questionnaire data.)

Region 1 of BMWC (Flathead)[1]

YEAR	TOTAL	BAB[2]	SPIKE	COW	CALF	UNK	HUNTERS
1964	1039	375	150	398	112	4	5422
1965	789	240	72	317	148	12	3878
1966	1529	516	273	570	159	11	5162
1967	1125	385	209	373	158	0	5708
1968	1284	374	146	625	132	7	6980
1969	892	217	190	390	87	8	5441
1970	938	528	141	181	82	6	5301
1971	1148	512	199	282	131	24	7566
1972	875	386	126	240	101	22	7404
1973	1359	471	241	470	122	55	9616
1974	949	390	170	193	97	99	10074
1975	1193	399	190	398	114	92	10320
1976	872	397	79	299	56	41	9088
1977	1082	534	162	263	98	25	9206
1978	777	308	115	235	88	31	9228
1979	680	291	105	207	59	18	8490
1980	794	307	136	271	63	17	8530
1981	716	294	194	181	47	-	6481
1982	759	379	149	186	37	8	6531
1983	698	302	206	157	33	-	6140
1984	950	388	281	199	82	-	5017
1985	673	357	124	144	48	-	5187

[1] Hunting districts: 130, 140, 141, 150, 151 (Hunter questionnaire data.)
[2] BAB: Branch Antlered Bull

801/18.1/16

Appendix 6. Elk harvest and composition, and numbers of hunters in Region 2 of the BMWC elk ecosystem.

Region 2 of BMWC (Blackfoot-Clearwater)[3]

YEAR	TOTAL	BAB	SPIKE	COW	CALF	UNK	HUNTERS
1966	217	103	11	84	19	0	1289
1967	336	89	62	144	41	0	1647
1968	342	127	44	126	34	11	2414
1969	367	190	0	137	40	0	1927
1970	275	157	53	45	19	0	1677
1971	203	99	51	46	4	3	2529
1972	247	106	44	66	27	4	2703
1973	289	119	35	94	25	16	2372
1974	288	104	20	99	35	30	3973
1975	521	148	83	201	64	25	4433
1976	222	97	43	66	13	3	2876
1977	257	102	63	56	26	10	3334
1978	274	129	57	65	14	9	3393
1979	127	54	19	33	12	5	2234
1980	209	79	81	40	9	-	2133
1981	219	93	64	47	15	-	2176
1982	236	91	95	44	6	-	1968
1983	170	63	45	38	24	-	1804
1984	303	99	90	97	17	-	1950
1985	263	80	96	68	19	-	1880

[3] Hunting districts: 280, 281, 282 (Hunter questionnaire data).

Appendix 7. Elk harvest and composition, and numbers of hunters in Region 4 of the BMWC elk ecosystem.

Region 4 of the BMWC (Two Medicine, Birch, Teton, Sun, Dearborn)[4]

YEAR	TOTAL	BAB	SPIKE	COW	CALF	UNK	HUNTERS
1964	272	90	44	103	30	4	2716
1965	524	258	96	127	35	9	2763
1966	612	205	132	242	33	0	3254
1967	901	317	119	335	130	0	5404
1968	676	238	82	187	155	14	4475
1969	810	174	64	270	151	0	3974
1970	1033	287	178	411	157	0	4870
1971	671	199	98	264	96	14	5623
1972	890	204	128	397	132	29	8377
1973	974	234	127	369	167	73	8135
1974	393	104	42	102	53	92	6302
1975	491	150	92	170	58	21	5859
1976	176	48	23	69	15	21	5193
1977	402	96	87	136	45	38	4957
1978	361	116	87	104	47	8	4992
1979	224	85	25	92	16	6	4336
1980	509	159	145	151	44	10	4645
1981	423	90	81	217	30	5	4184
1982	464	164	107	162	24	7	2962
1983	310	112	86	100	11	1	3337
1984	955	240	197	418	96	4	4992
1985	852	197	169	382	103	1	4866

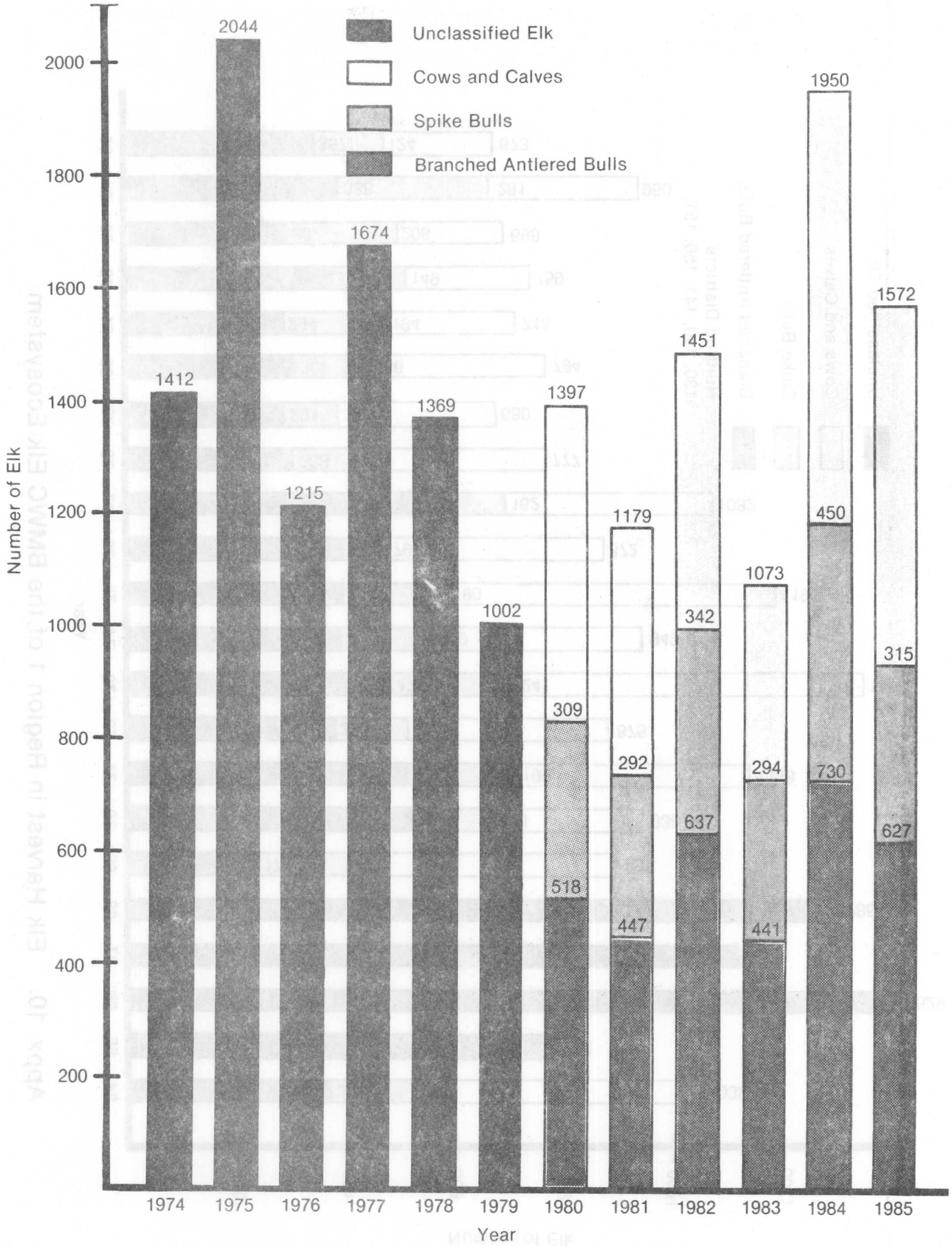
[4] Hunting districts: 415, 422, 424, 425, 427, 428, 441, 442 (Hunter questionnaire data).

Appendix 8. Elk harvest and composition, and numbers of hunters in Hunting District 28 (became 283 in 1973) involving the Clearwater, lower Blackfoot and portions of the Clark Fork river drainages.

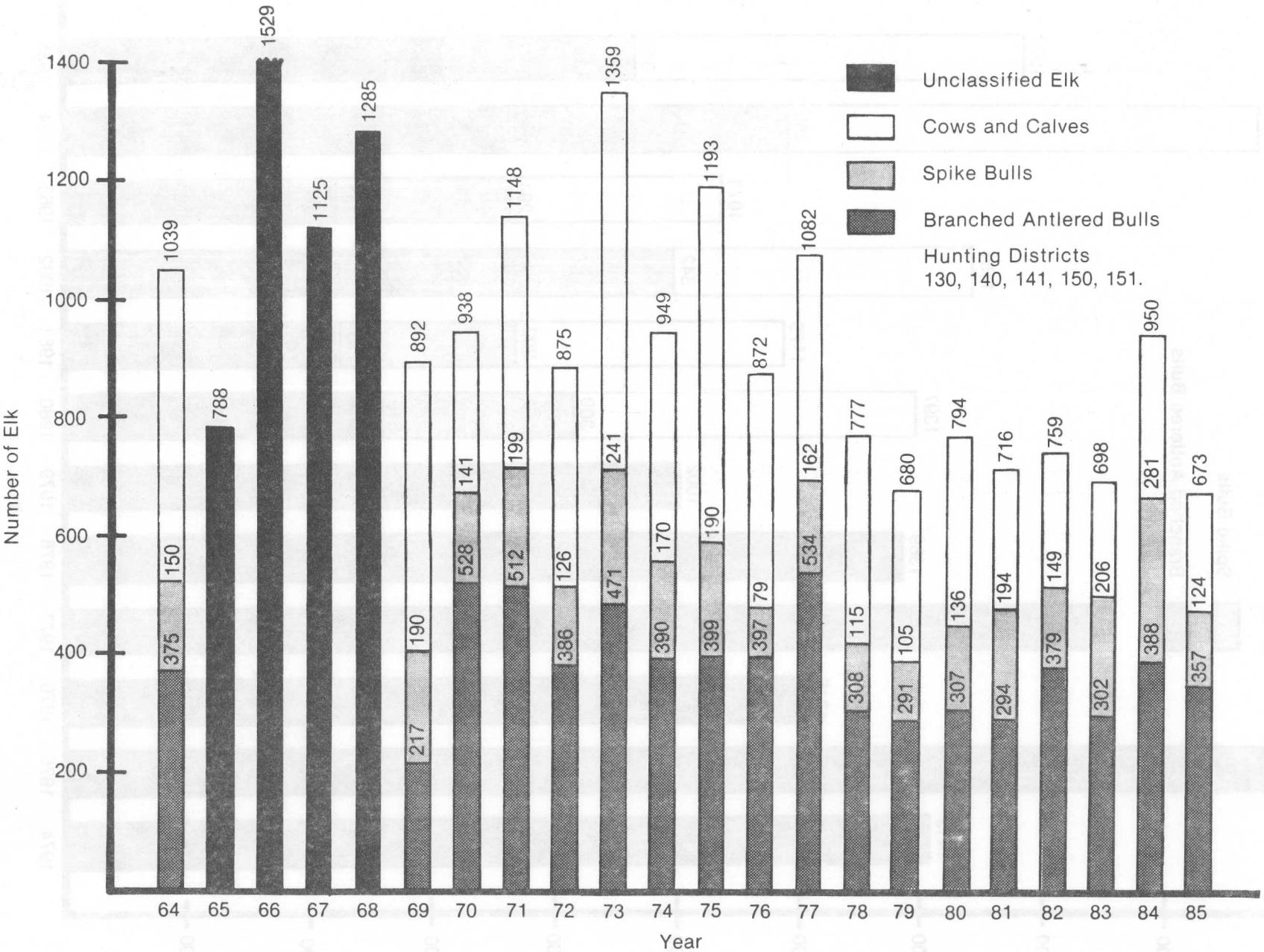
YEAR	TOTAL	BULL	SPIKE	COW	CALF	UNCL	HUNTERS	HD#
1964	441	113	67	172	83	6	220	28[1] (282, 283, 285)[2]
1965	360	100	50	156	53	0	1669	28 (282, 283, 285)
1966	363	152	34	113	65	0	1858	28 (283, 285)
1967	388	165	20	94	94	14	1686	28 (283, 285)
1968	514	183	59	206	66	0	2095	28 (283, 285)
1969	159	32	15	88	16	8	1551	28 (283, 285)
1970	307	93	74	111	28	0	2015	28 (283, 285)
1971	172	65	46	38	20	3	2323	28 (283, 285)
1972	210	99	22	70	21	0	2286	28 (283, 285)
1973	381	133	63	108	70	7	2917	283 (283, 285)
1974	240	78	38	80	7	37	3286	283 (283, 285)
1975	382	72	48	187	66	9	2647	283 (283, 285)
1976	151	47	38	48	13	5	2074	283 (283, 285)
1977	235	71	49	94	13	8	2563	283 (283, 285)
1978	187	37	52	82	18	0	2647	283 (283, 285)
1979	260	85	60	68	42	5	3057	283 (283, 285)
1980	275	86	132	43	11	3	2950	283 (283, 285)
1981	243	50	132	50	6	5	3043	283 (283, 285)
1982	237	70	100	53	13	1	3630	283 (283, 285)
1983	349	114	158	62	15	0	3485	283 (283, 285)
1984	182	54	95	30	3	0	2409	283
1985	156	45	71	37	2	1	2112	283

[1] About 1/3 of HD 28 occurs in the BMWC elk ecosystem.

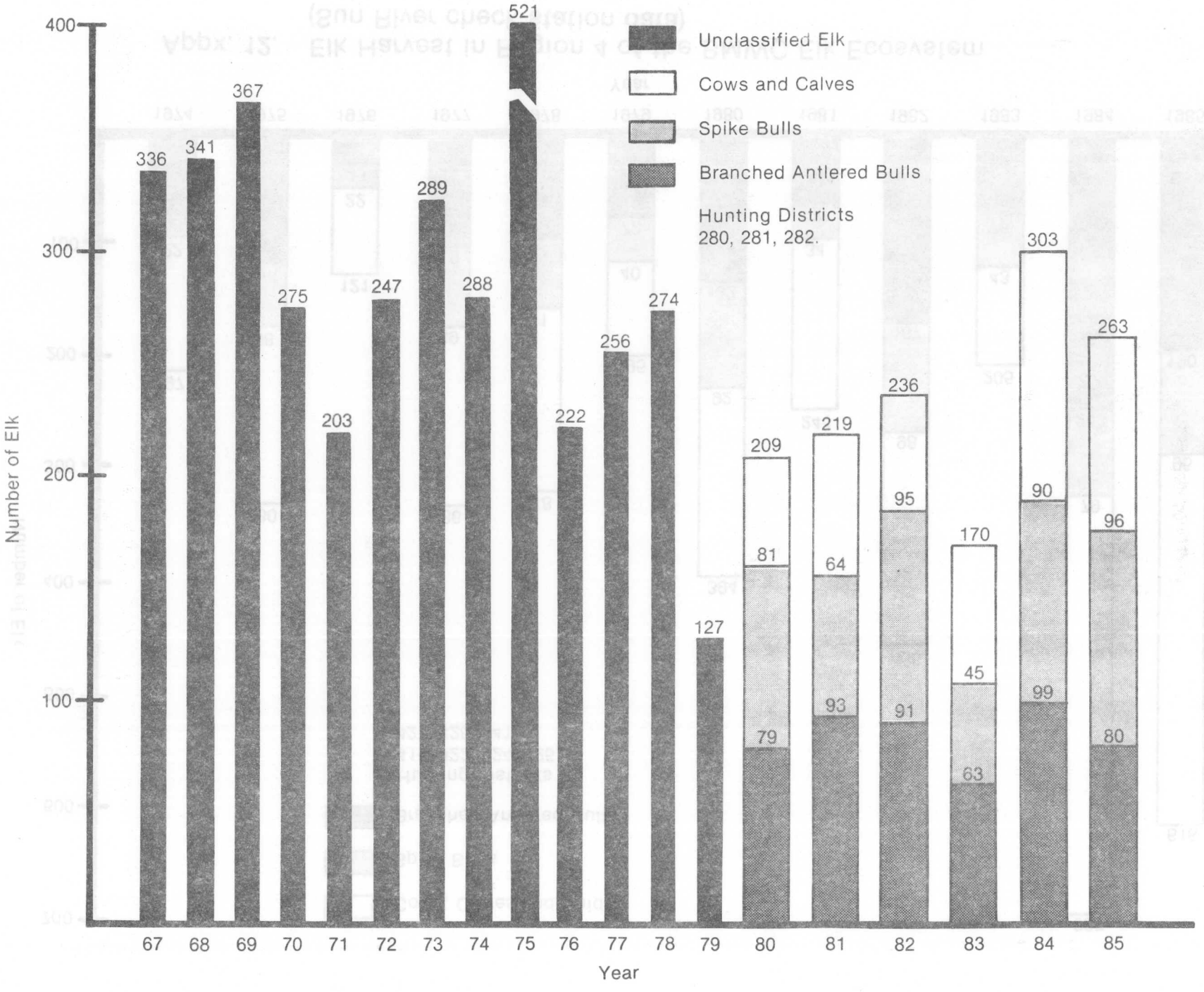
[2] In 1964 and 1965 HD 28 included the Blackfoot-Clearwater Wildlife Management Area (now HD 282), as well as HD's 283, which extends down the Blackfoot and Clark Fork Rivers to Missoula, and 285, west of the Clearwater River to the North Fork Blackfoot, until 1973 when the district number was changed to HD 283. From 1973 to 1983 it included what is now HD 285.



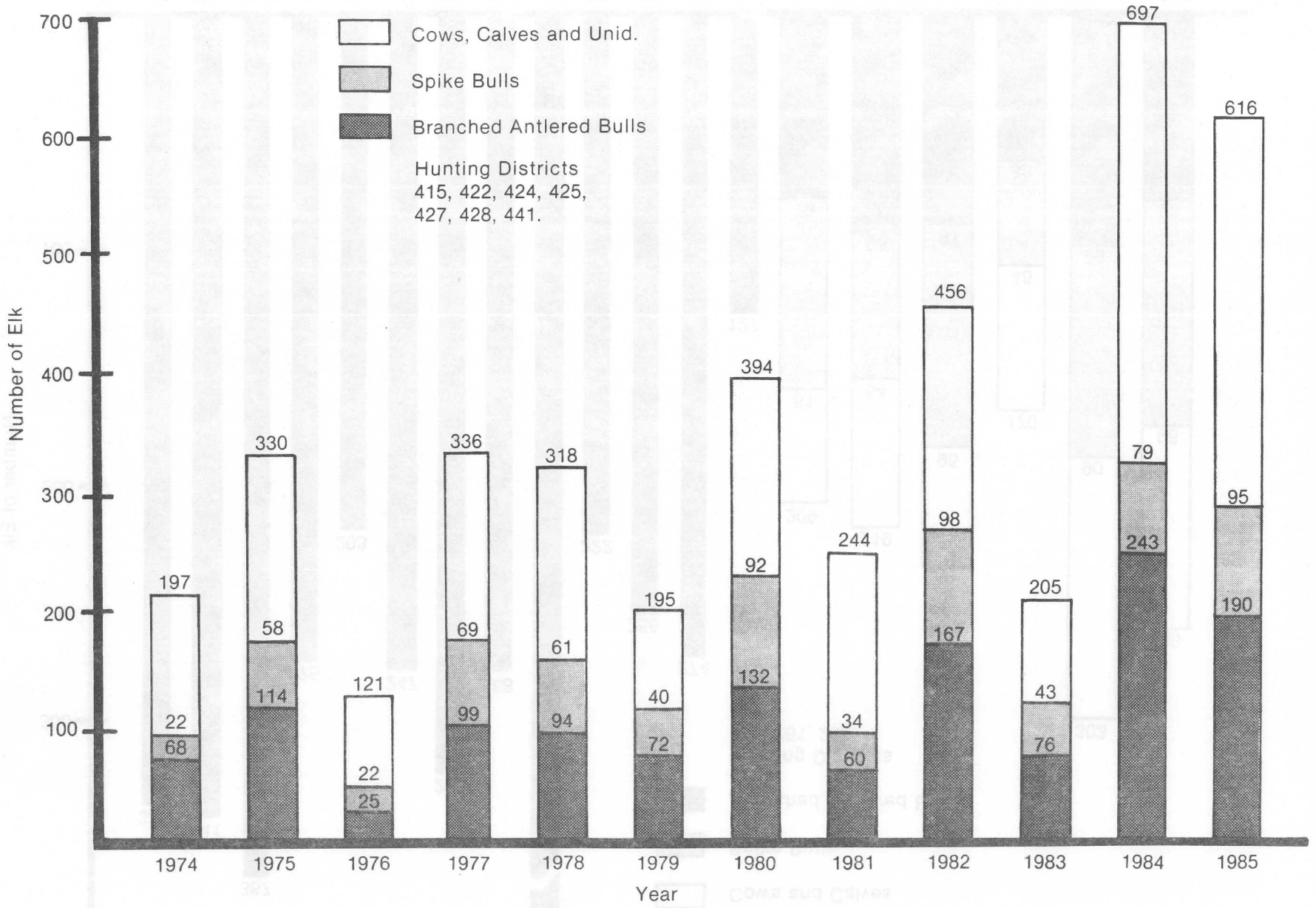
Appendix 9. Elk Harvest in the BMWC Elk Ecosystem (combined check station and questionnaire data.)



Appx. 10. Elk Harvest in Region 1 of the BMWC Elk Ecosystem



Appx. 11. Elk Harvest in Region 2 of the BMWC Elk Ecosystem



Appx. 12. Elk Harvest in Region 4 of the BMWC Elk Ecosystem (Sun River check station data)

Appendix 13. Percent composition of bull elk harvest in Regions 1, 2, 4, and the BMWC elk ecosystem.

	TOTAL BMWC			REGION 1 BMWC			REGION 2 BMWC			REGION 4 BMWC		
	NO. BULLS	%		NO. BULLS	%		NO. BULLS	%		NO. BULLS	%	
YEAR	HARVESTED	BAB	SPIKE	HARVESTED	BAB	SPIKE	HARVESTED	BAB	SPIKE	HARVESTED	BAB	SPIKE
1964				525	71	29				134	67	33
1965				312	77	23				354	73	27
1966	1240	66	34	789	65	35	114	90	10	337	61	39
1967	1181	67	33	594	65	35	151	59	41	436	73	27
1968	1011	73	27	520	72	28	171	74	26	320	74	26
1969	835	70	30	407	53	47	190	100	0	238	73	27
1970	1344	72	28	669	79	21	210	75	25	456	61	39
1971	1158	70	30	711	72	28	150	66	34	297	67	33
1972	994	70	30	512	75	25	150	71	29	332	61	39
1973	1227	67	33	712	66	34	154	77	23	361	65	35
1974	830	72	28	560	70	30	124	84	16	146	71	29
1975	1062	66	34	589	68	32	231	64	36	242	62	38
1976	687	79	21	476	83	17	140	69	31	71	68	32
1977	1044	70	30	696	77	23	165	62	38	183	52	48
1978	812	68	32	423	73	27	186	69	31	203	57	43
1979	579	74	26	396	73	27	73	74	26	110	77	23
1980	907	60	40	443	69	31	160	49	51	304	52	48
1981	816	58	42	488	60	40	157	59	49	171	53	47
1982	985	64	36	528	72	28	186	49	51	271	61	39
1983	814	59	41	508	59	41	108	58	42	198	57	43
1984	1295	56	44	669	58	42	189	52	48	437	55	45
1985	1023	62	38	481	74	26	176	45	55	366	54	46

FISHERIES OF THE BOB MARSHALL WILDERNESS COMPLEX

Limits of Acceptable Change Management Plan

Montana Department of Fish, Wildlife and Parks
1420 East Sixth Avenue
Helena, MT 59620

January, 1988

PREPARATION STATEMENT

This report was prepared under the direction of Jim Posewitz as part of a chapter for the Limits of Acceptable Change Management Plan for the Bob Marshall Wilderness. John Fraley organized and consolidated the report, wrote all general sections, the section on the Middle Fork Flathead drainage, and portions of other sections on each drainage. The section on the South Fork was adapted from a draft compilation report concerning the South Fork fisheries written by Ray Zubik. Don Peters wrote the section on the Blackfoot drainage. Bill Hill wrote portions of the section on the East Front drainages, and he and Al Wipperman provided data for that section. Others who contributed data and/or reviewed the report included Jim Vashro, Dennis Workman, Joe Huston, Scott Rumsey, Ray Zubik, Bob Domrose and Tom Weaver.

SUMMARY

The fisheries resource within the Bob Marshall Wilderness Complex (BMWC) is extensive and unique. More than 500 miles of stream and 35 lakes support populations of native and introduced species of salmonids. Waters within the BMWC represent a genetic stronghold for two native fish species of special concern, bull trout and westslope cutthroat, and provide thousands of angler days of recreation.

South Fork Flathead Drainage

The South Fork Flathead River drainage supports a fish assemblage similar to that of the Middle Fork. However, the river is isolated from the Flathead system by Hungry Horse Dam. Bull trout and some westslope cutthroat migrate between Hungry Horse Reservoir and the South Fork drainage within the BMWC. Information from tag returns has indicated that most cutthroat in the upper South Fork are fluvial residents of the river. Westslope cutthroat in the upper portion of the river were genetically tested and found to be genetically pure.

The ten productive lakes in the drainage support mostly rainbow and yellowstone cutthroat. MDFWP Region 1 is presently testing fish in these lakes for genetic characteristics and planting westslope cutthroat in some of these lakes.

A 1983 survey on the South Fork Flathead River indicated that anglers fish an average of 3.7 hours and kept 0.26 cutthroat per day. The total harvest estimate for the river was 4,382 cutthroat. About one-fourth of the anglers fished from boats.

Lengths of westslope cutthroat caught by MDFWP anglers in the South Fork between Independence Park and the headwaters averaged 228 and 230 mm (9.0 in) in 1960 and 1981. Cutthroat averaged 240 (9.4), 258 (10.2) and 273 mm (10.7 in) in the same river section in 1984, 1985 and 1986. This apparent increase in average length may be due to the angling limits of three fish, none over 12 inches established in 1984.

Population estimates for cutthroat on several sections of the river ranged from 183-680 fish per km (293-1,090 fish per mile). Highest densities of cutthroat were found in the Black Bear and Mid Creek sections. Catch rates of cutthroat by MDFWP anglers were highest near the headwaters. Populations of cutthroat in tributaries of the South Fork averaged 3.43 fish/100 m2 water surface area (approximately 40 fish/100 m of stream length). Upper Gordon Creek supported the highest densities of westslope cutthroat.

Options for managing fisheries in the South Fork drainage include:

1. Maintain the present stream angling regulations of three fish, none over 12 inches,

2. Conduct snorkel expansion estimates for cutthroat in alternate years in three river sections,

3. In conjunction with (2) above, conduct hook-and-line surveys in the three sections for catch rate, size, growth and movement information,

4. Conduct hook-and-line surveys annually in the headwaters section where comparable data exists over a three-year period.

Middle Fork Flathead Drainage

The Middle Fork Flathead River drainage supports a unique complex of migratory and resident native species including the bull trout, westslope cutthroat trout and mountain whitefish. Westslope cutthroat trout in the Middle Fork Flathead River are less numerous than in the South Fork. Estimates of mountain whitefish in the Middle Fork were greater than 1,000 fish per mile. Catch rates of cutthroat by anglers in the river ranged from 1.21 to 1.68 fish/hour from 1979-1981.

Tributaries in the Middle Fork drainage supported from 0.2 to 27.2 westslope cutthroat per 100 m^2 water surface area (approximately 1-100 fish per 100 m (328 ft) of stream length). Juvenile bull trout densities ranged from 0.1 - 7.2 fish/100 m^2, or approximately 1-30 fish per 100 m of stream length. The Middle Fork tributaries represent important nursery areas for migratory westslope cutthroat trout populations from the Middle Fork Flathead River, and migratory bull trout populations in Flathead Lake. Catch rates of westslope cutthroat in tributaries by MDFWP anglers averaged 4.4 fish/hour. These cutthroat averaged 200 mm (7.9 in) in length.

Bull trout spawning sites or redds in Middle Fork tributaries ranged from 237 to 523 in years when nearly complete surveys were conducted. Major tributaries used by spawning bull trout in the drainage within the BMWC include Strawberry, Trail, Bowl, Clack, Schafer, Dolly Varden, Morrison, Lodgepole and Granite creeks.

Cutthroat populations (genetically untested) exist in 12 mountain lakes in the Middle Fork drainage within the BMWC. Populations are maintained by planting in six lakes and natural reproduction in six lakes.

Options for managing fisheries in the Middle Fork drainage within the BMWC include the following:

1. Closely monitor the bull trout spawning migration and limit angling on bull trout if significant declines are detected.

2. Monitor fish populations in selected areas through snorkel surveys, hook-and-line sampling, redd counts and habitat monitoring.

3. Test westslope cutthroat in the Middle Fork Flathead River for genetic purity.

4. Begin a regular survey of selected mountain lakes for determination of population status, genetics and angler use.

5. Maintain the present limits of three fish, none over 12 inches (streams) and three fish, no size limit (lakes).

6. Increase enforcement of angling regulations by encouraging interagency patrols, MDFWP ex officio duty for fisheries, and more prominent posting of angling regulations.

7. Restrict trail improvements and maintenance along selected trout rearing and spawning areas.

8. Halt all timber harvest and road construction on lands within areas that drain into the BMWC.

Blackfoot Drainage

The Blackfoot River drainage within the BMWC provides some of the best spawning habitat available for large, fluvial bull trout which inhabit the Blackfoot and North Fork Blackfoot rivers. Other species in the drainage include westslope cutthroat, rainbow, hybrids of rainbow and westslope cutthroat, yellowstone cutthroat, brook trout and mountain whitefish.

Little information is available for major tributaries in the drainage within the BMWC. Major drainages include the North Fork Blackfoot, Landers Fork of the Blackfoot, the East Fork of the North Fork Blackfoot River and Monture Creek. Seven mountain lakes support yellowstone or cutthroat populations of undetermined genetic origin.

Options for fisheries in the Blackfoot drainage include:

1. Conduct a baseline study to collect fisheries information for management,

2. Plant Little Crystal lakes (westslope cutthroat) and Heart Lake (grayling),

3. Conduct a snorkel population estimate and hook-and-line sampling for cutthroat in a 1.5 km section of the North Fork Blackfoot. The work would be a cooperative effort between FWP Regions 1 and 2.

East Front Drainages

Streams draining the East Front within the BMWC support an important fishery for rainbow, cutthroat and eastern brook trout. Major East Front drainages include the North and South forks of the Sun River, the Dearborn River and streams in the Great Bear Addition (within the Teton and Marias River drainages).

Most available information has been collected on the North and South forks of the Sun River. Average lengths of rainbow trout in the forks from 1975-1985 have ranged from 277-322 mm (10.9 to 12.7 in). Approximately one-half of these rainbow (caught by MDFWP anglers) exceeded 12 inches in length. Fish reach 254 mm (10 in) during their third year of life. Three mountain lakes in the Sun River drainage support populations of yellowstone cutthroat.

Options for fisheries management for the East Front drainages within the BMWC include:

1. Conduct a baseline fisheries inventory to provide data necessary for management,

2. Test cutthroat for genetic purity in Sun River tributaries,

3. Continue annual monitoring of rainbow size by hook-and-line sampling in the North and South forks of the Sun River,

4. Estimate population densities of trout in the forks of the Sun River biannually, and

5. Maintain the present angling regulations.

Overall Recommendations:

The unique fisheries resources in the BMWC will benefit by comprehensive, consistent management that recognizes the balance between maintaining fish populations and providing angling recreation. Options for managing fisheries in the BMWC include the following:

1. Maintain the present angling limits of three fish, none over 12 inches (streams) and three fish, no size limits (lakes). Restrict tackle to artificial lures, barbless hooks on streams.

2. Continue strategies to reduce the chance of genetic interchange between westslope cutthroat trout and non-native species.

3. Revise and update the memorandum of understanding between MDFWP and USFS for fisheries management within wilderness areas. Specific items that should be clarified include: fish population sampling, fish planting, habitat protection, and enforcement of angling regulations.

4. Form a fisheries management committee for the BMWC made up of the MDFWP fish managers, representatives of each national forest within the BMWC and designated public representatives. This committee would formulate a detailed management plan, and recommend strategies to the MDFWP Director and the USFS Region 1 Forest Supervisor for implementation.

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INTRODUCTION

The Bob Marshall Wilderness Complex (BMWC) includes the Bob Marshall, Great Bear and Scapegoat wildernesses within the Flathead, Lewis and Clark, Helena, and Lolo National Forests. In 1985, the USDA Forest Service released a draft management plan for the BMWC based on the concept of Limits of Acceptable Change (LAC) (USDA 1985). The management plan, developed by a diverse task force, did not include a discussion of fish and wildlife populations or management.

In 1986, the LAC Task Force responded to public comment and asked the Montana Department of Fish, Wildlife and Parks to develop a chapter for the LAC plan that would include a discussion of fisheries and wildlife values. This chapter addresses the unique fisheries resource of the BMWC and includes a summary of available fisheries and habitat information, a discussion of sensitive fish species and habitat, recommendations for managing and monitoring important fish populations, and recommendations for further work needed to improve fisheries management in the complex.

Information in this chapter is organized by the four major drainages within the BMWC: South Fork Flathead, Middle Fork Flathead, Blackfoot, and East Front (includes North and South forks of the Sun, Dearborn, Marias and Teton). Fisheries information for each drainage includes fish habitat, life histories of important fish species, fish populations, age and growth, important spawning sites, and angler use. Recommendations for monitoring key species, management and further work are included.

Most of the information in this chapter is based on previous fisheries work conducted within the BMWC. The section on the Middle Fork Flathead drainage was adapted from Fraley et al. (1981) and several other reports produced during the Flathead River Basin Studies from 1980 through 1983 (MDFWP 1982, Shepard and Graham 1983). The section on the South Fork Flathead drainage was adapted from a draft fisheries consolidation by Ray Zubik, Shepard et al. (1982), and recent unpublished data collected by Region 1, MDFWP. The section on the Blackfoot drainage was based largely on unpublished data collected by Region 2, MDFWP. The section on the East Front drainages was based on unpublished data collected by Region 4, MDFWP and several job progress reports (MDFWP 1976 and MDFWP 1980). Lack of fisheries information on the Blackfoot and East Front drainages limited the recommendations that could be made for monitoring and management.

The final portion of this chapter includes overall recommendations for fisheries within the BMWC. These recommendations address habitat protection, fisheries management strategies, fishing regulations and interagency cooperation.

SOUTH FORK FLATHEAD RIVER

Description of the Drainage

The upper South Fork Flathead River originates at the junction of Danaher and Young's creeks and flows in a northerly direction for 95 km before entering Hungry Horse Reservoir (HHR) (Figure 1). The upper 66 km lies entirely within the Bob Marshall Wilderness Area. The upper 84 km of the South Fork from its headwaters to the Spotted Bear River is classified a Wild River under the National Wild and Scenic Rivers Act of 1976 and downstream to HHR the South Fork is classified as a Recreational River. The average annual discharge into the reservoir (1964 to 1980) was 2,301 cfs with a maximum discharge of 30,200 and a minimum of 127 cfs. Hungry Horse Dam lies at the foot of the 4,403-km^2 South Fork drainage basin. No fish passage structures were installed in the dam and, consequently, access to approximately 38 percent of the total drainage area available for spawning salmonids migrating upstream from Flathead Lake was permanently blocked.

The South Fork Flathead River has been divided into different management units depending on the type of activity surveyed and the kinds of information desired. Zubik and Fraley (1987) distinguished three primary fish habitat types in the South Fork River. The upper area included the confluence of the South Fork to Independence Park which was typified by the 2.2-km long Gordon section (Figure 1). This section meandered through an open valley floor with the banks frequently lacking vegetation during low summer flows. The river channel has shifted many times and there are some braided sections. The typical channel cross section was a flat, bowl-shape with shallow edges and a deeper mid channel. Substrate primarily consisted of cobble and large gravel. Average stream width was 31.3 m and there were about 1.8 riffle:pool complexes per kilometer. The gradient was about 0.20 percent for this section of river.

The middle area of the river began below Independence Park and ended at Meadow Creek Gorge. This area is typified by the 4.4-km Black Bear section (Zubik and Fraley 1987). This section meandered through a narrower valley floor than the upper area with a more defined channel and very little braiding. The stream banks frequently lacked vegetation during low summer flow. The typical channel cross section was a flat, bowl shape with shallow edges and a deeper mid channel with substrate that consisted of cobble and large gravel. Average stream width was 42.3 m and this section contained 3.3 riffle:pool complexes per kilometer. Gradient averaged 0.28 percent per kilometer.

The lower river area begins immediately below Meadow Creek Gorge and runs downstream to Spotted Bear River. The 2.2-km Harrison section typifies this area (Zubik and Fraley 1987). This section of river flows through a canyon with a very defined channel and a cross section that was characterized as a steep "U"

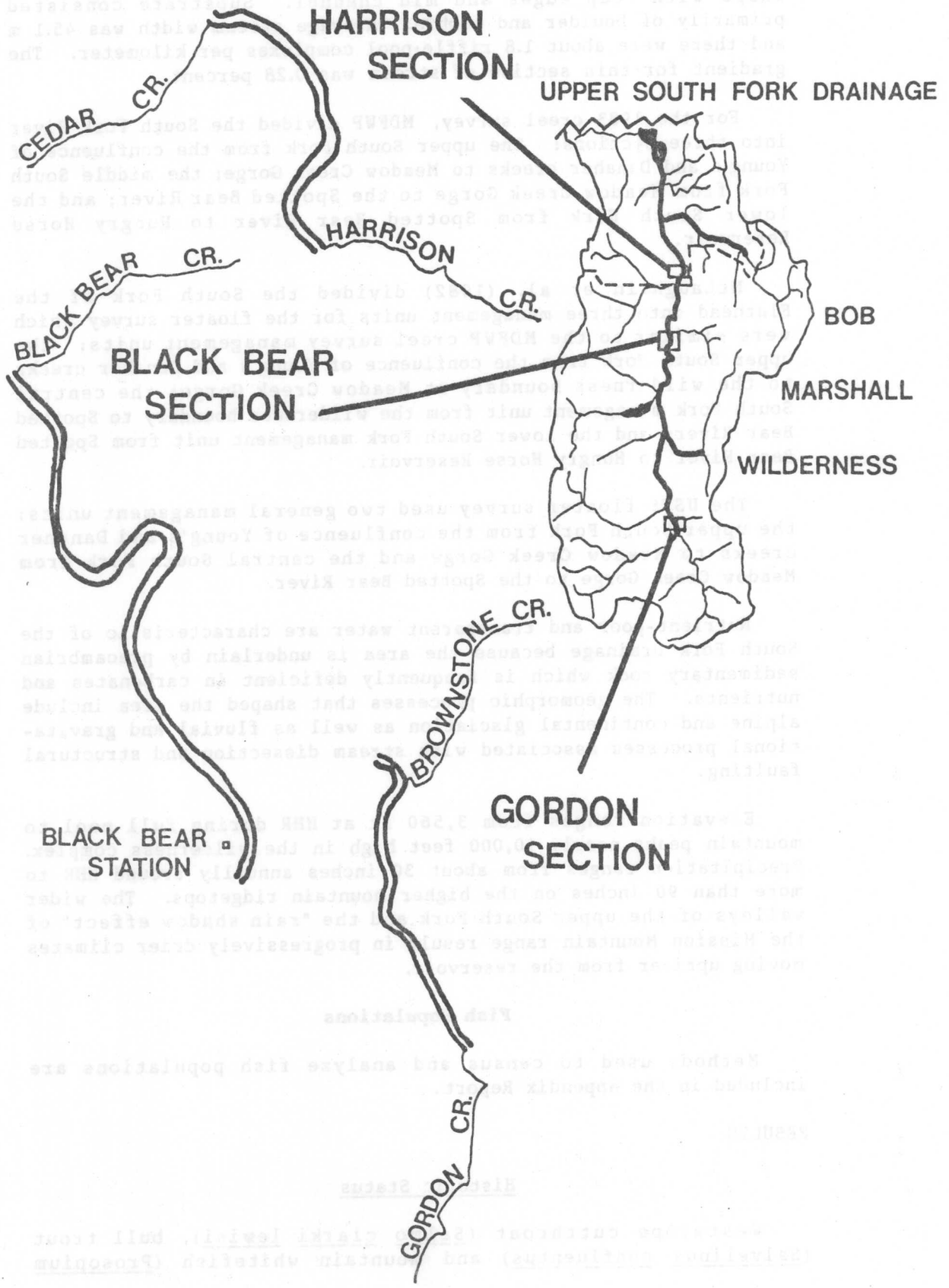

Figure 1. Map of the Upper South Fork Drainage.

shape with deep edges and mid channel. Substrate consisted primarily of boulder and cobble. Average stream width was 45.1 m and there were about 1.8 riffle:pool complexes per kilometer. The gradient for this section of stream was 0.28 percent.

For the 1983 creel survey, MDFWP divided the South Fork River into three sections: The upper South Fork from the confluence of Young's and Danaher creeks to Meadow Creek Gorge; the middle South Fork from Meadow Creek Gorge to the Spotted Bear River; and the lower South Fork from Spotted Bear River to Hungry Horse Reservoir.

McLaughlin et al. (1982) divided the South Fork of the Flathead into three management units for the floater survey which were similar to the MDFWP creel survey management units: the upper South Fork from the confluence of Young's and Danaher creeks to the wilderness boundary at Meadow Creek Gorge; the central South Fork management unit from the wilderness boundary to Spotted Bear River; and the lower South Fork management unit from Spotted Bear River to Hungry Horse Reservoir.

The USFS floater survey used two general management units: the upper South Fork from the confluence of Young's and Danaher creeks to Meadow Creek Gorge and the central South Fork from Meadow Creek Gorge to the Spotted Bear River.

Nutrient-poor and transparent water are characteristic of the South Fork drainage because the area is underlain by precambrian sedimentary rock which is frequently deficient in carbonates and nutrients. The geomorphic processes that shaped the area include alpine and continental glaciation as well as fluvial and gravitational processes associated with stream dissection and structural faulting.

Elevation ranges from 3,560 ft at HHR during full pool to mountain peaks nearly 10,000 feet high in the wilderness complex. Precipitation ranges from about 30 inches annually around HHR to more than 90 inches on the higher mountain ridgetops. The wider valleys of the upper South Fork and the "rain shadow effect" of the Mission Mountain range result in progressively drier climates moving upriver from the reservoir.

Fish Populations

Methods used to census and analyze fish populations are included in the Appendix Report.

RESULTS

Historic Status

Westslope cutthroat (*Salmo clarki lewisi*), bull trout (*Salvelinus confluentus*) and mountain whitefish (*Prosopium*

williamsoni) are the major game fish species found in the South Fork Flathead River and its tributaries above Hungry Horse Reservoir. Westslope cutthroat and bull trout are both classified as species of special concern in Montana because of declines in abundance and distribution statewide.

Prior to construction of Hungry Horse Dam, the South Fork drainage was considered the major spawning area for adfluvial fish stocks from Flathead Lake. Substantial numbers of bull trout and westslope cutthroat trout spawned in the South Fork drainage along with smaller numbers of mountain whitefish and kokanee salmon (Oncorhynchus nerka). Zubik and Fraley (1987a) estimated that potential habitat which would produce about 69,000 cutthroat juveniles to Flathead Lake annually was lost due to dam construction. They also estimated that potential spawning habitat which would support about 2,100 adult bull trout was lost due to blocked access to the South Fork drainage from Flathead Lake.

Other native fish species that used the South Fork drainage prior to dam construction included pygmy whitefish (Prosopium coulteri), northern squawfish (Ptychocheilus oregonensis), largescale sucker (Catostomus macrocheilus), longnose sucker (Catostomus catostomus), and sculpins (Cottus sp.). The fish species presently inhabiting the reservoir are native and nonnative riverine and migratory fish from Flathead Lake trapped behind Hungry Horse Dam when it impounded the South Fork. Exotic species which include yellowstone cutthroat (Salmo clarki bouvieri), rainbow trout (Salmo gairdneri) and arctic grayling (Thymallus arcticus) are present in the reservoir, but rarely collected.

Life History

Three distinct life history patterns of westslope cutthroat commonly occur throughout their native range (Graham et al. 1980). Juvenile adfluvial cutthroat spend one to three years in the tributaries before emigrating to a lake or reservoir. They generally reside in a lake or reservoir system for one to three years, mature and return to their natal stream in June and July to spawn and complete the life cycle. Some repeat spawners have been found, but most are alternate-year spawners. Fluvial westslope cutthroat trout are found in the main stem of the South and Middle Forks. These fish have a life cycle similar to the adfluvial strain, except that they grow and mature in a large river rather than a lake or reservoir. The resident strain of westslope cutthroat trout completes its entire life cycle in small headwater streams. Residents seldom reach total lengths greater than 200 mm, whereas fluvial and adfluvial cutthroat trout attain lengths up to 400-450 mm (Shepard et al. 1984).

Bull trout populations also exhibit ~~the~~ adfluvial, fluvial and resident patterns. Bull trout in the South Fork drainage are primarily adfluvials and migrate from HHR to spawn in tributary

streams. The initial spawning migration of adult bull trout peaks during May and June during high river flows. Adult bull trout spawners apparently move slowly upriver through early summer and probably hold near the mouths of their spawning tributary. The majority enter tributaries during August when stream temperatures drop to approximately 10°C. Repeat and alternate-year spawners have been found. Eggs hatch in January compared to July and August for cutthroat trout. Bull trout live longer, grow larger and are much more piscivorous (fish-eating) than cutthroat.

Fish Stocking

Cutthroat trout were periodically stocked in the South Fork, its tributaries and high mountain lakes. These fish were classified as undesignated cutthroat but for the most part were probably Yellowstone cutthroat trout (Huston, MDFWP pers. comm.). These fish were planted in various sections of the South Fork Flathead River from 1926 through 1947 (Table 1). Unfortunately, specific plant locations were not designated during that time period. MDFWP also stocked 17 South Fork tributaries in the wilderness complex primarily from 1938 to 1941 (Table 2). These undesignated cutthroat trout were last planted in 1950.

All lakes in the South Fork drainage were probably barren except for Big Salmon Lake prior to artificial fish planting which began in the lake 1920's. Westslope cutthroat, Yellowstone cutthroat and rainbow trout were stocked by MDFWP in nine South Fork drainage wilderness lakes through 1965 (Table 3). All of these lakes were planted at one time, but today most maintain themselves through natural reproduction (Table 4).

Although numerous plants have been made in various waters within the drainage, the South Fork Flathead River still contains pure westslope cutthroat. Electrophoretical testing of 23 suspected westslope cutthroat trout collected in 1981 from the Big Prairie area of the South Fork of the Flathead River indicated that these trout were pure westslope cutthroat typical of other populations throughout the range of this species (MDFWP, unpublished data). Thirty suspected cutthroat collected in 1985 from the Big Prairie area of the South Fork were tested electrophoretically (Leary, U of M, pers. comm.). He found that 29 were pure westslope cutthroat and the other a yellowstone-westslope cutthroat hybrid. He felt this single hybrid was probably a migrant from another tributary or lake and not a river resident. It is quite possible this single fish may have drifted out of one of the lakes into the South Fork or may have come up the South Fork from somewhere below the wilderness boundary, possibly from Hungry Horse Reservoir.

MDFWP sampling found that previously stocked tributaries to HHR that had high mountain lakes at their origin generally had hybrid populations of cutthroat trout in the stream system below the lake. Conversely, those previously planted tributaries

Table 1. Known MDFWP planting of various sizes of undesignated cutthroat trout in the South Fork of the Flathead River.

Year	Number
1926	40,000
1936	124,048
1939	50,000
1940	14,000
1942	139,000
1943	50,000
1944	65,000
1945	50,000
1946	114,360
1947	100,000

Table 2. Known MDFWP planting of various sizes of undesignated cutthroat trout for tributaries to the South Fork of the Flathead River in the Wilderness Complex.

Area	Stream	Year Planted	Number Planted
West Side	Gorge Creek	1941	20,000
	Hungry Creek	1939	20,000
		1941	44,000
	Pendant Creek	1938	9,400
	Holbrook Creek	1938	9,400
	Burnt Creek	1938	35,000
	Gordon Creek	1938	14,100
	Shaw Creek	1938	9,400
East Side	Lower Twin	1948	10,000
		1949	10,000
		1950	10,000
	Twin Creek	1940	10,000
		1948	10,000
		1949	15,000
		1950	15,000
	Dean Creek	1940	18,200
	Silver Tip	1940	22,500
		1948	5,000
	Harrison	1941	30,000
	Mid Creek	1939	30,000
		1941	15,000
	Black Bear Creek	1939	30,000
		1941	10,000
	Helen Creek	1939	20,000
		1941	10,000
	Pentagon	1938	8,000
		1939	23,500
		1940	11,500
		1948	5,000

Table 3. High mountain lakes and known planting of various fish species and sizes in the South Fork drainage of the wilderness complex.*

Area	Lake	Last Year Planted	Species	Number Planted
Westside	Inspiration			
	Olor Lakes (2)	1939	002	58,000
	Sunburst	1939	002	42,000
		1950	002	51,640
	Picture			
	Recluse			
	Palisade			
	Big Salmon			
	Woodward	1936	002(012,1986)	18,900
		1939	002	14,000
	Necklace Lakes (3)			
	Pendant	1940	001	24,000
	Lena	1928	001(012,1986)	
	Lick	1930	002	
	Koessler	1965	002	5,200
	Doctor	1940	002	24,960
	George	1965	002	5,200
	Crimson			
	Pyramid	1950	002	10,000
Eastside	Dean			
	Hart			
	Christopher			
	Diamond			
	Prisoner			

*001 = Rainbow trout
002 = Undesignated cutthroat trout
012 = Westslope cutthroat trout

Table 4. Fisheries information for lakes in the South Fork drainage within the BMWC from 1987 and past surveys.

Lake	Species Planted[a] (by Department records)	Species Present	Natural Reproduction	Common Size Range
		South Fork Flathead Drainage		
Sunburst	YCT	YCT, YCT xx RB[b]	Excellent	10 - 20"
Olor	YCT	None caught	Limited	--
Palisade	--	None caught	Limited	--
Big Salmon	--	WCT, RB, WCT xx RB	Excellent	10 - 16"
Woodward	RB, YCT	RB[b]	Poor	14 - 20"
Necklace (3)	RB	RB[c]	Good	8 - 12"
Lena	RB	RB, RB xx WCT[c]	Poor	9 - 14"
Doctor	YCT	WCT[b]	Good	8 - 11"
Koessler	YCT	YCT, YCT xx WCT[c]	Good	9 - 11"
George	YCT	YCT, YCT xx WCT[c]	Good	8 - 13"
Lick	YCT	YCT[c]	Excellent	7 - 13"
Pyramid	YCT	YCT[b]	Good	9 - 15"
Otis	--	None caught	--	--
Crimson	--	None caught	--	--

a/ Records are incomplete.
b/ Electrophoretically tested.
c/ Sampled but electrophoretic testing not complete.

without high mountain lakes at their origin contained pure westslope cutthroat trout. In other words, planted nonnative fish did not establish in streams without lakes in their system but did in those tributaries with established lake populations. It is possible that nonnative lake fish probably drift downstream and hybridize with resident fish.

MDFWP has begun a study to document the fish species present and genetic purity of cutthroat trout found in high mountain lakes of the South Fork drainage (Table 4).

Trout Movements

During 1985 and 1986, MDFWP personnel tagged 790 juveniles and 916 adults using hook-and-line sampling in the South Fork Flathead River above Bunker Creek. Approximately 76 percent of the 71 cutthroat recaptured by anglers during the summer months moved less than one km. Only ten cutthroat moved more than ten km with 37 km (23 miles) downstream the maximum distance documented. A single cutthroat adult tagged below Meadow Creek Gorge in the lower South Fork was recaptured about 1.2 km (0.75 mile) above Meadow Creek Gorge. None of the cutthroat tagged in the upper South Fork were recaptured in Hungry Horse Reservoir. None of the cutthroat tagged in Hungry Horse Reservoir were recaptured in the upper South Fork. From 1983 through 1986, MDFWP personnel marked 386 juveniles and 71 adult cutthroat trout in the lower South Fork from Bunker Creek downstream to Lower Twin Creek primarily using traps and secondly by hook-and-line sampling (May and Weaver 1987). One cutthroat adult tagged in the lower South Fork Flathead River was recaptured in Hungry Horse Reservoir.

The MDFWP found no angler returns of cutthroat trout in the upper South Fork River that were tagged in Hungry Horse Reservoir. During the summer of 1960, MDFWP personnel tagged 80 cutthroat in the South Fork but none were captured in HHR. Huston did obtain angler returns from four adult bull trout in various sections of the upper South Fork and its tributaries above Meadow Creek Gorge. May (1986) obtained a single adult bull trout return that was marked in Hungry Horse Reservoir and returned from the South Fork River at the Meadow Creek foot bridge. Significant downstream movement was found in fish tagged during 1986 in the South Fork (headwaters, see Appendix Report).

Fishing Pressure

Accurate estimates of fisherman use for the South Fork River are extremely difficult to obtain due to the vastness of the area, the many entry and exit points, and the high costs involved for a detailed survey. MDFWP has periodically estimated fishing pressure for state waters since 1958. Unfortunately, these estimates have wide confidence intervals when looking at a specific river such as the South Fork due to the low number of interviews. This river does not receive high use compared to

other much more popular and accessible blue-ribbon trout streams in Montana.

Generally, pressure has progressively increased from 2,702 fisherman-days for the entire South Fork River in 1958, to 6,493 for 1976, to an estimated high of 11,828 fisherman-days during the 1982 fishing season. Lucas (1985), who conducted a much more detailed study of recreational use in the wilderness complex, estimated that visitor use in the Bob Marshall wilderness complex increased from 114,500 visitor-days in 1970 to 178,200 in 1982, a 56 percent increase. Also, he found that about the same percentage of wilderness complex visitors fished in 1970 and 1982; 61 and 57 percent, respectively. Unfortunately, the portion of visitors trips that were spent fishing was not included.

No information exists on float fishermen prior to the 1980's, except for the fact that Lucas (1985) estimated that about three percent of wilderness complex visitors "ran rivers" in both 1970 and 1982.

The USFS estimated that about 291 individuals floated the upper South Fork in 1986, similar to 1985 (Table 5). About 60 percent of these people floated with outfitters in both years. Of those people in outfitted boats, about 38 percent were guests and the remaining portion boatmen and others. About 14 percent of all floaters made drop trips (packed in and out by outfitters, but floated alone). Twenty-seven percent of the total number of people that floated were not outfitted in the upper South Fork.

In the central South Fork, the total number of floaters increased from 102 individuals in 1985 to 148 in 1986 (an increase of 46 percent). USFS reported that the majority of this increase was attributed to the removal of use limitations on the floating permittees in this section of river (the number outfitted increased from 50 to 75 percent of the total floaters). Non-outfitted floaters dropped from 150 people in 1985 to 108 in 1986 for the central South Fork.

McLaughlin et al. (1982) estimated that about 194 and 301 individuals floated in the upper and central South Fork in 1980 and 1981, respectively. However, the USFS felt that they underestimated floater use by one-half. For the upper South Fork, McLaughlin et al. (1982) reported that one percent of the total floaters were outfitted and 59 percent were non-outfitted during 1980 and 1981. For the central South Fork, they reported that 64 percent were outfitted while 36 percent were non-outfitted floaters during 1980 and 1981. The USFS felt that these percentages did not reflect a true ratio of the total floaters since the survey did not include boatmen and others for outfitted float trips. It does, however, represent the percentage of non-outfitted to outfitted clients. In 1986, the USFS found that 21 and 24 percent of the use on the upper and central South Fork were related to boatmen, guides and "others" (nonpaying friends). The

Table 5. Upper and central South Fork floater use estimates for the 1985 and 1986 season, calculated by the USFS.

Area	Year	Number Craft	Number Parties	Total No. people	No. People outfitted (includes boatmen)	Drop Floats	No. People Non-outfitted
Upper							
	1985	89	44	266	163 (61%)	31 (12%)	72 (27%)
	1986	96	51	291	168 (58%)	43 (15%)	80 (27%)
Central							
	1985	102	68	300	150 (50%)	------	150 (50%)
	1986	148	76	437	329 (75%)	------	108 (25%)

USFS found that about 90 percent of the use occurred during July and August in the upper and central South Fork during 1985 and 1986. The remainder was split between late June and early September in both sections.

Fishing Regulations

Cutthroat. Prior to the 1983 fishing season, cutthroat trout limits for the South Fork Flathead River were the same as the general state-wide stream limit. From 1939 through 1954 the general stream limit was 15 fish. From 1955 through 1958, there could be no more than ten cutthroat in the 15 fish limit. From 1959 through 1981, the general stream limit for cutthroat trout was 10 pounds and one fish or ten fish, whichever was reached first. The 1982 general daily stream limit was changed to five cutthroat with no size restriction. For the 1983 season, the general statewide stream limit was changed to five cutthroat with only one greater than 14 inches. After 1983, more restrictive regulations were applied to the South Fork in an effort to limit harvest and reduce the effects of increased pressure on the cutthroat fishery. Beginning with the 1984 fishing season, Montana Fish and Game Commission established catch and release fishing in the central South Fork area and a three fish less than 12 inches limit for the upper South Fork.

Bull Trout. From 1939 through the 1950 fishing season, bull trout fishing limits for the South Fork were the same as for cutthroat. From 1951 through 1975, bull trout could be no less than 18 inches. From 1976 through 1981, the bull trout limit was the same as the cutthroat limit. From 1982 through the 1984 fishing season, bull trout limits in the Flathead drainage were reduced to one fish greater than 18 inches and after 1984 to one fish of any size.

Creel Survey

During the summer of 1983, MDFWP conducted a partial creel survey of the entire South Fork Flathead River from the Meadow Creek check station. Ninety-four percent of the fishermen surveyed entered the South Fork River from this access point. Based on total angler hours, 53 percent of those interviewed fished the South Fork below the wilderness boundary while 47 percent fished within the wilderness complex and most of these from the lower middle area of the South Fork, especially shore anglers. Therefore, this creel survey may not accurately represent the entire South Fork within the wilderness complex but is representative of the South Fork below the wilderness boundary.

Wilderness anglers fished 0.8 hour longer than nonwilderness anglers on a daily basis (Table 6). South Fork anglers caught about 2.8 times as many cutthroat per hour in the wilderness complex as those outside the wilderness although fishing pressure (hours fished) was about the same (Table 7). Nonwilderness

Table 6. Actual fishing pressure for 326 anglers surveyed at the Meadow Creek check station from June 15 through September 1, 1983.

	Total Days	Total Hours fished	Mean Hours fished per day
Nonwilderness	334	1,089	3.3
Wilderness	224	978	4.1
Total	558	2,067	3.7

Table 7. Numbers of cutthroat caught, kept and estimated catch rate (number per hour) for wilderness and nonwilderness anglers in the South Fork of the Flathead River during the summer of 1983.

Section	Number caught	Number kept	Catch rate (caught)	Percent kept
Nonwilderness	861	359	0.8	42%
Wilderness	2,160	181	2.2	8%
Total	3,021	540	1.5	18%

fishermen kept 0.33 cutthroat per hour while wilderness anglers kept 0.19 cutthroat per hour. Therefore, nonwilderness anglers kept over five times as many cutthroat that they caught compared to wilderness anglers although nonwilderness anglers only caught a third as many cutthroat.

From the 1983 statewide pressure survey, MDFWP calculated that there were about 4,555 (±3,058) fisherman-days of use for the entire South Fork River above Hungry Horse Reservoir. Since South Fork anglers fished an average of 3.7 hours and kept 0.26 cutthroat per day, we estimated that about 4,382 cutthroat trout were actually harvested from the entire South Fork River or 74 cutthroat per mile during the summer of 1983.

Vashro (MDFWP, unpublished data) found that angler harvest was greatly skewed toward larger fish. The average length for the cutthroat population in the Mid Creek section during 1983 was 214 mm (8.4 in) while the average length for cutthroat harvested primarily in the central South Fork was 269 mm.

Seventy-six percent of the individual South Fork anglers surveyed were bank fishermen, while 24 percent were float fishermen. Lucas (1985) found that three percent of all wilderness complex visitors rafted in 1970 and 1982. McLaughlin et al. (1982) found an average floater party size of 6.5 individuals for the upper South Fork. He found that 81 percent of these individuals actually fished resulting in a mean party size of 5.2 fishermen. McLaughlin et al. (1982) found that float fishermen expended an average of 18.4 hours and caught 16.3 cutthroat per trip for a catch rate of 0.9 cutthroat per hour. Boat anglers kept 28 percent of cutthroat caught.

The USFS estimated that 566 and 728 people floated the South Fork in the wilderness during 1985 and 1986, respectively. By averaging these estimates and assuming a similar number floated in 1983, then float anglers would have harvested a total of 2,426 cutthroat or 41 cutthroat per mile annually. Therefore, float anglers would have kept about 55 percent of the estimated annual cutthroat harvest for the South Fork on a fish per mile basis.

During 1983, nonwilderness anglers caught 75 bull trout and kept 53 percent of these fish. Wilderness anglers surveyed from the Meadow Creek station only caught 20 bull trout and kept 30 percent of those captured. Of the 20 bull trout caught in the wilderness, all but one was taken from the lower wilderness section (Black Bear Creek to the wilderness boundary). During 1980 and 1981, boat anglers caught 0.1 bull trout per person per trip in the wilderness complex (McLaughlin 1982).

Fisherman Characteristics and Preferences. Lucas (1985) found that 61 and 57 percent of all wilderness complex visitors fished in 1970 and 1982, respectively. Young (1986) found that about 80 percent of the anglers that responded to his survey fished the

South Fork of the Flathead River. Of those surveyed, Lucas (1985) found that fishing ranked first in ten various appeals in 1970 and dropped to sixth by 1982. He speculated that there seemed to be a shift from the consumptive, activity-oriented appeals (hunting and fishing) to more contemplative appeals (scenery, relaxation, escaping civilization). Fishing was still very important since Lucas (1985) found that the second most satisfying factor contributing to overall satisfaction in 1970 and 1982 was good hunting and good fishing. Also, McLaughlin et al. (1982) found that 60 percent of the South Fork floaters interviewed felt that fishing was either extremely or very important to them and that floaters rated fishing as the most important recreational activity in the upper South Fork.

Most respondents considered fishing an important part of their wilderness visit. Young (1986) found that only 34 percent of the respondents that expressed an opinion felt that the fishery was in worse shape in 1985 than in previous years. These included long-term respondents (6+ years). However, Young speculated that the greatest declines in the fishery may have occurred prior to this time period.

Sixty percent of the anglers that visited the South Fork from the Meadow Creek check station were locals from Flathead county. Another 19 percent were Montana residents (other than Flathead county) and 21 percent were nonresidents (out of state). The MDFWP statewide fishing pressure survey estimated that nonresident anglers for the entire South Fork ranged from a low of six percent to a high of 34 percent and this percentage generally increased from the late 1950's to early 1980's. Lucas (1985) found that nonresidents comprised 34 percent for the Bob Marshall complex visitors in 1970 and 39 percent in 1982.

The 1983 MDFWP creel survey estimated that 33 percent of South Fork fishermen used bait exclusively, 20 percent used lures exclusively, 16 percent used flies exclusively and 31 percent used a combination of the above based on total number of interviews. These estimates are probably more representative of the lower South Fork and not in the wilderness since only one access point was surveyed and about half of the anglers interviewed fished the South Fork outside the wilderness complex only.

Put-in and take-out points for floaters were limited to a few specific sites in the South Fork except on the upper South Fork where the major put-in points were Danaher-Young's Creek, Big Salmon and Gordon Creek (Table 8). Almost all the floaters that accessed the upper South Fork took out above the Gorge due to the difficulty and danger involved with floating through this section. The Gorge in general is rated as class 4 white water with some class 6 sections. Almost all those who floated the central South Fork put in at Harrison Creek and took out at either Spotted Bear

Table 8. Put-in and take-out points for the upper, central and lower areas of the South Fork Flathead River during 1980 and 1981. (Percentages are those who put in or took out in that area).

Area	Put-in Point	Percent	Take-out Point	Percent
Upper South Fork	Danaher-Young's Creek	23	Gorge	81
	Hahn Creek	6	Mid Cr.	19
	Big Salmon Creek	18		
	Big Prairie	10		
	Gordon Creek	18		
	White River Scarface	13		
	Bartlett Creek	11		
Central South Fork	Gorge	4	Spotted Bear	100
	Harrison Creek	96		
Lower	Spotted Bear	93	S. Fk. bridge	42
	South Fork bridge	7	Twin Creek	58

River, South Fork foot bridge, or one of the Twin creeks. Almost all the floaters on the lower South Fork put in at Spotted Bear River.

Angler Attitudes. Young (1986) found that anglers supported the current regulations and that these regulations would lead to increases in the average size and abundance of trout and quality of fishing. Catch-and-release regulations were less appealing to anglers. Although most felt angling quality would improve in the South Fork Flathead River, only slightly more than 50 percent would continue to fish under catch-and-release regulations. Conversely, over 75 percent of the respondents indicated that they kept fish. Lucas (1985) found that allowing visitors to catch fish to eat in the wilderness but not to bring out was favored by 58 percent and opposed by 26 percent in 1982, indicating most visitors opposed a "stock the freezer" attitude.

Cutthroat Populations

Cutthroat Lengths. Little information exists on the cutthroat trout population in the South Fork drainage prior to the 1980's. MDFWP has tracked sizes of cutthroat trout through information collected in fishermen logs since 1948. Cutthroat trout lengths have fluctuated through the years with an average of 284 mm (11.2 in). Mean lengths have ranged from 244 mm (9.6 in) to 366 mm (14.4 in). These data are difficult to interpret due to the low number of fishermen sampled which often results in high variability. Generally, no long-term declines or increases in cutthroat trout lengths could be detected from this information.

A single detailed angling survey was conducted on a section of the South Fork in 1960. During the 1980's, MDFWP personnel collected angling information and also estimated cutthroat trout densities for various sections of the South Fork River.

The upper middle area of the South Fork (headwaters to Independence Park) has the best long-term size information on angler-caught cutthroat trout. Prior to the 1984 regulation change (three cutthroat less than 305 mm (12 in)), MDFWP personnel collected angling data in 1960 and 1981 for this area. Cutthroat lengths were quite similar for both years and averaged about 229 mm (9.0 in) with about 10 percent greater than 305 mm (Table 9). MDFWP found a substantial increase in the average length of cutthroat and the percentage that were greater than 305 mm (12 in) following the regulation change. In the upper middle section in 1986, cutthroat averaged 10.7 inches in length, as compared to 9.1 inches in 1981. The percentage of cutthroat greater than 305 mm (12 in) also increased annually and comprised 31 percent of angler-caught cutthroat in 1986 compared to only eight percent in 1981.

In the headwaters area, comparable data on cutthroat have been collected for three consecutive years. Catch rates and size

Table 9. Length data for cutthroat trout captured with hook and line by MDFWP personnel in the South Fork of the Flathead River categorized by similar or same areas.

Area	Year	Section	N	Mean length (mm)	Mean length (in)	Range (mm)	Percent greater than 254 (mm) (1.0 in)	Percent greater than 305 (mm) (12 in)
Lower								
	1984	Harrison	150	196	(7.7)	112-338	14	02
	1985	Harrison	152	215	(8.5)	152-356	12	02
Lower Middle								
	1983	Mid Creek	112	213	(8.4)	160-378	8	02
	1985	Black Bear	595	228	(9.0)	117-401	28	08
	1986	Black Bear	54	231	(9.1)	101-421	26	13
Upper Middle								
	1960	Gordon-Murphy Flats	80	228	(9.0)	90-406	34	11
	1981	Headwaters - Ltl. Salmon Cr.	151	230	(9.1)	110-350	26	8
	1984	Headwaters - Big Salmon Cr.	92	240	(9.4)	170-370	46	12
	1985	Headwaters - Big Salmon Cr.	296	258	(10.2)	150-400	59	24
	1986	Gordon-Indep. Park	586	273	(10.2)	120-427	61	31
Headwaters								
	1985		111	255	(10.0)	120-430	42	23
	1986		142	268	(10.6)	190-425	52	24
	1987		137	264	(10.4)	165-400	57	20

distribution were similar in 1985, 1986 and 1987 (Table 9). The average size of cutthroat caught in the headwaters section was 10.0, 10.6 and 10.4 inches respectively in 1985, 1986 and 1987.

In the lower middle area, MDFWP had conducted one survey in 1983 prior to the regulation change. Cutthroat averaged 213 mm (8.4 in) and only two percent were greater than 305 mm (12 in). In 1986, cutthroat averaged 231 mm (9.1 in) and 13 percent were greater than 305 mm (12 in).

In the lower South Fork section, no population data was collected by MDFWP prior to 1984. Mean cutthroat length was 19 mm (0.75 in) greater in 1985 than in 1984, but the percentage of cutthroat greater than 254 mm (10 in) and 305 mm (12 in) was about the same. This suggests there may have been an increase in the numbers of cutthroat trout greater than 200 mm (7.9 in) and less than 254 mm (10 in) over the previous year. Mean cutthroat lengths and the percent of fish greater than 12 inches progressively increases moving upstream, based on 1985 angling data when all four areas were sampled.

Catch Rates. Angler catch rates can vary markedly depending on the ability of the angler and ambient fishing conditions. Therefore, we compared catch rates for MDFWP anglers with similar experience and abilities that were collected during similar times of the year (Table 10). Catch rates were lowest in the Harrison section and were highest for the upper river area in 1986. MDFWP anglers caught 3.7 cutthroat per hour in the upper middle area in 1981 prior to regulation change. Catch rates were 7.2 cutthroat per hour in 1985 and 8.7 cutthroat per hour in 1986. In the headwaters area, catch rates were similar in 1985, 1986 and 1987 (7.7, 8.8 and 7.7 fish per hour respectively). 1987 data for the other sections are not reported because of limited sample size. Although angling gives a good indication of the size and age structure of a population, it does not give good information on population density.

Population Density. In the population work that was conducted from 1984-1986, we found that cutthroat were nearly three times as abundant in the lower middle area (Black Bear and Mid Creek sections) than in the lower (Harrison section) or upper middle area (headwaters to Big Salmon Creek) (Table 11). Population surveys were conducted in the three sections in 1987, but late timing of the survey and unusually low flows prevented comparable estimates. The surveys did show that there is probably considerable cutthroat movement during unusual low flow periods. From our snorkel observations, it was obvious that the majority of cutthroat were found at the productive riffle:pool complexes. Young (1986) found that cutthroat trout were 3.4 times more abundant in pools than in riffles in the upper middle area of the South Fork. Shepard et al. (1982) found that 56 percent of all cutthroat observed were found in pools. Also, Pratt (1984) found

Table 10. Catch rate data for cutthroat trout captured by MDFWP anglers with similar experience in the South Fork of the Flathead River.

Year	Section	Number Caught	Hours Fished	Catch rate (#/hour)
	Lower			
1984	Harrison	243	144.0	1.7
1985	Harrison	152	73.5	2.1
	Lower Middle			
1985	Black Bear	653	103.3	6.3
	Upper Middle			
1981	Big Prairie to White R.	151	40.5	3.7
1985	White River	122	17.0	7.2
1985[a/]	Headwaters to Big Salmon Creek	174	24.9	7.0
1986	Gordon-Independence Park	597	68.8	8.7
	Headwaters			
1985	(Lower Youngs, Danaher,	111	14.5	7.7
1986	first two miles of the	142	16.15	8.8
1987	South Fork)	137	17.75	7.7

a/ Catch rates by U of M graduate student.

Table 11. MDFWP population estimates for cutthroat trout sampled in various sections of the South Fork of the Flathead River.

Year	Section	Method	Estimate (#/km)	95% C.I.	Percent >254 mm
	Lower				
1984	Harrison	Hook-and-line Peterson	248	±83	8
1985	Harrison	Snorkel-Peterson	215	±29	13
	Lower Middle				
1983	Mid	Hook-and-line Peterson	680	±234	25
1985	Black Bear	Snorkel-Peterson	527	±59	30
	Upper Middle				
1984[a/]	Headwaters to Big Salmon	Snorkel-Peterson	242	±62	--
1986	Gordon	Snorkel-Peterson	183	±37	54

a/ Calculated by U of M graduate student.

that cutthroat trout tend to occur at the heads of pools. We found that the higher the riffle:pool frequency for a section of stream, the larger the population estimate per kilometer of stream (Table 12).

In the Gordon section, there were only 1.8 riffle:pools per kilometer of stream compared to 3.3 riffle:pools for the upper middle area. Therefore, there were simply less of these productive areas in a length of stream in the upper middle area (Gordon section) compared to the lower middle area (Black Bear section) and consequently densities (number per kilometer) were less. This means that in the upper middle section of the South Fork, a fisherman would have to walk or float farther between pools for good fishing or that there is more flat, shallow, less secure habitat in the upper middle area of the South Fork than in the lower middle area.

The Harrison section also has a low riffle:pool frequency and a correspondingly low density estimate (Table 12). Additionally, this section of river flows through a canyon area with deep, slow-moving holes that hold cutthroat trout which were almost exclusively located at the head end of the pool. The lower ends of these pools were slow and contained higher amounts of sediment than the other upstream areas. Zubik and Fraley (1987a) felt that cutthroat trout found in the South Fork below the Gorge were primarily adfluvials from Hungry Horse Reservoir. This factor would also account for the reduced lengths of cutthroat in the Harrison section compared to those in upstream sections since adfluvial fish generally remain in the tributary/ river system for a maximum of three years and would not attain the size of fluvial cutthroat that remain in the river system.

MDFWP personnel found that the estimated percentage of cutthroat greater than 254 mm (10 in) in the population progressively increased upstream similar to that found by anglers (Table 10). Also, estimated size classes for a section of river were similar to those for angler-caught cutthroat indicating that anglers caught representatives from all size classes in the South Fork River population.

Tributaries. Shepard et al. (1982) estimated juvenile cutthroat and bull trout densities in five tributaries (eight reaches) of the South Fork in the wilderness complex during the summer of 1981 (Table 13). Bull trout juveniles were observed in two tributaries (three reaches). Mean densities of Age I and older fish were 3.4 cutthroat and 0.8 bull trout juveniles per 100 m^2 where the species were observed. This equates to about 40 cutthroat and ten juvenile bull trout per 100 linear yards of stream. Forty-five percent of the cutthroat observed were age III+ and older. Fraley et al. (1981) found 4.2 cutthroat and 1.7 bull trout juveniles per 100 m^2 in tributaries to the upper Middle Fork.

Table 12. Riffle:pool frequencies versus cutthroat trout estimates for the South Fork of the Flathead River.

Section	Riffle:Pool Frequency (#/km)	Cutthroat Estimate (#/km)
Gordon	1.8	183
Harrison	1.8	215
Black Bear	3.3	533
Mid Creek	3.6	680

Table 13. Mean densities (no./100 m^2) of cutthroat and juvenile bull trout in South Fork tributaries surveyed during late August, 1981. Total for each species refers to age class I, II, and III+ combined.

Stream	Reach	Area (m^2)	Cutthroat trout					Bull trout				
			Age 0	Age I	Age II	Age III+	Total	Age 0	Age I	Age II	Age III+	Total
Little Salmon	1	2823	---	---	0.1	0.3	0.4	---	---	---	---	---
White River	1	1602	0.2	---	0.3	0.9	1.2	---	---	---	---	---
	2	1414	---	---	0.2	3.0	3.2	---	---	---	0.1	0.1
Gordon	1	2055	1.5	0.3	---	---	0.3	---		---	---	
	3	1330	1.7	1.1	4.3	3.3	8.7	---	1.3	0.7	1.3	0.6
	4	1206	---	0.2	7.7	3.7	11.6	--	0.1	0.3	0.2	0.6
Danaher	1	1639	0.1	0.4	0.4	0.6	1.4	---	---	---	---	---
Youngs	1	2744	---	---	---	0.6	0.6	---	---	---	---	---
MEAN				0.25	1.63	1.55	3.43					

Discussion

Fishing Pressure. Generally, fishing pressure in the BMWC has increased about two or three fold since the 1950s. Lucas (1985) predicted that although visitor use has increased 56 percent since 1970, the rate of growth has probably slowed and may slow more in the future. Since a similar percentage of visitors fished in 1970 and 1982, fishing pressure will probably also experience slower future growth.

Prior to 1982, fishing regulations for the South Fork were the same as those for streams statewide. These liberal limits probably did not adversely affect the cutthroat fishery when fishing pressure was low, but as pressure increased, fishermen probably began to crop off an excessive number of cutthroat, especially the older, larger individuals. Cutthroat trout are one of the most susceptible salmonids to over-harvest by anglers. Vashro (1984) and others have documented that fishermen prefer to keep the larger, older cutthroat they catch in the South Fork. This type of over-harvest not only reduces fish numbers, but over-harvests the older, larger, more productive spawners in the population.

Initiation of more restrictive regulations on the South Fork above Meadow Creek Gorge in 1983 (three cutthroat less than 305 mm) has reduced harvest but still allows fishermen to keep fish to eat which is an important part of the wilderness experience. Young (1986) found that over 75 percent of the anglers surveyed that fished the South Fork in the wilderness kept fish. Lucas (1985) found that most fishermen opposed a "stock the freezer attitude" in the wilderness complex. Young (1986) found that about 70 percent of the respondents felt that the current regulations would increase the number and size of cutthroat trout. He also found that only 50 percent of anglers in the South Fork would continue to fish under catch-and-release regulations.

South Fork Cutthroat Population. These more restrictive regulations on the South Fork above Meadow Creek Gorge have resulted in an increase in the average size of angler-caught cutthroat and the percentage of larger fish in the population. In the upper middle area of the South Fork, department anglers found the mean length of cutthroat was 273 mm (10.7 inches) and has increased 43 mm (1.7 inches) from 1981 to 1986. The percent of those sampled greater than 305 mm (12 inches) has increased from eight to 31 percent of the total sampled. The Kootenai River below Lake Koocanusa is considered to be one of the most productive salmonid streams in Northwestern Montana. Huston (MDFWP unpublished data) estimated mean rainbow trout lengths at 249 mm (9.8 inches) and that about 10 percent of the population were greater than 305 mm. The Kootenai River has about 1,300 rainbow trout per mile while the upper middle South Fork River about 213 cutthroat per mile and the lower middle South Fork about 603 cutthroat per mile.

Young (1986) felt that his visual census of cutthroat trout indicated a reduced population but compared his one year of data to other stream populations which are much more biologically productive and, consequently, not similar to the South Fork Flathead River. Also, he estimated cutthroat trout densities in 1984 that were actually twice those estimated for two similar sections of the South Fork during 1981 (Shepard et al. 1982). The 1981 and 1984 estimates used somewhat different methods, but the estimates indicate an increase in the density of cutthroat over the period and not a decline. The Snorkel-Peterson method used by Young (1986) to estimate cutthroat density was similar to that used by Zubik and Fraley (in press). His 1984 density estimate was similar to that found by MDFWP in 1986 for the upper middle area of the South Fork.

MDFWP did not collect cutthroat population information for the lower South Fork prior to the initiation of catch-and-release regulations in 1984. Department personnel found little change in the cutthroat fishery for this section when comparing population and angling data collected in 1984 and 1985.

Based on tag returns and snorkeling data, Zubik and Fraley (1987a) and May and Weaver (1987) felt that cutthroat trout were primarily adfluvials from HHR in the main South Fork River below Meadow Creek Gorge and fluvials or residents upstream. This may account for the reduced lengths of cutthroat in the lower South Fork compared to other upstream areas and little increased length response to catch-and-release regulations.

It appears that cutthroat densities in the South Fork Flathead River are greater than those in the Middle Fork. During 1980, MDFWP anglers caught 224 cutthroat averaging 254 mm (10 inches) in 104 hours (2.2 fish per hour) on the Middle Fork in the Great Bear Wilderness. During 1981, on the upper South Fork (Salmon Forks to Gordon Creek) 151 cutthroat averaging 230 mm (9.1 inches) were caught in 40.5 angler hours (3.7 fish per hour) nearly twice the catch rate for the Middle Fork.

In addition, Department personnel estimated that age I and older cutthroat densities averaged about 37 fish per kilometer for two sections in the upper Middle Fork in 1980 (Fraley et al. 1981) and 69 fish per kilometer for two sections in the upper South Fork in 1981 (Shepard et al. 1982). Although the methods used are not comparable to density estimates made for rivers by MDFWP after 1982, it does show that cutthroat trout were about 1.9 times more abundant in the South Fork than in the Middle Fork within the BMWC based on similar estimate methods.

The only other density estimate made using a snorkel-expansion method similar to those in the South Fork was a 1985 estimate in the Whale Creek section of the North Fork Flathead River (Zubik and Fraley 1987). MDFWP estimated that cutthroat trout densities were quite similar to those for the Harrison section of the South

Fork and that most of these fish were probably migratory adfluvials in both river sections. MDFWP estimated cutthroat densities using the same method for the Black Bear section in 1985 that were 2.5 times greater than those for the Harrison section on the lower South Fork or the Whale Creek section on the North Fork.

Since MDFWP has little fisheries information prior to the 1980s, it is difficult to evaluate the conditions of the fishery prior to that time. Length information collected by MDFWP anglers indicated that the average size and composition of cutthroat trout were similar in 1960 and 1981. However, natural fluctuations in populations occur and many years of data are needed to make reliable comparisons between time periods. Liberal limits and cutthroat vulnerability to angling, angler preference for larger trout and increased pressure probably resulted in a decrease in numbers and size of cutthroat in recent years prior to implementation of more restrictive regulations in 1983. The magnitude of this decrease is not known. Growing concerns expressed by sportsmen, guides and outfitters in the early 1980s indicated that the cutthroat trout fishery was declining (Jim Vashro, MDFWP pers. comm.).

Trout Movements above Meadow Creek Gorge. Efforts to document use of the South Fork River and its tributaries above Meadow Creek Gorge by cutthroat trout from Hungry Horse Reservoir have been difficult. Although many cutthroat have been tagged in the South Fork above Meadow Creek Gorge, they were all marked in mid to late July and only in the main river. Trapping data for 1984 through 1986 on Hungry Horse Creek, a tributary to Hungry Horse Reservoir, showed that adult cutthroat have spawned and are completely out of the tributary system by early to mid July (May and Zubik 1985, May and Fraley 1986, and May and Weaver, 1987). Also, they found that downstream juvenile migration was nearly complete by the end of July. McLaughlin et al. (1982) found that about 92 percent of float fishermen use the South Fork during July and August. Therefore, by the time fishermen sample the South Fork Flathead River, spawning has nearly completed and almost all downstream juvenile migrants have left the system. Secondly, nearly all cutthroat spawning occurs in tributary streams and not in main stem rivers. Also, virtually all cutthroat trout juveniles rear in these smaller tributary streams. Zubik and Fraley (1987) observed no cutthroat trout juveniles less than two years old in the main South Fork River while conducting snorkel counts of cutthroat trout.

As a result, no conclusive information can be determined from this information since sampling occurs after migration and anglers are sampling the main river which migrants use for a very short time during upstream and downstream movement. The majority of cutthroat that anglers do capture and tag in the South Fork above Meadow Creek Gorge appear to be fluvial fish based on tag return data (May and Weaver 1987).

Downstream movement of cutthroat through Meadow Creek Gorge has been documented. One cutthroat tagged in the headwaters area in 1986 was captured below Meadow Creek Gorge in June, 1987. Substantial downstream movement was noted for cutthroat tagged in the headwaters area in 1986 (see Appendix Report).

Bull trout movement has been documented through the Meadow Creek Gorge probably because they migrate from late spring through early summer during lower flows, migration is much slower, and bull trout spend a considerable amount of time at the mouths of tributary streams before moving upstream to spawn. Consequently, they are available to anglers in the main river the entire summer during the period of heaviest fishing pressure.

Recommendations

Management. Since more restrictive regulations were initiated in 1983, the average size of cutthroat has increased almost two inches and these fish are up to 427 mm (16.8 inches) long in the upper middle area of the South Fork Flathead River within the wilderness complex. Catch rates have nearly doubled and density estimates appear to be good for an area noted for its clear, pristine, relatively nutrient-poor water. Because Lucas (1985) predicts reduced growth in visitor use for the wilderness complex, we recommend a continuance of the current angling limits of three fish per day, none over 12 inches. This regulation allows cutthroat to reach maturity yet still provides anglers with fish to eat, an important part of the wilderness experience.

Young (1986) noted that a number of anglers would like the opportunity to harvest one fish greater than 305 mm (12 inches). Due to the heavy angling pressure and high vulnerability of cutthroat to angling, this regulation may over-harvest the more mature, productive segment of the population.

Monitoring. A monitoring program should be continued to track the response of the fishery to fishing pressure and regulations. Three sections of the South Fork should be included in the monitoring program: the Gordon section in the upper area, the Black Bear section in the lower middle area of the wilderness, and the Harrison section in the South Fork below the wilderness boundary. These three sections have been previously surveyed using the snorkel-expansion method and would provide a good database for comparative purposes through the years. Also, these sections are representative of the three major fish habitat types found in the South Fork. An annual monitoring program on three sections of the South Fork would be ideal but may be cost-prohibitive due to the large amount of money and effort needed to survey the South Fork, especially in the wilderness complex. A more realistic option would be to survey a representative reach in the middle section of the South Fork every year (Black Bear Section), with a survey of all three sections every second or third year. This strategy would reduce costs considerably, yet

still enable biologists to detect significant differences in cutthroat population change.

Biologists should use the snorkel-expansion method to estimate cutthroat trout densities (Zubik and Fraley 1987). Although this method does not give more specific detailed population information since fish are not actually handled, it does give a good abundance estimate of various size classes that is accurate and precise, and can be done on a section of river in a single day. Other estimates require about one week between mark and recapture which would require two trips into the wilderness. A crew of four people floating in rafts could conduct the estimates and use hook-and-line sampling to mark and measure fish in order to determine catch rates, movement and growth patterns.

The headwaters area (including lower Danaher and Youngs Creek and the first two miles of the South Fork) should be sampled annually as a baseline indicator site. The site has been sampled three consecutive years using the same methods. These data can be used to monitor yearly fluctuations in cutthroat catch rates and size distribution, information important in evaluating effects of angling regulations on the population.

MIDDLE FORK FLATHEAD RIVER DRAINAGE

Description of the Drainage

GENERAL

The Middle Fork of the Flathead River is formed by the confluence of Strawberry and Bowl creeks in the Bob Marshall Wilderness Area below the western slopes of the Continental Divide (Figure 2). From its origin, the river flows northwest for approximately 144 km (88 mi) to meet the North Fork of the Flathead River below West Glacier. The drainage area of the Middle Fork is 2,922 km^2 (Pacific Northwest River Basins Commission, 1976) and the average annual discharge is 2,956 cubic feet per second (cfs) (U.S.G.S. 1979).

The 74 km (45 mi) portion of the Middle Fork above Bear Creek is within the Bob Marshall and Great Bear Wilderness Areas and was classified as a Wild River under the Wild and Scenic Rivers Act of 1976. This upper portion of the river flows from its headwaters through a timbered valley to Schafer Meadows, where the floodplain widens to approximately 2 km (1.2 mi). From 3 km below Schafer Meadows to Bear Creek, the Middle Fork flows through a steep, rocky canyon. The Middle Fork drops an average of 6.1 m/km from its origin to where it meets U.S. Highway 2 at Bear Creek.

The river upstream from Bear Creek is bound by the Lewis and Clark Range of the Rocky Mountains to the east and the Flathead Range to the west. Major tributaries to the upper Middle Fork are Gateway, Trail, Strawberry, Bowl, and Clack creeks above Schafer Meadows and Schafer and Dolly Varden creeks in the Schafer Meadows area. From below Schafer Meadows to Bear Creek, the major tributaries are Morrison, Lake, Granite, and Long creeks.

From Bear Creek to where it meets the North Fork, the river flows for 70 km (42 mi), mainly through a steep canyon, except for the Nyack Flats area where the floodplain is up to 3 km wide. This lower portion of the Middle Fork is classified as a recreational river. The Middle Fork drops an average of 3.1 m/km along this lower portion.

The lower Middle Fork is bound by the Flathead Range to the southwest and the Livingston Range to the northeast. The northeast bank of the Middle Fork forms a large portion of the southern boundary of Glacier National Park. Major tributaries to the river below Bear Creek entering from the Flathead Range are Java, Essex, Paola, Stanton, and Deerlick creeks. These creeks are small with relatively steep gradients. Major tributaries entering from the Livingston Range on the Glacier Park side are larger with flatter gradients and include Ole, Park, Muir, Coal, Nyack, Harrison, Lincoln, and McDonald creeks.

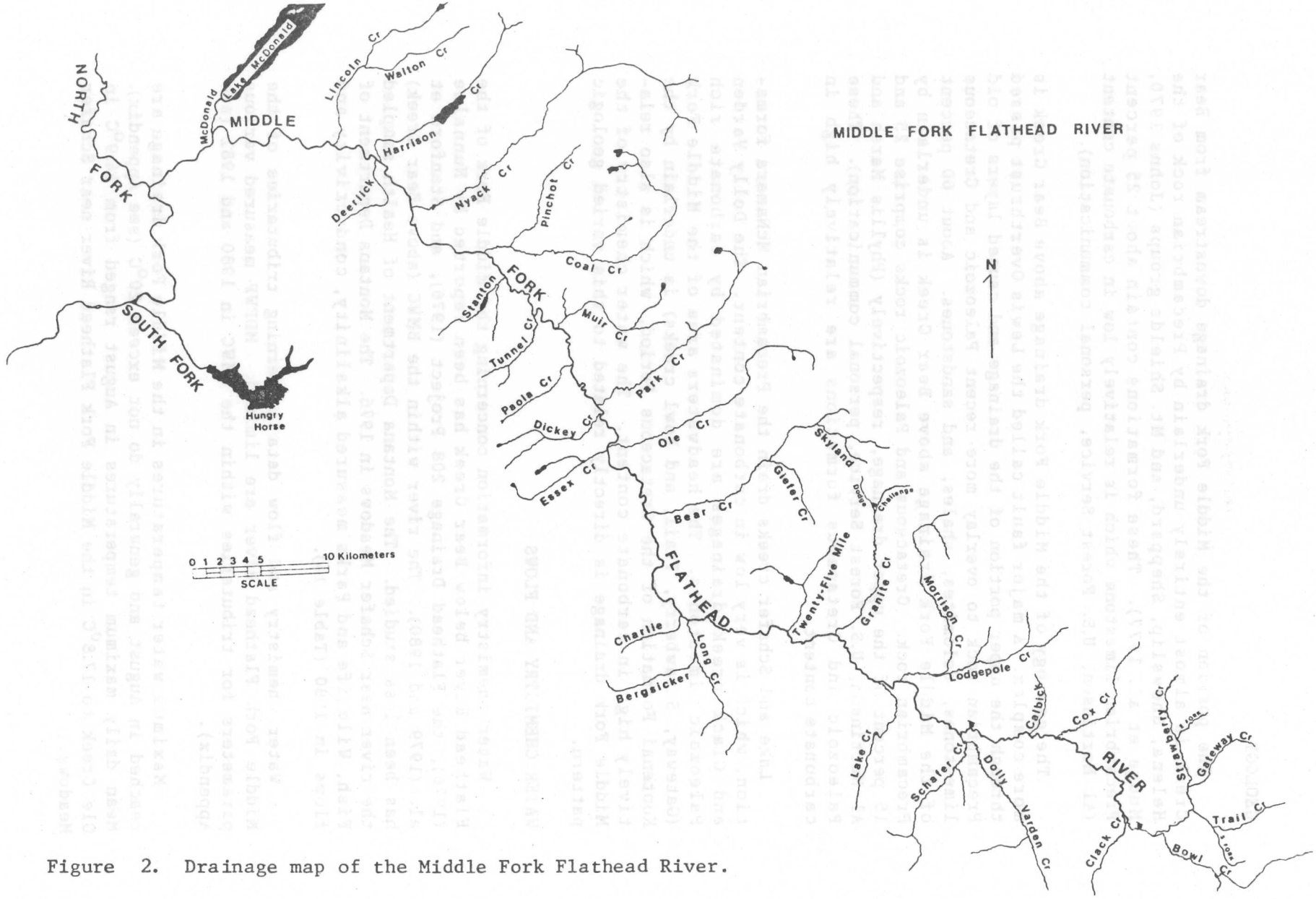

Figure 2. Drainage map of the Middle Fork Flathead River.

GEOLOGY

The portion of the Middle Fork drainage downstream from Bear Creek is almost entirely underlain by Precambrian rock of the Helena, Snowslip, Sheppard, and Mt. Shields groups (Johns 1970, Mudge et al. 1977). These formations contain about 25 percent Precambrian limestone which is relatively low in carbonate content (Al Martinson, U.S. Forest Service, personal communication).

The geology of the Middle Fork drainage above Bear Creek is more complex. A major fault called the Lewis Overthrust passed through the upper portion of the drainage and caused layers of old Precambrian rock to overlay more recent Paleozoic and Cretaceous limestones, dolomites, shales, and sandstones. About 60 percent of the Middle Fork drainage above Bear Creek is underlain by Precambrian rock. Cretaceous and Paleozoic rocks comprise 25 and 15 percent of the upper drainage, respectively (Phyllis Marsh and Al Martinson, U.S. Forest Service, personal communication). These Paleozoic and Cretaceous formations are relatively high in carbonate content.

Lake and Schafer creeks drain the Precambrian McNamara formation, which is very low in carbonate content. The Dolly Varden and Clack creek drainages are dominated by carbonate rich Paleozoic limestones. The headwaters area of the Middle Fork (Gateway, Strawberry, Trail, and Bowl creeks) is underlain by the Kootenai Formation of the Cretaceous Period, which is also relatively high in carbonate content. The water chemistry of the Middle Fork drainage is directly related to this varied geologic pattern.

WATER CHEMISTRY AND FLOWS

Water chemistry information concerning the Middle Fork of the Flathead River below Bear Creek has been reported by Nunnalee (1976), the Flathead Drainage 208 Project (1976), and Stanford et al. (1979 and 1980). The river within the BMWC (above Bear Creek) has been less studied. The Montana Department of Health sampled the river near Schafer Meadows in 1976. The Montana Department of Fish, Wildlife and Parks measured alkalinity, conductivity and flows in 1980 (Table 14).

Water chemistry and flow data concerning tributaries of the Middle Fork Flathead River are limited. MDFWP measured various parameters for tributaries within the BMWC in 1980 and 1981 (see Appendix).

Maximum water temperatures in the Middle Fork drainage are reached in August and generally do not exceed 20°C (see Appendix). Mean daily maximum temperatures in August ranged from 14.9°C in Ole Creek to 17.8°C in the Middle Fork Flathead River near Schafer Meadows.

Table 14. Alkalinity, conductivity, and flows measured at points on the Middle Fork of the Flathead River, October, 1980.

Site	Date	Alkalinity (mg/l $CaCO_3$)	Conductivity (pmhos/cm)	Flow(cfs)
Middle Fork at Gooseberry Park	10/7	150	220	44.1
Middle Fork at Schafer Meadows	10/10	152	220	56.0
Middle Fork at Granite Creek	10/16	117	185	--
Middle Fork[a/] at Bear Creek	9/18	114	210	198

a/ Alkalinity and conductivity are from measurements made by the Montana Bureau of Mines and Geology, September 13, 1980 (U.S. Forest Service, unpublished data).

HABITAT CHARACTERISTICS OF TRIBUTARIES TO THE MIDDLE FORK

Stream habitat was evaluated using a modification of the system developed by the Resource Analysis Branch of the British Columbia Ministry of the Environment (MDFWP 1983). Each tributary was surveyed by helicopter and divided into one or more reaches. Reaches were identified as portions of the stream having distinct associations of physical habitat characteristics.

Surveys were completed on 51 reaches of 21 major tributaries within the BMWC (Table 15). The Appendix Report includes a complete set of tributary maps delineating important habitat characteristics and barriers.

Fish Populations

RESULTS

It is important to describe the methods used to census fish populations, and determine fish age and growth so that valid comparisons between studies can be made. Refer to the Appendix Report for a detailed description of methods used to obtain the data in this section.

DISTRIBUTION AND ABUNDANCE

Based on information collected during the Flathead River basin studies, it appears that adfluvial cutthroat are most common in the Middle Fork drainage below Bear Creek (just outside the BMWC). The majority of cutthroat in the river upstream of Bear Creek are thought to be fluvial fish.

Bull trout in the Middle Fork Flathead system are adfluvial, growing to maturity in Flathead Lake and migrating into the river and tributary systems to spawn. Most juveniles rear in tributary streams from one to three years before returning to the lake. The bull trout has been designated a species of special concern in Montana because of the restricted distribution of the large adfluvial form and because of threats to spawning and rearing habitat.

River

Underwater fish counts were made in 120 pool, 41 run, 22 riffle, and 10 pocket water habitat units in the Middle Fork above Bear Creek within the BMWC during the summer of 1980. A total of 993 westslope cutthroat, 18 juvenile bull trout, 132 mature bull trout, and 5,762 mountain whitefish were counted by observers during fish density estimates.

Density estimates were made in mid summer for pool and run habitat units in a 23 km section of the Middle Fork above Schafer Meadows and a 48 km section below Schafer Meadows (Table 16).

Table 15. Reach information for Middle Fork tributaries surveyed in 1980.

Drainage	Reach number	Drainage area(km^2)	Length (km)	Gradient (%)	Late Summer flow (cfs)
Long Creek		19.37	8.61	2.5	
	1		2.72	1.8	
	2		1.32	1.8	
	3		4.57	3.2	
Granite Creek		74.6	13.42	1.4	13.7
	1		7.89	1.7	
	2[a/]		5.53	1.0	
Lake Creek		19.37	7.43	1.6	21.4
	1		2.54	2.5	
	2		4.89	0.7	
Miner Creek		19.53	4.36	2.8	
	1		2.5	1.7	
	2		1.86	3.7	
Morrison Creek		133.1	22.39	2.0	28.5
	1		7.48	1.1	
	2		3.78	2.3	
	3		8.80	1.7	
	4[a/]		2.33	5.2	
Lodgepole Creek		49.2	10.66	1.1	
	1		6.53	1.1	
	2		4.13	1.0	
Whistler					
	1		3.12	1.6	
Schafer Creek		126.4	14.17	2.1	15.3
	1		4.60	0.4	
	2		1.13	2.1	
	3		4.78	1.0	
	4		3.66	6.0	
W. Fork Schafer					
	1		3.25	3.0	
Dolly Varden Creek		68.4	14.79	1.1	14.7
	1		13.05	1.0	
	2		1.74		
Argosy		15.4	5.19	3.5	
	1		1.46	5.8	
	2		3.73	2.7	
Calbick Creek		21.70	4.3	2.3	2.5
	1		4.3	2.3	
Cox Creek		51.57	11.56	1.5	1.4
	1		3.27	0.4	
	2		6.15	1.6	
	3		2.14		

Table 15. Reach information for Middle Fork tributaries surveyed in 1980 (continued).

Drainage	Reach number	Drainage area(km^2)	Length (km)	Gradient (%)	Late Summer flow (cfs)
Clack Creek		36.57	10.56	3.8	9.9
	1		2.82	1.0	
	2		2.67	1.0	
	3		5.07	7.0	
Bowl Creek		46.80	17.19	2.5	18.3
	1		2.59	2.1	
	2		4.20	2.5	
	3		1.6	0.5	
	4		6.4	3.3	
	5		2.4	3.6	
Basin		25.25	10.5	1.3	4.1
	1		2.1	1.3	
	2		6.6	1.1	
	3		1.8	3.1	
Strawberry Creek		71.04	19.75	1.2	15.2
	1		4.88	0.5	
	2		7.53	1.1	
	3		5.07	1.9	
	4		2.27	1.0	
E. Fork Strawberry			5.00	3.6	
	1		3.04	5.2	
	2		1.96		
Trail		49.91	11.74	2.0	9.6
	1		7.74	1.6	
	2		4.0	2.7	
Gateway		19.63	7.47	3.4	4.0
	1		2.49	2.9	
	2		2.16	4.0	
	3		1.77	4.8	
	4		1.05	1.2	
S. Fork Trail					
	1	4.79	2.5		

[a] Outside the BMWC boundary.

Table 16. Fish densities (No./100 m^2) by age class in pool and run habitat units of the Middle Fork of the Flathead River during mid summer, 1980. Numbers of each feature snorkeled and numbers of fish observed are in parentheses.

	Cutthroat trout			Bull trout				Mountain whitefish	
Feature	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature	<152mm	>152mm
Middle Fork above Schafer Meadows (7/24 - 7/29)									
Pool (42)	.04 (13)	1.19 (342)	.41 (119)	---	---	.007 (2)	.06 (18)	.33 (96)	2.53 (727)
Run (7)	.09 (4)	.51 (22)	.33 (14)	---	---	---	.02 (1)	.49 (21)	2.21 (95)
Combined (49)	.05 (17)	1.10 (365)	.40 (133)	---	---	.006 (2)	.06 (19)	.35 (117)	2.49 (822)
Middle Fork below Schafer Meadows (8/5 - 8/12)									
Pool (56)	---	.01 (3)	.98 (330)	---	---	---	.11 (37)	.26 (86)	7.32 (2475)
Run (3)	---	---	.59 (10)	---	---	---	.29 (5)	---	11.46 (195)
Combined (59)	---	.01 (3)	.96 (340)	---	---	---	.12 (42)	.24 (86)	7.52 (2670)

Total densities of cutthroat were 1.55 fish per 100 m^2 (about 92 sq yd) surface area in pools and runs in the river upstream from Schafer Meadows and 0.97 fish per 100 m^2 downstream. Only two juvenile bull trout were seen during these mid-summer estimates. River densities of mature bull trout on their spawning migration from Flathead Lake were 0.06 fish per 100 m^2 in the upper section and 0.12 fish per 100 m^2 in the lower section. Mountain whitefish densities were relatively high, averaging 2.84 fish per 100 m^2 in the upper section and 7.76 fish per 100 m^2 in the lower section.

Density estimates by species (Table 17) were made in late summer in the same two areas of the Middle Fork. These estimates were concentrated on 16 km (10 mi) of the river above Schafer Meadows (Gooseberry Park downstream to Cox Creek) and a 16 km section downstream from Schafer Meadows (from 3 m below Schafer Meadows downstream to Granite Creek). Fish densities were estimated in every third pool, run, and pocket water habitat unit, and every fourth riffle habitat unit. Pools were stream features with a definite shallowing at the head and tail of the feature. Runs were deeper than riffles but did not fit the category of pools or pocket water. Pocket water was an area of the stream where the flow is broken by boulders. Riffles were shallow areas of flowing, broken water.

Late summer density of cutthroat in pool and run habitats was less than half of that found in mid-summer estimates. Smaller densities in late summer may be due to oversummer mortality, movement of trout into tributary streams or out-migration to the lower Flathead River or Flathead Lake. More juvenile bull trout were observed in late summer than in early summer. Densities of mature bull trout spawners was twice as high in the upper section and similar in the lower section in the mid-summer and late summer estimates.

Densities of cutthroat and juvenile bull trout in pocket water habitat units in both sections was similar to that found in run habitats and slightly lower than pool densities. No cutthroat trout and very few juvenile bull trout were seen in riffle habitats. Riffles were dominated by mountain whitefish in both river sections averaging just over one fish per 100 m^2 surface area. The average density of mountain whitefish in all features combined was more than ten times than the average total trout density.

An estimate of total surface area of each feature was calculated. The estimate was based on the total number of each habitat unit in two 16-km (10 mi) sections and average feature size measured on randomly selected features in each reach. A population estimate for each species in the 16 km sections was based on the average density of species in a randomly selected sample of each feature or habitat unit (Table 18). The number of mature adfluvial bull trout was estimated by actual counts of all likely looking habitat in each 10 mile section.

Table 17. Fish densities by age class for pool, riffle, run, and pocket water habitats in 16 km sections of the Middle Fork of the Flathead River above and below Schafer Meadows during late summer, 1980. Number of features snorkeled and numbers of fish observed in each age class are in parentheses.

	Fish per 100 m^2 surface area								
	Cutthroat trout			Bull trout				Mountain whitefish	
Feature	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature	<152mm	>152mm
Middle Fork above Schafer Meadows (8/23 - 8/27)									
Pool (12)	.01 (1)	---	.38 (44)	---	---	.02 (2)	.19 (22)	.43 (50)	2.30 (269)
Run (15)	---	.03 (2)	.26 (19)	.01 (1)	.04 (3)	.03 (2)	.15 (11)	.15 (11)	2.50 (185)
Riffle (11)	---	---	---	.03 (1)	---	.06 (2)	---	.15 (5)	.98 (33)
Pocket water (6)	---	.07 (2)	.22 (6)	.13 (3)	---	.04 (1)	---	.13 (3)	2.43 (66)
Combined (44)	.004 (1)	.016 (4)	.27 (69)	.02 (5)	.012 (3)	.027 (7)	.12 (33)	.27 (69)	2.17 (553)
Middle Fork below Schafer Meadows (9/5 - 9/8)									
Pool (10)	.01 (1)	---	.40 (30)	---	---	---	.24 (18)	.01 (1)	10.91 (820)
Run (16)	.01 (2)	---	.09 (24)	---	---	.004 (1)	.07 (20)	.04 (11)	2.1 (583)
Riffle (11)	---	---	---	---	---	---	---	.20 (14)	.86 (59)
Pocket water (4)	.07 (1)	---	.34 (5)	---	---	---	---	.27 (4)	3.78 (56)
Combined (41)	.01 (4)	---	.13 (59)	---	---	.002 (1)	.10 (38)	.07 (30)	3.48 (1518)

Table 18. Estimates of number of cutthroat trout, bull trout, and mountain whitefish in 16 km (10 mi) sections of the Middle Fork of the Flathead River above and below Schafer Meadows. Estimates are based on snorkeling in late summer. These numbers are useful for relative comparison and are not considered total estimates of the population.

	Number of fish per 16 km								
	Cutthroat trout			Bull trout				Mountain whitefish	
Area	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature[a/]	<150mm	>150mm
Above Schafer Meadows	10	41	670	61	29	6	42	720	5,850
Below Schafer Meadows	28	1	401	<1	55	<1	58	220	10,620

[a/] Estimated numbers per km is based on actual counts.

Mountain whitefish dominated the river fish population estimate calculated in this manner, outnumbering trout by more than ten to one. Cutthroat trout in the two sections averaged 575 fish per 16 km (10 mi). This estimate represents late summer numbers of the resident fluvial (river-dwelling) population of cutthroat after summer mortality or migration had occurred. Early summer population numbers of cutthroat were probably much higher. Accurate estimates of juvenile bull trout numbers, especially age I, were difficult to make in the river due to their secretiveness and association with the rocky substrate. They were common under rocks along the river margin, but very few were seen in snorkeling estimates. Mature bull trout were generally easy to observe because of low flows and good water clarity. They were observed mainly in pools and runs. Numbers were generally largest in areas just below the mouths of major bull trout spawning tributaries.

Tributaries

Westslope cutthroat trout were found in all Middle Fork tributaries surveyed in 1979 and 1980 (Table 19). Residence of adfluvial cutthroat in most tributaries of the Middle Fork within the BMWC remains uncertain because of the relatively small amount of stream trapping and tag return information available. Juvenile bull trout were observed in all but five of the tributaries surveyed.

Densities of westslope cutthroat trout in the reaches surveyed (Table 20) averaged 4.2 fish per 100 m^2 of surface area (about 25 fish per 100 linear yards of stream). Stream reaches supporting greater than 10 cutthroat/100 m^2 were identified as critical rearing areas. These included nine reaches of Gateway, East Fork Strawberry, Basin, Cox, Argosy, Challenge, Twenty-five Mile. Investigations showed that the number of cutthroat in a reach of tributary was related to the amount of fish cover in the form of logs, debris, etc. present in that reach (Fraley and Graham 1982).

Densities of juvenile bull trout were lower than those of cutthroat, partly because of the difficulty in observing the bottom-oriented bull trout (Table 20). Densities of juvenile bull trout in reaches where they were present averaged 1.7 fish/100 m^2 (about ten fish per 100 linear yards of stream). Critical areas for bull trout rearing (as identified by supporting densities of at least 1.5 bull trout/100 m^2) included nine reaches of Whistler, Morrison, Charlie, Strawberry, Granite, Long and Tail creeks.

A total of 333 pools, 425 runs, 441 riffles, and 108 pocket water areas were snorkeled in 1979 and 1980 (including North Fork tributaries). Densities of age II and III+ cutthroat were largest in pools, followed by runs, pocket water areas, and riffles in order of decreasing abundance (see Appendix Report). Bull trout densities varied little between features, except for age II fish which had substantially larger densities in pools than in other features.

Table 19. Fish distribution in upper (above Bear Creek) Middle Fork tributaries, + = species present, - = species absent, * = migratory cutthroat (confirmed by trapping and tagging), ? = unknown, needs further study.

	Cutthroat trout		
	Migratory	Resident	Bull trout
Charlie	?	+	+
Long	?	+	+
Bergsicker	?	+	+
Twenty-five Mile	?	+	-
Granite	*	+	+
Challenge	*	+	+
Dodge[a]	*	+	+
Lake	?	+	+[b]
Miner	?	+	-
Morrison	*	+	+
Lodgepole	?	+	+
Whistler	?	+	+
Schafer	?	+	+
W. Fork Schafer	?	+	-
Dolly Varden	?	+	+
Argosy	?	+	+
Calbic	?	+	+
Cox	?	+	-
Clack	?	+	+
Bowl	?	+	+
Basin	?	+	+
Strawberry	?	+	+
E. Fork Strawberry	?	+	+
Trail	?	+	+
S. Fork Trail	?	+	-
Gateway	?	+	+

[a] Outside the BMWC boundary.
[b] Bull trout were present below the falls.

Table 20. Mean densities (No./100 m^2) of cutthroat and juvenile bull trout in Middle Fork tributaries surveyed during the summer of 1979 and 1980. Total for each species refers to age classes I, II, and III+ combined.

Stream	Reach No.	Fish per 100 m^2 surface area: Cutthroat trout Age 0	Age I	Age II	Age III+	Total	Bull trout Age 0	Age I	Age II	Age III+	Total
Charlie Cr.	001	0.5	1.0	2.0	1.0	4.0	1.5	5.6	0.7	---	6.3
	002	---	---	---	0.3	0.3	---	4.5	4.2	---	8.7
Long Cr.	001	---	---	---	---	---	---	---	0.2	---	0.2
	002	0.2	---	0.2	0.5	0.7	---	0.2	0.7	0.3	1.2
	003	---	0.2	0.5	0.1	0.8	---	0.6	0.4	0.9	1.9
Bergsicker	001	---	---	---	0.6	0.6	---	---	0.4	---	0.4
Twenty-five Mile Cr.	003	---	5.7	5.0	3.0	13.7	---	---	---	---	---
Granite Cr.	001	---	---	---	0.5	0.5	---	---	0.7	1.4	2.1
	002	---	0.2	---	1.3	1.5	0.1	---	0.2	---	0.2
Challenge	001	1.3	3.8	6.6	3.5	13.9	---	---	---	0.25	0.25
Lake Cr.	001	---	---	0.3	2.1	2.4	---	---	---	---	---
	002	---	---	---	0.5	0.5	---	---	---	---	---
Miner Cr.	001	---	---	---	1.3	1.3	---	---	---	---	---
	002	---	---	---	2.8	2.8	---	---	---	---	---
Morrison Cr.	001	---	---	---	0.2	0.2	---	0.2	0.3	0.3	0.8
	002	---	---	---	0.7	0.7	---	0.5	1.1	2.4	4.0
	003	---	---	0.6	3.0	3.6	---	---	2.7	5.1	7.8
	004	---	---	---	---	---	0.4	0.5	0.5	0.3	1.3

Table 20. Mean densities (No./100 m^2) of cutthroat and juvenile bull trout in Middle Fork tributaries surveyed during the summer of 1979 and 1980. Total for each species refers to age classes I, II, and III+ combined (continued).

		Fish per 100 m^2 surface area									
		Cutthroat trout					Bull trout				
Stream	Reach No.	Age 0	Age I	Age II	Age III+	Total	Age 0	Age I	Age II	Age III+	Total
Lodgepole Cr.	001	---	---	0.1	0.4	0.5	---	0.3	---	---	0.4
	002	0.2	0.8	2.3	1.2	4.3	---	0.2	---	0.2	0.4
Whistler Cr.	001	---	---	0.2	1.2	1.4	---	0.5	5.5	1.2	7.2
Schafer Cr.	001	---	0.1	---	---	0.1	0.1	---	---	---	0.1
	002	---	0.1	0.5	1.1	1.7	---	---	---	---	---
	003	---	---	0.8	3.1	3.9	---	---	---	---	---
	004	---	1.3	1.7	0.9	3.9	---	---	---	---	---
W.F. Schafer Cr.	001	---	0.7	2.2	2.6	5.5	---	---	---	---	---
Dolly Varden Cr.	001	---	---	0.1	0.1	0.2	0.1	---	---	---	0.1
Argosy Cr.	001	---	---	0.2	1.0	1.2	---	---	---	0.4	0.4
	002	---	2.2	7.9	1.3	11.4	---	0.9	0.2	---	1.1
Calbic Cr.	001	---	2.4	4.1	0.6	7.1	---	0.6	---	---	0.6
Cox Cr.	001	---	---	0.1	0.3	0.4	---	---	---	---	---
	002	1.1	1.1	2.7	6.5	10.3	---	---	---	---	---
Clack Cr.	003	---	---	---	0.6	0.6	---	---	---	---	---
Bowl Cr.	001	---	---	0.2	---	0.2	---	---	---	---	---
	002	---	---	---	0.3	0.3	---	---	---	---	---
	003	0.1	1.0	1.2	2.4	4.6	---	0.2	0.4	0.2	0.8
	004	---	0.3	---	0.6	0.9	---	---	0.1	0.3	0.4
	005	---	---	0.2	---	0.2	---	---	---	0.2	0.2

Table 20. Mean densities (No./100 m^2) of cutthroat and juvenile bull trout in Middle Fork tributaries surveyed during the summer of 1979 and 1980. Total for each species refers to age classes I, II, and III+ combined (continued).

		Fish per 100 m^2 surface area									
		Cutthroat trout					Bull trout				
Stream	Reach No.	Age 0	Age I	Age II	Age III+	Total	Age 0	Age I	Age II	Age III+	Total
Basin Cr.	001	0.4	3.0	4.2	4.5	11.7	---	0.1	---	---	0.1
	002	1.2	1.3	3.4	2.0	6.7	---	---	0.5	0.1	0.6
	003	---	0.2	1.4	11.9	13.5	---	---	---	0.7	0.7
Strawberry Cr.	001	---	---	---	0.1	0.1	---	---	---	0.1	0.1
	002	---	0.7	2.6	2.0	5.3	---	0.2	0.2	0.3	0.7
	003	---	---	---	0.1	0.1	---	---	0.2	---	0.2
	004	---	0.2	0.4	---	0.6	---	0.2	3.1	---	3.3
E.F. Strawberry	001	---	---	2.1	9.6	11.7	---	---	0.6	0.8	1.4
Trail Cr.	001	---	---	---	0.3	0.3	0.7	0.4	0.7	0.5	1.6
	002	---	0.3	---	0.8	1.1	---	---	---	0.3	0.3
Gateway Cr.	001	---	---	0.5	0.3	0.8	---	0.4	0.5	0.2	1.1
	002	---	---	0.4	1.3	1.7	---	---	---	---	---
	003	0.6	3.3	4.0	3.2	10.5	---	---	---	---	---
	004	2.0	1.8	18.7	6.7	27.2	---	---	---	---	---

Refer to the Appendix Report for maps showing all the fisheries characteristics of each Middle Fork tributary.

AGE AND GROWTH

Cutthroat Trout

Eighty-seven percent of the cutthroat trout caught in tributary streams were 0-3 years old at time of aging, while 86 percent of the fish caught in the river were 3-5 years old. We determined that 75 percent of the fish collected in the Middle Fork Flathead River had reared two or three years in the tributaries before entering the river (see Appendix Report). About 22 percent had reared one year in tributaries. Lengths of fish each age class were larger in the river than in the tributaries (Table 21).

Cutthroat captured by Department anglers in the Middle Fork Flathead River in 1980 averaged 9.3 inches in length (Table 22). Over one-third of the cutthroat were greater than ten inches. Cutthroat captured by Department anglers in tributaries of the Middle Fork averaged 5.7 inches.

Backcalculated lengths of bull trout based on juveniles and adult spawners collected in the Middle Fork drainage differed substantially from lengths calculated from juveniles only (see Appendix Report). It appears that backcalculations for annuli 1, 2, and 3 (age marks relating to year 1, 2 and 3 in the life of the fish) are not accurate when adult spawners are included in the calculations. A total of 40 otoliths (inner ear bones) from juvenile bull trout were aged. Ages assigned otoliths and scales from the same fish were in nearly 100 percent agreement.

Average length of adult bull trout spawners collected by hook and line in the Middle Fork drainage in 1980 was similar to average lengths recorded for adult bull trout in some previous studies in the Flathead River system (Table 23).

Refer to the Appendix Report for more detailed information on age and growth of fish in the Middle Fork drainage.

FOOD HABITS OF TROUT

Ephemeroptera (mayflies), Diptera (true flies) and Trichoptera (caddis flies) were the major orders of insects in the diet of cutthroat less than or equal to 110 mm (4.3 in) in length in tributaries of the Middle Fork Flathead River (Appendix B). In the diet of cutthroat greater than 110 mm in length, major orders were Hymenoptera (terrestrial adults), Diptera adults, and Trichoptera.

Diets of cutthroat from the Middle Fork Flathead River included winged adults of the orders Trichoptera, Diptera, and

Table 21. Calculated lengths and increments of length (from scale samples) for cutthroat trout collected in the Middle Fork of the Flathead River and tributaries in 1980.

Age	Number of fish	Length at Age (annulus) (mm) 1	2	3	4	5
Middle Fork Flathead River						
1	0	--				
2	16	51	95			
3	82	49	99	154		
4	69	50	97	156	217	
5	17	51	107	161	217	269
Grand mean calculated length		50 (2.0 in)	99 (3.9 in)	156 (6.1 in)	217 (8.5 in)	269 (10.6)
Number of fish		(184)	(184)	(168)	(86)	(17)
Length increment (mm)		50	49	57	61	52

Age	Number of fish	Length at Age (annulus) (mm) 1	2	3	4	5
Middle Fork tributaries						
1	45	49				
2	135	51	95			
3	164	51	95	138		
4	24	48	90	141	191	
5	4	59	101	139	204	251
Grand mean calculated length		51 (2.0 in)	95 (3.7 in)	139 (5.5 in)	193 (7.6 in)	251 (9.9 in)
Number of fish		(377)	(327)	(191)	(28)	(4)
Length increment (mm)		51	44	44	52	47

Table 22. Size distribution of westslope cutthroat trout caught by department anglers in the Middle Fork of the Flathead River and in tributaries to the Middle Fork Flathead River during summer, 1980.

Number of Fish	$\bar{x}$ length	% > 6" (150 mm)	% > 8" (200 mm)	% > 10" (250mm)	% > 12" (300 mm)
Middle Fork Flathead River					
184	9.3" (237.4 mm)	95.1	78.8	38.0	12.5
Middle Fork Tributaries					
381	5.7" (145.5 mm)	47.8	13.6	3.4	1.0

Table 23. Comparison of lengths of adult bull trout collected in the Middle Fork drainage with previous studies in the Flathead River system.

Study	Average length (mm)	Number of fish
Middle Fork, BMWC, 1980	618	35
North Fork creel census, 1979	638	36
Flathead River, all forks, creel census, 1975	628	46
Middle Fork River trap at Bear Creek, 1957	622	87

Ephemeroptera (see Appendix Report). Large cutthroat trout in the Middle Fork Flathead River and tributaries feed largely on the water surface for winged insects.

Mayflies were by far the most important insect order in stomachs of both small and large bull trout in tributaries of the Middle Fork Flathead River. Other important orders in bull trout diets were Diptera and Trichoptera.

Baetidae was the major family in bull trout stomachs collected in the Middle Fork drainage, followed by Ephemerellidae and Siphlonuridae (see Appendix Report). Siphlonuridae was not a major mayfly family in Middle Fork benthic insect samples, but its presence in bull trout stomachs indicated selection for this family. The "free swimming" habits of siphlonurids may make them easier prey for the juvenile bull trout. Although Heptageniidae was the major mayfly family in the Middle Fork benthic samples, it was not the predominant family in the stomachs of juvenile bull trout collected from the Middle Fork drainage.

SURVEY OF BULL TROUT SPAWNING SITES

Numbers of bull trout spawning sites (redds) in tributaries of the Middle Fork Flathead drainage have ranged from 237-523 during years when all streams were surveyed (Table 24). During these years, bull trout spawning sites in the Middle Fork drainage averaged 46 percent of the total basin-wide count (including the North Fork). The majority of bull trout from Flathead Lake which spawn in the Middle Fork drainage enter tributaries within the BMWC.

Bull trout redds have been counted in selected streams within the BMWC annually since 1979 (see Table 24). These "monitoring counts" have fluctuated but generally indicate a stable spawning population.

Microhabitat measurements (size, water depth) of bull trout redds varied between tributaries (see Appendix Report). Redds averaged 2.2 m (2 yd) in length and 1.0 m (0.9 yd) in width, and were built in water depths averaging 0.26 m (0.3 yd).

SURVEY OF THE FISHERY

Creel Cards

Westslope cutthroat trout were the most numerous species in the recreational catch on the Middle Fork Flathead River from 1979-1981 based on voluntary creel card returns from anglers (Table 25). Anglers released approximately half of the cutthroat and most of the mountain whitefish that they caught. The release rate for bull trout was variable between years, ranging from 90 percent in 1979 to 33 percent in 1981.

Table 24. Numbers of bull trout redds in tributaries of the Middle Fork Flathead River during years when nearly complete surveys were conducted.

Tributary	Year				
	1986	1982	1981	1980	Average
Strawberry	41	39	21	17	30
Trail	53	30	26	31	35
Bowl	36	19	10	29	24
Clack	16	7	7	10	10
Schafer	30	17	12	10	17
Dolly Varden	42	36	31	21	33
Morrison[a/]	52	86	32[b/]	75	61
Lodgepole	42	23	18	14	24
Granite[a/]	37	34	14[b/]	34	30
Bear[c/]	21	23	12	9	16
Long	*	*	*	8	--
Charlie	*	*	*	7	--
Ole	36	51	23	19	32
Nyack[c/]	27	23	14	14	20
Lake	*	*	*	1	--
Dirtyface	*	*	*	0	--
Elk	*	*	*	1	--
Coal[c/]	3	*	4	*	4
Park[c/]	87	*	13	*	25
Total Middle Fork	523	388	237	300	

a/ Portions of the stream are outside the BMWC.
b/ Counts low due to ice cover.
c/ Entire stream is outside BMWC.

Table 25. Catch information from voluntary creel cards returned in 1979, 1980 and 1981. Number of fish caught are in parentheses.

Year	Number of anglers	Total angler hours	Catch per hour		
			Cutthroat trout	Bull trout	Mountain whitefish
1979	44	228	1.61 (367)	.08 (19)	.91 (197)
1980	38	243	1.68 (408)	.05 (11)	.97 (236)
1981	26	113	1.21 (137)	.05 (6)	.36 (41)

Hook and Line Sampling

In 1980, Department anglers caught cutthroat in the Middle Fork Flathead River at a rate of 2.15 fish per hour (Table 26). Bull trout catch rates averaged 0.33 fish per hour. These rates (especially for bull trout) were higher than recorded in 1962, but anglers in 1980 had the advantage of fishing areas where snorkel surveys had located mature bull trout.

Catch rates during 1980 in Middle Fork tributaries within the BMWC ranged from 0.5 to 12.5 fish per hour (Table 27). Mean lengths of cutthroat ranged from 134 mm to 293 mm.

MOUNTAIN LAKES

Information on mountain lakes in the Middle Fork drainage within the BMWC is limited (Table 28). Cutthroat populations (genetically untested) exist in 12 lakes. Populations are maintained by planting in six of the lakes and by natural reproduction in six of the lakes. The level of fishing pressure and harvest in these lakes is not well documented. Fishing use is relatively high on Stanton, Marion, Scott, Flotilla and Castle, and relatively light on Dickey, Tranquil (east and west), Cup and Almeda.

Recommendations

MANAGEMENT

Regulation of Angling

The major sport fish (numerically) in the Middle Fork Flathead River and its tributaries within the BMWC is the westslope cutthroat. Westslope cutthroat are a species of special concern, and have been shown to be highly susceptible to angler harvest. Therefore, we recommend maintaining the current stream fishery limits of three fish, none over 12 inches (305 mm) in the Middle Fork drainage within the BMWC.

Cutthroat trout inhabit all of the 12 mountain lakes in the Middle Fork drainage within the BMWC. Six of these lakes are planted with cutthroat regularly; in six of the lakes, populations are maintained through natural reproduction. The present lake fishing limit of three fish, no size restrictions, appears to allow for a reasonable harvest while maintaining an adequate population size.

Bull trout provide an important trophy fishery in the Middle Fork Flathead River and some of its tributaries (e.g., Schafer and Dolly Varden creeks). Anglers are willing to expend eight hours or more to catch a single mature bull trout. Based on our spawning site surveys, the number of bull trout spawning sites (redds) in the drainage has been relatively stable. Apparently,

Table 26. Catch rates (number of fish per hour) from hook and line sampling by Fish, Wildlife and Parks personnel on Middle Fork of the Flathead River within the BMWC during the summers of 1962 and 1980. The number of fish caught of each species is in parentheses.

Year	Total fishermen hours	Number of Fish Caught Per Hour		
		Cutthroat trout	Bull trout	Mountain whitefish
1962	164	.71 (117)	.06 (10)	.25 (39)
1980	104	2.15 (224)	.33 (35)	.62 (20)

Table 27. Catch information from hook and line sampling during the summer of 1980 by Department personnel on tributaries to the Middle Fork Flathead River within the BMWC.

Stream name	Number caught	Angler hours	Fish/ hour	Number measured	Minimum length (mm)	Maximum length (mm)	Average Length (mm)	Average Length (inches)
Granite	15	3.5	4.3	15	220	325	265	10.4
Lake	4	---	---	4	230	280	254	10.0
Morrison	6	5.5	1.1	4	255	310	293	11.5
Lodgepole	4	2.0	2.0	3	120	162	143	5.6
Schafer	30	6.0	5.0	30	105	228	153	6.0
Dolly Varden	6	13.0	0.5	3	187	248	217	8.5
Cox	15	6.0	2.5	12	135	216	176	6.9
Bowl	24	4.0	6.0	24	101	250	146	5.7
Basin	75	6.0	12.5	75	75	202	134	5.3
Strawberry	8	4.0	2.0	4	135	310	192	7.6
Trail	10	3.0	3.3	9	120	240	180	7.1
Gateway	1	1.5	0.7	1	252	252	252	9.9

Table 28. Fisheries information for lakes in the Middle Fork drainage within the BMWC (Wct = westslope cutthroat, Rb = rainbow trout, FSu = Finescale sucker, MWF = Mountain Whitefish, Yct = Yellowstone cutthroat). Year of the most recent plant is in parentheses.

Lake	Species	Planted/Natural	Common Size Range
	Middle Fork Drainage		
Stanton	Wct/Rb,MWF,FSu	Natural	8 - 13"
Marion	Wct (Rb/Wct)?	Natural	10 - 12"
Almeda	Wct	Planted (1984)	12 - 16"
East Tranquil	Wct	Natural	10 - 18"
West Tranquil	Wct	Natural	13 - 20"
Elk	Wct	Planted (1985)	13 - 17"
Castle	Wct	Planted (1985)	11 - 18"
Scott	Wct	Natural	13 - 15"
Flotilla	Wct (Yct/Wct?)	Natural	9 - 16"
Cup	Wct	Planted (1984)	11 - 16"
Dickey	Wct	Planted (1985)	11 - 13"
Bergsicker	Wct	Planted (1985)	11 - 13"

the current fishing limit of one fish daily and in possession is affording adequate protection for the spawning adults. However, if declines are detected in the number of bull trout spawning in the drainage steps should be taken to increase protection of the spawning run. Options for increased protection include:

(1) Restrict angling on Dolly Varden and Schafer creeks. These streams are important for bull trout spawning and are easily reached across from Schafer Meadows Guard Station (which is accessible by air).

(2) Restrict angling on all major spawning streams within the BMWC (Dolly Varden, Schafer, Clack, Strawberry, Bowl and Trail). Granite, Morrison, Long and Charlie creeks are already closed to angling.

(3) Restrict the season length for bull trout fishing in the river and/or tributaries.

(4) Close the river and/or tributaries to all taking of bull trout.

Adequate enforcement of angling regulations is difficult in the Middle Fork drainage within the BMWC. However, there are several steps which could be taken to improve compliance. First, prominent signs summarizing current regulations should be maintained at all trailheads. Second, personnel of the MDFWP and USFS could increase the frequency of joint enforcement patrols. Finally, a system similar to TIPMONT could be encouraged within the BMWC to reduce the illegal harvest of bull trout from streams in which they spawn. "Snagging" of bull trout in shallow spawning streams was the illegal fishing activity most frequently heard by biologists working in the drainage within the BMWC in 1980 and 1981.

Habitat Protection

The Middle Fork drainage is unique within the BMWC in that the upper portions of certain tributary drainages are undergoing timber harvest near the BMWC boundary. Stream habitat degradation from this activity is extending downstream within the BMWC. Man-caused habitat degradation is contrary to the concept of wilderness protection, and should be discontinued. Therefore, we recommend no further road construction, timber harvest, or other activities that cause pollution in tributaries that flow into the BMWC. To be consistent with the wilderness act, which the U.S. Forest Service administers, timber and road activities should be halted and no further work planned in the following drainages: Morrison, Granite (includes Challenge and Dodge) and Twenty-five Mile.

Trail construction improvements and location also could have a negative impact on the fishery in the Middle Fork drainage within

the BMWC. Trail locations should be examined carefully along tributary reaches important for bull trout spawning (see maps in Appendix Report), where large, mature bull trout spawners are vulnerable and very sensitive to disturbance. Specifically, Trail Creek supports a large number of bull trout spawners, and the existing trail has a history of limited maintenance. To reduce access and disturbance to this concentrated spawning area, we recommend halting all trail maintenance in the drainage.

Increased access to westslope cutthroat rearing areas could encourage overharvest of fish in important nursery areas. Basin Creek (above its junction with Bowl Creek) is a critical rearing area for cutthroat and the trail along its length has a history of low maintenance. To reduce access to this cutthroat rearing area, we recommend discontinuing all trail maintenance in the Basin Creek drainage above Bowl Creek.

MONITORING

Monitoring of fish populations and stream habitat in the Middle Fork drainage is essential to responsive fisheries management within the BMWC. Recommended monitoring includes (1) snorkel surveys of trout abundance in the river and tributaries, (2) hook and line surveys in the river for catch rate and age-growth determinations, (3) survey of bull trout redds and habitat in selected tributaries, and (4) survey of fish populations and angling in selected mountain lakes.

Snorkel Surveys

We recommend monitoring westslope cutthroat abundance by snorkeling in two 3-km sections (Gooseberry and Schafer) of the Middle Fork Flathead River (see Appendix Report for locations). These surveys should be conducted in late July - early August every other year beginning in 1988 following methods outlined in the South Fork section of this report. Past snorkel surveys in these sections were conducted using different methods (Shepard and Graham 1983) which yielded only density of trout per surface area of pools (Table 29). The updated snorkeling methods will produce much better estimates of abundance, and can still be used to calculate density information comparable to that collected in 1979 to 1982.

To monitor populations of juvenile trout, we recommend snorkel surveys of Schafer Creek (cutthroat) and Trail Creek (bull trout) (Table 30). These surveys should be conducted in alternate years beginning in 1988. (See Appendix Report for tributary snorkel methods and location of sample sites.)

Hook and Line Sampling

Hook and line sampling for westslope cutthroat should be conducted in conjunction with snorkeling on the Gooseberry and

Table 29. Summary of fish densities observed in monitoring sections of the Middle Fork of the Flathead River from snorkel counts in 1979, 1980 and 1982.

	Date	Area	Fish per 100 m^2 surface area by age class I	II	III+	Total
Schafer Section (3 km) (1.8 mi)						
Pools (6)	8/27/82 & 8/28/82	2937.7	--	.10	.41	.51
Schafer Section						
Pools (8)	8/5/80	3295.0	--	.03	1.10	1.13
Schafer Section						
Pools (6)	7/29/80	1544.0	--	.45	.51	.96
Schafer Section						
Pools (3)	9/4/79	630.0	--	--	.63	.63
Gooseberry Section (3 km)						
Pool (7)	8/25/82	3272.9	--	--	1.30	1.30
Gooseberry Section						
Pool (4)	8/22/80	1960.0	.05	--	.41	.46

Table 30. Summary of fish densities observed in Middle Fork Flathead tributaries recommended for monitoring.

				Fish per 100 m^2 surface area							
				Cutthroat Trout				Bull trout			
	Reach	Date	Area	I	II	III+	Total	I	II	III+	Total
Schafer	003	7/13/80	357.6	--	0.8	3.1	3.90	--	--	--	--
Trail	001	8/24/82	1097.8	0.5	0.8	2.2	3.50	0.5	0.4	--	.90
	001	8/8/80	1126.9	--	--	0.3	0.30	0.4	0.7	0.5	1.60

Schafer sections of the Middle Fork Flathead River. Anglers should measure and tag the captured fish and remove a scale sample for age and growth determination. Marked fish will allow a snorkel-Peterson estimate (see South Fork section); average length, age/growth information, and catch rates can be compared to data from past years.

Survey of Bull Trout Spawning Sites

Bull trout populations are very sensitive to disturbance both within and outside the BMWC boundary. Bull trout which spawn in the Middle Fork drainage within the BMWC migrate a minimum of 150 km. They are exposed to angling in Flathead Lake and in the Flathead River system along the length of their migration route. To monitor spawning success bull trout redds should be counted each year in selected tributaries within the BMWC (Table 31). Trends in the number of redds in each tributary (Figure 3) should be closely followed and compared to counts outside the BMWC in other portions of the Flathead Basin.

MDFWP should continue to measure streambed conditions on Granite Creek just upstream of the wilderness boundary (Weaver and Fraley 1987) to monitor sediment pollution entering the BMWC from timber activities upstream. Sediment conditions in this reach (44 percent fine sediments in the streambed in 1987) are the highest measured in the entire Flathead drainage.

Electrofishing estimates of juvenile bull trout and cutthroat trout in Morrison and Challenge creeks outside the wilderness boundary should be continued as they reflect population levels of progeny of adult fish which migrated upstream from the BMWC to spawn.

Mountain Lakes

To build a better data base for managing cutthroat in mountain lakes in the drainage, we recommend a survey of two lakes per year by gillnet and/or hook and line for size and age/growth determination. In 1988, we recommend survey of Stanton Lake and Tranquil Lakes (2). Stanton is an easy-access lake (1.5 miles, trail) with relatively heavy fishing pressure and small cutthroat. The Tranquil Lakes are difficult to reach, support lighter fishing pressure, and contain larger cutthroat. Cutthroat populations are maintained naturally in both Stanton and the Tranquil Lakes, but genetic make up of the fish is unknown. If funds are available, it would be desirable to collect fish from the two lakes for genetic testing. The remaining nine lakes in the drainage with fish populations could be surveyed as funds allowed, preferably two lakes per year.

Table 31. Bull trout redd counts for selected areas of tributaries chosen for monitoring in the Flathead drainage.

	1979	1980	1981	1982	1983	1984	1985	1986	1987
Morrison[a]	25[b]	75	32[b]	86	67	38	99	52	49
Granite[a]	14	34	14[b]	34	31	47	24	37	34
Lodegepole	32	14	18	23	23	23	20	42	21
Schafer	15	10	12	17	18	--	--	30	30
Dolly Varden	20	21	31	36	53	--	--	42	51
Ole[c]	--	19	19	51	35	26	30	36	45

[a] Portions of the section counted are outside the BMWC.
[b] Incomplete survey, counts probably low.
[c] Glacier National Park.

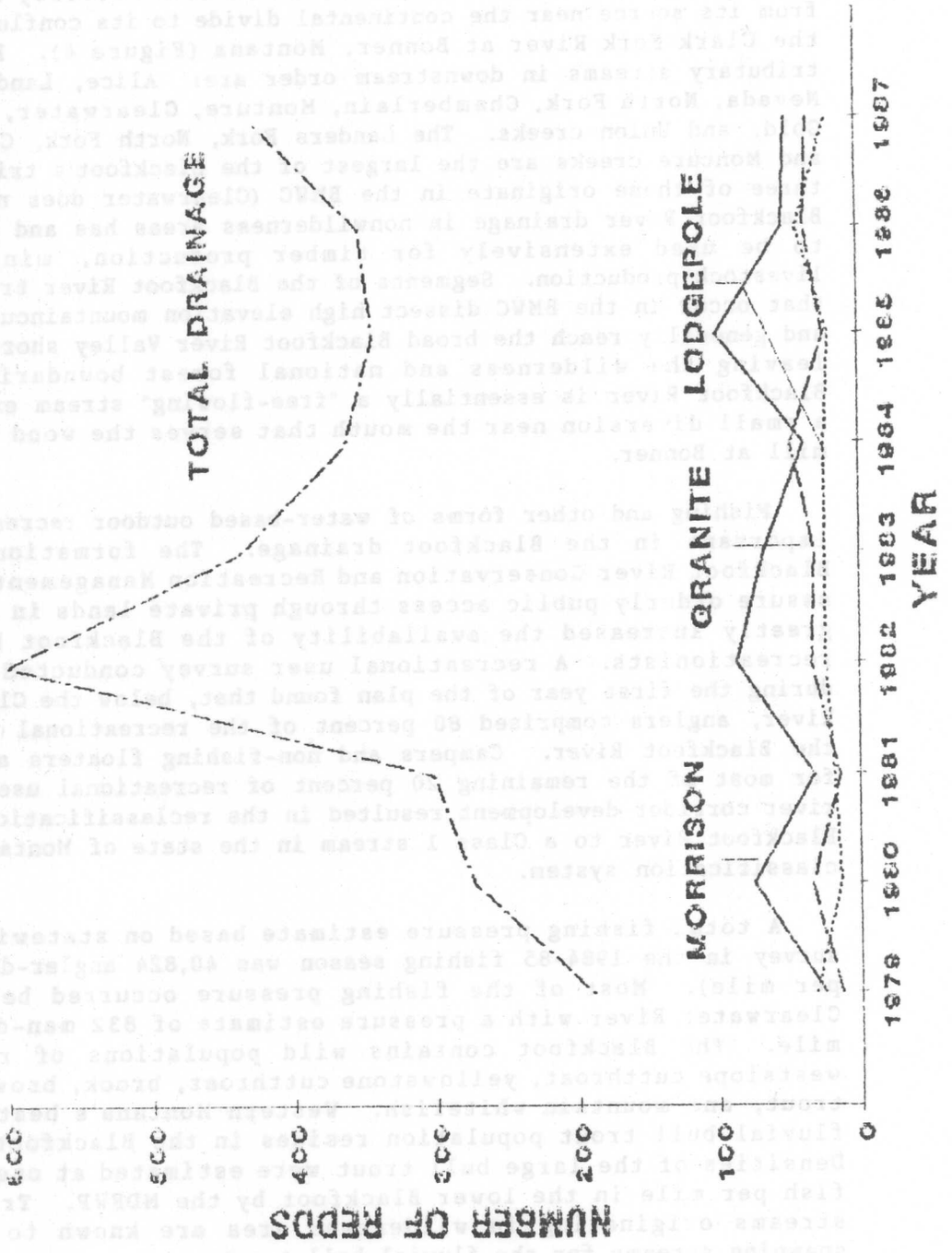

Figure 3. Comparison of bull trout redd counts in Morrison, Granite and Lodgepole creeks, and in all surveyed tributaries in the North and Middle Fork drainages combined, 1979-1987.

BLACKFOOT RIVER DRAINAGE

Introduction

BACKGROUND

The Blackfoot River flows 122 miles in a westerly direction from its source near the continental divide to its confluence with the Clark Fork River at Bonner, Montana (Figure 4). Principle tributary streams in downstream order are: Alice, Landers Fork, Nevada, North Fork, Chamberlain, Monture, Clearwater, Belmont, Gold, and Union creeks. The Landers Fork, North Fork, Clearwater and Monture creeks are the largest of the Blackfoot's tributaries; three of these originate in the BMWC (Clearwater does not). The Blackfoot River drainage in nonwilderness areas has and continues to be used extensively for timber production, mining, and livestock production. Segments of the Blackfoot River tributaries that occur in the BMWC dissect high elevation mountainous terrain and generally reach the broad Blackfoot River Valley shortly after leaving the wilderness and national forest boundaries. The Blackfoot River is essentially a "free-flowing" stream except for a small diversion near the mouth that serves the wood products mill at Bonner.

Fishing and other forms of water-based outdoor recreation are important in the Blackfoot drainage. The formation of the Blackfoot River Conservation and Recreation Management Plan to assure orderly public access through private lands in 1977 has greatly increased the availability of the Blackfoot River to recreationists. A recreational user survey conducted in 1977 during the first year of the plan found that, below the Clearwater River, anglers comprised 80 percent of the recreational users of the Blackfoot River. Campers and non-fishing floaters accounted for most of the remaining 20 percent of recreational users. The river corridor development resulted in the reclassification of the Blackfoot River to a Class 1 stream in the state of Montana river classification system.

A total fishing pressure estimate based on statewide mail survey in the 1984-85 fishing season was 40,824 angler-days (334 per mile). Most of the fishing pressure occurred below the Clearwater River with a pressure estimate of 832 man-days per mile. The Blackfoot contains wild populations of rainbow, westslope cutthroat, yellowstone cutthroat, brook, brown, bull trout, and mountain whitefish. Western Montana's best trophy fluvial bull trout population resides in the Blackfoot River. Densities of the large bull trout were estimated at one to two fish per mile in the lower Blackfoot by the MDFWP. Tributary streams originating in wilderness area are known to be key spawning streams for the fluvial bull trout.

Stream discharge on the Blackfoot River near the mouth averages 1,633 cubic feet per sec (cfs) and has ranged from 19,200

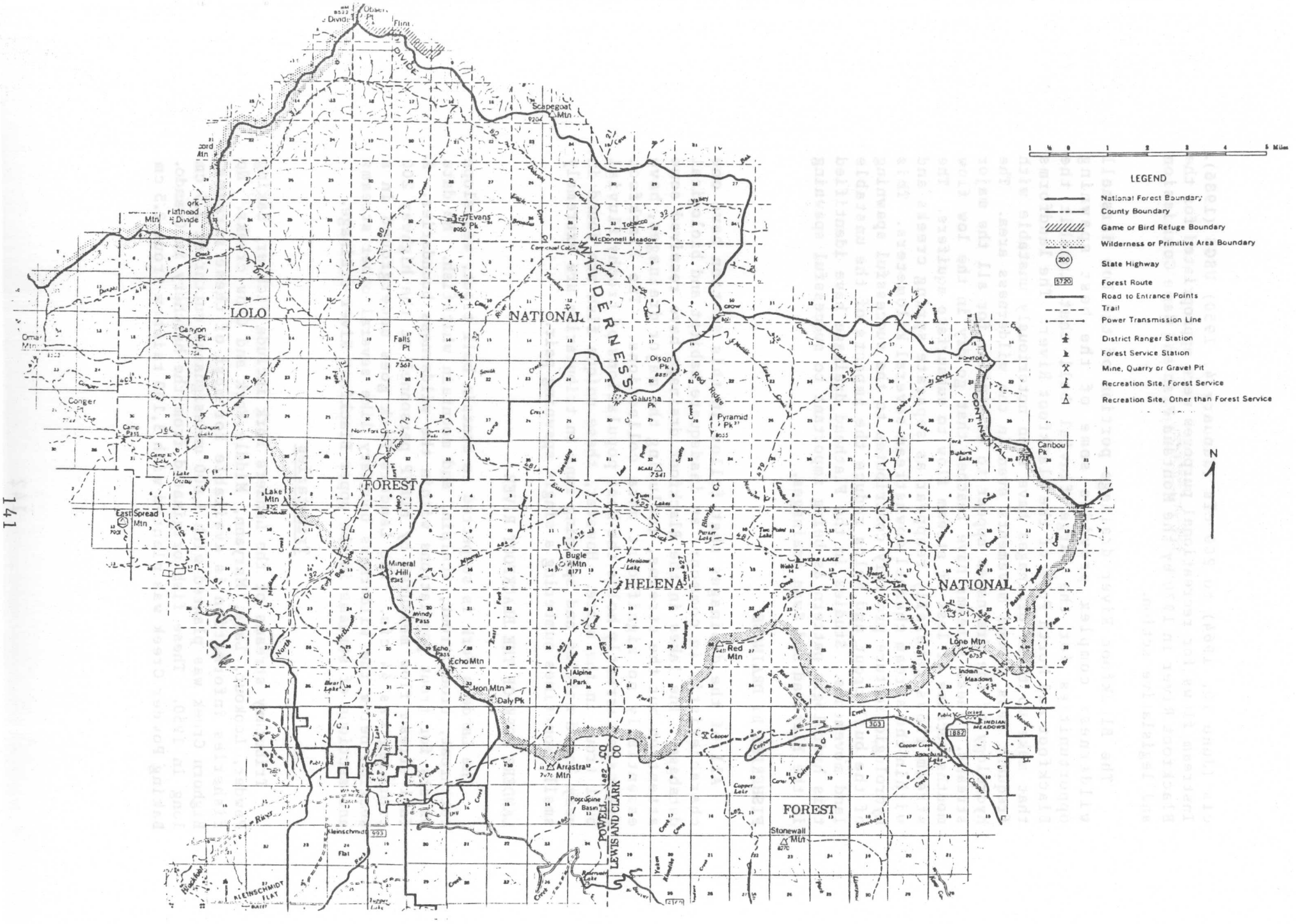

Figure 4. The Blackfoot River drainage within the BMWC.

cfs (June 10, 1964) to 200 cfs (January 4, 1950) USGS (1986). Instream flows for recreational purposes were appropriated for the Blackfoot River in 1970 by the Montana Fish and Game Commission and legislative action.

The Blackfoot River drainage portion of the Bob Marshall wilderness complex provides some of the best spawning opportunities for the large fluvial bull that inhabit the Blackfoot and North Fork of the Blackfoot River. The landforms that make up these drainages have been notoriously unstable with frequent mass ground movements even in the wilderness area. The hydrology of the drainages appear to be similar for all the major streams. These streams have reaches that go dry in the low flow months because of loss of stream flow to subsurface aquifers. The stream flows generally reappear as separate spring creeks and within the stream channel downstream several kilometers. This hydrologic feature probably contributes to the successful spawning of the bull trout and helps reduce the impacts of the unstable land movements. Studies in the Flathead drainage have identified this hydrologic pattern as being important to successful spawning in the Flathead and Swan drainages.

FISHERIES BY DRAINAGE

All of the drainages that follow in this section have one characteristic in common: an inadequate habitat and biological database. The lakes in the Blackfoot drainage have received some attention but the streams, including the major drainages, have essentially no significant data collections. The Blackfoot drainage currently holds the best populations of trophy fluvial bull trout in the state. However, these unique fish are found in very low densities and spawning runs in tributaries are extremely small, sometimes numbering a single spawning pair.

LANDERS FORK OF THE BLACKFOOT RIVER

The Landers Fork is suspected to contain bull trout, westslope cutthroat, brook trout, sculpin, and mountain whitefish. No data exists for trout populations within the wilderness boundaries. A fall stream flow measured by MDFWP personnel at the highway 200 crossing was 44 cfs. The Landers Fork goes underground in a section below the wilderness boundary like several other streams and sections of streams in the upper Blackfoot River drainage.

Tributaries

Tributary streams of the Landers Fork include Fickler, Baking Powder, Lookout, Lake, Maryann, Middle Fork and Crow creeks. No fisheries information is available for most of these streams. Bighorn Creek was planted with 3,600 undesignated cutthroat 2.5 cm long in 1950. These fish originated from the hatchery in Ovando. Baking Powder Creek was planted with 3,100 rainbow trout 2.5 cm

long in 1952. Ringeye Creek was planted with 4,000 undesignated cutthroat 2.5 cm long in 1943 from the hatchery in Ovando.

Lakes

Bighorn Lake. Bighorn Lake, located 24 km by trail up the Landers Fork and Bighorn Creek, has a good wild population of cutthroat trout. The wild population probably originates from the 1952 plant of 6,800 cutthroat trout from the Ovando hatchery. Records in the regional office of the MDFWP based on phenotype only indicate that the fish are yellowstone cutthroat. However, no records exist to indicate a plant of yellowstone cutthroat was ever made in the lake. Recent findings concerning the diverse phenotypes in westslope cutthroat certainly preclude a conclusion that the lake is inhabited by yellowstone cutthroat. The lake is 5.4 hectares in area and has a maximum depth of 16 m. The lake has an estimated annual usage of 100 angler-days and as estimated density of 85 cutthroat/100 m. This lake population of cutthroat is currently in a near natural condition and does not appear to be impacted by fisherman harvest in regards to population age and size distribution. The long distance to the lake coupled with a lack of other significant destinations make the trip to Bighorn Lake a single goal trip and helps reduce pressure. Angler trips into the lake in 1985 indicate that both size and numbers of cutthroat are being maintained with the current pressure. All efforts to improve access into this area or closely adjoining areas should be avoided because of the highly vulnerable nature of this cutthroat fishery.

Little Crystal Lakes (unnamed lakes northeast of Heart Lake). Two of the four lakes have the capability to produce a fishery. The middle largest lake (Little Crystal T16N, R8W, S17CB) had a remnant population of rainbow trout through the 1970's which has disappeared in the 1980's according to the local game warden. The other lake (upper Little Crystal T16N, R8W, S17CA) was planted with 200 westslope cutthroat in 1977 (unsuccessful in establishing a fish population). The lakes are both 6 m maximum in depth and less than 1 hectare in area.

The lakes are located next to Heart Lake, which has been heavily used over the past several years, but because of no trail access Little Crystal Lakes have received no noticeable use. No trail should ever be constructed to these lakes. A fisheries could be reestablished in both of these lakes.

Heart Lake. Heart Lake is located 9 km from the trailhead at Indian Meadows which is a major access trail for the Lincoln-Scapegoat Wilderness. The lake has a surface area 13.4 ha and a maximum depth of 15.2 m. A small outlet, with about 0.056 cubic meters per second (CMS) flow in the spring, drains into the Landers Fork via an unnamed tributary. Heart Lake was first planted in the early 1930's with grayling and, again, in the 1960's, a total of 874,000 2.5 cm fish were introduced.

Undesignated cutthroat were planted during the period 1942 to 1952 at a rate of 3,000 to 16,000 (fry to 5 cm) for a total of 48,000 introduced. Rainbow were planted once in 1937 (10,000 rainbow fry). Overnight gillnet sets in 1959 caught cutthroat and grayling at a rate of 1 and 2.5 per set respectively. An overnight gillnet set in 1968 produced 29 grayling and no cutthroat. The grayling averaged 25.4 cm (10 in) TL and ranged between 22.6 and 37.3 cm TL. An overnight gillnet set in 1975 produced 39 grayling with an average length of 37.3 cm TL and a range of 35.0 to 40.6 cm TL. Grayling ages were determined from scales and ranged from five to seven years in the 1975 sample. Angler and warden reports from Heart Lake in 1986 indicate that the grayling population disappeared and the lake is now barren. In 1974, the lake had an estimated use of 202 man-days based upon statewide mail survey which may be conservative.

This lake with a 30 percent littoral zone has produced good grayling fishing in the past and could be considered for reintroduction of the grayling and periodic replanting. The last plant in 1965 appeared to survive for at least ten years which would probably be a good planting cycle. A plant of 30,000 grayling for two years followed by ten years of no plants is an option for this lake.

Webb Lake. Webb Lake, a moderately productive moraine lake, is located about 11 km from the Indian Meadows trailhead. A USFS guard station cabin is built on one end of the lake and is used by administrative crews while in the area. Webb Lake is 2.7 ha in surface area and has maximum depth of 1.3 m. The outlet drains into an unnamed tributary to Ringeye Creek which flows into the Landers Fork. Webb Lake always has a high amount of turbidity that probably contributes cover for the fish residing there. Cutthroat trout captured in gillnets appear to be yellowstone cutthroat. Webb Lake was planted from 1940 to 1952 with an undesignated strain of cutthroat from hatcheries in Anaconda and Ovando. The annual plants of 5 cm fish varied from 1,000 to 15,000 for a total of 50,000 fish through the period. Two overnight gillnet sets in 1959 captured an average of 15 fish per set with an average TL of 29.5 cm and a range of 19.0 to 48.8 cm TL. The length frequencies of the catch indicated a healthy fish population. In 1968, a gillnet set caught 27 cutthroat with average TL of 29.5 cm and a range of 15.7 to 47.7 cm TL. The gillnet data confirms that Webb Lake is now a self sustaining fishery of unknown genetic make-up. Webb Lake in 1974 supported an estimated 300 man-days of angling.

EAST FORK OF THE NORTH FORK OF THE BLACKFOOT RIVER

Fish species present probably include westslope cutthroat and bull trout. Rainbow trout and yellowstone cutthroat may be present but are not confirmed. This drainage is in need of extensive survey work for any definitive management plan to be developed.

Historical fish planting records revealed that this stream was planted several times between 1940 and 1952 with 4,000 to 12,000 2.5 cm undesignated cutthroat. The earlier plants originated from the hatchery in Ovando and the later plants came from the Anaconda hatchery.

Tributaries

Tributary streams of the East Fork of the North Fork Blackfoot include Sourdough, Meadow, East Fork Meadow, Mineral, Camp, Spaulding, Lost Pony, and Scotty creeks. Very little information is available for these streams.

Historical fish planting records indicate that Meadow Creek was planted several times between 1932 and 1952. The plants of undesignated cutthroat trout 2.5 cm long numbered between 6,000 to 42,000 annually. The planted fish originated from the Anaconda and Ovando hatcheries. In 1945, 12,000 rainbow trout 5 cm long were also planted in this creek.

Fish species expected to be present include: undesignated cutthroat, rainbow, rainbow x cutthroat hybrids, and bull trout. In the 1984 statewide pressure estimates, this stream had an estimated annual pressure of 594 angler-days.

Scotty Creek was planted in 1943 and again in 1948 with undesignated cutthroat 5 cm long from the hatchery in Ovando. The plants numbered about 2,000 fish each.

Lakes

Meadow Creek Lake. This lake has a surface area of 5.1 ha with a maximum depth of 1.0 m. The lake was formed by a valley recessional moraine. No scientific data collections have been made on the lake. The cutthroat trout found in this lake are suspected to be yellowstone cutthroat. This lake receives an estimated annual fishing pressure of about 100 man-days. The naturally reproducing population could sustain more angling pressure but shoreline impacts would probably accompany the increased pressure. Historical fish planting records revealed several fish plants between the years 1932 to 1952. A total of 500,000 undesignated cutthroat and 29,280 rainbow trout were planted in 1937. The cutthroat originated from both the Anaconda and Ovando hatcheries and the rainbow from the Ovando station.

Upper Twin Lake. This lake has a surface area of 2.6 ha and a maximum depth of 3.0 m. The lake drains into an unnamed tributary to the East Fork of the North Fork Blackfoot River. The lake has never been stocked. This lake is accessible by trail 13 miles up Meadow Creek trail. In 1968, a single overnight gillnet set caught 17 undesignated cutthroat ranging in size from 17.8 to 55.9 cm long. In 1985, a fisherman reported numerous fish between 5.0 and 30.5 cm long. The species would probably be similar to the

lower Twin Lake population which is suspected to be yellowstone cutthroat.

Lower Twin Lake. This lake has a surface area of 6.3 ha and a maximum depth of 3.0 m. The lake drains in an unnamed tributary of the East Fork of the North Fork Blackfoot River. Abundant undesignated cutthroat populate this lake with natural reproduction. The cutthroat that inhabit this lake are suspected to be yellowstone cutthroat that were probably introduced with the fish plants of 1950 and 1952. Historical planting records show that 3,600 and 10,000 2.5 cm long cutthroat were planted respectively in 1950 and 1952. The fish came from the Anaconda hatchery.

Parker Lake. This lake has a surface area of 8.9 ha and is formed by a recessional moraine. The maximum depth of the lake is 1.3 m. Visual and angler surveys of the lake described the population of cutthroat trout as abundant. The naturally reproducing population of cutthroat in Parker Lake are suspected to be yellowstone cutthroat. Fish planting records indicate that from 3,000 to 6,000 undesignated cutthroat were planted per year between the years 1942 and 1952. The planted fish originated from the hatchery at Ovando. The estimated annual fishing pressure is 100 man-days. Parker Lake is accessed by trail 16 km from the trailhead at Indian Meadows.

NORTH FORK OF THE BLACKFOOT RIVER

This stream is the largest of the tributaries to the Blackfoot River. A major falls forms a natural barrier to upstream fish movement 9.6 km above the wilderness boundary. The North Fork supports a significant fall run of large fluvial bull trout from the Blackfoot and is suspected to have a resident population in addition to the migratory fish. The wilderness portion of the North Fork also supports a population of cutthroat trout of unknown species and may have some rainbow and/or yellowstone cutthroat.

Historical fish planting records show the river was planted throughout the period 1932 to 1954. The plants were made with both rainbow and undesignated cutthroat and numbered from 2,000 to 22,000 annually. The fish originated from the hatcheries in Anaconda and Ovando.

Tributaries. Tributaries of the North Fork Blackfoot River include Jakey, Cabin, Canyon, Dwight, South, Sorgo, Theodora, Cooney, Broadus, Eagle and Dabrota creeks, and the Dry Fork of the North Fork. Very little fisheries information exists for these streams. The Dry Fork was planted from 1928 to 1952 with 6,000 to 10,000 undesignated cutthroat 2.5 cm long. Cabin Creek was planted in 1952 with 6,000 undesignated cutthroat from the Anaconda hatchery. Cooney Creek was planted with 20,000 rainbow trout in 1941 and 4,000 undesignated cutthroat in 1950 from the

Ovando hatchery. Dabrota Creek was planted in 1950 with 3,600 undesignated cutthroat 2.5 cm long from the Ovando hatchery.

No productive lakes exist in the drainage within the BMWC.

Recommendations

The Blackfoot River drainage waters have received a significant number of cutthroat fish plants of unknown genetic make-up. We recommend that fish surveys in these drainages should include genetic evaluations to determine if the native westslope cutthroat trout stocks have been altered and how much.

The greatest need in the Blackfoot drainage is a biological database from which informed management decisions can be made. We recommend a three to five year baseline study with a full-time three-man crew (a biologist and two technicians) and adequate equipment and travel. The current regional staff will be sufficient to monitor trends after completion of the database.

To begin building a fisheries database for management decisions, we suggest a cooperative effort between FWP Regions 1 and 2 to sample a 1.5-km section of the North Fork Blackfoot River within the BMWC in July, 1988. This sampling would include hook-and-line methods to tag fish and collect scales for age and growth, followed by a snorkel survey to estimate cutthroat population densities.

Based on this analysis, other options include: (1) no further improvements on the Bighorn Lake trail, to protect the naturally reproducing cutthroat population there, (2) no trail construction to access Little Crystal lakes, (3) planting Little Crystal lakes with westslope cutthroat trout, and (4) planting Heart Lake with 30,000 grayling for two years followed by ten years of no plants.

EAST FRONT DRAINAGES

Description of the Drainages

NORTH FORK SUN RIVER

The North Fork of the Sun River originates along the continental divide and flows south to its junction with the South Fork of the Sun River at the head of Gibson Reservoir (Figure 5). The upper portion of the North Fork drainage and the entire west side of the drainage is timbered, while grass-covered hills follow the east side of the lower portion of the drainage. The summer flow of the North Fork ranges from 100 to 150 cubic feet per second (cfs).

Major tributaries of the North Fork Sun River include Headquarters, Rock, Biggs and Moose creeks. Summer flows in tributaries to the North Fork range from 5 to 50 cfs. Three of the ten mountain lakes in the North Fork drainage support fish populations.

SOUTH FORK SUN RIVER

The South Fork of the Sun River flows north from its origin on the continental divide to the junction with the North Fork at Gibson Reservoir. The drainage is timbered except for a meadow section at Pretty Prairie. Summer flows in the South Fork range from 100 to 150 cfs. The West Fork is the largest tributary in the drainage. One of the five mountain lakes in the drainage within the BMWC supports fish.

Dearborn River

The Dearborn River originates along the continental divide near Scapegoat Mountain and flows east-southeast to the downstream BMWC boundary. In the upper portion of the drainage, the stream meanders through a timbered floodplain. In the lower reaches, the Dearborn flows through a steep-walled canyon. There are no mountain lakes in the drainage which support fish.

STREAMS IN THE GREAT BEAR ADDITION

There are eight major streams in the proposed Great Bear addition. Tributaries in the Marias drainage include the North, Middle and South forks of Birch Creek, and the North and South forks of Dupuyer Creek. Streams in the Teton drainage include the North and East forks of the Teton River, and Bruce Creek. Floodplain signs of the 1964 and 1975 floods are evident in all these drainages. There are no mountain lakes in the drainages.

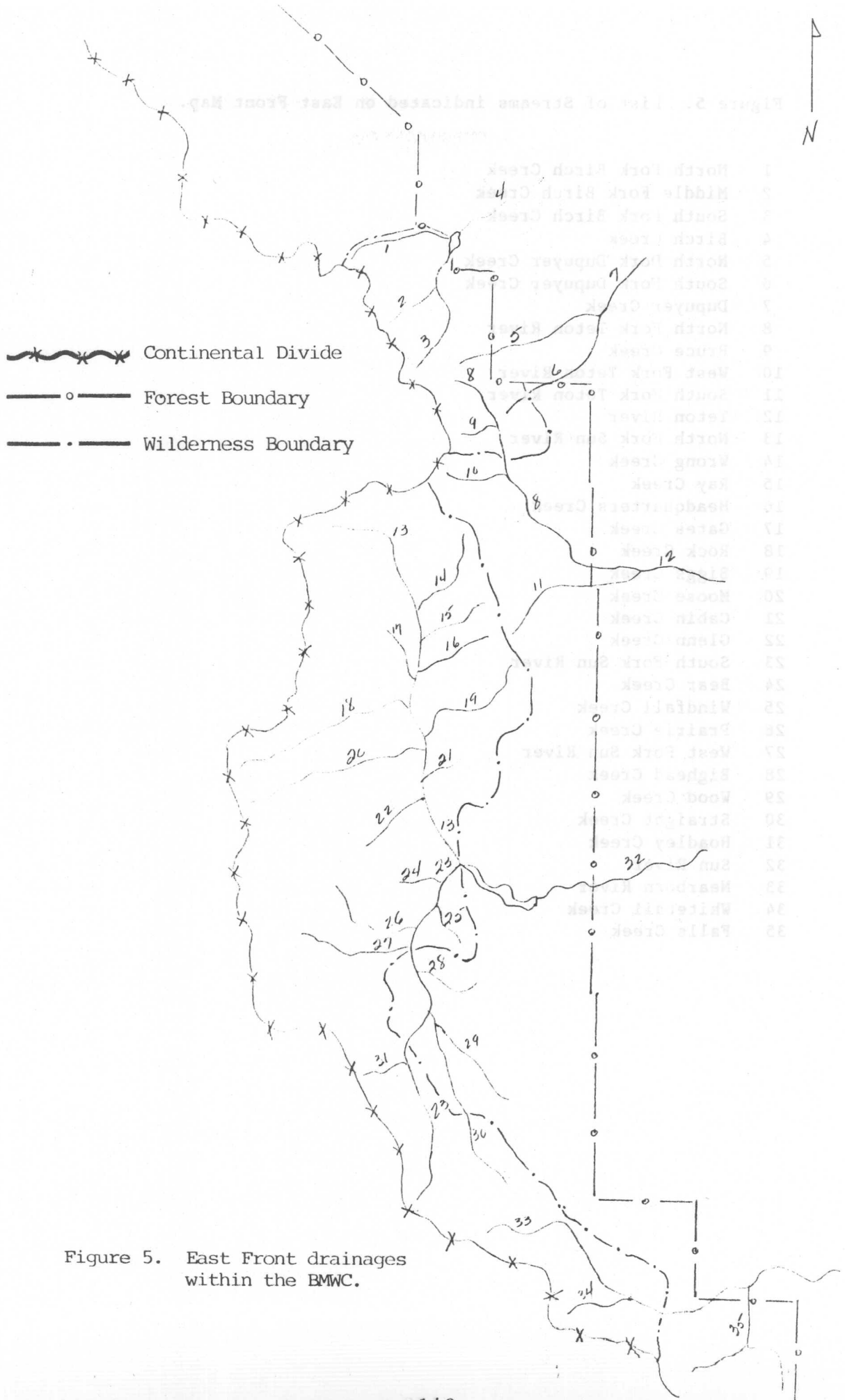

Figure 5. East Front drainages within the BMWC.

Figure 5. List of Streams indicated on East Front Map.

1 North Fork Birch Creek
2 Middle Fork Birch Creek
3 South Fork Birch Creek
4 Birch Creek
5 North Dork Dupuyer Creek
6 South Fork Dupuyer Creek
7 Dupuyer Creek
8 North Fork Teton River
9 Bruce Creek
10 West Fork Teton River
11 South Fork Teton River
12 Teton River
13 North Fork Sun River
14 Wrong Creek
15 Ray Creek
16 Headquarters Creek
17 Gates Creek
18 Rock Creek
19 Biggs Creek
20 Moose Creek
21 Cabin Creek
22 Glenn Creek
23 South Fork Sun River
24 Bear Creek
25 Windfall Creek
26 Prairie Creek
27 West Fork Sun River
28 Bighead Creek
29 Wood Creek
30 Straight Creek
31 Hoadley Creek
32 Sun River
33 Nearborn River
34 Whitetail Creek
35 Falls Creek

Fish Populations

NORTH AND SOUTH FORKS OF THE SUN RIVER

Fisheries information is limited on the forks of the Sun River within the BMWC. Most of the information was gathered to assess the effects of the two fish angling limit (1975-1983) on the trout population in the forks. After 1983, the general stream limit for the BMWC applied (three fish, none over 12 inches).

Average lengths of rainbow trout in the North Fork Sun River from 1975 to 1985 ranged from 10.7 to 12.2 inches (271 to 310 mm). Lengths of rainbow trout in the South Fork Sun River ranged from 11.4 to 12.7 inches, or 290 to 323 mm (Table 32). Other species present on the forks include cutthroat trout, hybrids of cutthroat and rainbow trout, and eastern brook trout.

Rainbow trout generally reach 10 inches (254 mm) in the forks of the Sun River during their third year of life (Tables 33 and 34). By their fourth year, rainbow exceed 12 inches in both forks.

A preliminary snorkel estimate (see Appendix Report for methods) conducted on the South Fork Sun River on August 3, 1987, indicated a rainbow trout population of 191 fish in a 1.05 mile (1.68 km) section from Burnt Creek to Deer Creek. However, because of the physical characteristics of the stream section, the estimate was thought to be a minimum value.

Grayling were introduced in Rock Creek in the North Fork Sun River drainage in 1984. Survival and status of the plant are unknown. Some grayling have moved downstream to the North Fork.

Very little information exists on mountain lakes in the drainage within the BMWC (Table 35). Mean lengths of yellowstone cutthroat trout ranged from 10.1 to 14.2 inches in the four lakes with fish populations.

DEARBORN RIVER

Almost no fisheries information is available for the Dearborn River within the BMWC. Reports indicate a viable fishery for rainbow and cutthroat trout. Whitetail Creek, a major tributary, contains cutthroat trout.

STREAMS IN THE GREAT BEAR ADDITION

Limited information is available on these streams. Cutthroat were introduced in the South Fork of Birch Creek below Crazy Creek (near Pinto and Circus creeks) in 1974. In 1979, cutthroat ranging from 5 to 12 inches were captured in the section.

Table 32. Length frequency of rainbow trout in the North and South forks of the Sun River from hook-and-line surveys. (Expressed as percent of the total trout sampled.)

	Length Group greater than or equal to	1975	1976	1977	1978	1979	1983	1985
North Fork	10 inches (254 mm)	70.6	74.0	81	92.1	67.1	77	82
	11 inches (279 mm)	54.4	59.4	66	81.7	52.1	63	67
	12 inches (305 mm)	29.4	41.7	51	68.3	37.0	39	42
	13 inches (330 mm)	17.6	22.9	34	35.7	20.5	15	22
	Number of fish in sample	68	96	41	126	73	73	75
	Average length (all fish)	10.9	11.3	11.5	12.2	10.7	11.3	11.6
South Fork	10 inches (254 mm)	71.2	80.0	91	80.0	86.8	88	87
	11 inches (279 mm)	56.0	63.3	84	64.2	64.7	79	75
	12 inches (305 mm)	40.8	50.5	79	49.5	44.1	46	48
	13 inches (330 mm)	30.6	24.8	51	37.9	29.4	18	39
	Number of fish in sample	59	102	70	95	68	82	61
	Average length (all fish)	11.4	11.8	12.7	11.8	11.6	11.8	12.2

Table 33. Length range and age class distribution of trout in the North and South forks of the Sun River, July 31 - August 1, 1979.

Stream	Species*	Number of Fish	Length Range (Average)	Age Class	Number of Fish	Length Range
NorthFork	Ct	12	7.5 - 12.0 (9.7)			
	Eb	2	6.0 - 7.0 (6.5)			
	RbxCt	4	8.9 - 16.2 (12.3)			
	Rb	73	5.3 - 14.5 (10.7)	I	10	5.3 - 8.6
				II	20	8.1 - 11.0
				III & older	42	9.3 - 14.5
South Fork	Ct	3	7.1 - 9.6 (8.7)			
	Eb	5	7.1 - 9.0 (7.8)			
	RBxCt	2	9.9 - 11.2 (10.6)			
	Rb	68	5.7 - 17.5 (11.6)	I	5	5.7 - 8.4
				II	17	7.8 - 12.2
				III & older	46	10.0 - 17.5

*Species abbreviations: Ct-cutthroat trout; Eb-brook trout; RbxCt-rainbow-cutthroat hybrid; Rb-rainbow trout.

Table 34. Calculated growth (in inches) of rainbow trout from the forks of the Sun River, August, 1975.

	Age Group	Number of Fish	Average total length at each year of life				
			I	II	III	IV	V
North Fork Sun River	I	6	4.4				
	II	11	3.7	7.0			
	III	30	3.8	7.2	9.7		
	IV	15	3.2	5.9	9.5	12.0	
	V	2	2.9	6.4	9.3	12.1	13.6
	Averages	64	3.6	6.8	9.6	12.0	13.6
South Fork Sun River	I	5	4.4				
	II	9	4.0	7.6			
	III	12	3.9	7.1	9.8		
	IV	12	3.9	6.9	10.3	12.9	
	Averages	38	4.0	7.1	10.1	12.9	

Table 35. Information on lakes in the Sun River drainage within the BMWC (all lakes contain yellowstone cutthroat).

Lake	Date of Survey	Number of Fish	Mean Length in inches (range)	Mean weight (pounds)
Bear (natural reproduction)	7/19-20/65	6	13.5 (12.8 - 13.9)	0.76 (0.63 - 0.84)
	8/11/76	4	14.2 (11.8 - 15.7)	—
Levale (natural reproduction)	7/21-23/65	36	10.1 (7.8 - 12.2)	0.36 (0.15 - 0.60)
Sock (planted every other year)	7/26/82	7	11.6 (10.0 - 14.7)	--
Unnamed (natural reproduction	7-24-82	5	13.2 (9.7 - 18.5)	--

Cutthroat trout ranging from 7.7 to 10.0 inches in length were sampled in the North Fork of Birch Creek in 1971. In the North Fork of Dupuyer Creek, cutthroat (7.6 to 10.5 inches) and eastern brook trout (6.5 to 10.6 inches) were sampled in 1976. In the South Fork Dupuyer Creek, cutthroat from 2.3 to 9.8 inches were sampled in 1976.

Recommendations

Streams draining the East Front within the BMWC support an important fishery resource for rainbow, cutthroat and eastern brook trout. Lack of information on the fishery limits the effective management of this resource. We recommend a three year baseline study on fisheries and stream habitat on the East Front drainages within the BMWC to collect information necessary for building a database for sound management.

The genetic purity of cutthroat populations within the drainages is unknown. We recommend genetic testing in North and South Fork Sun River Drainage tributaries where cutthroat populations exist, and in the Teton River, Birch Creek, Dupuyer Creek and Dearborn River drainages.

An information base spanning ten years exists for the size distribution of rainbow trout in the forks of the Sun River. We recommend continuing this period of record with annual hook-and-line surveys on both forks. To obtain comparable data on population levels of important trout species, we recommend a snorkel estimate (see Appendix Report for methods) on both forks of the Sun River within the BMWC in late July - early August, 1988 and alternate years after 1988 (cooperative effort between FWP Regions 1 and 4).

To maintain the present populations of rainbow and cutthroat trout in streams and lakes of the East Front drainages within the BMWC, we recommend maintaining the current regulations of three fish none over 12 inches (streams) and three fish no size limit (lakes).

OVERALL MANAGEMENT RECOMMENDATIONS

The fisheries resource within the BMWC is extensive and unique. More than 500 miles of streams and 35 lakes support populations of native and introduced species of salmonids. Waters within the BMWC represent a genetic stronghold for two native fish species of special concern, bull trout and westslope cutthroat, and provide thousands of angler days of recreation.

To preserve the quality of the BMWC fishery, we recommend maintaining the present stream angling limits of three fish, none over 12 inches (except for brook trout in East Front drainages) and three fish, no size limits (lakes). In addition, we recommend imposing a regulation on stream angling which restricts tackle to artificial flies and lures only, barbless hooks. This restriction would be consistent with the philosophy of preserving a high quality stream fishery within the BMWC.

To preserve the genetic integrity of westslope cutthroat trout, we recommend that all lakes within the Middle and South fork drainages which support non-native species (see Tables 3 and 28) be periodically planted with westslope cutthroat trout to reduce the chances of genetic interchange with rainbow and yellowstone cutthroat. This management strategy is already being implemented in certain lakes in the South Fork Flathead drainage within the BMWC. This action should be taken where practical and cost effective.

Presently, fisheries management within the BMWC is based on general guidelines agreed upon in 1979 by the MDFWP director and the regional forester for Region 1, USFS. Fisheries managers in MDFWP Regions 1, 2 and 4 cooperate with district rangers to formulate local management actions. We recommend that MDFWP and USFS reexamine the memorandum of understanding between the two agencies. The memorandum should be updated in light of new information and the results of this L.A.C. process. Strategies should be clarified and reaffirmed for the following:

1. Techniques of fish population sampling (rotenone, motorized electrofishing).

2. Chemical rehabilitation of lakes.

3. Fish planting (native vs. non-native species, endangered or threatened species, barren lakes, aerial planting).

4. Cooperative fish population monitoring.

5. Angling/recreation philosophy (harvest vs. population maintenance, angling and floating restrictions, angler access).

6. Habitat protection (trail construction within the BMWC, land use outside the BMWC that affects waters within the BMWC).

7. Management of fish species such as cutthroat and bull trout which migrate into and out of the BMWC.

8. Enforcement of angling regulations.

9. Consideration of a cooperative fisheries biologist position for the BMWC.

The valuable fisheries resource within the BMWC will be benefited by comprehensive, consistent fisheries management that recognizes the balance between maintaining the integrity of fish populations and providing angling recreation. We recommend formation of a fisheries management committee for the BMWC which would consist of the MDFWP fisheries managers, representatives of the four national forests within the BMWC, and designated public participants. This committee could formulate a detailed management plan, and recommend adaptive fisheries management policies for review by the MDFWP Director and regional forester.

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